Appendix B

Packets for Subwatershed Areas

Attachment B1

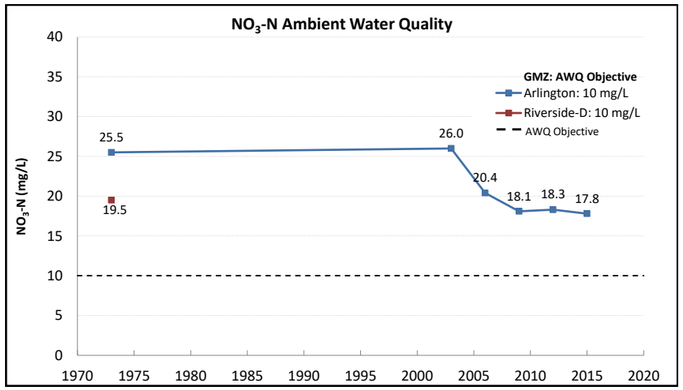
Arlington and Riverside-D GMZs

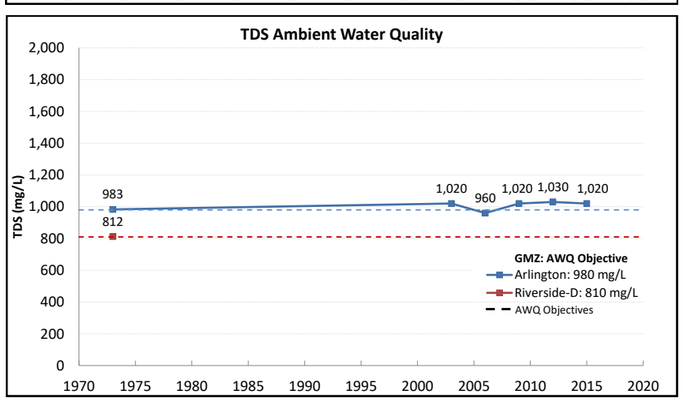
Attachment Contents:

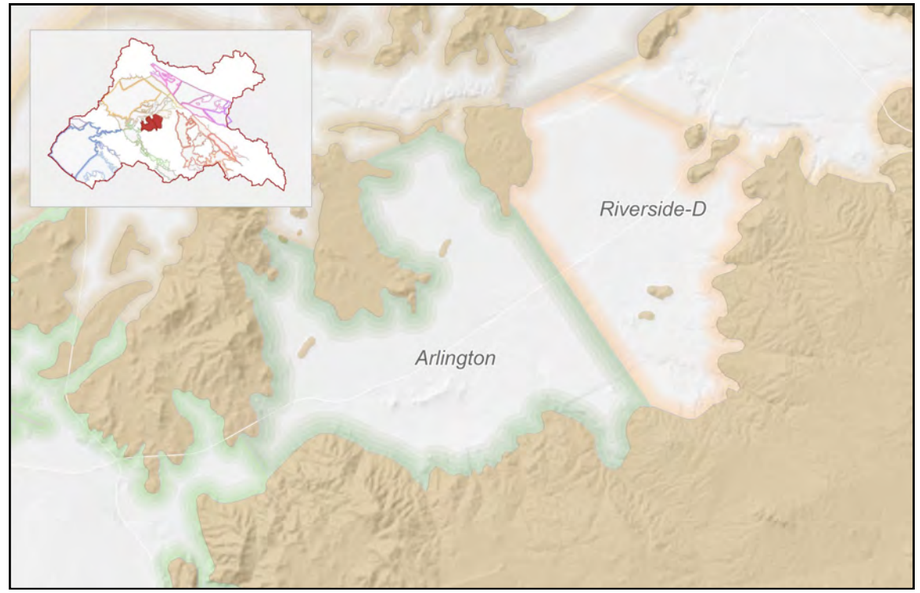
B1-1 Groundwater Storage and Elevation Contours Fall 2015
B1-2 NO_3-N Concentration and Contour Map
B1-3 TDS Concentration and Contour Map
B1-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B1-5 TDS Concentration Change (1993-2012 to 1996-2015)
B1-6 Key Well Analysis Charts

	Basin Analytics	Arlington	Riverside-D
Basin	GMZ Area (acres)	13,700	8,640
	Volume of Storage (acre-ft)	61,900	?
NO_3-N	Wells per GMZ	23	1
	Point Statistics per GMZ	10	1
	Total Mass (tons)	1,500	?
	1996-2015 AWQ	17.8	?
TDS	Wells per GMZ	19	1
	Point Statistics per GMZ	6	1
	Total Mass (tons)	86,000	?
	1996-2015 AWQ	1020	?

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Arlington

The nitrate objective for Arlington is 10.0 mg/L. The ambient nitrate concentration decreased from 18.3 mg/L in 2012 to 17.8 mg/L in 2015, and there is no assimilative capacity. One out of the three key wells in Arlington GMZ has a decreasing trend in nitrate concentrations, while the other two show no trends in the nitrate concentrations. One new well with statistics was added to the 1996 to 2015 AWQ recomputation.

Riverside-D

The nitrate objective for Riverside-D is 10.0 mg/L. The ambient nitrate concentration was not calculated in the 1996 to 2015 AWQ recomputation Riverside-D due to a lack of data. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Total Dissolved Solids (TDS)

Arlington

The TDS objective for Arlington is 980 mg/L. The ambient TDS concentration decreased from 1030 mg/L in 2012 to 1020 mg/L in 2015, and there is no assimilative capacity. Two out of the three key interpretive wells in Arlington GMZ have an increasing trend and the other one shows a decreasing trend in TDS concentrations. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Riverside-D

The TDS objective for Riverside-D is 810 mg/L. The ambient TDS concentration was not calculated in the 1996 to 2015 AWQ recomputation Riverside-D due to a lack of data. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Arlington	1004566	AD-5	15.8	Decreasing**	1,142	Increasing*
Arlington	1004580	AD-1	16.7	No Trend	1,077	Decreasing
Arlington	1004590	AD-3	19.9	No Trend	1,154	Increasing**

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B1-4 and B1-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Arlington	1004492	Army 3	Medium	2	24.7	Ave	Medium	2	915	Ave
Arlington	1004493	Iselin 1	Medium	2	23.5	Ave	Medium	2	913	Ave
Arlington	1004494	Iselin 2	Medium	1	24.8	Ave	Medium	1	960	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

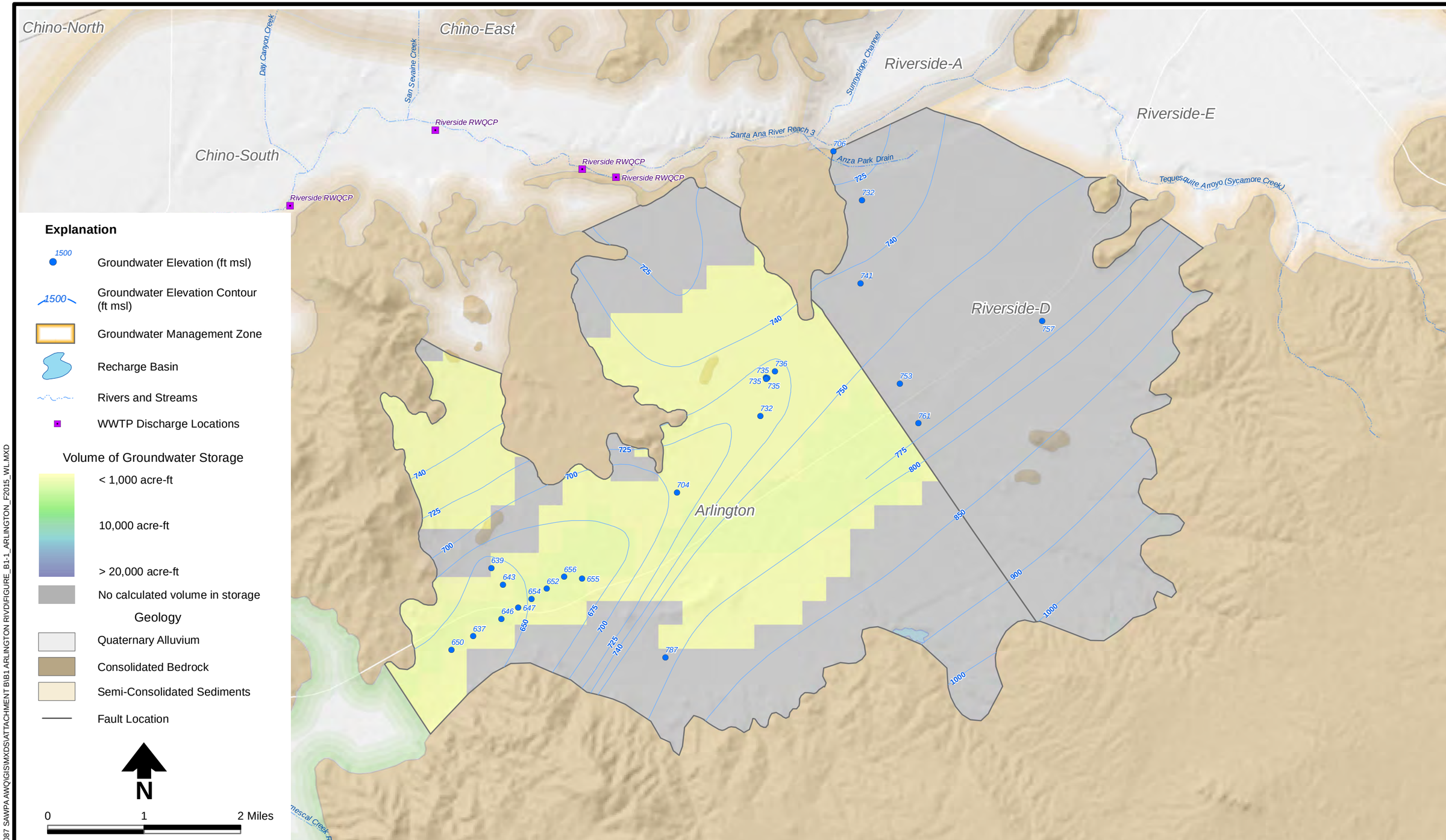
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B1-4 and B1-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Arlington	2000369	3310075-002	New	13	18.5	Stat	--	14	1123	Median
Arlington	2000370	3310075-005	New	13	14.5	Stat	New	14	1170	Stat
Arlington	2000376	MW-4	--	1	4.4	Ave	New	3	1322	Stat
Arlington	2000377	PZ-12A	New	4	34.9	Stat	--	--	--	--

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B1-4 and B1-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B1 ARLINGTON RIV\D\FIGURE_B1-1_ARLINGTON_F2015_WL.MXD

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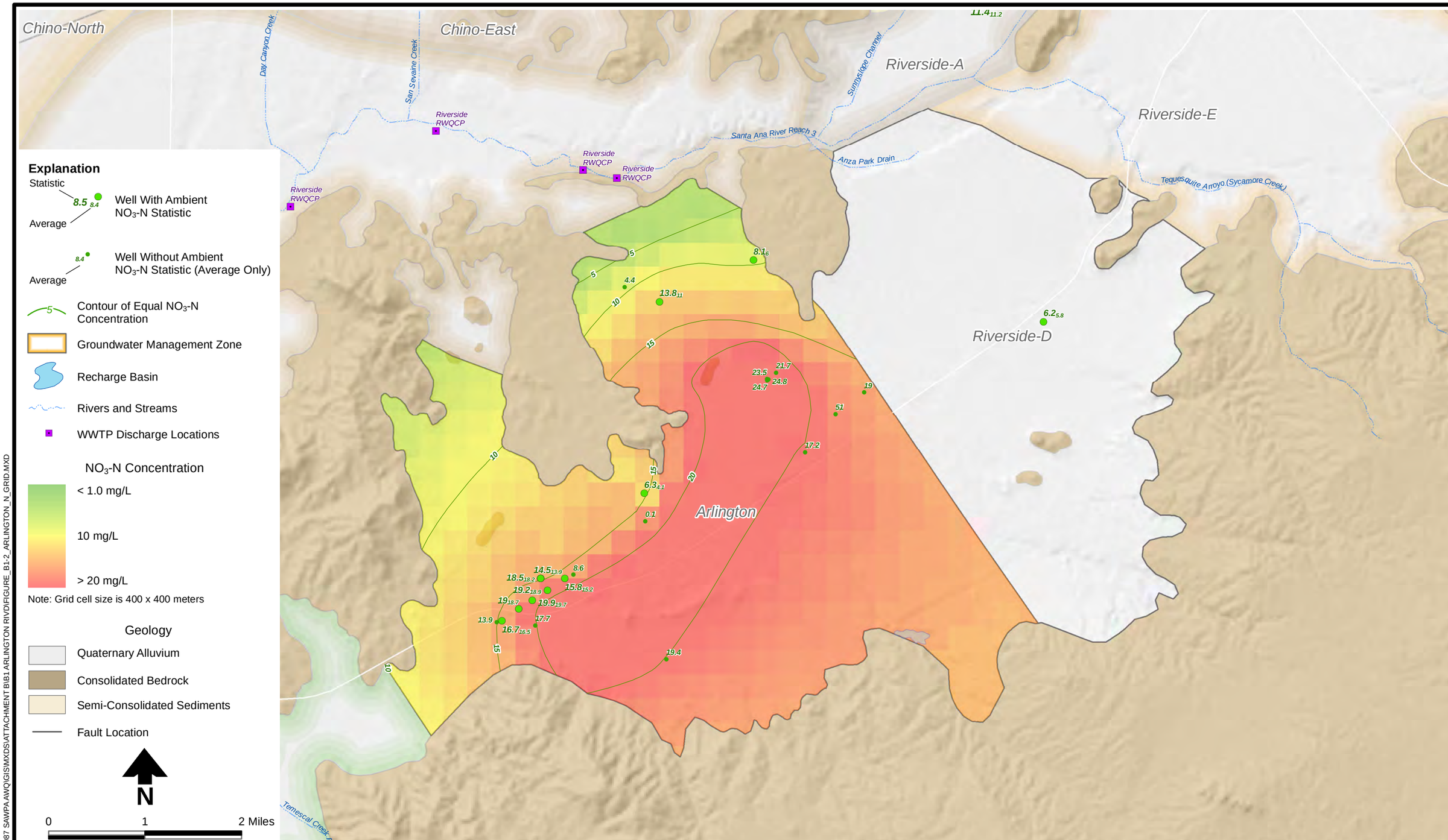
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Arlington and Riverside-D GMZs

Attachment B1-1



Source: SAWPA.net, January 2017

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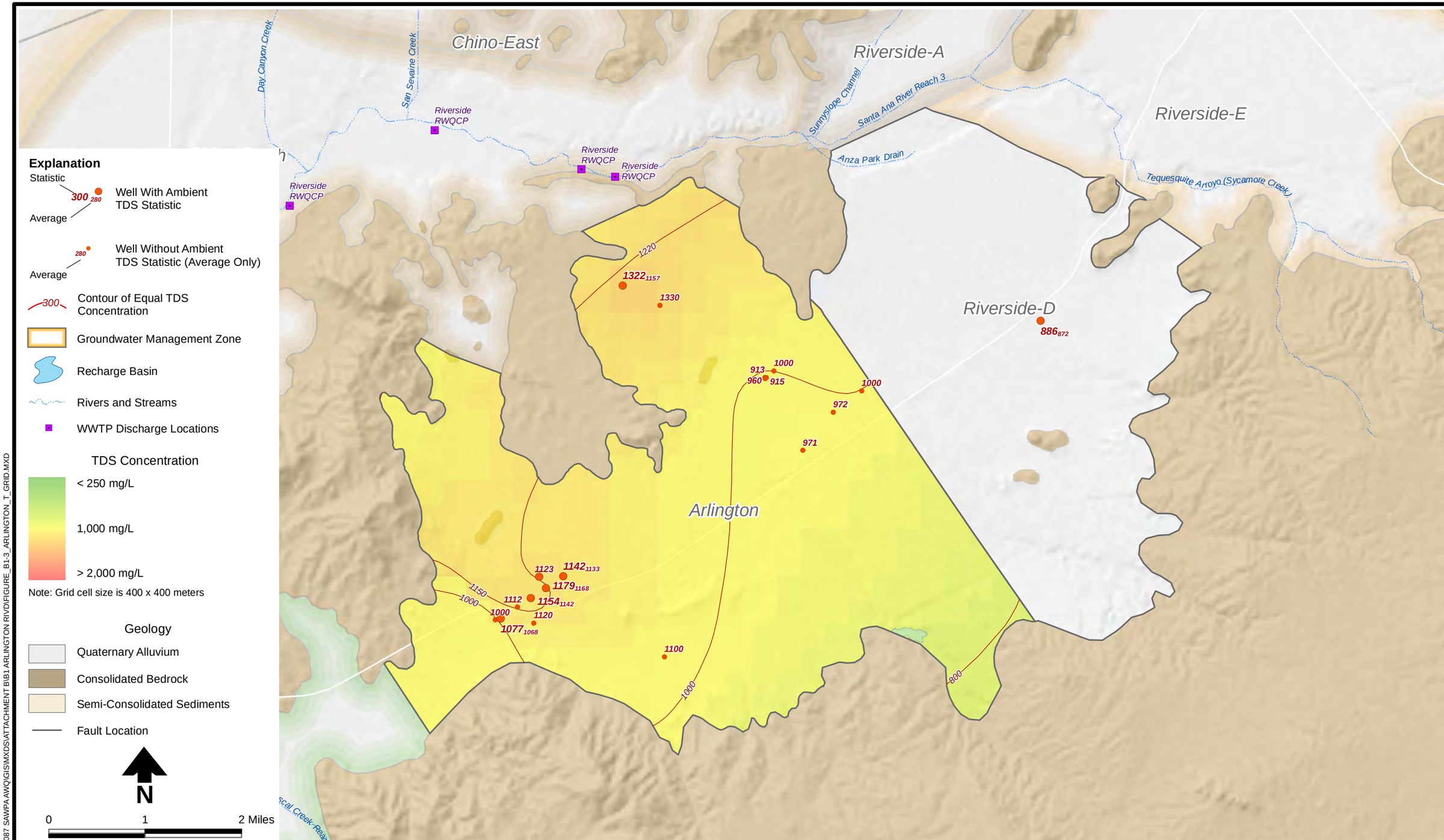
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Arlington and Riverside-D GMZs

Attachment B1-2



Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Arlington and Riverside-D GMZs

Attachment B1-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

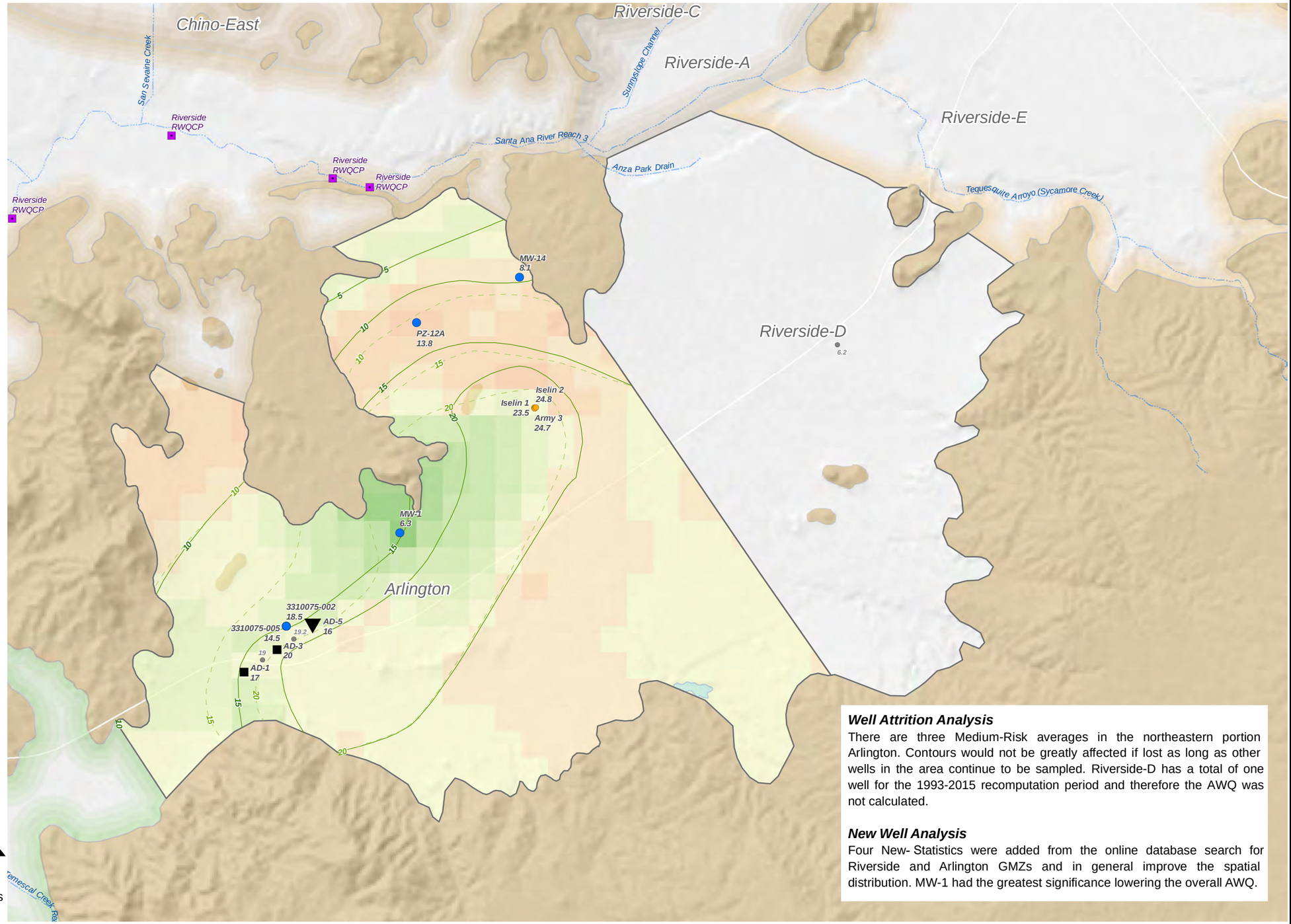
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are three Medium-Risk averages in the northeastern portion Arlington. Contours would not be greatly affected if lost as long as other wells in the area continue to be sampled. Riverside-D has a total of one well for the 1993-2015 recomputation period and therefore the AWQ was not calculated.

New Well Analysis

Four New- Statistics were added from the online database search for Riverside and Arlington GMZs and in general improve the spatial distribution. MW-1 had the greatest significance lowering the overall AWQ.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B1 ARLINGTON RIVD\FIGURE_B1-4_ARLINGTON_N_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Arlington and Riverside-D GMZs

Attachment B1-4

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

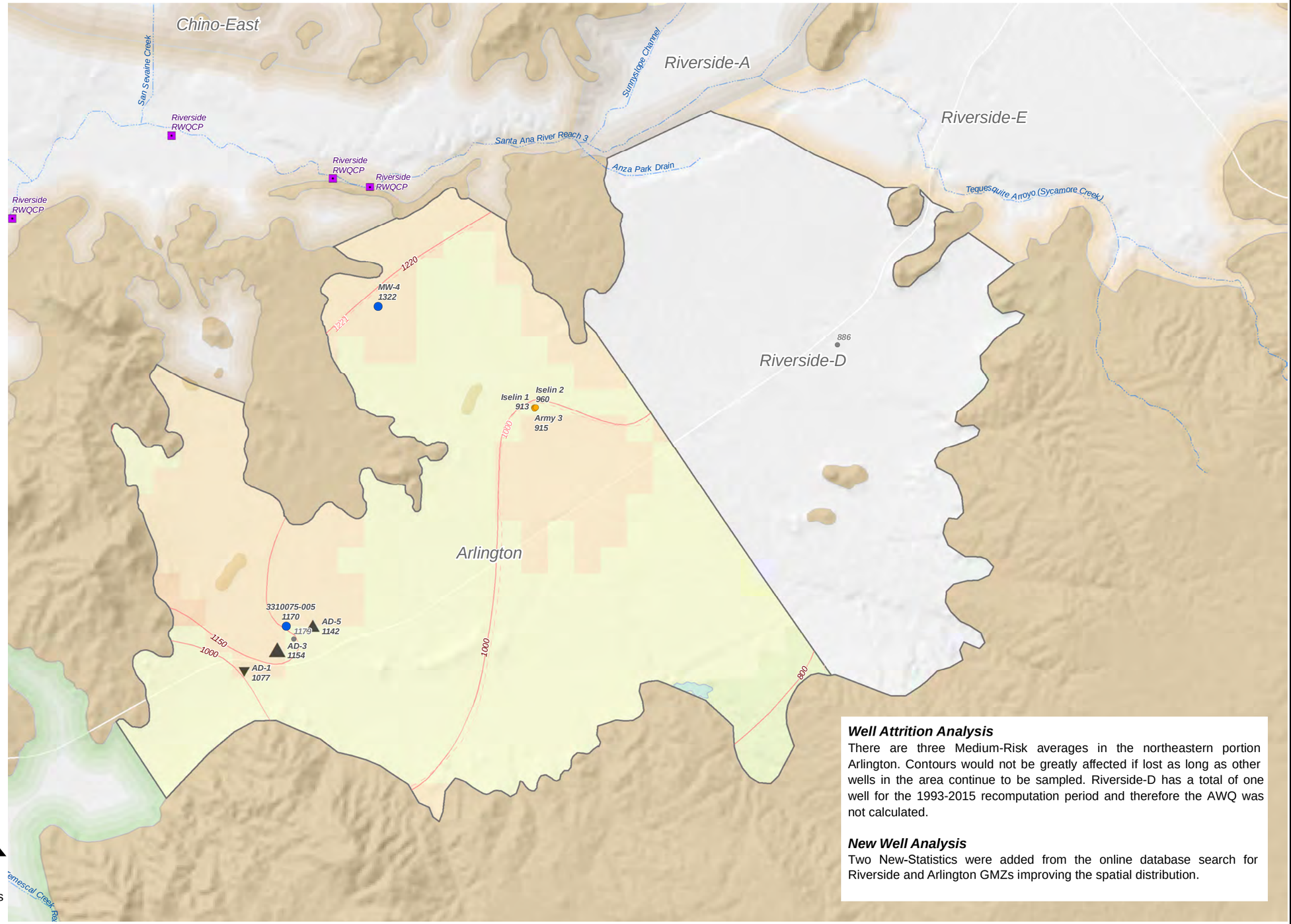
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are three Medium-Risk averages in the northeastern portion Arlington. Contours would not be greatly affected if lost as long as other wells in the area continue to be sampled. Riverside-D has a total of one well for the 1993-2015 recomputation period and therefore the AWQ was not calculated.

New Well Analysis

Two New-Statistics were added from the online database search for Riverside and Arlington GMZs improving the spatial distribution.

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Arlington and Riverside-D GMZs

Attachment B1-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

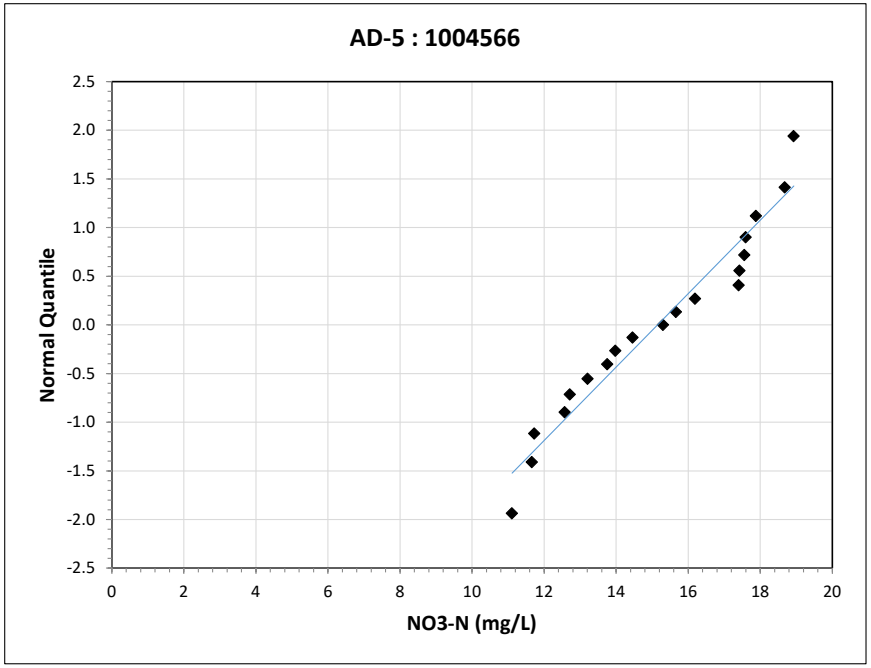
Mann-Kendall

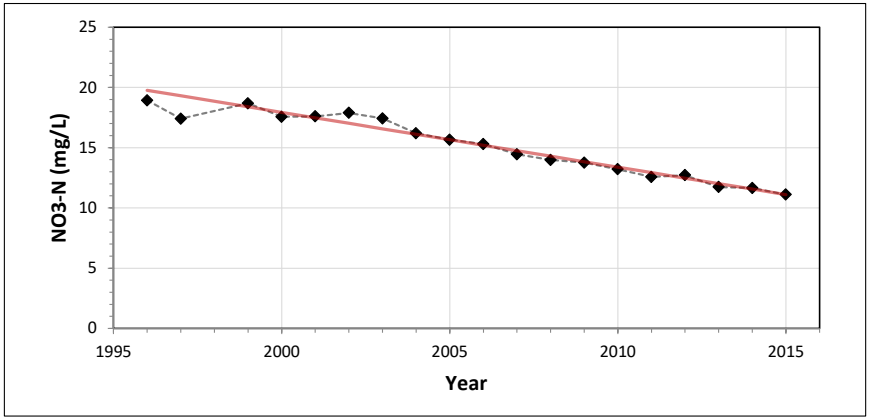
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

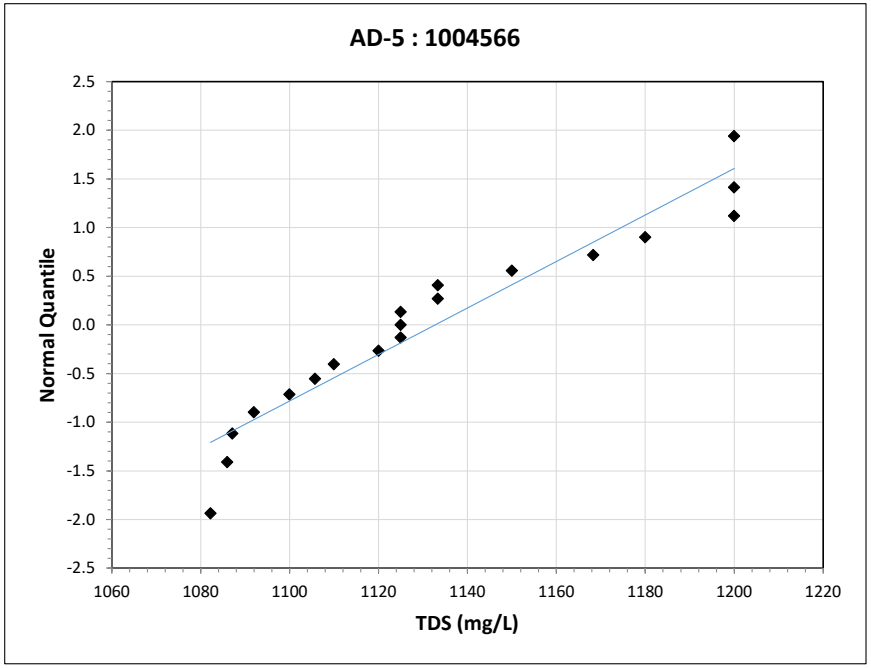
The significance of the trends is notated by * for significant and ** for very significant.

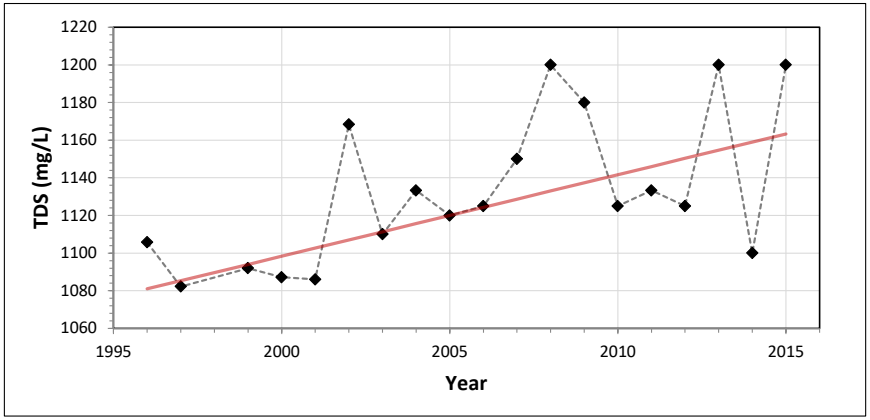
Statistics	
GMZ	Arlington
Well Name : ID	AD-5 : 1004566
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	11.11
Annual Average Max	18.93
Annual Average Mean	15.15
Annual Average Stdev	2.56
Shapiro-Wilk W	0.931
Shapiro-Wilk p-value	0.183
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.59
Student t	1.02
Mean + t*SE (UCL84)	15.75
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-153
Var(S)	817
Intercept	928
Slope	-0.46
p-value	1E-7
Significant Trend?	Decreasing**



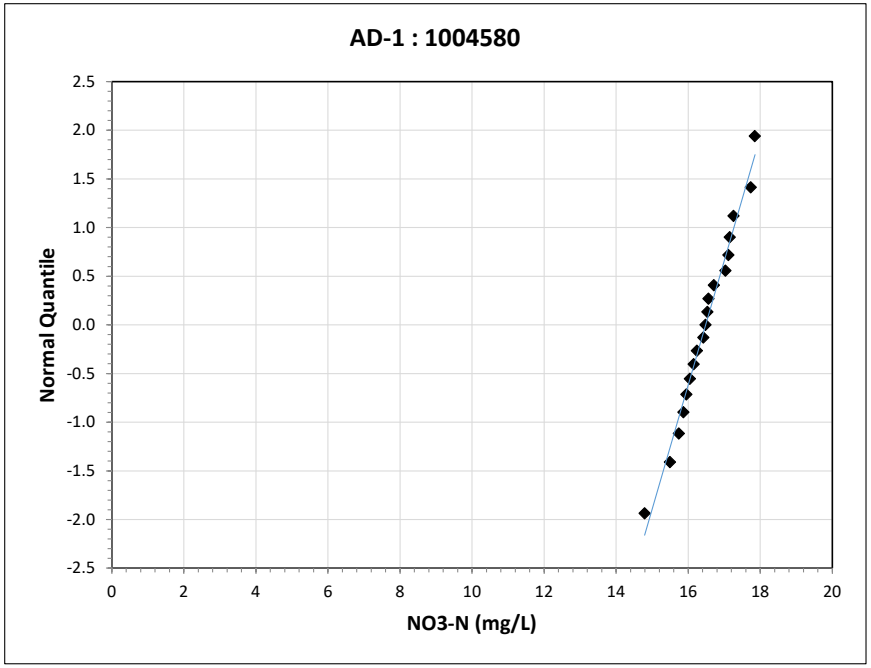


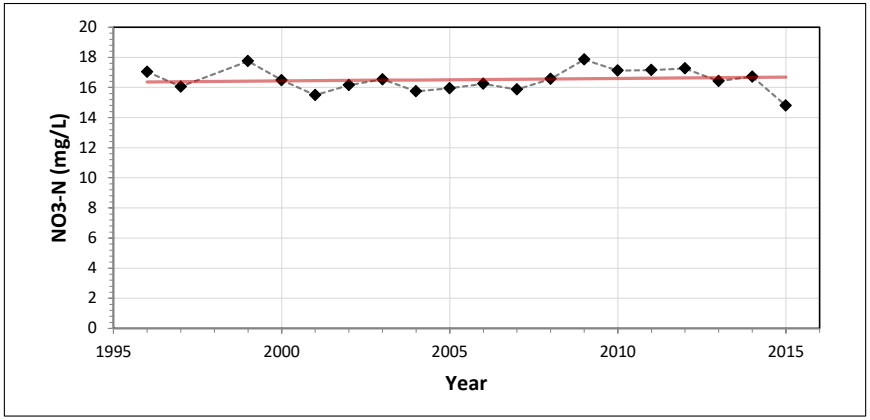
Statistics	
GMZ	Arlington
Well Name : ID	AD-5 : 1004566
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1082
Annual Average Max	1200
Annual Average Mean	1133
Annual Average Stdev	39.80
Shapiro-Wilk W	0.901
Shapiro-Wilk p-value	0.051
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.13
Student t	1.02
Mean + t*SE (UCL84)	1142
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	78
Var(S)	809
Intercept	-7568
Slope	4.33
p-value	0.007
Significant Trend?	Increasing*



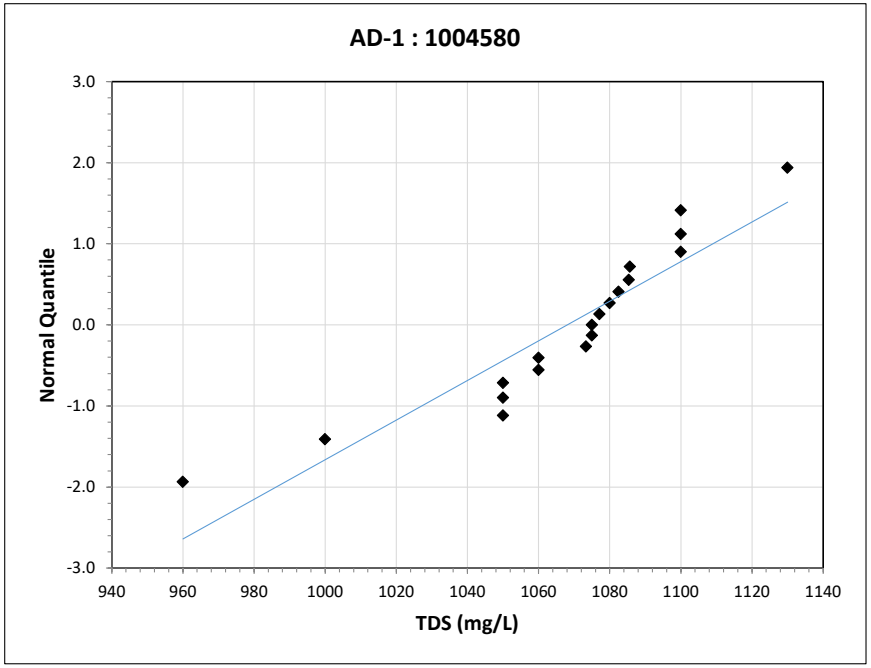


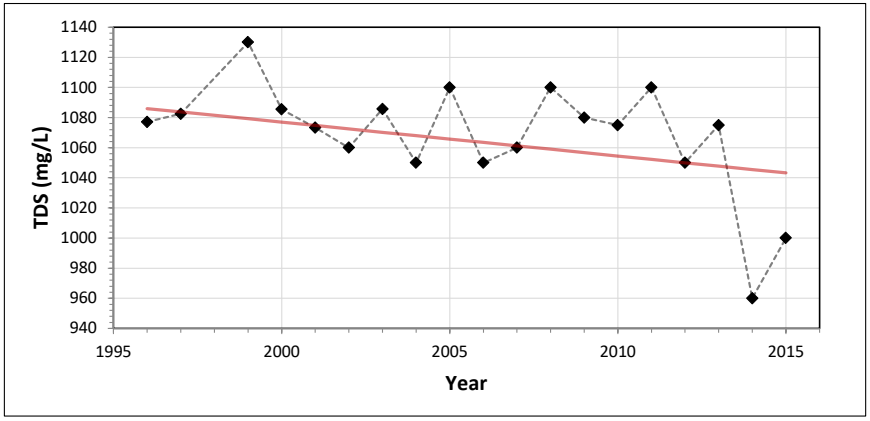
Statistics	
GMZ	Arlington
Well Name : ID	AD-1 : 1004580
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	14.80
Annual Average Max	17.86
Annual Average Mean	16.49
Annual Average Stdev	0.77
Shapiro-Wilk W	0.984
Shapiro-Wilk p-value	0.979
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.02
Mean + t*SE (UCL84)	16.67
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	17
Var(S)	817
Intercept	-17.10
Slope	0.02
p-value	0.576
Significant Trend?	No



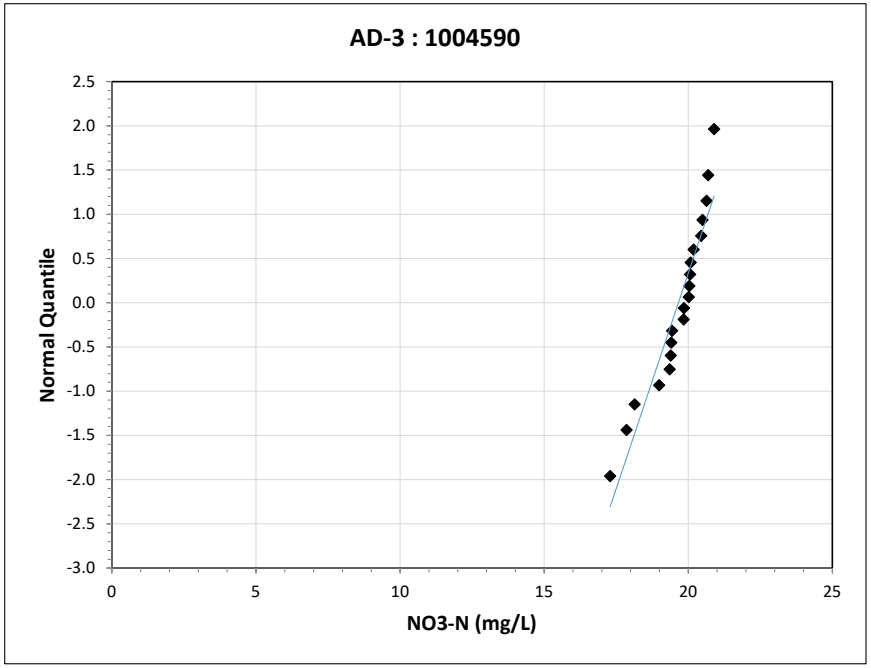


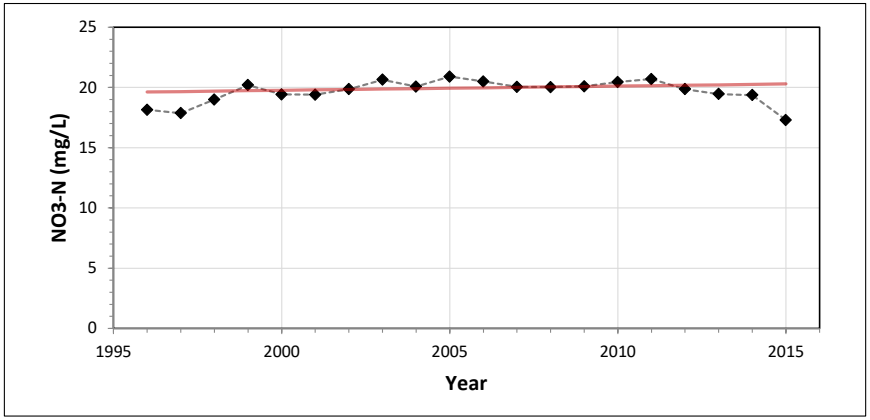
Statistics	
GMZ	Arlington
Well Name : ID	AD-1 : 1004580
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	960
Annual Average Max	1130
Annual Average Mean	1068
Annual Average Stdev	37.63
Shapiro-Wilk W	0.869
Shapiro-Wilk p-value	0.014
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.63
Student t	1.02
Mean + t*SE (UCL84)	1077
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-49
Var(S)	808
Intercept	5577
Slope	-2.25
p-value	0.091
Significant Trend?	Decreasing



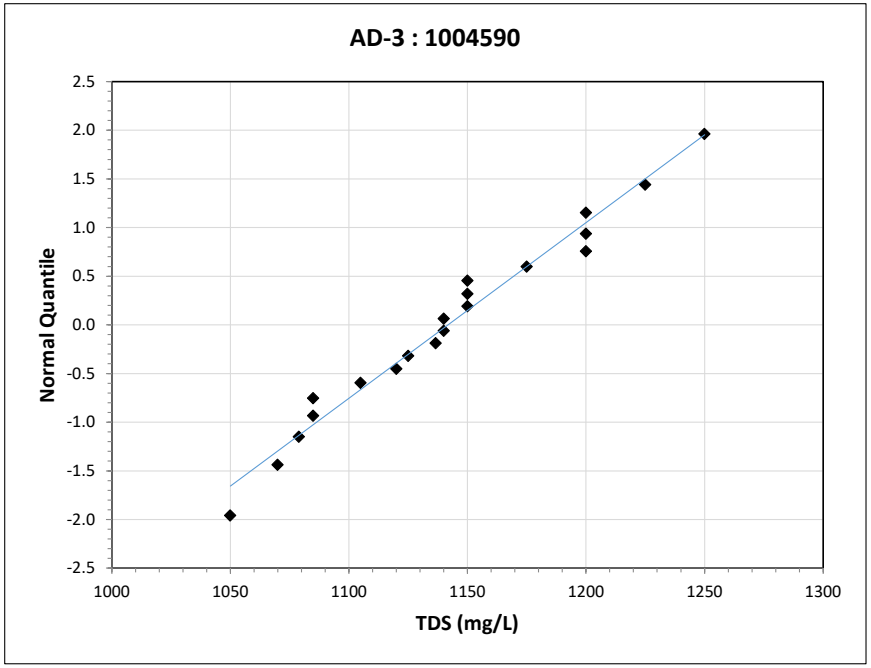


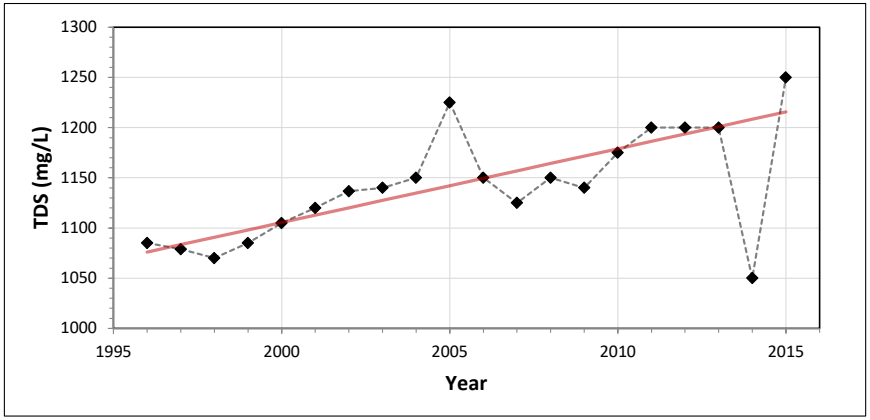
Statistics	
GMZ	Arlington
Well Name : ID	AD-3 : 1004590
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	17.30
Annual Average Max	20.90
Annual Average Mean	19.66
Annual Average Stdev	0.97
Shapiro-Wilk W	0.895
Shapiro-Wilk p-value	0.034
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.22
Student t	1.02
Mean + t*SE (UCL84)	19.89
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	20
Var(S)	950
Intercept	-50.49
Slope	0.04
p-value	0.538
Significant Trend?	No





Statistics	
GMZ	Arlington
Well Name : ID	AD-3 : 1004590
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1050
Annual Average Max	1250
Annual Average Mean	1142
Annual Average Stdev	54.40
Shapiro-Wilk W	0.970
Shapiro-Wilk p-value	0.763
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.16
Student t	1.02
Mean + t*SE (UCL84)	1154
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	110
Var(S)	941
Intercept	-13595
Slope	7.35
p-value	4E-4
Significant Trend?	Increasing**





Attachment B2

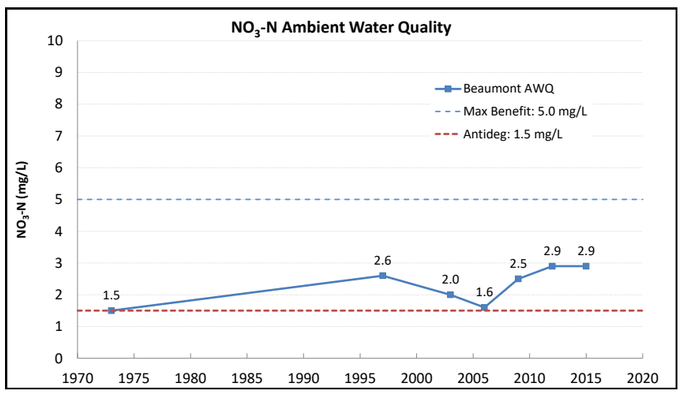
Beaumont GMZ

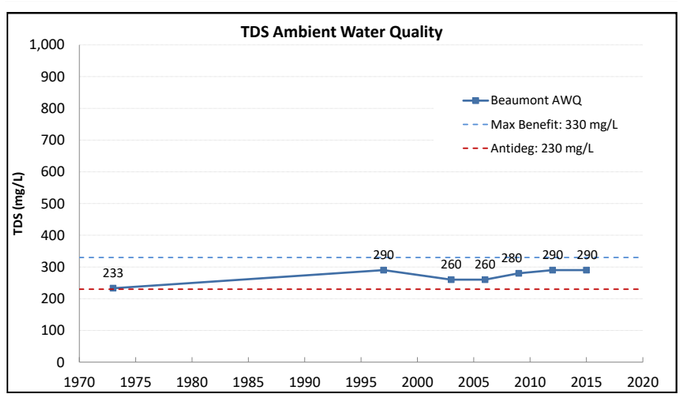
Attachment Contents:

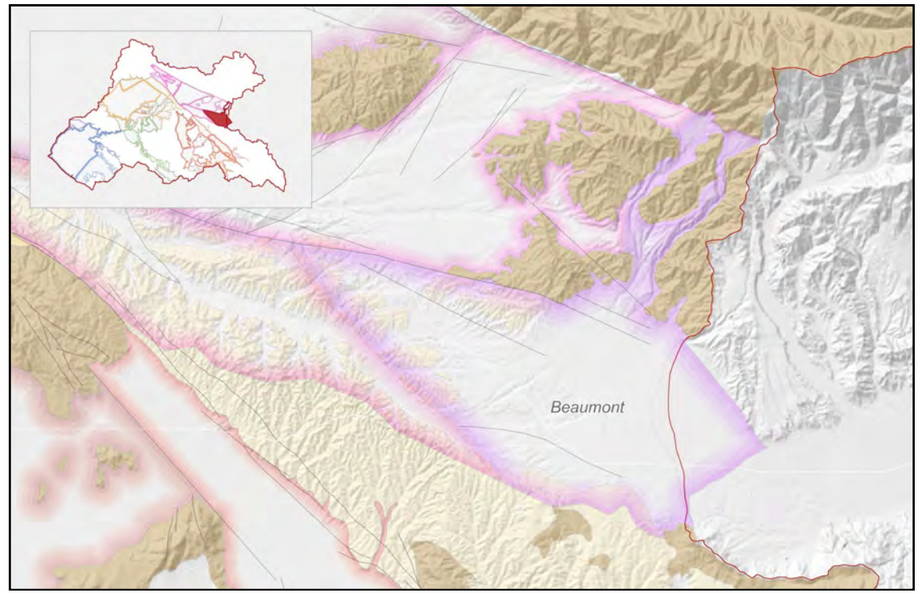
B2-1 Groundwater Storage and Elevation Contours Fall 2015
B2-2 NO_3-N Concentration and Contour Map
B2-3 TDS Concentration and Contour Map
B2-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B2-5 TDS Concentration Change (1993-2012 to 1996-2015)
B2-6 Key Well Analysis Charts

	Basin Analytics	Beaumont
Basin	GMZ Area (acres)	27,200
	Volume of Storage (acre-ft)	1,240,000
NO_3-N	Wells per GMZ	96
	Pont Statistics per GMZ	66
	Total Mass (tons)	4,910
	1996-2015 AWQ	2.9
TDS	Wells per GMZ	99
	Point Statistics per GMZ	61
	Total Mass (tons)	490,000
	1996-2015 AWQ	290

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Beaumont "max benefit" is 5.0 mg/L and for Beaumont "antideg" is 1.5 mg/L. The ambient nitrate concentration was unchanged from 2.9 mg/L in 2012 to 2.9 mg/L in 2015, allowing for 2.1 mg/L of assimilative capacity. One out of the six key wells in Beaumont GMZ have an increasing trend in nitrate concentrations, while the other five wells show no trends in the NITRATE concentrations. Three of the total 96 wells with nitrate values in Beaumont will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Four new wells with statistics were added to the 1996 to 2015 AWQ recomputation and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells is sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

The TDS objective for Beaumont "max benefit" is 330 mg/L and for Beaumont "antideg" is 230 mg/L. The ambient TDS concentration was unchanged from 290 mg/L in 2012 to 290 mg/L in 2015, allowing for 40 mg/L of assimilative capacity. The six key interpretive wells in Beaumont GMZ show no trend in TDS concentrations. Three of the total 99 wells with TDS values in Beaumont will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Four new wells with statistics were added to the 1996 to 2015 AWQ recomputation and three wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (2016-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Beaumont	1002901	BCVWD 11	1.3	No Trend	253	No Trend
Beaumont	1002938	BCVWD 16	4.5	Increasing**	334	No Trend
Beaumont	1003058	YVWD 35	7.3	No Trend	353	No Trend
Beaumont	1003063	YVWD 48	2.0	No Trend	210	No Trend
Beaumont	1004351	BCVWD 01	1.0	No Trend	250	No Trend
Beaumont	1208432	Ranch Well	11.0	No Trend	688	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B2-4 and B2-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Beaumont	1002898	BCVWD 09	High	3	1.6	Stat	High	2	217	Ave
Beaumont	1002900	YVWD 62	Medium	2	2.2	Ave	Medium	1	226	Ave
Beaumont	1002933	1	--	5	8.1	Stat	Medium	2	270	Ave
Beaumont	1002939	NA_1002939	--	8	2.1	Stat	Medium	2	325	Ave
Beaumont	1002965	NA_1002965	--	--	--	--	Medium	1	249	Ave
Beaumont	1003034	SMWC 2ND NO. 4 WELL	--	6	2.0	Ave	Medium	3	179	Stat
Beaumont	1003059	YVWD 34	Medium	1	5.0	Ave	--	2	356	Ave
Beaumont	1007015	7	High	1	2.0	Ave	--	--	--	--
Beaumont	1201425	BCVWD 17	High	3	0.9	Stat	High	1	220	Ave
Beaumont	1201426	YVWD 63	Medium	2	2.5	Ave	Medium	1	256	Ave
Beaumont	1207014	NA_1207014	Medium	1	0.5	Ave	Medium	1	210	Ave
Beaumont	1207760	335651116590901	--	--	--	--	High	1	223	Ave
Beaumont	1207836	335838116582503	Medium	1	0.1	Ave	--	--	--	--
Beaumont	1207837	335838116582504	Medium	1	2.3	Ave	--	--	--	--
Beaumont	1207844	335840116581702	Medium	1	2.1	Ave	Medium	2	229	Ave
Beaumont	1207848	335840116581706	Medium	2	2.3	Ave	Medium	1	244	Ave
Beaumont	1207860	335902116580901	--	--	--	--	Medium	1	856	Ave
Beaumont	1207861	335903116580902	--	--	--	--	Medium	1	363	Ave
Beaumont	1207863	335903116581001	--	--	--	--	Medium	1	231	Ave
Beaumont	1207866	335903116581004	--	--	--	--	Medium	1	840	Ave
Beaumont	1207869	335907116580801	--	--	--	--	Medium	2	345	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

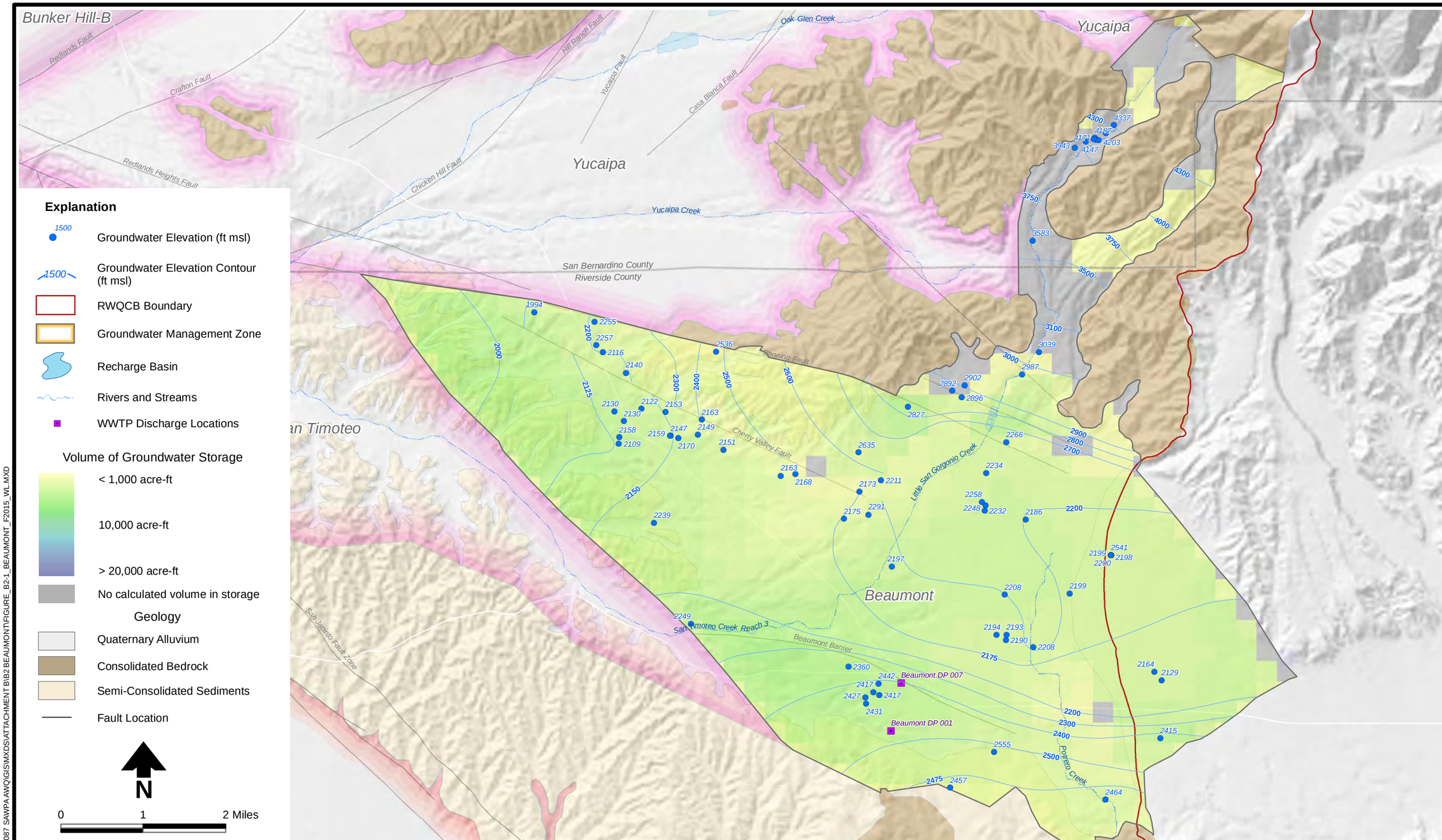
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B2-4 and B2-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Beaumont	1232662	OBMW-1	New	3	11.8	Stat	New	3	693	Stat
Beaumont	1232663	OBMW-2	New	3	15.4	Stat	New	3	679	Stat
Beaumont	1232664	OBMW-3	New	3	10.2	Stat	New	3	452	Stat
Beaumont	1232665	OBMW-4	New	3	12.6	Stat	New	3	635	Stat
Beaumont	1206892	NA_1206892	--	2	3.8	Ave	New*	2	256	Ave
Beaumont	1207012	E236b	--	2	20.2	Ave	New*	2	598	Ave
Beaumont	2000166	332909	New*	1	9.2	Ave	New*	1	920	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B2-4 and B2-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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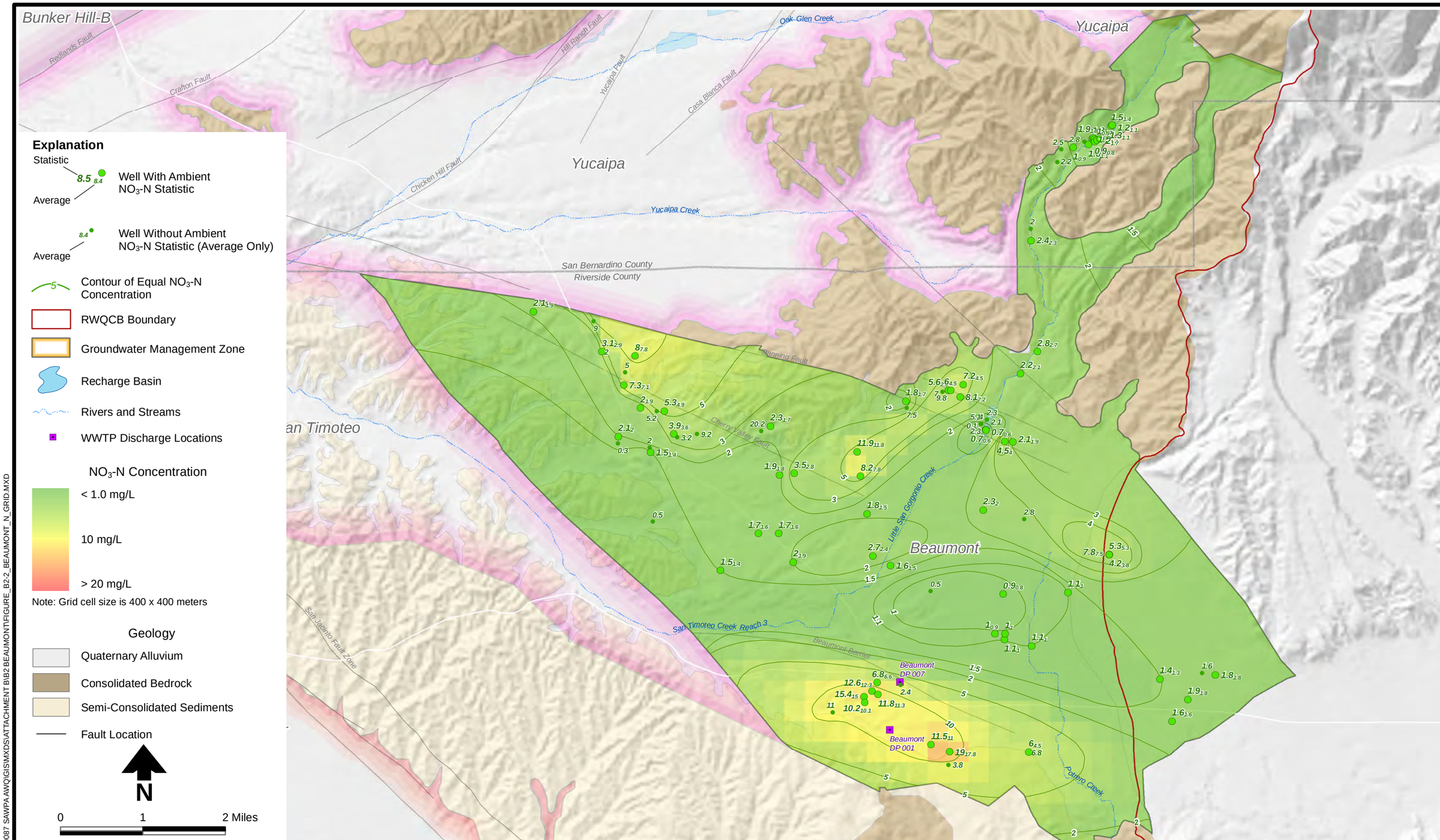
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Beaumont GMZ

Attachment B2-1



Source: SAWPA.net, January 2017

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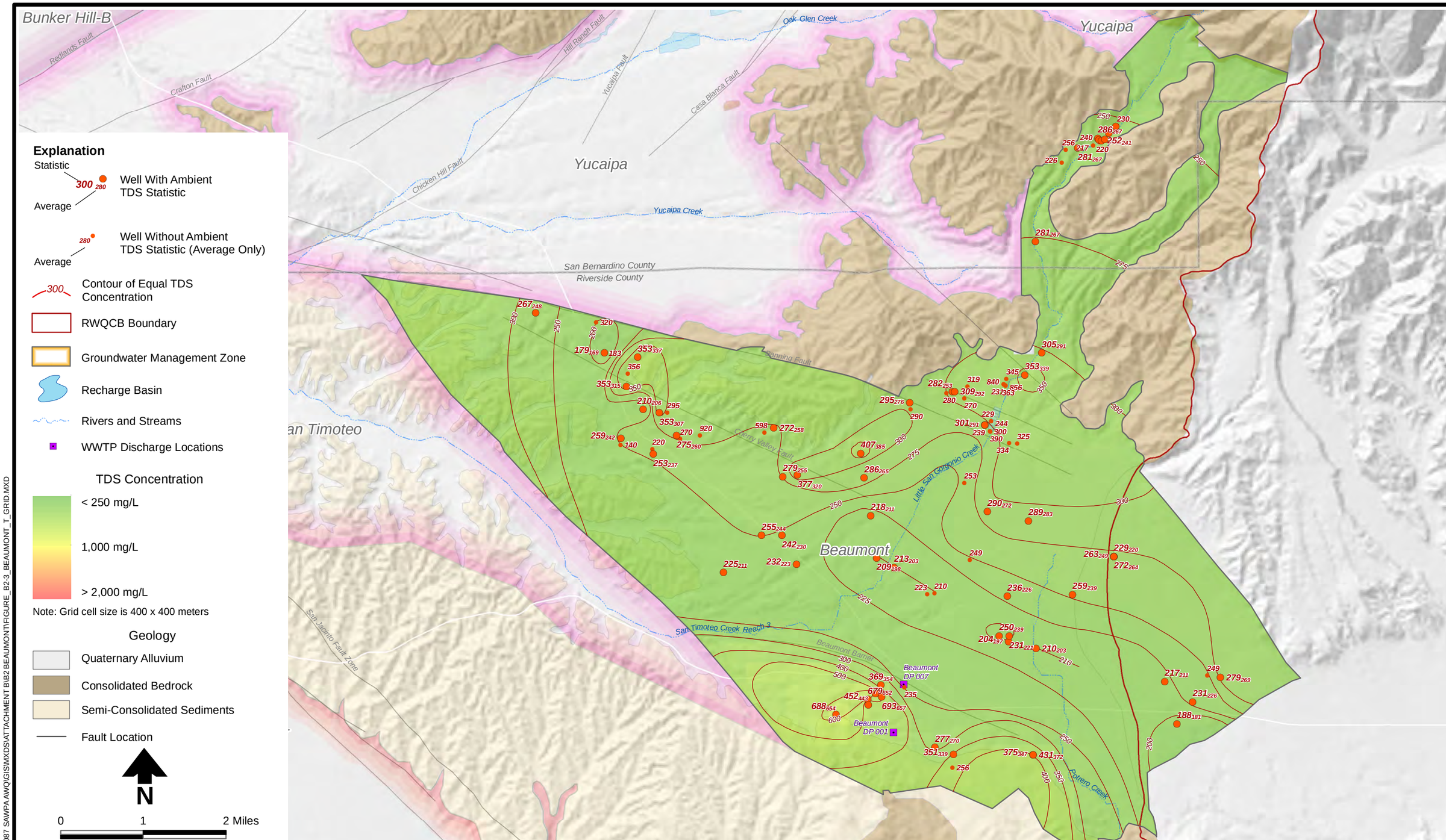
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Beaumont GMZ

Attachment B2-2



Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Beaumont GMZ

Attachment B2-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

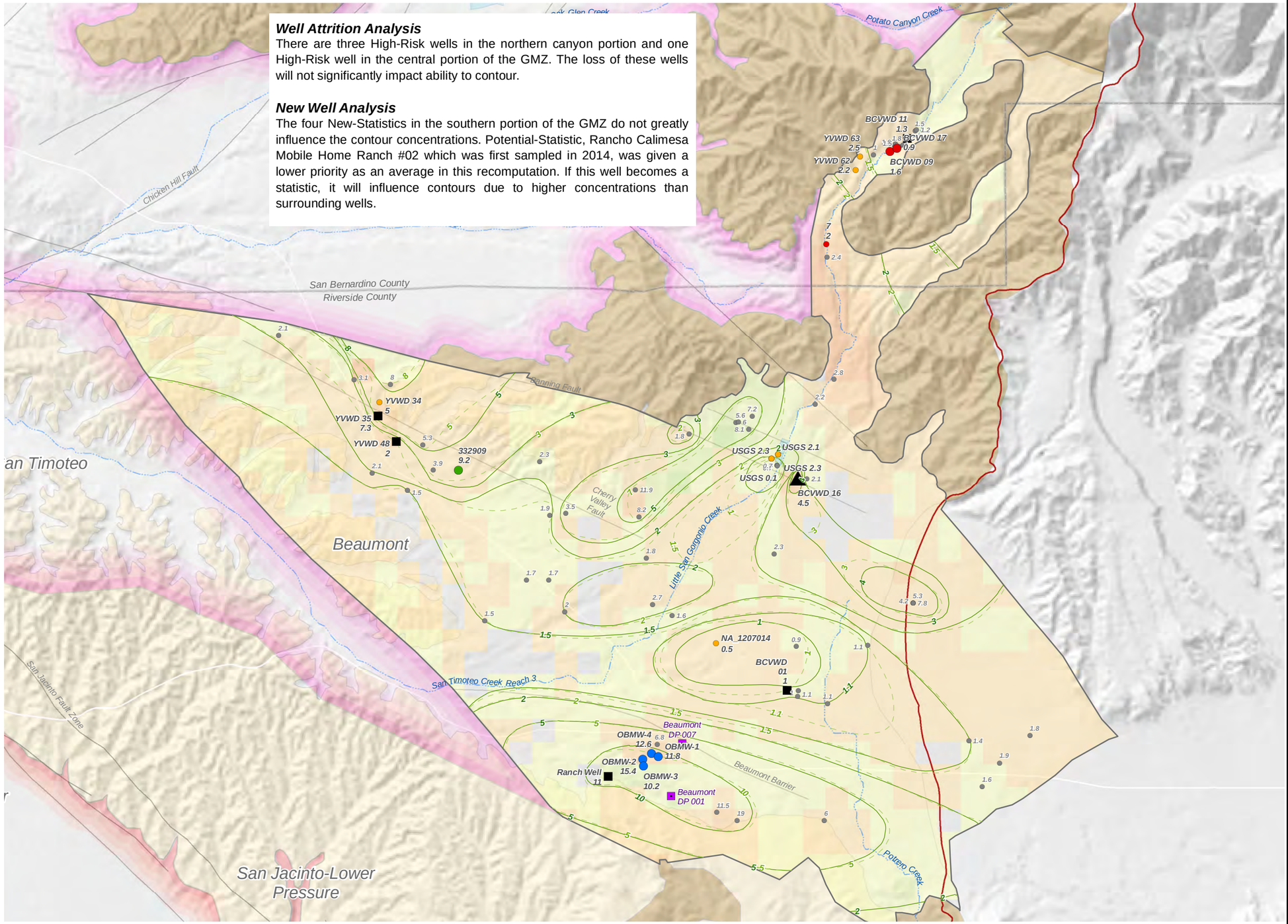
Source: SAWPA.net, January 2017

Well Attrition Analysis

There are three High-Risk wells in the northern canyon portion and one High-Risk well in the central portion of the GMZ. The loss of these wells will not significantly impact ability to contour.

New Well Analysis

The four New-Statistics in the southern portion of the GMZ do not greatly influence the contour concentrations. Potential-Statistic, Rancho Calimesa Mobile Home Ranch #02 which was first sampled in 2014, was given a lower priority as an average in this recomputation. If this well becomes a statistic, it will influence contours due to higher concentrations than surrounding wells.



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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Beaumont GMZ

Attachment B2-4

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B2 BEAUMONT\FIGURE_B2-4_BEAUMONT_N_CHANGE.MXD

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

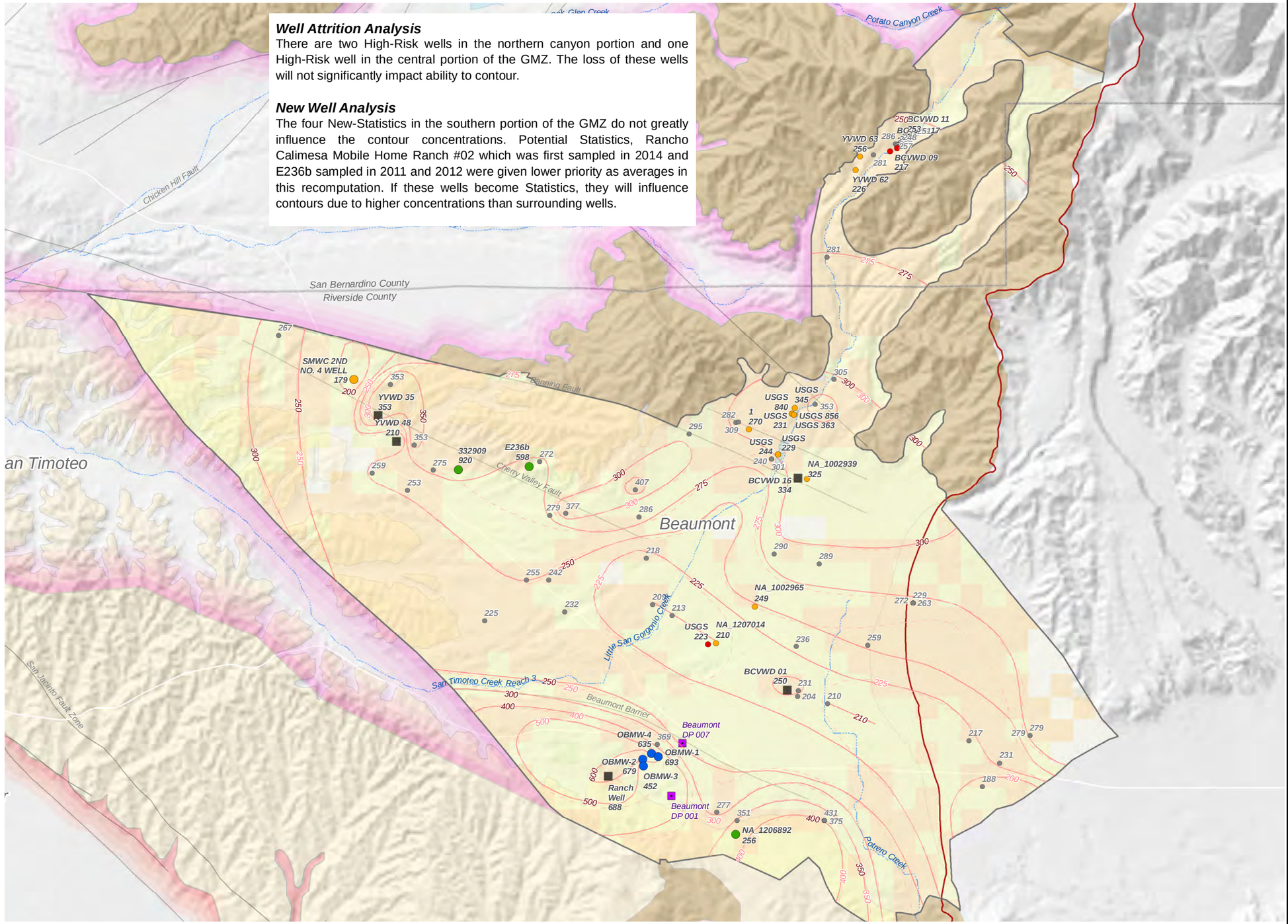
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are two High-Risk wells in the northern canyon portion and one High-Risk well in the central portion of the GMZ. The loss of these wells will not significantly impact ability to contour.

New Well Analysis

The four New-Statistics in the southern portion of the GMZ do not greatly influence the contour concentrations. Potential Statistics, Rancho Calimesa Mobile Home Ranch #02 which was first sampled in 2014 and E236b sampled in 2011 and 2012 were given lower priority as averages in this recomputation. If these wells become Statistics, they will influence contours due to higher concentrations than surrounding wells.

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Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Beaumont GMZ

Attachment B2-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

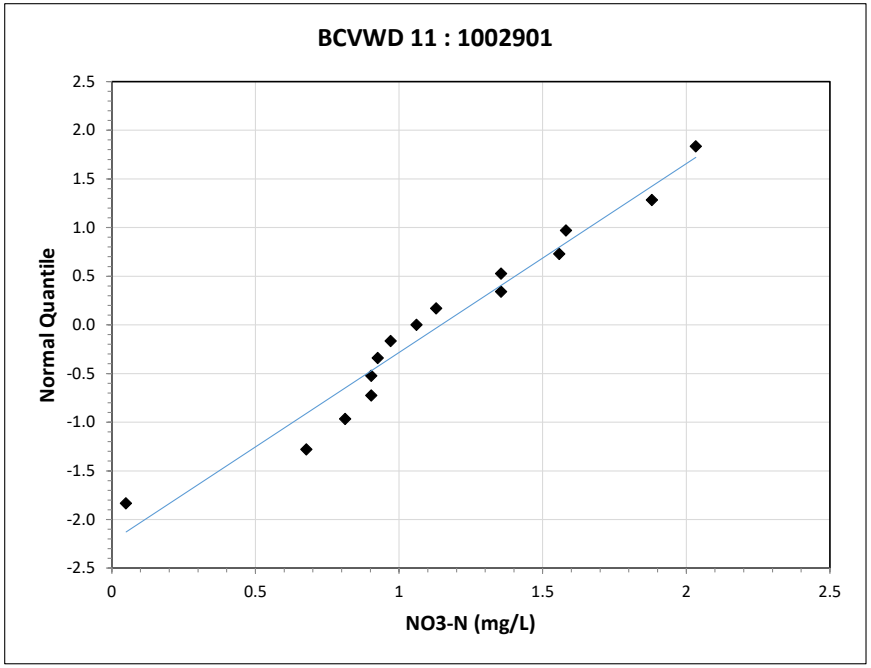
Mann-Kendall

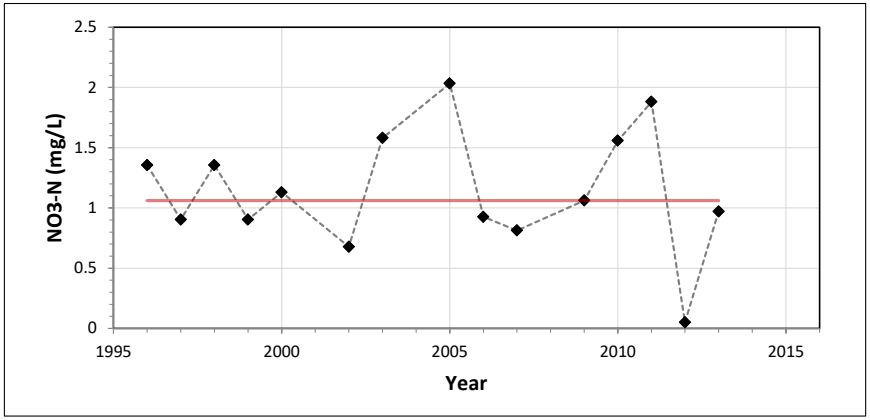
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

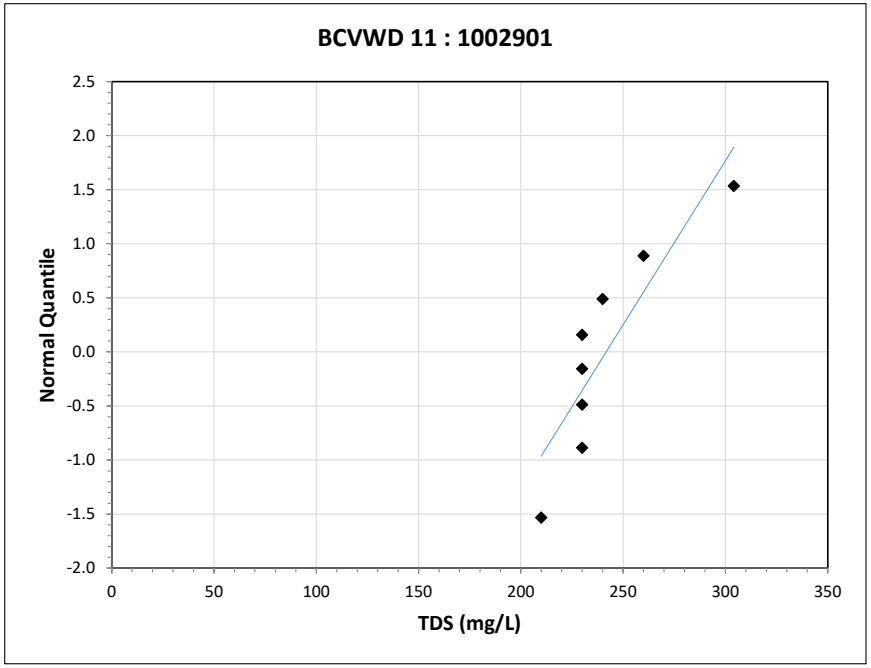
The significance of the trends is notated by * for significant and ** for very significant.

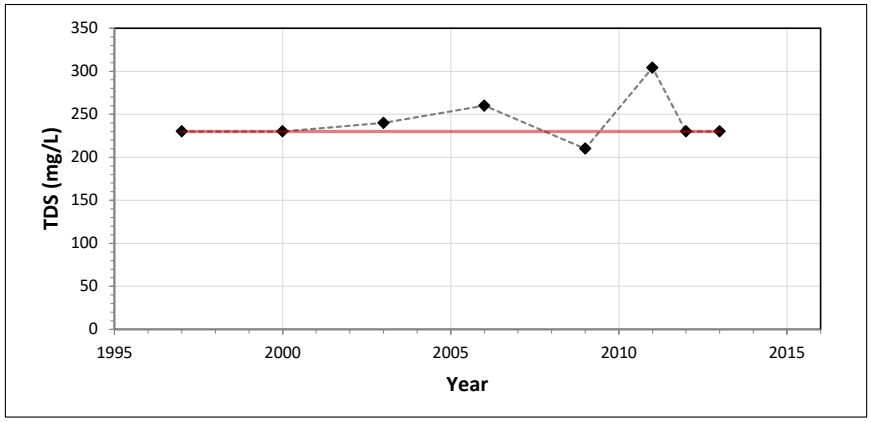
Statistics	
GMZ	Beaumont
Well Name : ID	BCVWD 11 : 1002901
Analyte	NO3-N (mg/L)
Count	15
Count Detects	14
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	0.05
Annual Average Max	2.03
Annual Average Mean	1.15
Annual Average Stdev	0.50
Shapiro-Wilk W	0.964
Shapiro-Wilk p-value	0.767
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.13
Student t	1.03
Mean + t*SE (UCL84)	1.28
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-1
Var(S)	406
Intercept	1.06
Slope	0.00
p-value	NC
Significant Trend?	No



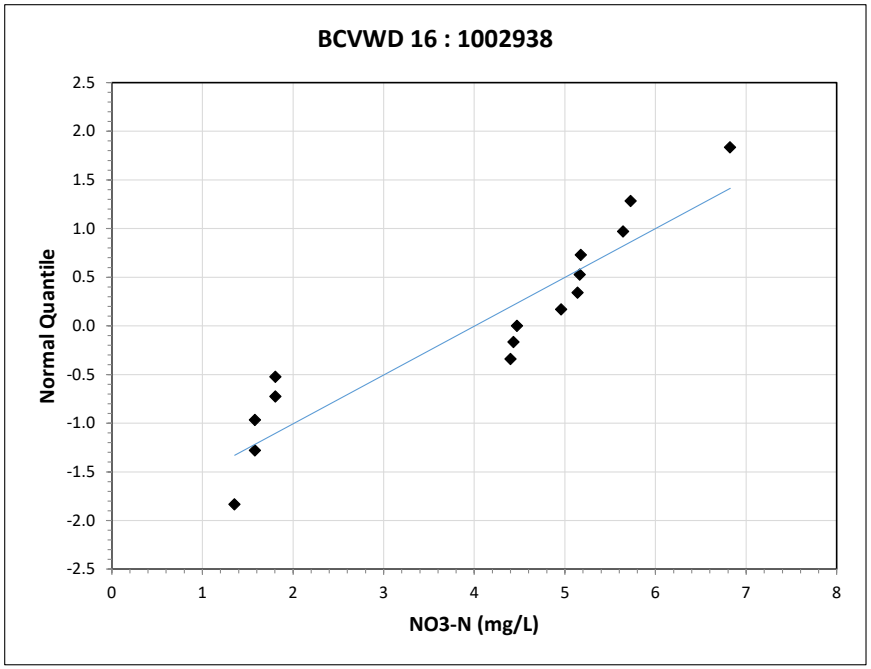


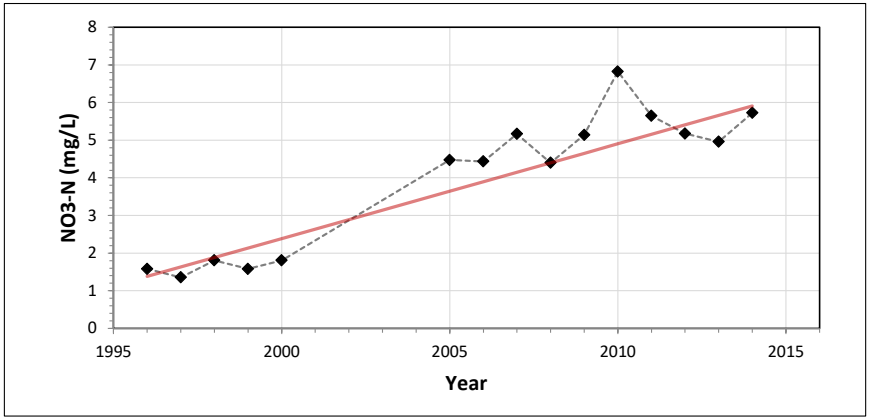
Statistics	
GMZ	Beaumont
Well Name : ID	BCVWD 11 : 1002901
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1997
Sample Year Max	2013
Annual Average Min	210
Annual Average Max	304
Annual Average Mean	242
Annual Average Stdev	28.77
Shapiro-Wilk W	0.803
Shapiro-Wilk p-value	0.031
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	10.17
Student t	1.07
Mean + t*SE (UCL84)	253
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	2
Var(S)	56.67
Intercept	230
Slope	0.00
p-value	NC
Significant Trend?	No



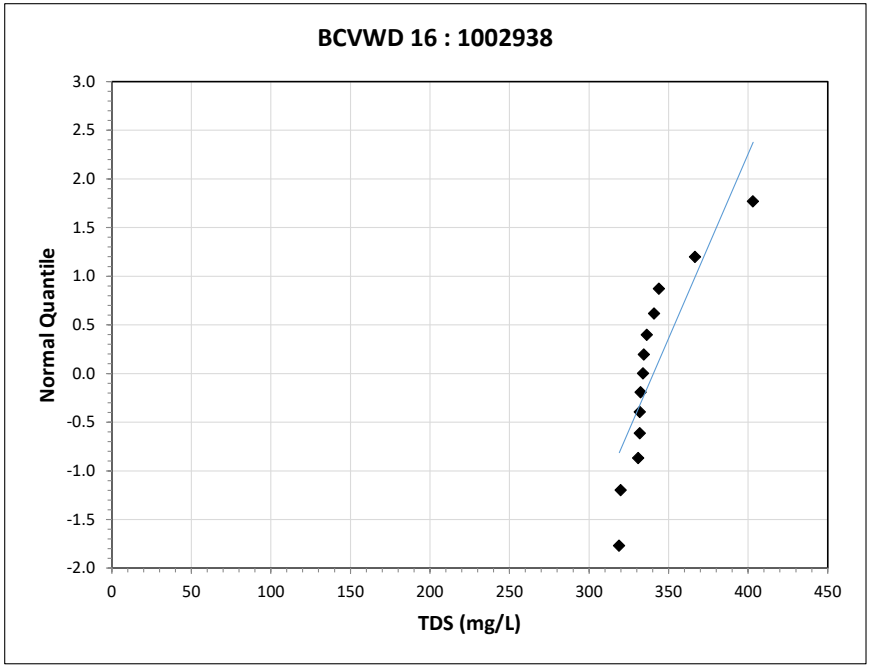


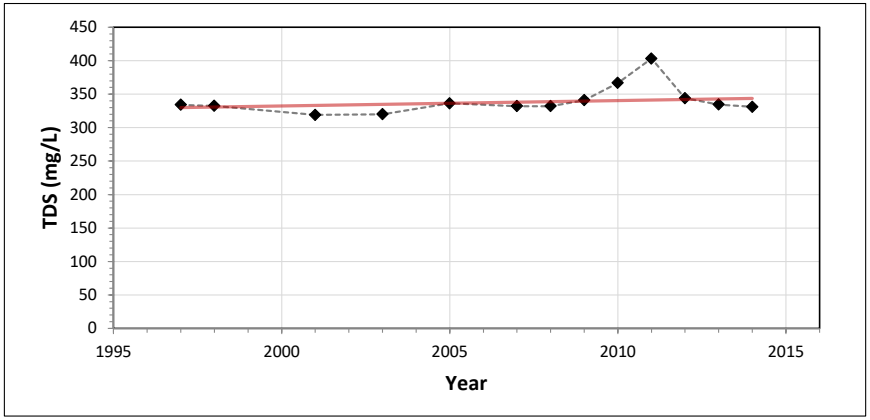
Statistics	
GMZ	Beaumont
Well Name : ID	BCVWD 16 : 1002938
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	1.36
Annual Average Max	6.82
Annual Average Mean	4.00
Annual Average Stdev	1.84
Shapiro-Wilk W	0.856
Shapiro-Wilk p-value	0.021
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.48
Student t	1.03
Mean + t*SE (UCL84)	4.50
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	71
Var(S)	406
Intercept	-501
Slope	0.25
p-value	5E-4
Significant Trend?	Increasing**



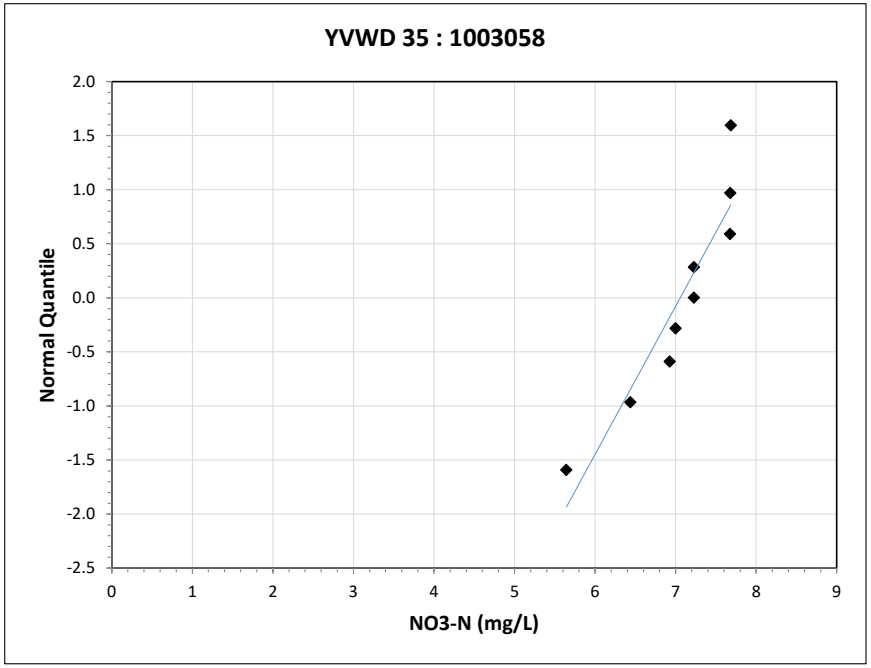


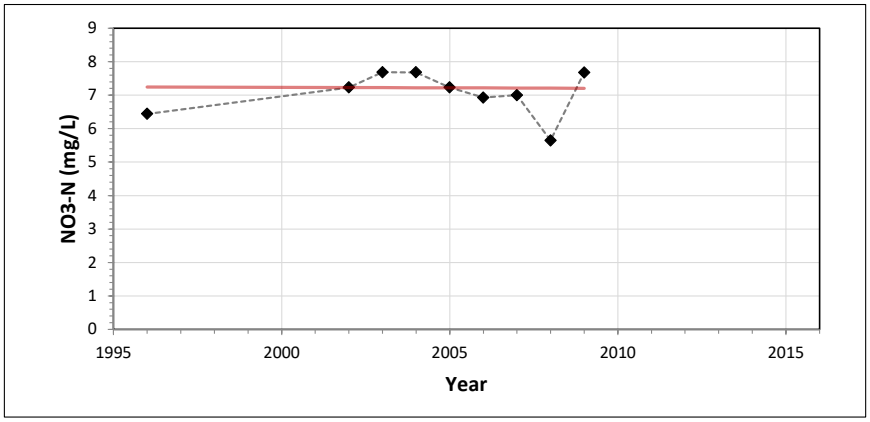
Statistics	
GMZ	Beaumont
Well Name : ID	BCVWD 16 : 1002938
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	319
Annual Average Max	403
Annual Average Mean	340
Annual Average Stdev	22.17
Shapiro-Wilk W	0.735
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	403
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	334
Trend Analysis	**Theil-Sen**
Kendall S	21
Var(S)	268
Intercept	-1262
Slope	0.80
p-value	0.222
Significant Trend?	No



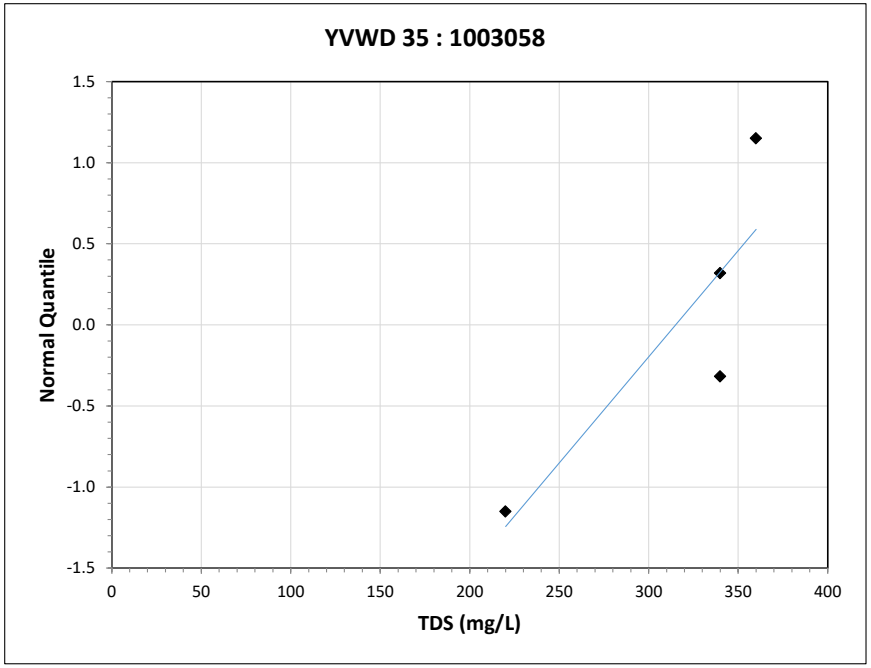


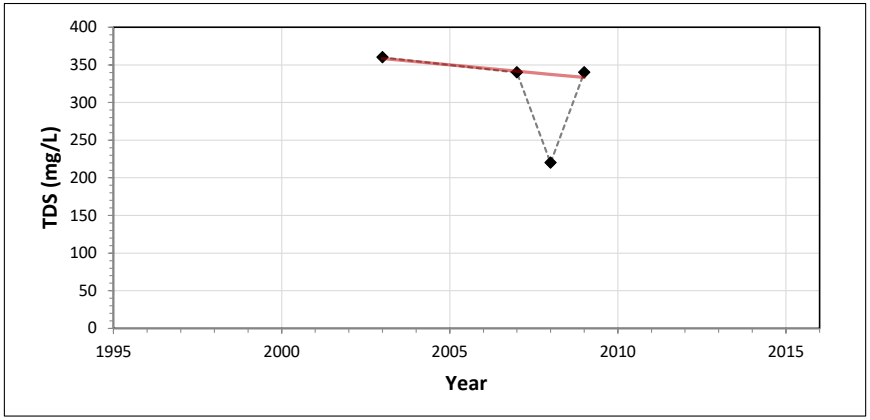
Statistics	
GMZ	Beaumont
Well Name : ID	YVWD 35 : 1003058
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	1996
Sample Year Max	2009
Annual Average Min	5.65
Annual Average Max	7.69
Annual Average Mean	7.06
Annual Average Stdev	0.67
Shapiro-Wilk W	0.869
Shapiro-Wilk p-value	0.119
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.22
Student t	1.06
Mean + t*SE (UCL84)	7.29
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	91.00
Intercept	13.42
Slope	0.00
p-value	0.675
Significant Trend?	No



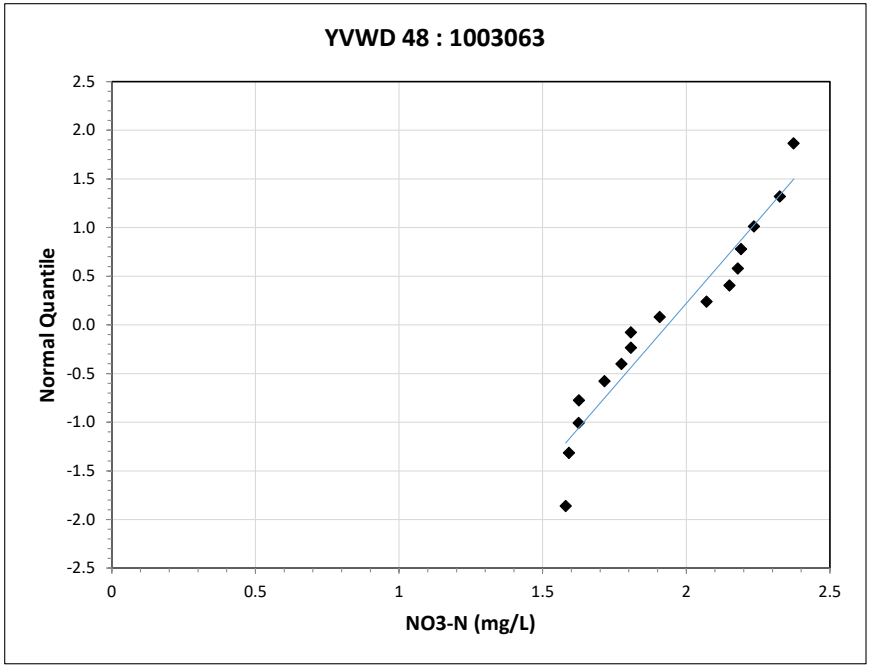


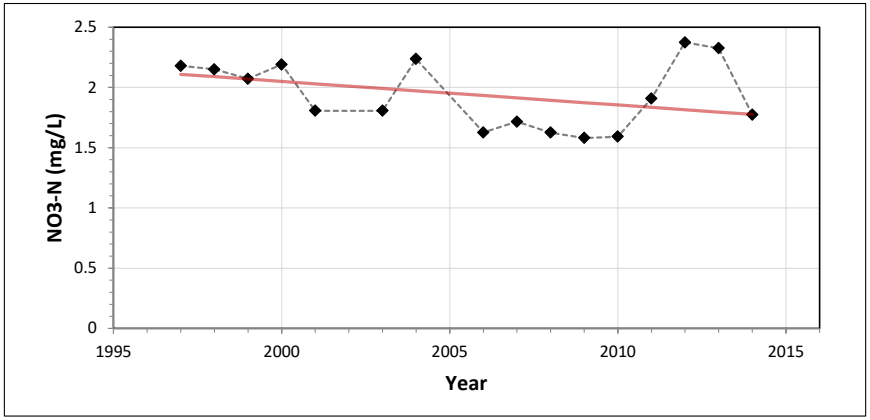
Statistics	
GMZ	Beaumont
Well Name : ID	YVWD 35 : 1003058
Analyte	TDS (mg/L)
Count	4
Count Detects	4
Sample Year Min	2003
Sample Year Max	2009
Annual Average Min	220
Annual Average Max	360
Annual Average Mean	315
Annual Average Stdev	64.03
Shapiro-Wilk W	0.753
Shapiro-Wilk p-value	0.041
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	32.02
Student t	1.19
Mean + t*SE (UCL84)	353
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	7.67
Intercept	8704
Slope	-4.17
p-value	0.470
Significant Trend?	No



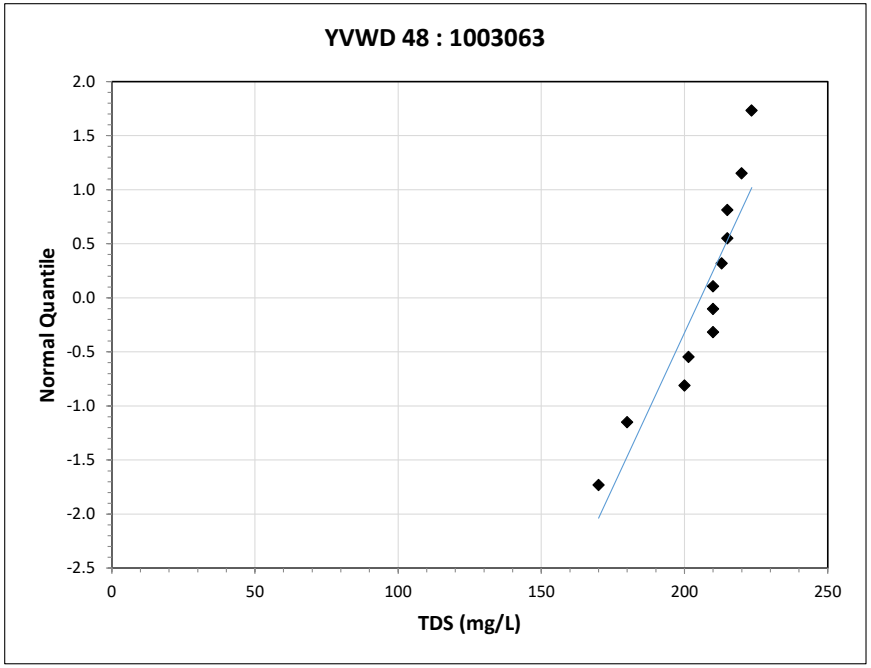


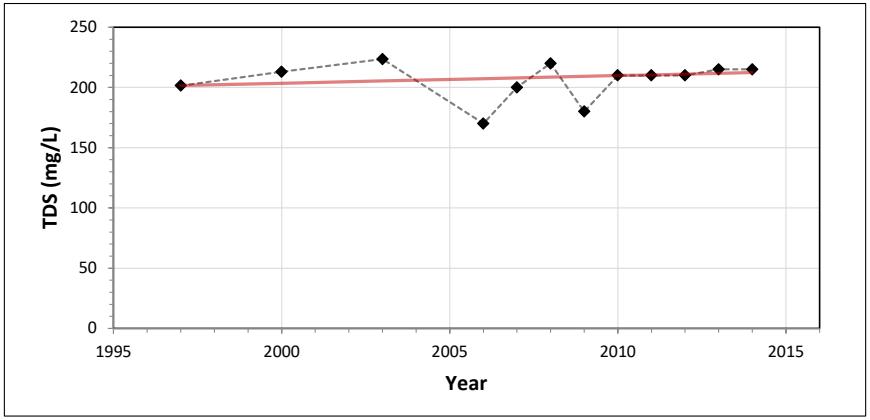
Statistics	
GMZ	Beaumont
Well Name : ID	YVWD 48 : 1003063
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	1.58
Annual Average Max	2.37
Annual Average Mean	1.94
Annual Average Stdev	0.28
Shapiro-Wilk W	0.906
Shapiro-Wilk p-value	0.100
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.07
Student t	1.03
Mean + t*SE (UCL84)	2.01
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-21
Var(S)	492
Intercept	41.25
Slope	-0.02
p-value	0.367
Significant Trend?	No



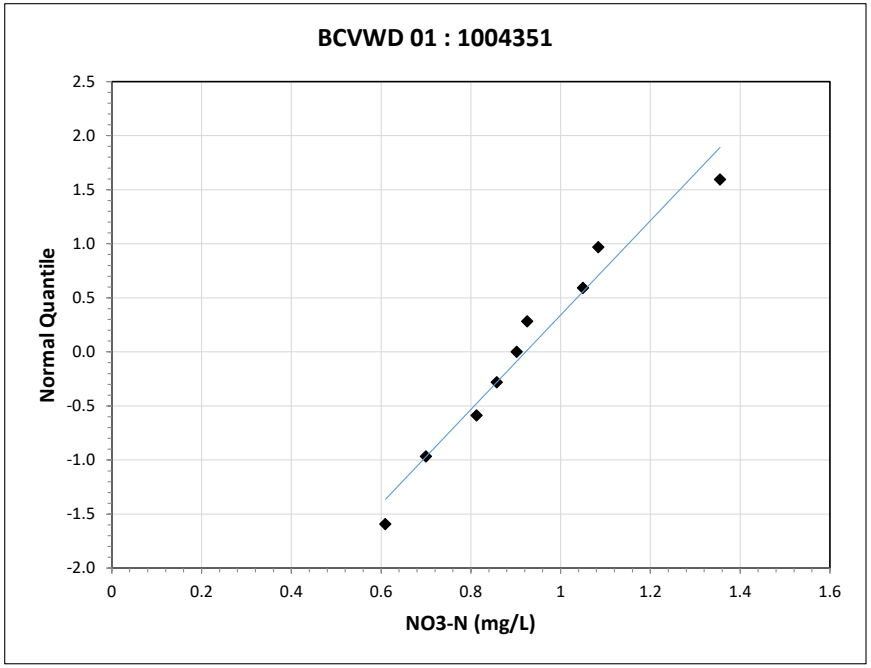


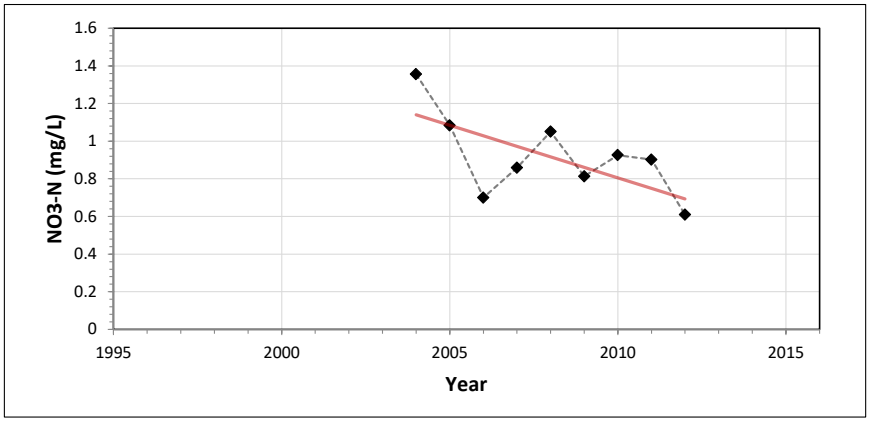
Statistics	
GMZ	Beaumont
Well Name : ID	YVWD 48 : 1003063
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	170
Annual Average Max	224
Annual Average Mean	206
Annual Average Stdev	15.92
Shapiro-Wilk W	0.845
Shapiro-Wilk p-value	0.032
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.60
Student t	1.04
Mean + t*SE (UCL84)	210
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	12
Var(S)	208
Intercept	-1057
Slope	0.63
p-value	0.446
Significant Trend?	No



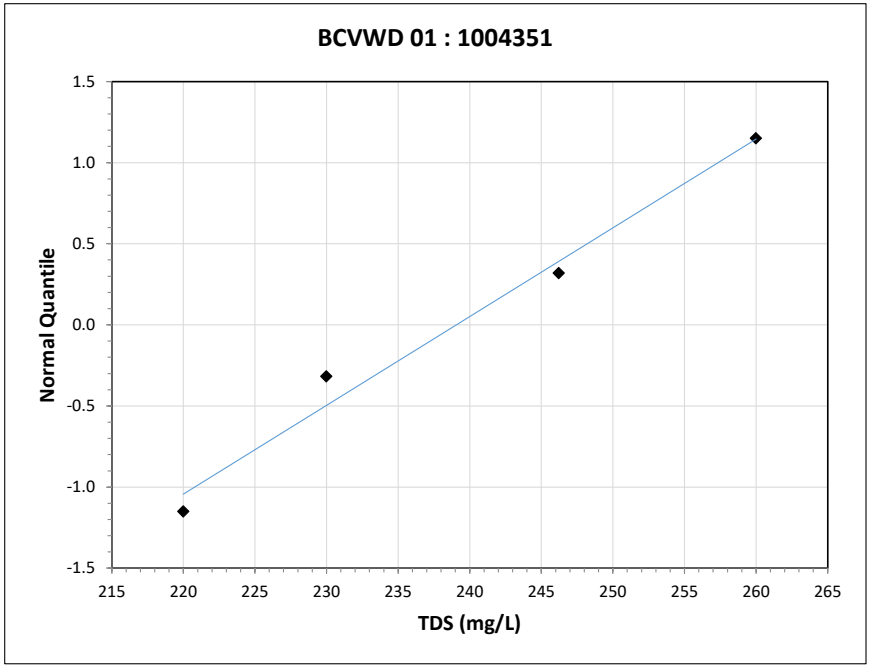


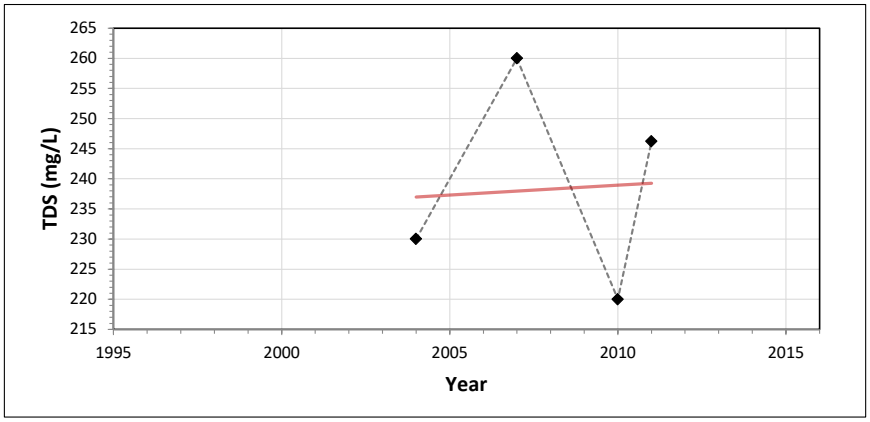
Statistics	
GMZ	Beaumont
Well Name : ID	BCVWD 01 : 1004351
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	2004
Sample Year Max	2012
Annual Average Min	0.61
Annual Average Max	1.36
Annual Average Mean	0.92
Annual Average Stdev	0.22
Shapiro-Wilk W	0.967
Shapiro-Wilk p-value	0.867
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.07
Student t	1.06
Mean + t*SE (UCL84)	1.00
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-16
Var(S)	92.00
Intercept	113
Slope	-0.06
p-value	0.118
Significant Trend?	No



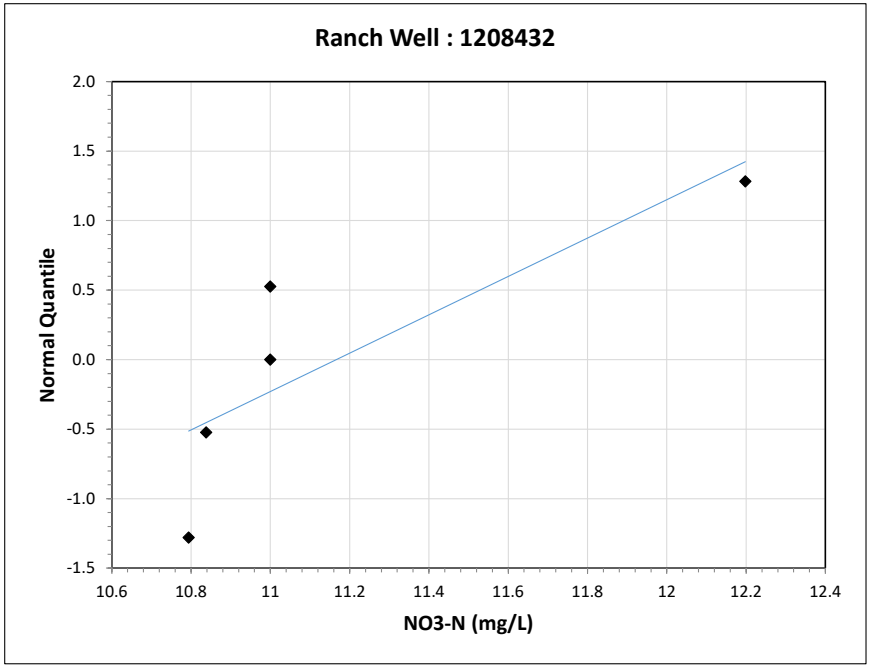


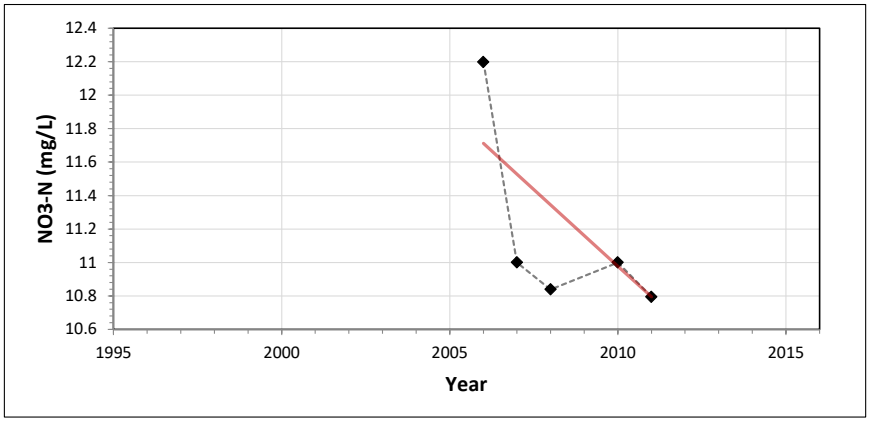
Statistics	
GMZ	Beaumont
Well Name : ID	BCVWD 01 : 1004351
Analyte	TDS (mg/L)
Count	4
Count Detects	4
Sample Year Min	2004
Sample Year Max	2011
Annual Average Min	220
Annual Average Max	260
Annual Average Mean	239
Annual Average Stdev	17.66
Shapiro-Wilk W	0.975
Shapiro-Wilk p-value	0.869
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.83
Student t	1.19
Mean + t*SE (UCL84)	250
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	8.67
Intercept	-416
Slope	0.33
p-value	1.000
Significant Trend?	No



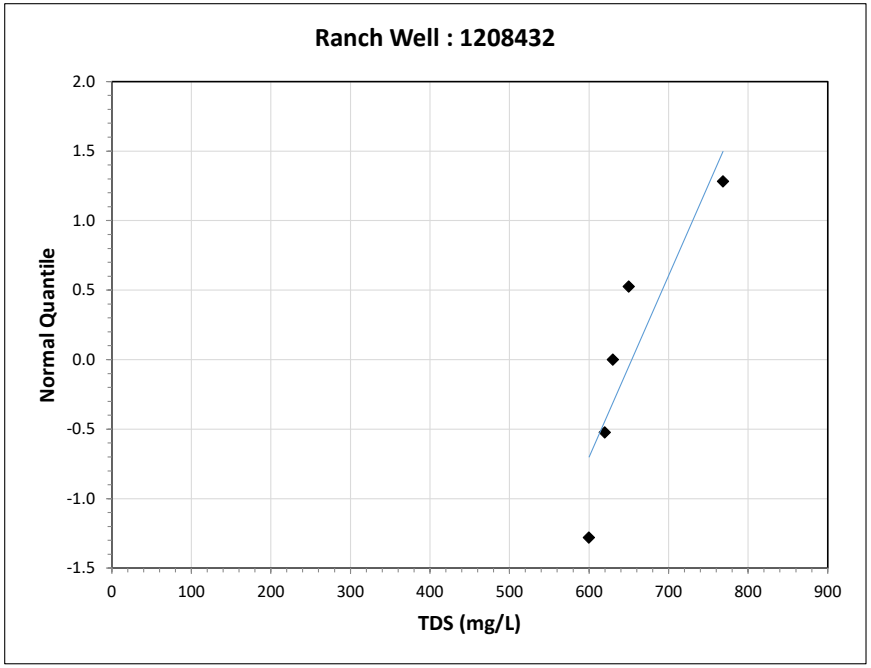


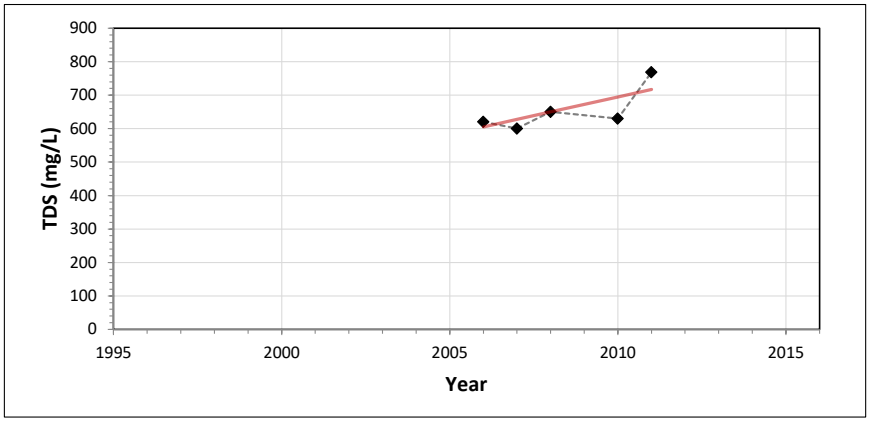
Statistics	
GMZ	Beaumont
Well Name : ID	Ranch Well : 1208432
Analyte	NO3-N (mg/L)
Count	5
Count Detects	5
Sample Year Min	2006
Sample Year Max	2011
Annual Average Min	10.79
Annual Average Max	12.20
Annual Average Mean	11.17
Annual Average Stdev	0.58
Shapiro-Wilk W	0.692
Shapiro-Wilk p-value	0.008
Critical Alpha	0.01
Most Discordant Value	12.20
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.009
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	11.00
Trend Analysis	**Theil-Sen**
Kendall S	-7
Var(S)	15.67
Intercept	380
Slope	-0.18
p-value	0.130
Significant Trend?	No





Statistics	
GMZ	Beaumont
Well Name : ID	Ranch Well : 1208432
Analyte	TDS (mg/L)
Count	5
Count Detects	5
Sample Year Min	2006
Sample Year Max	2011
Annual Average Min	600
Annual Average Max	768
Annual Average Mean	654
Annual Average Stdev	66.65
Shapiro-Wilk W	0.800
Shapiro-Wilk p-value	0.081
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	29.81
Student t	1.13
Mean + t*SE (UCL84)	688
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	6
Var(S)	16.67
Intercept	-44227
Slope	22.35
p-value	0.221
Significant Trend?	No





Attachment B3

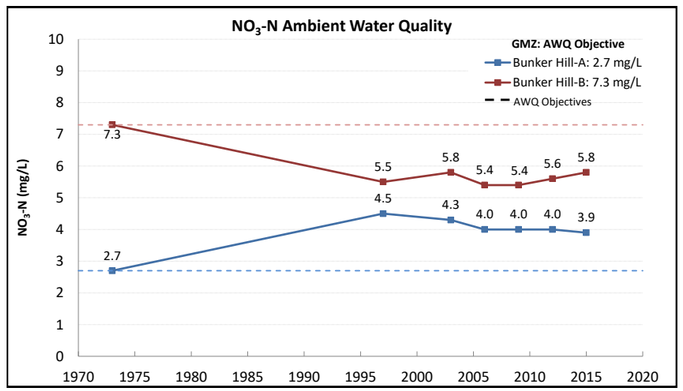
Bunker Hill-A and Bunker Hill-B GMZs

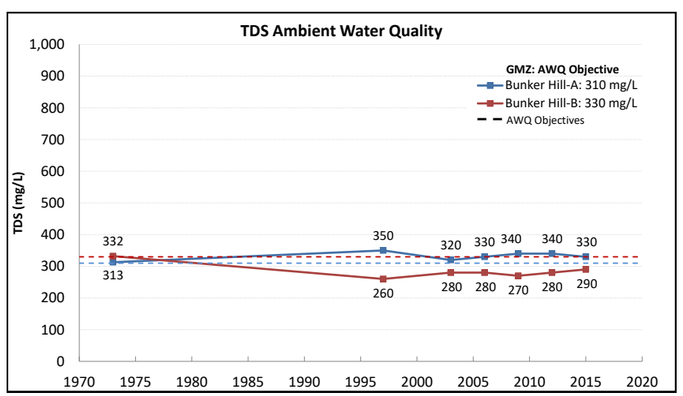
Attachment Contents:

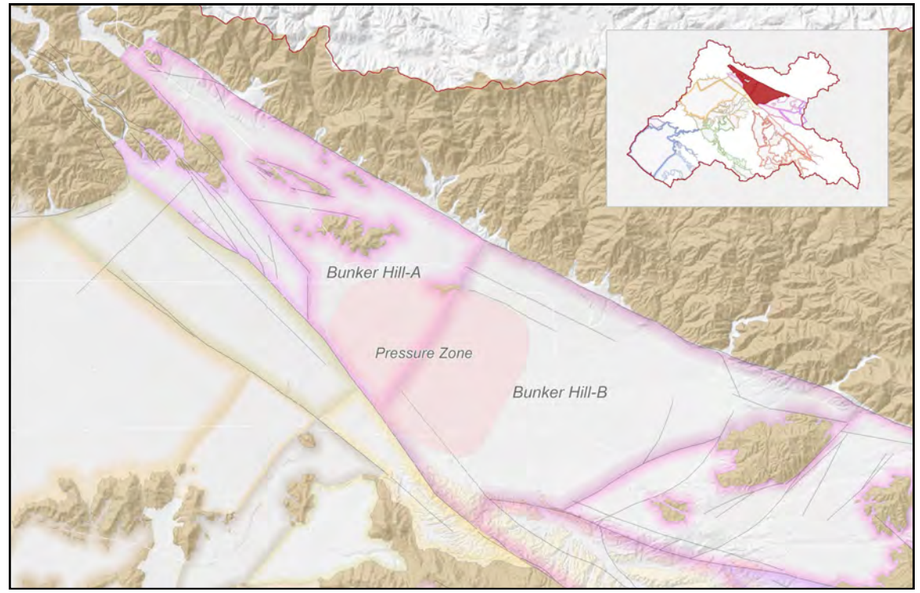
B3-1 Groundwater Storage and Elevation Contours Fall 2015
B3-2 NO_3-N Concentration and Contour Map
B3-3 TDS Concentration and Contour Map
B3-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B3-5 TDS Concentration Change (1993-2012 to 1996-2015)
B3-6 Key Well Analysis Charts

	Basin Analytics	Bunker Hill-A	Bunker Hill-B
Basin	GMZ Area (acres)	27,096	44,600
	Volume of Storage (acre-ft)	1,010,000	2,210,000
NO_3-N	Wells per GMZ	112	159
	Point Statistics per GMZ	93	105
	Total Mass (tons)	5,330	17,600
	1996-2015 AWQ	3.9	5.8
TDS	Wells per GMZ	162	165
	Point Statistics per GMZ	89	114
	Total Mass (tons)	455,000	859,000
	1996-2015 AWQ	330	290

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Bunker Hill-A

The nitrate objective for Bunker Hill-A is 2.7 mg/L. The ambient nitrate concentration decreased from 4.0 mg/L in 2012 to 3.9 mg/L in 2015, and there is no assimilative capacity. The five key wells in Bunker Hill-A GMZ show no trend in nitrate concentrations. Twelve of the total 112 wells with nitrate values in Bunker Hill-A will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Two new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Bunker Hill-B

The nitrate objective for Bunker Hill-B is 7.3 mg/L. The ambient nitrate concentration increased from 5.6 mg/L in 2012 to 5.8 mg/L in 2015, allowing for 1.5 mg/L of assimilative capacity. Two out of the five key wells in Bunker Hill-B GMZ have an increasing trend in nitrate concentrations, one key well shows a decreasing trend, and the other two show no trends in the nitrate concentrations. Twenty-four of the total 159 wells with nitrate values in Bunker Hill-B will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. One new well with statistics was added to the 1996 to 2015 AWQ recomputation and four wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

Bunker Hill-A

The TDS objective for Bunker Hill-A is 310 mg/L. The ambient TDS concentration decreased from 340 mg/L in 2012 to 330 mg/L in 2015, and there is no assimilative capacity. Three out of the five key interpretive wells in Bunker Hill-A GMZ show an increasing trend and the other two show no trends in TDS concentrations. Fifty-seven of the total 162 wells with TDS values in Bunker Hill-A will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation. Two wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Bunker Hill-B

The TDS objective for Bunker Hill-B is 330 mg/L. The ambient TDS concentration increased from 280 mg/L in 2012 to 290 mg/L in 2015, allowing for 40 mg/L of assimilative capacity. Three out of the five key interpretive wells in Bunker Hill-B GMZ show an increasing trend and the other two show no trends in TDS concentrations. Eighteen of the total 165 wells with TDS values in Bunker Hill-B will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation. Three wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Bunker Hill A	1000142	SBWD Newmark 1	3.0	No Trend	339	No Trend
Bunker Hill A	1000227	SBWD Waterman Ave.	5.8	No Trend	400	Increasing*
Bunker Hill A	1000262	SBWD Mt Vernon	5.0	No Trend	357	No Trend
Bunker Hill A	1001485	SBWD Mill & D	2.2	No Trend	400	Increasing
Bunker Hill A	1002866	SBWD Cajon Canyon	1.9	No Trend	444	Increasing*
Bunker Hill B	1000730	Agate 2	1.2	No Trend	189	Increasing**
Bunker Hill B	1000868	PL 40A	8.4	Increasing**	282	Increasing*
Bunker Hill B	1001145	Redlands 41	15.9	No Trend	417	No Trend
Bunker Hill B	1001175	Redlands 38	2.8	Increasing**	324	No Trend
Bunker Hill B	1001752	THORN 12	1.5	Decreasing**	402	Increasing*

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B3-4 and B3-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Bunker Hill-A	1000151	SBWD Paperboard	--	--	--	--	High	2	421	Ave
Bunker Hill-A	1000220	NA_1000220	High	2	7.5	Ave	--	--	--	--
Bunker Hill-A	1000235	SBWD 23rd St.	Medium	1	4.9	Ave	--	--	--	--
Bunker Hill-A	1000249	SBWD Colima	--	--	--	--	High	2	369	Ave
Bunker Hill-A	1000269	SBWD State St.	--	--	--	--	High	2	327	Ave
Bunker Hill-A	1000275	CITY 4	High	3	2.0	Stat	High	3	268	Stat
Bunker Hill-A	1000309	17TH ST #1	--	--	--	--	High	2	375	Ave
Bunker Hill-A	1000336	3	High	2	5.3	Ave	--	--	--	--
Bunker Hill-A	1001299	NA_1001299	Medium	1	5.2	Ave	Medium	1	384	Ave
Bunker Hill-A	1001301	NA_1001301	Medium	1	0.9	Ave	Medium	1	450	Ave
Bunker Hill-A	1001400	CITY 5	Medium	6	1.2	Stat	Medium	6	272	Stat
Bunker Hill-A	1001402	CITY 6	--	8	2.7	Stat	Medium	6	230	Ave
Bunker Hill-A	1001427	NA_1001427	Medium	5	3.2	Stat	Medium	2	281	Ave
Bunker Hill-A	1001429	NA_1001429	Medium	5	3.2	Stat	Medium	2	274	Ave
Bunker Hill-A	1001442	CLT 14	Medium	5	0.6	Stat	Medium	5	353	Stat
Bunker Hill-A	1001652	EVMWD Coburn	Medium	4	0.4	Stat	Medium	4	478	Stat
Bunker Hill-A	1001661	EVMWD Station 69	High	3	0.1	Ave	High	3	516	Stat
Bunker Hill-A	1002878	NA_1002878	High	2	6.6	Ave	--	--	--	--
Bunker Hill-A	1002879	NA_1002879	--	7	5.8	Stat	Medium	1	310	Ave
Bunker Hill-A	1002889	NA_1002889	High	2	4.7	Ave	--	--	--	--
Bunker Hill-A	1006930	CJ-10	High	3	5.9	Stat	High	3	392	Stat
Bunker Hill-A	1006934	CJ-14	High	3	3.0	Stat	High	3	329	Stat
Bunker Hill-A	1006937	CJ-08	High	3	3.3	Stat	High	3	361	Stat
Bunker Hill-A	1200094	SBWD DTSC 1C	--	--	--	--	High	2	326	Ave
Bunker Hill-A	1200095	SBWD DTSC 1B	--	--	--	--	High	2	434	Ave
Bunker Hill-A	1200097	SBWD DTSC 2B	--	--	--	--	High	2	515	Ave
Bunker Hill-A	1200099	SBWD DTSC 2A	--	--	--	--	High	2	315	Ave
Bunker Hill-A	1200102	SBWD MW-126	--	--	--	--	High	1	294	Ave
Bunker Hill-A	1200107	SBWD DTSC 3A	--	--	--	--	High	1	347	Ave
Bunker Hill-A	1200135	SBWD MW-01A	--	--	--	--	High	1	312	Ave
Bunker Hill-A	1200136	SBWD MW-01B	--	--	--	--	High	1	377	Ave
Bunker Hill-A	1200137	SBWD MW-01C	--	--	--	--	High	1	346	Ave
Bunker Hill-A	1200138	SBWD MW-01D	--	--	--	--	High	1	235	Ave
Bunker Hill-A	1200139	SBWD MW-01E	--	--	--	--	High	1	271	Ave
Bunker Hill-A	1200140	SBWD MW-01F	--	--	--	--	High	1	204	Ave
Bunker Hill-A	1200141	SBWD MW-01G	--	--	--	--	High	1	1,880	Ave
Bunker Hill-A	1200156	SBWD MW-10A	--	--	--	--	High	2	236	Ave
Bunker Hill-A	1200157	SBWD MW-10B	--	--	--	--	High	2	336	Ave
Bunker Hill-A	1200158	SBWD MW-10C	--	--	--	--	High	2	290	Ave
Bunker Hill-A	1200159	SBWD MW-11A	--	--	--	--	High	2	230	Ave
Bunker Hill-A	1200160	SBWD MW-11B	--	--	--	--	High	2	288	Ave
Bunker Hill-A	1200161	SBWD MW-11C	--	--	--	--	High	2	210	Ave
Bunker Hill-A	1200193	MW-COE-001A	--	--	--	--	High	1	359	Ave
Bunker Hill-A	1203682	CJ-12RD	High	3	3.4	Stat	High	3	410	Stat
Bunker Hill-A	1203685	CJ-17	High	3	6.8	Stat	High	3	485	Stat
Bunker Hill-A	1203690	CJ-09RD	High	3	3.3	Stat	High	3	379	Stat

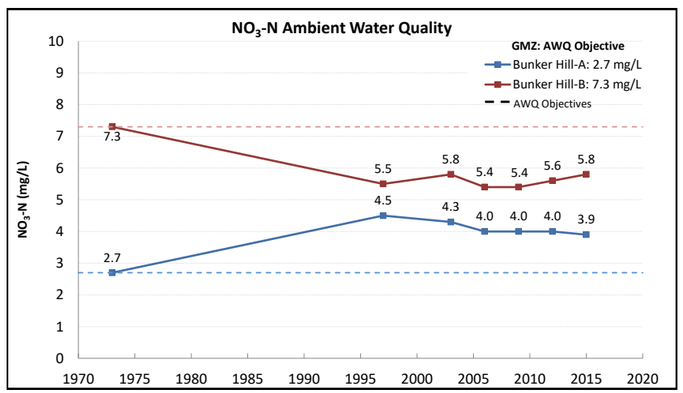
Continue on next page...

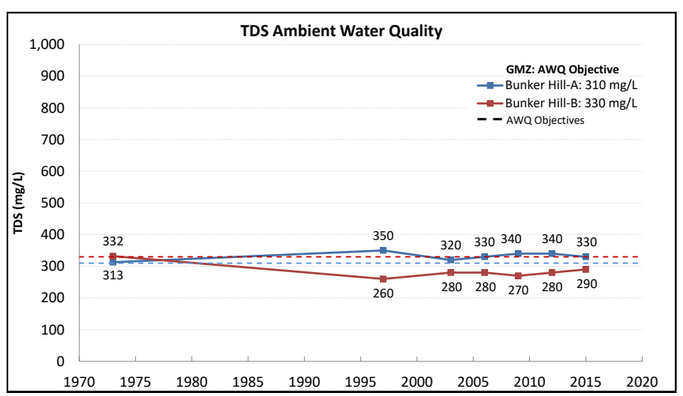
Attachment Contents:

B3-1 Groundwater Storage and Elevation Contours Fall 2015
B3-2 NO_3-N Concentration and Contour Map
B3-3 TDS Concentration and Contour Map
B3-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B3-5 TDS Concentration Change (1993-2012 to 1996-2015)
B3-6 Key Well Analysis Charts

	Basin Analytics	Bunker Hill-A	Bunker Hill-B
Basin	GMZ Area (acres)	27,096	44,600
	Volume of Storage (acre-ft)	1,010,000	2,210,000
NO_3-N	Wells per GMZ	112	159
	Point Statistics per GMZ	93	105
	Total Mass (tons)	5,330	17,600
	1996-2015 AWQ	3.9	5.8
TDS	Wells per GMZ	162	165
	Point Statistics per GMZ	89	114
	Total Mass (tons)	455,000	859,000
	1996-2015 AWQ	330	290

Table 1 - Basin Analytics





Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Bunker Hill-A	1200160	SBWD MW-11B	--	--	--	--	High	2	288	Ave
Bunker Hill-A	1200161	SBWD MW-11C	--	--	--	--	High	2	210	Ave
Bunker Hill-A	1200193	MW-COE-001A	--	--	--	--	High	1	359	Ave
Bunker Hill-A	1203682	CJ-12RD	High	3	3.4	Stat	High	3	410	Stat
Bunker Hill-A	1203685	CJ-17	High	3	6.8	Stat	High	3	485	Stat
Bunker Hill-A	1203690	CJ-09RD	High	3	3.3	Stat	High	3	379	Stat
Bunker Hill-A	1203796	SBWD MW-02A	--	--	--	--	High	2	291	Ave
Bunker Hill-A	1203797	SBWD MW-02B	--	--	--	--	High	2	364	Ave
Bunker Hill-A	1203798	SBWD MW-03A	--	--	--	--	High	2	309	Ave
Bunker Hill-A	1203799	SBWD MW-03B	--	--	--	--	High	2	359	Ave
Bunker Hill-A	1203800	SBWD MW-04A	--	--	--	--	High	2	327	Ave
Bunker Hill-A	1203801	SBWD MW-04B	--	--	--	--	High	2	350	Ave
Bunker Hill-A	1203802	SBWD MW-05A	--	--	--	--	High	2	356	Ave
Bunker Hill-A	1203803	SBWD MW-05B	--	--	--	--	High	2	349	Ave
Bunker Hill-A	1203804	SBWD MW-06A	--	--	--	--	High	2	274	Ave
Bunker Hill-A	1203805	SBWD MW-06B	--	--	--	--	High	2	312	Ave
Bunker Hill-A	1203806	SBWD MW-07A	--	--	--	--	High	2	361	Ave
Bunker Hill-A	1203807	SBWD MW-07B	--	--	--	--	High	2	346	Ave
Bunker Hill-A	1203808	SBWD MW-08A	--	--	--	--	High	2	301	Ave
Bunker Hill-A	1203809	SBWD MW-08B	--	--	--	--	High	2	360	Ave
Bunker Hill-A	1203811	SBWD MW-09B	--	--	--	--	High	2	298	Ave
Bunker Hill-A	1203812	SBWD MW-127B	--	--	--	--	High	1	385	Ave
Bunker Hill-A	1203813	SBWD MW-128A	--	--	--	--	High	2	338	Ave
Bunker Hill-A	1203814	SBWD MW-128B	--	--	--	--	High	2	214	Ave
Bunker Hill-A	1203815	SBWD MW-128C	--	--	--	--	High	2	194	Ave
Bunker Hill-A	1203816	SBWD MW-129A	--	--	--	--	High	2	329	Ave
Bunker Hill-A	1203817	SBWD MW-129B	--	--	--	--	High	2	308	Ave
Bunker Hill-A	1203818	SBWD MW-129C	--	--	--	--	High	2	241	Ave
Bunker Hill-A	1203819	SBWD MW-130A	--	--	--	--	High	2	382	Ave
Bunker Hill-A	1203820	SBWD MW-130B	--	--	--	--	High	2	285	Ave
Bunker Hill-A	1203821	SBWD MW-130C	--	--	--	--	High	2	238	Ave
Bunker Hill-A	1206692	MW-COE-005	--	--	--	--	Medium	1	360	Ave
Bunker Hill-A	1206693	MW-COE-006	--	--	--	--	Medium	1	270	Ave
Bunker Hill-A	1206694	MW-COE-007	--	--	--	--	Medium	1	360	Ave
Bunker Hill-B	1000034	PL 41	Medium	6	15.8	Stat	Medium	6	324	Stat
Bunker Hill-B	1000084	PL 138/PALM	High	1	9.5	Ave	High	1	323	Ave
Bunker Hill-B	1000365	PS & B 2	High	1	7.2	Ave	--	--	--	--
Bunker Hill-B	1000846	PL 121	Medium	5	3.5	Stat	Medium	5	171	Stat
Bunker Hill-B	1000867	PL 40	High	1	5.6	Ave	High	1	212	Ave
Bunker Hill-B	1000885	NA_1000885	High	2	8.9	Ave	--	--	--	--
Bunker Hill-B	1000888	NA_1000888	High	2	8.2	Ave	--	--	--	--
Bunker Hill-B	1000889	NA_1000889	High	2	6.9	Ave	--	--	--	--
Bunker Hill-B	1000962	NA_1000962	High	1	2.6	Ave	High	1	112	Ave
Bunker Hill-B	1000992	NA_1000992	High	1	3.8	Ave	High	1	208	Ave
Bunker Hill-B	1000994	NA_1000994	High	1	0.8	Ave	High	1	168	Ave
Bunker Hill-B	1001000	NA_1001000	High	3	3.9	Stat	High	3	239	Stat
Bunker Hill-B	1001001	Pioneer Ave.	High	2	4.0	Ave	High	2	232	Ave
Bunker Hill-B	1001051	SB STMP 2	--	--	--	--	Medium	4	190	Stat
Bunker Hill-B	1001064	FAIRBANKS RANCH	High	3	11.7	Stat	High	3	332	Stat
Bunker Hill-B	1001208	Nicks Well	Medium	6	7.6	Stat	Medium	5	456	Stat
Bunker Hill-B	1001254	NA_1001254	High	2	15.4	Ave	--	--	--	--
Bunker Hill-B	1001347	PL 11A	High	2	2.2	Ave	High	2	469	Ave
Bunker Hill-B	1001518	NA_1001518	High	1	5.3	Ave	High	1	199	Ave
Bunker Hill-B	1001570	#3 WELL	High	1	9.1	Ave	High	1	527	Ave
Bunker Hill-B	1001572	2	High	2	8.2	Ave	--	--	--	--
Bunker Hill-B	1001590	NA_1001590	High	1	3.0	Ave	--	--	--	--
Bunker Hill-B	1001776	THORN 5	High	1	1.6	Ave	High	1	902	Ave
Bunker Hill-B	1001780	WARREN 2	Medium	4	2.0	Stat	Medium	4	815	Stat
Bunker Hill-B	1001782	WARREN 3	Medium	4	2.8	Stat	Medium	3	458	Stat
Bunker Hill-B	1001786	NA_1001786	Medium	1	2.0	Ave	Medium	2	235	Ave
Bunker Hill-B	1001848	NA_1001848	High	3	5.5	Stat	High	3	210	Stat
Bunker Hill-B	1001849	Mountain View 02	Medium	5	2.9	Stat	Medium	5	205	Stat
Bunker Hill-B	1001851	NA_1001851	High	3	1.3	Stat	High	3	213	Stat
Bunker Hill-B	1001852	Richardson 02	Medium	4	4.0	Stat	Medium	4	221	Stat
Bunker Hill-B	1006971	NA_1006971	Medium	1	9.3	Ave	Medium	2	366	Ave
Bunker Hill-B	1006972	NA_1006972	--	--	--	--	High	1	244	Ave
Bunker Hill-B	1006973	NA_1006973	--	--	--	--	High	1	153	Ave
Bunker Hill-B	1006982	NA_1006982	--	--	--	--	High	1	226	Ave
Bunker Hill-B	1006983	NA_1006983	--	--	--	--	Medium	2	228	Ave
Bunker Hill-B	1006984	NA_1006984	--	--	--	--	Medium	2	247	Ave
Bunker Hill-B	1006985	NA_1006985	High	1	9.9	Ave	Medium	1	187	Ave
Bunker Hill-B	1006986	NA_1006986	--	--	--	--	Medium	2	211	Ave
Bunker Hill-B	1006989	NA_1006989	Medium	1	2.3	Ave	Medium	2	263	Ave
Bunker Hill-B	1006990	NA_1006990	--	--	--	--	Medium	1	253	Ave
Bunker Hill-B	1006991	NA_1006991	High	1	0.0	Ave	Medium	2	2,730	Ave
Bunker Hill-B	1200890	Mountain View 01	High	2	5.4	Ave	High	2	205	Ave
Bunker Hill-B	1232165	340439117173902	Medium	1	0.1	Ave	--	--	--	--
Bunker Hill-B	1232166	340439117173904	Medium	1	0.1	Ave	Medium	1	262	Ave
Bunker Hill-B	1232167	340439117173905	Medium	1	0.1	Ave	Medium	1	739	Ave
Bunker Hill-B	1232169	340439117173907	Medium	1	0.1	Ave	Medium	1	334	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

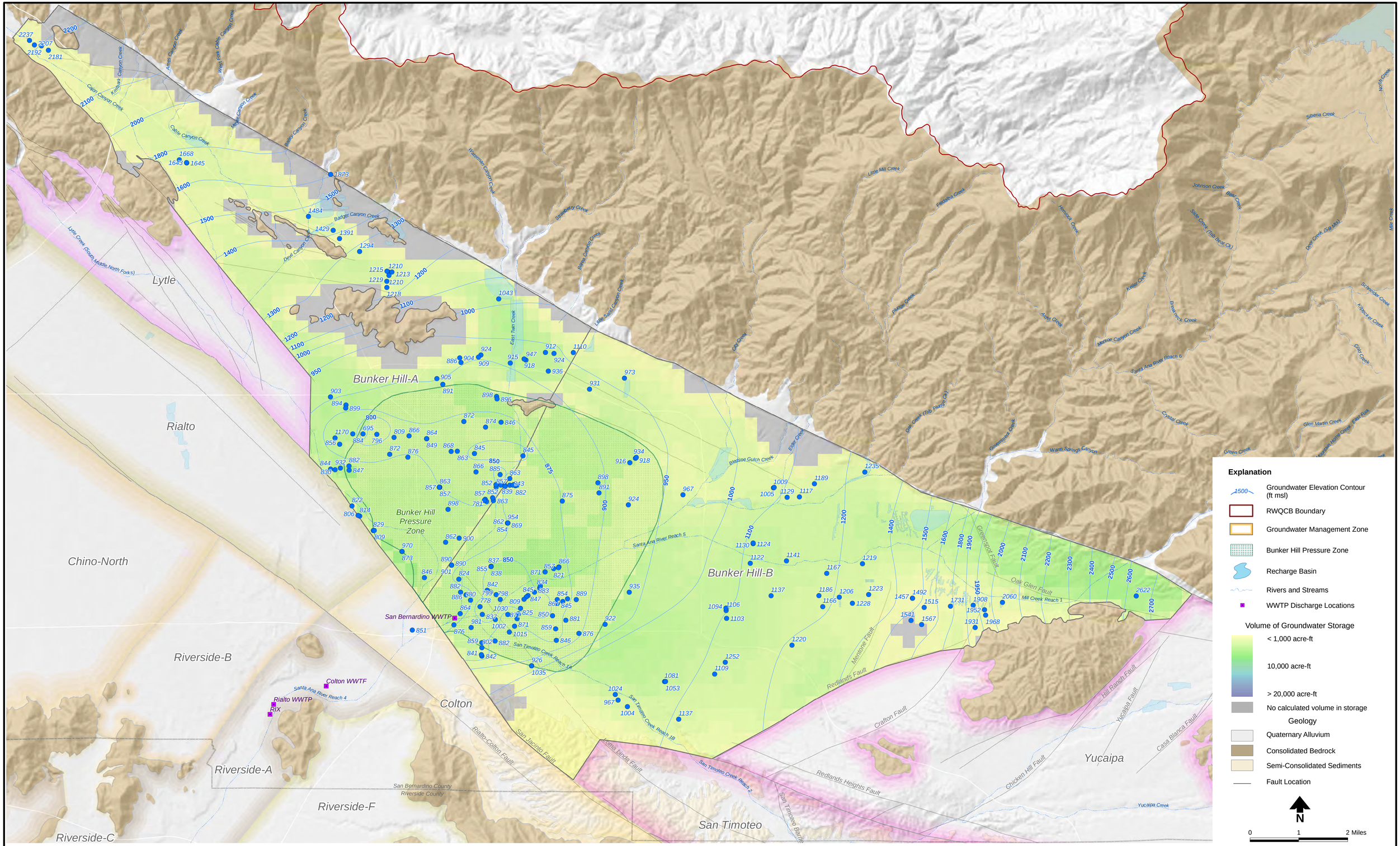
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B3-4 and B3-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Bunker Hill-A	2000174	WELL 9TH ST NORTH - BLF	New	3	6.3	Stat	New*	1	350	Ave
Bunker Hill-A	2000175	WELL 9TH ST SOUTH - BLF	New	3	4.7	Stat	New*	1	310	Ave
Bunker Hill-B	1208168	Mentone Acres #1	New*	1	3.1	Ave	--	--	--	--
Bunker Hill-B	1208177	BV (SB & NELSON)	New*	1	2.7	Ave	--	--	--	--
Bunker Hill-B	2000004	Gage 31-1R	New	3	6.0	Stat	New*	1	315	Ave
Bunker Hill-B	2000010	Meeks & Daley 59	New*	1	0.2	Ave	New*	1	280	Ave
Bunker Hill-B	2000011	Raub 4R	New*	1	4.6	Ave	New*	1	290	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B3-4 and B3-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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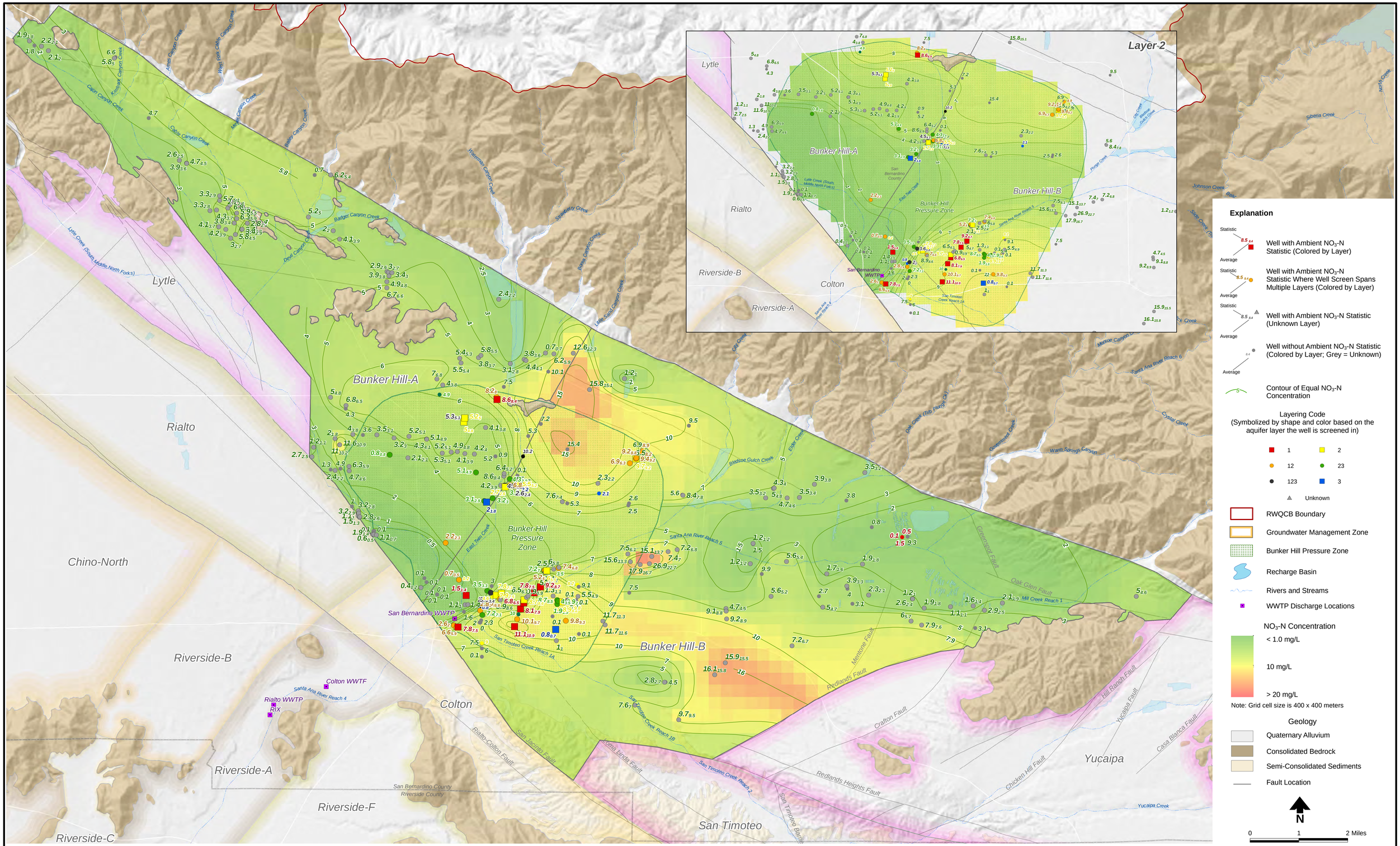
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Bunker Hill-A and Bunker Hill-B GMZs

Attachment B3-1



Source: SAWPA.net, January 2017

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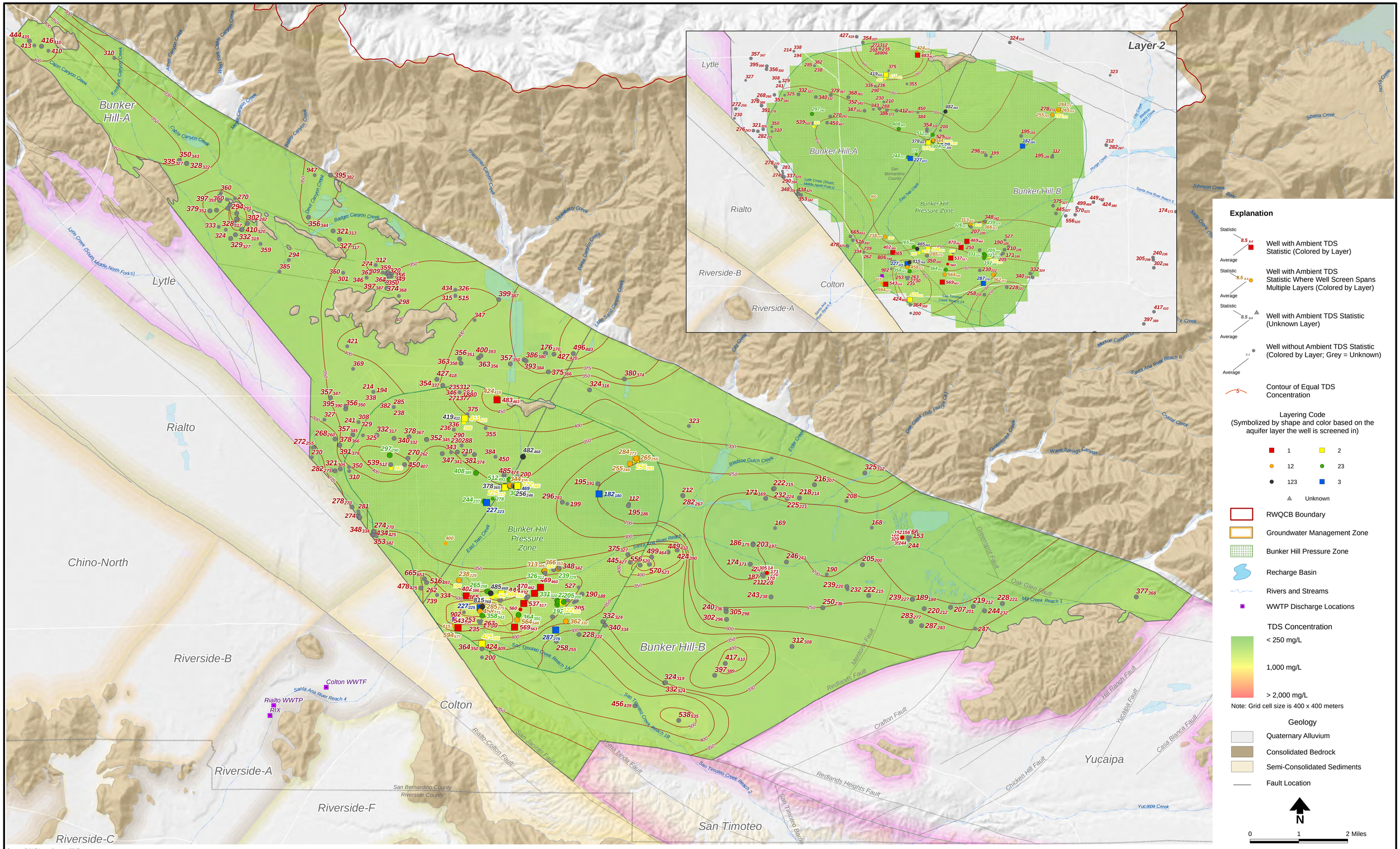
SAWPA

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Bunker Hill-A and Bunker Hill-B GMZs

Attachment B3-2



Source: SAWPA.net, January 2017

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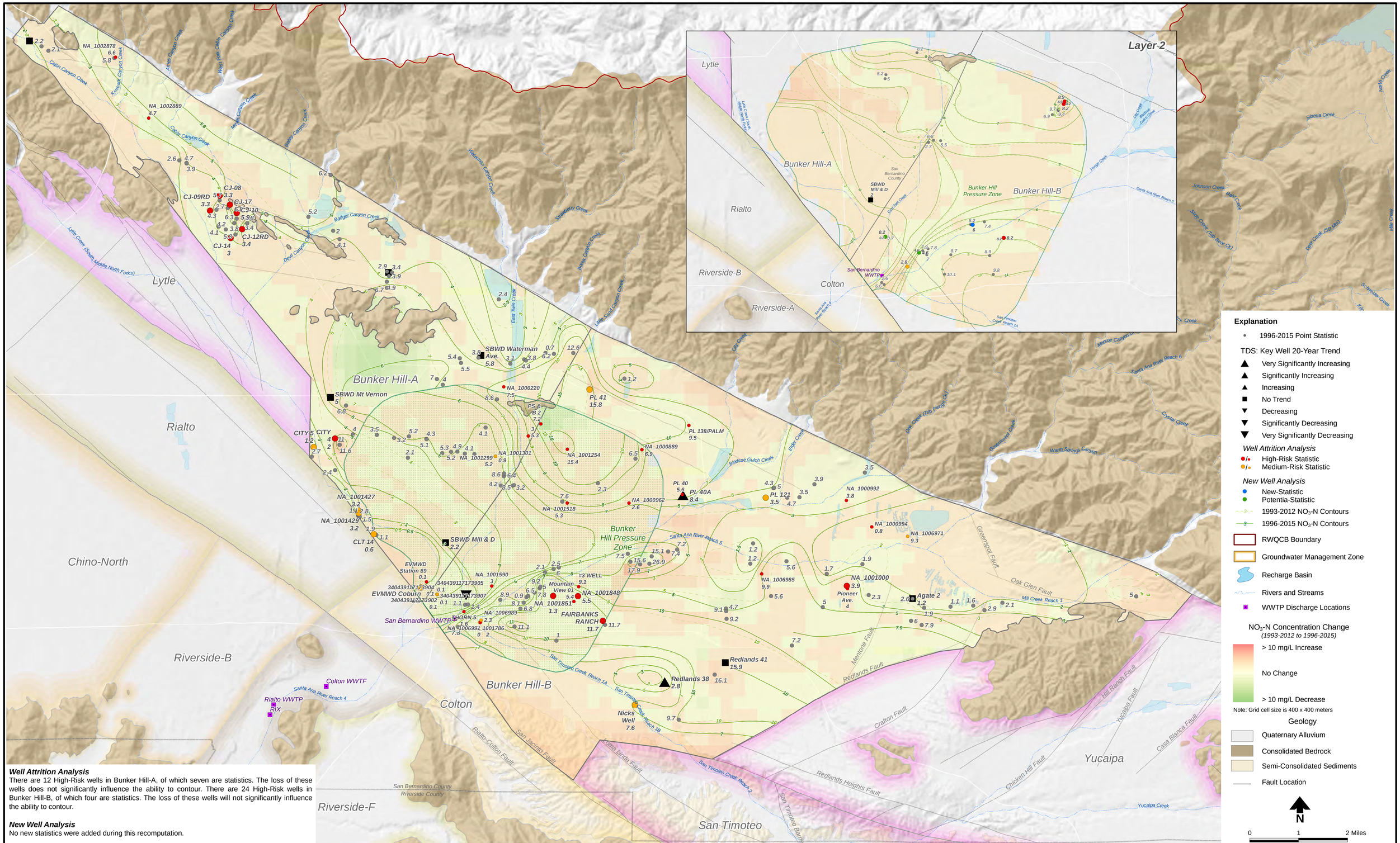
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration and Contour Map
Bunker Hill-A and Bunker Hill-B GMZs

Attachment B3-3



Well Attrition Analysis

There are 12 High-Risk wells in Bunker Hill-A, of which seven are statistics. The loss of these wells does not significantly influence the ability to contour. There are 24 High-Risk wells in Bunker Hill-B, of which four are statistics. The loss of these wells will not significantly influence the ability to contour.

New Well Analysis

No new statistics were added during this recomputation.

Source: SAWPA.net, January 2017

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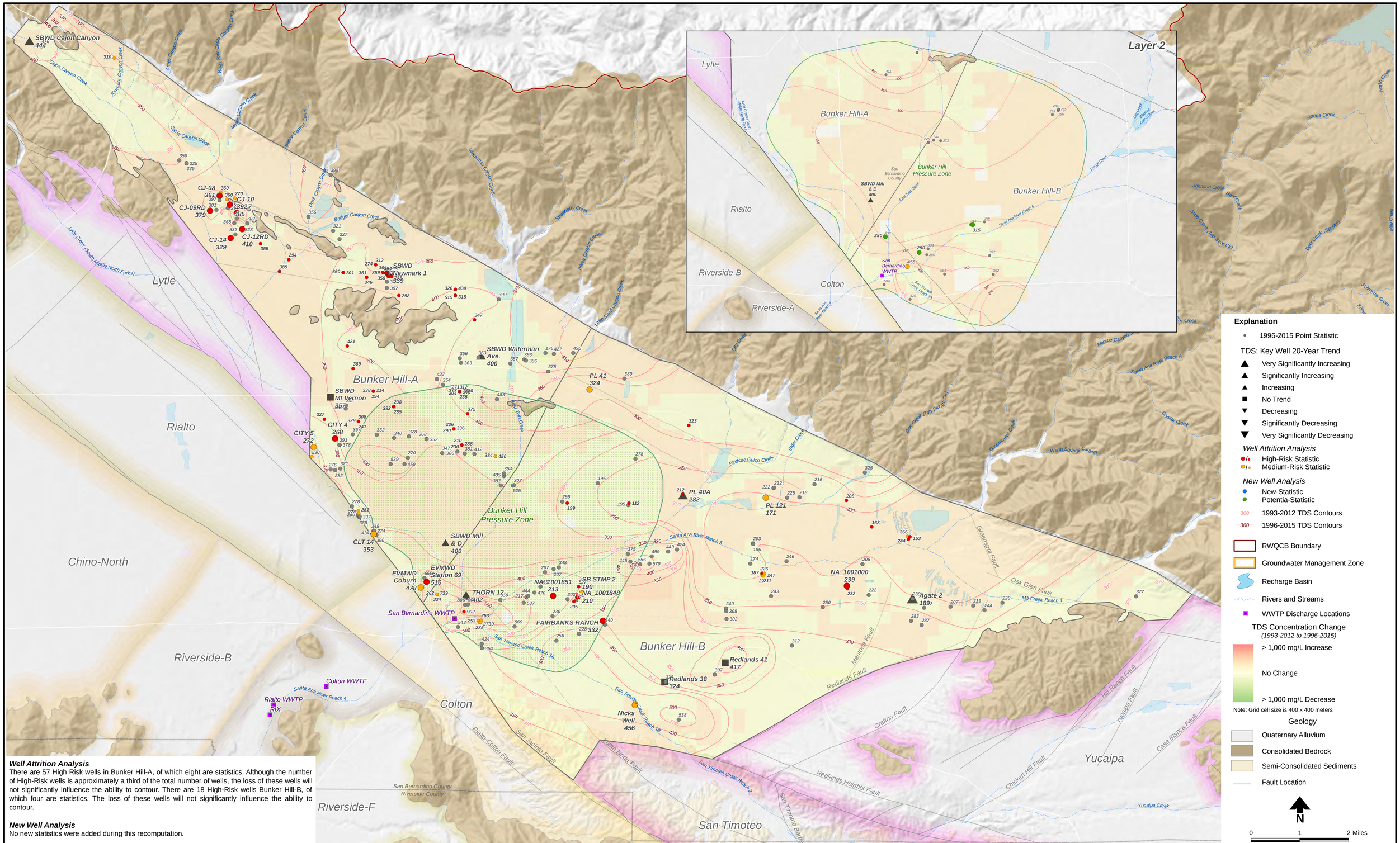
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)

Bunker Hill-A and Bunker Hill-B GMZs

Attachment B3-4



Well Attrition Analysis

There are 57 High Risk wells in Bunker Hill-A, of which eight are statistics. Although the number of High-Risk wells is approximately a third of the total number of wells, the loss of these wells will not significantly influence the ability to contour. There are 18 High-Risk wells Bunker Hill-B, of which four are statistics. The loss of these wells will not significantly influence the ability to contour.

New Well Analysis

No new statistics were added during this recomputation.

Source: SAWPA.net, January 2017

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SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Bunker Hill-A and Bunker Hill-B GMZs

Attachment B3-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

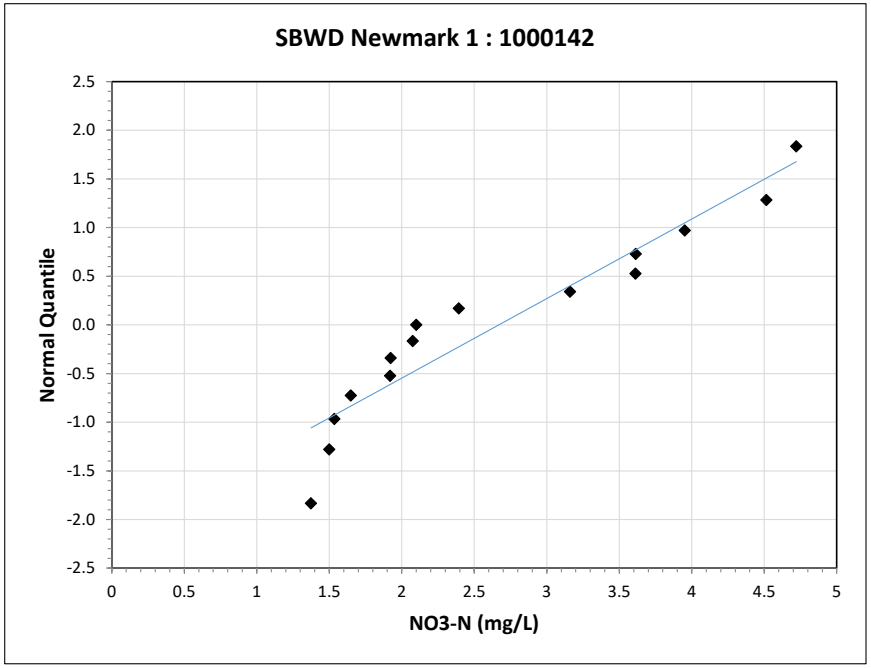
Mann-Kendall

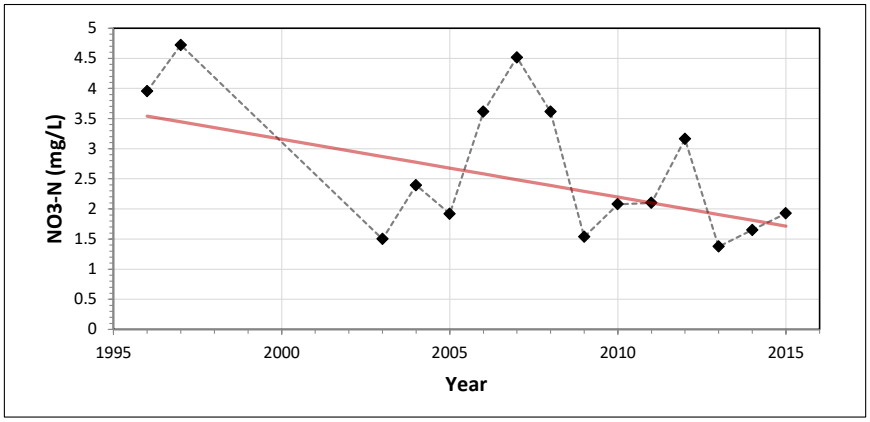
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

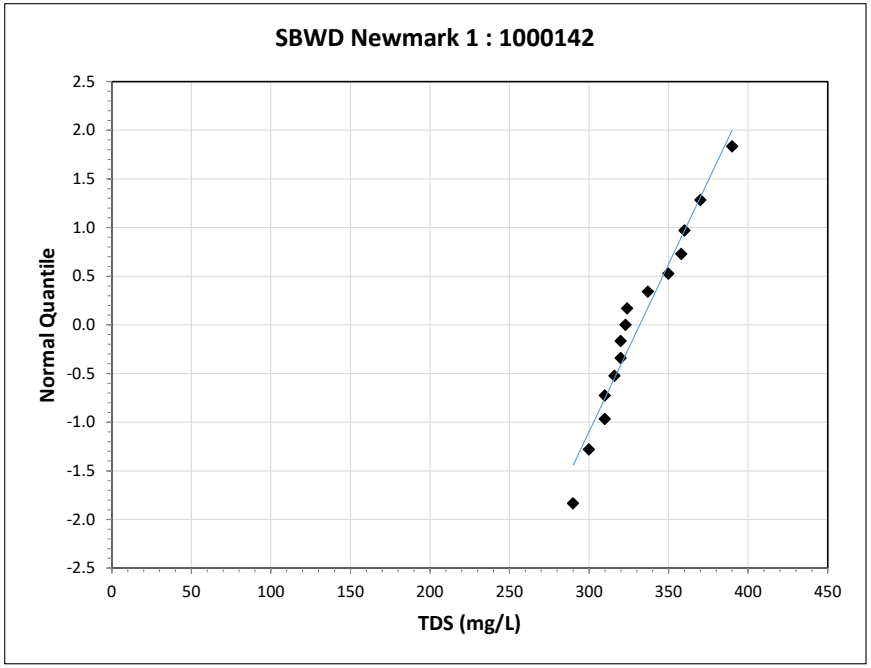
The significance of the trends is notated by * for significant and ** for very significant.

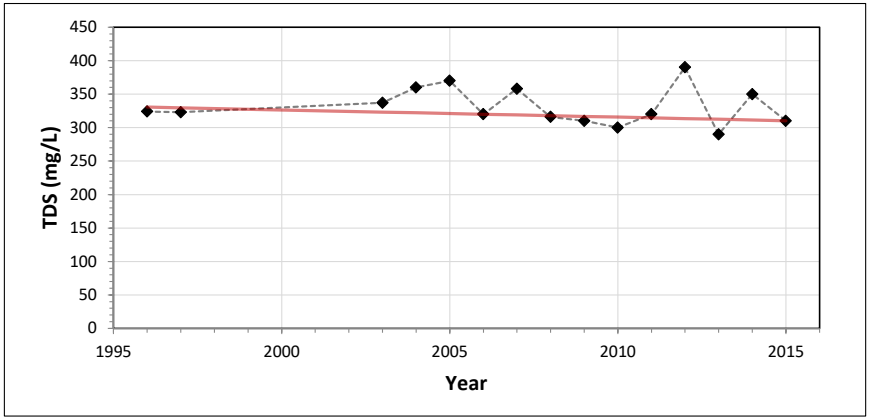
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Newmark 1 : 1000142
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.38
Annual Average Max	4.72
Annual Average Mean	2.67
Annual Average Stdev	1.15
Shapiro-Wilk W	0.883
Shapiro-Wilk p-value	0.052
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.30
Student t	1.03
Mean + t*SE (UCL84)	2.98
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-33
Var(S)	408
Intercept	196
Slope	-0.10
p-value	0.113
Significant Trend?	No



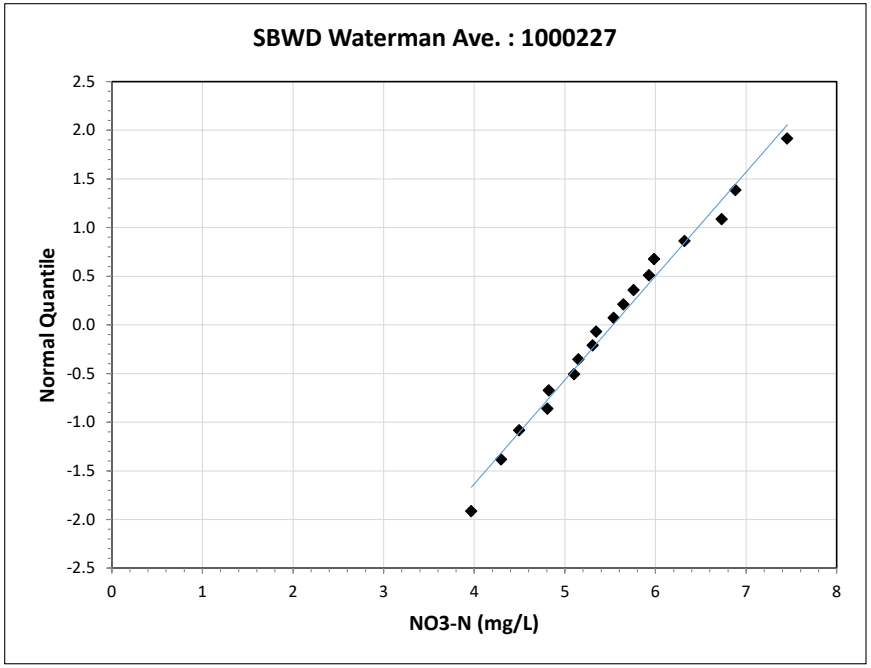


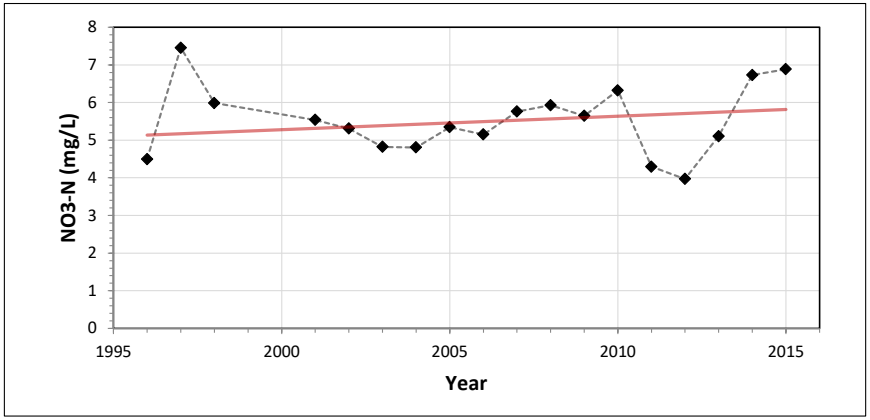
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Newmark 1 : 1000142
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	290
Annual Average Max	390
Annual Average Mean	332
Annual Average Stdev	28.11
Shapiro-Wilk W	0.948
Shapiro-Wilk p-value	0.494
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.26
Student t	1.03
Mean + t*SE (UCL84)	339
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-27
Var(S)	406
Intercept	2480
Slope	-1.08
p-value	0.197
Significant Trend?	No



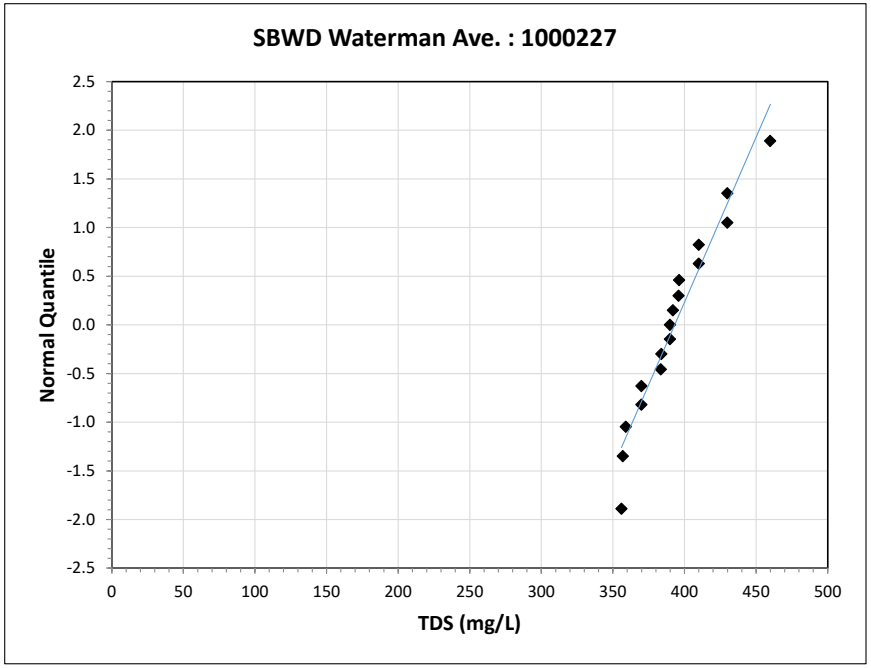


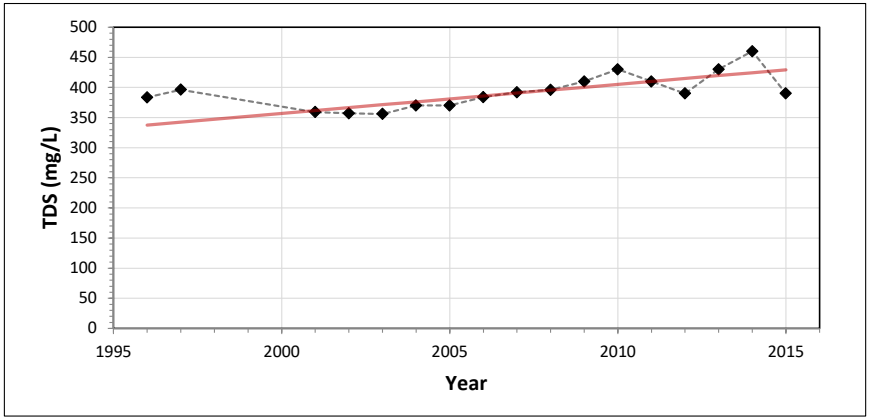
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Waterman Ave. : 1000227
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.97
Annual Average Max	7.45
Annual Average Mean	5.53
Annual Average Stdev	0.92
Shapiro-Wilk W	0.983
Shapiro-Wilk p-value	0.979
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.22
Student t	1.02
Mean + t*SE (UCL84)	5.75
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	11
Var(S)	697
Intercept	-66.33
Slope	0.04
p-value	0.705
Significant Trend?	No



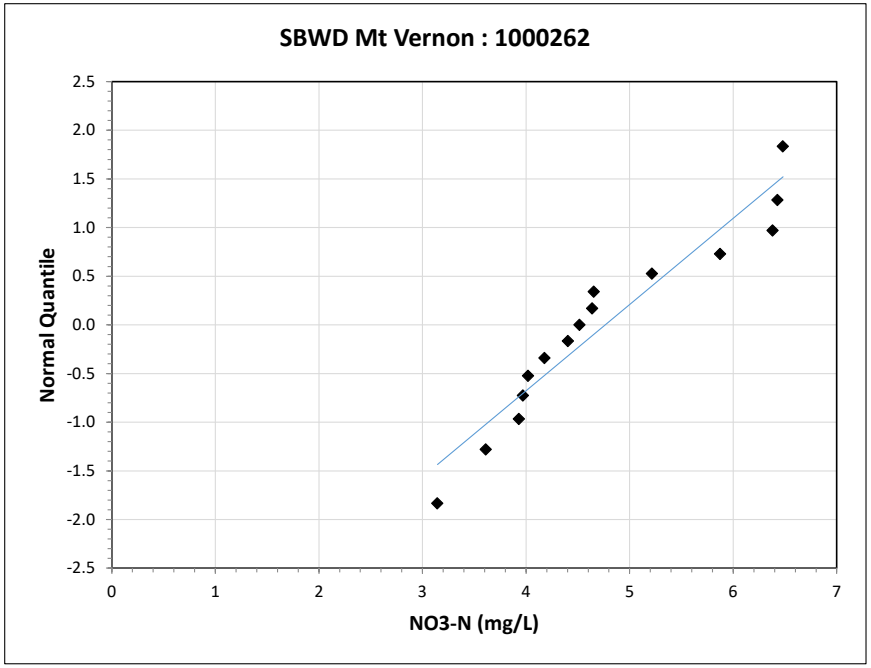


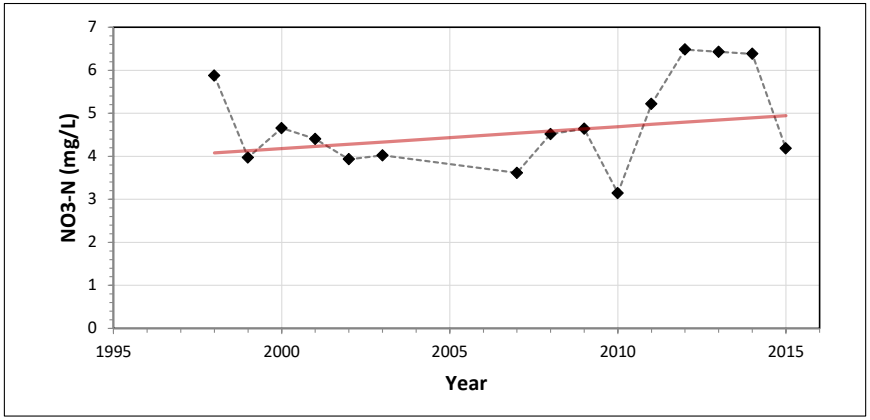
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Waterman Ave. : 1000227
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	356
Annual Average Max	460
Annual Average Mean	393
Annual Average Stdev	28.39
Shapiro-Wilk W	0.938
Shapiro-Wilk p-value	0.298
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.89
Student t	1.03
Mean + t*SE (UCL84)	400
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	70
Var(S)	585
Intercept	-9310
Slope	4.83
p-value	0.004
Significant Trend?	Increasing*



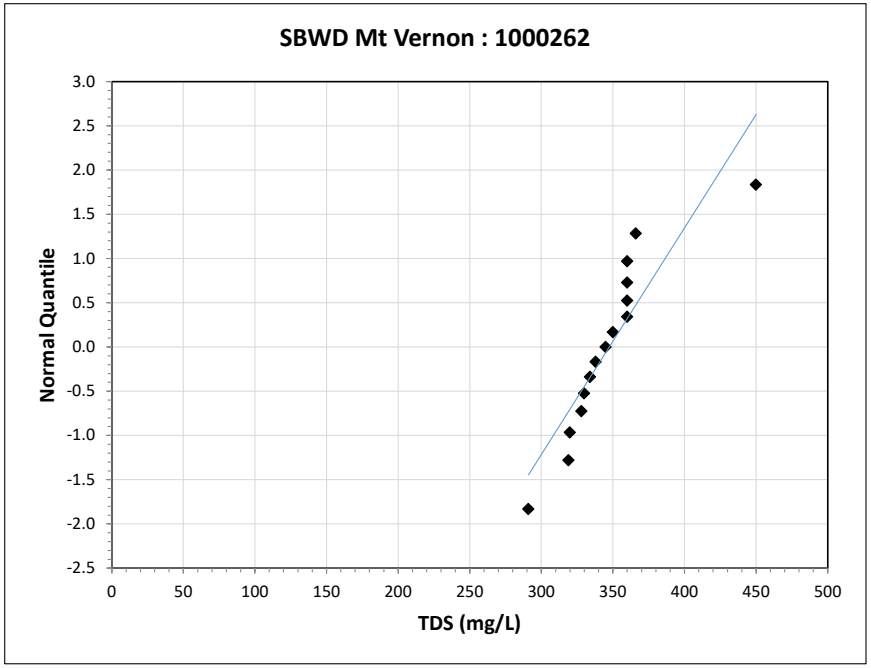


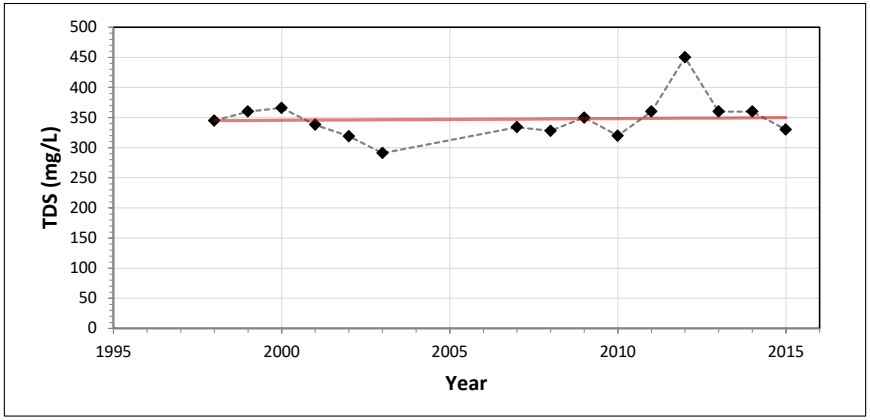
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Mt Vernon : 1000262
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	3.14
Annual Average Max	6.48
Annual Average Mean	4.76
Annual Average Stdev	1.07
Shapiro-Wilk W	0.909
Shapiro-Wilk p-value	0.131
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.28
Student t	1.03
Mean + t*SE (UCL84)	5.05
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	19
Var(S)	408
Intercept	-98.11
Slope	0.05
p-value	0.373
Significant Trend?	No



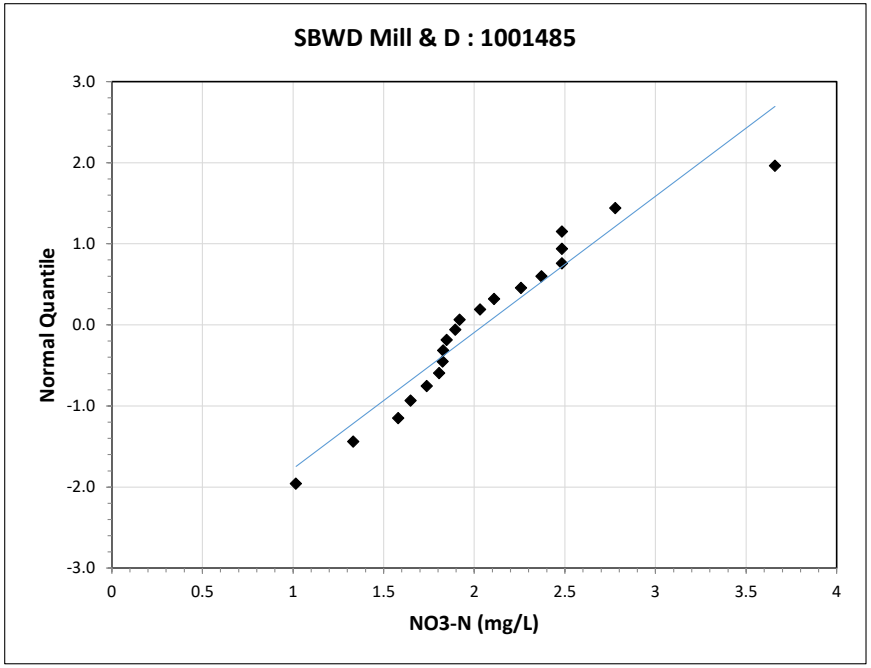


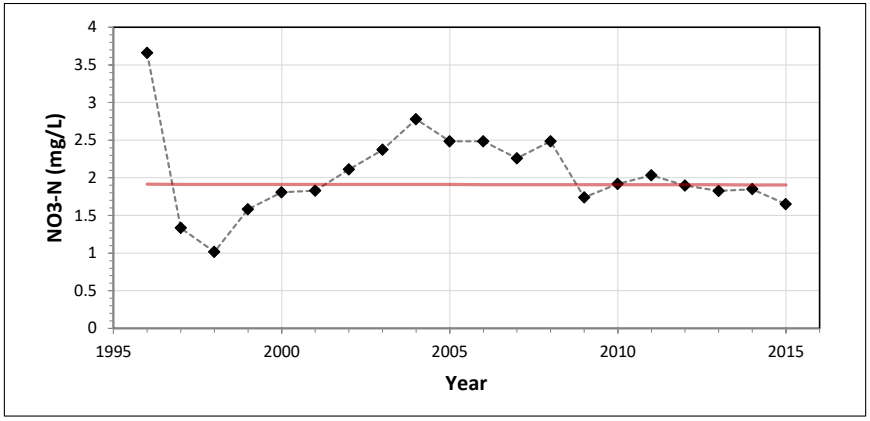
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Mt Vernon : 1000262
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	291
Annual Average Max	450
Annual Average Mean	347
Annual Average Stdev	35.06
Shapiro-Wilk W	0.841
Shapiro-Wilk p-value	0.013
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.05
Student t	1.03
Mean + t*SE (UCL84)	357
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	9
Var(S)	400
Intercept	-226
Slope	0.29
p-value	0.689
Significant Trend?	No



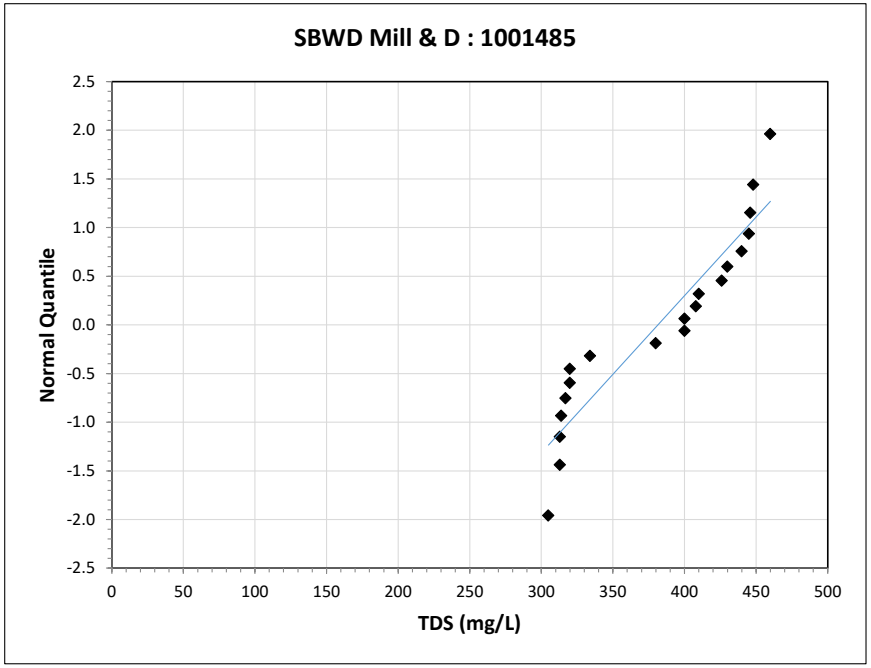


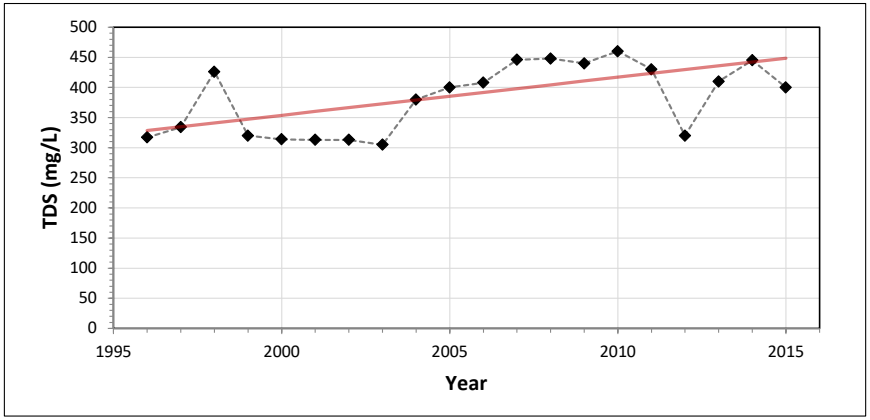
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Mill & D : 1001485
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.02
Annual Average Max	3.66
Annual Average Mean	2.06
Annual Average Stdev	0.57
Shapiro-Wilk W	0.934
Shapiro-Wilk p-value	0.186
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.13
Student t	1.02
Mean + t*SE (UCL84)	2.19
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	949
Intercept	2.75
Slope	0.00
p-value	0.897
Significant Trend?	No



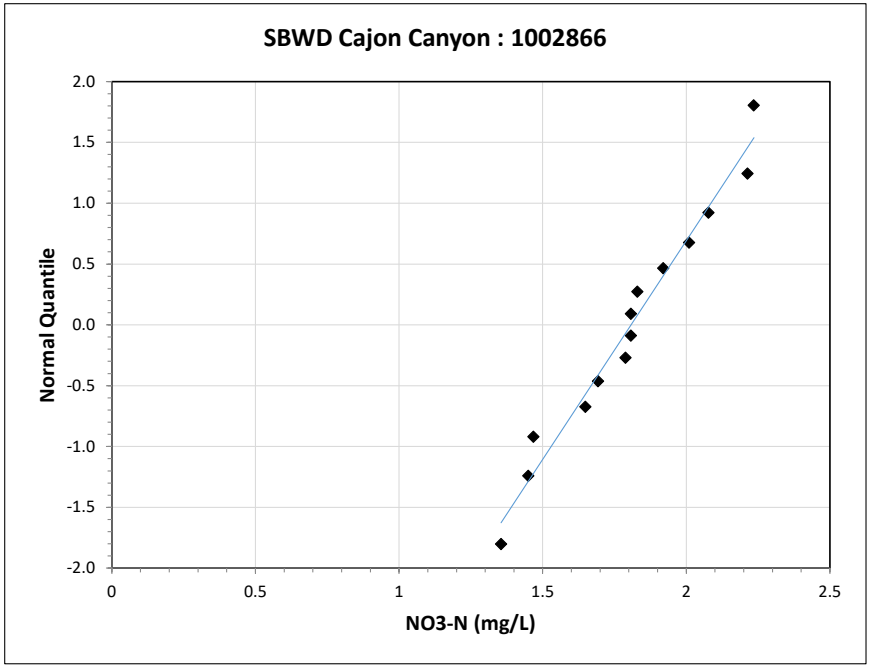


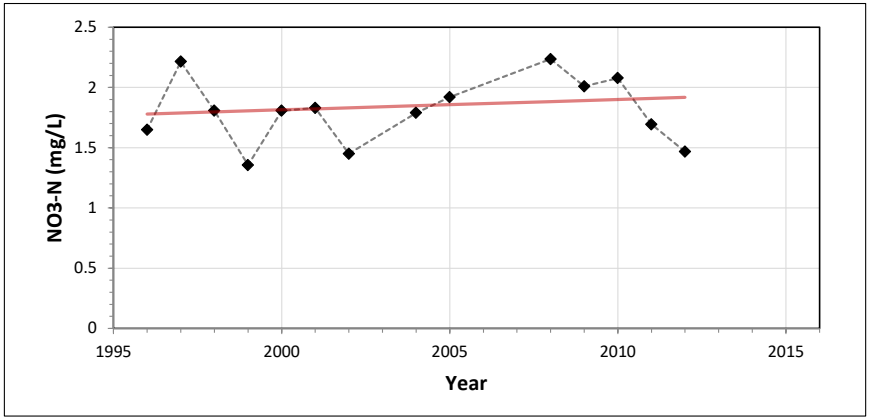
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Mill & D : 1001485
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	305
Annual Average Max	460
Annual Average Mean	381
Annual Average Stdev	57.36
Shapiro-Wilk W	0.853
Shapiro-Wilk p-value	0.006
Critical Alpha	0.01
Most Discordant Value	305
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.004
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	400
Trend Analysis	**Theil-Sen**
Kendall S	67
Var(S)	947
Intercept	-12289
Slope	6.32
p-value	0.032
Significant Trend?	Increasing



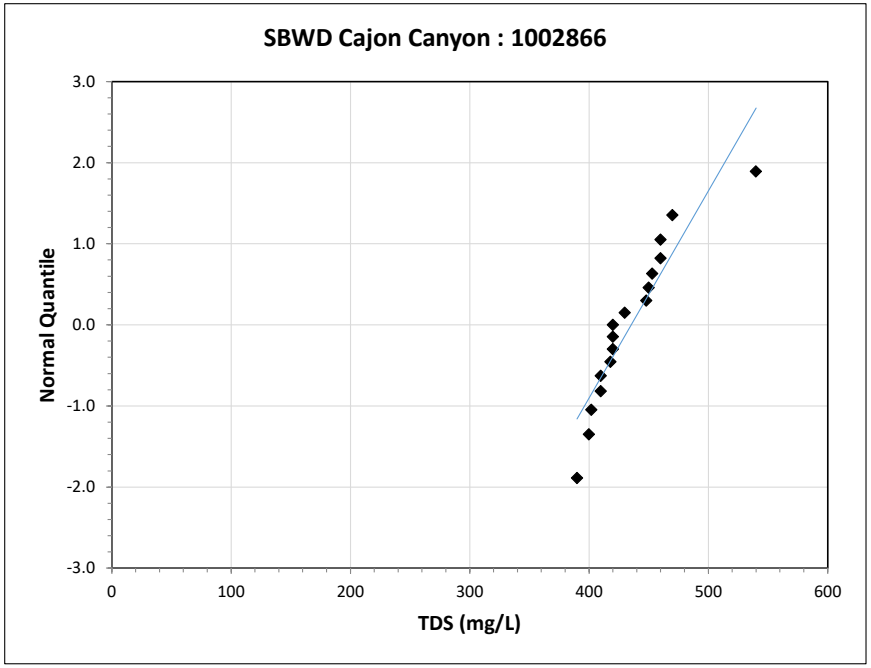


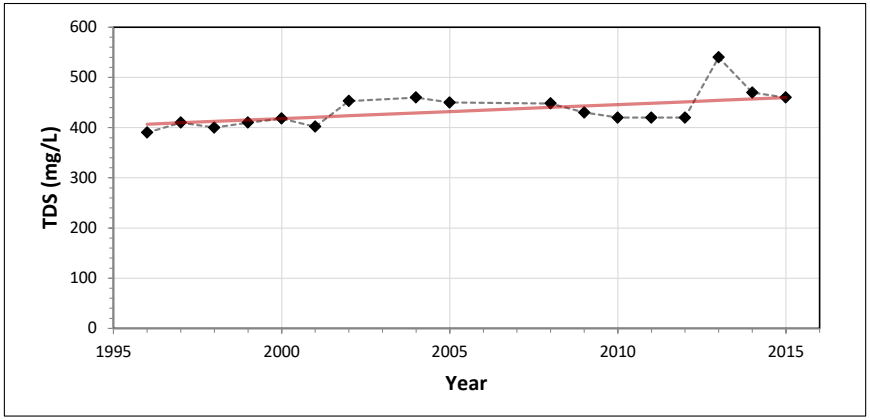
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Cajon Canyon : 1002866
Analyte	NO3-N (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	1.36
Annual Average Max	2.24
Annual Average Mean	1.81
Annual Average Stdev	0.27
Shapiro-Wilk W	0.962
Shapiro-Wilk p-value	0.752
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.07
Student t	1.03
Mean + t*SE (UCL84)	1.88
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	10
Var(S)	333
Intercept	-15.48
Slope	0.01
p-value	0.622
Significant Trend?	No



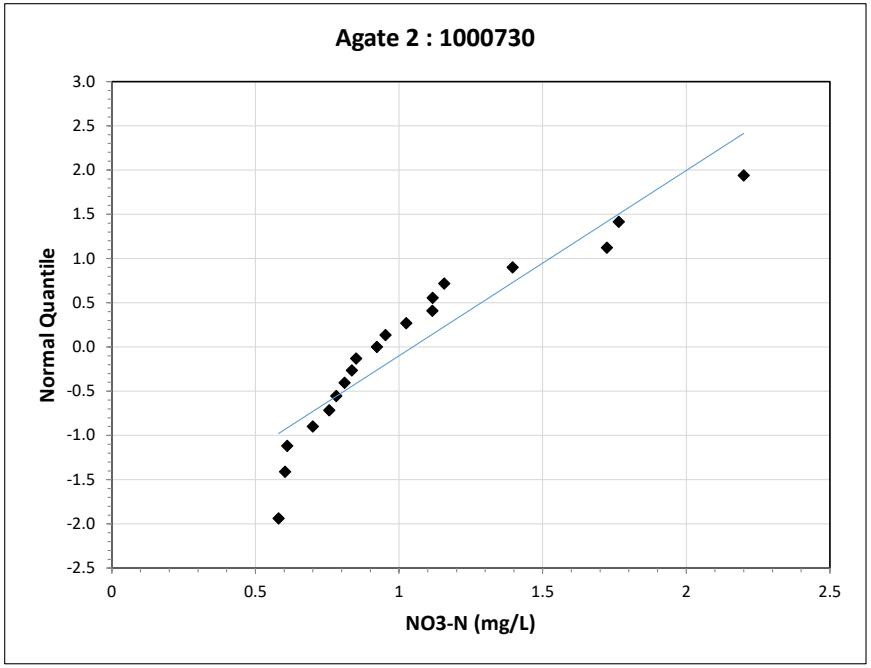


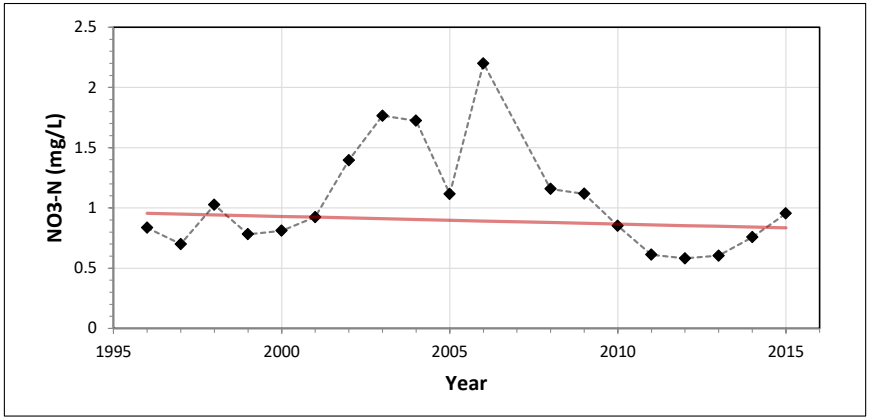
Statistics	
GMZ	Bunker Hill-A
Well Name : ID	SBWD Cajon Canyon : 1002866
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	390
Annual Average Max	540
Annual Average Mean	435
Annual Average Stdev	36.05
Shapiro-Wilk W	0.871
Shapiro-Wilk p-value	0.023
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.74
Student t	1.03
Mean + t*SE (UCL84)	444
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	69
Var(S)	584
Intercept	-5160
Slope	2.79
p-value	0.005
Significant Trend?	Increasing*



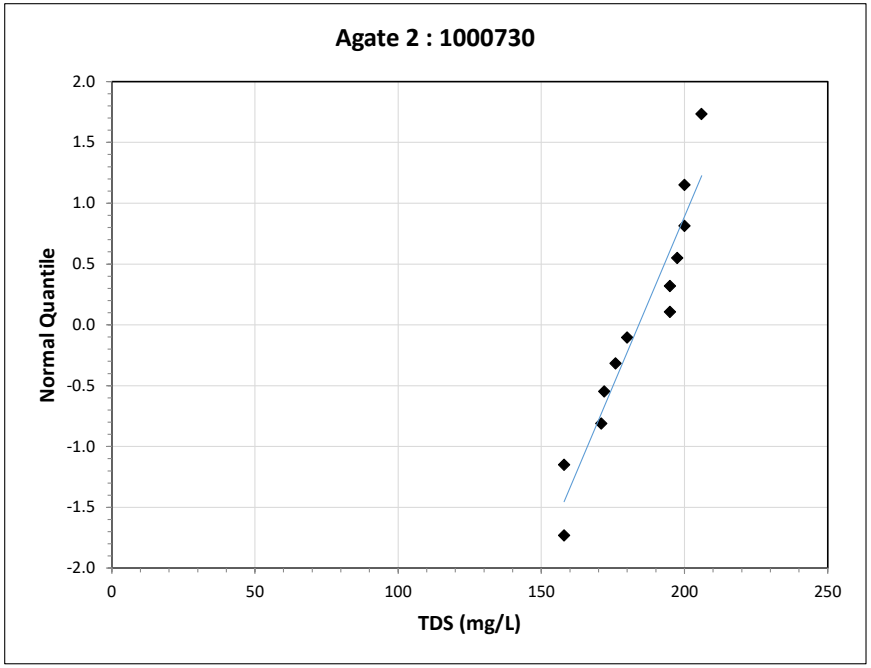


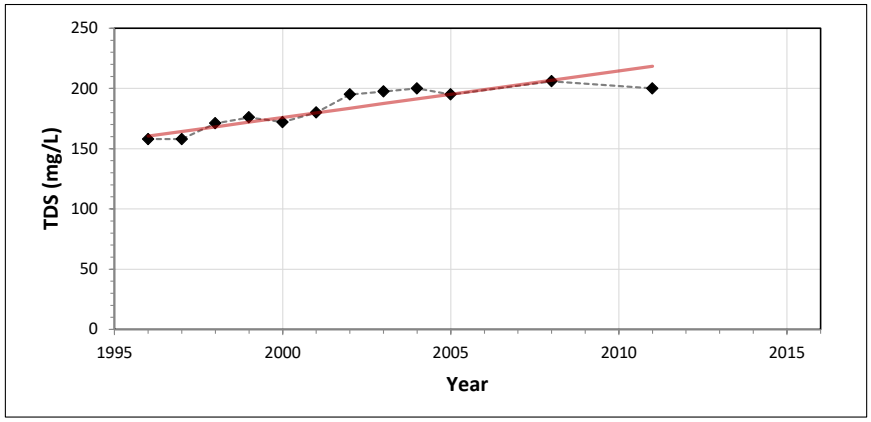
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	Agate 2 : 1000730
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.58
Annual Average Max	2.20
Annual Average Mean	1.05
Annual Average Stdev	0.44
Shapiro-Wilk W	0.861
Shapiro-Wilk p-value	0.010
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.10
Student t	1.02
Mean + t*SE (UCL84)	1.15
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-15
Var(S)	817
Intercept	13.61
Slope	-0.01
p-value	0.624
Significant Trend?	No



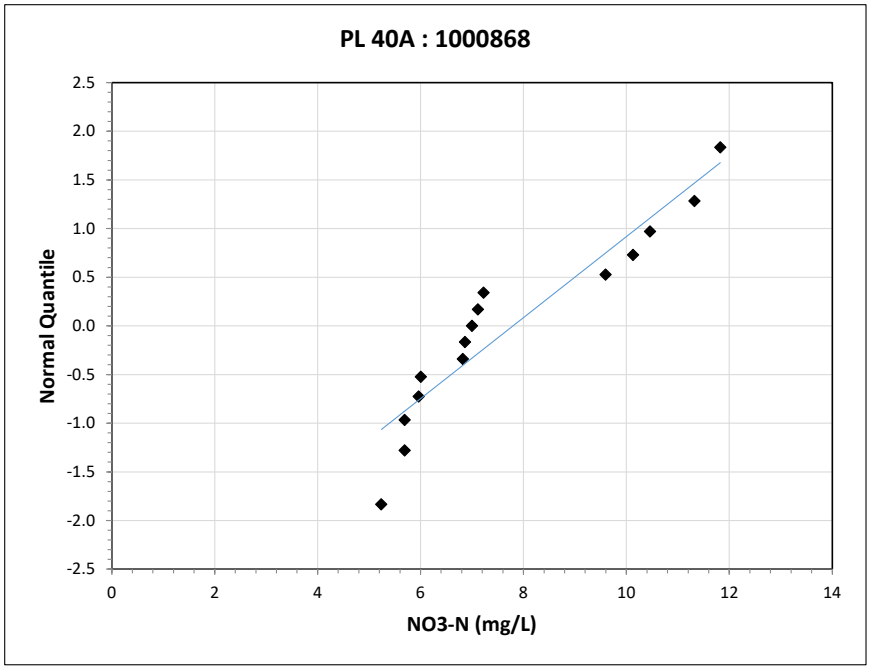


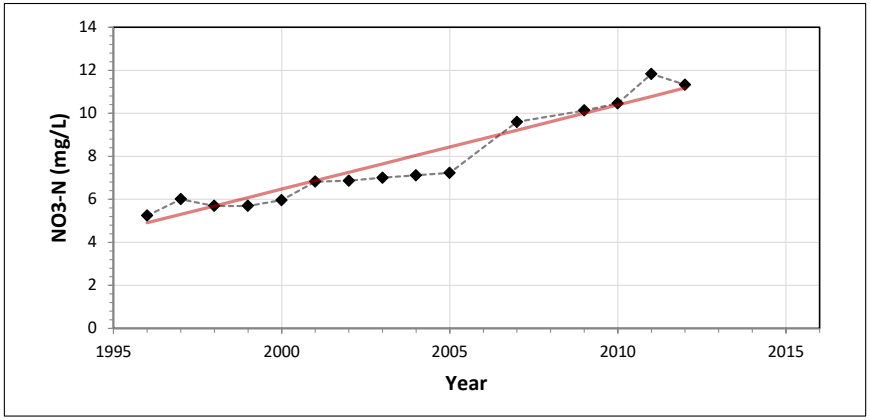
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	Agate 2 : 1000730
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2011
Annual Average Min	158
Annual Average Max	206
Annual Average Mean	184
Annual Average Stdev	16.96
Shapiro-Wilk W	0.898
Shapiro-Wilk p-value	0.149
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.90
Student t	1.04
Mean + t*SE (UCL84)	189
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	55
Var(S)	210
Intercept	-7574
Slope	3.88
p-value	2E-4
Significant Trend?	Increasing**



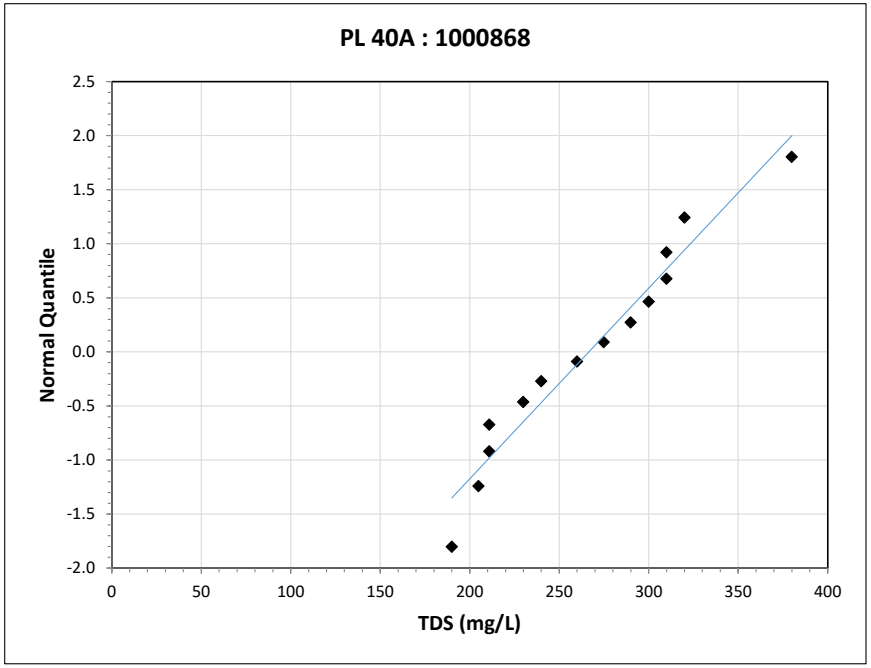


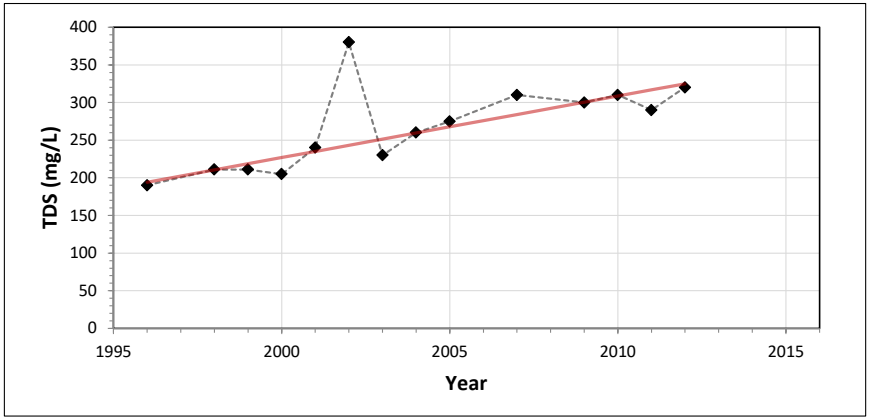
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	PL 40A : 1000868
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	5.24
Annual Average Max	11.83
Annual Average Mean	7.80
Annual Average Stdev	2.23
Shapiro-Wilk W	0.864
Shapiro-Wilk p-value	0.028
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.58
Student t	1.03
Mean + t*SE (UCL84)	8.39
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	96
Var(S)	407
Intercept	-777
Slope	0.39
p-value	3E-6
Significant Trend?	Increasing**



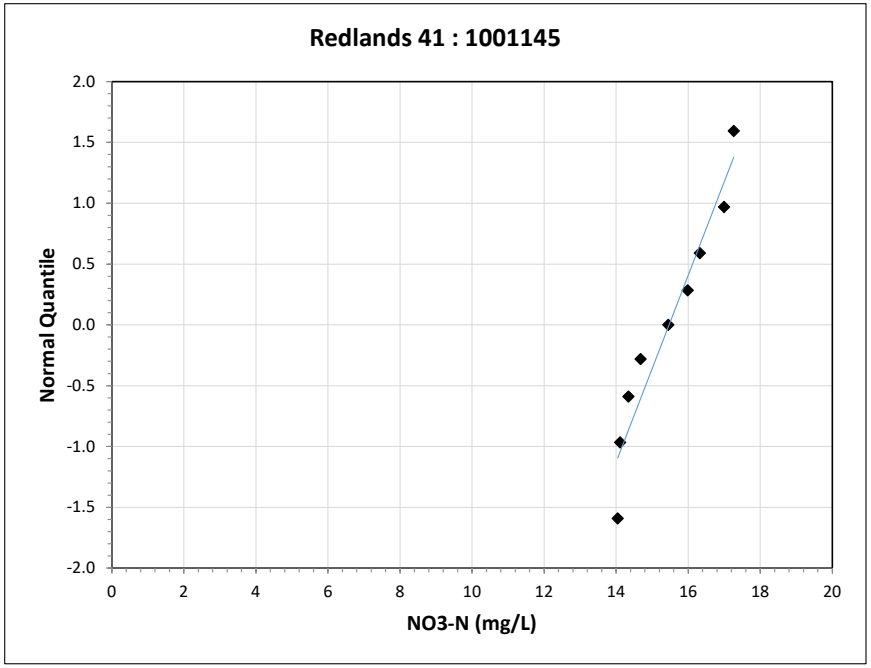


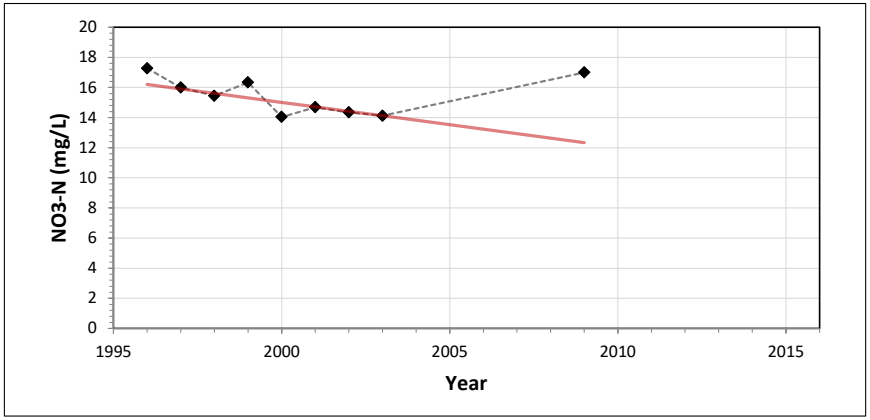
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	PL 40A : 1000868
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	190
Annual Average Max	380
Annual Average Mean	267
Annual Average Stdev	54.88
Shapiro-Wilk W	0.949
Shapiro-Wilk p-value	0.553
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	14.67
Student t	1.03
Mean + t*SE (UCL84)	282
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	59
Var(S)	332
Intercept	-16106
Slope	8.17
p-value	0.001
Significant Trend?	Increasing*



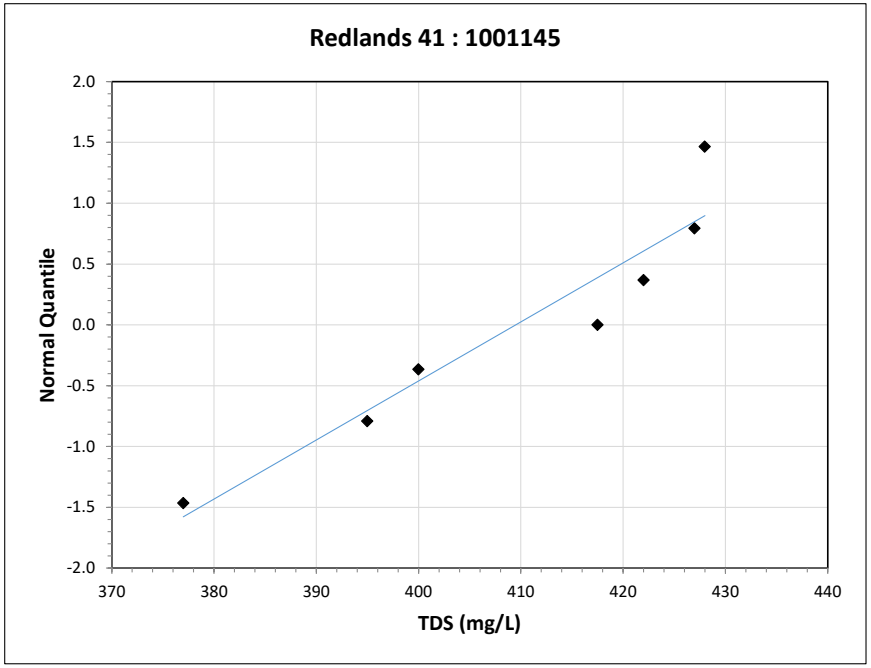


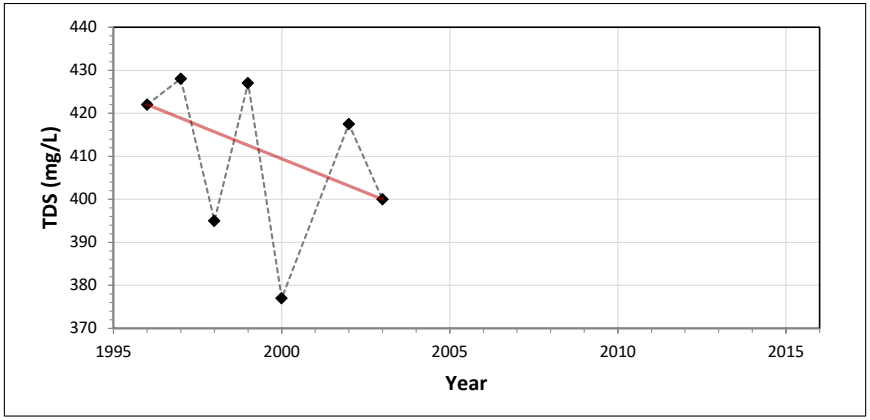
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	Redlands 41 : 1001145
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	1996
Sample Year Max	2009
Annual Average Min	14.05
Annual Average Max	17.27
Annual Average Mean	15.47
Annual Average Stdev	1.24
Shapiro-Wilk W	0.910
Shapiro-Wilk p-value	0.316
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.41
Student t	1.06
Mean + t*SE (UCL84)	15.91
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-12
Var(S)	92.00
Intercept	610
Slope	-0.30
p-value	0.251
Significant Trend?	No



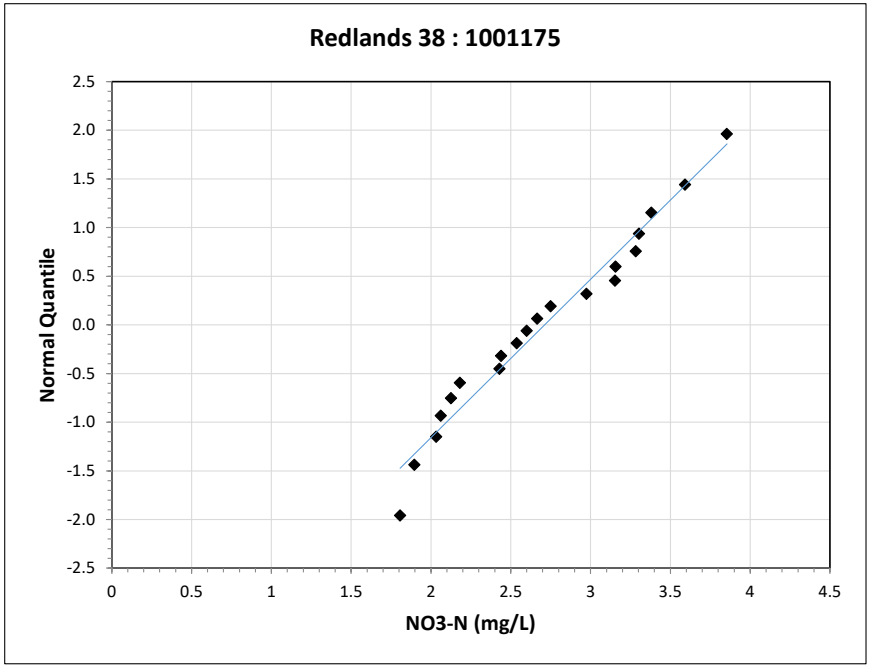


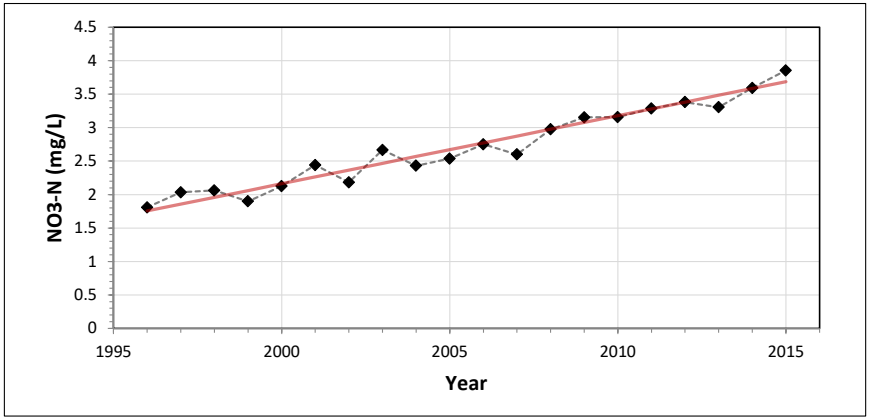
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	Redlands 41 : 1001145
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1996
Sample Year Max	2003
Annual Average Min	377
Annual Average Max	428
Annual Average Mean	410
Annual Average Stdev	19.26
Shapiro-Wilk W	0.893
Shapiro-Wilk p-value	0.291
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.28
Student t	1.08
Mean + t*SE (UCL84)	417
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-7
Var(S)	44.33
Intercept	6695
Slope	-3.14
p-value	0.368
Significant Trend?	No



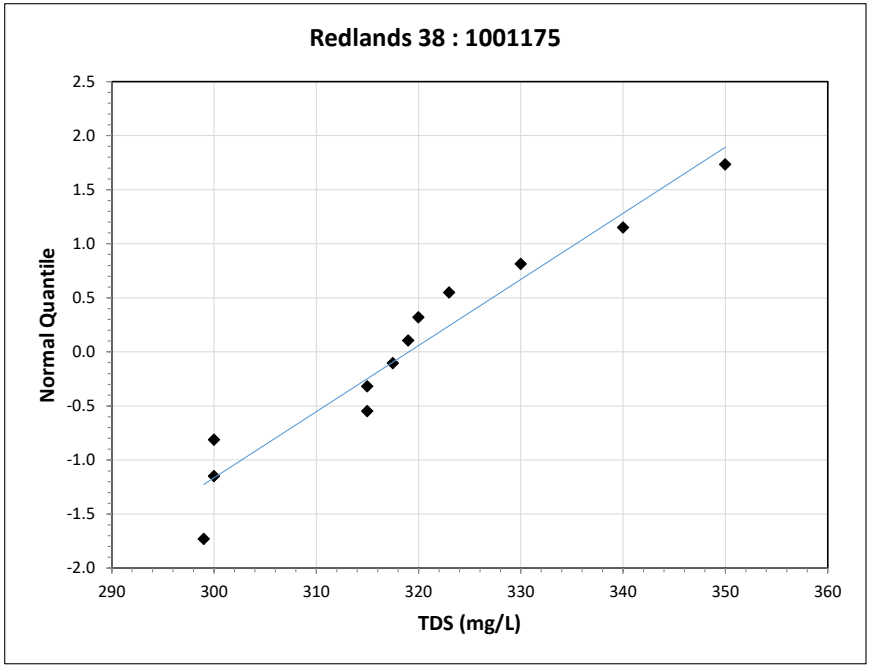


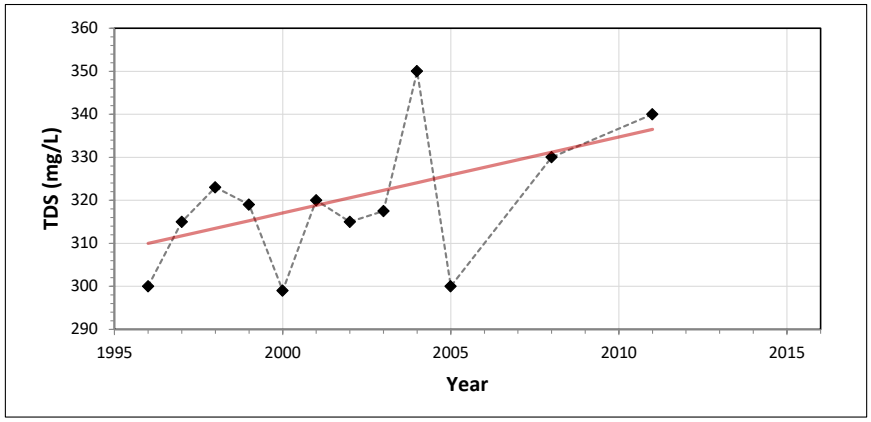
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	Redlands 38 : 1001175
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.81
Annual Average Max	3.85
Annual Average Mean	2.71
Annual Average Stdev	0.60
Shapiro-Wilk W	0.959
Shapiro-Wilk p-value	0.530
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.13
Student t	1.02
Mean + t*SE (UCL84)	2.85
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	172
Var(S)	950
Intercept	-201
Slope	0.10
p-value	3E-8
Significant Trend?	Increasing**



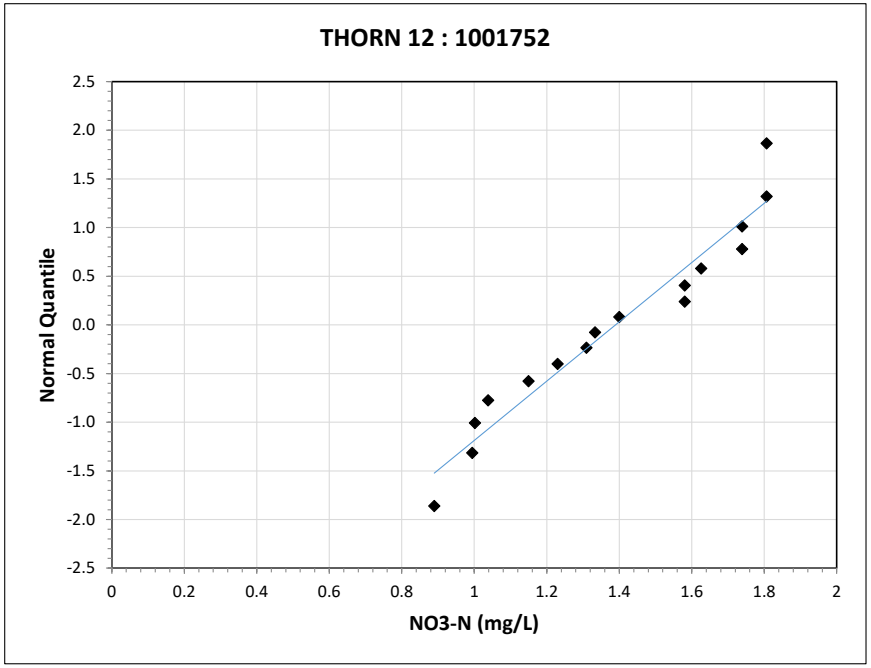


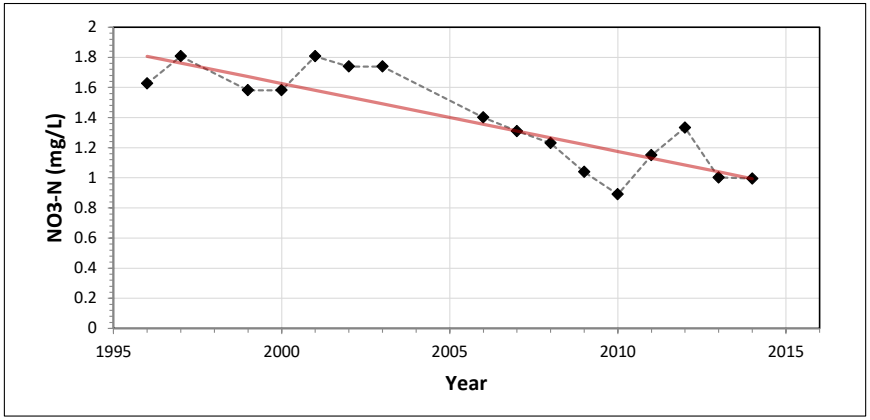
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	Redlands 38 : 1001175
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2011
Annual Average Min	299
Annual Average Max	350
Annual Average Mean	319
Annual Average Stdev	15.66
Shapiro-Wilk W	0.929
Shapiro-Wilk p-value	0.365
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.52
Student t	1.04
Mean + t*SE (UCL84)	324
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	22
Var(S)	211
Intercept	-3219
Slope	1.77
p-value	0.148
Significant Trend?	No



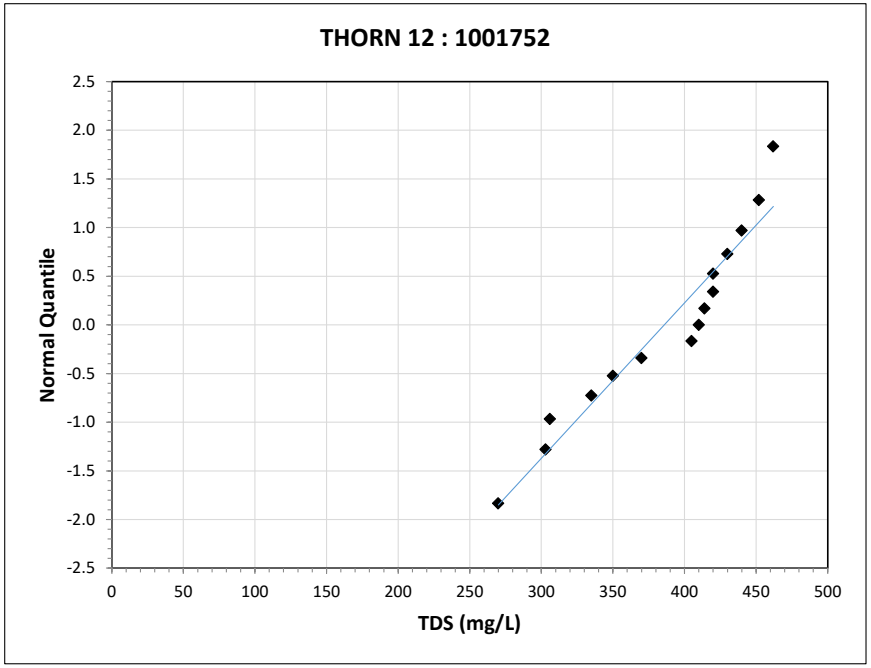


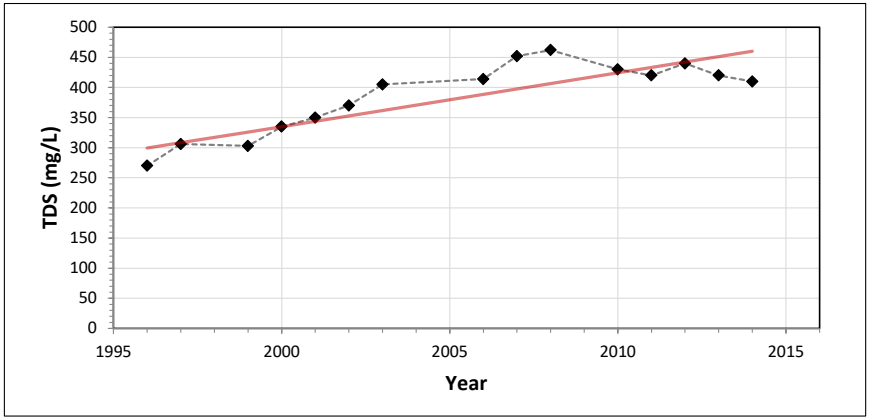
Statistics	
GMZ	Bunker Hill-B
Well Name : ID	THORN 12 : 1001752
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.89
Annual Average Max	1.81
Annual Average Mean	1.39
Annual Average Stdev	0.32
Shapiro-Wilk W	0.923
Shapiro-Wilk p-value	0.189
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.08
Student t	1.03
Mean + t*SE (UCL84)	1.47
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-80
Var(S)	491
Intercept	91.92
Slope	-0.05
p-value	4E-4
Significant Trend?	Decreasing**





Statistics	
GMZ	Bunker Hill-B
Well Name : ID	THORN 12 : 1001752
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	270
Annual Average Max	462
Annual Average Mean	386
Annual Average Stdev	59.71
Shapiro-Wilk W	0.915
Shapiro-Wilk p-value	0.160
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	15.42
Student t	1.03
Mean + t*SE (UCL84)	402
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	66
Var(S)	407
Intercept	-17532
Slope	8.93
p-value	0.001
Significant Trend?	Increasing*





Attachment B4

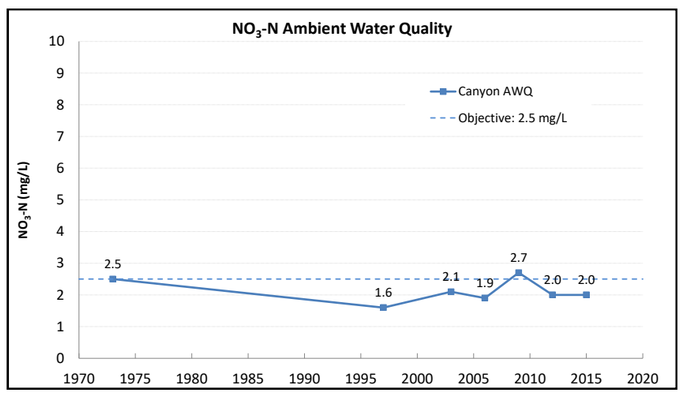
Canyon GMZ

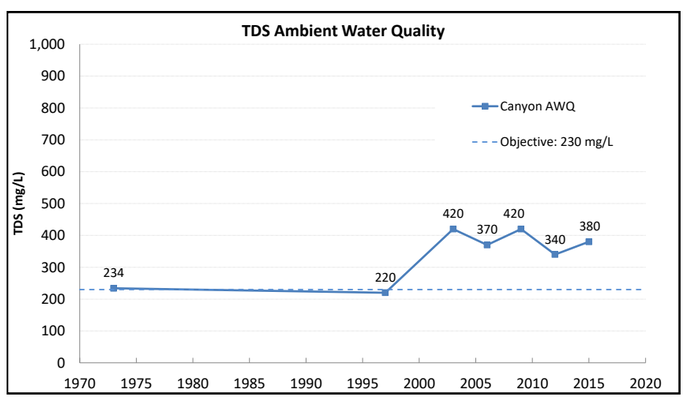
Attachment Contents:

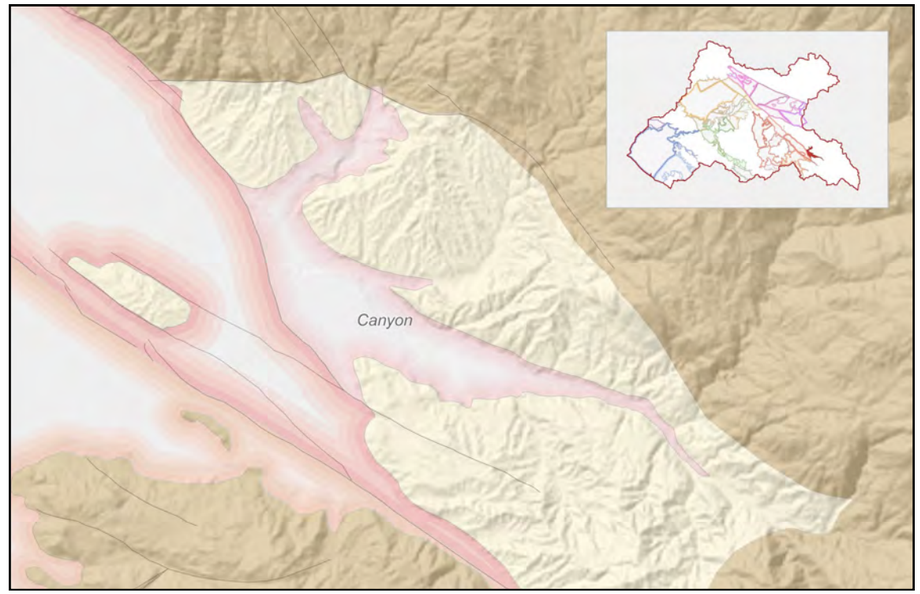
B4-1 Groundwater Storage and Elevation Contours Fall 2015
B4-2 NO_3-N Concentration and Contour Map
B4-3 TDS Concentration and Contour Map
B4-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B4-5 TDS Concentration Change (1993-2012 to 1996-2015)
B4-6 Key Well Analysis Charts

	Basin Analytics	Canyon
Basin	GMZ Area (acres)	4,390
	Volume of Storage (acre-ft)	76,200
NO_3-N	Wells per GMZ	24
	Point Statistics per GMZ	16
	Total Mass (tons)	200
	1996-2015 AWQ	2
TDS	Wells per GMZ	24
	Point Statistics per GMZ	20
	Total Mass (tons)	39,600
	1996-2015 AWQ	380

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Canyon is 2.5 mg/L. The ambient nitrate concentration was unchanged from 2.0 mg/L in 2012 to 2.0 mg/L in 2015, allowing for 0.5 mg/L of assimilative capacity. All of the four key wells in Canyon GMZ two show no trends in the nitrate concentrations. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation. One well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

The TDS objective Canyon is 230 mg/L. The ambient TDS concentration increased from 340 mg/L in 2012 to 380 mg/L in 2015, and there is no assimilative capacity. All of the four key wells in Canyon GMZ two show no trends in the TDS concentrations. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation. One well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Canyon	1211729	EMWD 17 Cienega	2.1	No Trend	249	No Trend
Canyon	1211787	LHMWD 04	0.8	No Trend	234	No Trend
Canyon	1211792	Washburn Grant/ Florida	11.7	No Trend	523	No Trend
Canyon	1211807	Royal Citrus Bee Canyon	0.1	No Trend	450	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B4-4 and B4-5 for NO_3-N and TDS well locations, respectively.

Well Attrition Analysis

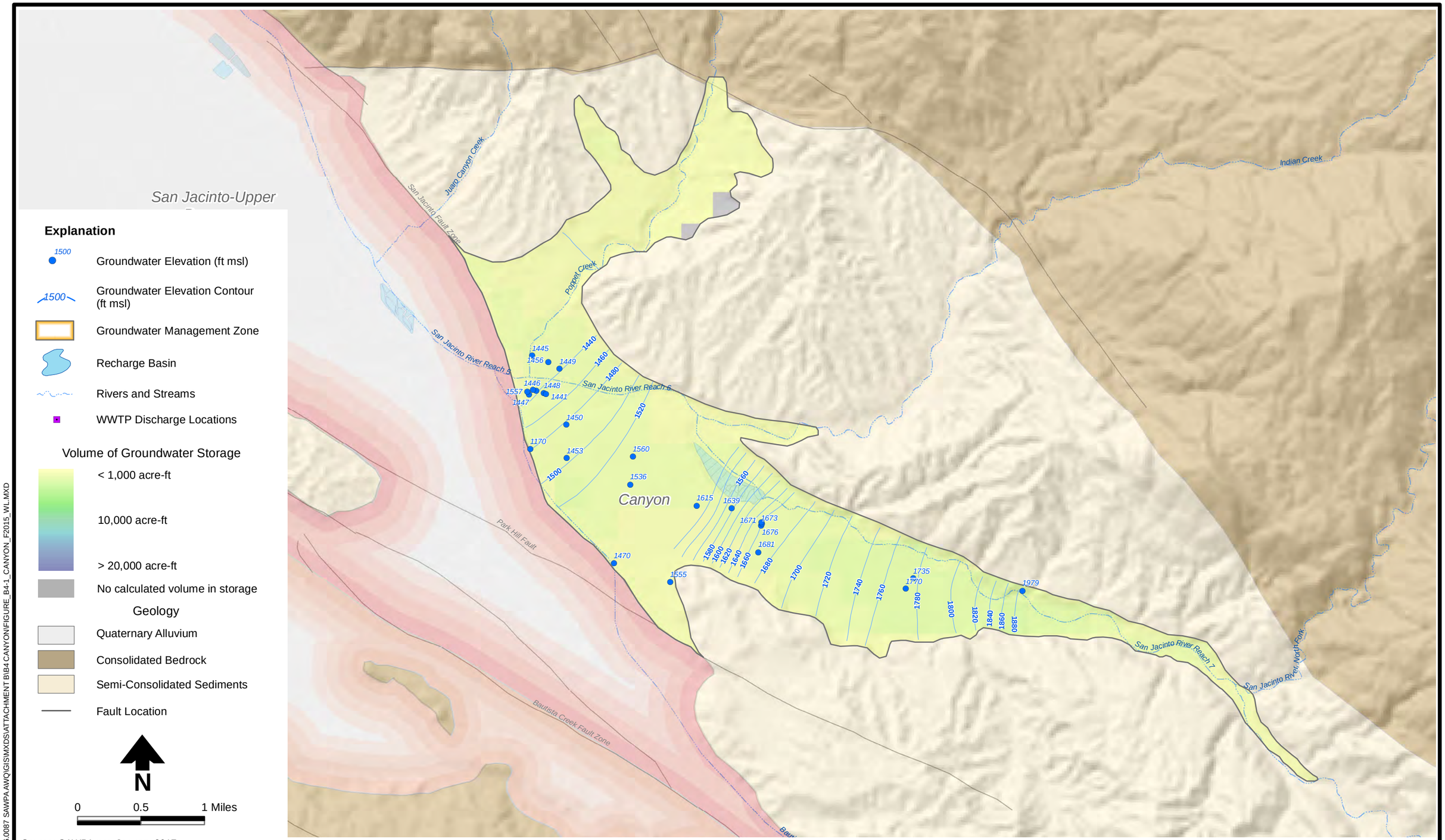
No well locations have been identified as locations likely to be lost in future AWQ recomputation studies.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Canyon	2000104	LHMWD 16	New*	1	2.0	Ave	New*	1	230	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 3 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 3 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B4-4 and B4-5 for NO_3-N and TDS well locations, respectively.



Explanation

- 1500 — Groundwater Elevation (ft msl)
- 1500 — Groundwater Elevation Contour (ft msl)
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

Volume of Groundwater Storage

- < 1,000 acre-ft
- 10,000 acre-ft
- > 20,000 acre-ft
- No calculated volume in storage

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 0.5 1 Miles

Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B4 CANYON\FIGURE_B4-1_CANYON_F2015_WL.MXD

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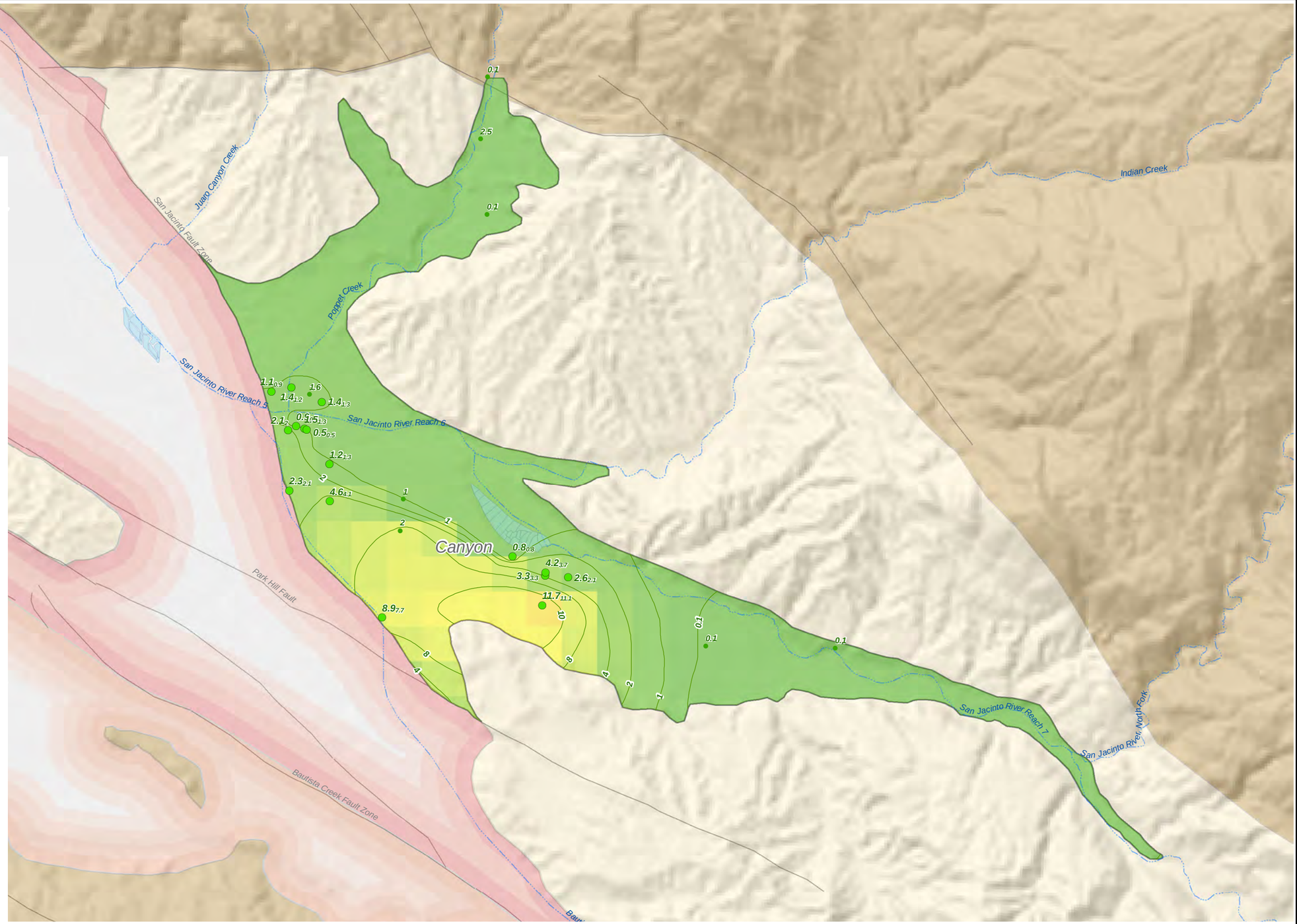
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Canyon GMZ

Attachment B18-1



Explanation

Statistic

8.5 8.4 — Well With Ambient NO_3-N Statistic

Average

8.4 — Well Without Ambient NO_3-N Statistic (Average Only)

Average

5 — Contour of Equal NO_3-N Concentration

Groundwater Management Zone

Recharge Basin

Rivers and Streams

WWTP Discharge Locations

NO_3-N Concentration

< 1.0 mg/L

10 mg/L

> 20 mg/L

Note: Grid cell size is 400 x 400 meters

Geology

Quaternary Alluvium

Consolidated Bedrock

Semi-Consolidated Sediments

Fault Location

N

0 0.5 1 Miles

Source: SAWPA.net, January 2017

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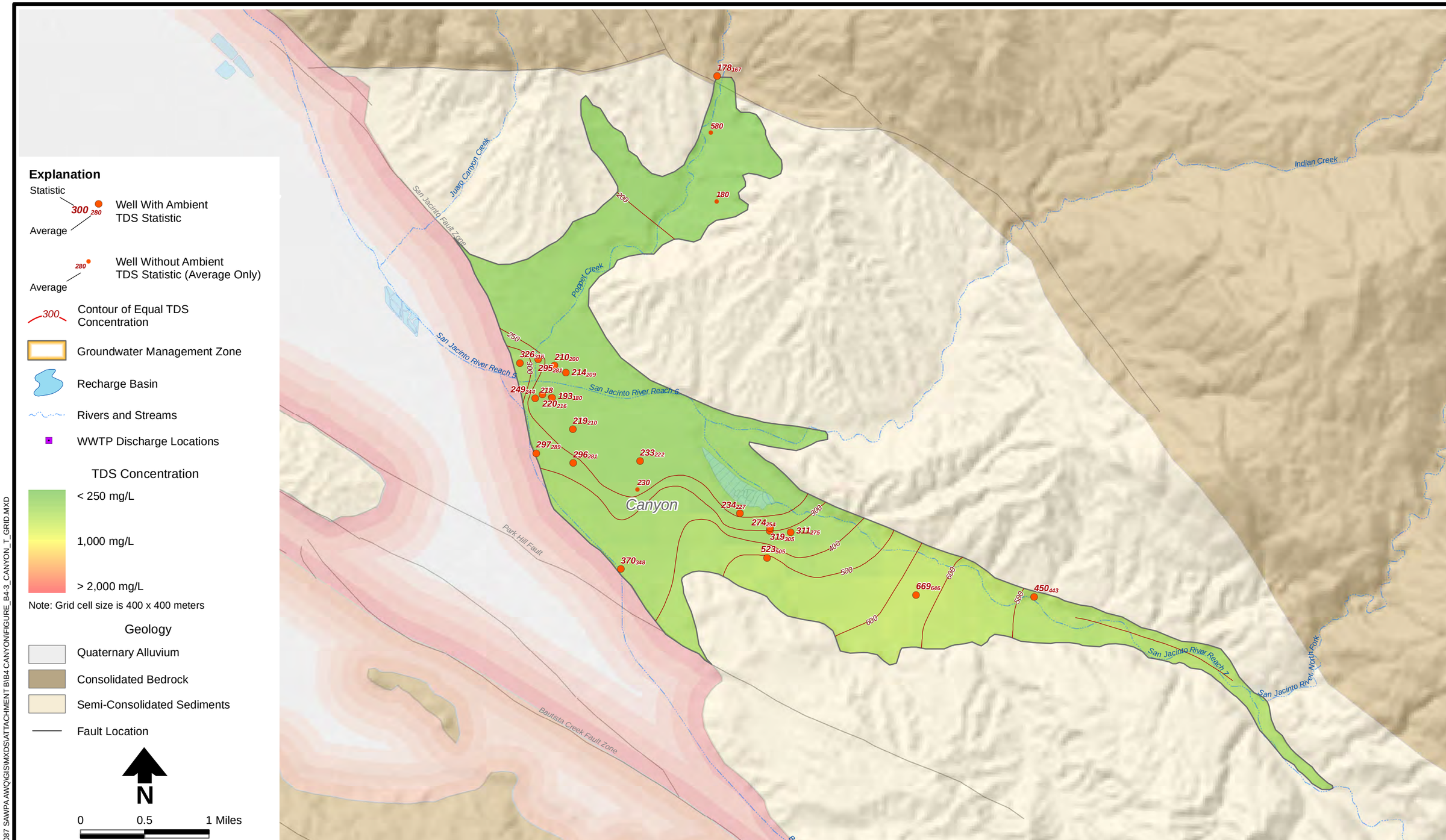
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Canyon GMZ

Attachment B4-2



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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Canyon GMZ

Attachment B4-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

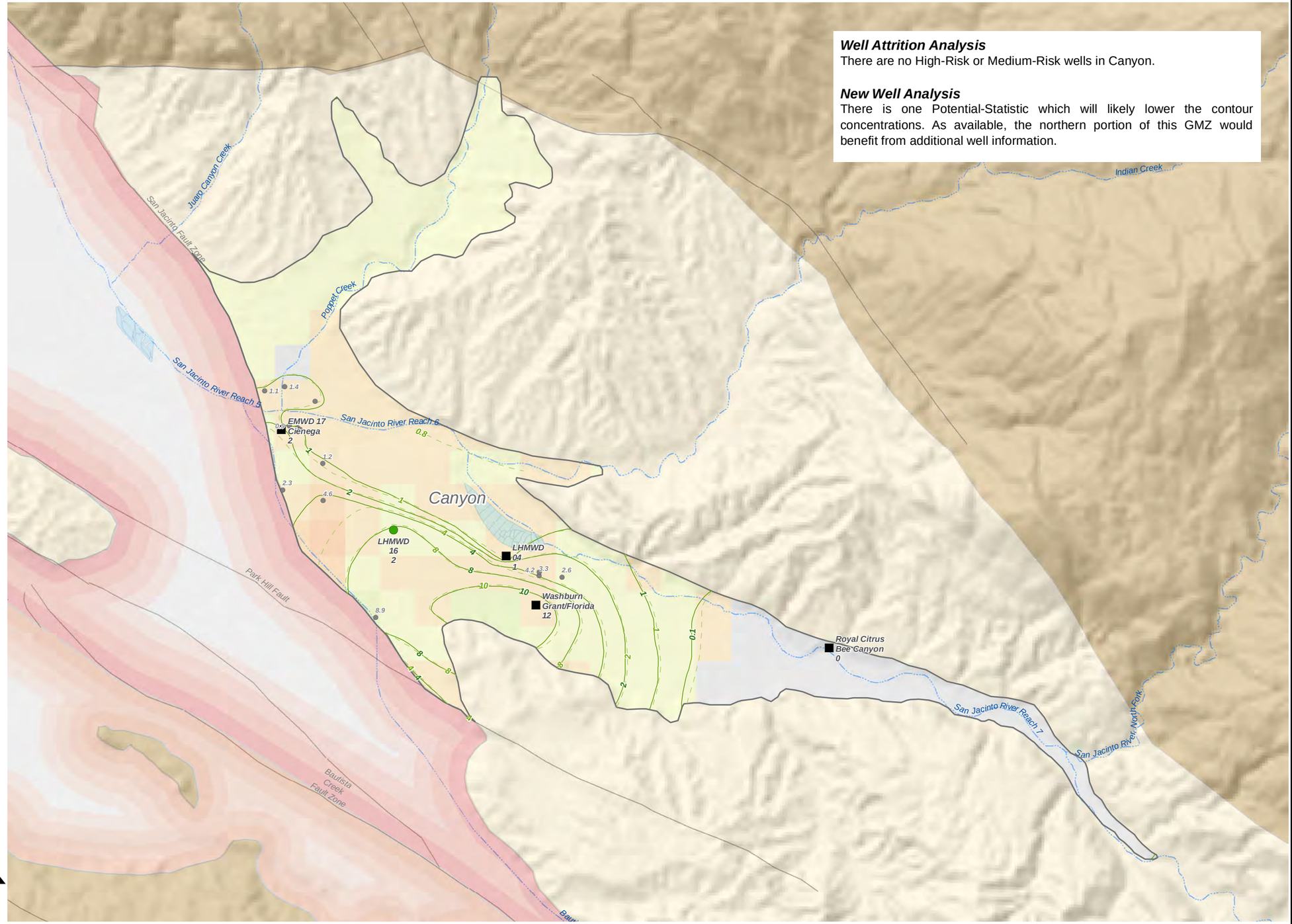
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 0.5 1 Miles

N

Source: SAWPA.net, January 2017



Well Attrition Analysis
There are no High-Risk or Medium-Risk wells in Canyon.

New Well Analysis
There is one Potential-Statistic which will likely lower the contour concentrations. As available, the northern portion of this GMZ would benefit from additional well information.

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Canyon GMZ

Attachment B4-4

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

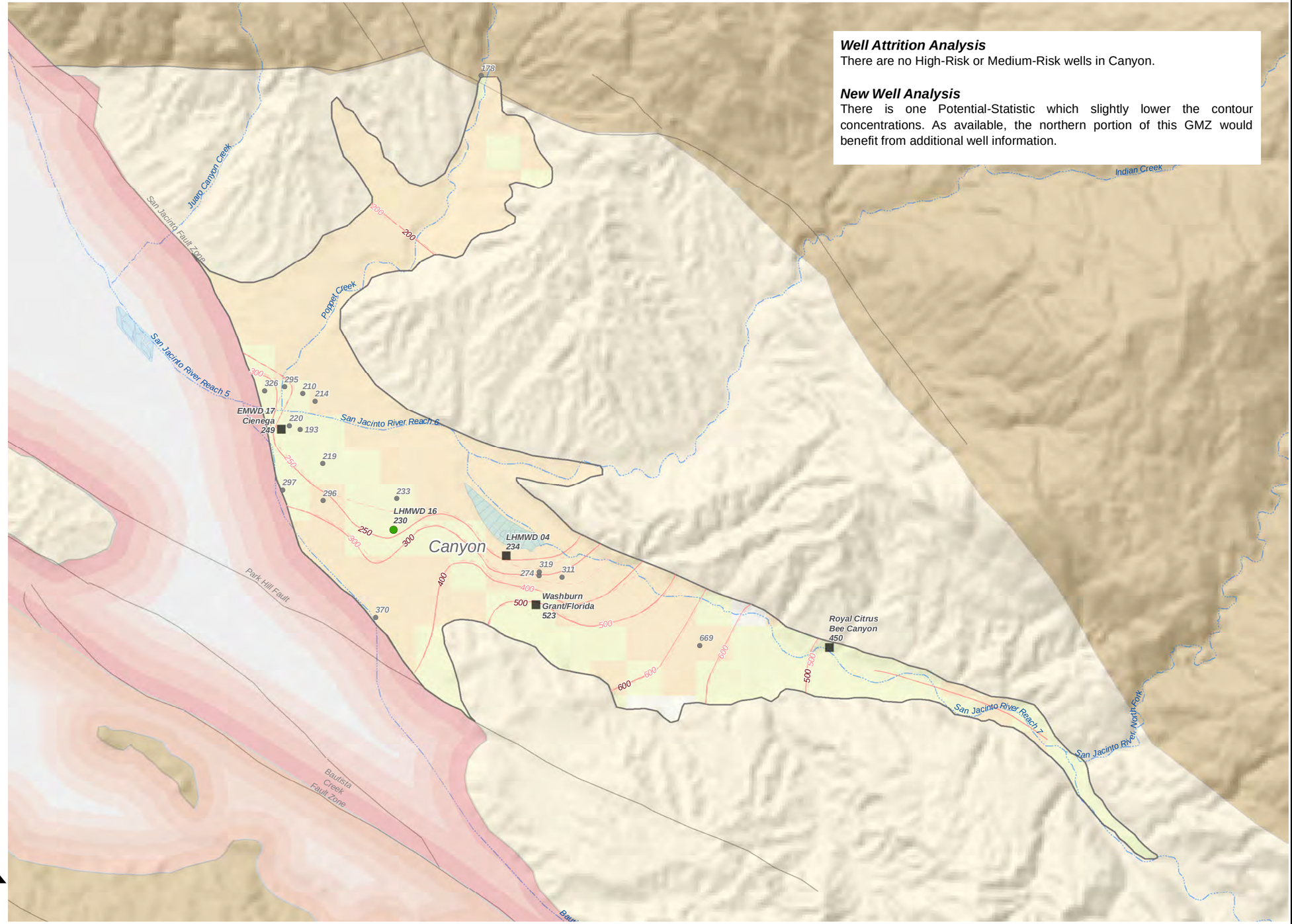
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 0.5 1 Miles

N

Source: SAWPA.net, January 2017



Well Attrition Analysis
There are no High-Risk or Medium-Risk wells in Canyon.

New Well Analysis
There is one Potential-Statistic which slightly lower the contour concentrations. As available, the northern portion of this GMZ would benefit from additional well information.

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Canyon GMZ

Attachment B4-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

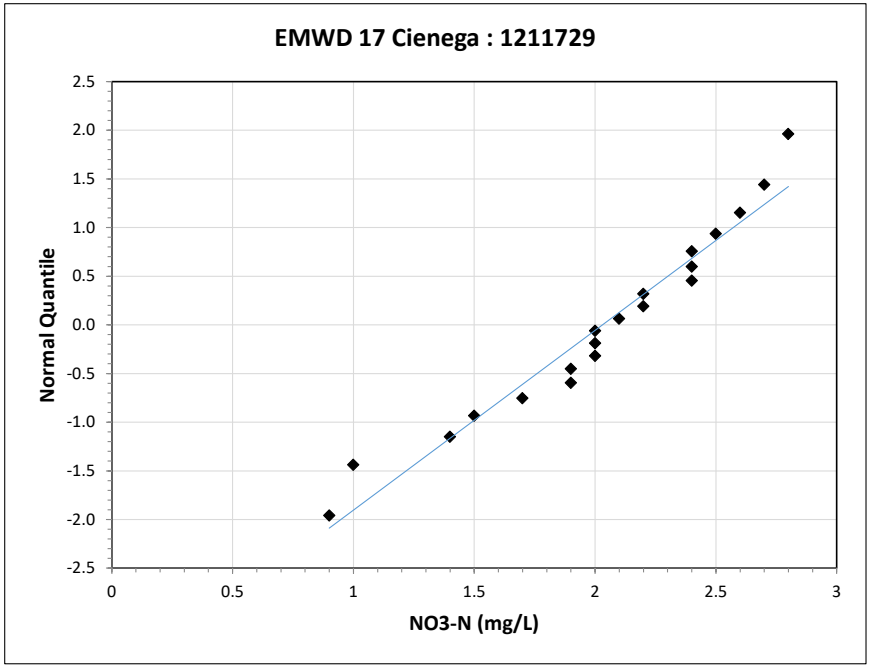
Mann-Kendall

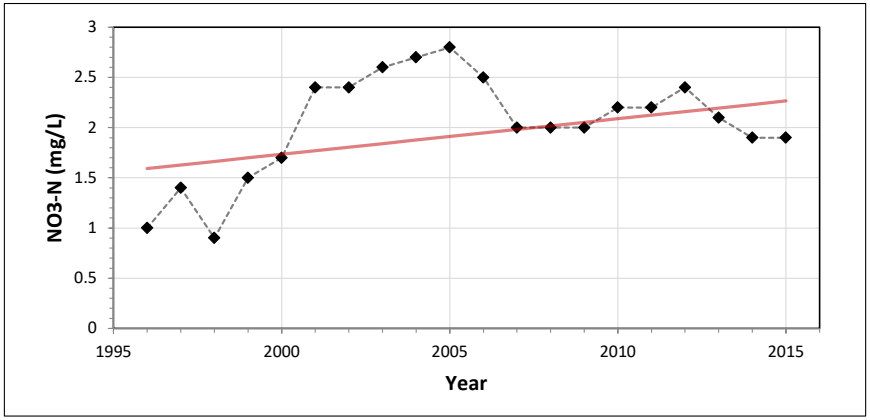
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

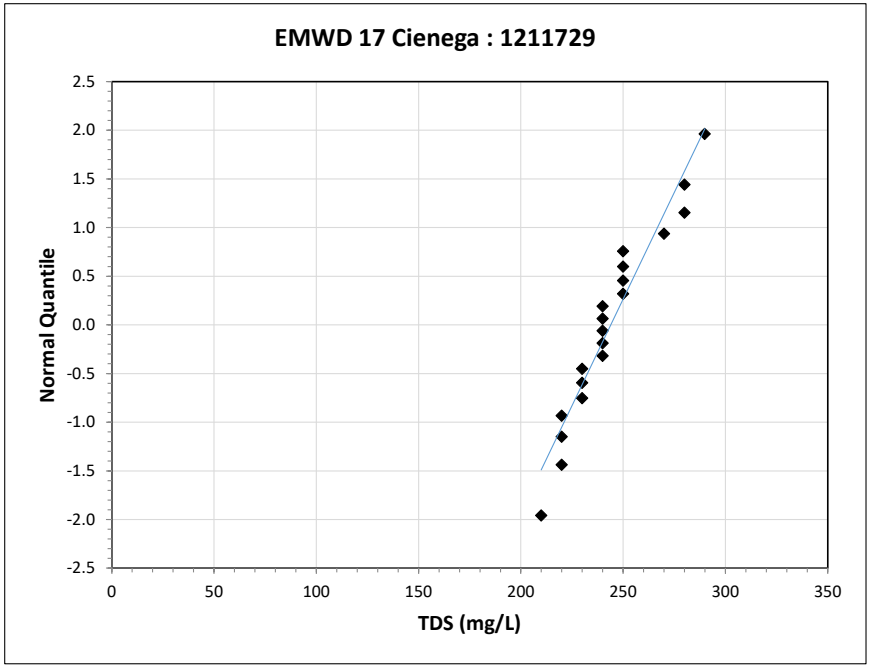
The significance of the trends is notated by * for significant and ** for very significant.

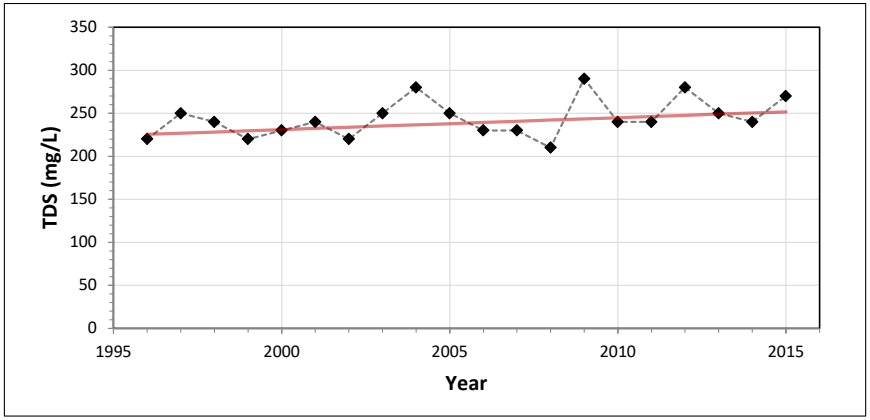
Statistics	
GMZ	Canyon
Well Name : ID	EMWD 17 Cienega : 1211729
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.90
Annual Average Max	2.80
Annual Average Mean	2.03
Annual Average Stdev	0.52
Shapiro-Wilk W	0.945
Shapiro-Wilk p-value	0.294
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.12
Student t	1.02
Mean + t*SE (UCL84)	2.15
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	34
Var(S)	941
Intercept	-69.10
Slope	0.04
p-value	0.282
Significant Trend?	No



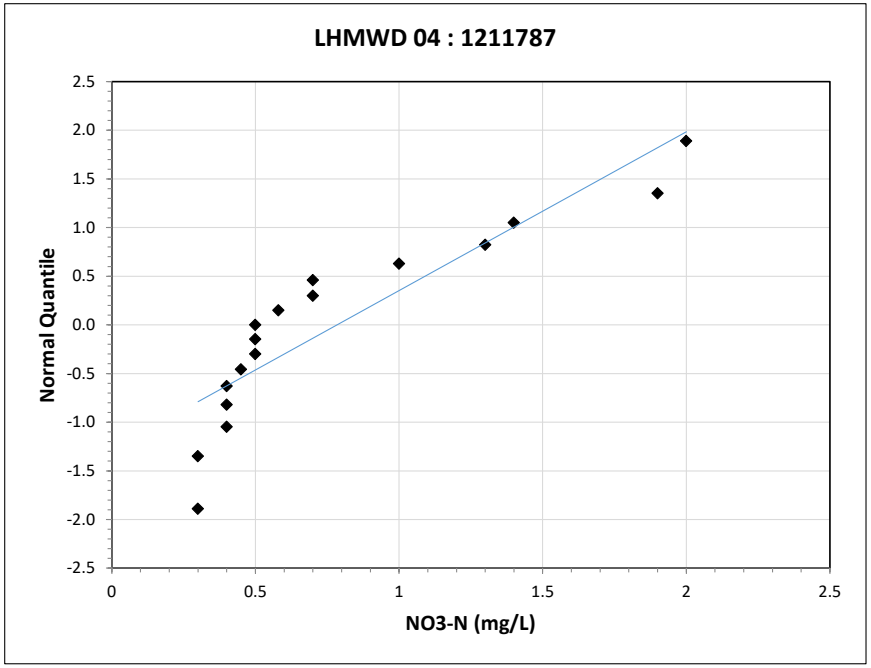


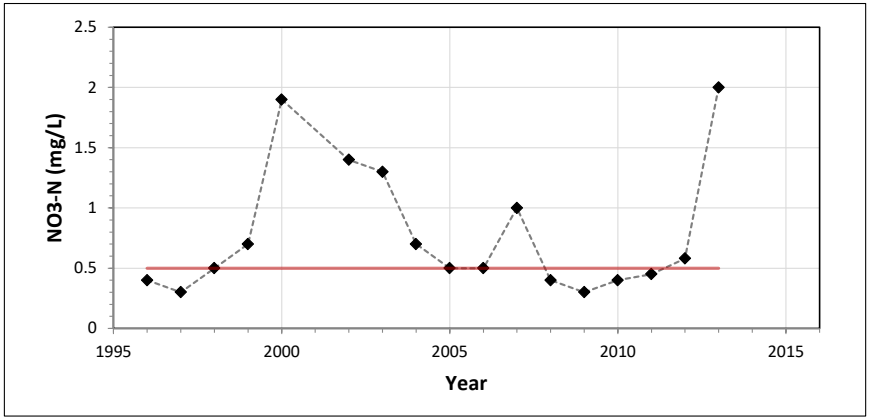
Statistics	
GMZ	Canyon
Well Name : ID	EMWD 17 Cienega : 1211729
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	210
Annual Average Max	290
Annual Average Mean	244
Annual Average Stdev	21.86
Shapiro-Wilk W	0.926
Shapiro-Wilk p-value	0.132
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.89
Student t	1.02
Mean + t*SE (UCL84)	249
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	49
Var(S)	916
Intercept	-2531
Slope	1.38
p-value	0.113
Significant Trend?	No



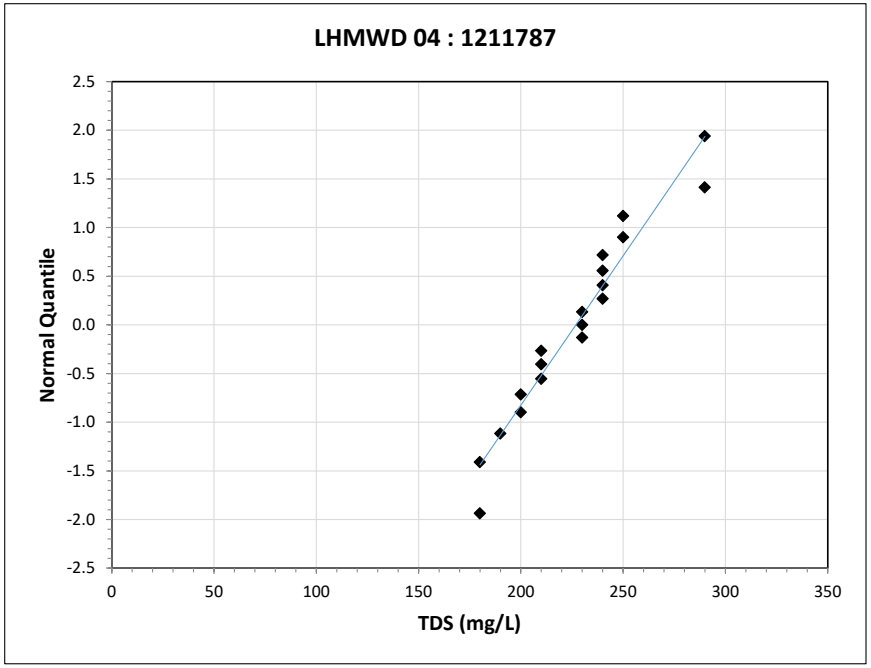


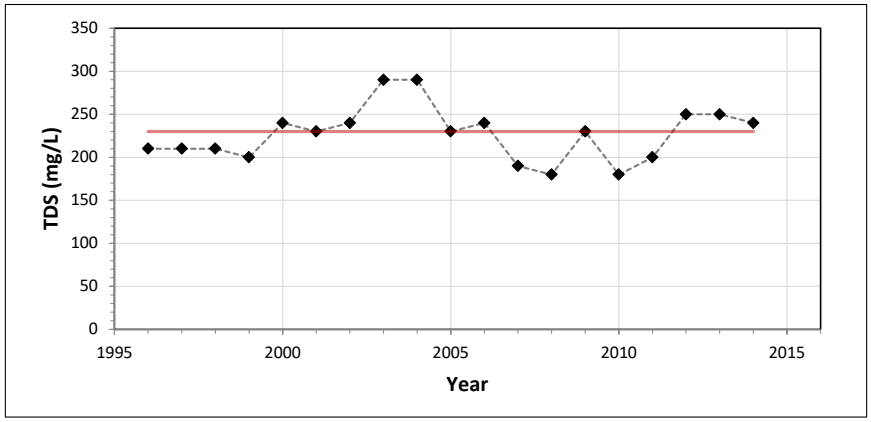
Statistics	
GMZ	Canyon
Well Name : ID	LHMWD 04 : 1211787
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	0.30
Annual Average Max	2.00
Annual Average Mean	0.78
Annual Average Stdev	0.54
Shapiro-Wilk W	0.793
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	2.00
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.03
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.081
Geomean	0.65
GM + t*GSE (UCL84)	0.75
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	580
Intercept	0.50
Slope	0.00
p-value	NC
Significant Trend?	No



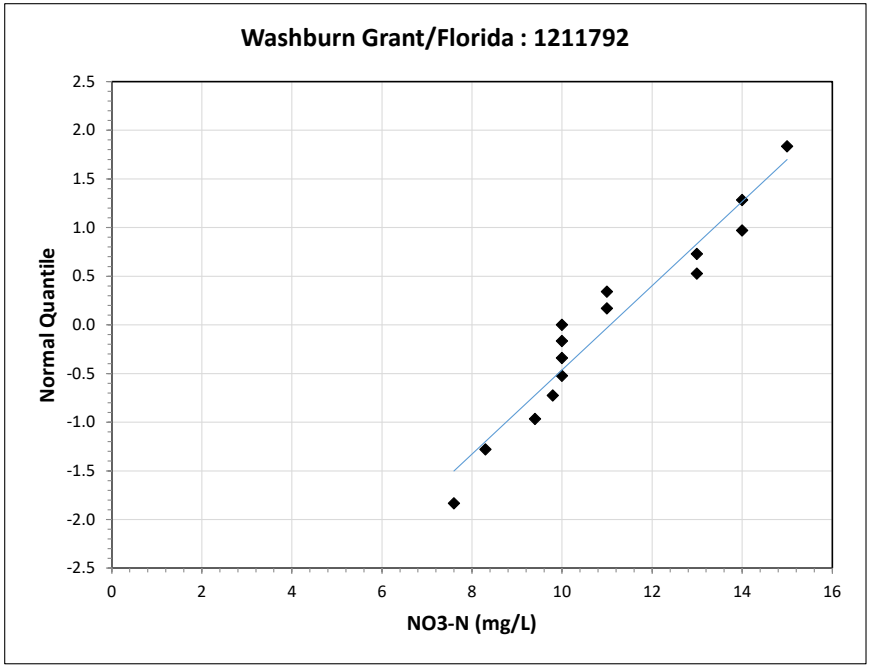


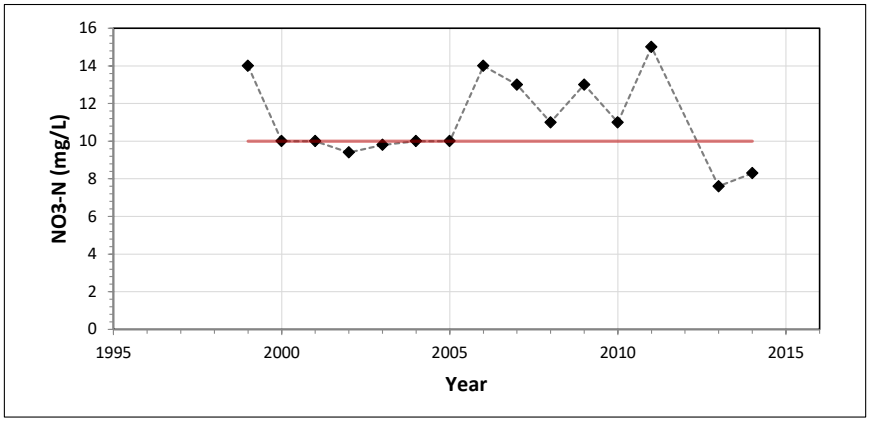
Statistics	
GMZ	Canyon
Well Name : ID	LHMWD 04 : 1211787
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	180
Annual Average Max	290
Annual Average Mean	227
Annual Average Stdev	31.46
Shapiro-Wilk W	0.936
Shapiro-Wilk p-value	0.225
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.22
Student t	1.02
Mean + t*SE (UCL84)	234
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	15
Var(S)	797
Intercept	230
Slope	0.00
p-value	NC
Significant Trend?	No



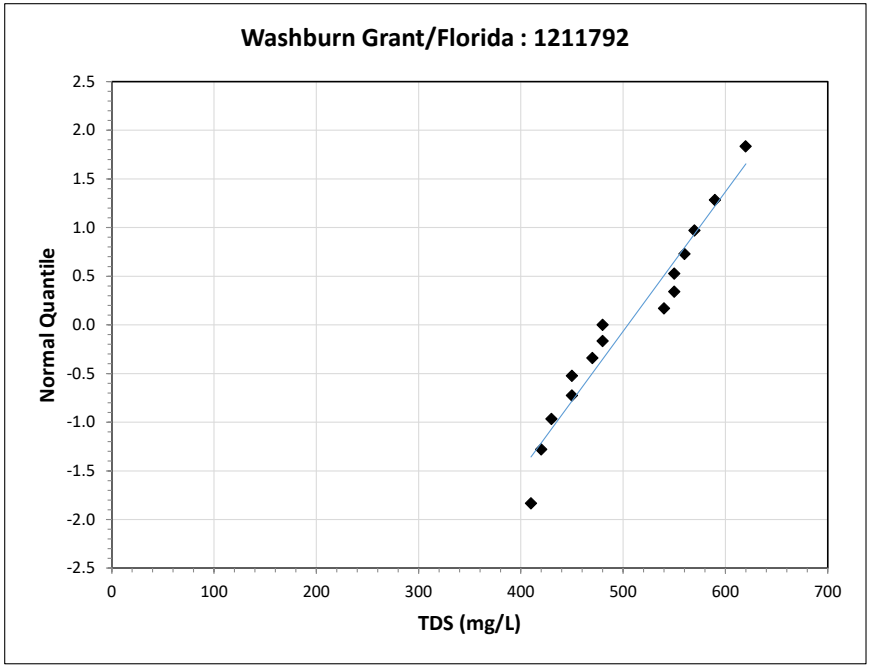


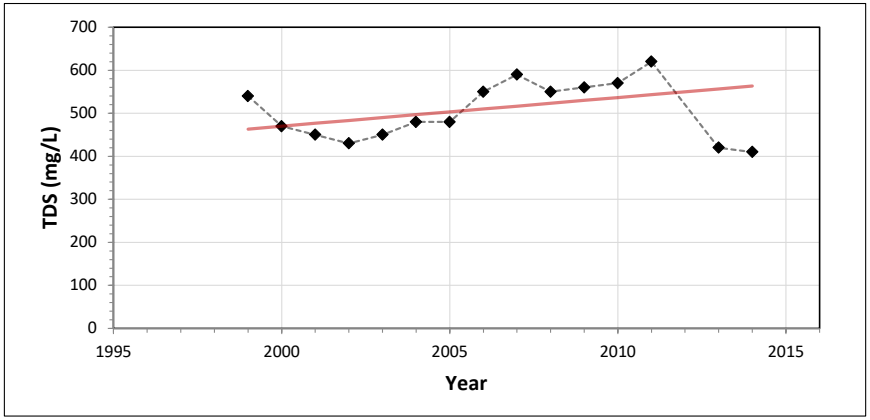
Statistics	
GMZ	Canyon
Well Name : ID	Washburn Grant/Florida : 1211792
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1999
Sample Year Max	2014
Annual Average Min	7.60
Annual Average Max	15.00
Annual Average Mean	11.07
Annual Average Stdev	2.22
Shapiro-Wilk W	0.926
Shapiro-Wilk p-value	0.241
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.57
Student t	1.03
Mean + t*SE (UCL84)	11.66
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	2
Var(S)	397
Intercept	10.00
Slope	0.00
p-value	NC
Significant Trend?	No



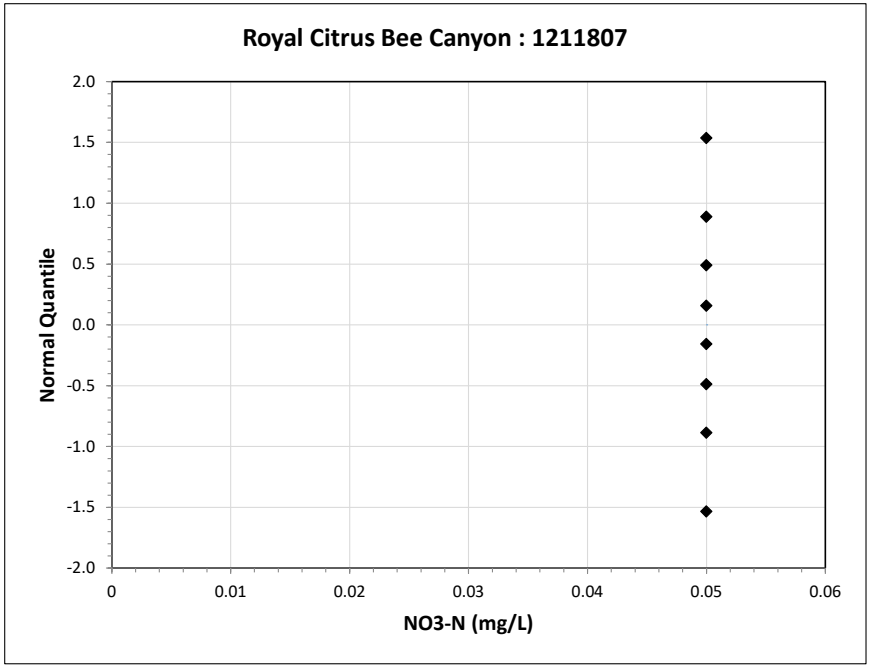


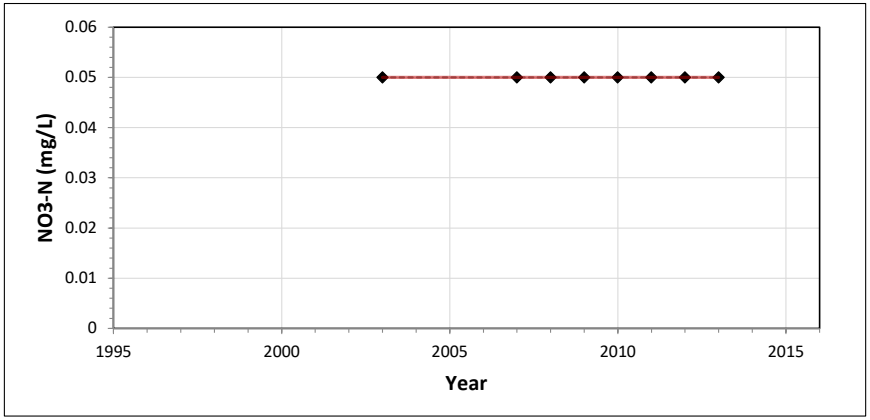
Statistics	
GMZ	Canyon
Well Name : ID	Washburn Grant/Florida : 1211792
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1999
Sample Year Max	2014
Annual Average Min	410
Annual Average Max	620
Annual Average Mean	505
Annual Average Stdev	67.28
Shapiro-Wilk W	0.933
Shapiro-Wilk p-value	0.300
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	17.37
Student t	1.03
Mean + t*SE (UCL84)	523
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	22
Var(S)	405
Intercept	-12863
Slope	6.67
p-value	0.297
Significant Trend?	No



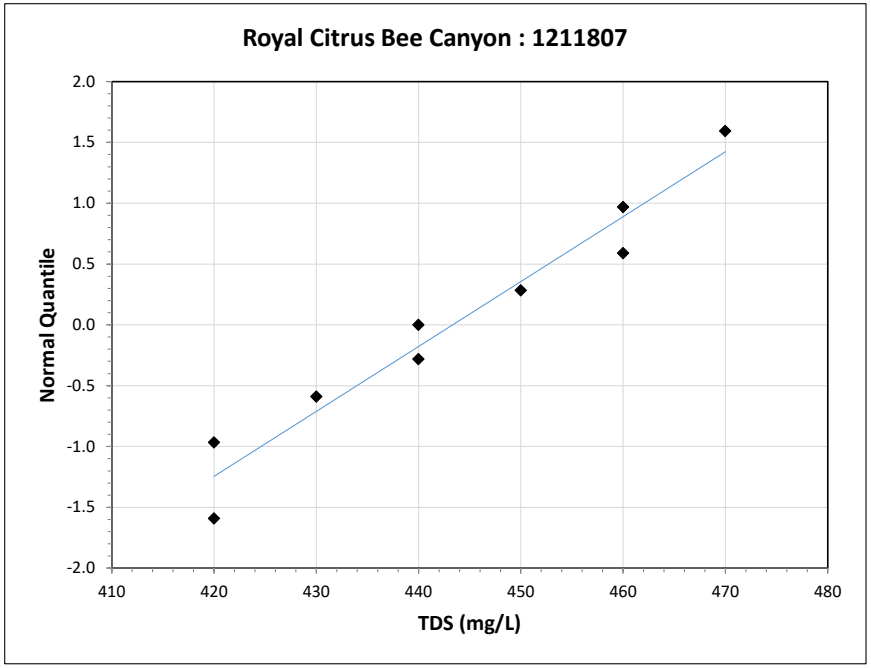


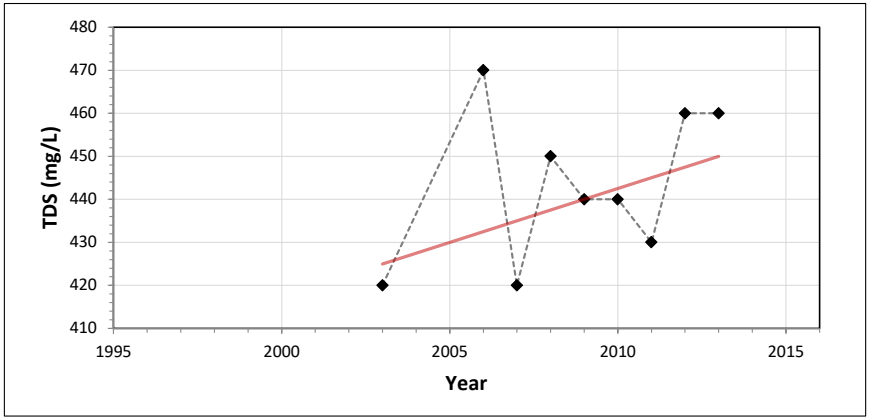
Statistics	
GMZ	Canyon
Well Name : ID	Royal Citrus Bee Canyon : 1211807
Analyte	NO3-N (mg/L)
Count	8
Count Detects	0
Sample Year Min	2003
Sample Year Max	2013
Annual Average Min	0.05
Annual Average Max	0.05
Annual Average Mean	0.05
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	0.00
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No





Statistics	
GMZ	Canyon
Well Name : ID	Royal Citrus Bee Canyon : 1211807
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	2003
Sample Year Max	2013
Annual Average Min	420
Annual Average Max	470
Annual Average Mean	443
Annual Average Stdev	18.03
Shapiro-Wilk W	0.935
Shapiro-Wilk p-value	0.529
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.01
Student t	1.06
Mean + t*SE (UCL84)	450
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	9
Var(S)	89.00
Intercept	-4583
Slope	2.50
p-value	0.396
Significant Trend?	No





Attachment B5

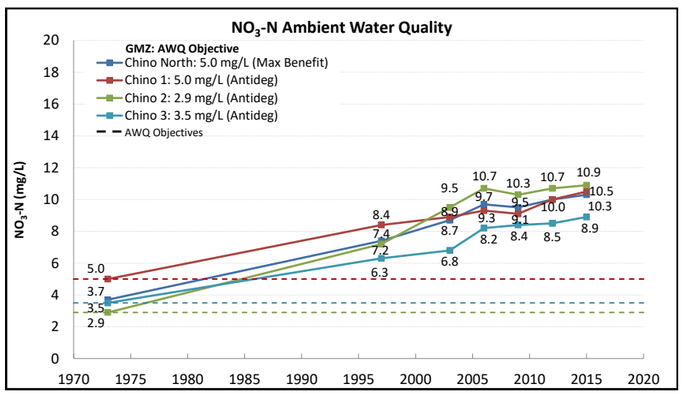
Chino-North GMZ

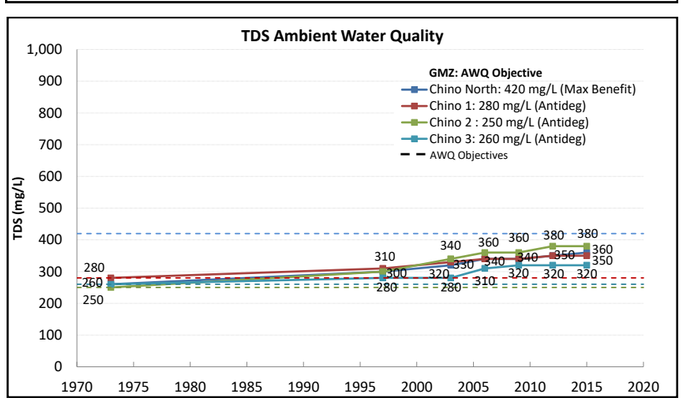
Attachment Contents:

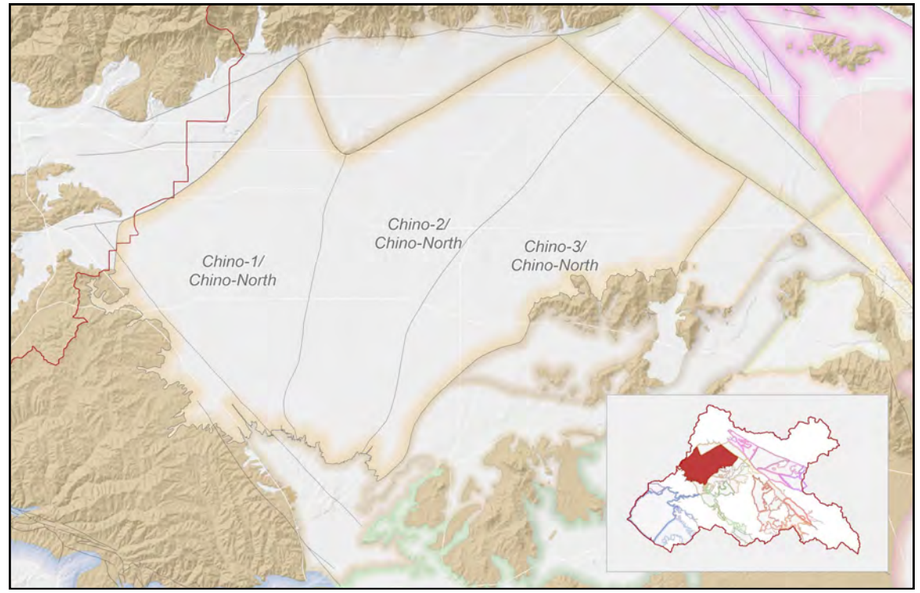
B5-1 Groundwater Storage and Elevation Contours Fall 2015
B5-2a,b,c NO_3-N Concentration and Contour Maps
B5-3a,b,c TDS Concentration and Contour Maps
B5-4a,b,c NO_3-N Concentration Change (1993-2012 to 1996-2015)
B5-5a,b,c TDS Concentration Change (1993-2012 to 1996-2015)
B5-6 Key Well Analysis Charts

	Basin Analytics	Chino-North	Chino-1	Chino-2	Chino-3
Basin	GMZ Area (acres)	121,000	39,500	43,400	38,500
	Volume of Storage (acre-ft)	5,870,000	2,100,000	2,500,000	1,270,000
NO_3-N	Wells per GMZ	999	278	467	254
	Point Statistics per GMZ	488	151	197	140
	Total Mass (tons)	82,400	30,100	36,900	15,400
	1996-2015 AWQ	10.3	10.5	10.9	8.9
TDS	Wells per GMZ	915	234	457	224
	Point Statistics per GMZ	453	119	223	111
	Total Mass (tons)	2,850,000	1,010,000	1,290,000	552,000
	1996-2015 AWQ	360	350	380	320

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Chino North

The nitrate objective for Chino North "max benefit" is 5.0 mg/L. The ambient nitrate concentration increased from 10.0 mg/L in 2012 to 10.3 mg/L in 2015, and there is no assimilative capacity. Thirteen out of the twenty-two key wells in Chino North GMZ have an increasing trend in nitrate concentrations, two key wells show a decreasing trend, and the other seven show no trends in the nitrate concentrations. Thirty of the total 999 wells with nitrate values in Chino North will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Eight new wells with statistics were added to the 1996 to 2015 AWQ recomputation and nineteen wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino-1/Chino-North

The nitrate objective for Chino 1 "antideg" is 5.0 mg/L. The ambient nitrate concentration increased from 10.0 mg/L in 2012 to 10.5 mg/L in 2015, and there is no assimilative capacity. Four out of the nine key wells in Chino-1/Chino-North GMZ have an increasing trend in NITRATE concentrations, one key wells shows a decreasing trend, and the other four show no trends in the nitrate concentrations. Fourteen of the total 278 wells with nitrate values in Chino-1/Chino-North will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Seven new wells with statistics were added to the 1996 to 2015 AWQ recomputation and six wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino-2/Chino-North

The nitrate objective for Chino 2 "antideg" is 2.9 mg/L. The ambient nitrate concentration increased from 10.7 mg/L in 2012 to 10.9 mg/L in 2015, and there is no assimilative capacity. Four out of the seven key wells in Chino-2/Chino-North GMZ have an increasing trend in nitrate concentrations, while the other three show no trends in the nitrate concentrations. Ten of the total 467 wells with nitrate values in Chino-2/Chino-North will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. One new well with statistics was added to the 1996 to 2015 AWQ recomputation and eight wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino-3/Chino-North

The nitrate objective for Chino 3 "antideg" is 3.5 mg/L. The ambient nitrate concentration increased from 8.5 mg/L in 2012 to 8.9 mg/L in 2015, and there is no assimilative capacity. Five out of the six key wells in Chino-3/Chino-North GMZ have an increasing trend in nitrate concentrations while the other one shows a decreasing trend in the nitrate concentration. Six of the total 254 wells with nitrate values in Chino-3/Chino-North will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and five wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N	NO_3-N	TDS	TDS
Chino-1/Chino-North	1002359	ONT 05	3.8	No Trend	370	No Trend
Chino-1/Chino-North	1002544	MVWD 05	7.1	Increasing**	259	Increasing
Chino-1/Chino-North	1002654	P-16	16.9	No Trend	468	Increasing
Chino-1/Chino-North	1002659	P-17	16.3	Increasing**	364	Increasing
Chino-1/Chino-North	1002741	5	10.1	Increasing**	265	Increasing
Chino-1/Chino-North	1004179	CH HIL 17	3.2	No Trend	200	No Trend
Chino-1/Chino-North	1004215	CH HIL 07A	8.7	Increasing	514	Increasing
Chino-1/Chino-North	1207989	HCMP-3/2	7.8	No Trend	--	--
Chino-1/Chino-North	1207990	HCMP-3/3	0.1	Decreasing	--	--
Chino-2/Chino-North	1002311	CVWD 5	1.0	Increasing**	196	No Trend
Chino-2/Chino-North	1002339	ONT 24	1.1	No Trend	194	No Trend
Chino-2/Chino-North	1002349	ONT 17	6.0	Increasing**	259	Increasing
Chino-2/Chino-North	1206677	I-3	8.7	Increasing**	--	--
Chino-2/Chino-North	1207978	HCMP-1/1	28.7	Increasing	1,223	No Trend
Chino-2/Chino-North	1207987	HCMP-1/2	1.2	No Trend	--	--
Chino-2/Chino-North	1207988	HCMP-1/3	1.3	No Trend	--	--
Chino-3/Chino-North	1002081	F31A	5.7	Increasing**	--	--
Chino-3/Chino-North	1002215	F37A	9.1	Increasing**	286	Increasing**
Chino-3/Chino-North	1003501	JCSD 14	11.1	Increasing**	357	Increasing**
Chino-3/Chino-North	1201075	Kaiser - MP2D	4.0	Increasing*	249	No Trend
Chino-3/Chino-North	1206962	II-2	17.7	Increasing**	--	--
Chino-3/Chino-North	1207984	HCMP-7/1	81.1	Decreasing*	1,875	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B5-4 and B5-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Chino-1/Chino-North	1002301	Upland 07	High	2	5.4	Ave	High	2	230	Ave
Chino-1/Chino-North	1002313	Upland 09	--	7	10.4	Stat	Medium	5	270	Stat
Chino-1/Chino-North	1002315	SAWC 12	--	4	8.8	Stat	Medium	1	203	Ave
Chino-1/Chino-North	1002321	SAWC 18	Medium	1	28.9	Ave	--	--	--	--
Chino-1/Chino-North	1002360	ONT 33	High	1	0.9	Ave	High	1	210	Ave
Chino-1/Chino-North	1002529	Upland 13	Medium	5	17.9	Stat	Medium	5	361	Stat
Chino-1/Chino-North	1002552	MVWD 11	--	8	8.3	Stat	Medium	5	299	Stat
Chino-1/Chino-North	1002646	MVWD 08	High	3	16.0	Stat	High	2	581	Ave
Chino-1/Chino-North	1002651	P-05(OLD)	Medium	2	7.5	Ave	Medium	2	295	Ave
Chino-1/Chino-North	1002685	P-24(OLD)	High	1	2.9	Ave	--	--	--	--
Chino-1/Chino-North	1003875	06	High	2	23.6	Ave	High	2	512	Ave
Chino-1/Chino-North	1004194	04	Medium	4	37.7	Stat	Medium	3	676	Stat
Chino-1/Chino-North	1004195	12	Medium	2	18.1	Ave	Medium	2	430	Ave
Chino-1/Chino-North	1004268	CH HIL 13	Medium	2	24.3	Ave	High	1	1,140	Ave
Chino-1/Chino-North	1004288	08	High	3	6.3	Stat	High	2	344	Ave
Chino-1/Chino-North	1004295	07	--	6	22.2	Stat	Medium	3	549	Stat
Chino-1/Chino-North	1004299	09	Medium	3	34.5	Stat	Medium	3	790	Stat
Chino-1/Chino-North	1201134	MW 3	Medium	4	16.4	Stat	Medium	4	355	Stat
Chino-1/Chino-North	1202139	IRR-#2-12P	Medium	1	53.6	Ave	Medium	1	970	Ave
Chino-1/Chino-North	1202834	Cypress Channel	Medium	1	14.8	Ave	Medium	1	410	Ave
Chino-1/Chino-North	1203217	CH HIL 14	Medium	3	14.5	Stat	Medium	2	390	Ave
Chino-1/Chino-North	1203240	DAIRY-1200 COWS	Medium	1	18.9	Ave	Medium	1	760	Ave
Chino-1/Chino-North	1203241	BACKUP-1000 CALVES	Medium	1	18.0	Ave	Medium	1	680	Ave
Chino-1/Chino-North	1203247	IRR	Medium	1	20.0	Ave	Medium	1	770	Ave
Chino-1/Chino-North	1203251	Dairy/Dom	Medium	1	17.6	Ave	Medium	1	660	Ave
Chino-1/Chino-North	1203278	74240	Medium	1	11.5	Ave	Medium	1	1,150	Ave

Continue on next page...

Well Information			NO3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Chino-1/Chino-North	1206754	MW-10	--	3	6.5	Stat	High	1	670	Ave
Chino-1/Chino-North	1206756	MW-18S	--	4	4.0	Stat	High	1	746	Ave
Chino-1/Chino-North	1206757	MW-19I	--	5	4.4	Stat	High	1	485	Ave
Chino-1/Chino-North	1206758	MW-19S	--	5	7.8	Stat	High	1	377	Ave
Chino-1/Chino-North	1206759	MW-19SA	--	4	27.6	Stat	High	1	465	Ave
Chino-1/Chino-North	1206760	MW-20I	--	5	15.2	Stat	High	1	323	Ave
Chino-1/Chino-North	1206761	MW-20S	--	4	25.0	Stat	High	1	763	Ave
Chino-1/Chino-North	1206762	MW-21I	--	5	10.5	Stat	High	1	410	Ave
Chino-1/Chino-North	1206763	MW-21S	--	4	4.6	Stat	High	1	529	Ave
Chino-1/Chino-North	1206764	MW-22DR	--	4	2.9	Stat	High	1	279	Ave
Chino-1/Chino-North	1206765	MW-24I	--	4	6.5	Stat	High	1	150	Ave
Chino-1/Chino-North	1206766	MW-24S	--	3	7.7	Stat	High	1	400	Ave
Chino-1/Chino-North	1206767	MW-25D	High	1	1.5	Ave	High	1	180	Ave
Chino-1/Chino-North	1206776	MW-33S	--	2	19.8	Ave	Medium	1	707	Ave
Chino-1/Chino-North	1206779	MW-4	--	3	30.6	Stat	High	1	577	Ave
Chino-1/Chino-North	1206782	MW-7	High	2	8.2	Ave	High	1	611	Ave
Chino-1/Chino-North	1206783	MW-8	High	2	2.4	Ave	High	1	688	Ave
Chino-1/Chino-North	1206785	P-23D	--	4	2.6	Stat	High	1	205	Ave
Chino-1/Chino-North	1206787	P-23S	--	3	12.3	Stat	High	1	552	Ave
Chino-1/Chino-North	1206825	MW-4BP	High	1	10.1	Ave	--	--	--	--
Chino-1/Chino-North	1206826	MW-5BP	High	1	24.0	Ave	--	--	--	--
Chino-1/Chino-North	1206827	MW-6BP	High	1	8.4	Ave	--	--	--	--
Chino-1/Chino-North	1207517	College Hghts	--	3	71.6	Stat	High	1	512	Ave
Chino-1/Chino-North	1220069	MW-28S	--	2	8.0	Ave	Medium	1	316	Ave
Chino-1/Chino-North	1220070	MW-28I	--	3	4.7	Stat	Medium	1	346	Ave
Chino-1/Chino-North	1220071	MW-29I	--	3	10.9	Stat	Medium	1	417	Ave
Chino-1/Chino-North	1220072	MW-30I	--	3	8.3	Stat	Medium	1	414	Ave
Chino-1/Chino-North	1220073	MW-31I	--	4	15.5	Stat	Medium	1	497	Ave
Chino-1/Chino-North	1220074	MW-32I	--	4	22.2	Stat	Medium	1	351	Ave
Chino-1/Chino-North	1220075	MW-34S	--	2	1.7	Ave	Medium	1	383	Ave
Chino-1/Chino-North	1220076	MW-35I	--	4	27.7	Stat	Medium	1	540	Ave
Chino-2/Chino-North	1002330	ONT 18	--	7	11.2	Stat	Medium	6	323	Stat
Chino-2/Chino-North	1002343	ONT 07	Medium	1	5.3	Ave	Medium	1	250	Ave
Chino-2/Chino-North	1003873	05	Medium	3	64.0	Stat	Medium	3	938	Stat
Chino-2/Chino-North	1004026	NA_1004026	High	2	15.1	Ave	High	1	527	Ave
Chino-2/Chino-North	1200251	construct I15/I30	Medium	1	1.8	Ave	Medium	1	220	Ave
Chino-2/Chino-North	1202447	DOM	Medium	1	61.5	Ave	Medium	1	1,060	Ave
Chino-2/Chino-North	1202904	74360-1	Medium	1	20.6	Ave	Medium	1	610	Ave
Chino-2/Chino-North	1202959	IRRIG 1-DOM	Medium	1	75.3	Ave	--	2	1,190	Ave
Chino-2/Chino-North	1203717	MIL M-11	High	2	2.9	Ave	High	2	405	Ave
Chino-2/Chino-North	1203718	MIL M-12A	High	3	5.0	Stat	High	3	301	Stat
Chino-2/Chino-North	1203720	MIL M-13A	High	3	6.3	Stat	High	3	325	Stat
Chino-2/Chino-North	1203721	MIL M-14A	High	3	10.4	Stat	High	3	361	Stat
Chino-2/Chino-North	1203732	MIL M-05A	High	3	8.6	Stat	High	3	325	Stat
Chino-2/Chino-North	1207078	1	--	5	4.2	Stat	Medium	3	199	Stat
Chino-2/Chino-North	1202546	73000-2	Medium	1	25.0	Ave	Medium	1	580	Ave
Chino-2/Chino-North	1202554	77760-PAR	Medium	1	64.5	Ave	Medium	1	870	Ave
Chino-2/Chino-North	1202823	AG#8/GAS-GOYENETCHE	Medium	1	30.8	Ave	Medium	1	1,070	Ave
Chino-2/Chino-North	1203468	75960-DOM	Medium	1	32.1	Ave	--	2	895	Ave
Chino-3/Chino-North	1002082	F18A	--	7	7.6	Stat	Medium	6	252	Stat
Chino-3/Chino-North	1002104	FU14	--	--	--	--	High	1	737	Ave
Chino-3/Chino-North	1002217	F3A	Medium	5	11.3	Stat	Medium	4	286	Stat
Chino-3/Chino-North	1003496	71820-DOM1	Medium	2	4.2	Ave	Medium	2	235	Ave
Chino-3/Chino-North	1003497	71820-IRR	Medium	1	5.3	Ave	Medium	1	240	Ave
Chino-3/Chino-North	1200190	TUDOR WELL	--	9	5.9	Stat	Medium	6	271	Stat
Chino-3/Chino-North	1200989	F25A	--	4	11.0	Stat	Medium	2	262	Ave
Chino-3/Chino-North	1201164	MIL M-02	High	2	3.5	Ave	High	2	294	Ave
Chino-3/Chino-North	1202671	FRED SHAKEL-75P	Medium	1	13.2	Ave	Medium	1	380	Ave
Chino-3/Chino-North	1202680	Regent-IRR	Medium	1	6.0	Ave	Medium	1	270	Ave
Chino-3/Chino-North	1202712	JCSD 03-4OH	Medium	2	22.6	Ave	Medium	2	490	Ave
Chino-3/Chino-North	1202739	D#1 n. of garage	Medium	1	8.5	Ave	Medium	1	270	Ave
Chino-3/Chino-North	1202742	Stratham S - Irrigation	Medium	1	85.0	Ave	Medium	1	970	Ave

Well Information			NO3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Chino-3/Chino-North	1203725	MIL M-16	High	3	4.8	Stat	High	3	341	Stat
Chino-3/Chino-North	1203727	MIL M-18	High	1	4.5	Ave	High	1	376	Ave
Chino-3/Chino-North	1203729	MIL M-02C	High	2	3.3	Ave	High	2	336	Ave
Chino-3/Chino-North	1203734	MIL M-06A	Medium	4	3.0	Stat	Medium	4	292	Stat
Chino-3/Chino-North	1232194	340649117260701	Medium	1	8.0	Ave	Medium	1	253	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B5-4 and B5-5 for NO_3-N and TDS well locations, respectively. As requested by Chino Basin Water Master, private well locations used in the 1996-2015 AWQ recomputation are not shown.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Chino-1/Chino-North	1207037	P-2	New*	1	14.6	Ave	New*	1	214	Ave
Chino-1/Chino-North	1207038	P-3	New*	1	10.1	Ave	New*	1	220	Ave
Chino-1/Chino-North	1208792	P-10(OLD)	New*	1	6.9	Ave	--	--	--	--
Chino-1/Chino-North	1222970	I-16	New	3	29.5	Stat	New	3	858	Stat
Chino-1/Chino-North	1224765	MVWD 34	New	5	13.9	Stat	New	3	330	Stat
Chino-1/Chino-North	1231828	CC M-101S	New	4	9.7	Stat	New	4	527	Stat
Chino-1/Chino-North	1231829	CC M-101D	New	4	12.2	Stat	New	4	271	Stat
Chino-1/Chino-North	1232244	CC M-102D	New	3	13.7	Stat	New	3	312	Stat
Chino-1/Chino-North	1232245	CC M-102S	New	3	27.4	Stat	New	3	682	Stat
Chino-1/Chino-North	1232813	11A	New*	2	13.0	Ave	New*	2	549	Ave
Chino-1/Chino-North	1233101	MW-1 T0603737443	New	5	5.7	Stat	--	--	--	--
Chino-1/Chino-North	1233105	MW-5 T0603737443	New*	3	0.1	Ave	--	--	--	--
Chino-1/Chino-North	1233528	Margarita #2	New*	1	4.1	Ave	New*	1	300	Ave
Chino-2/Chino-North	1208673	CDF Well 16	New	3	50.7	Stat	New	3	896	Stat
Chino-2/Chino-North	1224326	P-4	New*	2	9.3	Ave	New*	2	228	Ave
Chino-2/Chino-North	1224811	I-17	--	2	20.7	Ave	New	3	925	Stat
Chino-2/Chino-North	1232881	PB-2	New*	1	47.0	Ave	New*	1	2570	Ave
Chino-3/Chino-North	1002219	Cal Speedway 1	--	3	9.1	Stat	New*	2	416	Ave
Chino-3/Chino-North	1232847	F21B	New*	2	4.4	Ave	New*	2	218	Ave
Chino-3/Chino-North	1233787	JCSD 27	New*	2	3.3	Ave	New*	2	263	Ave
Chino-3/Chino-North	1233788	JCSD 28	New*	2	2.8	Ave	New*	2	340	Ave
Chino-3/Chino-North	1233816	FC-0754D	New*	1	8.2	Ave	New*	1	1150	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis (Middle Left)

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B11-4 and B11-5 for NO_3-N and TDS well locations, respectively. As requested by Chino Basin Water Master, private well locations used in the 1996-2015 AWQ recomputation are not shown.

Total Dissolved Solids (TDS)

Chino North

The TDS objective for Chino North "max benefit" is 420 mg/L. The ambient TDS concentration increased from 350 mg/L in 2012 to 360 mg/L in 2015, allowing for 60 mg/L of assimilative capacity. Eight out of the fifteen key interpretive wells in Chino North GMZ show an increasing trend while the other seven show no trends in TDS concentrations. Forty-four of the total 915 wells with TDS values in Chino North will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Eight new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and eighteen wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino-1/Chino-North

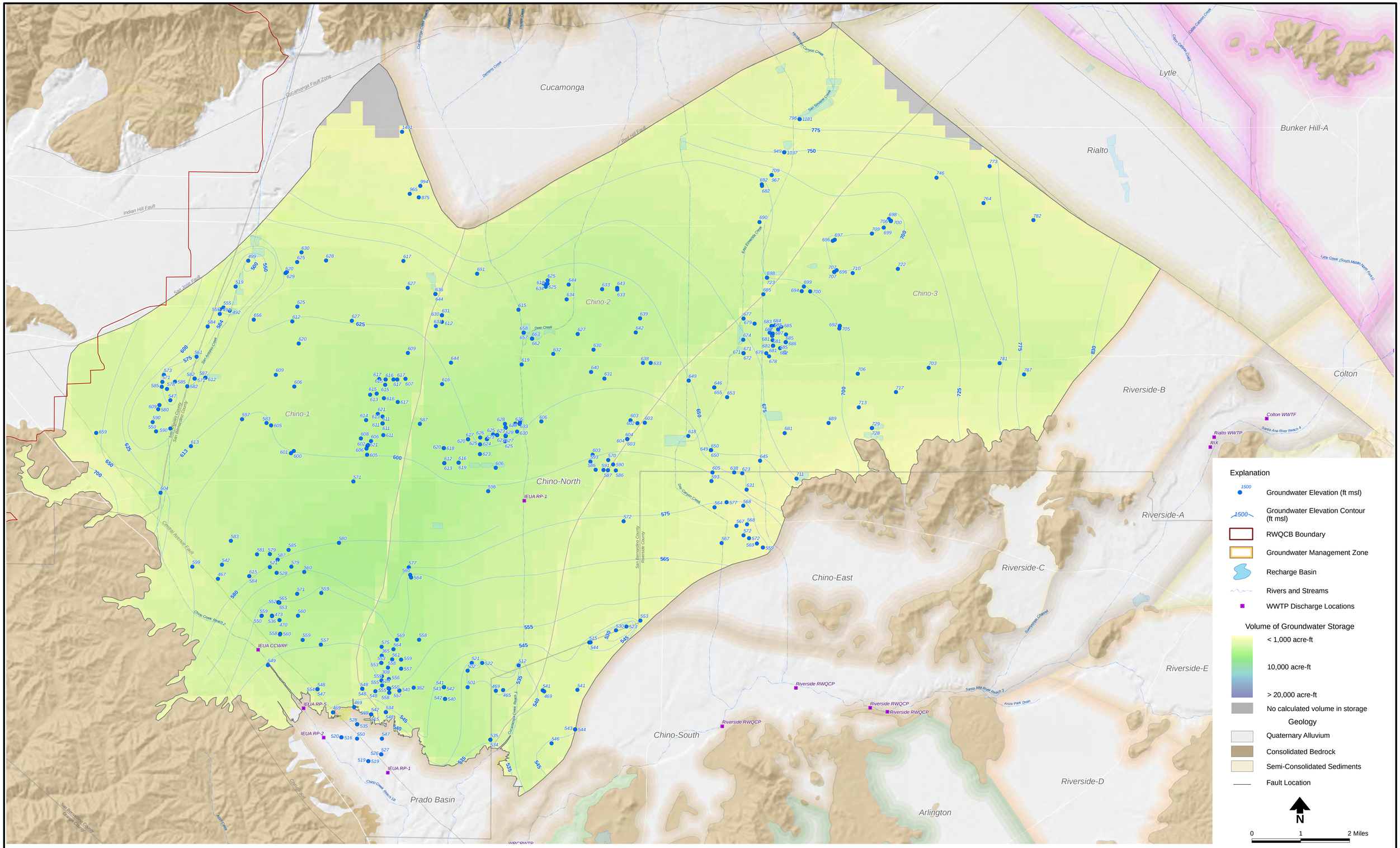
The TDS objective for Chino 1 "antideg" is 280 mg/L. The ambient TDS concentration was unchanged from 350 mg/L in 2012 to 350 mg/L in 2015, and there is no assimilative capacity. Five out of the seven key interpretive wells in Chino-1/Chino-North GMZ show an increasing trend while the other two show no trends in TDS concentrations. Twenty-seven of the total 234 wells with TDS values in Chino-1/Chino-North will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Six new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and four wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino-2/Chino-North

The TDS objective for Chino 2 "antideg" is 250 mg/L. The ambient TDS concentration was unchanged from 380 mg/L in 2012 to 380 mg/L in 2015, and there is no assimilative capacity. One out of the four key interpretive wells in Chino-2/Chino-North GMZ show an increasing trend while the other three show no trends in TDS concentrations. Ten of the total 457 wells with TDS values in Chino-2/Chino-North will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Two new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and eight wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino-3/Chino-North

The TDS objective for Chino 3 "antideg" is 260 mg/L. The ambient TDS concentration was unchanged from 320 mg/L in 2012 to 320 mg/L in 2015, and there is no assimilative capacity. Two out of the four key interpretive wells in Chino-3/Chino-North GMZ show an increasing trend while the other two show no trends in TDS concentrations. Seven of the total 224 wells with TDS values in Chino-3/Chino-North will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and six wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).



Source: SAWPA.net, January 2017

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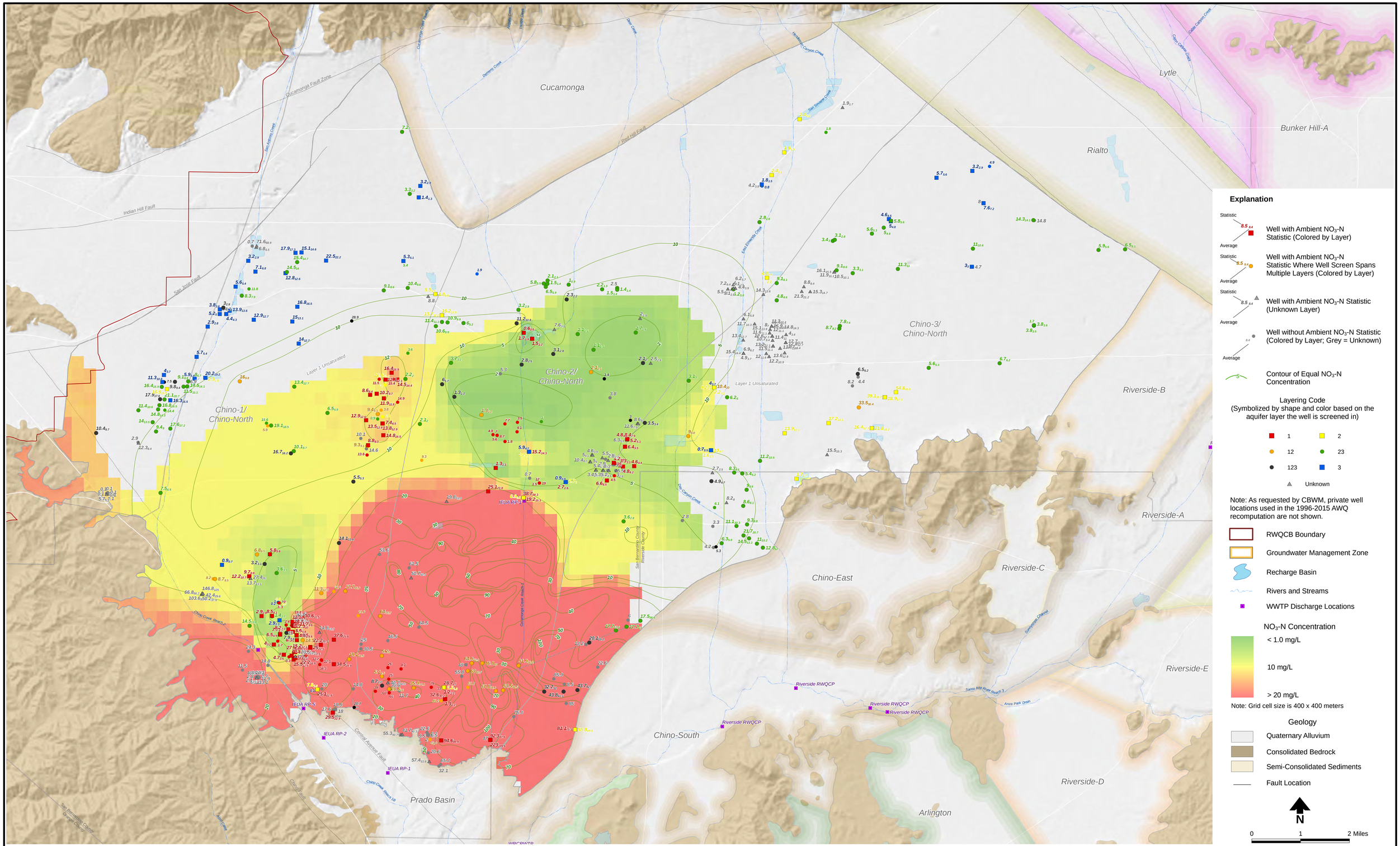
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015

Chino-North GMZ

Attachment B14-1



Source: SAWPA.net, January 2017

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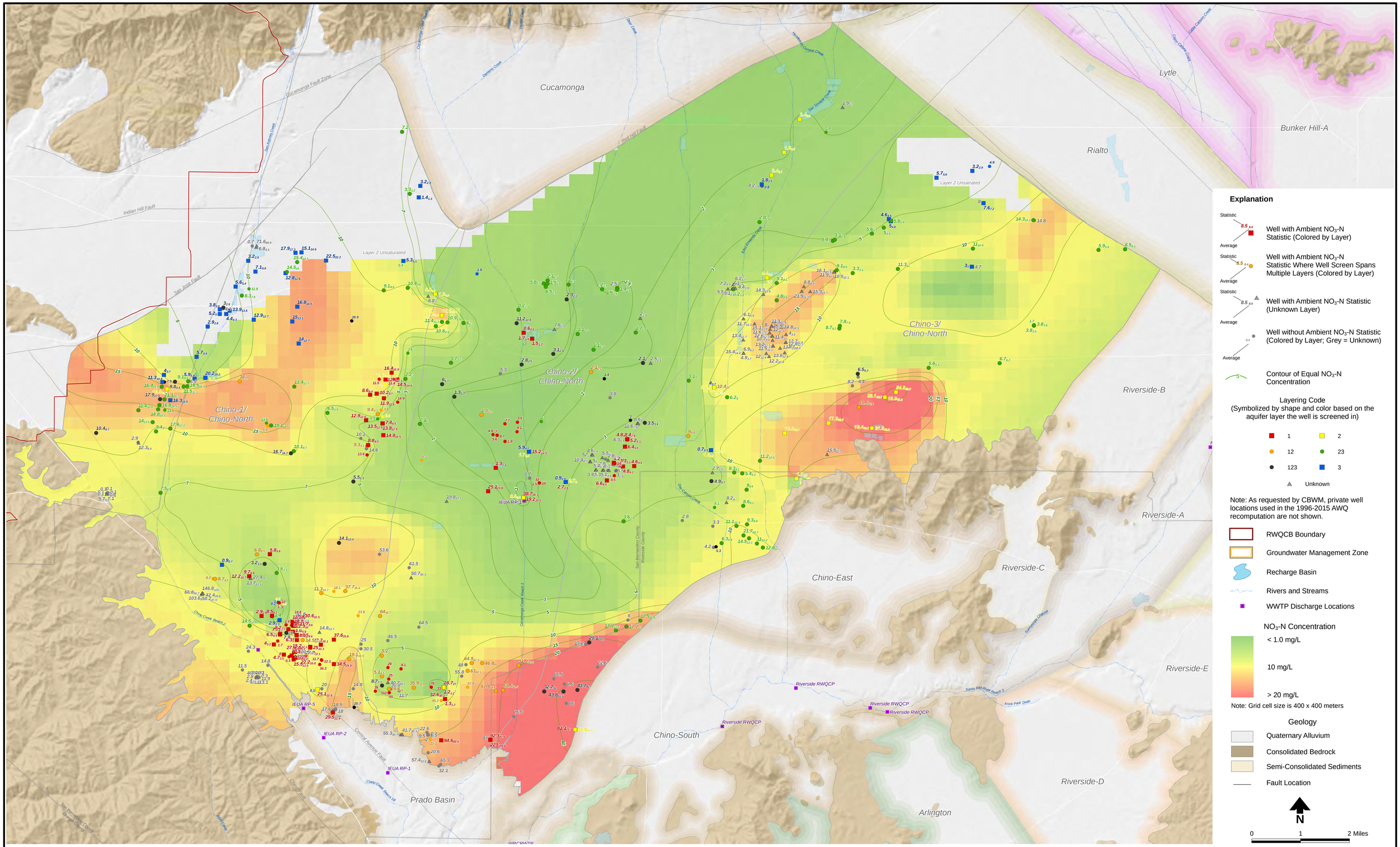
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Layer 1
Chino-North GMZ

Attachment B5-2a



Source: SAWPA.net, January 2017

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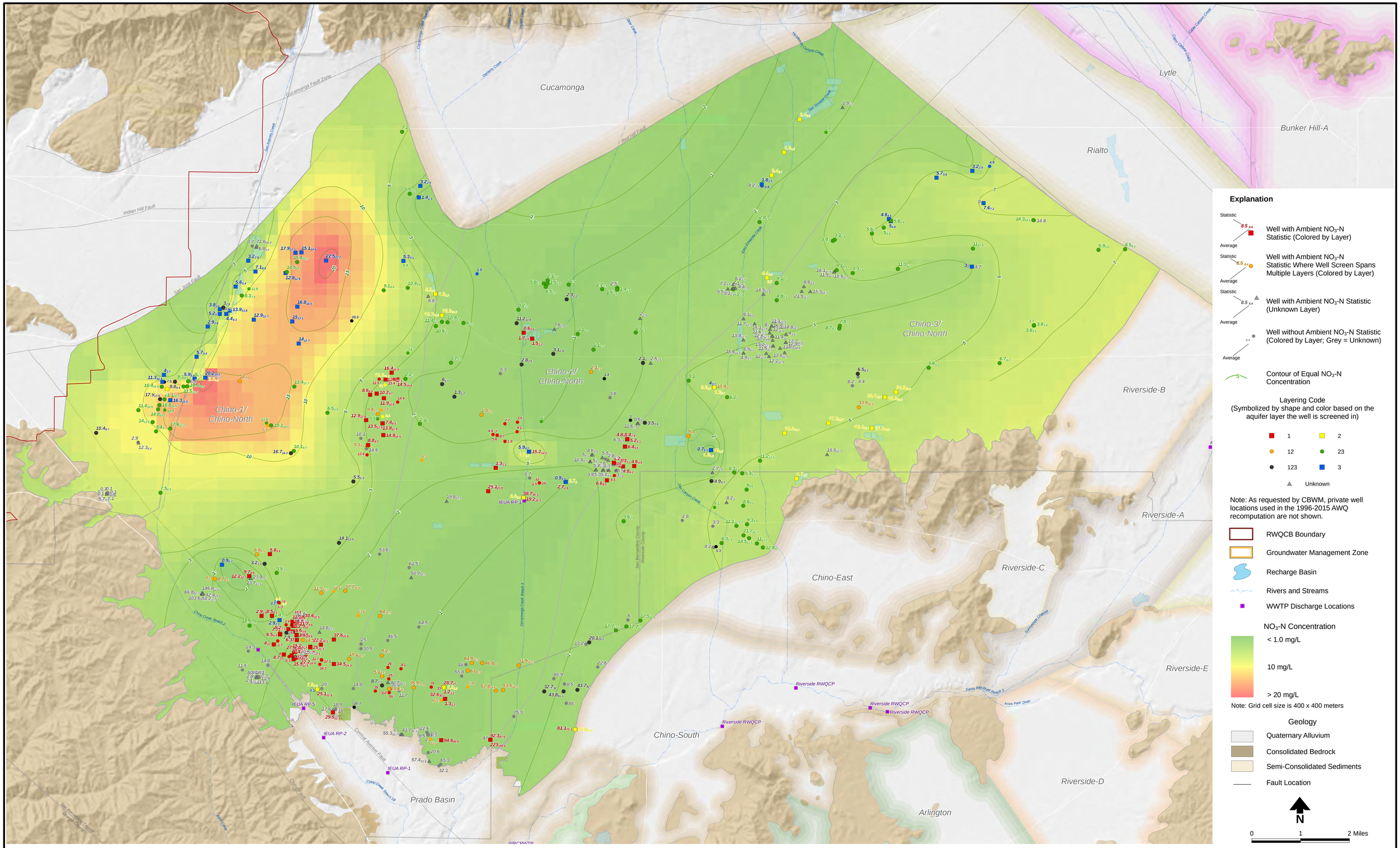
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Layer 2
Chino-North GMZ

Attachment B5-2b



Source: SAWPA.net, January 2017

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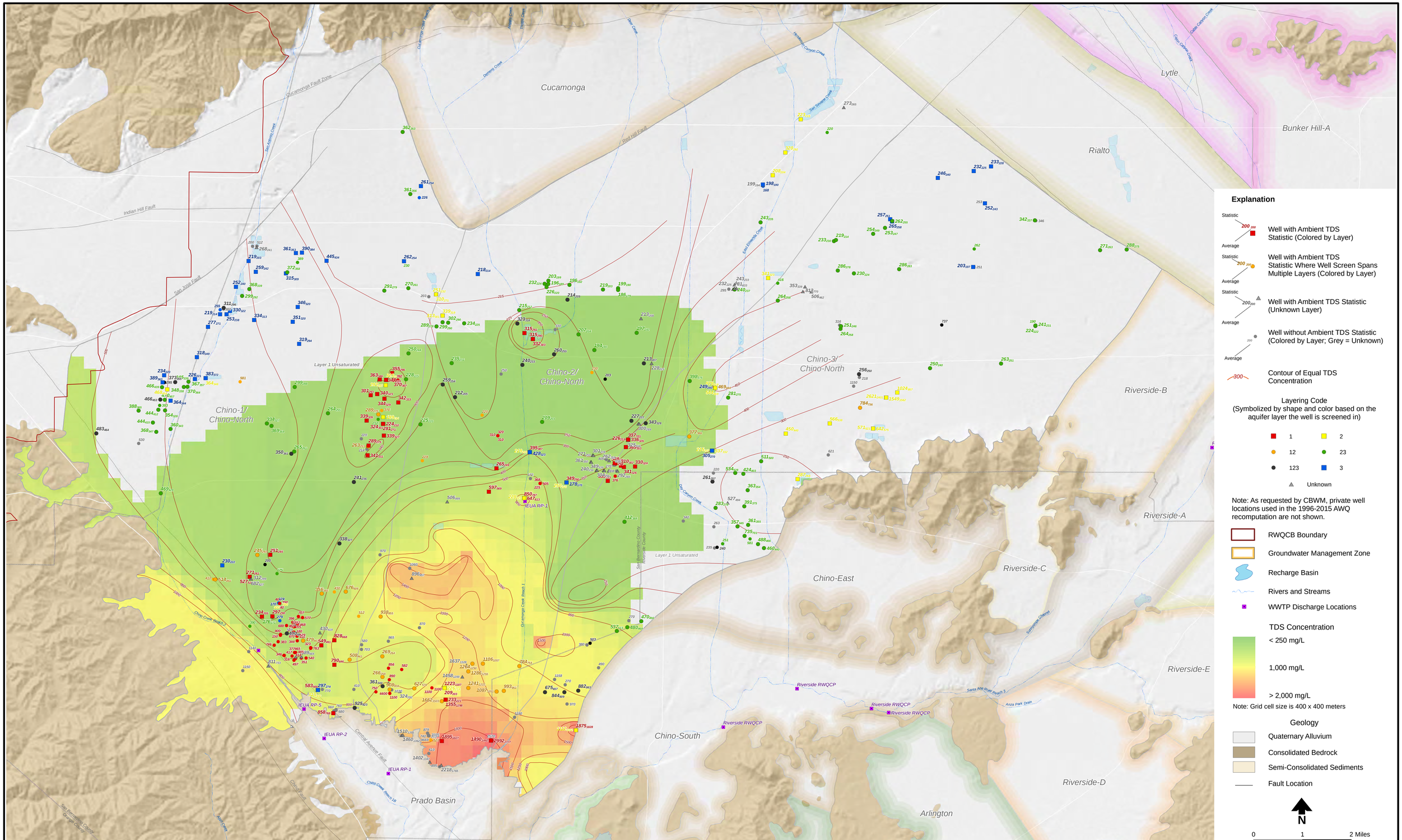
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Layer 3
Chino-North GMZ

Attachment B5-2c



Source: SAWPA.net, January 2017

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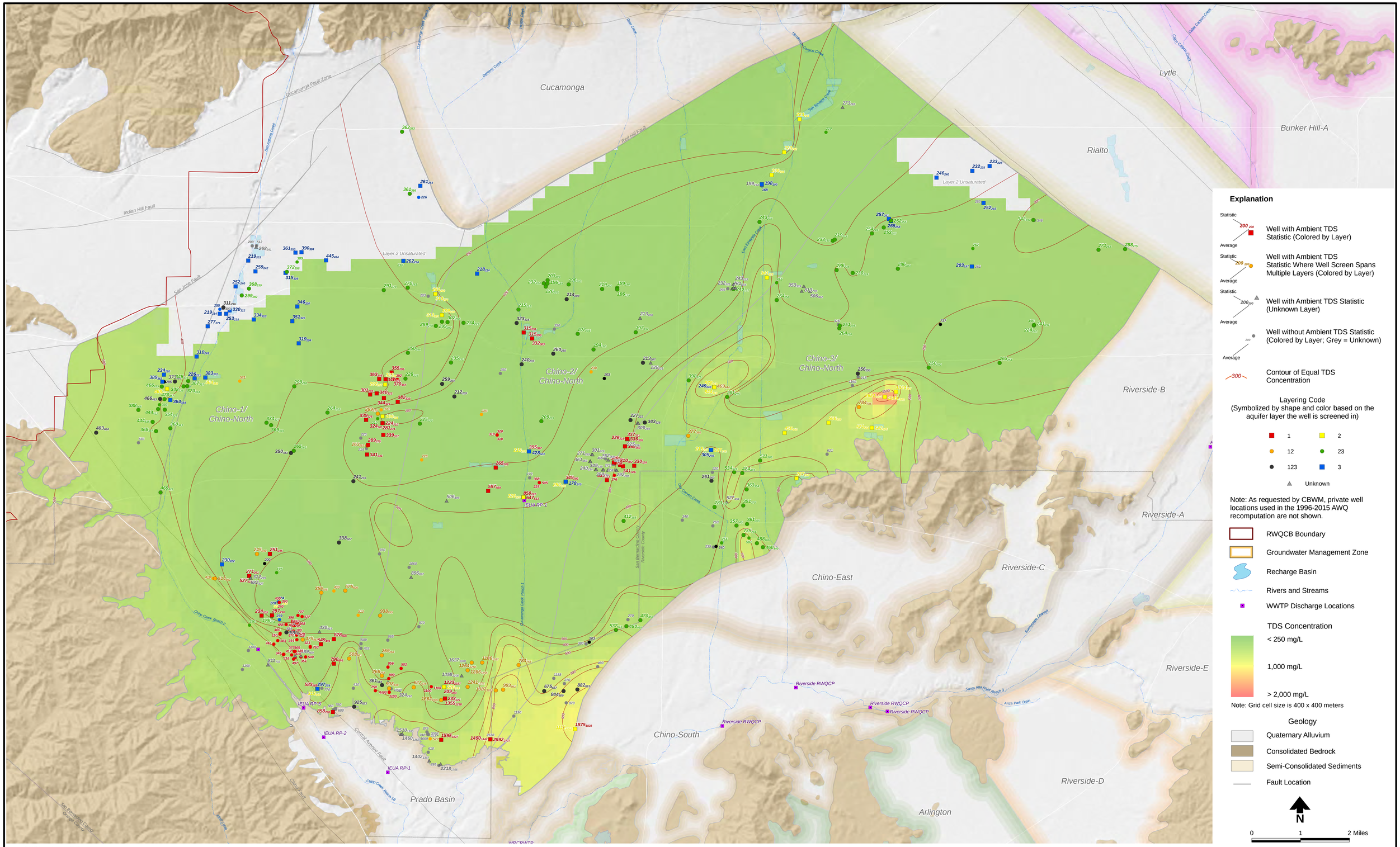
AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map Layer 1 Chino-North GMZ

Attachment B5-3a



Source: SAWPA.net, January 2017

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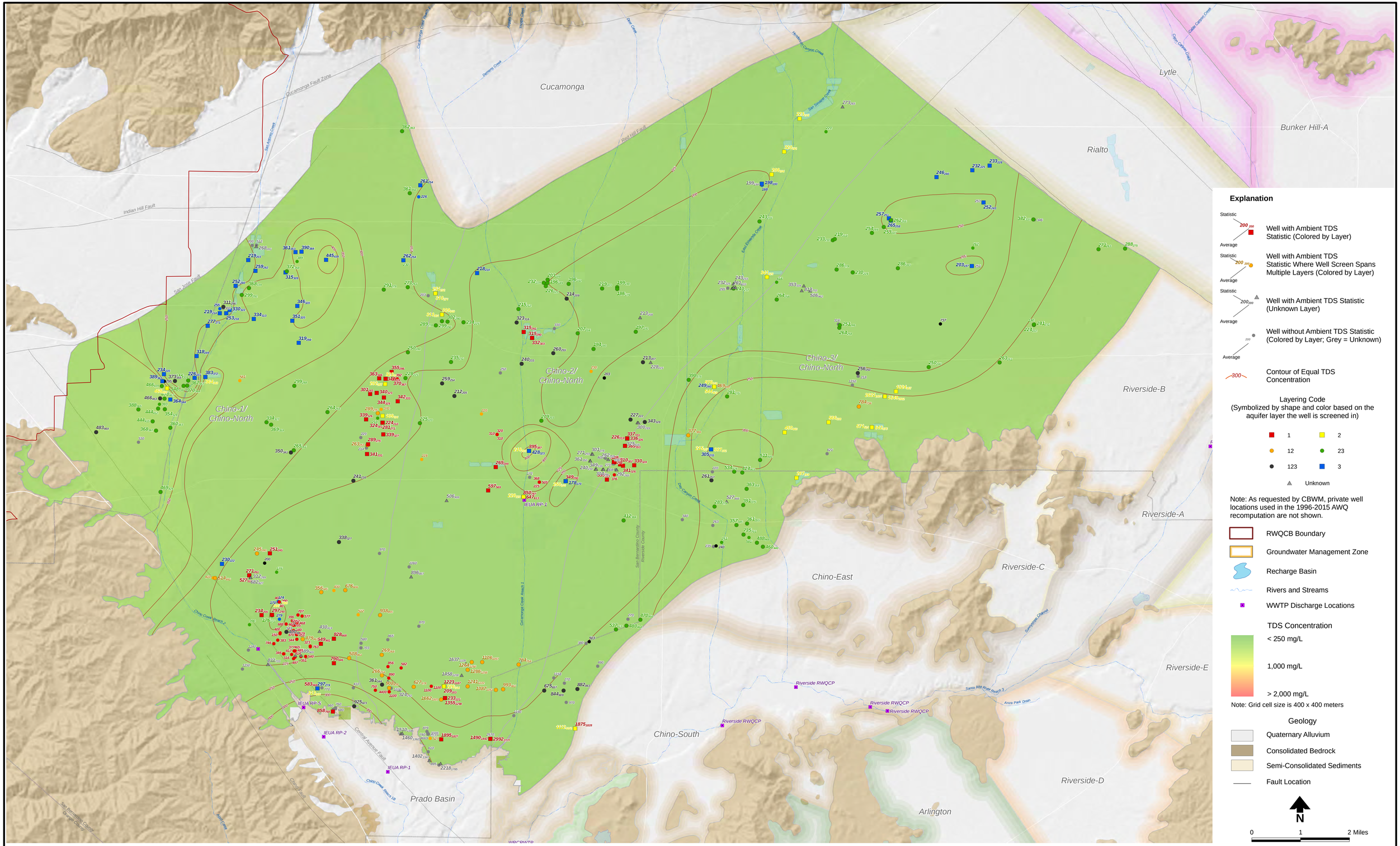
AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map Layer 2
Chino-North GMZ

Attachment B5-3b



Source: SAWPA.net, January 2017

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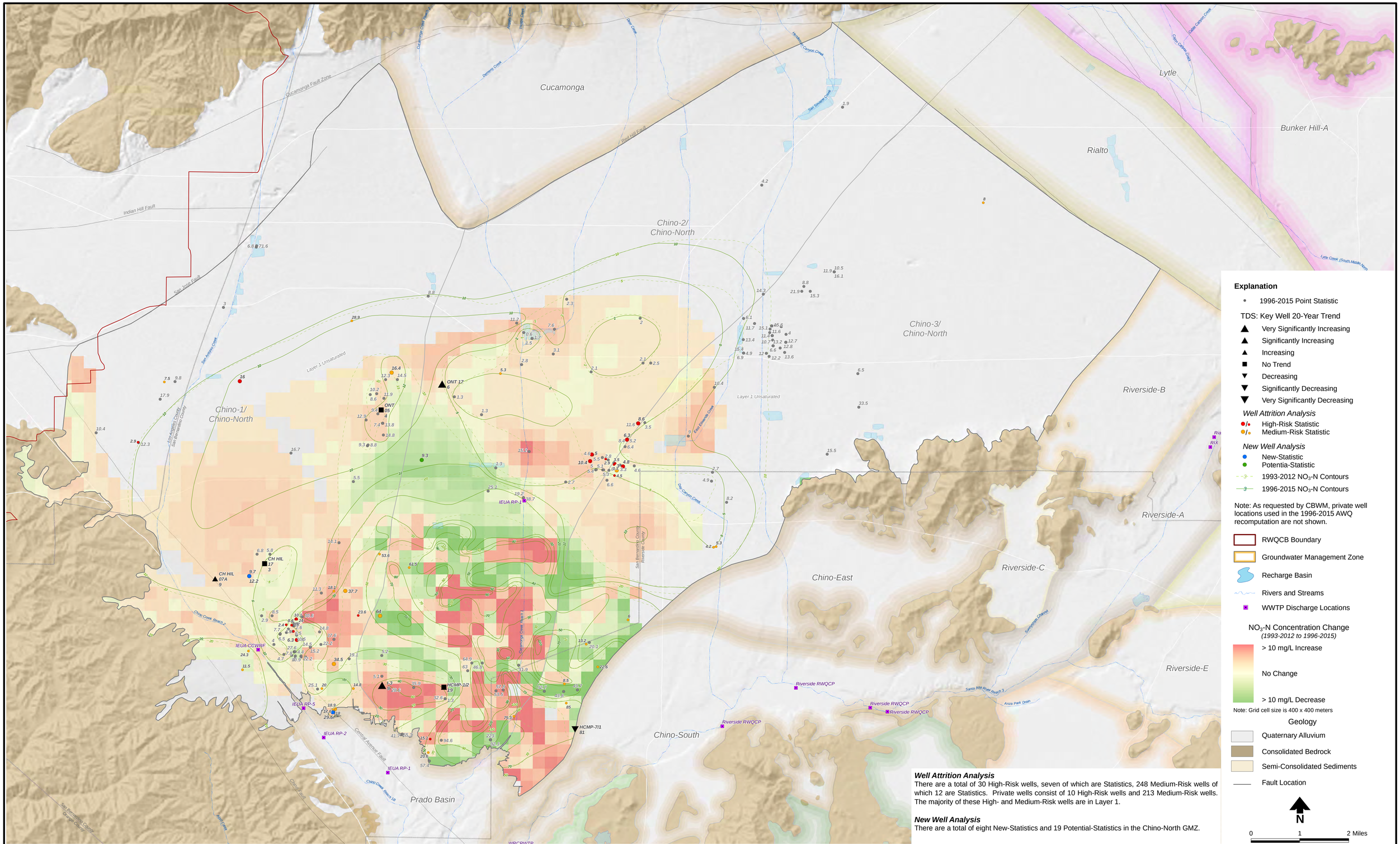
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map Layer 3

Chino-North GMZ

Attachment B5-3c



Well Attrition Analysis
There are a total of 30 High-Risk wells, seven of which are Statistics, 248 Medium-Risk wells of which 12 are Statistics. Private wells consist of 10 High-Risk wells and 213 Medium-Risk wells. The majority of these High- and Medium-Risk wells are in Layer 1.

New Well Analysis
There are a total of eight New-Statistics and 19 Potential-Statistics in the Chino-North GMZ.

Source: SAWPA.net, January 2017

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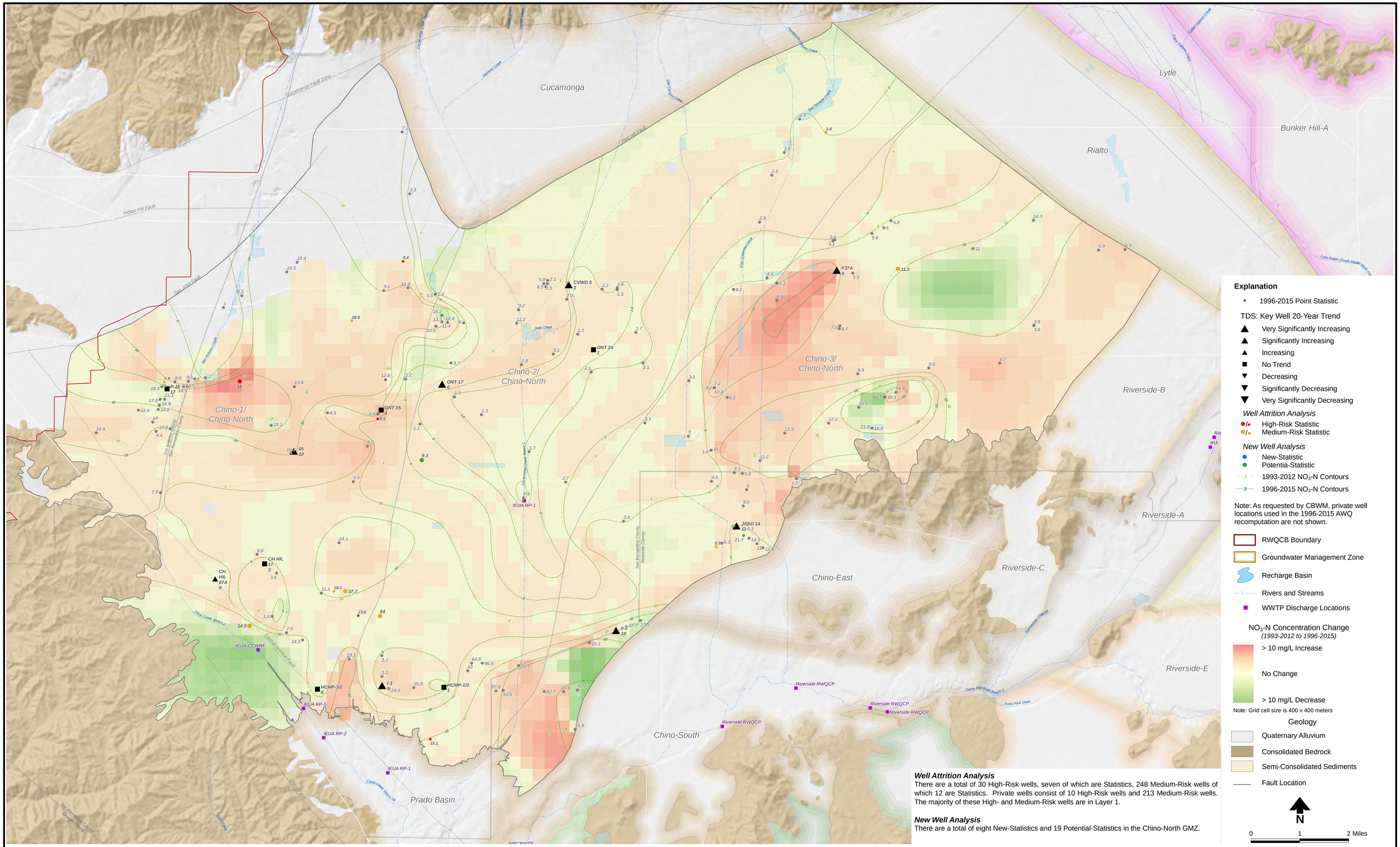
Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
NO_3-N Concentration Change (1993-2012 to 1996-2015) Layer 1
Chino-North GMZ

Attachment B5-4a



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There are a total of 30 High-Risk wells, seven of which are Statistics, 248 Medium-Risk wells of which 12 are Statistics. Private wells consist of 10 High-Risk wells and 213 Medium-Risk wells. The majority of these High- and Medium-Risk wells are in Layer 1.

New Well Analysis

There are a total of eight New-Statistics and 19 Potential-Statistics in the Chino-North GMZ.

Source: SAWPA.net, January 2017

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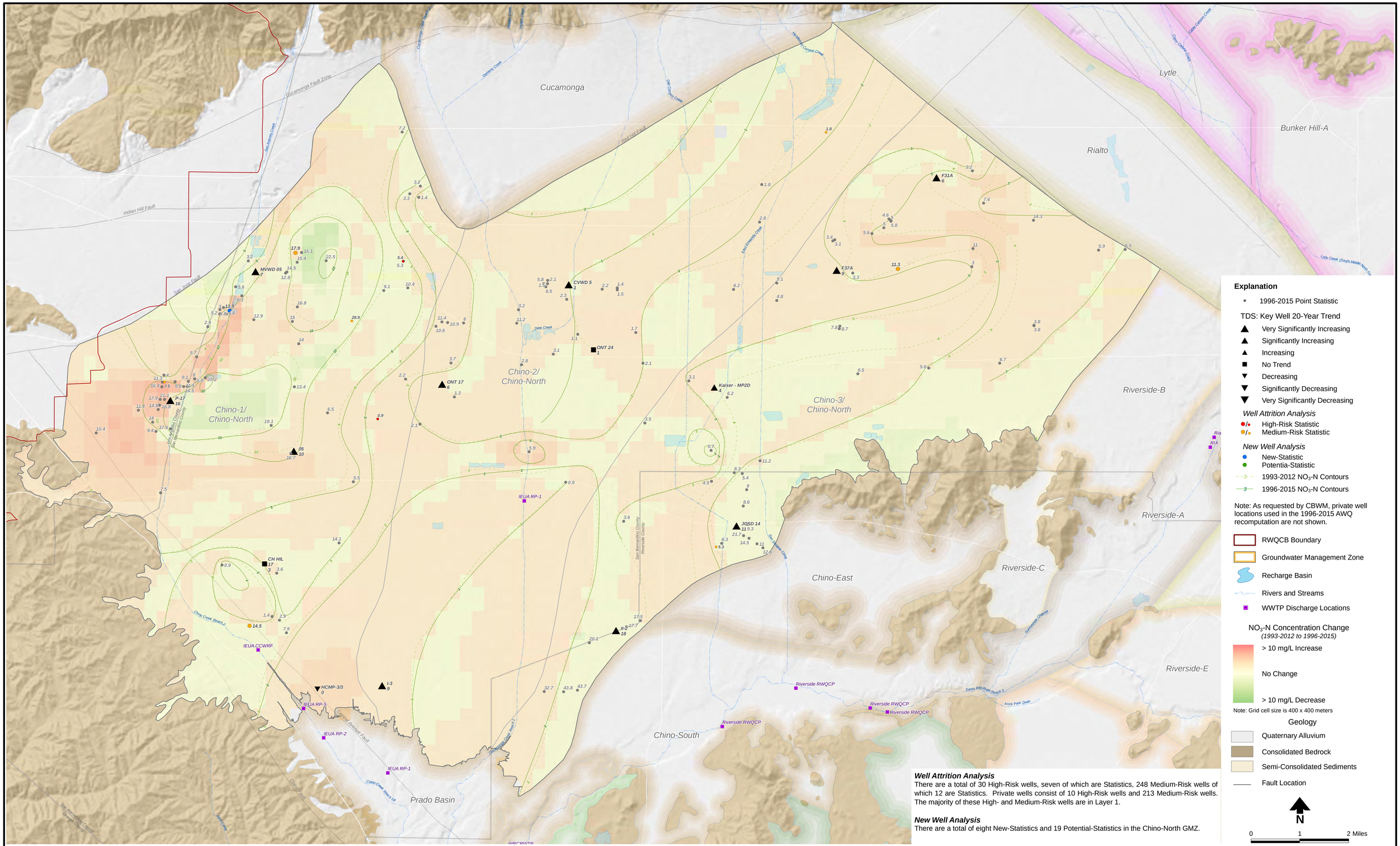
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015) Layer 2
Chino-North GMZ

Attachment B5-4b



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New Well Analysis
There are a total of eight New-Statistics and 19 Potential-Statistics in the Chino-North GMZ.

Source: SAWPA.net, January 2017

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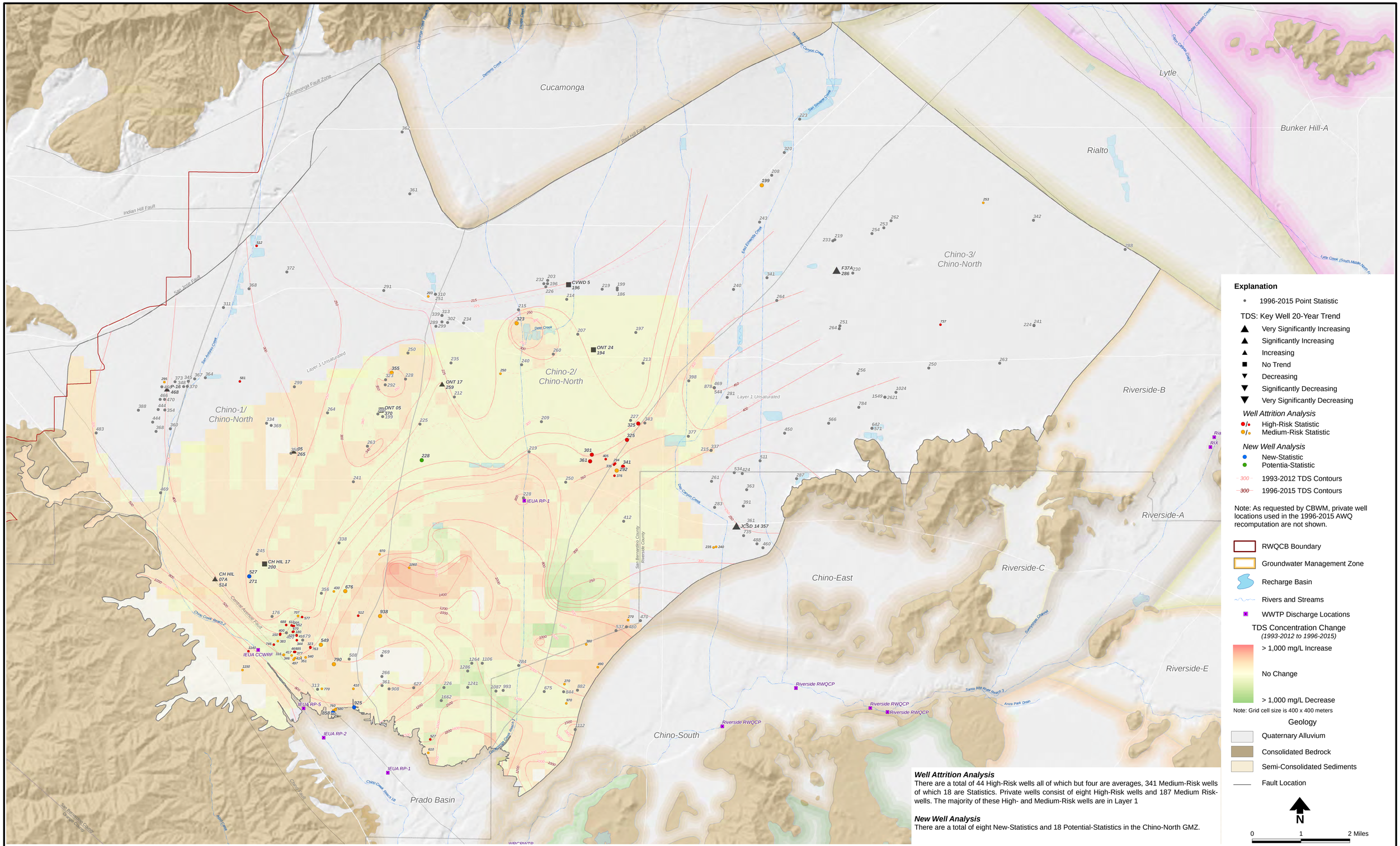
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
NO_3-N Concentration Change (1993-2012 to 1996-2015) Layer 3
Chino-North GMZ

Attachment B5-4c



Well Attrition Analysis
There are a total of 44 High-Risk wells all of which but four are averages, 341 Medium-Risk wells of which 18 are Statistics. Private wells consist of eight High-Risk wells and 187 Medium Risk-wells. The majority of these High- and Medium-Risk wells are in Layer 1

New Well Analysis
There are a total of eight New-Statistics and 18 Potential-Statistics in the Chino-North GMZ.

Source: SAWPA.net, January 2017

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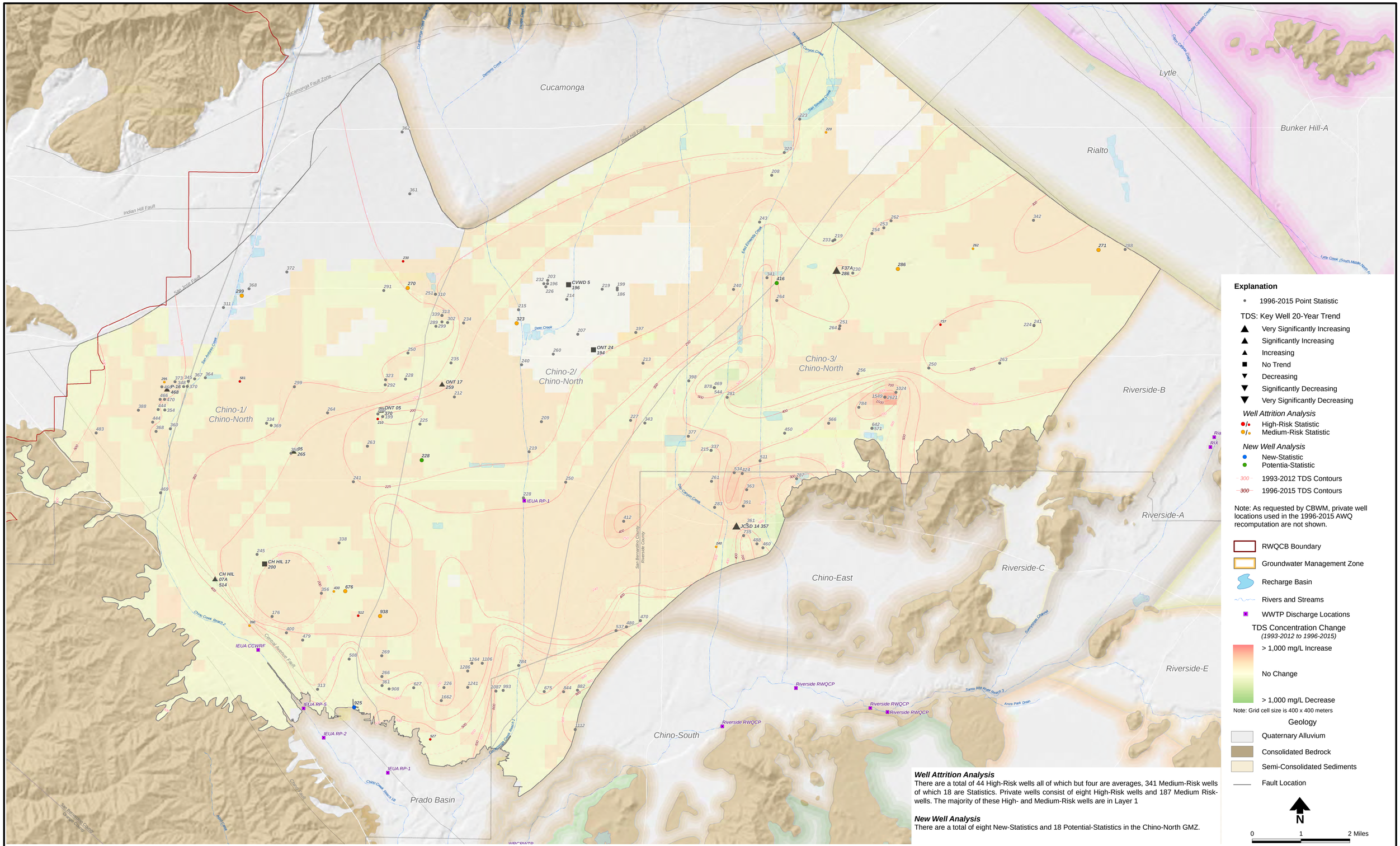
Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration Change (1993-2012 to 1996-2015) Layer 1
Chino-North GMZ

Attachment B5-5a



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There are a total of 44 High-Risk wells all of which but four are averages, 341 Medium-Risk wells of which 18 are Statistics. Private wells consist of eight High-Risk wells and 187 Medium Risk-wells. The majority of these High- and Medium-Risk wells are in Layer 1

New Well Analysis
There are a total of eight New-Statistics and 18 Potential-Statistics in the Chino-North GMZ.

Source: SAWPA.net, January 2017

DBS&A
Daniel B. Stephens & Associates, Inc.
01/31/2017 CA.16.0087

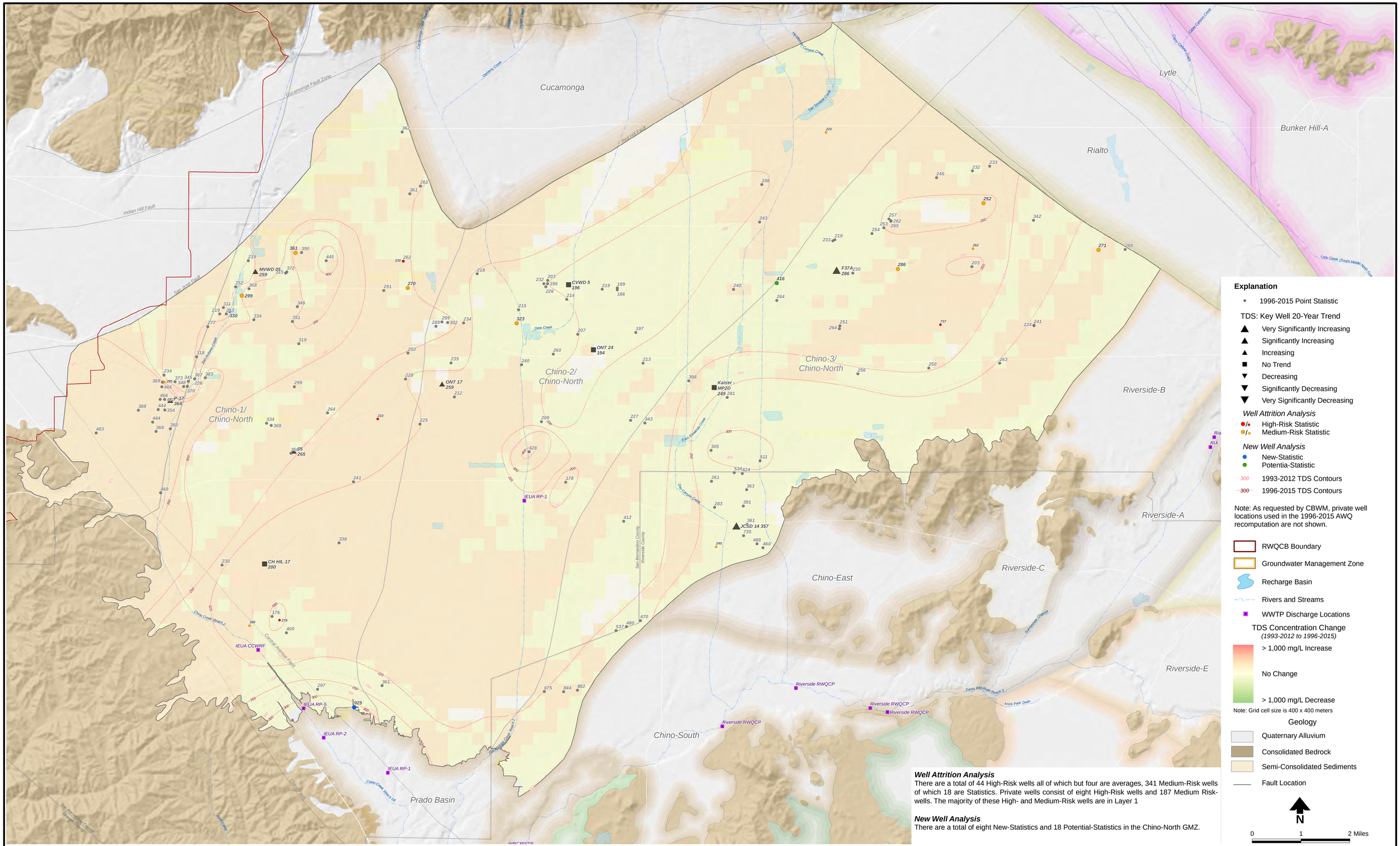
SAWPA Basin Monitoring Program Task Force

SAWPA

Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration Change (1993-2012 to 1996-2015) Layer 2
Chino-North GMZ

Attachment B5-5b



Well Attrition Analysis
There are a total of 44 High-Risk wells all of which but four are averages, 341 Medium-Risk wells of which 18 are Statistics. Private wells consist of eight High-Risk wells and 187 Medium Risk-wells. The majority of these High- and Medium-Risk wells are in Layer 1

New Well Analysis
There are a total of eight New-Statistics and 18 Potential-Statistics in the Chino-North GMZ.

Source: SAWPA.net, January 2017

DBS&A
Daniel B. Stephens & Associates, Inc.
01/31/2017 CA.16.0087

SAWPA Basin Monitoring Program Task Force

SAWPA

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration Change (1993-2012 to 1996-2015) Layer 3
Chino-North GMZ

Attachment B5-5c

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

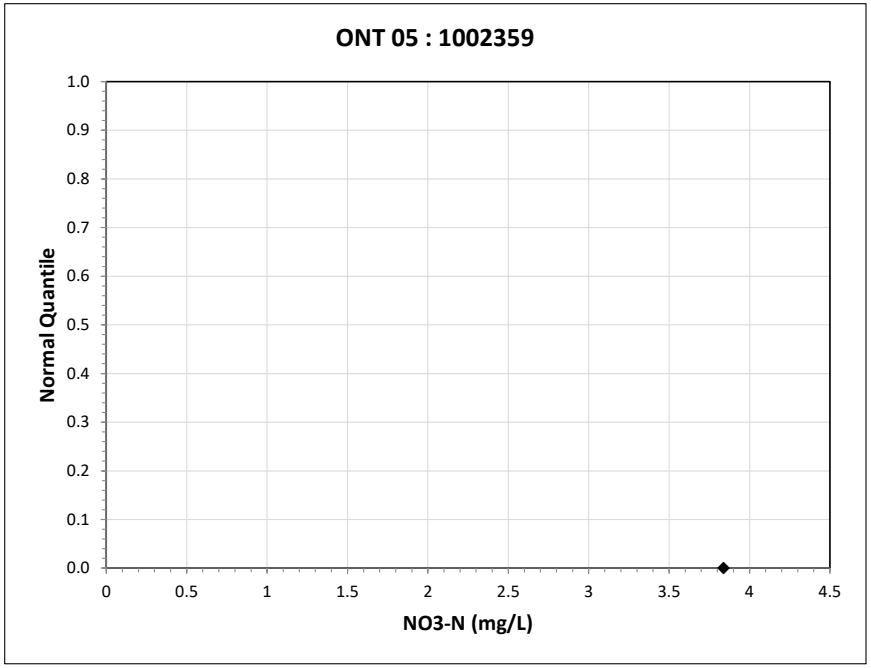
Mann-Kendall

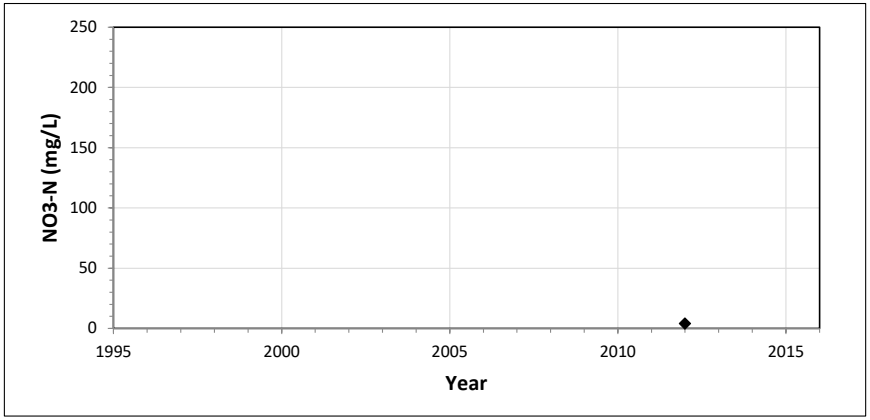
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

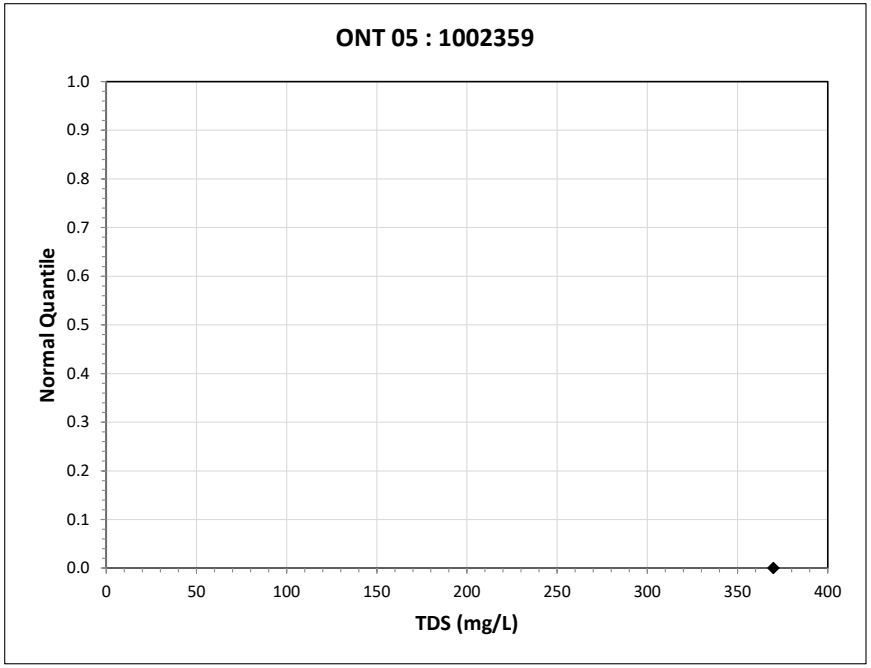
The significance of the trends is notated by * for significant and ** for very significant.

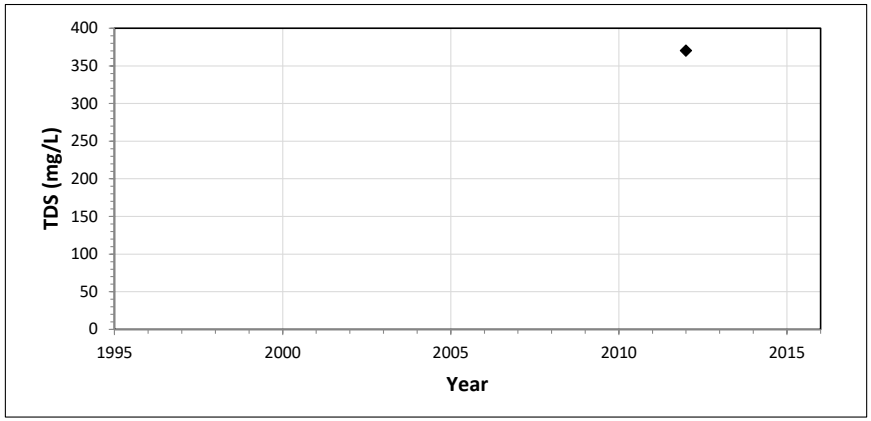
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	ONT 05 : 1002359
Analyte	NO3-N (mg/L)
Count	1
Count Detects	1
Sample Year Min	2012
Sample Year Max	2012
Annual Average Min	3.84
Annual Average Max	3.84
Annual Average Mean	3.84
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**NC**
Kendall S	NC
Var(S)	NC
Intercept	NC
Slope	NC
p-value	NC
Significant Trend?	NC



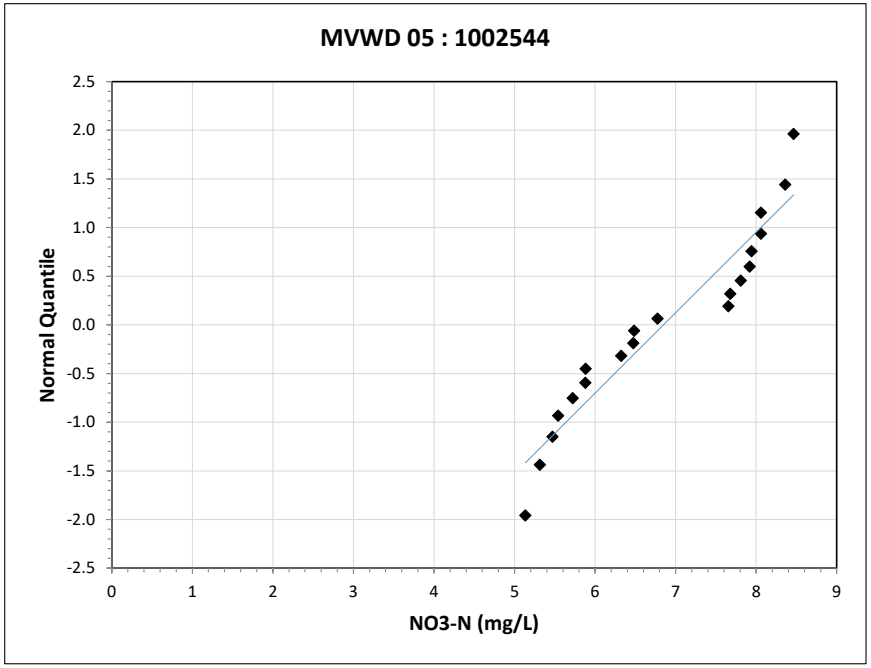


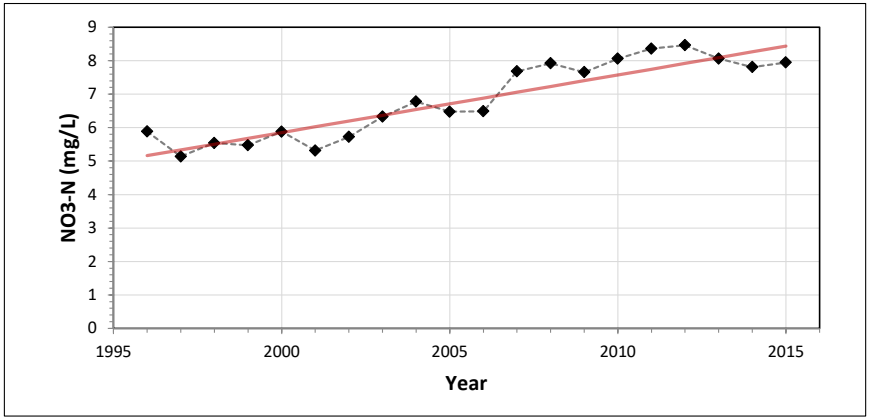
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	ONT 05 : 1002359
Analyte	TDS (mg/L)
Count	1
Count Detects	1
Sample Year Min	2012
Sample Year Max	2012
Annual Average Min	370
Annual Average Max	370
Annual Average Mean	370
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**NC**
Kendall S	NC
Var(S)	NC
Intercept	NC
Slope	NC
p-value	NC
Significant Trend?	NC



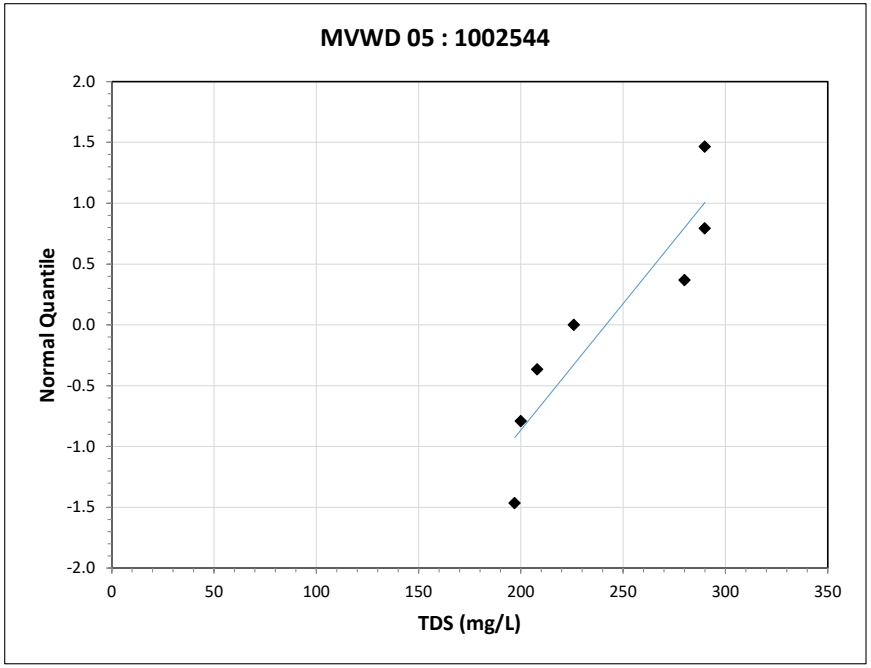


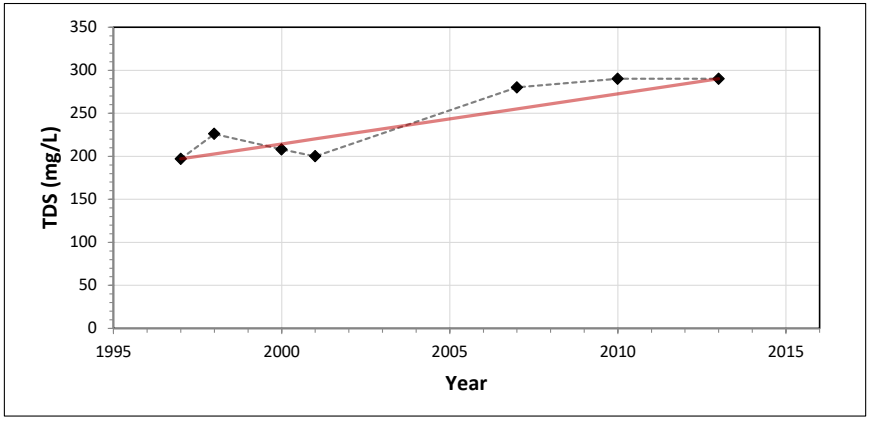
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	MVWD 05 : 1002544
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	5.14
Annual Average Max	8.46
Annual Average Mean	6.85
Annual Average Stdev	1.15
Shapiro-Wilk W	0.896
Shapiro-Wilk p-value	0.034
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.26
Student t	1.02
Mean + t*SE (UCL84)	7.11
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	138
Var(S)	950
Intercept	-339
Slope	0.17
p-value	9E-6
Significant Trend?	Increasing**



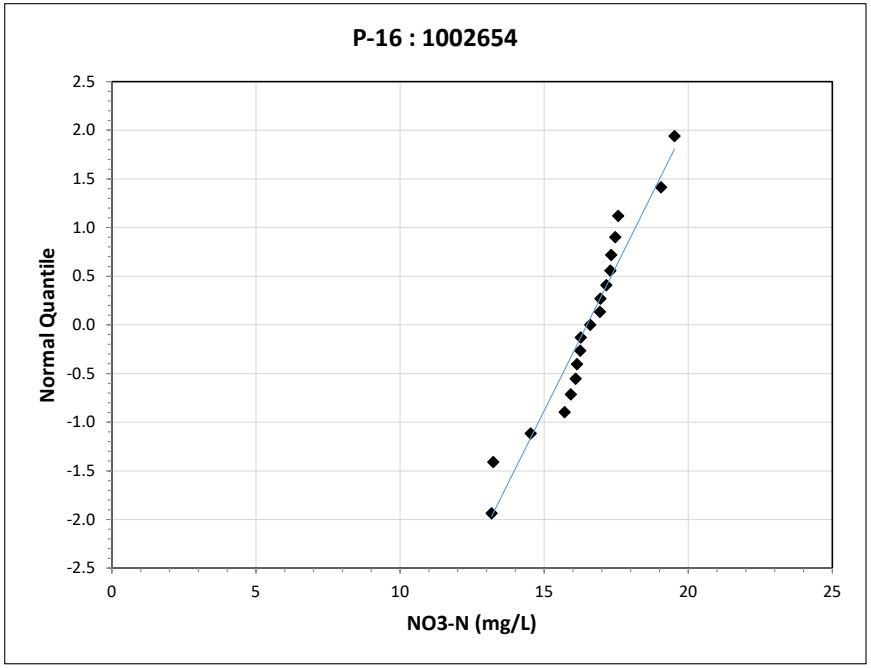


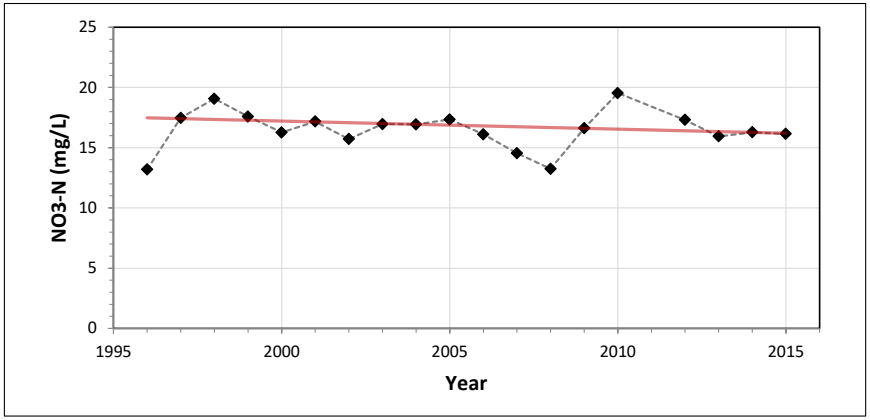
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	MVWD 05 : 1002544
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1997
Sample Year Max	2013
Annual Average Min	197
Annual Average Max	290
Annual Average Mean	242
Annual Average Stdev	43.30
Shapiro-Wilk W	0.809
Shapiro-Wilk p-value	0.050
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	16.37
Student t	1.08
Mean + t*SE (UCL84)	259
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	14
Var(S)	43.33
Intercept	-11411
Slope	5.81
p-value	0.048
Significant Trend?	Increasing



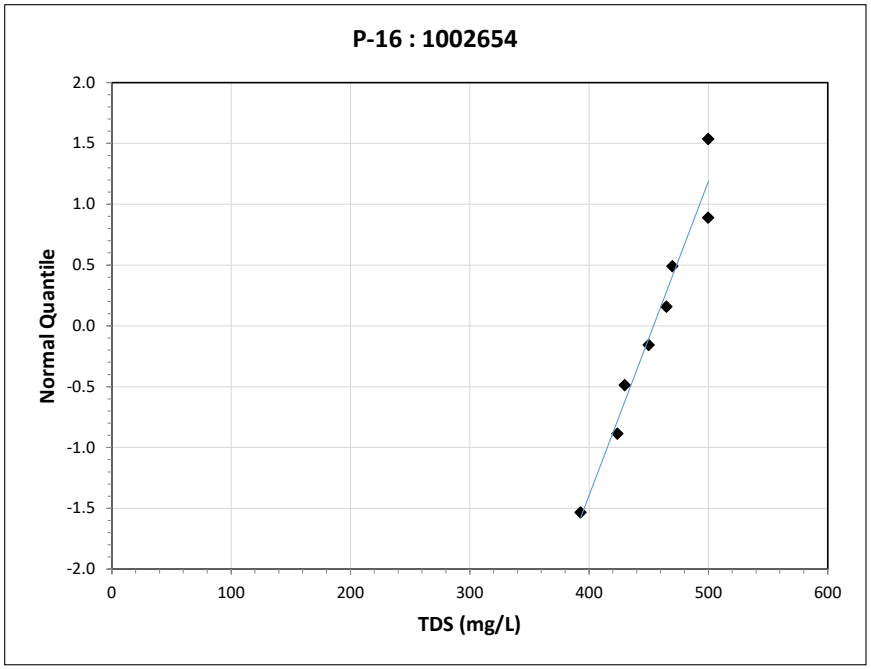


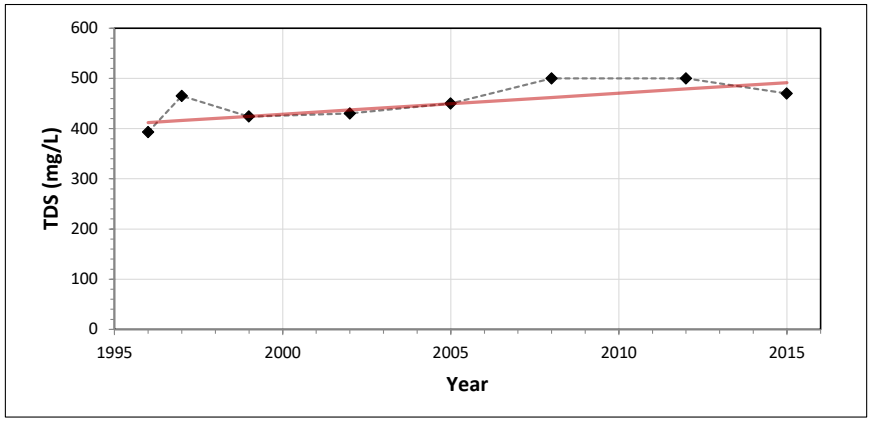
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	P-16 : 1002654
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	13.19
Annual Average Max	19.53
Annual Average Mean	16.50
Annual Average Stdev	1.61
Shapiro-Wilk W	0.934
Shapiro-Wilk p-value	0.205
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.37
Student t	1.02
Mean + t*SE (UCL84)	16.87
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-27
Var(S)	817
Intercept	150
Slope	-0.07
p-value	0.363
Significant Trend?	No



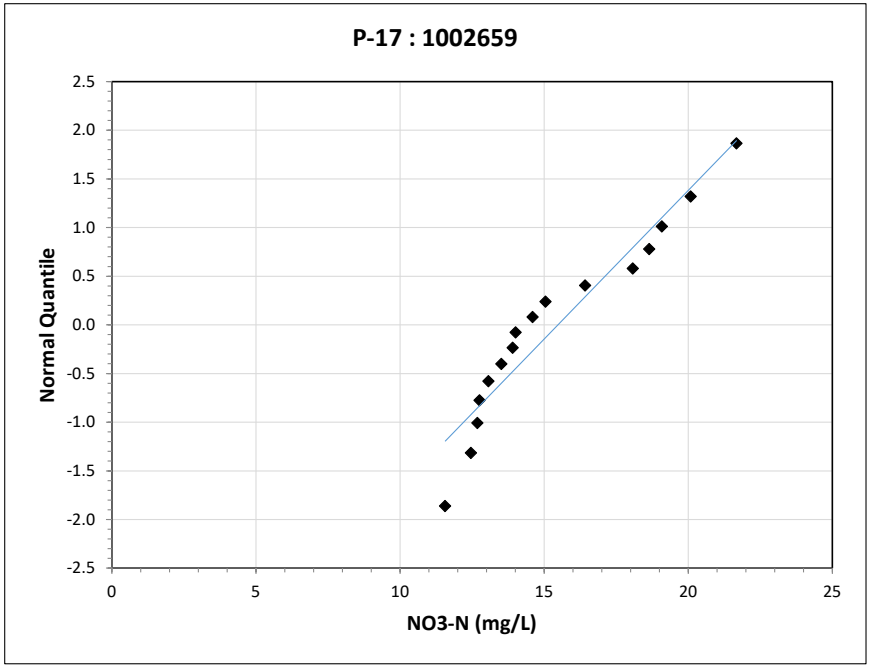


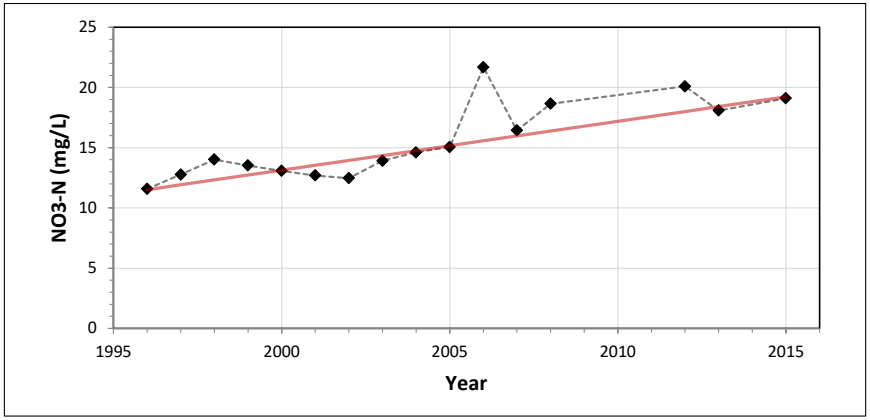
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	P-16 : 1002654
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	393
Annual Average Max	500
Annual Average Mean	454
Annual Average Stdev	37.46
Shapiro-Wilk W	0.951
Shapiro-Wilk p-value	0.718
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	13.24
Student t	1.07
Mean + t*SE (UCL84)	468
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	17
Var(S)	64.33
Intercept	-7957
Slope	4.19
p-value	0.046
Significant Trend?	Increasing



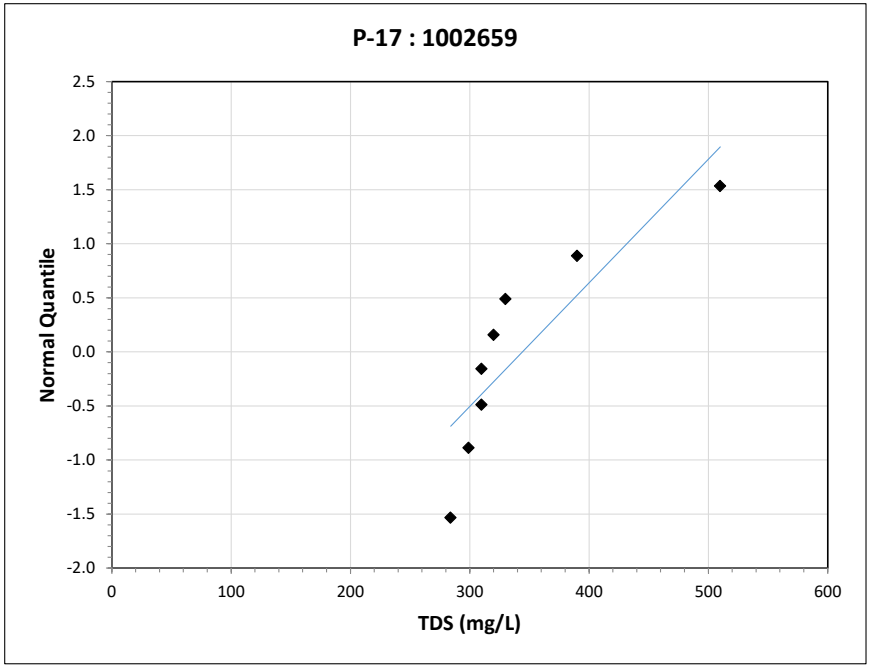


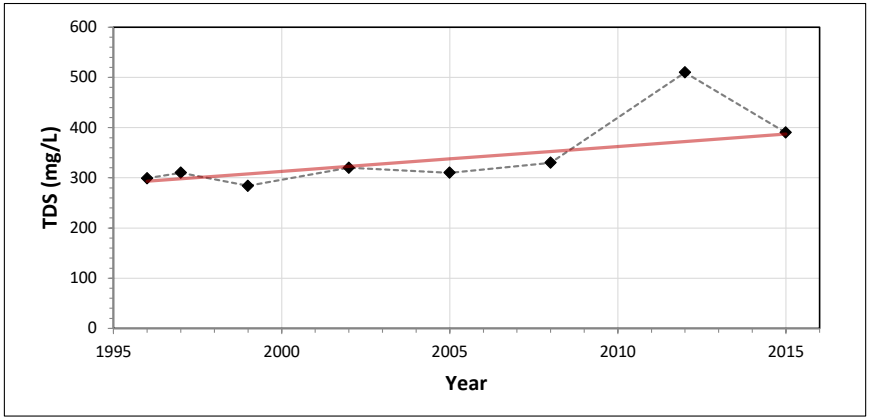
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	P-17 : 1002659
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	11.57
Annual Average Max	21.68
Annual Average Mean	15.48
Annual Average Stdev	3.11
Shapiro-Wilk W	0.906
Shapiro-Wilk p-value	0.102
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.78
Student t	1.03
Mean + t*SE (UCL84)	16.28
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	78
Var(S)	493
Intercept	-798
Slope	0.41
p-value	5E-4
Significant Trend?	Increasing**



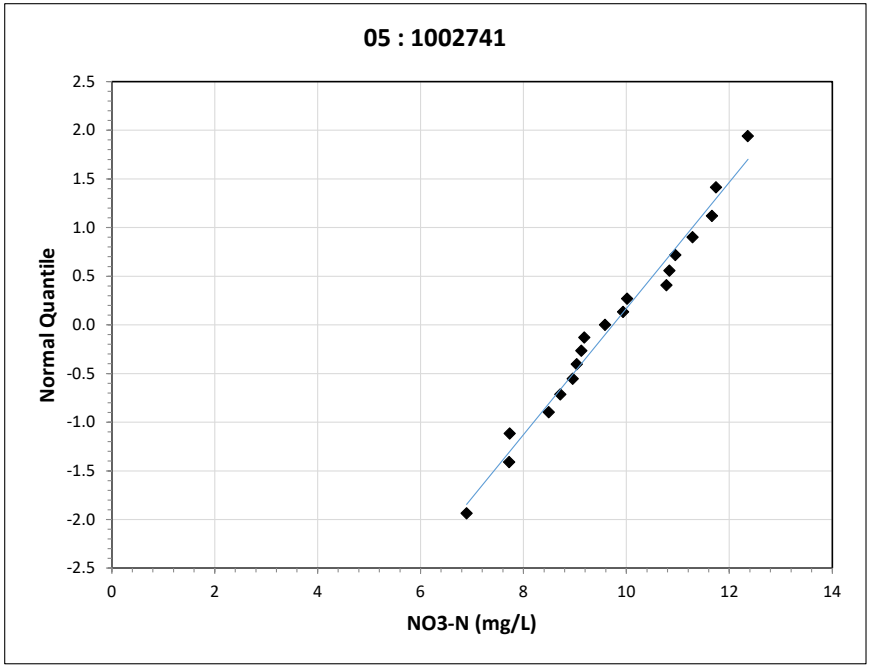


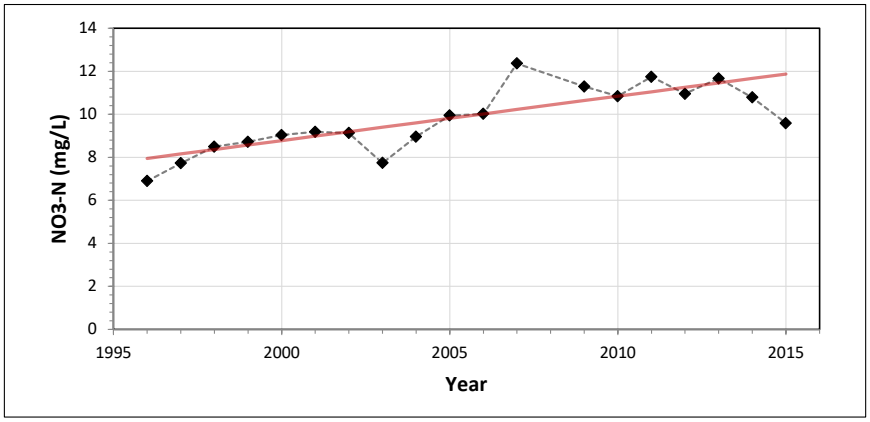
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	P-17 : 1002659
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	284
Annual Average Max	510
Annual Average Mean	344
Annual Average Stdev	74.05
Shapiro-Wilk W	0.749
Shapiro-Wilk p-value	0.008
Critical Alpha	0.01
Most Discordant Value	510
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.07
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.030
Geomean	338
GM + t*GSE (UCL84)	364
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	19
Var(S)	64.33
Intercept	-9588
Slope	4.95
p-value	0.025
Significant Trend?	Increasing



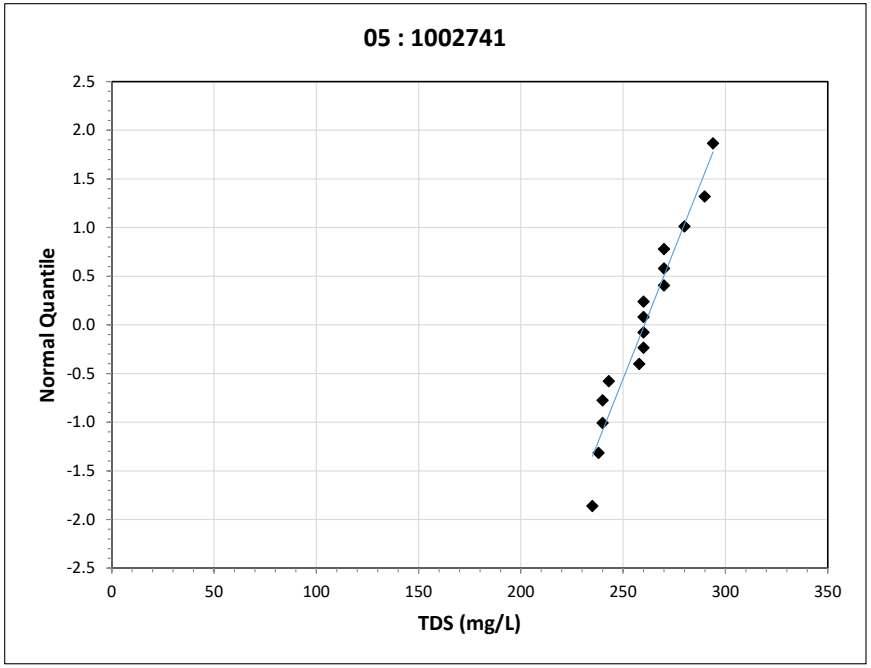


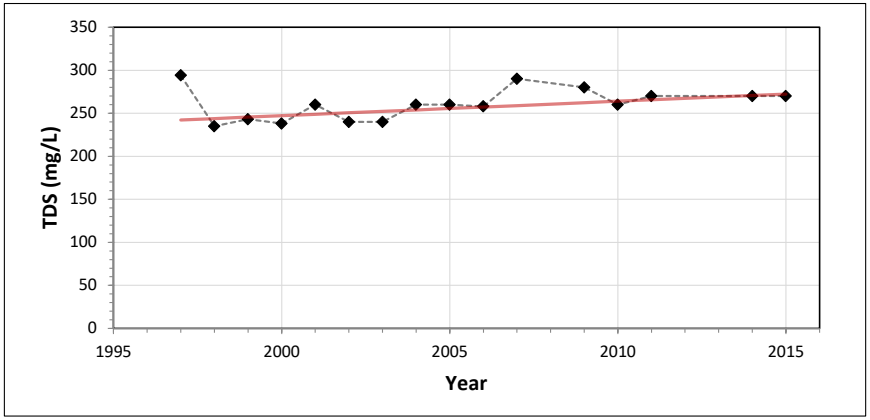
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	05 : 1002741
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	6.90
Annual Average Max	12.36
Annual Average Mean	9.74
Annual Average Stdev	1.52
Shapiro-Wilk W	0.974
Shapiro-Wilk p-value	0.851
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.35
Student t	1.02
Mean + t*SE (UCL84)	10.10
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	105
Var(S)	817
Intercept	-405
Slope	0.21
p-value	3E-4
Significant Trend?	Increasing**



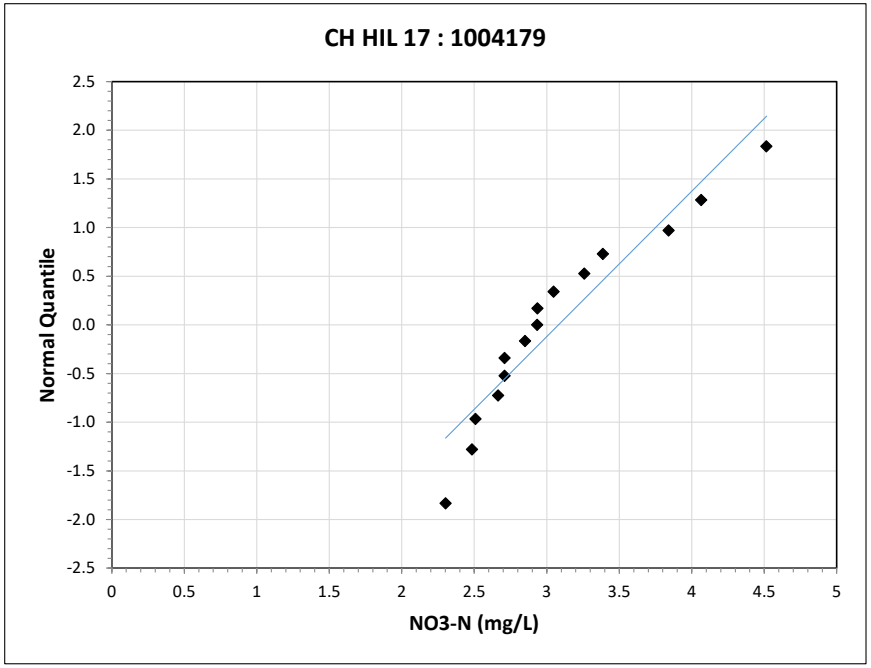


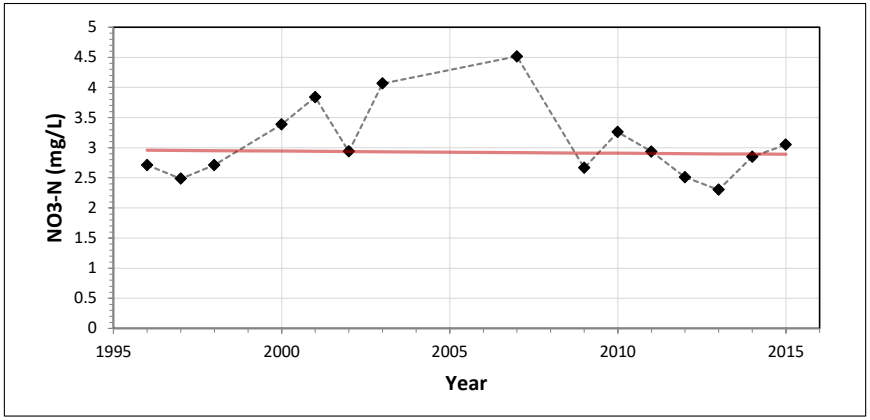
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	05 : 1002741
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	235
Annual Average Max	294
Annual Average Mean	261
Annual Average Stdev	18.17
Shapiro-Wilk W	0.932
Shapiro-Wilk p-value	0.263
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.54
Student t	1.03
Mean + t*SE (UCL84)	265
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	46
Var(S)	480
Intercept	-3107
Slope	1.68
p-value	0.040
Significant Trend?	Increasing



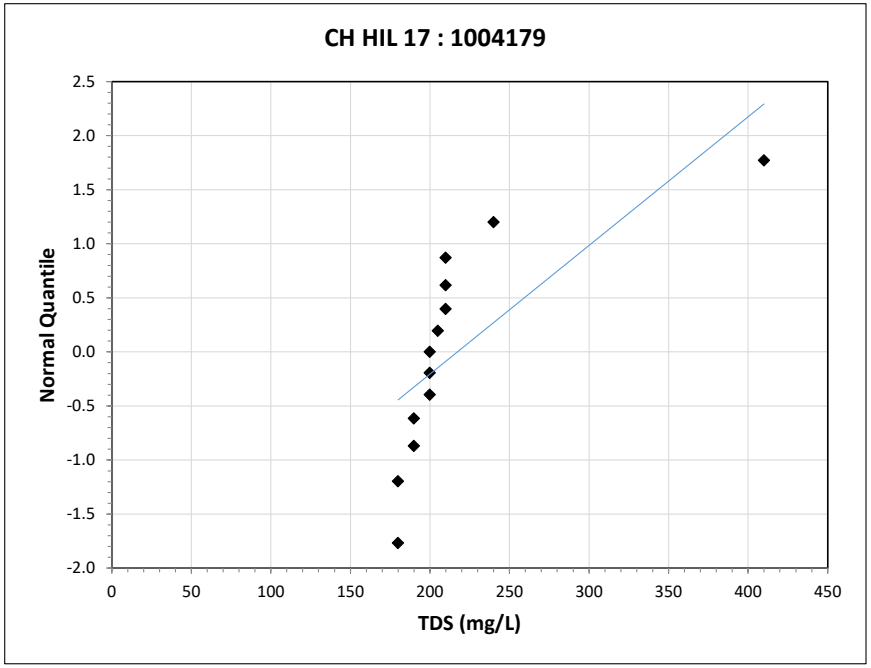


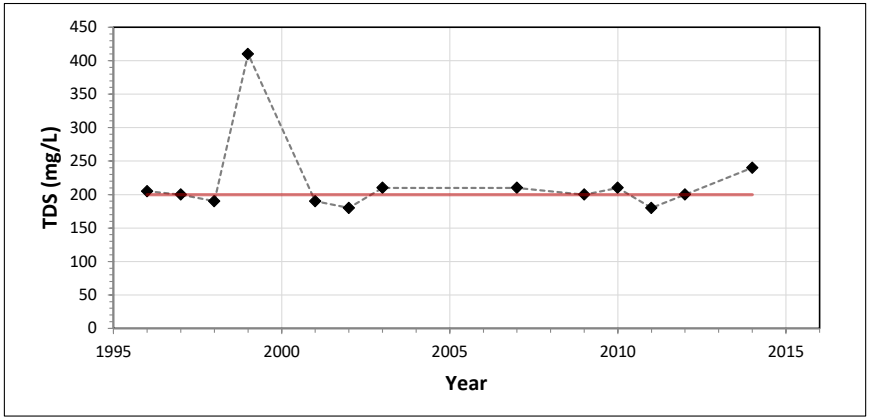
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	CH HIL 17 : 1004179
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.30
Annual Average Max	4.52
Annual Average Mean	3.08
Annual Average Stdev	0.63
Shapiro-Wilk W	0.900
Shapiro-Wilk p-value	0.096
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.16
Student t	1.03
Mean + t*SE (UCL84)	3.25
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-4
Var(S)	407
Intercept	10.06
Slope	0.00
p-value	0.882
Significant Trend?	No



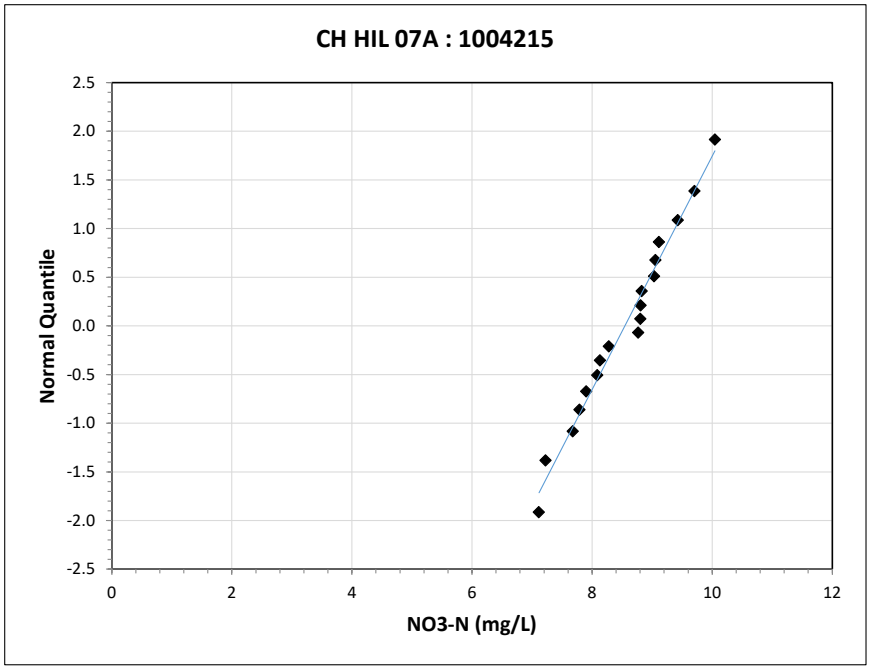


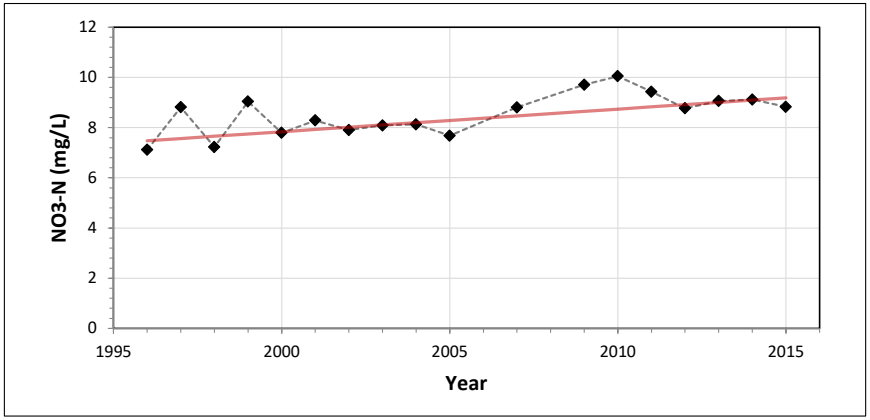
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	CH HIL 17 : 1004179
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	180
Annual Average Max	410
Annual Average Mean	217
Annual Average Stdev	59.95
Shapiro-Wilk W	0.541
Shapiro-Wilk p-value	2E-5
Critical Alpha	0.01
Most Discordant Value	410
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	200
Trend Analysis	**Theil-Sen**
Kendall S	4
Var(S)	259
Intercept	200
Slope	0.00
p-value	NC
Significant Trend?	No



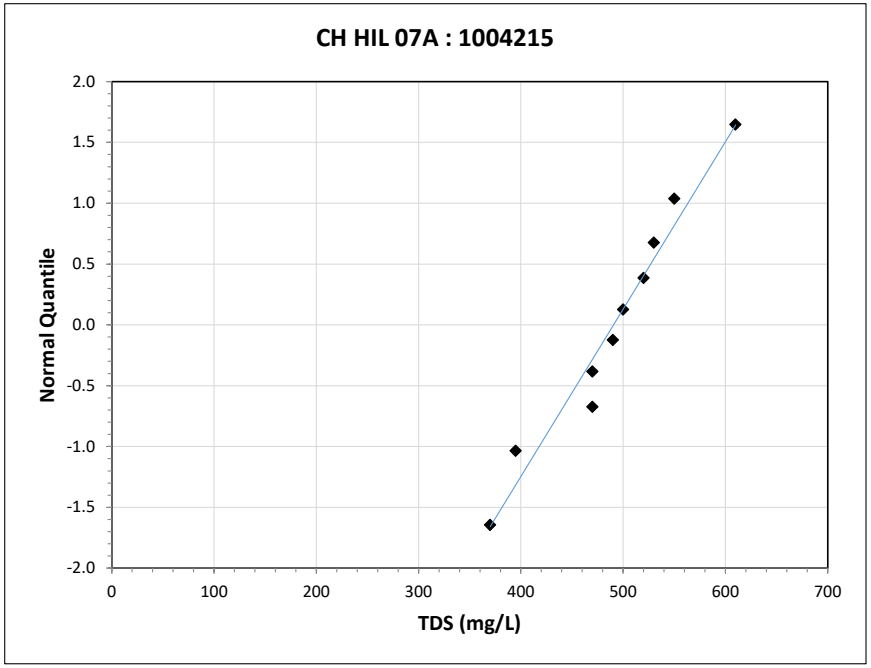


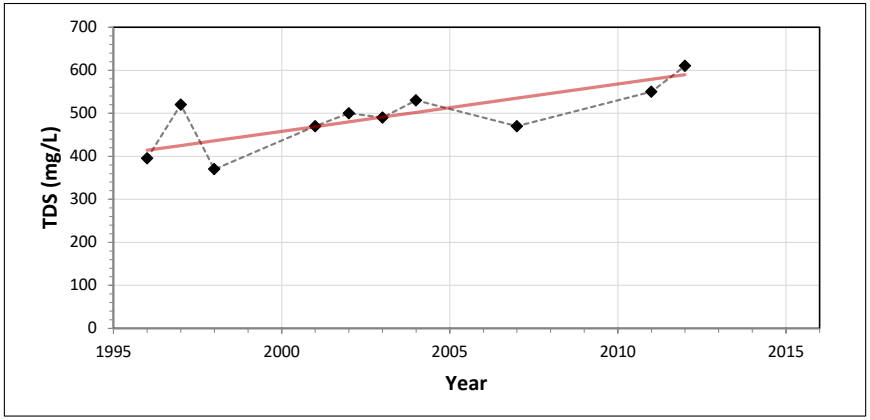
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	CH HIL 07A : 1004215
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	7.12
Annual Average Max	10.05
Annual Average Mean	8.55
Annual Average Stdev	0.82
Shapiro-Wilk W	0.972
Shapiro-Wilk p-value	0.843
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.19
Student t	1.02
Mean + t*SE (UCL84)	8.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	67
Var(S)	697
Intercept	-173
Slope	0.09
p-value	0.012
Significant Trend?	Increasing



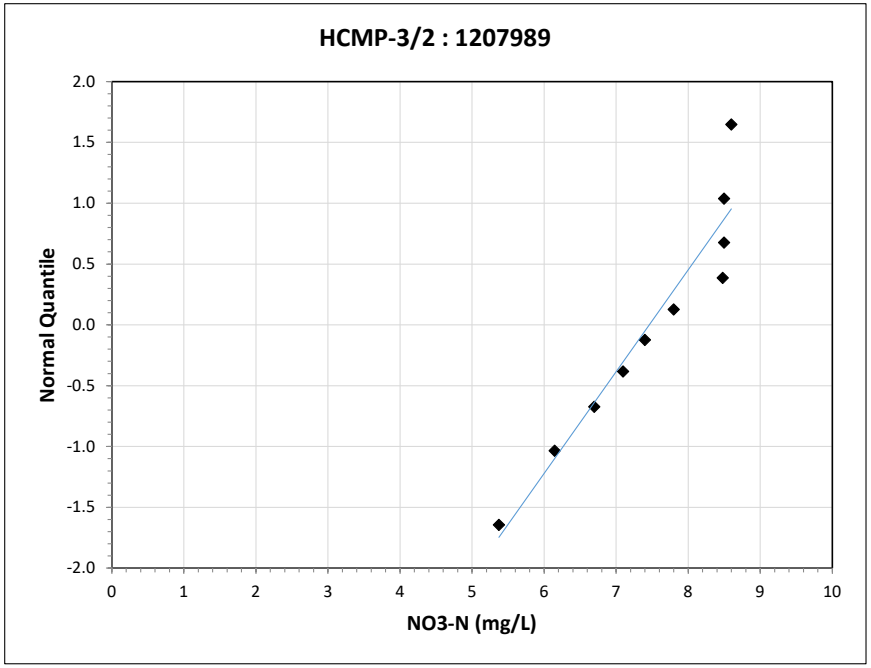


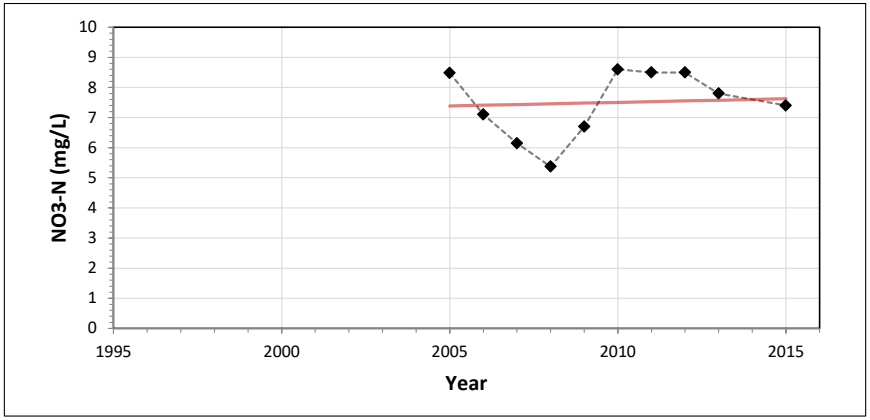
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	CH HIL 07A : 1004215
Analyte	TDS (mg/L)
Count	10
Count Detects	10
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	370
Annual Average Max	610
Annual Average Mean	491
Annual Average Stdev	70.57
Shapiro-Wilk W	0.966
Shapiro-Wilk p-value	0.852
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	22.32
Student t	1.05
Mean + t*SE (UCL84)	514
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	24
Var(S)	124
Intercept	-21542
Slope	11.00
p-value	0.039
Significant Trend?	Increasing



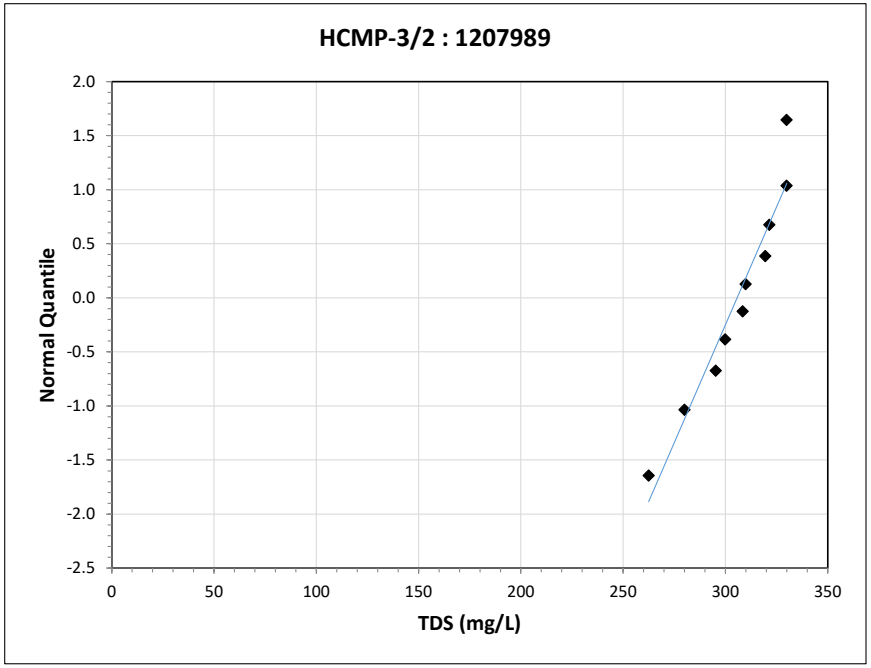


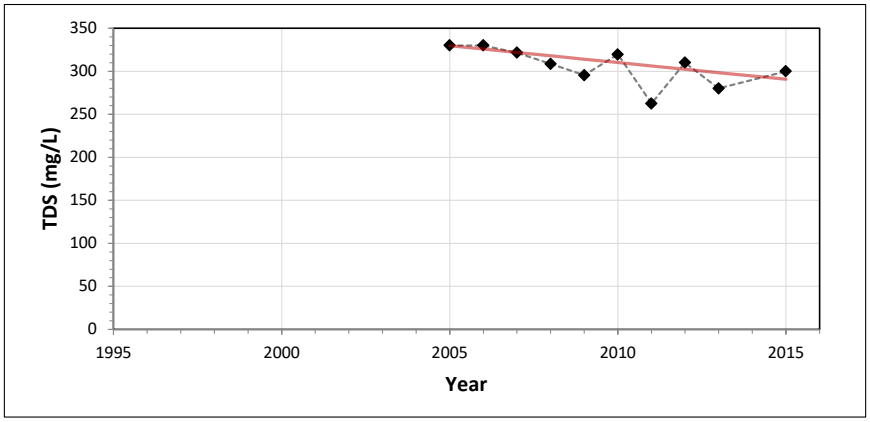
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	HCMP-3/2 : 1207989
Analyte	NO3-N (mg/L)
Count	10
Count Detects	10
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	5.38
Annual Average Max	8.60
Annual Average Mean	7.46
Annual Average Stdev	1.13
Shapiro-Wilk W	0.896
Shapiro-Wilk p-value	0.196
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.36
Student t	1.05
Mean + t*SE (UCL84)	7.84
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	6
Var(S)	124
Intercept	-39.93
Slope	0.02
p-value	0.653
Significant Trend?	No



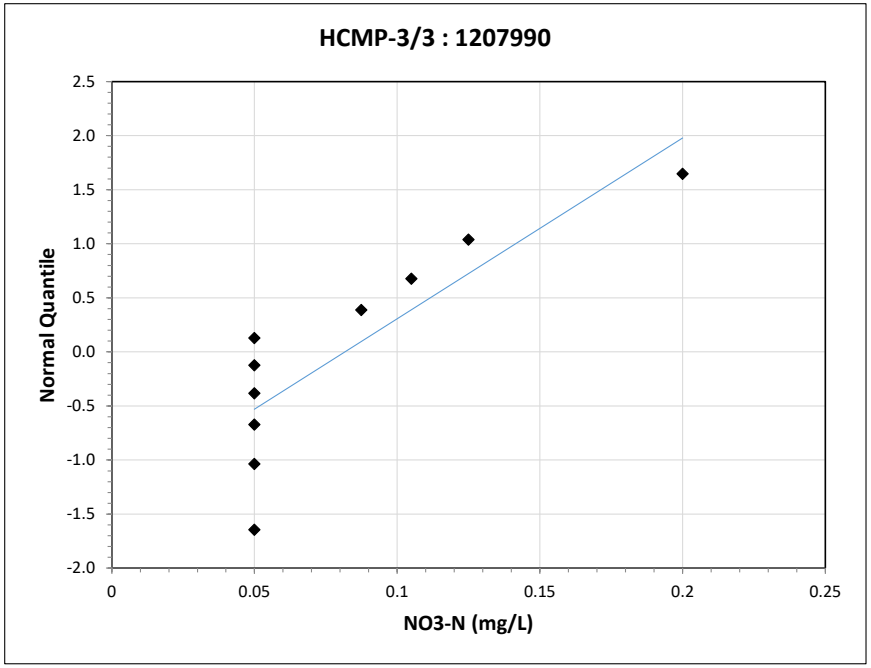


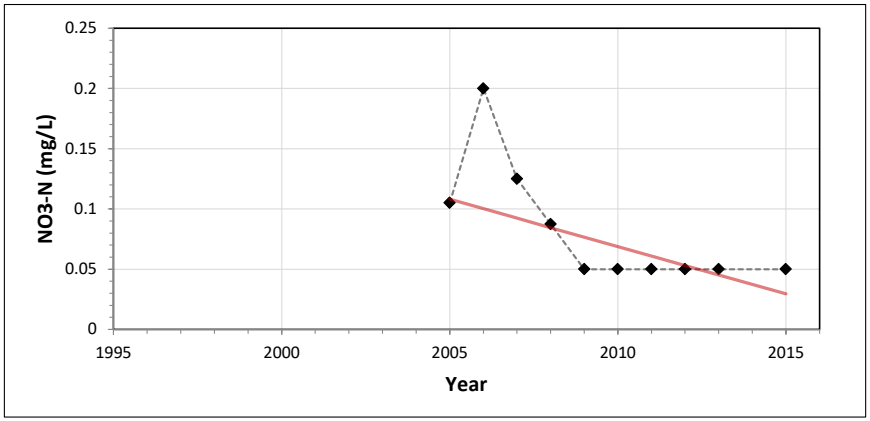
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	HCMP-3/2 : 1207989
Analyte	TDS (mg/L)
Count	10
Count Detects	10
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	263
Annual Average Max	330
Annual Average Mean	306
Annual Average Stdev	21.89
Shapiro-Wilk W	0.927
Shapiro-Wilk p-value	0.419
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.92
Student t	1.05
Mean + t*SE (UCL84)	313
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-26
Var(S)	124
Intercept	8149
Slope	-3.90
p-value	0.025
Significant Trend?	Decreasing



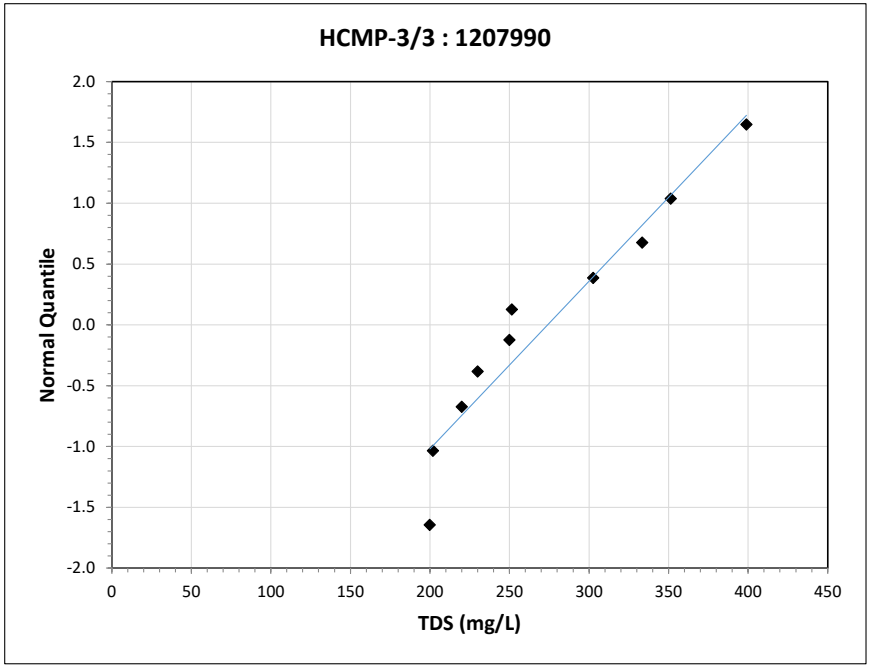


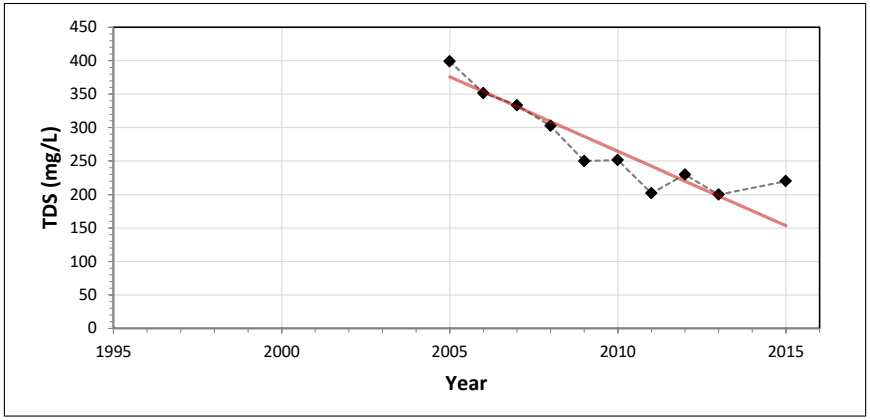
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	HCMP-3/3 : 1207990
Analyte	NO3-N (mg/L)
Count	10
Count Detects	4
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	0.20
Annual Average Mean	0.08
Annual Average Stdev	0.05
Shapiro-Wilk W	0.719
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	0.20
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.004
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-21
Var(S)	108
Intercept	15.86
Slope	-0.01
p-value	0.055
Significant Trend?	Decreasing



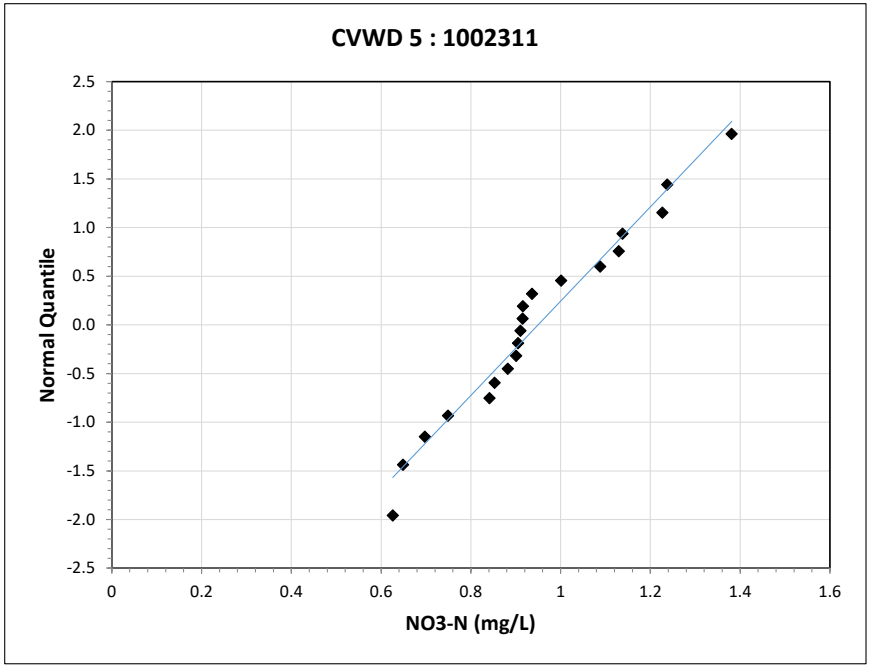


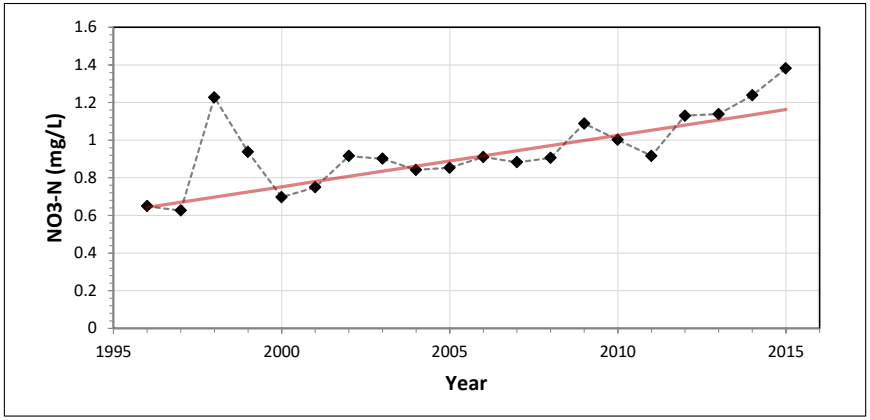
Statistics	
GMZ	Chino-1/Chino-North
Well Name : ID	HCMP-3/3 : 1207990
Analyte	TDS (mg/L)
Count	10
Count Detects	10
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	200
Annual Average Max	399
Annual Average Mean	274
Annual Average Stdev	68.79
Shapiro-Wilk W	0.908
Shapiro-Wilk p-value	0.269
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	21.75
Student t	1.05
Mean + t*SE (UCL84)	297
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-37
Var(S)	125
Intercept	44987
Slope	-22.25
p-value	0.001
Significant Trend?	Decreasing*



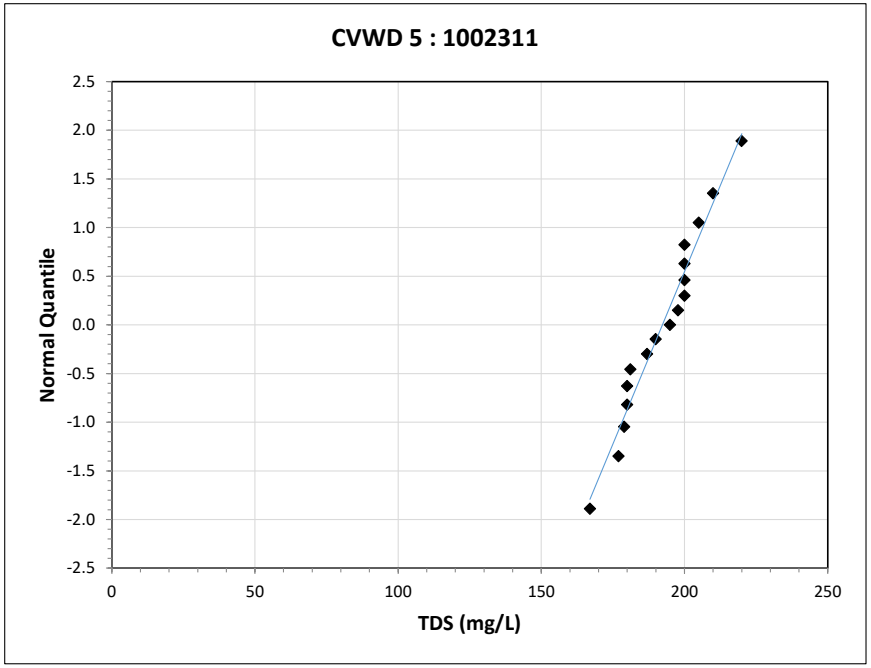


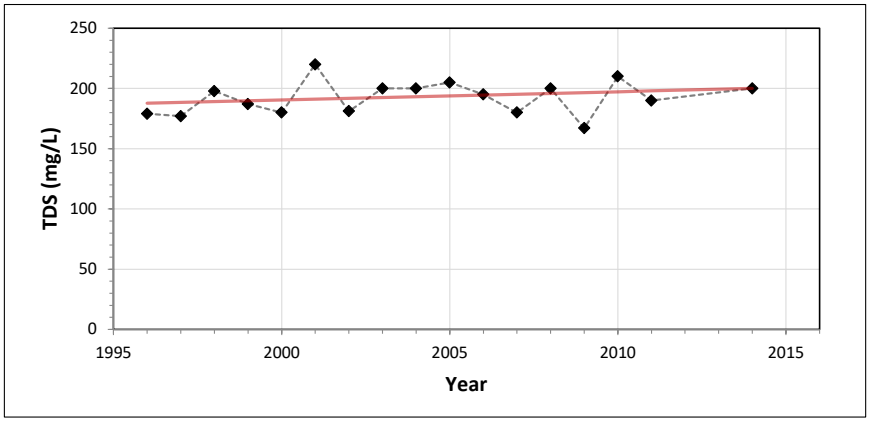
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	CVWD 5 : 1002311
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.63
Annual Average Max	1.38
Annual Average Mean	0.95
Annual Average Stdev	0.20
Shapiro-Wilk W	0.959
Shapiro-Wilk p-value	0.517
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.04
Student t	1.02
Mean + t*SE (UCL84)	1.00
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	110
Var(S)	950
Intercept	-53.89
Slope	0.03
p-value	4E-4
Significant Trend?	Increasing**



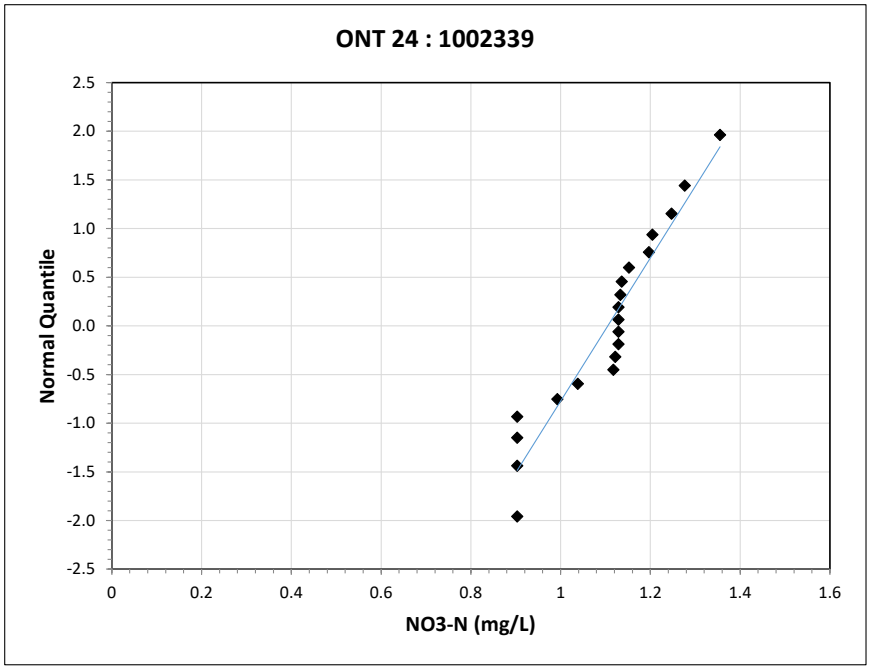


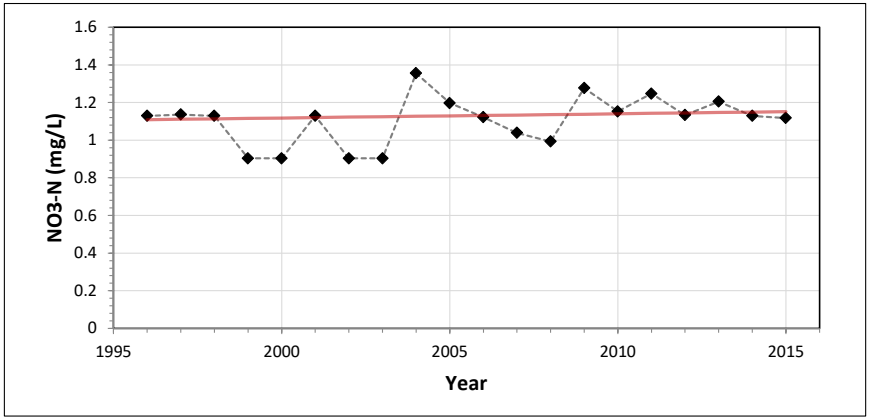
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	CVWD 5 : 1002311
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	167
Annual Average Max	220
Annual Average Mean	192
Annual Average Stdev	13.76
Shapiro-Wilk W	0.966
Shapiro-Wilk p-value	0.739
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	3.34
Student t	1.03
Mean + t*SE (UCL84)	196
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	29
Var(S)	580
Intercept	-1168
Slope	0.68
p-value	0.245
Significant Trend?	No



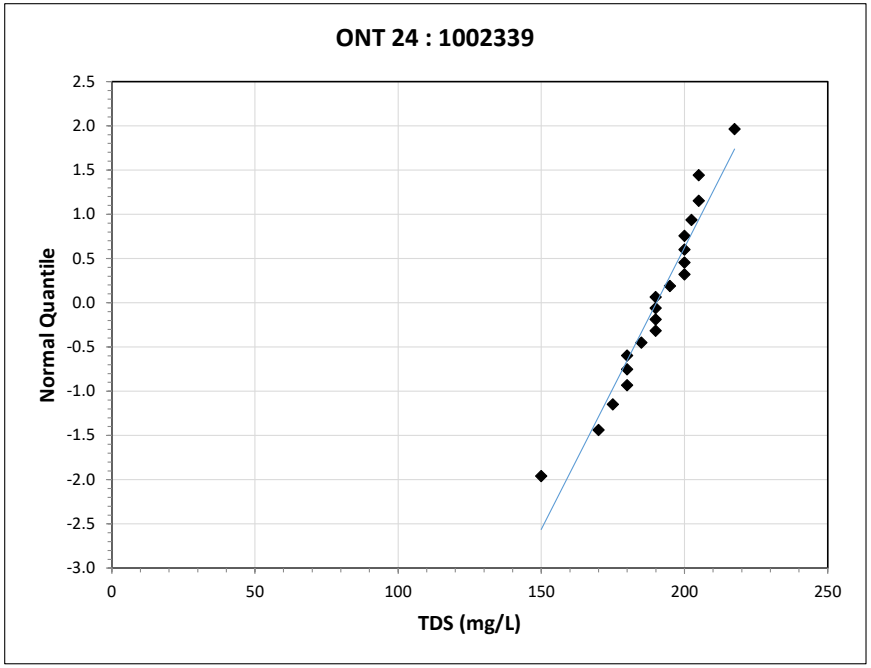


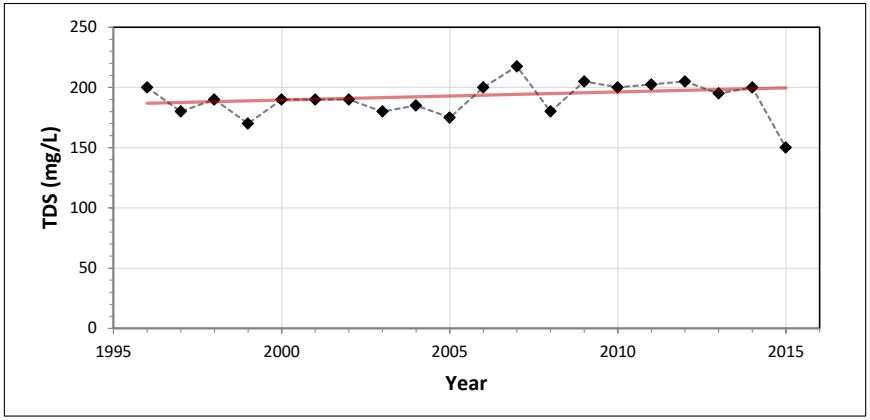
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	ONT 24 : 1002339
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.90
Annual Average Max	1.36
Annual Average Mean	1.11
Annual Average Stdev	0.13
Shapiro-Wilk W	0.909
Shapiro-Wilk p-value	0.062
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.03
Student t	1.02
Mean + t*SE (UCL84)	1.13
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	27
Var(S)	938
Intercept	-3.37
Slope	0.00
p-value	0.396
Significant Trend?	No



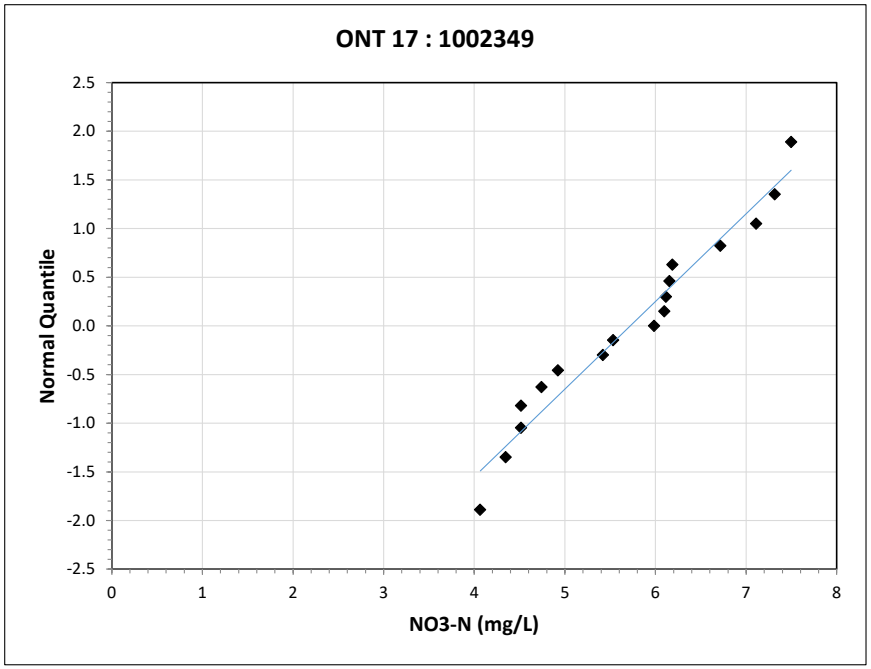


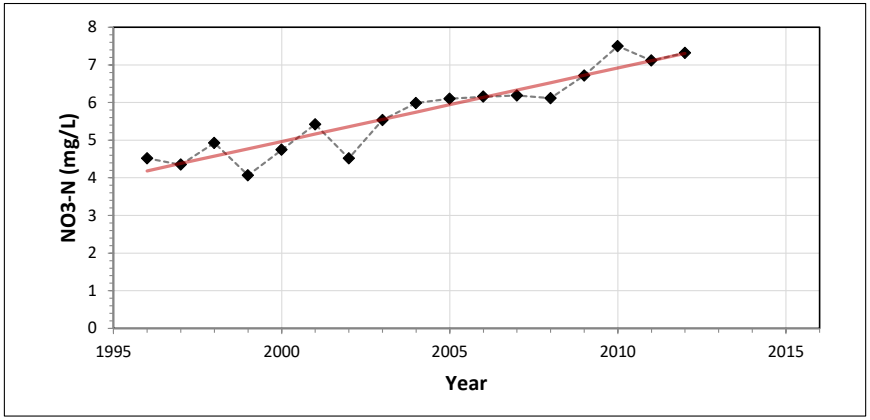
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	ONT 24 : 1002339
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	150
Annual Average Max	218
Annual Average Mean	190
Annual Average Stdev	15.11
Shapiro-Wilk W	0.946
Shapiro-Wilk p-value	0.316
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	3.38
Student t	1.02
Mean + t*SE (UCL84)	194
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	34
Var(S)	928
Intercept	-1150
Slope	0.67
p-value	0.279
Significant Trend?	No



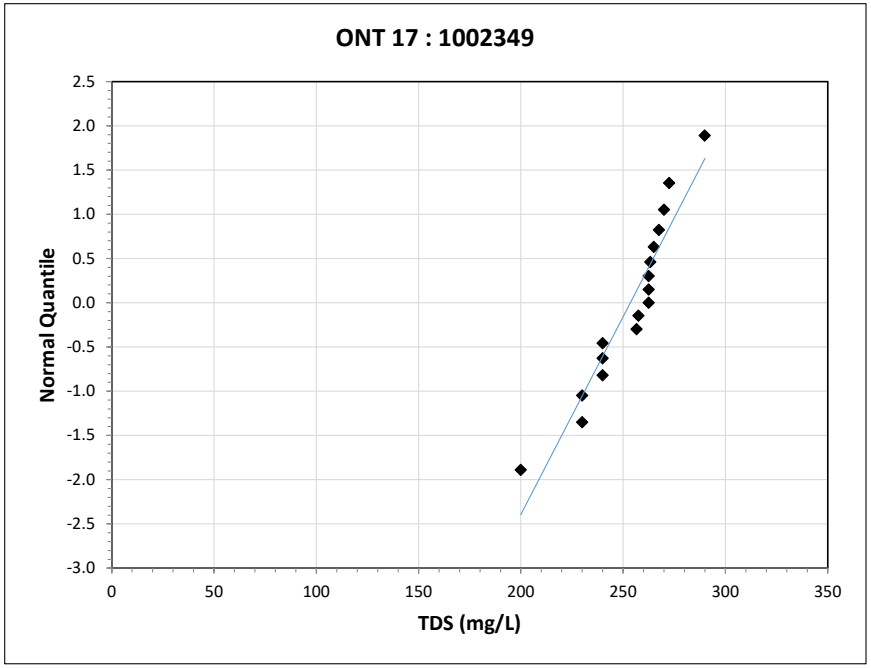


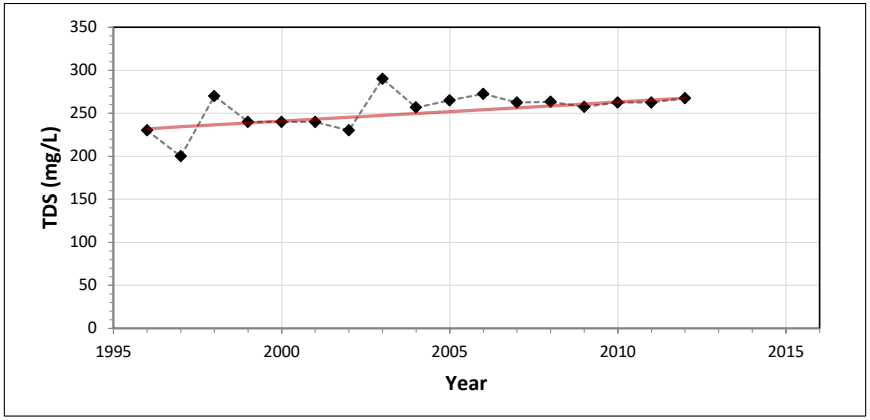
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	ONT 17 : 1002349
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	4.07
Annual Average Max	7.50
Annual Average Mean	5.72
Annual Average Stdev	1.08
Shapiro-Wilk W	0.946
Shapiro-Wilk p-value	0.398
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.26
Student t	1.03
Mean + t*SE (UCL84)	5.99
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	111
Var(S)	588
Intercept	-385
Slope	0.20
p-value	6E-6
Significant Trend?	Increasing**



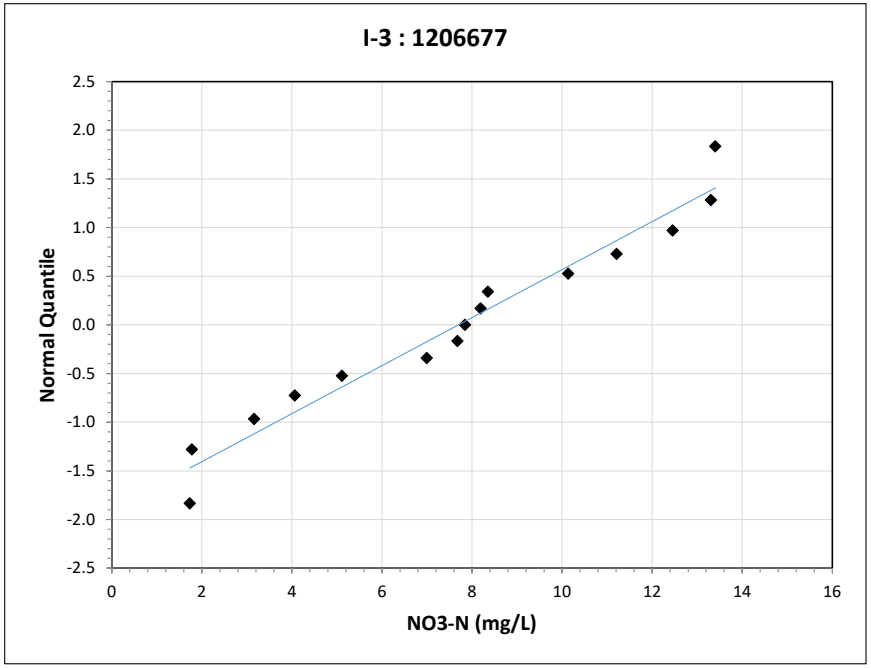


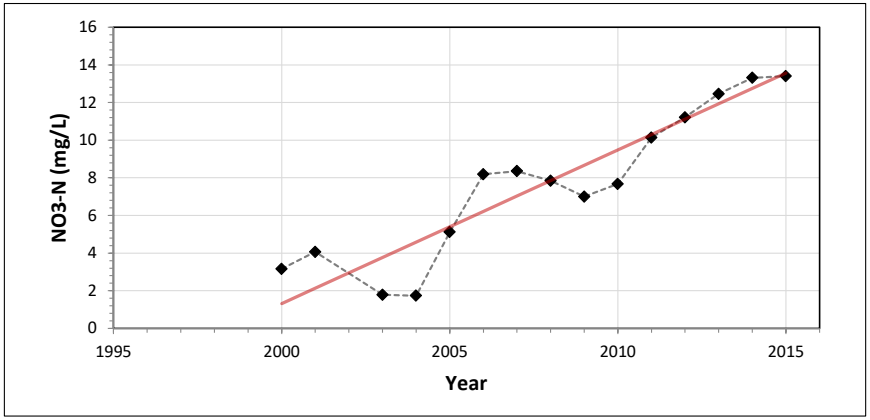
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	ONT 17 : 1002349
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	200
Annual Average Max	290
Annual Average Mean	254
Annual Average Stdev	21.17
Shapiro-Wilk W	0.920
Shapiro-Wilk p-value	0.149
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.14
Student t	1.03
Mean + t*SE (UCL84)	259
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	49
Var(S)	581
Intercept	-4197
Slope	2.22
p-value	0.046
Significant Trend?	Increasing



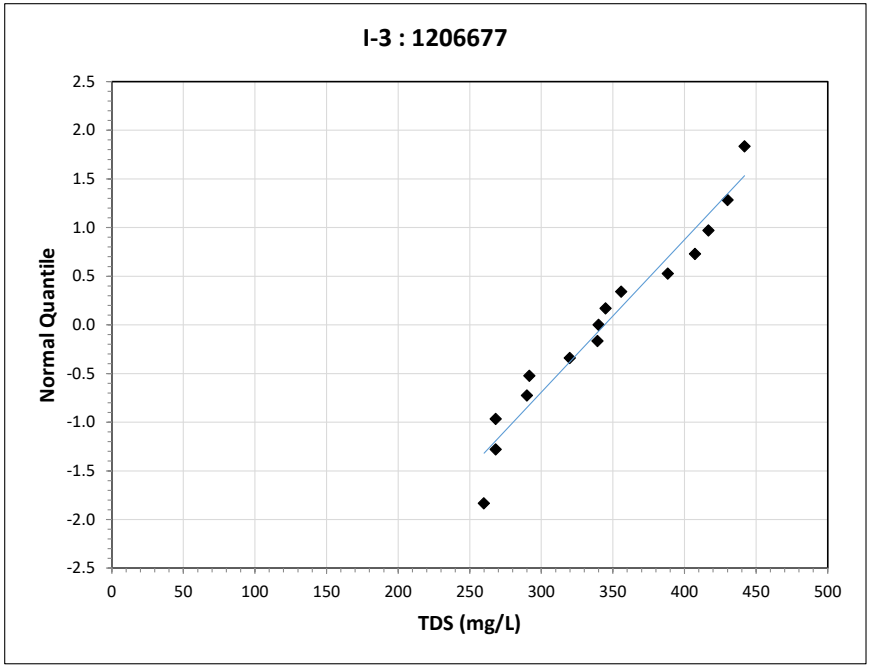


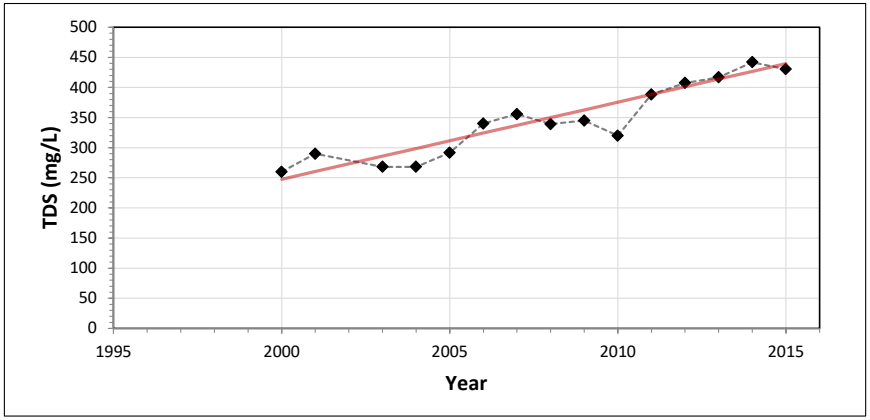
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	I-3 : 1206677
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	2000
Sample Year Max	2015
Annual Average Min	1.74
Annual Average Max	13.41
Annual Average Mean	7.70
Annual Average Stdev	3.94
Shapiro-Wilk W	0.942
Shapiro-Wilk p-value	0.408
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	1.02
Student t	1.03
Mean + t*SE (UCL84)	8.75
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	79
Var(S)	408
Intercept	-1633
Slope	0.82
p-value	1E-4
Significant Trend?	Increasing**



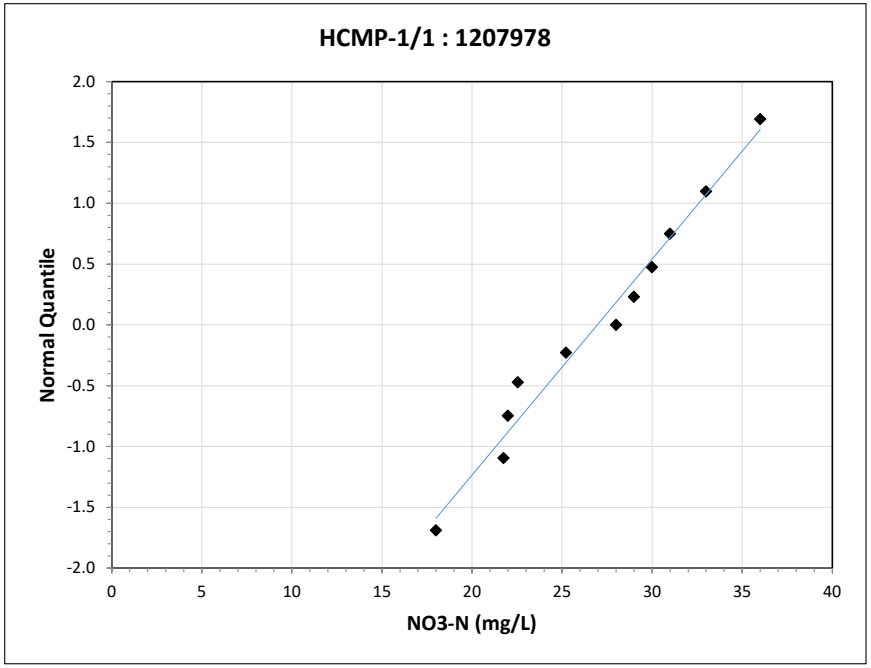


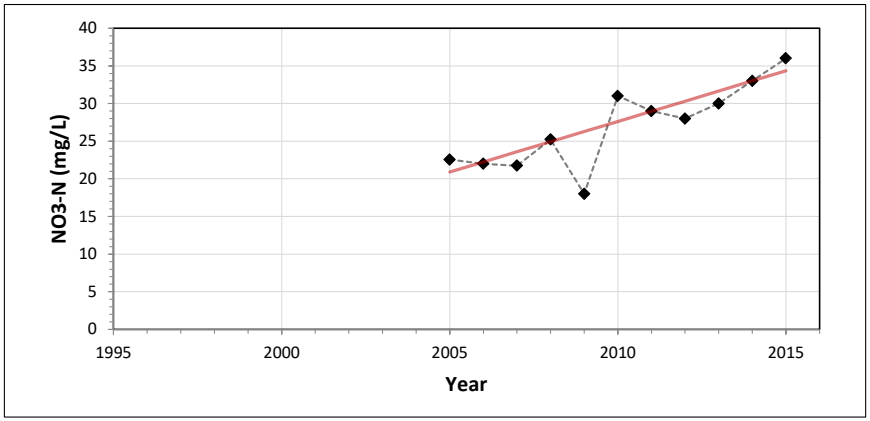
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	I-3 : 1206677
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	2000
Sample Year Max	2015
Annual Average Min	260
Annual Average Max	442
Annual Average Mean	344
Annual Average Stdev	61.69
Shapiro-Wilk W	0.933
Shapiro-Wilk p-value	0.298
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	15.93
Student t	1.03
Mean + t*SE (UCL84)	361
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	84
Var(S)	407
Intercept	-25358
Slope	12.80
p-value	4E-5
Significant Trend?	Increasing**



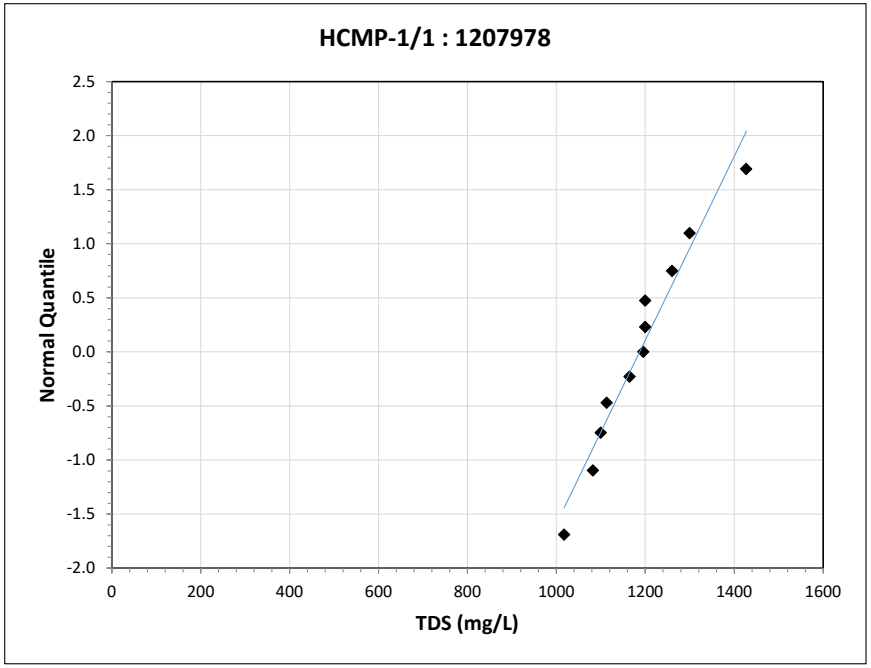


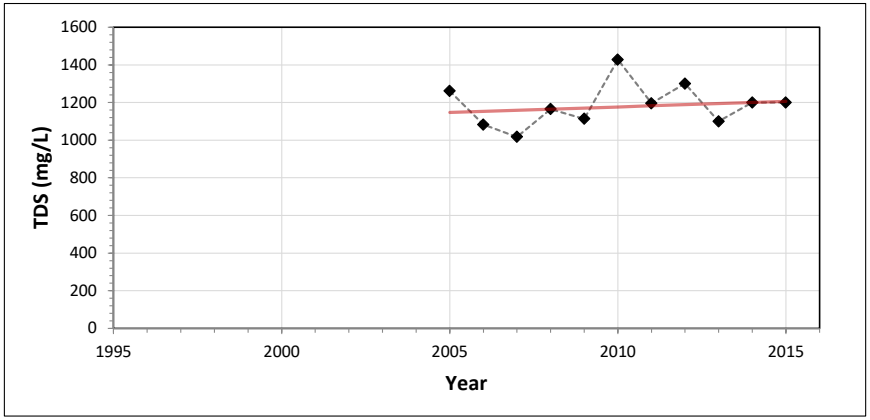
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	HCMP-1/1 : 1207978
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	18.00
Annual Average Max	36.00
Annual Average Mean	26.96
Annual Average Stdev	5.51
Shapiro-Wilk W	0.972
Shapiro-Wilk p-value	0.906
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	1.66
Student t	1.05
Mean + t*SE (UCL84)	28.70
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	33
Var(S)	165
Intercept	-2675
Slope	1.34
p-value	0.013
Significant Trend?	Increasing



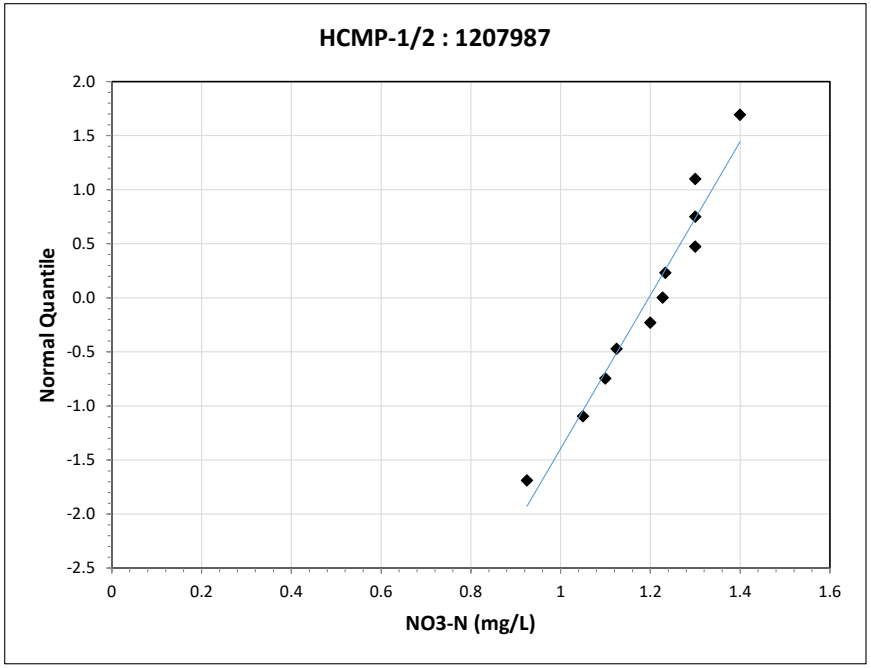


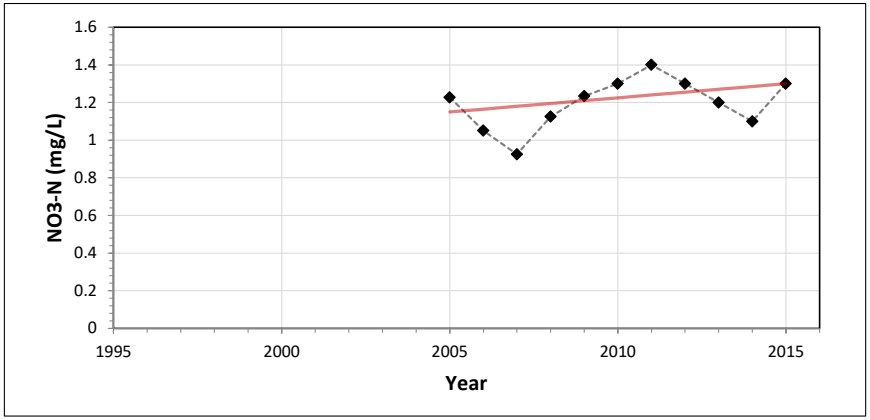
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	HCMP-1/1 : 1207978
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	1018
Annual Average Max	1428
Annual Average Mean	1187
Annual Average Stdev	113.83
Shapiro-Wilk W	0.961
Shapiro-Wilk p-value	0.785
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	34.32
Student t	1.05
Mean + t*SE (UCL84)	1223
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	12
Var(S)	164
Intercept	-10548
Slope	5.83
p-value	0.390
Significant Trend?	No



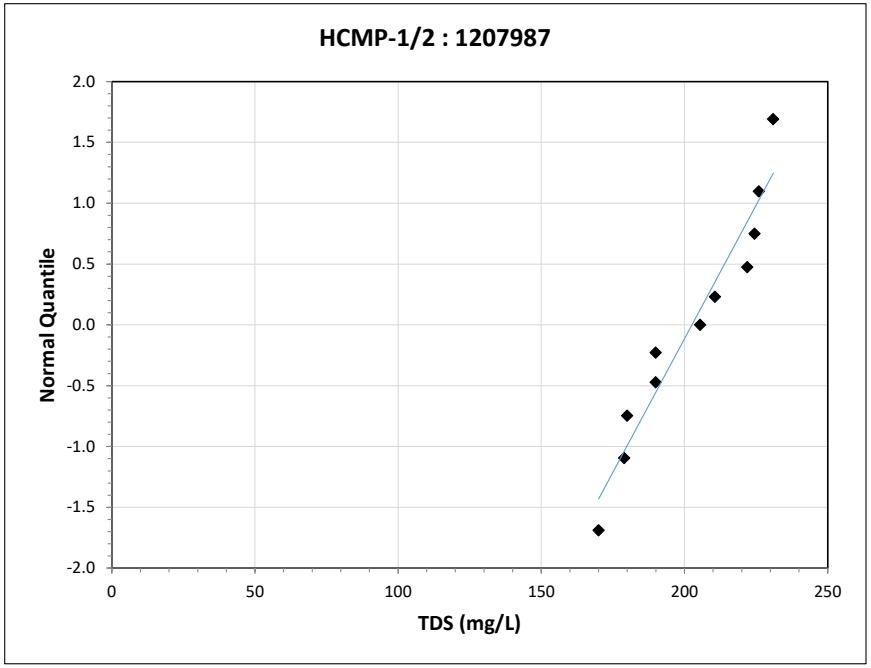


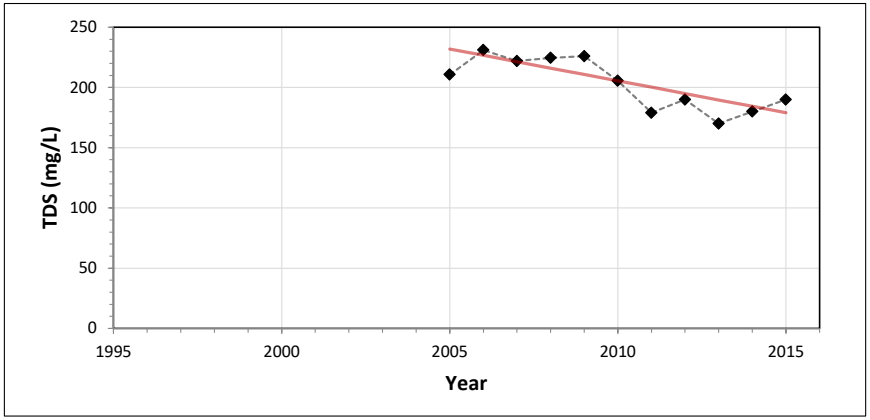
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	HCMP-1/2 : 1207987
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	0.93
Annual Average Max	1.40
Annual Average Mean	1.20
Annual Average Stdev	0.14
Shapiro-Wilk W	0.958
Shapiro-Wilk p-value	0.745
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.04
Student t	1.05
Mean + t*SE (UCL84)	1.24
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	16
Var(S)	161
Intercept	-28.93
Slope	0.02
p-value	0.238
Significant Trend?	No



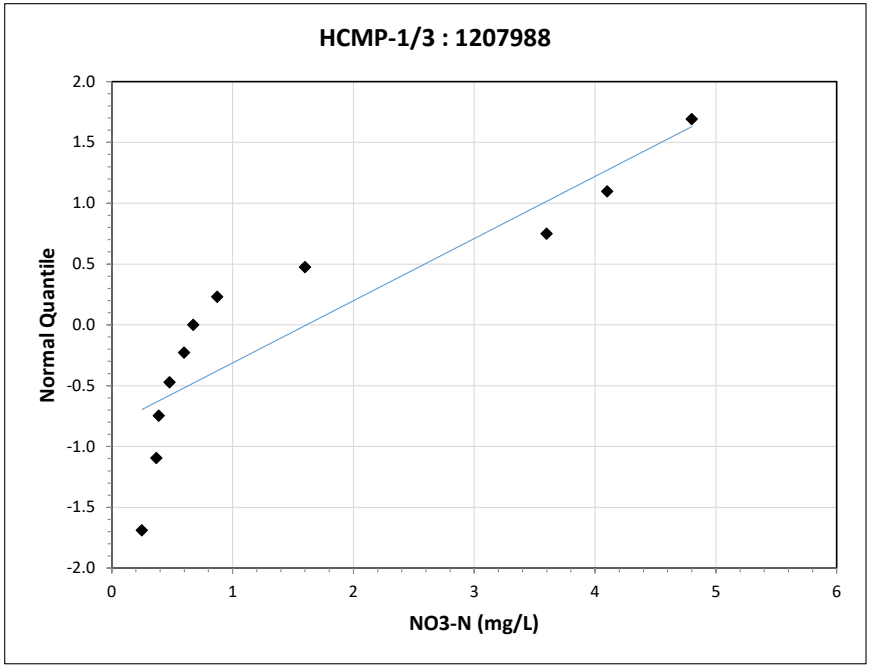


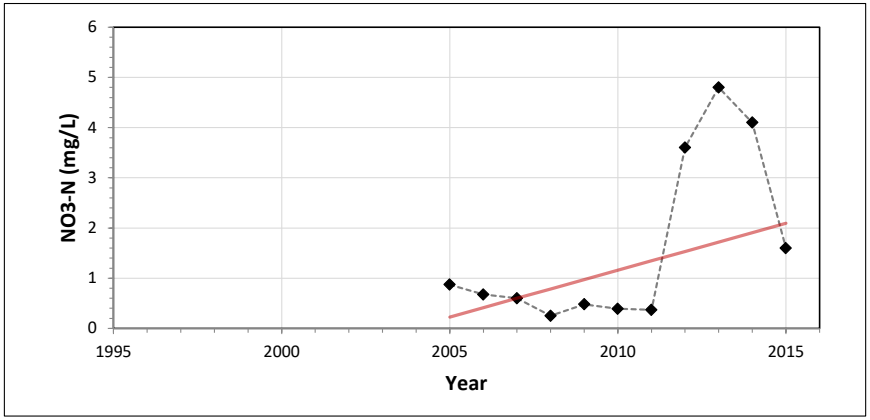
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	HCMP-1/2 : 1207987
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	170
Annual Average Max	231
Annual Average Mean	203
Annual Average Stdev	21.75
Shapiro-Wilk W	0.916
Shapiro-Wilk p-value	0.285
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.56
Student t	1.05
Mean + t*SE (UCL84)	209
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-28
Var(S)	164
Intercept	10814
Slope	-5.28
p-value	0.035
Significant Trend?	Decreasing



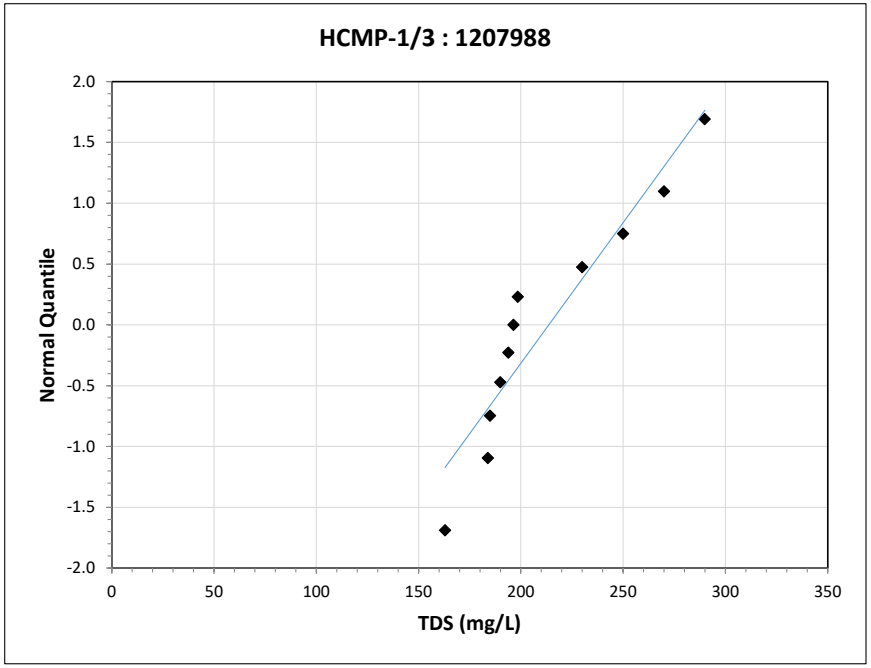


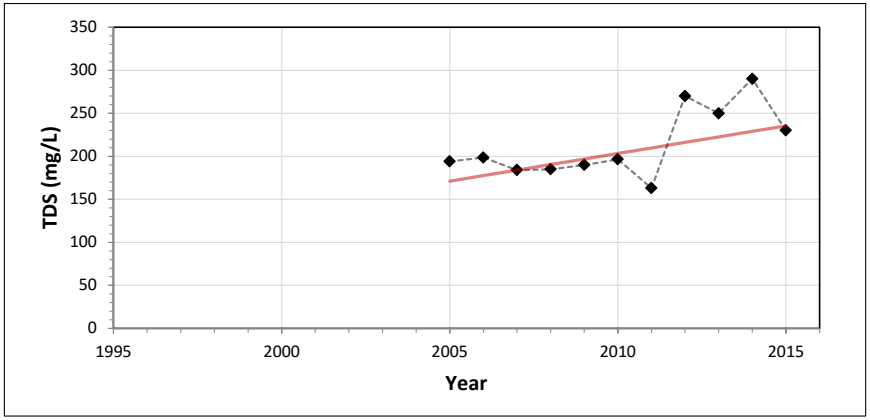
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	HCMP-1/3 : 1207988
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	0.25
Annual Average Max	4.80
Annual Average Mean	1.61
Annual Average Stdev	1.70
Shapiro-Wilk W	0.760
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	4.80
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.05
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.175
Geomean	0.97
GM + t*GSE (UCL84)	1.35
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	11
Var(S)	165
Intercept	-374
Slope	0.19
p-value	0.436
Significant Trend?	No



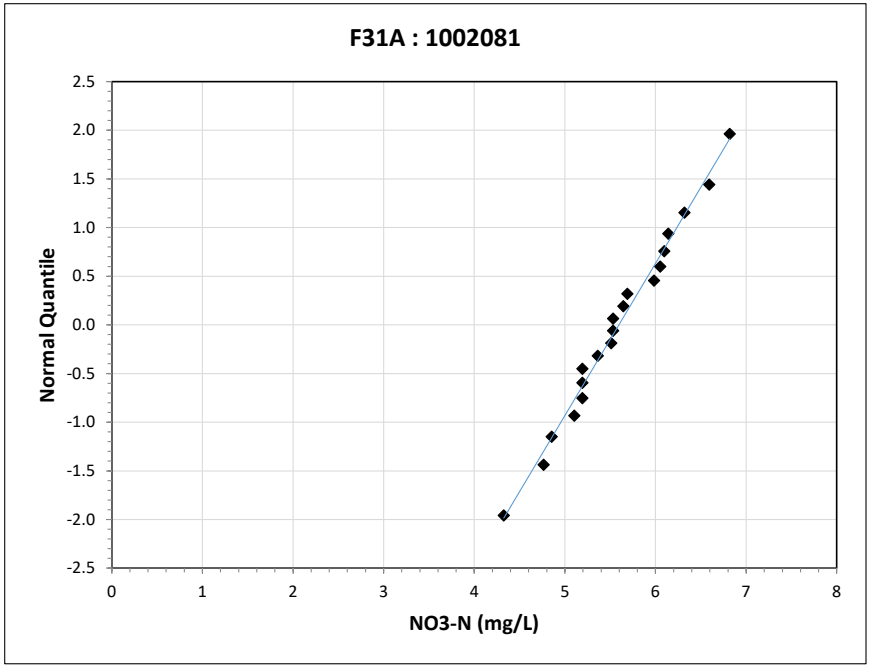


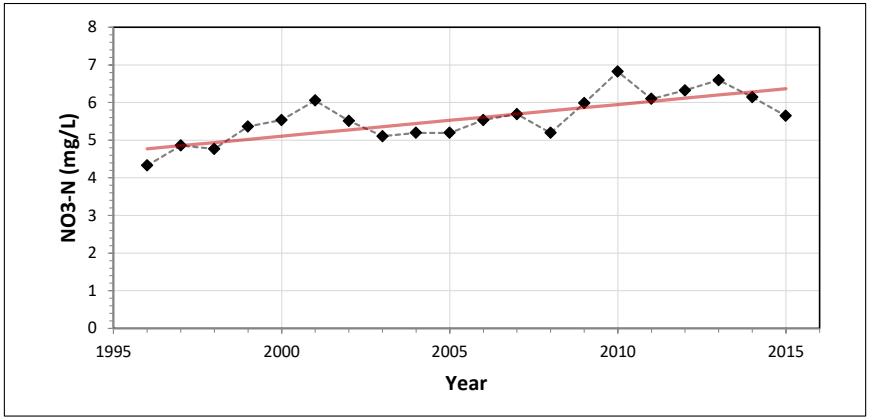
Statistics	
GMZ	Chino-2/Chino-North
Well Name : ID	HCMP-1/3 : 1207988
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	163
Annual Average Max	290
Annual Average Mean	214
Annual Average Stdev	40.41
Shapiro-Wilk W	0.887
Shapiro-Wilk p-value	0.129
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.18
Student t	1.05
Mean + t*SE (UCL84)	226
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	21
Var(S)	165
Intercept	-12718
Slope	6.43
p-value	0.119
Significant Trend?	No



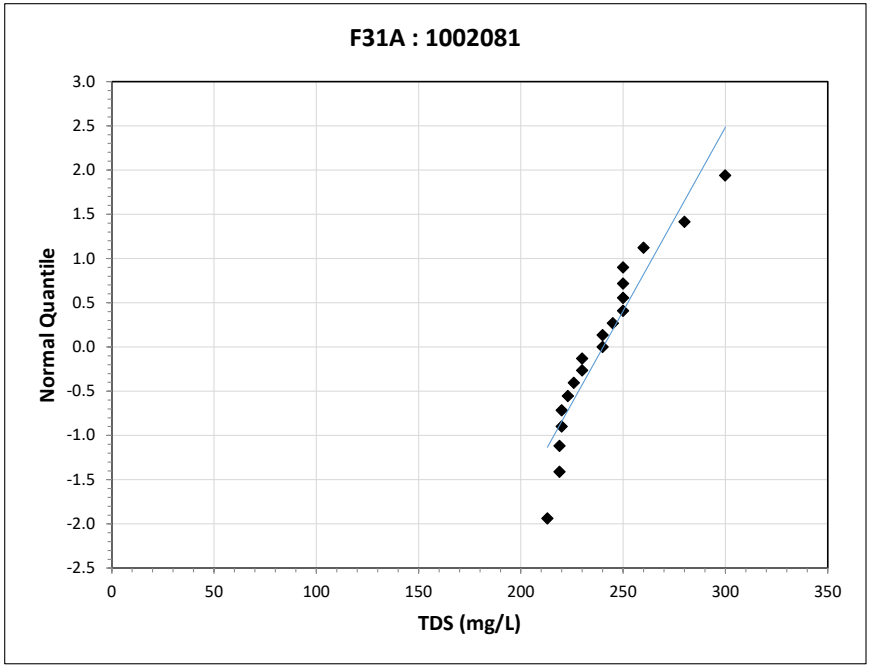


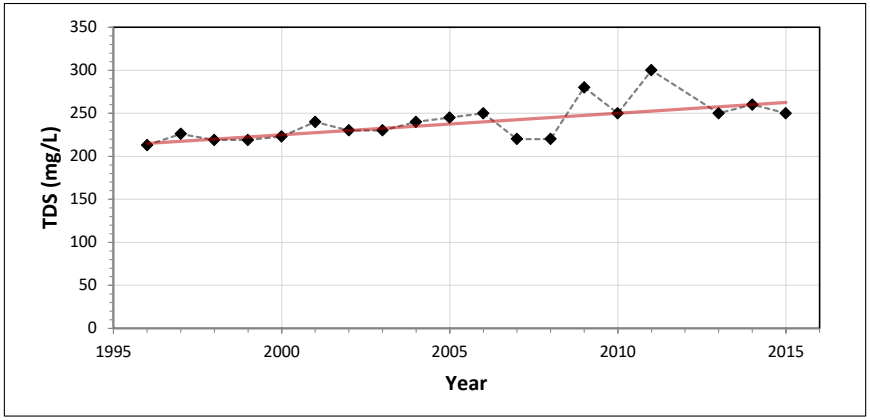
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	F31A : 1002081
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	4.33
Annual Average Max	6.82
Annual Average Mean	5.60
Annual Average Stdev	0.63
Shapiro-Wilk W	0.987
Shapiro-Wilk p-value	0.990
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.14
Student t	1.02
Mean + t*SE (UCL84)	5.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	106
Var(S)	950
Intercept	-163
Slope	0.08
p-value	7E-4
Significant Trend?	Increasing**



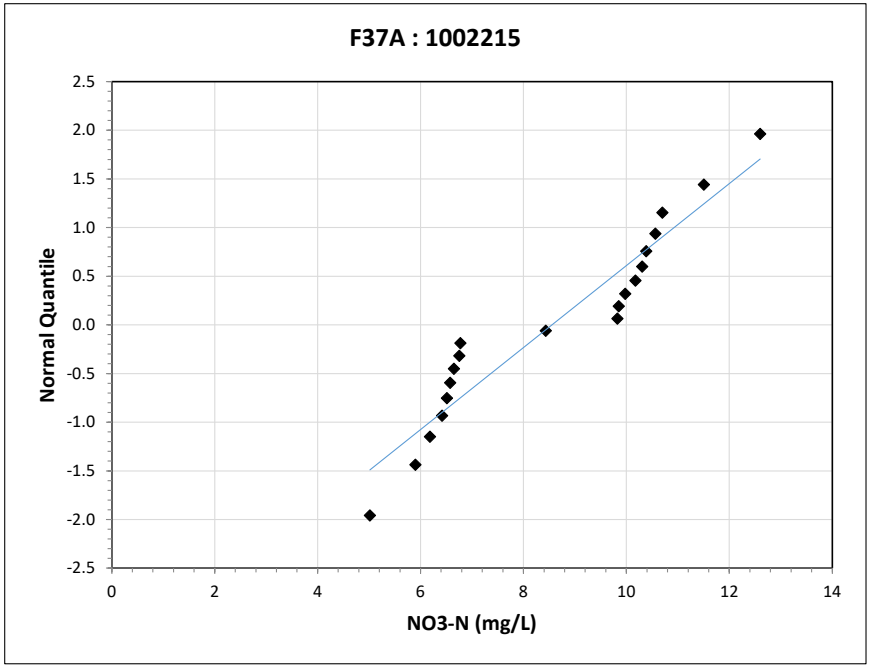


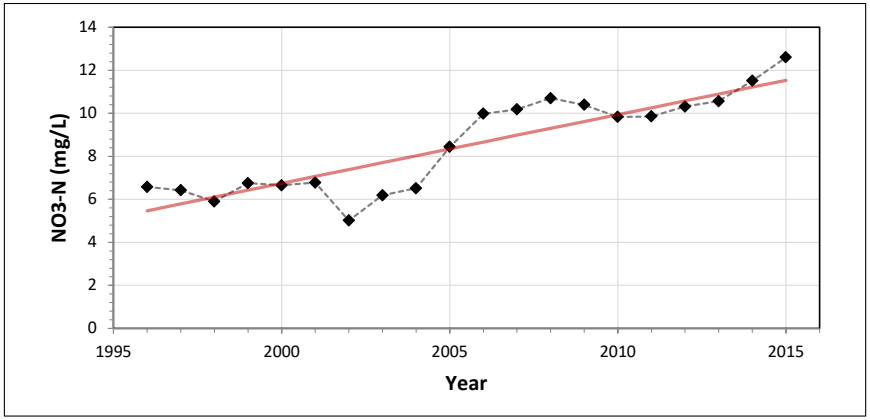
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	F31A : 1002081
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	213
Annual Average Max	300
Annual Average Mean	240
Annual Average Stdev	22.51
Shapiro-Wilk W	0.889
Shapiro-Wilk p-value	0.031
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.16
Student t	1.02
Mean + t*SE (UCL84)	246
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	103
Var(S)	804
Intercept	-4775
Slope	2.50
p-value	3E-4
Significant Trend?	Increasing**



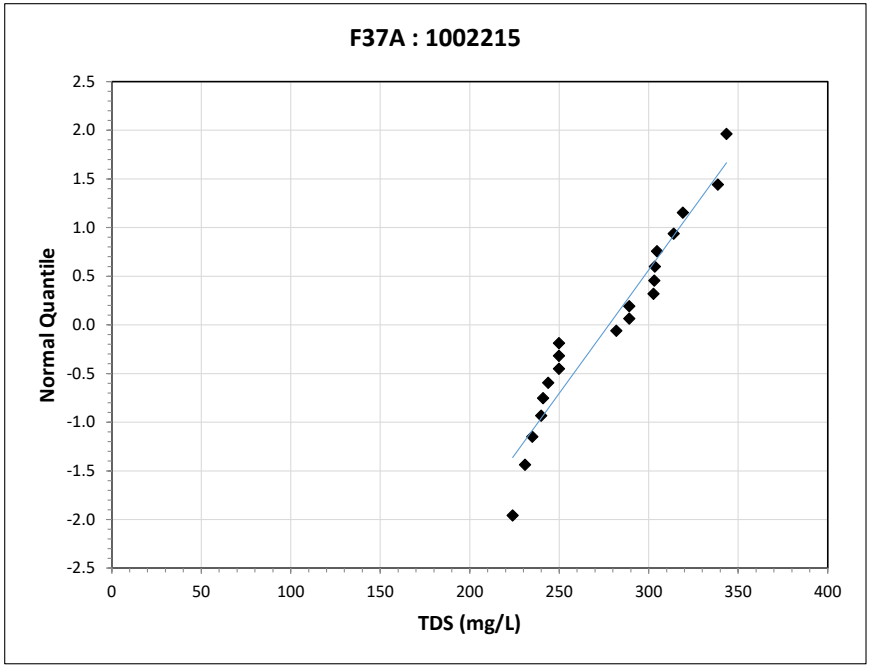


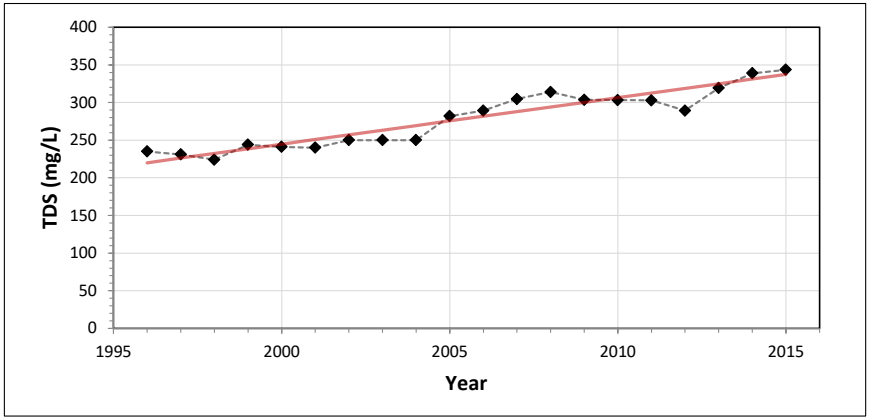
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	F37A : 1002215
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	5.02
Annual Average Max	12.60
Annual Average Mean	8.56
Annual Average Stdev	2.25
Shapiro-Wilk W	0.901
Shapiro-Wilk p-value	0.043
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.50
Student t	1.02
Mean + t*SE (UCL84)	9.07
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	128
Var(S)	950
Intercept	-632
Slope	0.32
p-value	4E-5
Significant Trend?	Increasing**



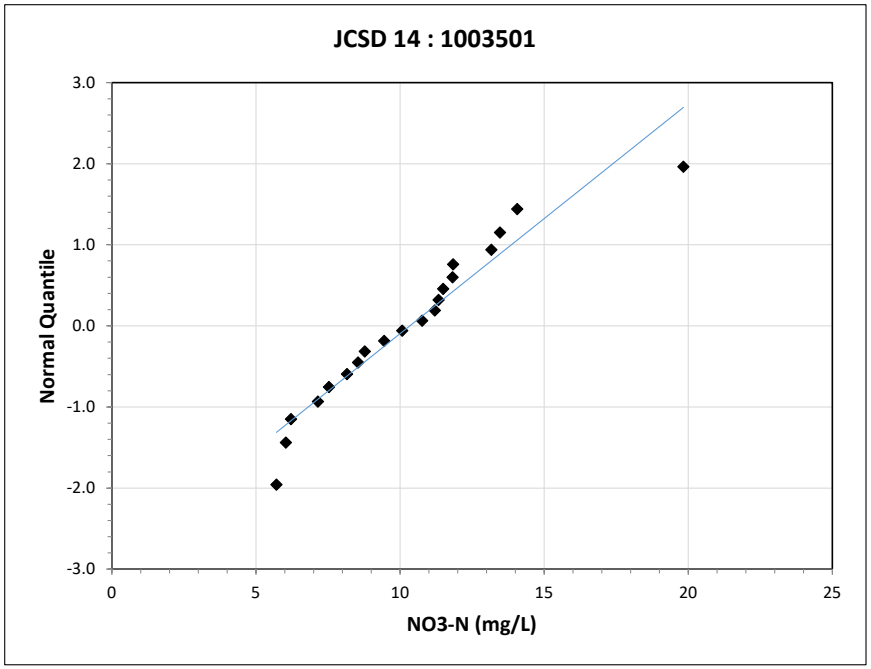


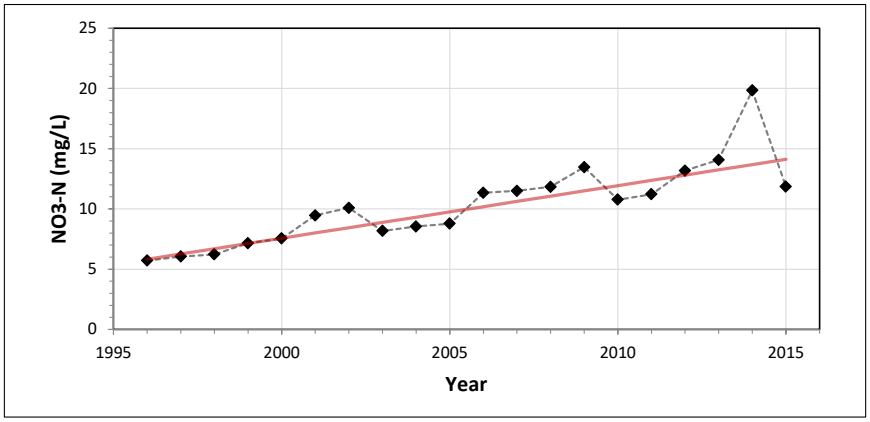
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	F37A : 1002215
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	224
Annual Average Max	344
Annual Average Mean	278
Annual Average Stdev	37.80
Shapiro-Wilk W	0.917
Shapiro-Wilk p-value	0.087
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.45
Student t	1.02
Mean + t*SE (UCL84)	286
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	146
Var(S)	945
Intercept	-12105
Slope	6.18
p-value	2E-6
Significant Trend?	Increasing**



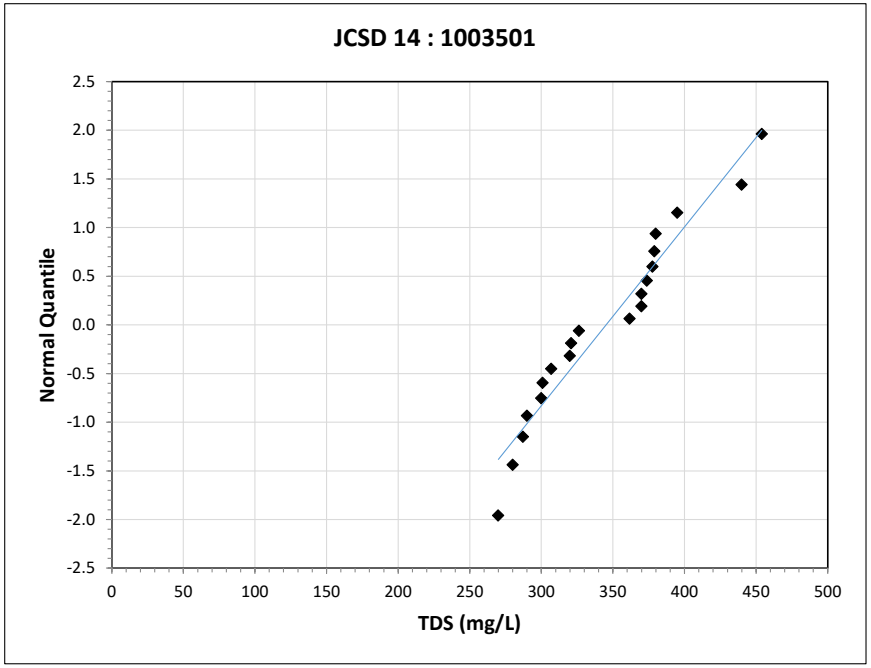


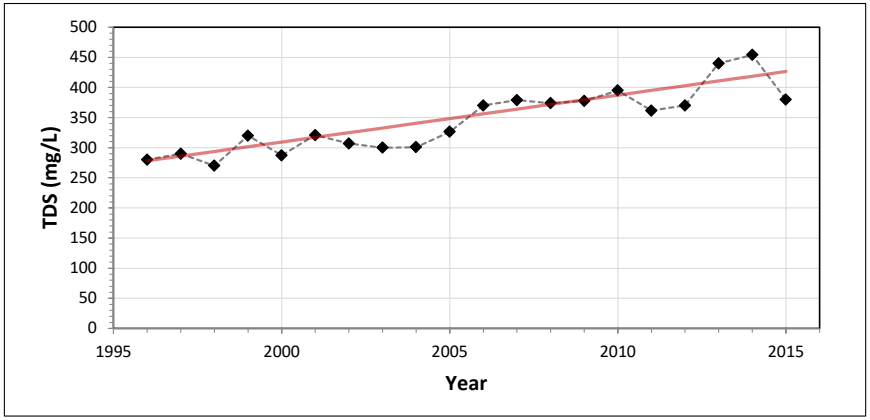
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	JCSD 14 : 1003501
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	5.72
Annual Average Max	19.84
Annual Average Mean	10.34
Annual Average Stdev	3.37
Shapiro-Wilk W	0.929
Shapiro-Wilk p-value	0.148
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.75
Student t	1.02
Mean + t*SE (UCL84)	11.11
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	152
Var(S)	950
Intercept	-865
Slope	0.44
p-value	1E-6
Significant Trend?	Increasing**



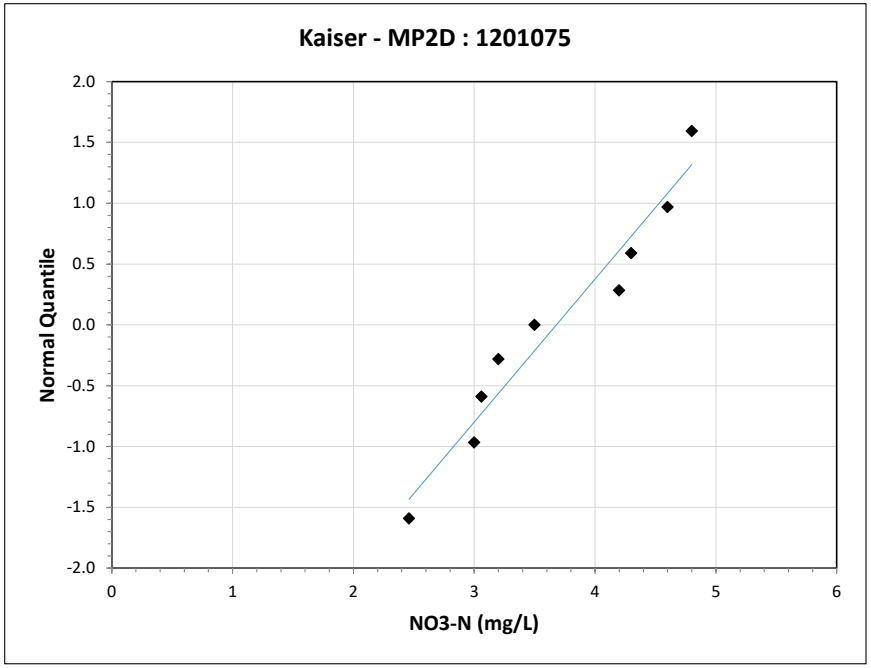


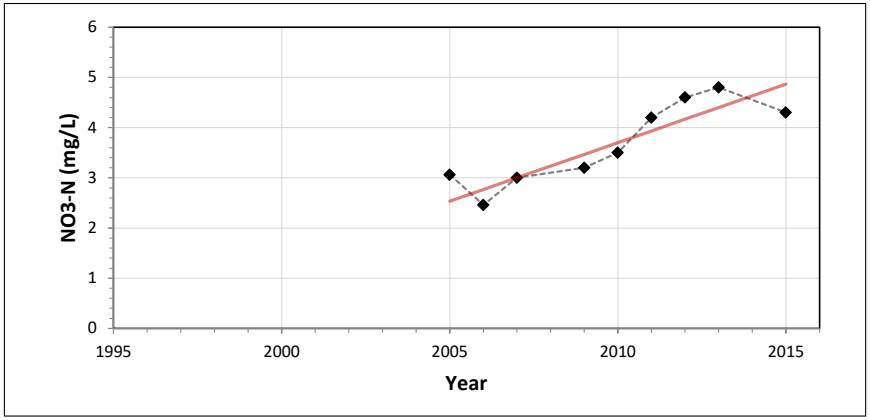
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	JCSD 14 : 1003501
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	270
Annual Average Max	454
Annual Average Mean	345
Annual Average Stdev	52.52
Shapiro-Wilk W	0.935
Shapiro-Wilk p-value	0.196
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.74
Student t	1.02
Mean + t*SE (UCL84)	357
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	137
Var(S)	949
Intercept	-15287
Slope	7.80
p-value	1E-5
Significant Trend?	Increasing**



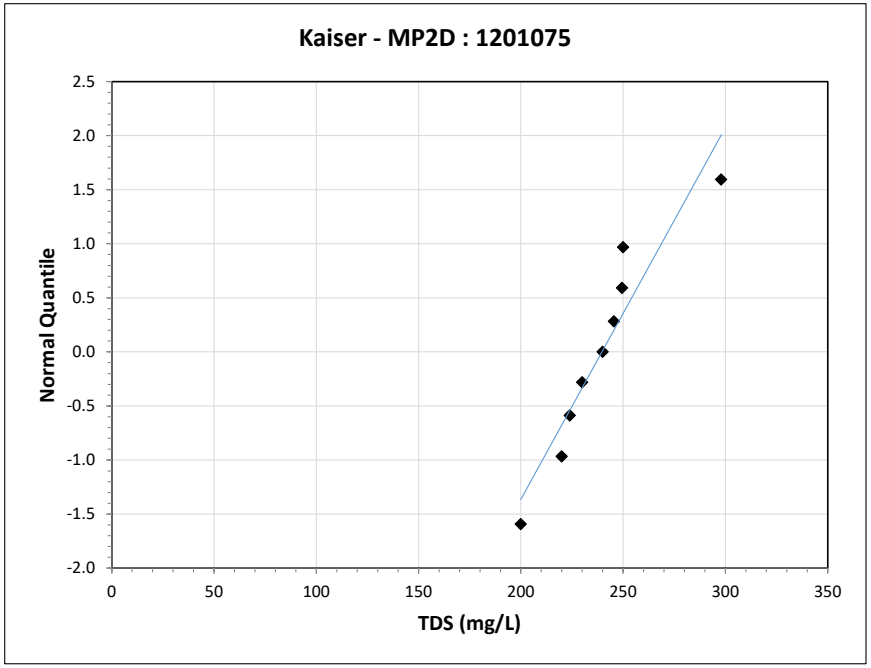


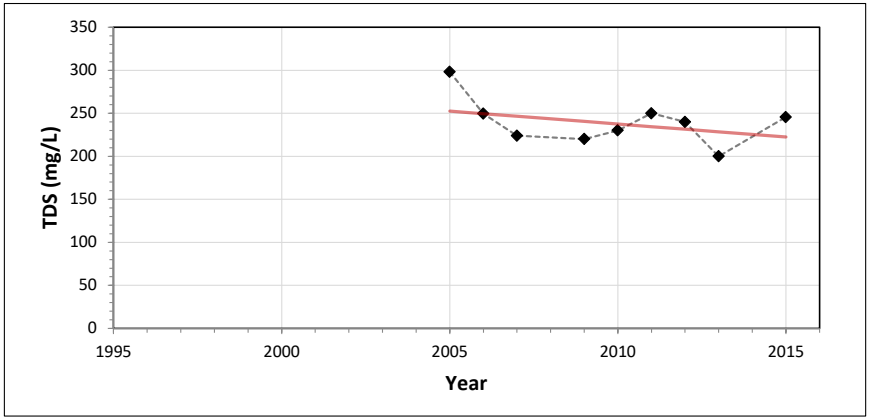
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	Kaiser - MP2D : 1201075
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	2.46
Annual Average Max	4.80
Annual Average Mean	3.68
Annual Average Stdev	0.82
Shapiro-Wilk W	0.935
Shapiro-Wilk p-value	0.530
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.27
Student t	1.06
Mean + t*SE (UCL84)	3.97
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	28
Var(S)	92.00
Intercept	-465
Slope	0.23
p-value	0.005
Significant Trend?	Increasing*



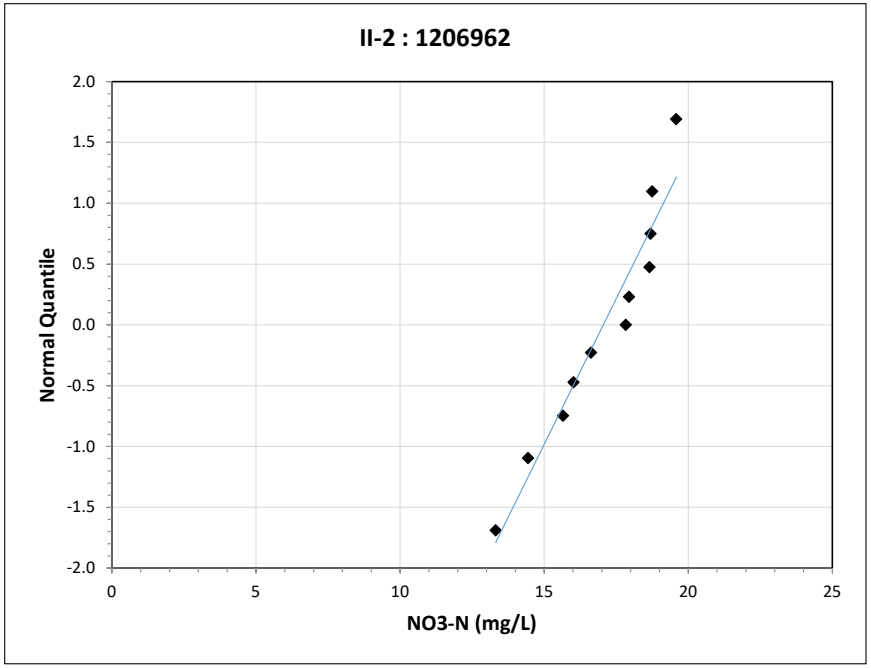


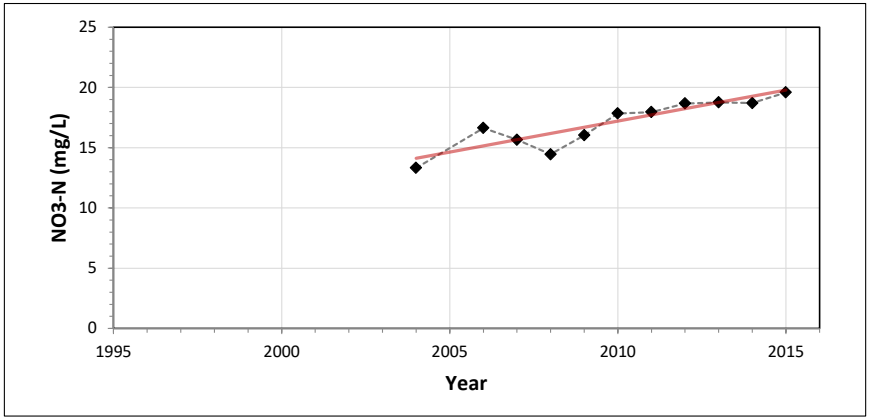
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	Kaiser - MP2D : 1201075
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	200
Annual Average Max	298
Annual Average Mean	240
Annual Average Stdev	27.25
Shapiro-Wilk W	0.921
Shapiro-Wilk p-value	0.398
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.08
Student t	1.06
Mean + t*SE (UCL84)	249
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-8
Var(S)	92.00
Intercept	6268
Slope	-3.00
p-value	0.466
Significant Trend?	No



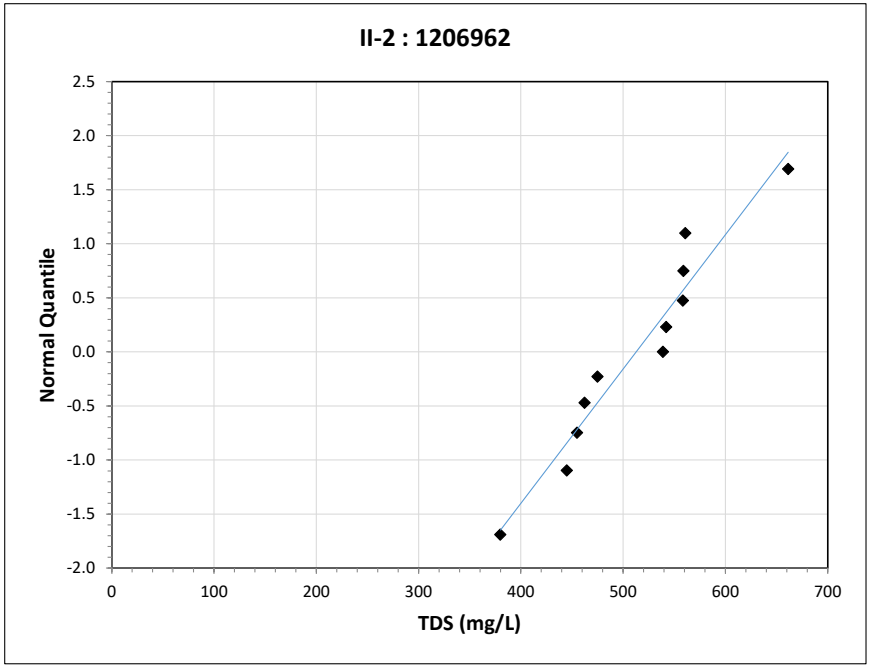


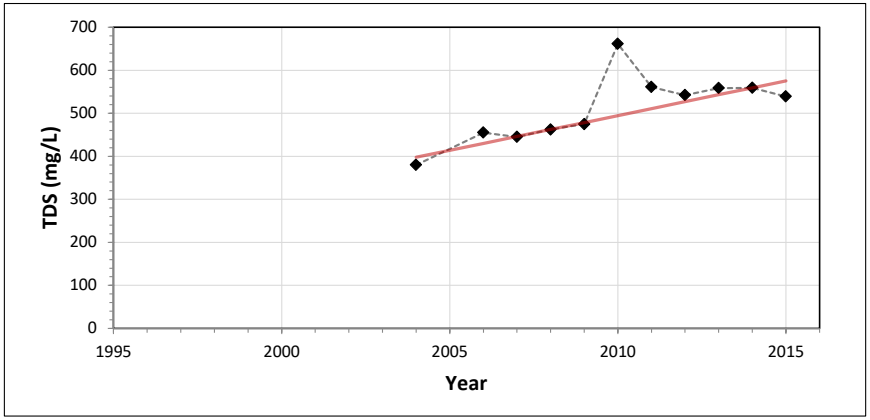
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	II-2 : 1206962
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2004
Sample Year Max	2015
Annual Average Min	13.32
Annual Average Max	19.59
Annual Average Mean	17.06
Annual Average Stdev	2.00
Shapiro-Wilk W	0.930
Shapiro-Wilk p-value	0.413
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.60
Student t	1.05
Mean + t*SE (UCL84)	17.69
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	45
Var(S)	165
Intercept	-1021
Slope	0.52
p-value	6E-4
Significant Trend?	Increasing**



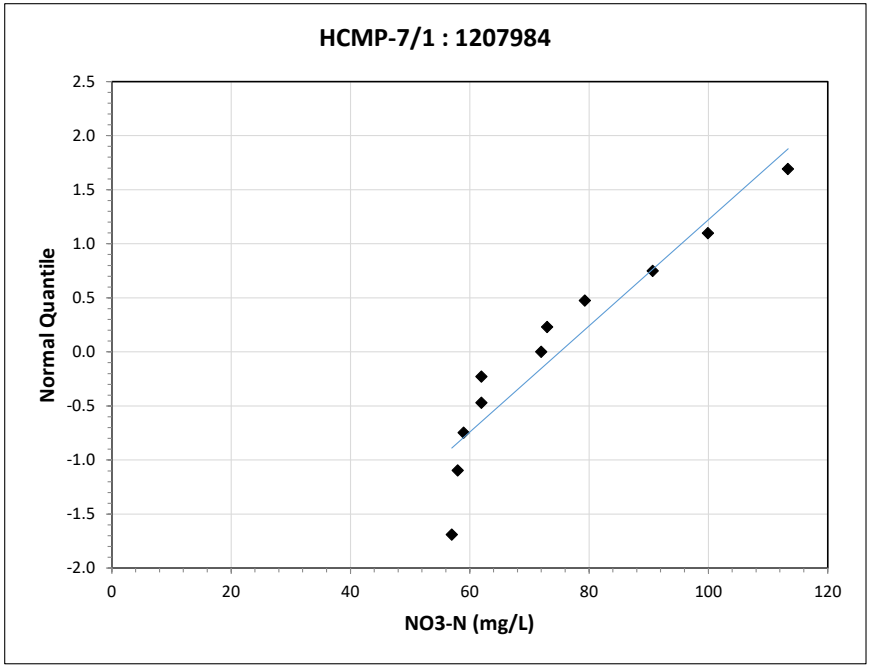


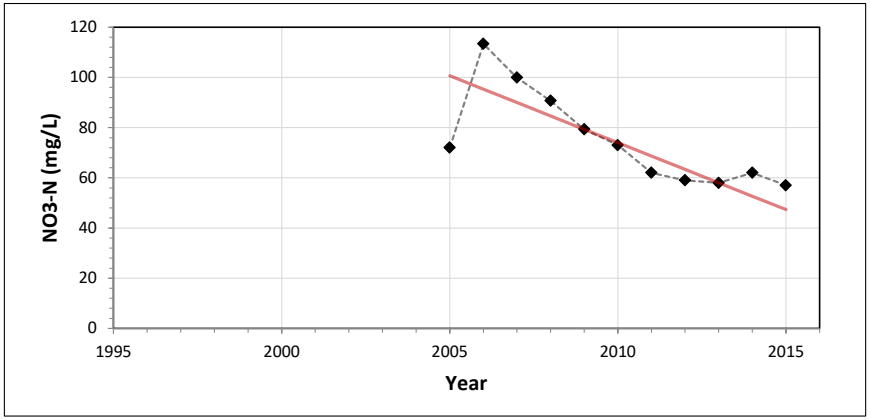
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	II-2 : 1206962
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2004
Sample Year Max	2015
Annual Average Min	380
Annual Average Max	661
Annual Average Mean	513
Annual Average Stdev	77.31
Shapiro-Wilk W	0.948
Shapiro-Wilk p-value	0.622
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	23.31
Student t	1.05
Mean + t*SE (UCL84)	537
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	29
Var(S)	165
Intercept	-31953
Slope	16.14
p-value	0.029
Significant Trend?	Increasing



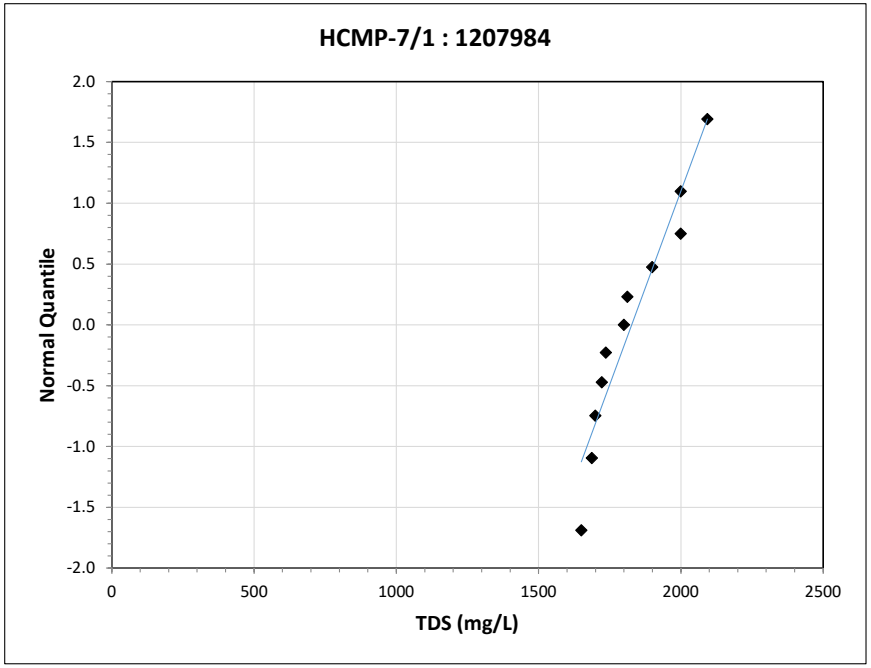


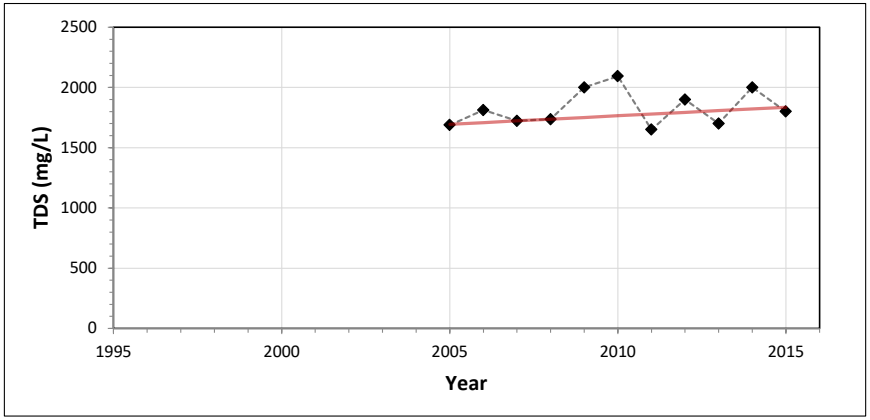
Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	HCMP-7/1 : 1207984
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	57.00
Annual Average Max	113
Annual Average Mean	75.12
Annual Average Stdev	18.92
Shapiro-Wilk W	0.873
Shapiro-Wilk p-value	0.084
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.70
Student t	1.05
Mean + t*SE (UCL84)	81.09
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-40
Var(S)	164
Intercept	10794
Slope	-5.33
p-value	0.002
Significant Trend?	Decreasing*





Statistics	
GMZ	Chino-3/Chino-North
Well Name : ID	HCMP-7/1 : 1207984
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	1651
Annual Average Max	2094
Annual Average Mean	1828
Annual Average Stdev	149.27
Shapiro-Wilk W	0.909
Shapiro-Wilk p-value	0.237
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	45.01
Student t	1.05
Mean + t*SE (UCL84)	1875
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	10
Var(S)	164
Intercept	-26710
Slope	14.17
p-value	0.482
Significant Trend?	No





Attachment B6

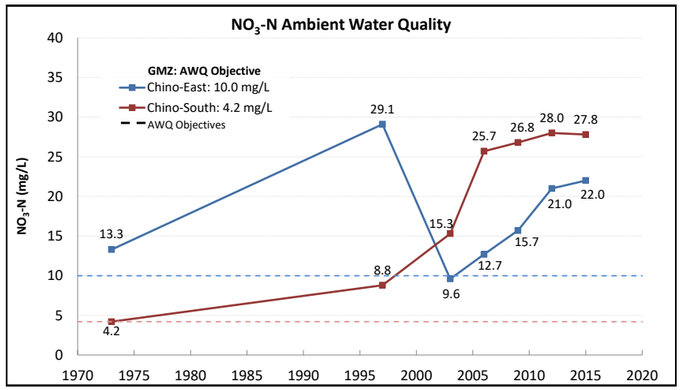
Chino-South and Chino-East GMZs

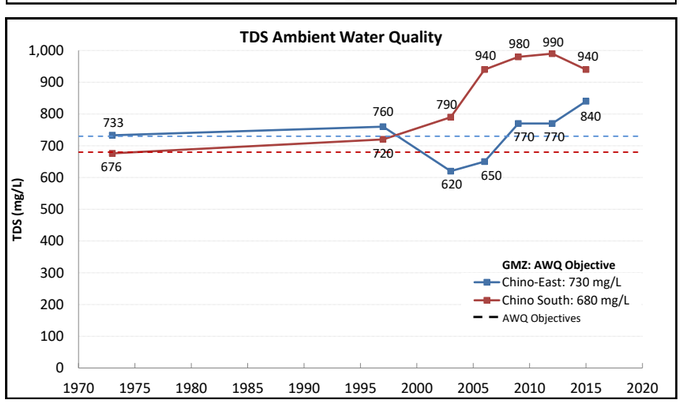
Attachment Contents:

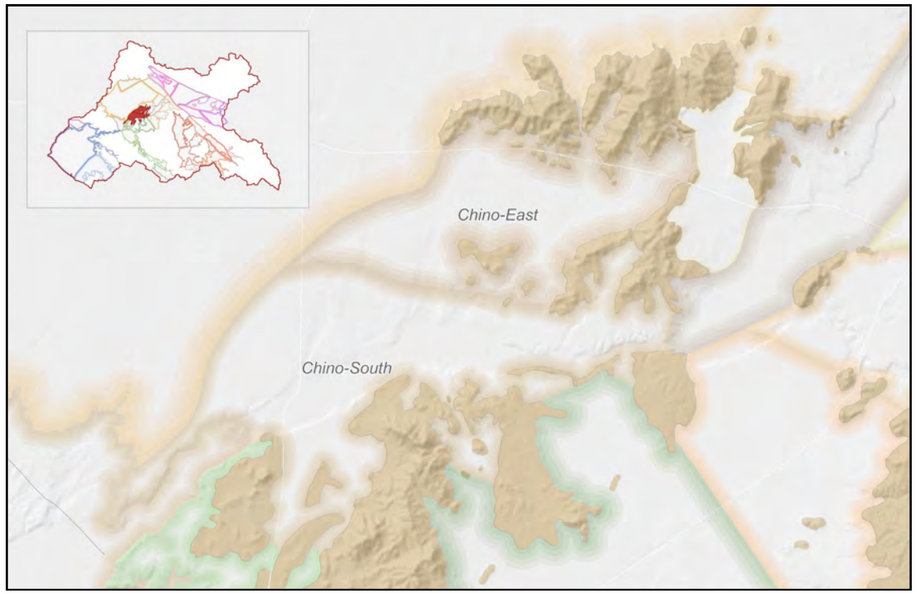
B6-1 Groundwater Storage and Elevation Contours Fall 2015
B6-2 NO_3-N Concentration and Contour Map
B6-3 TDS Concentration and Contour Map
B6-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B6-5 TDS Concentration Change (1993-2012 to 1996-2015)
B6-6 Key Well Analysis Charts

	Basin Analytics	Chino-East	Chino-South
Basin	GMZ Area (acres)	7,950	13,100
	Volume of Storage (acre-ft)	80,100	187,000
NO_3-N	Wells per GMZ	499	178
	Point Statistics per GMZ	271	51
	Total Mass (tons)	2,400	7,060
	1996-2015 AWQ	22	27.8
TDS	Wells per GMZ	205	125
	Point Statistics per GMZ	29	25
	Total Mass (tons)	91,500	239,000
	1996-2015 AWQ	840	940

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Chino South

The nitrate objective for Chino South is 4.2 mg/L. The ambient nitrate concentration decreased from 28.0 mg/L in 2012 to 27.8 mg/L in 2015, and there is no assimilative capacity. One out of the five key wells in Chino South GMZ have an increasing trend in nitrate concentrations, three key wells show a decreasing trend, and the other one shows no trend in the nitrate concentrations. Seven of the total 178 wells with nitrate values in Chino South will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and nineteen wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Chino East

The nitrate objective for Chino East is 10.0 mg/L. The ambient nitrate concentration increased from 21.0 mg/L in 2012 to 22.0 mg/L in 2015, and there is no assimilative capacity. Two out of the five key wells in Chino East GMZ have a decreasing trend in nitrate concentrations, while the other three shows no trends in the nitrate concentrations. Thirteen of the total 499 wells with nitrate values in Chino East will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Forty-two new wells with statistics were added to the 1996 to 2015 AWQ recomputation and sixty-nine wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

Chino South

The TDS objective for Chino South is 680 mg/L. The ambient TDS concentration decreased from 990 mg/L in 2012 to 940 mg/L in 2015, and there is no assimilative capacity. Two out of the five key interpretive wells in Chino South GMZ show a decreasing trend while the other three show no trends in TDS concentrations. Five of the total 125 wells with TDS values in Chino South will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and nineteen wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Chino-East	1003583	03A	21.5	No Trend	--	--
Chino-East	1206966	II-6	24.7	No Trend	609	No Trend
Chino-East	1207150	CTP-TW1	25.9	No Trend	977	Decreasing
Chino-East	1207986	HCMP-9/1	12.2	Decreasing	734	Decreasing
Chino-East	1207998	HCMP-9/2	0.2	Decreasing	178	No Trend
Chino-South	1003624	JCSD 01 (Sky Country #1)	10.0	Increasing	731	No Trend
Chino-South	1003663	9	1.5	Decreasing	601	No Trend
Chino-South	1206968	II-8	15.7	Decreasing*	800	Decreasing**
Chino-South	1207985	HCMP-8/1	61.9	Decreasing	1,354	Decreasing
Chino-South	1207997	HCMP-8/2	3.3	No Trend	225	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B6-4 and B6-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Chino-East	1003513	JCSD 05	High	1	8.8	Ave	--	--	--	--
Chino-East	1003582	03	High	2	20.6	Ave	--	--	--	--
Chino-East	1207144	AGA4875	High	1	4.4	Ave	--	--	--	--
Chino-East	1207145	AGA4915	High	2	5.0	Ave	--	--	--	--
Chino-East	1207146	AGA4930	Medium	3	5.9	Stat	--	--	--	--
Chino-East	1207147	AGA5040	High	2	7.0	Ave	--	--	--	--
Chino-East	1207181	FC-249A3	Medium	2	8.6	Ave	Medium	2	966	Ave
Chino-East	1207202	FC-5A3	Medium	1	5.7	Ave	Medium	1	837	Ave
Chino-East	1207241	LEM-4A	Medium	1	5.2	Ave	--	--	--	--
Chino-East	1207264	PED5029	High	3	9.3	Stat	--	--	--	--
Chino-East	1207265	PED5071	Medium	2	9.4	Ave	--	--	--	--
Chino-East	1207266	PYR3851	Medium	2	2.2	Ave	--	--	--	--
Chino-East	1207270	PYR4352	Medium	1	0.0	Ave	--	--	--	--
Chino-East	1207272	STN4800	Medium	3	5.8	Stat	--	--	--	--
Chino-East	1207393	60TH8792	Medium	1	4.5	Ave	--	--	--	--
Chino-East	1207407	PED4931	Medium	3	4.5	Stat	--	--	--	--
Chino-East	1207408	PED5106	Medium	3	23.3	Stat	--	--	--	--
Chino-East	1207409	PED5151	Medium	1	5.2	Ave	--	--	--	--
Chino-East	1207410	PED5261	High	1	36.1	Ave	--	--	--	--
Chino-East	1207411	PED5424	Medium	1	7.2	Ave	--	--	--	--
Chino-East	1207412	STN4992	Medium	1	5.2	Ave	--	--	--	--
Chino-East	1208835	LC-4B	High	2	0.0	Ave	--	--	--	--
Chino-East	1208836	OW-62D	High	1	4.8	Ave	--	--	--	--
Chino-East	1208837	OW-63D	High	1	4.6	Ave	--	--	--	--
Chino-East	1208877	FC-738A2	--	10	15.8	Stat	Medium	2	1,039	Ave
Chino-East	1208895	LE-109A	Medium	1	5.3	Ave	--	--	--	--
Chino-East	1208902	OW-63A	Medium	2	5.9	Ave	--	--	--	--
Chino-East	1208903	OW-64A	Medium	1	3.8	Ave	--	--	--	--
Chino-East	1208904	OW-65A	Medium	2	4.1	Ave	--	--	--	--
Chino-South	1003611	NOR 09	High	1	0.1	Ave	High	1	468	Ave
Chino-South	1003612	NOR 10	High	1	10.6	Ave	--	--	--	--
Chino-South	1003630	07	High	2	12.1	Ave	--	--	--	--
Chino-South	1202703	6OH	Medium	1	84.9	Ave	Medium	1	1,160	Ave
Chino-South	1207394	60TH9709	Medium	1	5.9	Ave	--	--	--	--
Chino-South	1207398	60TH9957	Medium	1	9.5	Ave	--	--	--	--
Chino-South	1207399	60TH9989	Medium	1	8.1	Ave	--	--	--	--
Chino-South	1207402	APP6111	Medium	1	3.2	Ave	--	--	--	--

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B6-4 and B6-5 for NO_3-N and TDS well locations, respectively. As requested by Chino Basin Water Master, private well locations used in the 1996-2015 AWQ recomputation are not shown.

Total Dissolved Solids Continued

Chino East

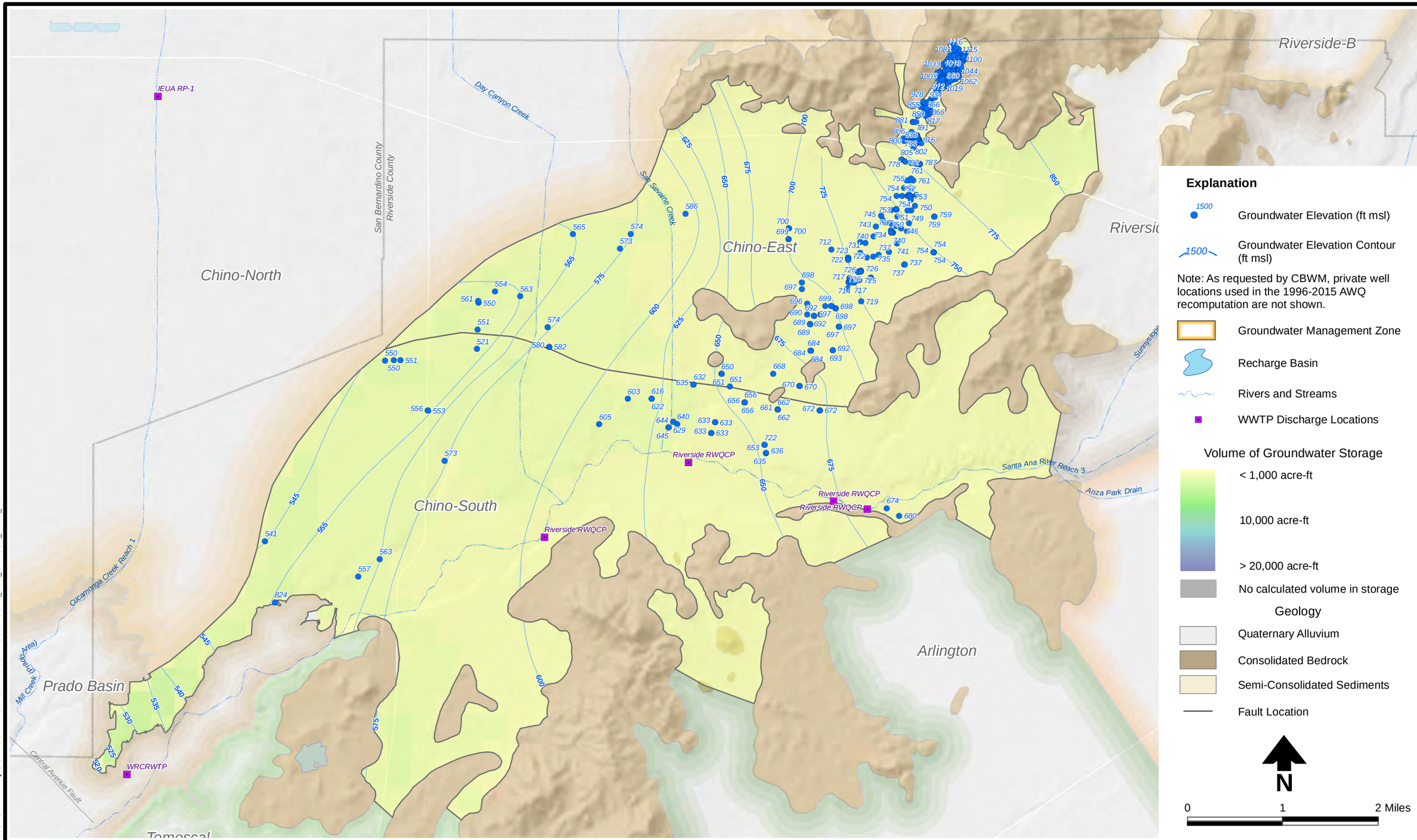
The TDS objective for Chino East is 730 mg/L. The ambient TDS concentration increased from 770 mg/L in 2012 to 840 mg/L in 2015, and there is no assimilative capacity. Two out of the four key interpretive wells in Chino East GMZ show a decreasing trend while the other two show no trends in TDS concentrations. Three of the total 205 wells with TDS values in Chino East will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Seventeen new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and eighty-eight wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Chino-East	1221808	MA-2	New	3	24.5	Stat	--	1	1,000	Ave
Chino-East	1221809	MA-3	New	3	22.6	Stat	--	1	1,700	Ave
Chino-East	1221812	MA-6	New	3	29.9	Stat	--	1	1,200	Ave
Chino-East	1221814	MB-2	New	3	0.6	Stat	--	1	320	Ave
Chino-East	1221815	MB-3	New	3	0.6	Stat	--	1	460	Ave
Chino-East	1221817	MW-10B	New	3	25.5	Stat	--	1	960	Ave
Chino-East	1221818	MW-11B	New	3	20.2	Stat	--	1	750	Ave
Chino-East	1221819	MW-13B	New	3	36.0	Stat	--	1	660	Ave
Chino-East	1221820	MW-14B	New	3	54.2	Stat	--	1	1,300	Ave
Chino-East	1221822	MW-1B	New	3	21.3	Stat	--	1	1,100	Ave
Chino-East	1221823	MW-20B	New	3	26.0	Stat	--	1	2,600	Ave
Chino-East	1221825	MW-2B	New	3	20.8	Stat	--	1	7,800	Ave
Chino-East	1221830	MW-7B	New	3	17.9	Stat	--	1	2,300	Ave
Chino-East	1221831	MW-8B	New	3	25.6	Stat	--	1	840	Ave
Chino-East	1208926	OW-90D	--	8	22.1	Stat	New	3	715	Stat
Chino-East	1230544	FC-1011A	New	5	18.4	Stat	New	3	850	Stat
Chino-East	1230545	FC-1011B1	New	4	17.8	Stat	New	3	656	Stat
Chino-East	1230546	FC-1011B2	New	4	17.5	Stat	New	3	671	Stat
Chino-East	1230547	FC-1011D	New	5	17.3	Ave	New	3	678	Stat
Chino-East	1230566	OW-103D	New	3	23.9	Stat	New	3	744	Stat
Chino-East	1230577	OW-96D	New	5	23.4	Stat	New	3	1,004	Stat
Chino-East	1230578	OW-97D	New	5	18.2	Stat	New	3	667	Stat
Chino-East	1231835	OW-71B	New	3	124.7	Stat	New	3	7,934	Stat
Chino-East	1231836	OW-71D	New	3	61.5	Stat	New	3	8,194	Stat
Chino-East	1231838	OW-70D	New	3	48.3	Stat	New	3	9,255	Stat
Chino-East	1231839	OW-70B	New	3	91.8	Stat	New	3	10,943	Stat
Chino-East	1232625	OW-75DB	New	3	21.8	Stat	New	3	7,252	Stat
Chino-East	1232629	OW-106D	New	3	21.5	Stat	New	3	438	Stat
Chino-East	1232630	OW-77D	New	3	26.8	Stat	New	3	1,125	Stat
Chino-East	1232631	OW-78D2	New	3	20.1	Stat	New	3	525	Stat
Chino-East	1232632	OW-79D	New	3	24.8	Stat	New	3	709	Stat
Chino-East	1201877	High School Irrigation Well	--	2	29.5	Ave	New*	2	1,133	Ave
Chino-East	1221837	OC-10D	--	2	4.0	Ave	New*	2	6,517	Ave
Chino-East	1230550	LEO-11D1	--	2	25.2	Ave	New*	2	765	Ave
Chino-East	1230552	MW-30A1	--	2	16.6	Ave	New*	2	1,954	Ave
Chino-East	1230555	MW-31A	--	2	23.6	Ave	New*	2	775	Ave
Chino-East	1230557	MW-32A	--	2	25.4	Ave	New*	2	958	Ave
Chino-East	1221836	OC-10B	New	4	14.8	Stat	New*	2	8,050	Ave
Chino-East	1230539	LEO-11B	New	3	15.5	Stat	New*	2	983	Ave
Chino-East	1230548	FC-558A2R	New	5	14.8	Stat	New*	2	793	Ave
Chino-East	1230551	LEO-11D2	New	3	25.1	Stat	New*	2	1,030	Ave
Chino-East	1230553	MW-30A2	New	3	23.9	Stat	New*	2	1,153	Ave
Chino-East	1230554	MW-30D	New	3	86.0	Stat	New*	2	5,582	Ave
Chino-East	1230556	MW-31D	New	3	23.1	Stat	New*	2	766	Ave
Chino-East	1230558	MW-32D3	New	3	0.1	Stat	New*	2	341	Ave
Chino-East	1230564	MW-35D	New	3	29.3	Stat	New*	2	977	Ave
Chino-East	1230568	MW-32D2	New	3	0.3	Stat	New*	2	828	Ave
Chino-East	1230569	OW-98D	New	3	23.5	Stat	New*	2	728	Ave
Chino-East	1230570	MW-32D1	New	3	13.6	Stat	New*	2	874	Ave
Chino-East	1230575	OW-66D	New	3	22.4	Stat	New*	2	773	Ave
Chino-East	1230580	OW-102D	New*	2	27.9	Ave	New*	2	523	Ave
Chino-East	1230581	OW-104A	New*	2	22.8	Ave	New*	2	695	Ave
Chino-East	1230582	OW-105D	New*	2	23.8	Ave	New*	2	616	Ave
Chino-East	1231833	LEO-8D	New*	2	27.0	Ave	New*	2	868	Ave
Chino-East	1231834	OW-99D	New*	2	26.3	Ave	New*	2	1,083	Ave
Chino-East	1231835	OW-71B	New	3	124.7	Stat	New	3	7,934	Stat
Chino-East	1231836	OW-71D	New	3	61.5	Stat	New	3	8,194	Stat
Chino-East	1231838	OW-70D	New	3	48.3	Stat	New	3	9,255	Stat
Chino-East	1231839	OW-70B	New	3	91.8	Stat	New	3	10,943	Stat
Chino-East	1232625	OW-75DB	New	3	21.8	Stat	New	3	7,252	Stat
Chino-East	1232629	OW-106D	New	3	21.5	Stat	New	3	438	Stat
Chino-East	1232630	OW-77D	New	3	26.8	Stat	New	3	1,125	Stat
Chino-East	1232631	OW-78D2	New	3	20.1	Stat	New	3	525	Stat
Chino-East	1232632	OW-79D	New	3	24.8	Stat	New	3	709	Stat
Chino-East	1233035	MW-1 (T0606500612)	New*	1	3.0	Ave	New*	1	870	Ave
Chino-East	1233036	MW-10 (T0606500612)	New*	1	0.1	Ave	New*	1	880	Ave
Chino-East	1233037	MW-11 (T0606500612)	New*	1	1.1	Ave	New*	1	830	Ave
Chino-East	1233038	MW-12 (T0606500612)	New*	1	1.2	Ave	New*	1	790	Ave
Chino-East	1233042	MW-16 (T0606500612)	New*	1	1.1	Ave	New*	1	850	Ave
Chino-East	1233044	MW-3 (T0606500612)	New*	1	3.0	Ave	New*	1	570	Ave
Chino-East	1233047	MW-6 (T0606500612)	New*	1	0.6	Ave	New*	1	740	Ave
Chino-East	1233049	MW-8 (T0606500612)	New*	1	1.1	Ave	New*	1	840	Ave
Chino-East	1233050	MW-9 (T0606500612)	New*	1	2.1	Ave	New*	1	880	Ave
Chino-East	1233789	EPAMW-11D1	New*	2	8.5	Ave	New*	2	7,250	Ave
Chino-East	1233790	EPAMW-1D1	New*	1	3.5	Ave	New*	1	455	Ave
Chino-East	1233791	EPAMW-1D2	New*	1	3.7	Ave	New*	1	430	Ave
Chino-East	1233792	EPAMW-3B	New*	2	1.1	Ave	New*	2	453	Ave
Chino-East	1233793	OW-78D1	New*	2	13.3	Ave	New*	2	500	Ave
Chino-East	1233794	EPAMW-10B	New*	2	30.1	Ave	New*	2	4,275	Ave
Chino-East	1233795	EPAMW-11D2	New*	2	8.6	Ave	New*	2	7,100	Ave
Chino-East	1233797	EPAMW-3D	New*	2	13.3	Ave	New*	2	590	Ave
Chino-East	1233798	EPAMW-4B	New*	2	0.2	Ave	New*	2	323	Ave
Chino-East	1233799	EPAMW-5B	New*	2	2.7	Ave	New*	2	713	Ave
Chino-East	1233800	EPAMW-5D2	New*	2	3.5	Ave	New*	2	595	Ave
Chino-East	1233801	EPAMW-5D3	New*	2	7.1	Ave	New*	2	735	Ave
Chino-East	1233802	EPAMW-6B	New*	2	0.0	Ave	New*	2	508	Ave
Chino-East	1233803	EPAMW-7B	New*	2	3.9	Ave	New*	2	613	Ave
Chino-East	1233805	EPAMW-9B	New*	2	9.7	Ave	New*	2	878	Ave
Chino-East	1233806	OW-107A	New*	2	0.1	Ave	New*	2	6,425	Ave
Chino-East	1233807	OW-107B	New*	2	0.0	Ave	New*	2	880	Ave
Chino-East	1233808	OW-107D2	New*	2	8.9	Ave	New*	2	4,675	Ave
Chino-East	1233809	FC-0165D	New*	1	2.8	Ave	New*	1	753	Ave
Chino-East	1233810	FC-0166D	New*	1	4.2	Ave	New*	1	635	Ave
Chino-East	1233811	FC-0265D	New*	1	3.8	Ave	New*	1	703	Ave
Chino-East	1233812	FC-0266D	New*	1	9.0	Ave	New*	1	1,050	Ave
Chino-East	1233813	FC-0267D	New*	1	12.4	Ave	New*	1	1,100	Ave
Chino-East	1233814	FC-0164A	New*	1	10.0	Ave	New*	1	977	Ave
Chino-East	1233815	EPAMW-1B	New*	1	2.5	Ave	New*	1	470	Ave
Chino-East	1233817	FC-0755D	New*	1	6.6	Ave	New*	1	963	Ave
Chino-East	1233818	FC-0756D	New*	1	5.9	Ave	New*	1	775	Ave
Chino-East	1233819	FC-0758A	New*	1	8.6	Ave	New*	1	1,300	Ave
Chino-East	1233820	FC-753A	New*	1	11.2	Ave	New*	1	1,200	Ave
Chino-East	1233821	FC-757A	New*	1	6.7	Ave	New*	1	975	Ave
Chino-East	1233822	FC-953D	New*	1	5.8	Ave	New*	1	915	Ave
Chino-East	1233823	EPAMW-12B	New*	1	4.3	Ave	New*	1	670	Ave
Chino-East	1233824	EPAMW-12D1	New*	1	4.7	Ave	New*	1	727	Ave
Chino-East	1233825	EPAMW-12D2	New*	1	5.0	Ave	New*	1	470	Ave
Chino-East	1233826	EPAMW-13B	New*	1	3.8	Ave	New*	1	328	Ave
Chino-East	1233827	EPAMW-13D	New*	1	2.8	Ave	New*	1	610	Ave
Chino-East	1233828	FC-1201D	New*	1	6.3	Ave	New*	1	978	Ave
Chino-East	1233922	4485AGATE32PZD1	New*	1	7.2	Ave	New*	1	1,100	Ave
Chino-East	1233923	7858SHERRY34PZD1	New*	1	17.2	Ave	New*	1	1,500	Ave
Chino-East	1233924	8391WDPONY33PZD1	New*	1	5.6	Ave	New*	1	870	Ave
Chino-East	1233925	879044TH31PZD1	New*	1	3.8	Ave	New*	1	780	Ave
Chino-East	1233927	FC-0571D	New*	1	6.3	Ave	New*	1	980	Ave
Chino-East	1233928	FC-1051A	New*	1	3.3	Ave	New*	1	845	Ave
Chino-East	1233929	FC-1051D	New*	1	1.6	Ave	New*	1	745	Ave
Chino-East	1233930	FC-1052A	New*	1	3.6	Ave	New*	1	1,000	Ave
Chino-East	1233931	FC-1053A	New*	1	2.2	Ave	New*	1	1,200	Ave
Chino-East	1233932	FC-1100A	New*	1	1.8	Ave	New*	1	915	Ave
Chino-East	1233936	FC-1206A	New*	1	2.9	Ave	New*	1	720	Ave
Chino-East	1233939	FC-1209A	New*	1	5.9	Ave	New*	1	2,000	Ave
Chino-East	1233949	FC-268A	New*	1	5.6	Ave	New*	1	850	Ave
Chino-East	1233950	FC-268D	New*	1	3.8	Ave	New*	1	800	Ave
Chino-East	1233951	FC-679A	New*	1	3.8	Ave	New*	1	1,100	Ave
Chino-East	1233952	FC-761A	New*	1	9.0	Ave	New*	1	1,500	Ave
Chino-East	1233958	PED5001	New*	1	6.5	Ave	New*	1	960	Ave
Chino-East	1233959	PED5011B	New*	1	8.1	Ave	New*	1	1,100	Ave
Chino-South	1232877	PB-4/1	New*	1	1.7	Ave	New*	1	842	Ave
Chino-South	1232878	PB-4/2	New*	1	0.1	Ave	New*	1	804	Ave
Chino-South	1232879	PB-3/1	New*	1	1.3	Ave	New*	1	745	Ave
Chino-South	1232880	PB-3/2	New*	1	5.4	Ave	New*	1	601	Ave
Chino-South	1233829	FC-1203A	New*	1	7.0	Ave	New*	1	1,100	Ave
Chino-South	1233830	FC-1205A	New*	1	7.2	Ave	New*	1	1,100	Ave
Chino-South	1233831	FC-1303A	New*	1	3.3	Ave	New*	1	555	Ave
Chino-South	1233832	FC-1304D	New*	1	2.4	Ave	New*	1	780	Ave
Chino-South	1233933	FC-1200A	New*	1	3.3	Ave	New*	1	1,350	Ave
Chino-South	1233934	FC-1202A	New*	1	10.9	Ave	New*	1	1,700	Ave
Chino-South	1233935	FC-1204A	New*	1	0.6	Ave	New*	1	490	Ave
Chino-South	1233937	FC-1207A	New*	1	0.7	Ave	New*	1	630	Ave
Chino-South	1233938	FC-1208A	New*	1	1.0	Ave	New*	1	680	Ave
Chino-South	1233940	FC-1210A	New*	1	3.1	Ave	New*	1	1,200	Ave
Chino-South	1233941	FC-1211A	New*	1	4.7	Ave	New*	1	1,150	Ave
Chino-South	1233942	FC-1212A	New*	1	2.6	Ave	New*	1	790	Ave
Chino-South	1233943	FC-1300A	New*	1	4.2	Ave	New*	1	1,000	Ave
Chino-South	1233947	FC-1306A	New*	1	0.2	Ave	New*	1	427	Ave
Chino-South	1233948	FC-1307A	New*	1	3.0	Ave	New*	1	1,150	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B6-4 and B6-5 for NO_3-N and TDS well locations, respectively. As requested by Chino Basin Water Master, private well locations used in the 1996-2015 AWQ recomputation are not shown.



Source: SAWPA.net, January 2017

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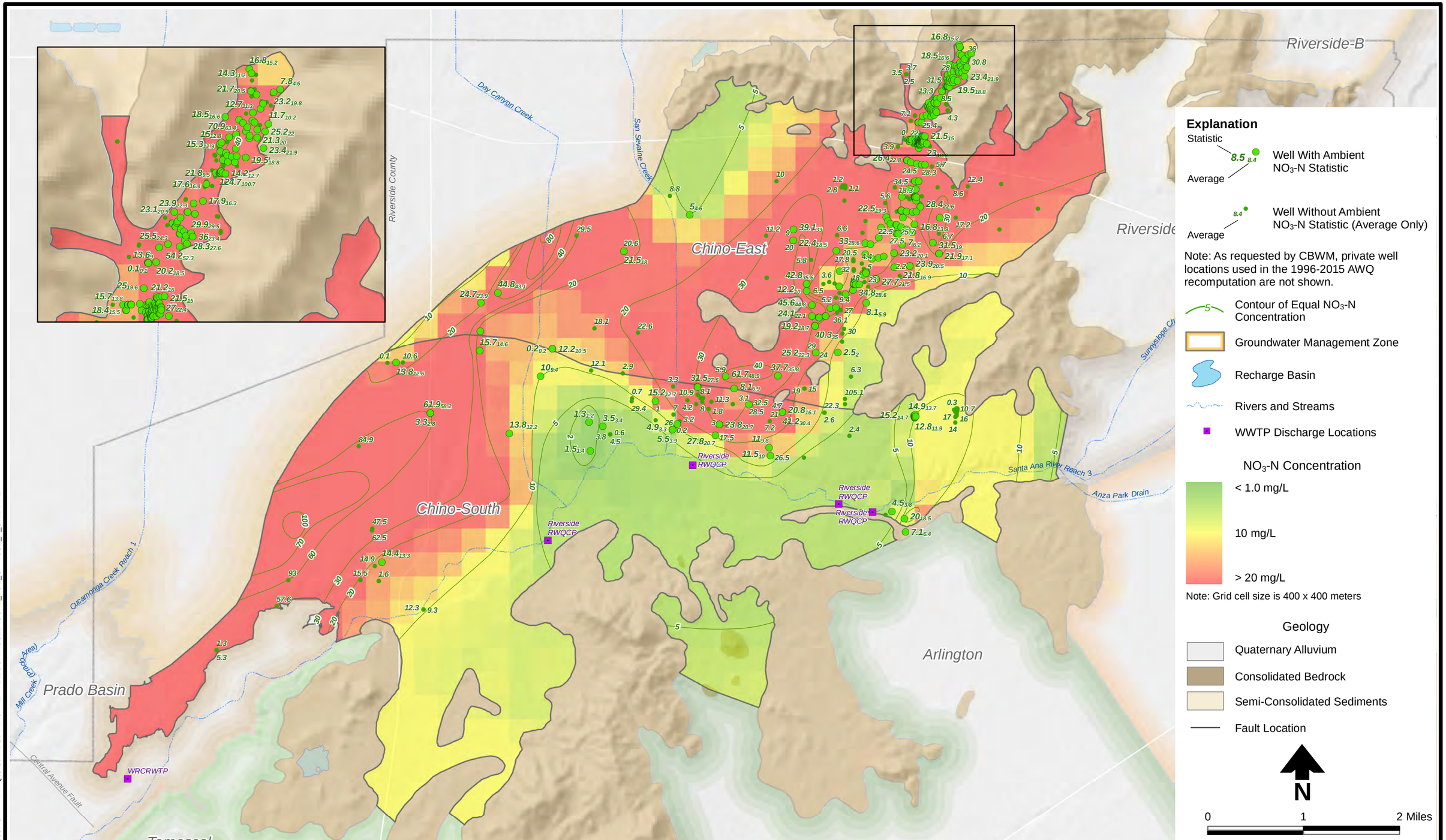
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Chino-South and Chino-East GMZs

Attachment B6-1



Source: SAWPA.net, January 2017

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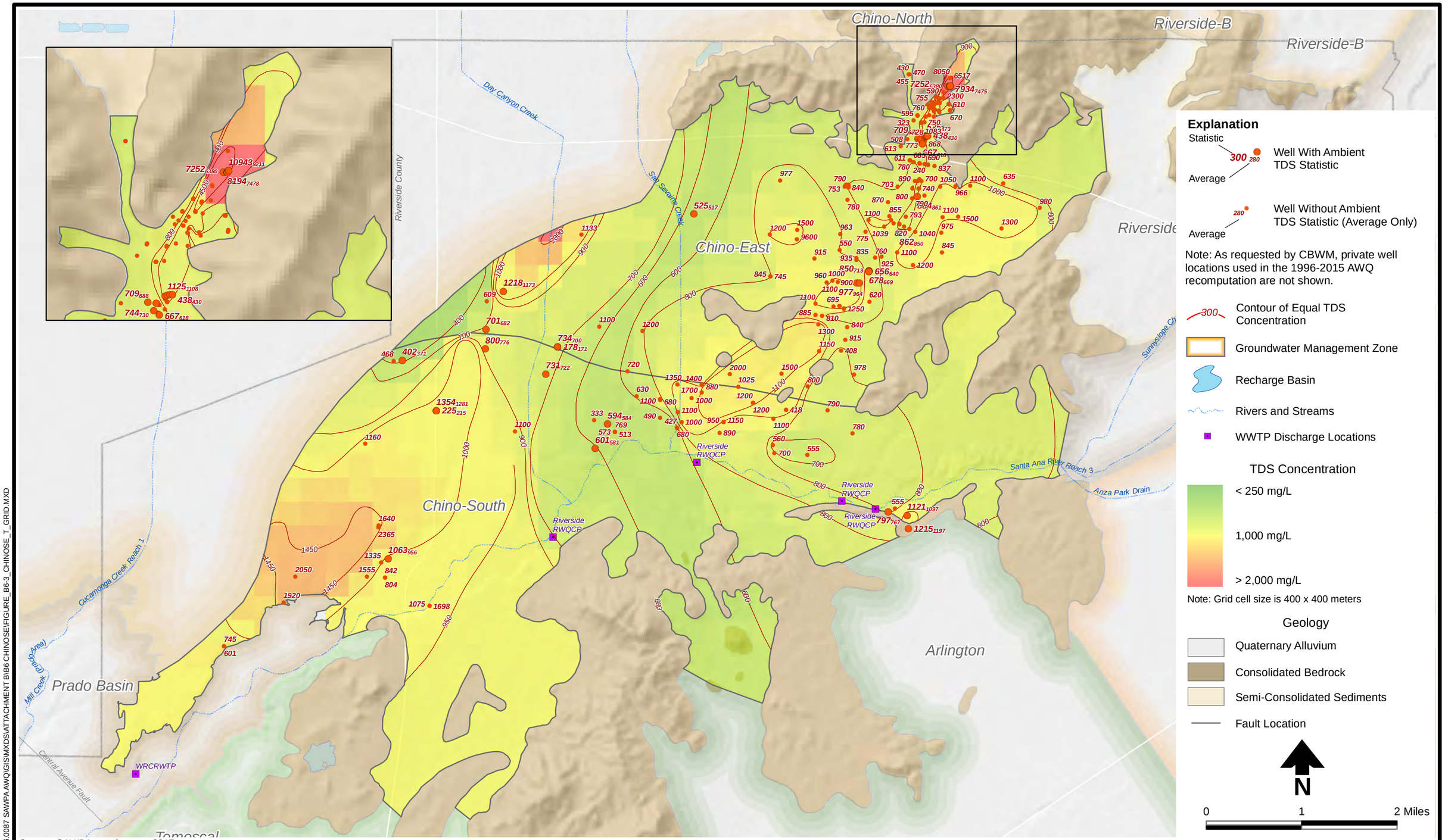
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Chino-South and Chino-East GMZs

Attachment B6-2



Source: SAWPA.net, January 2017

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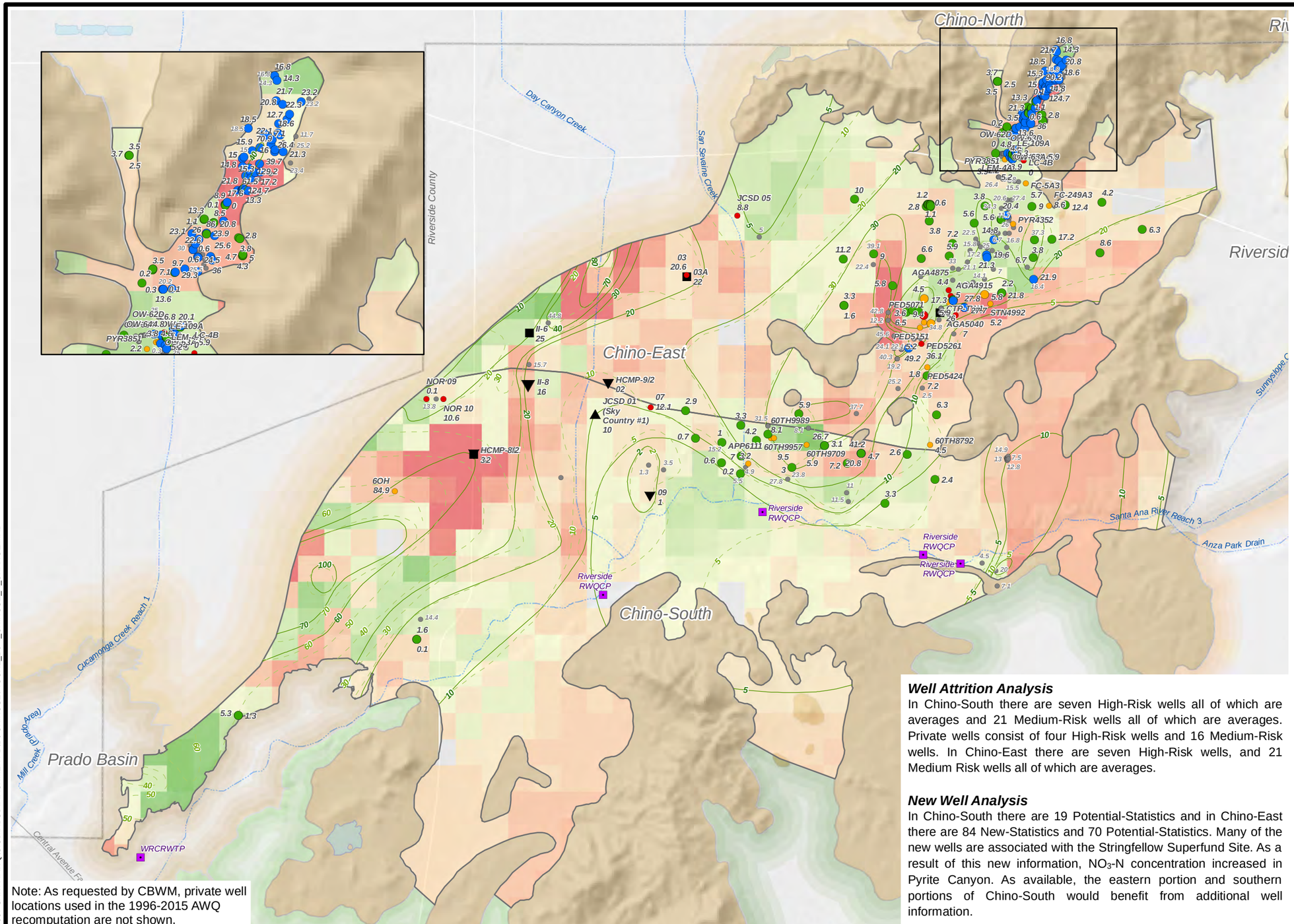
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map Chino-South and Chino-East GMZs

Attachment B6-3



Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Well Attrition Analysis

In Chino-South there are seven High-Risk wells all of which are averages and 21 Medium-Risk wells all of which are averages. Private wells consist of four High-Risk wells and 16 Medium-Risk wells. In Chino-East there are seven High-Risk wells, and 21 Medium Risk wells all of which are averages.

New Well Analysis

In Chino-South there are 19 Potential-Statistics and in Chino-East there are 84 New-Statistics and 70 Potential-Statistics. Many of the new wells are associated with the Stringfellow Superfund Site. As a result of this new information, NO_3-N concentration increased in Pyrite Canyon. As available, the eastern portion and southern portions of Chino-South would benefit from additional well information.

Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.
Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B6 CHINOSE\FIGURE_B6-4_CHINOSE_N_CHANGE.MXD

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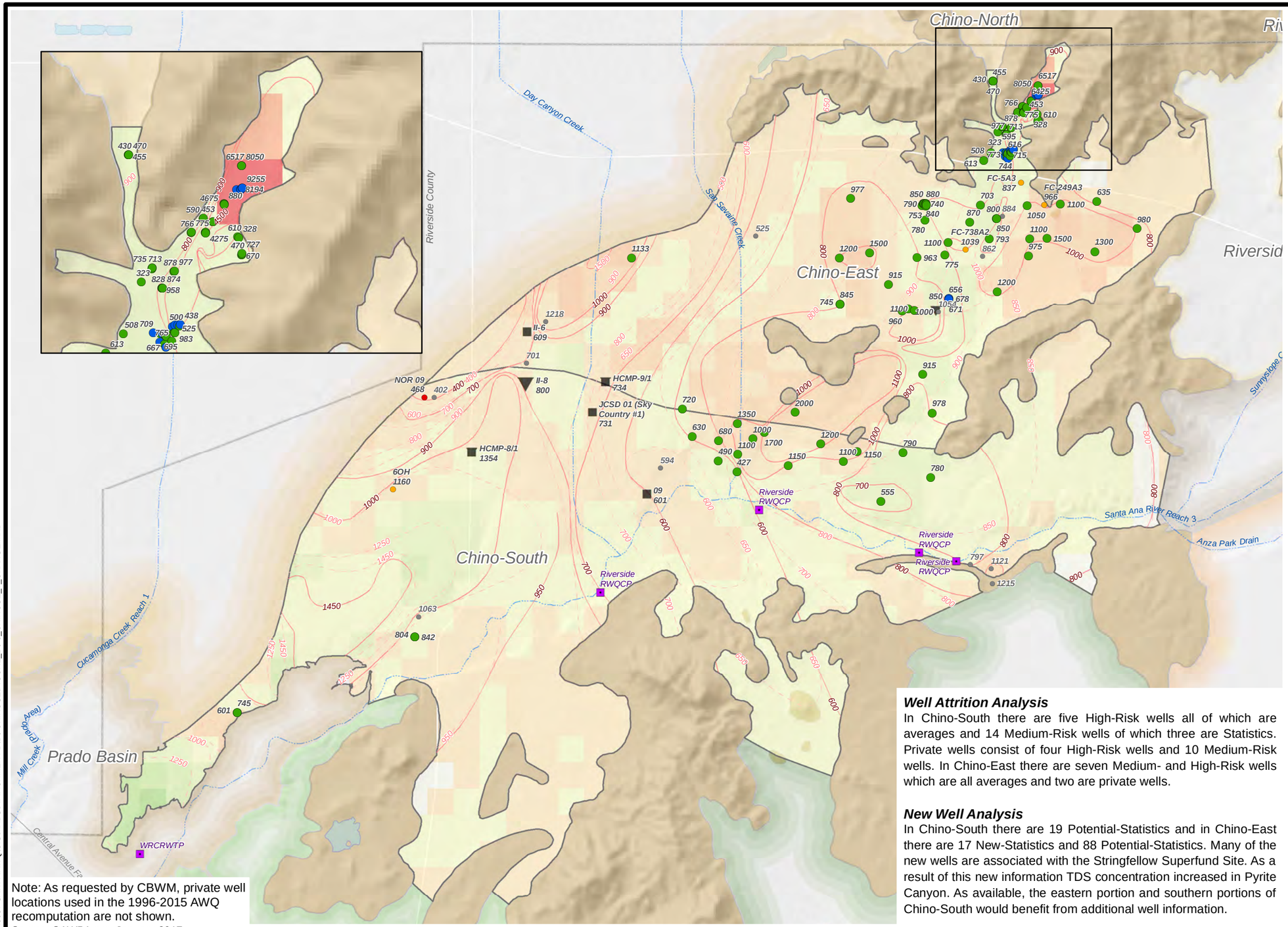
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015) Chino-South and Chino-East GMZs

Attachment B6-4



Note: As requested by CBWM, private well locations used in the 1996-2015 AWQ recomputation are not shown.
Source: SAWPA.net, January 2017

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Well Attrition Analysis

In Chino-South there are five High-Risk wells all of which are averages and 14 Medium-Risk wells of which three are Statistics. Private wells consist of four High-Risk wells and 10 Medium-Risk wells. In Chino-East there are seven Medium- and High-Risk wells which are all averages and two are private wells.

New Well Analysis

In Chino-South there are 19 Potential-Statistics and in Chino-East there are 17 New-Statistics and 88 Potential-Statistics. Many of the new wells are associated with the Stringfellow Superfund Site. As a result of this new information TDS concentration increased in Pyrite Canyon. As available, the eastern portion and southern portions of Chino-South would benefit from additional well information.

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015) Chino-South and Chino-East GMZs

Attachment B6-5

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

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9/21/2017 CA16.0087

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B6 CHINOSE\FIGURE_B6-5_CHINOSE_T_CHANGE.MXD

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

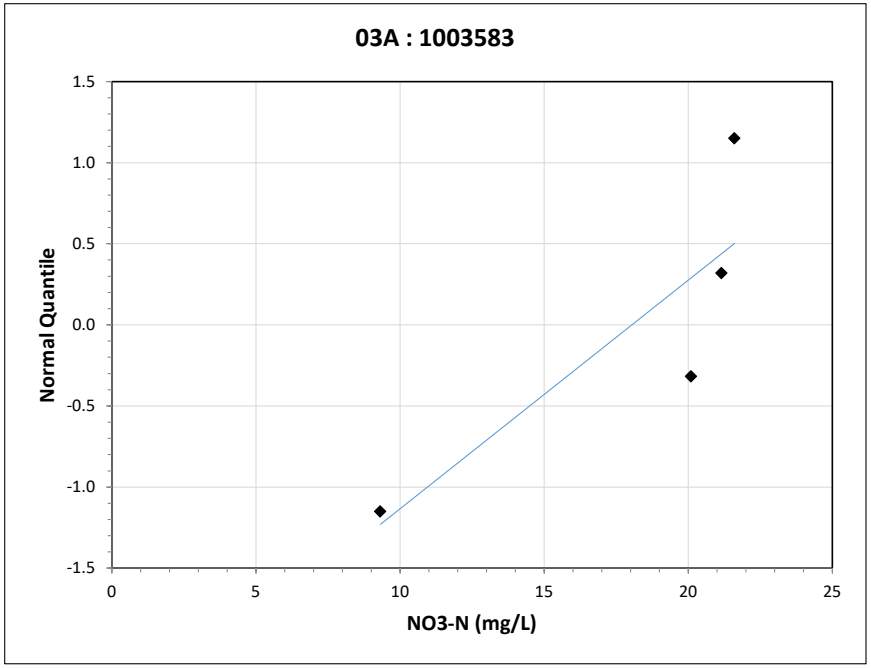
Mann-Kendall

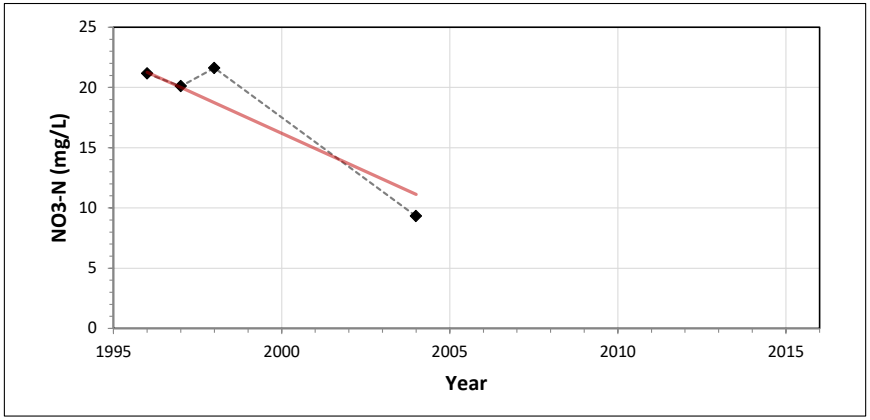
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

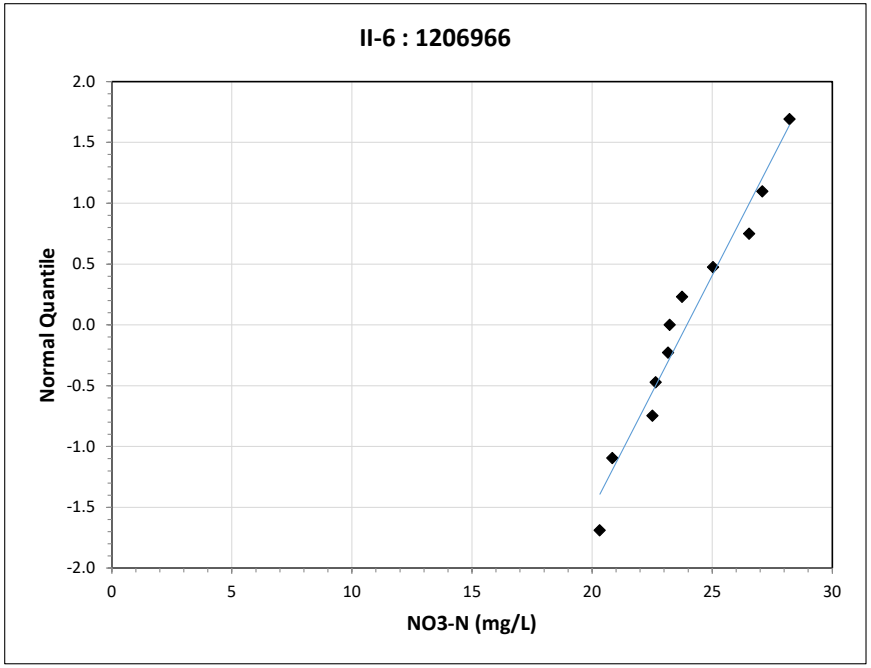
The significance of the trends is notated by * for significant and ** for very significant.

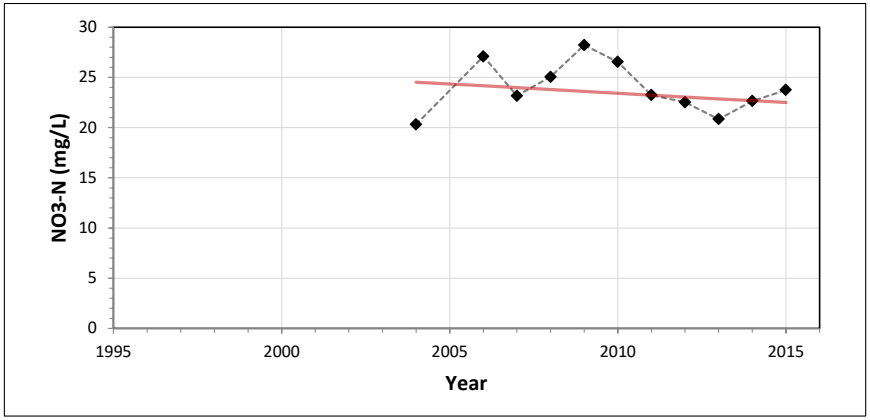
Statistics	
GMZ	Chino-East
Well Name : ID	03A : 1003583
Analyte	NO3-N (mg/L)
Count	4
Count Detects	4
Sample Year Min	1996
Sample Year Max	2004
Annual Average Min	9.32
Annual Average Max	21.61
Annual Average Mean	18.05
Annual Average Stdev	5.85
Shapiro-Wilk W	0.723
Shapiro-Wilk p-value	0.021
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	2.93
Student t	1.19
Mean + t*SE (UCL84)	21.53
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-2
Var(S)	8.67
Intercept	2550
Slope	-1.27
p-value	0.734
Significant Trend?	No



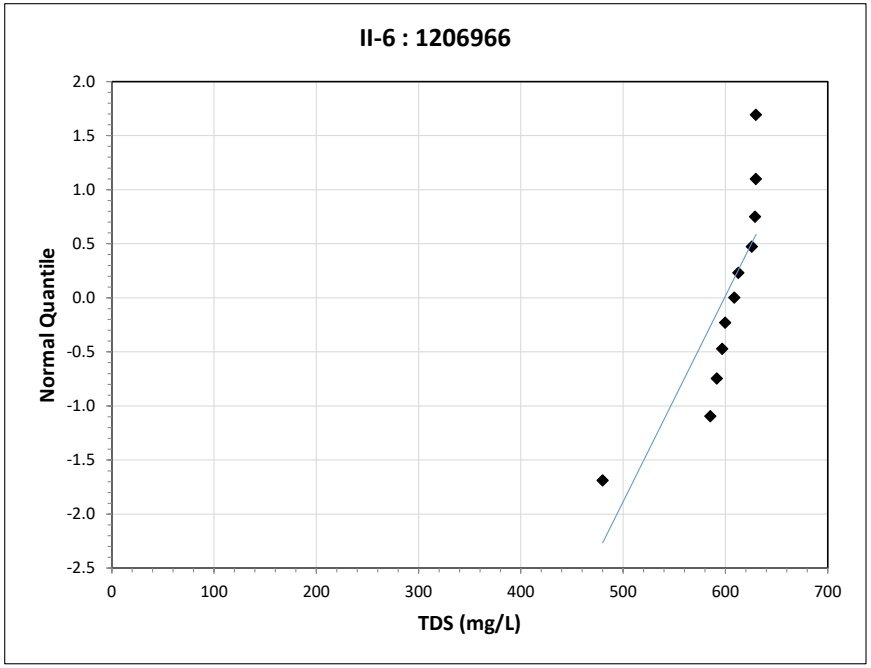


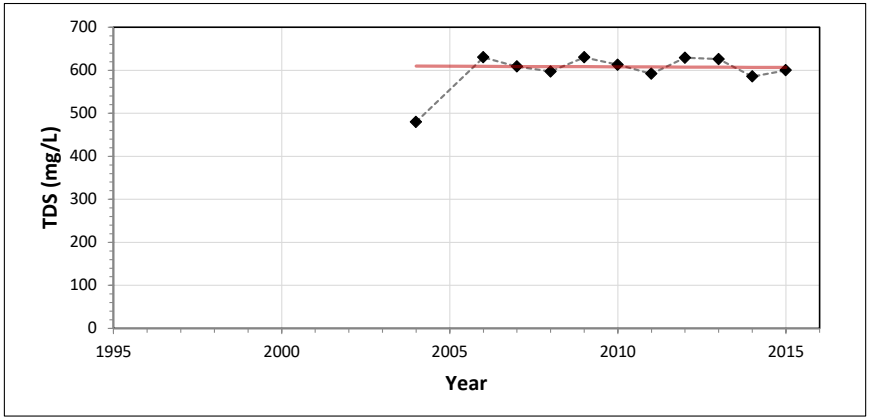
Statistics	
GMZ	Chino-East
Well Name : ID	II-6 : 1206966
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2004
Sample Year Max	2015
Annual Average Min	20.32
Annual Average Max	28.23
Annual Average Mean	23.95
Annual Average Stdev	2.53
Shapiro-Wilk W	0.951
Shapiro-Wilk p-value	0.663
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.76
Student t	1.05
Mean + t*SE (UCL84)	24.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-7
Var(S)	165
Intercept	395
Slope	-0.18
p-value	0.640
Significant Trend?	No



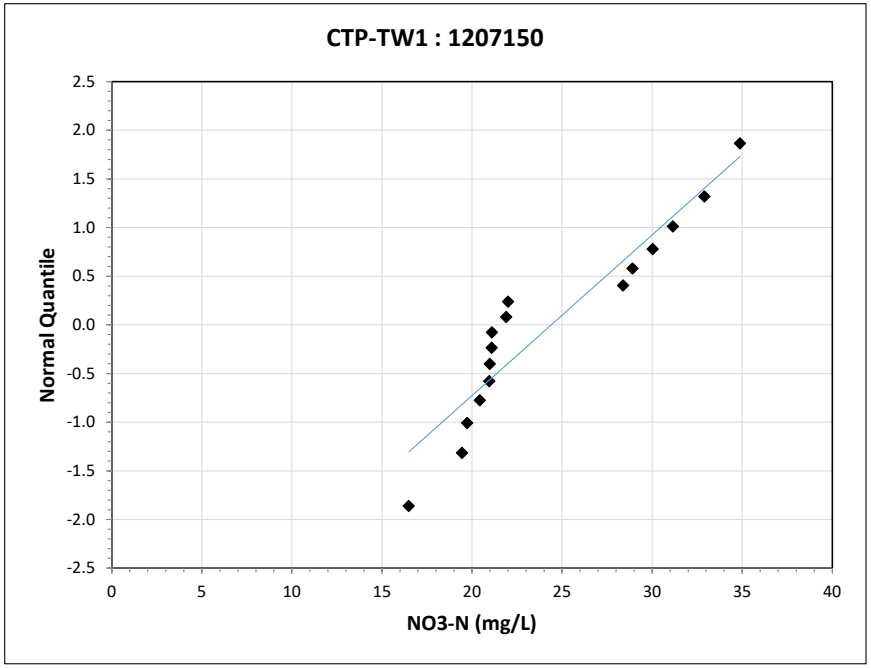


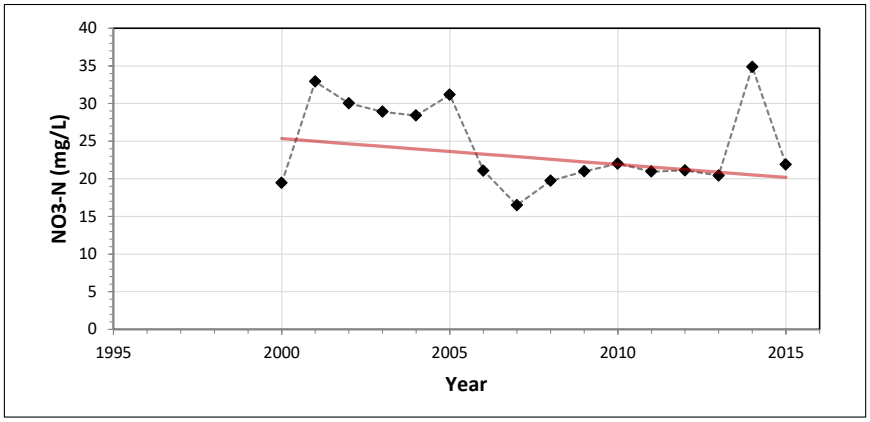
Statistics	
GMZ	Chino-East
Well Name : ID	II-6 : 1206966
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2004
Sample Year Max	2015
Annual Average Min	480
Annual Average Max	630
Annual Average Mean	599
Annual Average Stdev	42.71
Shapiro-Wilk W	0.691
Shapiro-Wilk p-value	4E-4
Critical Alpha	0.01
Most Discordant Value	480
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	609
Trend Analysis	**Theil-Sen**
Kendall S	-4
Var(S)	164
Intercept	1166
Slope	-0.28
p-value	0.815
Significant Trend?	No



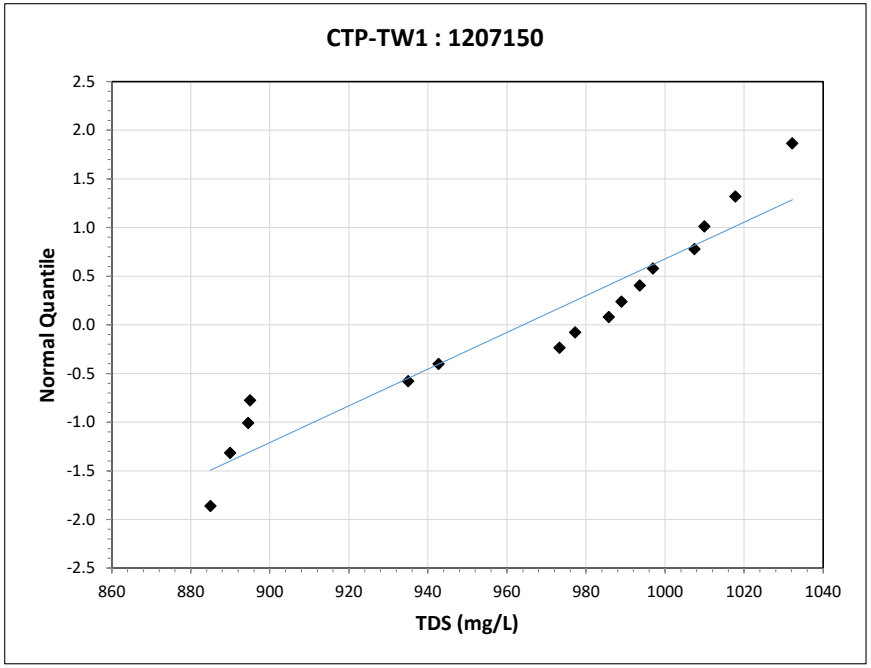


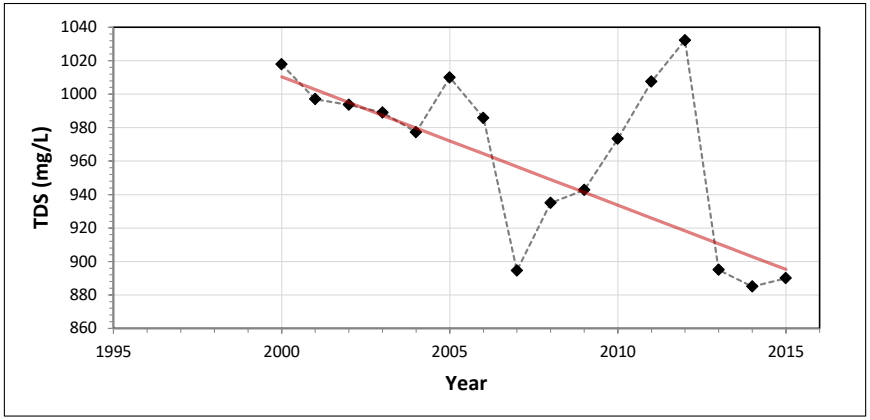
Statistics	
GMZ	Chino-East
Well Name : ID	CTP-TW1 : 1207150
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	2000
Sample Year Max	2015
Annual Average Min	16.49
Annual Average Max	34.88
Annual Average Mean	24.41
Annual Average Stdev	5.64
Shapiro-Wilk W	0.874
Shapiro-Wilk p-value	0.031
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	1.41
Student t	1.03
Mean + t*SE (UCL84)	25.86
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-14
Var(S)	493
Intercept	711
Slope	-0.34
p-value	0.558
Significant Trend?	No



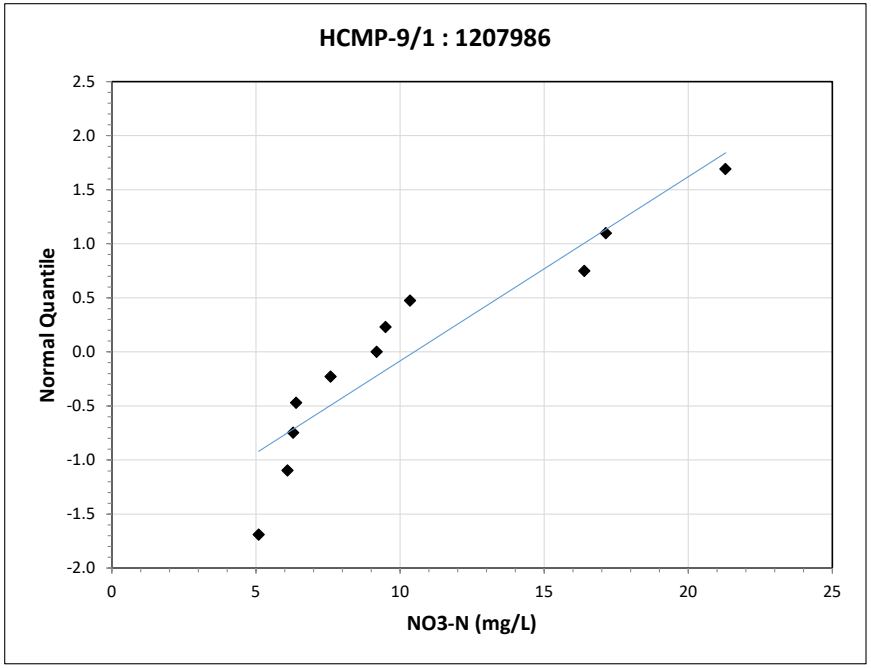


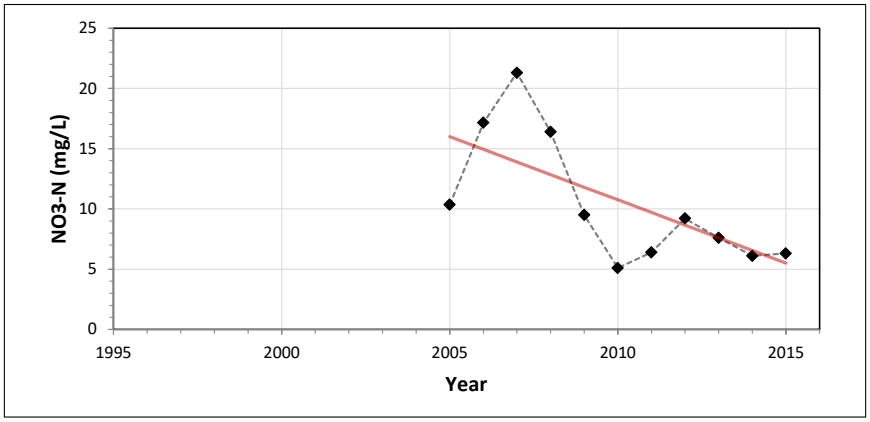
Statistics	
GMZ	Chino-East
Well Name : ID	CTP-TW1 : 1207150
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	2000
Sample Year Max	2015
Annual Average Min	885
Annual Average Max	1032
Annual Average Mean	964
Annual Average Stdev	49.99
Shapiro-Wilk W	0.889
Shapiro-Wilk p-value	0.054
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.50
Student t	1.03
Mean + t*SE (UCL84)	977
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-52
Var(S)	493
Intercept	16365
Slope	-7.68
p-value	0.022
Significant Trend?	Decreasing



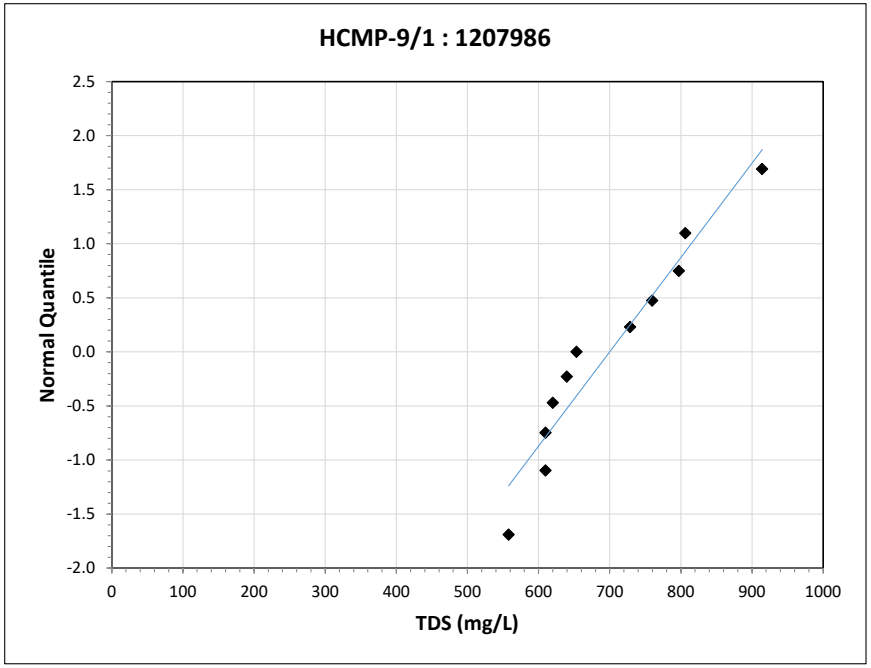


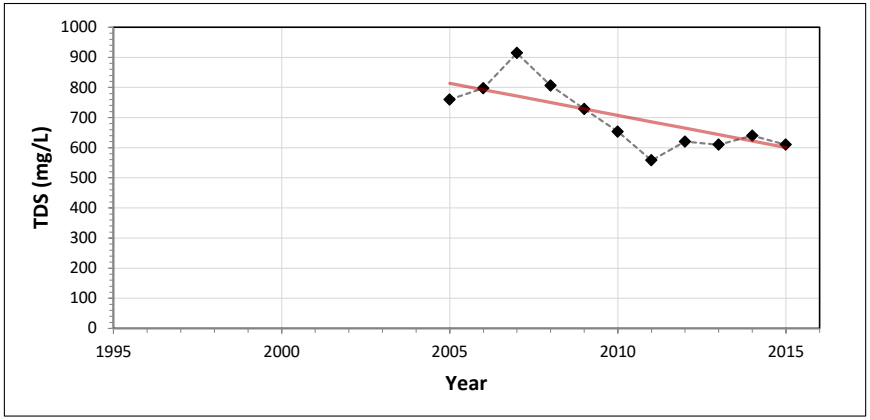
Statistics	
GMZ	Chino-East
Well Name : ID	HCMP-9/1 : 1207986
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	5.10
Annual Average Max	21.30
Annual Average Mean	10.49
Annual Average Stdev	5.38
Shapiro-Wilk W	0.853
Shapiro-Wilk p-value	0.046
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	1.62
Student t	1.05
Mean + t*SE (UCL84)	12.19
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-31
Var(S)	165
Intercept	2124
Slope	-1.05
p-value	0.020
Significant Trend?	Decreasing



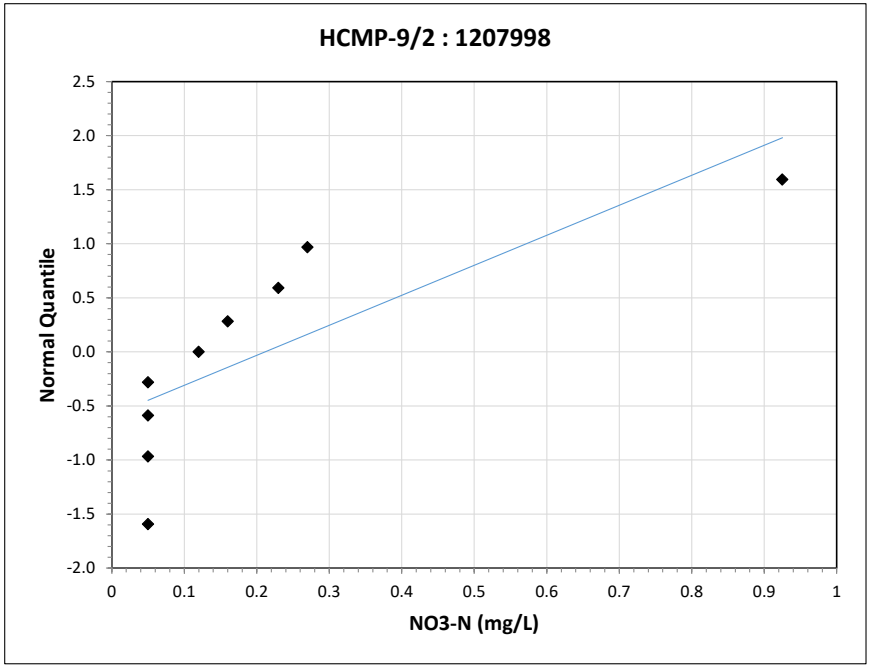


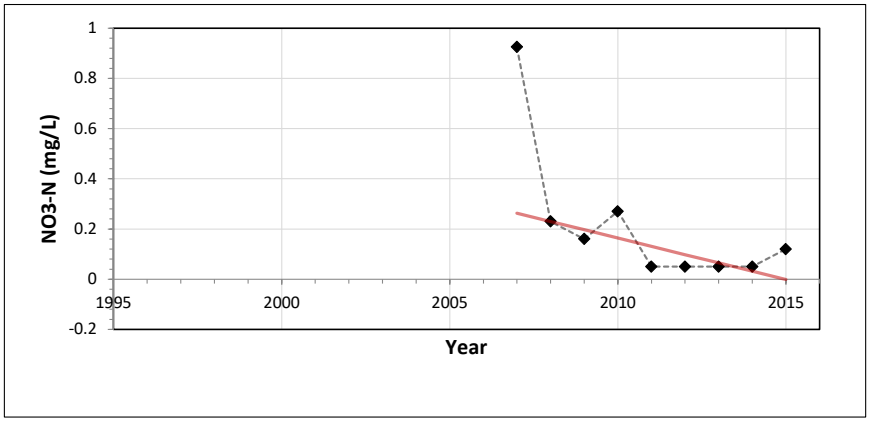
Statistics	
GMZ	Chino-East
Well Name : ID	HCMP-9/1 : 1207986
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	558
Annual Average Max	915
Annual Average Mean	700
Annual Average Stdev	109.46
Shapiro-Wilk W	0.928
Shapiro-Wilk p-value	0.390
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	33.00
Student t	1.05
Mean + t*SE (UCL84)	734
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-32
Var(S)	164
Intercept	43520
Slope	-21.30
p-value	0.015
Significant Trend?	Decreasing



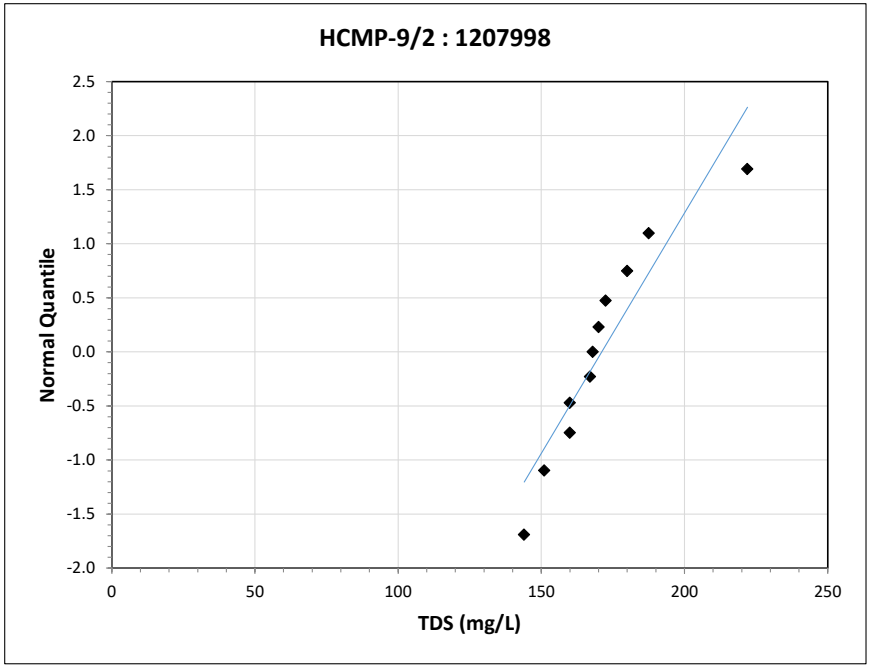


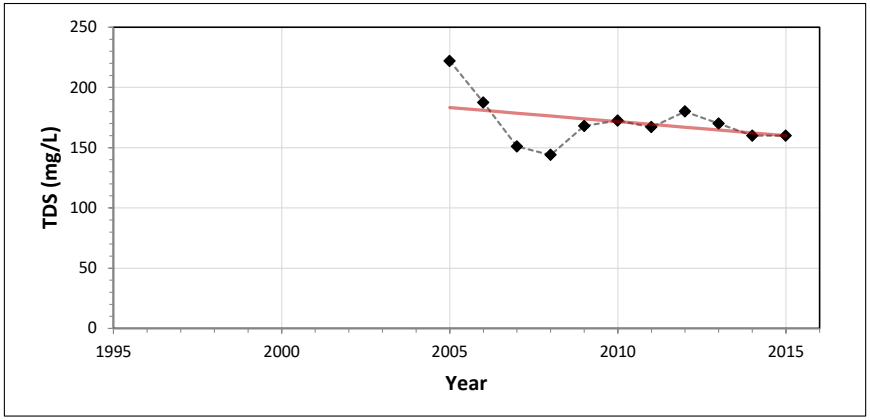
Statistics	
GMZ	Chino-East
Well Name : ID	HCMP-9/2 : 1207998
Analyte	NO3-N (mg/L)
Count	9
Count Detects	5
Sample Year Min	2007
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	0.93
Annual Average Mean	0.21
Annual Average Stdev	0.28
Shapiro-Wilk W	0.637
Shapiro-Wilk p-value	3E-4
Critical Alpha	0.01
Most Discordant Value	0.93
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.06
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.083
Geomean	0.12
GM + t*GSE (UCL84)	0.18
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-18
Var(S)	83.33
Intercept	66.49
Slope	-0.03
p-value	0.063
Significant Trend?	Decreasing



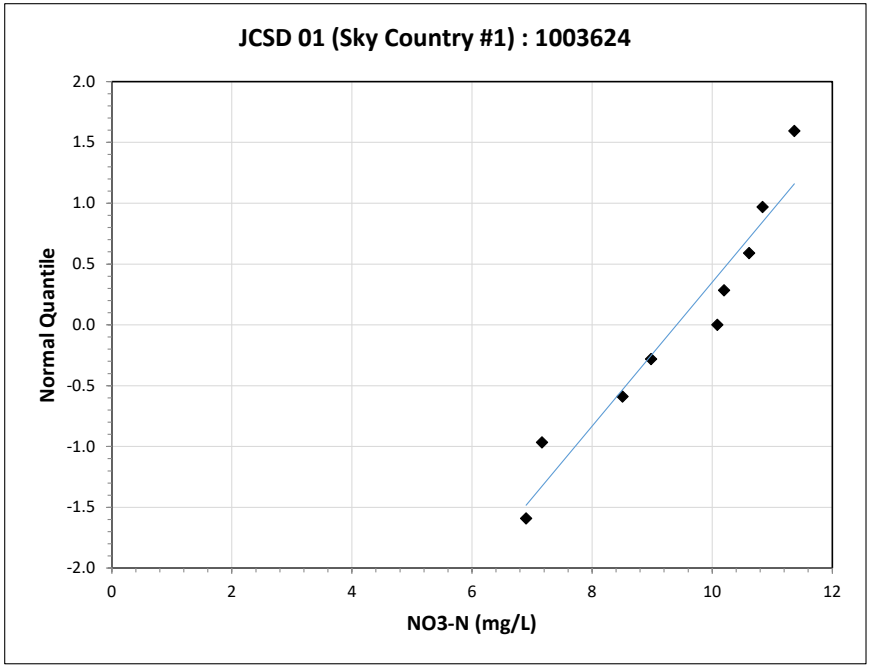


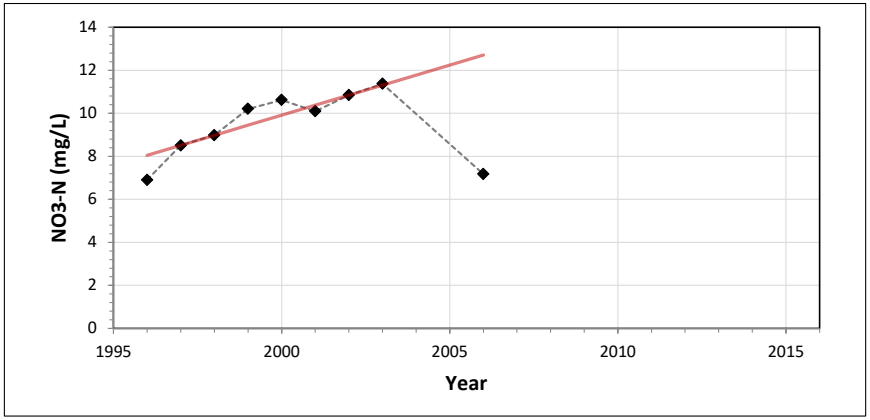
Statistics	
GMZ	Chino-East
Well Name : ID	HCMP-9/2 : 1207998
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	144
Annual Average Max	222
Annual Average Mean	171
Annual Average Stdev	20.86
Shapiro-Wilk W	0.892
Shapiro-Wilk p-value	0.146
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.29
Student t	1.05
Mean + t*SE (UCL84)	178
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-14
Var(S)	164
Intercept	4862
Slope	-2.33
p-value	0.310
Significant Trend?	No



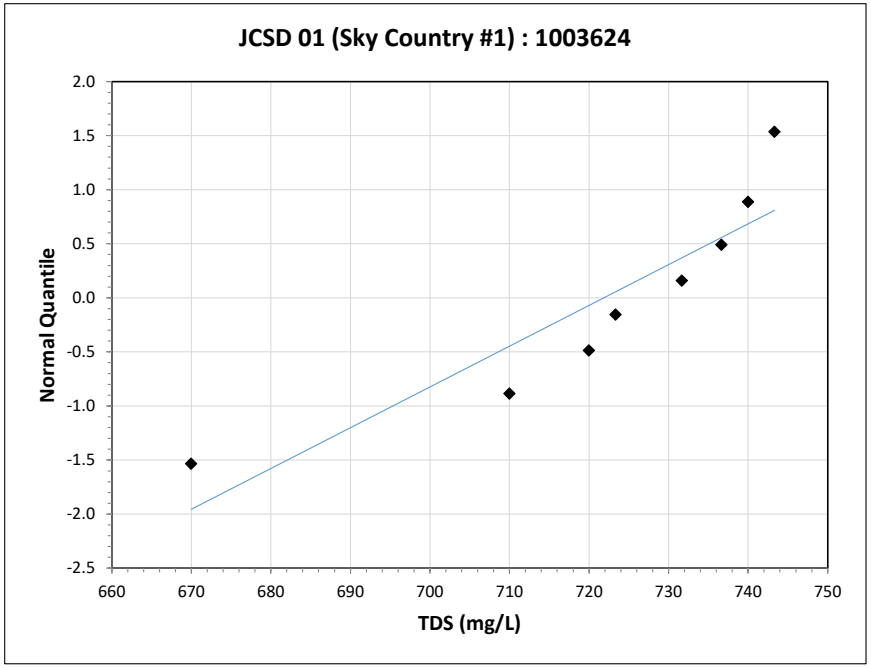


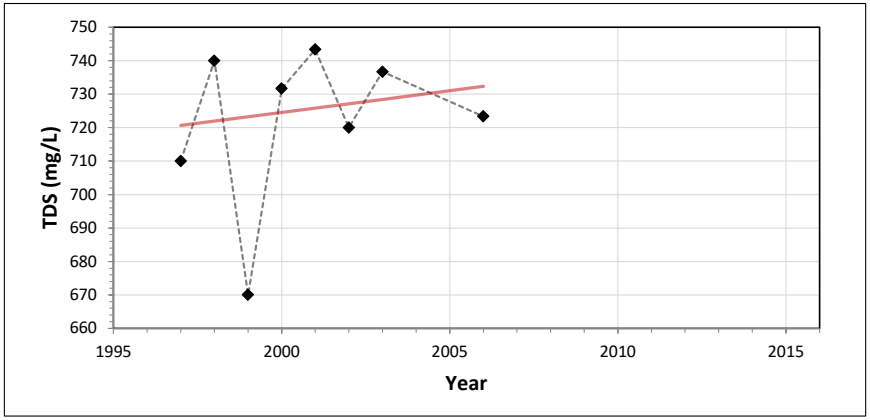
Statistics	
GMZ	Chino-South
Well Name : ID	JCSD 01 (Sky Country #1) : 1003624
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	1996
Sample Year Max	2006
Annual Average Min	6.90
Annual Average Max	11.37
Annual Average Mean	9.41
Annual Average Stdev	1.61
Shapiro-Wilk W	0.914
Shapiro-Wilk p-value	0.346
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.54
Student t	1.06
Mean + t*SE (UCL84)	9.98
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	18
Var(S)	92.00
Intercept	-922
Slope	0.47
p-value	0.076
Significant Trend?	Increasing



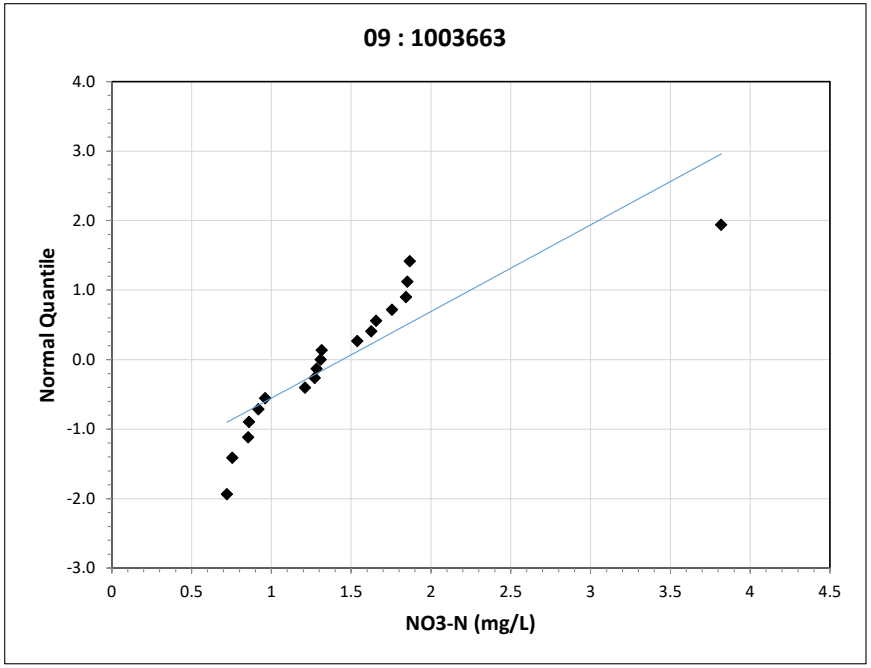


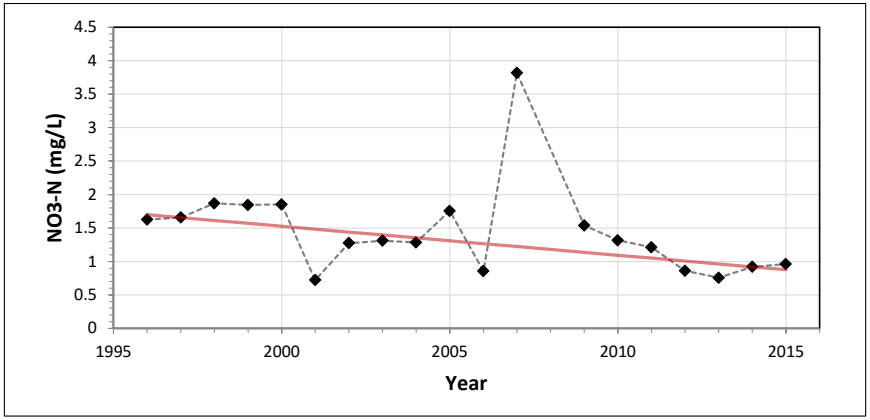
Statistics	
GMZ	Chino-South
Well Name : ID	JCSD 01 (Sky Country #1) : 1003624
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1997
Sample Year Max	2006
Annual Average Min	670
Annual Average Max	743
Annual Average Mean	722
Annual Average Stdev	23.73
Shapiro-Wilk W	0.832
Shapiro-Wilk p-value	0.062
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.39
Student t	1.07
Mean + t*SE (UCL84)	731
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	4
Var(S)	65.33
Intercept	-1868
Slope	1.30
p-value	0.711
Significant Trend?	No



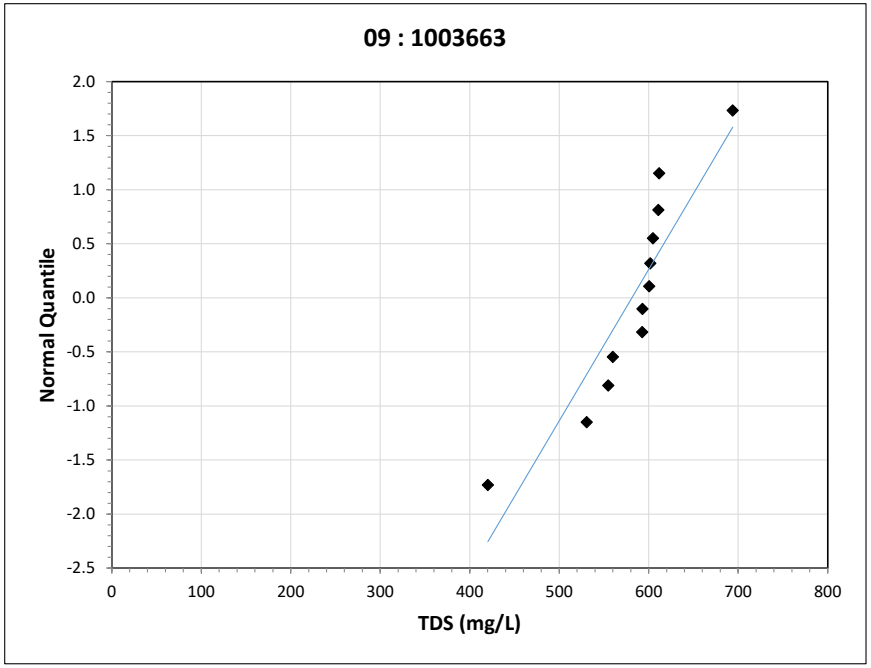


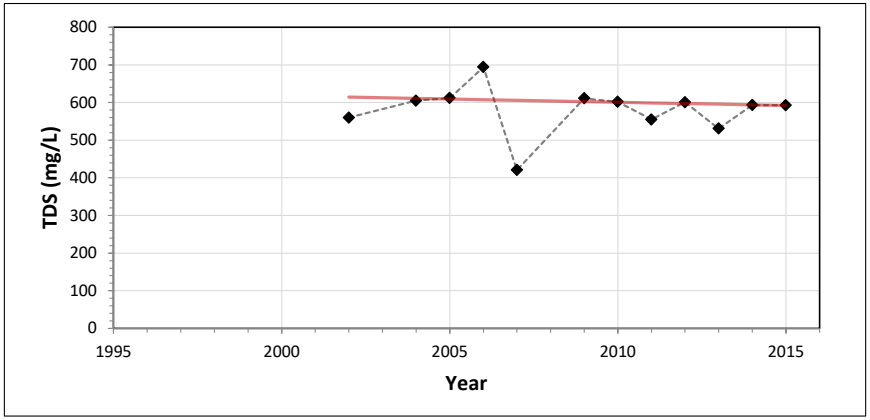
Statistics	
GMZ	Chino-South
Well Name : ID	09 : 1003663
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.72
Annual Average Max	3.82
Annual Average Mean	1.44
Annual Average Stdev	0.69
Shapiro-Wilk W	0.773
Shapiro-Wilk p-value	5E-4
Critical Alpha	0.01
Most Discordant Value	3.82
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.202
Geomean	1.33
GM + t*GSE (UCL84)	1.46
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-61
Var(S)	817
Intercept	88.17
Slope	-0.04
p-value	0.036
Significant Trend?	Decreasing



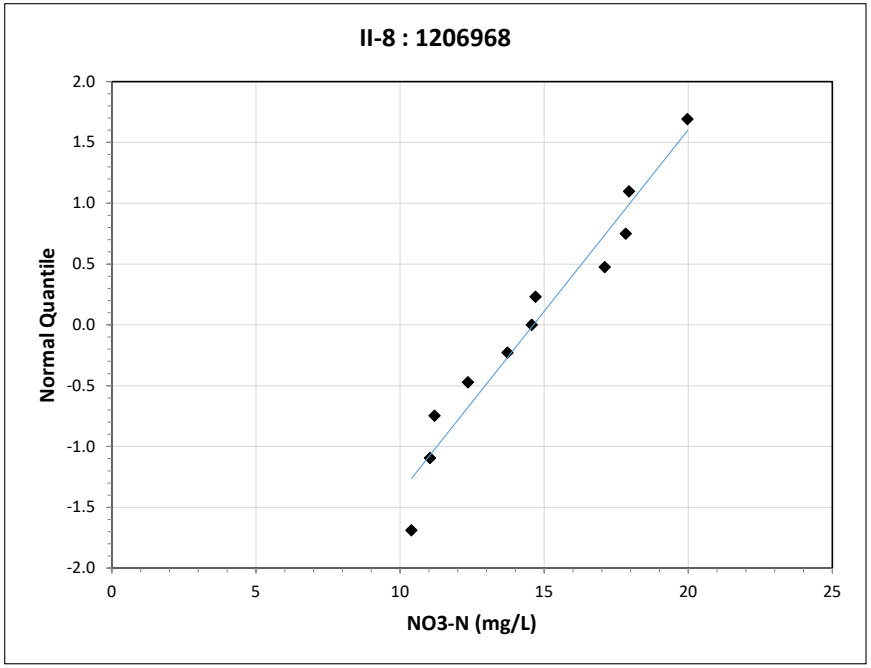


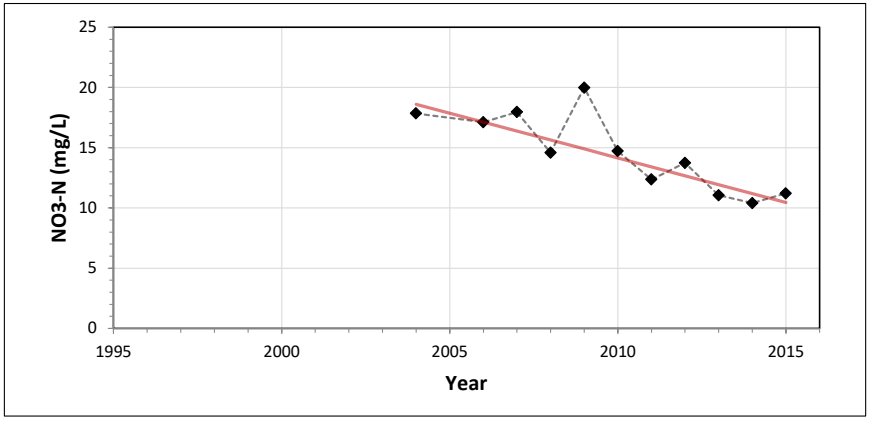
Statistics	
GMZ	Chino-South
Well Name : ID	09 : 1003663
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	2002
Sample Year Max	2015
Annual Average Min	420
Annual Average Max	694
Annual Average Mean	581
Annual Average Stdev	64.45
Shapiro-Wilk W	0.857
Shapiro-Wilk p-value	0.045
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	18.61
Student t	1.04
Mean + t*SE (UCL84)	601
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-18
Var(S)	213
Intercept	4020
Slope	-1.70
p-value	0.244
Significant Trend?	No



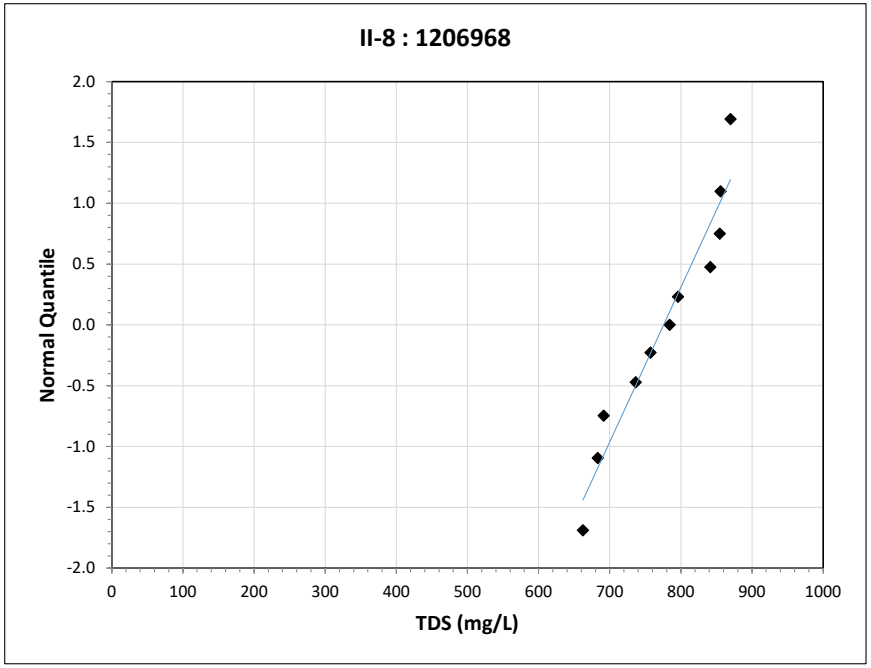


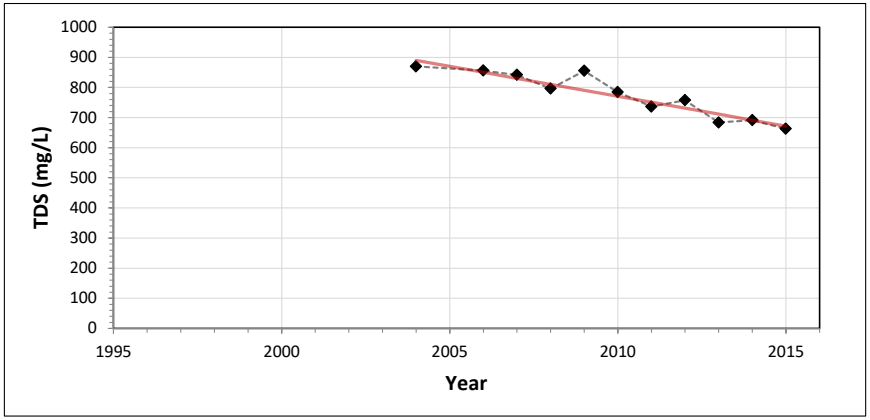
Statistics	
GMZ	Chino-South
Well Name : ID	II-8 : 1206968
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2004
Sample Year Max	2015
Annual Average Min	10.41
Annual Average Max	19.98
Annual Average Mean	14.63
Annual Average Stdev	3.23
Shapiro-Wilk W	0.938
Shapiro-Wilk p-value	0.495
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.97
Student t	1.05
Mean + t*SE (UCL84)	15.65
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-35
Var(S)	165
Intercept	1502
Slope	-0.74
p-value	0.008
Significant Trend?	Decreasing*



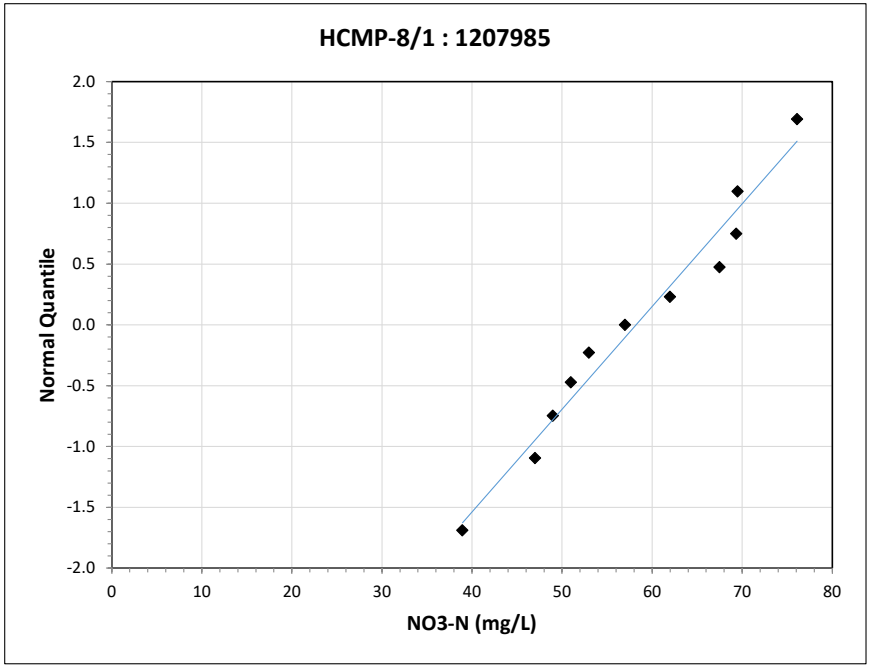


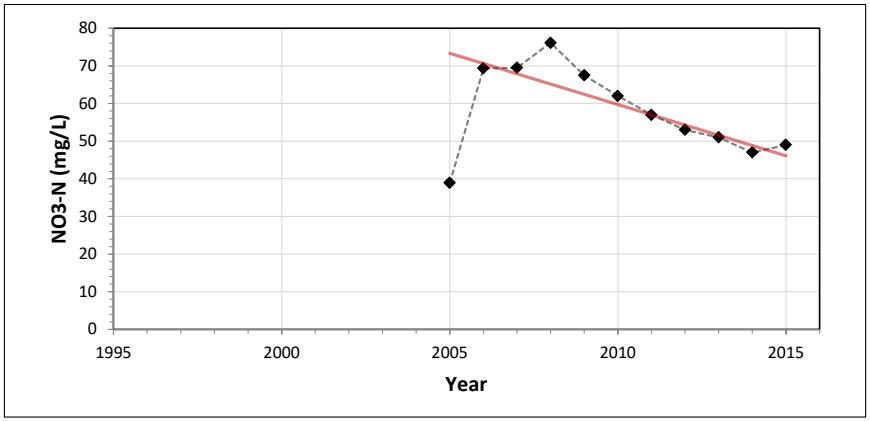
Statistics	
GMZ	Chino-South
Well Name : ID	II-8 : 1206968
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2004
Sample Year Max	2015
Annual Average Min	663
Annual Average Max	870
Annual Average Mean	776
Annual Average Stdev	75.31
Shapiro-Wilk W	0.917
Shapiro-Wilk p-value	0.295
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	22.71
Student t	1.05
Mean + t*SE (UCL84)	800
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-47
Var(S)	165
Intercept	40627
Slope	-19.83
p-value	3E-4
Significant Trend?	Decreasing**



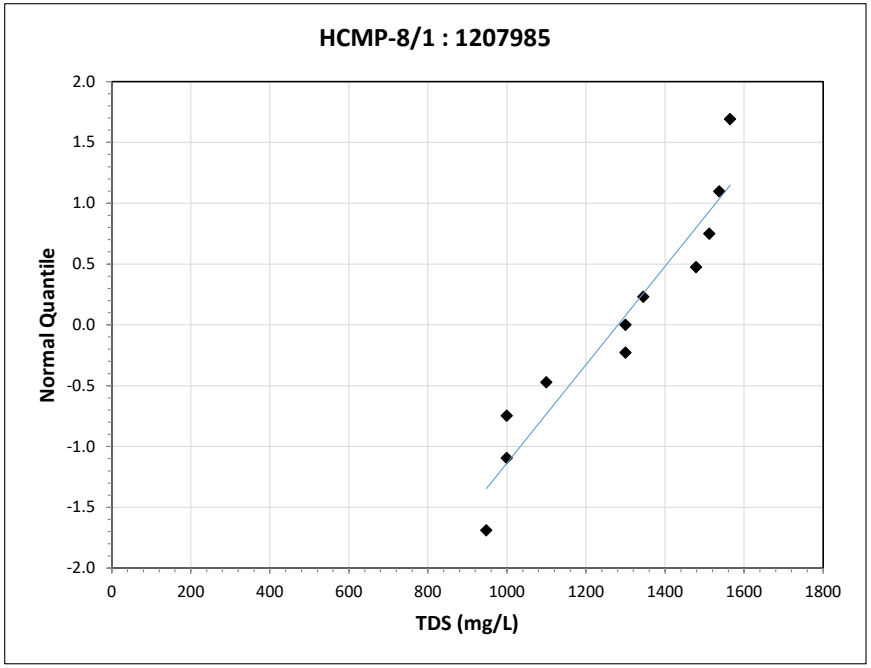


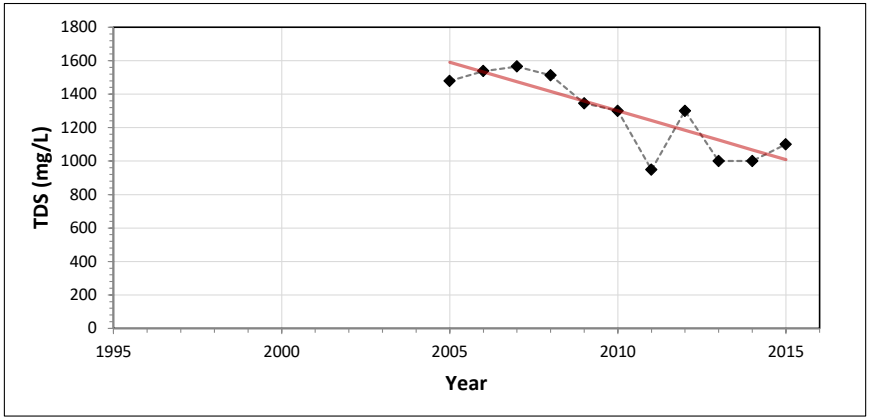
Statistics	
GMZ	Chino-South
Well Name : ID	HCMP-8/1 : 1207985
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	38.95
Annual Average Max	76.10
Annual Average Mean	58.22
Annual Average Stdev	11.55
Shapiro-Wilk W	0.963
Shapiro-Wilk p-value	0.814
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	3.48
Student t	1.05
Mean + t*SE (UCL84)	61.86
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-27
Var(S)	165
Intercept	5537
Slope	-2.73
p-value	0.043
Significant Trend?	Decreasing



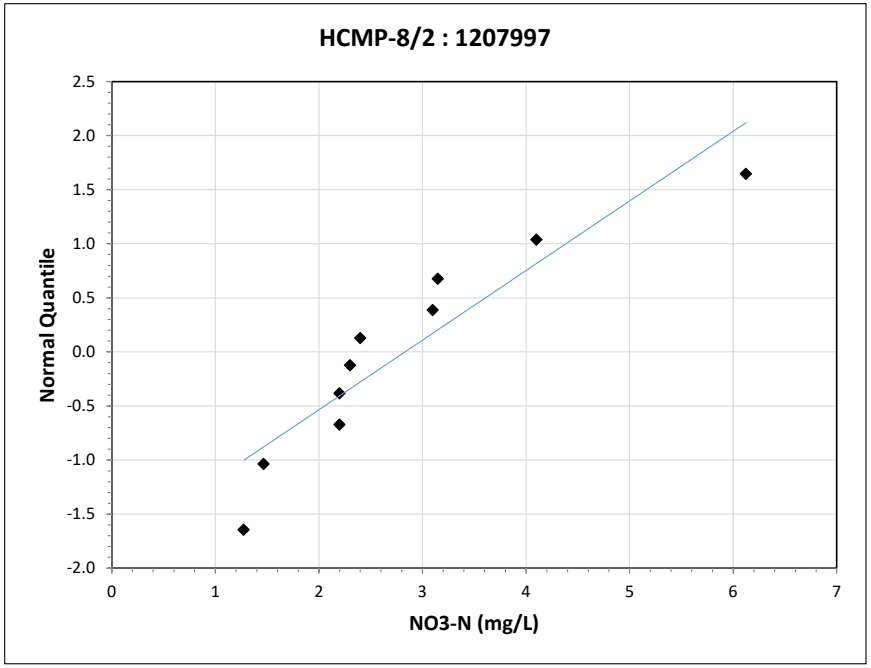


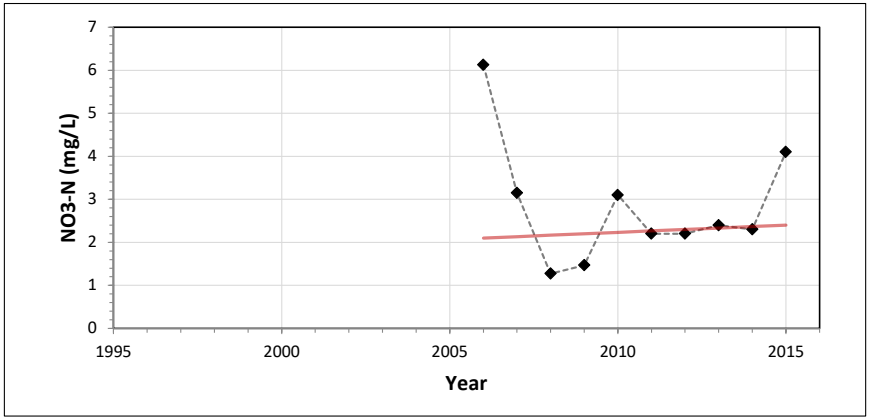
Statistics	
GMZ	Chino-South
Well Name : ID	HCMP-8/1 : 1207985
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	948
Annual Average Max	1565
Annual Average Mean	1281
Annual Average Stdev	233.59
Shapiro-Wilk W	0.890
Shapiro-Wilk p-value	0.140
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	70.43
Student t	1.05
Mean + t*SE (UCL84)	1354
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-33
Var(S)	163
Intercept	118131
Slope	-58.13
p-value	0.012
Significant Trend?	Decreasing



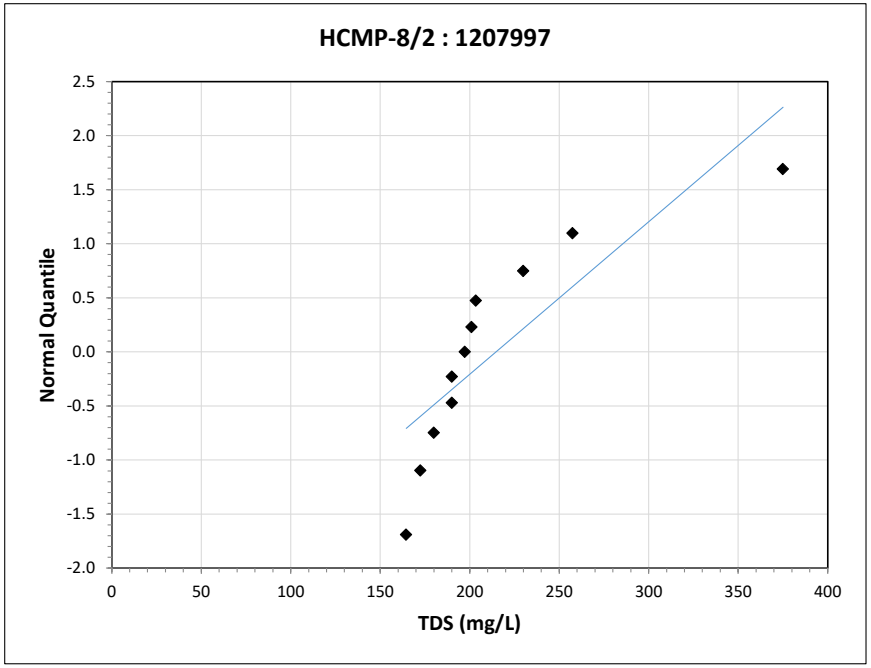


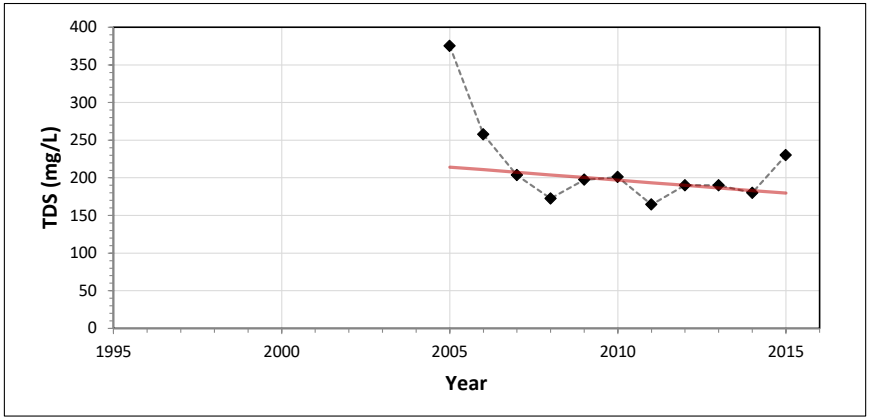
Statistics	
GMZ	Chino-South
Well Name : ID	HCMP-8/2 : 1207997
Analyte	NO3-N (mg/L)
Count	10
Count Detects	10
Sample Year Min	2006
Sample Year Max	2015
Annual Average Min	1.28
Annual Average Max	6.13
Annual Average Mean	2.83
Annual Average Stdev	1.42
Shapiro-Wilk W	0.866
Shapiro-Wilk p-value	0.089
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.45
Student t	1.05
Mean + t*SE (UCL84)	3.30
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	2
Var(S)	124
Intercept	-64.77
Slope	0.03
p-value	0.928
Significant Trend?	No





Statistics	
GMZ	Chino-South
Well Name : ID	HCMP-8/2 : 1207997
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2005
Sample Year Max	2015
Annual Average Min	165
Annual Average Max	375
Annual Average Mean	215
Annual Average Stdev	59.25
Shapiro-Wilk W	0.730
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	375
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.05
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.019
Geomean	209
GM + t*GSE (UCL84)	225
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-20
Var(S)	164
Intercept	7165
Slope	-3.47
p-value	0.138
Significant Trend?	No





Attachment B7

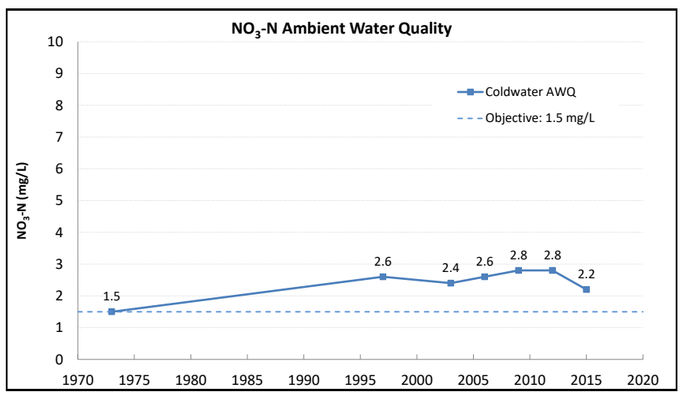
Coldwater and Bedford GMZs

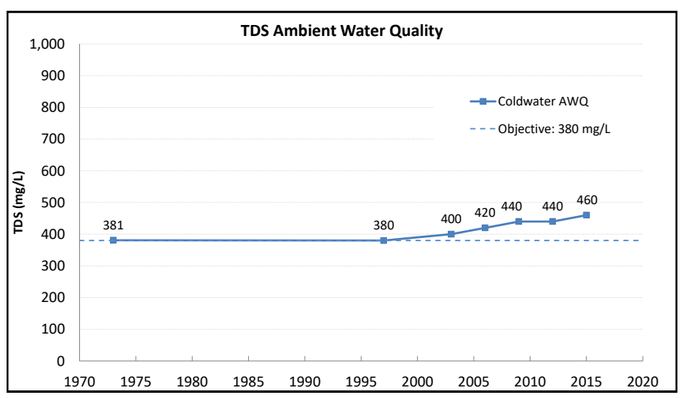
Attachment Contents:

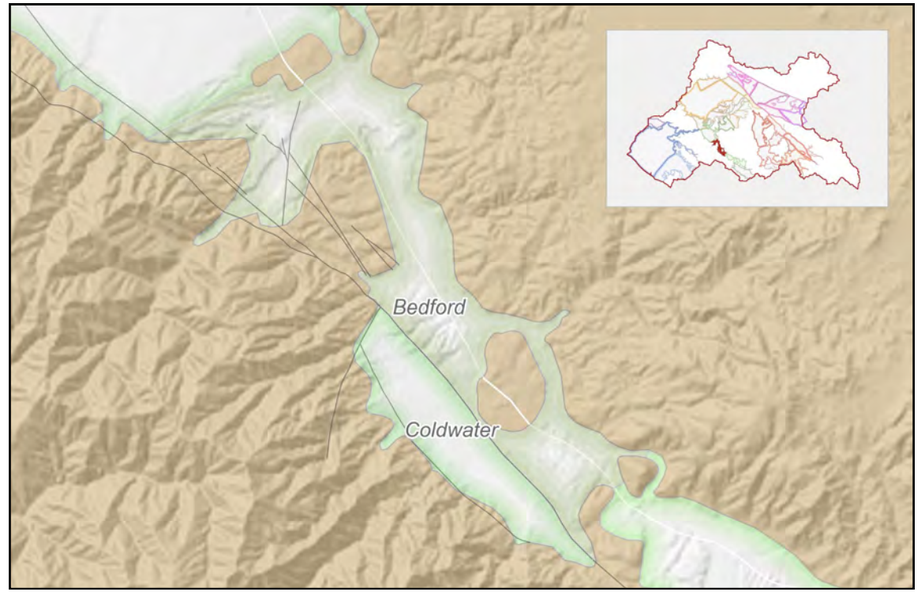
B7-1 Groundwater Storage and Elevation Contours Fall 2015
B7-2 NO_3-N Concentration and Contour Map
B7-3 TDS Concentration and Contour Map
B7-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B7-5 TDS Concentration Change (1993-2012 to 1996-2015)
B7-6 Key Well Analysis Charts

	Basin Analytics	Coldwater	Bedford
Basin	GMZ Area (acres)	1,770	5,030
	Volume of Storage (acre-ft)	45,200	?
NO_3-N	Wells per GMZ	9	9
	Point Statistics per GMZ	8	8
	Total Mass (tons)	140	?
	1996-2015 AWQ	2.2	?
TDS	Wells per GMZ	9	9
	Point Statistics per GMZ	8	8
	Total Mass (tons)	28,000	?
	1996-2015 AWQ	460	?

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Coldwater

The nitrate objective for Coldwater is 1.5 mg/L. The ambient nitrate concentration decreased from 2.8 mg/L in 2012 to 2.2 mg/L in 2015, and there is no assimilative capacity. One out of the three key wells in Coldwater GMZ have a decreasing trend in nitrate concentrations, and the other two show no trends in the nitrate concentrations. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Bedford

The ambient water quality was not determined during the objective setting period and therefore there is no nitrate objective for Bedford. Consistent with previous reports the ambient nitrate concentration was not calculated in the 1996 to 2015 AWQ recomputation .

Total Dissolved Solids (TDS)

Coldwater

The TDS objective for Coldwater is 380 mg/L. The ambient TDS concentration increased from 440 mg/L in 2012 to 460 mg/L in 2015, and there is no assimilative capacity. One out of the three key interpretive wells in Coldwater GMZ show an increasing trend while the other two show no trends in TDS concentrations. One of the total 9 wells with TDS values in Coldwater will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Bedford

The ambient water quality was not determined during the objective setting period and therefore there is no TDS objective for Bedford. Consistent with previous reports the ambient TDS concentration was not calculated in the 1996 to 2015 AWQ recomputation .

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Coldwater	1005787	COR 03	3.1	Decreasing	440	No Trend
Coldwater	1005789	EVMWD Station 71	3.4	No Trend	454	Increasing
Coldwater	1005792	EVMWD Mayhew 2 (Mayhew Well)	4.0	No Trend	515	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B7-4 and B7-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Coldwater	1005788	COR 01	--	4	3.3	Stat	High	3	456	Stat
Bedford	1005345	COR 04	High	2	3.8	Ave	High	1	780	Ave

[1] number of years with samples [2]final value used to contour well concentrations -- not applicable

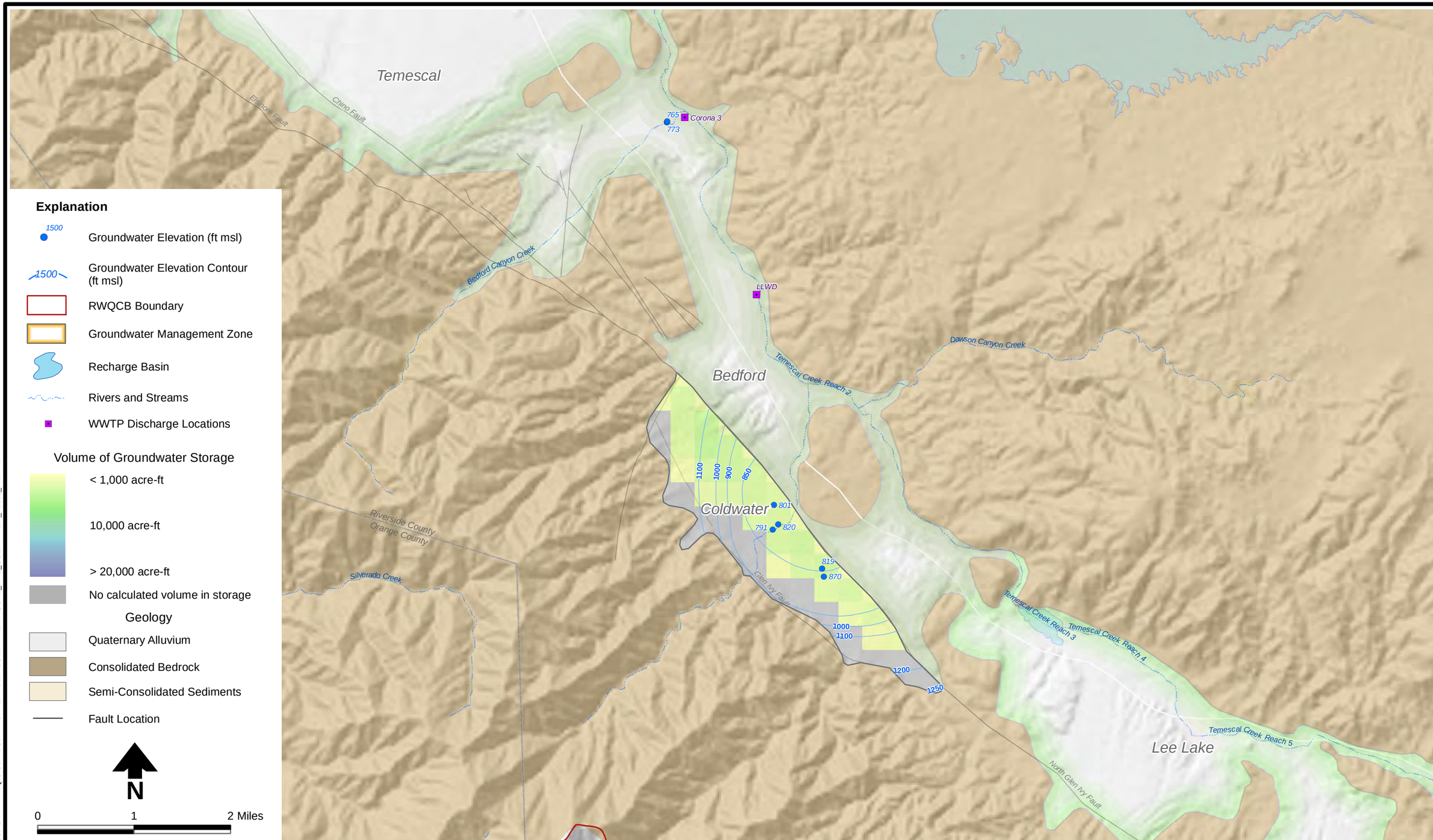
Table 3 - Well Attrition Analysis

The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B7-4 and B7-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Additions				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Bedford	2000362	Well 1A	New	3	1.8	Stat	New	3	866	Stat

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B7-4 and B7-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B7 COLDWATER\FIGURE_B7-1_COLDWATER_F2015_WL.MXD

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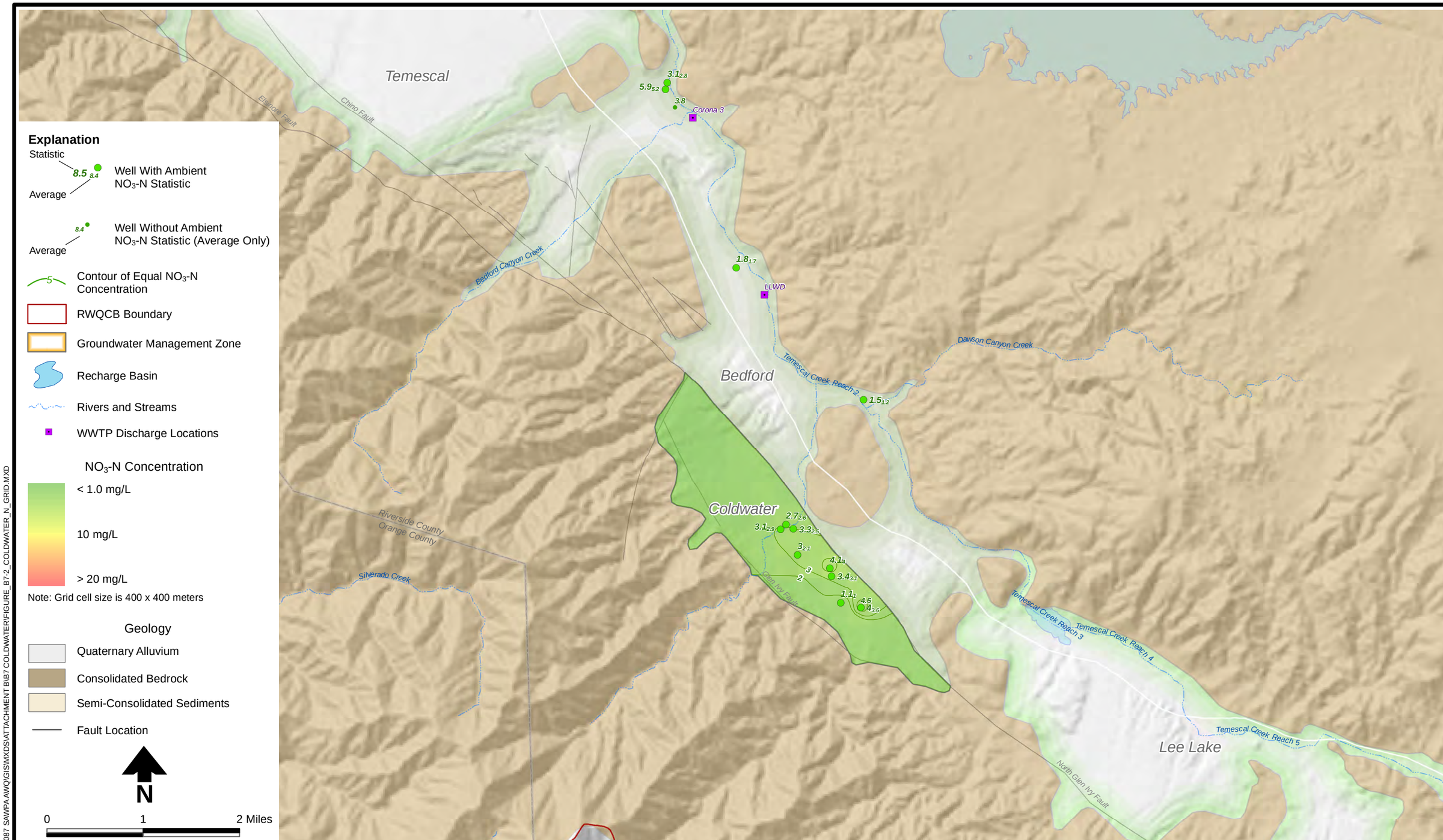
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015 Coldwater and Bedford GMZs

Attachment B7-1



Source: SAWPA.net, January 2017

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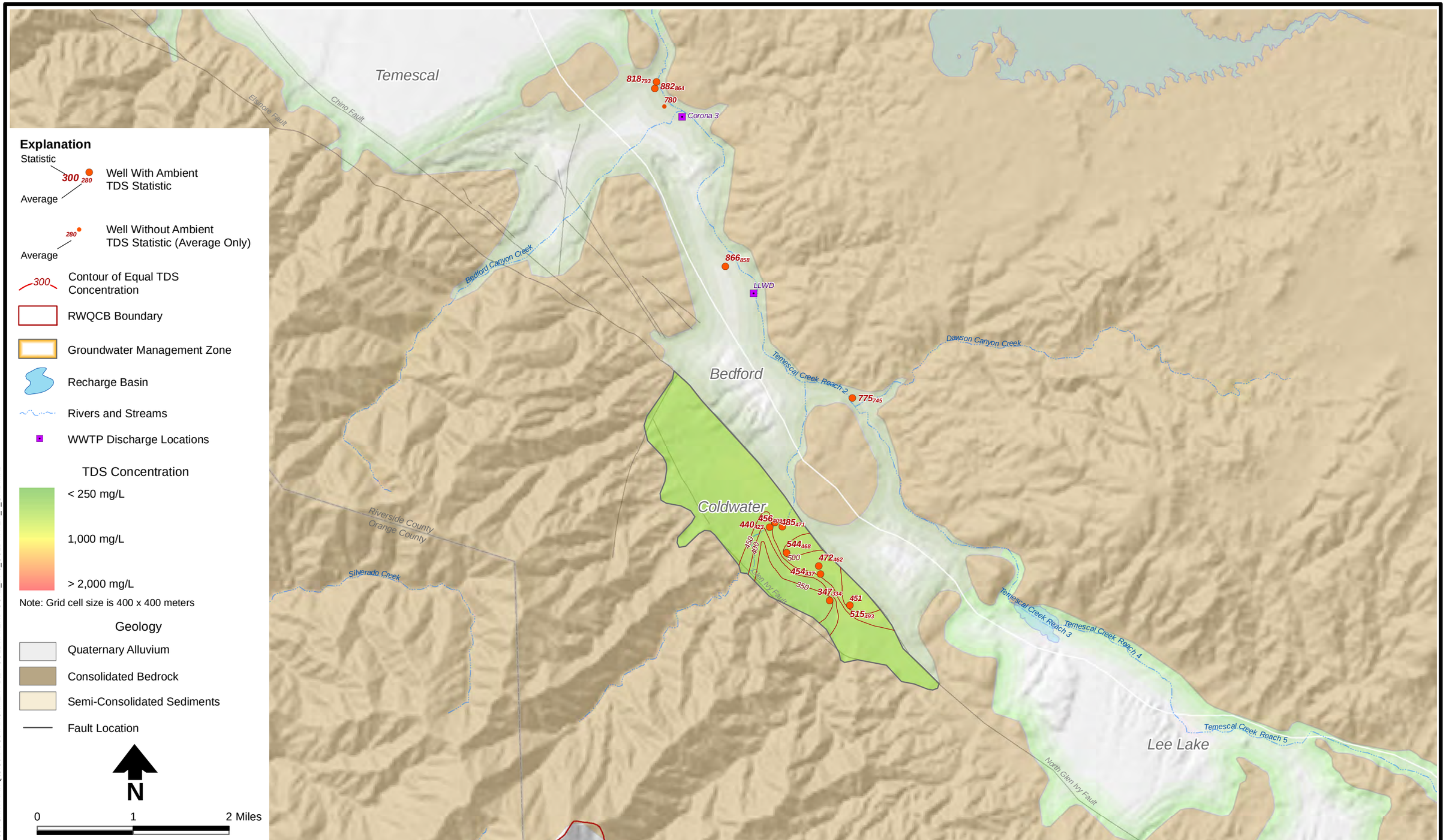
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Coldwater and Bedford GMZs

Attachment B7-2



Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Coldwater and Bedford GMZs

Attachment B7-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

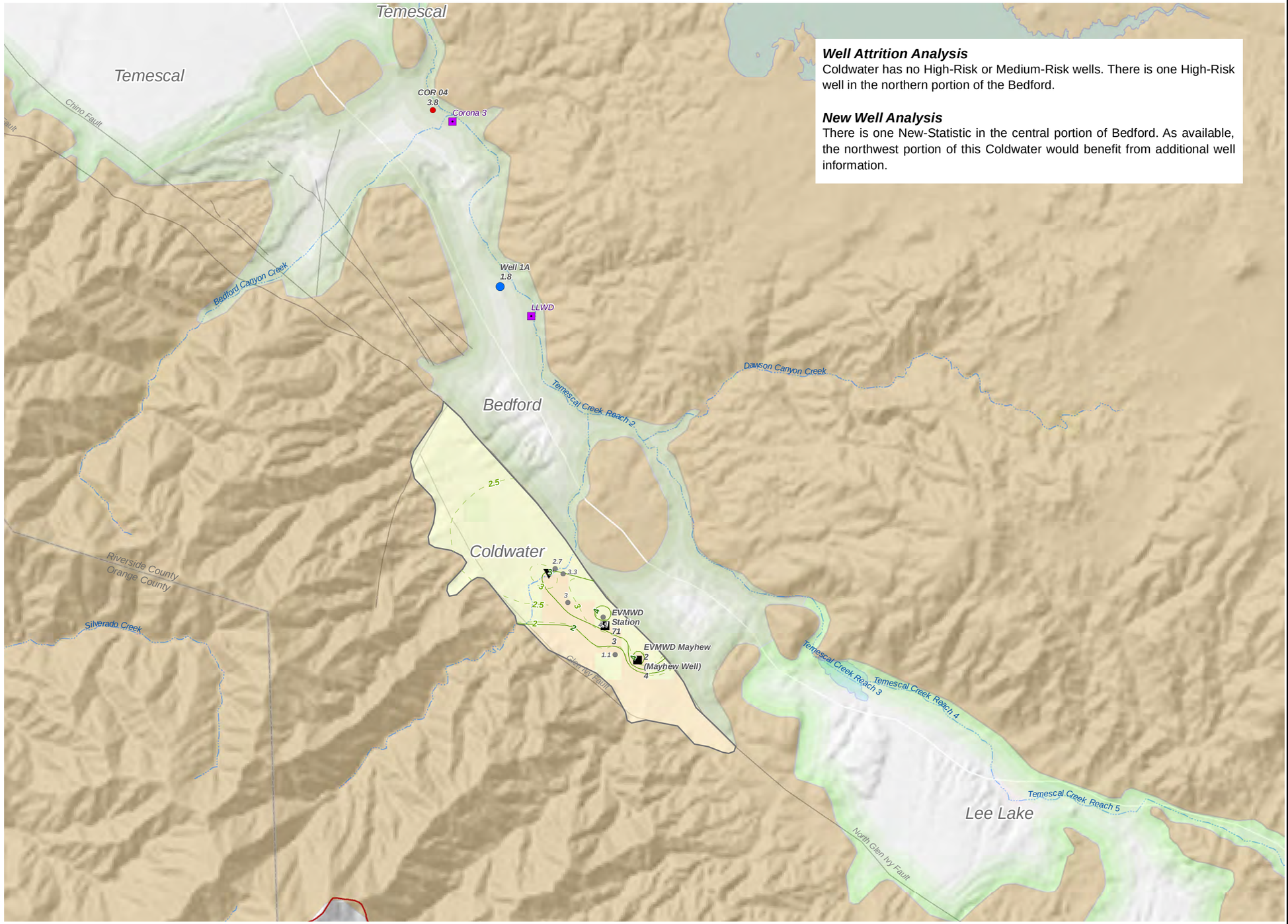
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis
Coldwater has no High-Risk or Medium-Risk wells. There is one High-Risk well in the northern portion of the Bedford.

New Well Analysis
There is one New-Statistic in the central portion of Bedford. As available, the northwest portion of this Coldwater would benefit from additional well information.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B7 COLDWATER\FIGURE_B7-4_COLDWATER_N_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Coldwater and Coldwater GMZs

Attachment B7-4

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

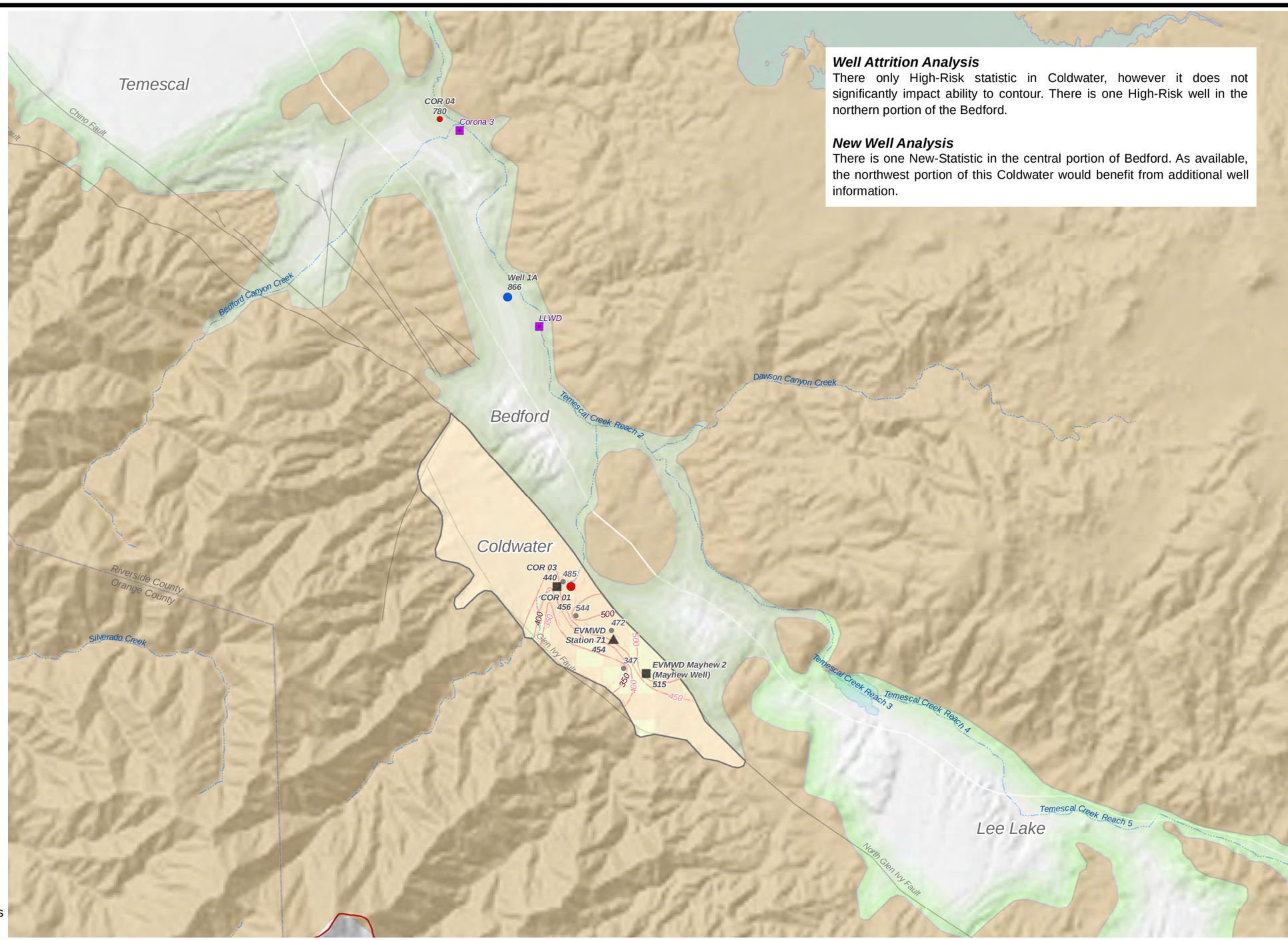
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There only High-Risk statistic in Coldwater, however it does not significantly impact ability to contour. There is one High-Risk well in the northern portion of the Bedford.

New Well Analysis

There is one New-Statistic in the central portion of Bedford. As available, the northwest portion of this Coldwater would benefit from additional well information.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B7 COLDWATER\FIGURE_B7-5_COLDWATER_T_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Coldwater and Bedford GMZs

Attachment B7-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

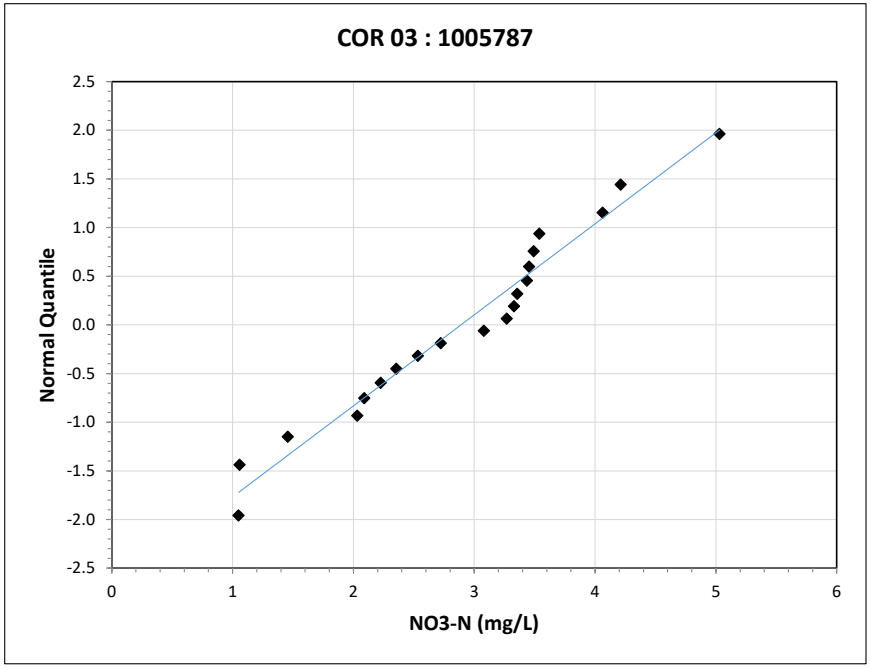
Mann-Kendall

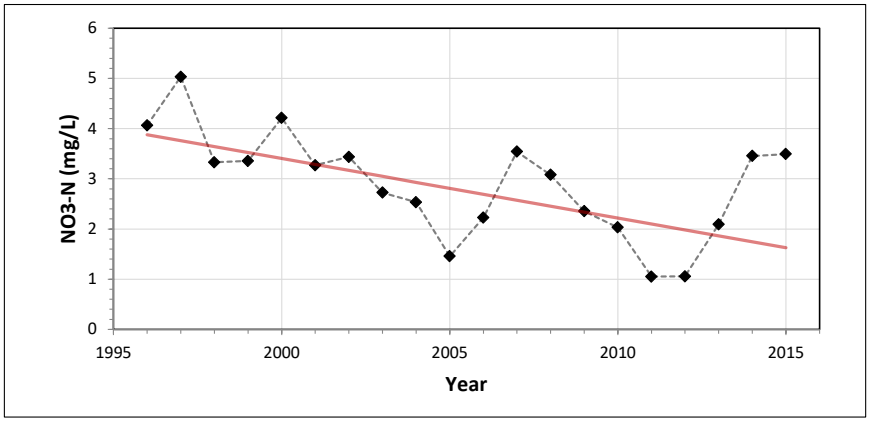
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

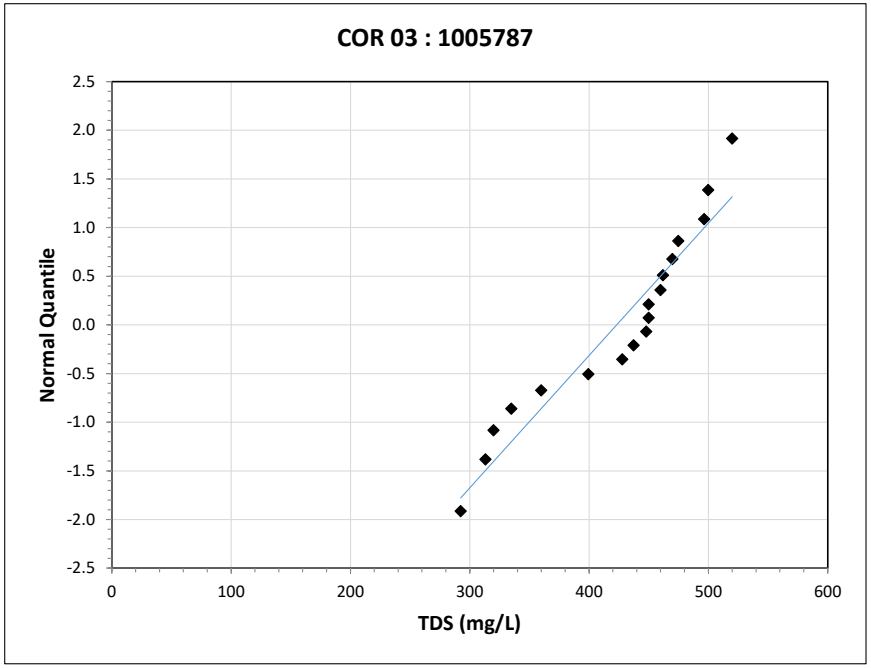
The significance of the trends is notated by * for significant and ** for very significant.

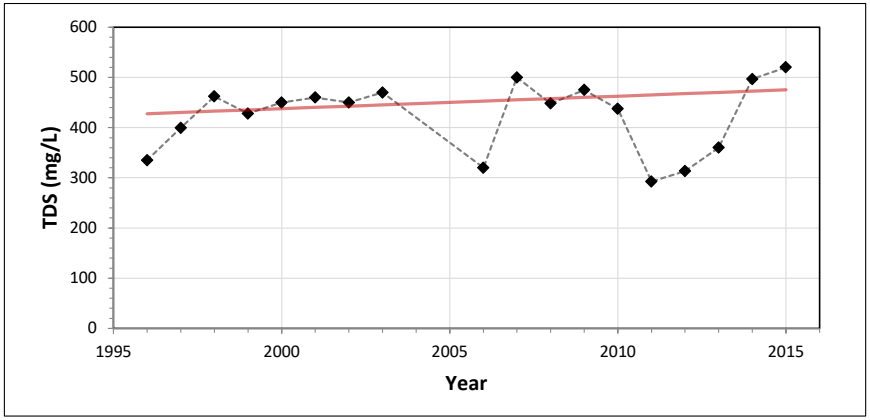
Statistics	
GMZ	Coldwater
Well Name : ID	COR 03 : 1005787
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.05
Annual Average Max	5.03
Annual Average Mean	2.89
Annual Average Stdev	1.05
Shapiro-Wilk W	0.966
Shapiro-Wilk p-value	0.663
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.23
Student t	1.02
Mean + t*SE (UCL84)	3.13
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-74
Var(S)	950
Intercept	240
Slope	-0.12
p-value	0.018
Significant Trend?	Decreasing



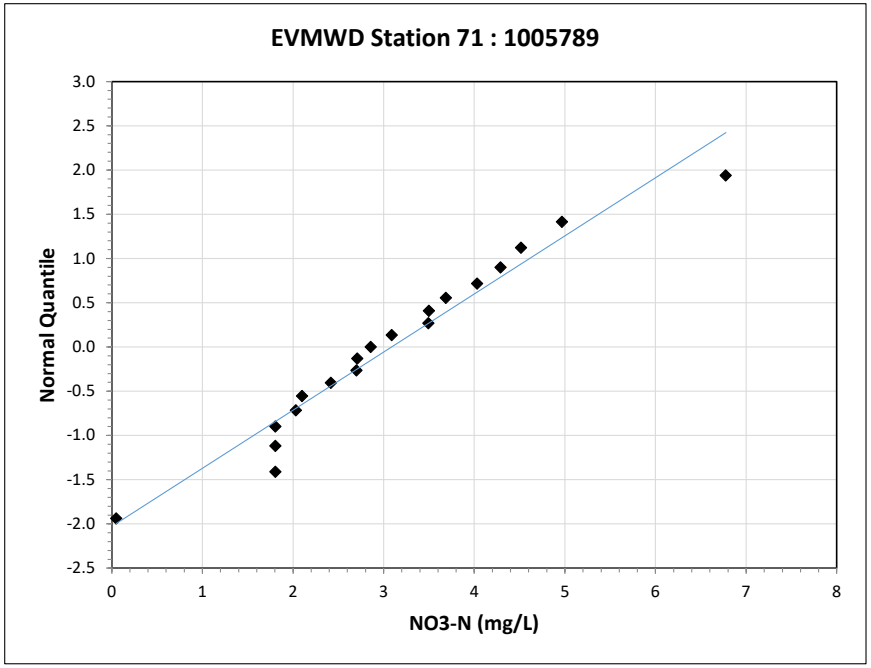


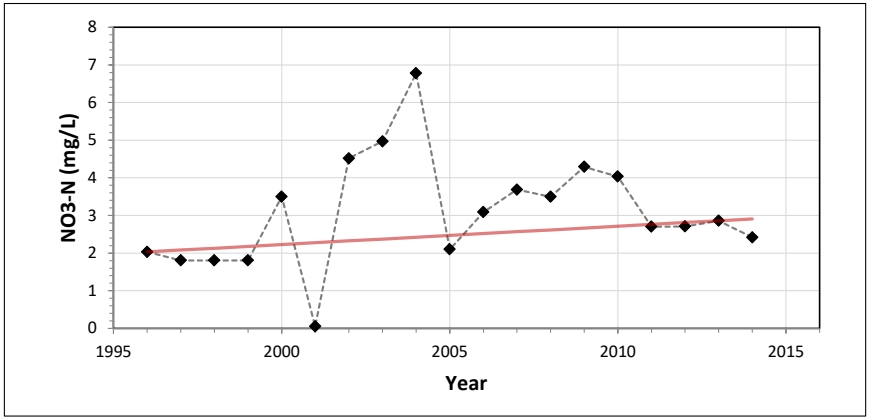
Statistics	
GMZ	Coldwater
Well Name : ID	COR 03 : 1005787
Analyte	TDS (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	293
Annual Average Max	520
Annual Average Mean	423
Annual Average Stdev	69.80
Shapiro-Wilk W	0.904
Shapiro-Wilk p-value	0.067
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	16.45
Student t	1.02
Mean + t*SE (UCL84)	440
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	20
Var(S)	696
Intercept	-4562
Slope	2.50
p-value	0.471
Significant Trend?	No



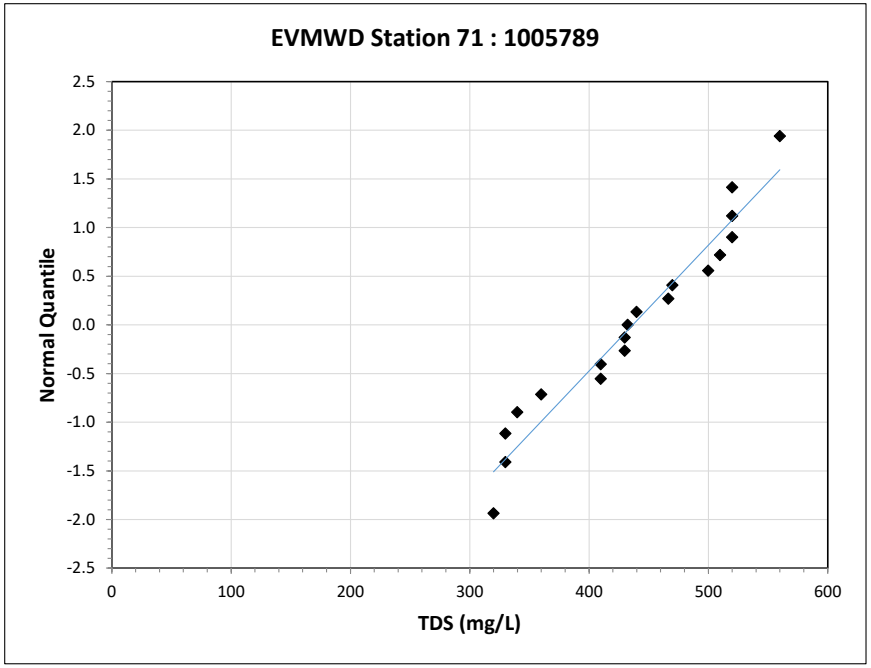


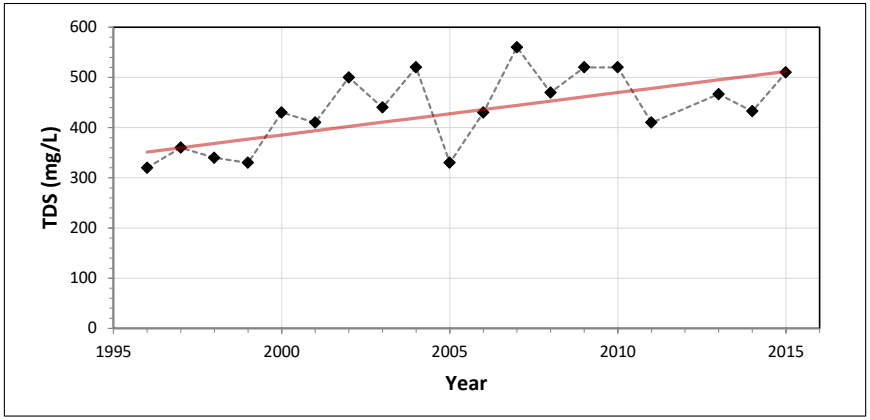
Statistics	
GMZ	Coldwater
Well Name : ID	EVMWD Station 71 : 1005789
Analyte	NO3-N (mg/L)
Count	19
Count Detects	18
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	6.78
Annual Average Mean	3.09
Annual Average Stdev	1.48
Shapiro-Wilk W	0.964
Shapiro-Wilk p-value	0.656
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.34
Student t	1.02
Mean + t*SE (UCL84)	3.43
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	28
Var(S)	813
Intercept	-95.07
Slope	0.05
p-value	0.344
Significant Trend?	No



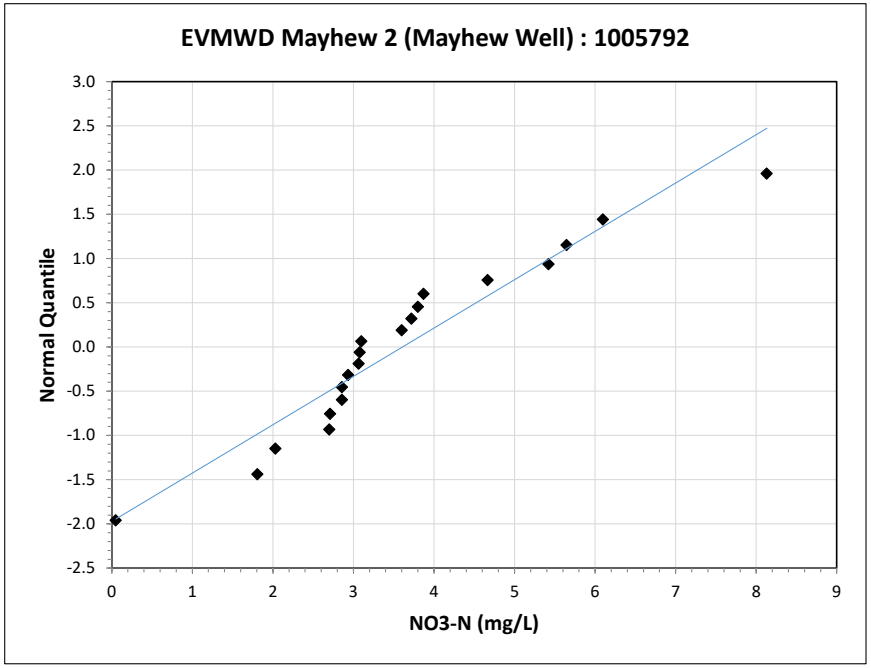


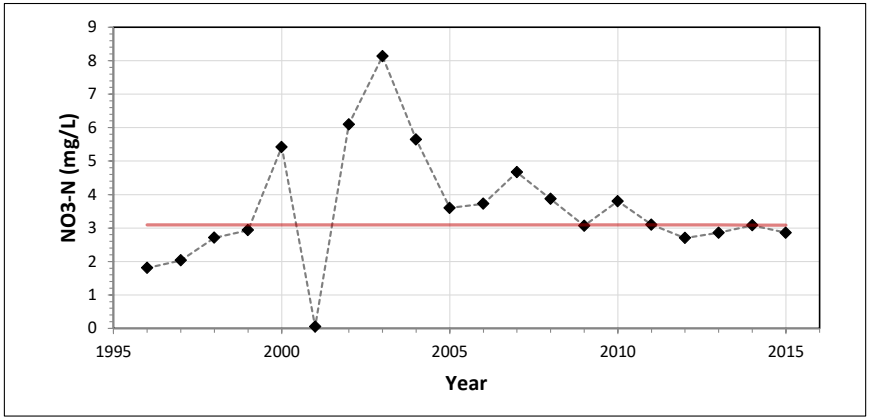
Statistics	
GMZ	Coldwater
Well Name : ID	EVMWD Station 71 : 1005789
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	320
Annual Average Max	560
Annual Average Mean	437
Annual Average Stdev	74.75
Shapiro-Wilk W	0.935
Shapiro-Wilk p-value	0.215
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	17.15
Student t	1.02
Mean + t*SE (UCL84)	454
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	71
Var(S)	810
Intercept	-16504
Slope	8.44
p-value	0.014
Significant Trend?	Increasing



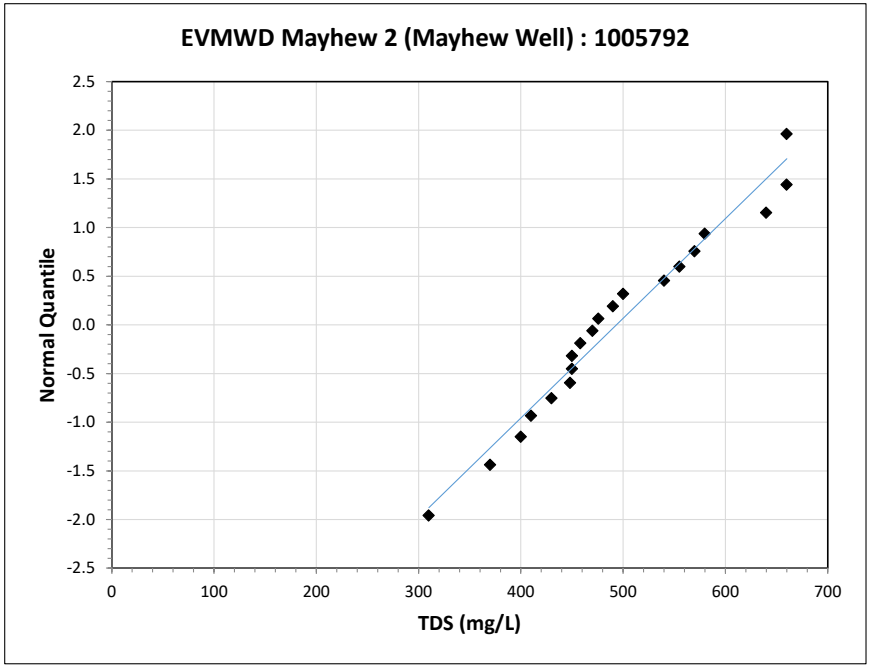


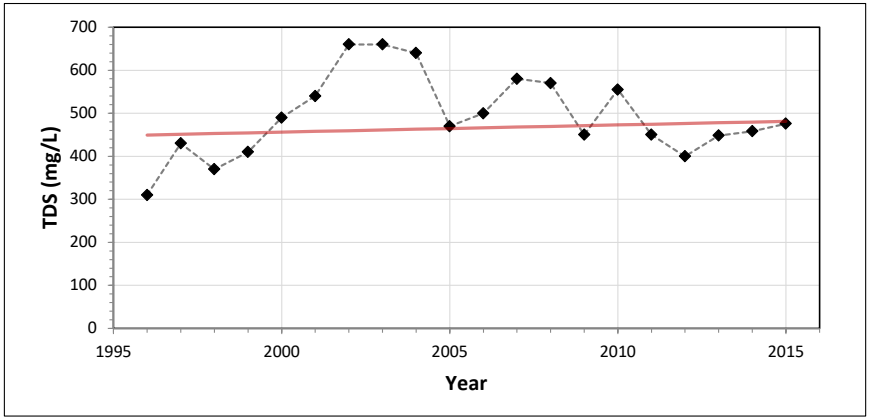
Statistics	
GMZ	Coldwater
Well Name : ID	EVMWD Mayhew 2 (Mayhew Well) : 1005792
Analyte	NO3-N (mg/L)
Count	20
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	8.13
Annual Average Mean	3.61
Annual Average Stdev	1.74
Shapiro-Wilk W	0.932
Shapiro-Wilk p-value	0.167
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.39
Student t	1.02
Mean + t*SE (UCL84)	4.01
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	950
Intercept	3.86
Slope	0.00
p-value	1.000
Significant Trend?	No





Statistics	
GMZ	Coldwater
Well Name : ID	EVMWD Mayhew 2 (Mayhew Well) : 1005792
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	310
Annual Average Max	660
Annual Average Mean	493
Annual Average Stdev	95.38
Shapiro-Wilk W	0.962
Shapiro-Wilk p-value	0.582
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	21.33
Student t	1.02
Mean + t*SE (UCL84)	515
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	10
Var(S)	948
Intercept	-2877
Slope	1.67
p-value	0.770
Significant Trend?	No





Attachment B8

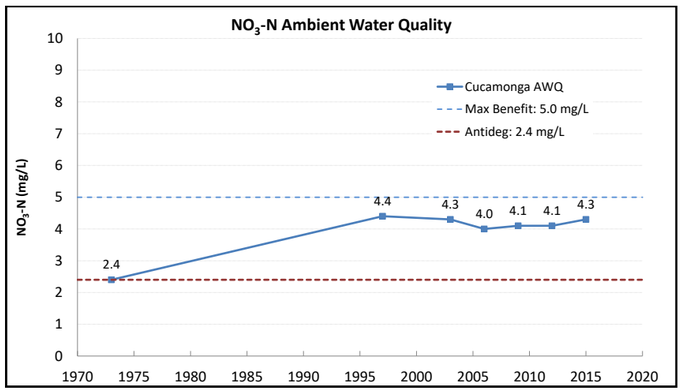
Cucamonga GMZ

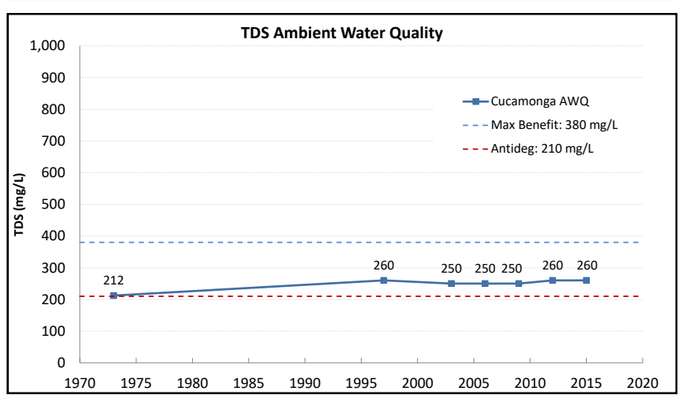
Attachment Contents:

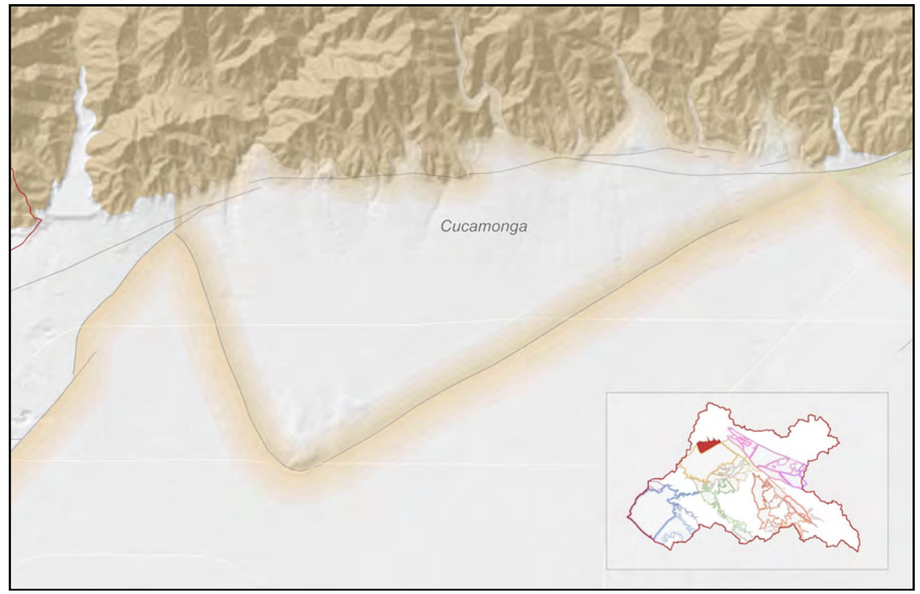
B8-1 Groundwater Storage and Elevation Contours Fall 2015
B8-2 NO_3-N Concentration and Contour Map
B8-3 TDS Concentration and Contour Map
B8-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B8-5 TDS Concentration Change (1993-2012 to 1996-2015)
B8-6 Key Well Analysis Charts

	Basin Analytics	Cucamonga
Basin	GMZ Area (acres)	15,900
	Volume of Storage (acre-ft)	76,900
NO_3-N	Wells per GMZ	29
	Point Statistics per GMZ	26
	Total Mass (tons)	4,520
	1996-2015 AWQ	4.3
TDS	Wells per GMZ	28
	Point Statistics per GMZ	26
	Total Mass (tons)	270,000
	1996-2015 AWQ	260

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Cucamonga "max benefit" is 5.0 mg/L and for Cucamonga "antideg" is 2.4 mg/L. The ambient nitrate concentration increased from 4.1 mg/L in 2012 to 4.3 mg/L in 2015, allowing for 0.7 mg/L of assimilative capacity. Two out of the three key wells in Cucamonga GMZ have an increasing trend in nitrate concentrations, and the other one shows no trends in the nitrate concentrations. One of the total 29 wells with nitrate values in Cucamonga will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Total Dissolved Solids (TDS)

The TDS objective for Cucamonga "max benefit" is 380 mg/L and for Cucamonga "antideg" is 210 mg/L. The ambient TDS concentration was unchanged from 260 mg/L in 2012 to 260 mg/L in 2015, allowing for 120 mg/L of assimilative capacity. Two out of the three key interpretive wells in Cucamonga GMZ show an increasing trend while the other one shows no trends in TDS concentrations. One of the total 28 wells with TDS values in Cucamonga will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Cucamonga	1000539	CVWD 13	5.2	No Trend	285	Increasing*
Cucamonga	1000547	CVWD 16	10.6	Increasing**	252	No Trend
Cucamonga	1000563	SAWC 03	5.4	Increasing*	251	Increasing**

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B8-4 and B8-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Cucamonga	1000542	HELLMAN AVE#2	High	3	11.4	Stat	High	2	326	Ave
Cucamonga	1000600	CVWD 7	Medium	1	0.5	Ave	Medium	1	192	Ave

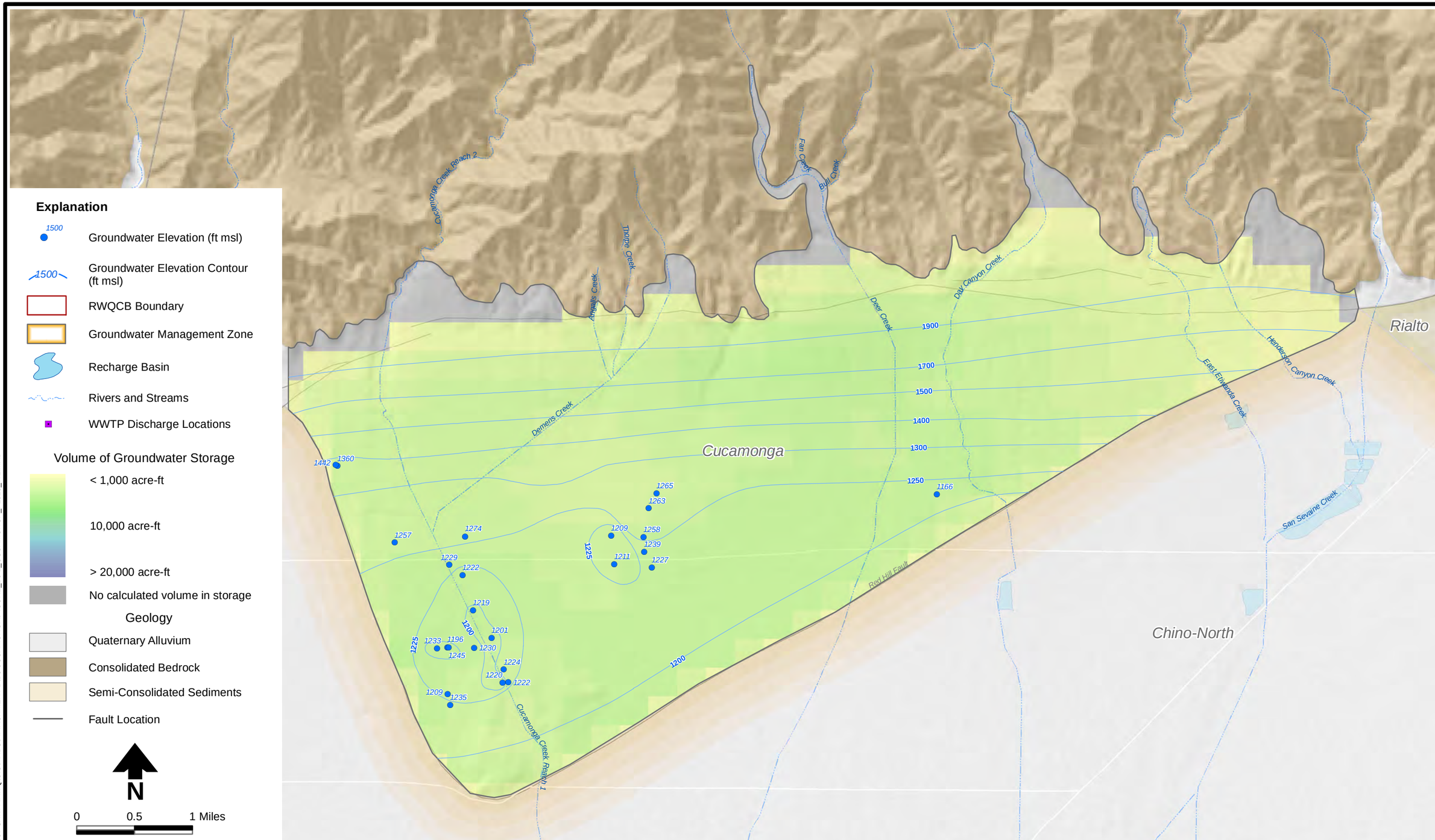
[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B8-4 and B8-5 for NO_3-N and TDS well locations, respectively.

New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. No new statistics have been identified in Coldwater groundwater management zone.



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B8 CUCAMONGA\FIGURE_B8-1_CUCAMONGA_F2015_WL.MXD

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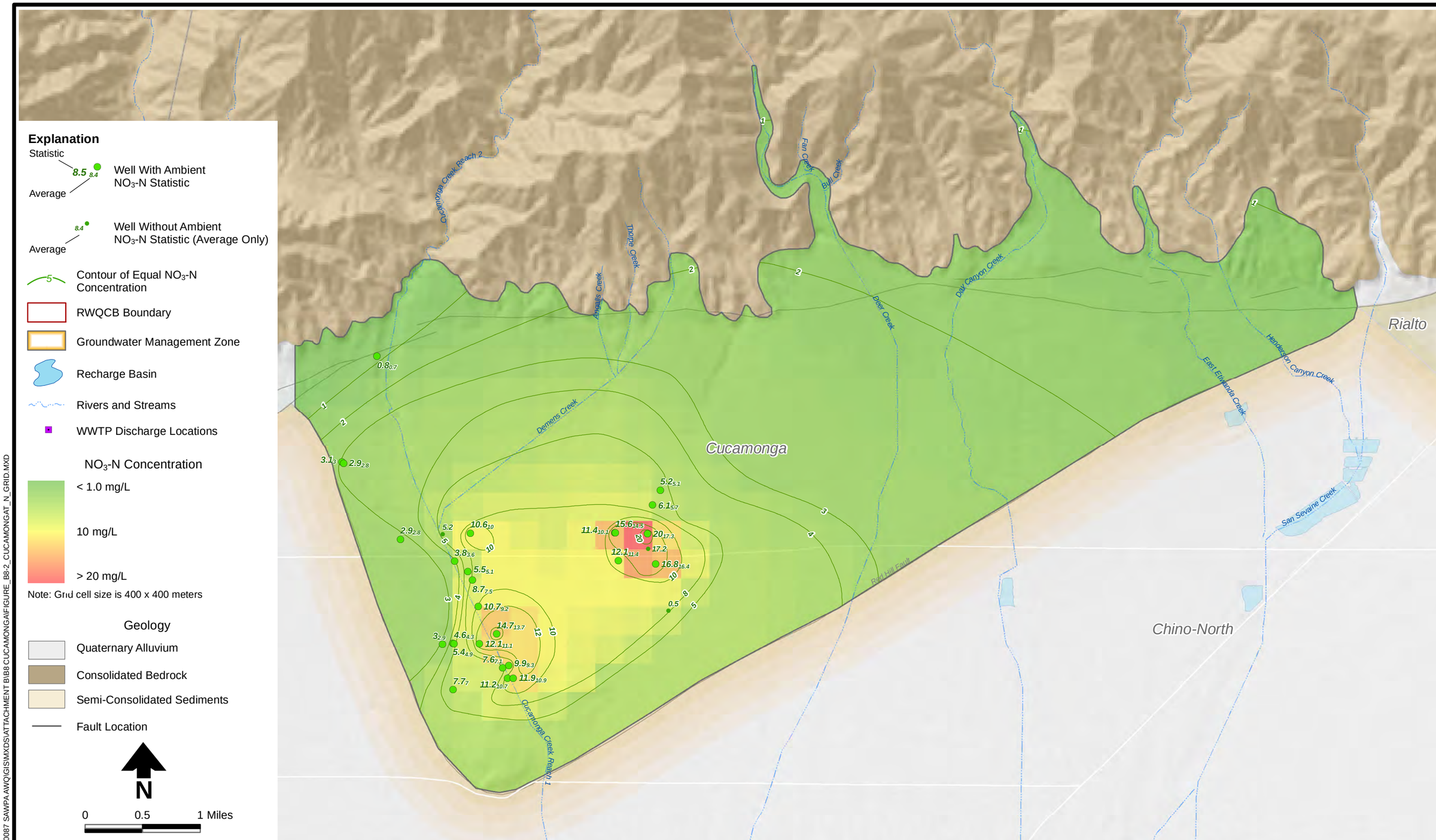
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Cucamonga GMZ

Attachment B8-1



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B8 CUCAMONGA\FIGURE_B8-2_CUCAMONGAT_N_GRID.MXD

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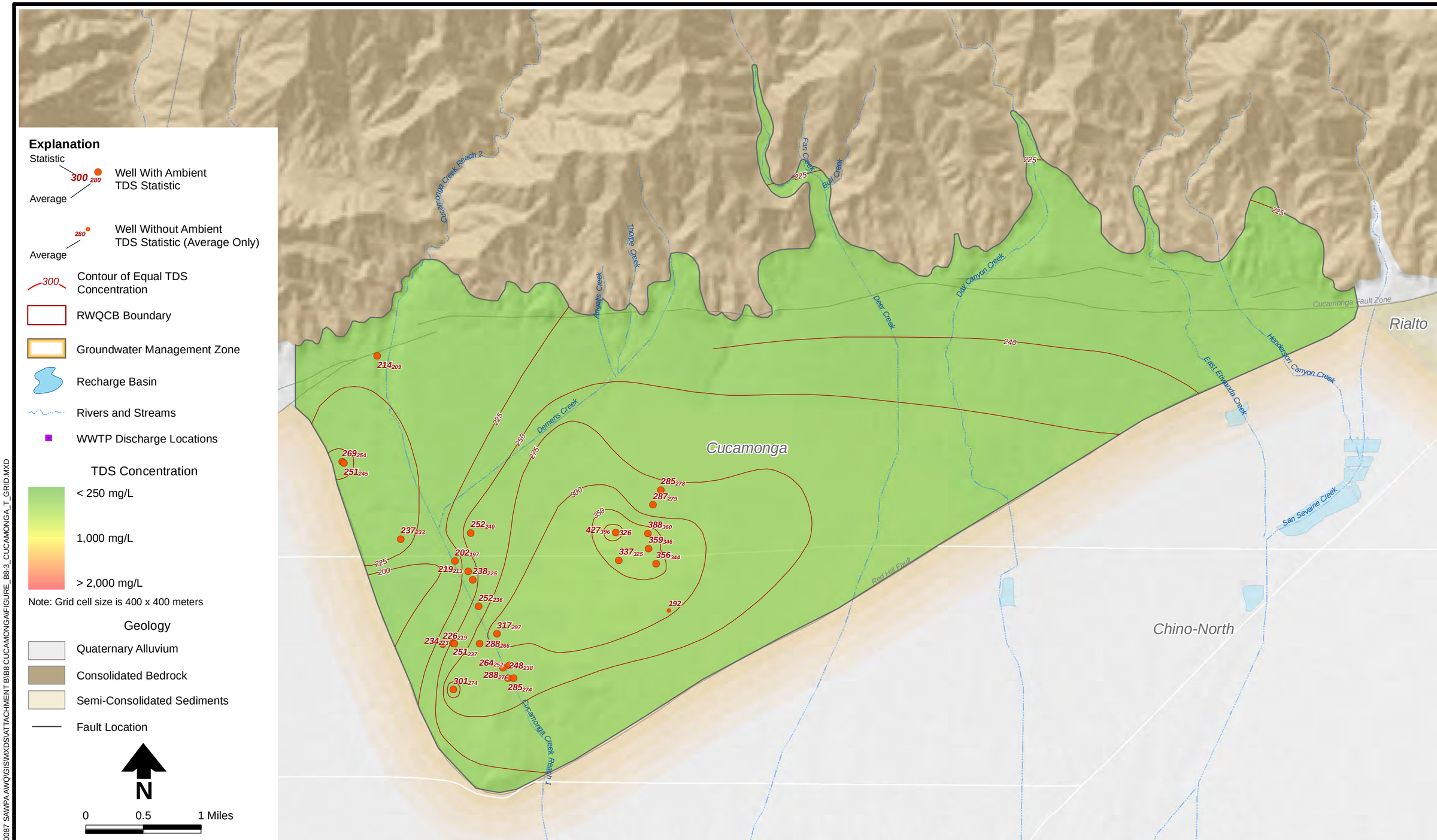
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Cucamonga GMZ

Attachment B8-2



AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Cucamonga GMZ

Attachment B8-3

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J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B8 CUCAMONGA\FIGURE_B8-3_CUCAMONGA_T_GRID.MXD

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

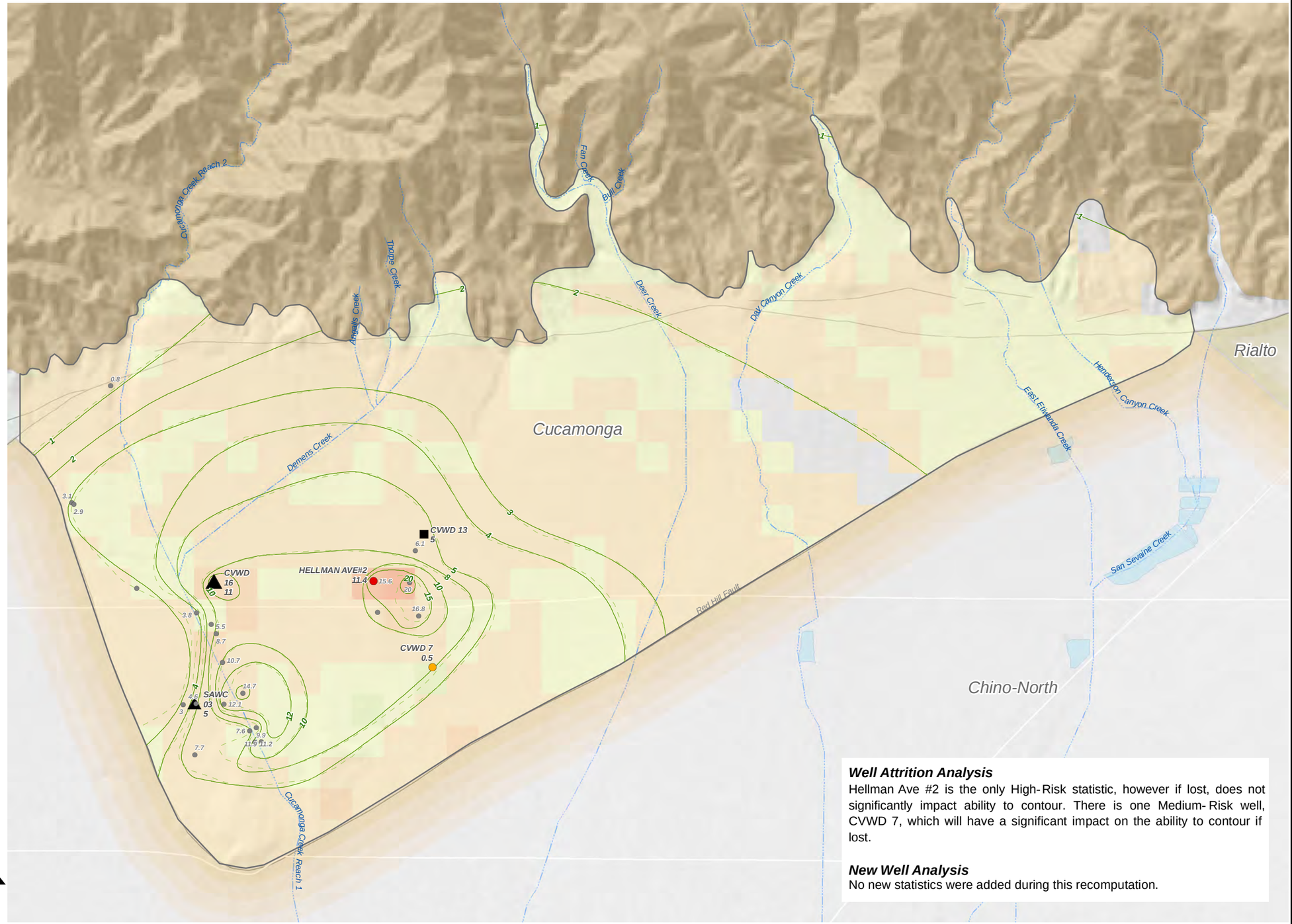
Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 0.5 1 Miles

N



Well Attrition Analysis

Hellman Ave #2 is the only High-Risk statistic, however if lost, does not significantly impact ability to contour. There is one Medium-Risk well, CVWD 7, which will have a significant impact on the ability to contour if lost.

New Well Analysis

No new statistics were added during this recomputation.

Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Cucamonga GMZ

Attachment B8-4

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B8 CUCAMONGA\FIGURE_B8-4_CUCAMONGA_N_CHANGE.MXD

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 1993-2012 TDS Contours
- 300 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

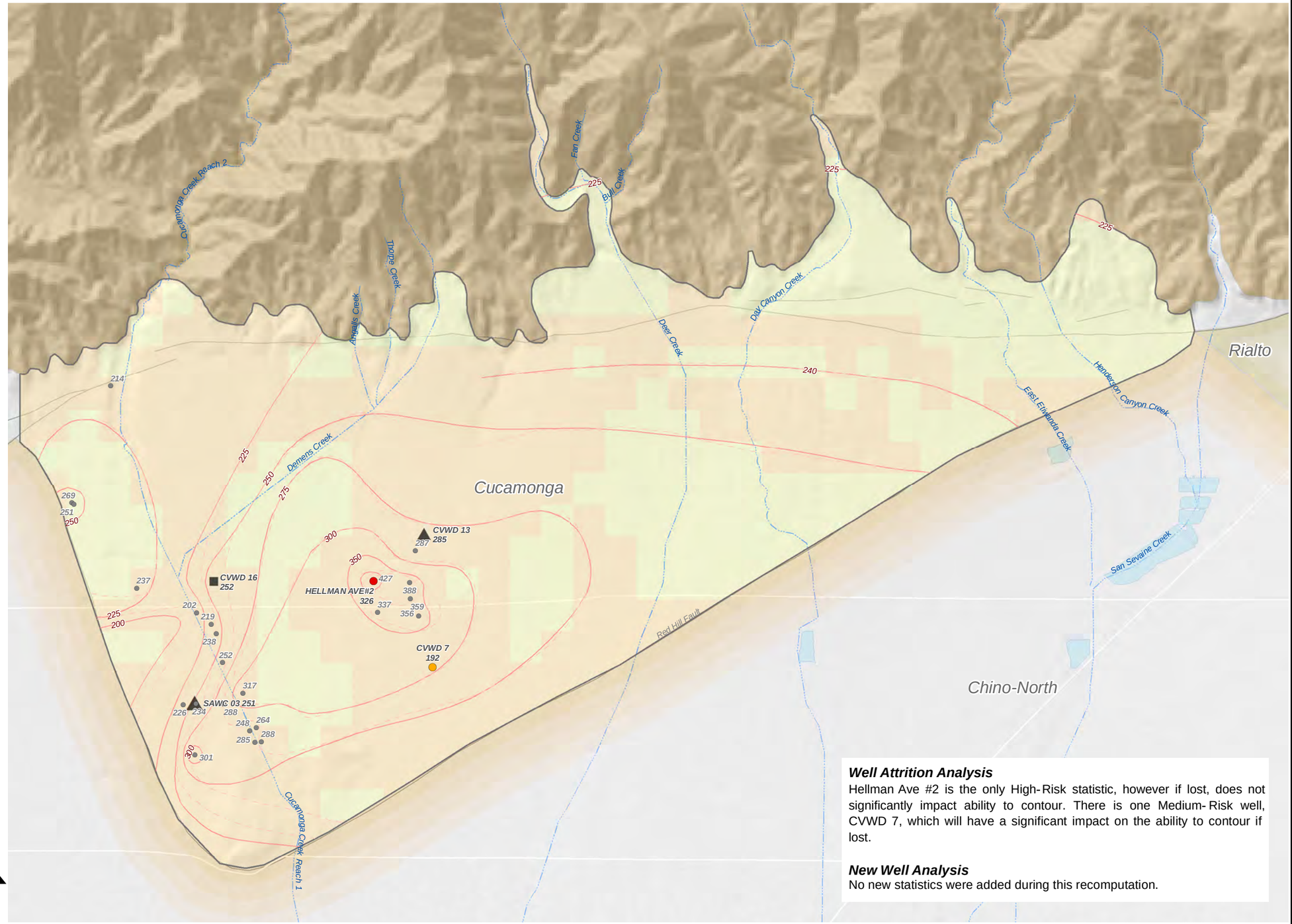
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 0.5 1 Miles

N

Source: SAWPA.net, January 2017



Well Attrition Analysis

Hellman Ave #2 is the only High-Risk statistic, however if lost, does not significantly impact ability to contour. There is one Medium-Risk well, CVWD 7, which will have a significant impact on the ability to contour if lost.

New Well Analysis

No new statistics were added during this recomputation.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B8 CUCAMONGA\FIGURE_B8-5_CUCAMONGA_T_CHANGE.MXD

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Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Cucamonga GMZ

Attachment B8-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

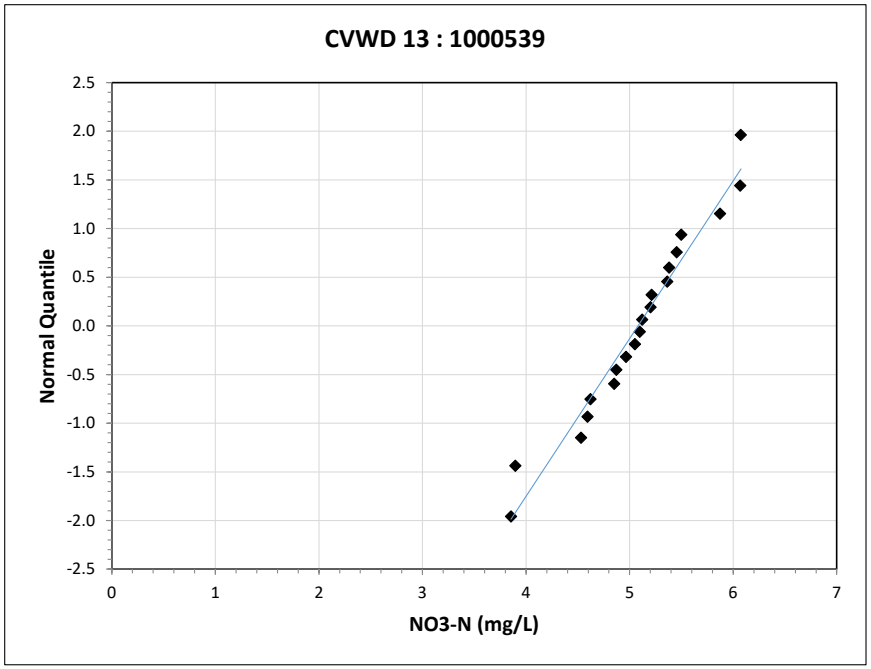
Mann-Kendall

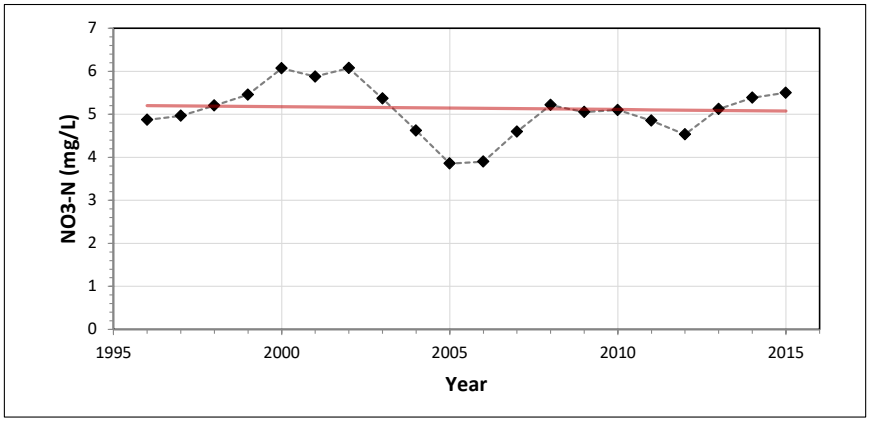
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

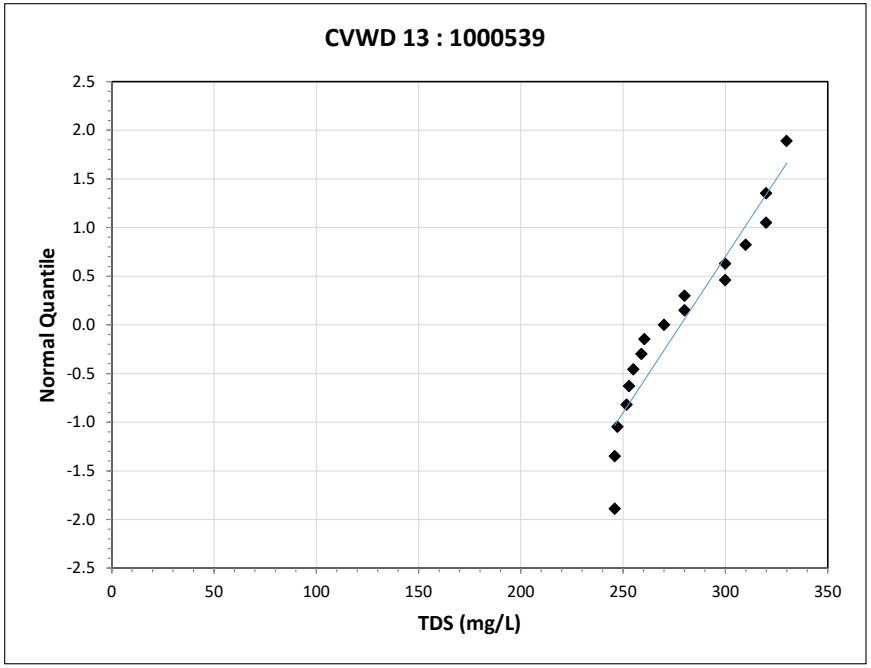
The significance of the trends is notated by * for significant and ** for very significant.

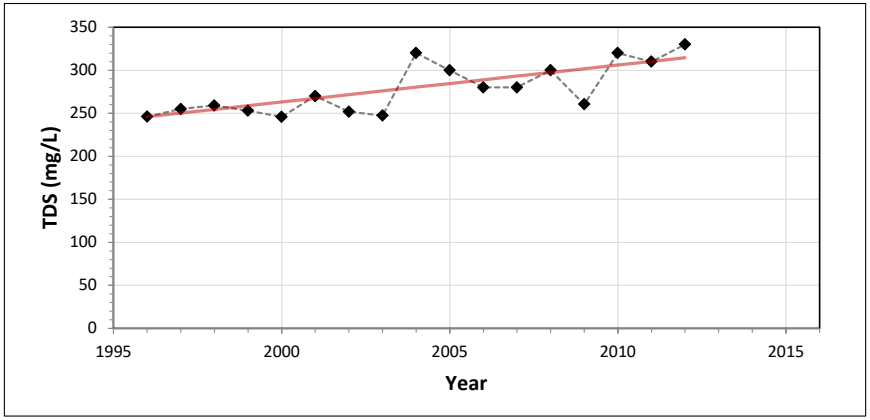
Statistics	
GMZ	Cucamonga
Well Name : ID	CVWD 13 : 1000539
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.86
Annual Average Max	6.07
Annual Average Mean	5.08
Annual Average Stdev	0.60
Shapiro-Wilk W	0.958
Shapiro-Wilk p-value	0.509
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.13
Student t	1.02
Mean + t*SE (UCL84)	5.22
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-6
Var(S)	950
Intercept	18.59
Slope	-0.01
p-value	0.871
Significant Trend?	No



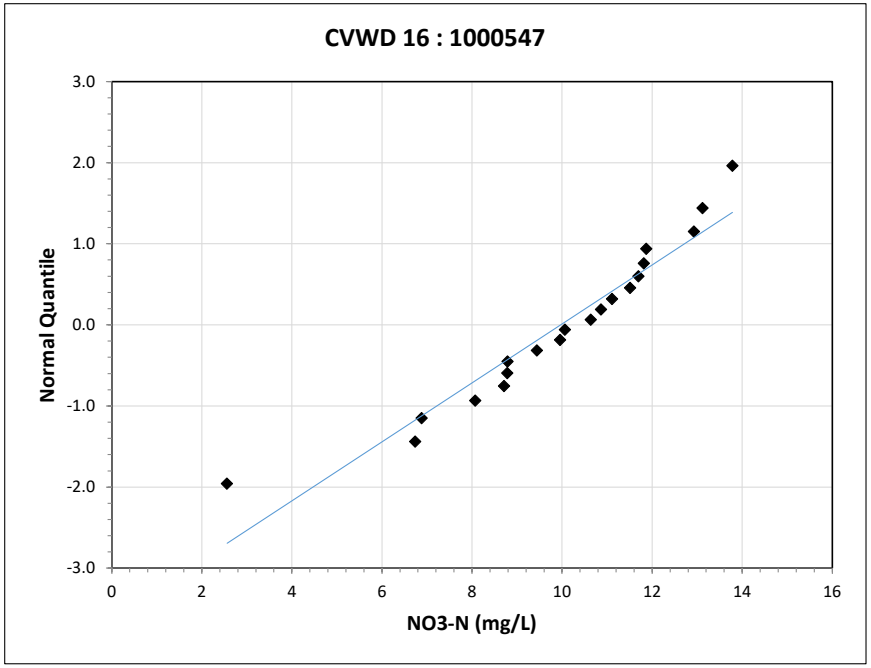


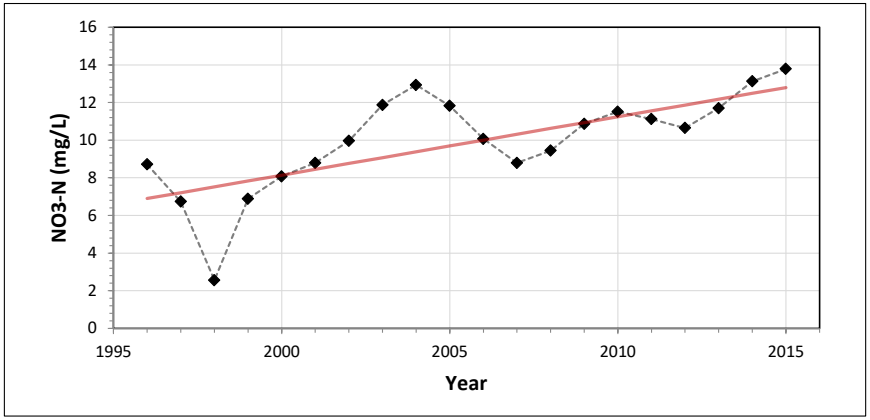
Statistics	
GMZ	Cucamonga
Well Name : ID	CVWD 13 : 1000539
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	246
Annual Average Max	330
Annual Average Mean	278
Annual Average Stdev	29.37
Shapiro-Wilk W	0.883
Shapiro-Wilk p-value	0.036
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.12
Student t	1.03
Mean + t*SE (UCL84)	285
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	75
Var(S)	586
Intercept	-8308
Slope	4.29
p-value	0.002
Significant Trend?	Increasing*



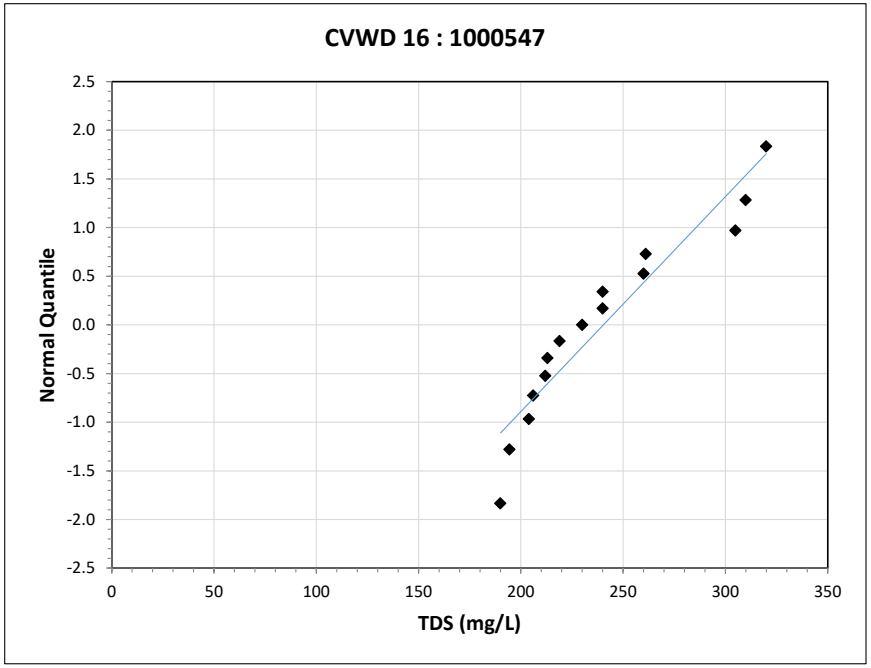


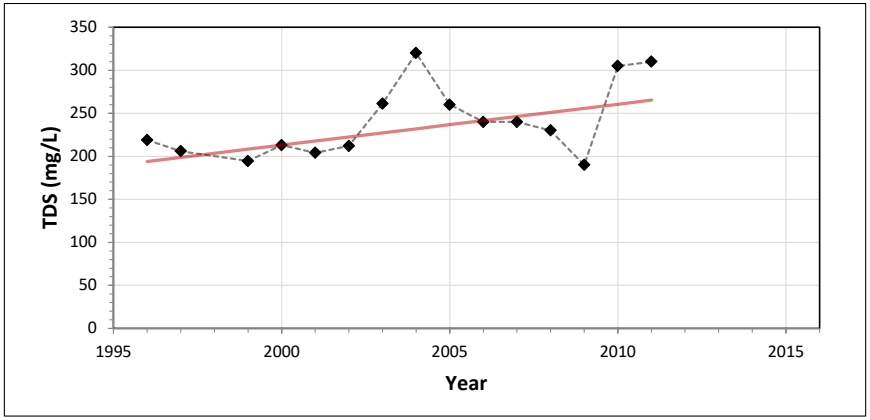
Statistics	
GMZ	Cucamonga
Well Name : ID	CVWD 16 : 1000547
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.56
Annual Average Max	13.78
Annual Average Mean	9.97
Annual Average Stdev	2.63
Shapiro-Wilk W	0.931
Shapiro-Wilk p-value	0.161
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.59
Student t	1.02
Mean + t*SE (UCL84)	10.57
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	110
Var(S)	950
Intercept	-612
Slope	0.31
p-value	4E-4
Significant Trend?	Increasing**



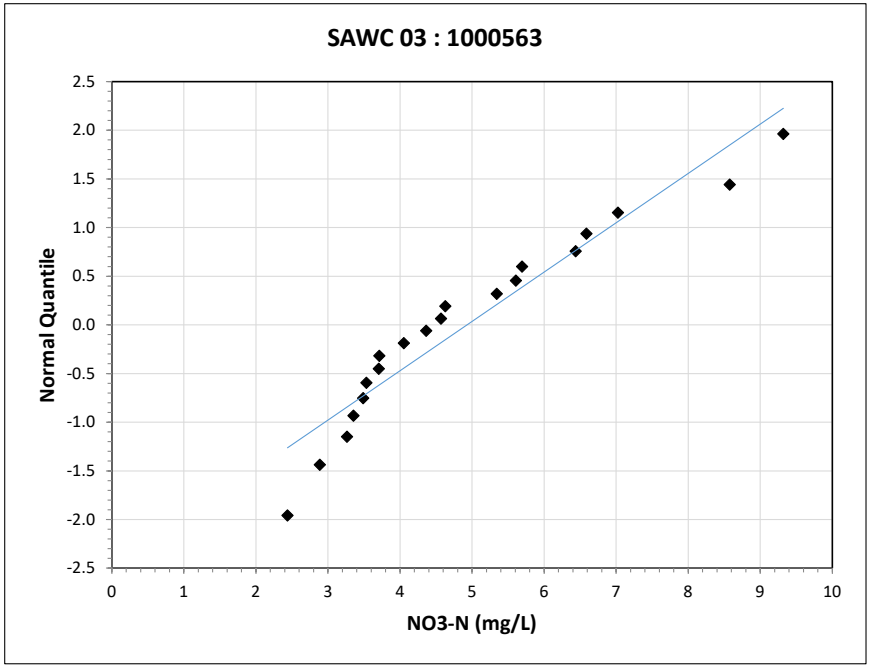


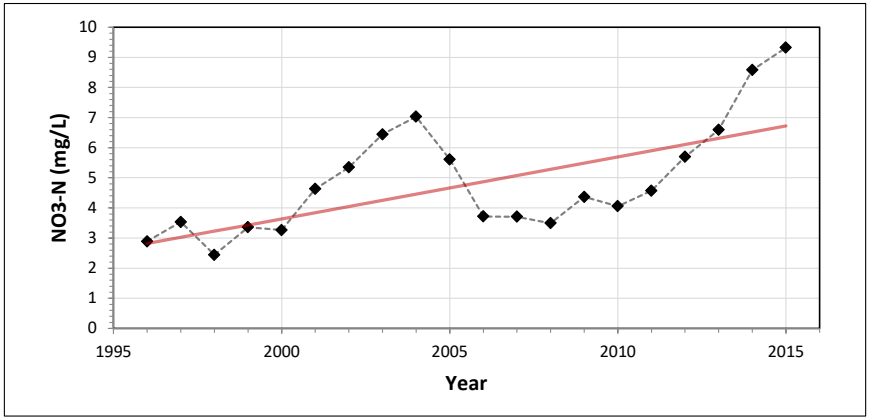
Statistics	
GMZ	Cucamonga
Well Name : ID	CVWD 16 : 1000547
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2011
Annual Average Min	190
Annual Average Max	320
Annual Average Mean	240
Annual Average Stdev	42.63
Shapiro-Wilk W	0.890
Shapiro-Wilk p-value	0.066
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.01
Student t	1.03
Mean + t*SE (UCL84)	252
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	32
Var(S)	407
Intercept	-9287
Slope	4.75
p-value	0.125
Significant Trend?	No



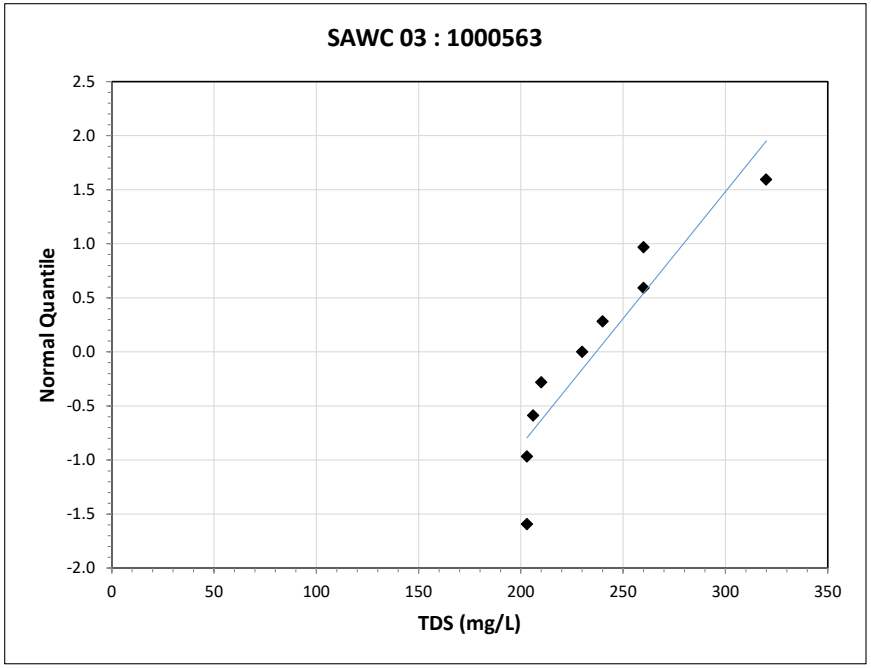


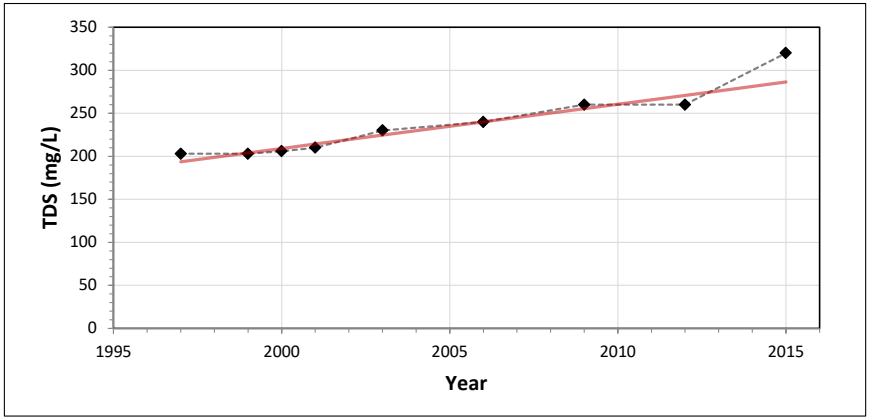
Statistics	
GMZ	Cucamonga
Well Name : ID	SAWC 03 : 1000563
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.44
Annual Average Max	9.32
Annual Average Mean	4.93
Annual Average Stdev	1.88
Shapiro-Wilk W	0.917
Shapiro-Wilk p-value	0.085
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.42
Student t	1.02
Mean + t*SE (UCL84)	5.36
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	100
Var(S)	950
Intercept	-407
Slope	0.21
p-value	0.001
Significant Trend?	Increasing*





Statistics	
GMZ	Cucamonga
Well Name : ID	SAWC 03 : 1000563
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	203
Annual Average Max	320
Annual Average Mean	237
Annual Average Stdev	38.74
Shapiro-Wilk W	0.848
Shapiro-Wilk p-value	0.071
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.91
Student t	1.06
Mean + t*SE (UCL84)	251
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	34
Var(S)	90.00
Intercept	-10077
Slope	5.14
p-value	5E-4
Significant Trend?	Increasing**





Attachment B9

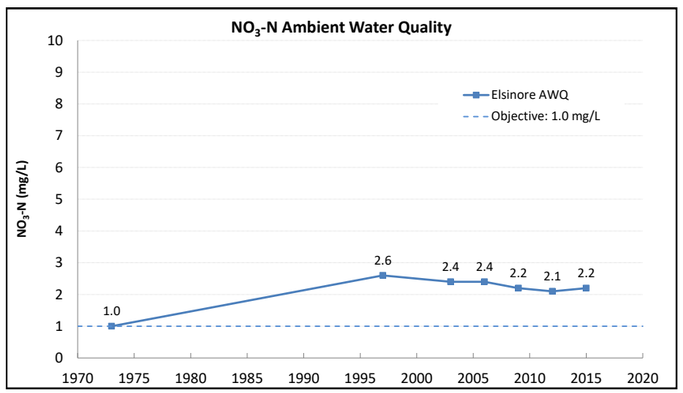
Elsinore GMZ

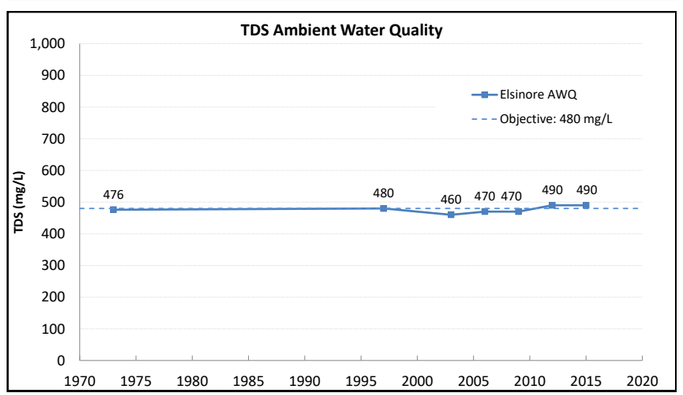
Attachment Contents:

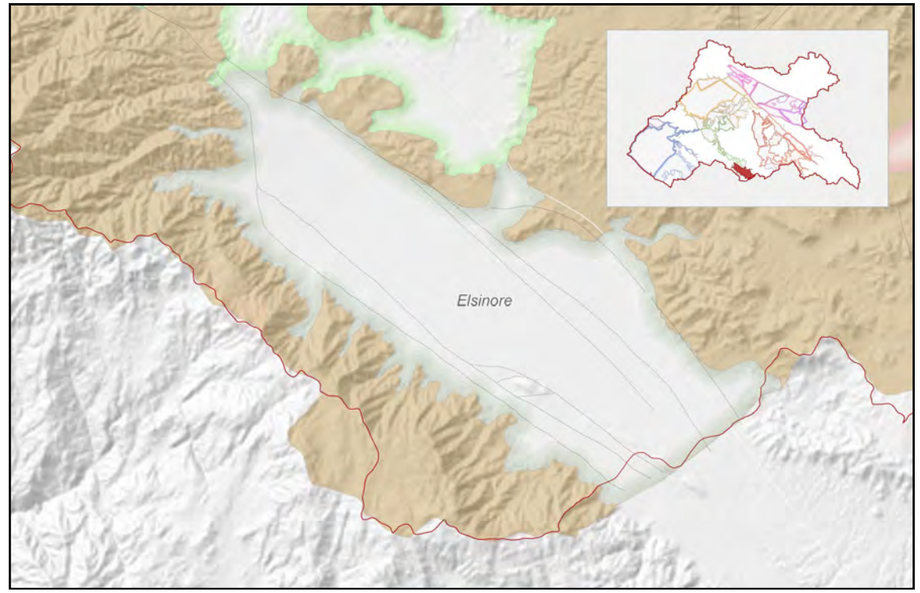
B9-1 Groundwater Storage and Elevation Contours Fall 2015
B9-2 NO_3-N Concentration and Contour Map
B9-3 TDS Concentration and Contour Map
B9-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B9-5 TDS Concentration Change (1993-2012 to 1996-2015)
B9-6 Key Well Analysis Charts

	Basin Analytics	Elsinore
Basin	GMZ Area (acres)	15,000
	Volume of Storage (acre-ft)	548,000
NO_3-N	Wells per GMZ	16
	Point Statistics per GMZ	10
	Total Mass (tons)	1,640
	1996-2015 AWQ	2.2
TDS	Wells per GMZ	16
	Point Statistics per GMZ	12
	Total Mass (tons)	364,000
	1996-2015 AWQ	490

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Elsinore is 1.0 mg/L. The ambient nitrate concentration increased from 2.1 mg/L in 2012 to 2.2mg/L in 2015, and there is no assimilative capacity. One out of the five key wells in Elsinore GMZ have an increasing trend in nitrate concentrations, two key wells show a decreasing trend, and the other two show no trends in the nitrate concentrations. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

The TDS objective for Elsinore is 480 mg/L. The ambient TDS concentration was unchanged from 490 mg/L in 2012 to 490 mg/L in 2015, and there is no assimilative capacity. Two out of the five key interpretive wells in Elsinore GMZ show an increasing trend while the other three show no trends in TDS concentrations. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Elsinore	1005913	CEREAL STREET 3	0.1	Increasing*	343	No Trend
Elsinore	1005914	CEREAL STREET 4	0.1	No Trend	467	No Trend
Elsinore	1005916	EVMWD Cereal 1	1.2	No Trend	482	No Trend
Elsinore	1203675	EVMWD Corydon	1.4	Decreasing	324	Increasing
Elsinore	1208006	EVMWD Machado	4.7	Decreasing	542	Increasing**

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B9-4 and B9-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Elsinore	1005917	EVMWD Olive	Medium	4	2.2	Stat	Medium	4	289	Stat
Elsinore	1203646	EWD Fraiser	Medium	2	6.8	Ave	Medium	2	1,085	Ave
Elsinore	1203677	EWD Fraiser II	Medium	2	5.9	Ave	Medium	2	810	Ave
Elsinore	1232189	333753117174301	Medium	1	1.5	Ave	Medium	1	514	Ave
Elsinore	1232190	333844117190801	Medium	1	0.1	Ave	Medium	1	455	Ave
Elsinore	1232191	334037117224301	Medium	1	3.3	Ave	Medium	1	465	Ave

[1] number of years with samples [2]final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

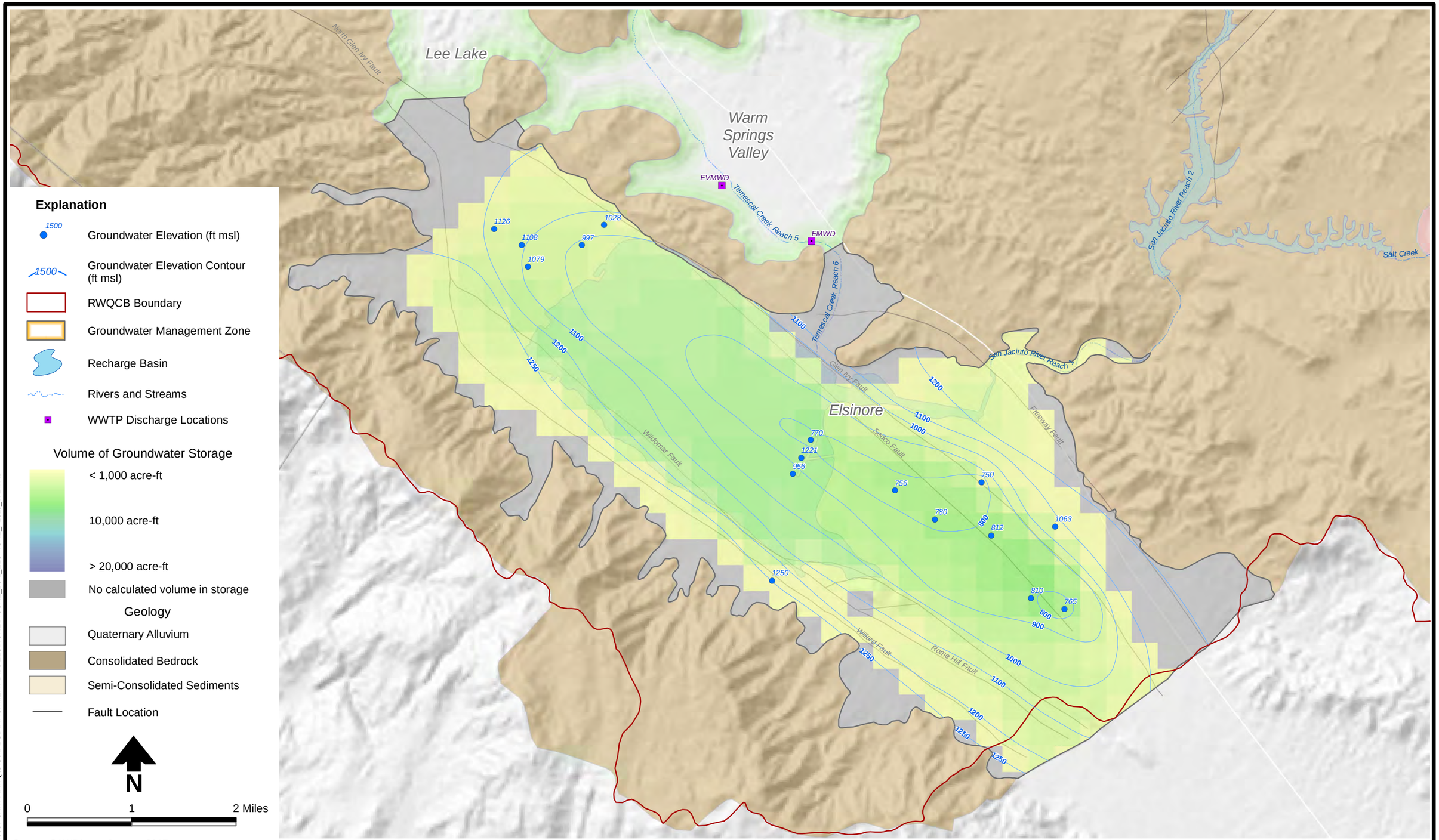
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B9-4 and B9-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Elsinore	1232310	Terra Cotta	New*	1	5.8	Ave	New*	2	461	Ave

[1] number of years with samples [2]final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B9-4 and B9-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B9 ELSINORE\FIGURE_B9-1_ELSINORE_F2015_WL.MXD

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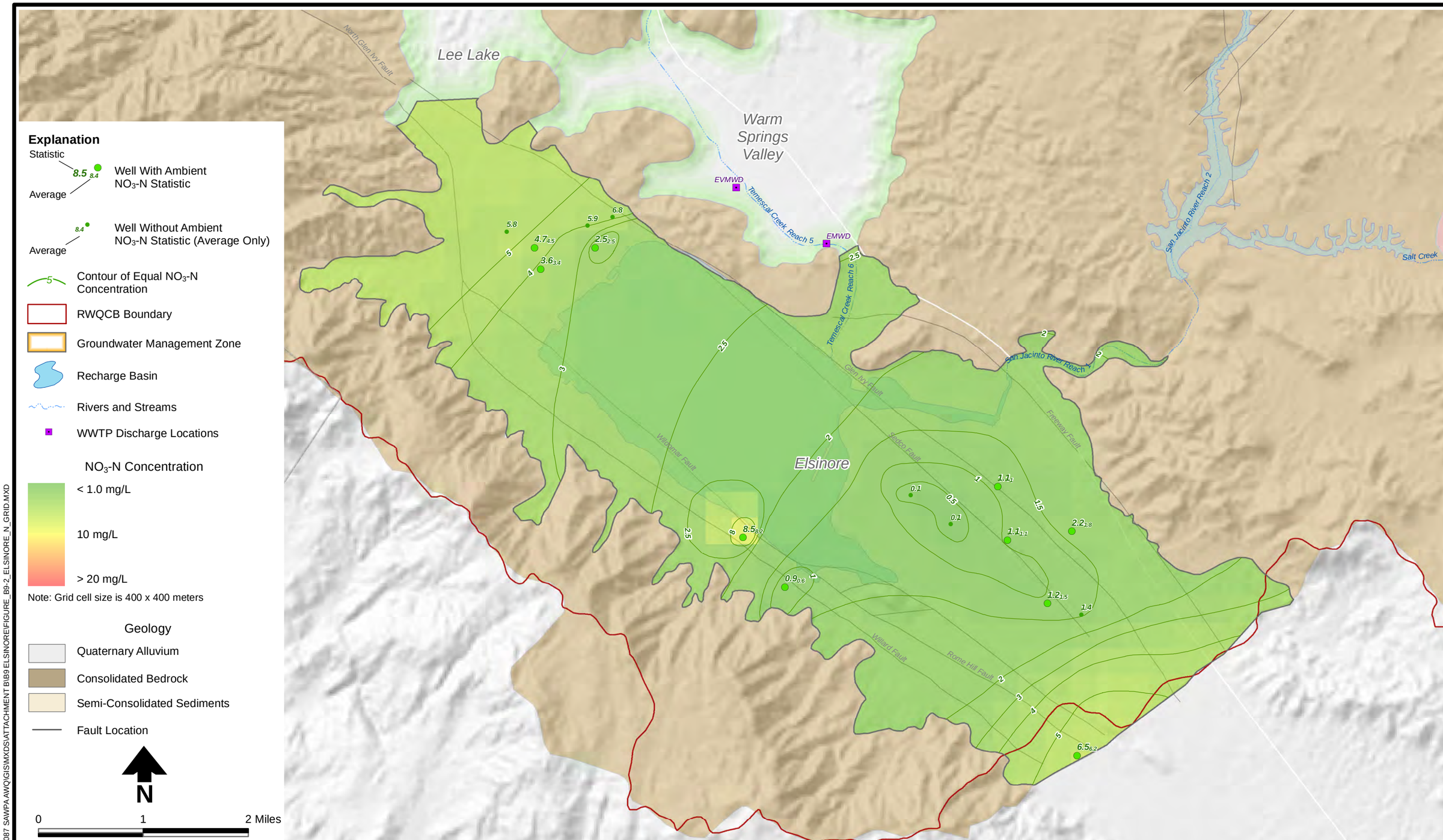
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Elsinore GMZ

Attachment B9-1



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B9 ELSINORE\FIGURE_B9-2_ELSINORE_N_GRID.MXD

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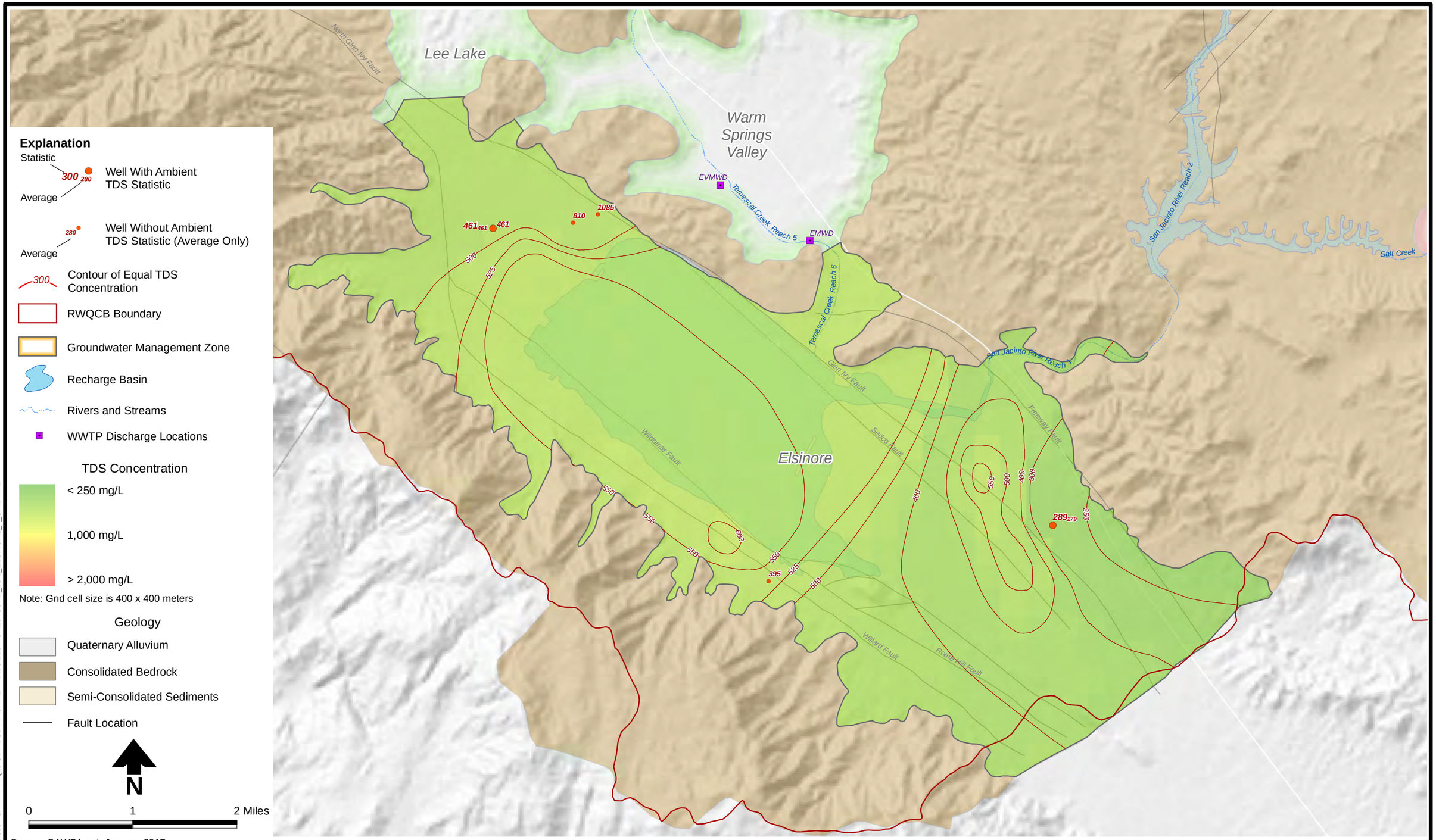
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Elsinore GMZ

Attachment B9-2



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B9 ELSINORE\FIGURE_B9-3_ELSINORE_T_GRID.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Elsinore GMZ

Attachment B9-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

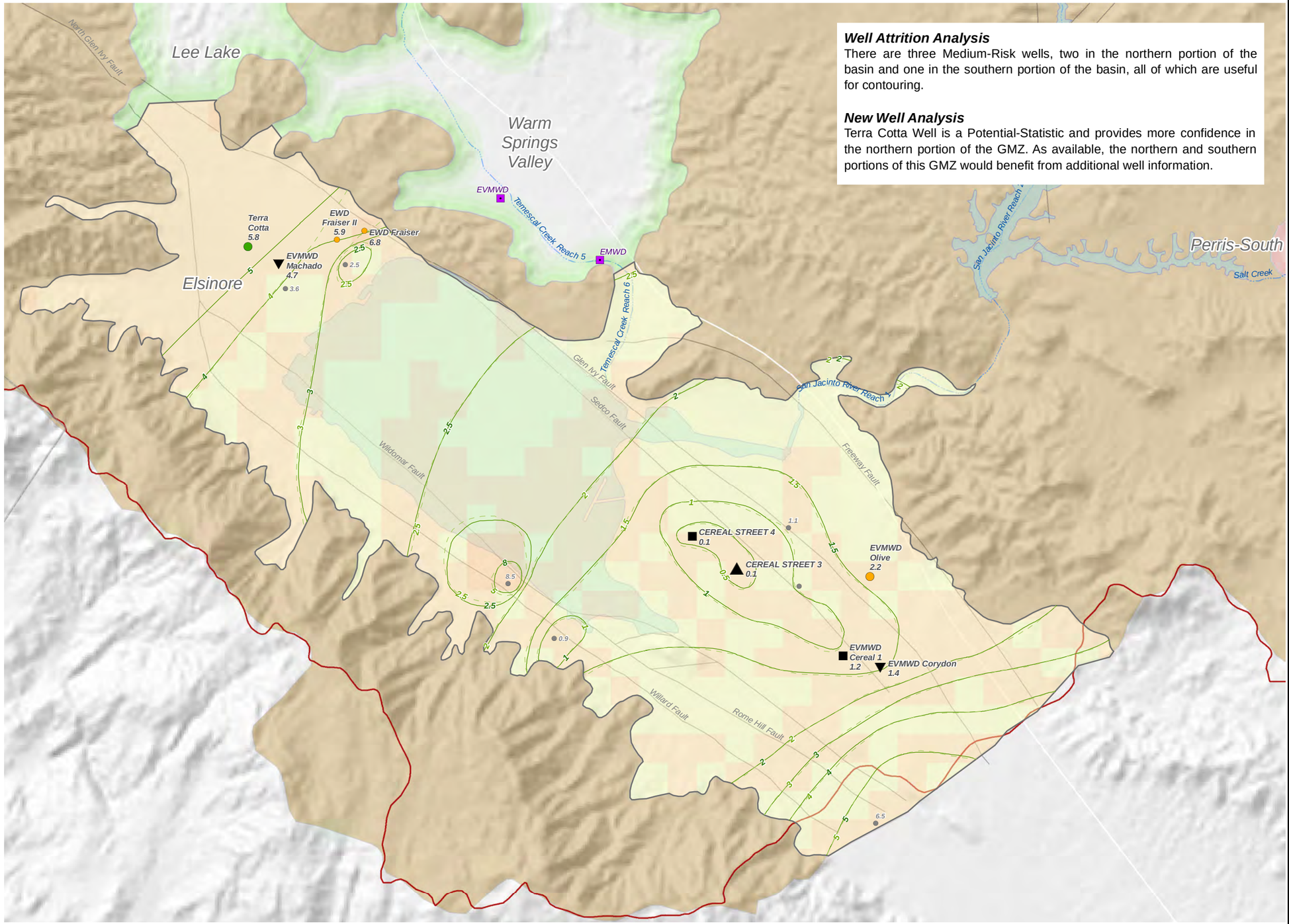
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are three Medium-Risk wells, two in the northern portion of the basin and one in the southern portion of the basin, all of which are useful for contouring.

New Well Analysis

Terra Cotta Well is a Potential-Statistic and provides more confidence in the northern portion of the GMZ. As available, the northern and southern portions of this GMZ would benefit from additional well information.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B9 ELSINORE\FIGURE_B9-4_ELSINORE_N_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Elsinore GMZ

Attachment B9-4

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 TDS Contours
- 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

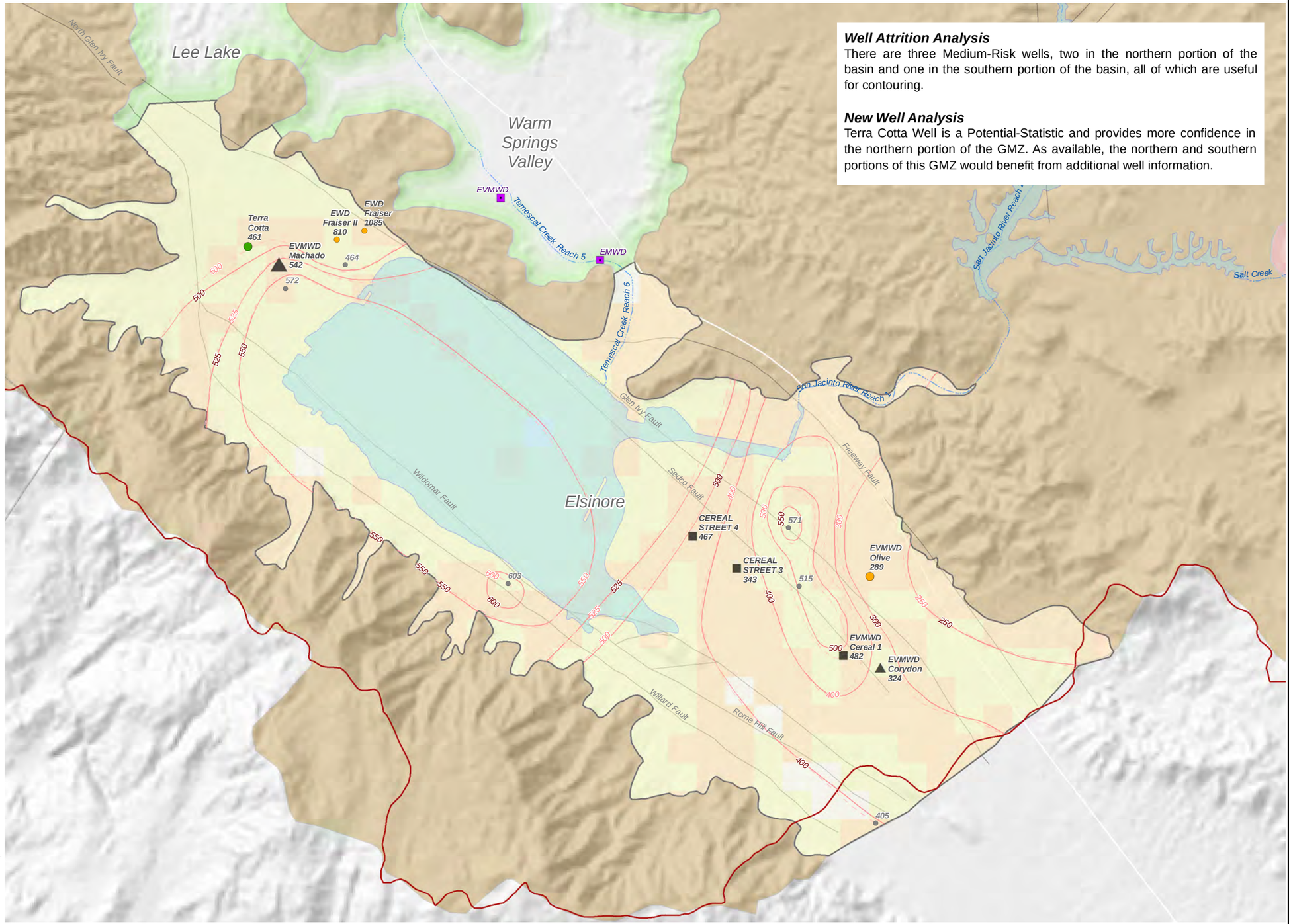
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are three Medium-Risk wells, two in the northern portion of the basin and one in the southern portion of the basin, all of which are useful for contouring.

New Well Analysis

Terra Cotta Well is a Potential-Statistic and provides more confidence in the northern portion of the GMZ. As available, the northern and southern portions of this GMZ would benefit from additional well information.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B9 ELSINORE\FIGURE_B9-5_ELSINORE_T_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Elsinore GMZ

Attachment B9-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

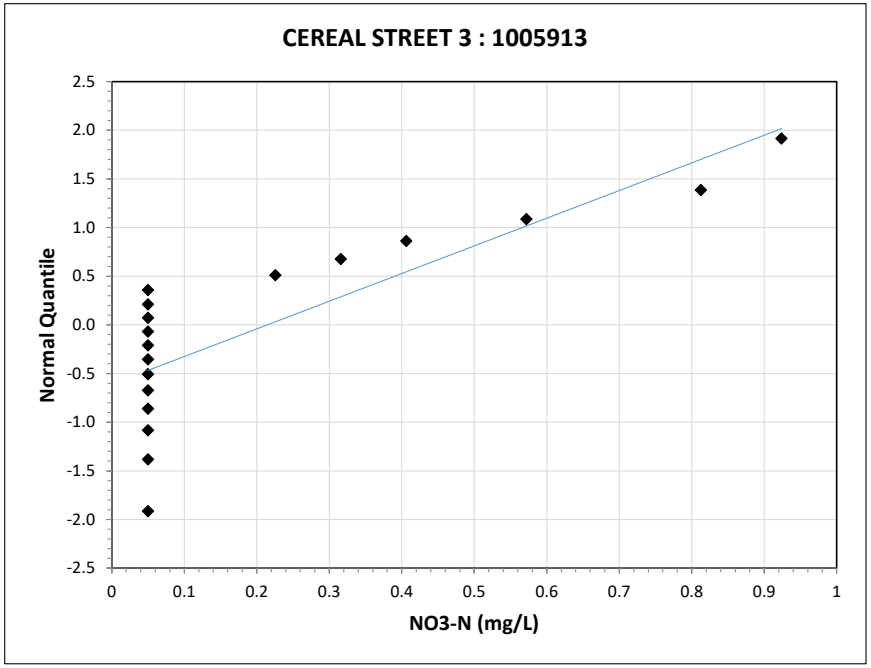
Mann-Kendall

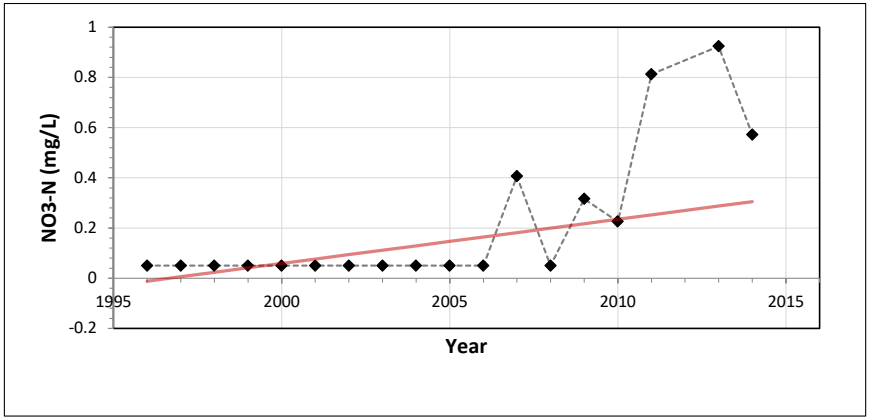
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

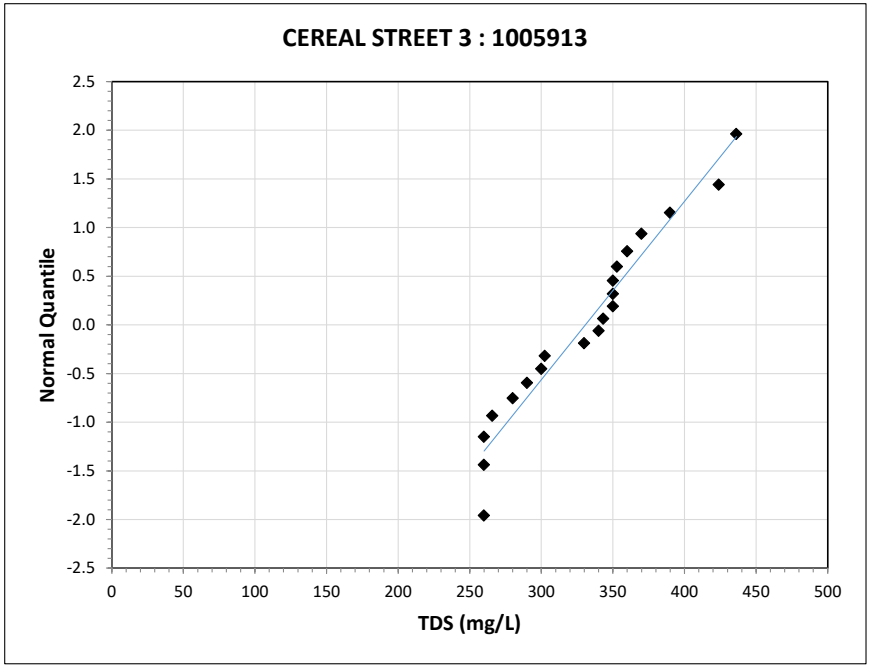
The significance of the trends is notated by * for significant and ** for very significant.

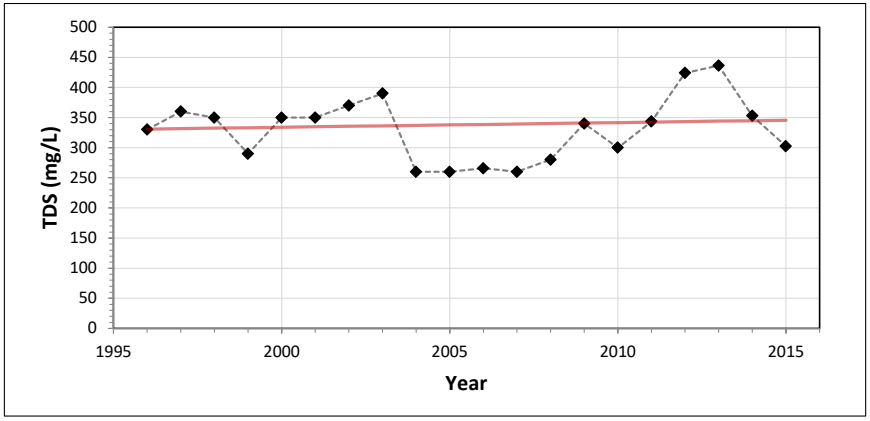
Statistics	
GMZ	Elsinore
Well Name : ID	CEREAL STREET 3 : 1005913
Analyte	NO3-N (mg/L)
Count	18
Count Detects	6
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.92
Annual Average Mean	0.21
Annual Average Stdev	0.28
Shapiro-Wilk W	0.655
Shapiro-Wilk p-value	2E-5
Critical Alpha	0.01
Most Discordant Value	0.92
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	4E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	66
Var(S)	532
Intercept	-35.10
Slope	0.02
p-value	0.005
Significant Trend?	Increasing*



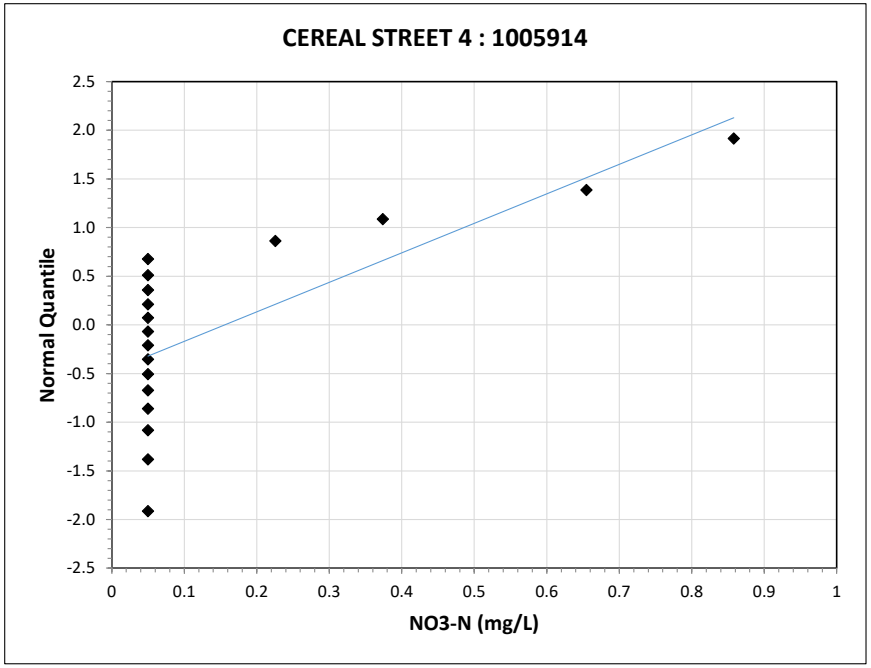


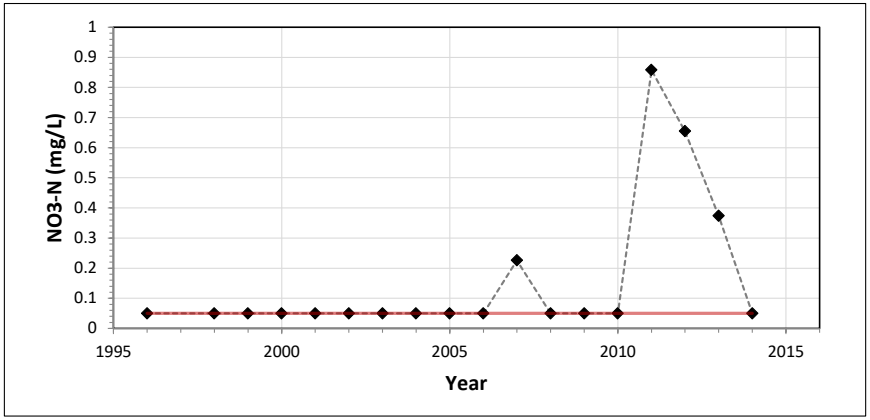
Statistics	
GMZ	Elsinore
Well Name : ID	CEREAL STREET 3 : 1005913
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	260
Annual Average Max	436
Annual Average Mean	331
Annual Average Stdev	52.72
Shapiro-Wilk W	0.937
Shapiro-Wilk p-value	0.207
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.79
Student t	1.02
Mean + t*SE (UCL84)	343
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	16
Var(S)	943
Intercept	-1217
Slope	0.78
p-value	0.625
Significant Trend?	No



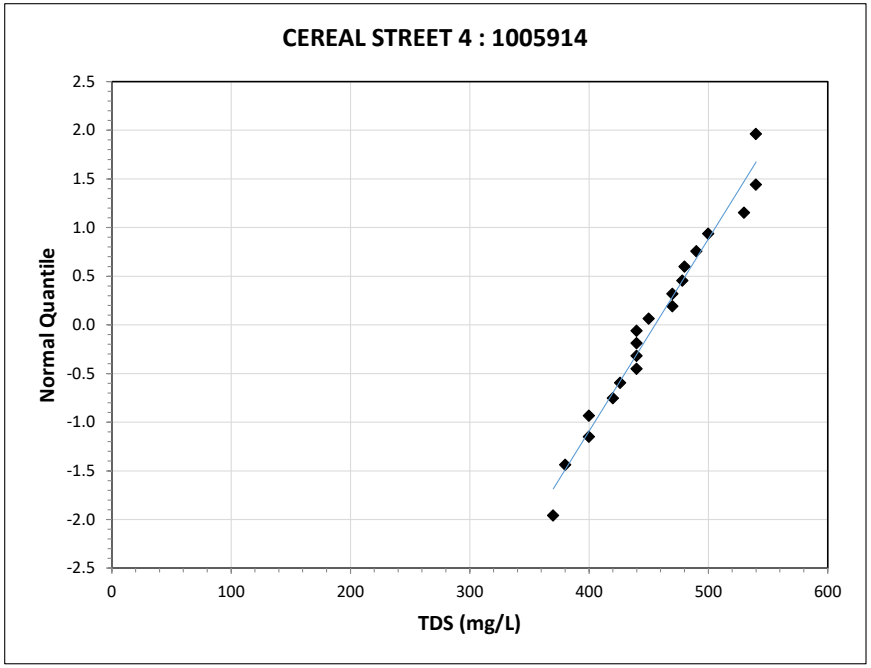


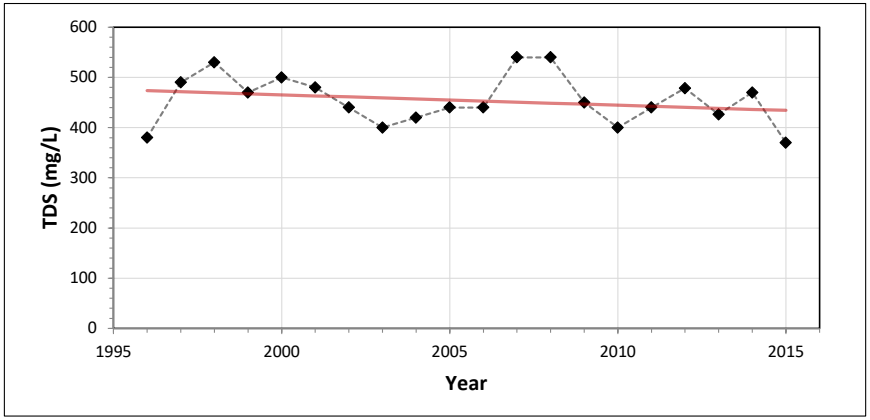
Statistics	
GMZ	Elsinore
Well Name : ID	CEREAL STREET 4 : 1005914
Analyte	NO3-N (mg/L)
Count	18
Count Detects	4
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.86
Annual Average Mean	0.16
Annual Average Stdev	0.24
Shapiro-Wilk W	0.530
Shapiro-Wilk p-value	1E-6
Critical Alpha	0.01
Most Discordant Value	0.86
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	3E-6
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	42
Var(S)	363
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



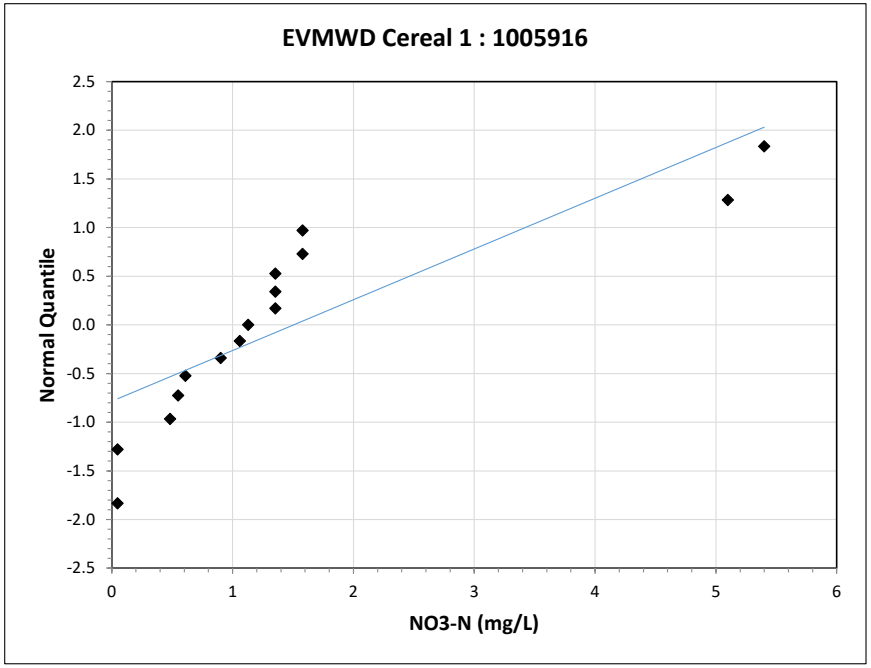


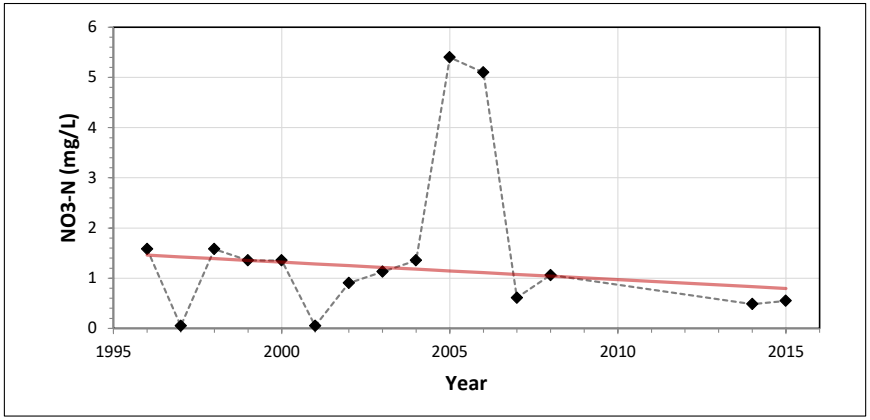
Statistics	
GMZ	Elsinore
Well Name : ID	CEREAL STREET 4 : 1005914
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	370
Annual Average Max	540
Annual Average Mean	455
Annual Average Stdev	49.64
Shapiro-Wilk W	0.964
Shapiro-Wilk p-value	0.625
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.10
Student t	1.02
Mean + t*SE (UCL84)	467
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-29
Var(S)	938
Intercept	4608
Slope	-2.07
p-value	0.361
Significant Trend?	No



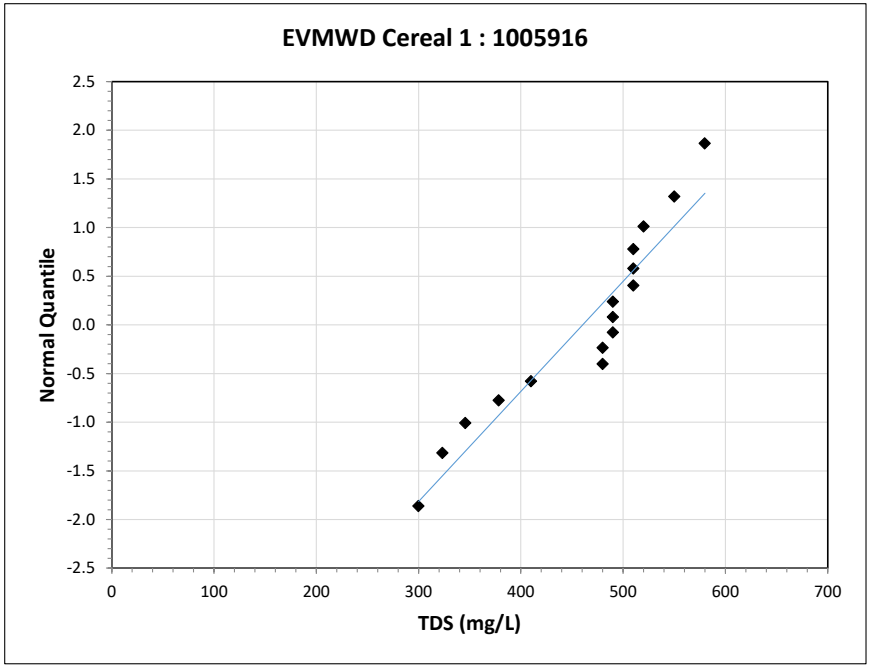


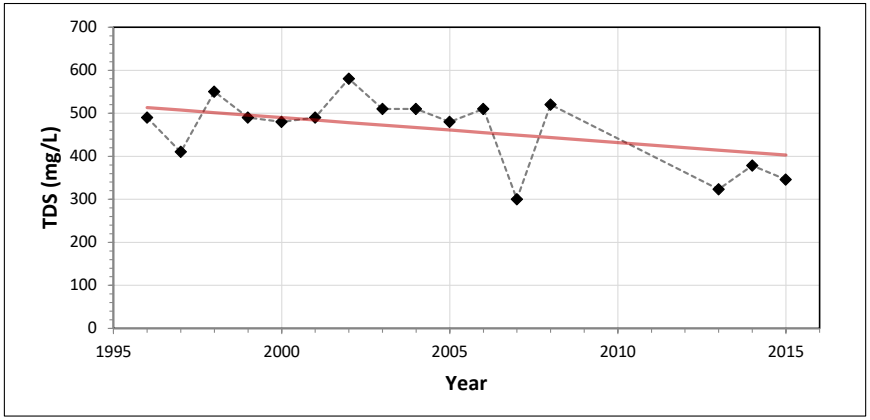
Statistics	
GMZ	Elsinore
Well Name : ID	EVMWD Cereal 1 : 1005916
Analyte	NO3-N (mg/L)
Count	15
Count Detects	13
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	5.40
Annual Average Mean	1.50
Annual Average Stdev	1.60
Shapiro-Wilk W	0.710
Shapiro-Wilk p-value	3E-4
Critical Alpha	0.01
Most Discordant Value	5.40
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.03
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.016
Geomean	0.84
GM + t*GSE (UCL84)	1.20
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-18
Var(S)	403
Intercept	71.24
Slope	-0.03
p-value	0.397
Significant Trend?	No



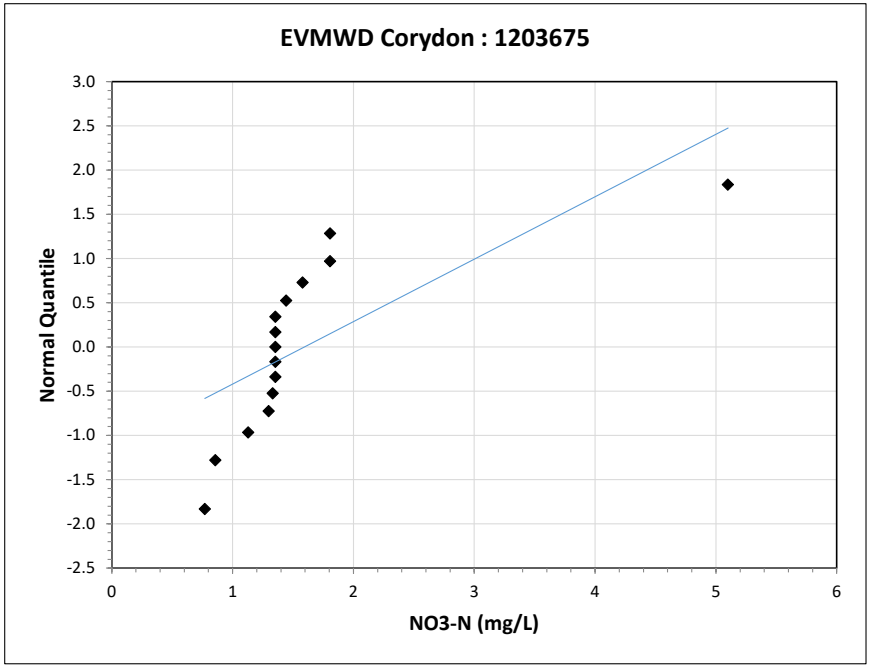


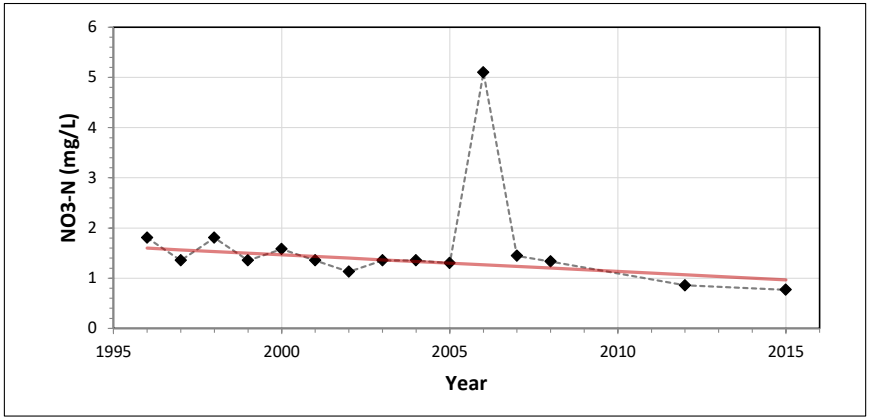
Statistics	
GMZ	Elsinore
Well Name : ID	EVMWD Cereal 1 : 1005916
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	300
Annual Average Max	580
Annual Average Mean	460
Annual Average Stdev	83.10
Shapiro-Wilk W	0.890
Shapiro-Wilk p-value	0.056
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	20.77
Student t	1.03
Mean + t*SE (UCL84)	482
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-25
Var(S)	485
Intercept	12110
Slope	-5.81
p-value	0.276
Significant Trend?	No



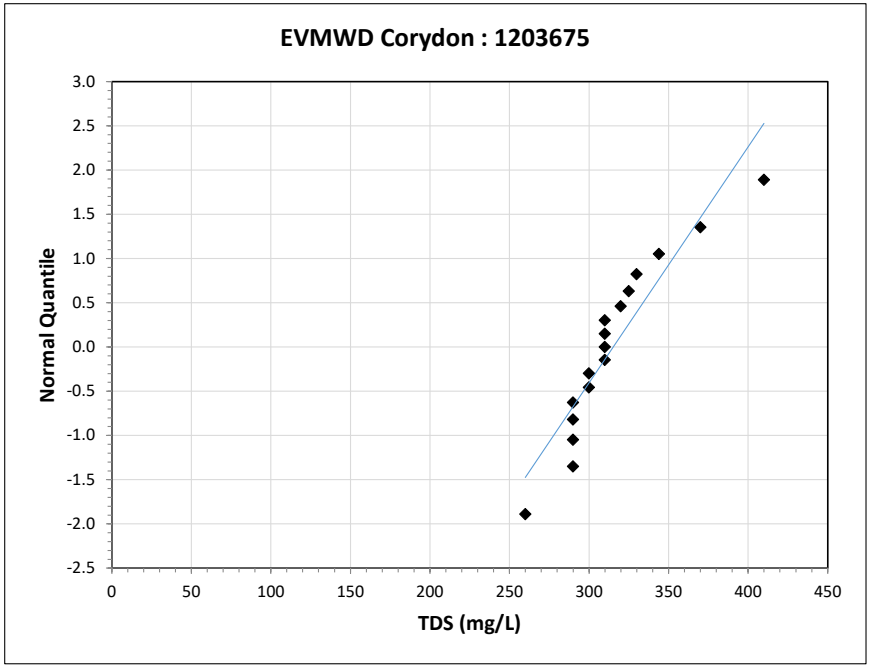


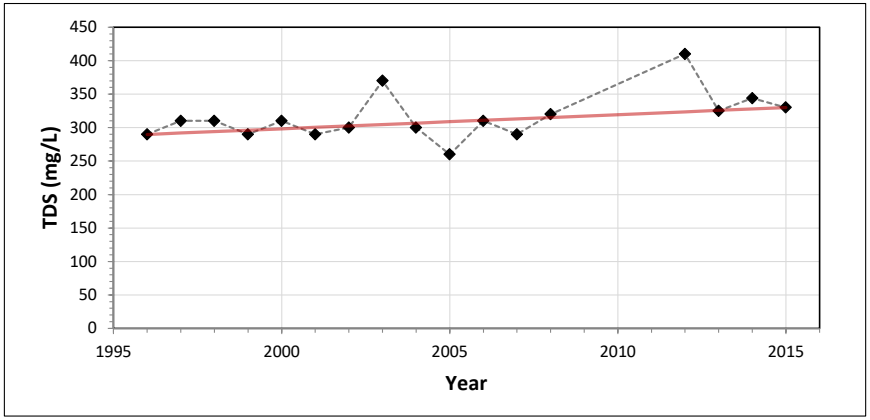
Statistics	
GMZ	Elsinore
Well Name : ID	EVMWD Corydon : 1203675
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.77
Annual Average Max	5.10
Annual Average Mean	1.59
Annual Average Stdev	1.01
Shapiro-Wilk W	0.541
Shapiro-Wilk p-value	8E-6
Critical Alpha	0.01
Most Discordant Value	5.10
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	1.36
Trend Analysis	**Theil-Sen**
Kendall S	-44
Var(S)	391
Intercept	67.77
Slope	-0.03
p-value	0.030
Significant Trend?	Decreasing



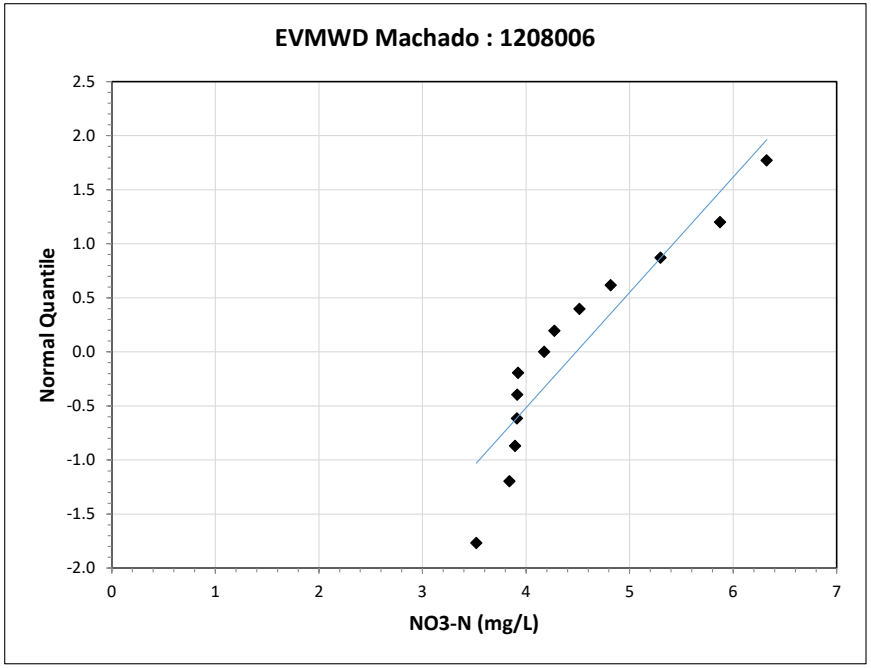


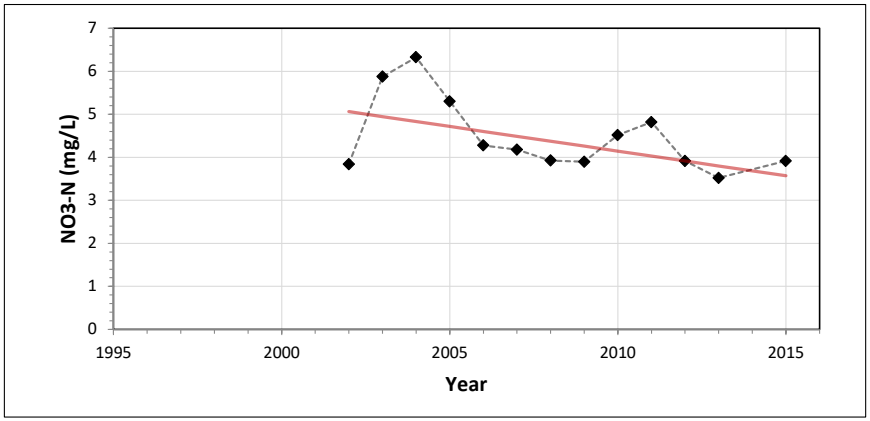
Statistics	
GMZ	Elsinore
Well Name : ID	EVMWD Corydon : 1203675
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	260
Annual Average Max	410
Annual Average Mean	315
Annual Average Stdev	34.74
Shapiro-Wilk W	0.884
Shapiro-Wilk p-value	0.037
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.43
Student t	1.03
Mean + t*SE (UCL84)	324
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	49
Var(S)	571
Intercept	-3932
Slope	2.12
p-value	0.045
Significant Trend?	Increasing



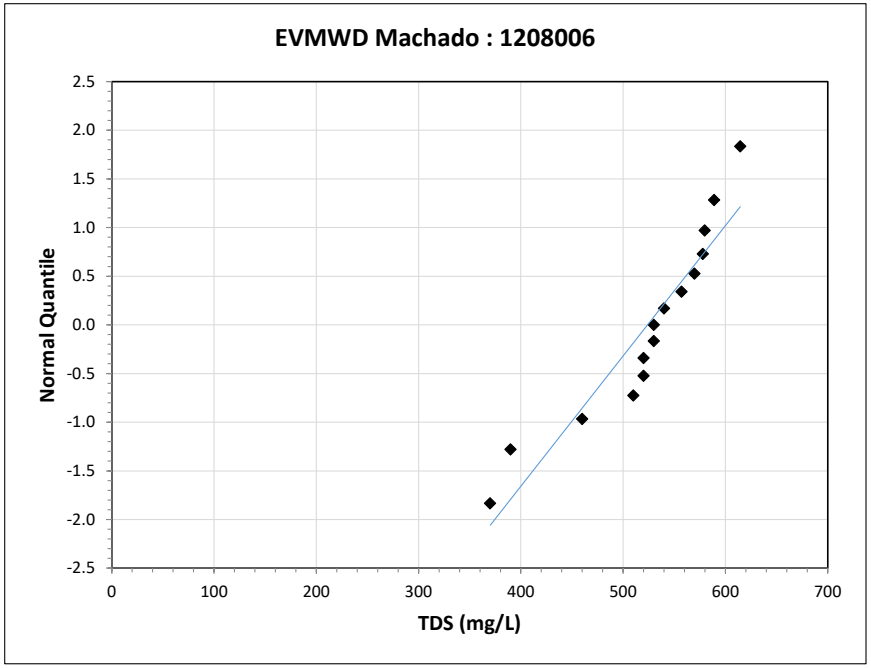


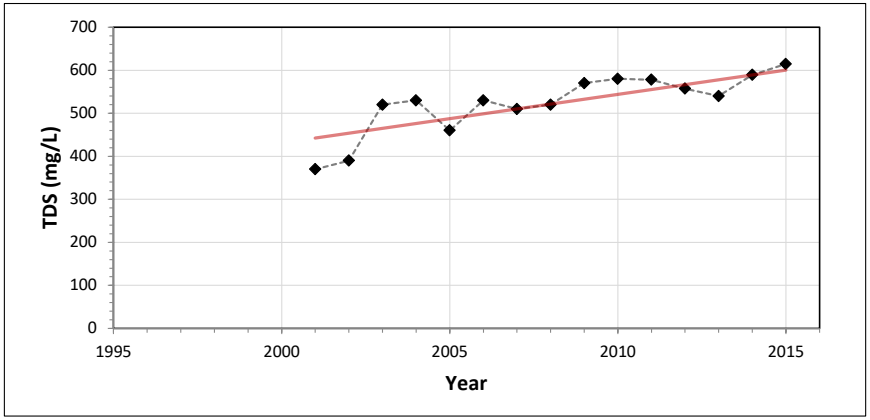
Statistics	
GMZ	Elsinore
Well Name : ID	EVMWD Machado : 1208006
Analyte	NO3-N (mg/L)
Count	13
Count Detects	13
Sample Year Min	2002
Sample Year Max	2015
Annual Average Min	3.52
Annual Average Max	6.33
Annual Average Mean	4.48
Annual Average Stdev	0.86
Shapiro-Wilk W	0.855
Shapiro-Wilk p-value	0.033
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.24
Student t	1.04
Mean + t*SE (UCL84)	4.73
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-28
Var(S)	269
Intercept	235
Slope	-0.11
p-value	0.100
Significant Trend?	Decreasing





Statistics	
GMZ	Elsinore
Well Name : ID	EVMWD Machado : 1208006
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	2001
Sample Year Max	2015
Annual Average Min	370
Annual Average Max	615
Annual Average Mean	524
Annual Average Stdev	69.72
Shapiro-Wilk W	0.882
Shapiro-Wilk p-value	0.051
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	18.00
Student t	1.03
Mean + t*SE (UCL84)	542
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	73
Var(S)	406
Intercept	-22188
Slope	11.31
p-value	4E-4
Significant Trend?	Increasing**





Attachment B10

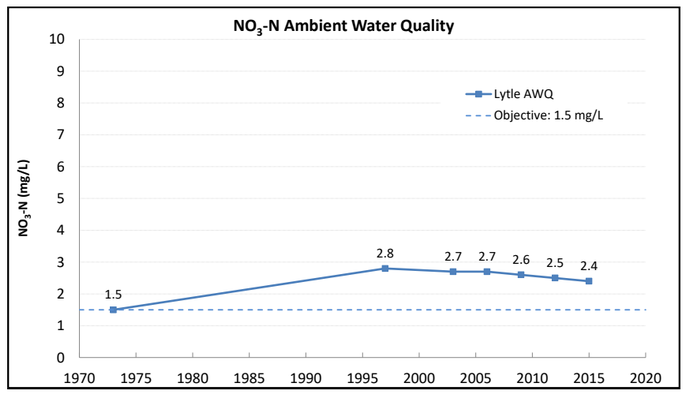
Lytle GMZ

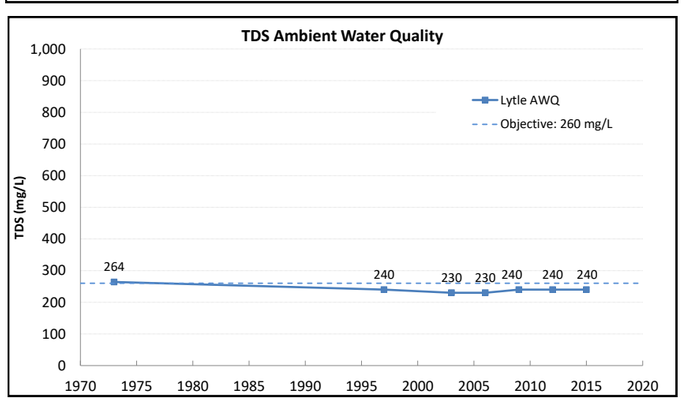
Attachment Contents:

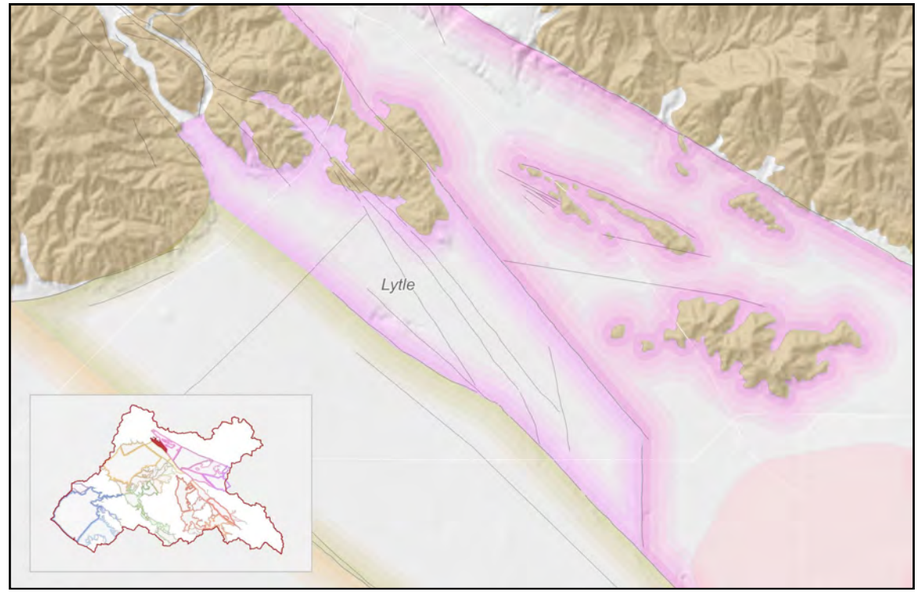
B10-1 Groundwater Storage and Elevation Contours Fall 2015
B10-2 NO_3-N Concentration and Contour Map
B10-3 TDS Concentration and Contour Map
B10-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B10-5 TDS Concentration Change (1993-2012 to 1996-2015)
B10-6 Key Well Analysis Charts

	Basin Analytics	Lytle
Basin	GMZ Area (acres)	6,850
	Volume of Storage (acre-ft)	405,000
NO_3-N	Wells per GMZ	42
	Point Statistics per GMZ	18
	Total Mass (tons)	1,330
	1996-2015 AWQ	2.4
TDS	Wells per GMZ	42
	Point Statistics per GMZ	30
	Total Mass (tons)	131,000
	1996-2015 AWQ	240

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Lytle is 1.5 mg/L. The ambient nitrate concentration decreased from 2.5 mg/L in 2012 to 2.4 mg/L in 2015, and there is no assimilative capacity. One out of the four key wells in Lytle GMZ have an increasing trend in nitrate concentrations, while the other three show no trends in the nitrate concentrations. Four of the total 42 wells with nitrate values in Lytle will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Total Dissolved Solids (TDS)

The TDS objective for Lytle is 260 mg/L. The ambient TDS concentration was unchanged from 240 mg/L in 2012 to 240 mg/L in 2015, allowing for 20 mg/L of assimilative capacity. One out of the four key interpretive wells in Lytle GMZ show an increasing trend while the other three show no trends in TDS concentrations. Four of the total 42 wells with TDS values in Lytle will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Lytle	1000260	SBWD Mallory Street Well (Mallory 03)	3.8	Increasing	313	No Trend
Lytle	1000388	F42A	1.6	No Trend	201	No Trend
Lytle	1000424	F28A	1.3	No Trend	209	Increasing*
Lytle	1000436	WELL 03	2.9	No Trend	313	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B10-4 and B10-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Lytle	1000263	NA_1000263	High	3	1.9	Stat	High	1	238	Ave
Lytle	1000264	LC 1	--	7	1.8	Stat	Medium	2	235	Ave
Lytle	1000451	NA_1000451	High	1	2.5	Ave	High	1	158	Ave
Lytle	1000453	NA_1000453	High	2	3.3	Ave	High	1	296	Ave
Lytle	1000455	WVWD 05	High	1	1.6	Ave	High	1	173	Ave
Lytle	1000457	WVWD 35	--	3	2.3	Stat	Medium	1	180	Ave
Lytle	1000505	3	--	8	1.3	Stat	Medium	6	205	Stat

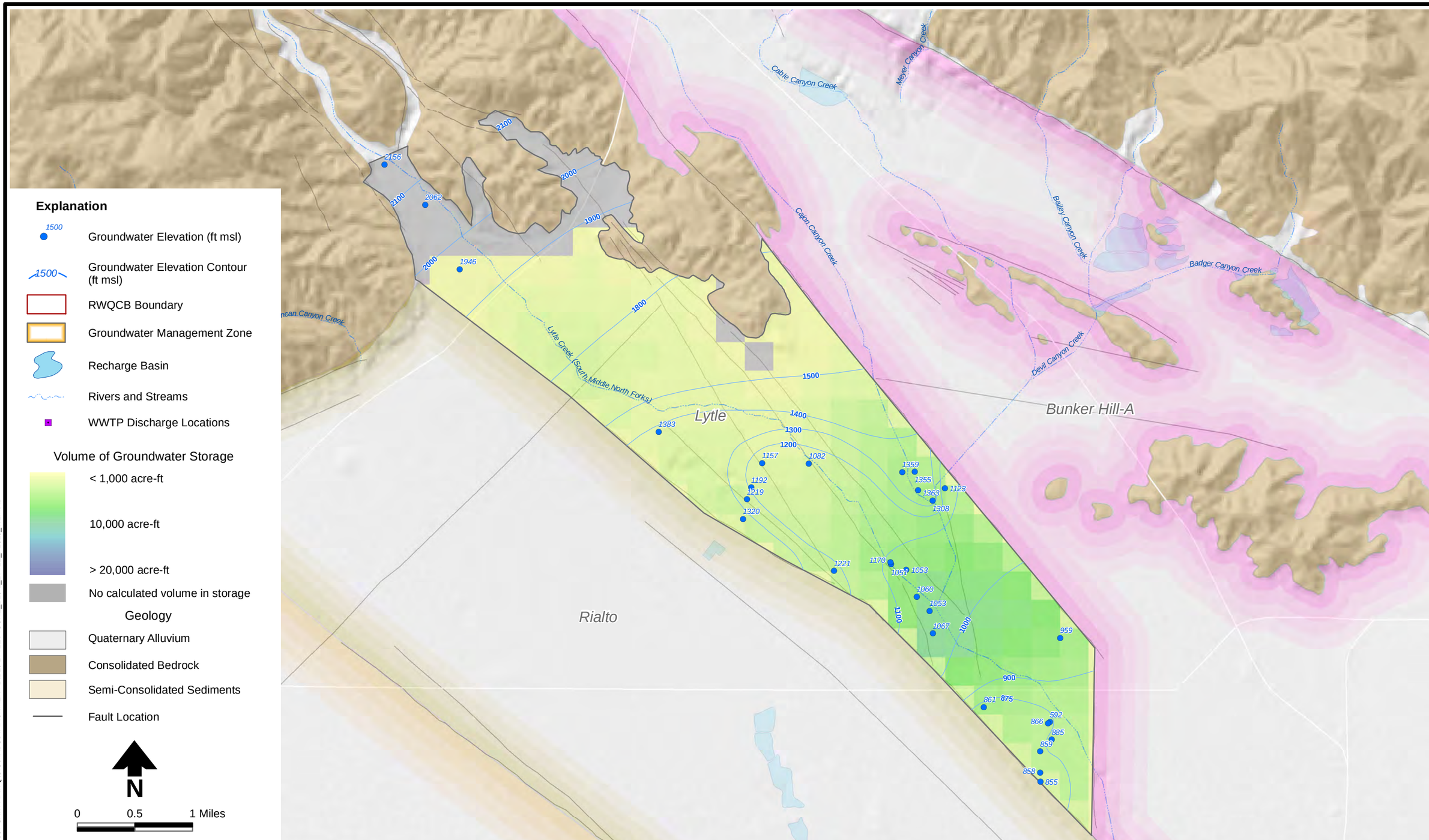
[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B10-4 and B10-5 for NO_3-N and TDS well locations, respectively.

New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. No new statistics have been identified in Lytle groundwater management zone.



Source: SAWPA.net, January 2017

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9/19/2017
CA16.0087

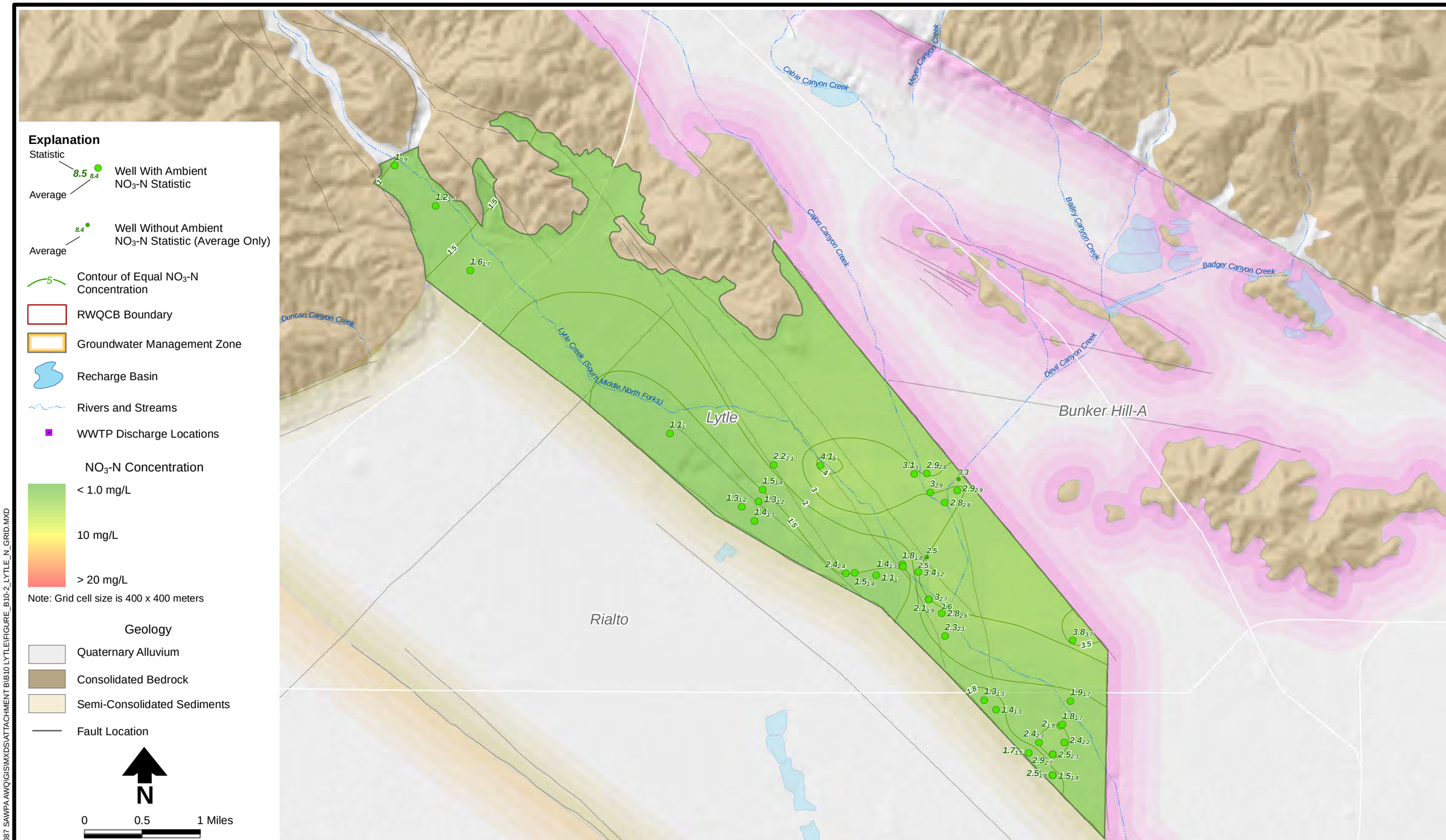
SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Lytle GMZ

Attachment B10-1



Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Lytle GMZ

Attachment B10-2

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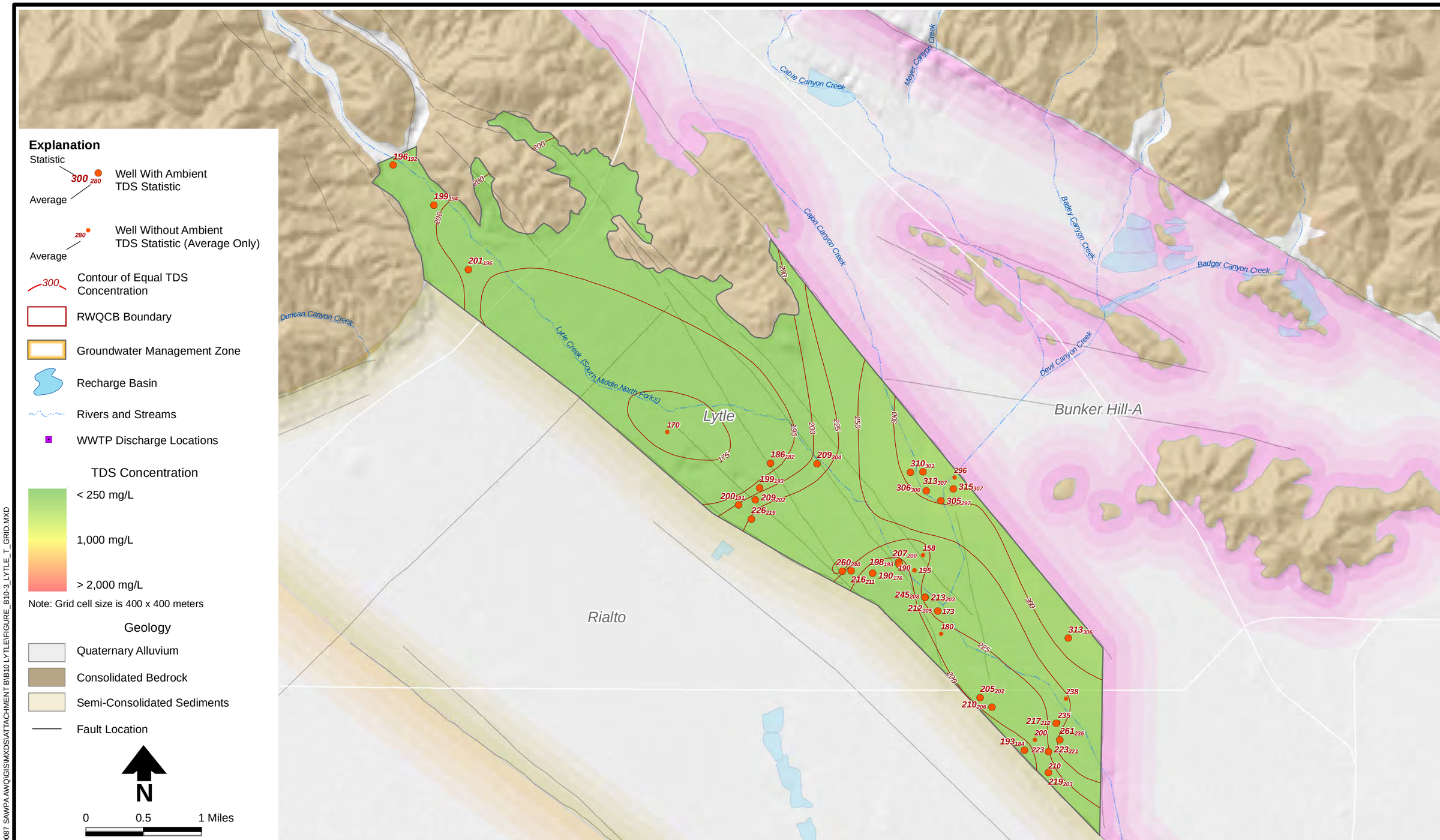

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SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Lytle GMZ

Attachment B10-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

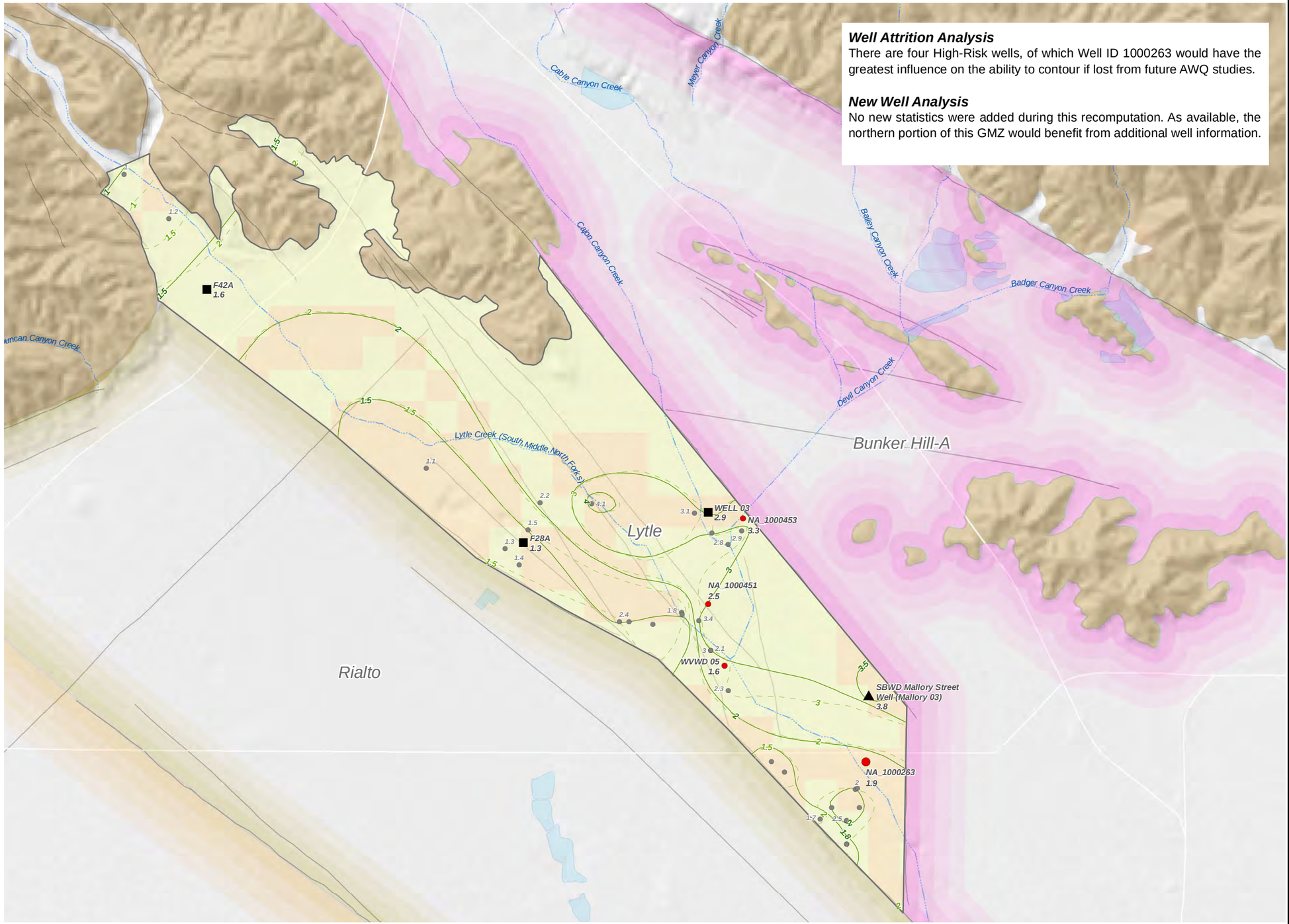
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 0.5 1 Miles

N

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are four High-Risk wells, of which Well ID 1000263 would have the greatest influence on the ability to contour if lost from future AWQ studies.

New Well Analysis

No new statistics were added during this recomputation. As available, the northern portion of this GMZ would benefit from additional well information.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B10 LYTLE\FIGURE_B10-4_LYTLE_N_CHANGE.MXD

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9/19/2017 CA16.0087

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)

Lytle GMZ

Attachment B10-4

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 TDS Contours
- 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

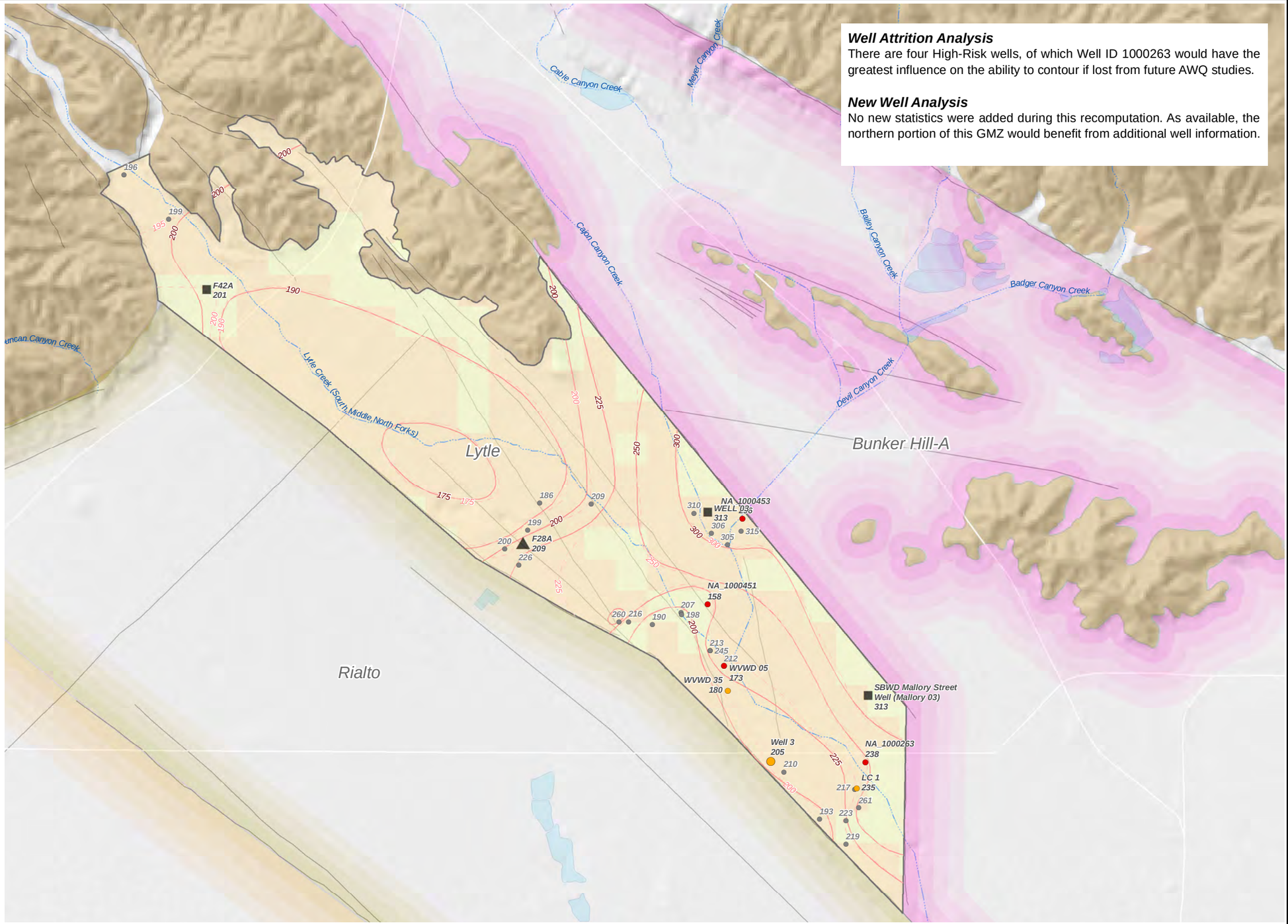
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 0.5 1 Miles

N

Source: SAWPA.net, January 2017



Well Attrition Analysis
There are four High-Risk wells, of which Well ID 1000263 would have the greatest influence on the ability to contour if lost from future AWQ studies.

New Well Analysis
No new statistics were added during this recomputation. As available, the northern portion of this GMZ would benefit from additional well information.

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B10 LYTLE\FIGURE_B10-5_LYTLE_T_CHANGE.MXD

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SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Lytle GMZ

Attachment B10-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

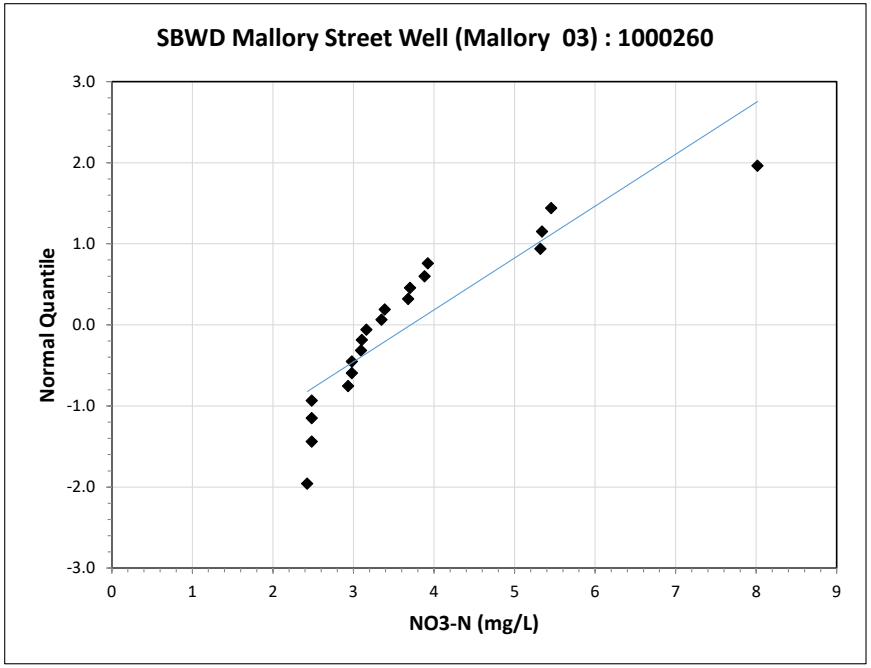
Mann-Kendall

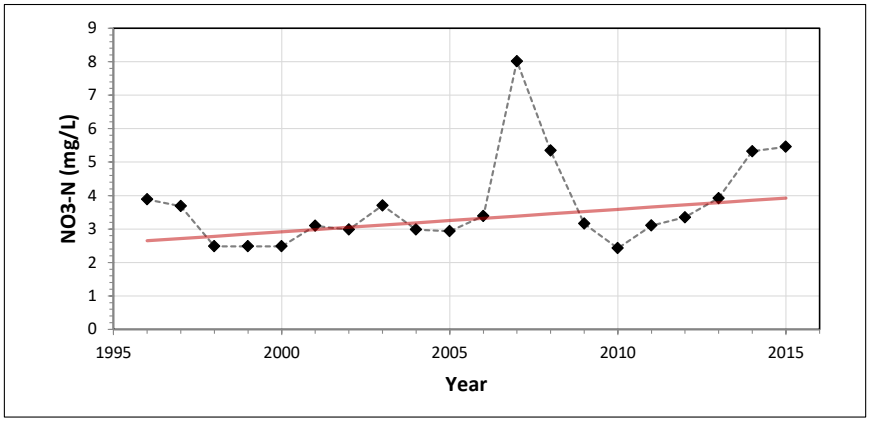
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

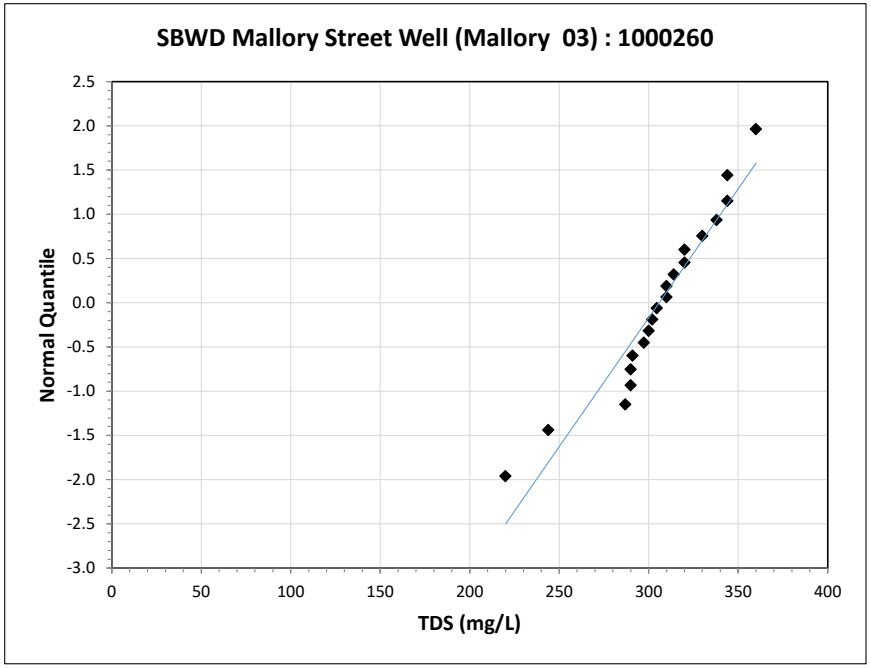
The significance of the trends is notated by * for significant and ** for very significant.

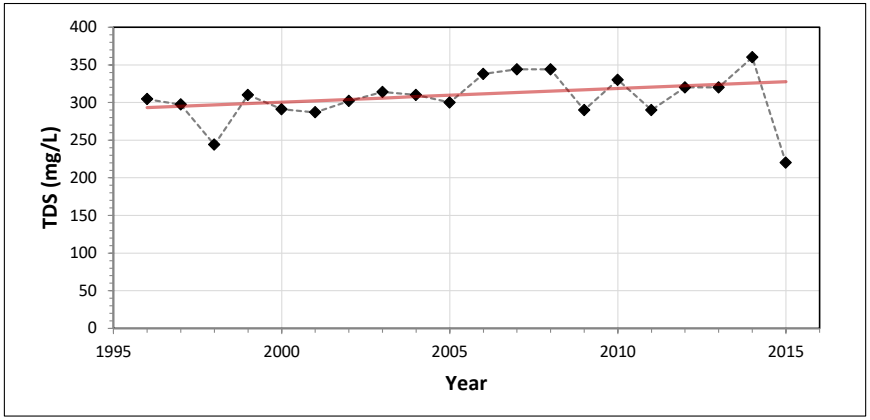
Statistics	
GMZ	Lytle
Well Name : ID	SBWD Mallory Street Well (Mallory 03) : 1000260
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.43
Annual Average Max	8.02
Annual Average Mean	3.71
Annual Average Stdev	1.38
Shapiro-Wilk W	0.792
Shapiro-Wilk p-value	7E-4
Critical Alpha	0.01
Most Discordant Value	8.02
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.032
Geomean	3.52
GM + t*GSE (UCL84)	3.79
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	56
Var(S)	945
Intercept	-131
Slope	0.07
p-value	0.074
Significant Trend?	Increasing



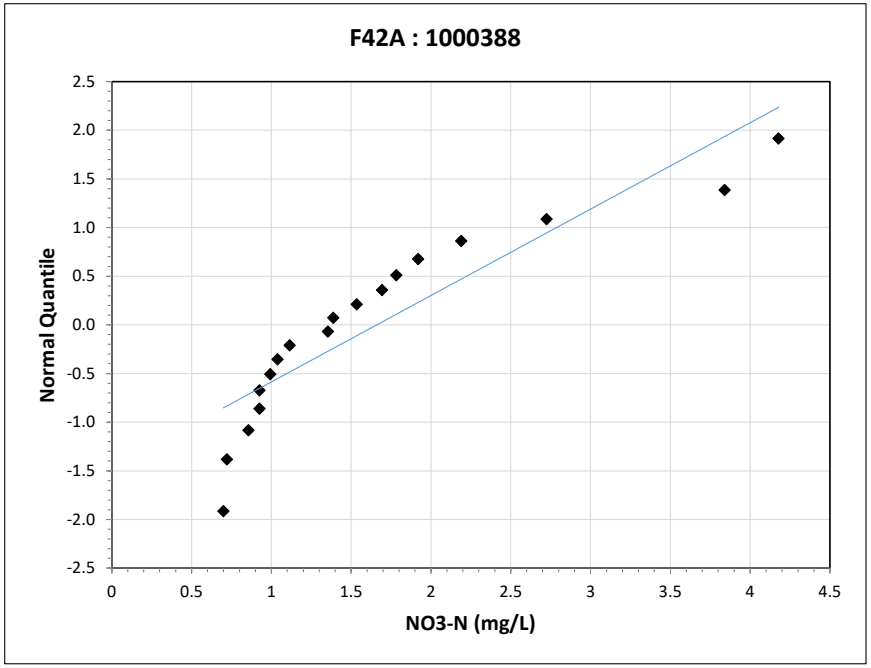


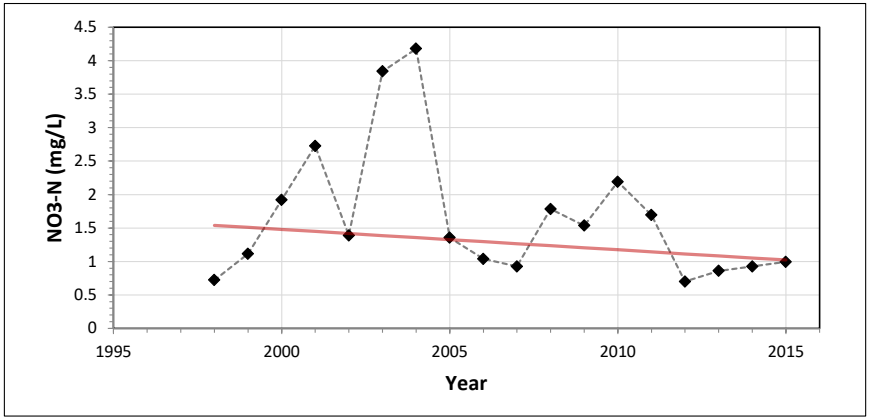
Statistics	
GMZ	Lytle
Well Name : ID	SBWD Mallory Street Well (Mallory 03) : 1000260
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	220
Annual Average Max	360
Annual Average Mean	306
Annual Average Stdev	32.73
Shapiro-Wilk W	0.927
Shapiro-Wilk p-value	0.133
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.32
Student t	1.02
Mean + t*SE (UCL84)	313
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	44
Var(S)	946
Intercept	-3309
Slope	1.80
p-value	0.162
Significant Trend?	No



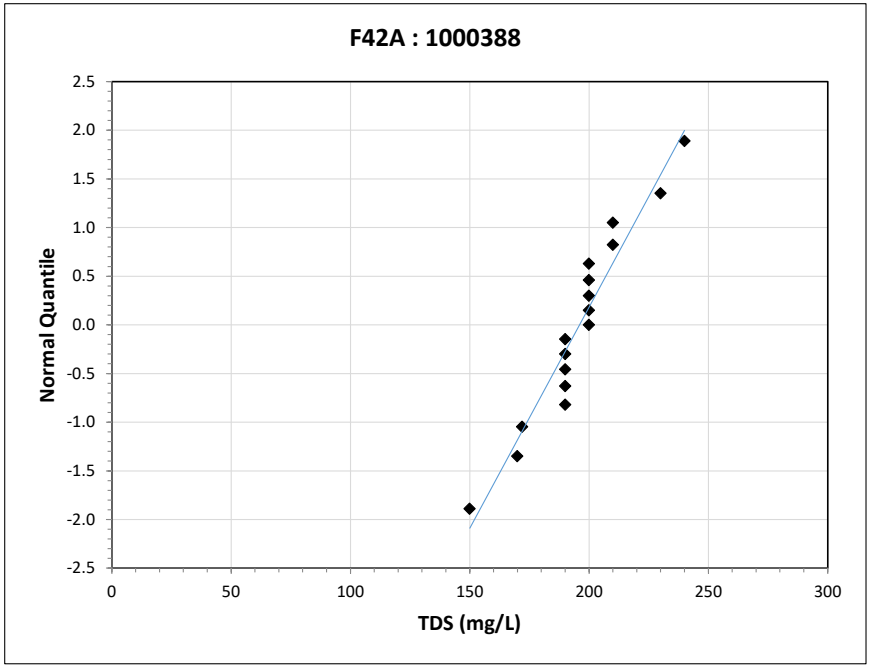


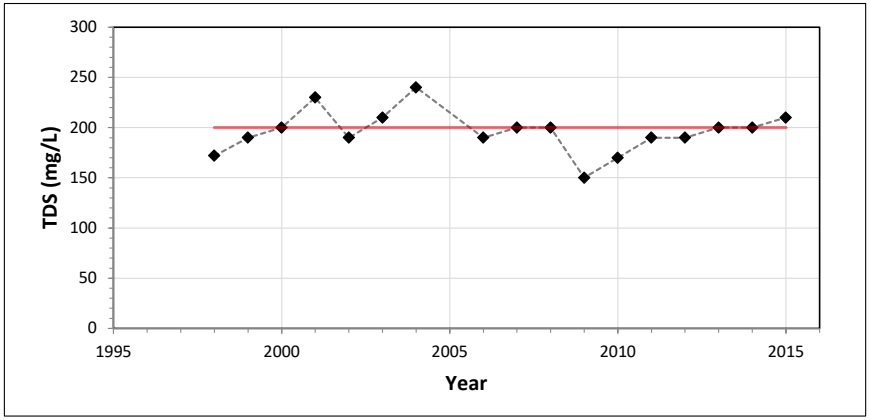
Statistics	
GMZ	Lytle
Well Name : ID	F42A : 1000388
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	0.70
Annual Average Max	4.18
Annual Average Mean	1.66
Annual Average Stdev	1.01
Shapiro-Wilk W	0.818
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	4.18
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.323
Geomean	1.44
GM + t*GSE (UCL84)	1.63
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-29
Var(S)	697
Intercept	62.36
Slope	-0.03
p-value	0.289
Significant Trend?	No



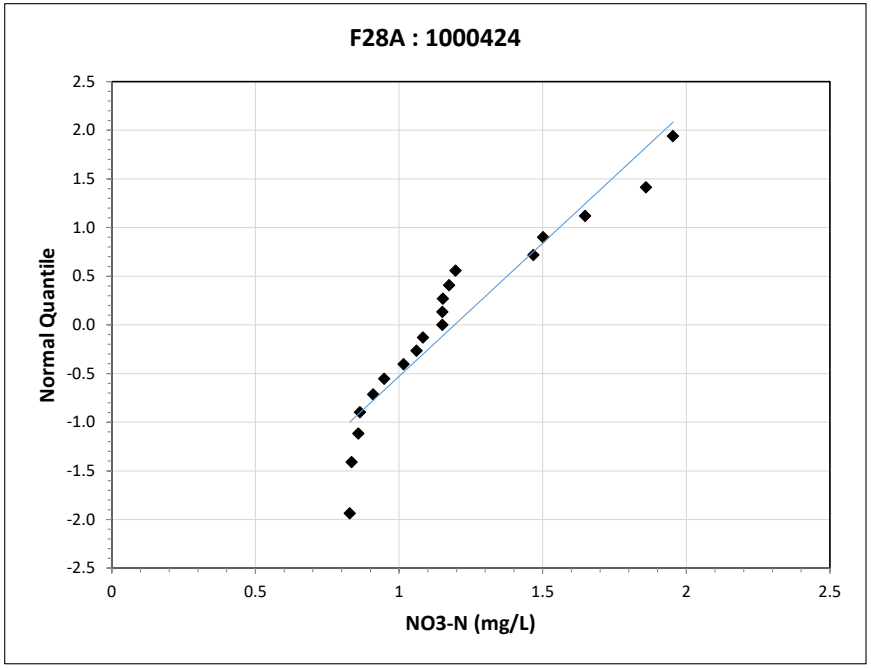


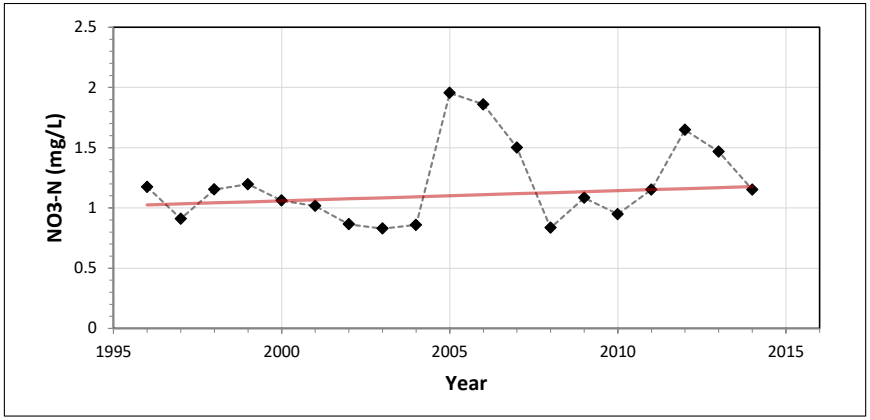
Statistics	
GMZ	Lytle
Well Name : ID	F42A : 1000388
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	150
Annual Average Max	240
Annual Average Mean	196
Annual Average Stdev	21.08
Shapiro-Wilk W	0.938
Shapiro-Wilk p-value	0.300
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.11
Student t	1.03
Mean + t*SE (UCL84)	201
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	9
Var(S)	555
Intercept	200
Slope	0.00
p-value	NC
Significant Trend?	No



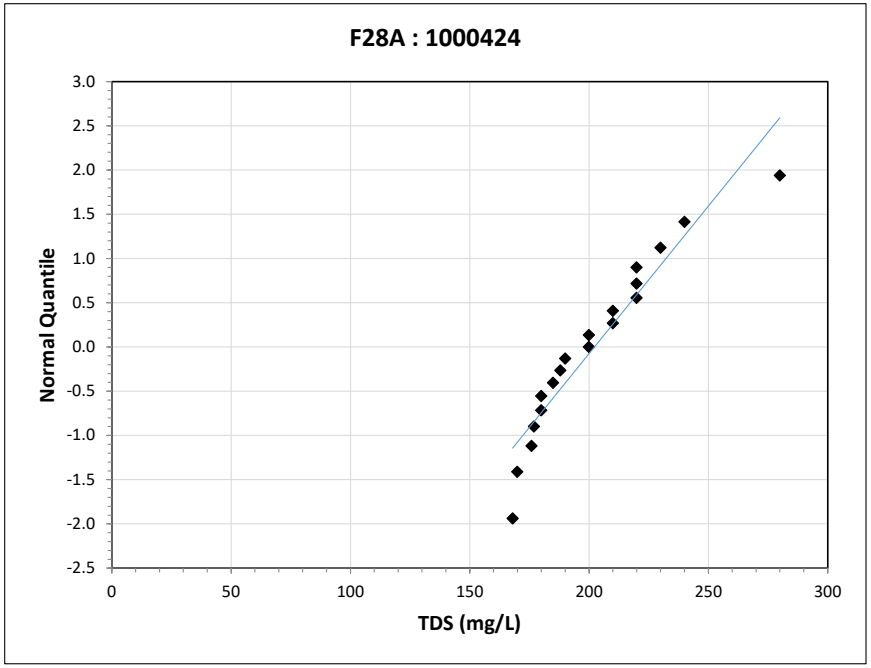


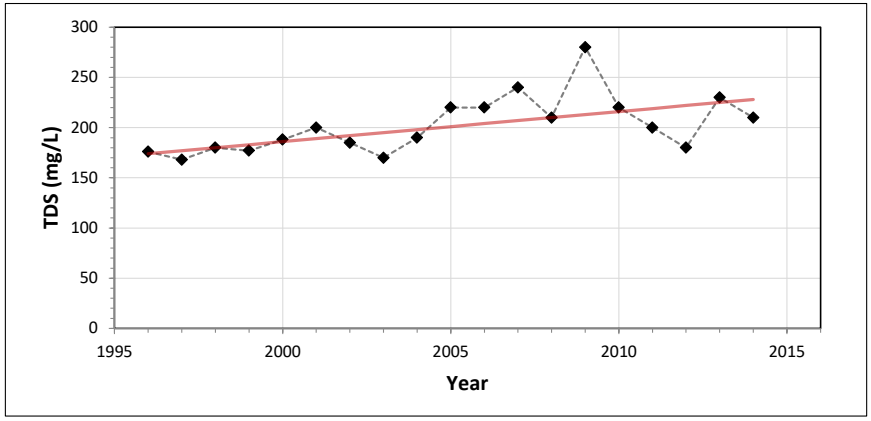
Statistics	
GMZ	Lytle
Well Name : ID	F28A : 1000424
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.83
Annual Average Max	1.95
Annual Average Mean	1.19
Annual Average Stdev	0.34
Shapiro-Wilk W	0.874
Shapiro-Wilk p-value	0.017
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.08
Student t	1.02
Mean + t*SE (UCL84)	1.27
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	14
Var(S)	816
Intercept	-15.77
Slope	0.01
p-value	0.649
Significant Trend?	No



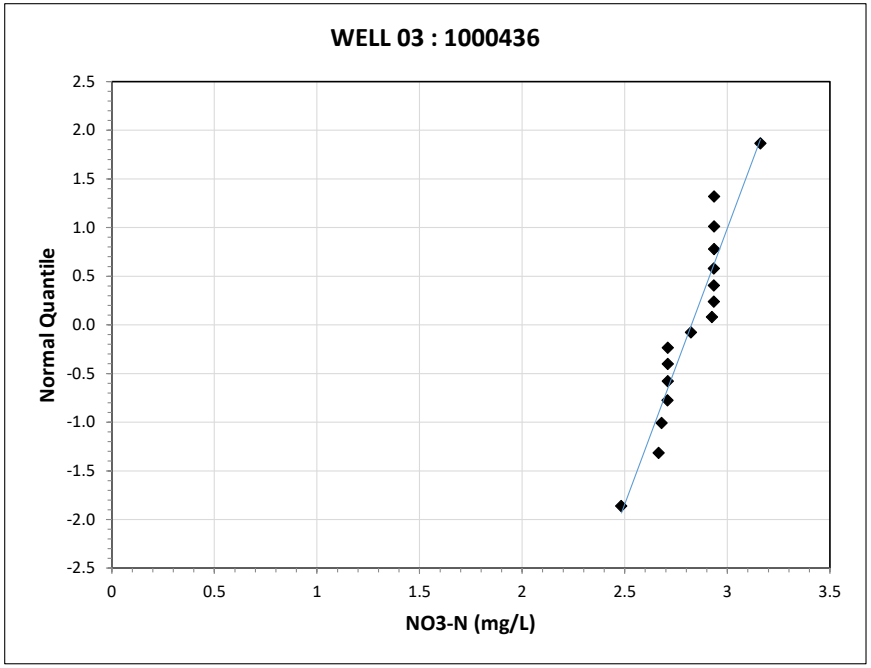


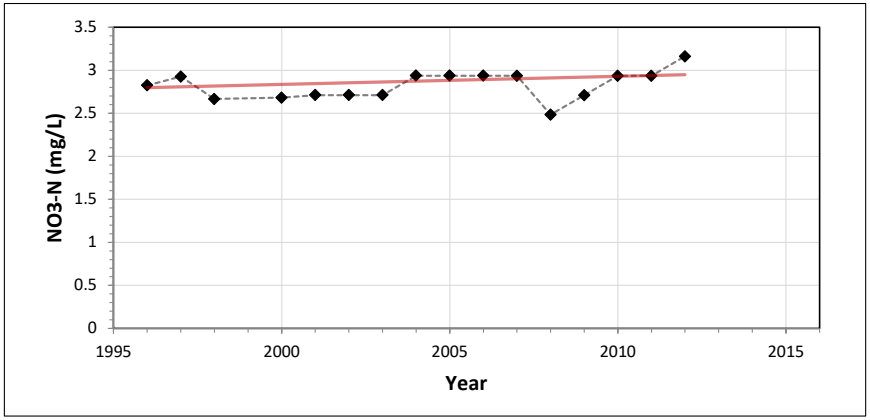
Statistics	
GMZ	Lytle
Well Name : ID	F28A : 1000424
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	168
Annual Average Max	280
Annual Average Mean	202
Annual Average Stdev	28.38
Shapiro-Wilk W	0.909
Shapiro-Wilk p-value	0.071
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.51
Student t	1.02
Mean + t*SE (UCL84)	209
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	83
Var(S)	810
Intercept	-5814
Slope	3.00
p-value	0.004
Significant Trend?	Increasing*



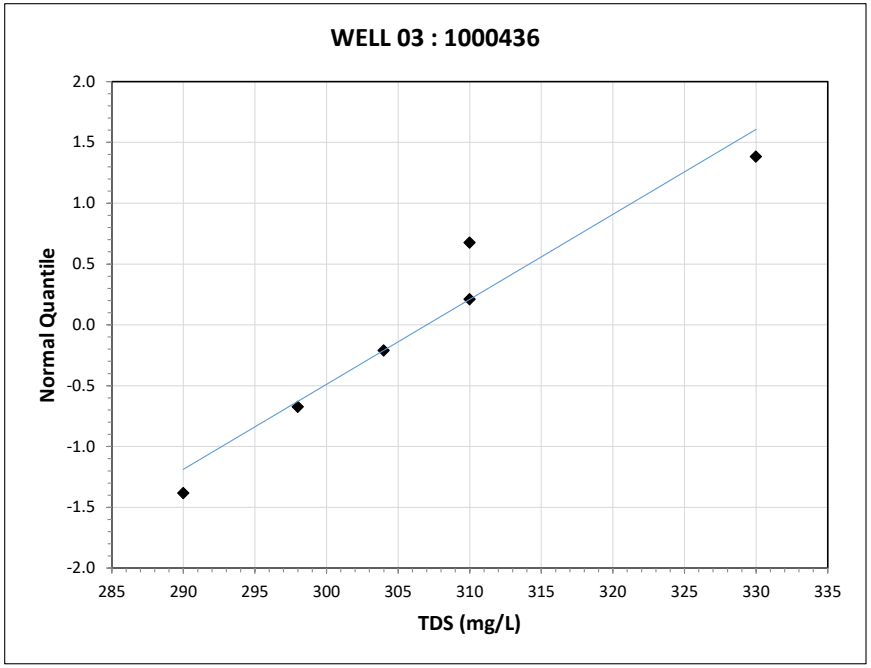


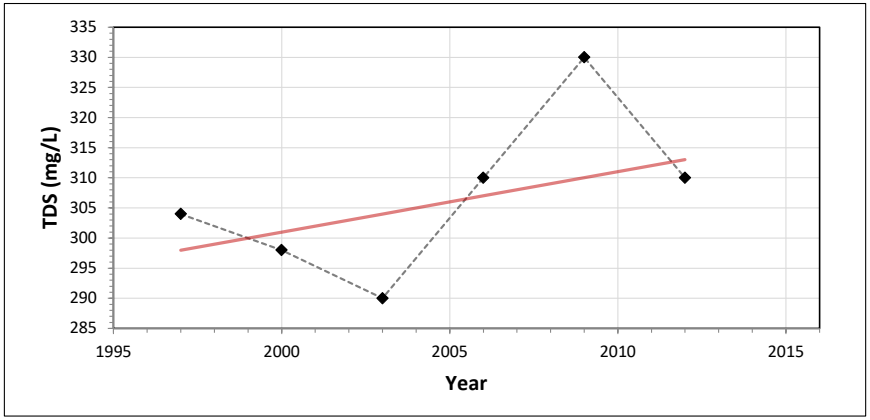
Statistics	
GMZ	Lytle
Well Name : ID	WELL 03 : 1000436
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	2.48
Annual Average Max	3.16
Annual Average Mean	2.82
Annual Average Stdev	0.17
Shapiro-Wilk W	0.905
Shapiro-Wilk p-value	0.096
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.04
Student t	1.03
Mean + t*SE (UCL84)	2.87
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	33
Var(S)	482
Intercept	-16.24
Slope	0.01
p-value	0.145
Significant Trend?	No





Statistics	
GMZ	Lytle
Well Name : ID	WELL 03 : 1000436
Analyte	TDS (mg/L)
Count	6
Count Detects	6
Sample Year Min	1997
Sample Year Max	2012
Annual Average Min	290
Annual Average Max	330
Annual Average Mean	307
Annual Average Stdev	13.61
Shapiro-Wilk W	0.947
Shapiro-Wilk p-value	0.718
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.56
Student t	1.10
Mean + t*SE (UCL84)	313
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	6
Var(S)	27.33
Intercept	-1699
Slope	1.00
p-value	0.339
Significant Trend?	No





Attachment B11

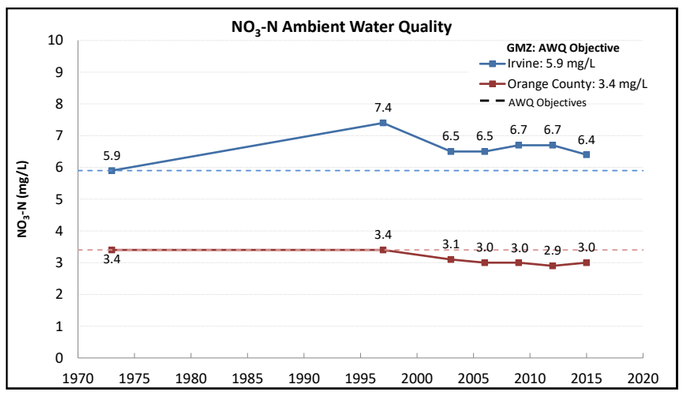
Orange County and Irvine GMZs

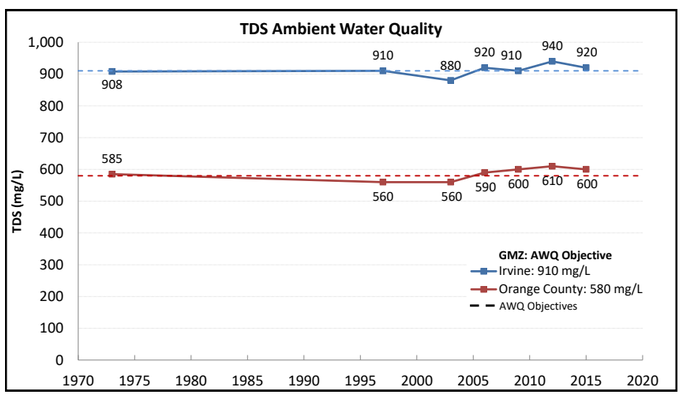
Attachment Contents:

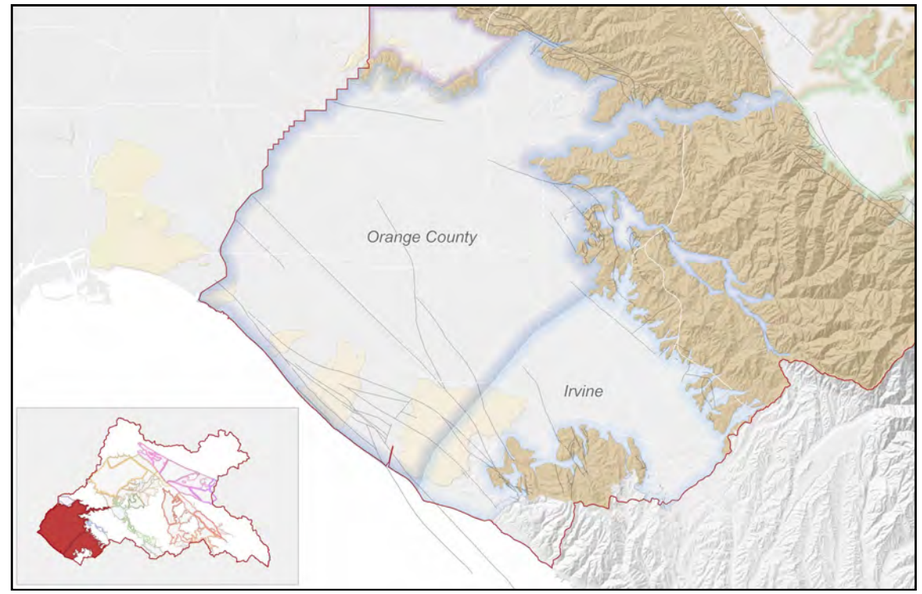
B11-1a,b Groundwater Storage and Elevation Contours Fall 2015
B11-2a,b NO_3-N Concentration and Contour Map
B11-3a,b TDS Concentration and Contour Map
B11-4a,b NO_3-N Concentration Change (1993-2012 to 1996-2015)
B11-5a,b TDS Concentration Change (1993-2012 to 1996-2015)
B11-6 Key Well Analysis Charts

	Basin Analytics	Irvine	Orange County
Basin	GMZ Area (acres)	53,900	163,000
	Volume of Storage (acre-ft)	1,800,000	23,600,000
NO_3-N	Wells per GMZ	133	1639
	Point Statistics per GMZ	63	824
	Total Mass (tons)	15,700	96,300
	1996-2015 AWQ	6.4	3.0
TDS	Wells per GMZ	131	1666
	Point Statistics per GMZ	90	1331
	Total Mass (tons)	2,250,000	19,300,000
	1996-2015 AWQ	920	600

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Irvine

The nitrate objective for Irvine is 5.9 mg/L. The ambient nitrate concentration decreased from 6.7 mg/L in 2012 to 6.4 mg/L in 2015, and there is no assimilative capacity. Five out of the nine key wells in Irvine GMZ have an increasing trend in nitrate concentrations, two show a decreasing trend, and two show no trends in the nitrate concentrations. Fourteen of the total 133 wells with nitrate values in Irvine will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and sixteen wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Orange County

The nitrate objective for Orange County is 3.4 mg/L. The ambient nitrate concentration increased from 2.9 mg/L in 2012 to 3.0 mg/L in 2015, allowing for 0.4 mg/L of assimilative capacity. Two out of the twenty-three key wells in Orange County GMZ have an increasing trend in nitrate concentrations, twelve key wells show a decreasing trend, and the other nine show no trends in the nitrate concentrations. Sixty-seven of the total 1,639 wells with NITRATE values in Orange County will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Thirty-three new wells with statistics were added to the 1996 to 2015 AWQ recomputation and forty-five wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

Irvine

The TDS objective for Irvine is 910 mg/L. The ambient TDS concentration decreased from 940 mg/L in 2012 to 920 mg/L in 2015, and there is no assimilative capacity. One out of the nine key interpretive wells in Irvine GMZ show an increasing trend, five show a decreasing trend, and three show no trends in TDS concentrations. Thirteen of the total 131 wells with TDS values in Irvine will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and sixteen wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Orange County

The TDS objective for Orange County is 580 mg/L. The ambient TDS concentration decreased from 610 mg/L in 2012 to 600 mg/L in 2015, and there is no assimilative capacity. Five out of the twenty-three key wells in Orange County GMZ have an increasing trend in TDS concentrations, seven key wells show a decreasing trend, and the other eleven show no trends in the TDS concentrations. Sixty-one of the total 1,666 wells with TDS values in Orange County will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Forty-seven new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and sixty-six wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Irvine	1213535	ET-1/1	10.8	Increasing	931	Decreasing
Irvine	1213902	IRWD-78/1	0.5	Decreasing	579	No Trend
Irvine	1213987	MCAS-1/1/WB2/MP1	44.2	Increasing**	2,420	Increasing**
Irvine	1213988	MCAS-1/1/WB2/MP2	34.8	Increasing	2,263	Decreasing*
Irvine	1213994	MCAS-10/1	1.0	No Trend	777	No Trend
Irvine	1214019	MCAS-3/1/WB2/MP1	15.5	Decreasing**	1,281	Decreasing**
Irvine	1214020	MCAS-3/1/WB2/MP2	22.8	Increasing*	1,371	Decreasing
Irvine	1214048	MCAS-7/1/WB3/MP1	34.0	No Trend	2,261	Decreasing
Irvine	1215112	TIC-61/1	10.7	Increasing	1,745	No Trend
Orange County	1213146	AM-13/1	2.7	Decreasing**	579	Increasing
Orange County	1213164	AM-23/1	3.2	Decreasing**	564	Decreasing**
Orange County	1213186	AM-37/1	3.2	Decreasing	588	Decreasing*
Orange County	1213206	AM-8/1	2.7	Decreasing**	511	Decreasing
Orange County	1213225	AMD-11/2	2.8	Decreasing**	564	Decreasing*
Orange County	1213296	AMD-7/1/WB1/MP1	10.0	Decreasing*	972	No Trend
Orange County	1213407	BPM-2/1/WB1/MP1	0.1	No Trend	344	Increasing*
Orange County	1213515	DIAW-SA/1	7.9	Increasing**	866	Increasing
Orange County	1213533	EOCW-W/1	5.0	Decreasing**	592	No Trend
Orange County	1213579	FM-1/1	4.8	No Trend	663	No Trend
Orange County	1213609	FM-7A/1	6.6	No Trend	731	No Trend
Orange County	1213673	GG-24/1	4.7	No Trend	564	Increasing
Orange County	1213707	GGM-2/1/WB1/MP1	0.1	No Trend	269	No Trend
Orange County	1214069	MCWD-5/1	0.4	Increasing**	297	Decreasing**
Orange County	1214212	O-3/1	3.7	Decreasing**	604	No Trend
Orange County	1214529	OCWD-SA12/1	4.1	No Trend	766	Decreasing**
Orange County	1214837	SB-LEI/1	0.1	No Trend	223	No Trend
Orange County	1214955	SCS-7/1	3.4	No Trend	501	No Trend
Orange County	1214983	SCWC-PLJ2/1	2.9	Decreasing**	512	Decreasing**
Orange County	1214993	SCWC-SSHR/1	5.0	No Trend	654	No Trend
Orange County	1215500	WBS-2A/1/WB1/MP2	2.3	Decreasing*	619	Increasing**
Orange County	1215504	WBS-3/1/WB1/MP2	3.3	Decreasing*	601	No Trend
Orange County	1215593	YLWD-5/1	3.5	Decreasing**	644	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B11-4 and B11-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Irvine	1213833	IDM-1/1/WB1/MP1	Medium	3	46.4	Stat	Medium	3	1,888	Stat
Irvine	1213834	IDM-1/1/WB1/MP10	High	2	0.1	Ave	High	2	583	Ave
Irvine	1213835	IDM-1/1/WB1/MP2	Medium	3	0.6	Stat	Medium	3	878	Stat
Irvine	1213836	IDM-1/1/WB1/MP3	Medium	3	5.2	Stat	Medium	3	987	Stat
Irvine	1213837	IDM-1/1/WB1/MP4	High	2	0.1	Ave	High	2	690	Ave
Irvine	1213838	IDM-1/1/WB1/MP5	High	2	0.1	Ave	High	2	488	Ave
Irvine	1213839	IDM-1/1/WB1/MP6	High	2	0.1	Ave	High	2	538	Ave
Irvine	1213840	IDM-1/1/WB1/MP7	High	2	0.1	Ave	High	2	526	Ave
Irvine	1213841	IDM-1/1/WB1/MP8	High	2	0.1	Ave	High	2	535	Ave
Irvine	1213842	IDM-1/1/WB1/MP9	High	2	0.1	Ave	High	2	574	Ave
Irvine	1213872	IDP-2/1	Medium	3	26.9	Stat	Medium	2	1,720	Ave
Irvine	1213875	IDP-3/1	Medium	3	22.9	Stat	Medium	2	1,079	Ave
Irvine	1213876	IDP-4/1	Medium	2	33.2	Ave	Medium	2	1,280	Ave
Irvine	1213899	IRWD-72/1	High	2	14.2	Ave	High	2	1,030	Ave
Irvine	1214564	OSUM-T/1	Medium	2	3.2	Ave	Medium	2	665	Ave
Irvine	1215093	TIC-109/1	High	3	10.1	Stat	High	3	1,299	Stat
Irvine	1215094	TIC-110/1	Medium	1	22.4	Ave	--	--	--	--
Irvine	1215095	TIC-111/1	High	2	6.0	Ave	High	2	1,111	Ave
Irvine	1215096	TIC-112/1	High	3	9.0	Stat	High	3	868	Stat
Irvine	1215110	TIC-56/1	High	1	9.4	Ave	High	1	988	Ave
Irvine	1215115	TIC-68/1	High	1	3.0	Ave	High	1	858	Ave
Irvine	1215132	T-PANK/1	High	3	11.9	Stat	--	--	--	--
Irvine	1215604	IDP-1/1	Medium	2	24.6	Ave	Medium	2	1,368	Ave

Continue on next page...

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Orange County	1212992	A-10/1	Medium	2	5.5	Ave	Medium	1	734	Ave
Orange County	1212998	A-129/1	Medium	3	4.3	Stat	Medium	2	668	Ave
Orange County	1213001	A-16/1	High	3	5.9	Stat	High	2	730	Ave
Orange County	1213007	A-23/1	High	1	3.7	Ave	--	--	--	--
Orange County	1213018	A-35/1	Medium	1	3.2	Ave	Medium	1	638	Ave
Orange County	1213034	A-6/1	Medium	4	5.0	Stat	High	1	628	Ave
Orange County	1213082	AET-RMW2/4	Medium	1	2.9	Ave	Medium	1	762	Ave
Orange County	1213380	BP-ART/1	Medium	6	0.8	Stat	Medium	2	624	Ave
Orange County	1213389	BP-LARW/1	High	1	0.1	Ave	High	1	398	Ave
Orange County	1213422	BP-MOSS/1	High	3	3.0	Stat	High	1	458	Ave
Orange County	1213516	DICE-SA/1	High	1	8.9	Ave	--	--	--	--
Orange County	1213524	DOSS-BP/1	Medium	1	0.1	Ave	Medium	1	972	Ave
Orange County	1213570	F-FS13/1	Medium	4	4.2	Stat	Medium	3	673	Stat
Orange County	1213572	F-KIM1/1	Medium	6	4.1	Stat	Medium	3	695	Stat
Orange County	1213618	FUJI-WM/1	High	1	3.9	Ave	High	1	650	Ave
Orange County	1213631	FVM-1/1/WB1/MP1	High	2	3.8	Ave	High	2	547	Ave
Orange County	1213632	FVM-1/1/WB1/MP10	High	2	0.1	Ave	High	2	202	Ave
Orange County	1213633	FVM-1/1/WB1/MP11	High	2	0.1	Ave	High	2	185	Ave
Orange County	1213634	FVM-1/1/WB1/MP12	High	2	0.1	Ave	High	2	192	Ave
Orange County	1213635	FVM-1/1/WB1/MP13	High	2	0.1	Ave	High	2	243	Ave
Orange County	1213636	FVM-1/1/WB1/MP14	High	2	0.1	Ave	High	2	280	Ave
Orange County	1213637	FVM-1/1/WB1/MP15	High	2	0.9	Ave	High	2	403	Ave
Orange County	1213638	FVM-1/1/WB1/MP16	High	1	0.1	Ave	High	1	370	Ave
Orange County	1213639	FVM-1/1/WB1/MP17	High	2	0.1	Ave	High	2	482	Ave
Orange County	1213640	FVM-1/1/WB1/MP18	High	2	0.1	Ave	High	2	481	Ave
Orange County	1213641	FVM-1/1/WB1/MP2	High	2	0.3	Ave	High	2	369	Ave
Orange County	1213642	FVM-1/1/WB1/MP3	High	2	0.5	Ave	High	2	340	Ave
Orange County	1213643	FVM-1/1/WB1/MP4	High	2	0.1	Ave	High	2	235	Ave
Orange County	1213644	FVM-1/1/WB1/MP5	High	2	0.3	Ave	High	2	289	Ave
Orange County	1213645	FVM-1/1/WB1/MP6	High	2	0.3	Ave	High	2	313	Ave
Orange County	1213646	FVM-1/1/WB1/MP7	High	2	0.2	Ave	High	2	301	Ave
Orange County	1213647	FVM-1/1/WB1/MP8	High	2	0.1	Ave	High	2	294	Ave
Orange County	1213648	FVM-1/1/WB1/MP9	High	2	0.1	Ave	High	2	164	Ave
Orange County	1213740	HALD-BP/1	Medium	1	0.1	Ave	Medium	1	302	Ave
Orange County	1213747	HB-2/1	High	1	0.1	Ave	High	1	270	Ave
Orange County	1213755	HB-DYKE/1	Medium	5	0.1	Stat	Medium	4	406	Stat
Orange County	1213809	HBM-6/1/WB1/MP4	Medium	2	0.2	Ave	Medium	3	1,010	Stat
Orange County	1213816	HELL-SB2/1	Medium	3	0.2	Stat	Medium	3	296	Stat
Orange County	1213917	IWMD-LVM2/1	High	1	17.0	Ave	High	1	694	Ave
Orange County	1213918	IWMD-LVM3/1	High	1	9.9	Ave	High	1	642	Ave
Orange County	1213919	IWMD-LVM4/1	High	1	2.6	Ave	High	1	518	Ave
Orange County	1213920	IWMD-RPM3/1	High	1	1.9	Ave	High	1	1,280	Ave
Orange County	1213921	IWMD-RPM5/1	High	1	0.1	Ave	High	1	1,190	Ave
Orange County	1213978	MB-SA/1	Medium	1	1.3	Ave	Medium	1	498	Ave
Orange County	1214079	MIDT-APAR/1	High	1	4.4	Ave	--	--	--	--
Orange County	1214092	MOBL-MW8AU/1	High	1	5.9	Ave	High	1	558	Ave
Orange County	1214094	MOBL-MW8ML/1	High	1	3.6	Ave	High	1	536	Ave
Orange County	1214106	NAKM-A/1	High	1	0.1	Ave	High	1	672	Ave
Orange County	1214108	NARI-GG/1	Medium	2	2.8	Ave	Medium	2	408	Ave
Orange County	1214196	O-1/1	Medium	2	10.6	Ave	--	--	--	--
Orange County	1214218	OCHI-GG/1	High	1	4.3	Ave	High	1	512	Ave
Orange County	1214297	OCWD-BSO5/2	High	1	0.1	Ave	High	1	1,710	Ave
Orange County	1214298	OCWD-BSO6A/1	--	--	--	--	Medium	1	18,800	Ave
Orange County	1214341	OCWD-HG1/1	Medium	3	2.9	Stat	Medium	3	607	Stat
Orange County	1214391	OCWD-M15B/1	Medium	3	0.3	Stat	Medium	3	386	Stat
Orange County	1214400	OCWD-M18/1	Medium	1	0.1	Ave	Medium	1	300	Ave
Orange County	1214403	OCWD-M18/4	High	1	0.2	Ave	High	1	406	Ave
Orange County	1214518	OCWD-P2/1	--	--	--	--	Medium	1	3,260	Ave
Orange County	1214520	OCWD-P3/1	Medium	1	0.1	Ave	--	4	3,503	Stat
Orange County	1214522	OCWD-P6/1	Medium	1	0.1	Ave	--	4	7,353	Stat
Orange County	1214523	OCWD-P7/1	Medium	1	3.4	Ave	--	4	10,335	Stat
Orange County	1214536	OCWD-SA5/1	Medium	1	0.1	Ave	--	9	403	Stat
Orange County	1214537	OCWD-SA5/2	Medium	1	0.1	Ave	--	8	236	Stat
Orange County	1214547	OCWD-T5/2	--	--	--	--	Medium	1	268,000	Ave
Orange County	1214557	OM-5/1	High	2	4.2	Ave	High	2	591	Ave
Orange County	1214572	PEIR-A/1	Medium	1	0.3	Ave	Medium	1	408	Ave
Orange County	1214578	PLTZ-GG/1	High	1	0.1	Ave	High	1	326	Ave

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Orange County	1214599	RADT-C/1	High	1	0.2	Ave	High	1	296	Ave
Orange County	1214601	RHWC-W/1	--	7	1.3	Stat	Medium	3	317	Stat
Orange County	1214607	RUIZ-5J1/1	High	1	1.1	Ave	High	1	464	Ave
Orange County	1214608	RUIZ-6A3/1	Medium	1	0.1	Ave	Medium	1	248	Ave
Orange County	1214612	RWLM-GG/1	High	1	0.8	Ave	High	1	708	Ave
Orange County	1214613	SA-13/1	--	8	8.5	Stat	Medium	5	602	Stat
Orange County	1214614	SA-14/1	High	1	9.5	Ave	--	--	--	--
Orange County	1214619	SA-22/1	High	1	0.6	Ave	--	--	--	--
Orange County	1214727	SAR-4/1/WB1/MP1	High	1	9.6	Ave	High	1	854	Ave
Orange County	1214761	SAR-5/1/WB2/MP10	Medium	4	0.1	Ave	Medium	4	184	Stat
Orange County	1214763	SAR-5/1/WB2/MP12	Medium	4	0.1	Ave	Medium	4	369	Stat
Orange County	1214764	SAR-5/1/WB2/MP2	Medium	4	8.1	Stat	Medium	4	727	Stat
Orange County	1214766	SAR-5/1/WB2/MP4	Medium	4	9.9	Stat	Medium	4	585	Stat
Orange County	1214768	SAR-5/1/WB2/MP6	Medium	4	0.1	Ave	Medium	4	255	Stat
Orange County	1214770	SAR-5/1/WB2/MP8	Medium	4	0.1	Ave	Medium	4	224	Stat
Orange County	1214801	SAR-7/1/WB1/MP8	Medium	3	0.1	Ave	Medium	4	339	Stat
Orange County	1214834	SB-7/1	Medium	6	0.1	Ave	Medium	2	236	Ave
Orange County	1214858	SC-2/1/WB1/MP2	High	2	2.0	Ave	High	2	467	Ave
Orange County	1214859	SC-2/1/WB1/MP3	High	2	2.0	Ave	High	2	458	Ave
Orange County	1214860	SC-2/1/WB1/MP4	High	2	0.2	Ave	High	2	412	Ave
Orange County	1214861	SC-2/1/WB1/MP5	High	2	1.7	Ave	High	2	428	Ave
Orange County	1214862	SC-2/1/WB1/MP6	High	2	1.4	Ave	High	2	469	Ave
Orange County	1214863	SC-2/1/WB1/MP7	High	2	0.4	Ave	High	2	453	Ave
Orange County	1214955	SCS-7/1	High	1	3.4	Ave	High	1	501	Ave
Orange County	1214970	SCWC-LABL/1	High	1	0.1	Ave	--	--	--	--
Orange County	1214986	SCWC-SCER/1	High	1	1.5	Ave	--	--	--	--
Orange County	1214996	SCWC-YLBA/1	Medium	2	3.0	Ave	High	1	656	Ave
Orange County	1214997	SCWC-YLCO/1	Medium	4	3.1	Stat	High	1	642	Ave
Orange County	1214999	SEA-HB/1	Medium	2	1.4	Ave	Medium	2	509	Ave
Orange County	1215001	SFE-1/1	High	1	0.1	Ave	--	--	--	--
Orange County	1215002	SFE-2/1	High	1	0.1	Ave	--	--	--	--
Orange County	1215067	SPNO-HB/1	High	2	4.7	Ave	High	2	1,254	Ave
Orange County	1215070	SSON-SAQ1/1	Medium	1	0.1	Ave	Medium	1	230	Ave
Orange County	1215072	STEH-A/1	Medium	1	2.9	Ave	Medium	1	574	Ave
Orange County	1215080	T-17S1/1	--	7	14.1	Stat	Medium	3	1,164	Stat
Orange County	1215083	T868-S1/1	High	2	1.8	Ave	--	--	--	--
Orange County	1215084	T868-S2/1	High	2	0.9	Ave	--	--	--	--
Orange County	1215126	TMIX-O/1	Medium	3	4.5	Stat	Medium	2	557	Ave
Orange County	1215128	T-MS2/1	Medium	4	12.7	Stat	High	1	1,040	Ave
Orange County	1215383	W-14659/1	High	1	0.1	Ave	High	1	1,450	Ave
Orange County	1215497	WARN-WHNY/1	Medium	1	7.8	Ave	Medium	1	870	Ave
Orange County	1215516	WM-124/1	High	1	0.1	Ave	--	--	--	--
Orange County	1215523	WM-8/1	Medium	4	0.4	Stat	Medium	2	273	Ave
Orange County	1215540	WMM-1/1/WB1/MP16	Medium	5	0.1	Ave	Medium	5	247	Stat
Orange County	1215541	WMM-1/1/WB1/MP17	Medium	4	0.1	Ave	Medium	4	246	Stat
Orange County	1215542	WMM-1/1/WB1/MP18	Medium	4	0.1	Ave	Medium	4	243	Stat
Orange County	1215580	YLCC-35C2/1	Medium	2	3.9	Ave	Medium	2	954	Ave
Orange County	1215595	YLWD-9/1	--	8	4.4	Stat	Medium	2	703	Ave
Orange County	1215596	MIDT-ARV/1	--	8	4.7	Stat	Medium	2	628	Ave
Orange County	1215597	OCWD-35G/1	--	--	--	--	High	1	552	Ave
Orange County	1215599	OCWD-BS102/1	--	--	--	--	High	1	252	Ave
Orange County	1215614	CHEV-PC1/1	Medium	2	0.1	Ave	Medium	1	584	Ave
Orange County	1215616	BENH-A/1	High	1	4.5	Ave	High	1	568	Ave
Orange County	1215622	SCE-GGQ1/1	Medium	1	7.1	Ave	Medium	1	640	Ave
Orange County	1215624	DONO-AP1/1	Medium	1	0.1	Ave	Medium	1	684	Ave
Orange County	1215626	RUIZ-6A1/1	High	1	0.1	Ave	High	1	256	Ave
Orange County	1215627	HBHS-WM/1	Medium	1	0.1	Ave	Medium	1	262	Ave
Orange County	1215635	GWRC-HBF4/1	Medium	1	0.1	Ave	Medium	1	11,700	Ave
Orange County	1215656	FRAN-S/1	Medium	1	0.1	Ave	Medium	1	626	Ave
Orange County	1215670	LECR-HB/1	Medium	5	2.0	Stat	Medium	4	573	Stat
Orange County	1215675	W-4959/1	High	1	3.8	Ave	--	--	--	--
Orange County	1222115	OCWD-I21/2	Medium	1	0.1	Ave	Medium	1	136	Ave
Orange County	1222119	PRUD-P04/1	--	--	--	--	High	2	1,800	Ave
Orange County	1222120	PRUD-P02/1	High	1	0.7	Ave	High	2	2,000	Ave
Orange County	1222121	PRUD-P05/1	High	1	0.7	Ave	High	2	1,850	Ave
Orange County	1222131	OCWD-I24/1	Medium	1	0.2	Ave	Medium	1	294	Ave
Orange County	1222132	OCWD-I24/2	Medium	2	0.1	Ave	Medium	2	224	Ave

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Orange County	1222133	OCWD-I25/1	Medium	1	0.1	Ave	--	2	128	Ave
Orange County	1222134	PRUD-P06/1	High	1	0.7	Ave	High	2	1,950	Ave
Orange County	1222150	OCWD-HH6C/1	Medium	1	0.1	Ave	--	4	436	Stat
Orange County	2000027	CALT-A/1	Medium	5	3.3	Stat	Medium	2	1,360	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. Greyed out sites indicate wells which have been destroyed. See Attachment B11-4 and B11-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Irvine	1215231	USMC-MW03A/1	New*	1	13.2	Ave	New*	1	748	Ave
Irvine	1215234	USMC-MW03E/1	New*	1	14.3	Ave	New*	1	994	Ave
Irvine	2000031	IRWD-115R/1	New*	2	1.0	Ave	New*	2	638	Ave
Irvine	2000063	OCWD-M51A/1	New*	1	16.1	Ave	New*	1	1,220	Ave
Irvine	2000064	OCWD-M51B/1	New*	1	0.1	Ave	New*	1	319	Ave
Irvine	2000065	OCWD-M52A/1	New*	1	0.1	Ave	New*	1	1,305	Ave
Irvine	2000066	OCWD-M52B/1	New*	1	0.1	Ave	New*	1	273	Ave
Irvine	2000067	OCWD-M52C/1	New*	1	0.1	Ave	New*	1	274	Ave
Irvine	2000068	OCWD-M52D/1	New*	1	0.1	Ave	New*	1	246	Ave
Irvine	2000069	OCWD-M53A/1	New*	1	0.8	Ave	New*	1	14,300	Ave
Irvine	2000070	OCWD-M53B/1	New*	1	0.1	Ave	New*	1	485	Ave
Irvine	2000071	OCWD-M53C/1	New*	1	0.1	Ave	New*	1	373	Ave
Irvine	2000072	OCWD-M54A/1	New*	1	0.1	Ave	New*	1	4,460	Ave
Irvine	2000073	OCWD-M54B/1	New*	1	0.9	Ave	New*	1	3,050	Ave
Irvine	2000074	OCWD-MRSH/1	New*	1	1.2	Ave	New*	1	3,590	Ave
Irvine	2000087	USMC-MW2D2/1	New*	1	13.7	Ave	New*	1	2,230	Ave
Orange County	1232326	AMD-2/1/WB2/MP1	--	3	0.1	Ave	New	3	435	Stat
Orange County	1232329	AMD-2/1/WB2/MP4	--	3	0.1	Ave	New	3	345	Stat
Orange County	1232334	AMD-2/1/WB2/MP9	--	3	0.1	Ave	New	3	351	Stat
Orange County	1232335	AMD-2/1/WB2/MP10	--	3	0.1	Ave	New	3	390	Stat
Orange County	1232442	SAR-10/3	--	4	0.1	Ave	New	4	272	Stat
Orange County	1232443	SAR-10/4	--	3	0.1	Ave	New	4	267	Stat
Orange County	1232447	SAR-5/1/WB3/MP1	--	3	0.1	Ave	New	3	363	Stat
Orange County	1232452	SAR-5/1/WB3/MP6	--	3	0.1	Ave	New	3	262	Stat
Orange County	1232453	SAR-5/1/WB3/MP7	--	3	0.1	Ave	New	3	172	Stat
Orange County	1232454	SAR-5/1/WB3/MP8	--	3	0.1	Ave	New	3	219	Stat
Orange County	1232455	SAR-5/1/WB3/MP9	--	3	0.1	Ave	New	3	164	Stat
Orange County	1232456	SAR-5/1/WB3/MP10	--	3	0.1	Ave	New	3	192	Stat
Orange County	1232457	SAR-5/1/WB3/MP11	--	3	0.1	Ave	New	3	223	Stat
Orange County	1232458	SAR-5/1/WB3/MP12	--	3	0.1	Ave	New	3	322	Stat
Orange County	1232460	SB-LAM/1	--	5	0.1	Ave	New	3	226	Stat
Orange County	1232462	SC-1/1/WB2/MP2	--	4	0.1	Ave	New	4	1,011	Stat
Orange County	1232463	SC-1/1/WB2/MP3	--	4	0.1	Ave	New	4	950	Stat
Orange County	1232464	SC-1/1/WB2/MP4	--	4	0.1	Ave	New	4	906	Stat
Orange County	1232465	SC-1/1/WB2/MP5	--	4	0.1	Ave	New	4	460	Stat
Orange County	1232466	SC-1/1/WB2/MP6	--	4	0.1	Ave	New	4	378	Stat
Orange County	1213891	IRWD-21/1	New	3	12.8	Stat	New	3	789	Stat
Orange County	1232313	A-56/1	New	5	2.4	Stat	New	3	571	Stat
Orange County	1232314	AM-50/1	New	4	2.1	Stat	New	4	71	Stat
Orange County	1232327	AMD-2/1/WB2/MP2	New	3	0.9	Stat	New	3	564	Stat
Orange County	1232328	AMD-2/1/WB2/MP3	New	3	0.1	Stat	New	3	386	Stat
Orange County	1232330	AMD-2/1/WB2/MP5	New	3	0.3	Stat	New	3	351	Stat
Orange County	1232331	AMD-2/1/WB2/MP6	New	3	0.3	Stat	New	3	420	Stat
Orange County	1232332	AMD-2/1/WB2/MP7	New	3	3.3	Stat	New	3	602	Stat
Orange County	1232333	AMD-2/1/WB2/MP8	New	3	0.1	Stat	New	3	446	Stat
Orange County	1232336	A-YARD-MW1/1	New	5	4.8	Stat	New	5	669	Stat
Orange County	1232337	A-YARD-MW2/1	New	5	3.6	Stat	New	5	611	Stat
Orange County	1232344	FM-25/1	New	5	2.6	Stat	New	5	393	Stat
Orange County	1232345	FM-27/1	New	4	17.3	Stat	New	4	1,191	Stat

Continue on next page...

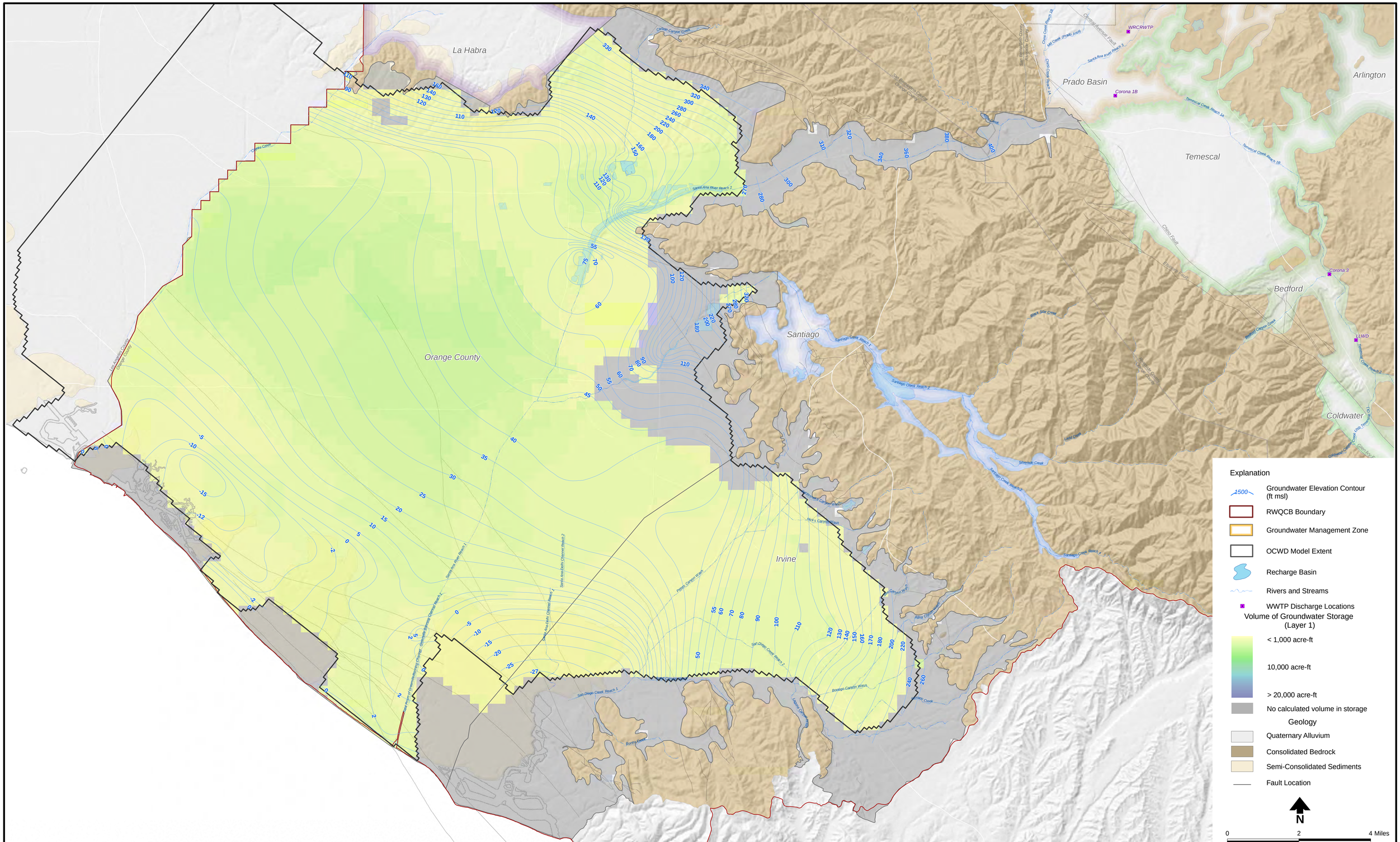
Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years	Value[2]	Method	Status	Years[1]	Value[2]	Method
Orange County	1232361	IRWD-78R/1	New	4	1.0	Stat	New	4	637	Stat
Orange County	1232440	SAR-10/1	New	4	0.5	Stat	New	4	275	Stat
Orange County	1232444	SAR-11/1	New	5	0.1	Stat	New	5	267	Stat
Orange County	1232445	SAR-11/2	New	5	0.5	Stat	New	5	246	Stat
Orange County	1232446	SAR-11/3	New	5	0.1	Ave	New	5	209	Stat
Orange County	1232448	SAR-5/1/WB3/MP2	New	3	5.9	Stat	New	3	721	Stat
Orange County	1232449	SAR-5/1/WB3/MP3	New	3	9.8	Stat	New	3	674	Stat
Orange County	1232450	SAR-5/1/WB3/MP4	New	3	8.3	Stat	New	3	621	Stat
Orange County	1232451	SAR-5/1/WB3/MP5	New	3	1.0	Stat	New	3	363	Stat
Orange County	2000015	AM-51/1	New	3	1.9	Stat	New	3	717	Stat
Orange County	2000079	SAR-8/1/WB2/MP1	New	3	2.8	Stat	New	3	612	Stat
Orange County	2000080	SAR-8/1/WB2/MP2	New	3	2.8	Stat	New	3	614	Stat
Orange County	2000081	SAR-8/1/WB2/MP3	New	3	3.0	Stat	New	3	568	Stat
Orange County	1215496	WALL-A/1	--	2	4.2	Ave	New*	2	1,590	Ave
Orange County	1232316	AMD-1/1/WB2/MP1	--	2	1.8	Ave	New*	2	484	Ave
Orange County	1232317	AMD-1/1/WB2/MP2	--	2	0.4	Ave	New*	2	377	Ave
Orange County	1232318	AMD-1/1/WB2/MP3	--	2	1.9	Ave	New*	2	323	Ave
Orange County	1232319	AMD-1/1/WB2/MP4	--	2	2.0	Ave	New*	2	489	Ave
Orange County	1232320	AMD-1/1/WB2/MP5	--	2	1.2	Ave	New*	2	486	Ave
Orange County	1232321	AMD-1/1/WB2/MP6	--	2	1.2	Ave	New*	2	609	Ave
Orange County	1232322	AMD-1/1/WB2/MP7	--	2	1.2	Ave	New*	2	562	Ave
Orange County	1232323	AMD-1/1/WB2/MP8	--	2	2.3	Ave	New*	2	607	Ave
Orange County	1232324	AMD-1/1/WB2/MP9	--	2	2.2	Ave	New*	2	575	Ave
Orange County	1232325	AMD-1/1/WB2/MP10	--	2	0.1	Ave	New*	2	527	Ave
Orange County	1232436	OCWD-M26A/1	--	2	0.6	Ave	New*	2	2,873	Ave
Orange County	1232437	OCWD-M27A/1	--	2	1.3	Ave	New*	2	2,040	Ave
Orange County	1232438	OCWD-M2A/1	--	2	0.1	Ave	New*	2	27,550	Ave
Orange County	1213892	IRWD-22/1	New	3	8.0	Stat	New*	2	566	Ave
Orange County	1232346	FV-9/1	New	4	2.1	Stat	New*	2	575	Ave
Orange County	1232355	GSWC-SCL5/1	New	4	0.6	Stat	New*	2	336	Ave
Orange County	1232360	IRWD-107R/1	New	4	0.6	Stat	New*	2	699	Ave
Orange County	1232441	SAR-10/2	New	4	1.2	Stat	New*	4	264	Ave
Orange County	1232495	YLWD-20/1	New	4	2.7	Stat	New*	2	638	Ave
Orange County	2000029	GG-31/1	New	3	4.2	Stat	New*	2	600	Ave
Orange County	1214524	OCWD-RVW1/1	New*	2	1.9	Ave	New*	2	615	Ave
Orange County	2000013	A-58/1	New*	1	2.8	Ave	New*	1	692	Ave
Orange County	2000014	AM-31AR/1	New*	1	5.6	Ave	New*	1	660	Ave
Orange County	2000016	AM-51A/1	New*	1	1.9	Ave	New*	1	512	Ave
Orange County	2000017	AM-53/1	New*	1	0.1	Ave	New*	1	634	Ave
Orange County	2000022	BOE-MW96A/1	New*	1	0.1	Ave	New*	1	376	Ave
Orange County	2000023	BOE-MW97A/1	New*	2	0.1	Ave	New*	2	350	Ave
Orange County	2000024	BOE-MW98A/1	New*	2	0.1	Ave	New*	2	279	Ave
Orange County	2000025	BOE-MW99A/1	New*	2	0.2	Ave	New*	2	407	Ave
Orange County	2000028	CCC-LA1/1	New*	1	0.1	Ave	New*	1	272	Ave
Orange County	2000030	GRGC-CO1/1	New*	2	1.2	Ave	New*	2	876	Ave
Orange County	2000032	IRWD-OPA1/1	New*	1	3.8	Ave	New*	1	716	Ave
Orange County	2000033	MBI-1/1	New*	1	2.2	Ave	New*	1	74	Ave
Orange County	2000035	MVCC-COSD3/1	New*	2	0.1	Ave	New*	2	393	Ave
Orange County	2000036	NVLW-70POC02/1	New*	2	0.1	Ave	New*	2	851	Ave
Orange County	2000037	NVLW-70POC03/1	New*	2	0.1	Ave	New*	2	11,725	Ave
Orange County	2000038	NVLW-70POC04/1	New*	2	0.1	Ave	New*	2	21,025	Ave
Orange County	2000039	OCWD-BS14/1	New*	1	0.1	Ave	New*	1	758	Ave
Orange County	2000040	OCWD-BS14/2	New*	1	0.1	Ave	New*	1	296	Ave
Orange County	2000041	OCWD-BS14/3	New*	1	0.1	Ave	New*	1	5,080	Ave
Orange County	2000042	OCWD-BS14/4	New*	1	0.1	Ave	New*	1	728	Ave
Orange County	2000043	OCWD-BS14/5	New*	1	0.1	Ave	New*	1	204	Ave
Orange County	2000044	OCWD-BS17/1	New*	1	0.1	Ave	New*	1	318	Ave
Orange County	2000045	OCWD-BS17/2	New*	1	0.2	Ave	New*	1	656	Ave
Orange County	2000046	OCWD-BS17/3	New*	1	0.1	Ave	New*	1	262	Ave
Orange County	2000047	OCWD-BS17/4	New*	1	0.1	Ave	New*	1	272	Ave
Orange County	2000049	OCWD-BS18B/1	New*	1	0.1	Ave	New*	1	3,460	Ave
Orange County	2000051	OCWD-BS21/1	New*	1	0.1	Ave	New*	1	1,430	Ave
Orange County	2000052	OCWD-BS21/2	New*	1	0.1	Ave	New*	1	1,270	Ave
Orange County	2000053	OCWD-BS21/3	New*	1	0.1	Ave	New*	1	1,330	Ave
Orange County	2000054	OCWD-BS21/4	New*	1	0.1	Ave	New*	1	3,020	Ave
Orange County	2000055	OCWD-BS22/1	New*	1	0.1	Ave	New*	1	598	Ave
Orange County	2000056	OCWD-BS22/2	New*	1	0.1	Ave	New*	1	2,090	Ave
Orange County	2000057	OCWD-BS22/3	New*	1	0.1	Ave	New*	1	564	Ave
Orange County	2000058	OCWD-BS22/4	New*	1	0.1	Ave	New*	1	326	Ave
Orange County	2000075	OCWD-SA22R/1	New*	2	0.1	Ave	New*	2	312	Ave
Orange County	2000076	OCWD-SA22R/2	New*	2	0.1	Ave	New*	2	2,995	Ave
Orange County	2000077	OCWD-SA22R/3	New*	2	0.1	Ave	New*	2	8,280	Ave
Orange County	2000078	OCWD-SA22R/4	New*	2	0.1	Ave	New*	2	282	Ave
Orange County	2000082	SCS-2/1/WB2/MP1	New*	1	2.2	Ave	New*	1	626	Ave
Orange County	2000083	SCS-2/1/WB2/MP3	New*	1	0.1	Ave	New*	1	384	Ave
Orange County	2000084	SCS-2/1/WB2/MP4	New*	1	1.2	Ave	New*	1	638	Ave
Orange County	2000085	SCS-2/1/WB2/MP5	New*	1	0.1	Ave	New*	1	566	Ave
Orange County	2000086	SCSH-SA1/1	New*	1	0.1	Ave	New*	1	302	Ave
Orange County	2000088	YLCC-35F3/1	New*	2	2.9	Ave	New*	2	1,295	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B11-4 and B11-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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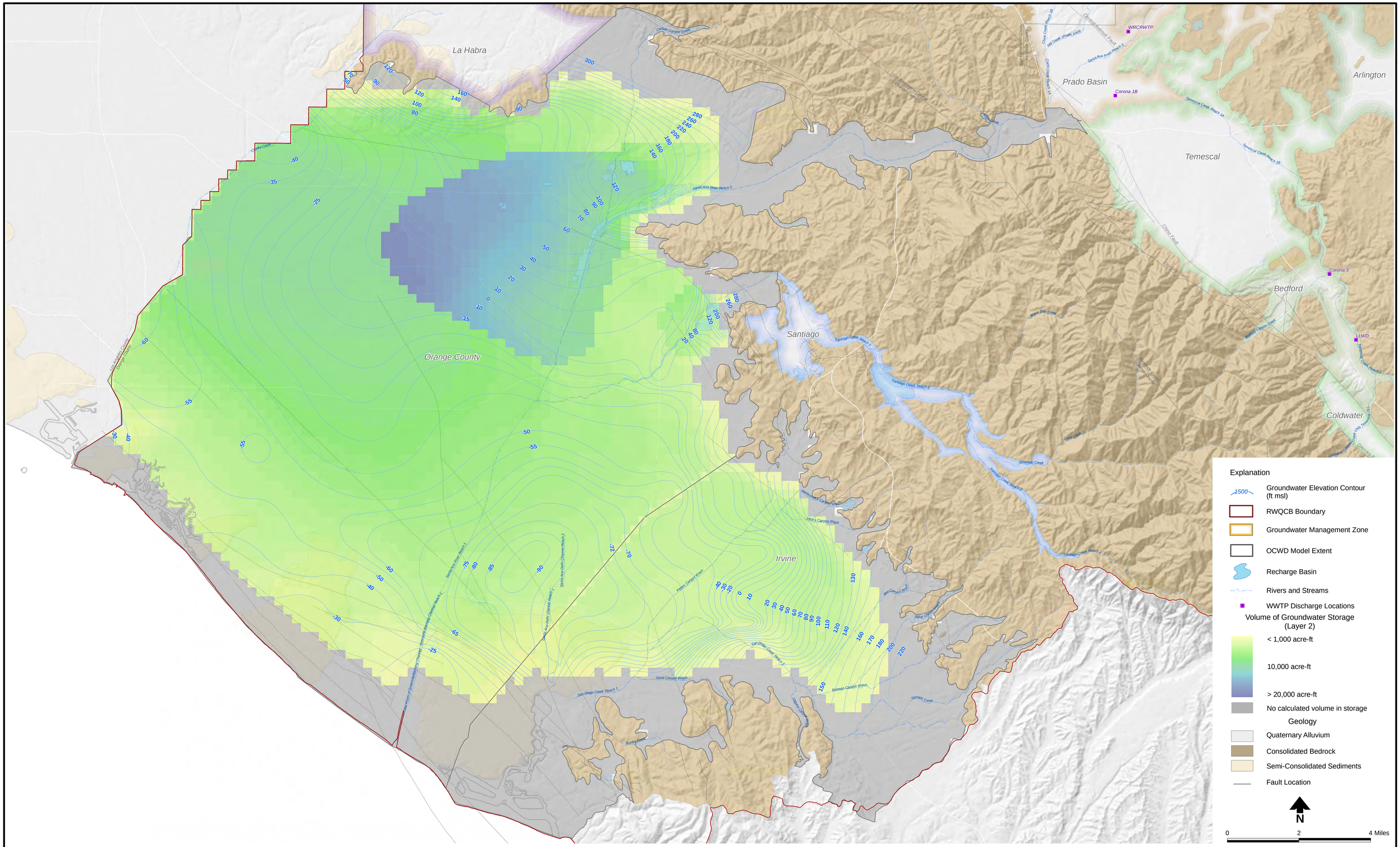
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Layer 1 Fall 2015
Orange County and Irvine GMZs

Attachment B11-1a



Source: SAWPA.net, January 2017

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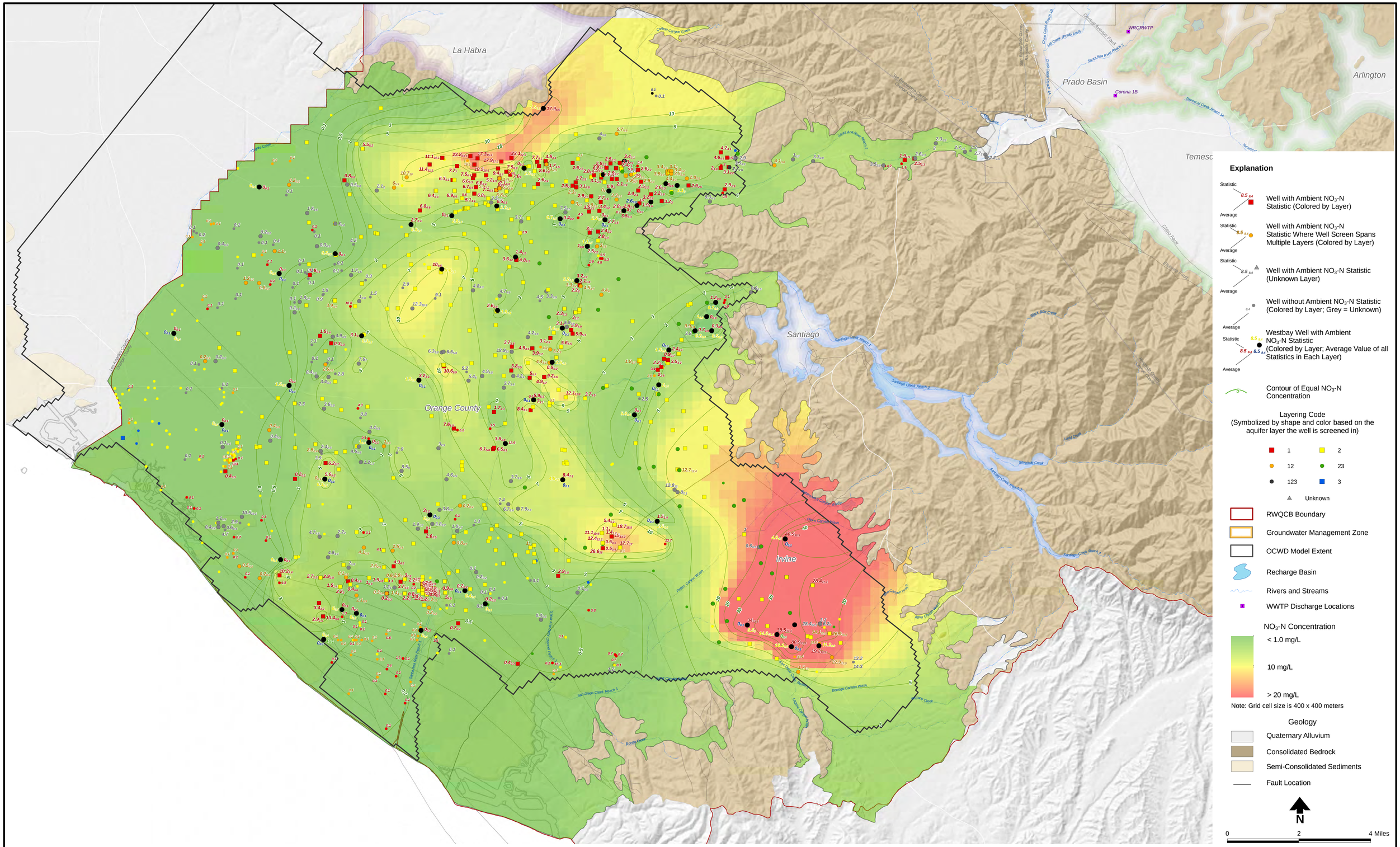
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Layer 2 Fall 2015
Orange County and Irvine GMZs

Attachment B11-1b



Source: SAWPA.net, January 2017

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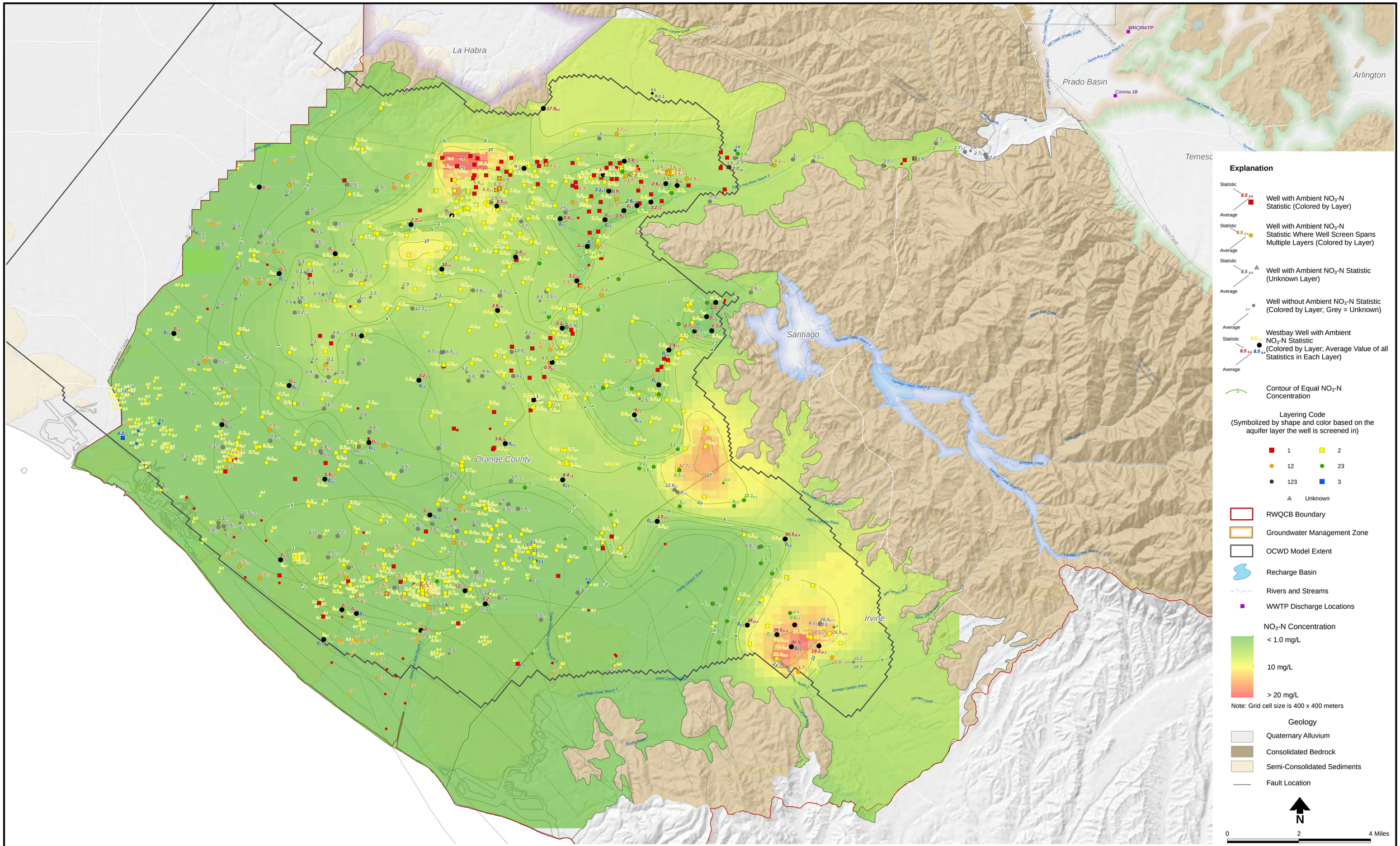
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Layer 1
Orange County and Irvine GMZs

Attachment B11-2a



Source: SAWPA.net, January 2017

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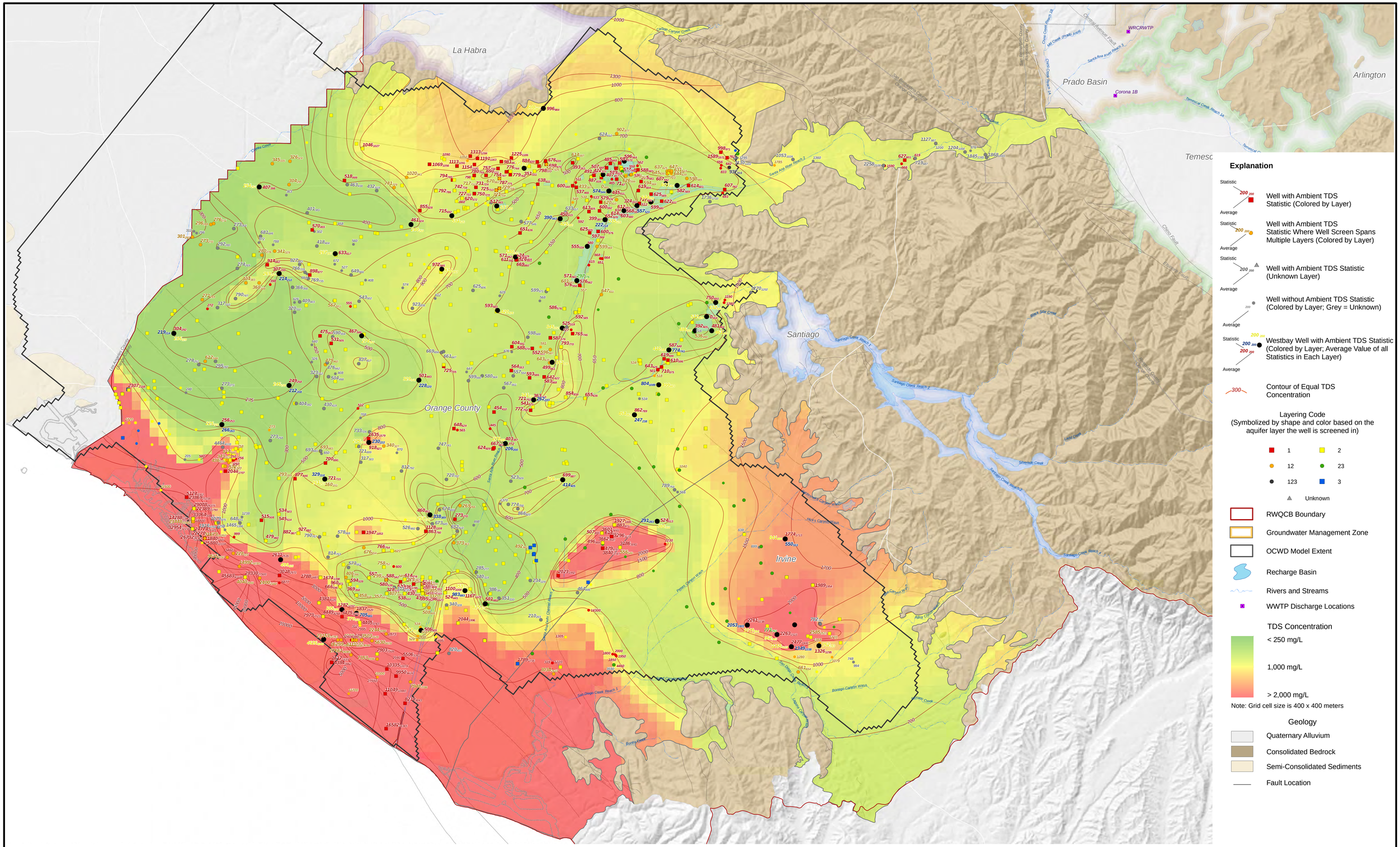
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map Layer 2
Orange County and Irvine GMZs

Attachment B11-2b



Source: SAWPA.net, January 2017

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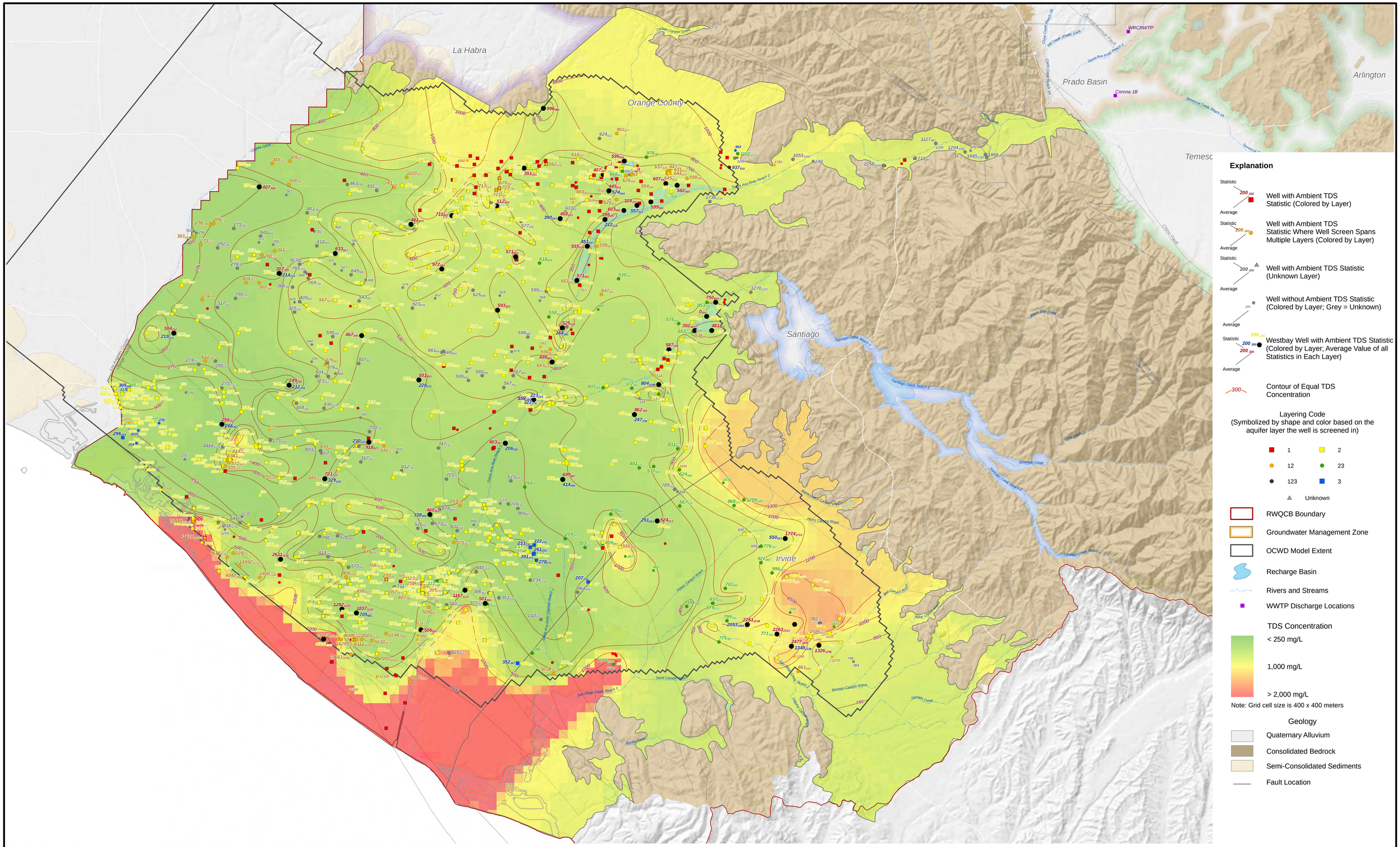
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map Layer 1
Orange County and Irvine GMZs

Attachment B11-3a



Source: SAWPA.net, January 2017

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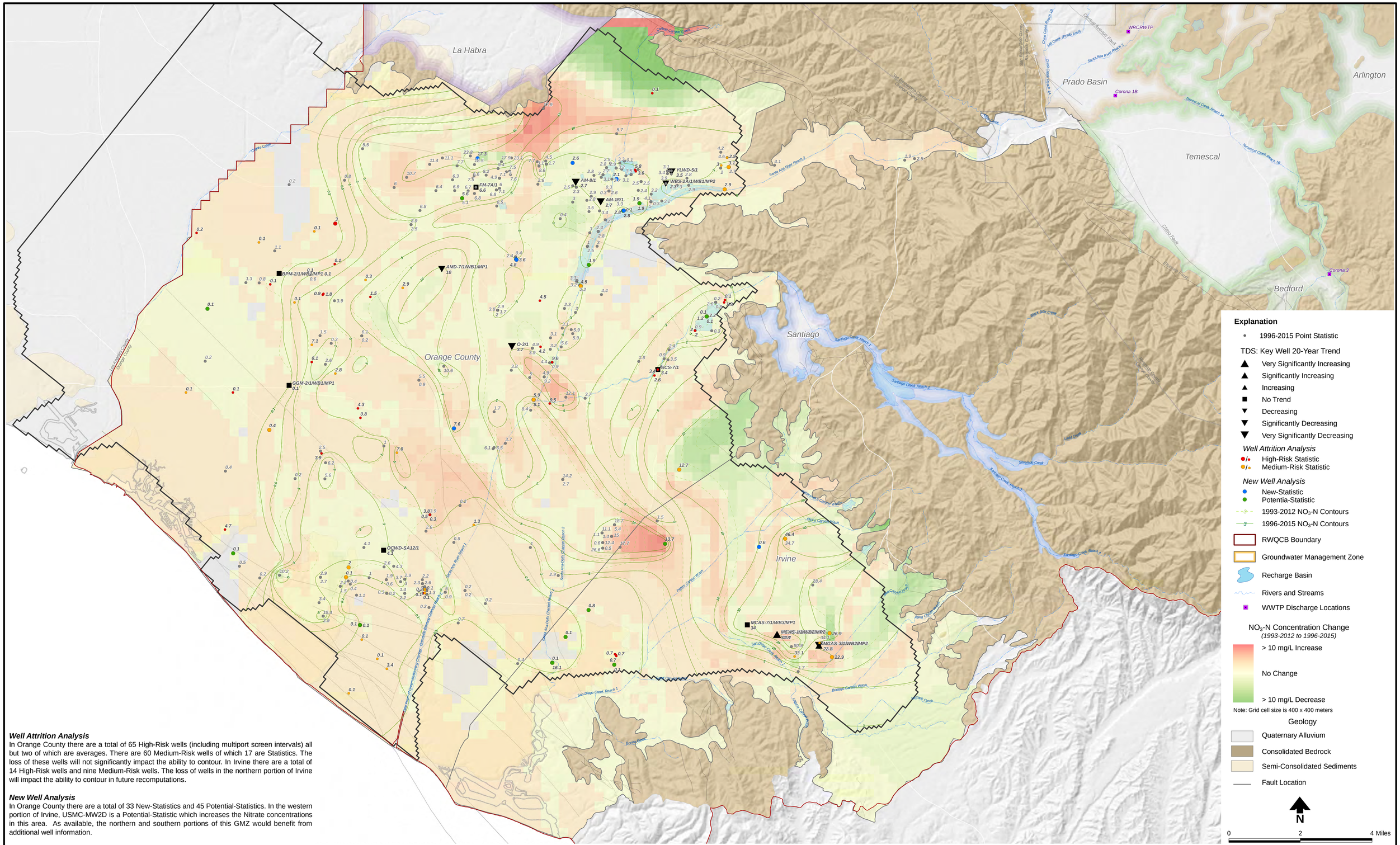
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map Layer 2
Orange County and Irvine GMZs

Attachment B11-3b



Well Attrition Analysis

In Orange County there are a total of 65 High-Risk wells (including multiport screen intervals) all but two of which are averages. There are 60 Medium-Risk wells of which 17 are Statistics. The loss of these wells will not significantly impact the ability to contour. In Irvine there are a total of 14 High-Risk wells and nine Medium-Risk wells. The loss of wells in the northern portion of Irvine will impact the ability to contour in future recomputations.

New Well Analysis

In Orange County there are a total of 33 New-Statistics and 45 Potential-Statistics. In the western portion of Irvine, USMC-MW2D is a Potential-Statistic which increases the Nitrate concentrations in this area. As available, the northern and southern portions of this GMZ would benefit from additional well information.

Source: SAWPA.net, January 2017

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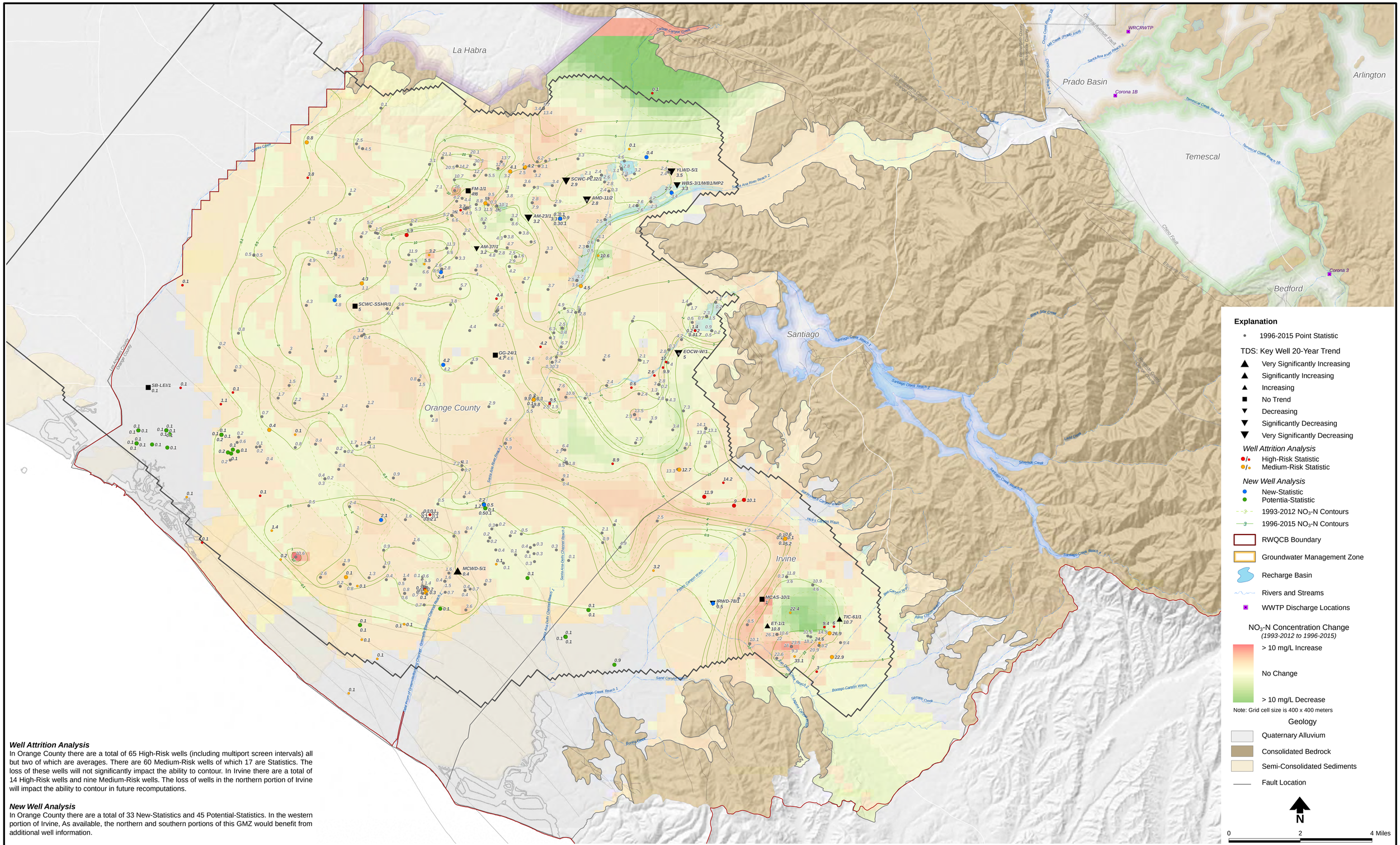
Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015) Layer 1
Orange County and Irvine GMZs

Attachment B11-4a



Well Attrition Analysis

In Orange County there are a total of 65 High-Risk wells (including multiport screen intervals) all but two of which are averages. There are 60 Medium-Risk wells of which 17 are Statistics. The loss of these wells will not significantly impact the ability to contour. In Irvine there are a total of 14 High-Risk wells and nine Medium-Risk wells. The loss of wells in the northern portion of Irvine will impact the ability to contour in future recomputations.

New Well Analysis

In Orange County there are a total of 33 New-Statistics and 45 Potential-Statistics. In the western portion of Irvine, As available, the northern and southern portions of this GMZ would benefit from additional well information.

Source: SAWPA.net, January 2017

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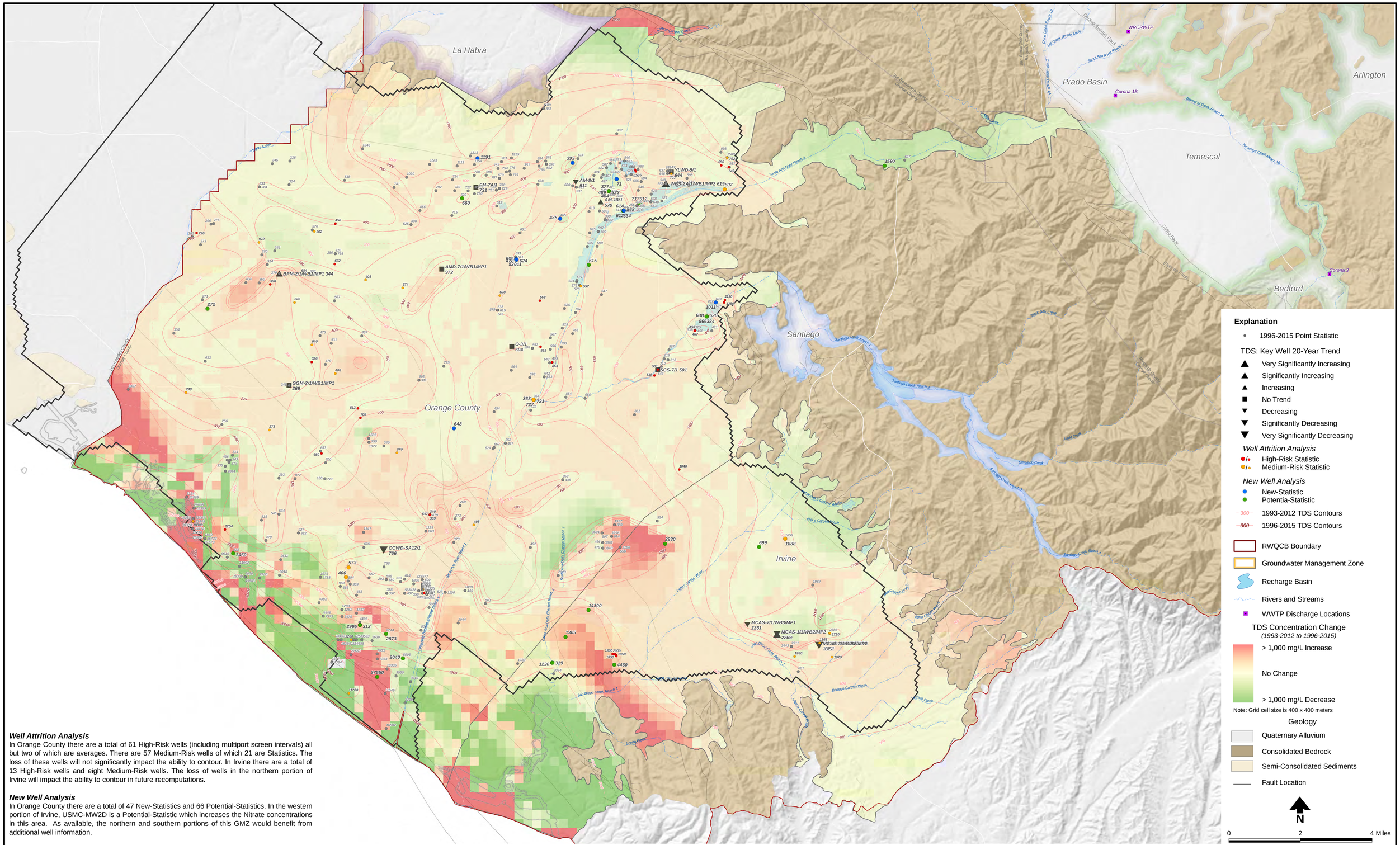
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015) Layer 2
Orange County and Irvine GMZs

Attachment B11-4b



Well Attrition Analysis

In Orange County there are a total of 61 High-Risk wells (including multiport screen intervals) all but two of which are averages. There are 57 Medium-Risk wells of which 21 are Statistics. The loss of these wells will not significantly impact the ability to contour. In Irvine there are a total of 13 High-Risk wells and eight Medium-Risk wells. The loss of wells in the northern portion of Irvine will impact the ability to contour in future recomputations.

New Well Analysis

In Orange County there are a total of 47 New-Statistics and 66 Potential-Statistics. In the western portion of Irvine, USMC-MW2D is a Potential-Statistic which increases the Nitrate concentrations in this area. As available, the northern and southern portions of this GMZ would benefit from additional well information.

Source: SAWPA.net, January 2017

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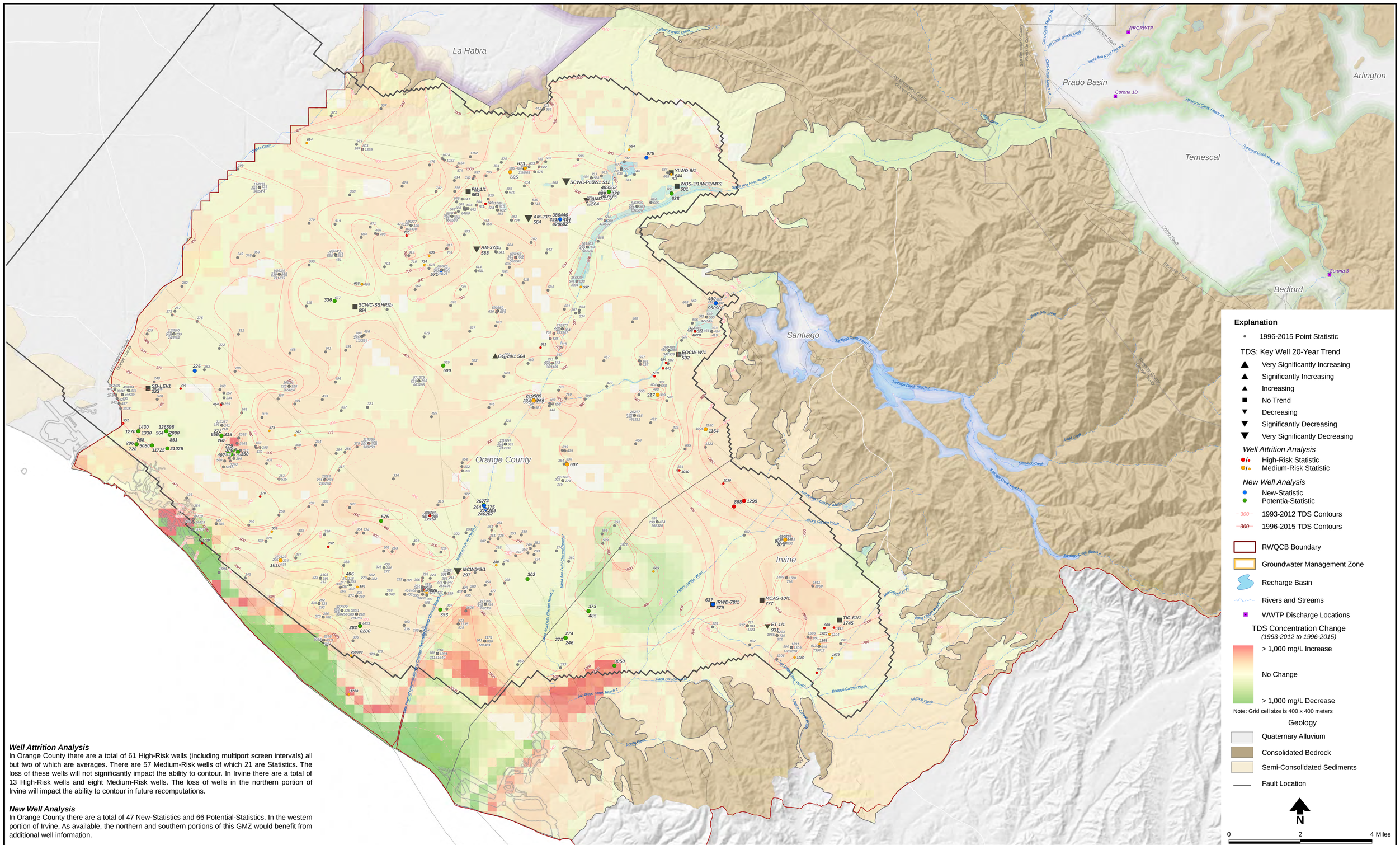
SAWPA

Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015) Layer 1
Orange County and Irvine GMZs

Attachment B11-5a



Well Attrition Analysis

In Orange County there are a total of 61 High-Risk wells (including multiport screen intervals) all but two of which are averages. There are 57 Medium-Risk wells of which 21 are Statistics. The loss of these wells will not significantly impact the ability to contour. In Irvine there are a total of 13 High-Risk wells and eight Medium-Risk wells. The loss of wells in the northern portion of Irvine will impact the ability to contour in future recomputations.

New Well Analysis

In Orange County there are a total of 47 New-Statistics and 66 Potential-Statistics. In the western portion of Irvine, As available, the northern and southern portions of this GMZ would benefit from additional well information.

Source: SAWPA.net, January 2017

DBS&A
Daniel B. Stephens & Associates, Inc.
01/31/2017
CA.16.0087

SAWPA Basin Monitoring Program Task Force

SAWPA

Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015) Layer 2
Orange County and Irvine GMZs

Attachment B11-5b

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

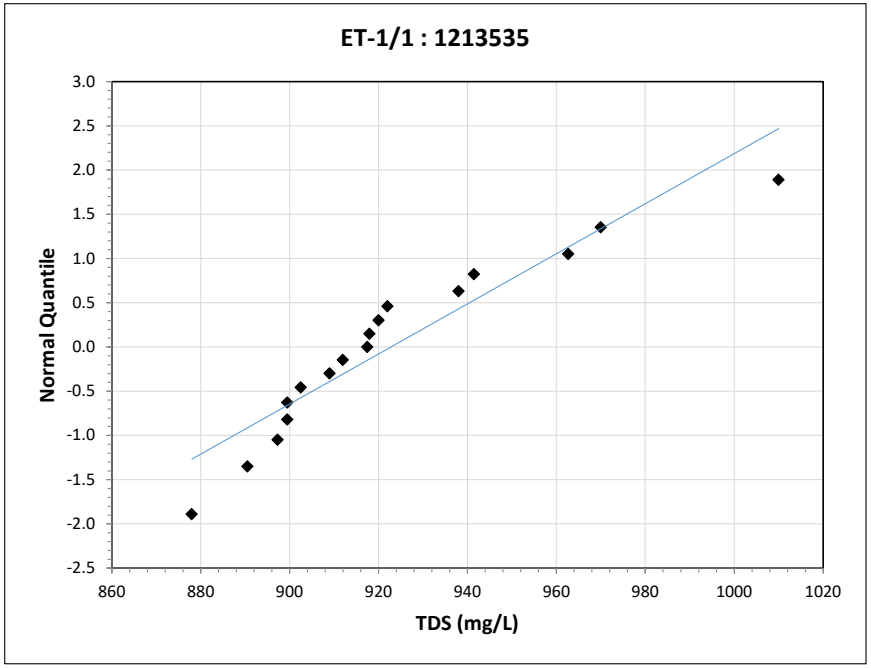
Mann-Kendall

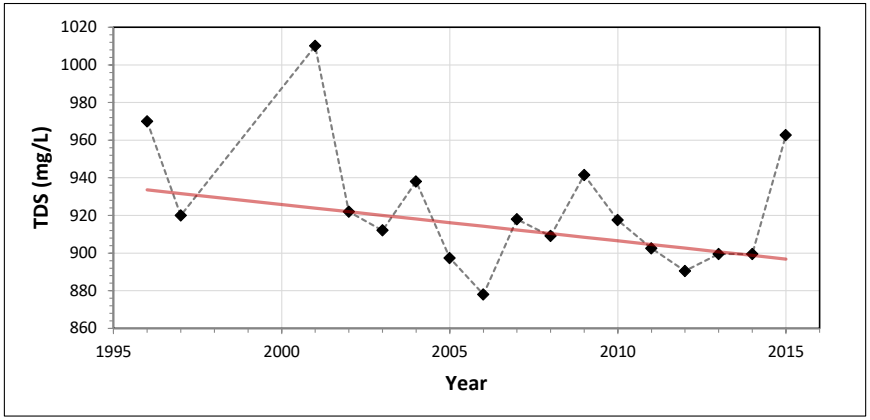
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

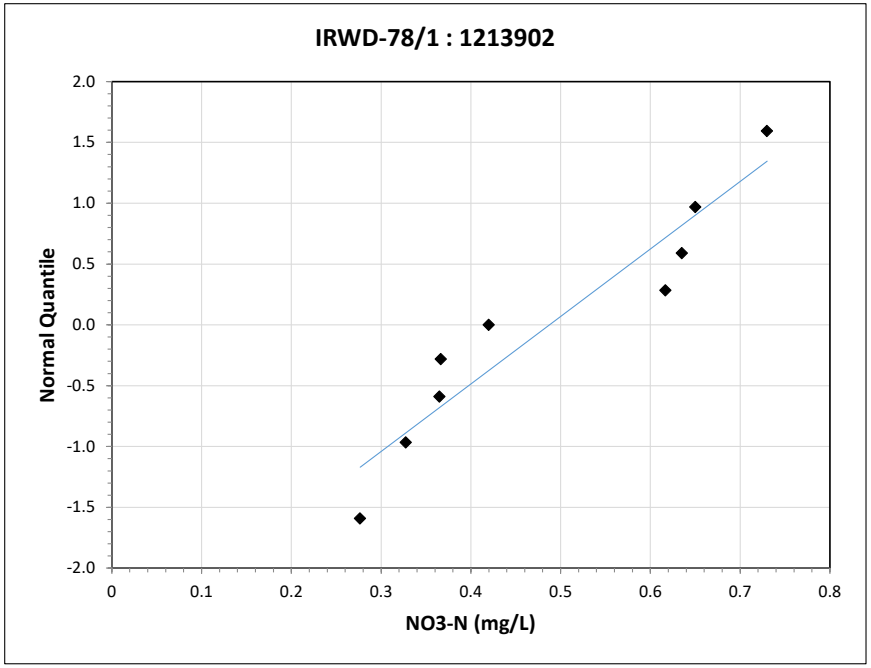
The significance of the trends is notated by * for significant and ** for very significant.

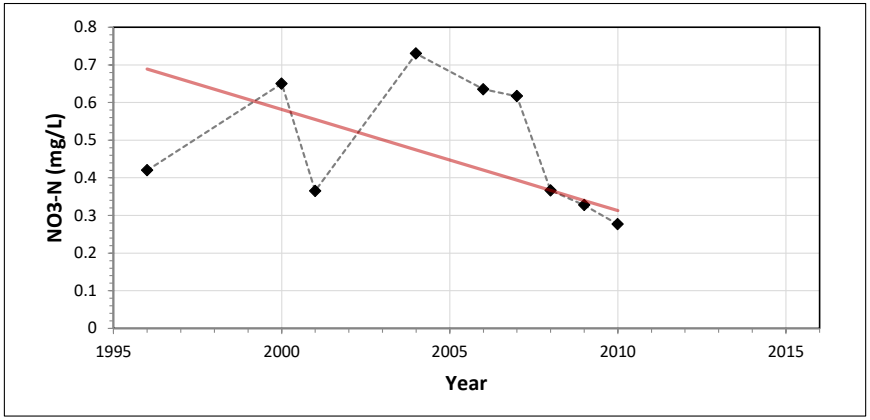
Statistics	
GMZ	Irvine
Well Name : ID	ET-1/1 : 1213535
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	878
Annual Average Max	1010
Annual Average Mean	923
Annual Average Stdev	33.13
Shapiro-Wilk W	0.898
Shapiro-Wilk p-value	0.062
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.04
Student t	1.03
Mean + t*SE (UCL84)	931
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-43
Var(S)	588
Intercept	4793
Slope	-1.93
p-value	0.083
Significant Trend?	Decreasing



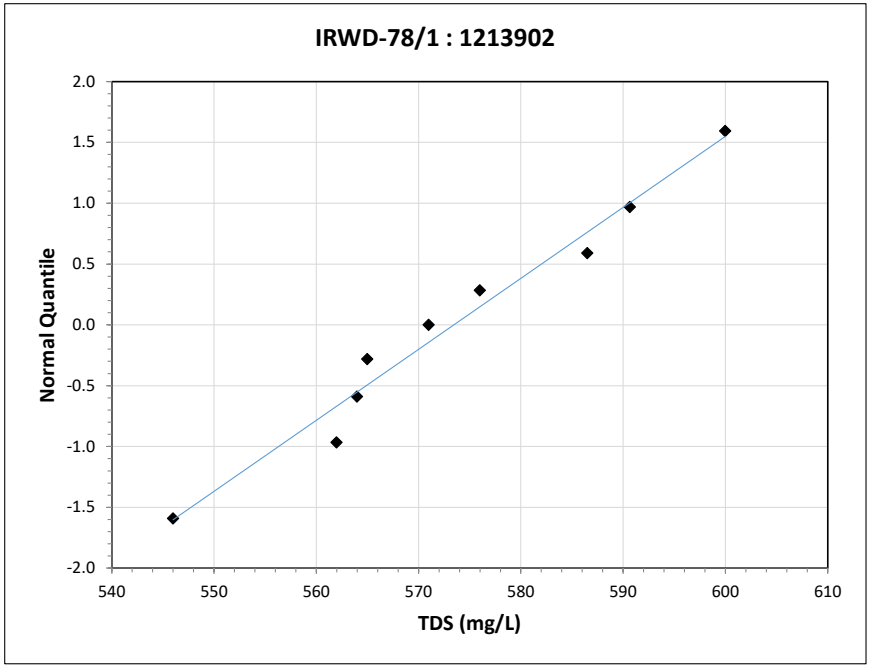


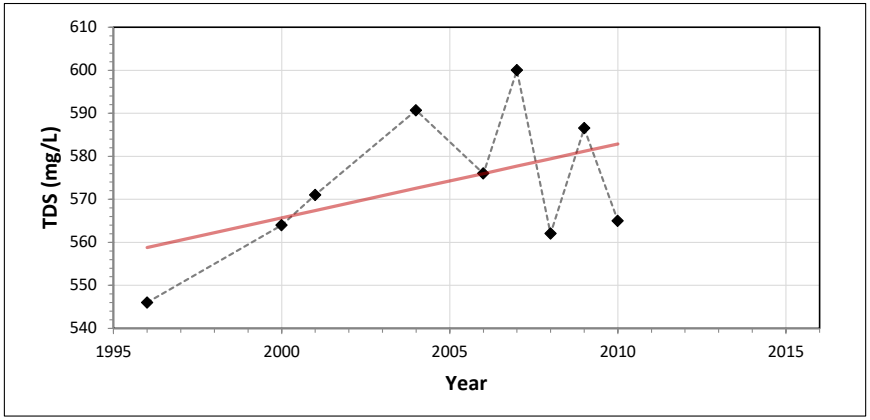
Statistics	
GMZ	Irvine
Well Name : ID	IRWD-78/1 : 1213902
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	1996
Sample Year Max	2010
Annual Average Min	0.28
Annual Average Max	0.73
Annual Average Mean	0.49
Annual Average Stdev	0.17
Shapiro-Wilk W	0.884
Shapiro-Wilk p-value	0.171
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.06
Student t	1.06
Mean + t*SE (UCL84)	0.55
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-18
Var(S)	92.00
Intercept	54.33
Slope	-0.03
p-value	0.076
Significant Trend?	Decreasing



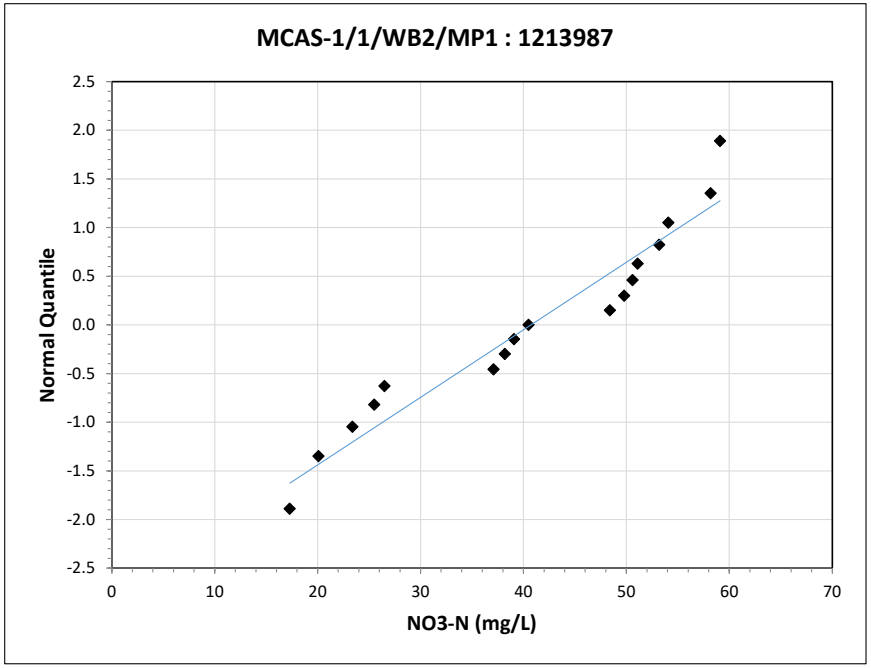


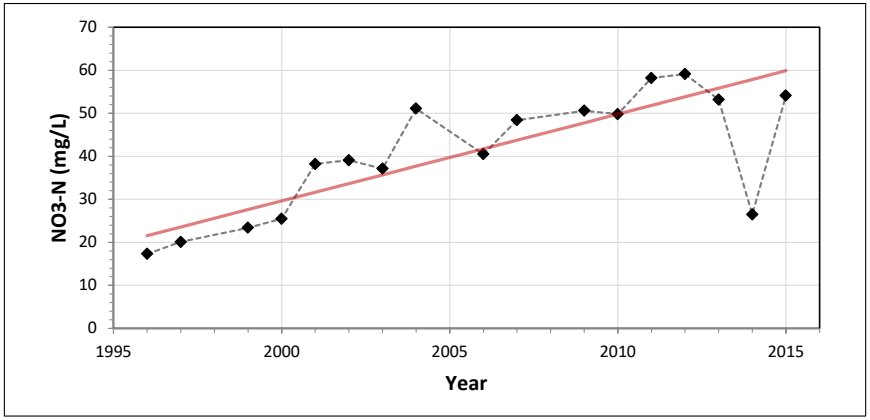
Statistics	
GMZ	Irvine
Well Name : ID	IRWD-78/1 : 1213902
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	1996
Sample Year Max	2010
Annual Average Min	546
Annual Average Max	600
Annual Average Mean	573
Annual Average Stdev	16.69
Shapiro-Wilk W	0.974
Shapiro-Wilk p-value	0.923
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.56
Student t	1.06
Mean + t*SE (UCL84)	579
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	10
Var(S)	92.00
Intercept	-2872
Slope	1.72
p-value	0.348
Significant Trend?	No



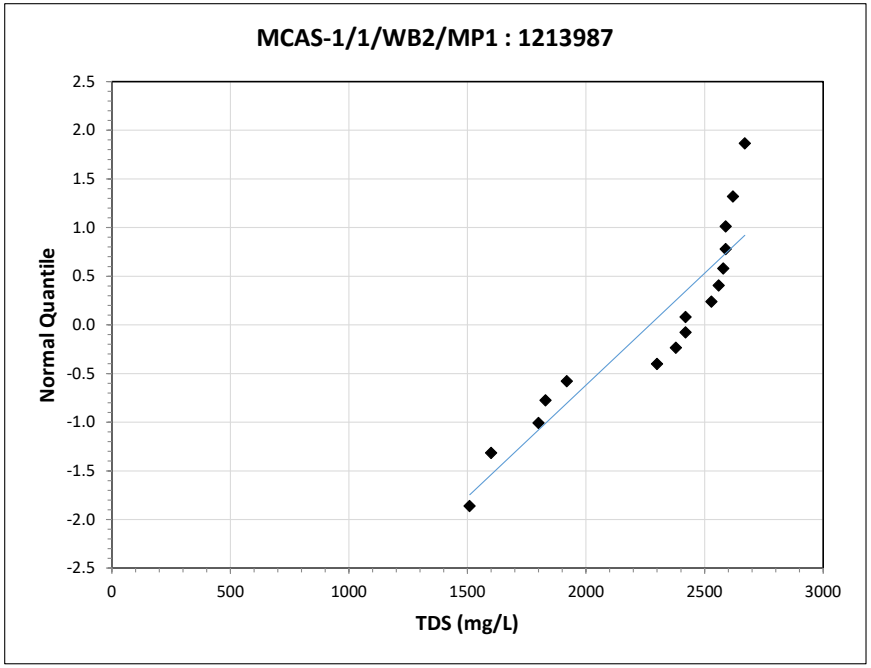


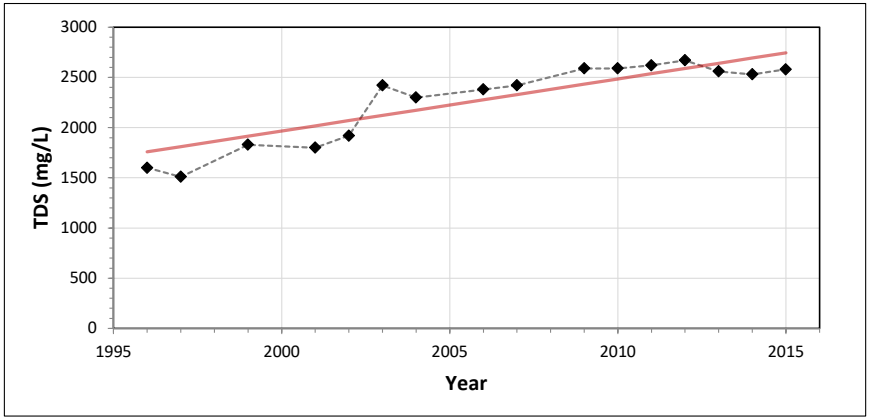
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-1/1/WB2/MP1 : 1213987
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	17.30
Annual Average Max	59.10
Annual Average Mean	40.72
Annual Average Stdev	13.82
Shapiro-Wilk W	0.918
Shapiro-Wilk p-value	0.138
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	3.35
Student t	1.03
Mean + t*SE (UCL84)	44.16
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	92
Var(S)	589
Intercept	-4004
Slope	2.02
p-value	2E-4
Significant Trend?	Increasing**



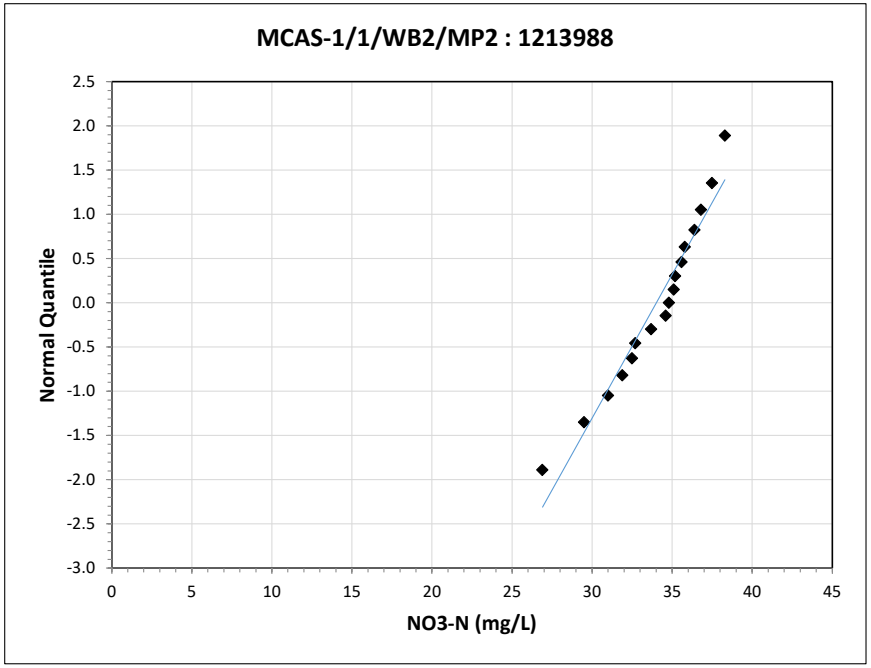


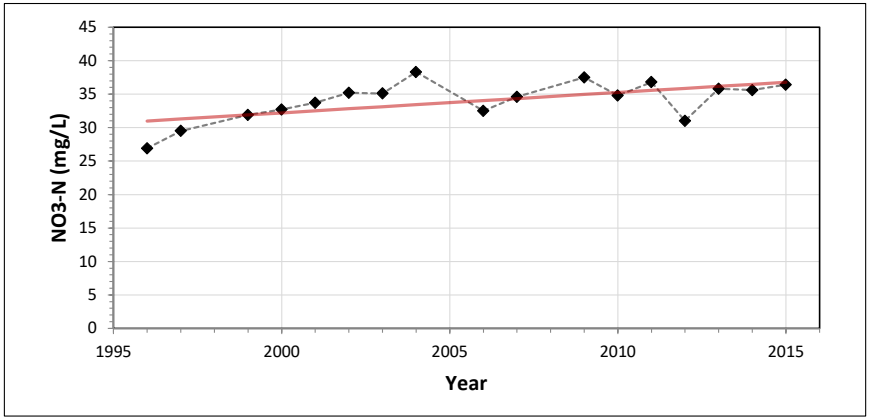
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-1/1/WB2/MP1 : 1213987
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1510
Annual Average Max	2670
Annual Average Mean	2270
Annual Average Stdev	396.37
Shapiro-Wilk W	0.831
Shapiro-Wilk p-value	0.007
Critical Alpha	0.01
Most Discordant Value	1510
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.004
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	2420
Trend Analysis	**Theil-Sen**
Kendall S	84
Var(S)	491
Intercept	-101843
Slope	51.90
p-value	2E-4
Significant Trend?	Increasing**



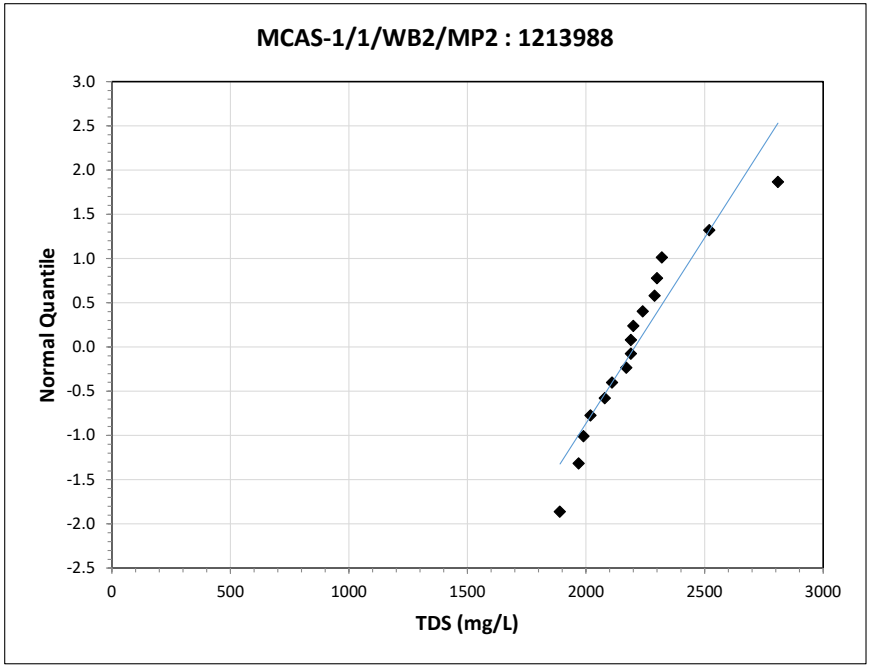


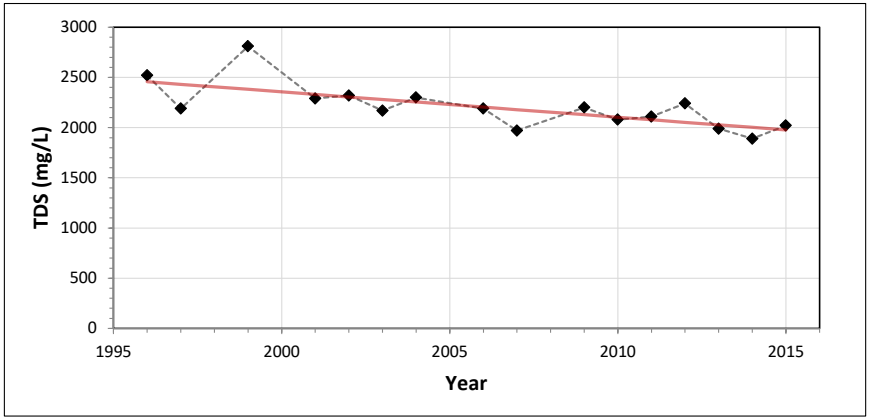
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-1/1/WB2/MP2 : 1213988
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	26.90
Annual Average Max	38.30
Annual Average Mean	34.02
Annual Average Stdev	2.98
Shapiro-Wilk W	0.948
Shapiro-Wilk p-value	0.433
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.72
Student t	1.03
Mean + t*SE (UCL84)	34.76
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	62
Var(S)	589
Intercept	-578
Slope	0.31
p-value	0.012
Significant Trend?	Increasing



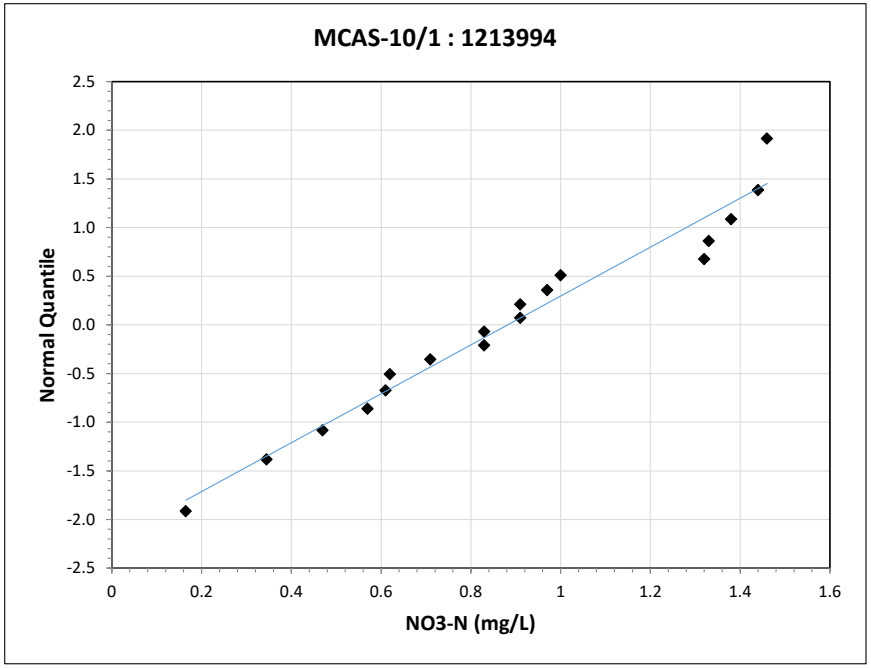


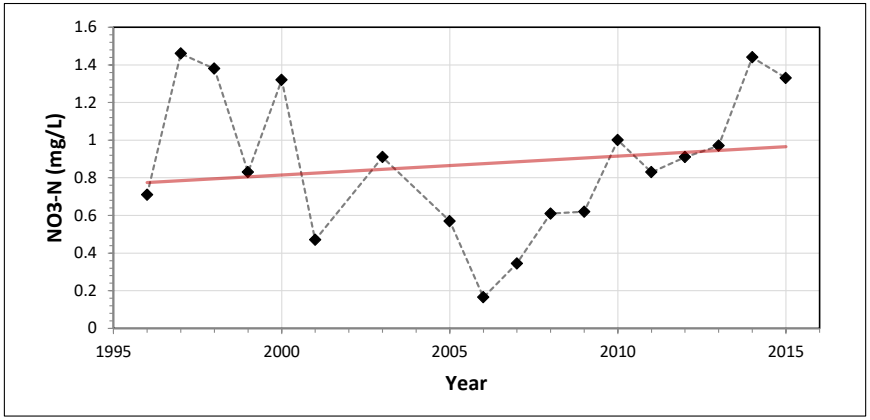
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-1/1/WB2/MP2 : 1213988
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1890
Annual Average Max	2810
Annual Average Mean	2206
Annual Average Stdev	224.68
Shapiro-Wilk W	0.907
Shapiro-Wilk p-value	0.106
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	56.17
Student t	1.03
Mean + t*SE (UCL84)	2263
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-65
Var(S)	492
Intercept	52810
Slope	-25.23
p-value	0.004
Significant Trend?	Decreasing*



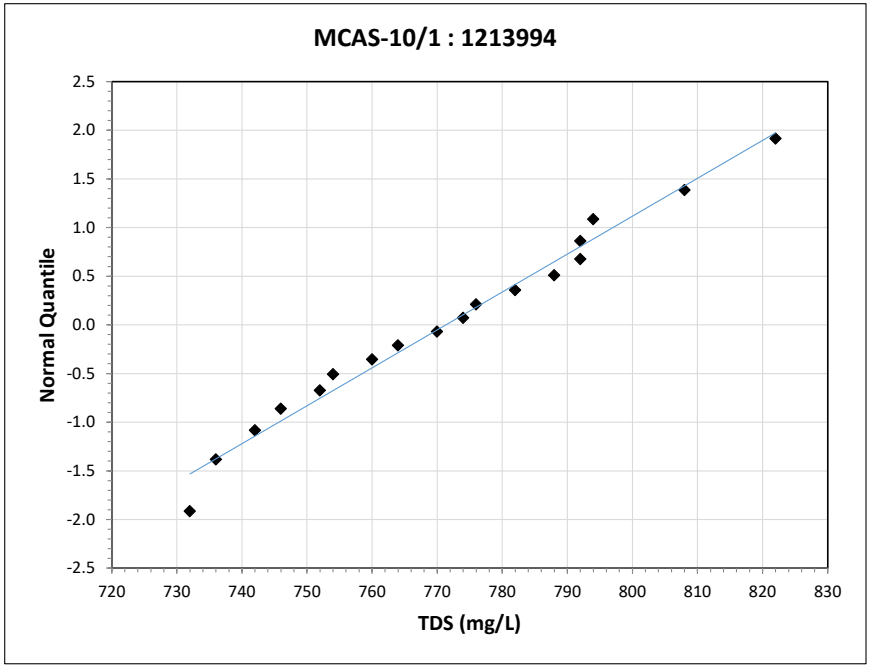


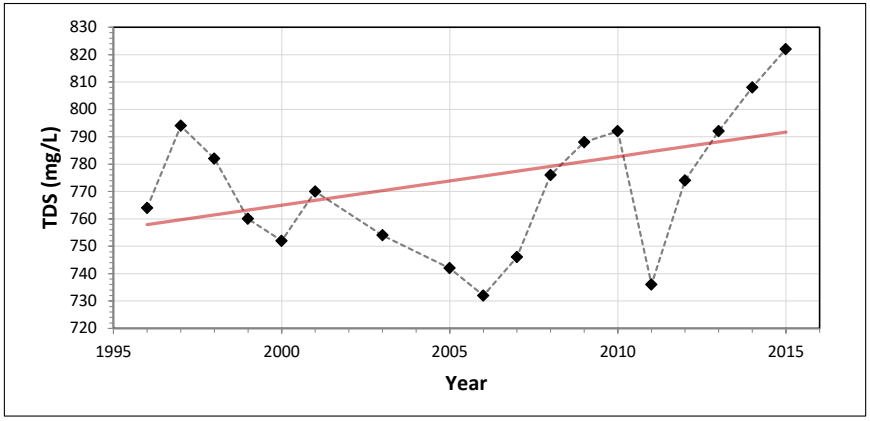
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-10/1 : 1213994
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.17
Annual Average Max	1.46
Annual Average Mean	0.88
Annual Average Stdev	0.39
Shapiro-Wilk W	0.952
Shapiro-Wilk p-value	0.465
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.09
Student t	1.02
Mean + t*SE (UCL84)	0.98
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	17
Var(S)	695
Intercept	-19.19
Slope	0.01
p-value	0.544
Significant Trend?	No



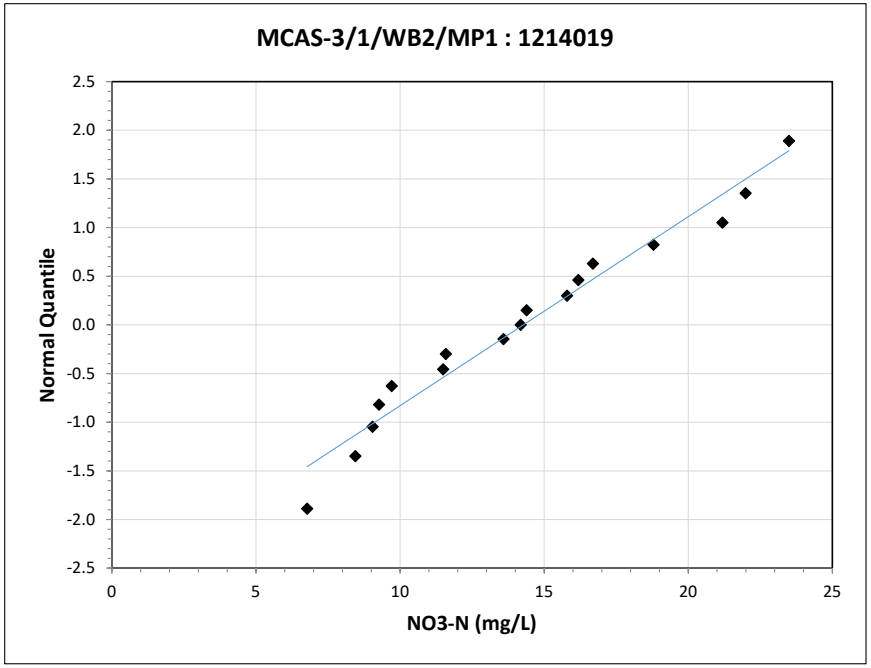


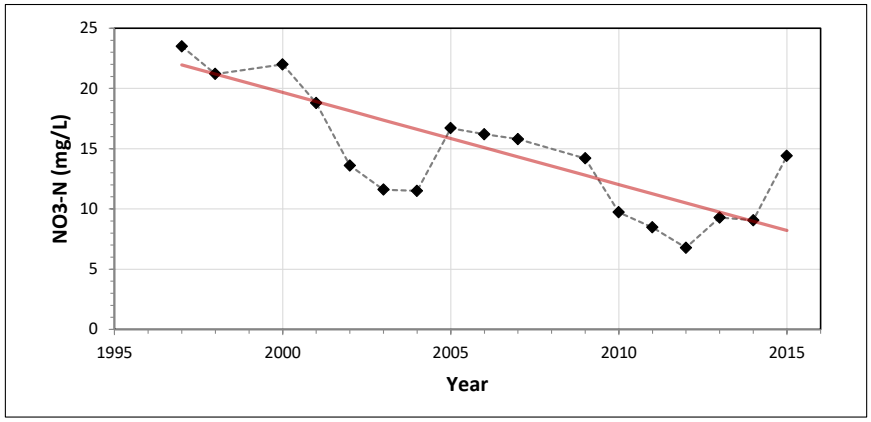
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-10/1 : 1213994
Analyte	TDS (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	732
Annual Average Max	822
Annual Average Mean	771
Annual Average Stdev	25.27
Shapiro-Wilk W	0.976
Shapiro-Wilk p-value	0.895
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.96
Student t	1.02
Mean + t*SE (UCL84)	777
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	34
Var(S)	696
Intercept	-2791
Slope	1.78
p-value	0.211
Significant Trend?	No



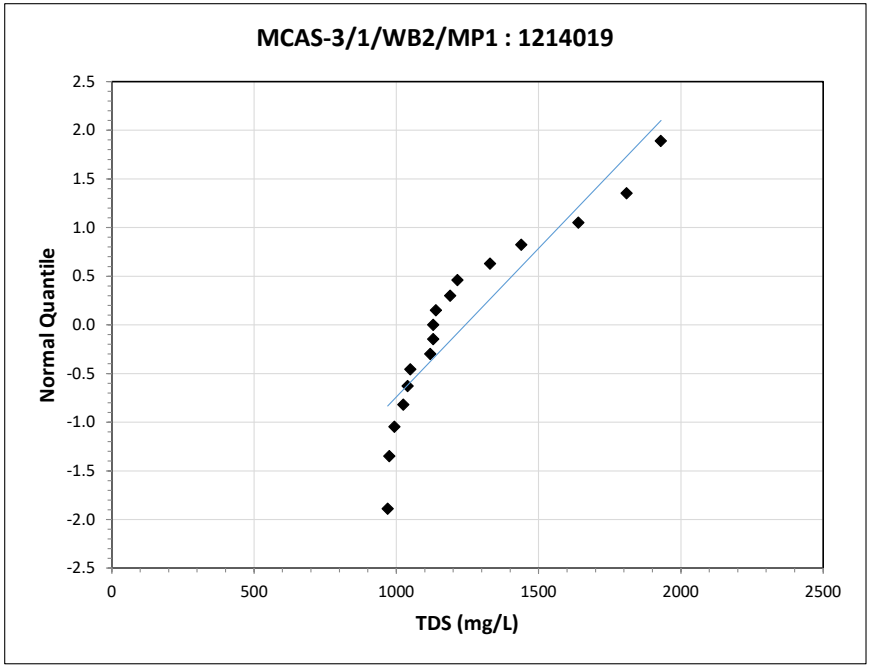


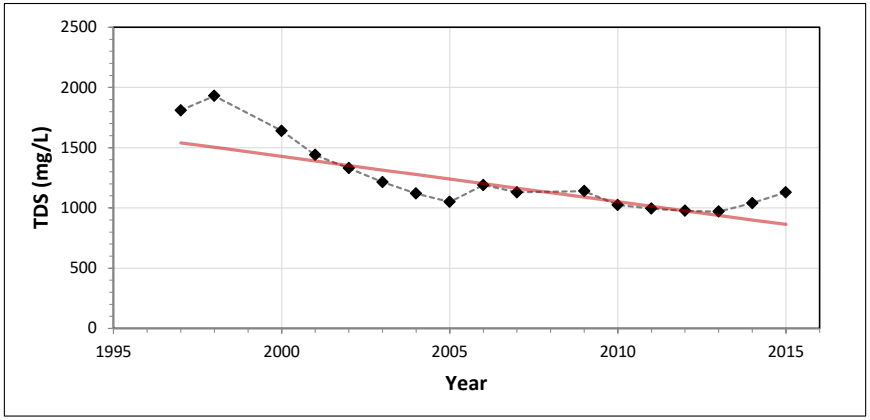
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-3/1/WB2/MP1 : 1214019
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	6.78
Annual Average Max	23.50
Annual Average Mean	14.28
Annual Average Stdev	5.02
Shapiro-Wilk W	0.955
Shapiro-Wilk p-value	0.547
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	1.22
Student t	1.03
Mean + t*SE (UCL84)	15.53
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-84
Var(S)	589
Intercept	1548
Slope	-0.76
p-value	6E-4
Significant Trend?	Decreasing**



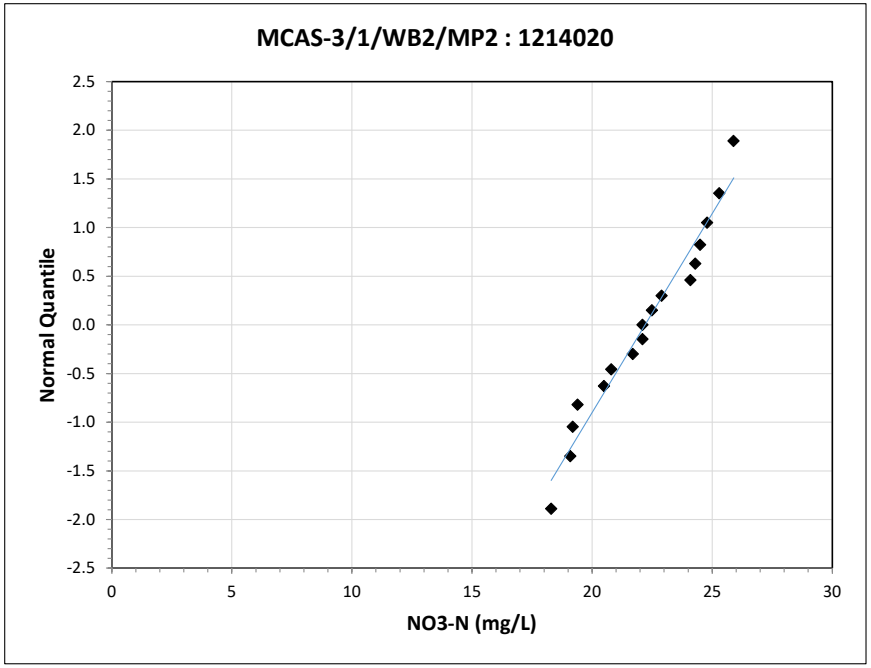


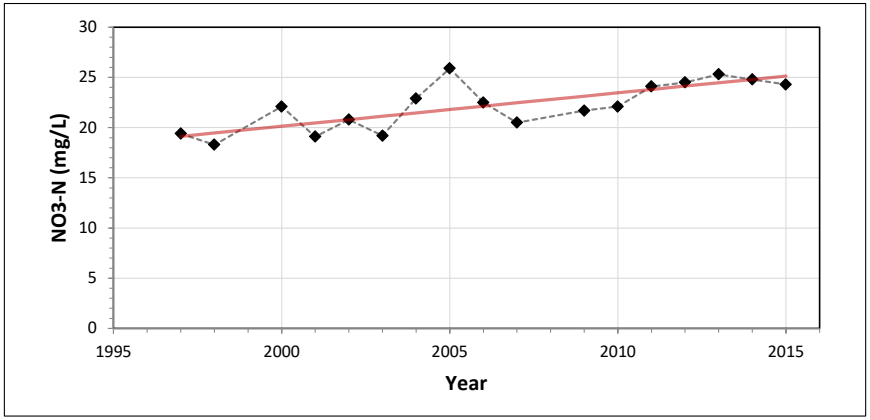
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-3/1/WB2/MP1 : 1214019
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	970
Annual Average Max	1930
Annual Average Mean	1243
Annual Average Stdev	294.33
Shapiro-Wilk W	0.817
Shapiro-Wilk p-value	0.004
Critical Alpha	0.01
Most Discordant Value	1930
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.03
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.018
Geomean	1215
GM + t*GSE (UCL84)	1281
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-97
Var(S)	588
Intercept	76705
Slope	-37.64
p-value	8E-5
Significant Trend?	Decreasing**



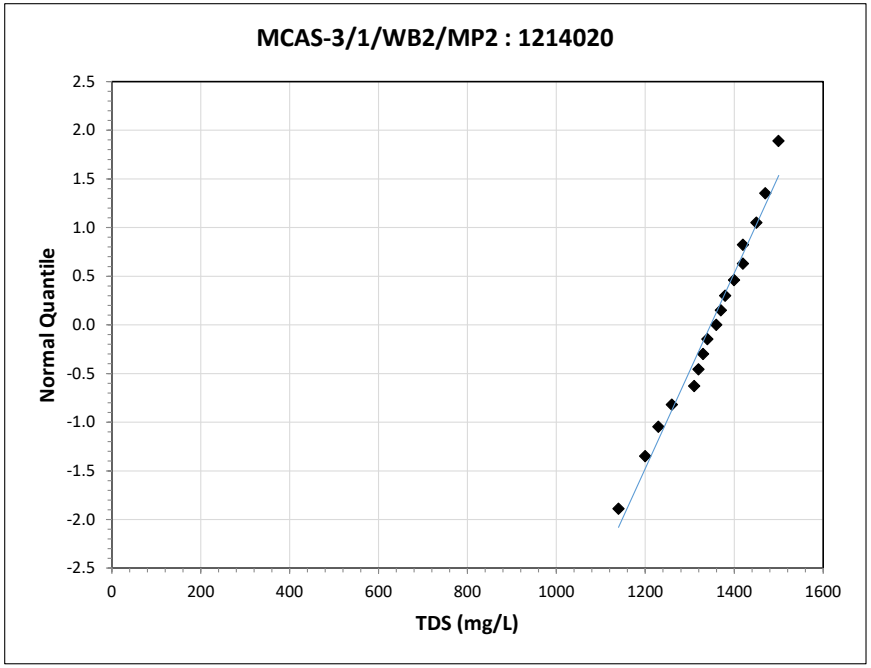


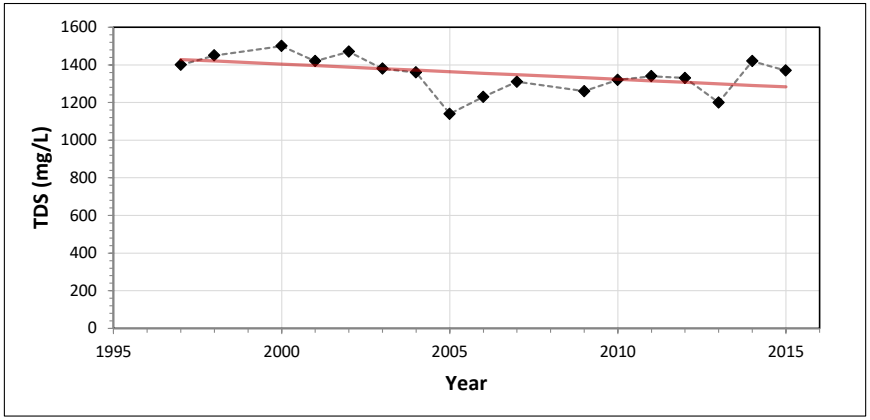
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-3/1/WB2/MP2 : 1214020
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	18.30
Annual Average Max	25.90
Annual Average Mean	22.21
Annual Average Stdev	2.38
Shapiro-Wilk W	0.951
Shapiro-Wilk p-value	0.466
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.58
Student t	1.03
Mean + t*SE (UCL84)	22.80
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	75
Var(S)	588
Intercept	-647
Slope	0.33
p-value	0.002
Significant Trend?	Increasing*



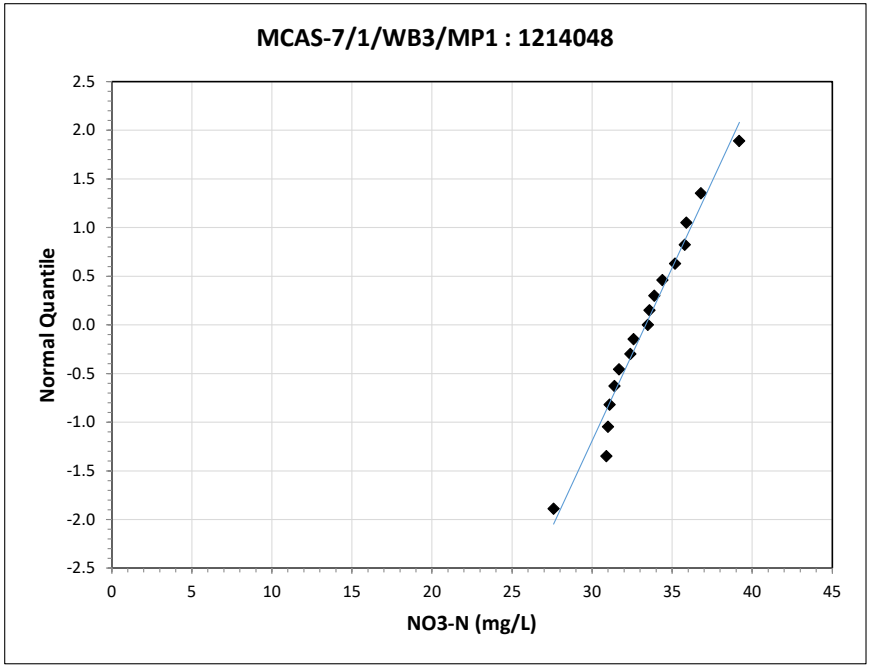


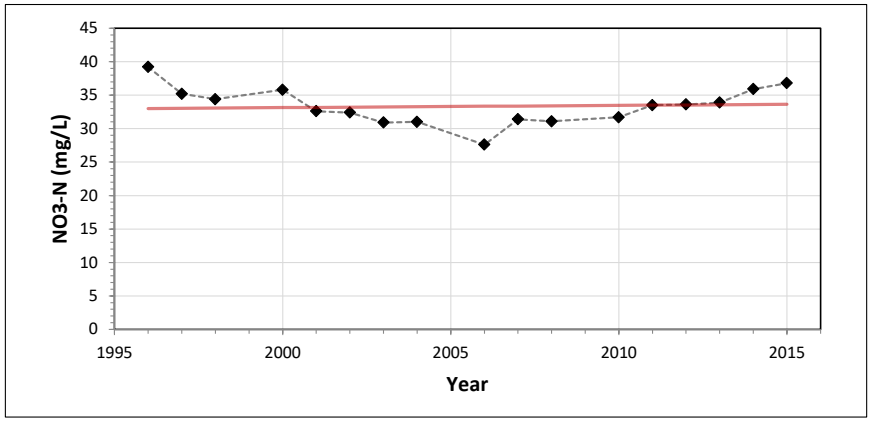
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-3/1/WB2/MP2 : 1214020
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	1140
Annual Average Max	1500
Annual Average Mean	1347
Annual Average Stdev	97.65
Shapiro-Wilk W	0.973
Shapiro-Wilk p-value	0.864
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	23.68
Student t	1.03
Mean + t*SE (UCL84)	1371
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-41
Var(S)	588
Intercept	17586
Slope	-8.09
p-value	0.099
Significant Trend?	Decreasing



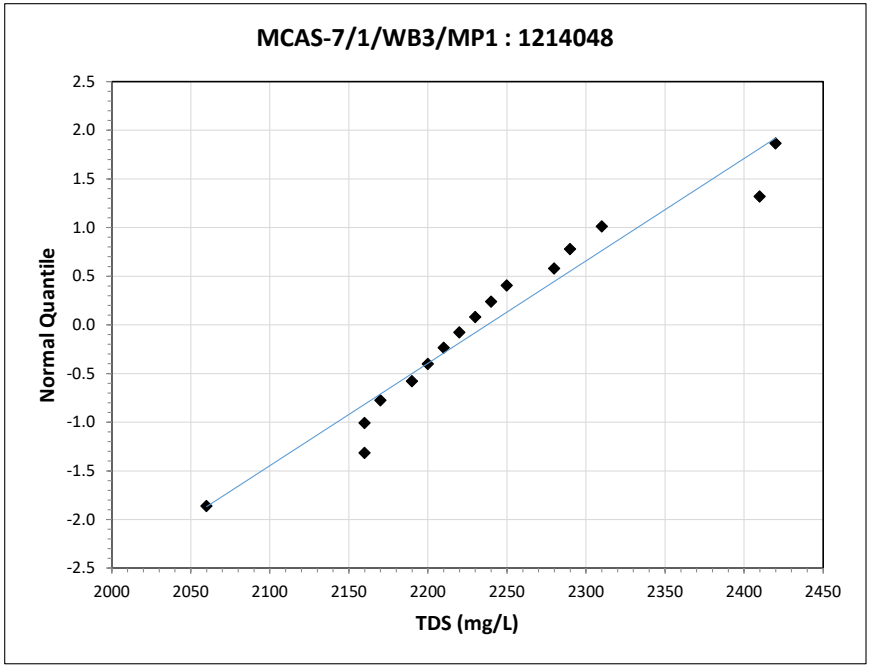


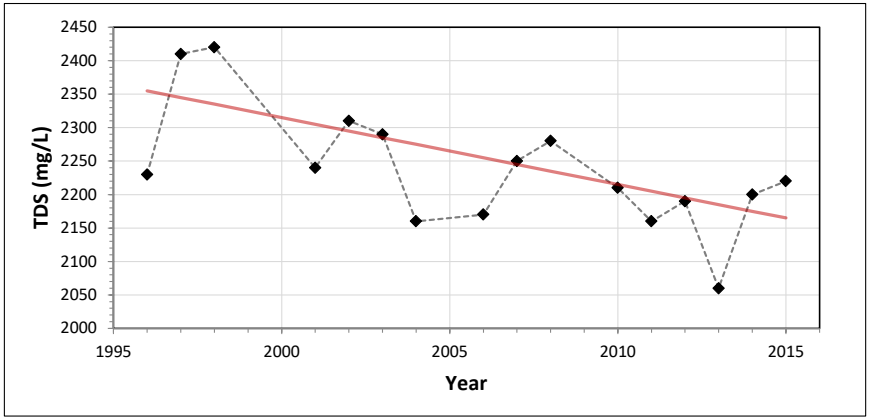
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-7/1/WB3/MP1 : 1214048
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	27.60
Annual Average Max	39.20
Annual Average Mean	33.35
Annual Average Stdev	2.75
Shapiro-Wilk W	0.980
Shapiro-Wilk p-value	0.954
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.67
Student t	1.03
Mean + t*SE (UCL84)	34.04
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	4
Var(S)	589
Intercept	-31.86
Slope	0.03
p-value	0.902
Significant Trend?	No



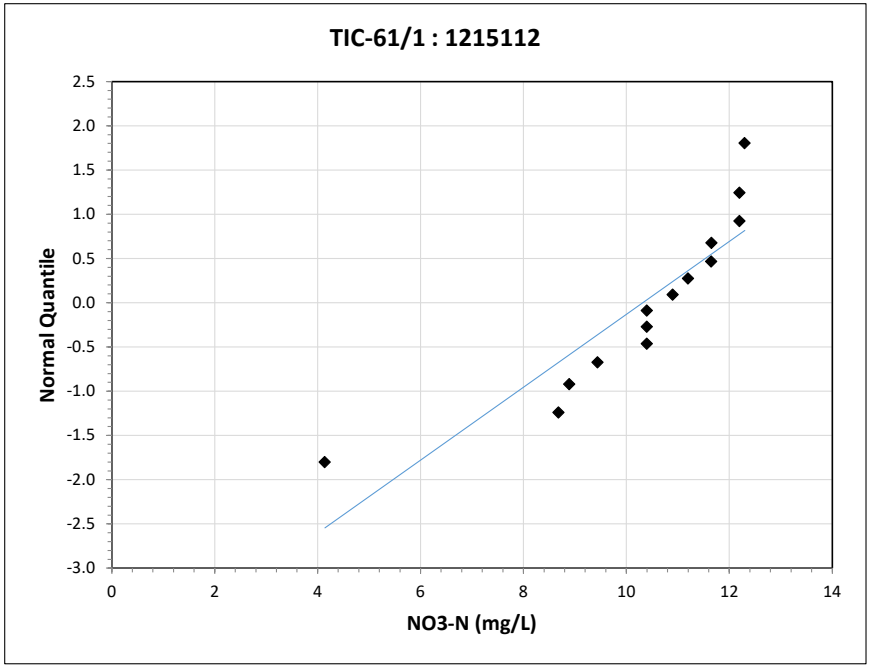


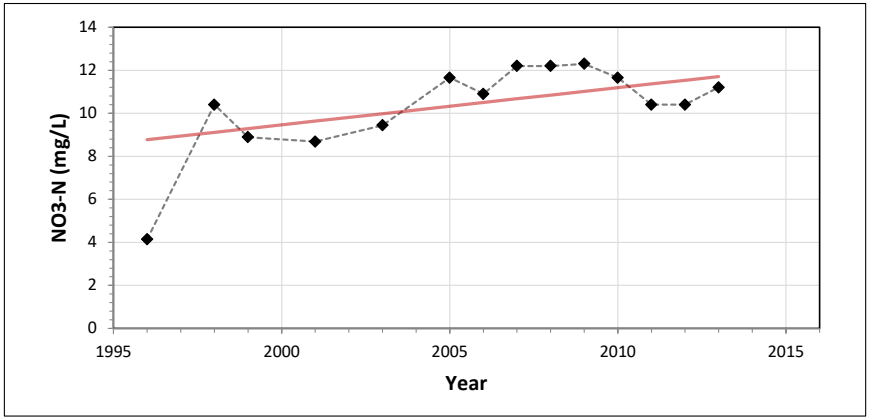
Statistics	
GMZ	Irvine
Well Name : ID	MCAS-7/1/WB3/MP1 : 1214048
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2060
Annual Average Max	2420
Annual Average Mean	2238
Annual Average Stdev	91.62
Shapiro-Wilk W	0.948
Shapiro-Wilk p-value	0.453
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	22.90
Student t	1.03
Mean + t*SE (UCL84)	2261
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-49
Var(S)	492
Intercept	22315
Slope	-10.00
p-value	0.031
Significant Trend?	Decreasing



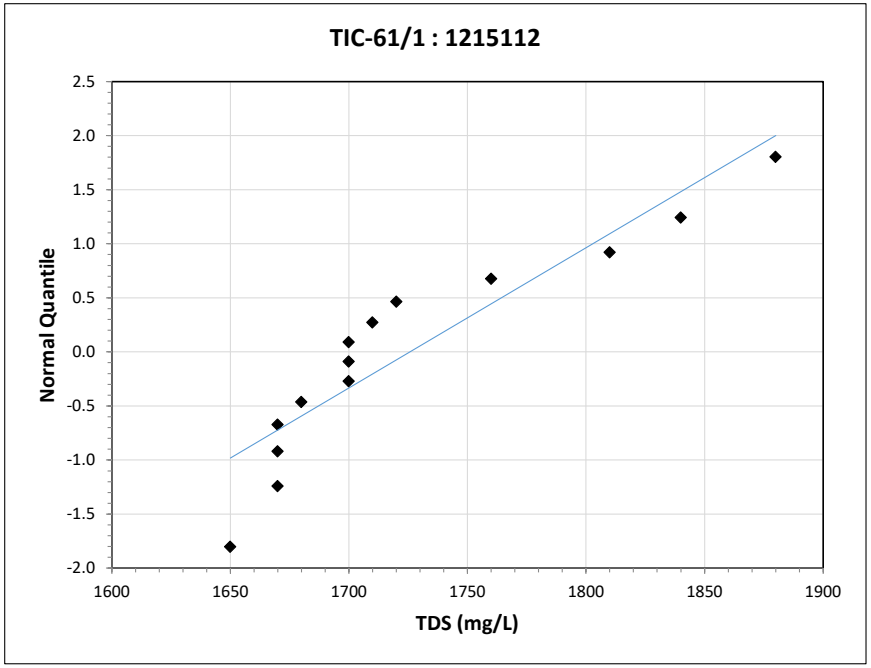


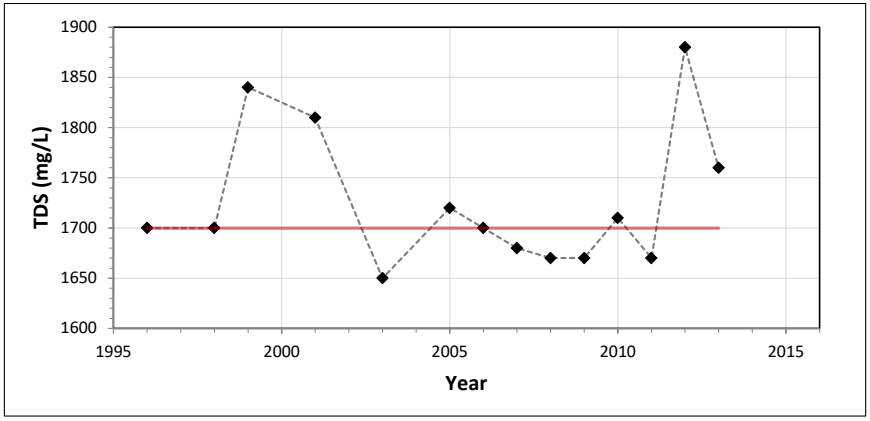
Statistics	
GMZ	Irvine
Well Name : ID	TIC-61/1 : 1215112
Analyte	NO3-N (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	4.14
Annual Average Max	12.30
Annual Average Mean	10.32
Annual Average Stdev	2.14
Shapiro-Wilk W	0.800
Shapiro-Wilk p-value	0.005
Critical Alpha	0.01
Most Discordant Value	4.14
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	10.65
Trend Analysis	**Theil-Sen**
Kendall S	35
Var(S)	329
Intercept	-336
Slope	0.17
p-value	0.061
Significant Trend?	Increasing



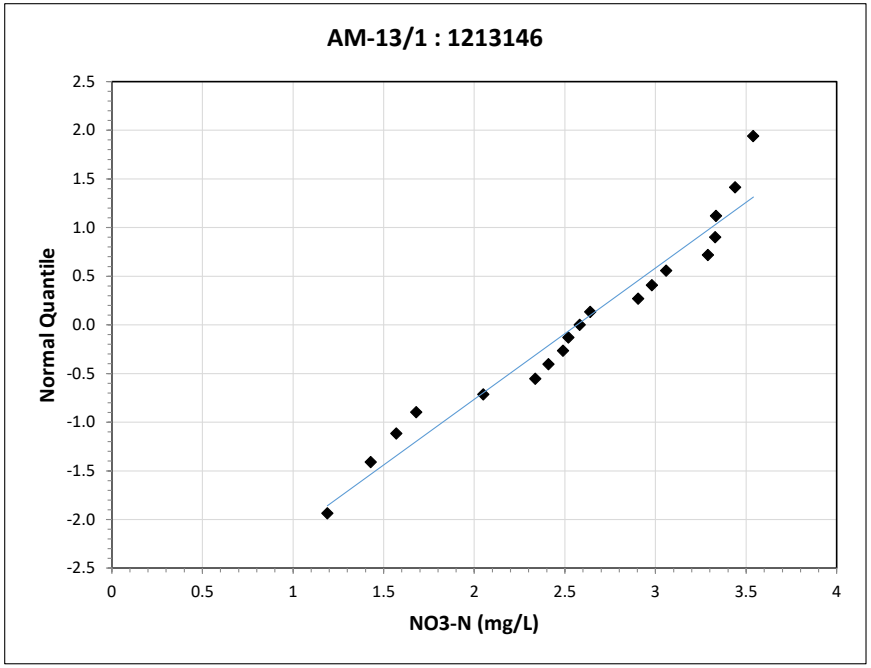


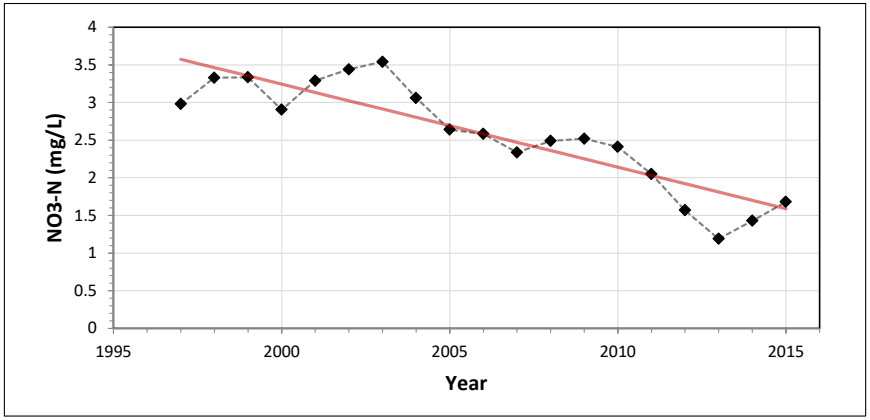
Statistics	
GMZ	Irvine
Well Name : ID	TIC-61/1 : 1215112
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	1650
Annual Average Max	1880
Annual Average Mean	1726
Annual Average Stdev	70.46
Shapiro-Wilk W	0.845
Shapiro-Wilk p-value	0.019
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	18.83
Student t	1.03
Mean + t*SE (UCL84)	1745
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	326
Intercept	1700
Slope	0.00
p-value	NC
Significant Trend?	No



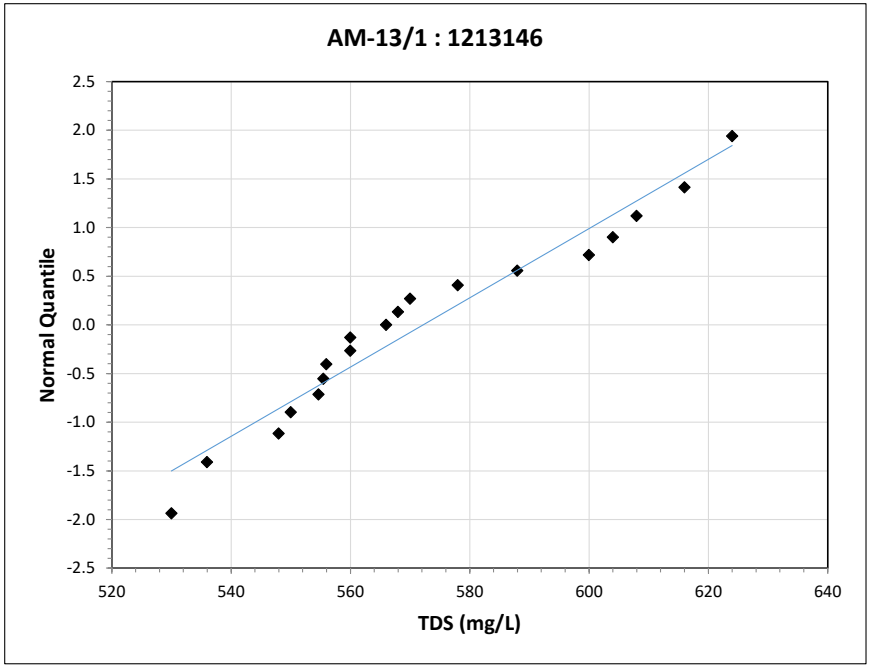


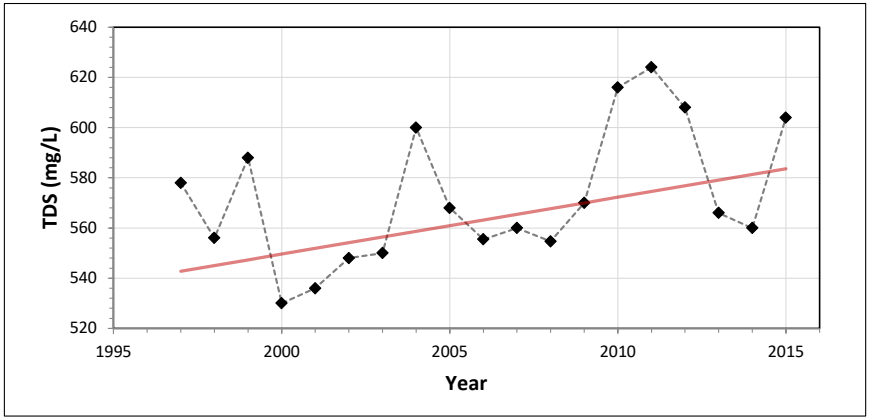
Statistics	
GMZ	Orange County
Well Name : ID	AM-13/1 : 1213146
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	1.19
Annual Average Max	3.54
Annual Average Mean	2.57
Annual Average Stdev	0.72
Shapiro-Wilk W	0.939
Shapiro-Wilk p-value	0.251
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.16
Student t	1.02
Mean + t*SE (UCL84)	2.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-119
Var(S)	817
Intercept	224
Slope	-0.11
p-value	4E-5
Significant Trend?	Decreasing**



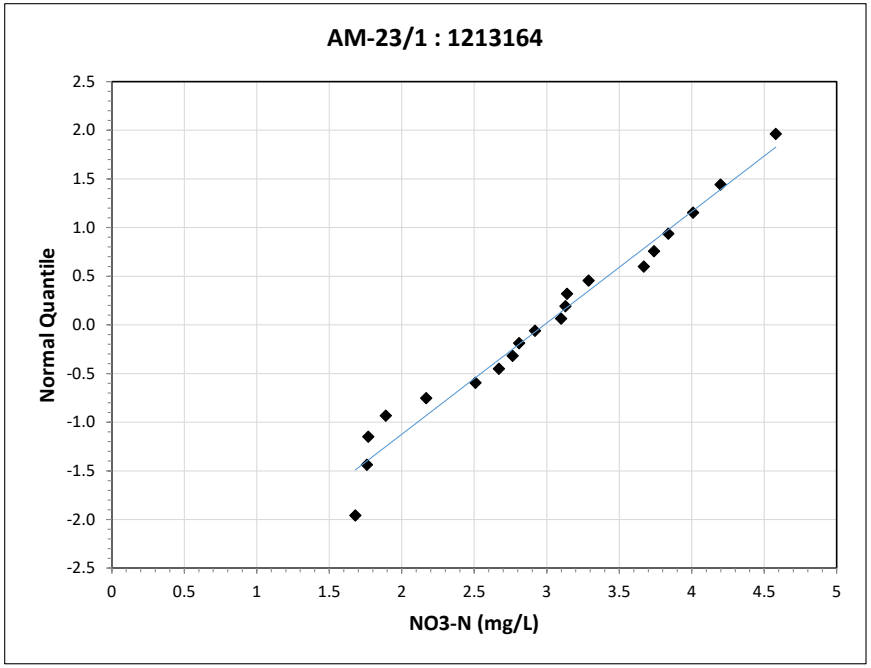


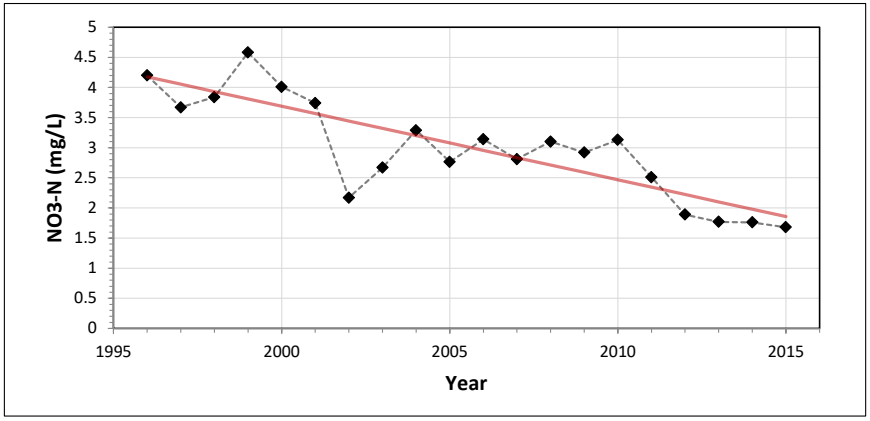
Statistics	
GMZ	Orange County
Well Name : ID	AM-13/1 : 1213146
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	530
Annual Average Max	624
Annual Average Mean	572
Annual Average Stdev	27.21
Shapiro-Wilk W	0.941
Shapiro-Wilk p-value	0.279
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.24
Student t	1.02
Mean + t*SE (UCL84)	579
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	56
Var(S)	816
Intercept	-3984
Slope	2.27
p-value	0.054
Significant Trend?	Increasing



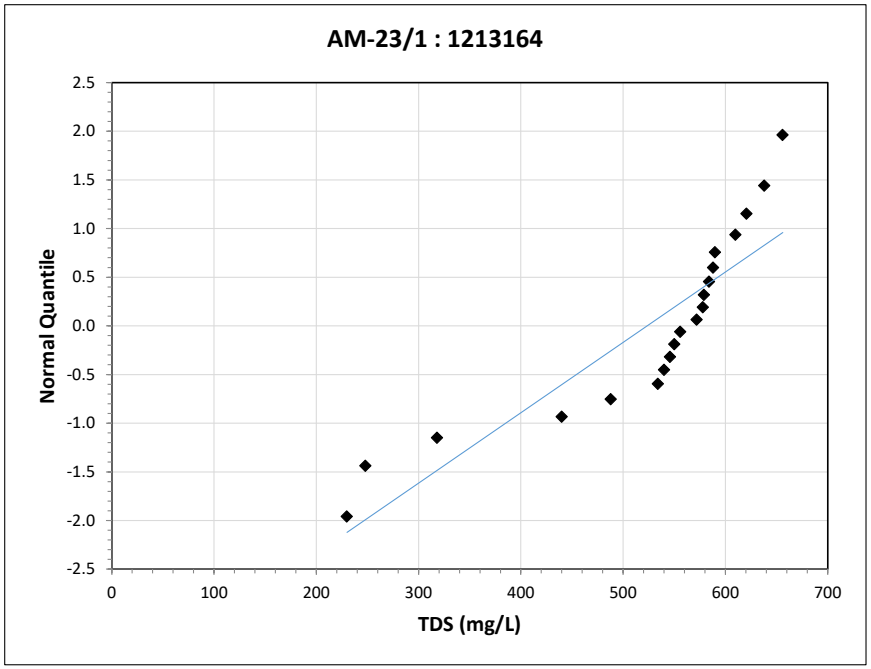


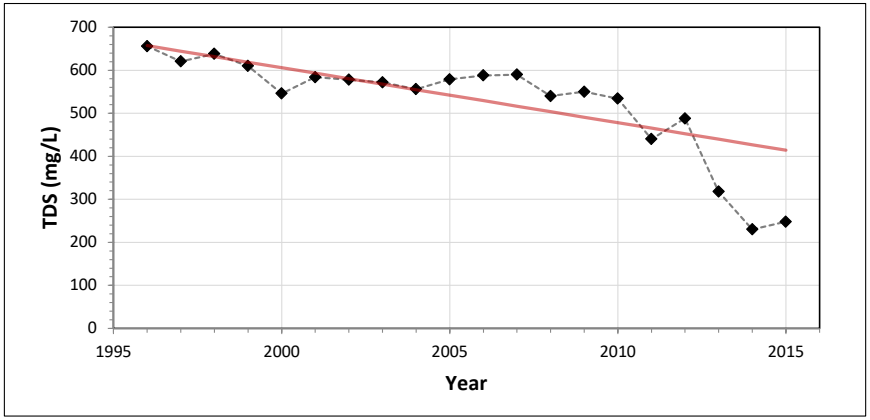
Statistics	
GMZ	Orange County
Well Name : ID	AM-23/1 : 1213164
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.68
Annual Average Max	4.58
Annual Average Mean	2.98
Annual Average Stdev	0.86
Shapiro-Wilk W	0.962
Shapiro-Wilk p-value	0.581
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.19
Student t	1.02
Mean + t*SE (UCL84)	3.18
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-124
Var(S)	950
Intercept	248
Slope	-0.12
p-value	7E-5
Significant Trend?	Decreasing**



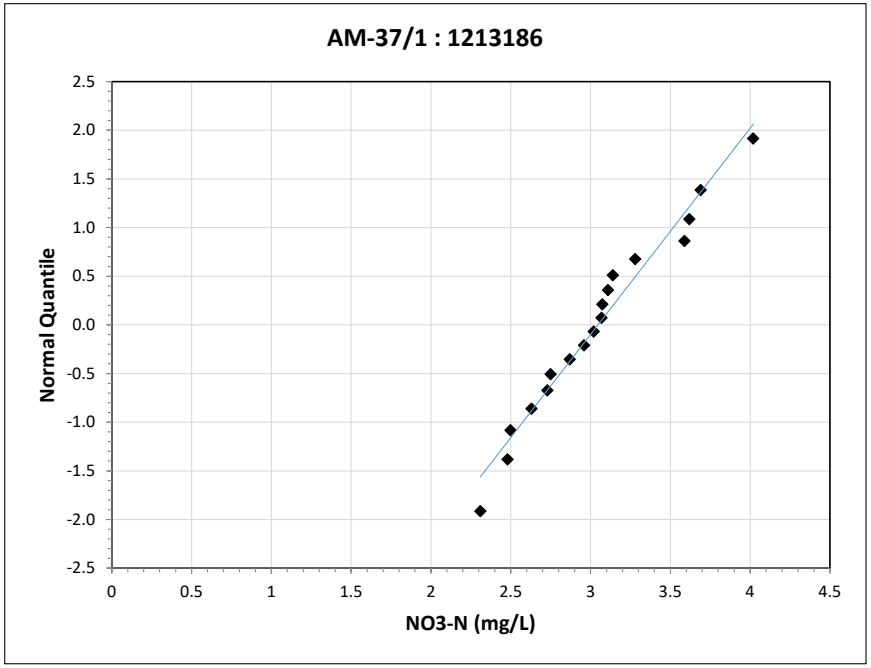


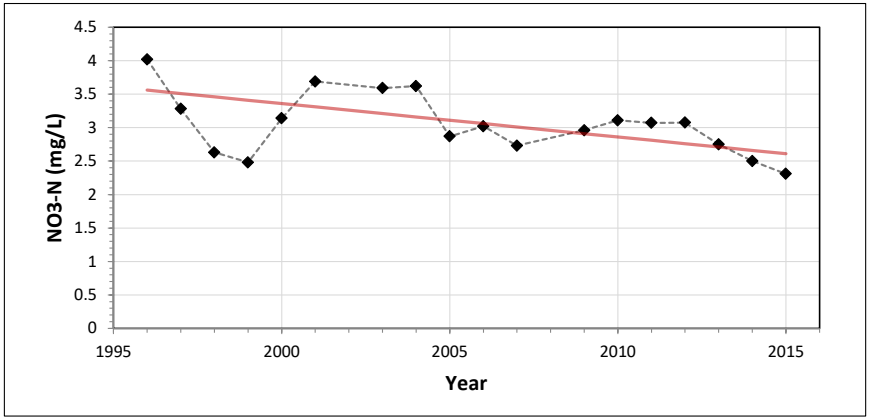
Statistics	
GMZ	Orange County
Well Name : ID	AM-23/1 : 1213164
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	230
Annual Average Max	656
Annual Average Mean	523
Annual Average Stdev	122.13
Shapiro-Wilk W	0.788
Shapiro-Wilk p-value	6E-4
Critical Alpha	0.01
Most Discordant Value	230
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	5E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	564
Trend Analysis	**Theil-Sen**
Kendall S	-138
Var(S)	950
Intercept	26177
Slope	-12.79
p-value	9E-6
Significant Trend?	Decreasing**



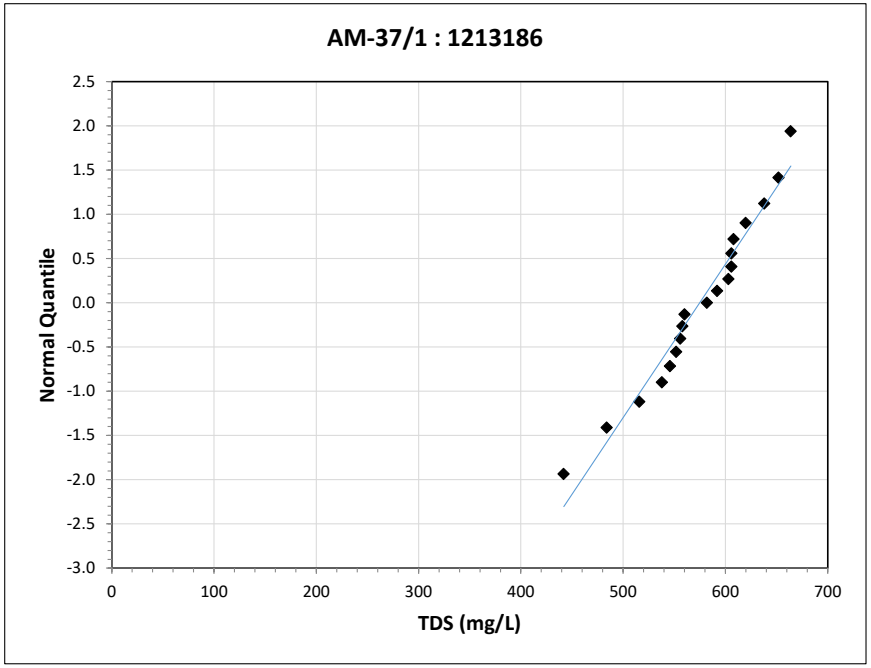


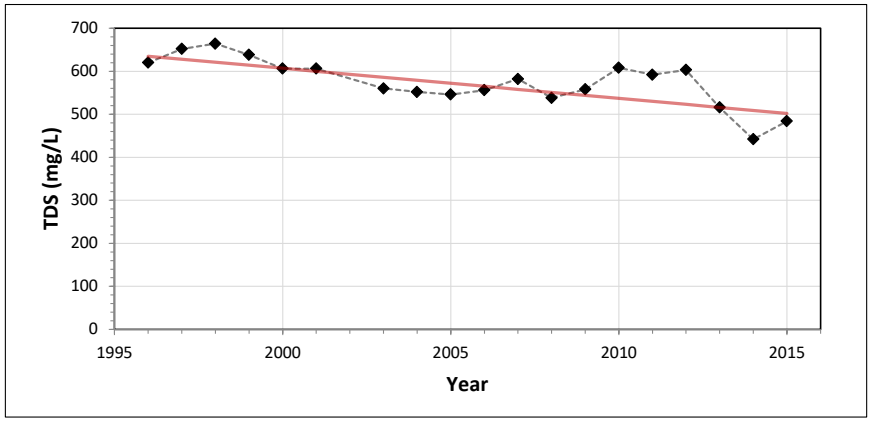
Statistics	
GMZ	Orange County
Well Name : ID	AM-37/1 : 1213186
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.31
Annual Average Max	4.02
Annual Average Mean	3.05
Annual Average Stdev	0.46
Shapiro-Wilk W	0.967
Shapiro-Wilk p-value	0.731
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.11
Student t	1.02
Mean + t*SE (UCL84)	3.16
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-55
Var(S)	697
Intercept	103
Slope	-0.05
p-value	0.041
Significant Trend?	Decreasing



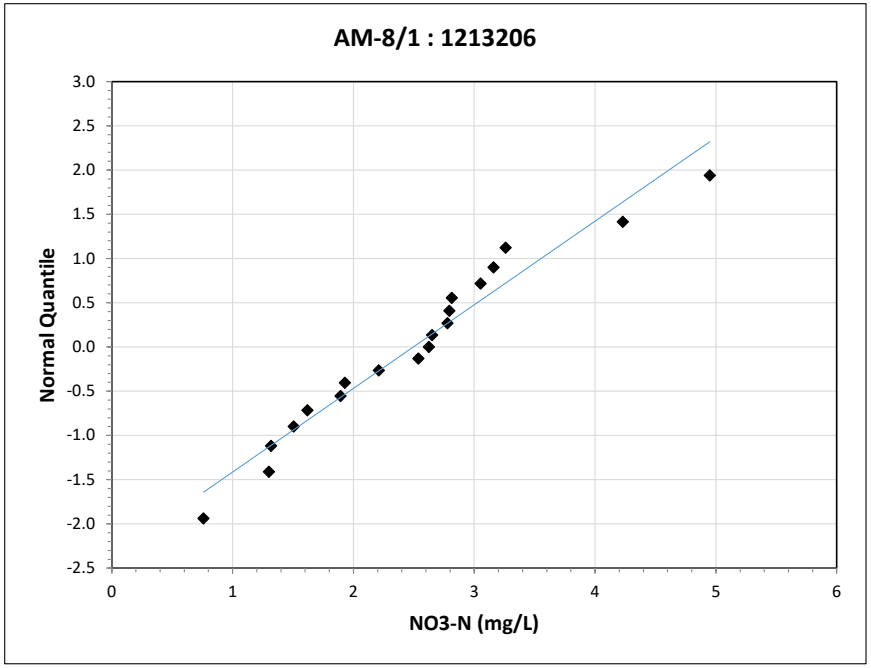


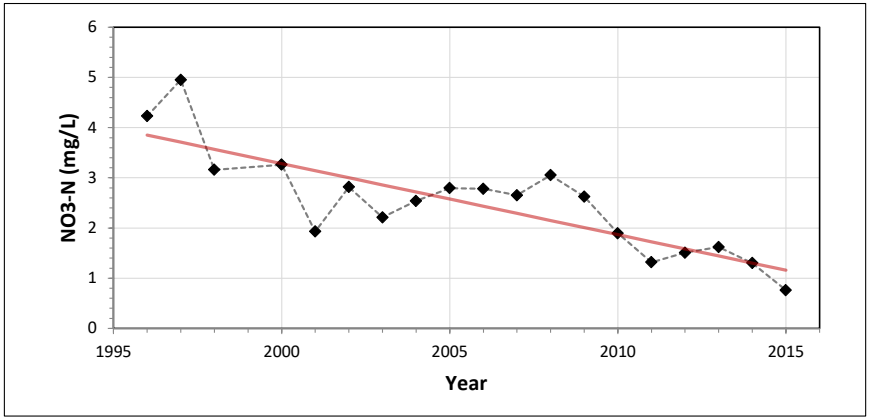
Statistics	
GMZ	Orange County
Well Name : ID	AM-37/1 : 1213186
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	442
Annual Average Max	664
Annual Average Mean	575
Annual Average Stdev	56.29
Shapiro-Wilk W	0.965
Shapiro-Wilk p-value	0.669
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.91
Student t	1.02
Mean + t*SE (UCL84)	588
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-92
Var(S)	816
Intercept	14607
Slope	-7.00
p-value	0.001
Significant Trend?	Decreasing*



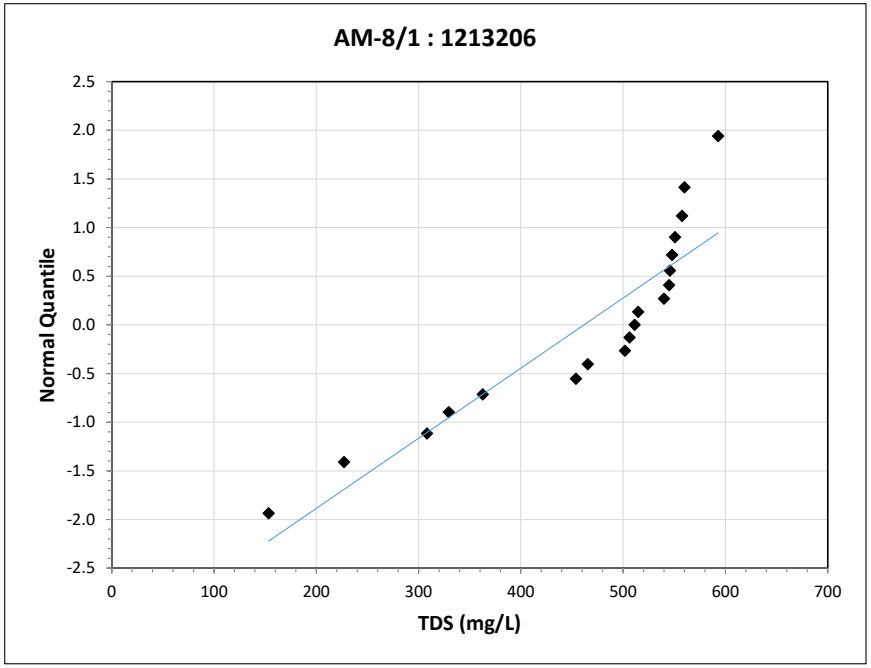


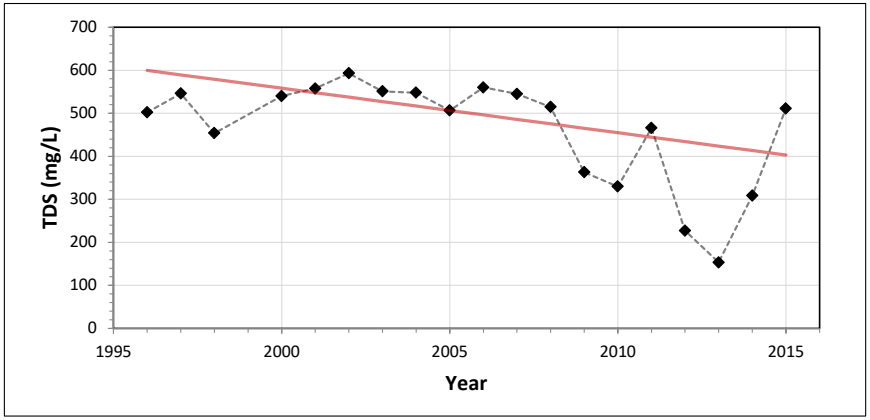
Statistics	
GMZ	Orange County
Well Name : ID	AM-8/1 : 1213206
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.76
Annual Average Max	4.95
Annual Average Mean	2.50
Annual Average Stdev	1.03
Shapiro-Wilk W	0.959
Shapiro-Wilk p-value	0.550
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.24
Student t	1.02
Mean + t*SE (UCL84)	2.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-115
Var(S)	817
Intercept	287
Slope	-0.14
p-value	7E-5
Significant Trend?	Decreasing**



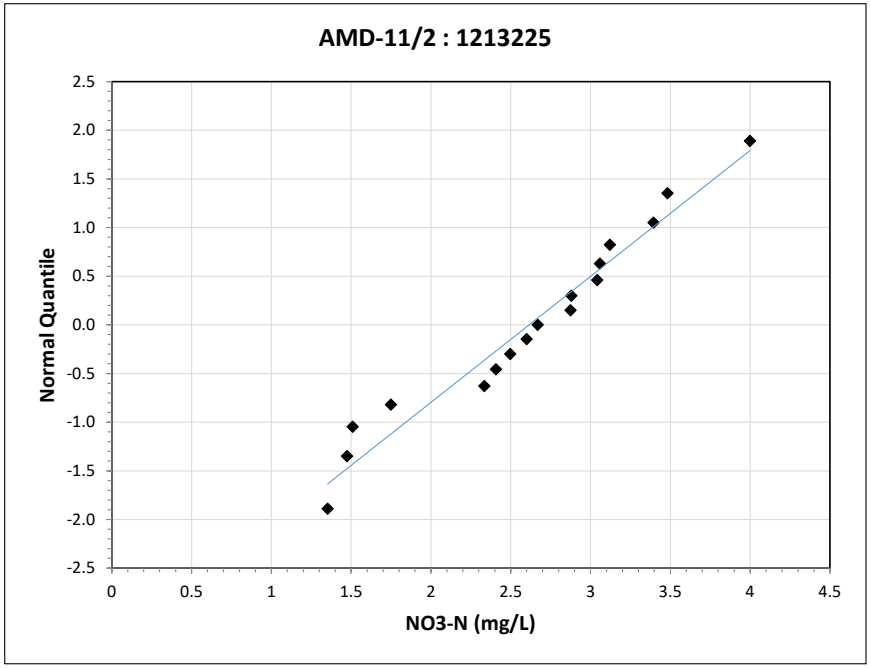


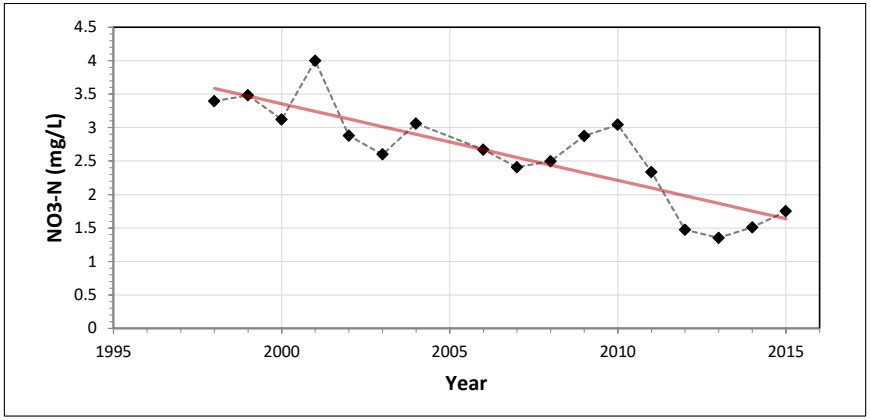
Statistics	
GMZ	Orange County
Well Name : ID	AM-8/1 : 1213206
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	154
Annual Average Max	593
Annual Average Mean	462
Annual Average Stdev	125.01
Shapiro-Wilk W	0.820
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	154
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	511
Trend Analysis	**Theil-Sen**
Kendall S	-69
Var(S)	817
Intercept	21267
Slope	-10.35
p-value	0.017
Significant Trend?	Decreasing



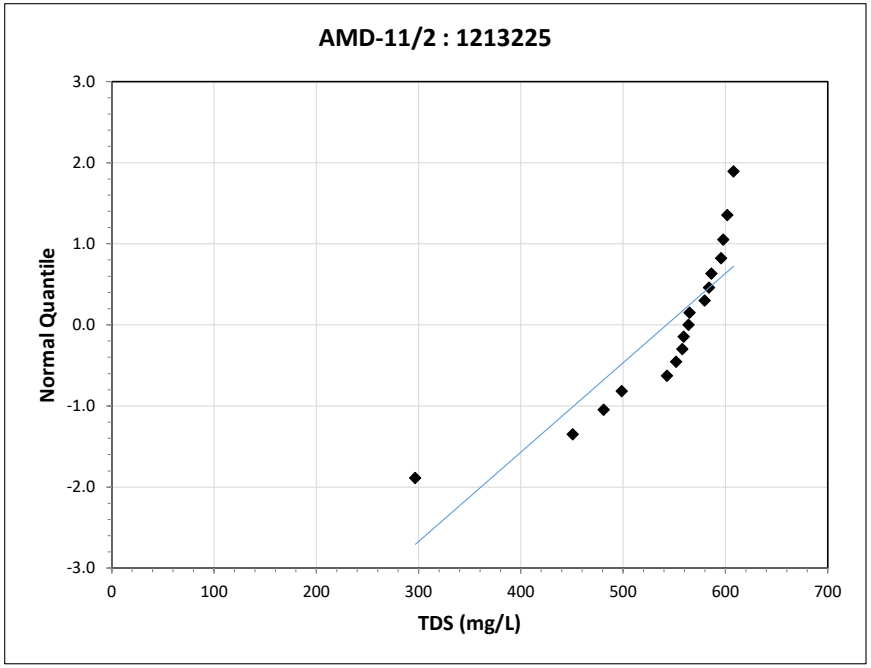


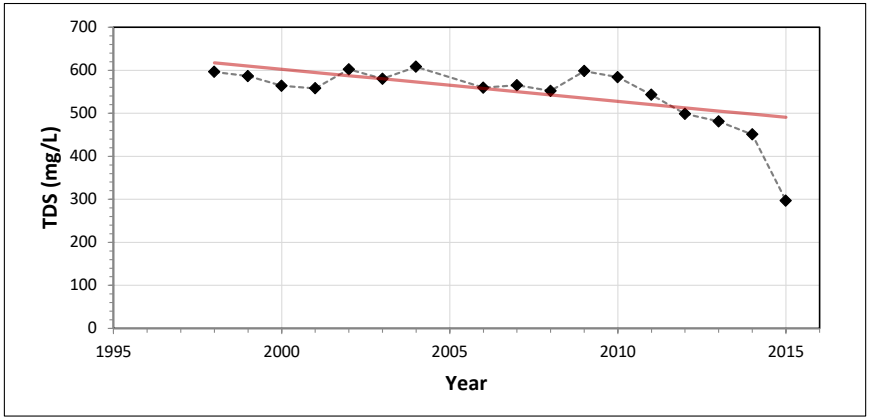
Statistics	
GMZ	Orange County
Well Name : ID	AMD-11/2 : 1213225
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	1.35
Annual Average Max	4.00
Annual Average Mean	2.61
Annual Average Stdev	0.75
Shapiro-Wilk W	0.956
Shapiro-Wilk p-value	0.553
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.03
Mean + t*SE (UCL84)	2.80
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-90
Var(S)	589
Intercept	233
Slope	-0.11
p-value	2E-4
Significant Trend?	Decreasing**



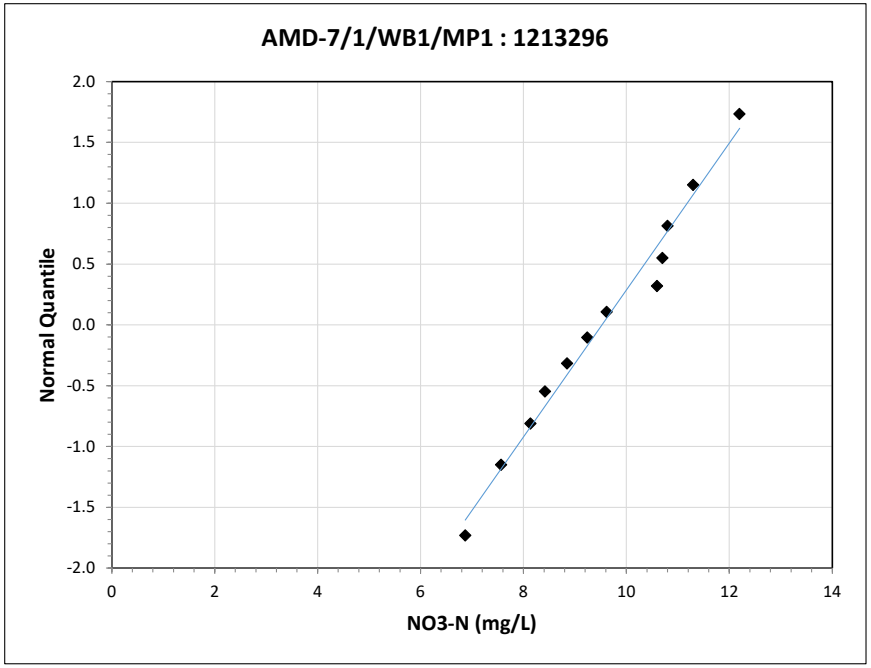


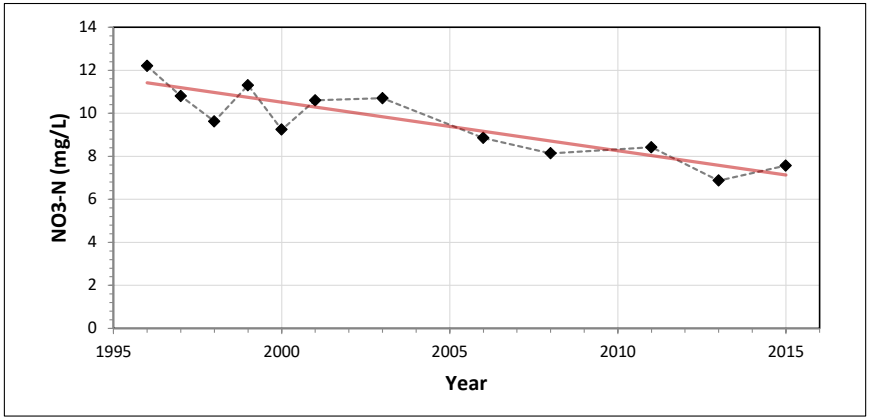
Statistics	
GMZ	Orange County
Well Name : ID	AMD-11/2 : 1213225
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	297
Annual Average Max	608
Annual Average Mean	543
Annual Average Stdev	77.01
Shapiro-Wilk W	0.741
Shapiro-Wilk p-value	3E-4
Critical Alpha	0.01
Most Discordant Value	297
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	4E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	564
Trend Analysis	**Theil-Sen**
Kendall S	-76
Var(S)	589
Intercept	15528
Slope	-7.46
p-value	0.002
Significant Trend?	Decreasing*



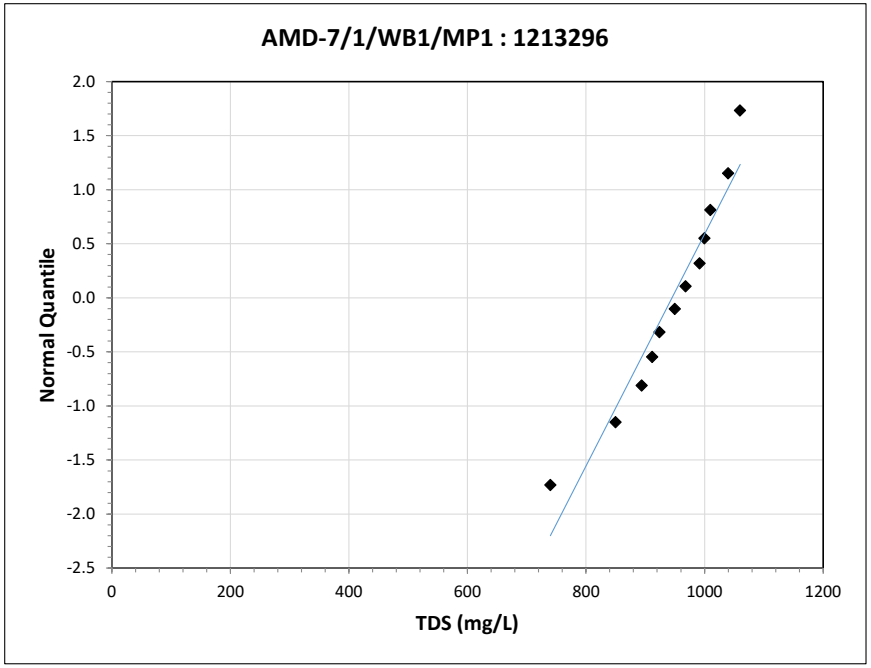


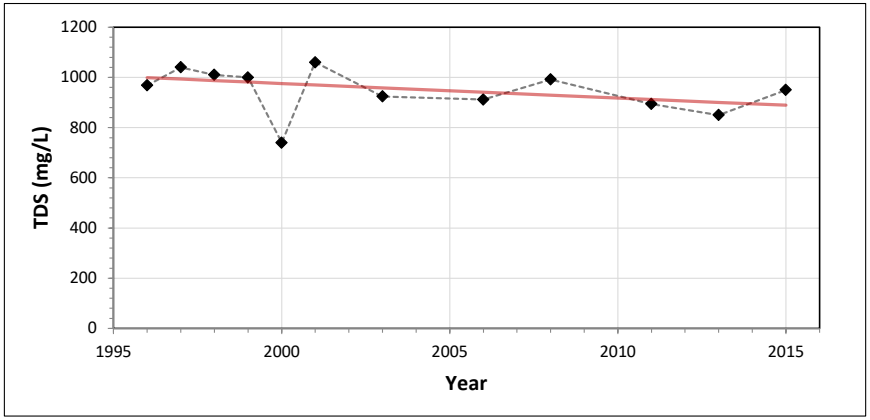
Statistics	
GMZ	Orange County
Well Name : ID	AMD-7/1/WB1/MP1 : 1213296
Analyte	NO3-N (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	6.87
Annual Average Max	12.20
Annual Average Mean	9.53
Annual Average Stdev	1.62
Shapiro-Wilk W	0.974
Shapiro-Wilk p-value	0.950
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.47
Student t	1.04
Mean + t*SE (UCL84)	10.01
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-48
Var(S)	213
Intercept	462
Slope	-0.23
p-value	0.001
Significant Trend?	Decreasing*



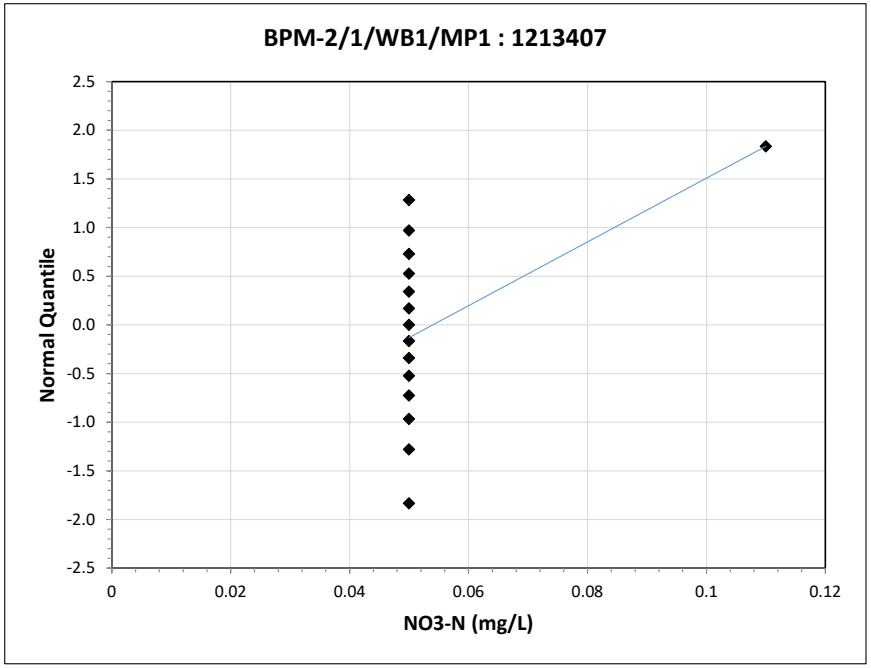


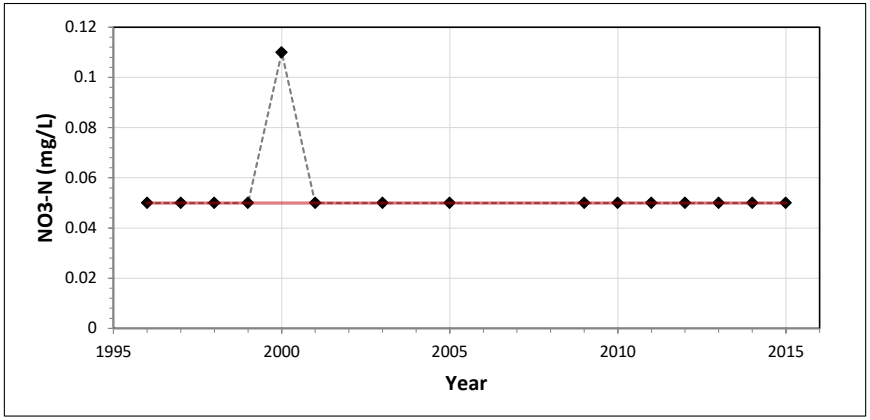
Statistics	
GMZ	Orange County
Well Name : ID	AMD-7/1/WB1/MP1 : 1213296
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	740
Annual Average Max	1060
Annual Average Mean	945
Annual Average Stdev	89.16
Shapiro-Wilk W	0.938
Shapiro-Wilk p-value	0.472
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	25.74
Student t	1.04
Mean + t*SE (UCL84)	972
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-24
Var(S)	213
Intercept	12576
Slope	-5.80
p-value	0.115
Significant Trend?	No



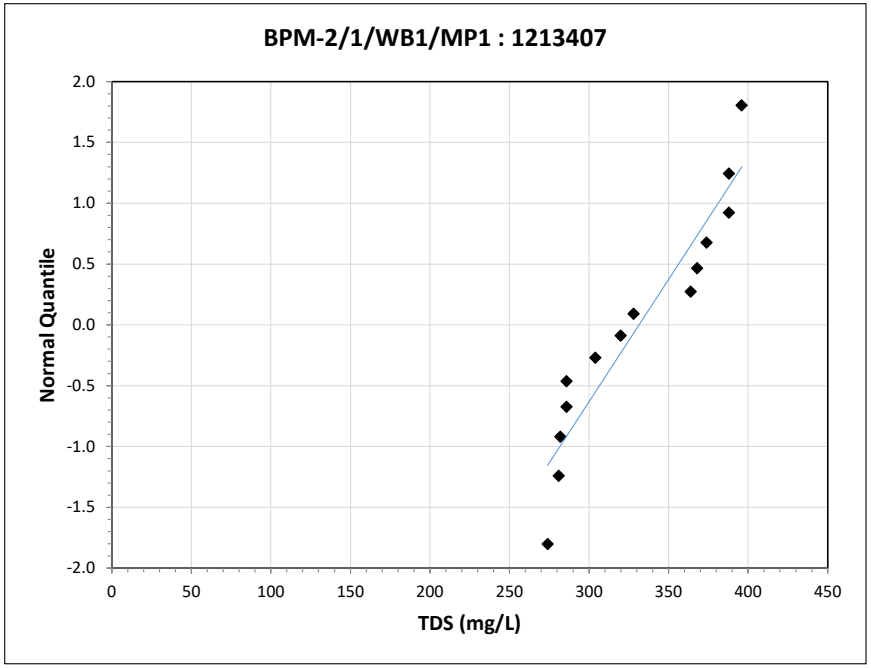


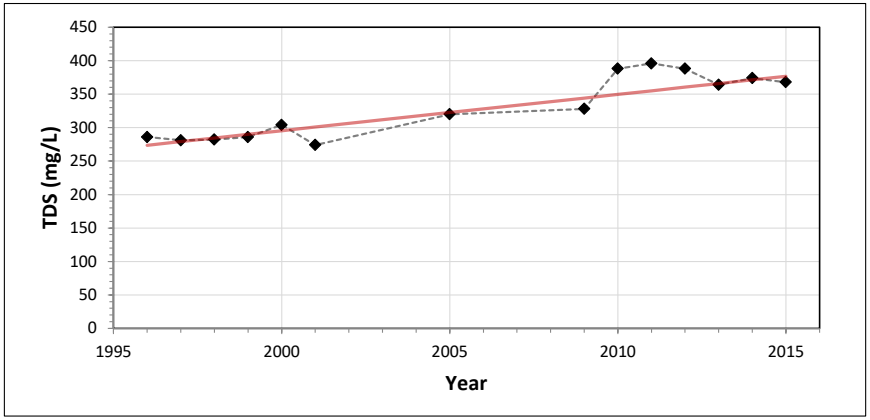
Statistics	
GMZ	Orange County
Well Name : ID	BPM-2/1/WB1/MP1 : 1213407
Analyte	NO3-N (mg/L)
Count	15
Count Detects	1
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	0.11
Annual Average Mean	0.05
Annual Average Stdev	0.02
Shapiro-Wilk W	0.284
Shapiro-Wilk p-value	1E-7
Critical Alpha	0.01
Most Discordant Value	0.11
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-7
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-6
Var(S)	74.67
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



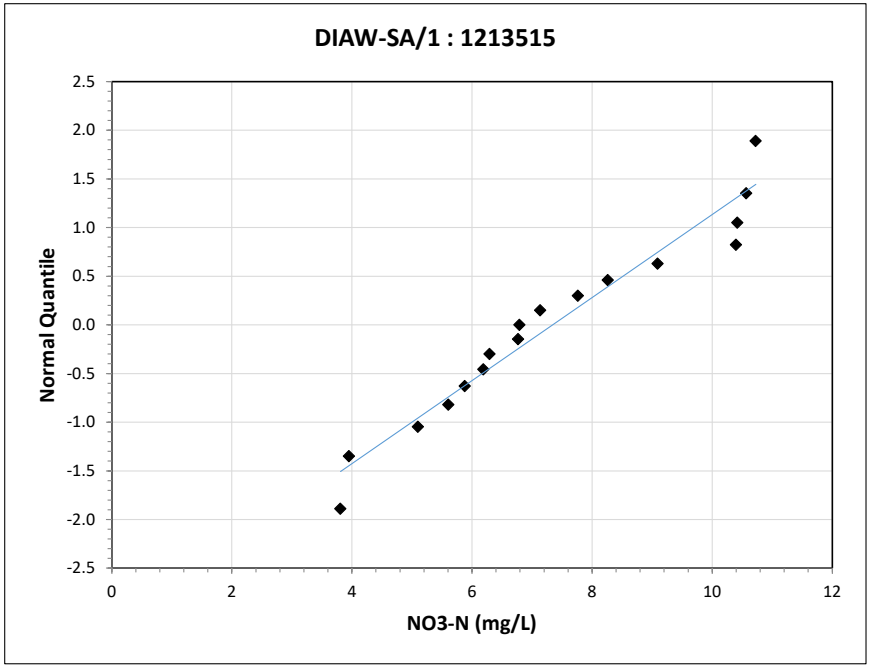


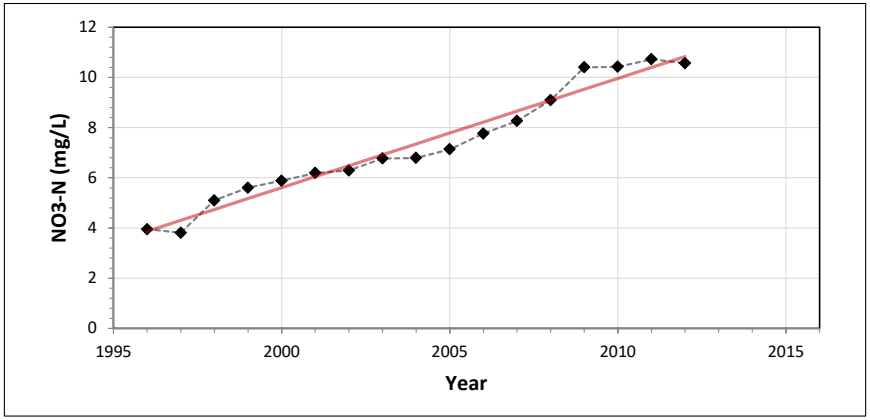
Statistics	
GMZ	Orange County
Well Name : ID	BPM-2/1/WB1/MP1 : 1213407
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	274
Annual Average Max	396
Annual Average Mean	331
Annual Average Stdev	46.48
Shapiro-Wilk W	0.869
Shapiro-Wilk p-value	0.041
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.42
Student t	1.03
Mean + t*SE (UCL84)	344
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	53
Var(S)	332
Intercept	-10562
Slope	5.43
p-value	0.004
Significant Trend?	Increasing*



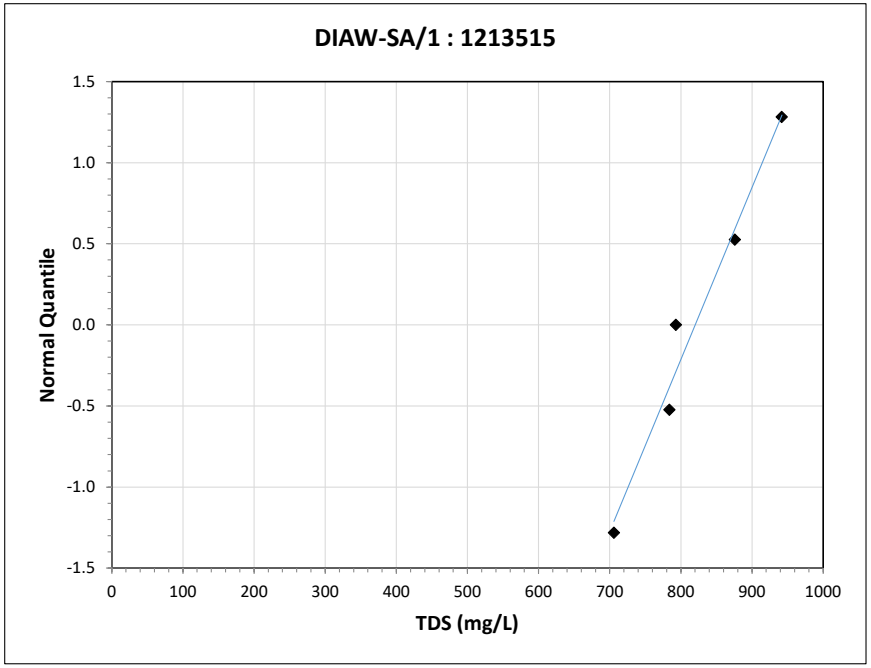


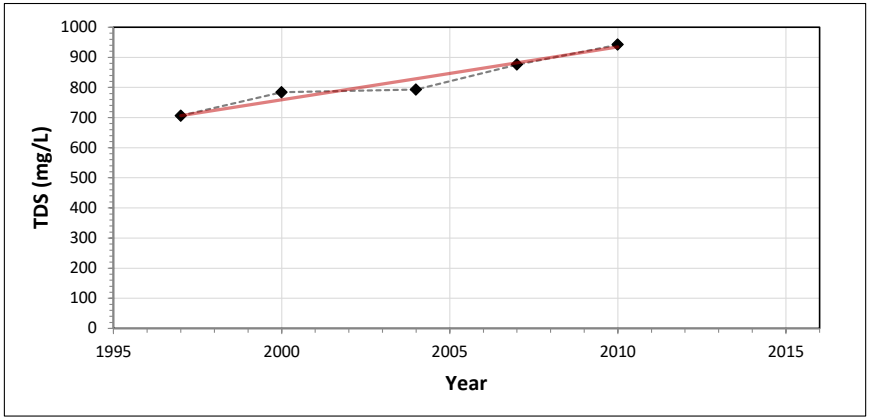
Statistics	
GMZ	Orange County
Well Name : ID	DIAW-SA/1 : 1213515
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	3.81
Annual Average Max	10.73
Annual Average Mean	7.34
Annual Average Stdev	2.26
Shapiro-Wilk W	0.932
Shapiro-Wilk p-value	0.237
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.55
Student t	1.03
Mean + t*SE (UCL84)	7.90
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	132
Var(S)	589
Intercept	-865
Slope	0.44
p-value	7E-8
Significant Trend?	Increasing**



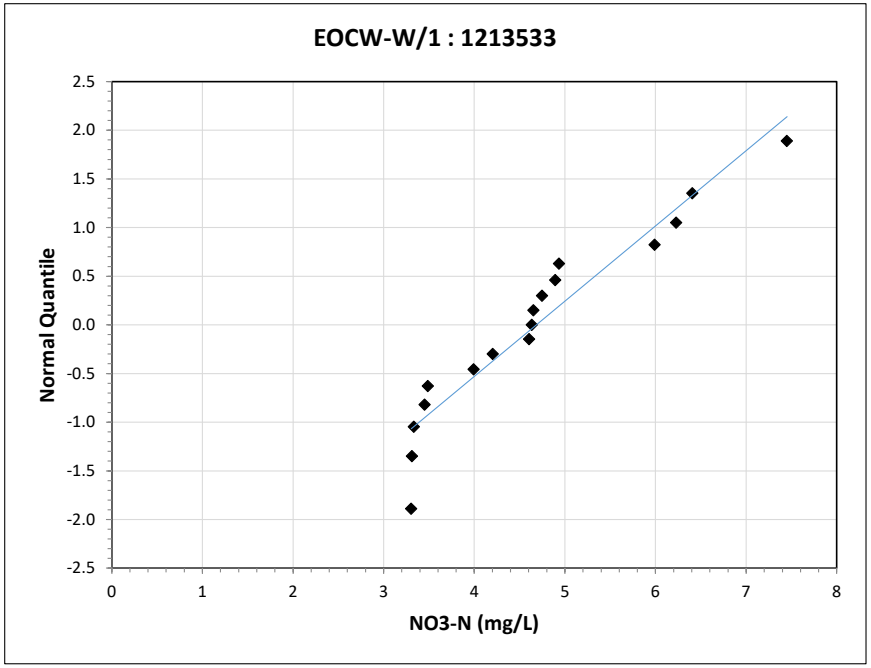


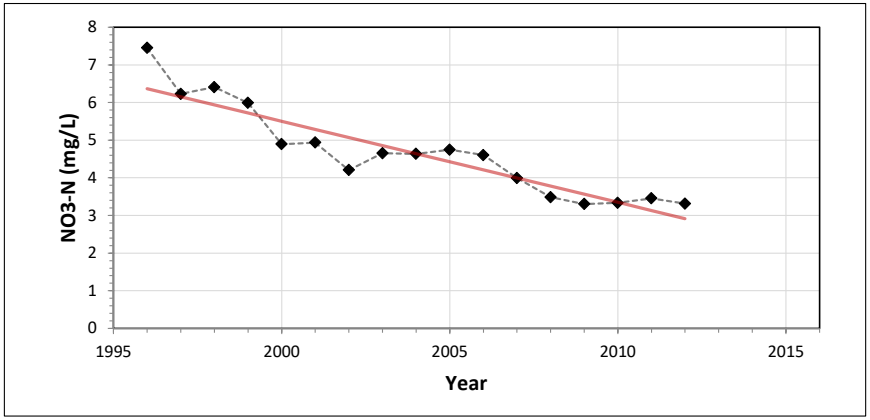
Statistics	
GMZ	Orange County
Well Name : ID	DIAW-SA/1 : 1213515
Analyte	TDS (mg/L)
Count	5
Count Detects	5
Sample Year Min	1997
Sample Year Max	2010
Annual Average Min	706
Annual Average Max	942
Annual Average Mean	820
Annual Average Stdev	90.89
Shapiro-Wilk W	0.970
Shapiro-Wilk p-value	0.878
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	40.65
Student t	1.13
Mean + t*SE (UCL84)	866
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	10
Var(S)	16.67
Intercept	-34395
Slope	17.58
p-value	0.027
Significant Trend?	Increasing



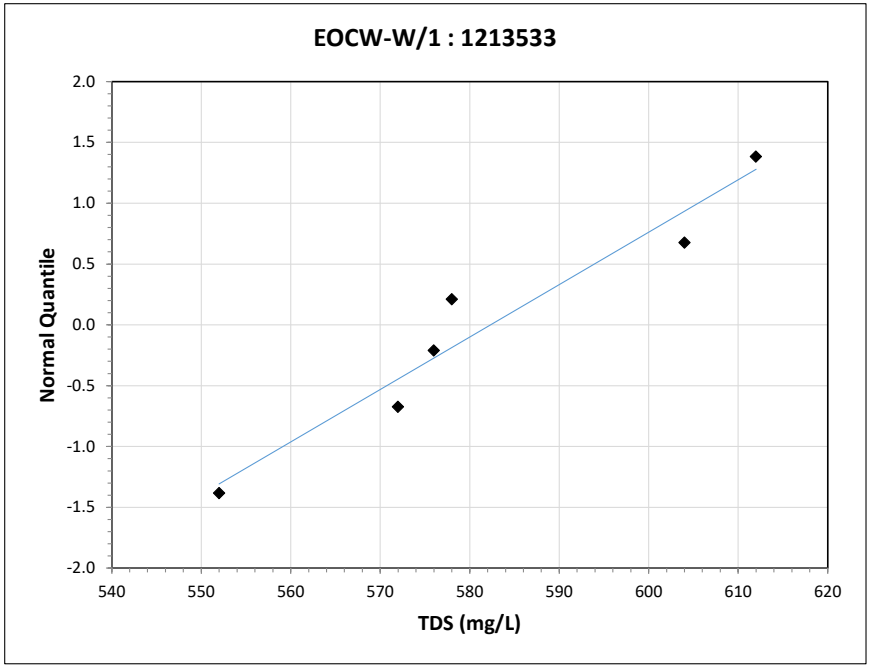


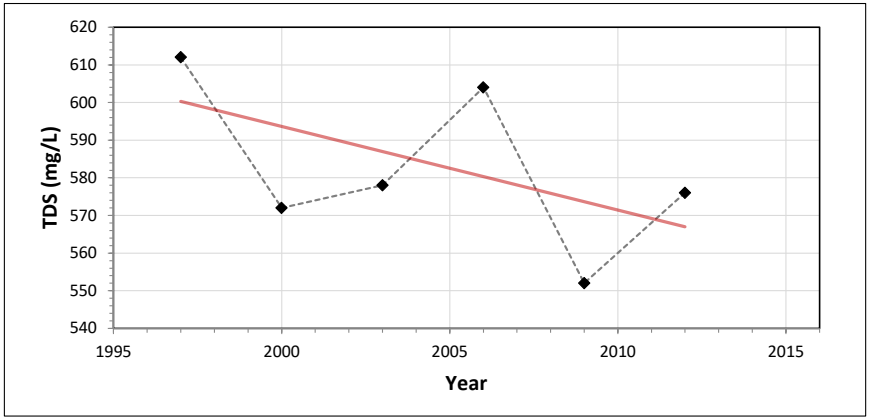
Statistics	
GMZ	Orange County
Well Name : ID	EOCW-W/1 : 1213533
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	3.31
Annual Average Max	7.45
Annual Average Mean	4.69
Annual Average Stdev	1.23
Shapiro-Wilk W	0.906
Shapiro-Wilk p-value	0.087
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.30
Student t	1.03
Mean + t*SE (UCL84)	4.99
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-112
Var(S)	589
Intercept	437
Slope	-0.22
p-value	5E-6
Significant Trend?	Decreasing**



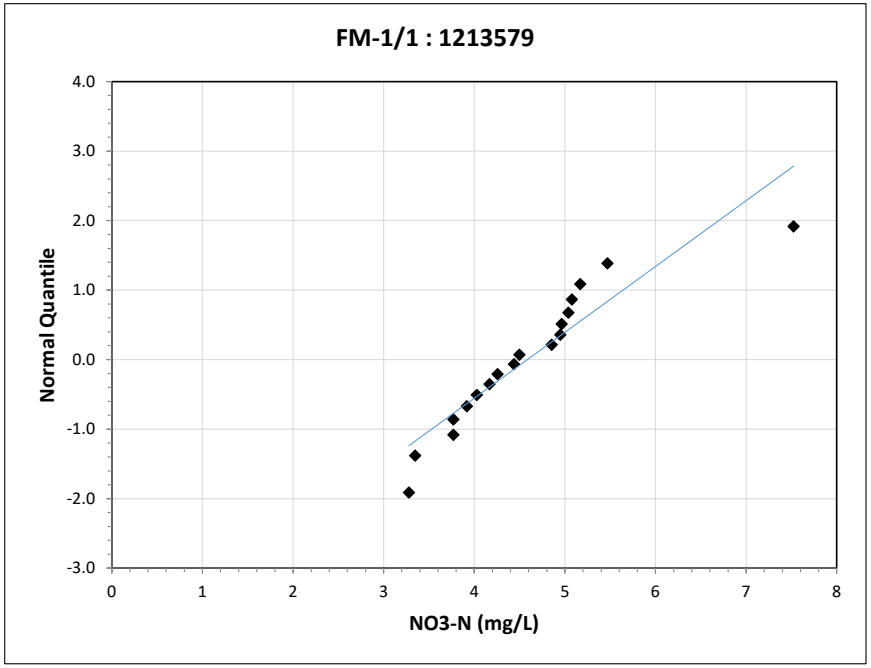


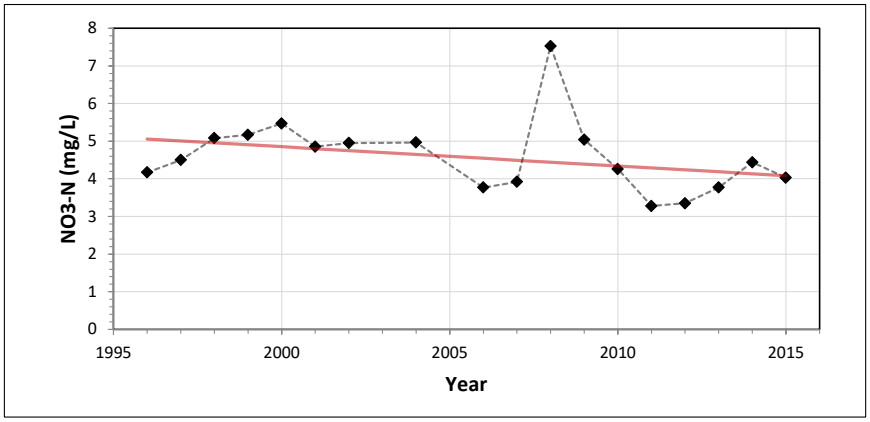
Statistics	
GMZ	Orange County
Well Name : ID	EOCW-W/1 : 1213533
Analyte	TDS (mg/L)
Count	6
Count Detects	6
Sample Year Min	1997
Sample Year Max	2012
Annual Average Min	552
Annual Average Max	612
Annual Average Mean	582
Annual Average Stdev	22.07
Shapiro-Wilk W	0.936
Shapiro-Wilk p-value	0.625
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.01
Student t	1.10
Mean + t*SE (UCL84)	592
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	28.33
Intercept	5038
Slope	-2.22
p-value	0.452
Significant Trend?	No



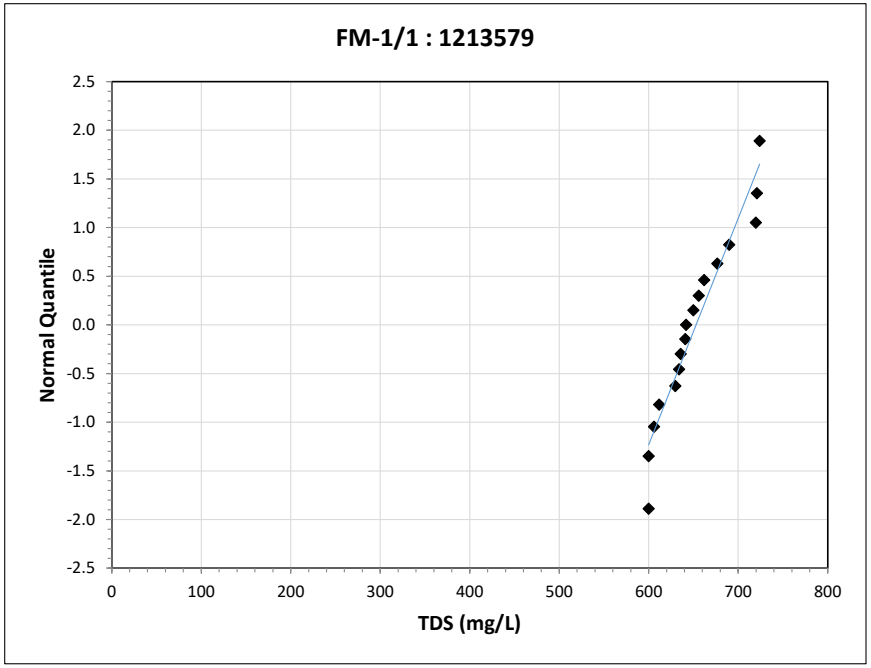


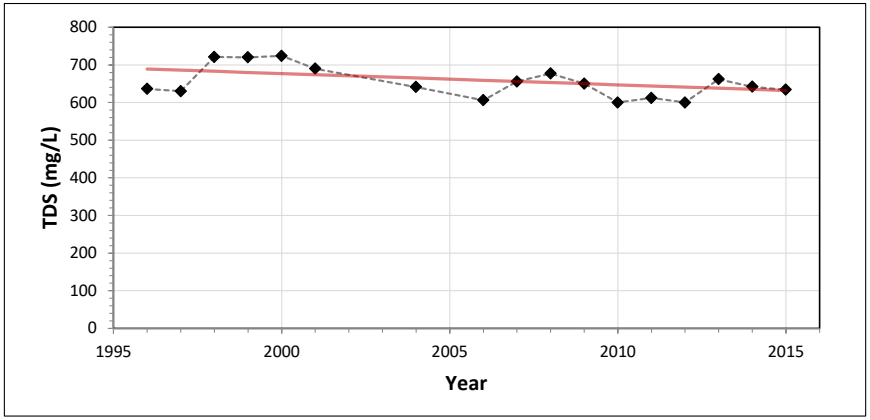
Statistics	
GMZ	Orange County
Well Name : ID	FM-1/1 : 1213579
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.28
Annual Average Max	7.53
Annual Average Mean	4.59
Annual Average Stdev	0.98
Shapiro-Wilk W	0.879
Shapiro-Wilk p-value	0.025
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.23
Student t	1.02
Mean + t*SE (UCL84)	4.82
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-42
Var(S)	696
Intercept	107
Slope	-0.05
p-value	0.120
Significant Trend?	No



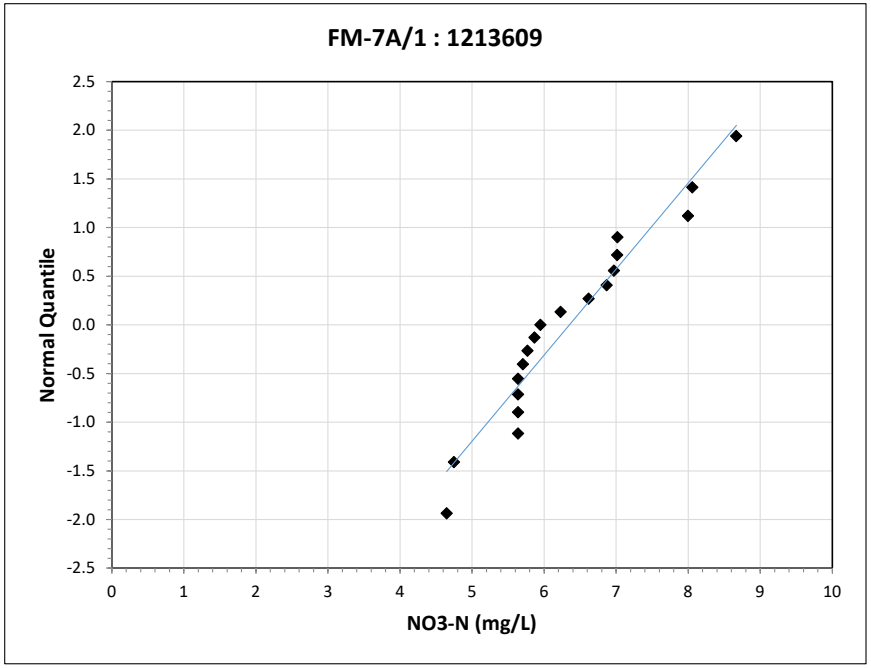


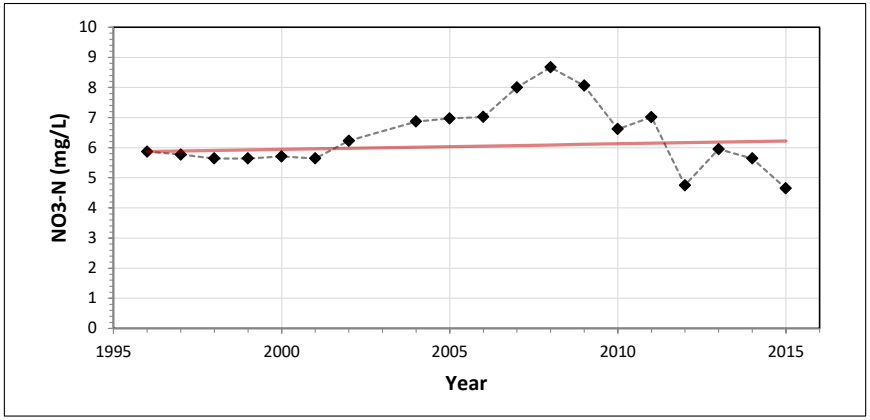
Statistics	
GMZ	Orange County
Well Name : ID	FM-1/1 : 1213579
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	600
Annual Average Max	724
Annual Average Mean	653
Annual Average Stdev	41.19
Shapiro-Wilk W	0.916
Shapiro-Wilk p-value	0.125
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.99
Student t	1.03
Mean + t*SE (UCL84)	663
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-39
Var(S)	588
Intercept	6677
Slope	-3.00
p-value	0.117
Significant Trend?	No



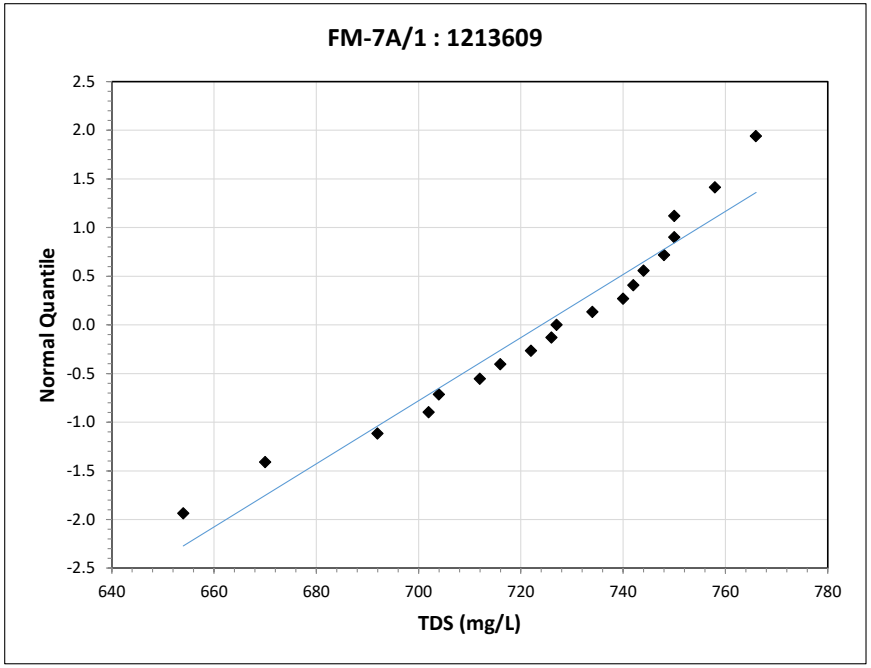


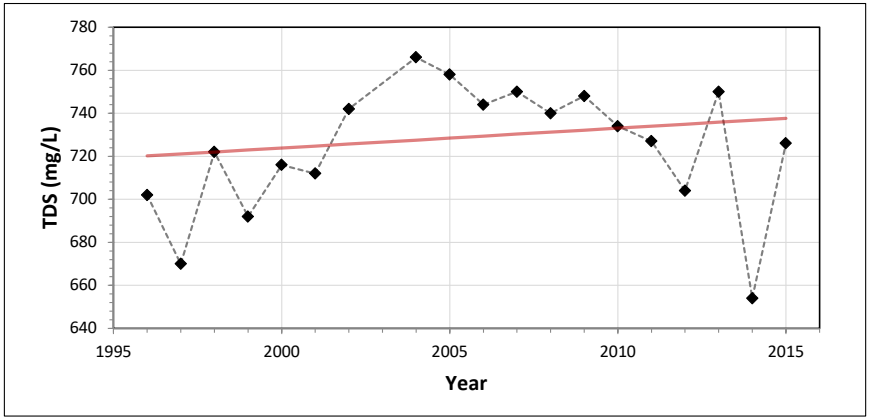
Statistics	
GMZ	Orange County
Well Name : ID	FM-7A/1 : 1213609
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	4.65
Annual Average Max	8.67
Annual Average Mean	6.35
Annual Average Stdev	1.09
Shapiro-Wilk W	0.934
Shapiro-Wilk p-value	0.207
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.25
Student t	1.02
Mean + t*SE (UCL84)	6.61
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	13
Var(S)	808
Intercept	-30.98
Slope	0.02
p-value	0.673
Significant Trend?	No



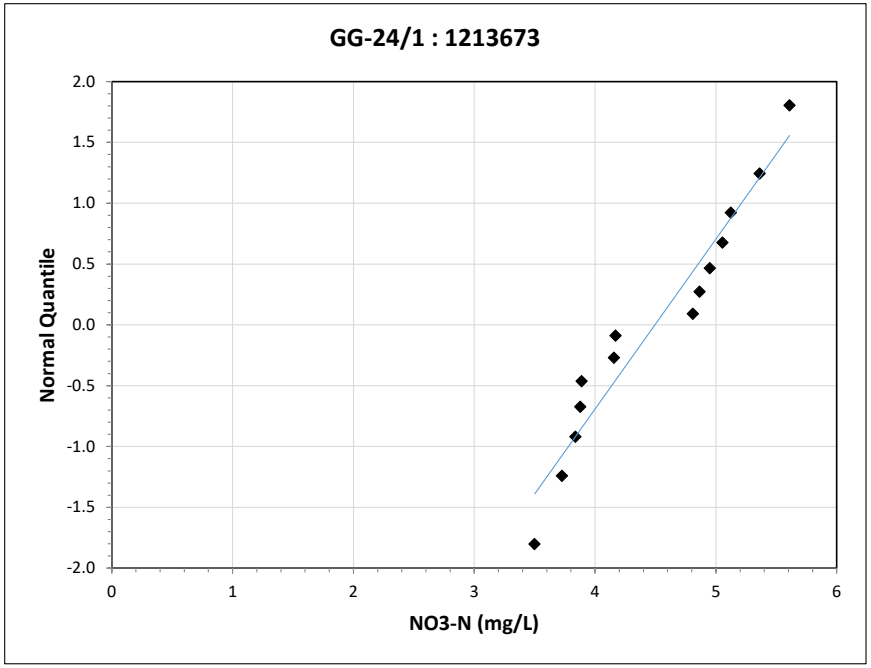


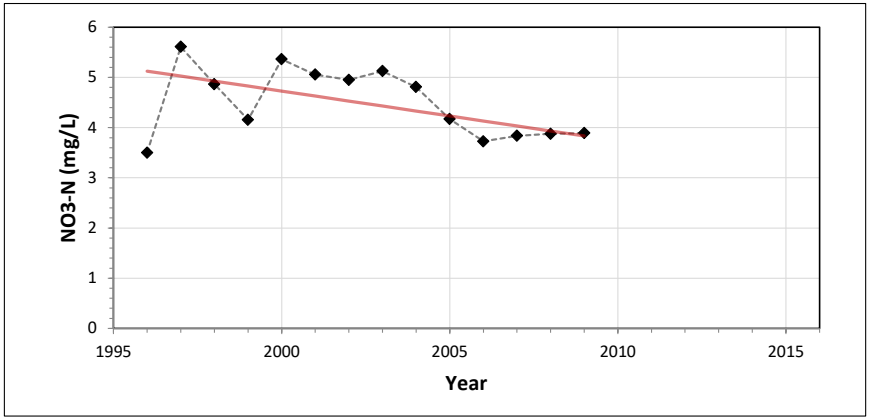
Statistics	
GMZ	Orange County
Well Name : ID	FM-7A/1 : 1213609
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	654
Annual Average Max	766
Annual Average Mean	724
Annual Average Stdev	29.70
Shapiro-Wilk W	0.939
Shapiro-Wilk p-value	0.251
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.81
Student t	1.02
Mean + t*SE (UCL84)	731
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	20
Var(S)	816
Intercept	-1122
Slope	0.92
p-value	0.506
Significant Trend?	No



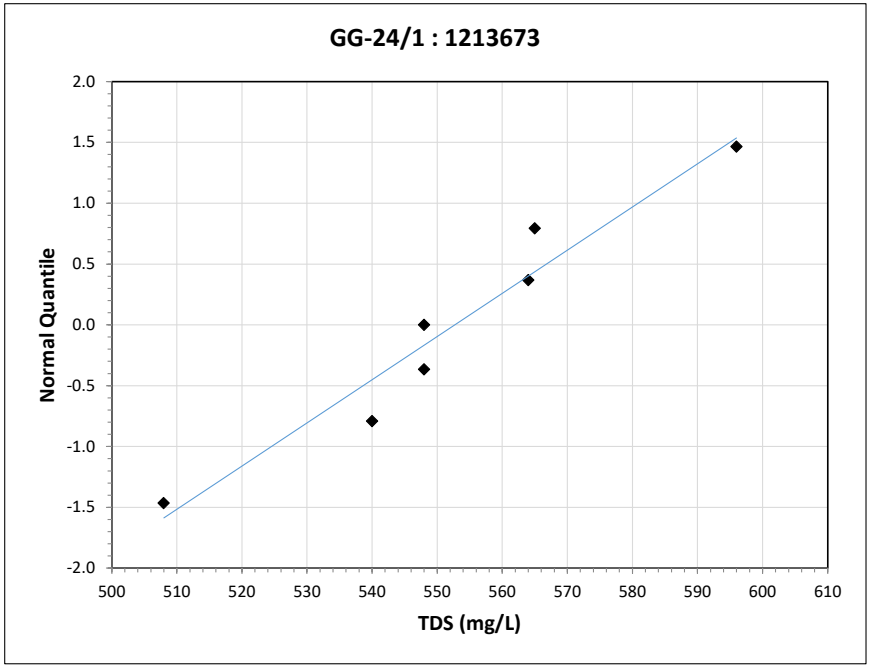


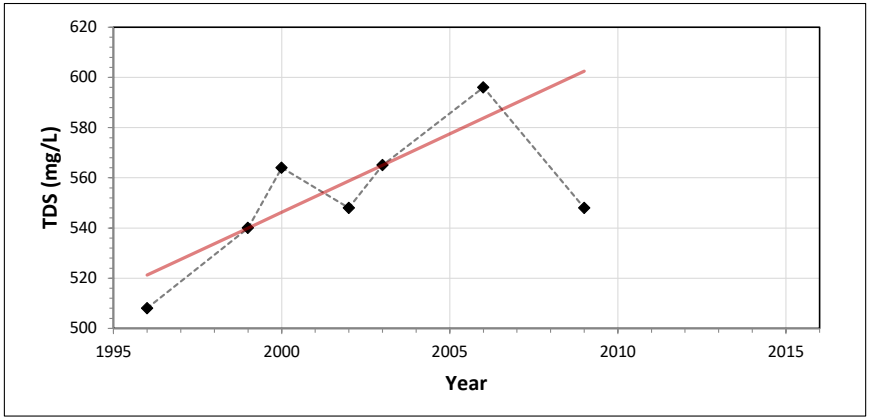
Statistics	
GMZ	Orange County
Well Name : ID	GG-24/1 : 1213673
Analyte	NO3-N (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2009
Annual Average Min	3.50
Annual Average Max	5.61
Annual Average Mean	4.50
Annual Average Stdev	0.69
Shapiro-Wilk W	0.923
Shapiro-Wilk p-value	0.240
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.03
Mean + t*SE (UCL84)	4.69
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-29
Var(S)	334
Intercept	203
Slope	-0.10
p-value	0.125
Significant Trend?	No



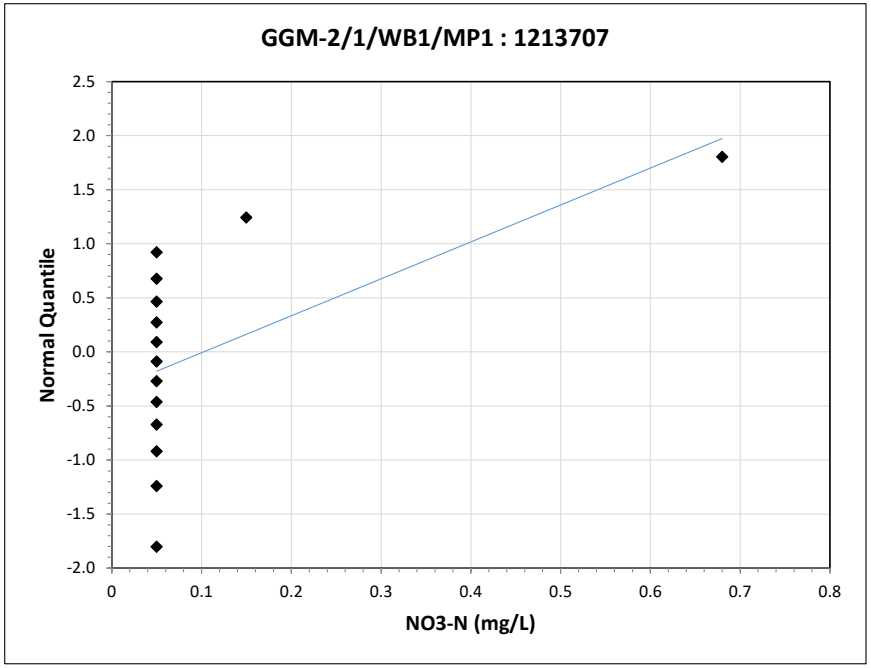


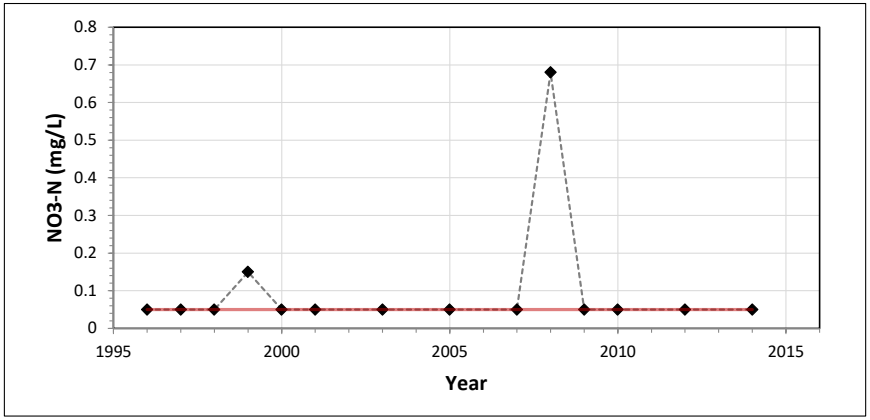
Statistics	
GMZ	Orange County
Well Name : ID	GG-24/1 : 1213673
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1996
Sample Year Max	2009
Annual Average Min	508
Annual Average Max	596
Annual Average Mean	553
Annual Average Stdev	26.95
Shapiro-Wilk W	0.960
Shapiro-Wilk p-value	0.816
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	10.19
Student t	1.08
Mean + t*SE (UCL84)	564
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	12
Var(S)	43.33
Intercept	-11954
Slope	6.25
p-value	0.095
Significant Trend?	Increasing



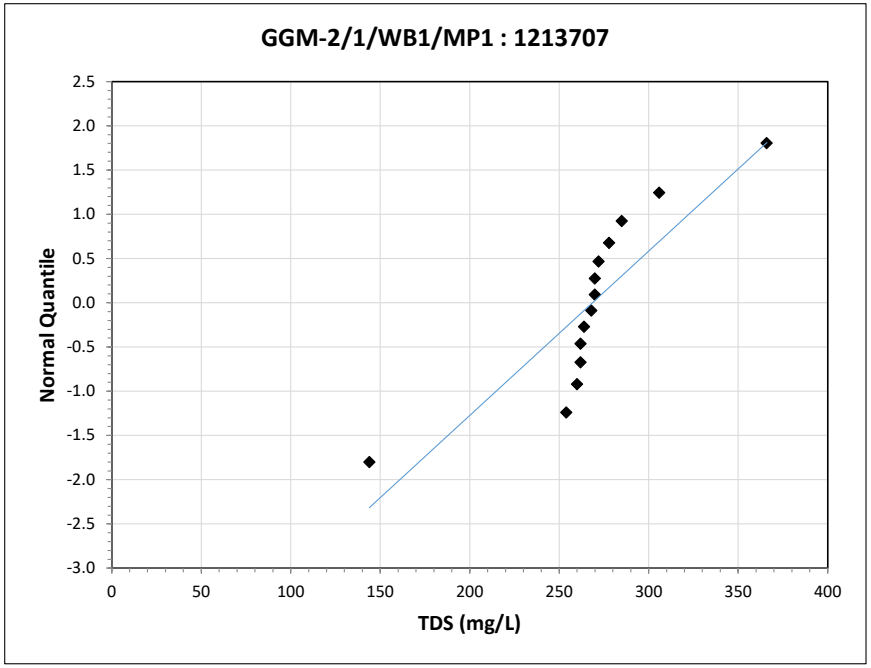


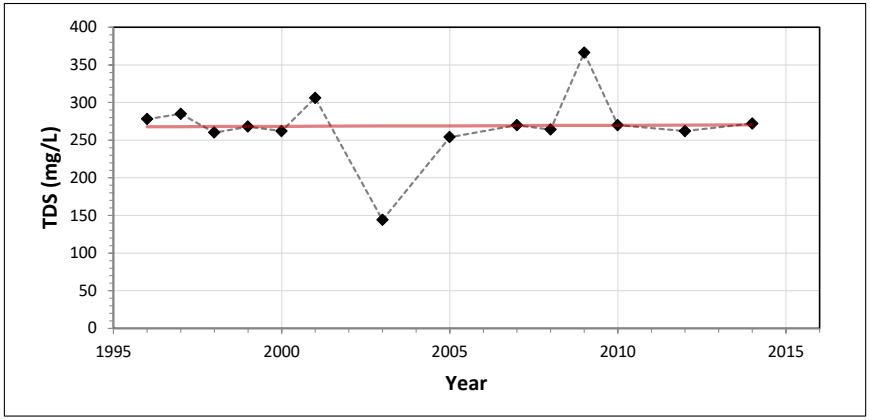
Statistics	
GMZ	Orange County
Well Name : ID	GGM-2/1/WB1/MP1 : 1213707
Analyte	NO3-N (mg/L)
Count	14
Count Detects	2
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.68
Annual Average Mean	0.10
Annual Average Stdev	0.17
Shapiro-Wilk W	0.359
Shapiro-Wilk p-value	6E-7
Critical Alpha	0.01
Most Discordant Value	0.68
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-6
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-1
Var(S)	121
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



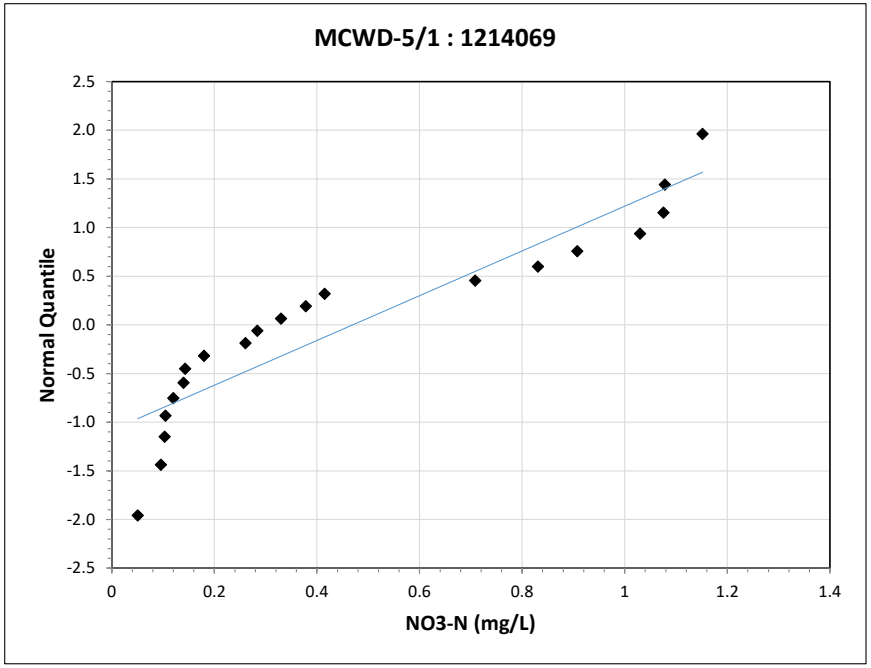


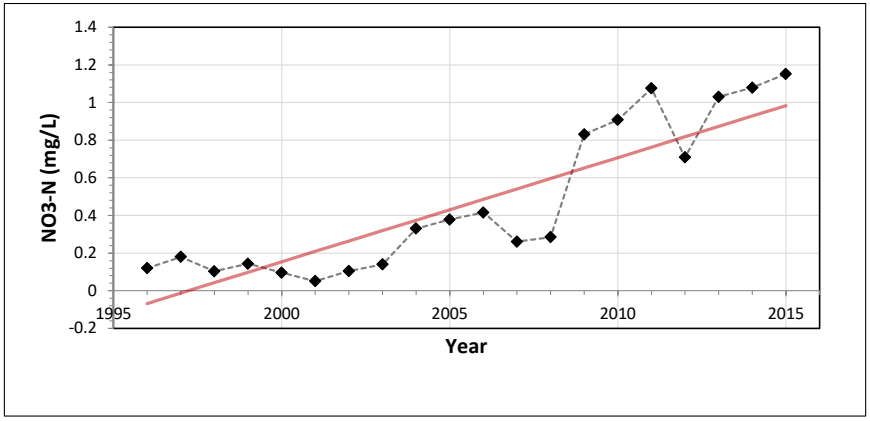
Statistics	
GMZ	Orange County
Well Name : ID	GGM-2/1/WB1/MP1 : 1213707
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	144
Annual Average Max	366
Annual Average Mean	269
Annual Average Stdev	45.72
Shapiro-Wilk W	0.769
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	144
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	3E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	269
Trend Analysis	**Theil-Sen**
Kendall S	3
Var(S)	332
Intercept	-17.36
Slope	0.14
p-value	0.913
Significant Trend?	No



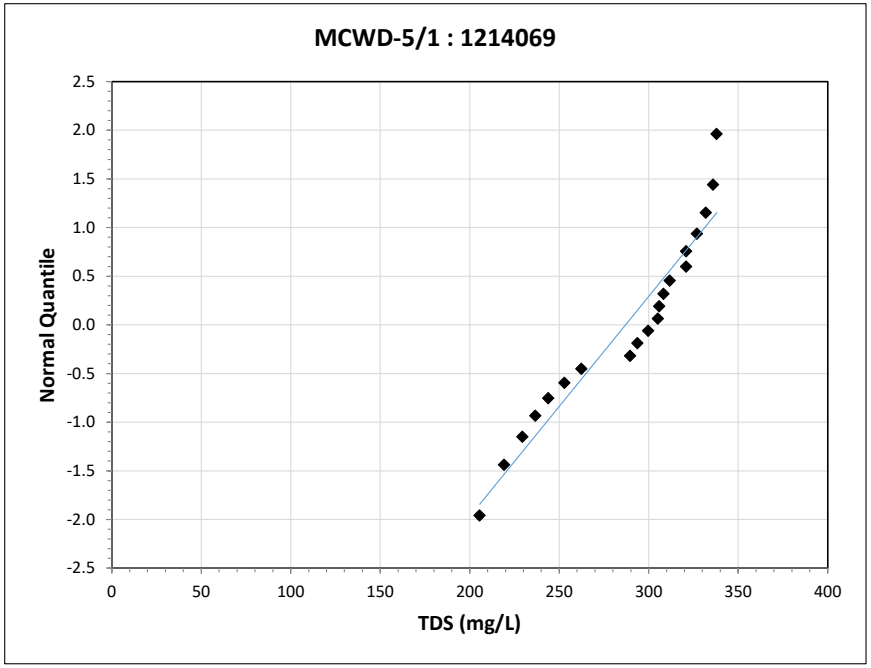


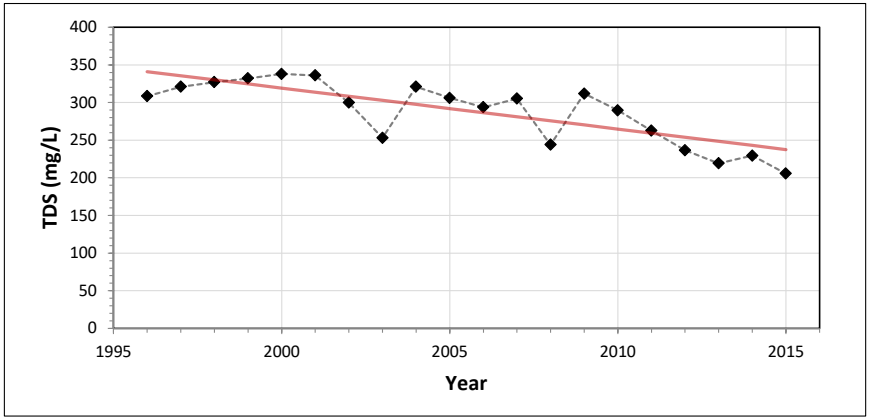
Statistics	
GMZ	Orange County
Well Name : ID	MCWD-5/1 : 1214069
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	1.15
Annual Average Mean	0.47
Annual Average Stdev	0.40
Shapiro-Wilk W	0.833
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	1.15
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.104
Geomean	0.31
GM + t*GSE (UCL84)	0.39
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	136
Var(S)	950
Intercept	-111
Slope	0.06
p-value	1E-5
Significant Trend?	Increasing**



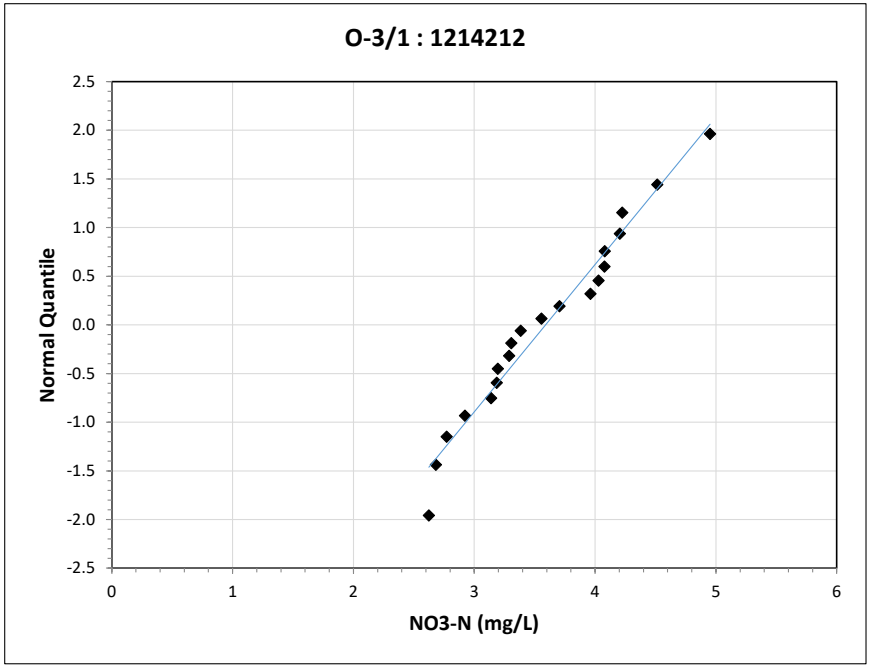


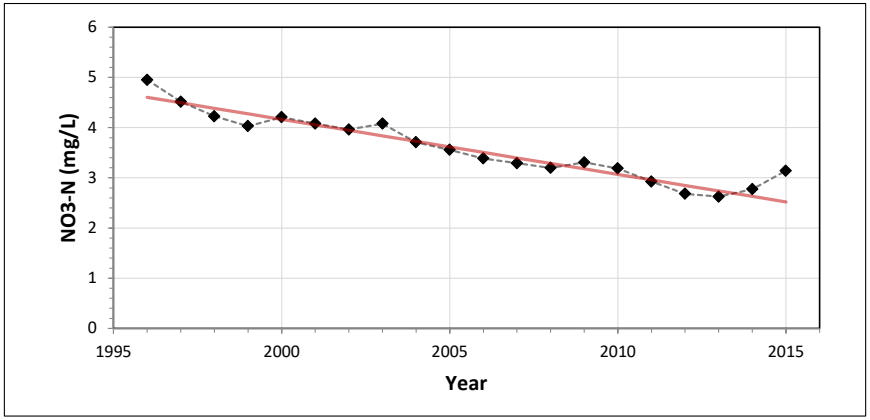
Statistics	
GMZ	Orange County
Well Name : ID	MCWD-5/1 : 1214069
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	206
Annual Average Max	338
Annual Average Mean	287
Annual Average Stdev	42.04
Shapiro-Wilk W	0.904
Shapiro-Wilk p-value	0.050
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.40
Student t	1.02
Mean + t*SE (UCL84)	297
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-119
Var(S)	949
Intercept	11206
Slope	-5.44
p-value	1E-4
Significant Trend?	Decreasing**



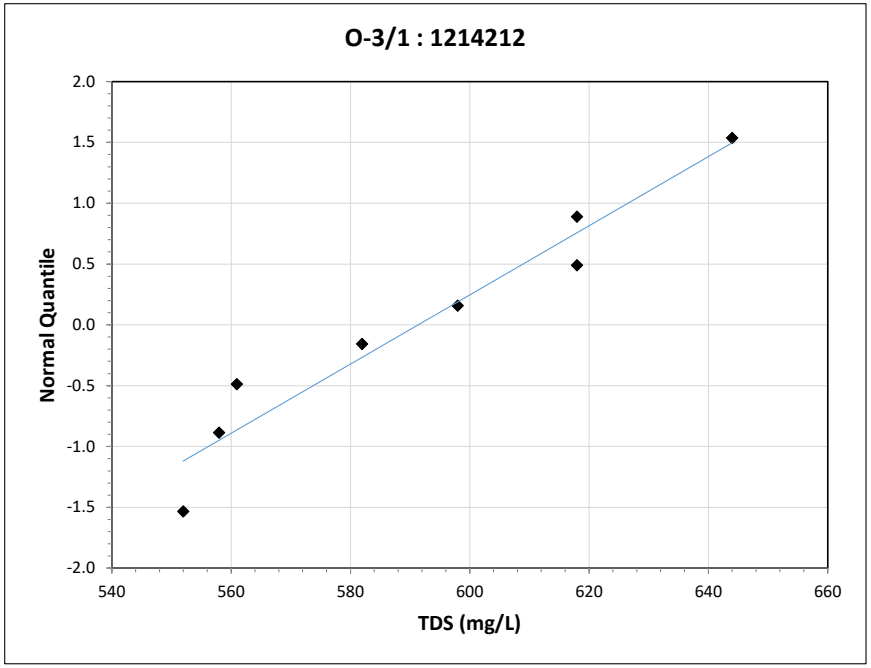


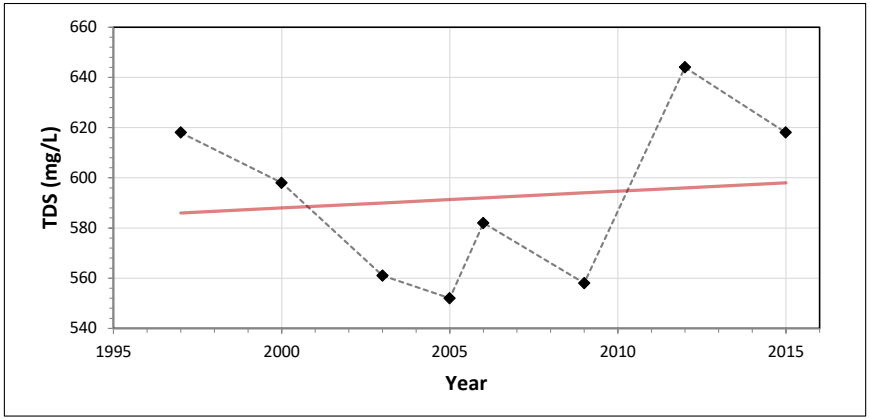
Statistics	
GMZ	Orange County
Well Name : ID	O-3/1 : 1214212
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.63
Annual Average Max	4.95
Annual Average Mean	3.59
Annual Average Stdev	0.65
Shapiro-Wilk W	0.961
Shapiro-Wilk p-value	0.572
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.14
Student t	1.02
Mean + t*SE (UCL84)	3.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-166
Var(S)	950
Intercept	223
Slope	-0.11
p-value	9E-8
Significant Trend?	Decreasing**



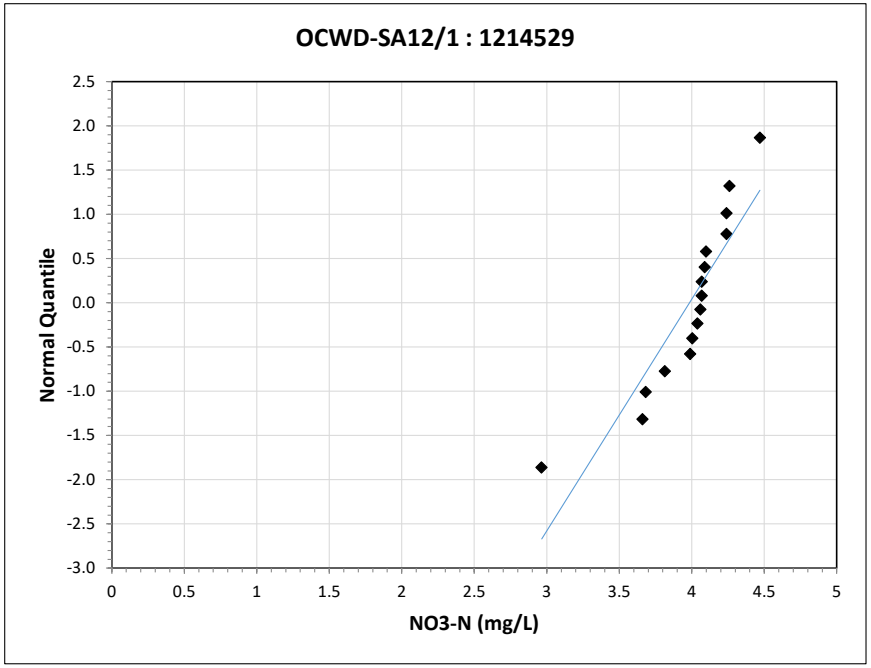


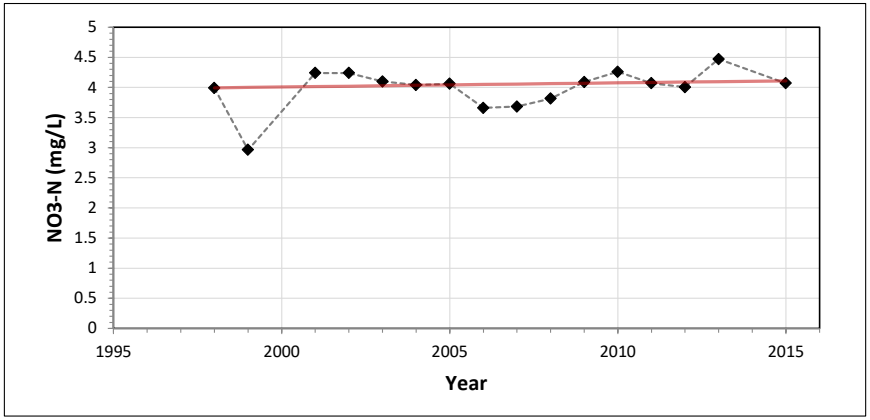
Statistics	
GMZ	Orange County
Well Name : ID	O-3/1 : 1214212
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	552
Annual Average Max	644
Annual Average Mean	591
Annual Average Stdev	33.61
Shapiro-Wilk W	0.925
Shapiro-Wilk p-value	0.474
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.88
Student t	1.07
Mean + t*SE (UCL84)	604
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	1
Var(S)	64.33
Intercept	-745
Slope	0.67
p-value	1.000
Significant Trend?	No



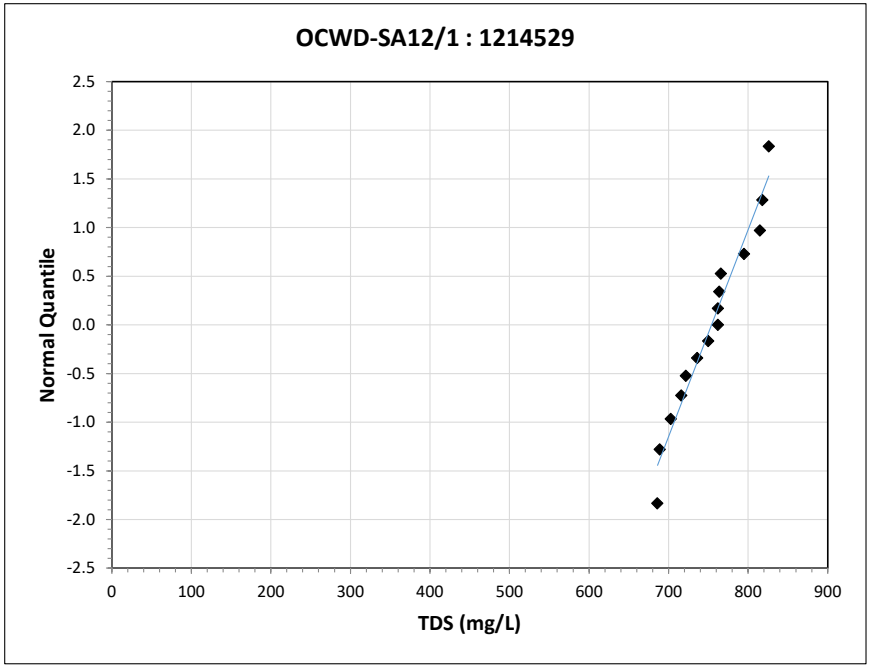


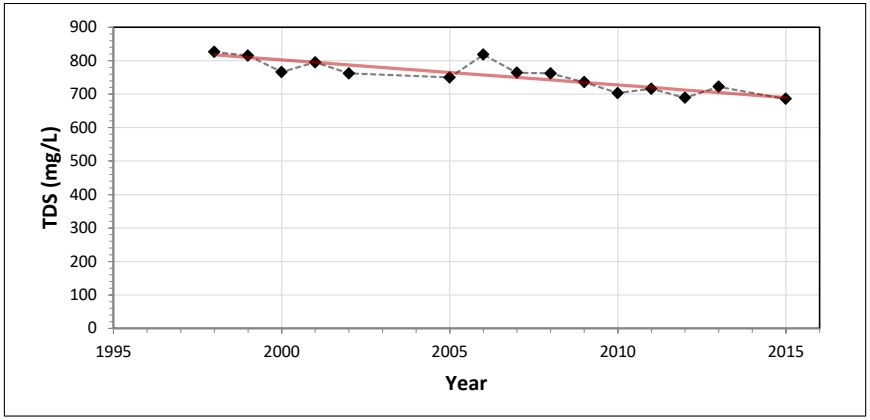
Statistics	
GMZ	Orange County
Well Name : ID	OCWD-SA12/1 : 1214529
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	2.97
Annual Average Max	4.47
Annual Average Mean	3.98
Annual Average Stdev	0.34
Shapiro-Wilk W	0.831
Shapiro-Wilk p-value	0.007
Critical Alpha	0.01
Most Discordant Value	2.97
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	4.07
Trend Analysis	**Theil-Sen**
Kendall S	20
Var(S)	491
Intercept	-9.65
Slope	0.01
p-value	0.391
Significant Trend?	No



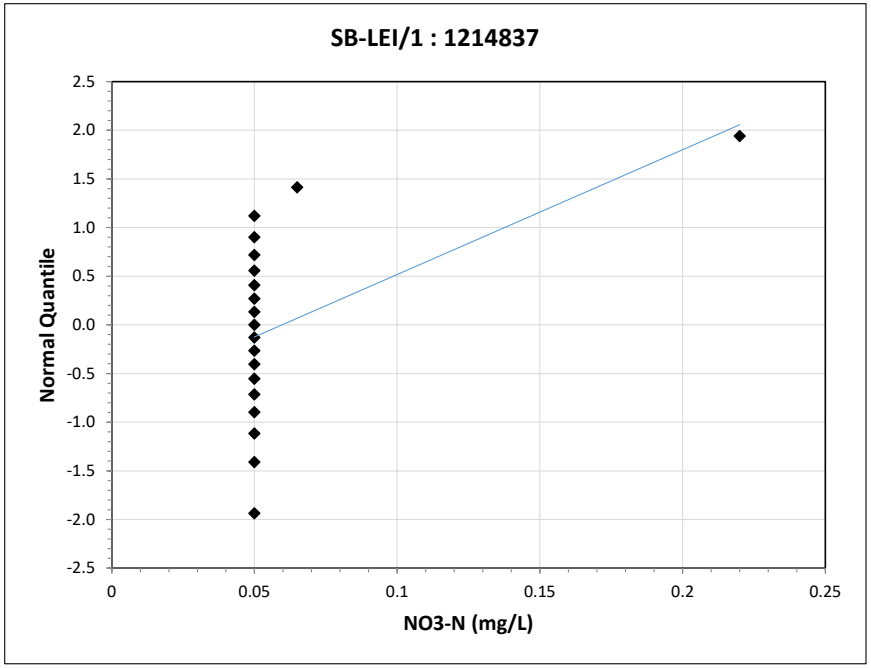


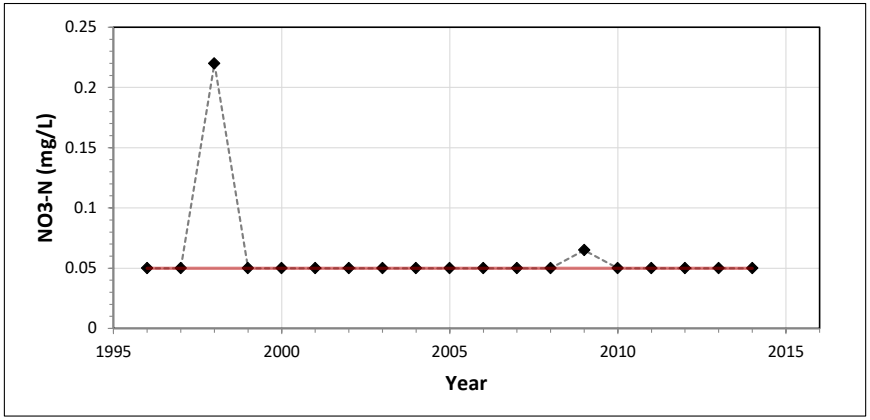
Statistics	
GMZ	Orange County
Well Name : ID	OCWD-SA12/1 : 1214529
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	686
Annual Average Max	826
Annual Average Mean	754
Annual Average Stdev	45.76
Shapiro-Wilk W	0.945
Shapiro-Wilk p-value	0.454
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.81
Student t	1.03
Mean + t*SE (UCL84)	766
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-78
Var(S)	407
Intercept	15803
Slope	-7.50
p-value	1E-4
Significant Trend?	Decreasing**



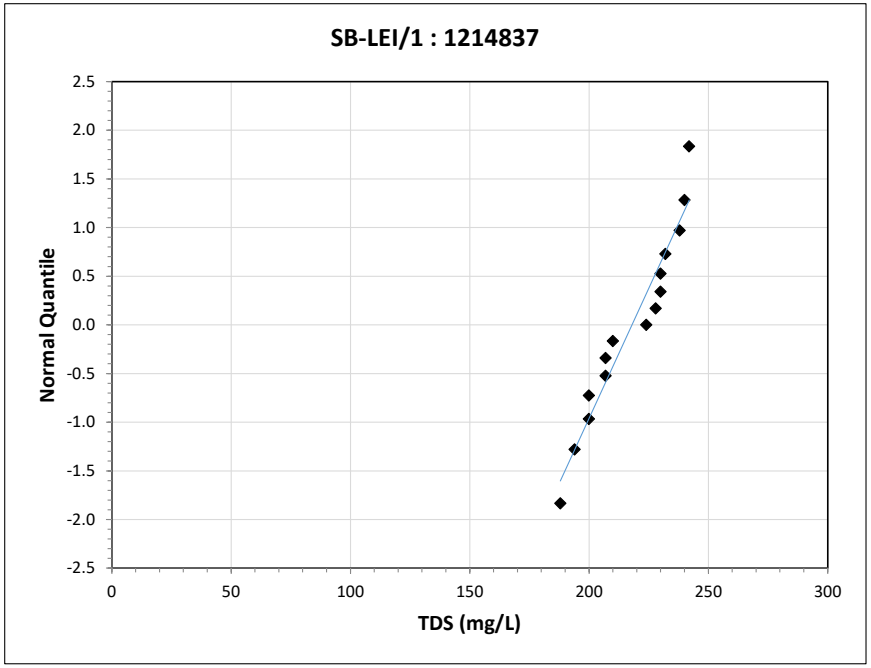


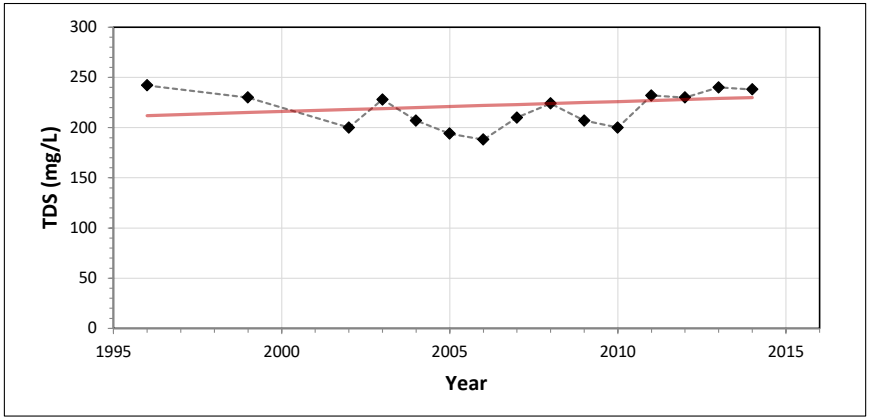
Statistics	
GMZ	Orange County
Well Name : ID	SB-LEI/1 : 1214837
Analyte	NO3-N (mg/L)
Count	19
Count Detects	2
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.22
Annual Average Mean	0.06
Annual Average Stdev	0.04
Shapiro-Wilk W	0.274
Shapiro-Wilk p-value	9E-9
Critical Alpha	0.01
Most Discordant Value	0.22
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-8
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	324
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



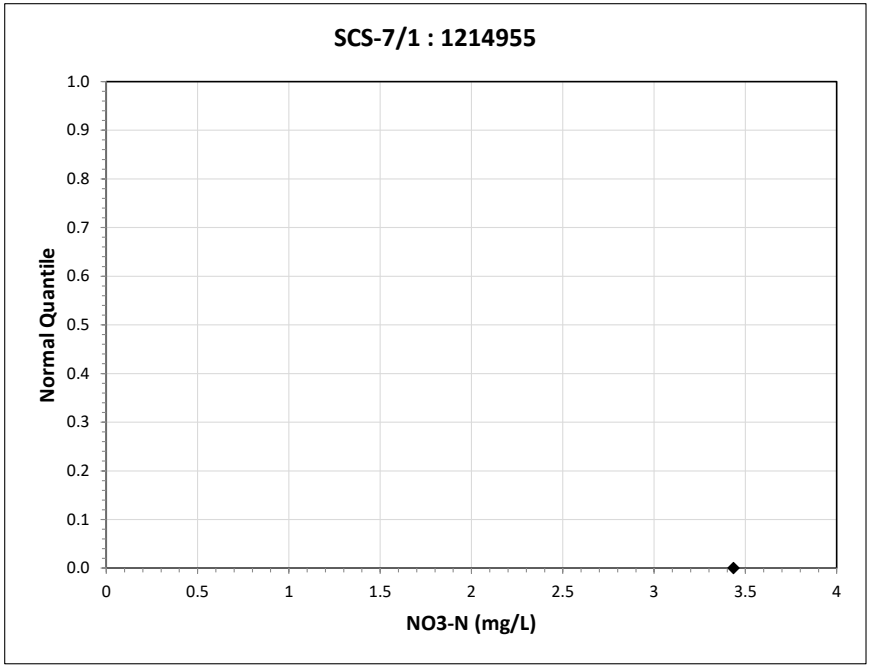


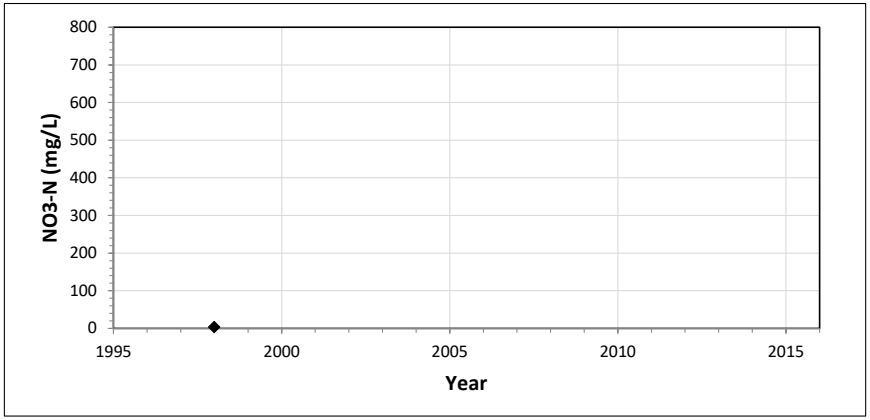
Statistics	
GMZ	Orange County
Well Name : ID	SB-LEI/1 : 1214837
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	188
Annual Average Max	242
Annual Average Mean	218
Annual Average Stdev	17.95
Shapiro-Wilk W	0.920
Shapiro-Wilk p-value	0.196
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.63
Student t	1.03
Mean + t*SE (UCL84)	223
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	16
Var(S)	405
Intercept	-1784
Slope	1.00
p-value	0.456
Significant Trend?	No



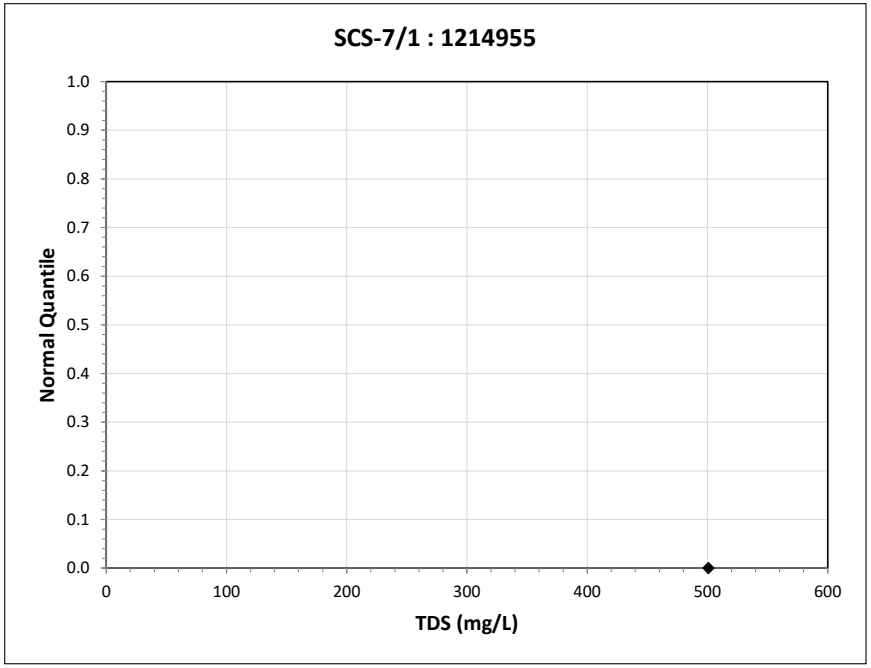


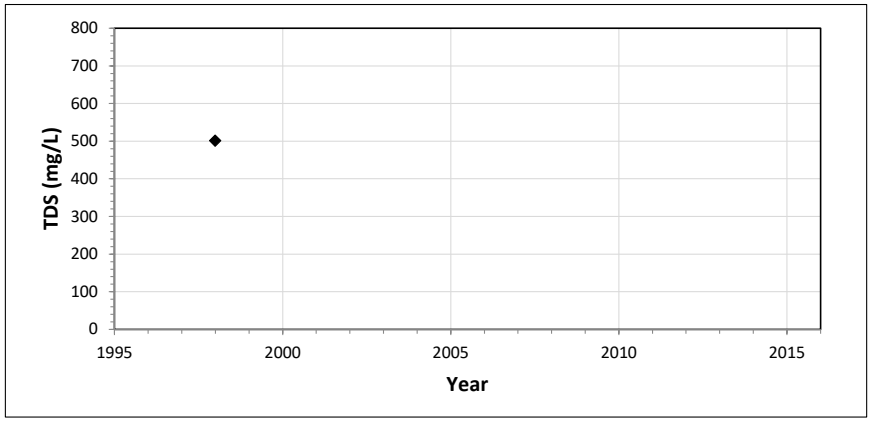
Statistics	
GMZ	Orange County
Well Name : ID	SCS-7/1 : 1214955
Analyte	NO3-N (mg/L)
Count	1
Count Detects	1
Sample Year Min	1998
Sample Year Max	1998
Annual Average Min	3.44
Annual Average Max	3.44
Annual Average Mean	3.44
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**NC**
Kendall S	NC
Var(S)	NC
Intercept	NC
Slope	NC
p-value	NC
Significant Trend?	NC



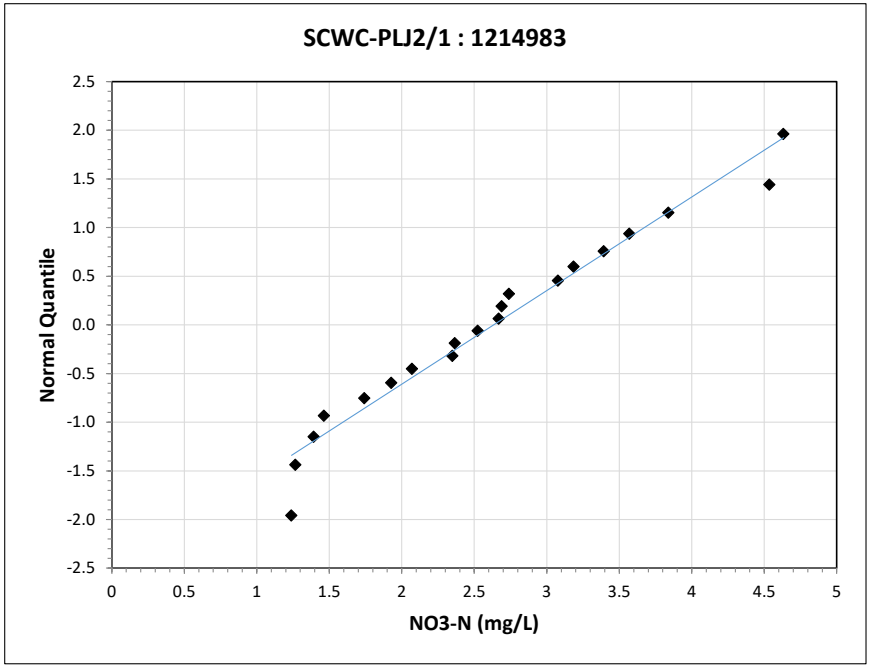


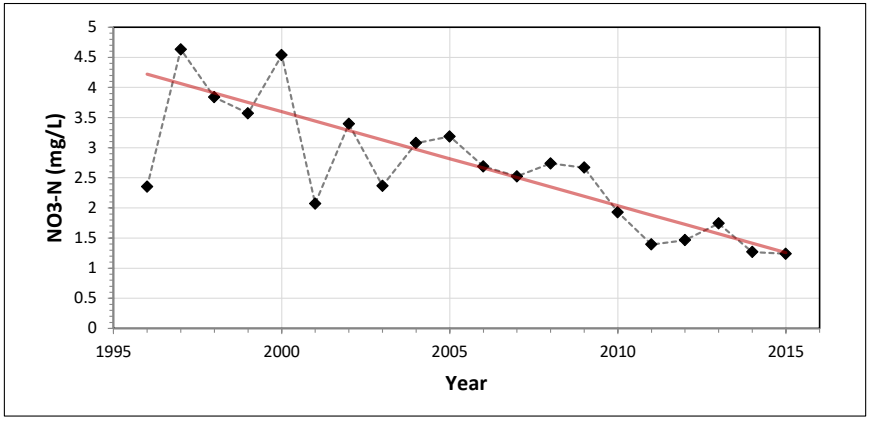
Statistics	
GMZ	Orange County
Well Name : ID	SCS-7/1 : 1214955
Analyte	TDS (mg/L)
Count	1
Count Detects	1
Sample Year Min	1998
Sample Year Max	1998
Annual Average Min	501
Annual Average Max	501
Annual Average Mean	501
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**NC**
Kendall S	NC
Var(S)	NC
Intercept	NC
Slope	NC
p-value	NC
Significant Trend?	NC



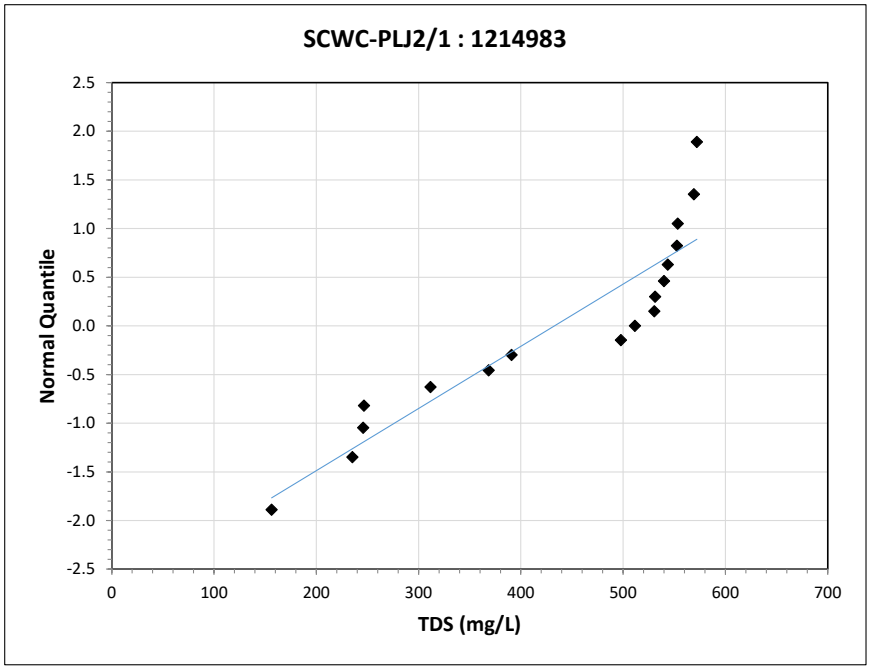


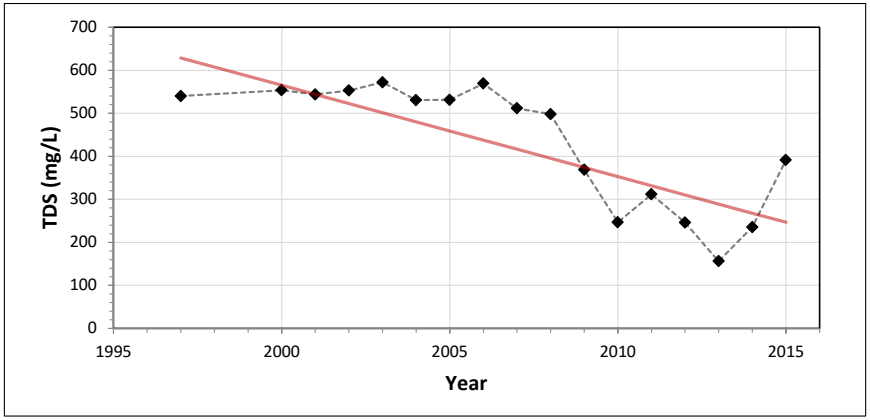
Statistics	
GMZ	Orange County
Well Name : ID	SCWC-PLJ2/1 : 1214983
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.24
Annual Average Max	4.63
Annual Average Mean	2.63
Annual Average Stdev	1.01
Shapiro-Wilk W	0.953
Shapiro-Wilk p-value	0.415
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.23
Student t	1.02
Mean + t*SE (UCL84)	2.87
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-120
Var(S)	950
Intercept	315
Slope	-0.16
p-value	1E-4
Significant Trend?	Decreasing**



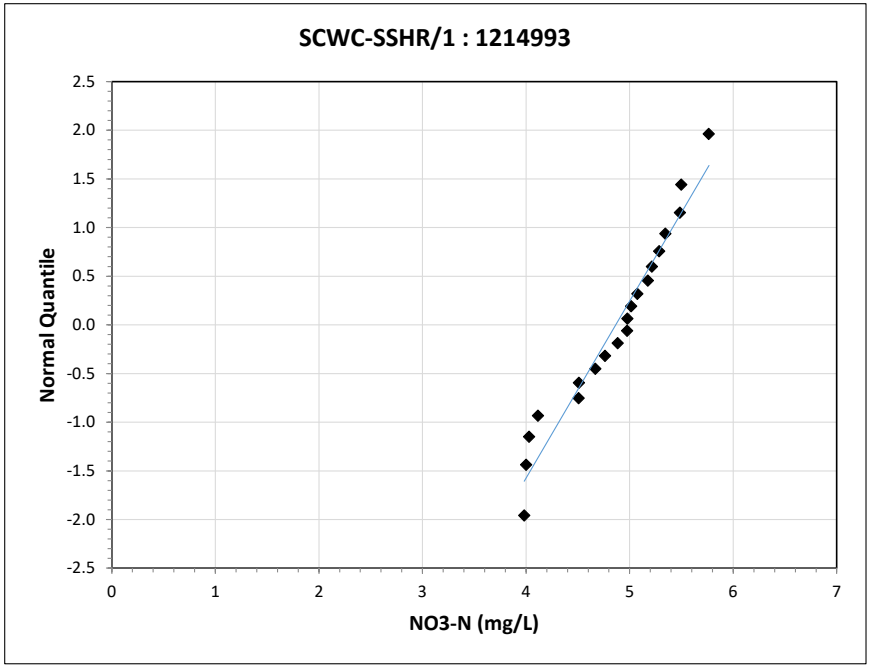


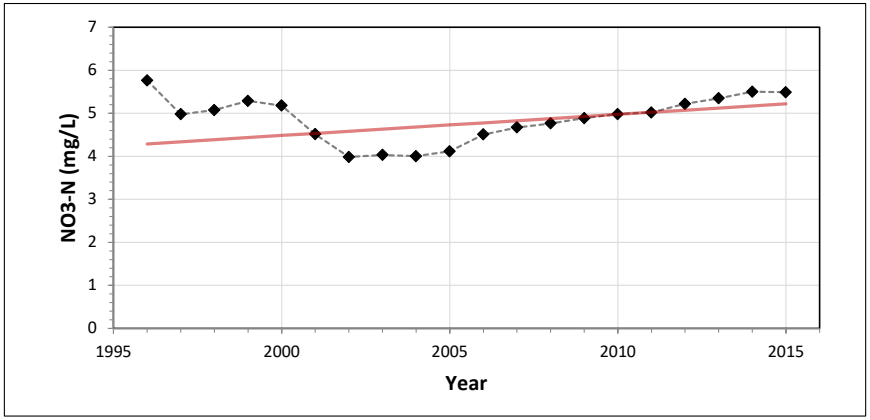
Statistics	
GMZ	Orange County
Well Name : ID	SCWC-PLJ2/1 : 1214983
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	156
Annual Average Max	572
Annual Average Mean	433
Annual Average Stdev	142.73
Shapiro-Wilk W	0.831
Shapiro-Wilk p-value	0.006
Critical Alpha	0.01
Most Discordant Value	156
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	512
Trend Analysis	**Theil-Sen**
Kendall S	-90
Var(S)	589
Intercept	43020
Slope	-21.23
p-value	2E-4
Significant Trend?	Decreasing**



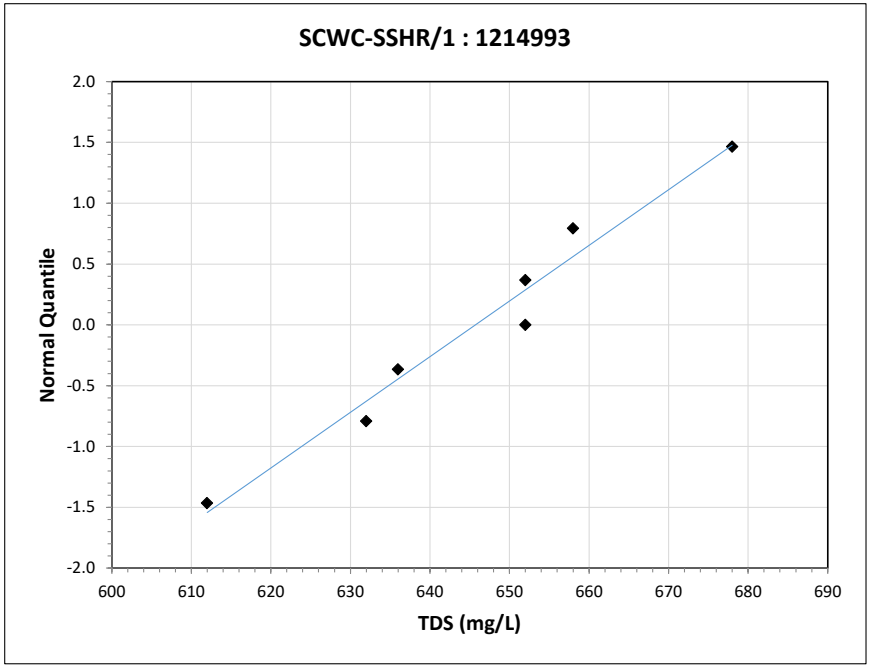


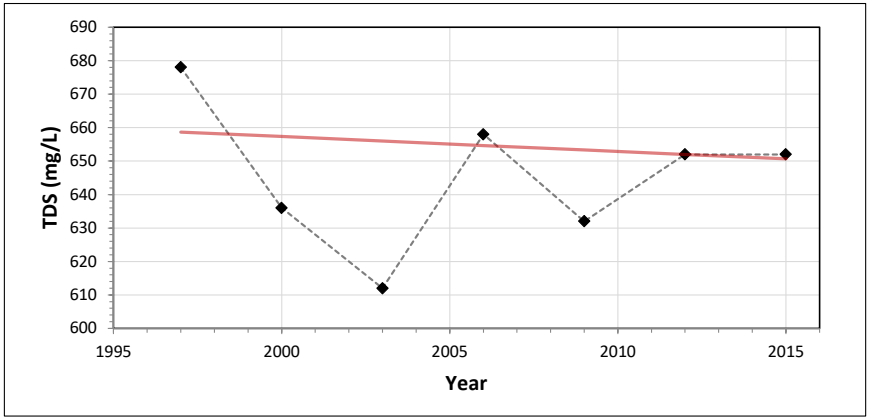
Statistics	
GMZ	Orange County
Well Name : ID	SCWC-SSHR/1 : 1214993
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.98
Annual Average Max	5.77
Annual Average Mean	4.87
Annual Average Stdev	0.53
Shapiro-Wilk W	0.944
Shapiro-Wilk p-value	0.287
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.12
Student t	1.02
Mean + t*SE (UCL84)	4.99
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	50
Var(S)	950
Intercept	-93.43
Slope	0.05
p-value	0.112
Significant Trend?	No



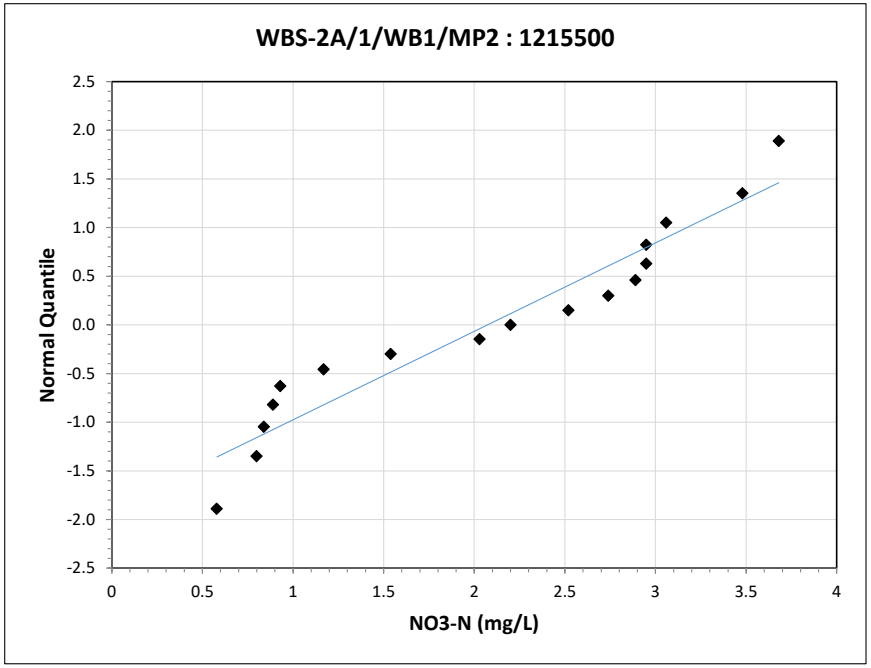


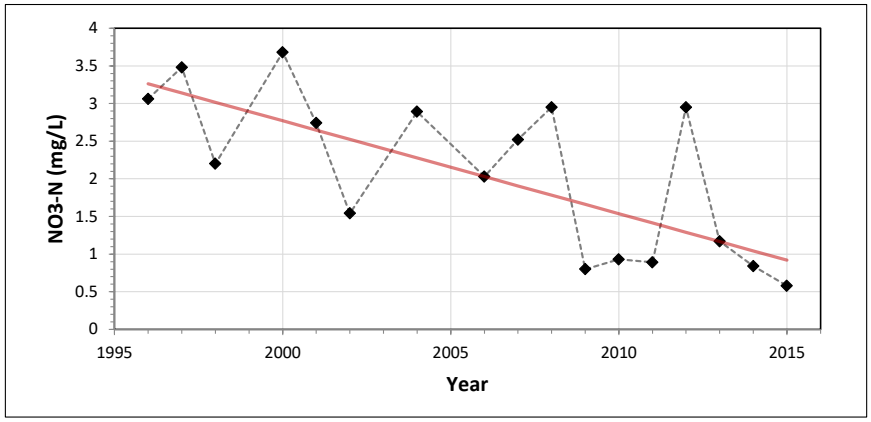
Statistics	
GMZ	Orange County
Well Name : ID	SCWC-SSHR/1 : 1214993
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	612
Annual Average Max	678
Annual Average Mean	646
Annual Average Stdev	21.18
Shapiro-Wilk W	0.976
Shapiro-Wilk p-value	0.940
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.01
Student t	1.08
Mean + t*SE (UCL84)	654
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-2
Var(S)	43.33
Intercept	1546
Slope	-0.44
p-value	0.879
Significant Trend?	No



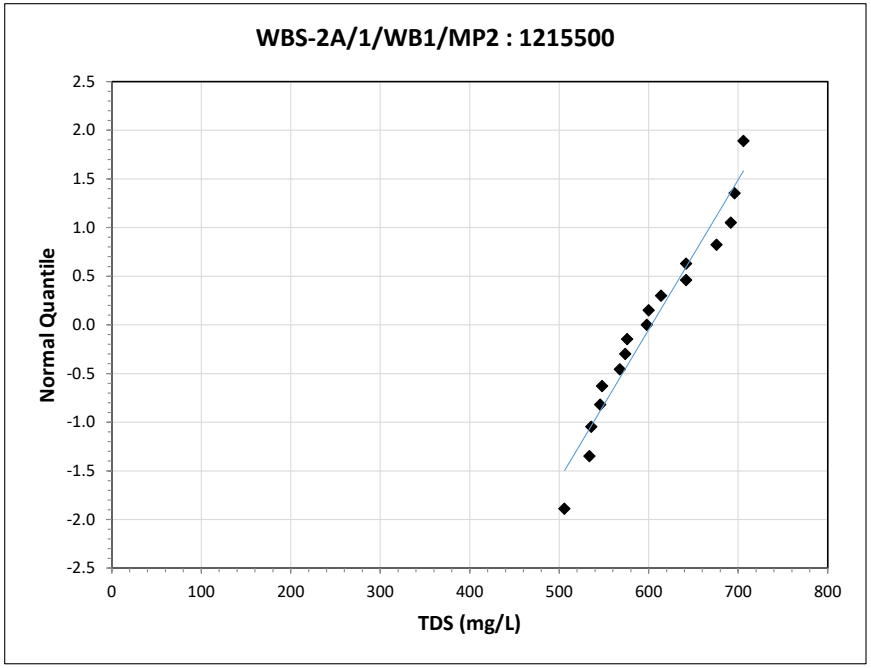


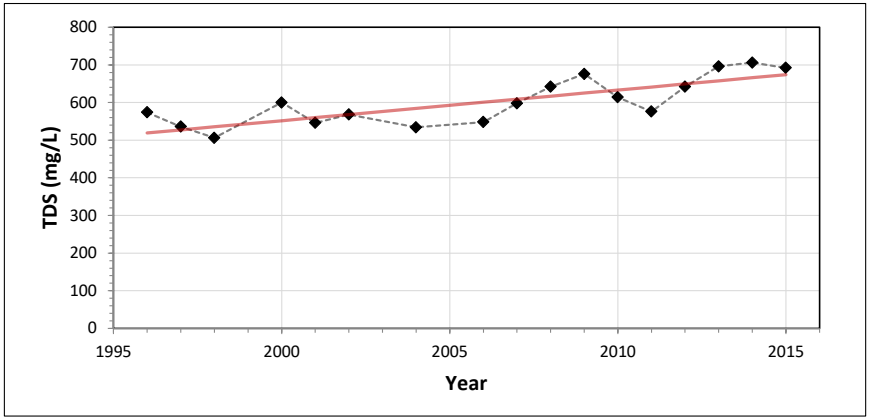
Statistics	
GMZ	Orange County
Well Name : ID	WBS-2A/1/WB1/MP2 : 1215500
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.58
Annual Average Max	3.68
Annual Average Mean	2.07
Annual Average Stdev	1.05
Shapiro-Wilk W	0.907
Shapiro-Wilk p-value	0.090
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.25
Student t	1.03
Mean + t*SE (UCL84)	2.33
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-69
Var(S)	588
Intercept	249
Slope	-0.12
p-value	0.005
Significant Trend?	Decreasing*



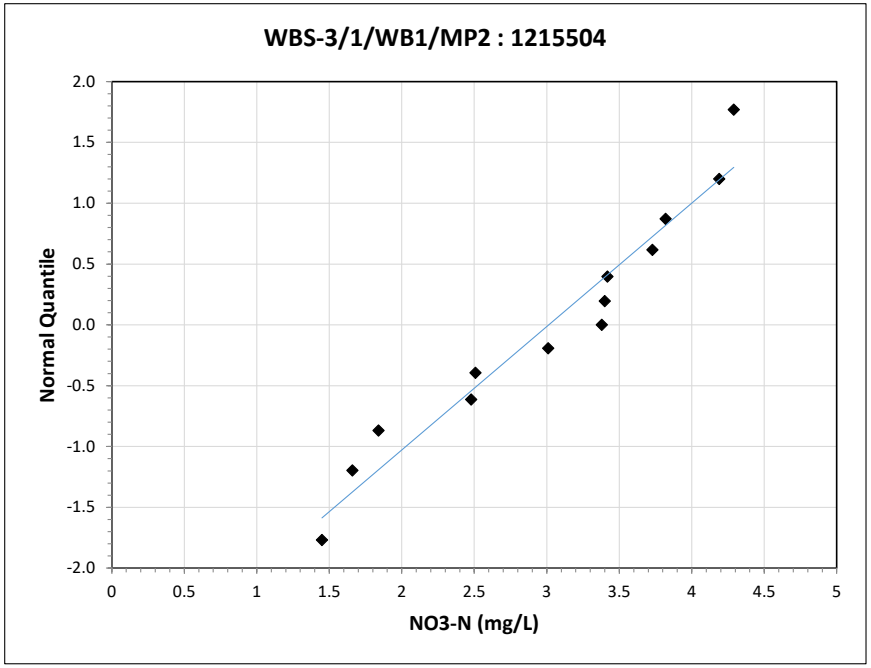


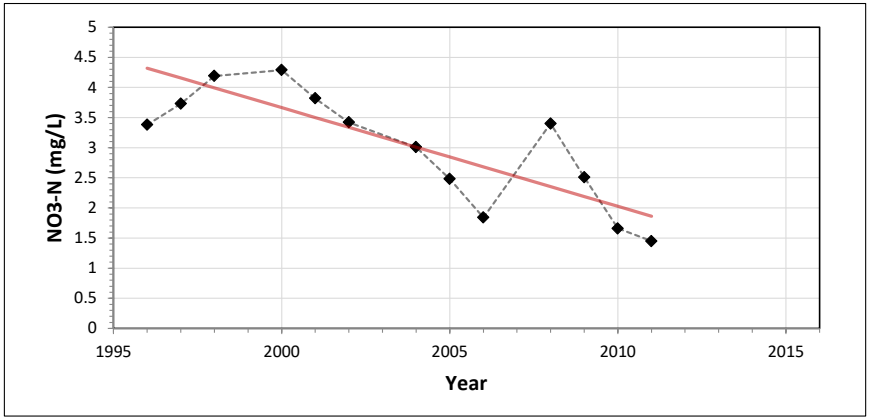
Statistics	
GMZ	Orange County
Well Name : ID	WBS-2A/1/WB1/MP2 : 1215500
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	506
Annual Average Max	706
Annual Average Mean	603
Annual Average Stdev	62.96
Shapiro-Wilk W	0.939
Shapiro-Wilk p-value	0.312
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	15.27
Student t	1.03
Mean + t*SE (UCL84)	619
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	83
Var(S)	588
Intercept	-15739
Slope	8.15
p-value	7E-4
Significant Trend?	Increasing**



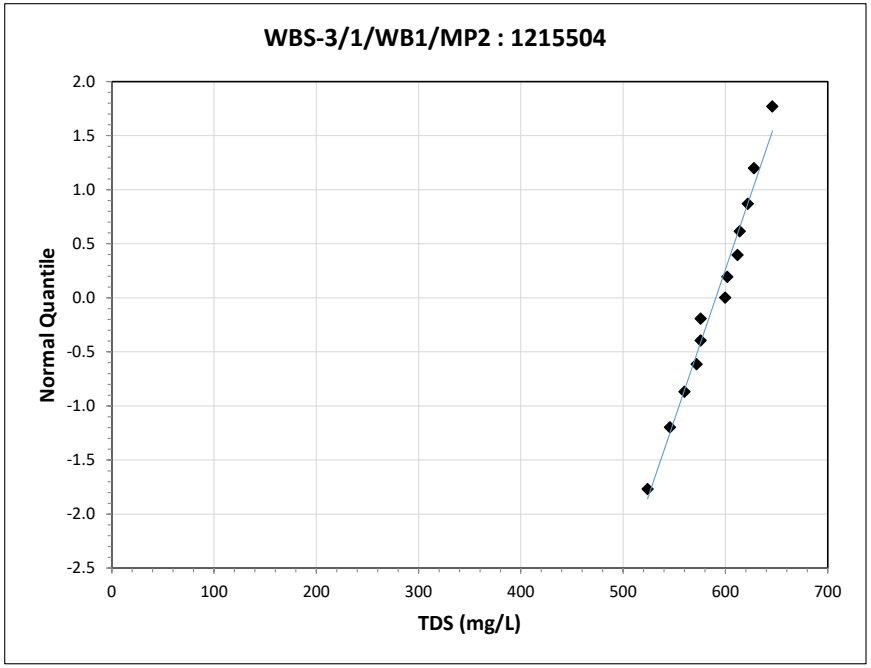


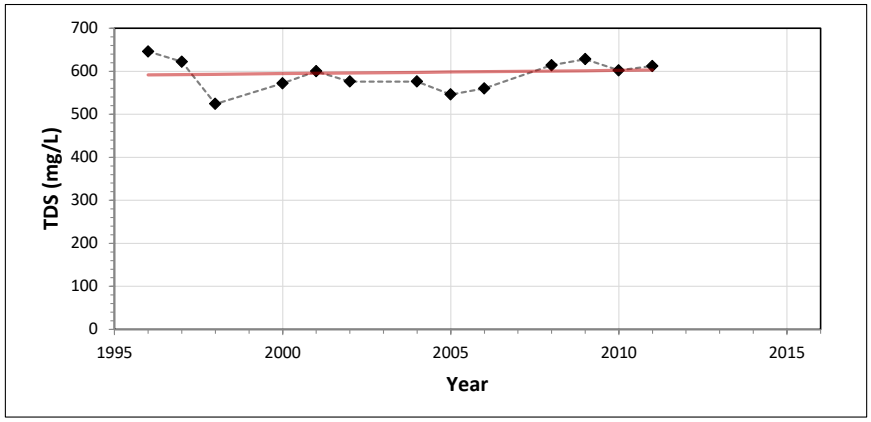
Statistics	
GMZ	Orange County
Well Name : ID	WBS-3/1/WB1/MP2 : 1215504
Analyte	NO3-N (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2011
Annual Average Min	1.45
Annual Average Max	4.29
Annual Average Mean	3.01
Annual Average Stdev	0.95
Shapiro-Wilk W	0.932
Shapiro-Wilk p-value	0.360
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.26
Student t	1.04
Mean + t*SE (UCL84)	3.29
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-48
Var(S)	269
Intercept	331
Slope	-0.16
p-value	0.004
Significant Trend?	Decreasing*



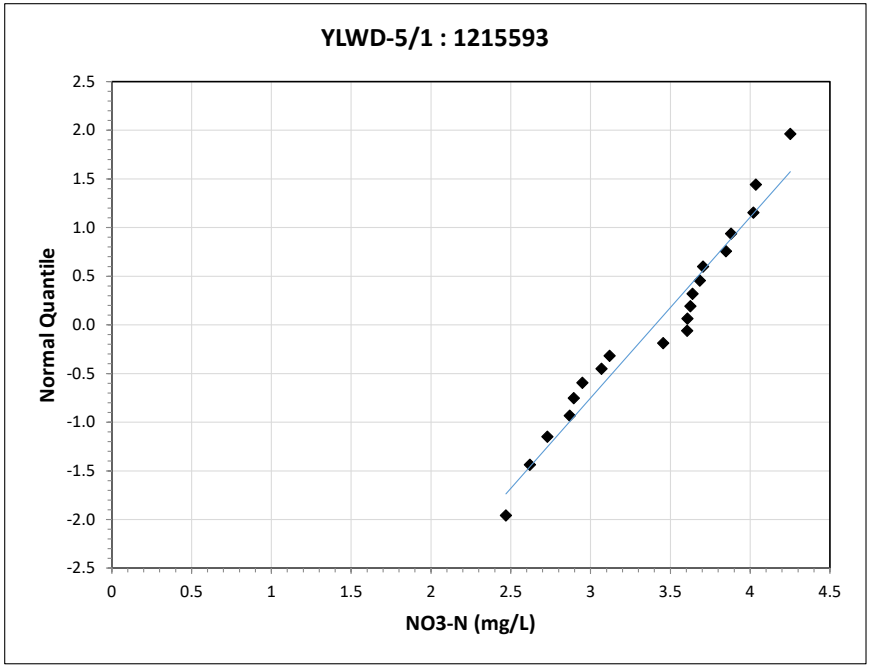


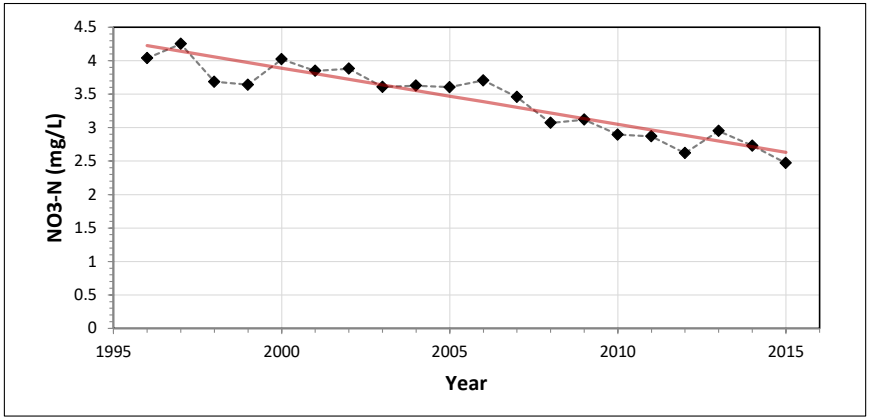
Statistics	
GMZ	Orange County
Well Name : ID	WBS-3/1/WB1/MP2 : 1215504
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2011
Annual Average Min	524
Annual Average Max	646
Annual Average Mean	591
Annual Average Stdev	35.13
Shapiro-Wilk W	0.974
Shapiro-Wilk p-value	0.939
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.74
Student t	1.04
Mean + t*SE (UCL84)	601
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	5
Var(S)	268
Intercept	-906
Slope	0.75
p-value	0.807
Significant Trend?	No



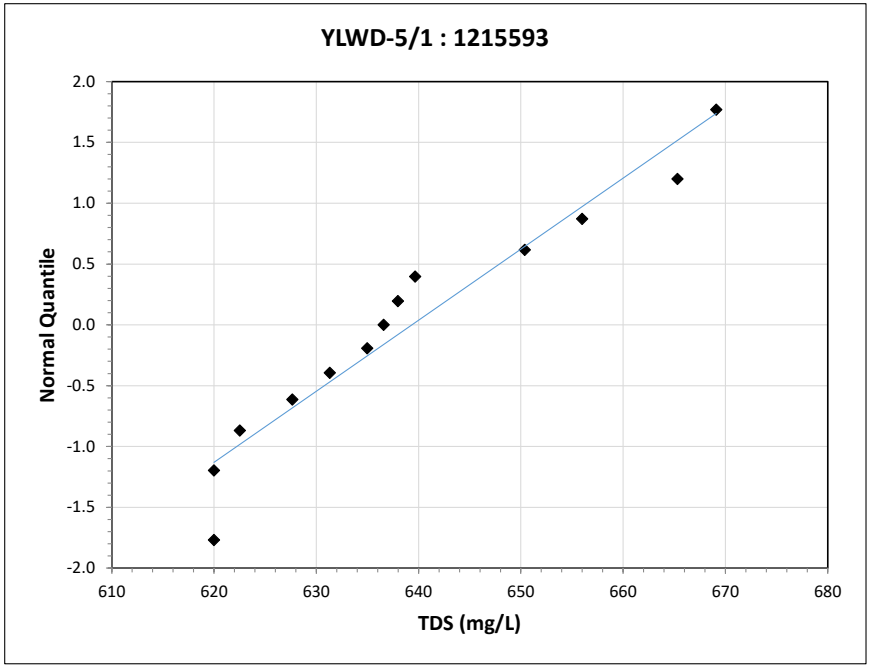


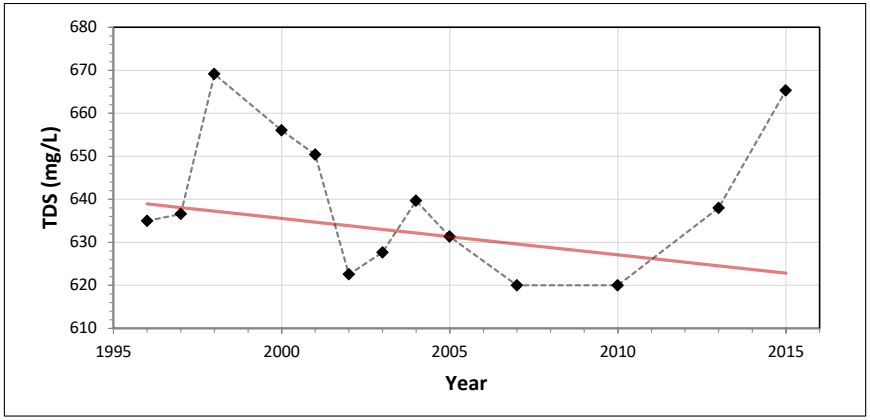
Statistics	
GMZ	Orange County
Well Name : ID	YLWD-5/1 : 1215593
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2.47
Annual Average Max	4.25
Annual Average Mean	3.40
Annual Average Stdev	0.52
Shapiro-Wilk W	0.944
Shapiro-Wilk p-value	0.279
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.12
Student t	1.02
Mean + t*SE (UCL84)	3.52
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-152
Var(S)	950
Intercept	172
Slope	-0.08
p-value	1E-6
Significant Trend?	Decreasing**





Statistics	
GMZ	Orange County
Well Name : ID	YLWD-5/1 : 1215593
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	620
Annual Average Max	669
Annual Average Mean	639
Annual Average Stdev	16.38
Shapiro-Wilk W	0.919
Shapiro-Wilk p-value	0.246
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.54
Student t	1.04
Mean + t*SE (UCL84)	644
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-13
Var(S)	268
Intercept	2327
Slope	-0.85
p-value	0.463
Significant Trend?	No





Attachment B12

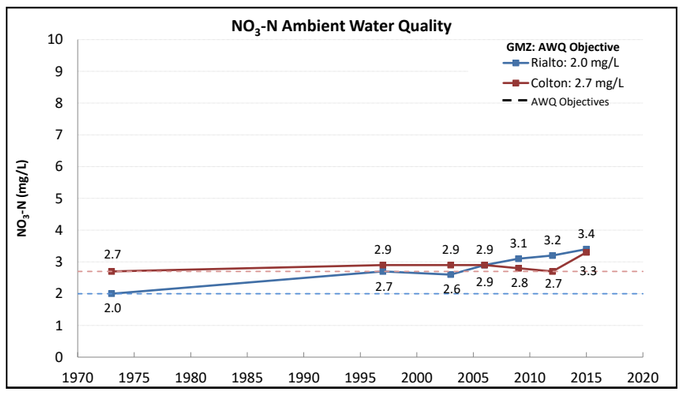
Rialto and Colton GMZs

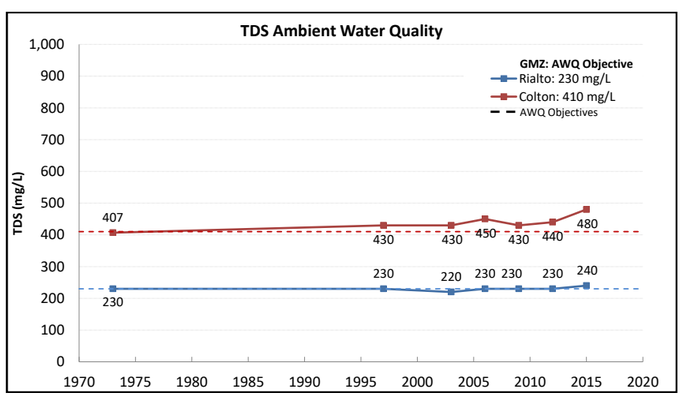
Attachment Contents:

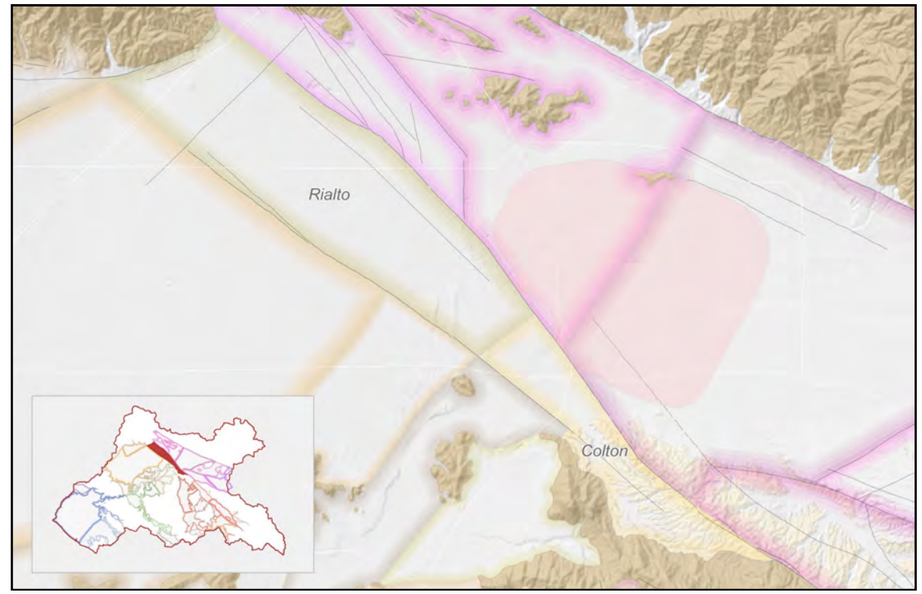
B12-1 Groundwater Storage and Elevation Contours Fall 2015
B12-2 NO_3-N Concentration and Contour Map
B12-3 TDS Concentration and Contour Map
B12-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B12-5 TDS Concentration Change (1993-2012 to 1996-2015)
B12-6 Key Well Analysis Charts

	Basin Analytics	Colton	Rialto
Basin	GMZ Area (acres)	6,080	17,600
	Volume of Storage (acre-ft)	19,300	1,000,000
NO_3-N	Wells per GMZ	9	100
	Point Statistics per GMZ	5	63
	Total Mass (tons)	870	4,650
	1996-2015 AWQ	3.3	3.4
TDS	Wells per GMZ	9	86
	Point Statistics per GMZ	6	56
	Total Mass (tons)	127,000	327,000
	1996-2015 AWQ	480	240

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Rialto

The nitrate objective for Rialto is 2.0 mg/L. The ambient nitrate concentration increased from 3.2 mg/L in nitrate to 3.4 mg/L in 2015 and there is no assimilative capacity. Three out of the four key wells in Rialto GMZ have an increasing trend in NITRATE concentrations, while the other one shows no trend in the nitrate concentrations. One of the total 100 wells with nitrate values in Rialto will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. One new well with statistics was added to the 1996 to 2015 AWQ recomputation and three wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Colton

The nitrate objective for Colton is 2.7 mg/L. The ambient nitrate concentration increased from 2.7 mg/L in 2012 to 3.3 mg/L in 2015, and there is no assimilative capacity. One out of the two key wells in Colton GMZ has a decreasing trend in nitrate concentrations, while the other one shows an increasing trend in the nitrate concentrations. One of the total 9 wells with nitrate values in Colton will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

Rialto

The TDS objective for Rialto is 230 mg/L. The ambient TDS concentration increased from 230 mg/L in 2012 to 240 mg/L in 2015, and there is no assimilative capacity. Two out of the four key interpretive wells in Rialto GMZ show an increasing trend while the other two show no trend in TDS concentrations. One of the total 86 wells with TDS values in Rialto will not be eligible for the next AWQ recomputation if not sampled prior to 2018. One new well with statistics was added to the 1996 to 2015 AWQ recomputation, and three wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Colton

The TDS objective for Colton is 410 mg/L. The ambient TDS concentration increased from 440 mg/L in 2012 to 480 mg/L in 2015, and there is no assimilative capacity. One out of the two key wells in Colton GMZ has a decreasing trend in TDS concentration, while the other one shows an increasing trend in the TDS concentration. One of the total 9 wells with TDS values in Colton will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Colton	1001707	CLT 23	1.5	Decreasing*	441	Decreasing*
Colton	1001941	CLT 22	3.3	Increasing*	466	Increasing
Rialto	1001671	CLT 17	5.9	No Trend	266	No Trend
Rialto	1002069	RIALTO 4	2.8	Increasing	184	Increasing
Rialto	1002094	WVWD 17	6.6	Increasing	274	No Trend
Rialto	1200213	F13A	2.1	Increasing	205	Increasing

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B12-4 and B12-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Colton	1001955	CR 4	High	1	1.6	Ave	High	1	540	Ave
Colton	1001956	CR 4A	Medium	5	1.6	Stat	Medium	2	525	Ave
Rialto	1000486	F38A	Medium	4	5.6	Stat	Medium	4	228	Stat
Rialto	1002065	NA_1002065	High	3	4.6	Stat	High	3	232	Stat
Rialto	1002079	F10A	Medium	5	6.2	Stat	Medium	4	297	Stat
Rialto	1204667	MID F-16	Medium	6	3.0	Stat	Medium	6	326	Stat
Rialto	1204668	MID F-17	Medium	4	2.9	Stat	Medium	4	406	Stat
Rialto	1204673	MID F-22	Medium	4	5.8	Stat	Medium	4	452	Stat
Rialto	1204674	MID F-23	Medium	3	4.1	Stat	Medium	3	262	Stat
Rialto	1204682	MID F-30	Medium	3	5.2	Stat	Medium	3	269	Stat
Rialto	1204683	MID F-31	Medium	4	2.6	Stat	Medium	4	232	Stat

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

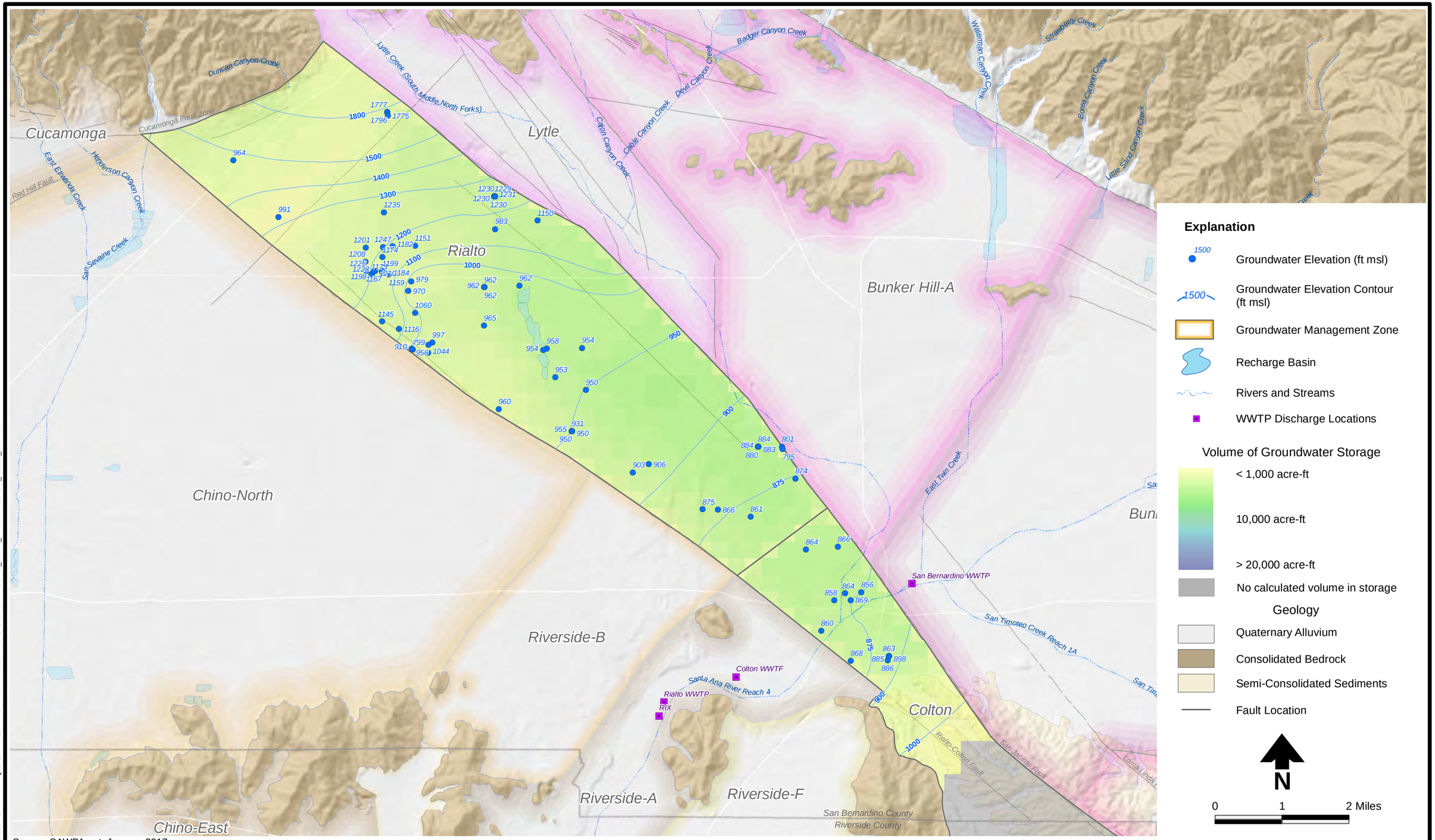
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B12-4 and B12-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Colton	1200845	JOHNSON 4	New*	1	3.8	Ave	New*	1	590	Ave
Rialto	1222081	MID F-34A	New*	2	4.3	Ave	New*	2	422	Ave
Rialto	1222083	MID F-33A	New*	2	3.2	Ave	New*	2	308	Ave
Rialto	1232525	F10D	New	3	6.6	Stat	New	3	273	Stat
Rialto	1232860	F54A	New*	1	1.5	Ave	New*	1	200	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B12-4 and B12-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Rialto and Colton GMZs

Attachment B12-1

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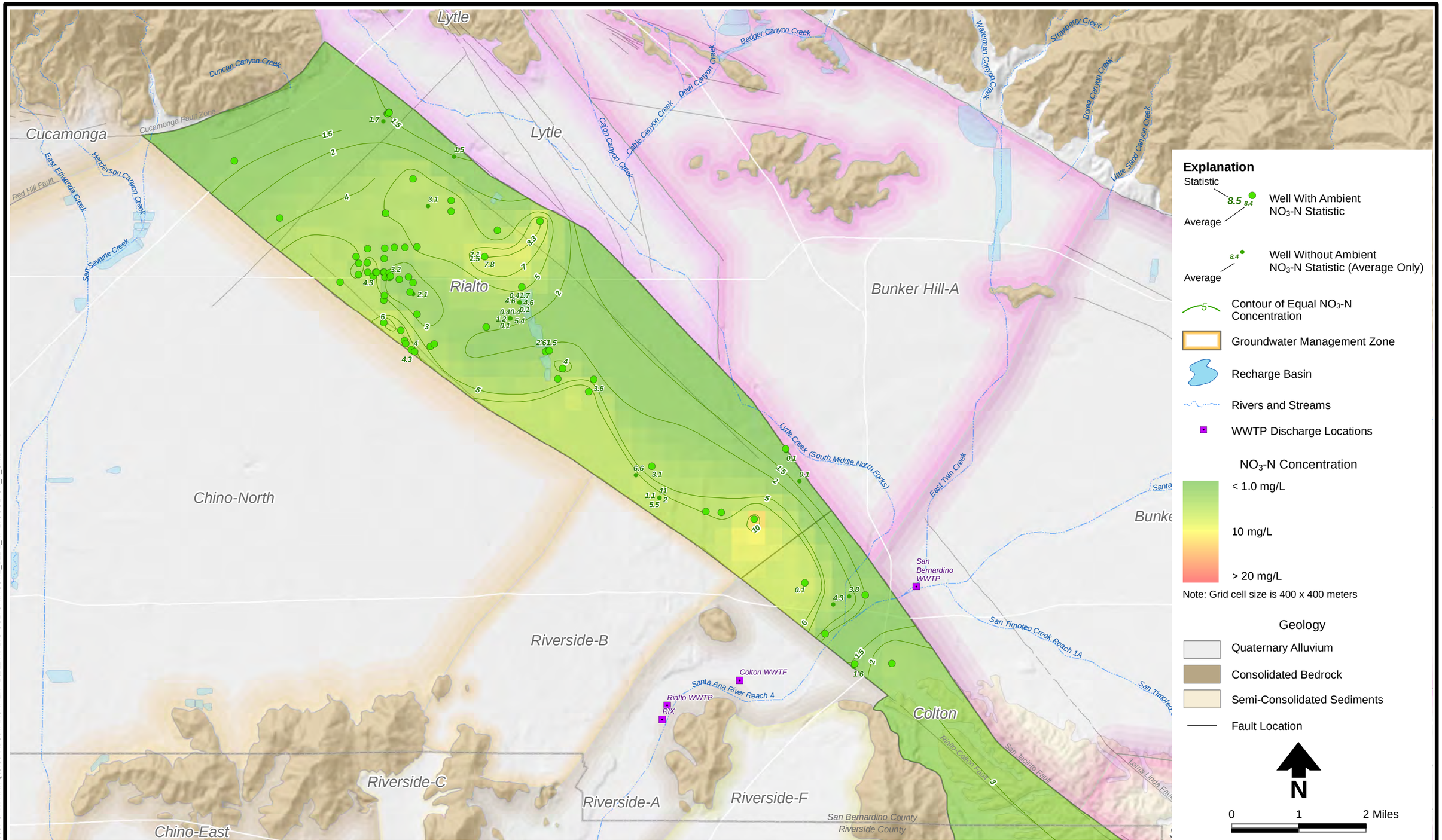
Recomputation of Ambient Water Quality for the Period 1996 to 2015

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B12 RIALTO COLTON\FIGURE_B12-1_RIALTOCOLTON_F2015_WL.MXD



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B12 RIALTO COLTON\FIGURE_B12-2_RIALTOCOLTON_N_GRID.MXD

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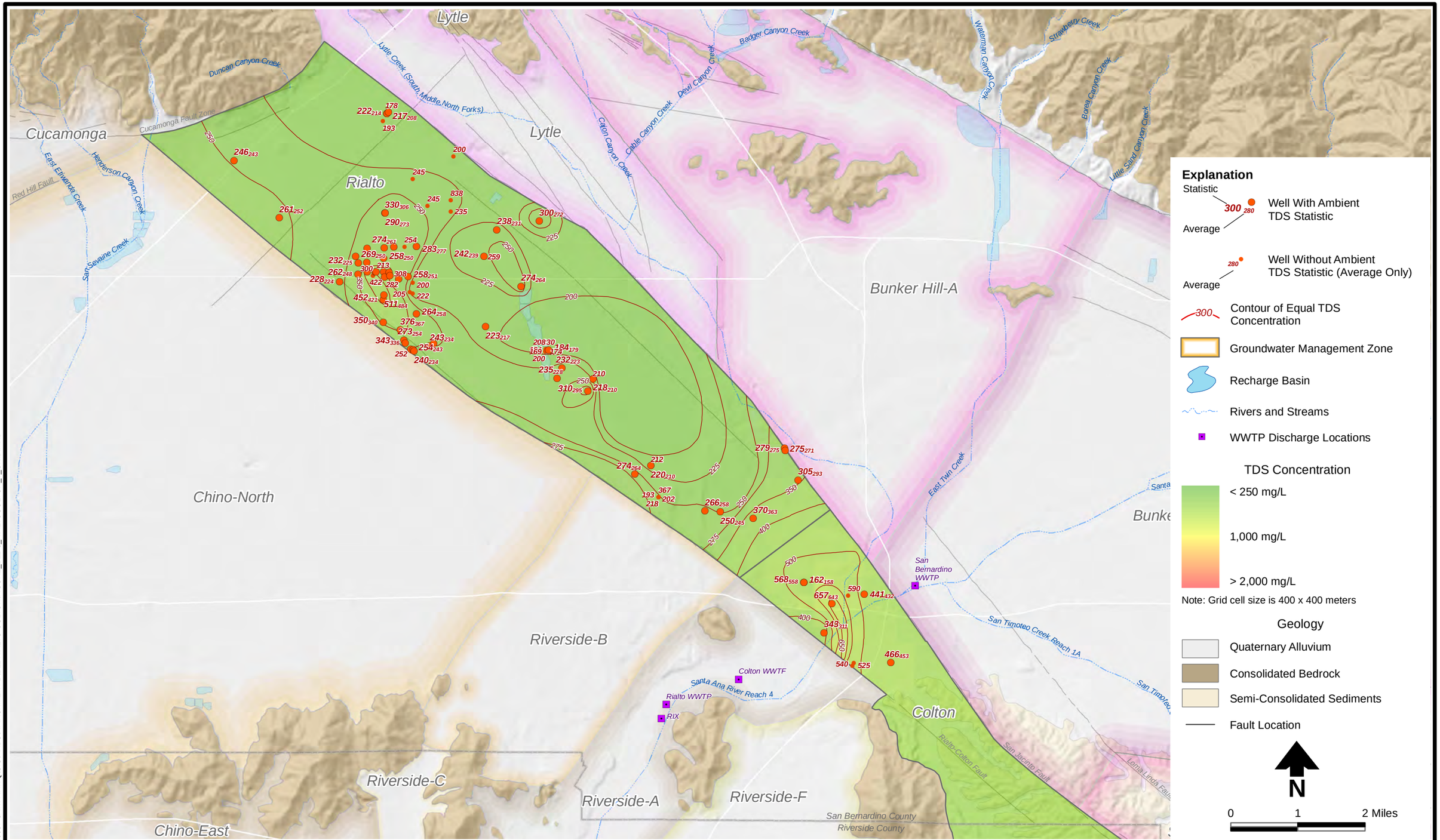
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Rialto and Colton GMZs

Attachment B12-2



Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B12 RIALTO COLTON\FIGURE_B12-3_RIALTOCOLTON_T_GRID.MXD

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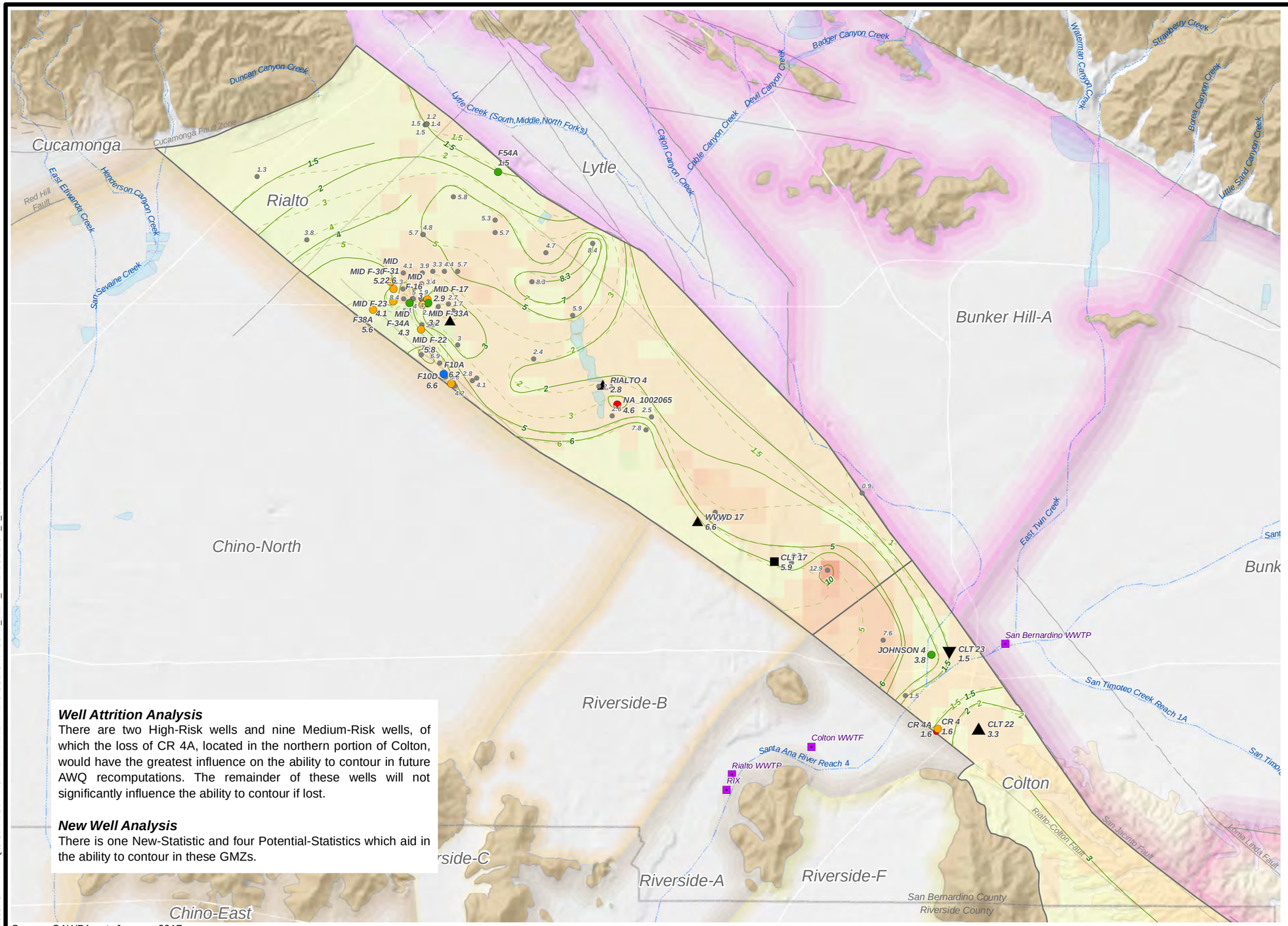
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Rialto and Colton GMZs

Attachment B12-3



Well Attrition Analysis

There are two High-Risk wells and nine Medium-Risk wells, of which the loss of CR 4A, located in the northern portion of Colton, would have the greatest influence on the ability to contour in future AWQ recomputations. The remainder of these wells will not significantly influence the ability to contour if lost.

New Well Analysis

There is one New-Statistic and four Potential-Statistics which aid in the ability to contour in these GMZs.

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 1 2 Miles

N

Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B12 RIALTO COLTON\FIGURE_B12-4_RIALTOCOLTON_N_CHANGE.MXD

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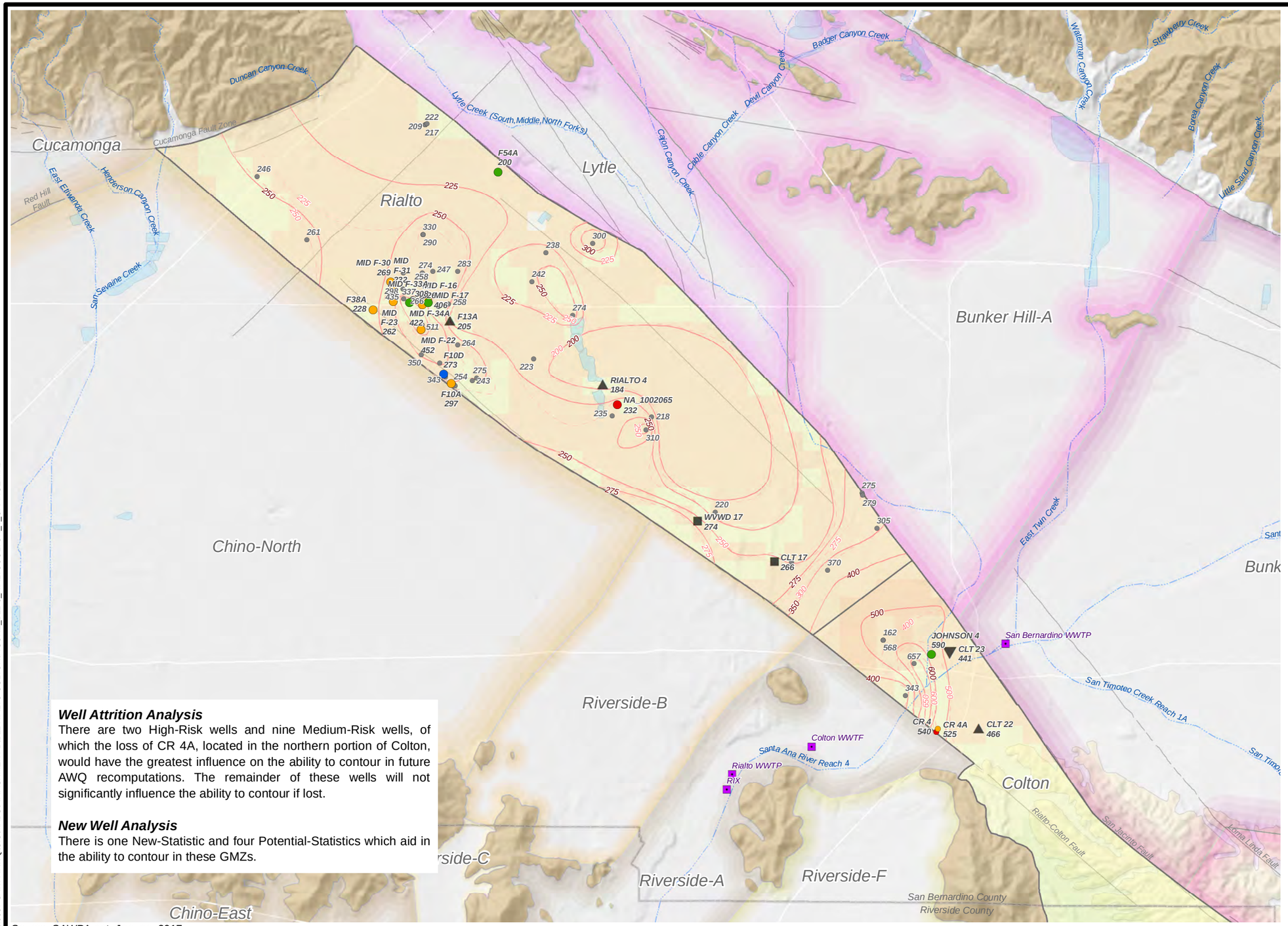
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Rialto and Colton GMZs

Attachment B12-4



Well Attrition Analysis

There are two High-Risk wells and nine Medium-Risk wells, of which the loss of CR 4A, located in the northern portion of Colton, would have the greatest influence on the ability to contour in future AWQ recomputations. The remainder of these wells will not significantly influence the ability to contour if lost.

New Well Analysis

There is one New-Statistic and four Potential-Statistics which aid in the ability to contour in these GMZs.

Source: SAWPA.net, January 2017

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 1 2 Miles

N

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B12 RIALTO COLTON\FIGURE_B12-5_RIALTOCOLTON_T_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Rialto and Colton GMZs

Attachment B12-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

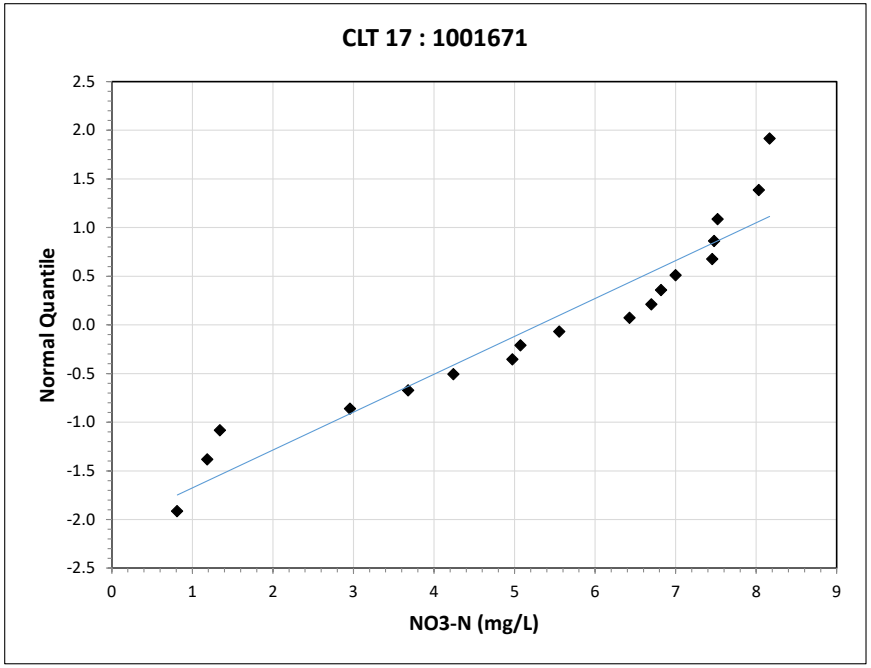
Mann-Kendall

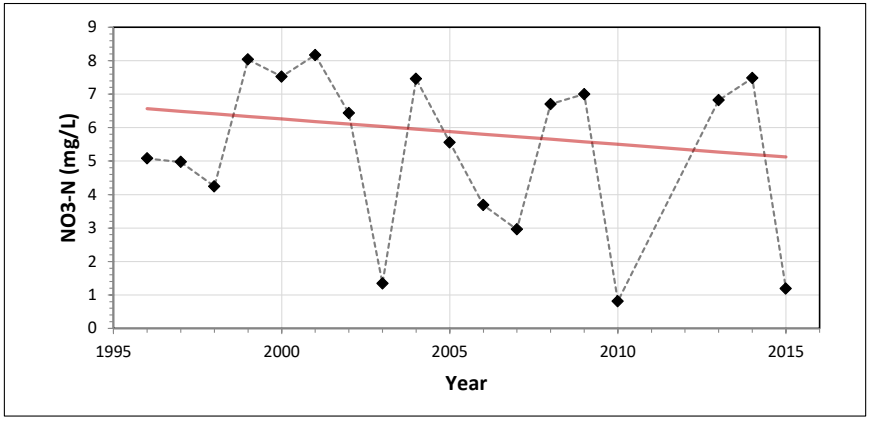
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

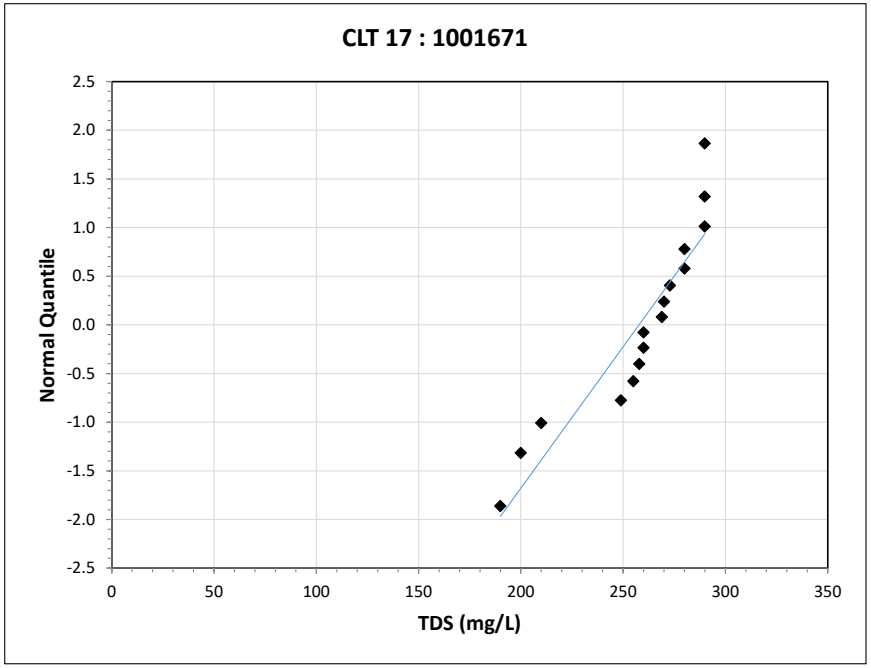
The significance of the trends is notated by * for significant and ** for very significant.

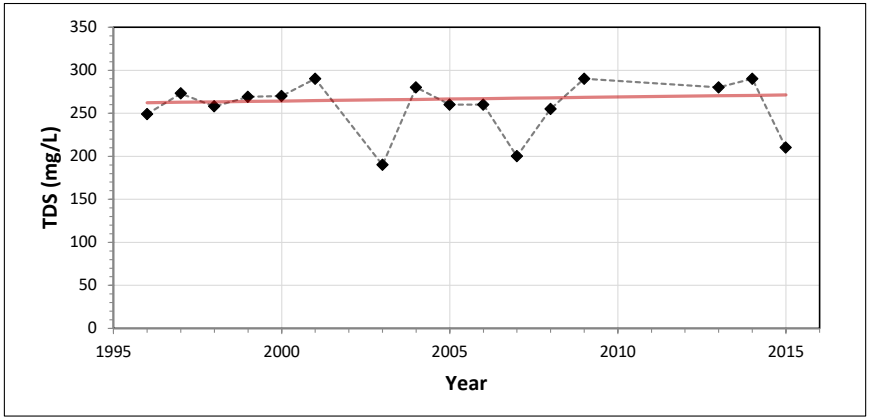
Statistics	
GMZ	Rialto
Well Name : ID	CLT 17 : 1001671
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.81
Annual Average Max	8.17
Annual Average Mean	5.30
Annual Average Stdev	2.43
Shapiro-Wilk W	0.895
Shapiro-Wilk p-value	0.048
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.57
Student t	1.02
Mean + t*SE (UCL84)	5.89
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-21
Var(S)	697
Intercept	158
Slope	-0.08
p-value	0.449
Significant Trend?	No



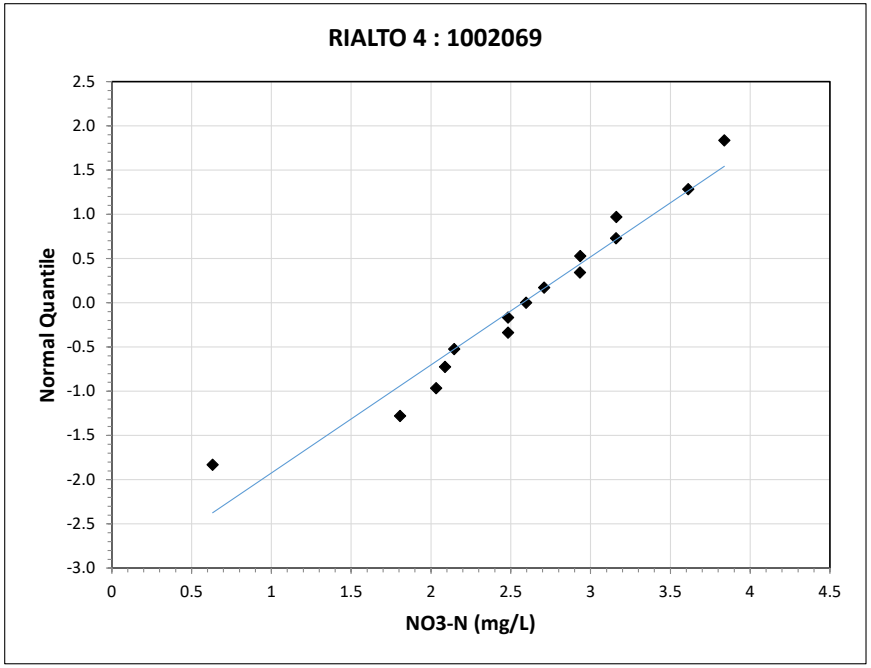


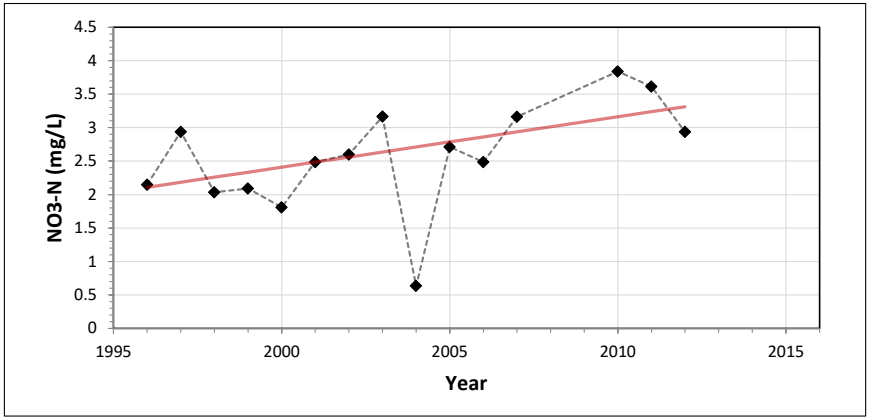
Statistics	
GMZ	Rialto
Well Name : ID	CLT 17 : 1001671
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	190
Annual Average Max	290
Annual Average Mean	258
Annual Average Stdev	31.54
Shapiro-Wilk W	0.844
Shapiro-Wilk p-value	0.011
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.88
Student t	1.03
Mean + t*SE (UCL84)	266
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	11
Var(S)	488
Intercept	-673
Slope	0.47
p-value	0.651
Significant Trend?	No



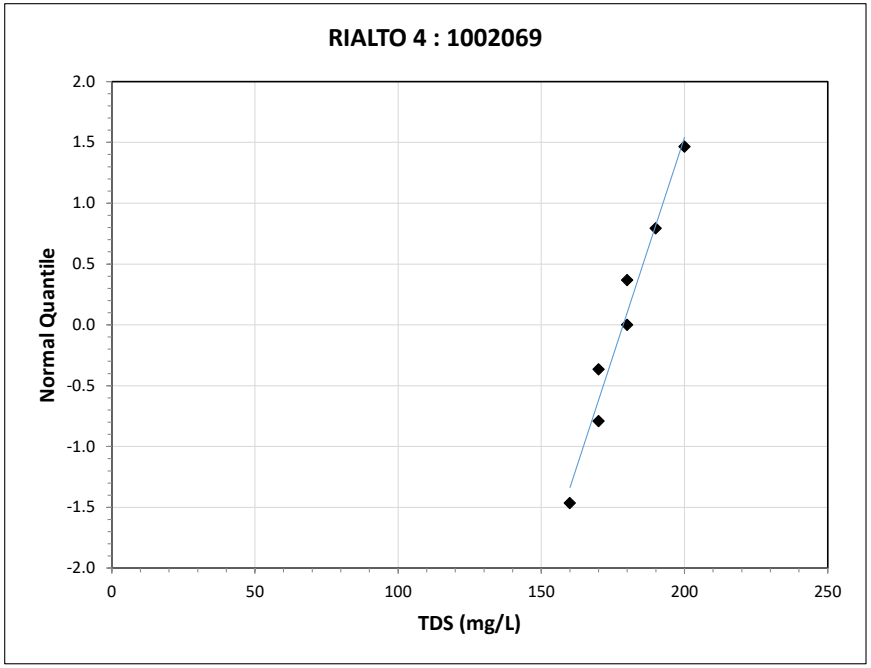


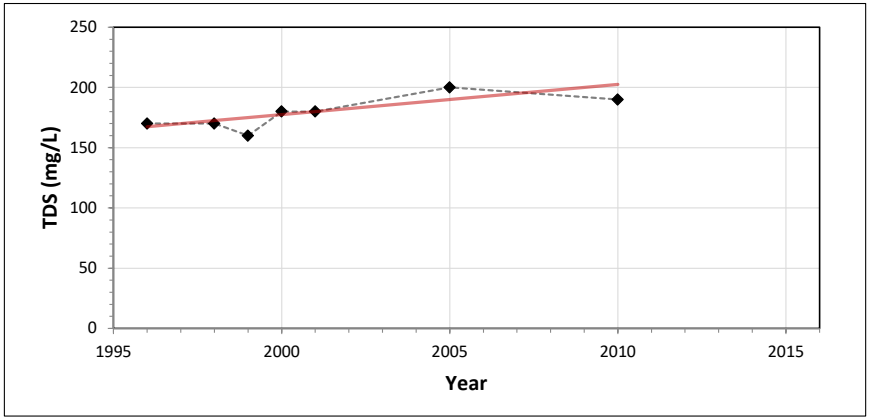
Statistics	
GMZ	Rialto
Well Name : ID	RIALTO 4 : 1002069
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	0.63
Annual Average Max	3.84
Annual Average Mean	2.58
Annual Average Stdev	0.79
Shapiro-Wilk W	0.955
Shapiro-Wilk p-value	0.602
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.20
Student t	1.03
Mean + t*SE (UCL84)	2.79
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	42
Var(S)	407
Intercept	-148
Slope	0.08
p-value	0.042
Significant Trend?	Increasing



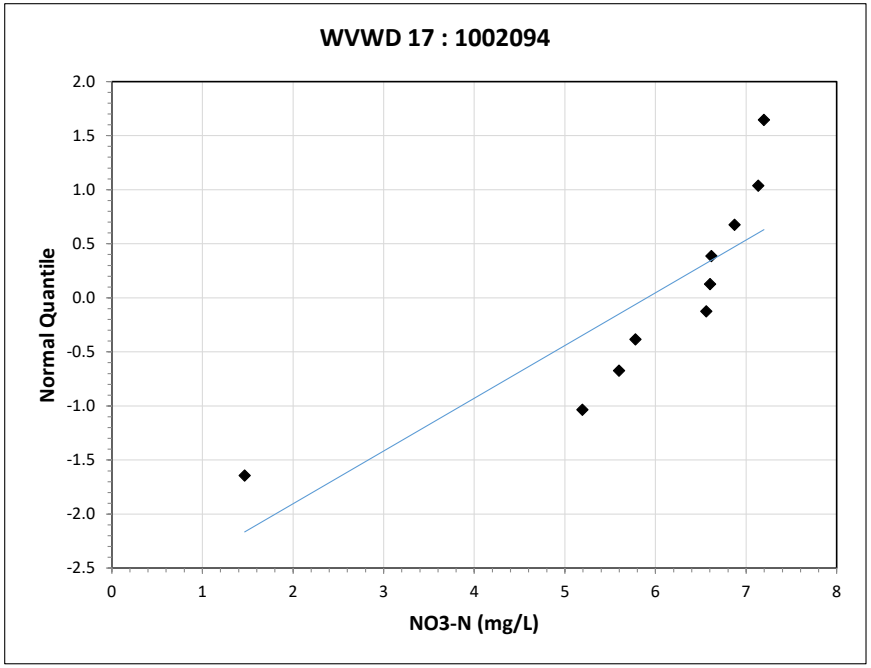


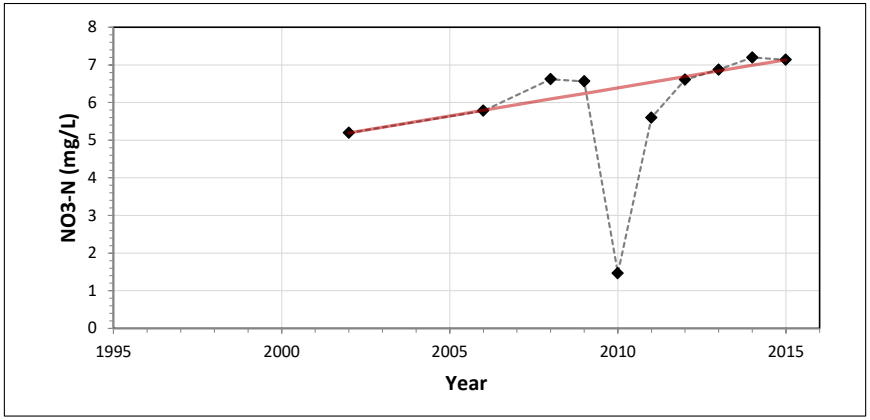
Statistics	
GMZ	Rialto
Well Name : ID	RIALTO 4 : 1002069
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1996
Sample Year Max	2010
Annual Average Min	160
Annual Average Max	200
Annual Average Mean	179
Annual Average Stdev	13.45
Shapiro-Wilk W	0.967
Shapiro-Wilk p-value	0.873
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.08
Student t	1.08
Mean + t*SE (UCL84)	184
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	13
Var(S)	42.33
Intercept	-4823
Slope	2.50
p-value	0.065
Significant Trend?	Increasing



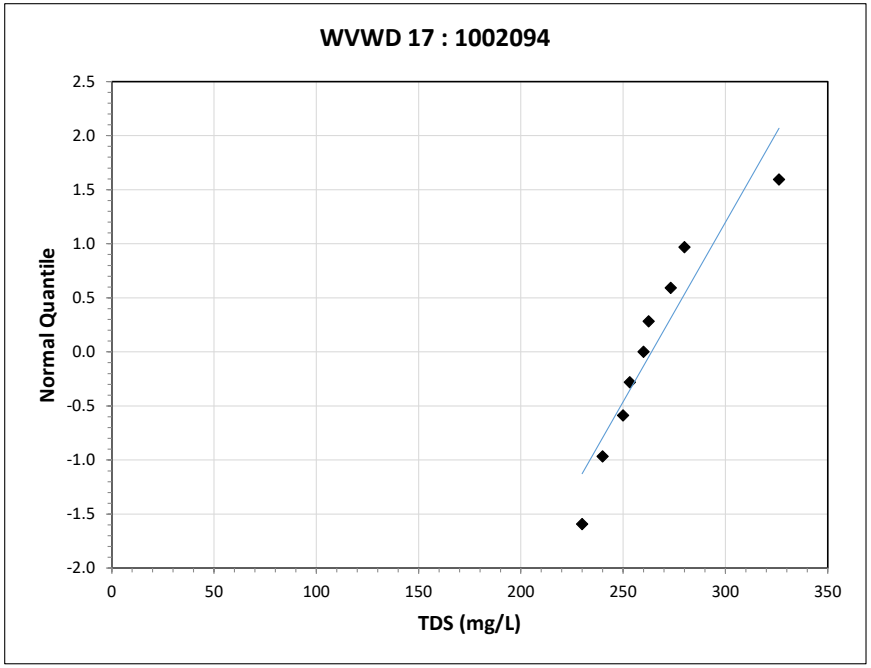


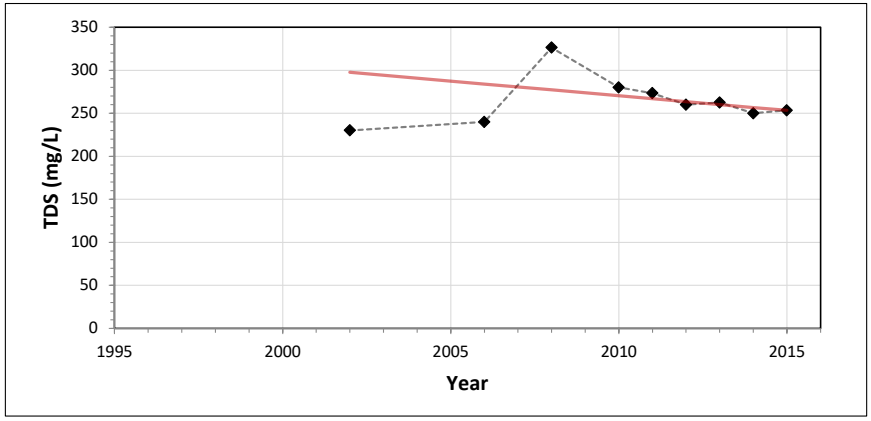
Statistics	
GMZ	Rialto
Well Name : ID	WVWD 17 : 1002094
Analyte	NO3-N (mg/L)
Count	10
Count Detects	10
Sample Year Min	2002
Sample Year Max	2015
Annual Average Min	1.47
Annual Average Max	7.20
Annual Average Mean	5.90
Annual Average Stdev	1.69
Shapiro-Wilk W	0.716
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	1.47
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	6.58
Trend Analysis	**Theil-Sen**
Kendall S	25
Var(S)	125
Intercept	-294
Slope	0.15
p-value	0.032
Significant Trend?	Increasing



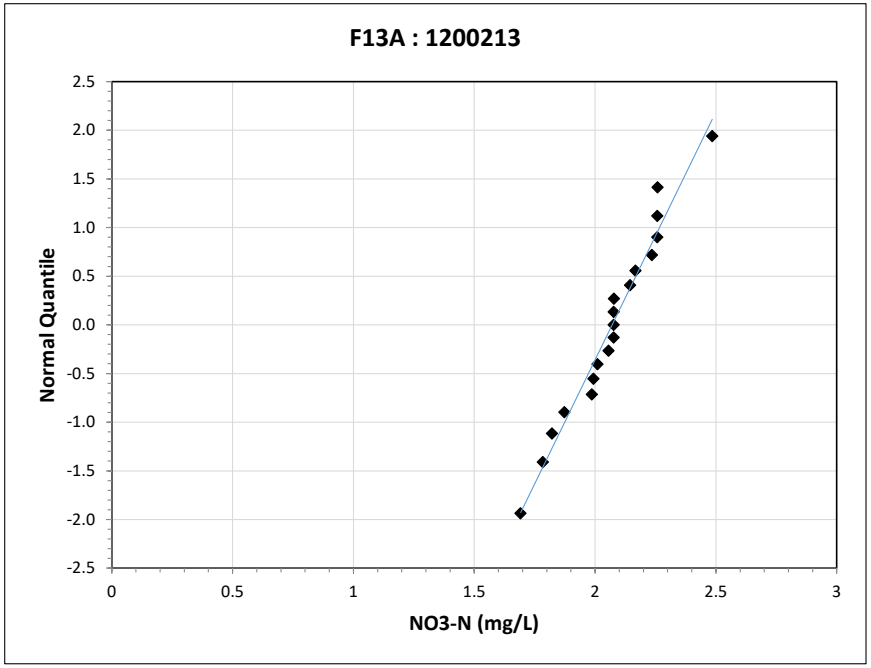


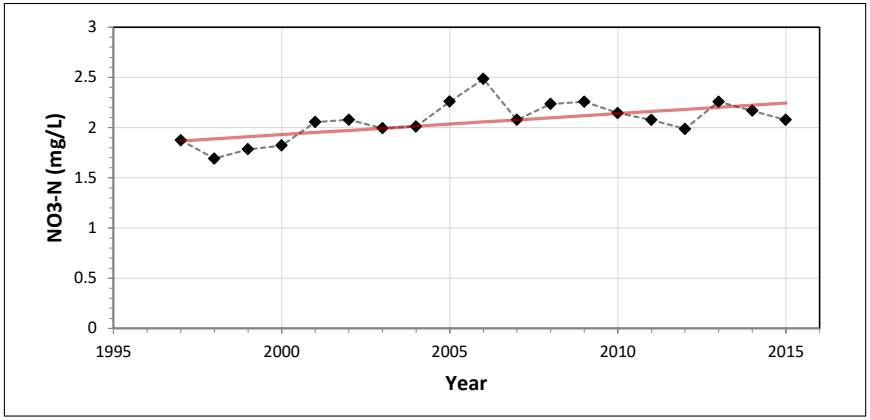
Statistics	
GMZ	Rialto
Well Name : ID	WVWD 17 : 1002094
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	2002
Sample Year Max	2015
Annual Average Min	230
Annual Average Max	326
Annual Average Mean	264
Annual Average Stdev	28.01
Shapiro-Wilk W	0.899
Shapiro-Wilk p-value	0.246
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.34
Student t	1.06
Mean + t*SE (UCL84)	274
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-2
Var(S)	92.00
Intercept	7110
Slope	-3.40
p-value	0.917
Significant Trend?	No



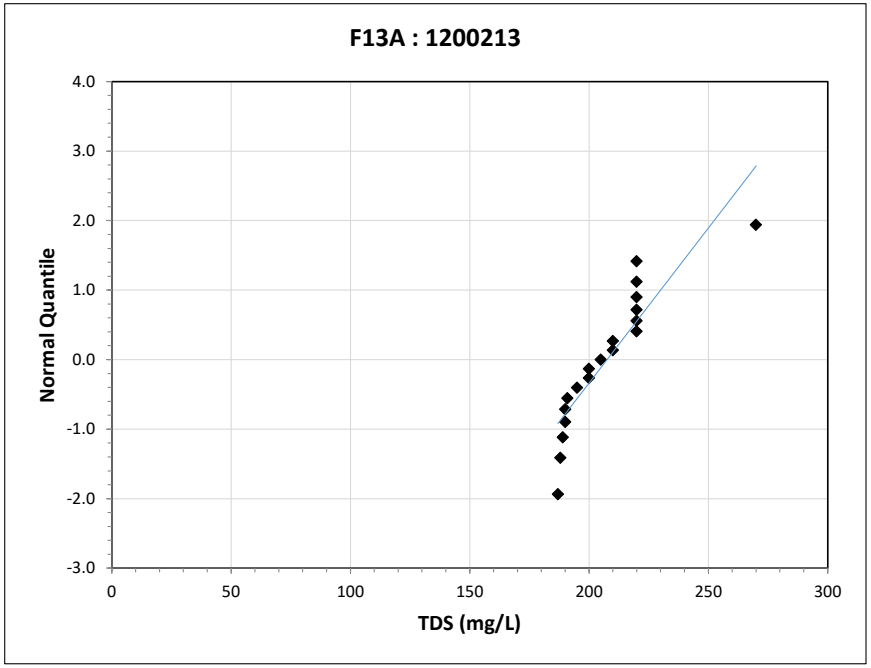


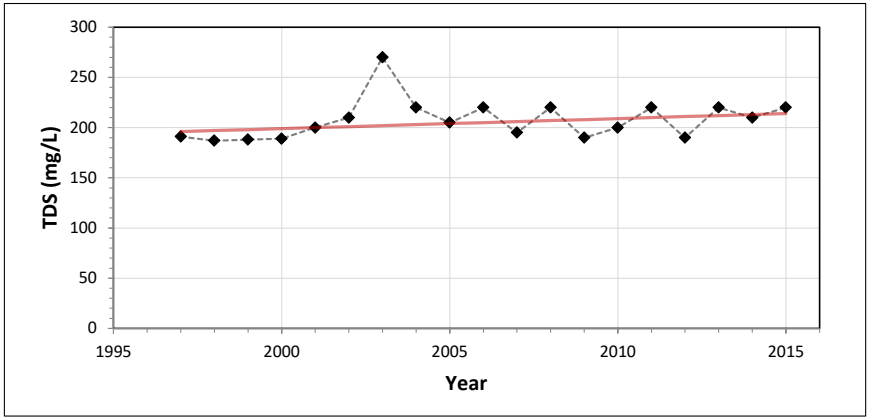
Statistics	
GMZ	Rialto
Well Name : ID	F13A : 1200213
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	1.69
Annual Average Max	2.48
Annual Average Mean	2.07
Annual Average Stdev	0.19
Shapiro-Wilk W	0.971
Shapiro-Wilk p-value	0.805
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.04
Student t	1.02
Mean + t*SE (UCL84)	2.12
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	69
Var(S)	815
Intercept	-40.00
Slope	0.02
p-value	0.017
Significant Trend?	Increasing



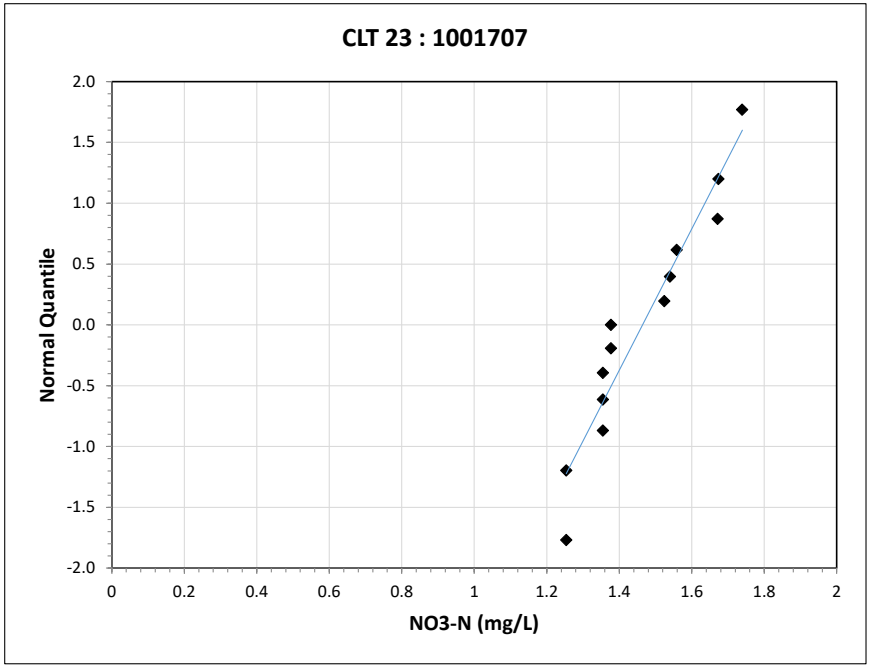


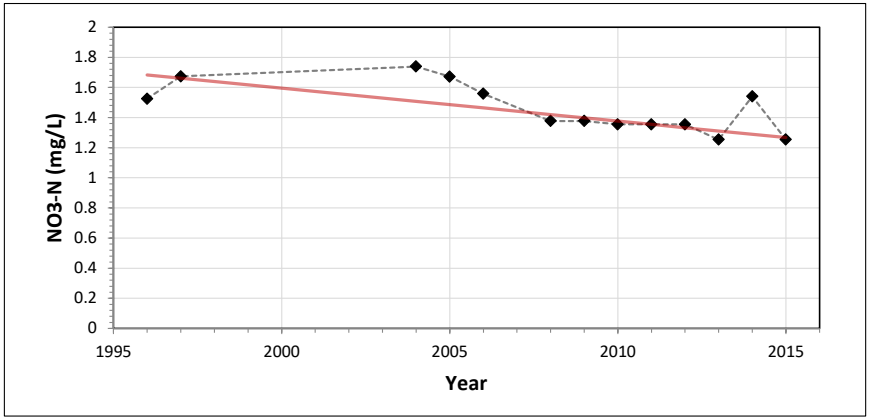
Statistics	
GMZ	Rialto
Well Name : ID	F13A : 1200213
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	187
Annual Average Max	270
Annual Average Mean	208
Annual Average Stdev	19.94
Shapiro-Wilk W	0.811
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	270
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.006
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	205
Trend Analysis	**Theil-Sen**
Kendall S	53
Var(S)	786
Intercept	-1801
Slope	1.00
p-value	0.064
Significant Trend?	Increasing



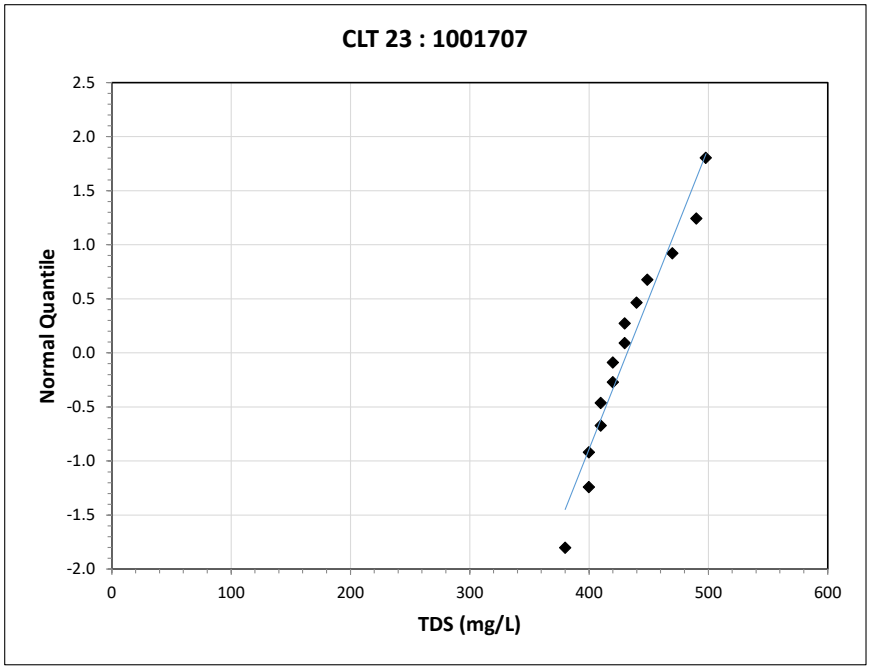


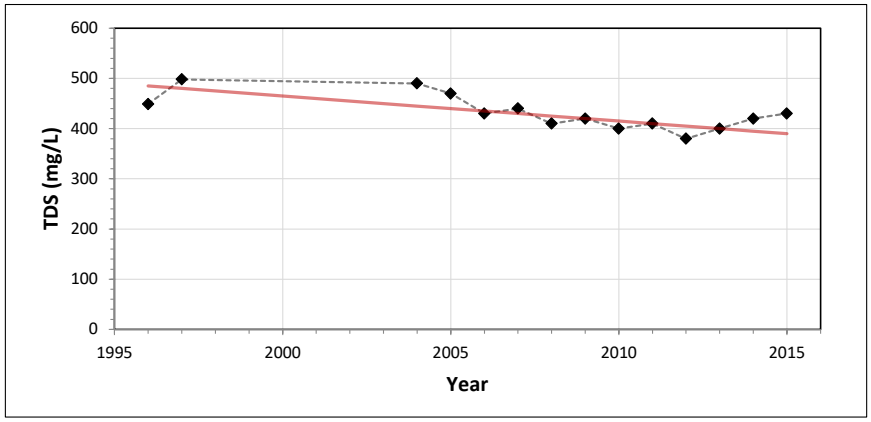
Statistics	
GMZ	Colton
Well Name : ID	CLT 23 : 1001707
Analyte	NO3-N (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.25
Annual Average Max	1.74
Annual Average Mean	1.46
Annual Average Stdev	0.16
Shapiro-Wilk W	0.908
Shapiro-Wilk p-value	0.170
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.05
Student t	1.04
Mean + t*SE (UCL84)	1.51
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-48
Var(S)	264
Intercept	45.46
Slope	-0.02
p-value	0.004
Significant Trend?	Decreasing*



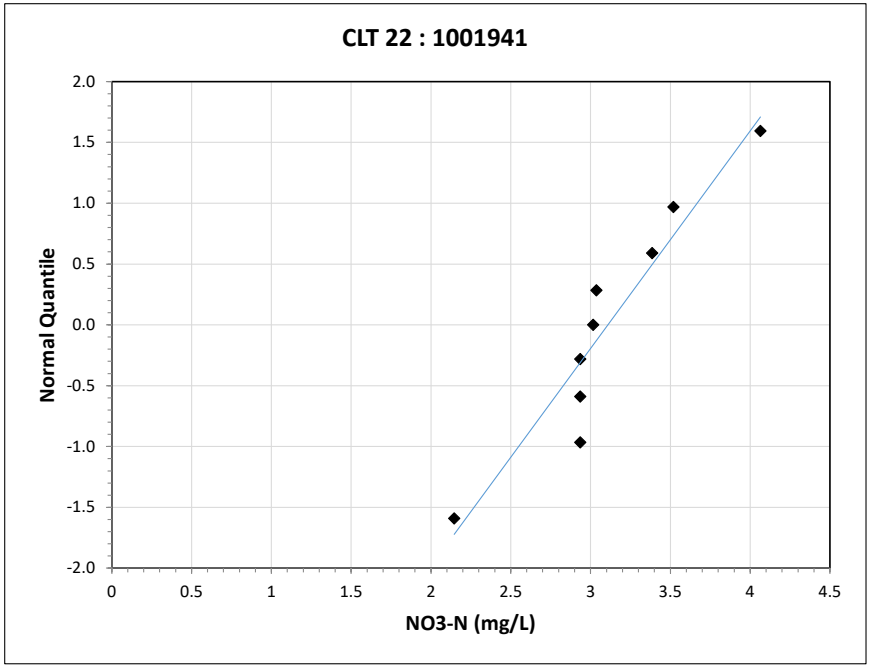


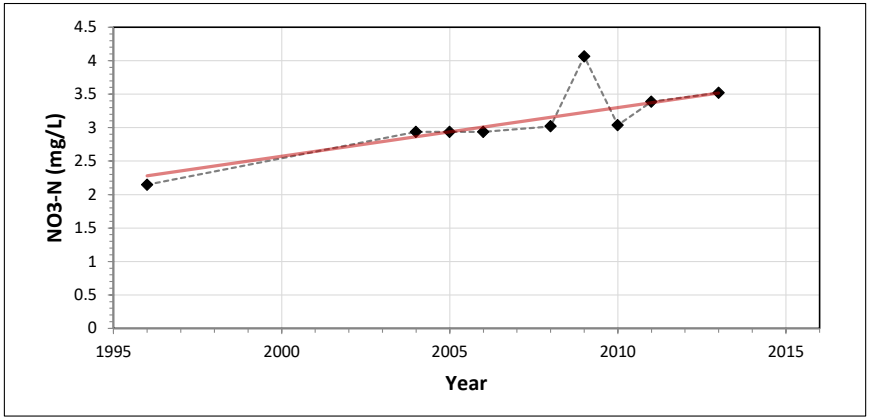
Statistics	
GMZ	Colton
Well Name : ID	CLT 23 : 1001707
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	380
Annual Average Max	498
Annual Average Mean	432
Annual Average Stdev	34.57
Shapiro-Wilk W	0.939
Shapiro-Wilk p-value	0.402
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.24
Student t	1.03
Mean + t*SE (UCL84)	441
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-49
Var(S)	330
Intercept	10465
Slope	-5.00
p-value	0.008
Significant Trend?	Decreasing*



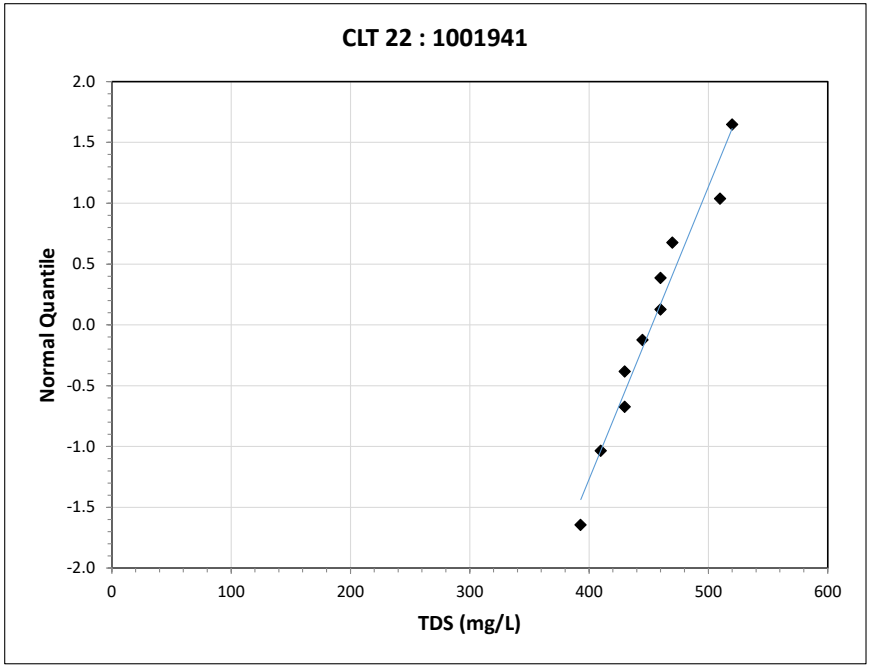


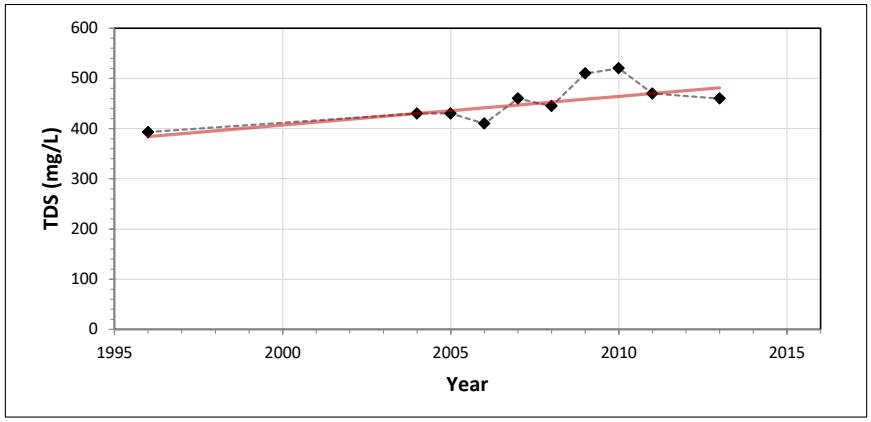
Statistics	
GMZ	Colton
Well Name : ID	CLT 22 : 1001941
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	2.15
Annual Average Max	4.06
Annual Average Mean	3.11
Annual Average Stdev	0.52
Shapiro-Wilk W	0.918
Shapiro-Wilk p-value	0.373
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.17
Student t	1.06
Mean + t*SE (UCL84)	3.29
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	27
Var(S)	88.33
Intercept	-143
Slope	0.07
p-value	0.006
Significant Trend?	Increasing*





Statistics	
GMZ	Colton
Well Name : ID	CLT 22 : 1001941
Analyte	TDS (mg/L)
Count	10
Count Detects	10
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	393
Annual Average Max	520
Annual Average Mean	453
Annual Average Stdev	40.41
Shapiro-Wilk W	0.957
Shapiro-Wilk p-value	0.756
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	12.78
Student t	1.05
Mean + t*SE (UCL84)	466
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	27
Var(S)	123
Intercept	-11021
Slope	5.71
p-value	0.019
Significant Trend?	Increasing





Attachment B13

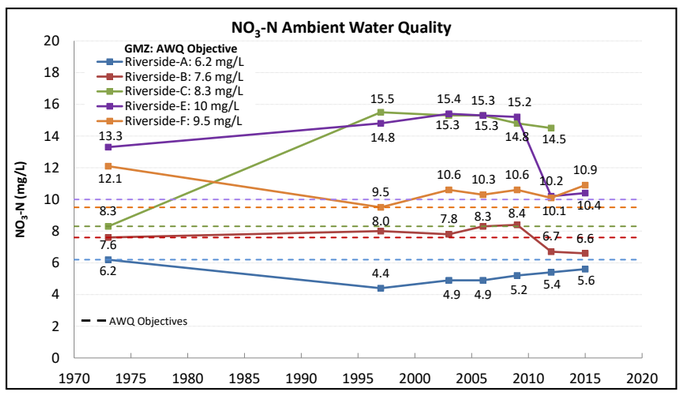
Riverside-A, -B, -C, -E, and -F GMZs

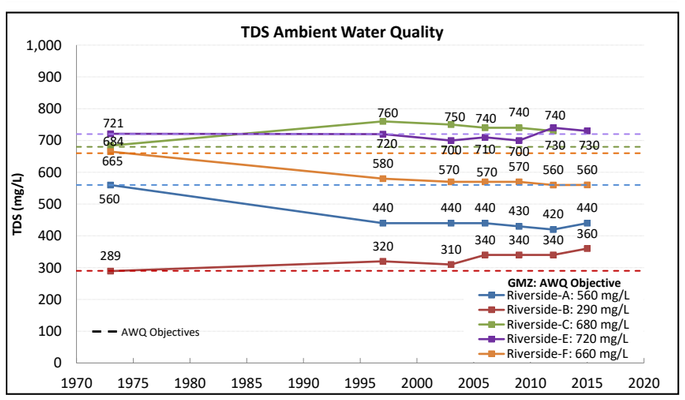
Attachment Contents:

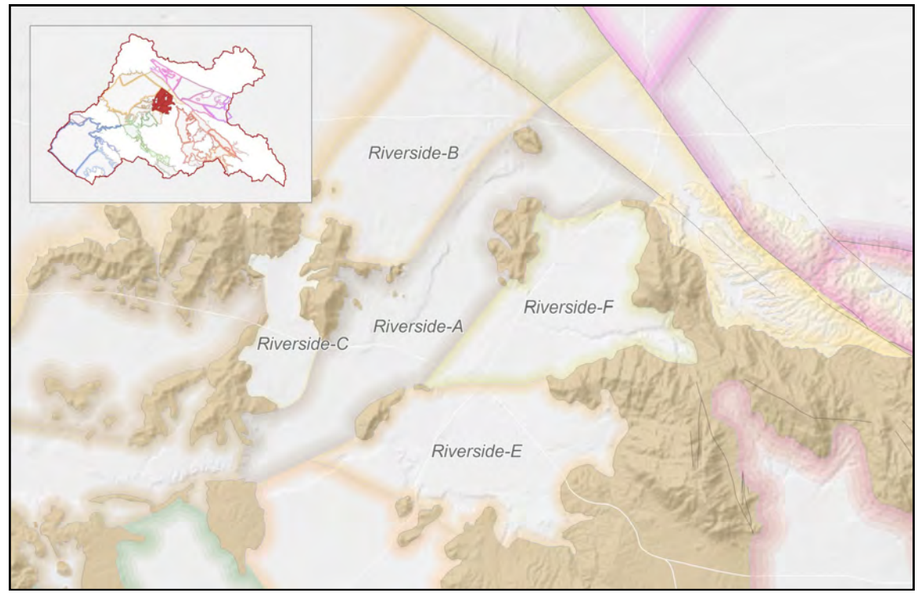
B13-1 Groundwater Elevation Contours Fall 2015
B13-2 $N0_3$-N Concentration and Contour Map
B13-3 TDS Concentration and Contour Map
B13-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B13-5 TDS Concentration Change (1993-2012 to 1996-2015)
B13-6 Key Well Analysis Charts

	Basin Analytics	Riverside-A	Riverside-B	Riverside-C	Riverside-E	Riverside-F
Basin	GMZ Area (acres)	9,350	6,710	1,990	7,320	6,070
	Volume of Storage (acre-ft)	184,000	182,000	14,200	180,000	132,000
NO_3-N	Wells per GMZ	82	50	2	9	27
	Point Statistics per GMZ	48	23	1	6	19
	Total Mass (tons)	1,400	1,640	?	2,540	1,960
	1996-2015 AWQ	5.6	6.6	?	10.4	10.9
TDS	Wells per GMZ	87	30	2	8	27
	Point Statistics per GMZ	46	10	0	7	24
	Total Mass (tons)	110,000	88,700	?	179,000	101,000
	1996-2015 AWQ	440	360	?	730	560

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Riverside-A

The nitrate objective for Riverside-A is 6.2 mg/L. The ambient nitrate concentration increased from 5.4 mg/L in 2012 to 5.6 mg/L in 2015, allowing for 0.6 mg/L of assimilative capacity. Four out of the five key wells in Riverside-A GMZ have an increasing trend in nitrate concentrations, while the other one shows no trend in nitrate concentration. Ten of the total 82 wells with nitrate values in Riverside-A will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Four new wells with statistics were added to the 1996 to 2015 AWQ recomputation and two wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (2016-2018).

Riverside-B

The nitrate objective for Riverside-B is 7.6 mg/L. The ambient nitrate concentration decreased from 6.7 mg/L in 2012 to 6.6 mg/L in 2015 allowing for 1.0 mg/L of assimilative capacity. One out of the three interpretive wells in Riverside-B GMZ have an increasing trend and the other two wells show no trend in nitrate concentrations. Two of the total 50 wells with nitrate values in Riverside-B will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and two wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (2016-2018).

Riverside-C

The nitrate objective for Riverside-C is 8.3 mg/L. The ambient nitrate concentration was not calculated in Riverside-C due to a lack of data. AWQ statistics could be computed for only one well and one well that did not qualify for a statistics had an average value. Riverside-C does not have a key well. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation. Only one of the total two wells with nitrate values in Riverside-C will not be eligible for the next AWQ recomputation if not sampled prior to 2018.

Riverside-E

The nitrate objective for Riverside-F is 9.5 mg/L. The ambient nitrate concentration increased from 10.1 mg/L in 2012 to 10.9 mg/L in 2015, and there is no assimilative capacity. Two out of the four key wells in Riverside-F GMZ have an increasing trend and the other two have a decreasing or no trend in nitrate concentrations. One of the total 27 wells with nitrate values in Riverside-F will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Riverside A	1001958	RN 20	6.6	Increasing	686	Increasing
Riverside A	1001987	FLUME 6	2.3	Increasing**	338	No Trend
Riverside A	1003300	RCSD #4 Old Skotty	12.2	No Trend	434	No Trend
Riverside A	1003312	GARNER B	4.4	Increasing*	415	Increasing*
Riverside A	1003362	RCSD #2 Troyer	11.6	Increasing	520	No Trend
Riverside B	1002121	WVWD 29	8.0	No Trend	275	No Trend
Riverside B	1006994	CLT 24	5.7	No Trend	255	Increasing*
Riverside B	1206897	WVWD 18A	6.7	Increasing*	300	No Trend
Riverside E	1003413	FILL	17.1	Decreasing*	641	No Trend
Riverside E	1003416	FIRST STREET	4.7	No Trend	600	Decreasing
Riverside E	1003425	OLIVEWOOD 3	10.7	Decreasing	840	No Trend
Riverside F	1002044	LV 3	2.5	Increasing*	293	No Trend
Riverside F	1003142	RN 7	5.6	No Trend	536	No Trend
Riverside F	1003148	ELECTRIC STREET	9.6	Increasing*	581	No Trend
Riverside F	1003324	TWIN SPRINGS	9.0	Decreasing**	500	Decreasing*

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B13-4 and B13-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Riverside-A	1002185	CL-02	High	3	0.3	Stat	High	3	439	Stat
Riverside-A	1003289	1	High	1	10.4	Ave	--	--	--	--
Riverside-A	1003291	RCSD #3 28th St.	Medium	2	11.1	Ave	--	--	--	--
Riverside-A	1003301	NA_1003301	High	3	13.2	Stat	High	1	460	Ave
Riverside-A	1003349	RCSD #1-Crestmore	Medium	6	1.9	Stat	Medium	4	458	Stat
Riverside-A	1003351	NA_1003351	High	3	1.8	Stat	High	1	450	Ave
Riverside-A	1003361	NA_1003361	High	3	11.3	Stat	High	1	520	Ave
Riverside-A	1003384	RCSD #13 Hunter 1	High	1	9.7	Ave	High	1	610	Ave
Riverside-A	1003386	NA_1003386	High	1	6.8	Ave	High	1	630	Ave
Riverside-A	1003387	RCSD #16 Hunter 2	High	3	6.4	Stat	High	1	490	Ave
Riverside-A	1003396	RCSD #12 Airport	High	1	12.0	Ave	High	1	550	Ave
Riverside-A	1003397	NA_1003397	High	3	8.6	Stat	High	1	540	Ave
Riverside-A	1207097	Park HQ 2	Medium	1	22.3	Ave	Medium	1	490	Ave
Riverside-A	2000382	3310044-001	Medium	6	1.9	Stat	Medium	4	458	Stat
Riverside-A	2000387	335843117243501	Medium	1	0.8	Ave	Medium	1	302	Ave
Riverside-A	2000388	335843117243502	--	--	--	--	Medium	1	336	Ave
Riverside-B	1002121	WVWD 29	High	1	8.0	Ave	High	1	275	Ave
Riverside-B	2000399	3610004-023	High	1	7.8	Ave	High	1	275	Ave
Riverside-C	1003378	RCSD #14 46th St	High	3	9.0	Stat	High	2	535	Ave
Riverside-C	1222266	RCSD #11 Clement	Medium	1	14.5	Ave	--	1	663	Ave
Riverside-F	1003309	RUSSELL B	Medium	4	4.4	Stat	High	3	412	Stat
Riverside-F	1003326	BRUNTON	High	1	6.1	Ave	High	1	420	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

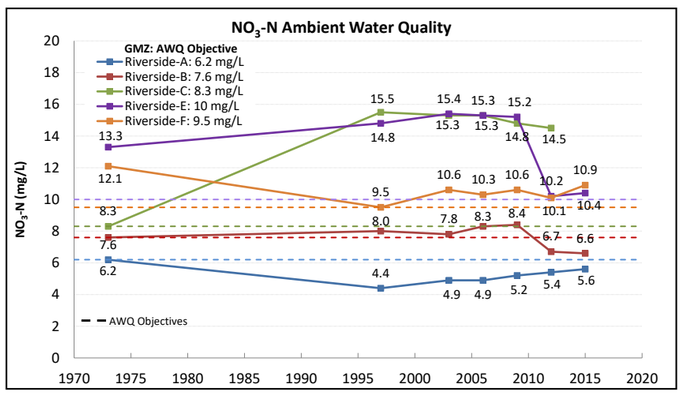
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B13-4 and B13-5 for NO_3-N and TDS well locations, respectively.

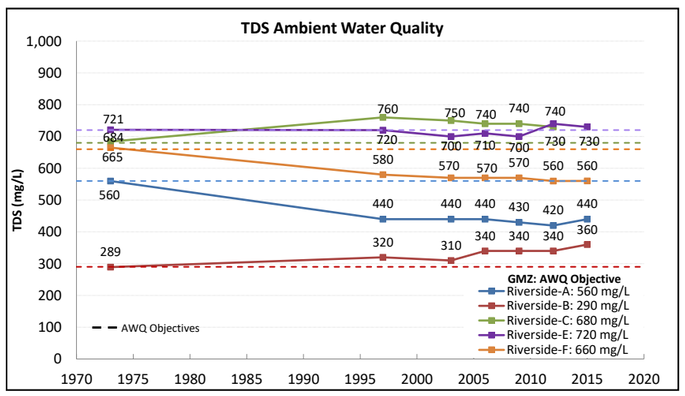
Attachment Contents:

B13-1 Groundwater Elevation Contours Fall 2015
B13-2 NO_3-N Concentration and Contour Map
B13-3 TDS Concentration and Contour Map
B13-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B13-5 TDS Concentration Change (1993-2012 to 1996-2015)
B13-6 Key Well Analysis Charts

	Basin Analytics	Riverside-A	Riverside-B	Riverside-C	Riverside-E	Riverside-F
Basin	GMZ Area (acres)	9,350	6,710	1,990	7,320	6,070
	Volume of Storage (acre-ft)	184,000	182,000	14,200	180,000	132,000
NO_3-N	Wells per GMZ	82	50	2	9	27
	Point Statistics per GMZ	48	23	1	6	19
	Total Mass (tons)	1,400	1,640	?	2,540	1,960
	1996-2015 AWQ	5.6	6.6	?	10.4	10.9
TDS	Wells per GMZ	87	30	2	8	27
	Point Statistics per GMZ	46	10	0	7	24
	Total Mass (tons)	110,000	88,700	?	179,000	101,000
	1996-2015 AWQ	440	360	?	730	560

Table 1 - Basin Analytics





Nitrate as Nitrogen Continued

Riverside-F

The nitrate objective for Riverside-F is 9.5 mg/L. The ambient nitrate concentration increased from 10.1 mg/L in 2012 to 10.9 mg/L in 2015, and there is no assimilative capacity. Two out of the four key wells in Riverside-F GMZ have an increasing trend and the other two have a decreasing or no trend in nitrate concentrations. One of the total 27 wells with nitrate values in Riverside-F will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Total Dissolved Solids (TDS)

Riverside-A

The TDS objective for Riverside-A is 560 mg/L. The ambient TDS concentration increased from 420 mg/L in 2012 to 440 mg/L in 2015, allowing for 120 mg/L of assimilative capacity. Two out of the five key interpretive wells in Riverside-A GMZ have an increasing trend and the other three wells show no trend in TDS concentrations. Nine of the total 87 wells with TDS values in Riverside-A will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Four new wells with statistics were added to the 1996 to 2015 AWQ recomputation and three wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (2016-2018).

Riverside-B

The TDS objective for Riverside-B is 290 mg/L. The ambient TDS concentration increased from 340 mg/L in 2012 to 360 mg/L in 2015, and there is no assimilative capacity. One out of the three interpretive wells in Riverside-B GMZ have an increasing trend and the other two wells show no trend in TDS concentrations. Two of the total 30 wells with TDS values in Riverside-B will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Riverside-C

The TDS objective for Riverside-C is 680 mg/L. The ambient TDS concentration was not calculated in Riverside-C due to a lack of data. AWQ statistics could be computed for any wells and two wells that did not qualify for a statistics had an average value. Riverside-C does not have a key well. Only one of the total two wells with TDS values in Riverside-C will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Riverside-E

The TDS objective for Riverside-E is 720 mg/L. The ambient TDS concentration decreased from 740 mg/L in 2012 to 730 mg/L in 2015 and there is no assimilative capacity. One of the three key wells in Riverside-E GMZ has a decreasing trend and the other two wells showed no trend in TDS concentrations. One new well with statistics was added to the 1996 to 2015 AWQ recomputation.

Riverside-F

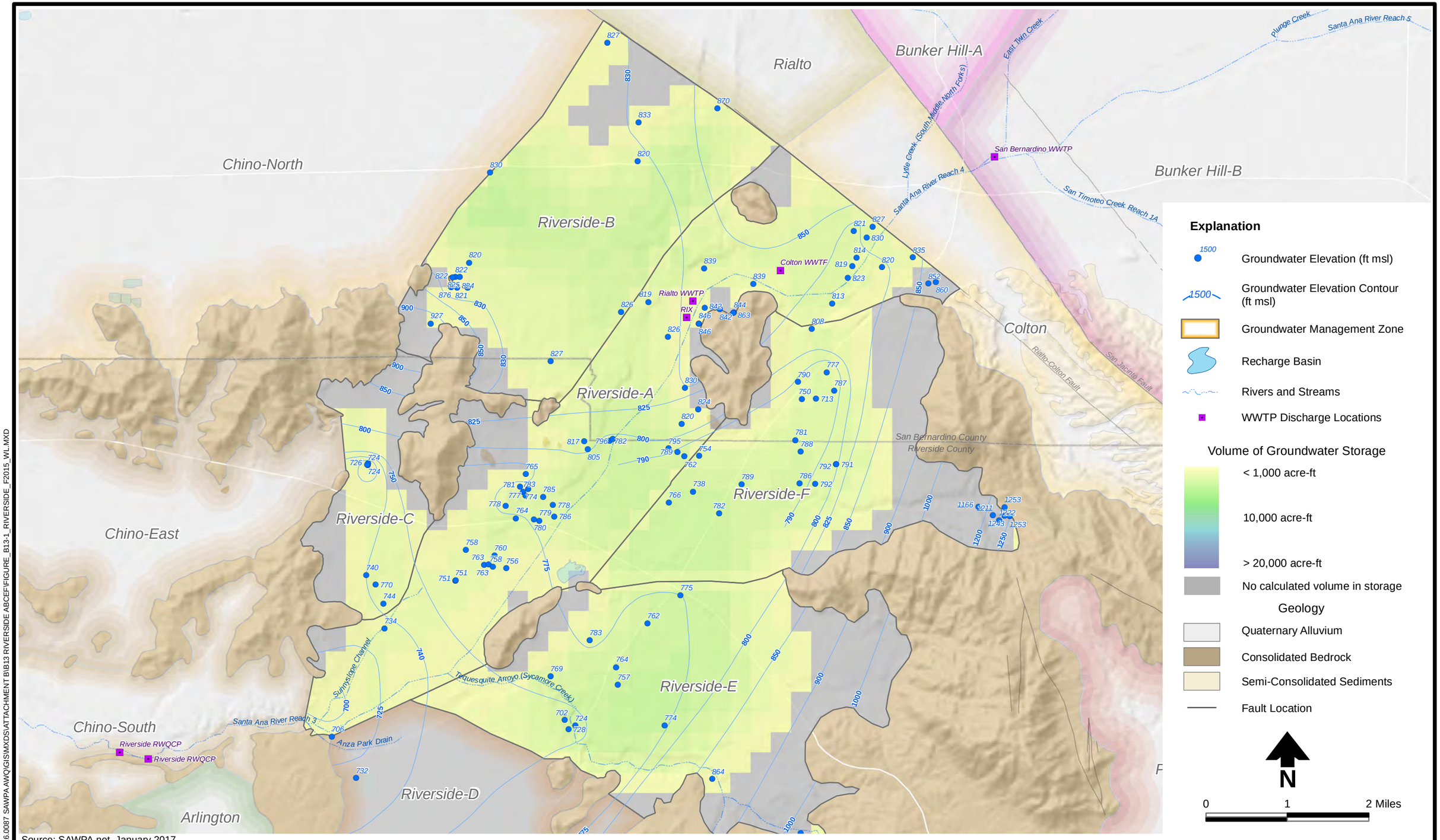
The TDS objective for Riverside-F is 660 mg/L. The ambient TDS concentration was unchanged with a value of 560 mg/L in 2012 and in 2015, allowing for 100 mg/L of assimilative capacity. One out of the four key wells in Riverside-F GMZ has a decreasing trend and the other three have no trend in TDS concentrations. Two of the total 27 wells with TDS values in Riverside-F will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Riverside-A	1001977	FLUME 1	New*	1	1.6	Ave	New*	1	330	Ave
Riverside-A	1003193	Pellissier Ranch Main	New	3	8.4	Stat	New	4	532	Stat
Riverside-A	1231989	CL-10D	New	4	22.4	Stat	New	4	650	Stat
Riverside-A	1231990	CL-10S	New	4	22.5	Stat	New	4	695	Stat
Riverside-A	1231991	CL-9	New	5	22.6	Stat	New	5	623	Stat
Riverside-A	1232196	Flume 7 Well	New	4	6.9	Stat	New*	2	380	Average
Riverside-A	1232251	CLT 30	--	4	4.6	Ave	New	3	466	Stat
Riverside-A	2000012	Brunton 1R	New*	1	4.5	Ave	New*	1	290	Ave
Riverside-A	2000383	3310044-002	New	19	11.4	Stat	New	18	529	Stat
Riverside-A	2000384	CL-B	New	9	8.6	Stat	New	11	494	Stat
Riverside-A	2000392	USGS-	--	2	1.2	Ave	New	3	222	Stat
Riverside-B	2000398	3601089-001	New	3	8.9	Stat	--	1	350	Average
Riverside-B	2000400	3610038-017	New	18	4.3	Stat	New	11	261	Stat
Riverside-B	2000403	EMW-10	New*	1	0.1	Ave	--	--	--	--
Riverside-B	2000405	PVX-5	New*	1	0.1	Ave	--	--	--	--
Riverside-E	1003422	OLIVEWOOD 2	New	3	14.0	Stat	New	3	708	Stat
Riverside-F	1003163	RN 21	New	3	26.5	Stat	New	3	785	Stat
Riverside-F	1003164	RN 22	New	3	18.9	Stat	--	3	722	Stat

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 3 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B13-4 and B13-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Riverside A,B,C,E and F GMZs

Attachment B13-1

DBS&A
Daniel B. Stephens & Associates, Inc.
9/19/2017
CA16.0087

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

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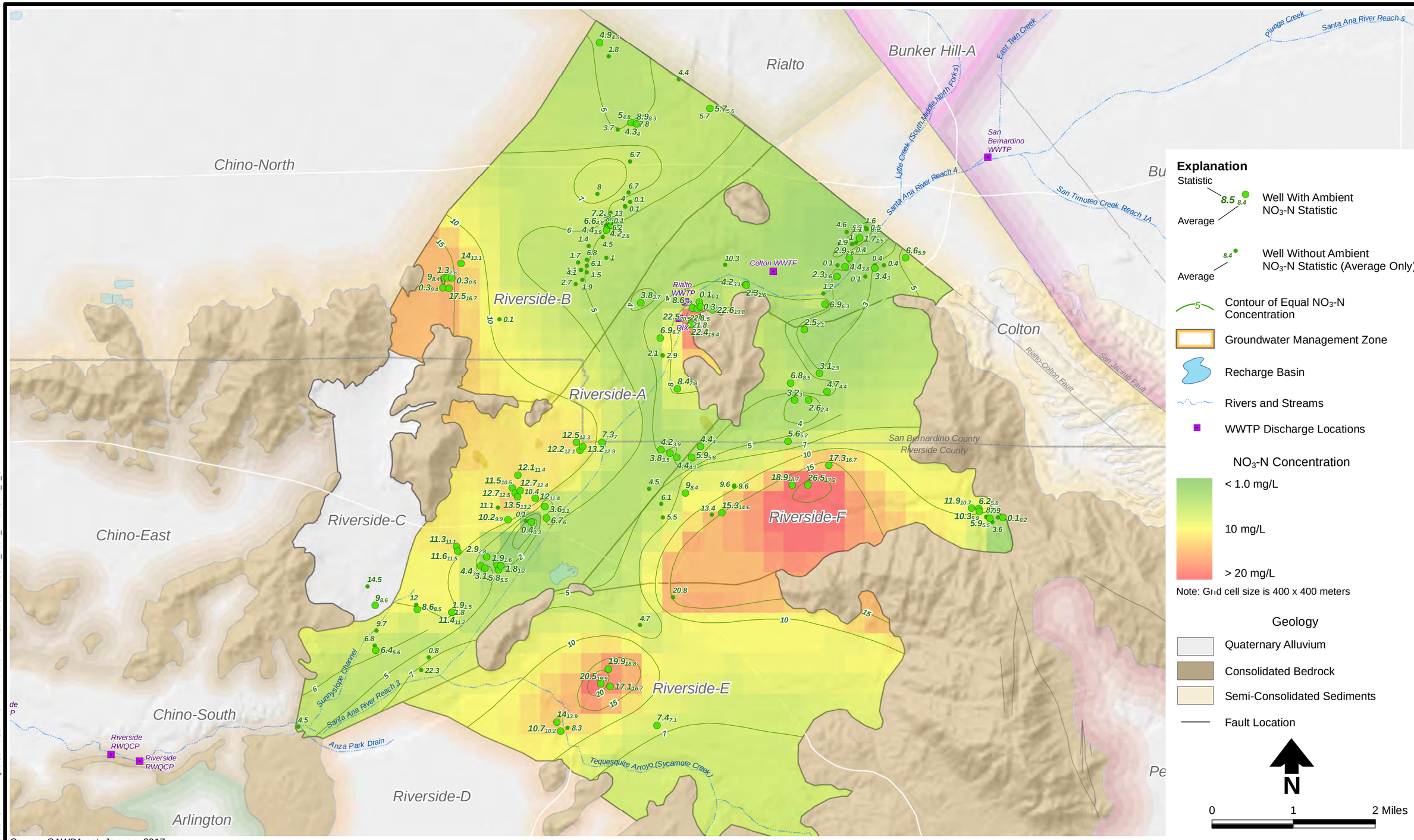


Source: SAWPA.net, January 2017

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Riverside A,B,C,E and F GMZs

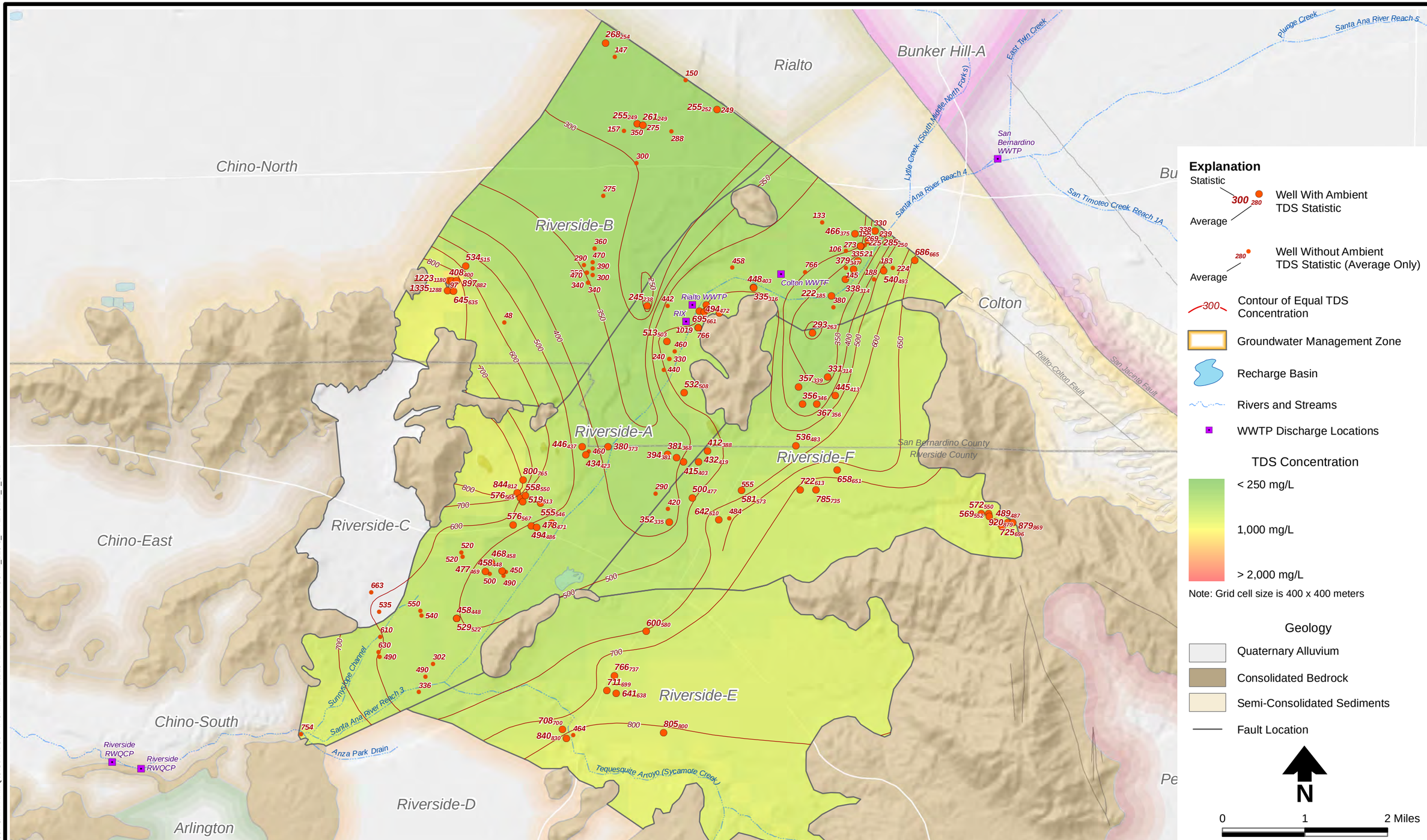
SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

DBS&A
Daniel B. Stephens & Associates, Inc.
9/19/2017 CA16.0087

Attachment B13-2

J:\PROJECTS\CA16.0087 SAWPA\AWQ\GIS\MXDS\ATTACHMENT B\B13 RIVERSIDE ABCEF\FIGURE_B13-2_RIVERSIDE_N_GRID.MXD



Source: SAWPA.net, January 2017

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9/19/2017 CA16.0087

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Riverside A,B,C,E and F GMZs

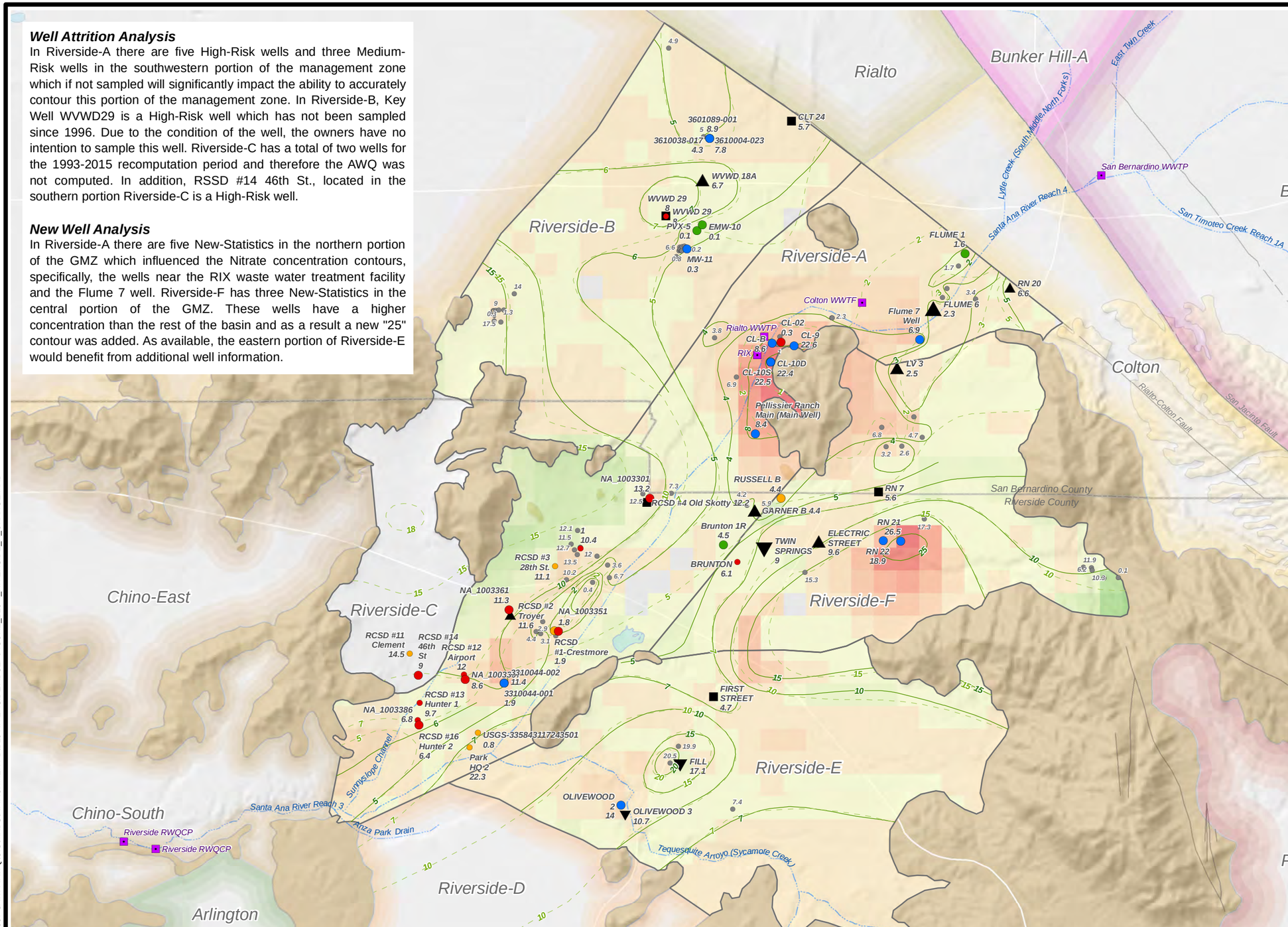
Attachment B13-3

Well Attrition Analysis

In Riverside-A there are five High-Risk wells and three Medium-Risk wells in the southwestern portion of the management zone which if not sampled will significantly impact the ability to accurately contour this portion of the management zone. In Riverside-B, Key Well WVWD29 is a High-Risk well which has not been sampled since 1996. Due to the condition of the well, the owners have no intention to sample this well. Riverside-C has a total of two wells for the 1993-2015 recomputation period and therefore the AWQ was not computed. In addition, RSSD #14 46th St., located in the southern portion Riverside-C is a High-Risk well.

New Well Analysis

In Riverside-A there are five New-Statistics in the northern portion of the GMZ which influenced the Nitrate concentration contours, specifically, the wells near the RIX waste water treatment facility and the Flume 7 well. Riverside-F has three New-Statistics in the central portion of the GMZ. These wells have a higher concentration than the rest of the basin and as a result a new "25" contour was added. As available, the eastern portion of Riverside-E would benefit from additional well information.



Source: SAWPA.net, January 2017

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B13 RIVERSIDE ABCEF\FIGURE_B13-4_RIVERSIDE_N_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Riverside A,B,C,E and F GMZs

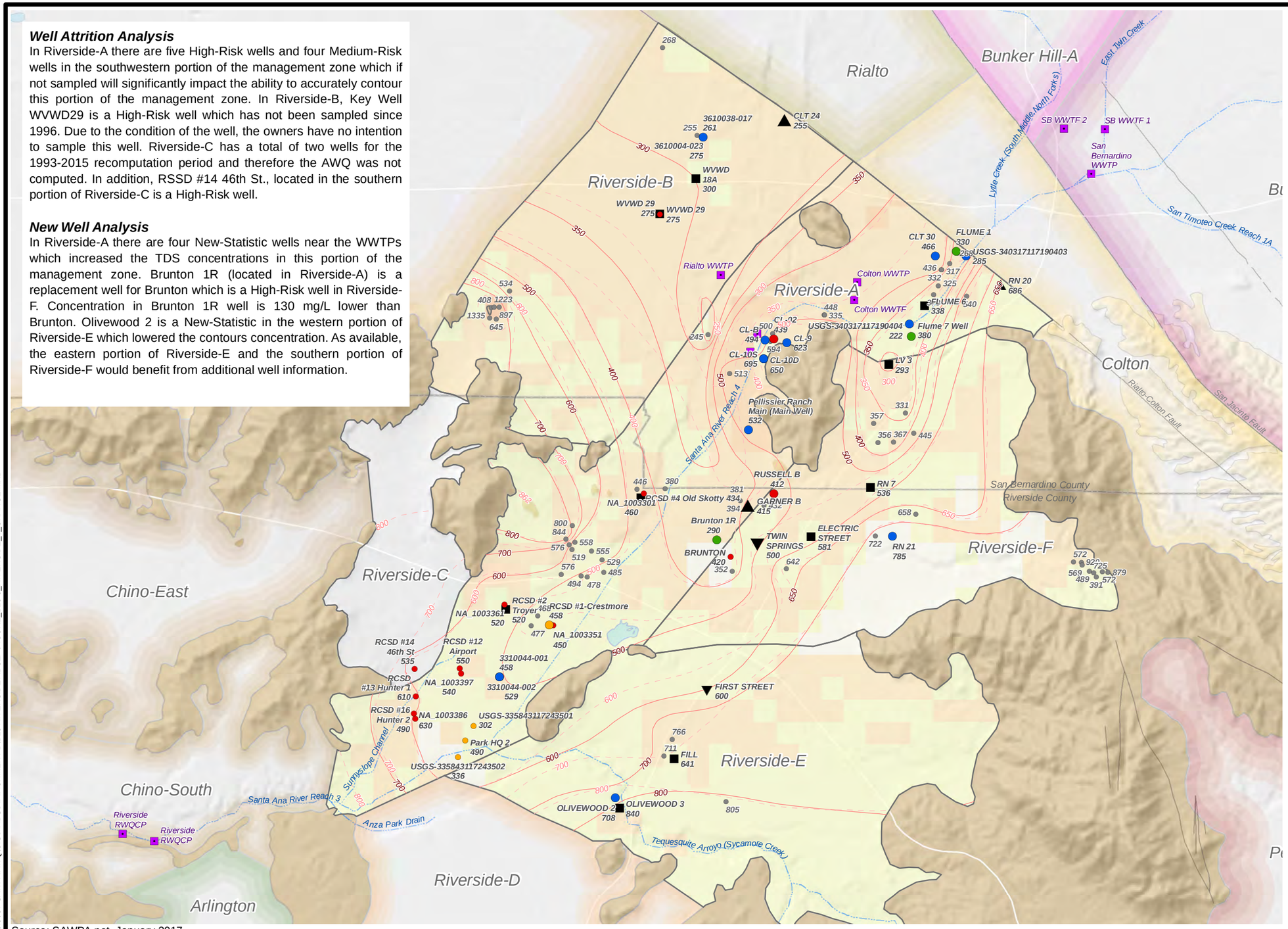
Attachment B13-4

Well Attrition Analysis

In Riverside-A there are five High-Risk wells and four Medium-Risk wells in the southwestern portion of the management zone which if not sampled will significantly impact the ability to accurately contour this portion of the management zone. In Riverside-B, Key Well WVWD29 is a High-Risk well which has not been sampled since 1996. Due to the condition of the well, the owners have no intention to sample this well. Riverside-C has a total of two wells for the 1993-2015 recomputation period and therefore the AWQ was not computed. In addition, RSSD #14 46th St., located in the southern portion of Riverside-C is a High-Risk well.

New Well Analysis

In Riverside-A there are four New-Statistic wells near the WWTPs which increased the TDS concentrations in this portion of the management zone. Brunton 1R (located in Riverside-A) is a replacement well for Brunton which is a High-Risk well in Riverside-F. Concentration in Brunton 1R well is 130 mg/L lower than Brunton. Olivewood 2 is a New-Statistic in the western portion of Riverside-E which lowered the contours concentration. As available, the eastern portion of Riverside-E and the southern portion of Riverside-F would benefit from additional well information.



Source: SAWPA.net, January 2017

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B13 RIVERSIDE ABCEF\FIGURE_B13-5_RIVERSIDE_T_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Riverside A,B,C,E and F GMZs

Attachment B13-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

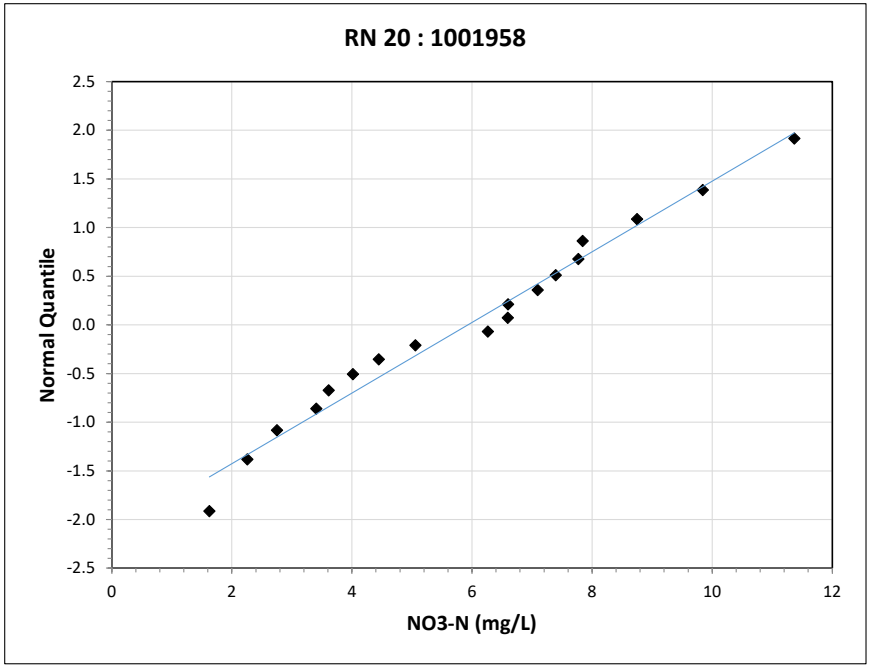
Mann-Kendall

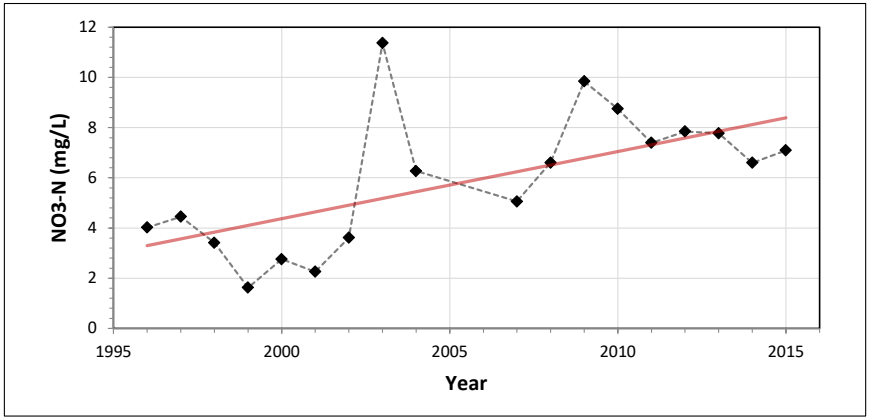
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

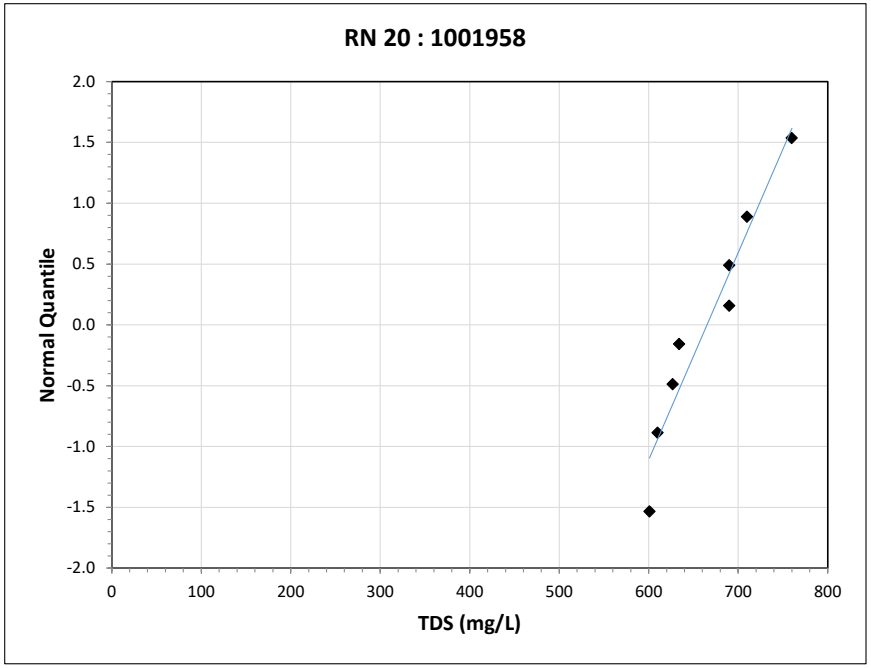
The significance of the trends is notated by * for significant and ** for very significant.

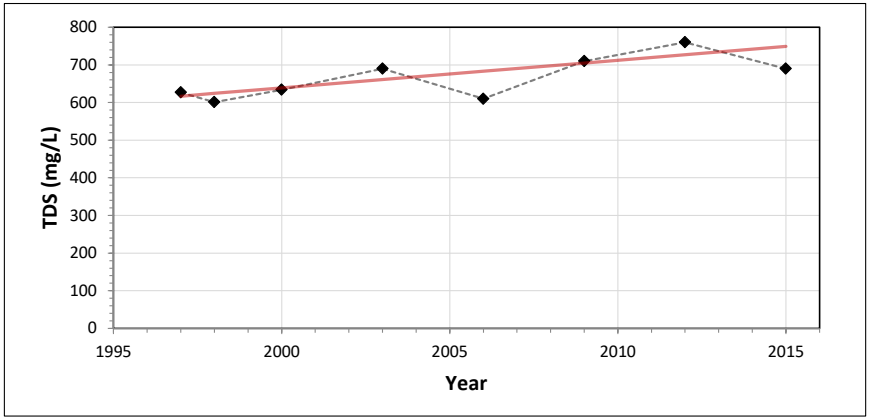
Statistics	
GMZ	Riverside-A
Well Name : ID	RN 20 : 1001958
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.63
Annual Average Max	11.37
Annual Average Mean	5.93
Annual Average Stdev	2.71
Shapiro-Wilk W	0.974
Shapiro-Wilk p-value	0.863
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.64
Student t	1.02
Mean + t*SE (UCL84)	6.58
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	65
Var(S)	697
Intercept	-531
Slope	0.27
p-value	0.015
Significant Trend?	Increasing



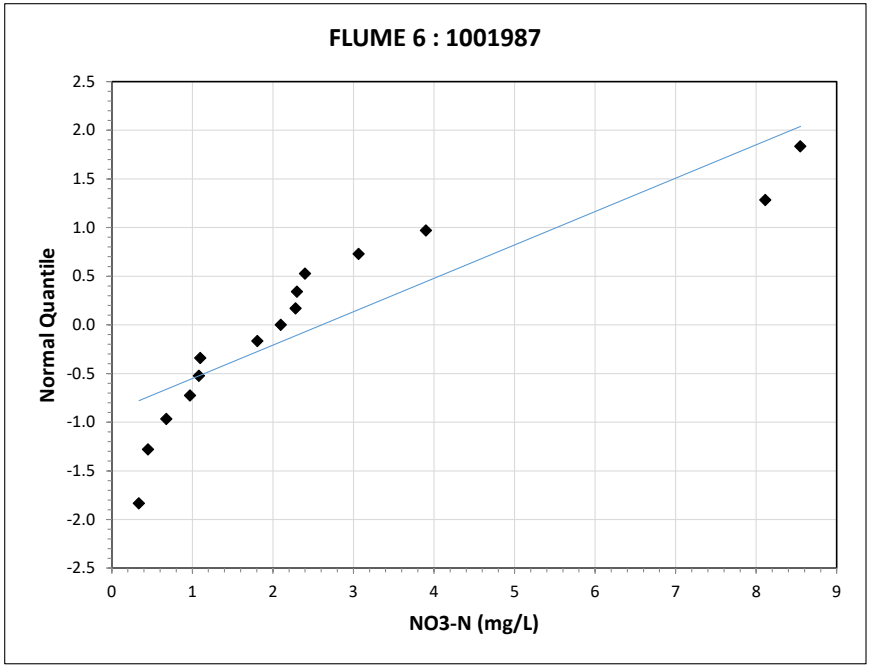


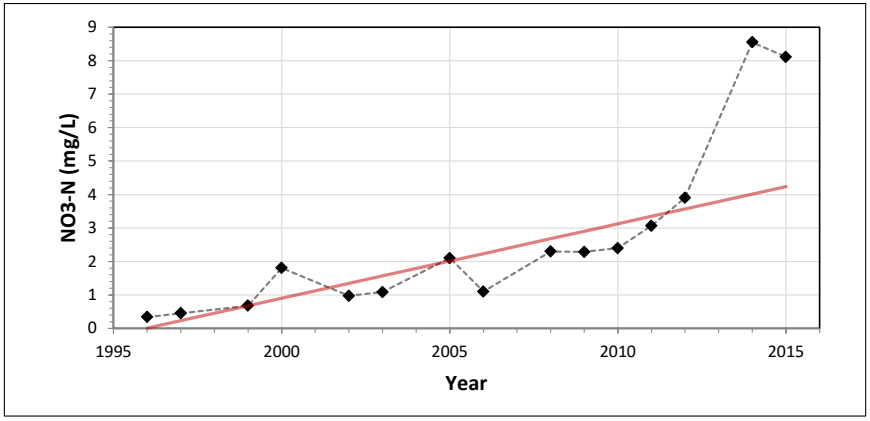
Statistics	
GMZ	Riverside-A
Well Name : ID	RN 20 : 1001958
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	601
Annual Average Max	760
Annual Average Mean	665
Annual Average Stdev	55.84
Shapiro-Wilk W	0.924
Shapiro-Wilk p-value	0.465
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	19.74
Student t	1.07
Mean + t*SE (UCL84)	686
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	15
Var(S)	64.33
Intercept	-14056
Slope	7.35
p-value	0.081
Significant Trend?	Increasing



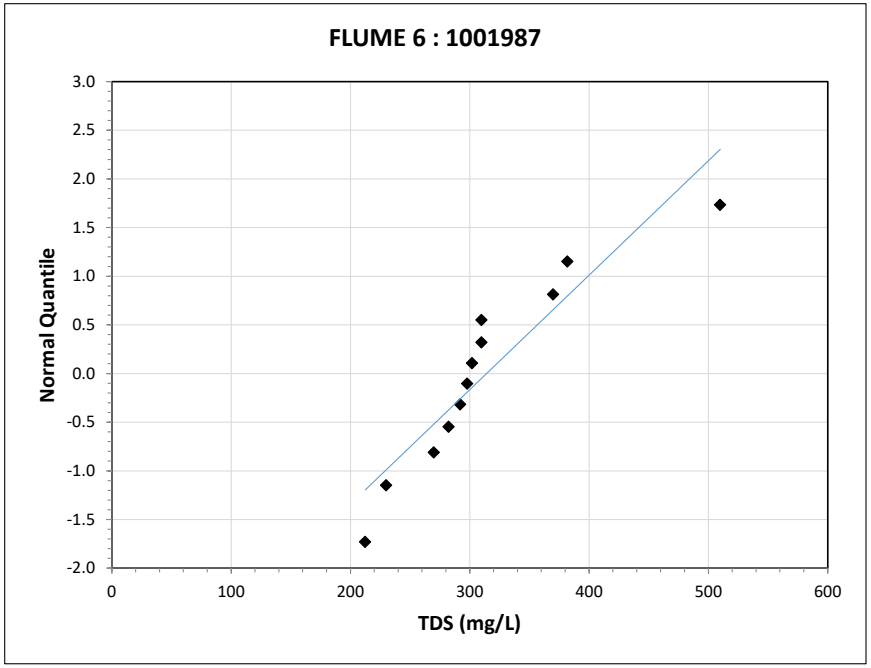


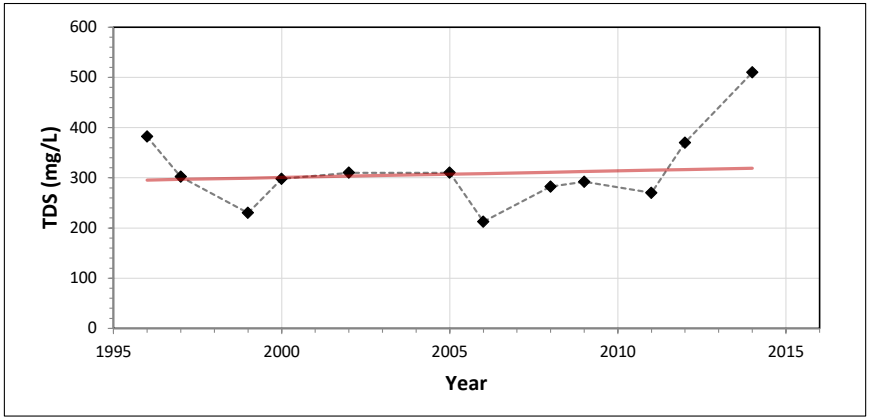
Statistics	
GMZ	Riverside-A
Well Name : ID	FLUME 6 : 1001987
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.34
Annual Average Max	8.55
Annual Average Mean	2.61
Annual Average Stdev	2.53
Shapiro-Wilk W	0.764
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	8.55
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.03
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.814
Geomean	1.76
GM + t*GSE (UCL84)	2.26
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	93
Var(S)	408
Intercept	-444
Slope	0.22
p-value	5E-6
Significant Trend?	Increasing**



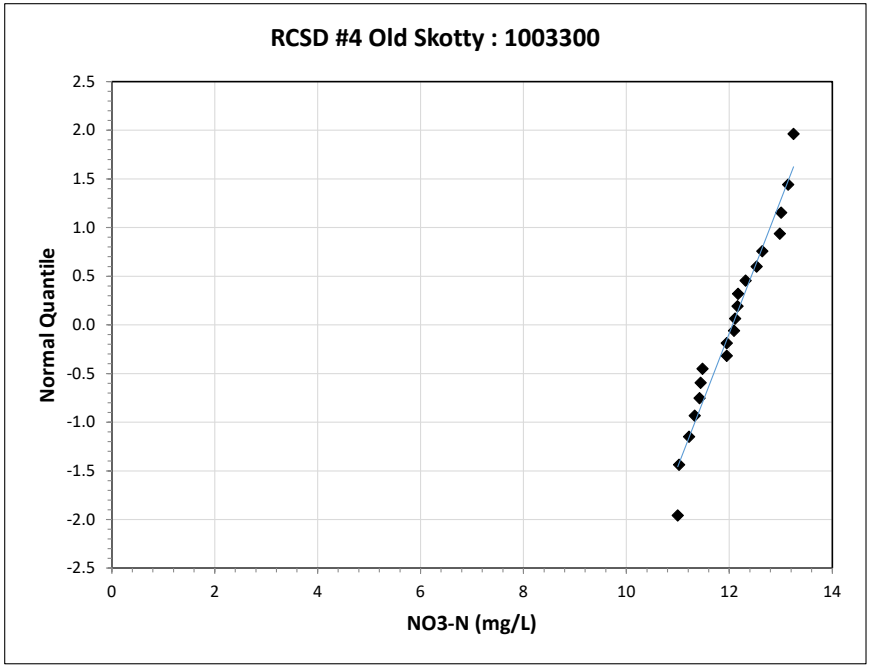


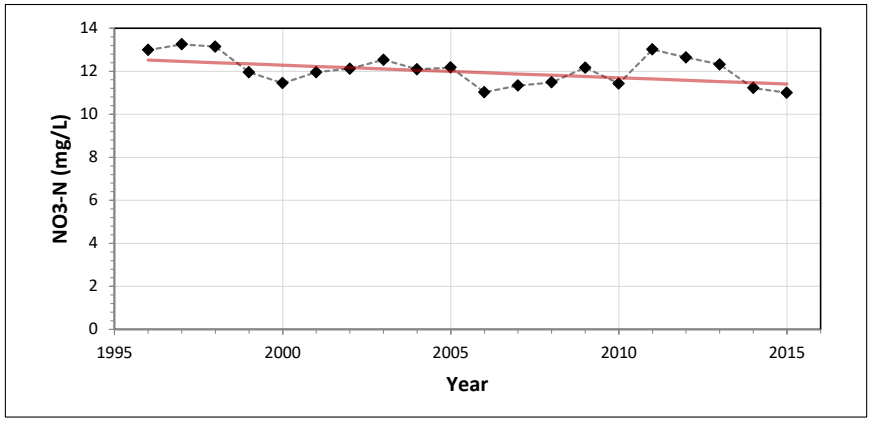
Statistics	
GMZ	Riverside-A
Well Name : ID	FLUME 6 : 1001987
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	213
Annual Average Max	510
Annual Average Mean	314
Annual Average Stdev	78.27
Shapiro-Wilk W	0.877
Shapiro-Wilk p-value	0.079
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	22.59
Student t	1.04
Mean + t*SE (UCL84)	338
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	3
Var(S)	212
Intercept	-2299
Slope	1.30
p-value	0.891
Significant Trend?	No



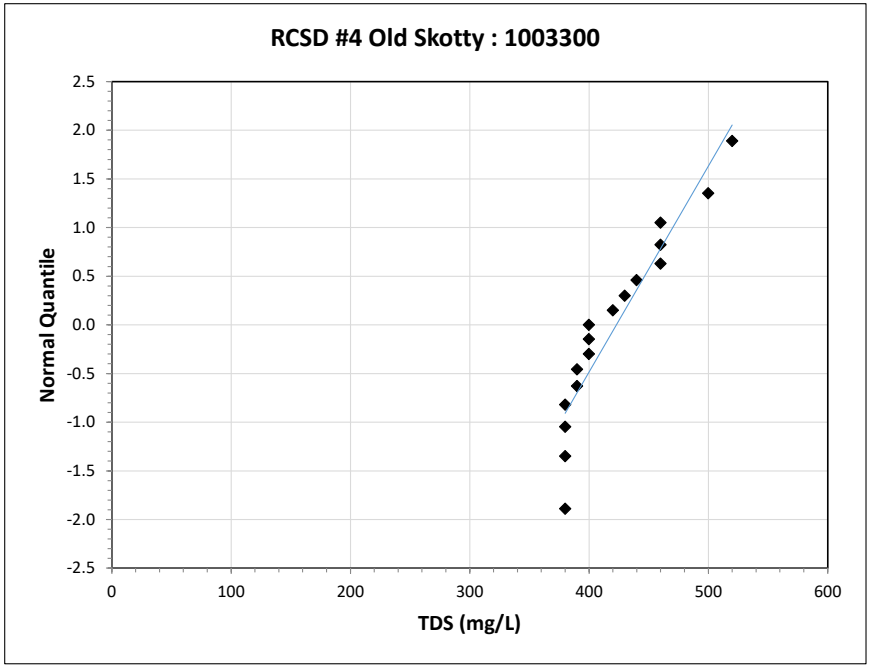


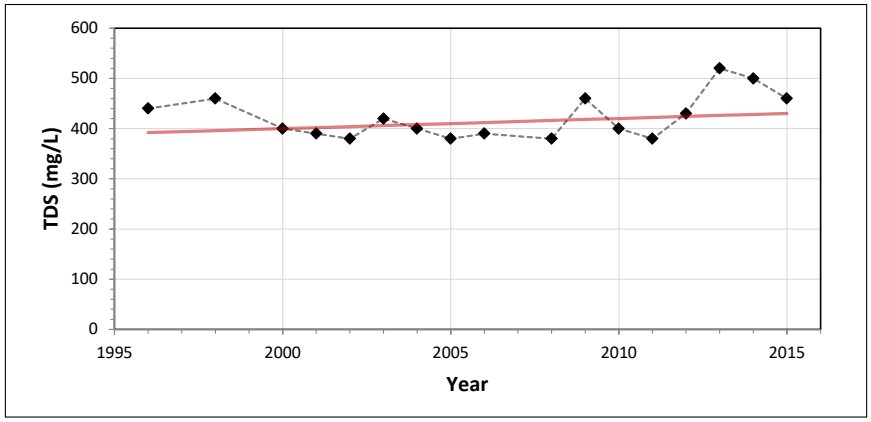
Statistics	
GMZ	Riverside-A
Well Name : ID	RCSD #4 Old Skotty : 1003300
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	11.00
Annual Average Max	13.25
Annual Average Mean	12.06
Annual Average Stdev	0.71
Shapiro-Wilk W	0.946
Shapiro-Wilk p-value	0.307
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.16
Student t	1.02
Mean + t*SE (UCL84)	12.23
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-50
Var(S)	950
Intercept	129
Slope	-0.06
p-value	0.112
Significant Trend?	No



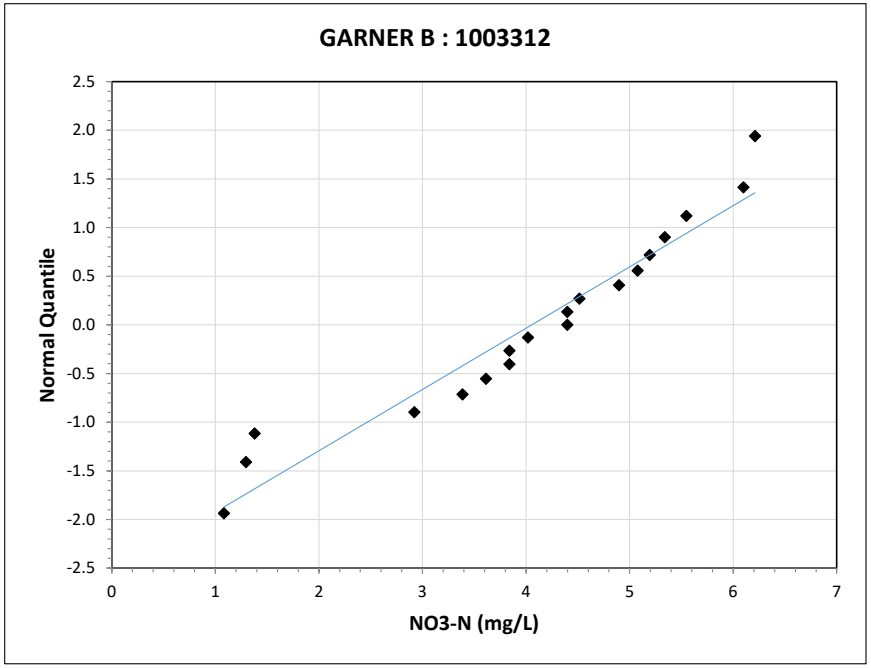


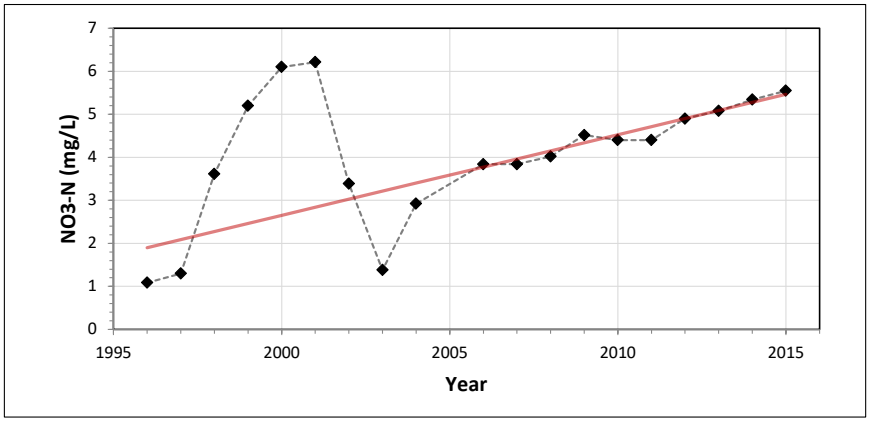
Statistics	
GMZ	Riverside-A
Well Name : ID	RCSD #4 Old Skotty : 1003300
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	380
Annual Average Max	520
Annual Average Mean	423
Annual Average Stdev	43.98
Shapiro-Wilk W	0.871
Shapiro-Wilk p-value	0.023
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	10.67
Student t	1.03
Mean + t*SE (UCL84)	434
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	21
Var(S)	572
Intercept	-3638
Slope	2.02
p-value	0.403
Significant Trend?	No



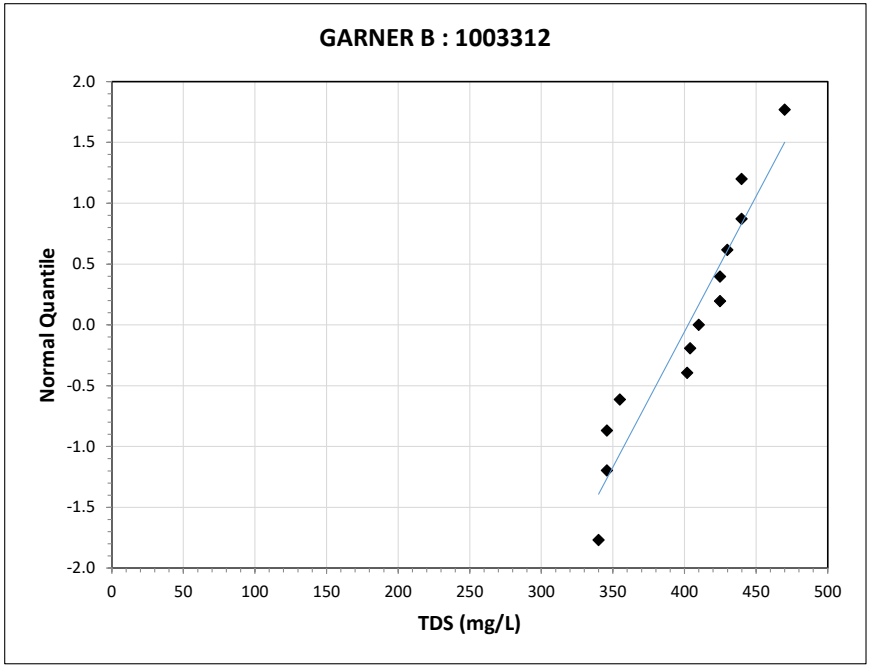


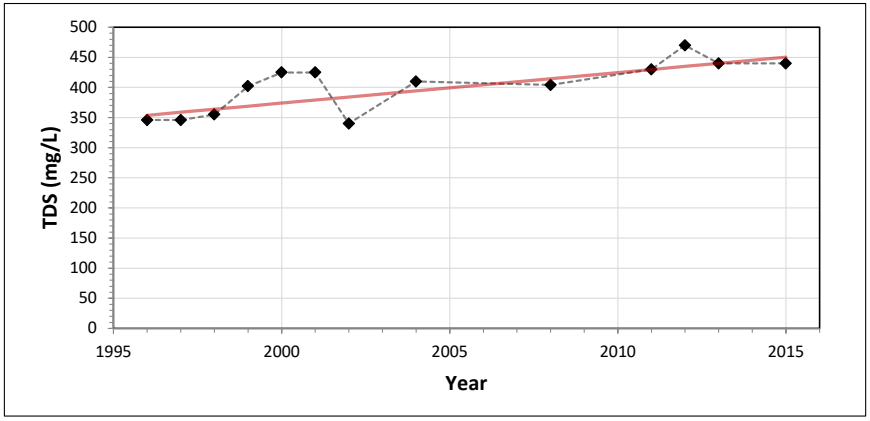
Statistics	
GMZ	Riverside-A
Well Name : ID	GARNER B : 1003312
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.08
Annual Average Max	6.21
Annual Average Mean	4.06
Annual Average Stdev	1.52
Shapiro-Wilk W	0.924
Shapiro-Wilk p-value	0.134
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.35
Student t	1.02
Mean + t*SE (UCL84)	4.41
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	80
Var(S)	816
Intercept	-372
Slope	0.19
p-value	0.006
Significant Trend?	Increasing*



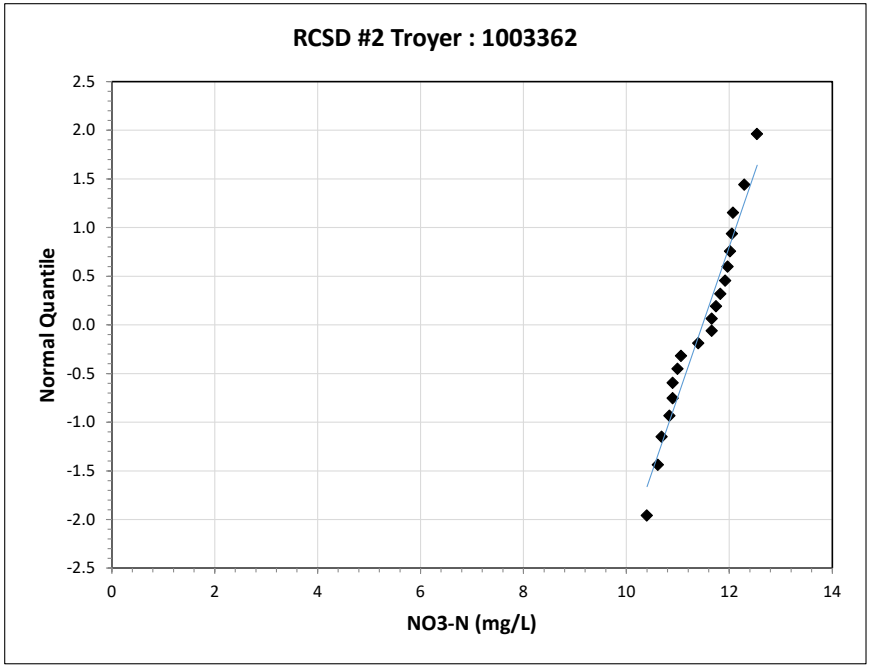


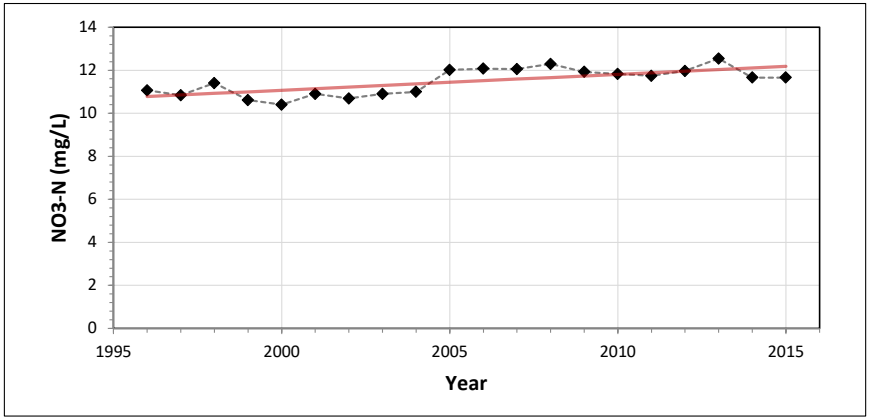
Statistics	
GMZ	Riverside-A
Well Name : ID	GARNER B : 1003312
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	340
Annual Average Max	470
Annual Average Mean	403
Annual Average Stdev	42.57
Shapiro-Wilk W	0.902
Shapiro-Wilk p-value	0.143
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.81
Student t	1.04
Mean + t*SE (UCL84)	415
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	49
Var(S)	266
Intercept	-9769
Slope	5.07
p-value	0.003
Significant Trend?	Increasing*



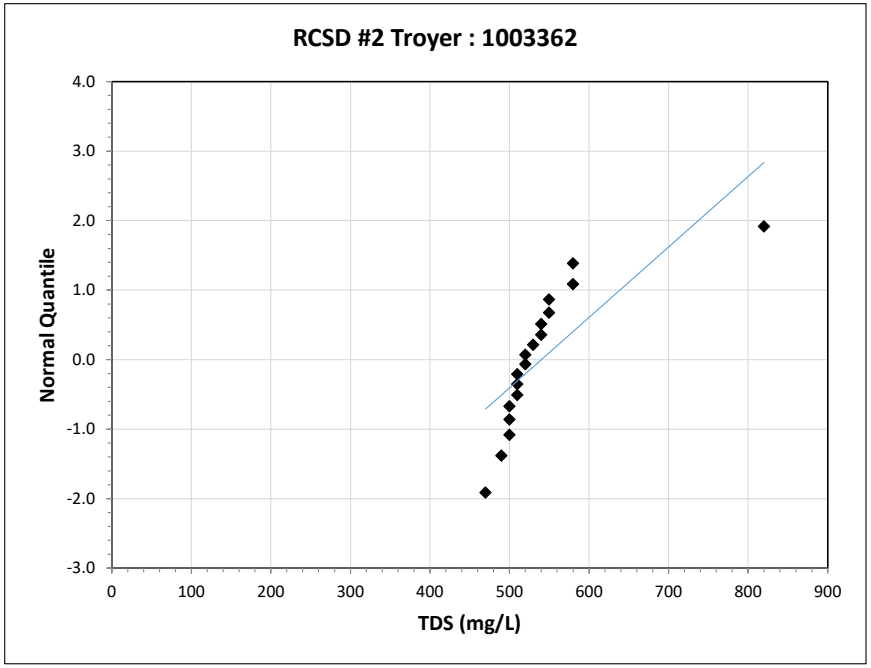


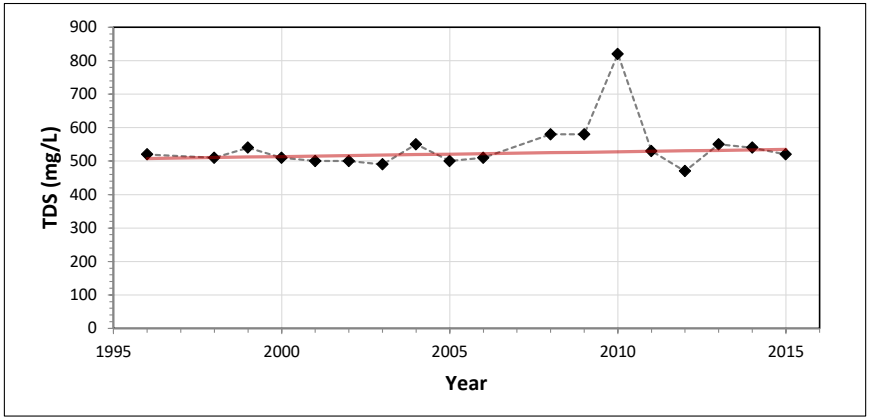
Statistics	
GMZ	Riverside-A
Well Name : ID	RCSD #2 Troyer : 1003362
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	10.40
Annual Average Max	12.54
Annual Average Mean	11.48
Annual Average Stdev	0.63
Shapiro-Wilk W	0.942
Shapiro-Wilk p-value	0.256
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.14
Student t	1.02
Mean + t*SE (UCL84)	11.62
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	77
Var(S)	949
Intercept	-136
Slope	0.07
p-value	0.014
Significant Trend?	Increasing



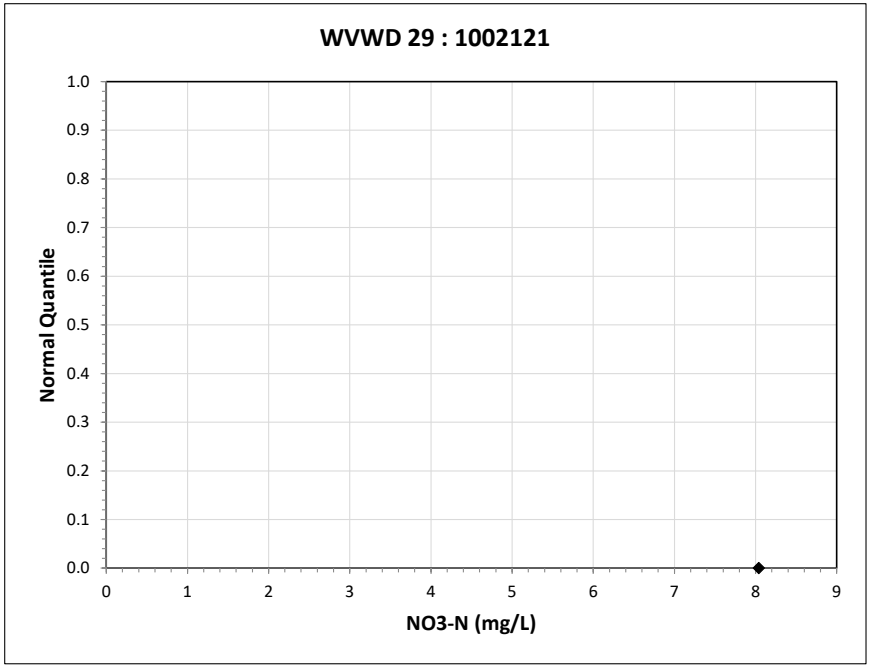


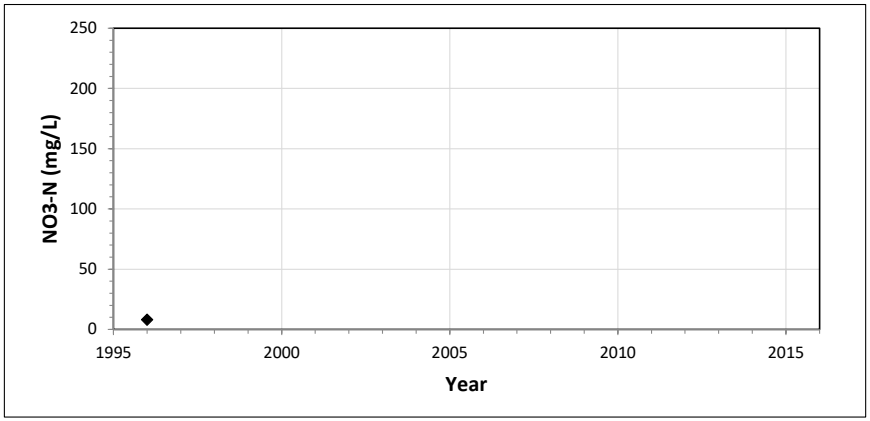
Statistics	
GMZ	Riverside-A
Well Name : ID	RCSD #2 Troyer : 1003362
Analyte	TDS (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	470
Annual Average Max	820
Annual Average Mean	540
Annual Average Stdev	75.77
Shapiro-Wilk W	0.619
Shapiro-Wilk p-value	1E-5
Critical Alpha	0.01
Most Discordant Value	820
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	8E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	520
Trend Analysis	**Theil-Sen**
Kendall S	23
Var(S)	686
Intercept	-2344
Slope	1.43
p-value	0.401
Significant Trend?	No



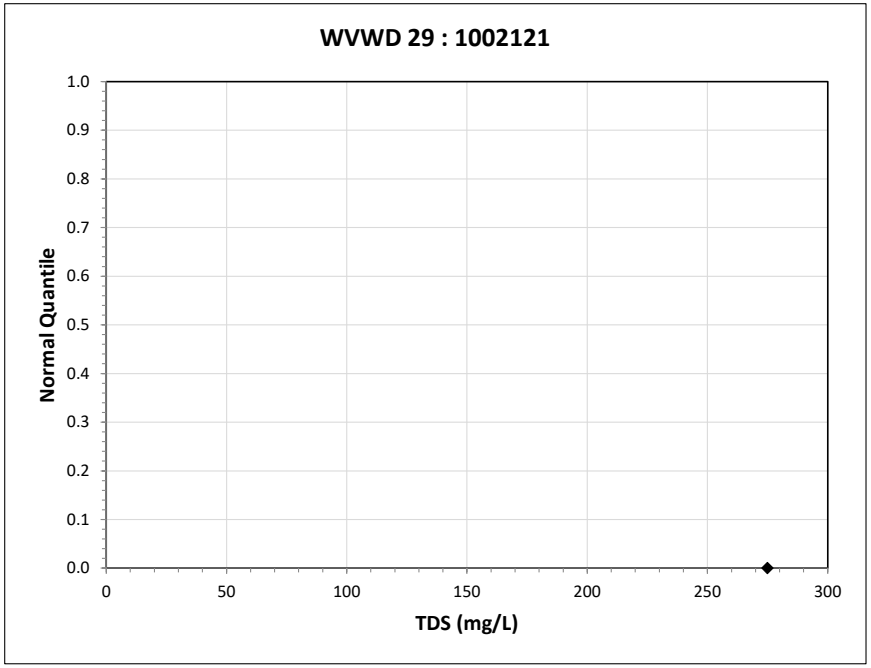


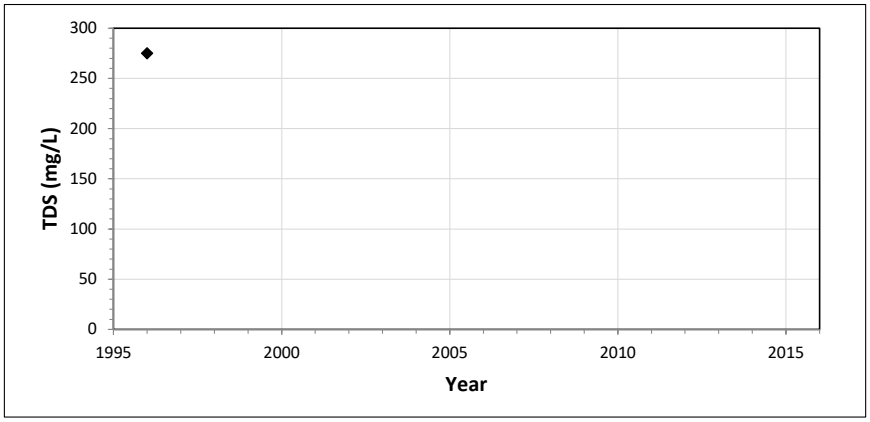
Statistics	
GMZ	Riverside-B
Well Name : ID	WVWD 29 : 1002121
Analyte	NO3-N (mg/L)
Count	1
Count Detects	1
Sample Year Min	1996
Sample Year Max	1996
Annual Average Min	8.04
Annual Average Max	8.04
Annual Average Mean	8.04
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**NC**
Kendall S	NC
Var(S)	NC
Intercept	NC
Slope	NC
p-value	NC
Significant Trend?	NC



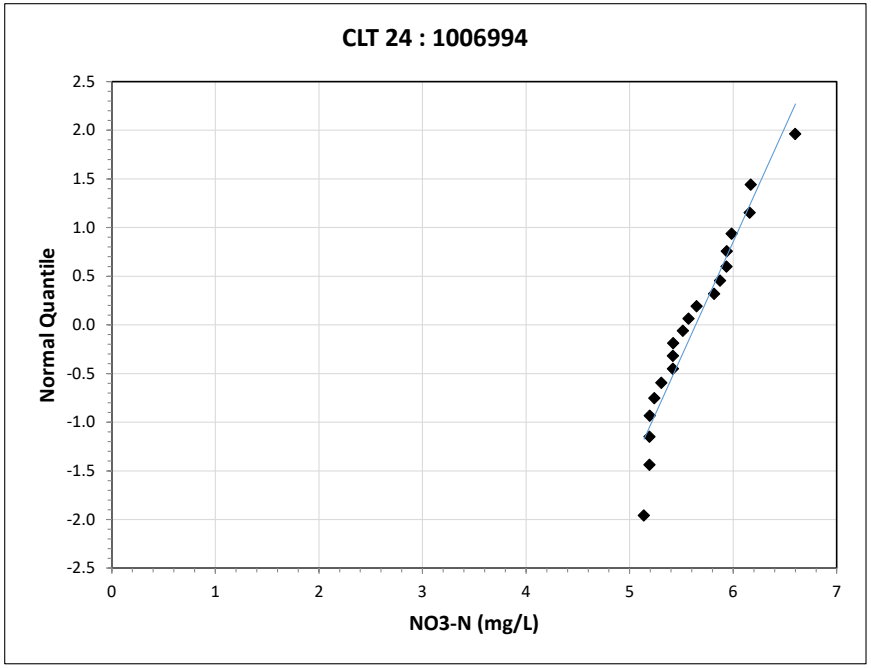


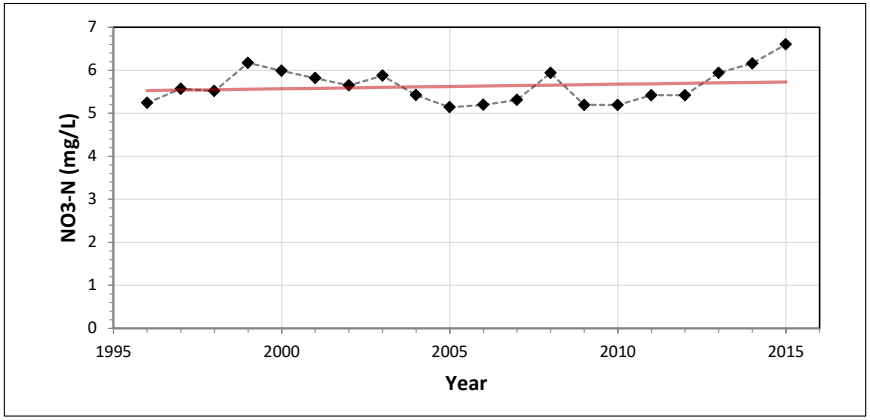
Statistics	
GMZ	Riverside-B
Well Name : ID	WVWD 29 : 1002121
Analyte	TDS (mg/L)
Count	1
Count Detects	1
Sample Year Min	1996
Sample Year Max	1996
Annual Average Min	275
Annual Average Max	275
Annual Average Mean	275
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**NC**
Kendall S	NC
Var(S)	NC
Intercept	NC
Slope	NC
p-value	NC
Significant Trend?	NC



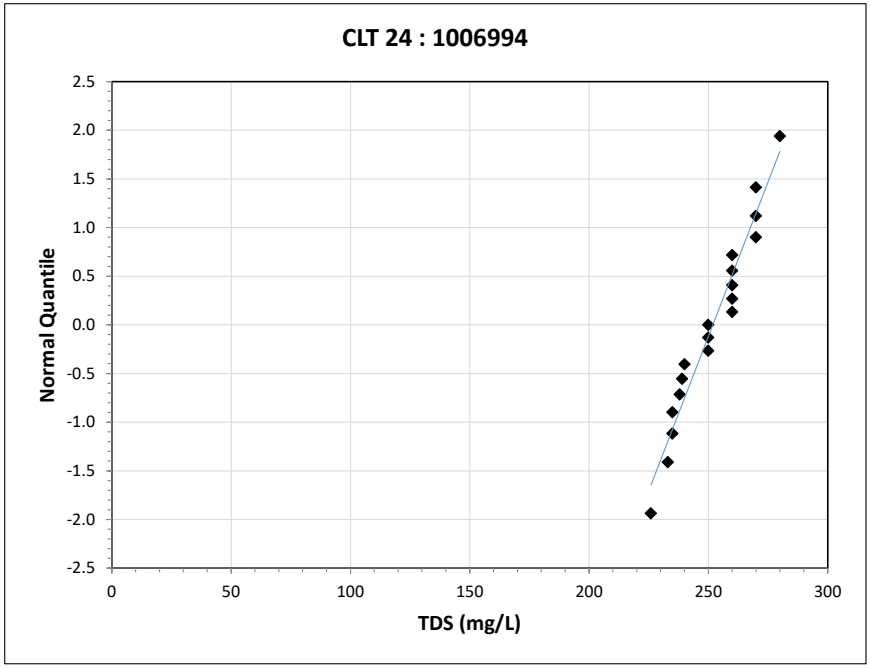


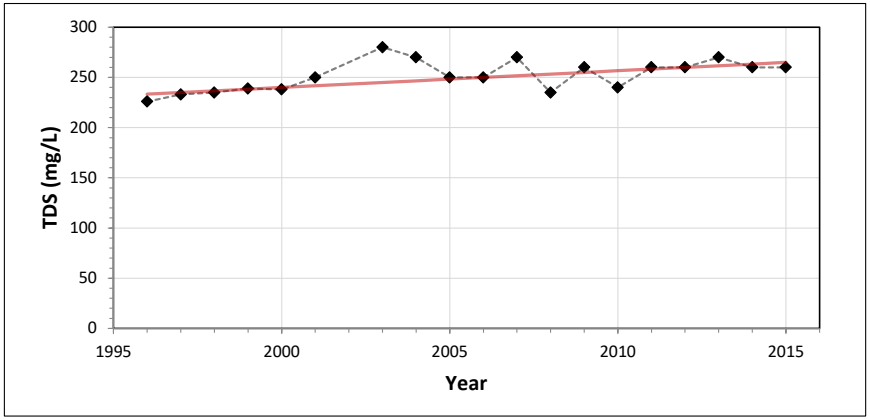
Statistics	
GMZ	Riverside-B
Well Name : ID	CLT 24 : 1006994
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	5.14
Annual Average Max	6.60
Annual Average Mean	5.64
Annual Average Stdev	0.41
Shapiro-Wilk W	0.925
Shapiro-Wilk p-value	0.126
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.09
Student t	1.02
Mean + t*SE (UCL84)	5.73
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	10
Var(S)	948
Intercept	-15.57
Slope	0.01
p-value	0.770
Significant Trend?	No



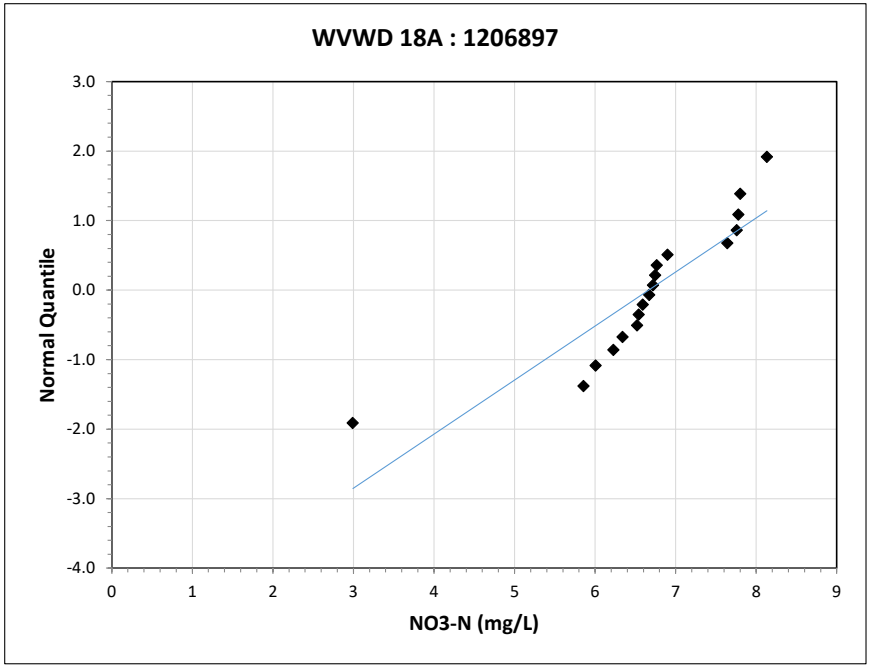


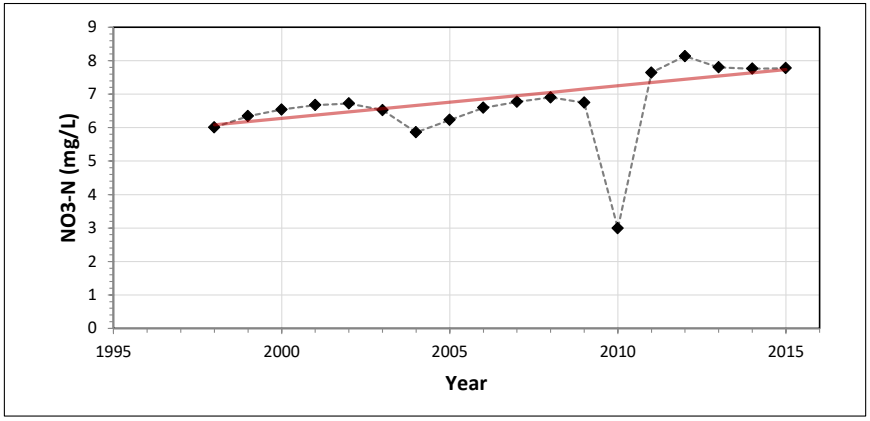
Statistics	
GMZ	Riverside-B
Well Name : ID	CLT 24 : 1006994
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	226
Annual Average Max	280
Annual Average Mean	252
Annual Average Stdev	15.30
Shapiro-Wilk W	0.947
Shapiro-Wilk p-value	0.347
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	3.51
Student t	1.02
Mean + t*SE (UCL84)	255
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	74
Var(S)	792
Intercept	-3093
Slope	1.67
p-value	0.009
Significant Trend?	Increasing*



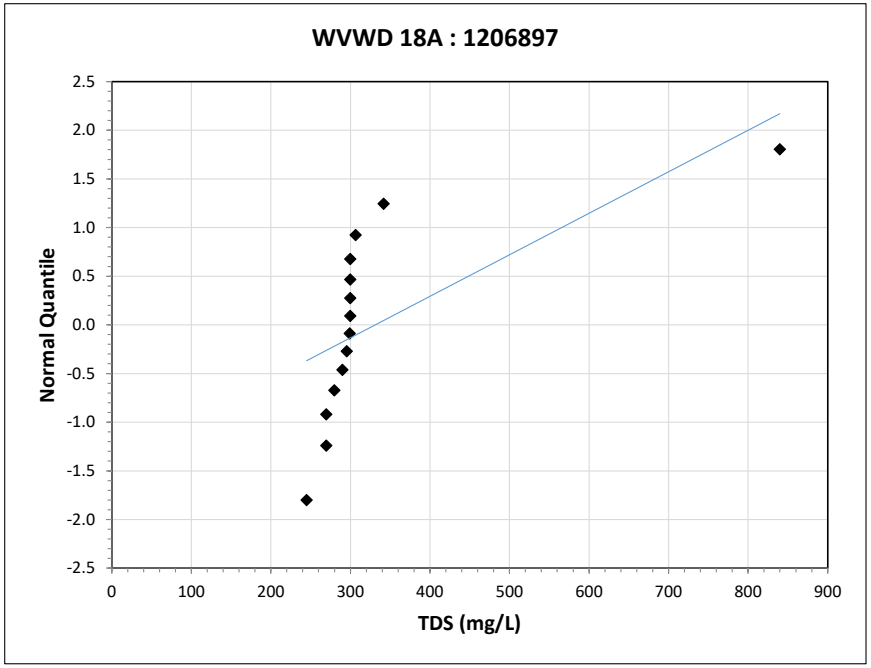


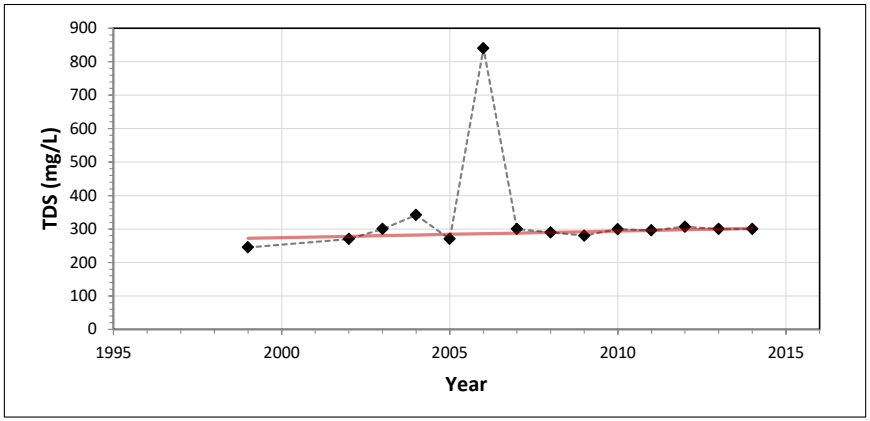
Statistics	
GMZ	Riverside-B
Well Name : ID	WVWD 18A : 1206897
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	2.99
Annual Average Max	8.13
Annual Average Mean	6.67
Annual Average Stdev	1.13
Shapiro-Wilk W	0.802
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	2.99
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	4E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	6.70
Trend Analysis	**Theil-Sen**
Kendall S	83
Var(S)	697
Intercept	-188
Slope	0.10
p-value	0.002
Significant Trend?	Increasing*



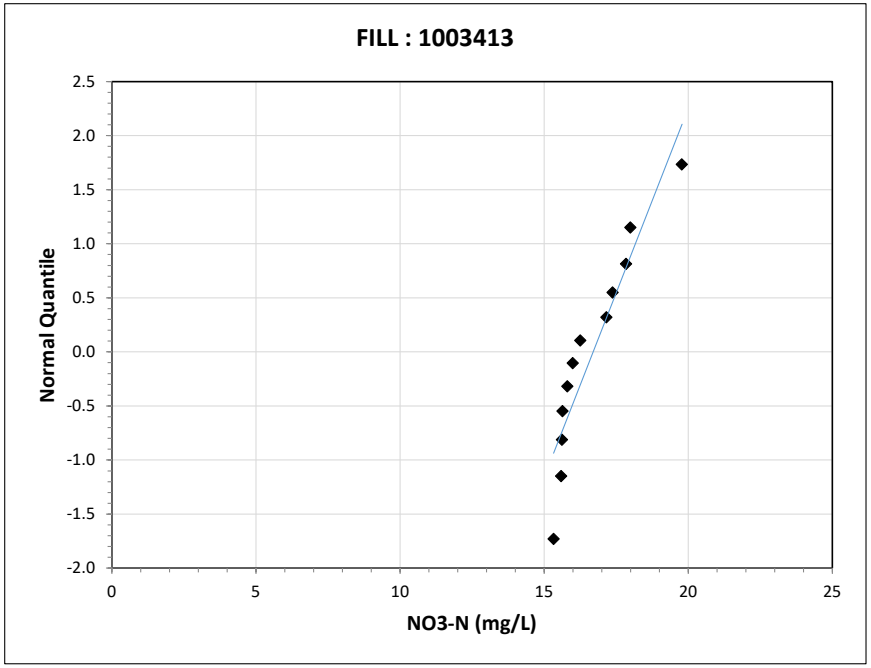


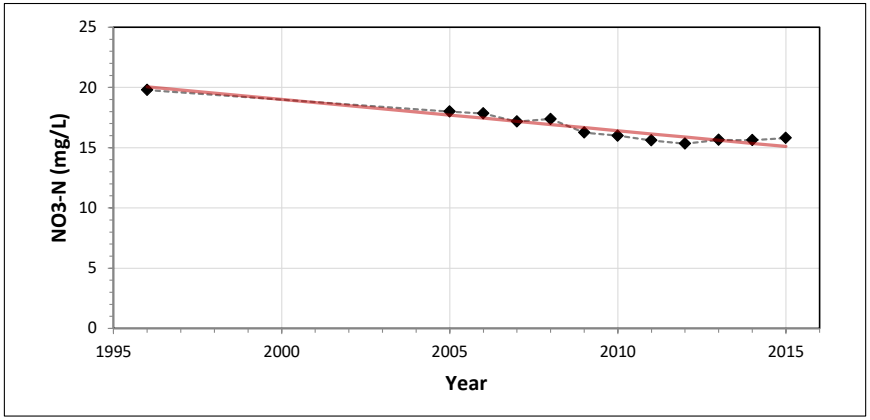
Statistics	
GMZ	Riverside-B
Well Name : ID	WVWD 18A : 1206897
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1999
Sample Year Max	2014
Annual Average Min	245
Annual Average Max	840
Annual Average Mean	331
Annual Average Stdev	148.07
Shapiro-Wilk W	0.431
Shapiro-Wilk p-value	2E-6
Critical Alpha	0.01
Most Discordant Value	840
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	300
Trend Analysis	**Theil-Sen**
Kendall S	24
Var(S)	324
Intercept	-3726
Slope	2.00
p-value	0.201
Significant Trend?	No



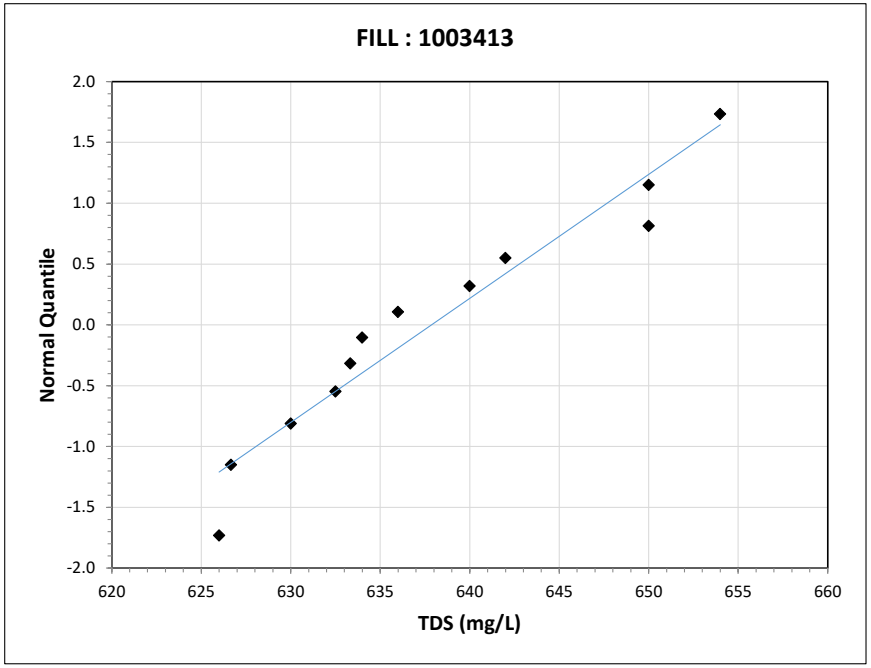


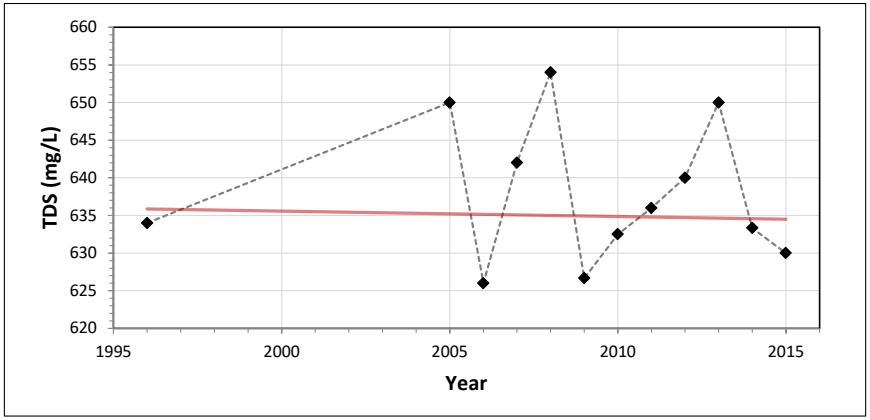
Statistics	
GMZ	Riverside-E
Well Name : ID	FILL : 1003413
Analyte	NO3-N (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	15.33
Annual Average Max	19.79
Annual Average Mean	16.71
Annual Average Stdev	1.35
Shapiro-Wilk W	0.866
Shapiro-Wilk p-value	0.058
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.39
Student t	1.04
Mean + t*SE (UCL84)	17.11
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-48
Var(S)	213
Intercept	541
Slope	-0.26
p-value	0.001
Significant Trend?	Decreasing*



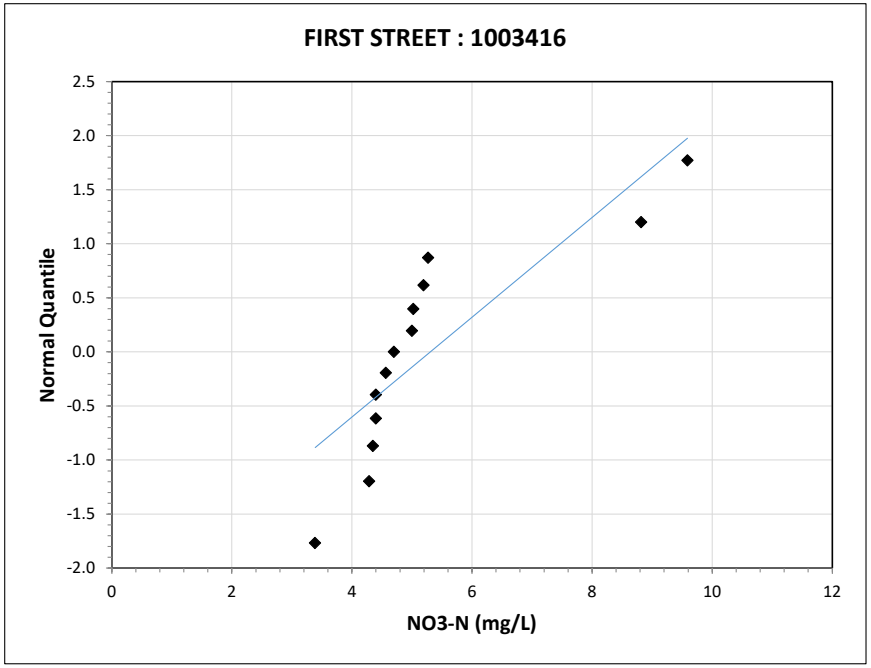


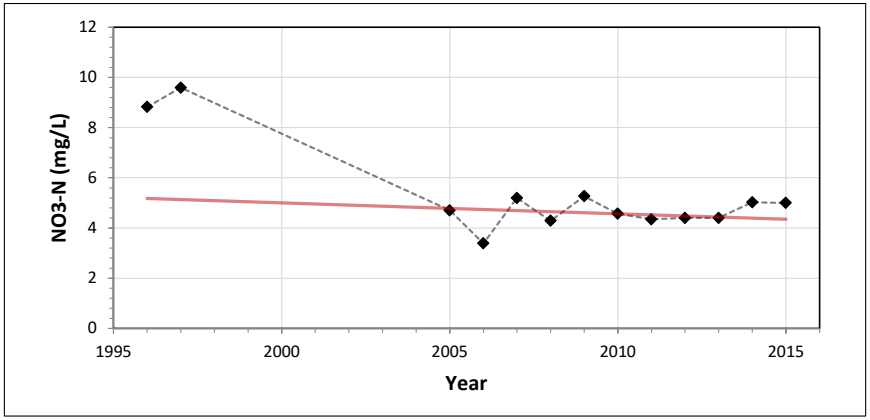
Statistics	
GMZ	Riverside-E
Well Name : ID	FILL : 1003413
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	626
Annual Average Max	654
Annual Average Mean	638
Annual Average Stdev	9.40
Shapiro-Wilk W	0.924
Shapiro-Wilk p-value	0.316
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	2.71
Student t	1.04
Mean + t*SE (UCL84)	641
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	212
Intercept	780
Slope	-0.07
p-value	0.891
Significant Trend?	No



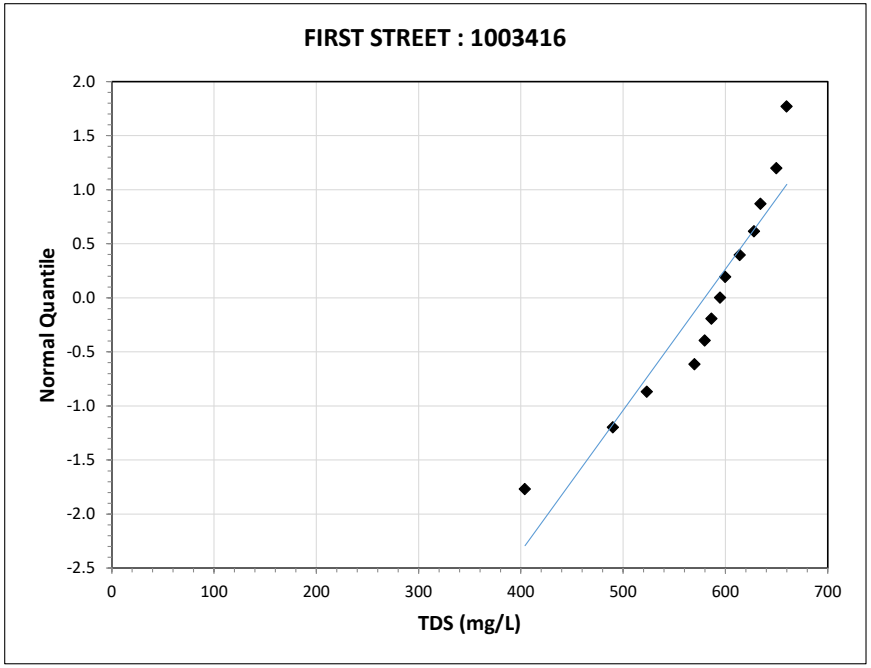


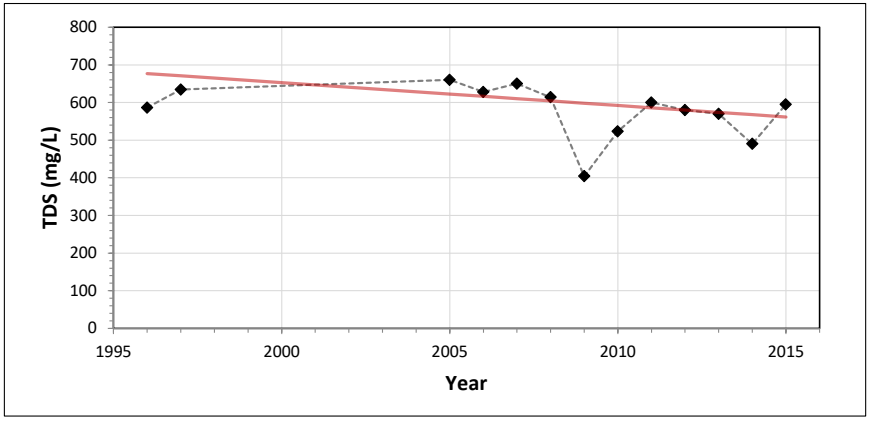
Statistics	
GMZ	Riverside-E
Well Name : ID	FIRST STREET : 1003416
Analyte	NO3-N (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.39
Annual Average Max	9.59
Annual Average Mean	5.31
Annual Average Stdev	1.80
Shapiro-Wilk W	0.713
Shapiro-Wilk p-value	8E-4
Critical Alpha	0.01
Most Discordant Value	9.59
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.008
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	4.70
Trend Analysis	**Theil-Sen**
Kendall S	-12
Var(S)	269
Intercept	92.65
Slope	-0.04
p-value	0.502
Significant Trend?	No



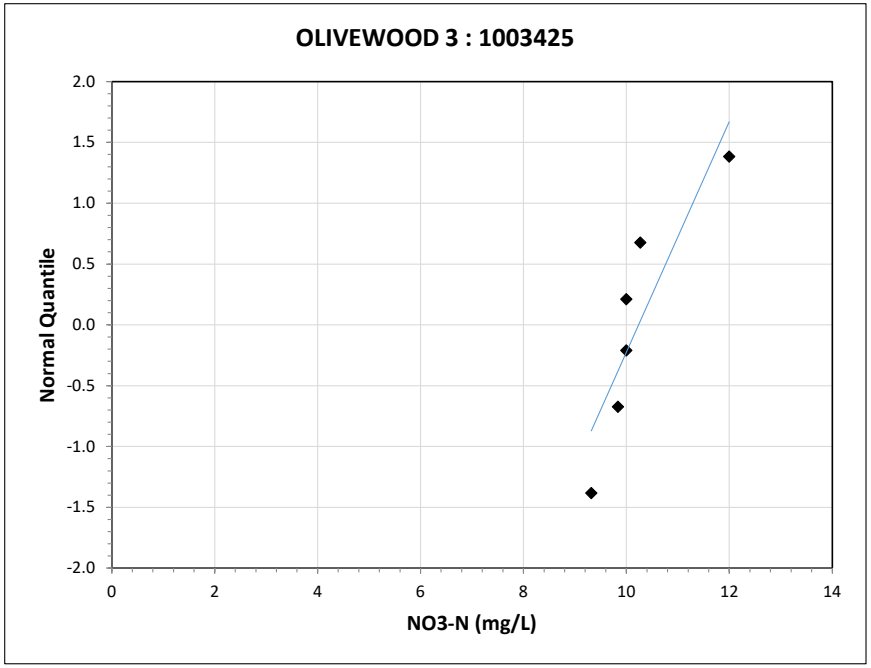


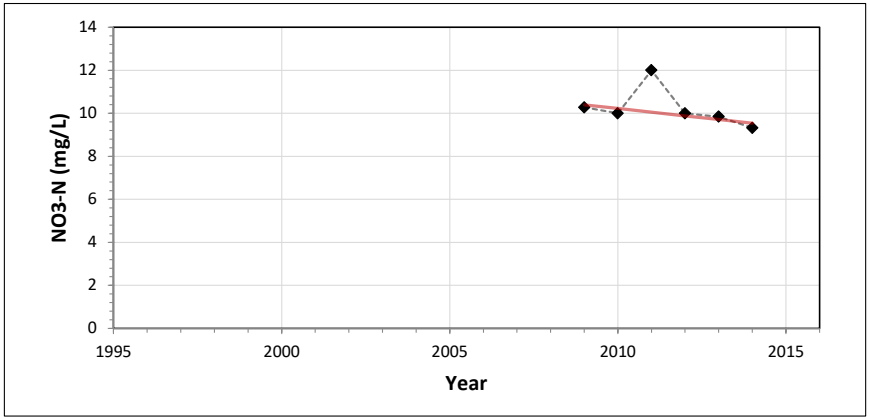
Statistics	
GMZ	Riverside-E
Well Name : ID	FIRST STREET : 1003416
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	404
Annual Average Max	660
Annual Average Mean	580
Annual Average Stdev	71.17
Shapiro-Wilk W	0.882
Shapiro-Wilk p-value	0.076
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	19.74
Student t	1.04
Mean + t*SE (UCL84)	600
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-32
Var(S)	269
Intercept	12753
Slope	-6.05
p-value	0.059
Significant Trend?	Decreasing



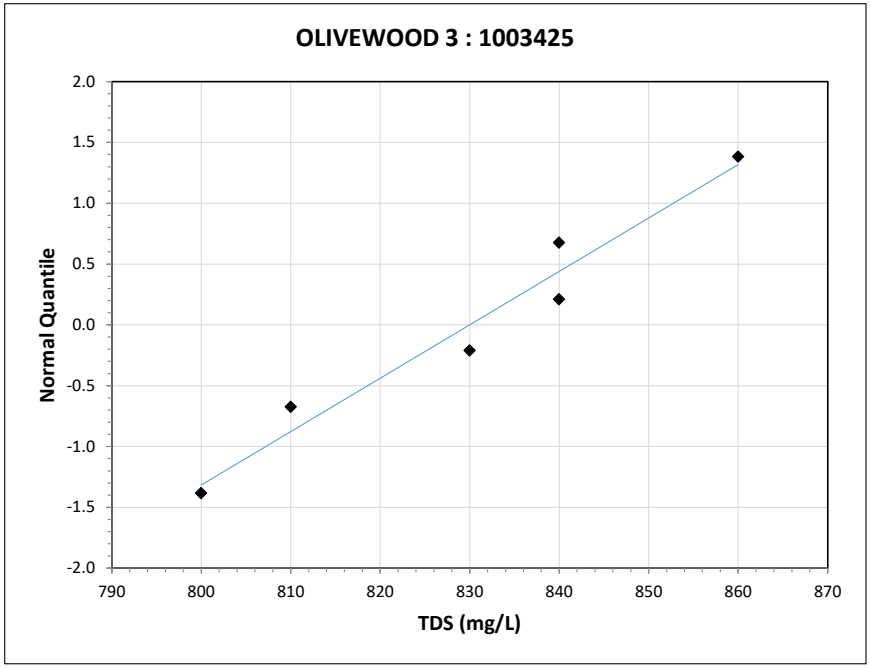


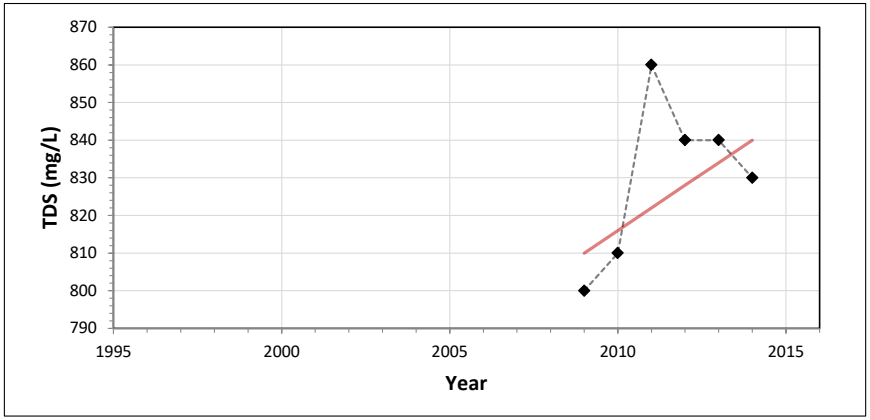
Statistics	
GMZ	Riverside-E
Well Name : ID	OLIVEWOOD 3 : 1003425
Analyte	NO3-N (mg/L)
Count	6
Count Detects	6
Sample Year Min	2009
Sample Year Max	2014
Annual Average Min	9.32
Annual Average Max	12.00
Annual Average Mean	10.24
Annual Average Stdev	0.92
Shapiro-Wilk W	0.807
Shapiro-Wilk p-value	0.067
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.38
Student t	1.10
Mean + t*SE (UCL84)	10.65
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-10
Var(S)	27.33
Intercept	352
Slope	-0.17
p-value	0.085
Significant Trend?	Decreasing



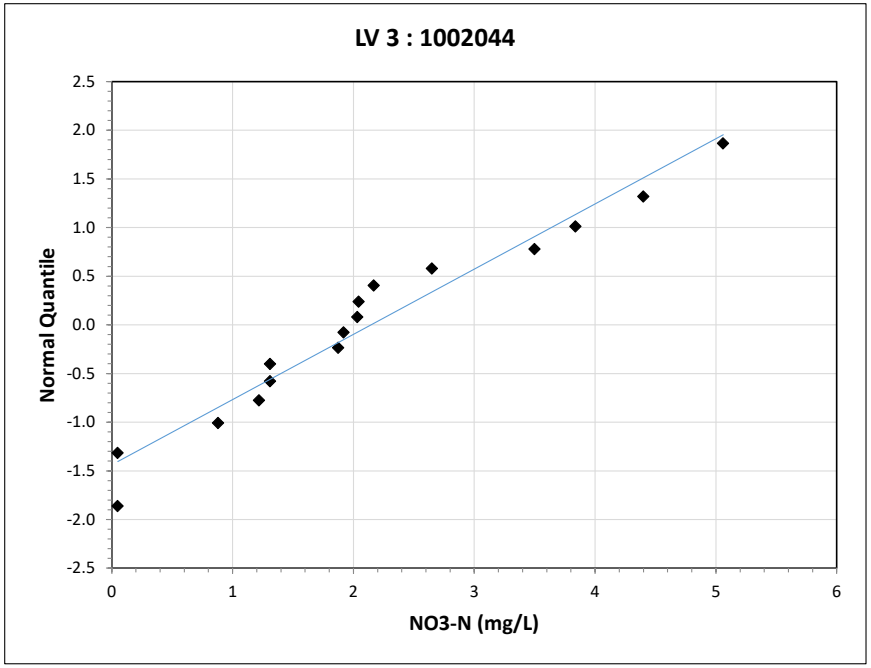


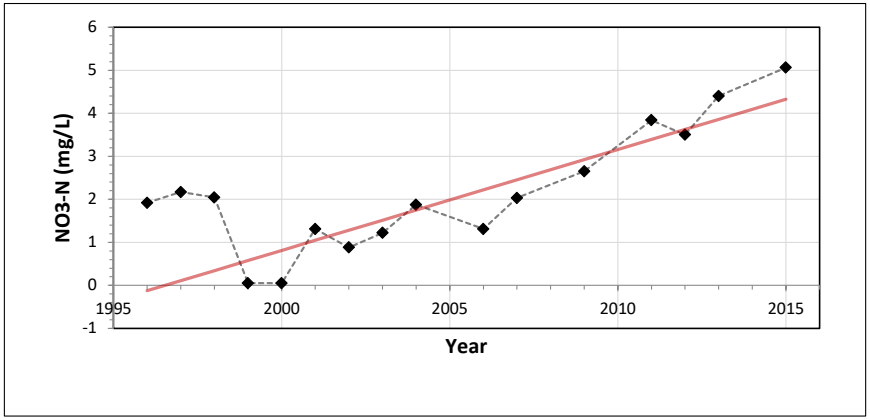
Statistics	
GMZ	Riverside-E
Well Name : ID	OLIVEWOOD 3 : 1003425
Analyte	TDS (mg/L)
Count	6
Count Detects	6
Sample Year Min	2009
Sample Year Max	2014
Annual Average Min	800
Annual Average Max	860
Annual Average Mean	830
Annual Average Stdev	21.91
Shapiro-Wilk W	0.955
Shapiro-Wilk p-value	0.783
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.94
Student t	1.10
Mean + t*SE (UCL84)	840
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	4
Var(S)	27.33
Intercept	-11244
Slope	6.00
p-value	0.566
Significant Trend?	No



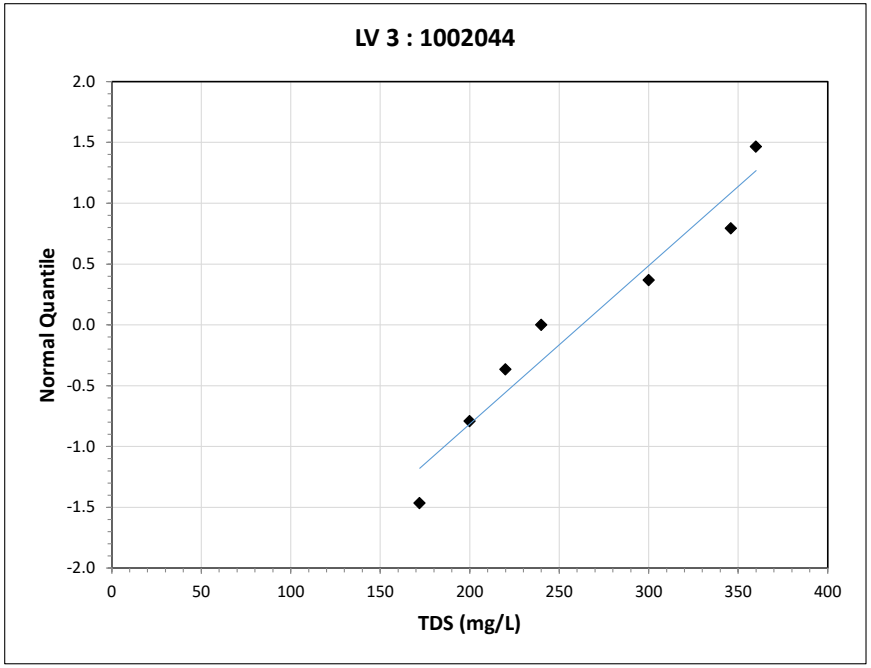


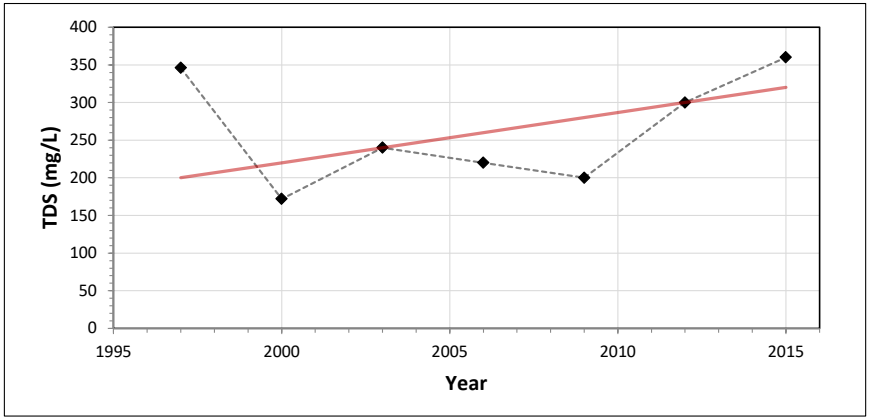
Statistics	
GMZ	Riverside-F
Well Name : ID	LV 3 : 1002044
Analyte	NO3-N (mg/L)
Count	16
Count Detects	14
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	5.06
Annual Average Mean	2.14
Annual Average Stdev	1.44
Shapiro-Wilk W	0.947
Shapiro-Wilk p-value	0.439
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.36
Student t	1.03
Mean + t*SE (UCL84)	2.52
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	62
Var(S)	491
Intercept	-468
Slope	0.23
p-value	0.006
Significant Trend?	Increasing*



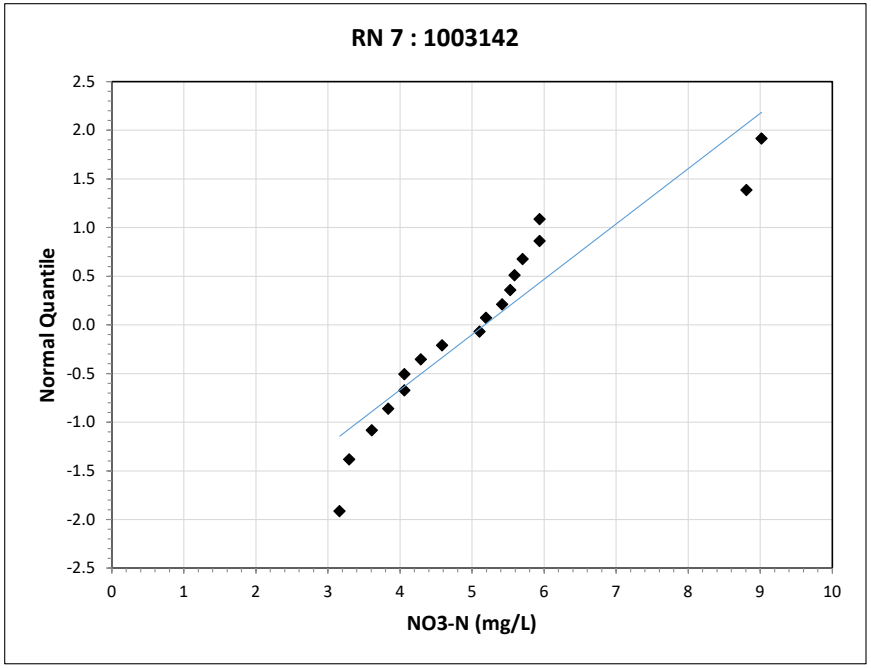


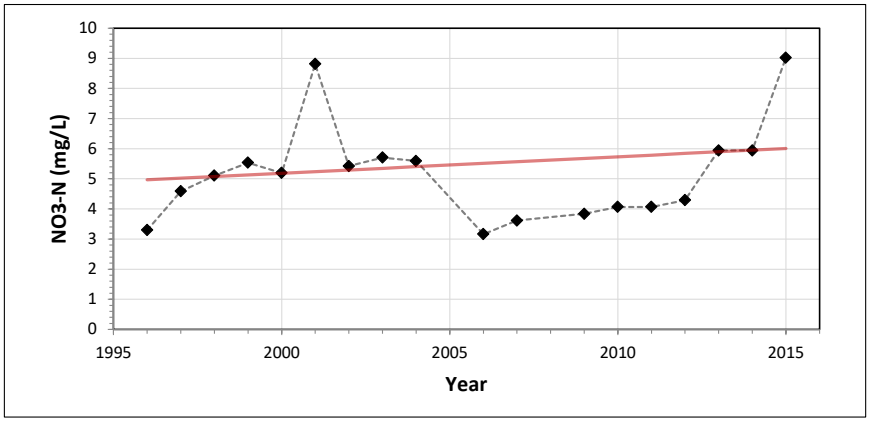
Statistics	
GMZ	Riverside-F
Well Name : ID	LV 3 : 1002044
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	172
Annual Average Max	360
Annual Average Mean	263
Annual Average Stdev	73.36
Shapiro-Wilk W	0.923
Shapiro-Wilk p-value	0.495
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	27.73
Student t	1.08
Mean + t*SE (UCL84)	293
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	5
Var(S)	44.33
Intercept	-13113
Slope	6.67
p-value	0.548
Significant Trend?	No



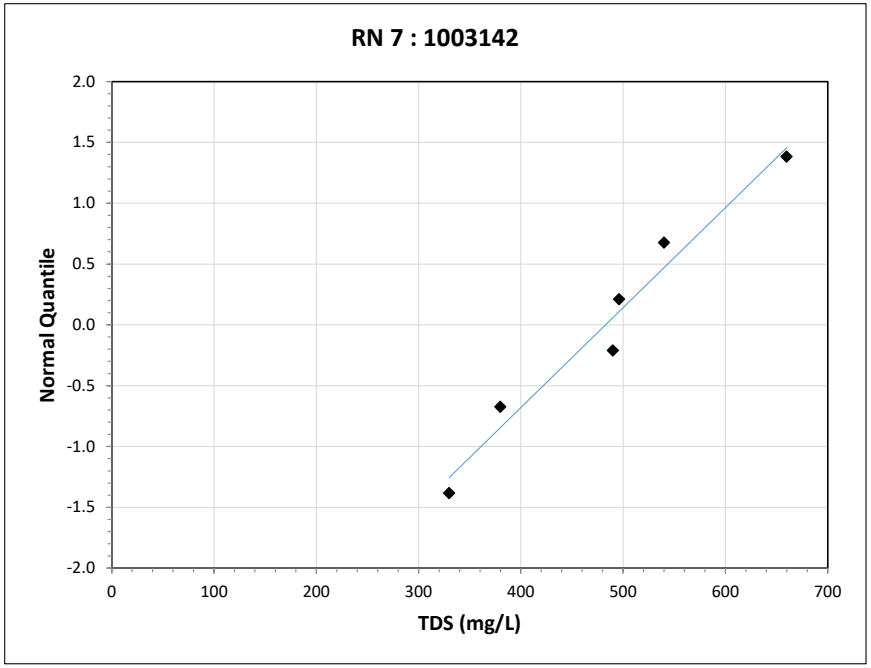


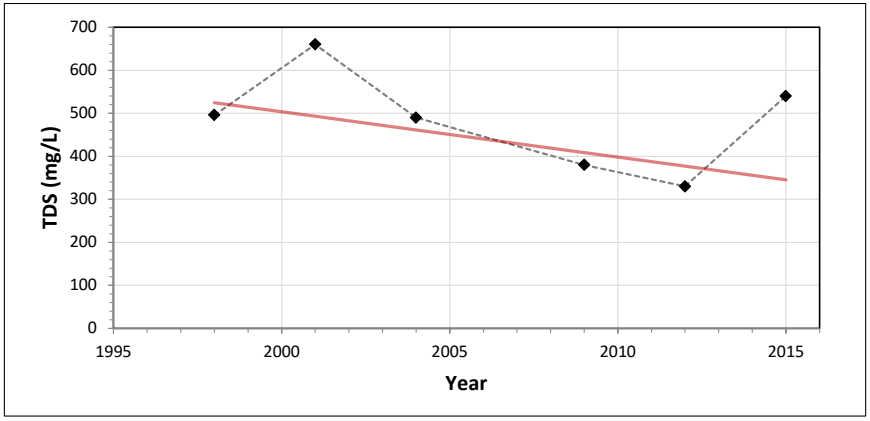
Statistics	
GMZ	Riverside-F
Well Name : ID	RN 7 : 1003142
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.16
Annual Average Max	9.02
Annual Average Mean	5.18
Annual Average Stdev	1.63
Shapiro-Wilk W	0.868
Shapiro-Wilk p-value	0.017
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.38
Student t	1.02
Mean + t*SE (UCL84)	5.57
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	37
Var(S)	695
Intercept	-104
Slope	0.05
p-value	0.172
Significant Trend?	No



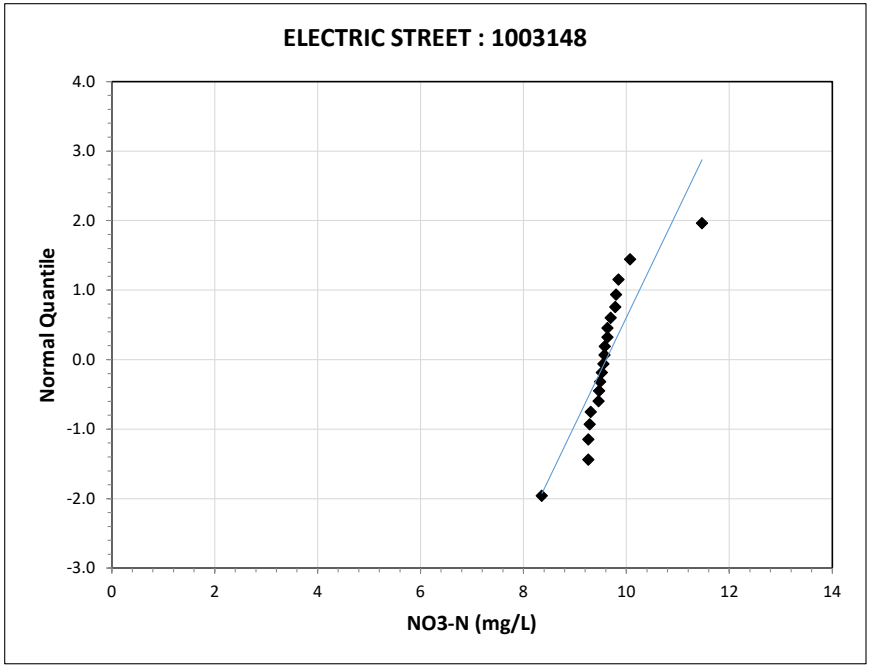


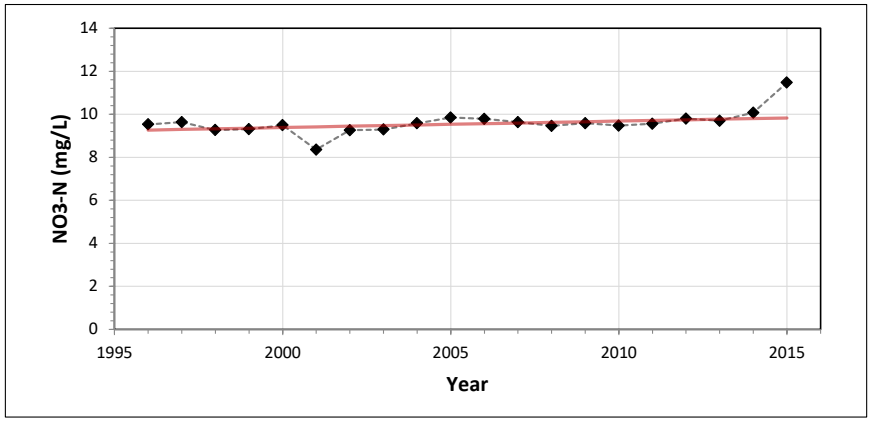
Statistics	
GMZ	Riverside-F
Well Name : ID	RN 7 : 1003142
Analyte	TDS (mg/L)
Count	6
Count Detects	6
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	330
Annual Average Max	660
Annual Average Mean	483
Annual Average Stdev	117.31
Shapiro-Wilk W	0.964
Shapiro-Wilk p-value	0.854
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	47.89
Student t	1.10
Mean + t*SE (UCL84)	536
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	28.33
Intercept	21594
Slope	-10.55
p-value	0.452
Significant Trend?	No



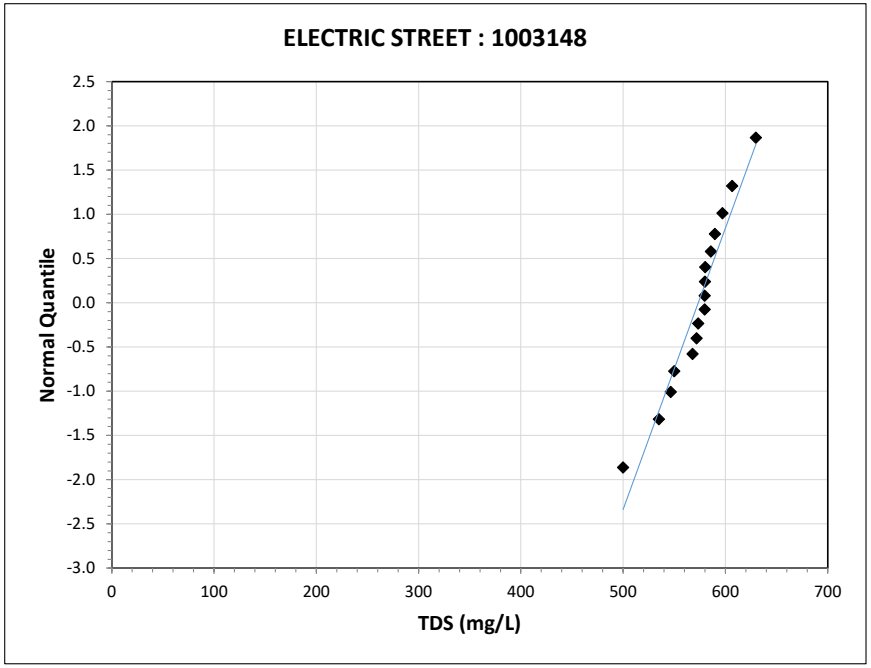


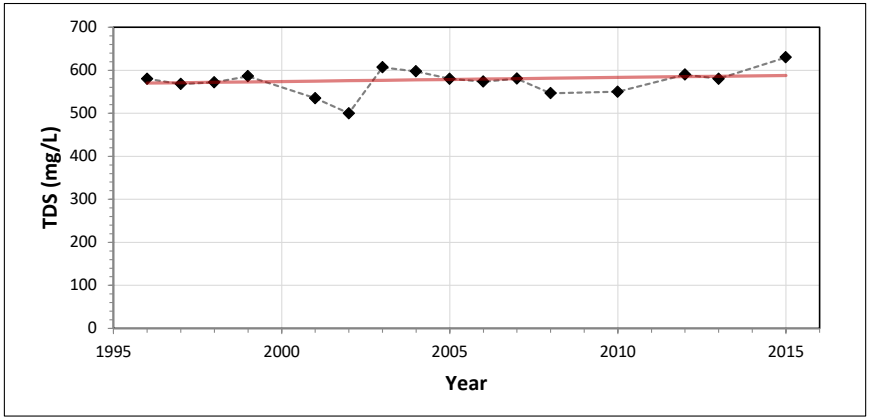
Statistics	
GMZ	Riverside-F
Well Name : ID	ELECTRIC STREET : 1003148
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	8.36
Annual Average Max	11.47
Annual Average Mean	9.61
Annual Average Stdev	0.56
Shapiro-Wilk W	0.773
Shapiro-Wilk p-value	4E-4
Critical Alpha	0.01
Most Discordant Value	11.47
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	8E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	9.57
Trend Analysis	**Theil-Sen**
Kendall S	84
Var(S)	950
Intercept	-50.08
Slope	0.03
p-value	0.007
Significant Trend?	Increasing*



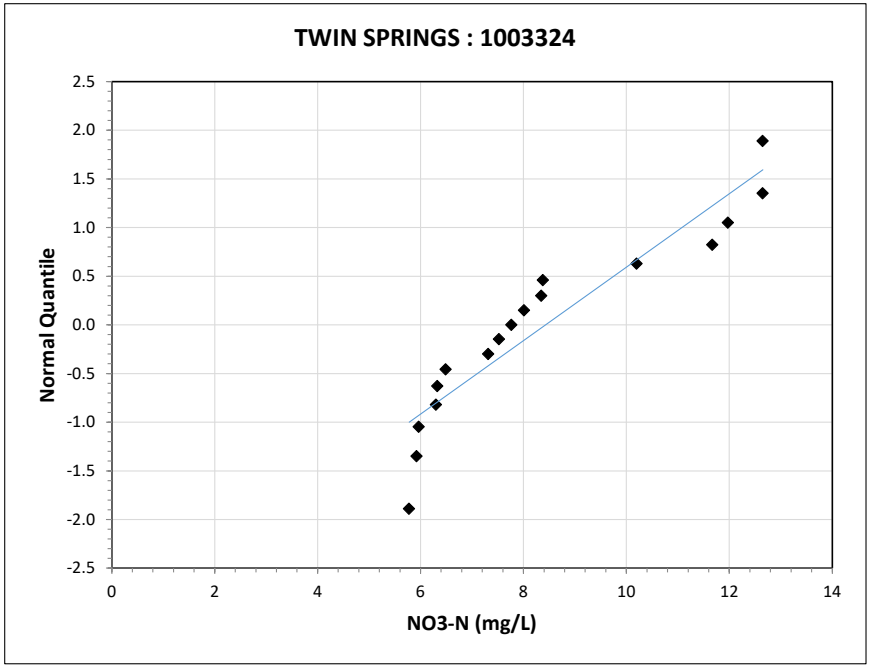


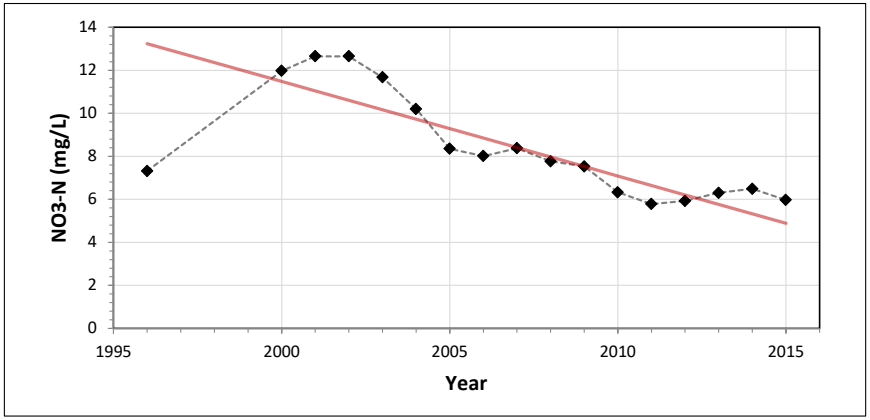
Statistics	
GMZ	Riverside-F
Well Name : ID	ELECTRIC STREET : 1003148
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	500
Annual Average Max	630
Annual Average Mean	573
Annual Average Stdev	30.17
Shapiro-Wilk W	0.947
Shapiro-Wilk p-value	0.437
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.54
Student t	1.03
Mean + t*SE (UCL84)	581
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	19
Var(S)	492
Intercept	-1299
Slope	0.94
p-value	0.417
Significant Trend?	No



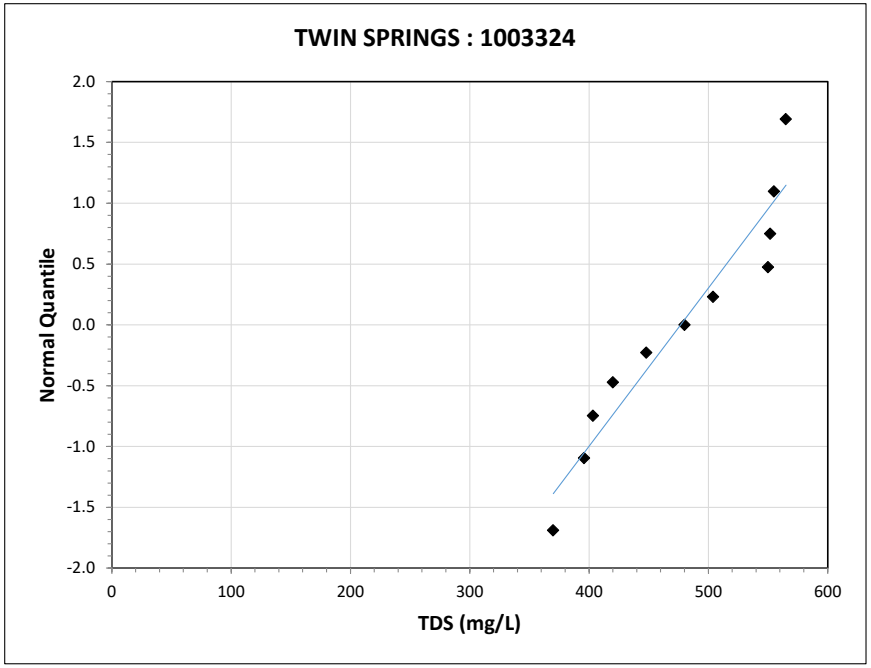


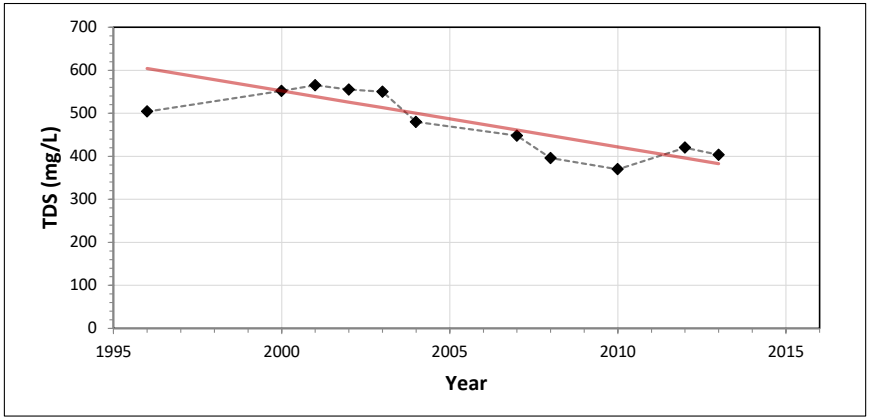
Statistics	
GMZ	Riverside-F
Well Name : ID	TWIN SPRINGS : 1003324
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	5.78
Annual Average Max	12.65
Annual Average Mean	8.43
Annual Average Stdev	2.46
Shapiro-Wilk W	0.857
Shapiro-Wilk p-value	0.014
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.60
Student t	1.03
Mean + t*SE (UCL84)	9.04
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-89
Var(S)	588
Intercept	891
Slope	-0.44
p-value	3E-4
Significant Trend?	Decreasing**





Statistics	
GMZ	Riverside-F
Well Name : ID	TWIN SPRINGS : 1003324
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	1996
Sample Year Max	2013
Annual Average Min	370
Annual Average Max	565
Annual Average Mean	477
Annual Average Stdev	72.83
Shapiro-Wilk W	0.896
Shapiro-Wilk p-value	0.167
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	21.96
Student t	1.05
Mean + t*SE (UCL84)	500
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-35
Var(S)	165
Intercept	26552
Slope	-13.00
p-value	0.008
Significant Trend?	Decreasing*





Attachment B14

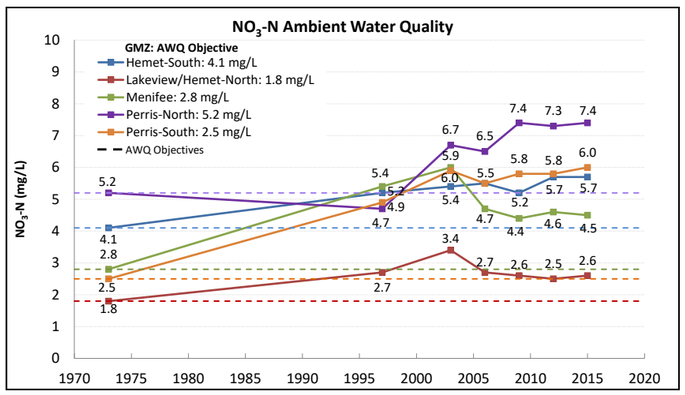
San Jacinto GMZs

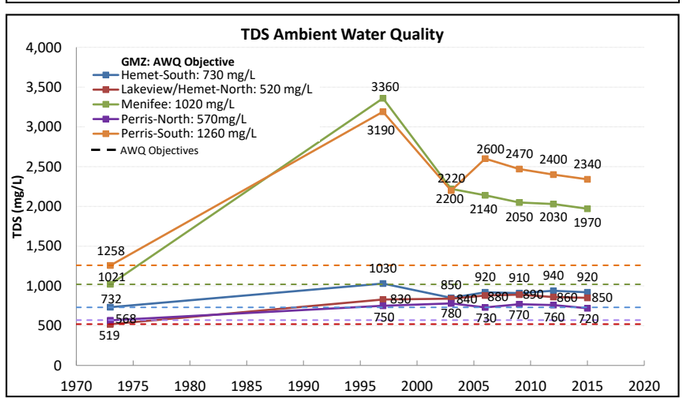
Attachment Contents:

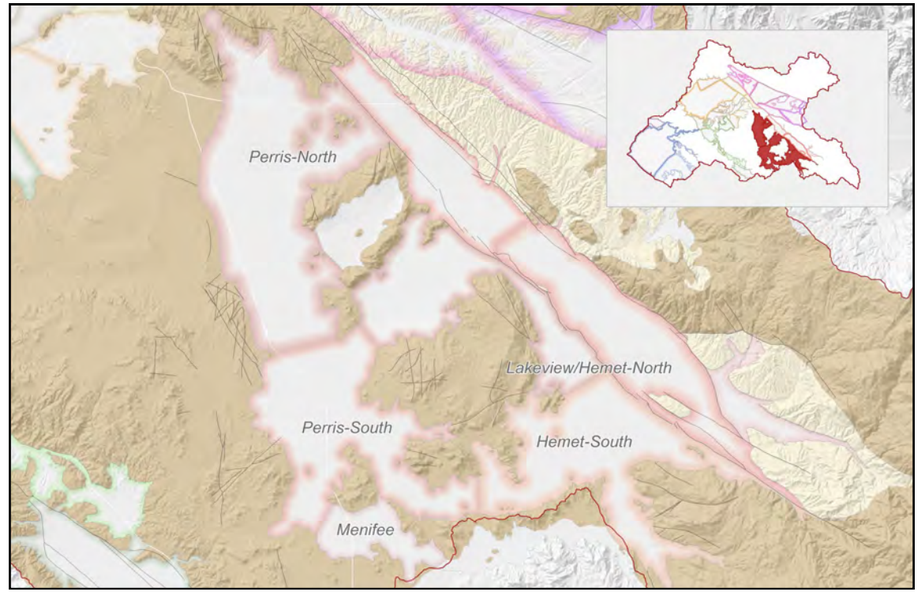
B14-1 Groundwater Storage and Elevation Contours Fall 2015
B14-2 NO_3-N Concentration and Contour Map
B14-3 TDS Concentration and Contour Map
B14-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B14-5 TDS Concentration Change (1993-2012 to 1996-2015)
B14-6 Key Well Analysis Charts

	Basin Analytics	Hemet-South	Lakeview/ Hemet-North	Menifee	Perris-North	Perris-South
Basin	GMZ Area (acres)	25,200	17,500	5,630	38,000	25,200
	Volume of Storage (acre-ft)	453,000	541,000	105,314	452,000	760,000
NO_3-N	Wells per GMZ	63	81	22	44	71
	Point Statistics per GMZ	40	55	75	33	49
	Total Mass (tons)	3,500	1,940	640	4,510	6,160
	1996-2015 AWQ	5.7	2.6	4.5	7.4	6
TDS	Wells per GMZ	63	81	22	44	71
	Point Statistics per GMZ	40	64	20	37	53
	Total Mass (tons)	567,000	624,000	282,000	441,000	2,420,000
	1996-2015 AWQ	920	850	1970	720	2340

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

Hemet-South

The nitrate objective for Hemet-South is 4.1 mg/L. The ambient nitrate concentration was unchanged from 5.7 mg/L in 2012 to 5.7 mg/L in 2015, and there is no assimilative capacity. Three out of the five key wells in Hemet-South GMZ have an increasing trend in nitrate concentrations, while the other two show no trends in the nitrate concentrations. Seven of the total 63 wells with nitrate values in Hemet-South will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new well with statistics was added to the 1996 to 2015 AWQ recomputation, and two wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Lakeview/Hemet-North

The nitrate objective for Lakeview/Hemet-North is 1.8 mg/L. The ambient nitrate concentration was increased from 2.5 mg/L in 2012 to 2.6 mg/L in 2015, and there is no assimilative capacity. Two out of the four key wells in Lakeview/Hemet-North GMZ have an increasing trend in nitrate concentrations, one shows a decreasing trend, and the other shows no trend in the nitrate concentration. Four new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and four wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Menifee

The nitrate objective for Menifee is 2.8 mg/L. The ambient nitrate concentration decreased from 4.6 mg/L in 2012 to 4.5 mg/L in 2015, and there is no assimilative capacity. Two out of the five key wells in Menifee GMZ have an increasing trend in nitrate concentrations, while the other three show no trends in the nitrate concentrations. One of the total 22 wells with nitrate values in Menifee will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Perris-North

The nitrate objective for Perris-North is 5.2 mg/L. The ambient nitrate concentration increased from 7.3 mg/L in 2012 to 7.4 mg/L in 2015, and there is no assimilative capacity. Three out of the four key wells in Perris-North GMZ have an increasing trend in nitrate concentrations, while the other one shows no trend in the nitrate concentration. Three of the total 44 wells with nitrate values in Perris-North will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new well with statistics was added to the 1996 to 2015 AWQ recomputation.

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Hemet-South	1211895	McMillan South	26.9	Increasing**	880	Increasing*
Hemet-South	1212013	EMWD 19 Lyon/Menlo	8.7	Increasing	1,215	Increasing*
Hemet-South	1212038	City of Hemet 02	7.1	No Trend	880	No Trend
Hemet-South	1212068	EMWD 22 Sneed	0.7	No Trend	849	No Trend
Hemet-South	1212114	City of Hemet 04	7.5	Increasing*	561	Decreasing
Lakeview/Hemet-North	1211371	Ferriera Dairy	3.1	Increasing**	545	No Trend
Lakeview/Hemet-North	1211448	Archibek	10.7	Decreasing**	805	Increasing
Lakeview/Hemet-North	1211471	EMWD 32 New Dairy-land	1.1	No Trend	1,034	Increasing*
Lakeview/Hemet-North	1211624	Smith C Nuevo/Olivas	9.3	Increasing	2,178	Decreasing**
Menifee	1212680	Agri Leon/Holland	8.9	No Trend	946	No Trend
Menifee	1212744	Abacherli Dairy	12.0	No Trend	2,980	No Trend
Menifee	1212752	EMWD 71 Menifee 01	5.0	Increasing	2,803	Decreasing**
Menifee	1212754	EMWD 73 Menifee 03	5.1	Increasing	2,406	No Trend
Menifee	1212755	EMWD 74 Menifee 04	4.7	No Trend	1,162	No Trend
Perris-North	1210596	Lantz West	16.0	No Trend	525	Decreasing
Perris-North	1210725	EMWD 48 Edgemont 04	17.8	Increasing**	686	Increasing*
Perris-North	1211521	EMWD 56 New Perry	4.8	Increasing	757	Increasing**
Perris-North	1211585	EMWD 57 New Follico	6.0	Increasing**	1,052	Increasing*
Perris-South	1211633	EMWD Skiland 05	0.1	No Trend	1,654	Decreasing
Perris-South	1212350	EMWD Winchester Ponds 02	2.3	No Trend	2,175	Increasing
Perris-South	1212394	EMWD B6	4.3	Increasing**	3,425	Decreasing
Perris-South	1212400	EMWD A1	1.1	No Trend	3,043	Increasing
Perris-South	1212478	EMWD 76 McLaughlin	7.5	Increasing**	1,960	Decreasing*
Perris-South	1212562	EMWD C4	2.3	No Trend	4,696	Decreasing

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B14-4 and B14-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Hemet-South	1212008	USGS Kirby/Florida	Medium	1	12.0	Ave	Medium	1	1,170	Ave
Hemet-South	1212012	City of Hemet 05	High	1	3.4	Ave	High	1	850	Ave
Hemet-South	1212049	Washburn Cornell	Medium	2	0.3	Ave	Medium	2	458	Ave
Hemet-South	1212091	Merriman, Theodora	High	3	4.3	Stat	High	3	675	Stat
Hemet-South	1212109	Seven Hills	High	1	3.4	Ave	High	1	560	Ave
Hemet-South	1212276	Riverside County Airport Warren	Medium	2	3.1	Ave	Medium	2	1,285	Ave
Hemet-South	1212305	USGS Model Air 02	High	1	0.9	Ave	High	1	680	Ave
Hemet-South	1212306	USGS Model Air 03	High	1	4.7	Ave	High	1	1,260	Ave
Hemet-South	1212307	USGS Model Air 04	High	1	3.1	Ave	High	1	1,640	Ave
Hemet-South	1212308	USGS Model Air 05	High	1	3.8	Ave	High	1	3,270	Ave
Lakeview/Hemet-North	1211349	Hammerschmidt 02	Medium	5	0.7	Stat	Medium	5	828	Stat
Lakeview/Hemet-North	1211354	Walker Lakeview	Medium	4	7.1	Stat	Medium	4	744	Stat
Lakeview/Hemet-North	1211440	Lauda Diesel	Medium	5	1.4	Stat	Medium	5	3,756	Stat
Lakeview/Hemet-North	1211616	Bean Reservoir/12th	Medium	4	6.9	Stat	Medium	4	2,366	Stat
Menifee	1212582	EMWD 54 Menifee Test West	Medium	4	2.1	Stat	Medium	4	2,451	Stat
Menifee	1212808	DeJong Dairy	High	1	9.2	Ave	High	1	1,050	Ave

Continue on next page...

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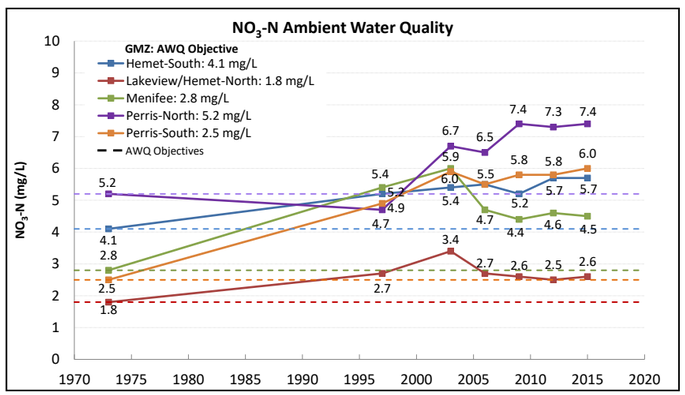
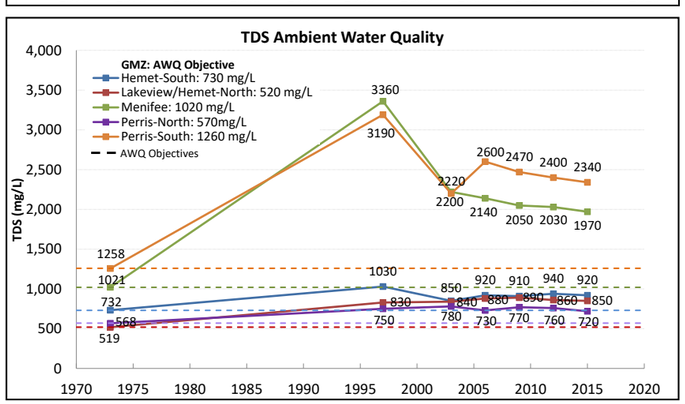
B14-6 Key Well Analysis Charts

	Basin Analytics	Hemet-South	Lakeview/ Hemet-North	Menifee	Perris-North	Perris-South
Basin	GMZ Area (acres)	25,200	17,500	5,630	38,000	25,200
	Volume of Storage (acre-ft)	453,000	541,000	105,314	452,000	760,000
NO_3-N	Wells per GMZ	63	81	22	44	71
	Point Statistics per GMZ	40	55	75	33	49
	Total Mass (tons)	3,500	1,940	640	4,510	6,160
	1996-2015 AWQ	5.7	2.6	4.5	7.4	6
TDS	Wells per GMZ	63	81	22	44	71
	Point Statistics per GMZ	40	64	20	37	53
	Total Mass (tons)	567,000	624,000	282,000	441,000	2,420,000
	1996-2015 AWQ	920	850	1970	720	2340

Table 1 - Basin Analytics





Nitrate as Nitrogen Continued

Perris-South

The nitrate objective for Perris-South is 2.5 mg/L. The ambient nitrate concentration increased from 5.8 mg/L in 2012 to 6.0 mg/L in 2015, and there is no assimilative capacity. Two out of the six key wells in Perris-South GMZ have an increasing trend in nitrate concentrations, while the other four show no trends in the nitrate concentrations. Six of the total 71 wells with nitrate values in Perris-South will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. Six new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and two wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

Hemet-South

The TDS objective for Hemet-South is 730 mg/L. The ambient TDS concentration was decreased from 940 mg/L in 2012 to 920 mg/L in 2015, and there is no assimilative capacity. Two out of the five key wells in Hemet-South GMZ have an increasing trend in TDS concentrations, one well shows a decreasing trend, and the other two show no trends in the TDS concentrations. Seven of the total 63 wells with TDS values in Hemet-South will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and five wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Lakeview/Hemet-North

The TDS objective for Lakeview/Hemet-North is 520 mg/L. The ambient TDS concentration was decreased from 860 mg/L in 2012 to 850 mg/L in 2015, and there is no assimilative capacity. Two out of the four key wells in Lakeview/Hemet-North GMZ have an increasing trend in TDS concentrations, one well shows a decreasing trend, and the other one shows no trend in the TDS concentration. Three new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and five wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Menifee

The TDS objective for Menifee is 1020 mg/L. The ambient TDS concentration was decreased from 2030 mg/L in 2012 to 1970 mg/L in 2015, and there is no assimilative capacity. One out of the five key wells in Menifee GMZ have a decreasing trend in TDS concentrations, while the other four show no trends in the TDS concentrations. One of the total 22 wells with TDS values in Menifee will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Perris-North

The TDS objective for Perris-North is 570 mg/L. The ambient TDS concentration was decreased from 760 mg/L in 2012 to 720 mg/L in 2015, and there is no assimilative capacity. Three out of the four key wells in Perris-North GMZ have an increasing trend in TDS concentrations, while the other one shows a decreasing trend. Three of the total 44 wells with TDS values in Perris-North will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Perris-South

The TDS objective for Perris-South is 1260 mg/L. The ambient TDS concentration was decreased from 2400 mg/L in 2012 to 2340 mg/L in 2015, and there is no assimilative capacity. Two out of the six key wells in Perris-South GMZ have an increasing trend in TDS concentrations, while the other four show a decreasing trend. Six of the total 71 wells with TDS values in Perris-South will not be eligible for the next AWQ recomputation if not sampled prior to 2018. Six new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and two wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Perris-North	1210632	Sunnymead Poultry Cottonwood	High	2	40.0	Ave	High	2	1,265	Ave
Perris-North	1210686	UCR Coray	Medium	5	1.7	Stat	Medium	5	625	Stat
Perris-North	1211522	AG Sod Dawes	High	2	4.4	Ave	High	2	1,075	Ave
Perris-North	1211545	Bean Rider East	Medium	1	5.6	Ave	Medium	1	520	Ave
Perris-North	1211584	EMWD 52 Follico	Medium	1	6.3	Ave	Medium	1	1,000	Ave
Perris-North	1211701	Clark Reservoir	High	2	6.6	Ave	High	2	575	Ave
Perris-South	1211645	Harries	High	1	2.6	Ave	High	1	14,800	Ave
Perris-South	1211646	Kreuzer	High	1	8.8	Ave	High	1	2,420	Ave
Perris-South	1212346	Solar Aqua Farms	Medium	4	12.5	Stat	Medium	4	3,881	Stat
Perris-South	1212405	Smith C Mapes OC	High	1	0.1	Ave	High	1	1,240	Ave
Perris-South	1212488	Wilderness Pines Xmas Tree Farm	High	1	4.7	Ave	High	1	1,455	Ave
Perris-South	1212489	12767 Underwood 0.5 Miles W of Menifee/McCall	High	1	4.7	Ave	High	1	1,455	Ave
Perris-South	1212507		Medium	1	8.5	Ave	Medium	1	1,130	Ave
Perris-South	1212524	USGS Menifee/McCall	High	1	15.0	Ave	High	1	1,370	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

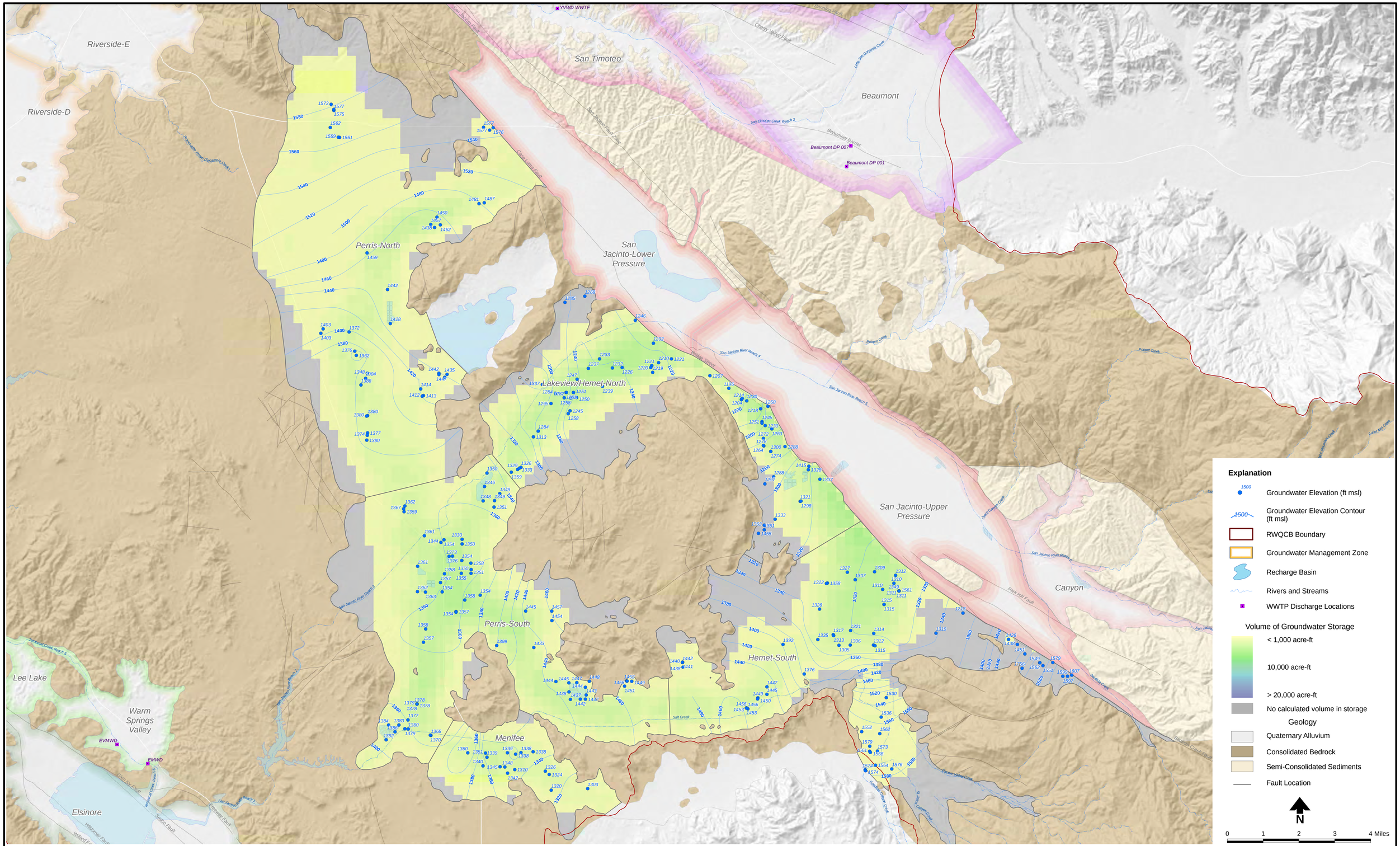
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. Greyed out sites indicate wells which have been destroyed. See Attachment B14-4 and B14-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Hemet-South	1232135	MWD BH-03	--	2	21.3	Ave	New*	2	1,225	Ave
Hemet-South	1232136	MWD BH-04	--	2	17.5	Ave	New*	2	920	Ave
Hemet-South	1232137	MWD BH-06	--	2	28.0	Ave	New*	2	1,060	Ave
Hemet-South	2000091	City of Hemet 02A	New*	1	7.5	Ave	New*	1	770	Ave
Hemet-South	2000115	Rheingans South Property Line	New*	2	9.0	Ave	New*	2	505	Ave
Lakeview/Hemet-North	2000137	HE-2	New	3	0.2	Stat	New	3	945	Stat
Lakeview/Hemet-North	2000138	HE-3	New	3	23.8	Stat	New	3	1,341	Stat
Lakeview/Hemet-North	2000140	HE-5	New	3	19.6	Stat	New	3	657	Stat
Lakeview/Hemet-North	2000139	HE-4	New	3	0.4	Stat	New*	3	1,100	Ave
Lakeview/Hemet-North	1210917	Pinheiro Matson	New*	2	6.2	Ave	New*	2	520	Ave
Lakeview/Hemet-North	1210920	EMWD Pinheiro Record	New*	2	2.1	Ave	New*	2	750	Ave
Lakeview/Hemet-North	2000093	EMWD Buena Vida Clubhouse	New*	2	3.4	Ave	New*	2	600	Ave
Lakeview/Hemet-North	2000114	NWC 15	New*	2	9.4	Ave	New*	2	500	Ave
Perris-South	2000102	EMWD Trumble MW-1	New	3	10.2	Stat	New	3	1,058	Stat
Perris-South	2000116	Smith C Jackson	New	3	7.3	Stat	New	3	1,112	Stat
Perris-South	2000120	DG-10	New	3	158.7	Stat	New	3	4,570	Stat
Perris-South	2000124	DG-4	New	3	8.0	Stat	New	3	637	Stat
Perris-South	2000129	DG-8b	New	3	5.3	Stat	New	3	1,527	Stat
Perris-South	2000130	DG-9	New	3	64.8	Stat	New	3	1,582	Stat
Perris-South	2000103	EMWD Trumble MW-3	New*	2	12.7	Ave	New*	2	985	Ave
Perris-South	2000128	DG-8a	New*	1	5.0	Ave	New*	1	1,600	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B14-4 and B14-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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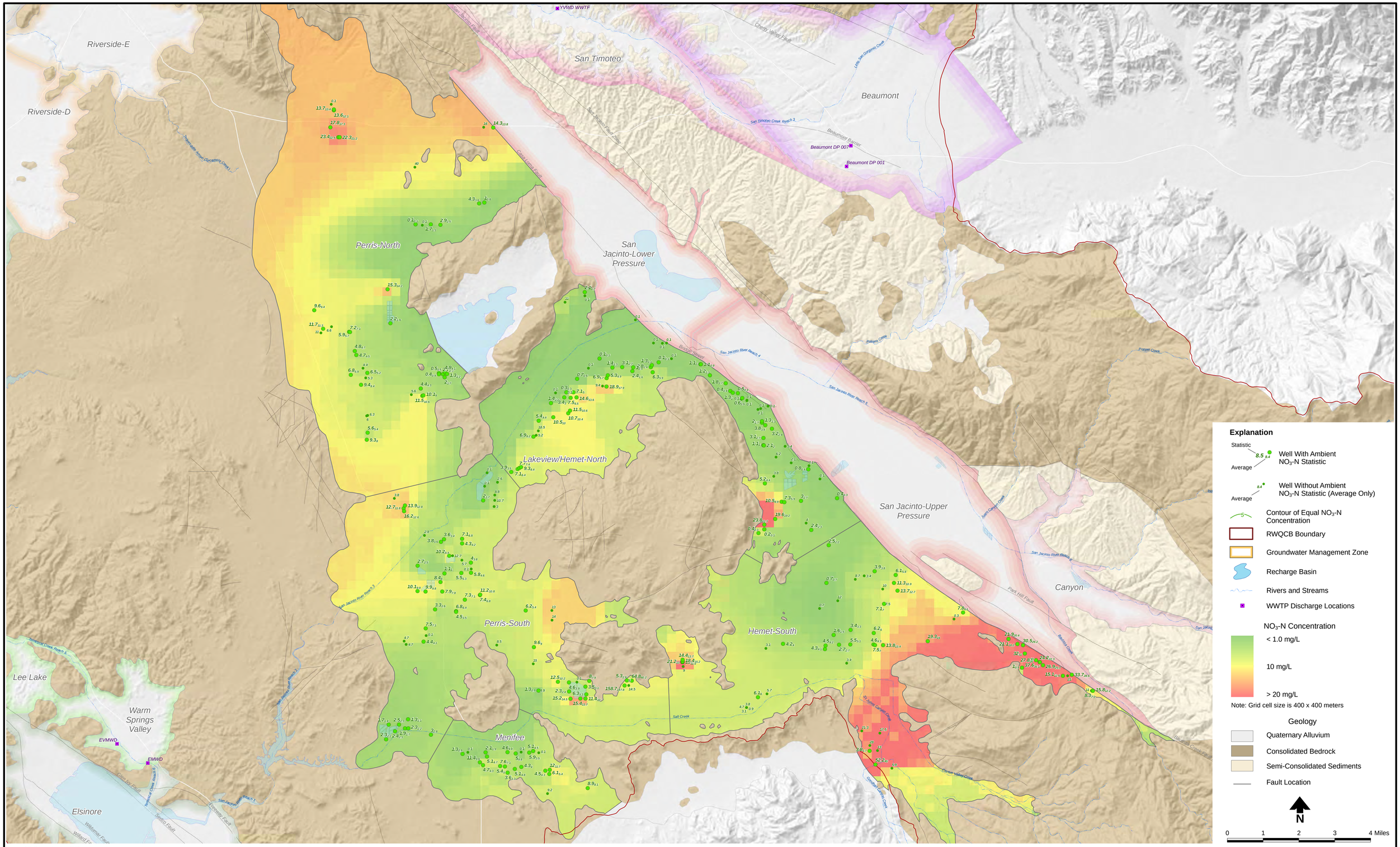
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Spring 2015
San Jacinto GMZs

Attachment B14-1



Source: SAWPA.net, January 2017

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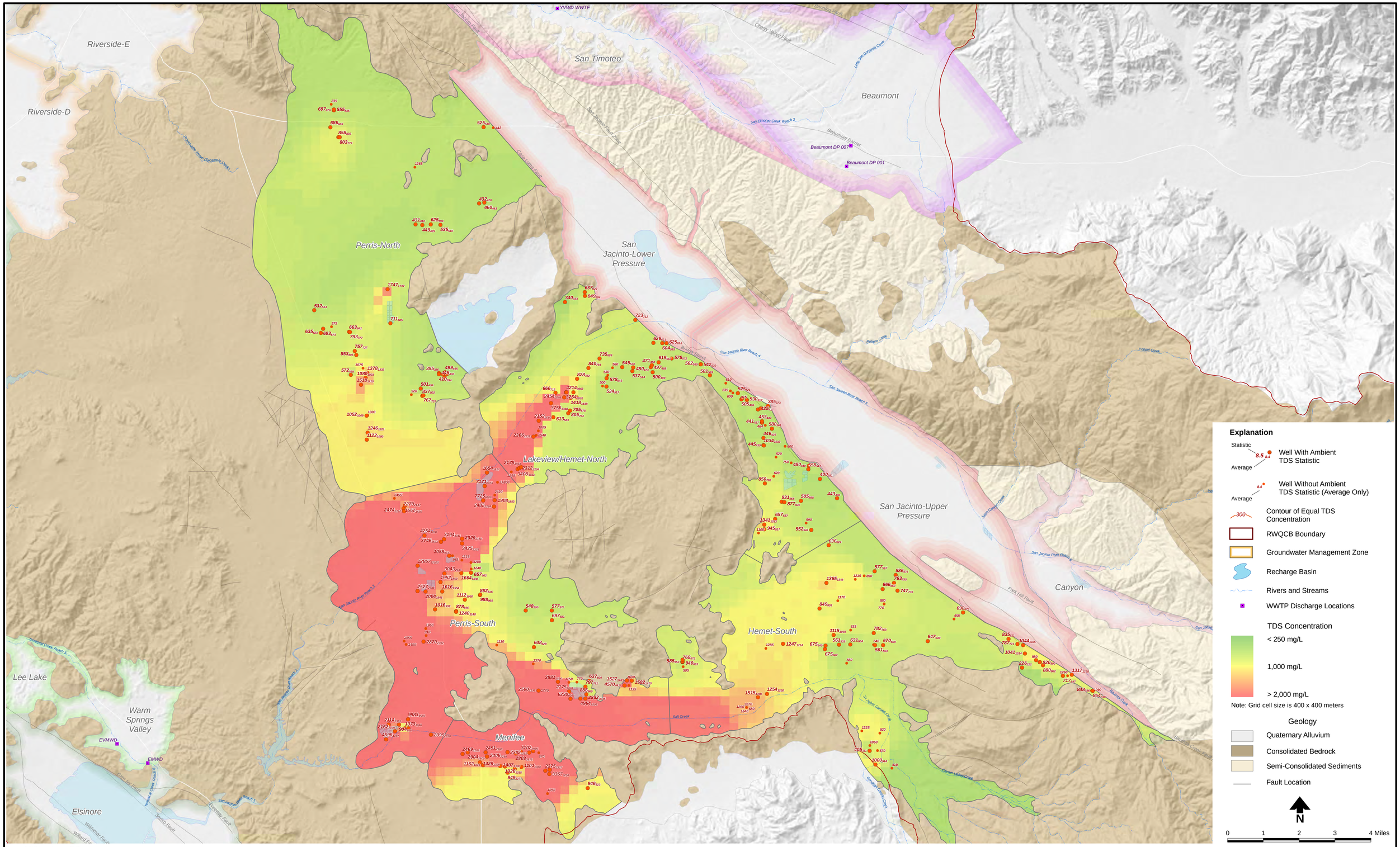
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
NO_3-N Concentration and Contour Map
San Jacinto GMZs

Attachment B14-2



Source: SAWPA.net, January 2017

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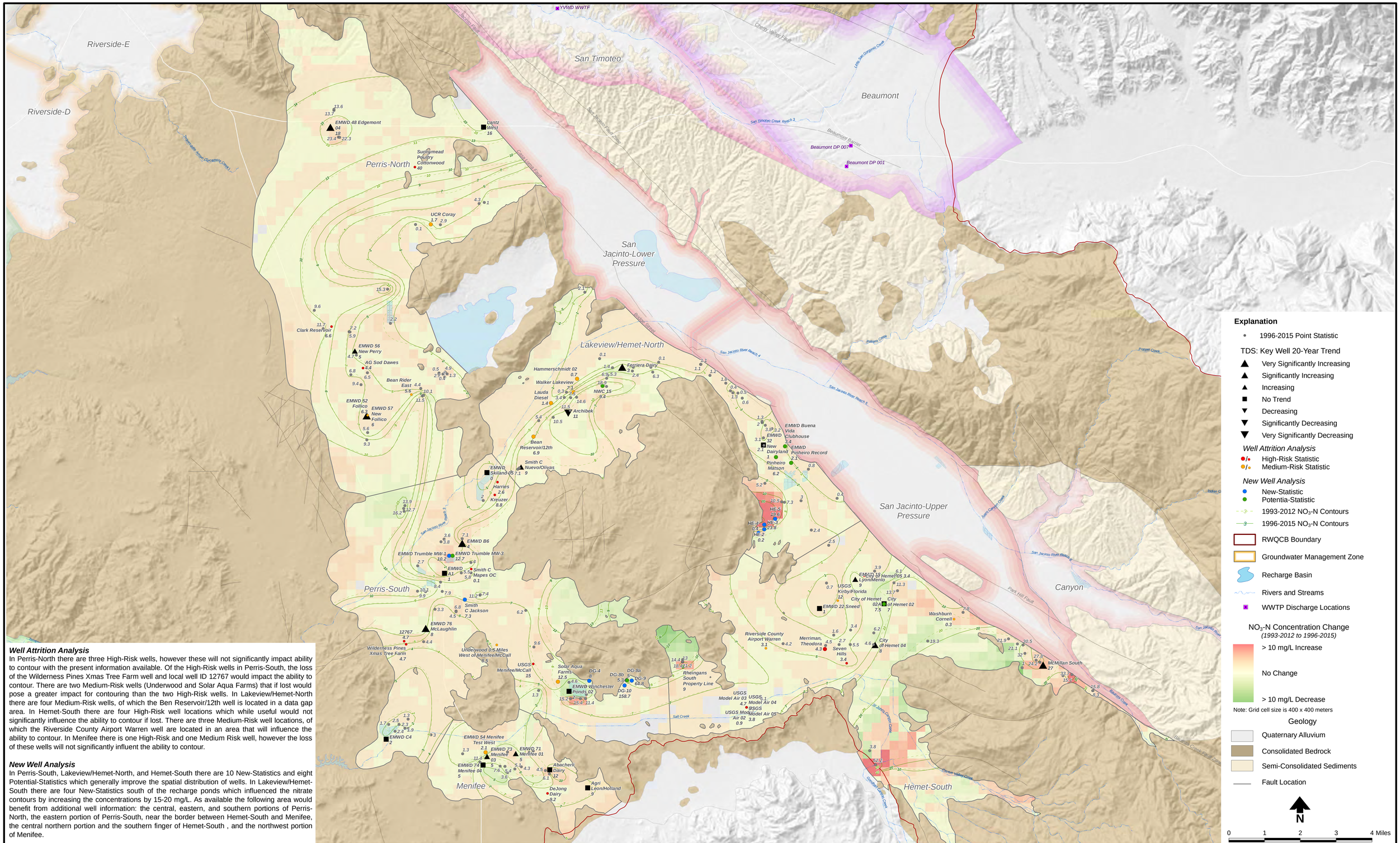
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)
TDS Concentration and Contour Map
San Jacinto GMZs

Attachment B14-3



Well Attrition Analysis

In Perris-North there are three High-Risk wells, however these will not significantly impact ability to contour with the present information available. Of the High-Risk wells in Perris-South, the loss of the Wilderness Pines Xmas Tree Farm well and local well ID 12767 would impact the ability to contour. There are two Medium-Risk wells (Underwood and Solar Aqua Farms) that if lost would pose a greater impact for contouring than the two High-Risk wells. In Lakeview/Hemet-North there are four Medium-Risk wells, of which the Ben Reservoir/12th well is located in a data gap area. In Hemet-South there are four High-Risk well locations which while useful would not significantly influence the ability to contour if lost. There are three Medium-Risk well locations, of which the Riverside County Airport Warren well are located in an area that will influence the ability to contour. In Menifee there is one High-Risk and one Medium Risk well, however the loss of these wells will not significantly influent the ability to contour.

New Well Analysis

In Perris-South, Lakeview/Hemet-North, and Hemet-South there are 10 New-Statistics and eight Potential-Statistics which generally improve the spatial distribution of wells. In Lakeview/Hemet-South there are four New-Statistics south of the recharge ponds which influenced the nitrate contours by increasing the concentrations by 15-20 mg/L. As available the following area would benefit from additional well information: the central, eastern, and southern portions of Perris-North, the eastern portion of Perris-South, near the border between Hemet-South and Menifee, the central northern portion and the southern finger of Hemet-South , and the northwest portion of Menifee.

Source: SAWPA.net, January 2017

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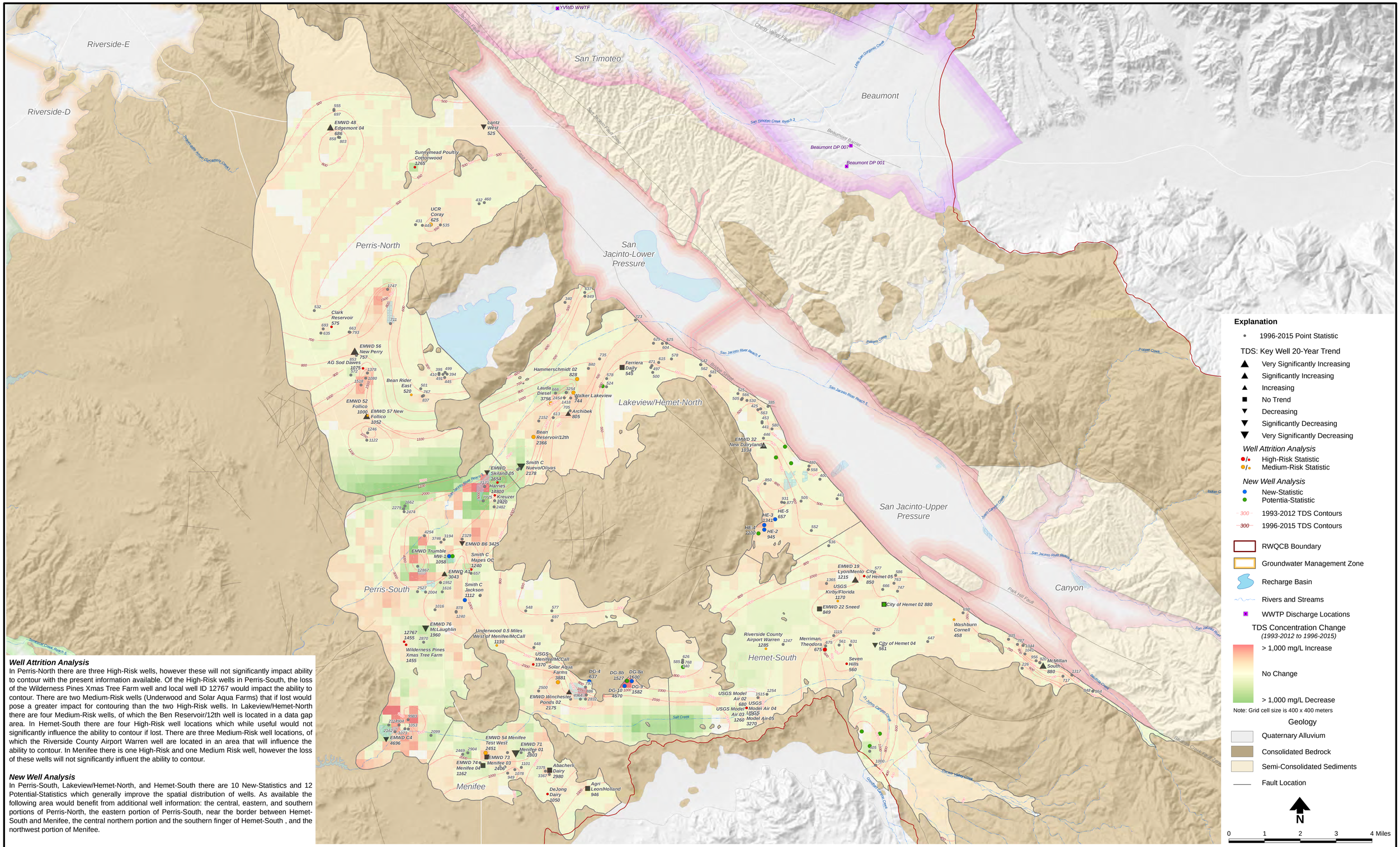
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)

San Jacinto GMZs

Attachment B14-4



Well Attrition Analysis

In Perris-North there are three High-Risk wells, however these will not significantly impact ability to contour with the present information available. Of the High-Risk wells in Perris-South, the loss of the Wilderness Pines Xmas Tree Farm well and local well ID 12767 would impact the ability to contour. There are two Medium-Risk wells (Underwood and Solar Aqua Farms) that if lost would pose a greater impact for contouring than the two High-Risk wells. In Lakeview/Hemet-North there are four Medium-Risk wells, of which the Ben Reservoir/12th well is located in a data gap area. In Hemet-South there are four High-Risk well locations which while useful would not significantly influence the ability to contour if lost. There are three Medium-Risk well locations, of which the Riverside County Airport Warren well are located in an area that will influence the ability to contour. In Menifee there is one High-Risk and one Medium Risk well, however the loss of these wells will not significantly influent the ability to contour.

New Well Analysis

In Perris-South, Lakeview/Hemet-North, and Hemet-South there are 10 New-Statistics and 12 Potential-Statistics which generally improve the spatial distribution of wells. As available the following area would benefit from additional well information: the central, eastern, and southern portions of Perris-North, the eastern portion of Perris-South, near the border between Hemet-South and Menifee, the central northern portion and the southern finger of Hemet-South , and the northwest portion of Menifee.

Source: SAWPA.net, January 2017

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SAWPA

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)

San Jacinto GMZs

Attachment B14-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

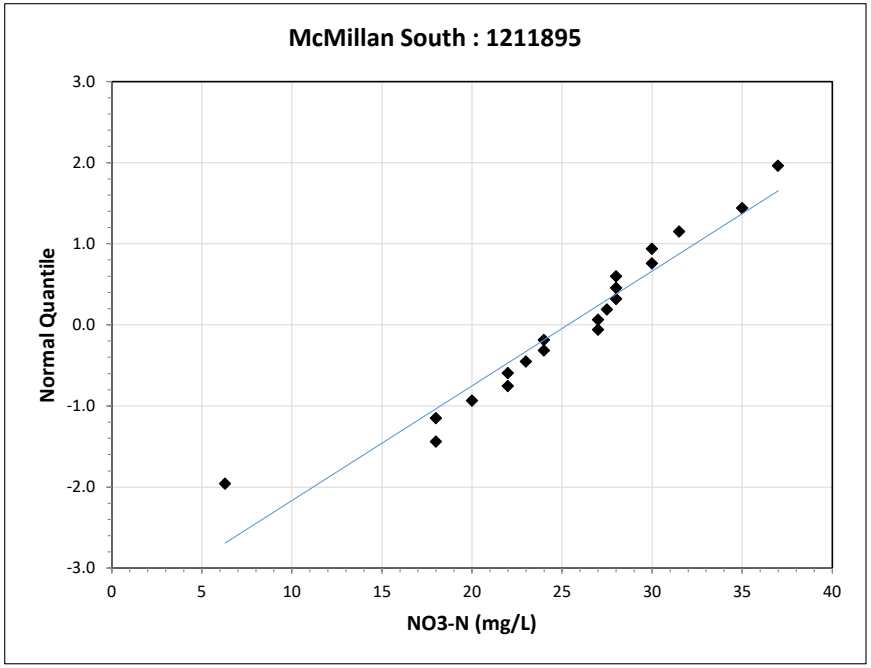
Mann-Kendall

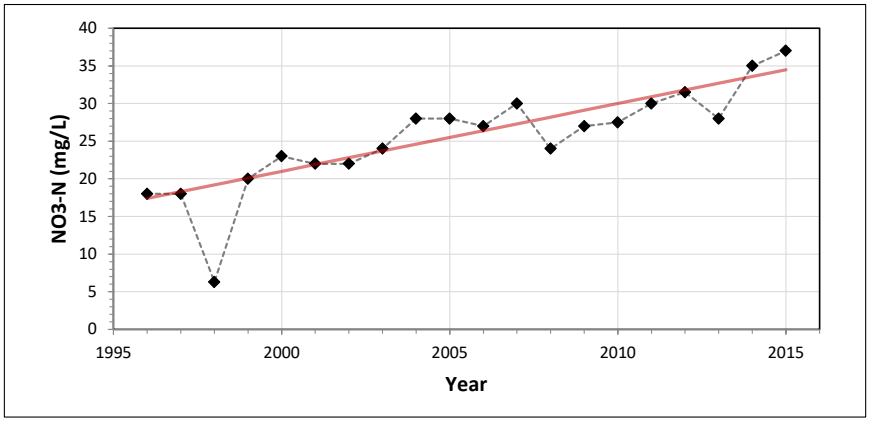
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

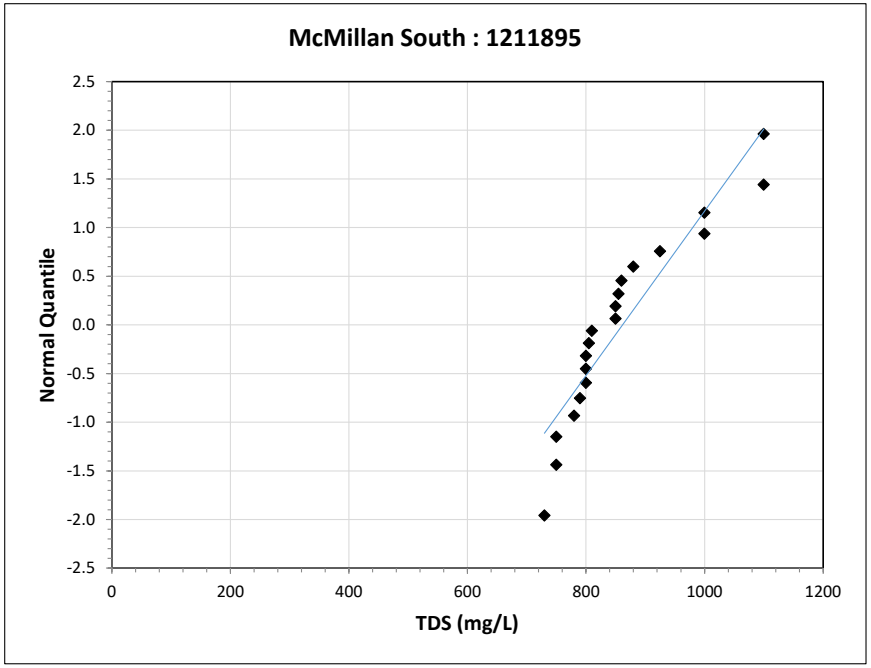
The significance of the trends is notated by * for significant and ** for very significant.

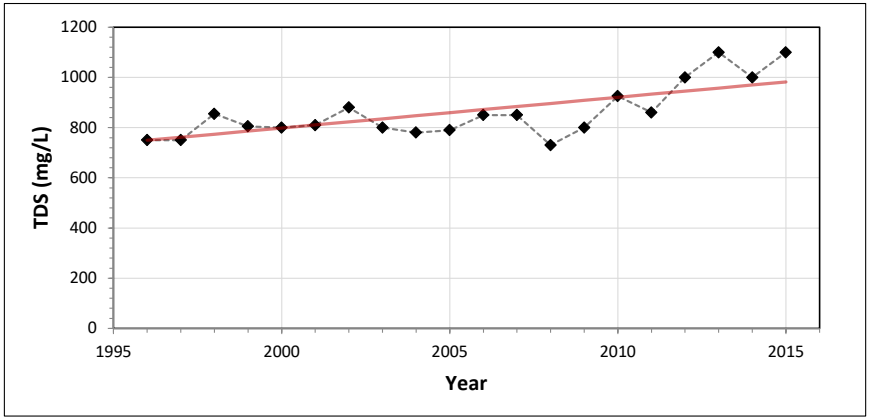
Statistics	
GMZ	Hemet-South
Well Name : ID	McMillan South : 1211895
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	6.30
Annual Average Max	37.00
Annual Average Mean	25.32
Annual Average Stdev	6.78
Shapiro-Wilk W	0.940
Shapiro-Wilk p-value	0.236
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	1.52
Student t	1.02
Mean + t*SE (UCL84)	26.86
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	144
Var(S)	941
Intercept	-1779
Slope	0.90
p-value	3E-6
Significant Trend?	Increasing**



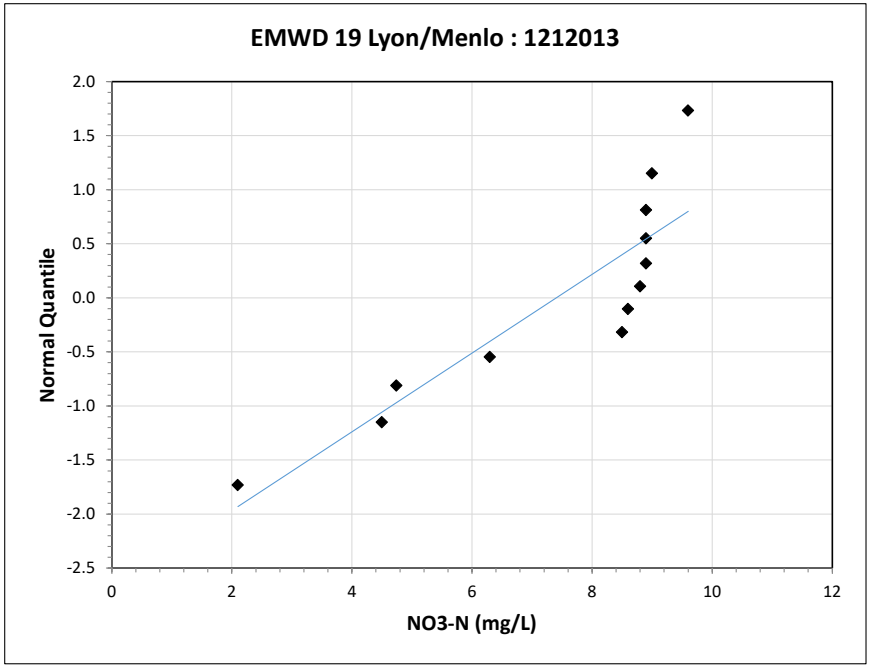


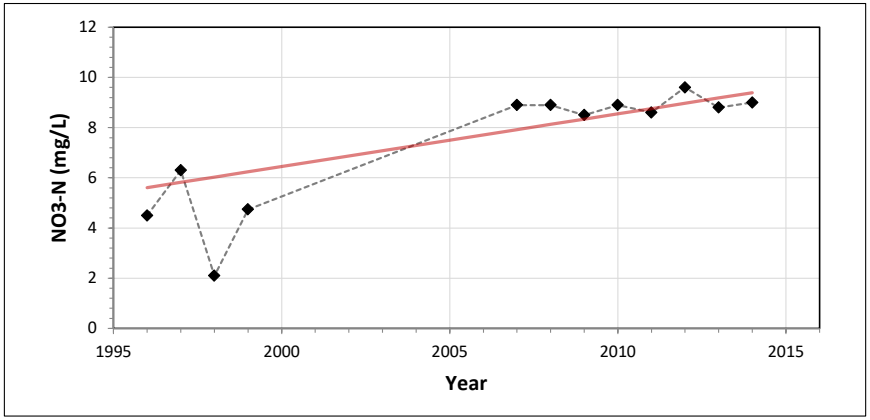
Statistics	
GMZ	Hemet-South
Well Name : ID	McMillan South : 1211895
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	730
Annual Average Max	1100
Annual Average Mean	862
Annual Average Stdev	109.52
Shapiro-Wilk W	0.863
Shapiro-Wilk p-value	0.009
Critical Alpha	0.01
Most Discordant Value	1100
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.029
Geomean	856
GM + t*GSE (UCL84)	880
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	93
Var(S)	942
Intercept	-23702
Slope	12.25
p-value	0.003
Significant Trend?	Increasing*





Statistics	
GMZ	Hemet-South
Well Name : ID	EMWD 19 Lyon/Menlo : 1212013
Analyte	NO3-N (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	2.10
Annual Average Max	9.60
Annual Average Mean	7.40
Annual Average Stdev	2.40
Shapiro-Wilk W	0.779
Shapiro-Wilk p-value	0.005
Critical Alpha	0.01
Most Discordant Value	2.10
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.001
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	8.70
Trend Analysis	**Theil-Sen**
Kendall S	37
Var(S)	209
Intercept	-414
Slope	0.21
p-value	0.013
Significant Trend?	Increasing





Statistics	
GMZ	Hemet-South
Well Name : ID	EMWD 19 Lyon/Menlo : 1212013
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	750
Annual Average Max	1300
Annual Average Mean	1090
Annual Average Stdev	243.31
Shapiro-Wilk W	0.753
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	750
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	1215
Trend Analysis	**Theil-Sen**
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Var(S)	209
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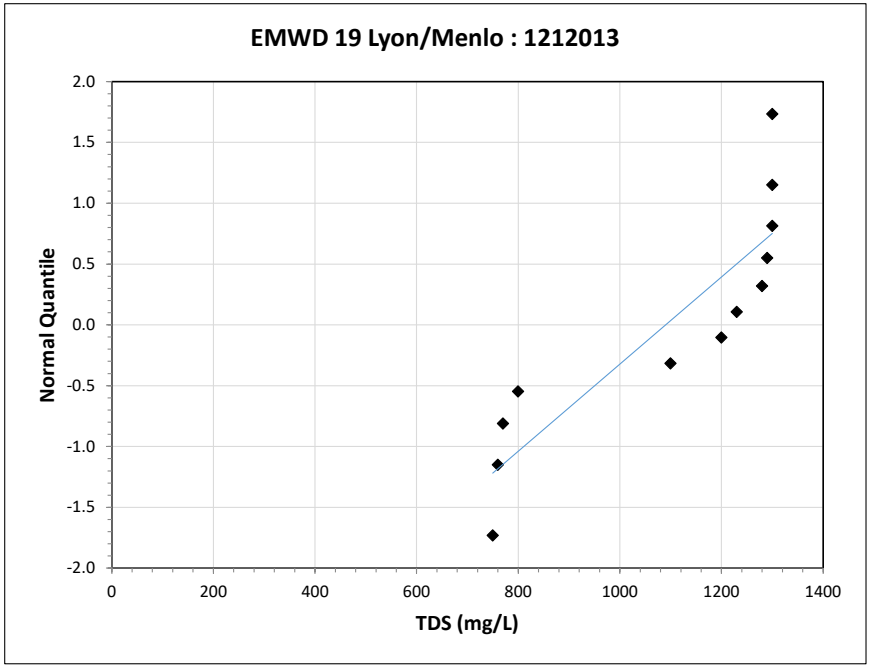
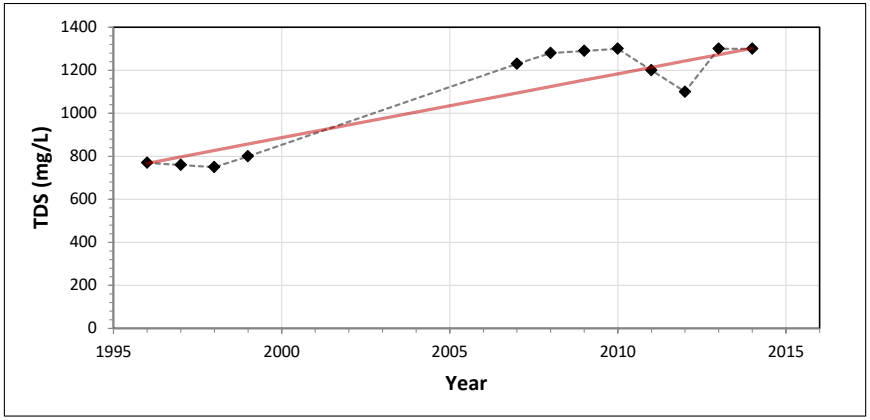
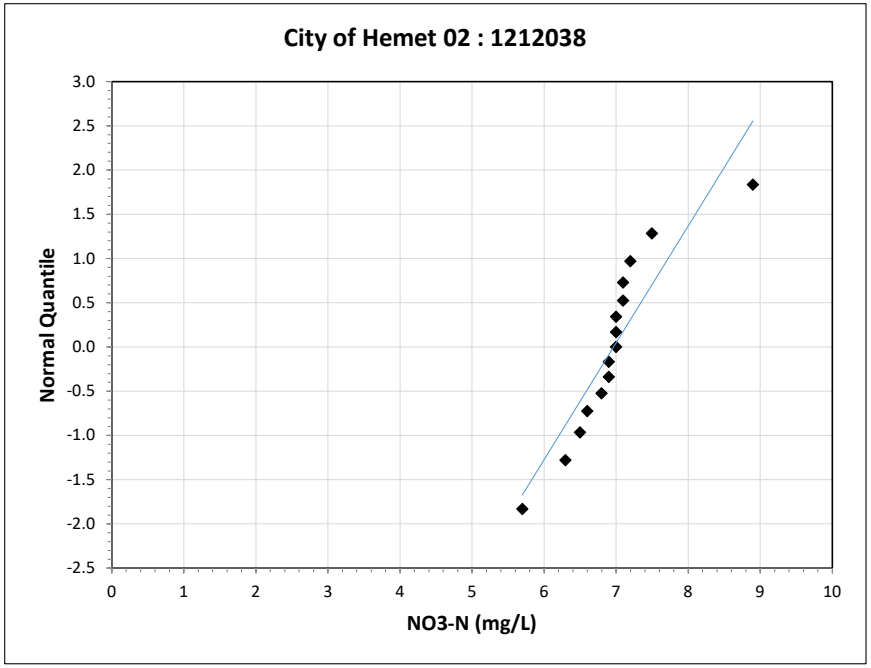
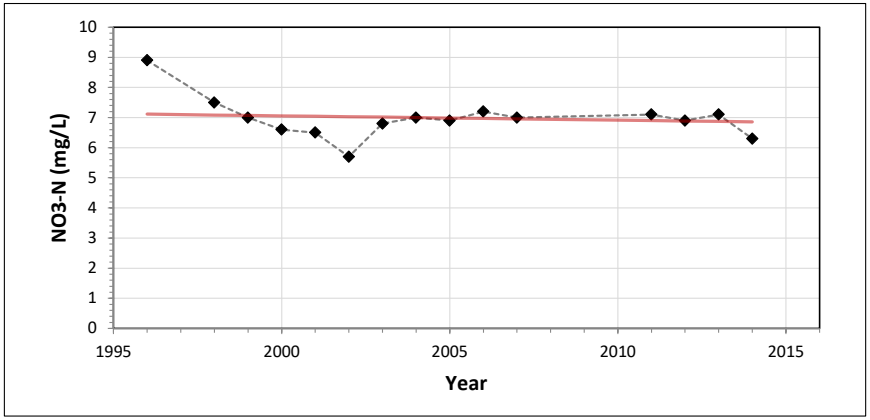
Slope	29.72
p-value	0.009
Significant Trend?	Increasing*



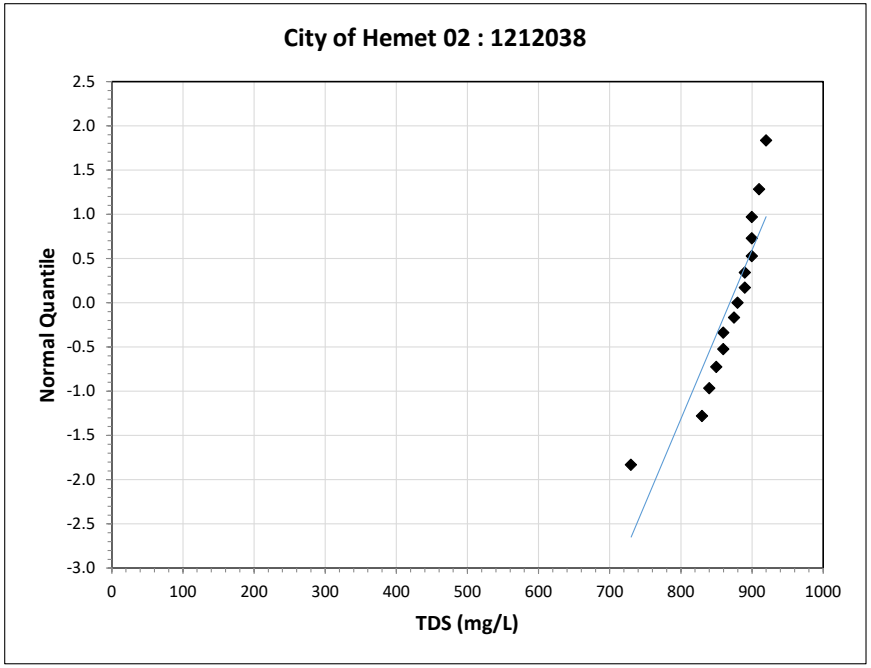


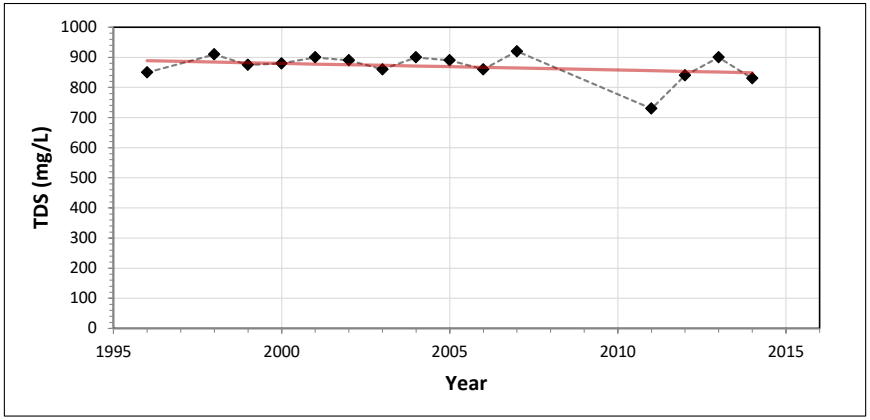
Statistics	
GMZ	Hemet-South
Well Name : ID	City of Hemet 02 : 1212038
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	5.70
Annual Average Max	8.90
Annual Average Mean	6.97
Annual Average Stdev	0.68
Shapiro-Wilk W	0.855
Shapiro-Wilk p-value	0.020
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.03
Mean + t*SE (UCL84)	7.15
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-9
Var(S)	404
Intercept	35.60
Slope	-0.01
p-value	0.690
Significant Trend?	No



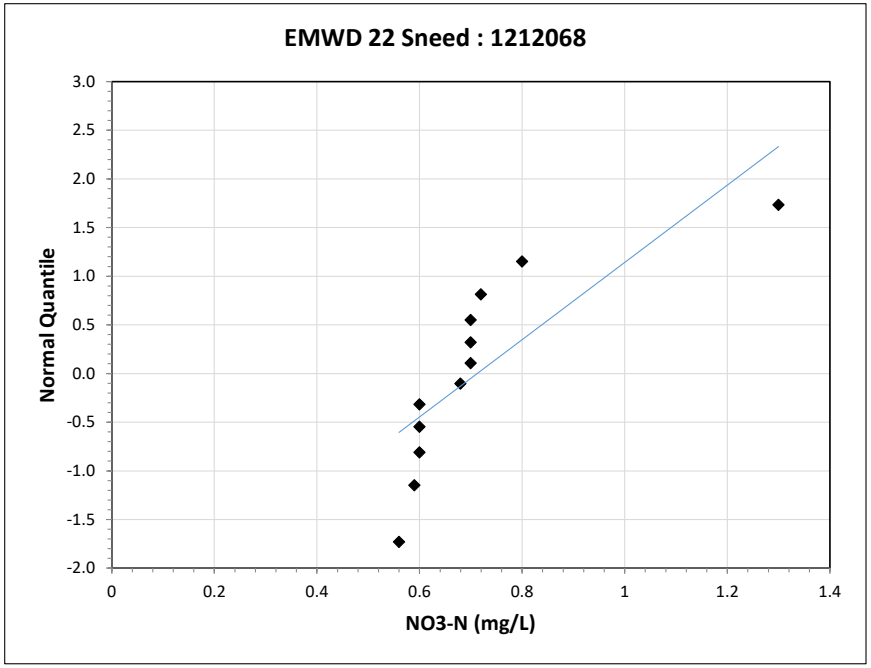


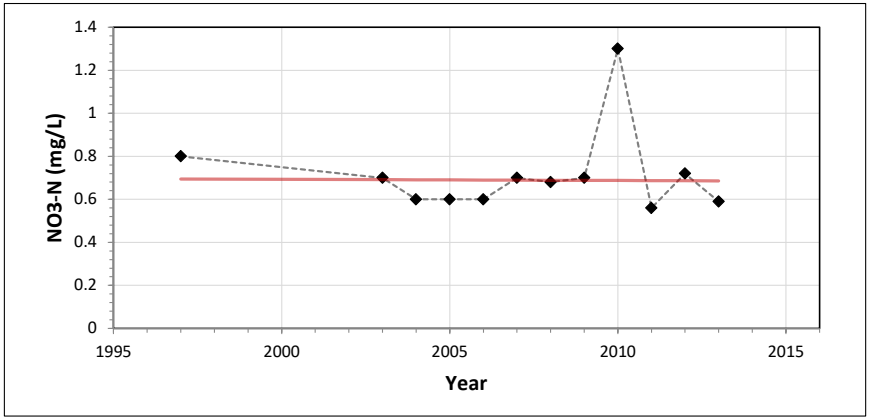
Statistics	
GMZ	Hemet-South
Well Name : ID	City of Hemet 02 : 1212038
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	730
Annual Average Max	920
Annual Average Mean	869
Annual Average Stdev	46.61
Shapiro-Wilk W	0.814
Shapiro-Wilk p-value	0.006
Critical Alpha	0.01
Most Discordant Value	730
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	880
Trend Analysis	**Theil-Sen**
Kendall S	-16
Var(S)	403
Intercept	5324
Slope	-2.22
p-value	0.455
Significant Trend?	No



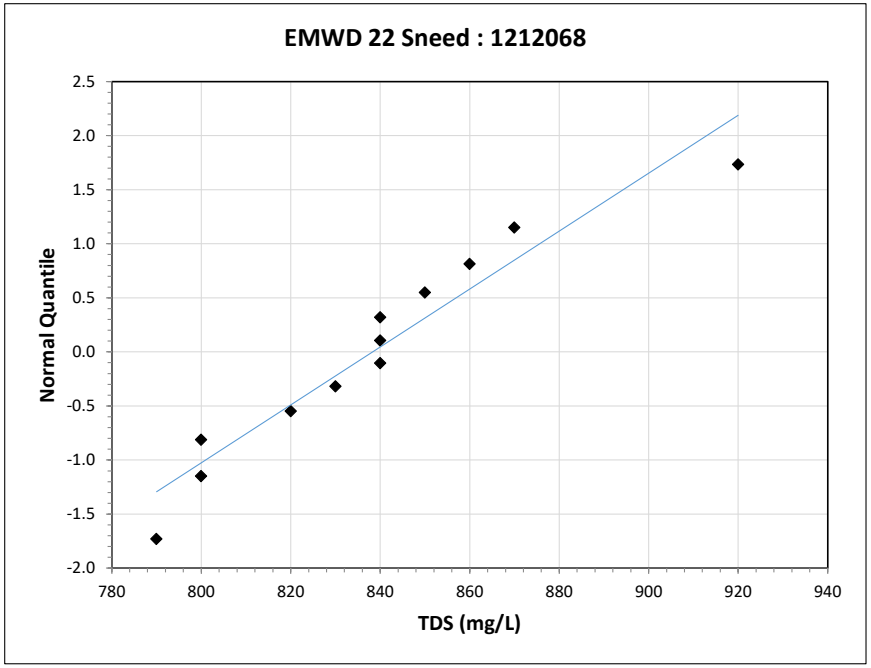


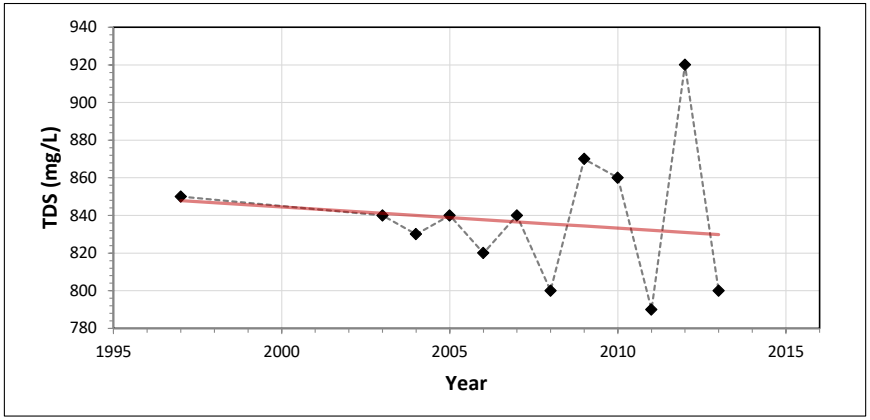
Statistics	
GMZ	Hemet-South
Well Name : ID	EMWD 22 Sneed : 1212068
Analyte	NO3-N (mg/L)
Count	12
Count Detects	12
Sample Year Min	1997
Sample Year Max	2013
Annual Average Min	0.56
Annual Average Max	1.30
Annual Average Mean	0.71
Annual Average Stdev	0.20
Shapiro-Wilk W	0.649
Shapiro-Wilk p-value	3E-4
Critical Alpha	0.01
Most Discordant Value	1.30
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.003
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.69
Trend Analysis	**Theil-Sen**
Kendall S	-6
Var(S)	205
Intercept	1.80
Slope	0.00
p-value	0.727
Significant Trend?	No



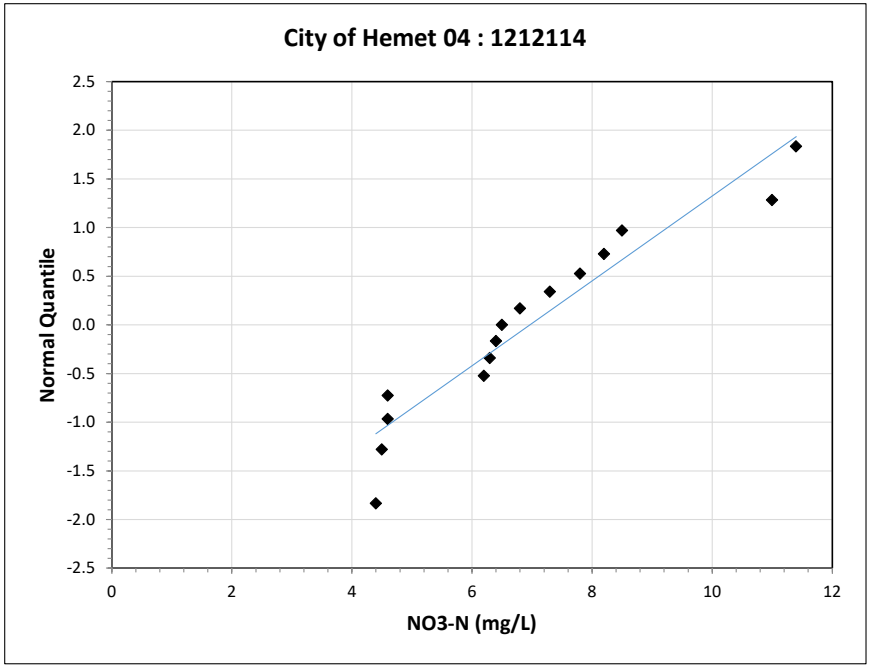


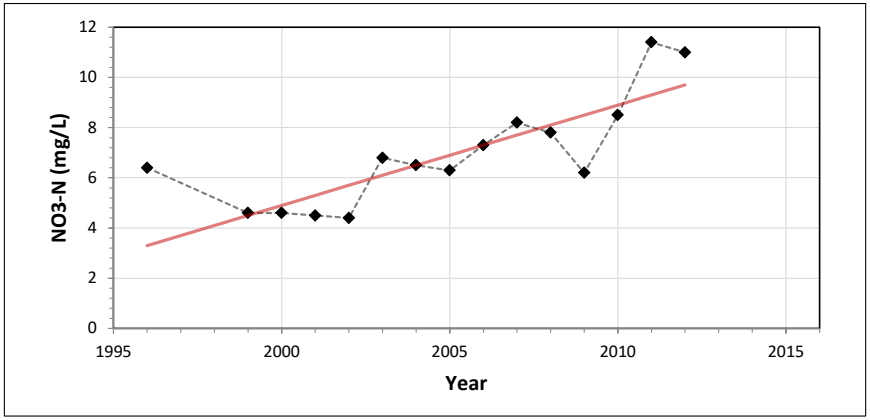
Statistics	
GMZ	Hemet-South
Well Name : ID	EMWD 22 Sneed : 1212068
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1997
Sample Year Max	2013
Annual Average Min	790
Annual Average Max	920
Annual Average Mean	838
Annual Average Stdev	35.63
Shapiro-Wilk W	0.934
Shapiro-Wilk p-value	0.424
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	10.29
Student t	1.04
Mean + t*SE (UCL84)	849
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-6
Var(S)	208
Intercept	3095
Slope	-1.13
p-value	0.729
Significant Trend?	No



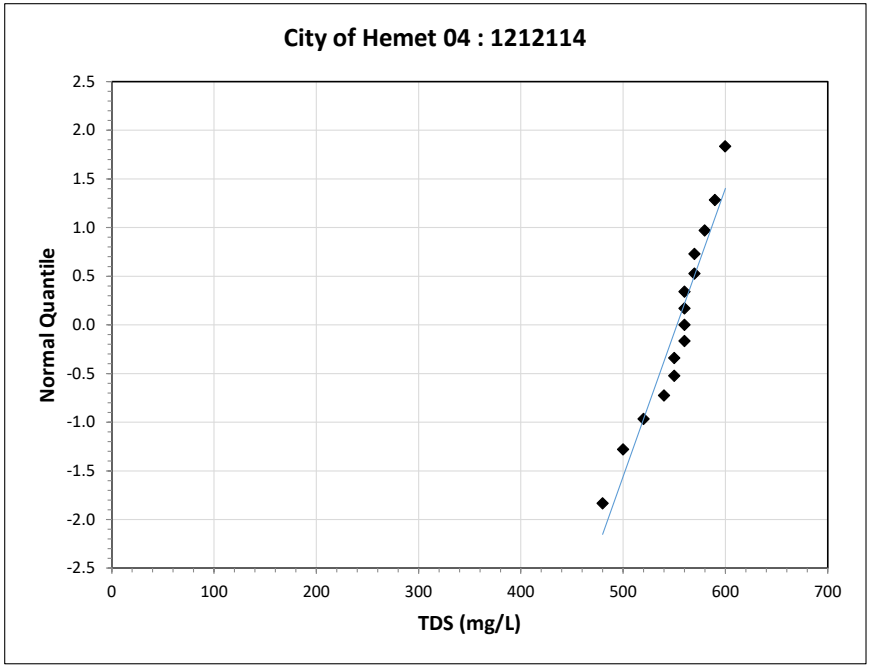


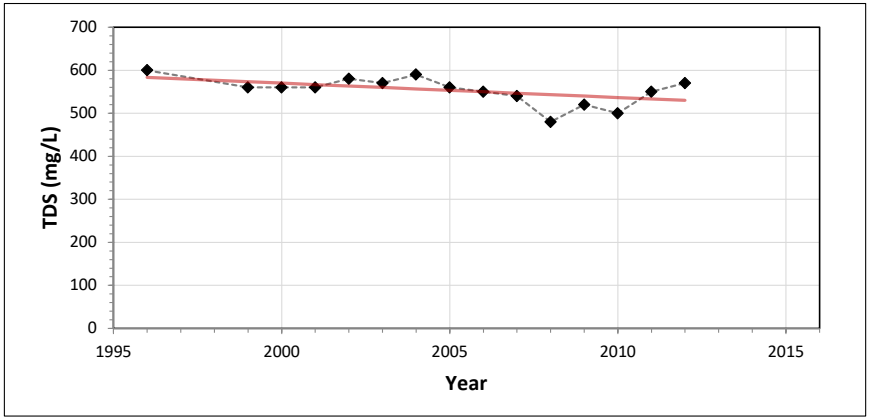
Statistics	
GMZ	Hemet-South
Well Name : ID	City of Hemet 04 : 1212114
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	4.40
Annual Average Max	11.40
Annual Average Mean	6.97
Annual Average Stdev	2.17
Shapiro-Wilk W	0.903
Shapiro-Wilk p-value	0.107
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.56
Student t	1.03
Mean + t*SE (UCL84)	7.54
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	60
Var(S)	407
Intercept	-795
Slope	0.40
p-value	0.003
Significant Trend?	Increasing*



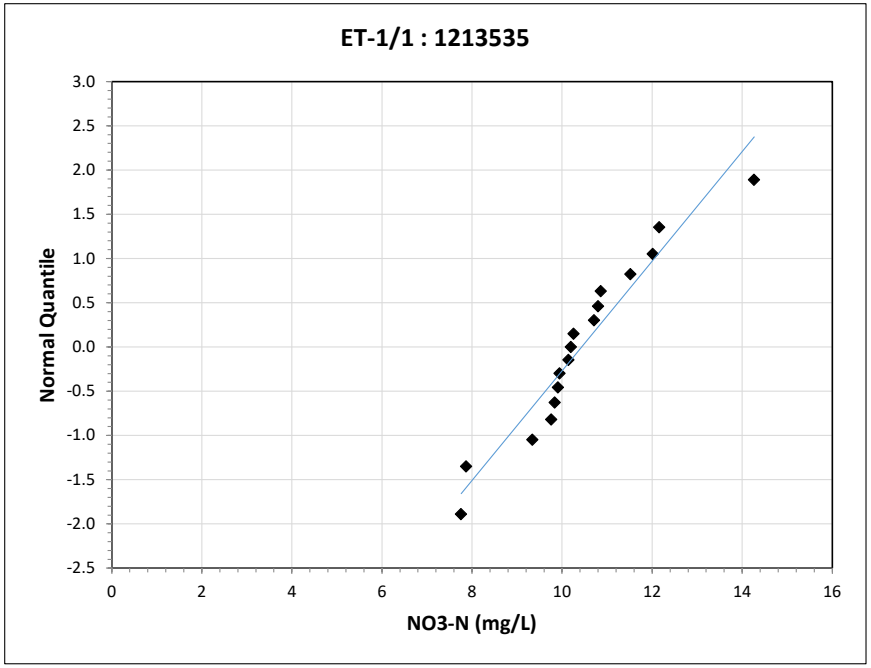


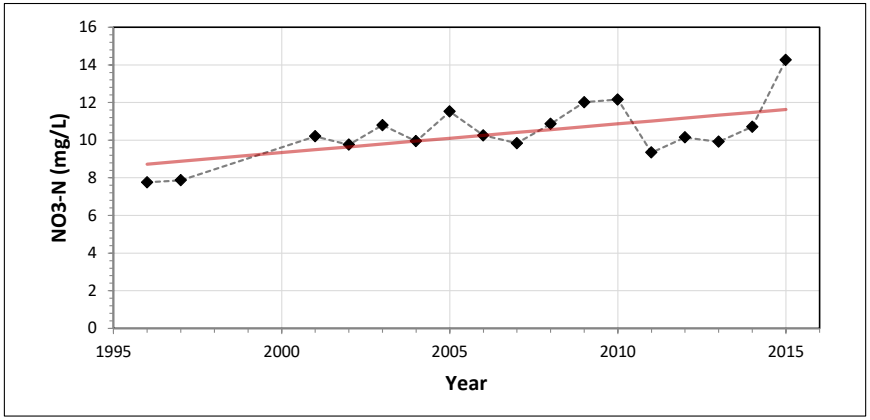
Statistics	
GMZ	Hemet-South
Well Name : ID	City of Hemet 04 : 1212114
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1996
Sample Year Max	2012
Annual Average Min	480
Annual Average Max	600
Annual Average Mean	553
Annual Average Stdev	32.18
Shapiro-Wilk W	0.924
Shapiro-Wilk p-value	0.224
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.31
Student t	1.03
Mean + t*SE (UCL84)	561
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-43
Var(S)	398
Intercept	7237
Slope	-3.33
p-value	0.035
Significant Trend?	Decreasing



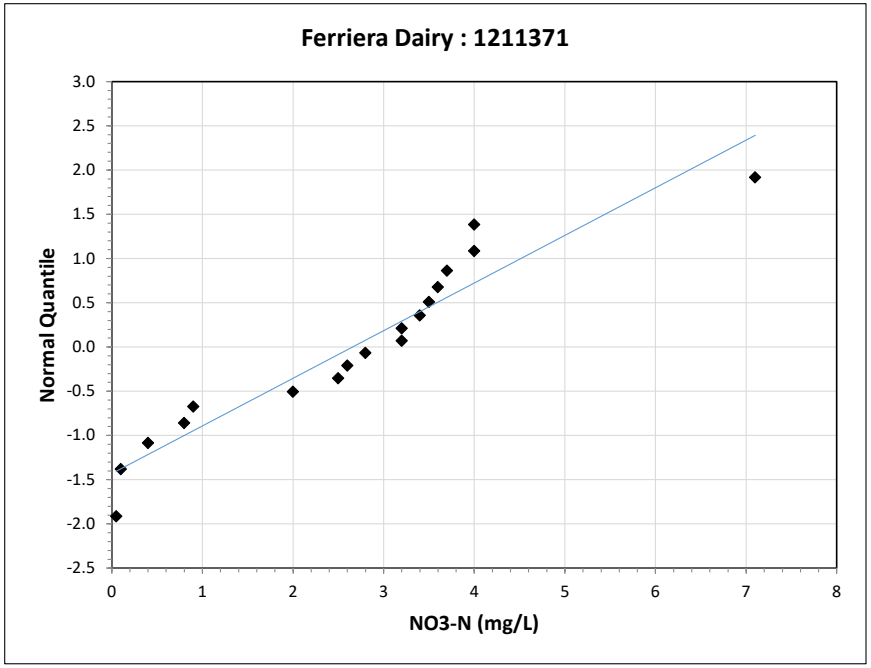


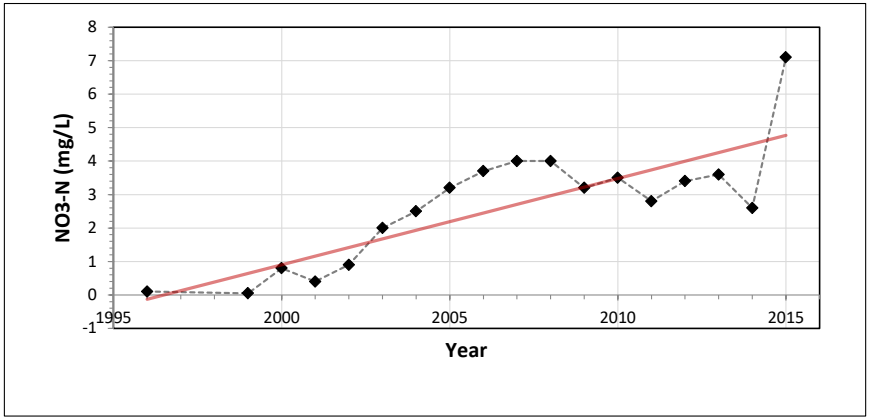
Statistics	
GMZ	Irvine
Well Name : ID	ET-1/1 : 1213535
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	7.76
Annual Average Max	14.27
Annual Average Mean	10.43
Annual Average Stdev	1.54
Shapiro-Wilk W	0.937
Shapiro-Wilk p-value	0.287
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.37
Student t	1.03
Mean + t*SE (UCL84)	10.82
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	52
Var(S)	589
Intercept	-297
Slope	0.15
p-value	0.036
Significant Trend?	Increasing



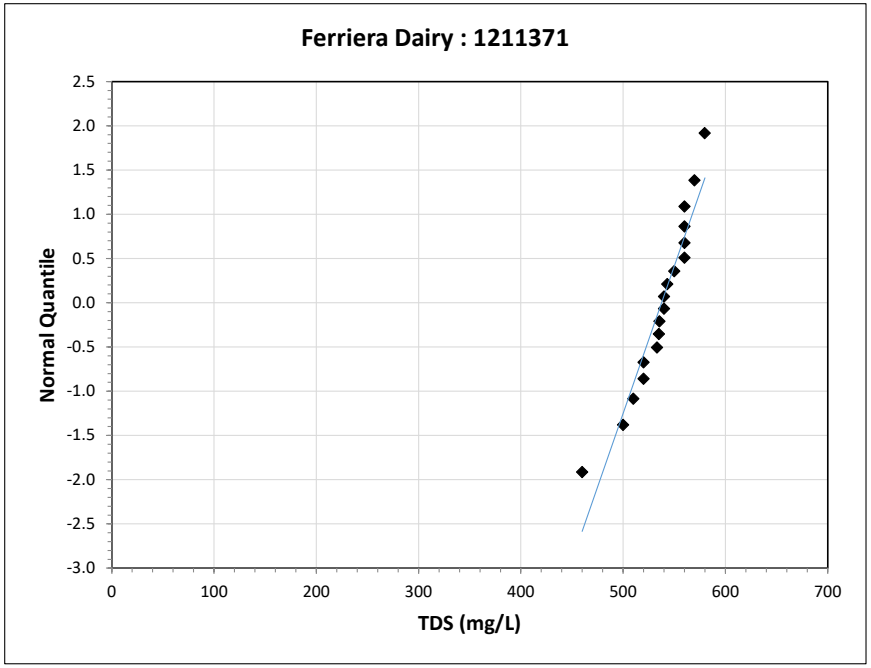


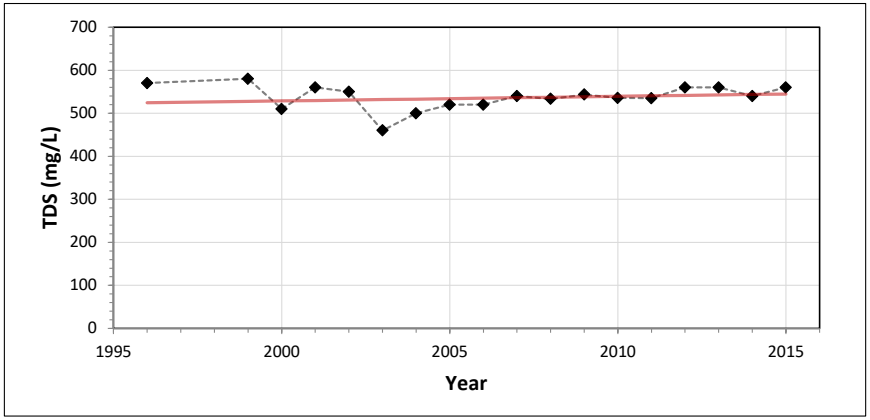
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	Ferriera Dairy : 1211371
Analyte	NO3-N (mg/L)
Count	18
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	7.10
Annual Average Mean	2.66
Annual Average Stdev	1.76
Shapiro-Wilk W	0.915
Shapiro-Wilk p-value	0.106
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.41
Student t	1.02
Mean + t*SE (UCL84)	3.08
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	91
Var(S)	695
Intercept	-514
Slope	0.26
p-value	6E-4
Significant Trend?	Increasing**



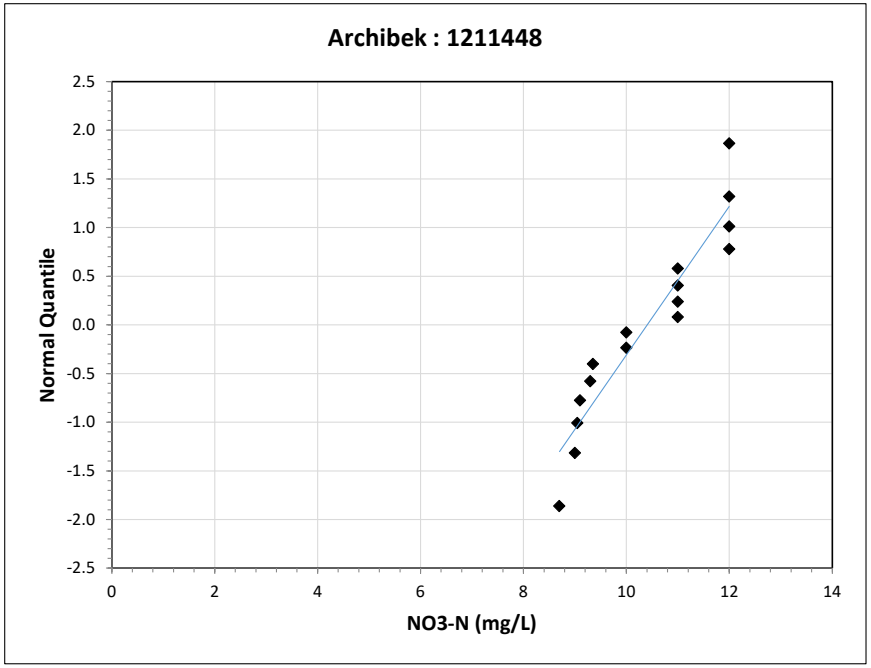


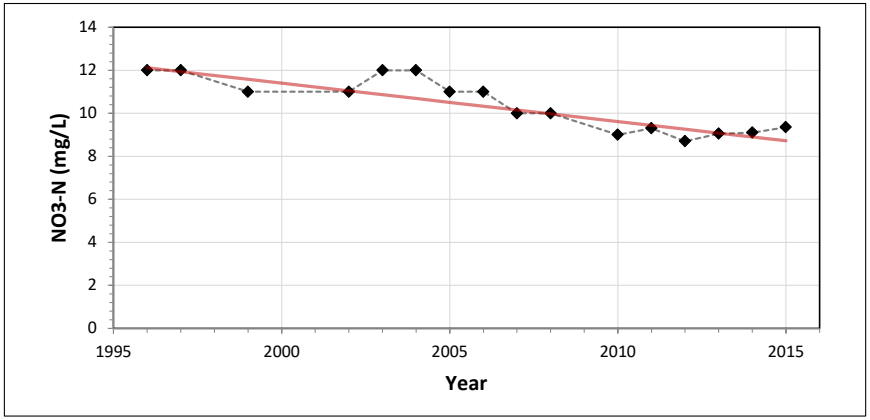
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	Ferriera Dairy : 1211371
Analyte	TDS (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	460
Annual Average Max	580
Annual Average Mean	538
Annual Average Stdev	28.59
Shapiro-Wilk W	0.926
Shapiro-Wilk p-value	0.165
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.74
Student t	1.02
Mean + t*SE (UCL84)	545
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	17
Var(S)	686
Intercept	-1638
Slope	1.08
p-value	0.541
Significant Trend?	No



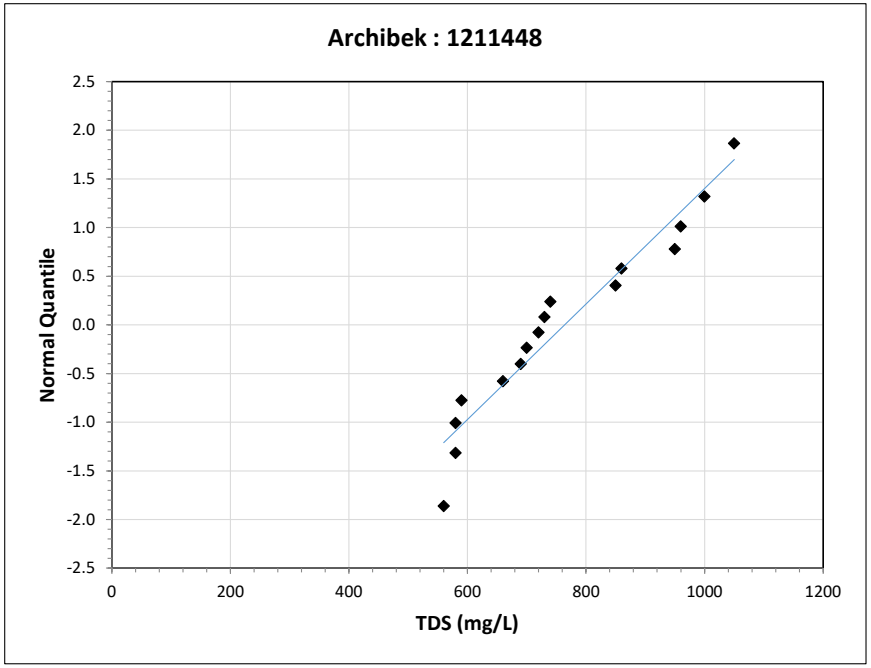


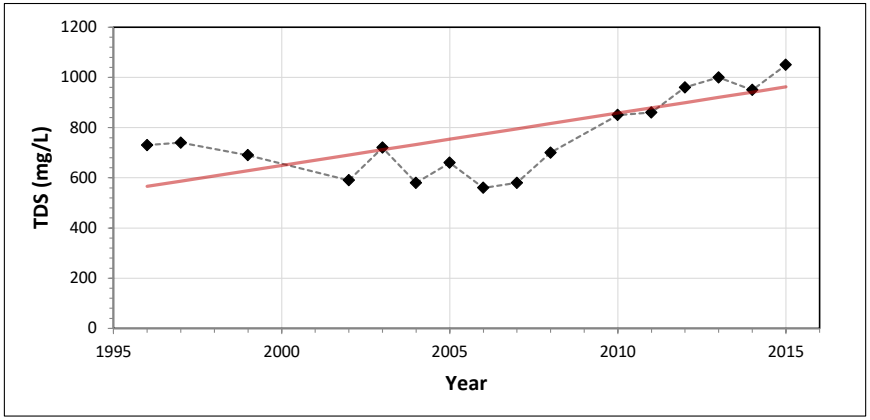
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	Archibek : 1211448
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	8.70
Annual Average Max	12.00
Annual Average Mean	10.41
Annual Average Stdev	1.23
Shapiro-Wilk W	0.874
Shapiro-Wilk p-value	0.032
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.31
Student t	1.03
Mean + t*SE (UCL84)	10.72
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-77
Var(S)	475
Intercept	369
Slope	-0.18
p-value	5E-4
Significant Trend?	Decreasing**



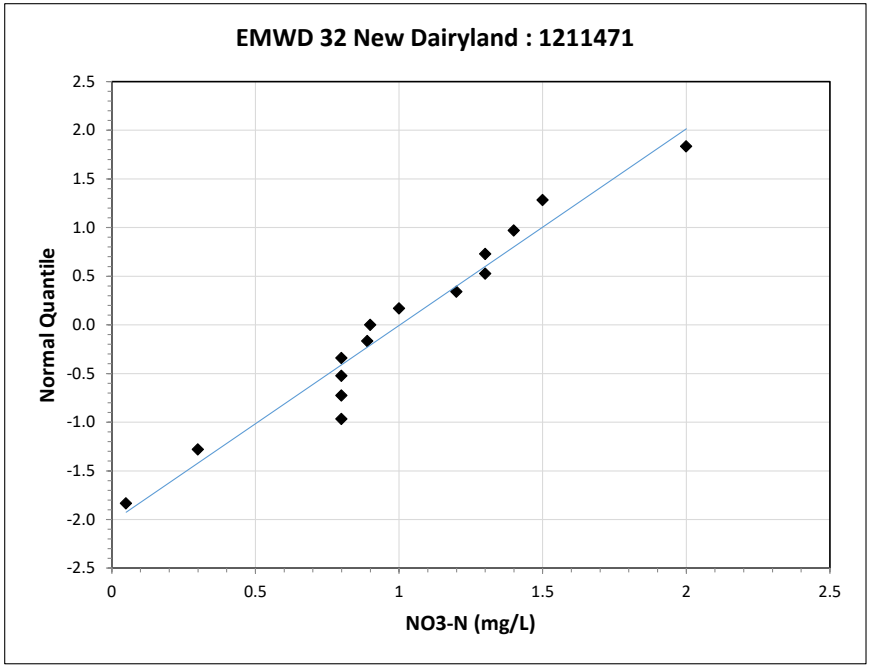


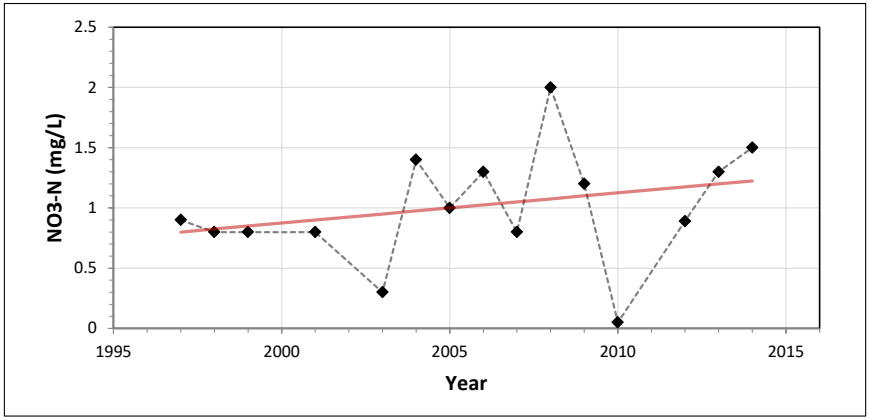
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	Archibek : 1211448
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	560
Annual Average Max	1050
Annual Average Mean	764
Annual Average Stdev	161.41
Shapiro-Wilk W	0.918
Shapiro-Wilk p-value	0.159
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	40.35
Student t	1.03
Mean + t*SE (UCL84)	805
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	51
Var(S)	492
Intercept	-41029
Slope	20.84
p-value	0.024
Significant Trend?	Increasing



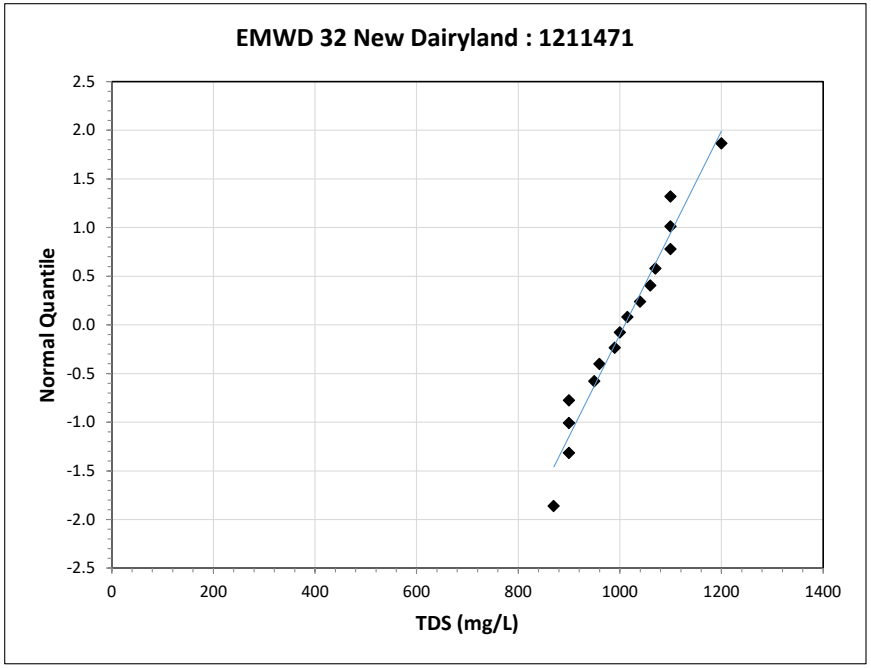


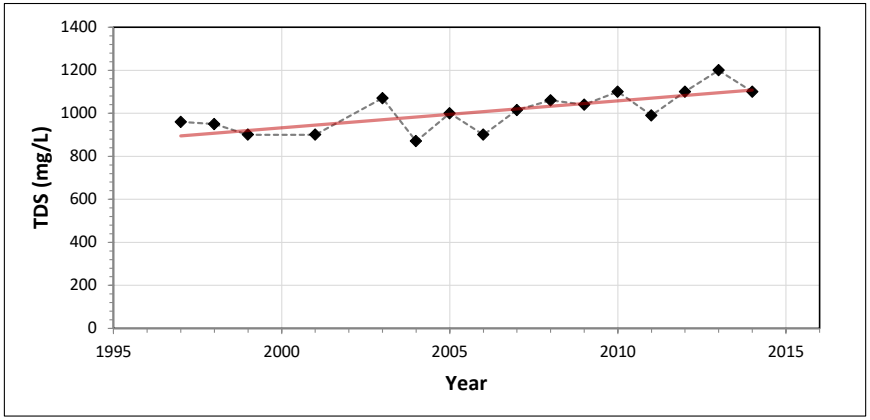
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	EMWD 32 New Dairyland : 1211471
Analyte	NO3-N (mg/L)
Count	15
Count Detects	14
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	2.00
Annual Average Mean	1.00
Annual Average Stdev	0.48
Shapiro-Wilk W	0.958
Shapiro-Wilk p-value	0.663
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.12
Student t	1.03
Mean + t*SE (UCL84)	1.13
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	27
Var(S)	400
Intercept	-49.15
Slope	0.03
p-value	0.193
Significant Trend?	No



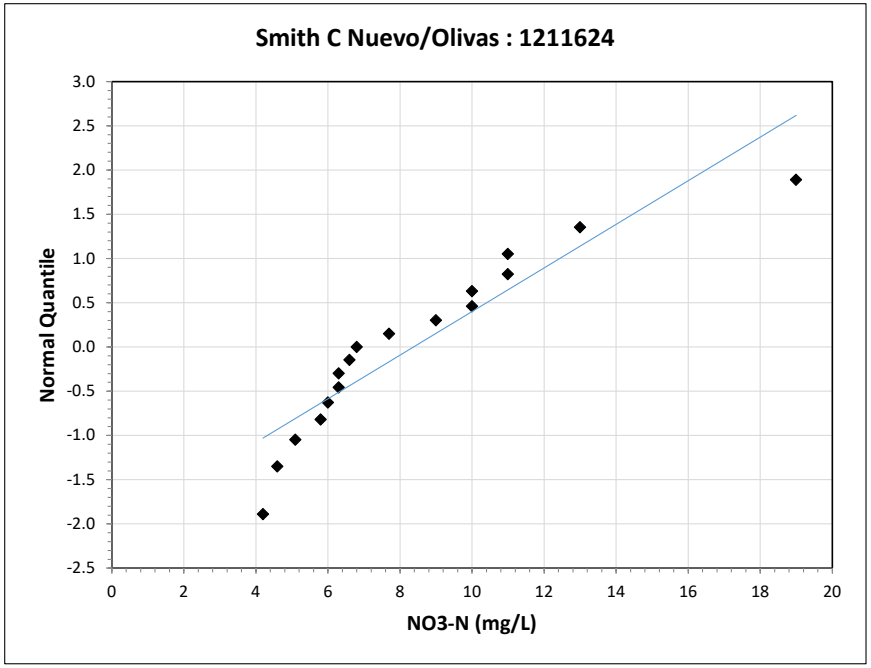


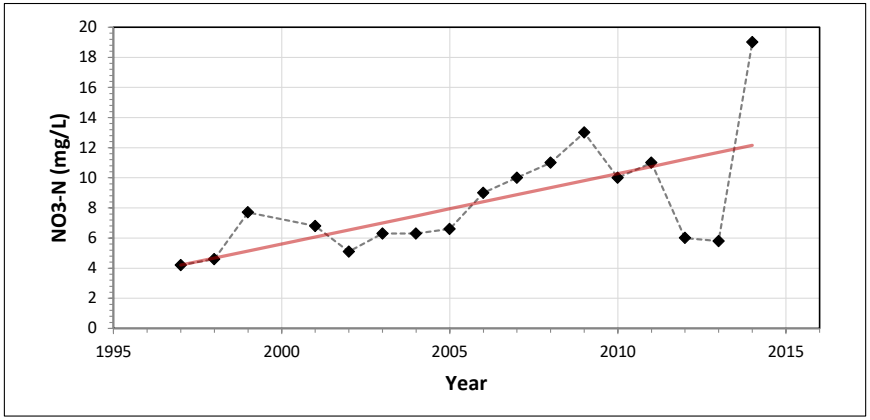
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	EMWD 32 New Dairyland : 1211471
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	870
Annual Average Max	1200
Annual Average Mean	1010
Annual Average Stdev	93.07
Shapiro-Wilk W	0.956
Shapiro-Wilk p-value	0.598
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	23.27
Student t	1.03
Mean + t*SE (UCL84)	1034
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	62
Var(S)	486
Intercept	-24068
Slope	12.50
p-value	0.006
Significant Trend?	Increasing*



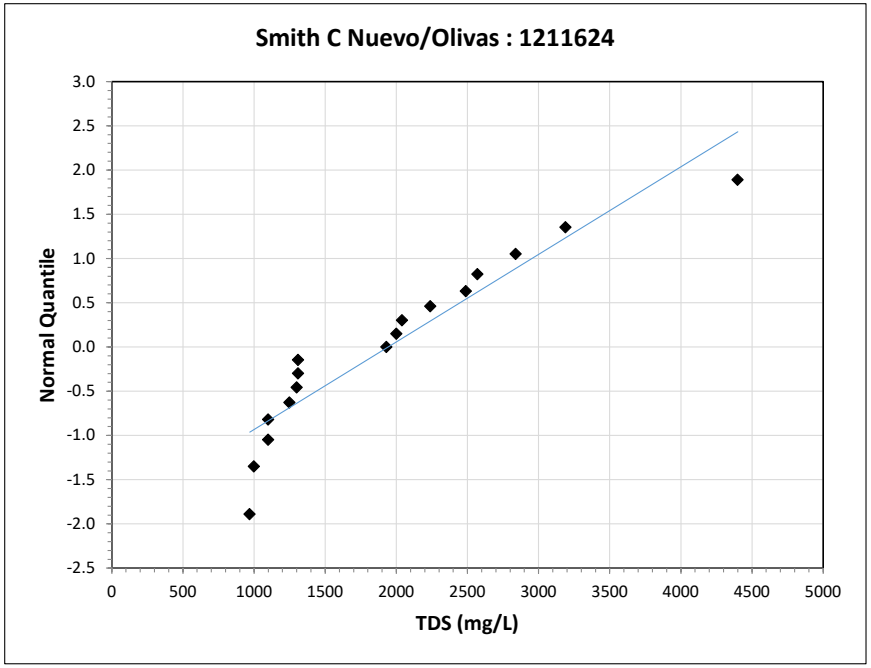


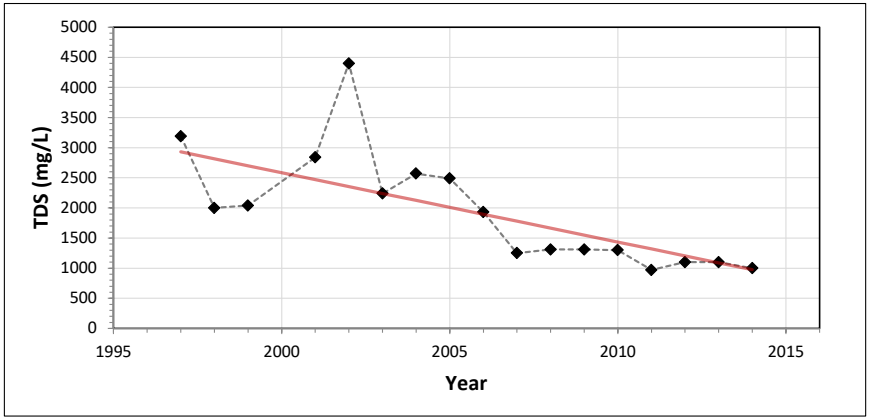
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	Smith C Nuevo/Olivas : 1211624
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	4.20
Annual Average Max	19.00
Annual Average Mean	8.38
Annual Average Stdev	3.73
Shapiro-Wilk W	0.865
Shapiro-Wilk p-value	0.018
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.91
Student t	1.03
Mean + t*SE (UCL84)	9.31
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	63
Var(S)	586
Intercept	-930
Slope	0.47
p-value	0.010
Significant Trend?	Increasing



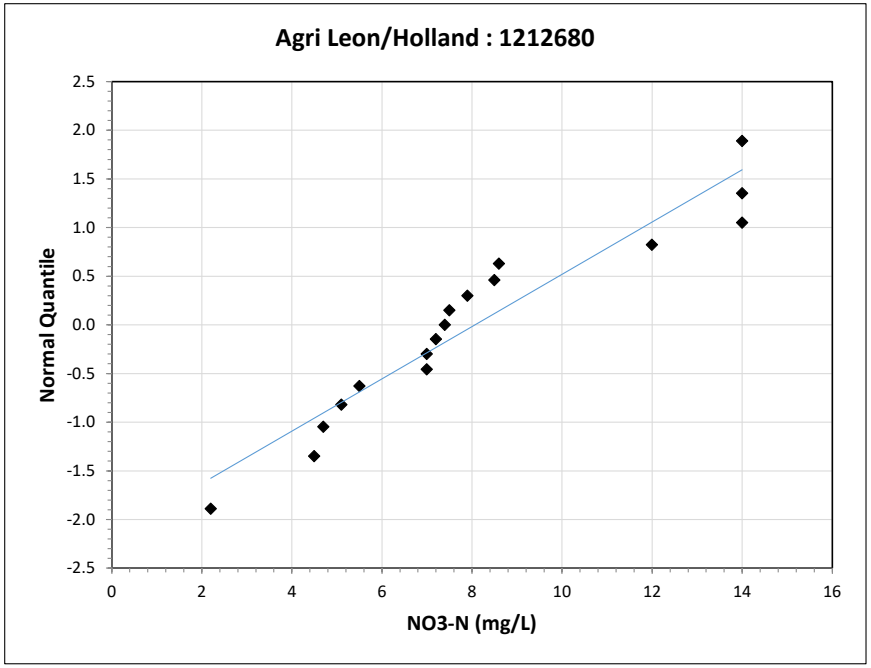


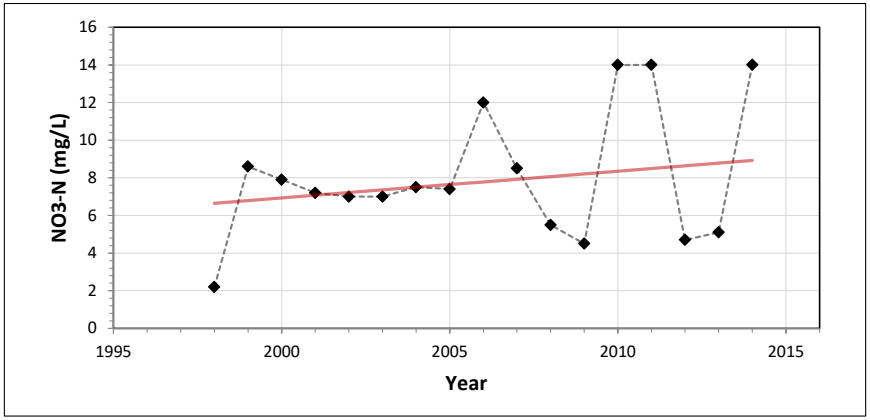
Statistics	
GMZ	Lakeview/Hemet-North
Well Name : ID	Smith C Nuevo/Olivas : 1211624
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	970
Annual Average Max	4400
Annual Average Mean	1944
Annual Average Stdev	940.15
Shapiro-Wilk W	0.879
Shapiro-Wilk p-value	0.031
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	228.02
Student t	1.03
Mean + t*SE (UCL84)	2178
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-92
Var(S)	587
Intercept	232835
Slope	-115.13
p-value	2E-4
Significant Trend?	Decreasing**



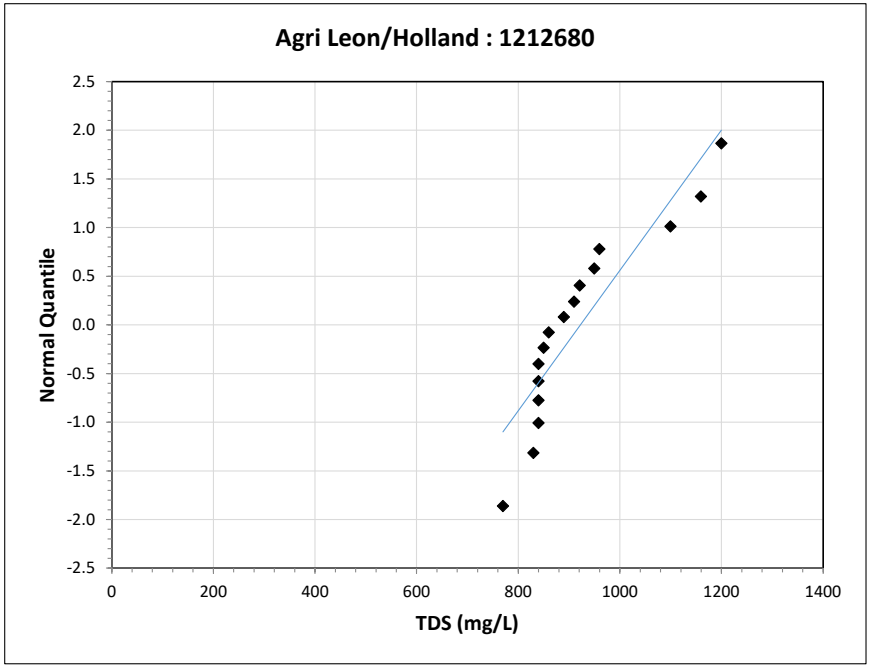


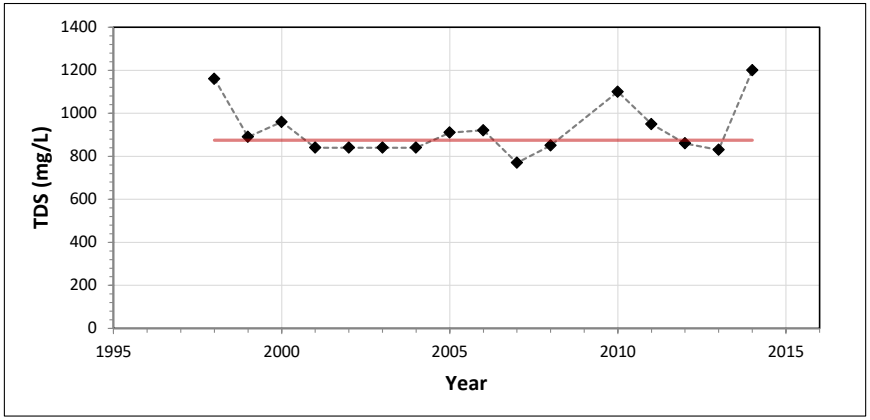
Statistics	
GMZ	Menifee
Well Name : ID	Agri Leon/Holland : 1212680
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1998
Sample Year Max	2014
Annual Average Min	2.20
Annual Average Max	14.00
Annual Average Mean	8.06
Annual Average Stdev	3.53
Shapiro-Wilk W	0.904
Shapiro-Wilk p-value	0.078
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.86
Student t	1.03
Mean + t*SE (UCL84)	8.94
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	14
Var(S)	585
Intercept	-276
Slope	0.14
p-value	0.591
Significant Trend?	No



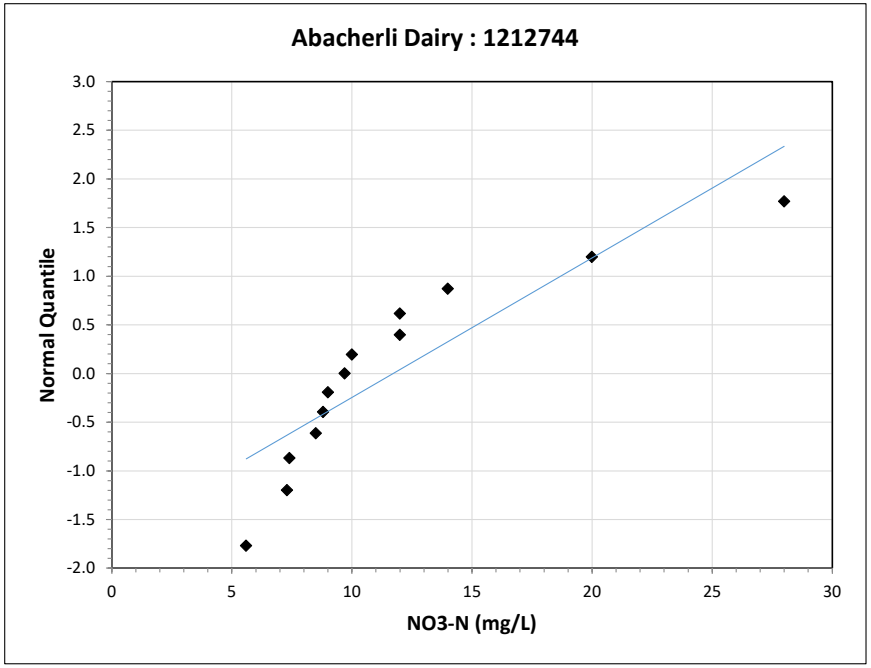


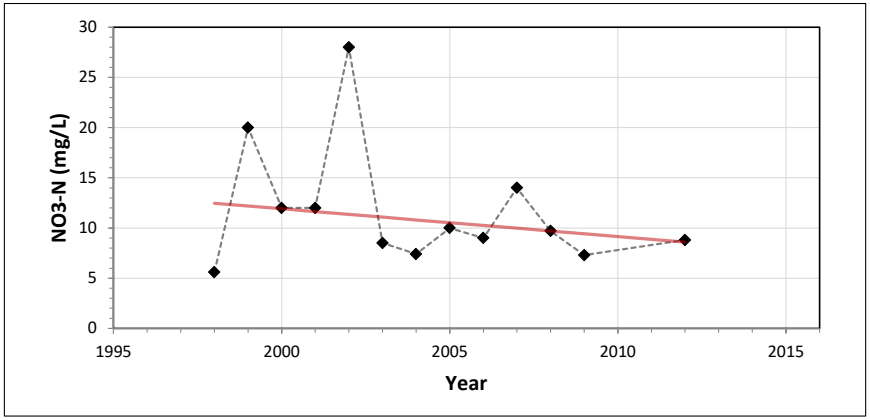
Statistics	
GMZ	Menifee
Well Name : ID	Agri Leon/Holland : 1212680
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1998
Sample Year Max	2014
Annual Average Min	770
Annual Average Max	1200
Annual Average Mean	923
Annual Average Stdev	125.56
Shapiro-Wilk W	0.830
Shapiro-Wilk p-value	0.007
Critical Alpha	0.01
Most Discordant Value	1200
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.03
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.019
Geomean	915
GM + t*GSE (UCL84)	946
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	2
Var(S)	485
Intercept	875
Slope	0.00
p-value	NC
Significant Trend?	No



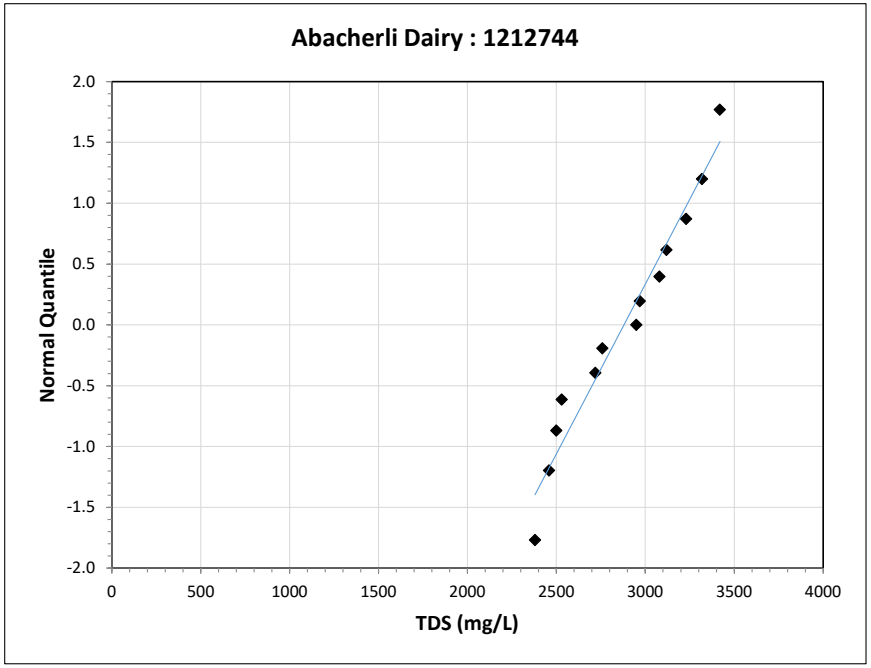


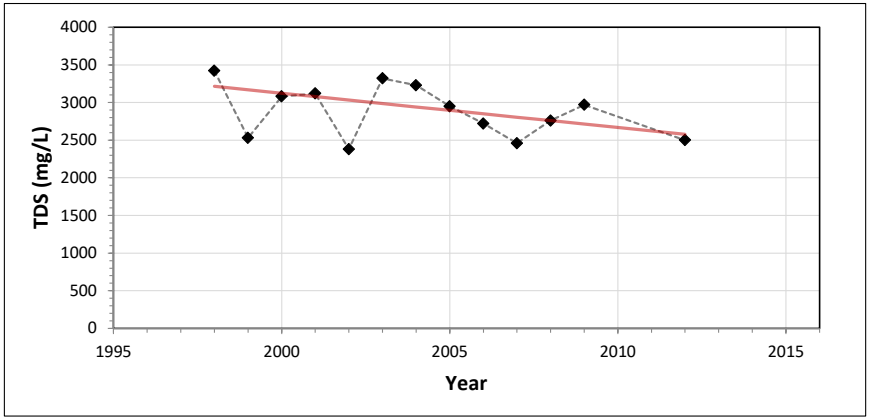
Statistics	
GMZ	Menifee
Well Name : ID	Abacherli Dairy : 1212744
Analyte	NO3-N (mg/L)
Count	13
Count Detects	13
Sample Year Min	1998
Sample Year Max	2012
Annual Average Min	5.60
Annual Average Max	28.00
Annual Average Mean	11.72
Annual Average Stdev	6.11
Shapiro-Wilk W	0.791
Shapiro-Wilk p-value	0.005
Critical Alpha	0.01
Most Discordant Value	28.00
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.04
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.381
Geomean	10.64
GM + t*GSE (UCL84)	12.05
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-15
Var(S)	268
Intercept	566
Slope	-0.28
p-value	0.392
Significant Trend?	No



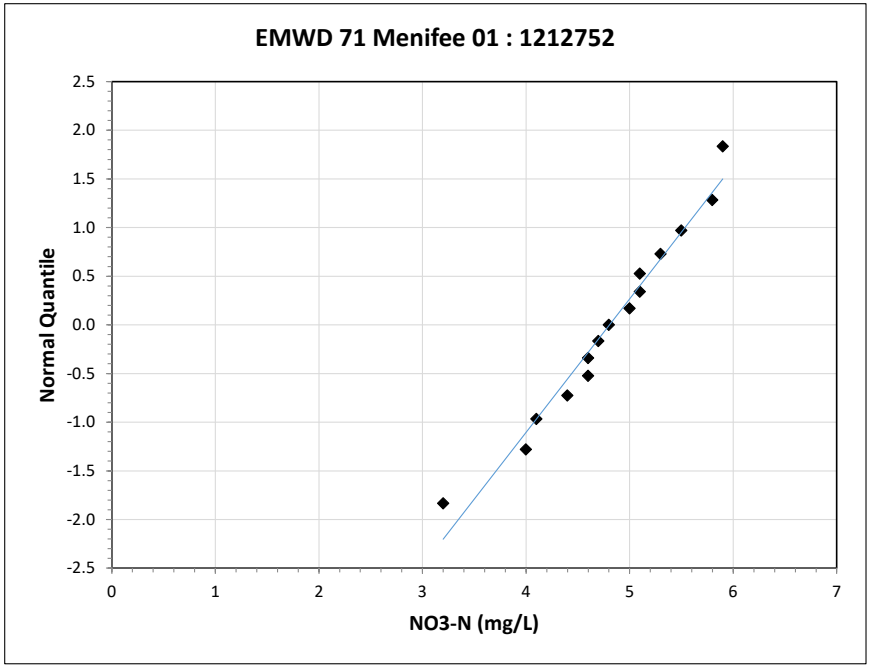


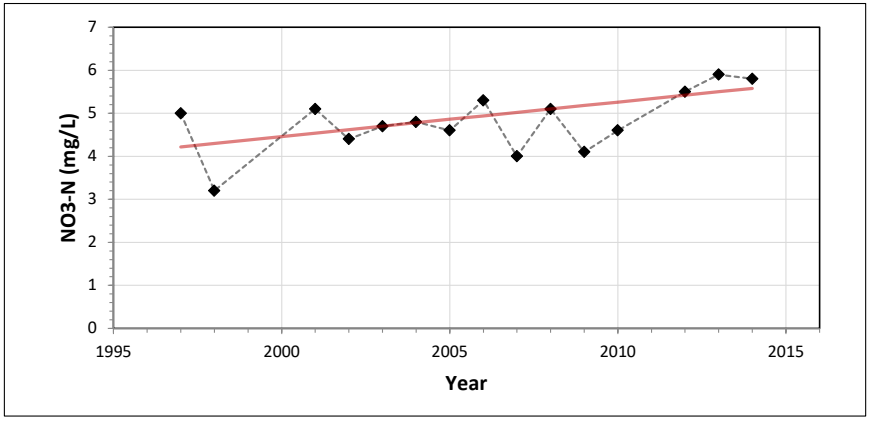
Statistics	
GMZ	Menifee
Well Name : ID	Abacherli Dairy : 1212744
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1998
Sample Year Max	2012
Annual Average Min	2380
Annual Average Max	3420
Annual Average Mean	2880
Annual Average Stdev	347.80
Shapiro-Wilk W	0.945
Shapiro-Wilk p-value	0.519
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	96.46
Student t	1.04
Mean + t*SE (UCL84)	2980
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-22
Var(S)	269
Intercept	93957
Slope	-45.42
p-value	0.200
Significant Trend?	No



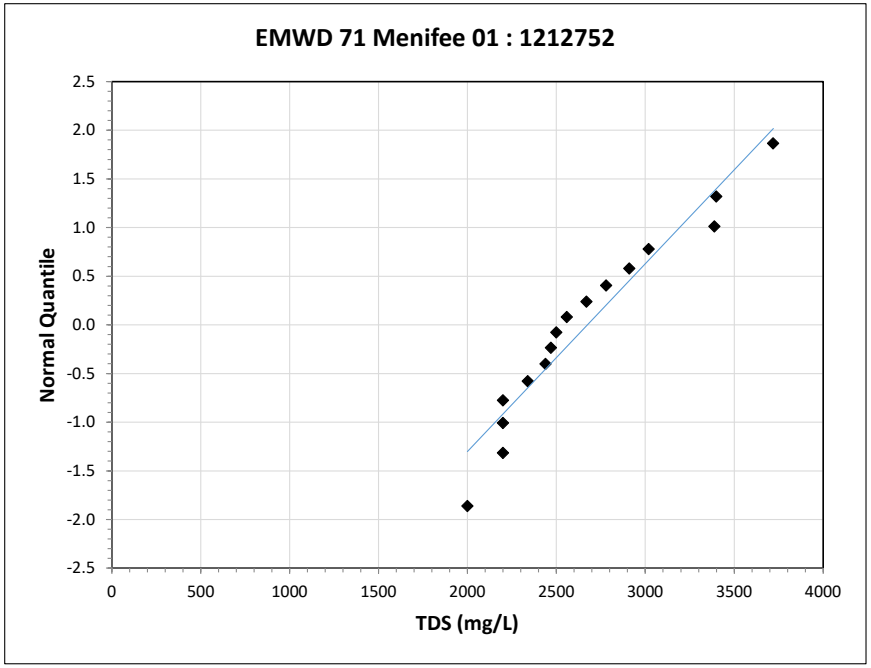


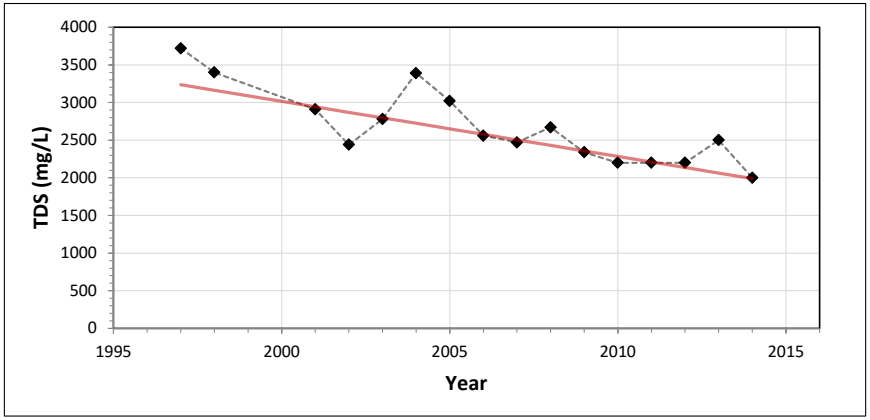
Statistics	
GMZ	Menifee
Well Name : ID	EMWD 71 Menifee 01 : 1212752
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	3.20
Annual Average Max	5.90
Annual Average Mean	4.81
Annual Average Stdev	0.71
Shapiro-Wilk W	0.972
Shapiro-Wilk p-value	0.885
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.03
Mean + t*SE (UCL84)	5.00
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	35
Var(S)	406
Intercept	-156
Slope	0.08
p-value	0.092
Significant Trend?	Increasing



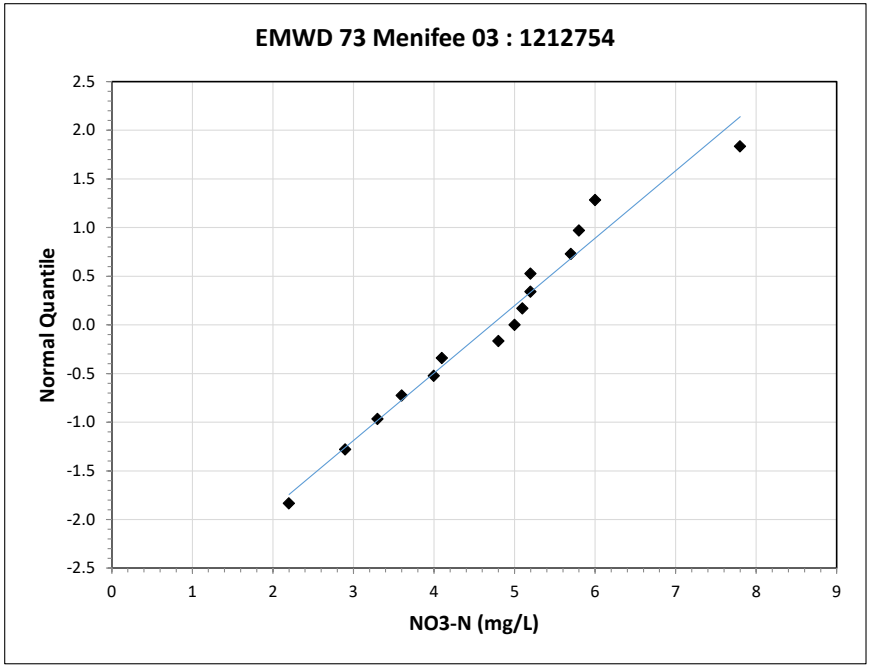


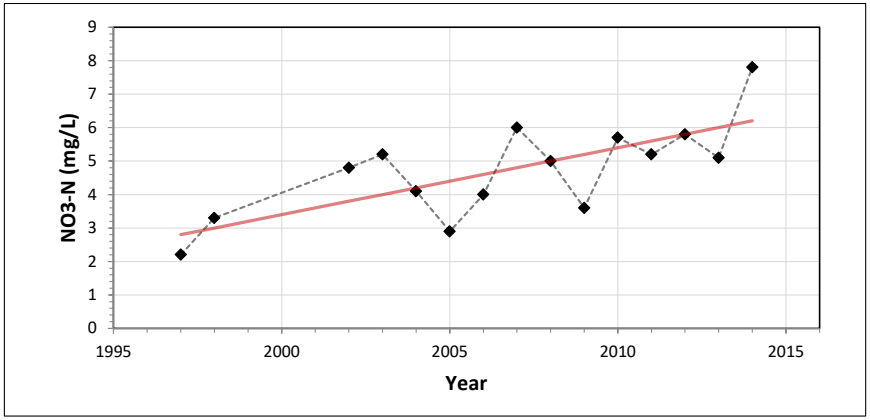
Statistics	
GMZ	Menifee
Well Name : ID	EMWD 71 Menifee 01 : 1212752
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	2000
Annual Average Max	3720
Annual Average Mean	2675
Annual Average Stdev	496.66
Shapiro-Wilk W	0.928
Shapiro-Wilk p-value	0.227
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	124.16
Student t	1.03
Mean + t*SE (UCL84)	2803
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-81
Var(S)	490
Intercept	149683
Slope	-73.33
p-value	3E-4
Significant Trend?	Decreasing**



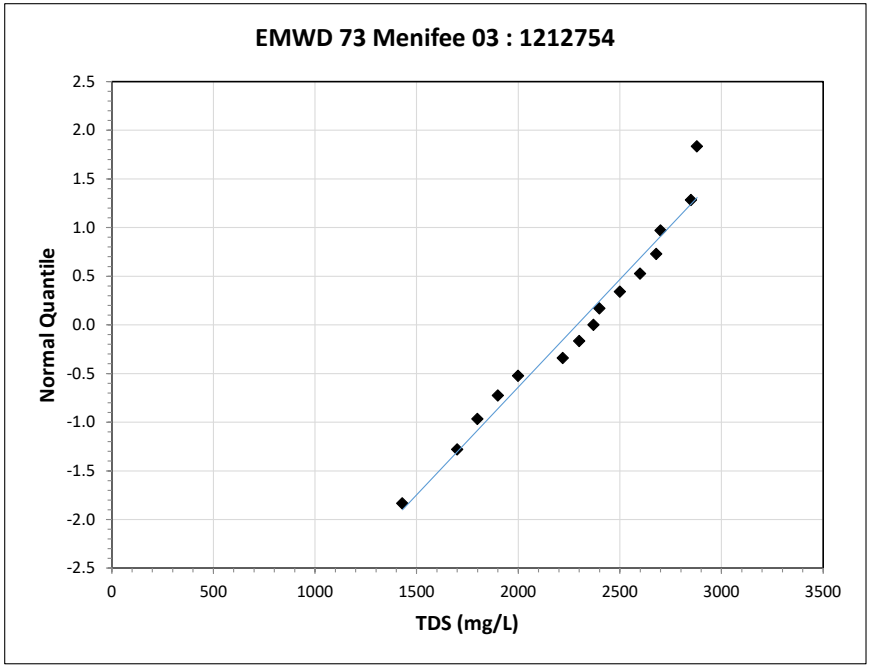


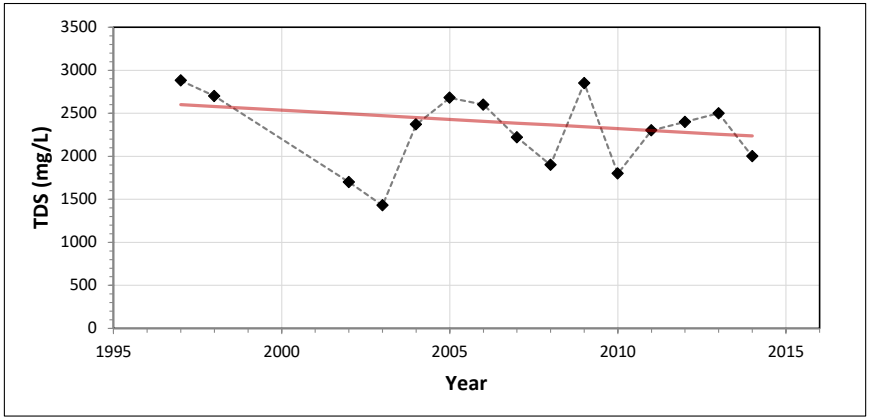
Statistics	
GMZ	Menifee
Well Name : ID	EMWD 73 Menifee 03 : 1212754
Analyte	NO3-N (mg/L)
Count	15
Count Detects	15
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	2.20
Annual Average Max	7.80
Annual Average Mean	4.71
Annual Average Stdev	1.41
Shapiro-Wilk W	0.973
Shapiro-Wilk p-value	0.902
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.36
Student t	1.03
Mean + t*SE (UCL84)	5.09
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	52
Var(S)	407
Intercept	-397
Slope	0.20
p-value	0.012
Significant Trend?	Increasing



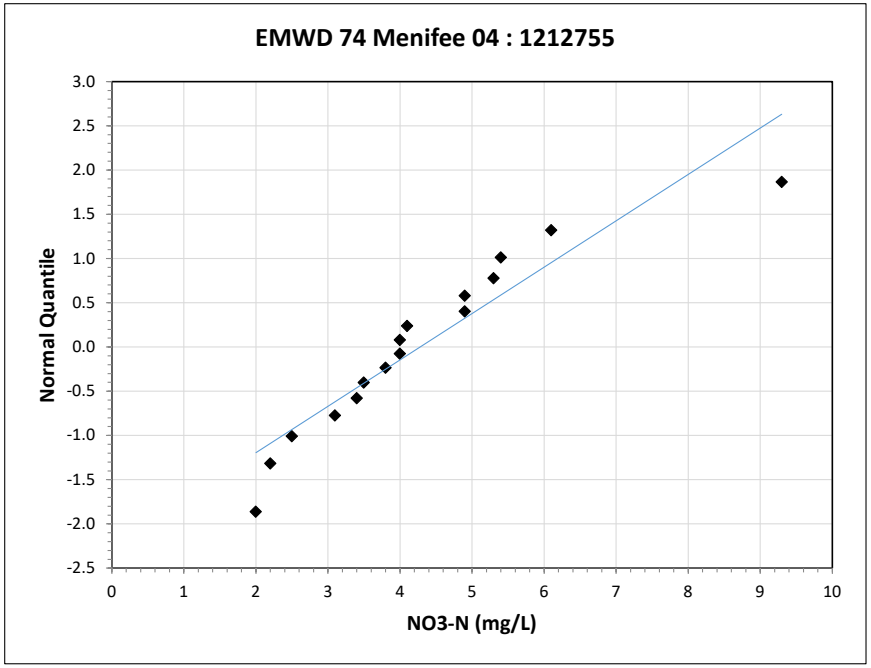


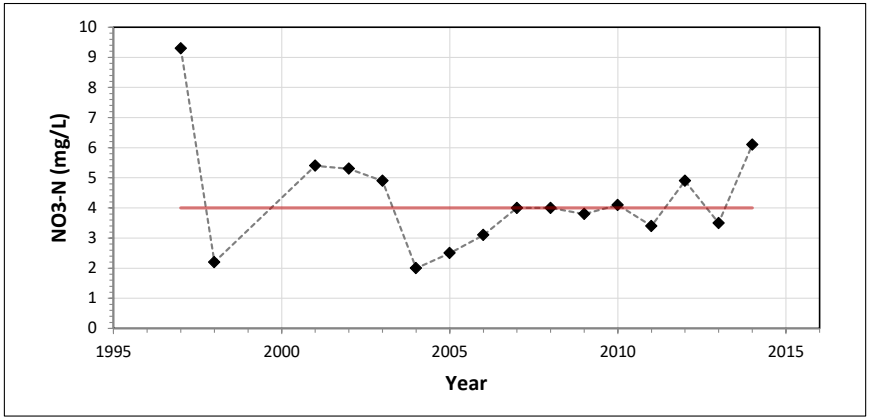
Statistics	
GMZ	Menifee
Well Name : ID	EMWD 73 Menifee 03 : 1212754
Analyte	TDS (mg/L)
Count	15
Count Detects	15
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	1430
Annual Average Max	2880
Annual Average Mean	2289
Annual Average Stdev	439.93
Shapiro-Wilk W	0.955
Shapiro-Wilk p-value	0.598
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	113.59
Student t	1.03
Mean + t*SE (UCL84)	2406
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-13
Var(S)	408
Intercept	45393
Slope	-21.43
p-value	0.553
Significant Trend?	No



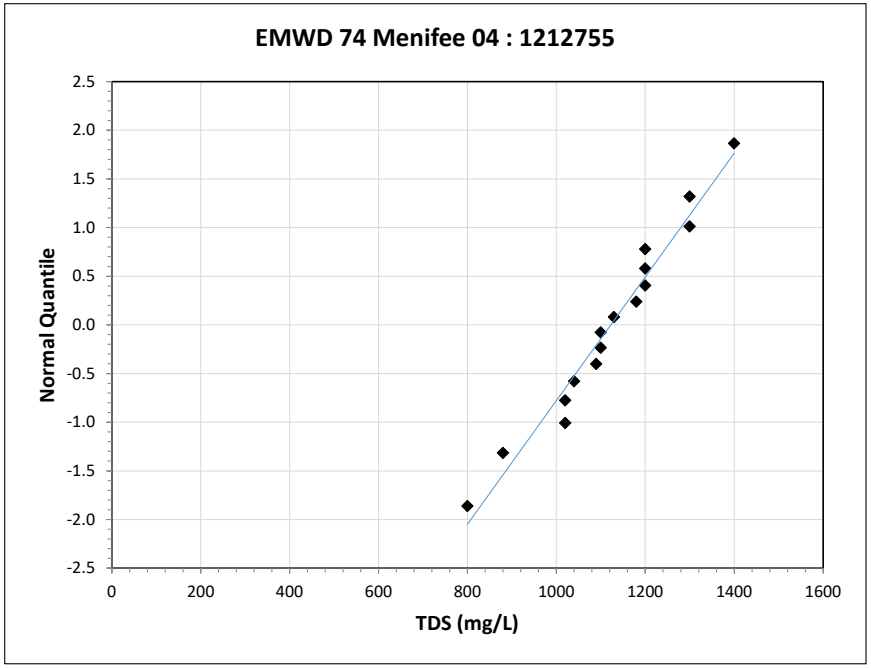


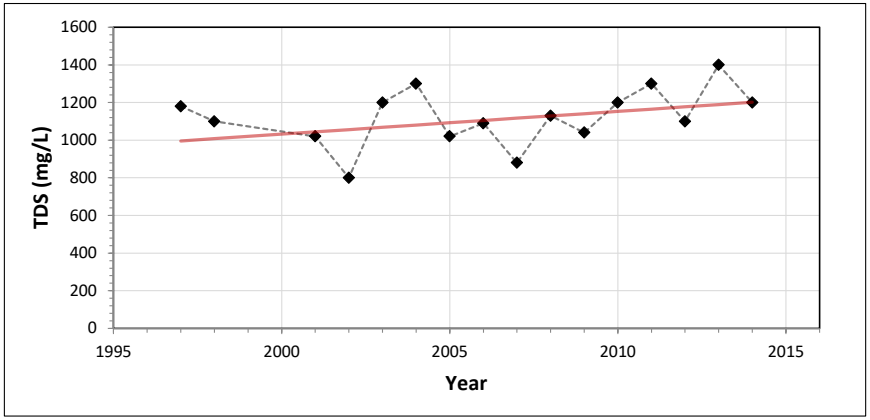
Statistics	
GMZ	Menifee
Well Name : ID	EMWD 74 Menifee 04 : 1212755
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	2.00
Annual Average Max	9.30
Annual Average Mean	4.28
Annual Average Stdev	1.78
Shapiro-Wilk W	0.892
Shapiro-Wilk p-value	0.060
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.44
Student t	1.03
Mean + t*SE (UCL84)	4.74
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	491
Intercept	4.00
Slope	0.00
p-value	NC
Significant Trend?	No



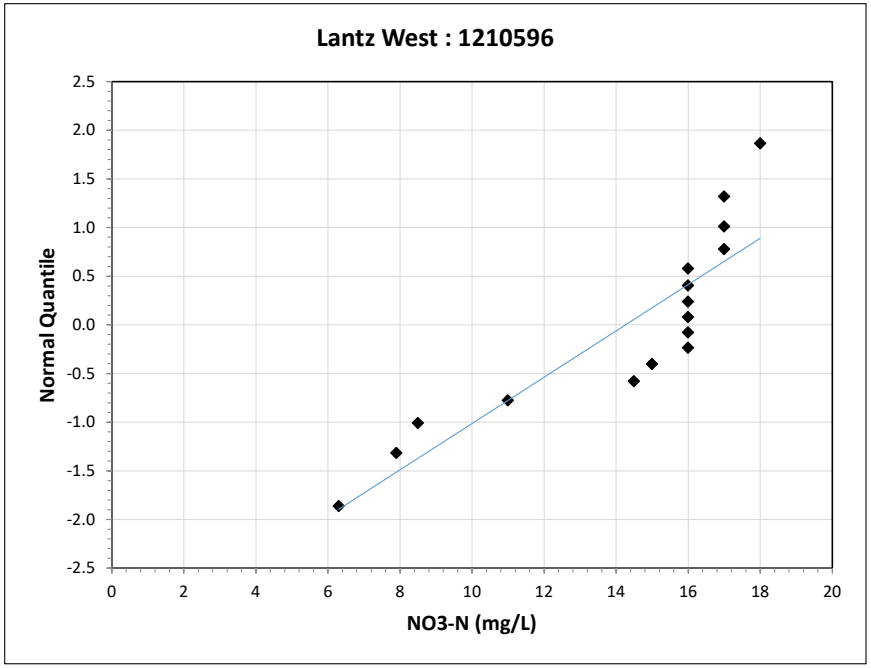


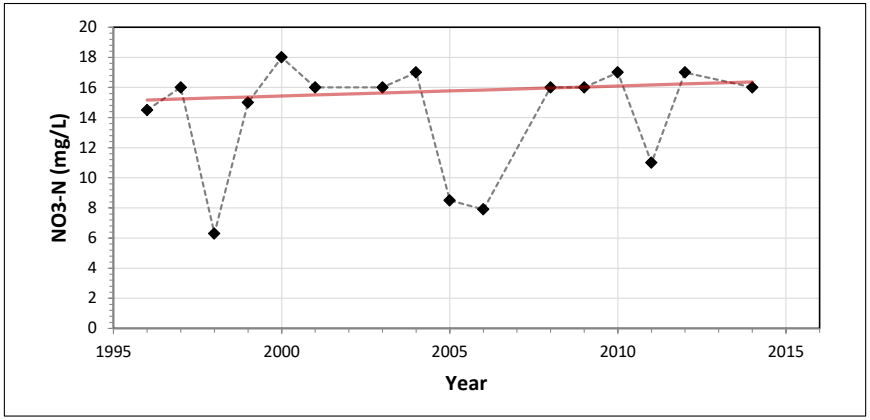
Statistics	
GMZ	Menifee
Well Name : ID	EMWD 74 Menifee 04 : 1212755
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1997
Sample Year Max	2014
Annual Average Min	800
Annual Average Max	1400
Annual Average Mean	1123
Annual Average Stdev	153.64
Shapiro-Wilk W	0.972
Shapiro-Wilk p-value	0.867
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	38.41
Student t	1.03
Mean + t*SE (UCL84)	1162
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	34
Var(S)	487
Intercept	-23135
Slope	12.08
p-value	0.135
Significant Trend?	No



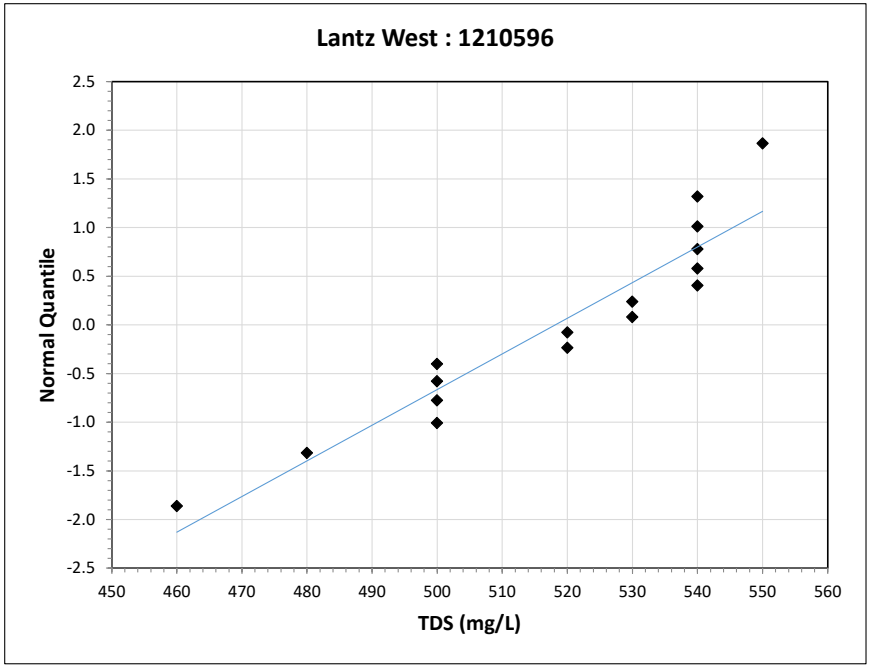


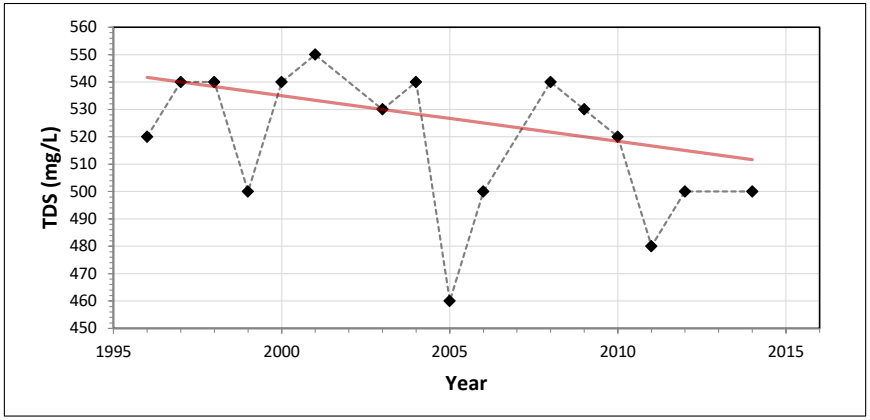
Statistics	
GMZ	Perris-North
Well Name : ID	Lantz West : 1210596
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	6.30
Annual Average Max	18.00
Annual Average Mean	14.26
Annual Average Stdev	3.68
Shapiro-Wilk W	0.774
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	6.30
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	3E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	16.00
Trend Analysis	**Theil-Sen**
Kendall S	20
Var(S)	461
Intercept	-118
Slope	0.07
p-value	0.376
Significant Trend?	No



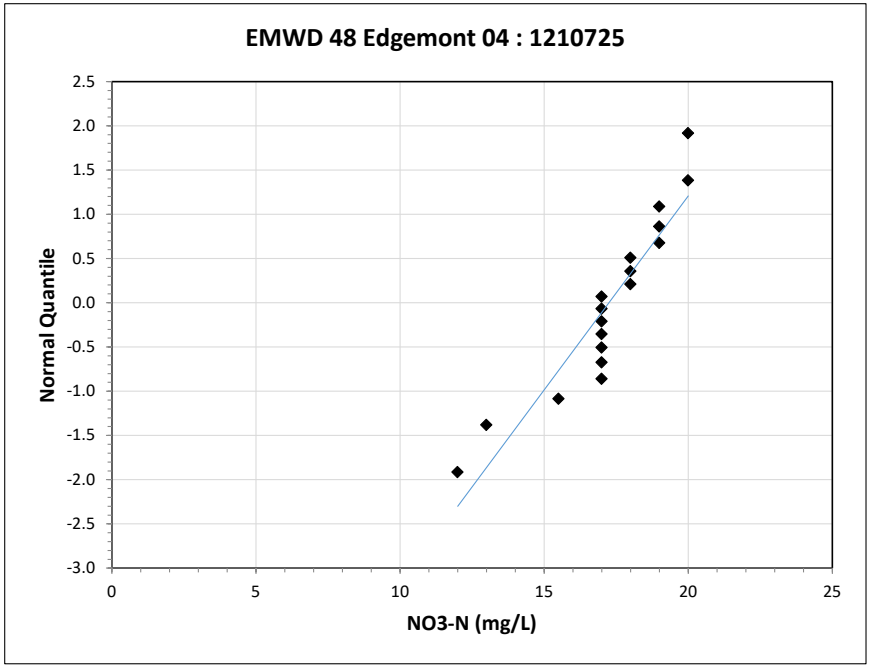


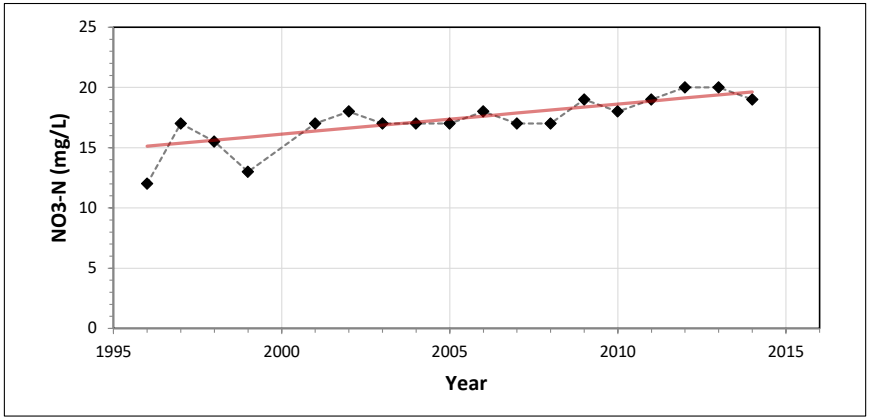
Statistics	
GMZ	Perris-North
Well Name : ID	Lantz West : 1210596
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	460
Annual Average Max	550
Annual Average Mean	518
Annual Average Stdev	25.62
Shapiro-Wilk W	0.892
Shapiro-Wilk p-value	0.059
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	6.40
Student t	1.03
Mean + t*SE (UCL84)	525
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-38
Var(S)	466
Intercept	3868
Slope	-1.67
p-value	0.087
Significant Trend?	Decreasing



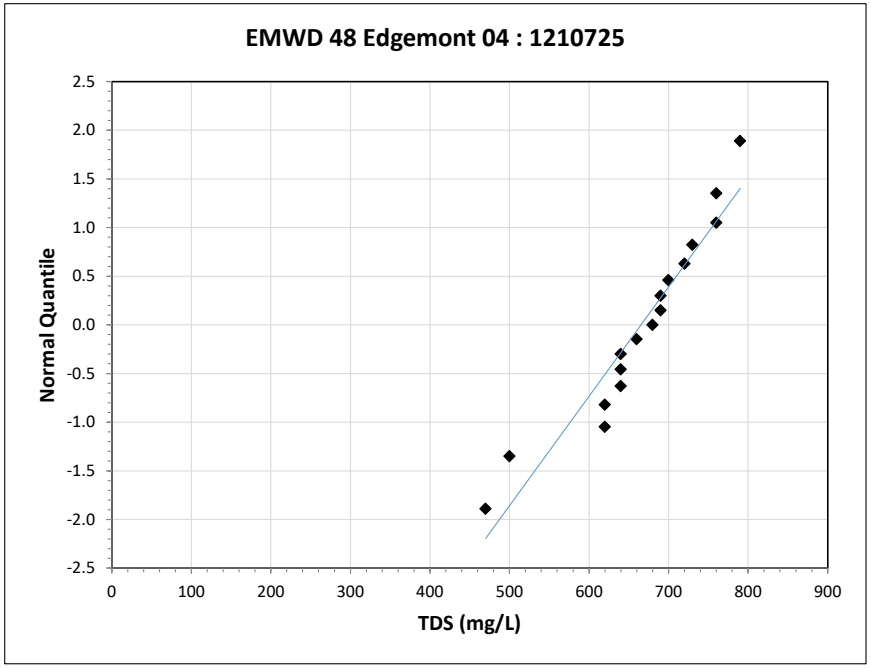


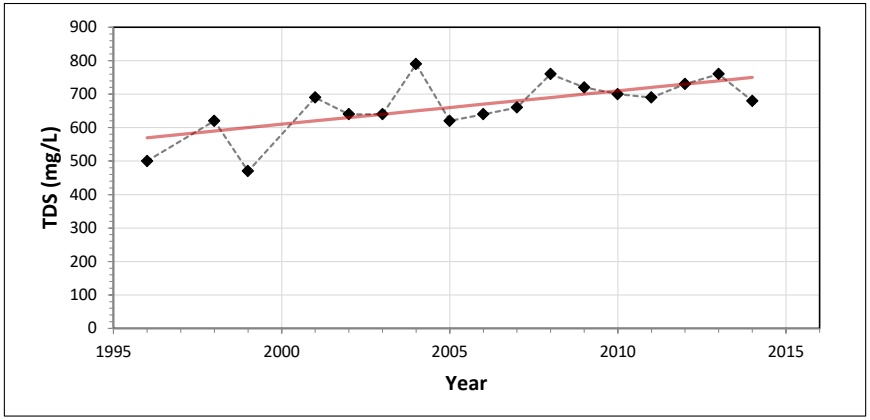
Statistics	
GMZ	Perris-North
Well Name : ID	EMWD 48 Edgemont 04 : 1210725
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	12.00
Annual Average Max	20.00
Annual Average Mean	17.25
Annual Average Stdev	2.10
Shapiro-Wilk W	0.864
Shapiro-Wilk p-value	0.014
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.50
Student t	1.02
Mean + t*SE (UCL84)	17.76
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	99
Var(S)	644
Intercept	-484
Slope	0.25
p-value	1E-4
Significant Trend?	Increasing**



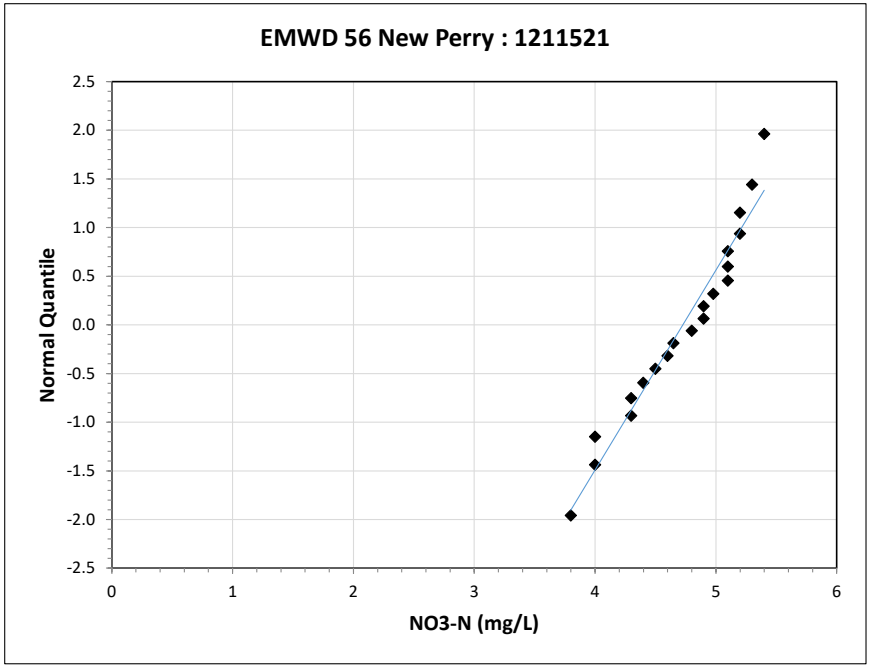


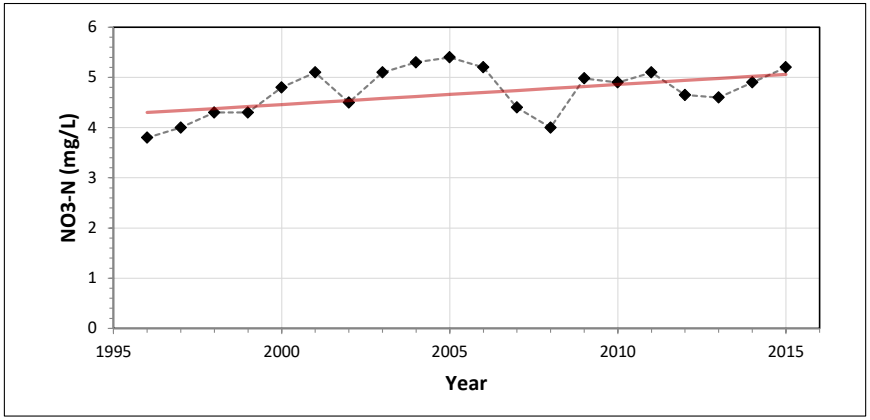
Statistics	
GMZ	Perris-North
Well Name : ID	EMWD 48 Edgemont 04 : 1210725
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	470
Annual Average Max	790
Annual Average Mean	665
Annual Average Stdev	84.71
Shapiro-Wilk W	0.920
Shapiro-Wilk p-value	0.149
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	20.55
Student t	1.03
Mean + t*SE (UCL84)	686
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	64
Var(S)	583
Intercept	-19390
Slope	10.00
p-value	0.009
Significant Trend?	Increasing*



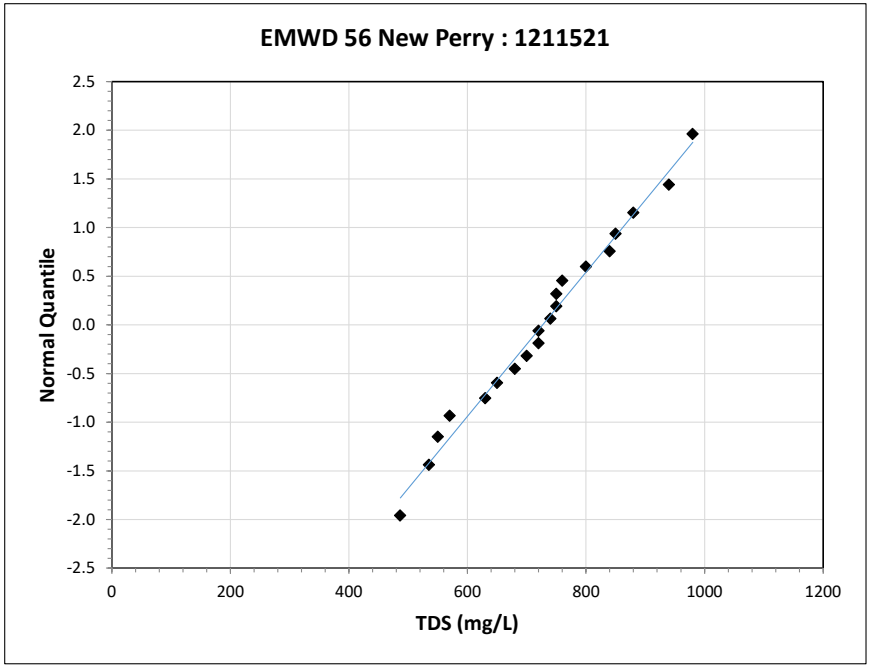


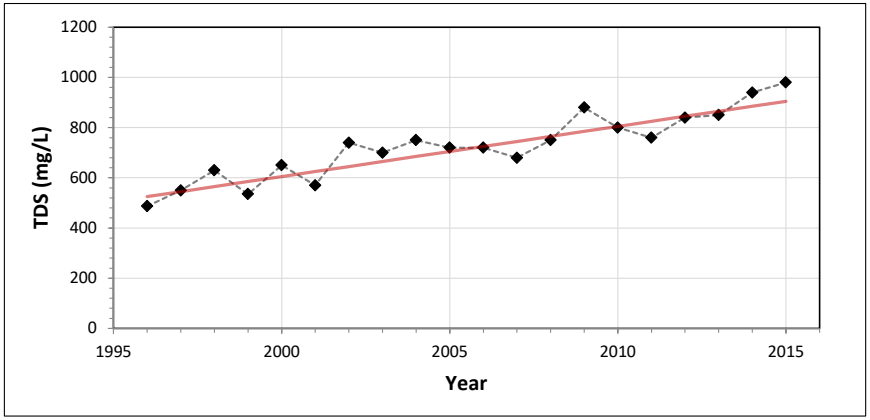
Statistics	
GMZ	Perris-North
Well Name : ID	EMWD 56 New Perry : 1211521
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.80
Annual Average Max	5.40
Annual Average Mean	4.73
Annual Average Stdev	0.47
Shapiro-Wilk W	0.943
Shapiro-Wilk p-value	0.267
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.11
Student t	1.02
Mean + t*SE (UCL84)	4.83
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	60
Var(S)	946
Intercept	-75.54
Slope	0.04
p-value	0.055
Significant Trend?	Increasing



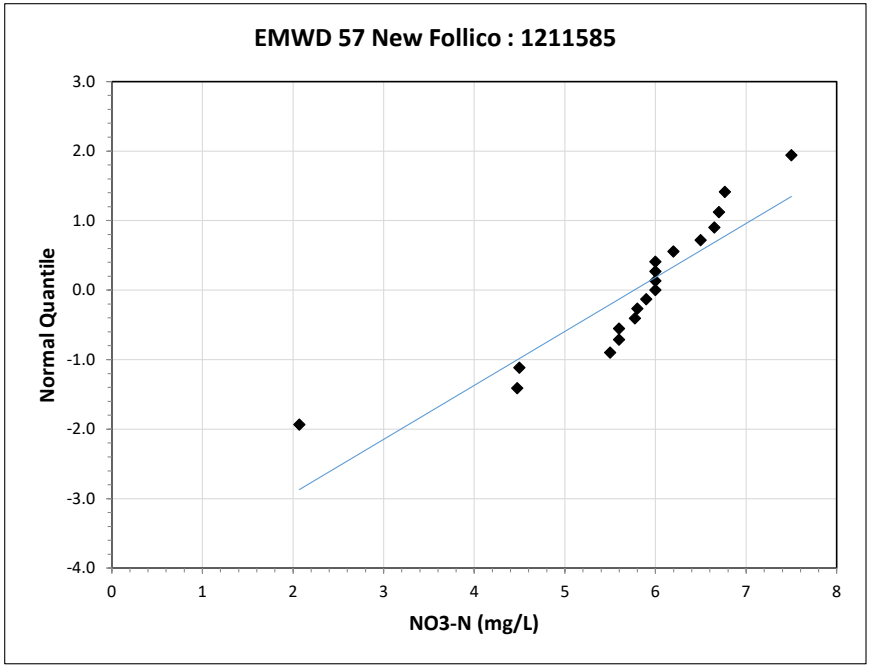


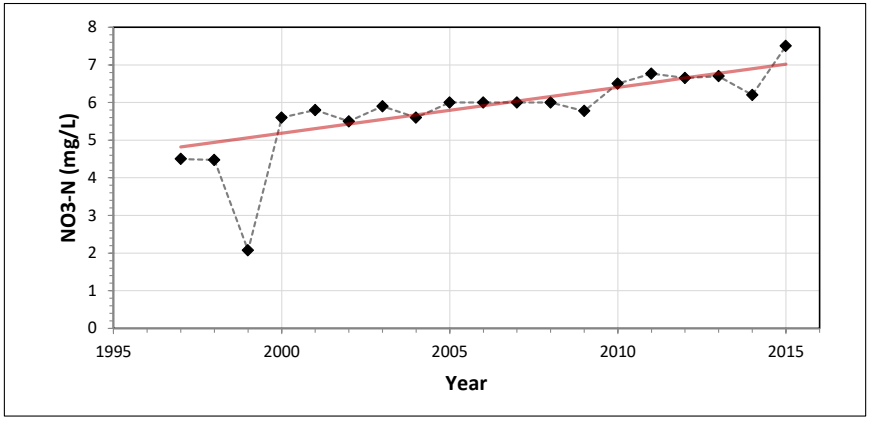
Statistics	
GMZ	Perris-North
Well Name : ID	EMWD 56 New Perry : 1211521
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	487
Annual Average Max	980
Annual Average Mean	727
Annual Average Stdev	133.24
Shapiro-Wilk W	0.981
Shapiro-Wilk p-value	0.945
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	29.79
Student t	1.02
Mean + t*SE (UCL84)	757
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	150
Var(S)	948
Intercept	-39395
Slope	20.00
p-value	1E-6
Significant Trend?	Increasing**



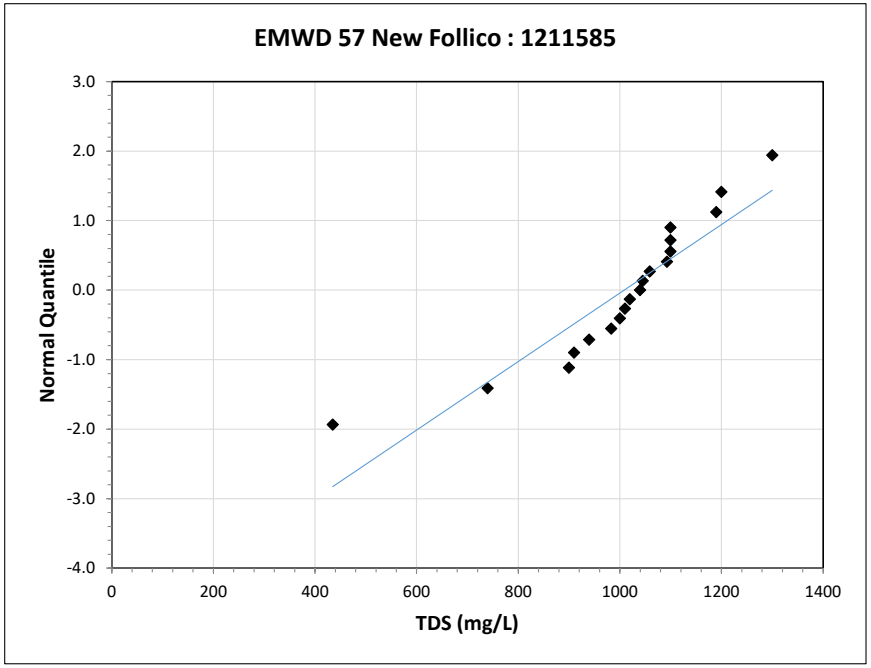


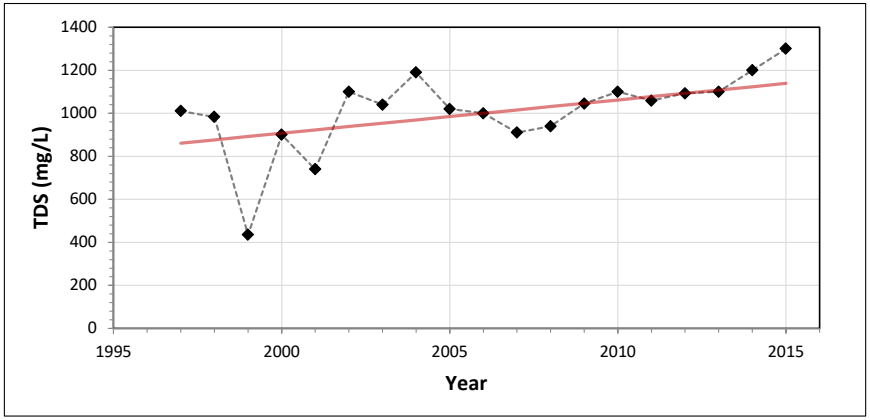
Statistics	
GMZ	Perris-North
Well Name : ID	EMWD 57 New Follico : 1211585
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	2.07
Annual Average Max	7.50
Annual Average Mean	5.77
Annual Average Stdev	1.15
Shapiro-Wilk W	0.822
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	2.07
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	6.00
Trend Analysis	**Theil-Sen**
Kendall S	126
Var(S)	807
Intercept	-239
Slope	0.12
p-value	1E-5
Significant Trend?	Increasing**



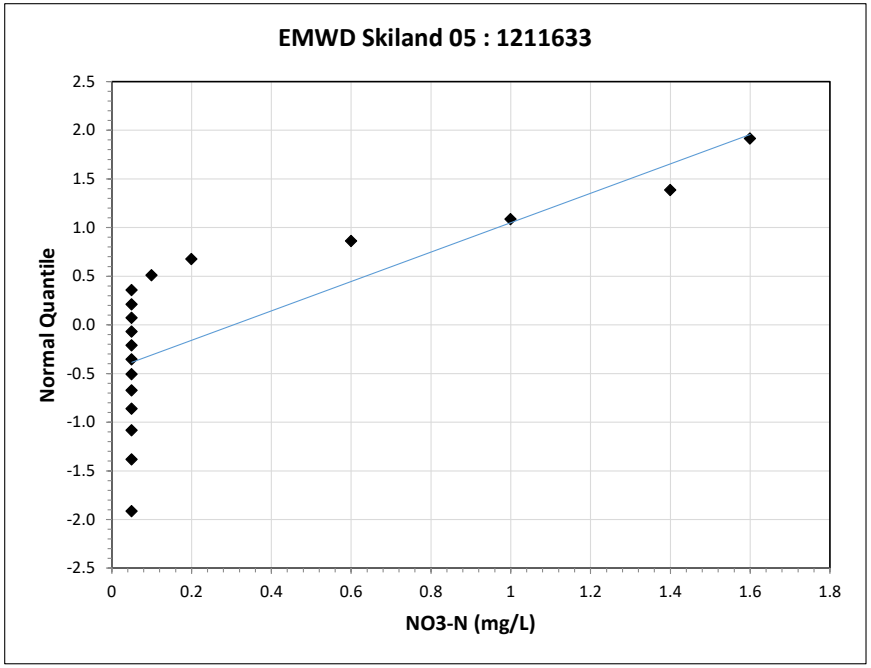


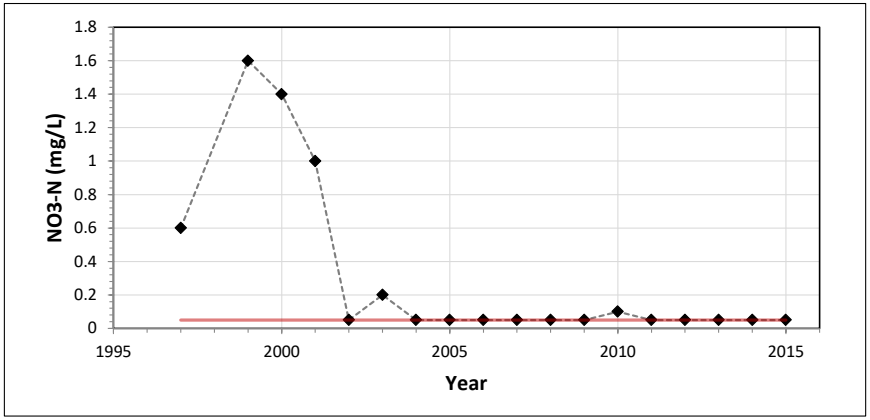
Statistics	
GMZ	Perris-North
Well Name : ID	EMWD 57 New Follico : 1211585
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	435
Annual Average Max	1300
Annual Average Mean	1009
Annual Average Stdev	185.54
Shapiro-Wilk W	0.863
Shapiro-Wilk p-value	0.011
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	42.57
Student t	1.02
Mean + t*SE (UCL84)	1052
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	86
Var(S)	813
Intercept	-29994
Slope	15.45
p-value	0.003
Significant Trend?	Increasing*



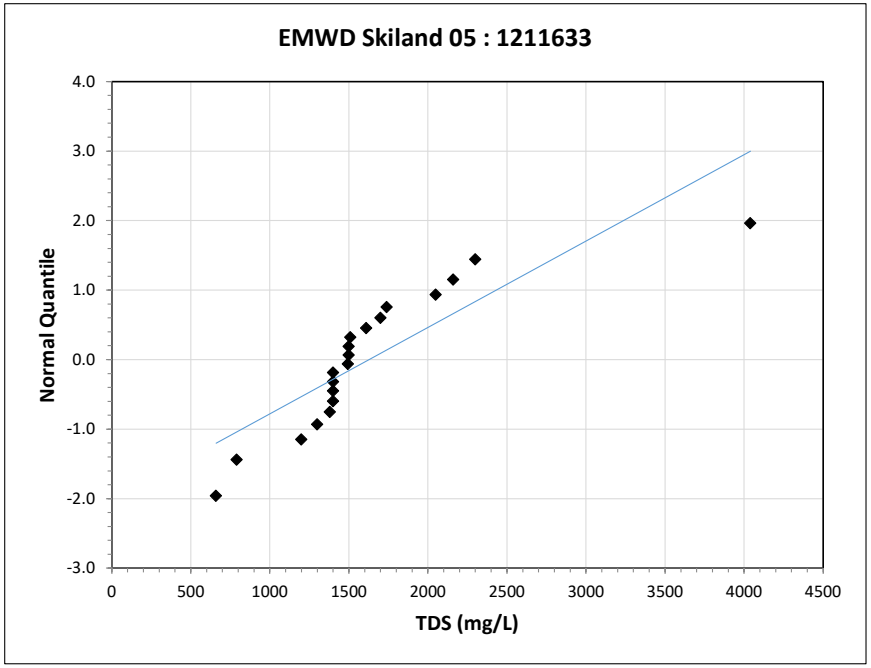


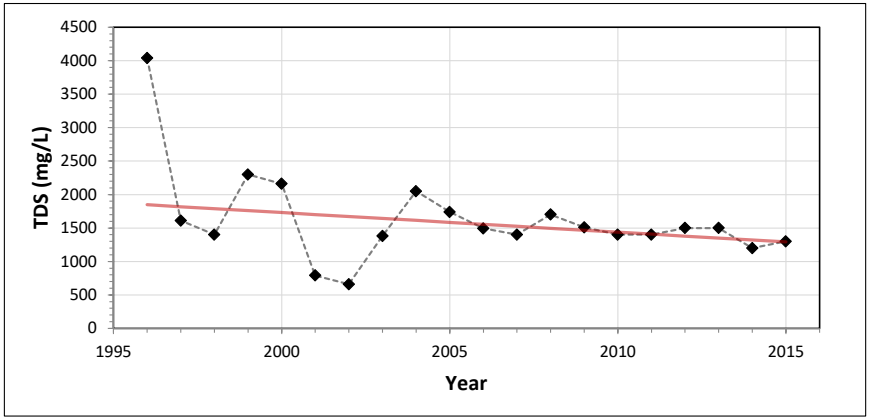
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD Skiland 05 : 1211633
Analyte	NO3-N (mg/L)
Count	18
Count Detects	6
Sample Year Min	1997
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	1.60
Annual Average Mean	0.31
Annual Average Stdev	0.50
Shapiro-Wilk W	0.583
Shapiro-Wilk p-value	5E-6
Critical Alpha	0.01
Most Discordant Value	1.60
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-65
Var(S)	484
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



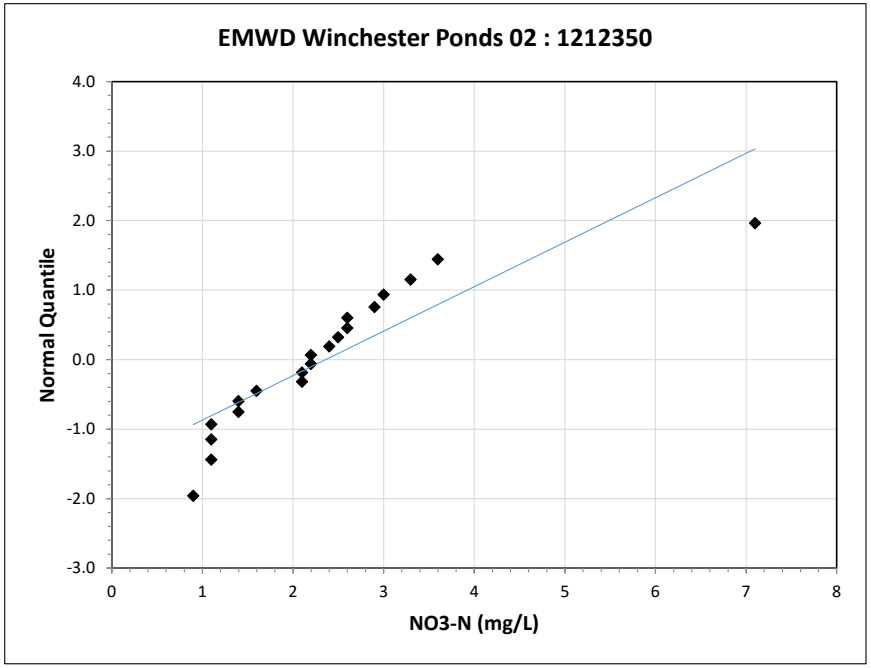


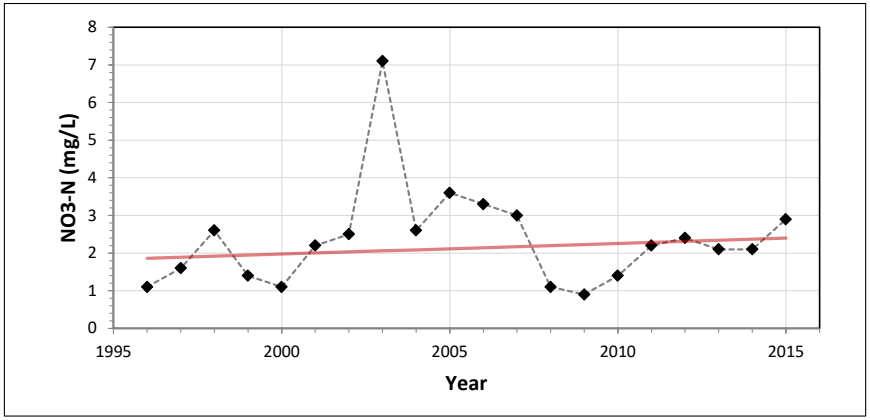
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD Skiland 05 : 1211633
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	660
Annual Average Max	4040
Annual Average Mean	1627
Annual Average Stdev	688.73
Shapiro-Wilk W	0.763
Shapiro-Wilk p-value	3E-4
Critical Alpha	0.01
Most Discordant Value	4040
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.041
Geomean	1519
GM + t*GSE (UCL84)	1654
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-57
Var(S)	940
Intercept	60302
Slope	-29.29
p-value	0.068
Significant Trend?	Decreasing



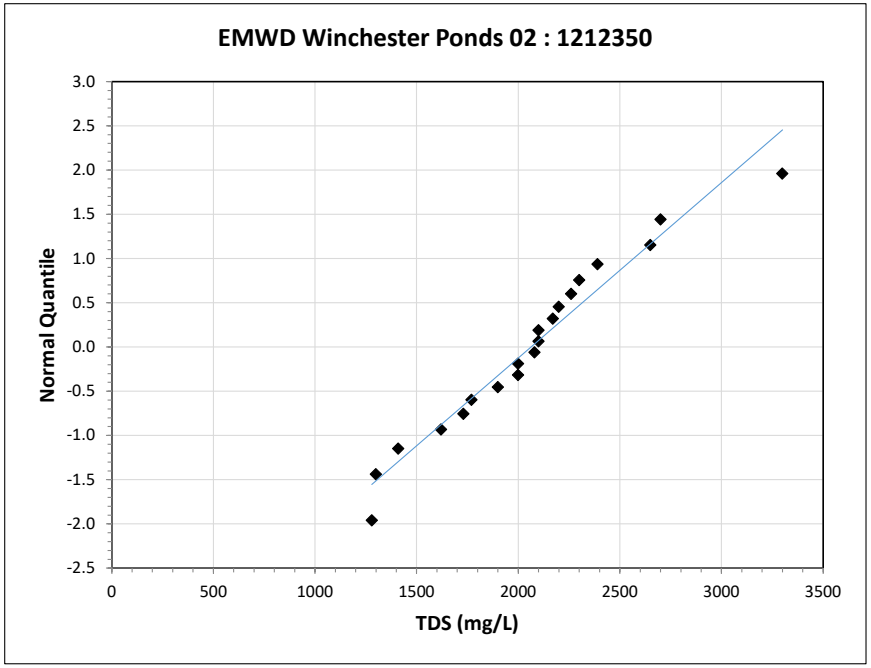


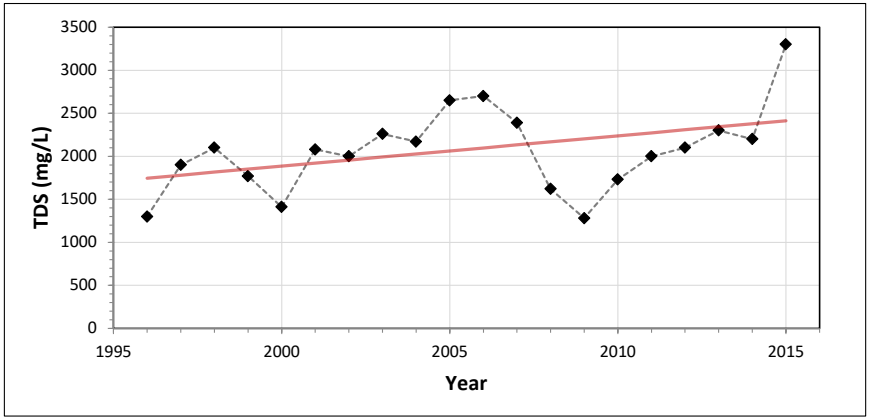
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD Winchester Ponds 02 : 1212350
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.90
Annual Average Max	7.10
Annual Average Mean	2.36
Annual Average Stdev	1.36
Shapiro-Wilk W	0.783
Shapiro-Wilk p-value	5E-4
Critical Alpha	0.01
Most Discordant Value	7.10
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.404
Geomean	2.08
GM + t*GSE (UCL84)	2.34
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	15
Var(S)	942
Intercept	-54.72
Slope	0.03
p-value	0.648
Significant Trend?	No



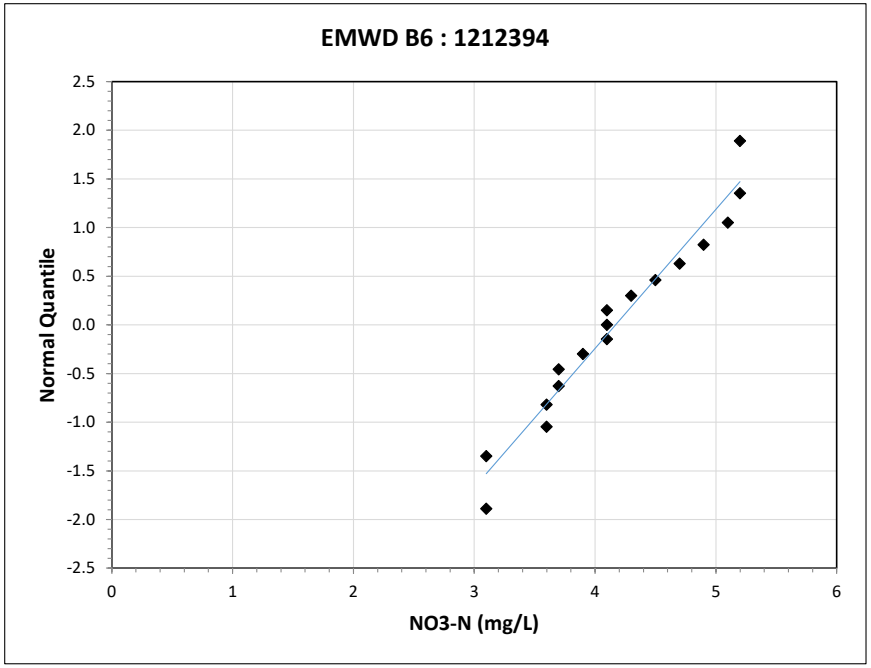


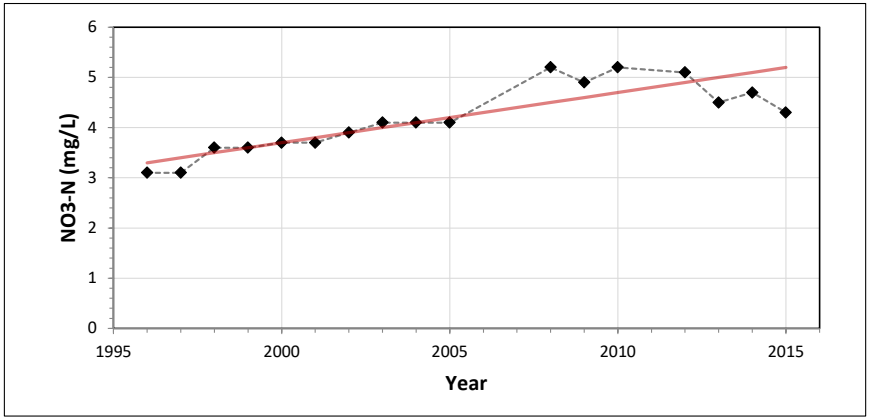
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD Winchester Ponds 02 : 1212350
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1280
Annual Average Max	3300
Annual Average Mean	2063
Annual Average Stdev	490.16
Shapiro-Wilk W	0.959
Shapiro-Wilk p-value	0.532
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	109.60
Student t	1.02
Mean + t*SE (UCL84)	2175
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	60
Var(S)	948
Intercept	-68471
Slope	35.18
p-value	0.055
Significant Trend?	Increasing



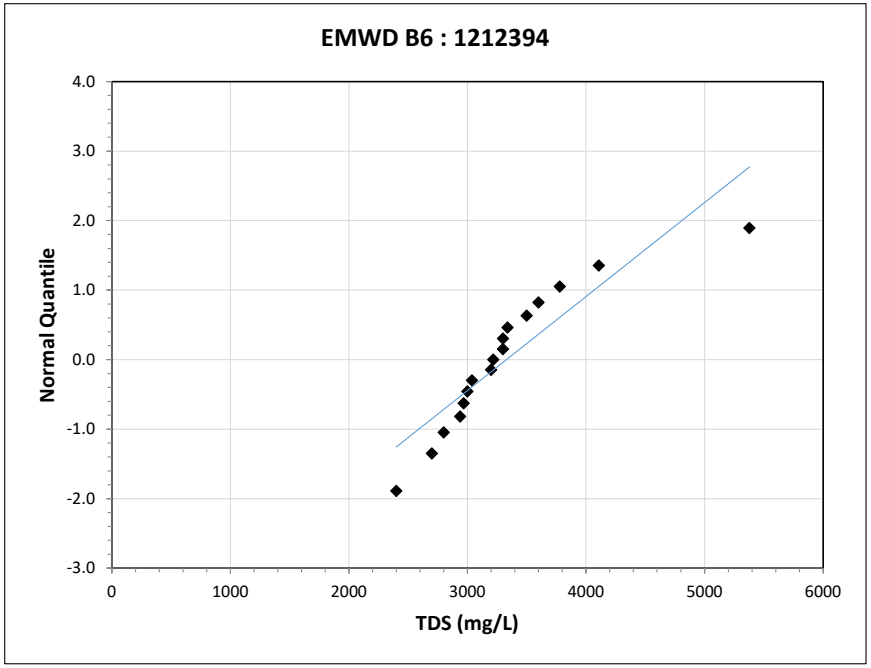


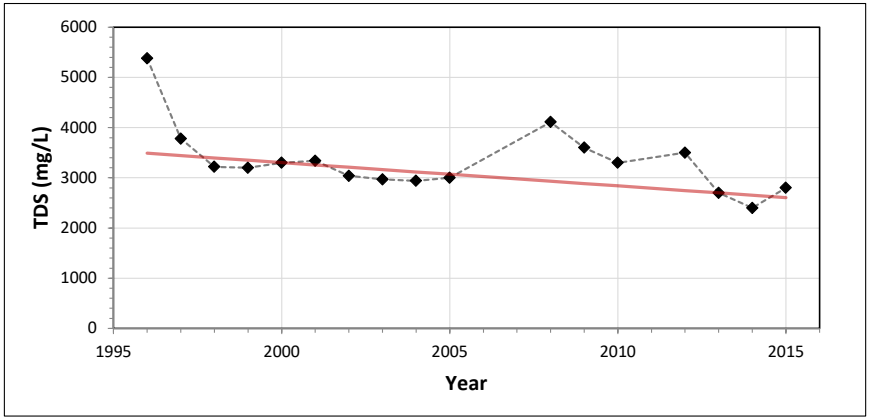
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD B6 : 1212394
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	3.10
Annual Average Max	5.20
Annual Average Mean	4.17
Annual Average Stdev	0.68
Shapiro-Wilk W	0.943
Shapiro-Wilk p-value	0.350
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.16
Student t	1.03
Mean + t*SE (UCL84)	4.34
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	95
Var(S)	582
Intercept	-196
Slope	0.10
p-value	1E-4
Significant Trend?	Increasing**



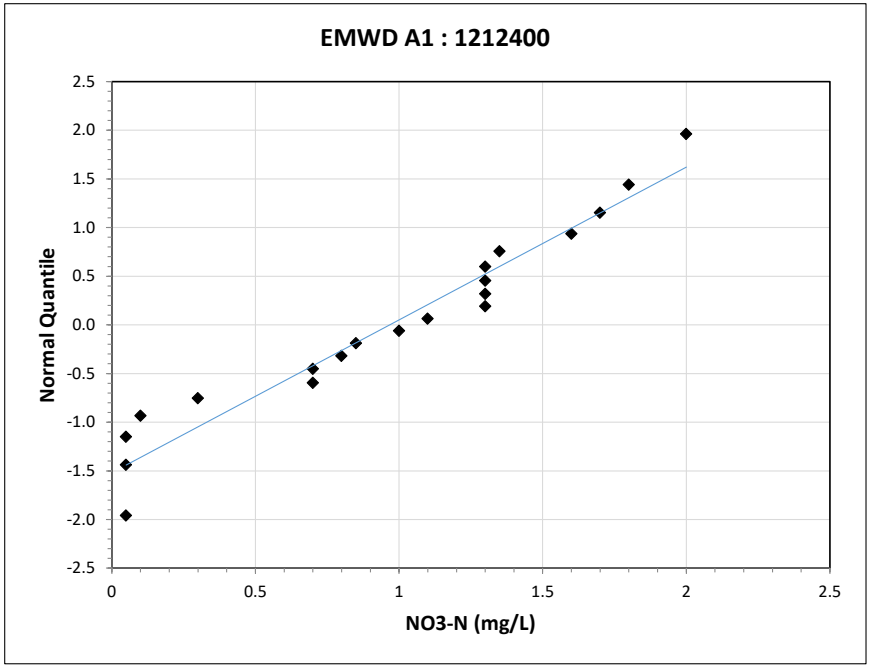


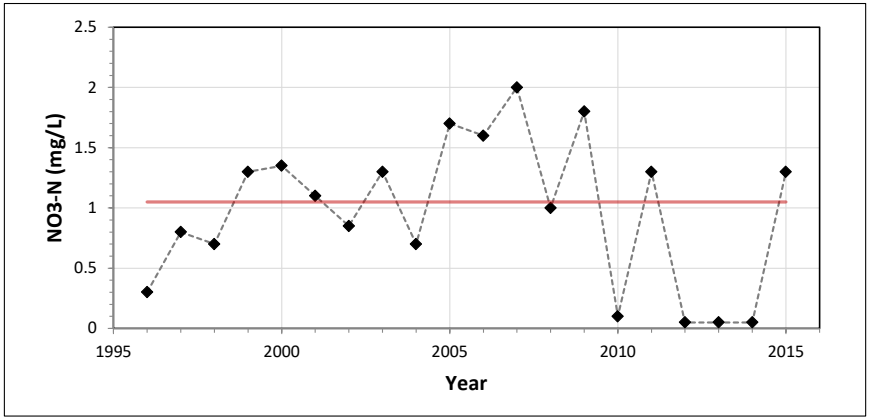
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD B6 : 1212394
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2400
Annual Average Max	5380
Annual Average Mean	3328
Annual Average Stdev	669.12
Shapiro-Wilk W	0.847
Shapiro-Wilk p-value	0.010
Critical Alpha	0.01
Most Discordant Value	5380
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.03
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.207
Geomean	3274
GM + t*GSE (UCL84)	3425
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-53
Var(S)	588
Intercept	96124
Slope	-46.41
p-value	0.032
Significant Trend?	Decreasing



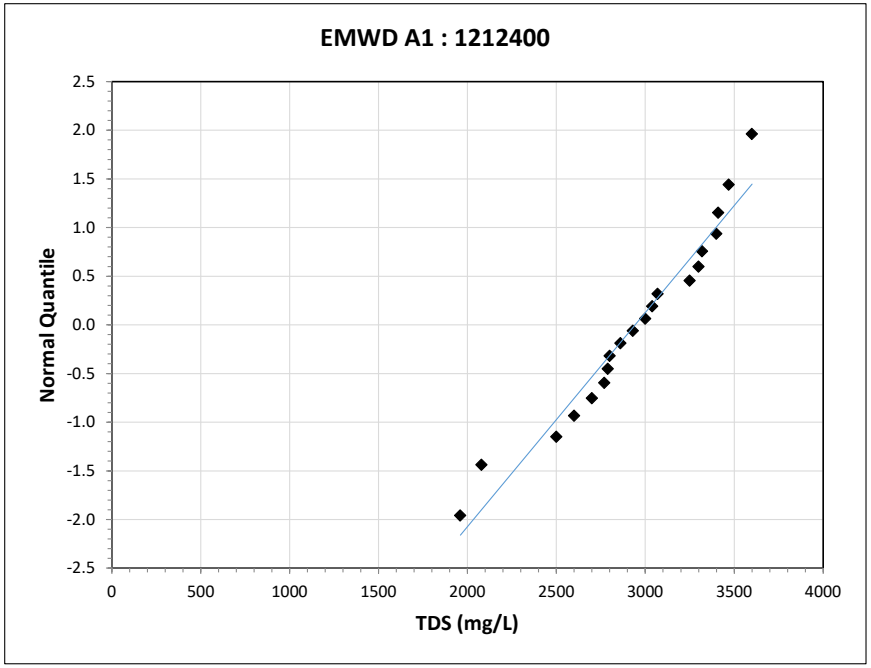


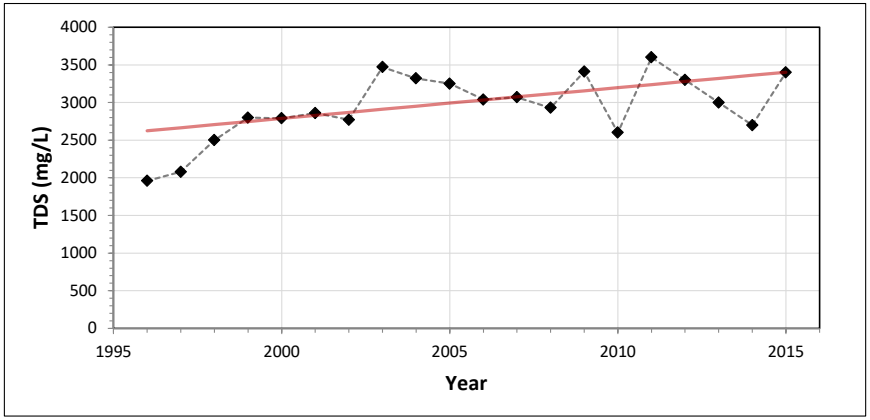
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD A1 : 1212400
Analyte	NO3-N (mg/L)
Count	20
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	2.00
Annual Average Mean	0.97
Annual Average Stdev	0.62
Shapiro-Wilk W	0.934
Shapiro-Wilk p-value	0.181
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.14
Student t	1.02
Mean + t*SE (UCL84)	1.11
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	942
Intercept	1.05
Slope	0.00
p-value	NC
Significant Trend?	No



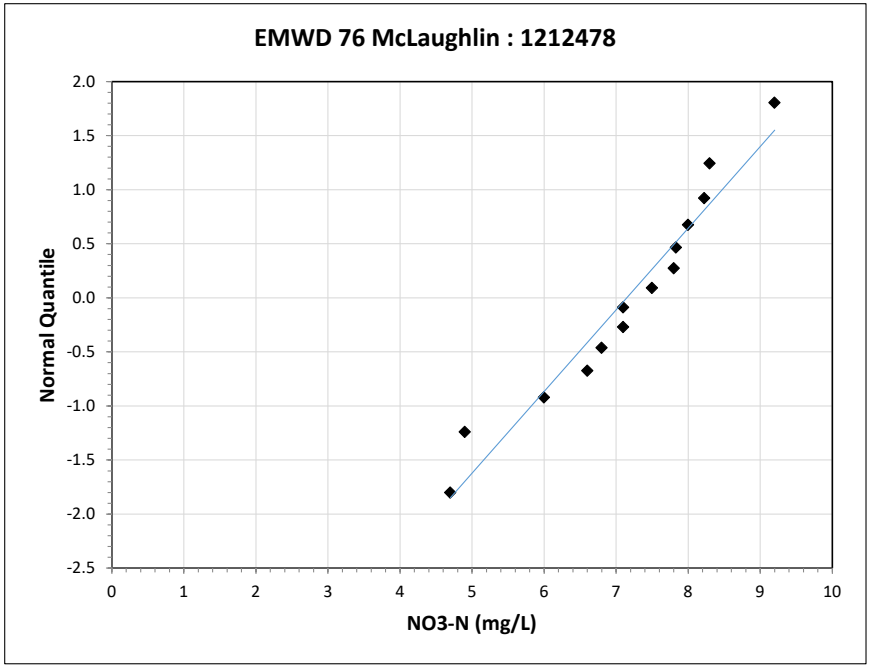


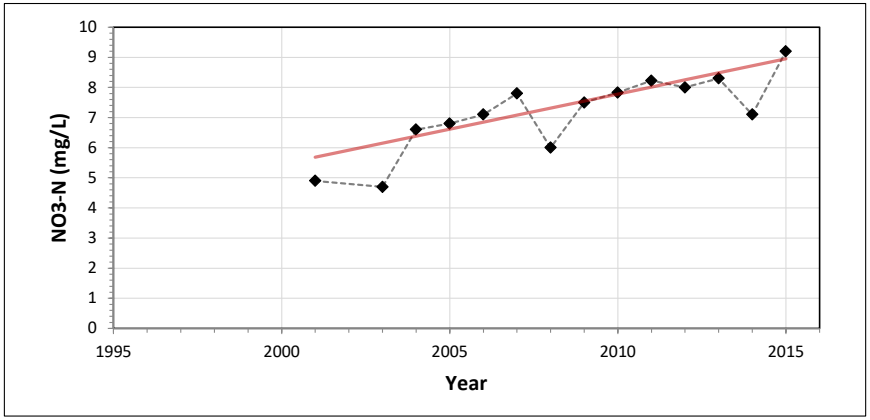
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD A1 : 1212400
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1960
Annual Average Max	3600
Annual Average Mean	2943
Annual Average Stdev	440.92
Shapiro-Wilk W	0.949
Shapiro-Wilk p-value	0.359
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	98.59
Student t	1.02
Mean + t*SE (UCL84)	3043
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	72
Var(S)	950
Intercept	-78989
Slope	40.89
p-value	0.021
Significant Trend?	Increasing



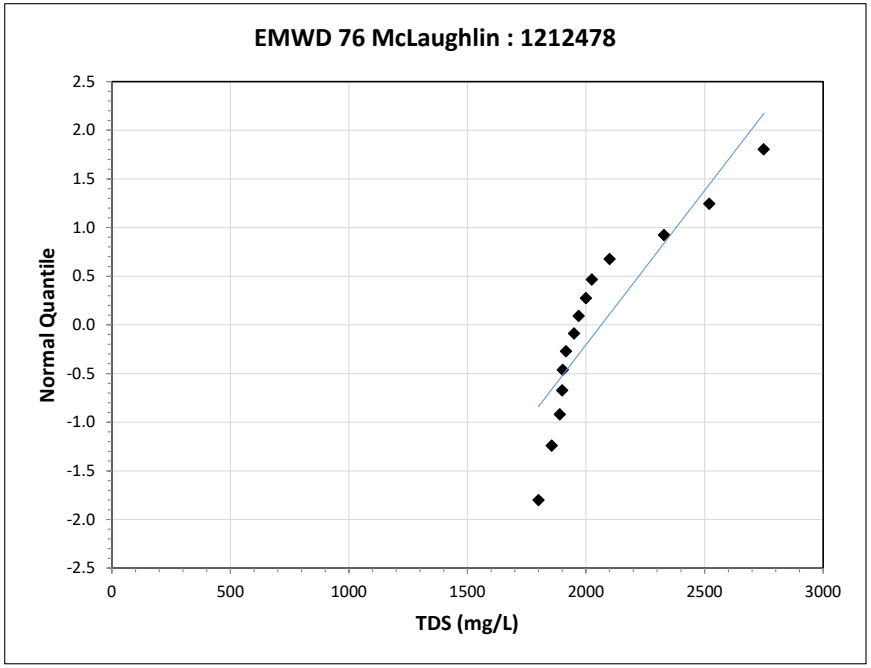


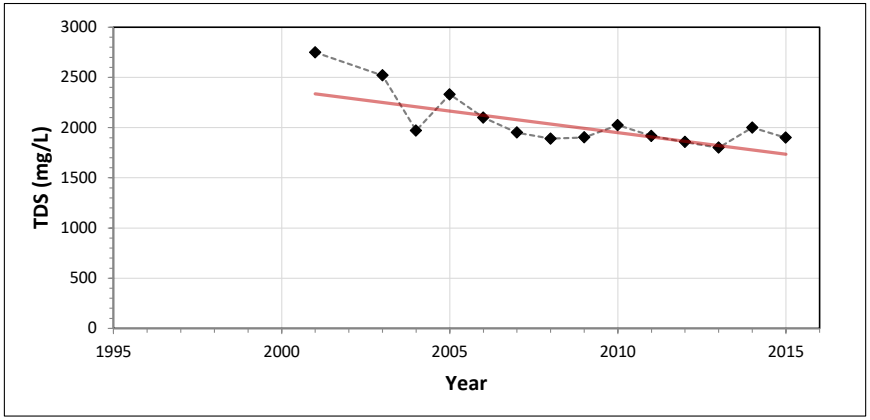
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD 76 McLaughlin : 1212478
Analyte	NO3-N (mg/L)
Count	14
Count Detects	14
Sample Year Min	2001
Sample Year Max	2015
Annual Average Min	4.70
Annual Average Max	9.20
Annual Average Mean	7.15
Annual Average Stdev	1.28
Shapiro-Wilk W	0.945
Shapiro-Wilk p-value	0.485
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.34
Student t	1.03
Mean + t*SE (UCL84)	7.50
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	65
Var(S)	334
Intercept	-461
Slope	0.23
p-value	5E-4
Significant Trend?	Increasing**



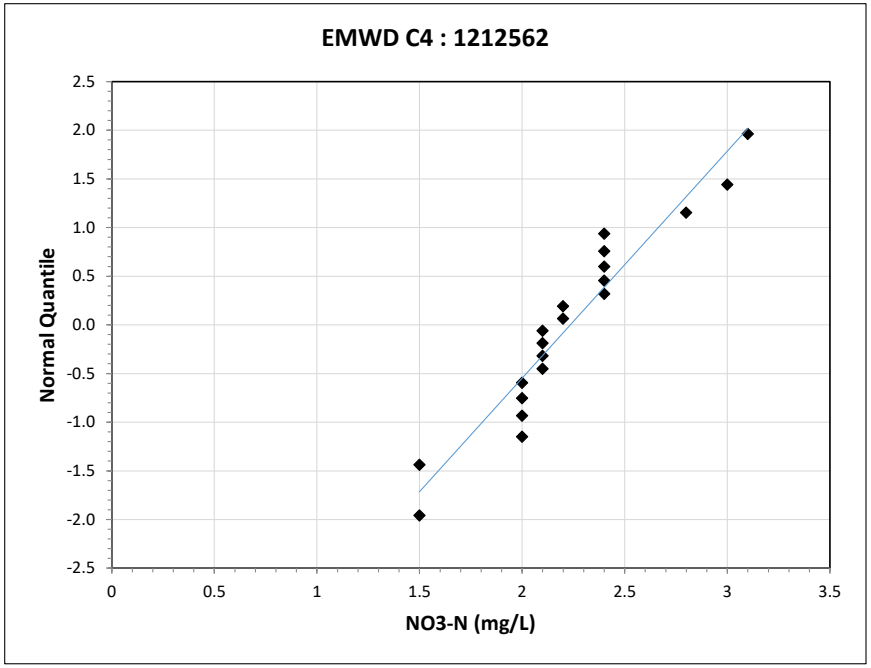


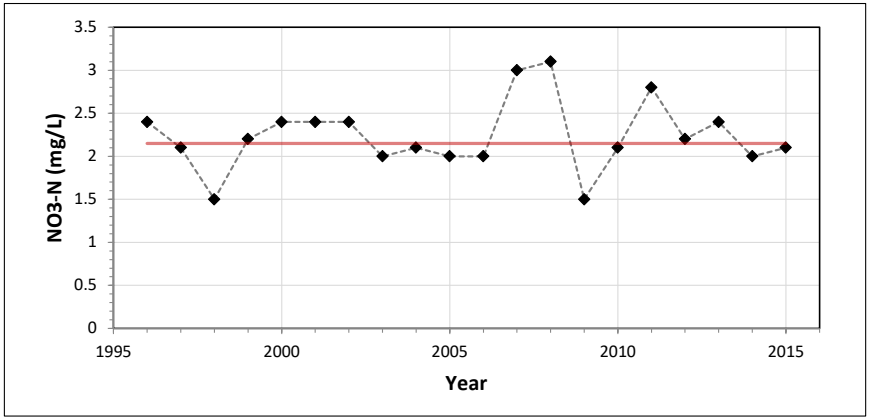
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD 76 McLaughlin : 1212478
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	2001
Sample Year Max	2015
Annual Average Min	1800
Annual Average Max	2750
Annual Average Mean	2065
Annual Average Stdev	276.77
Shapiro-Wilk W	0.786
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	2750
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.008
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	1960
Trend Analysis	**Theil-Sen**
Kendall S	-53
Var(S)	334
Intercept	88093
Slope	-42.86
p-value	0.004
Significant Trend?	Decreasing*



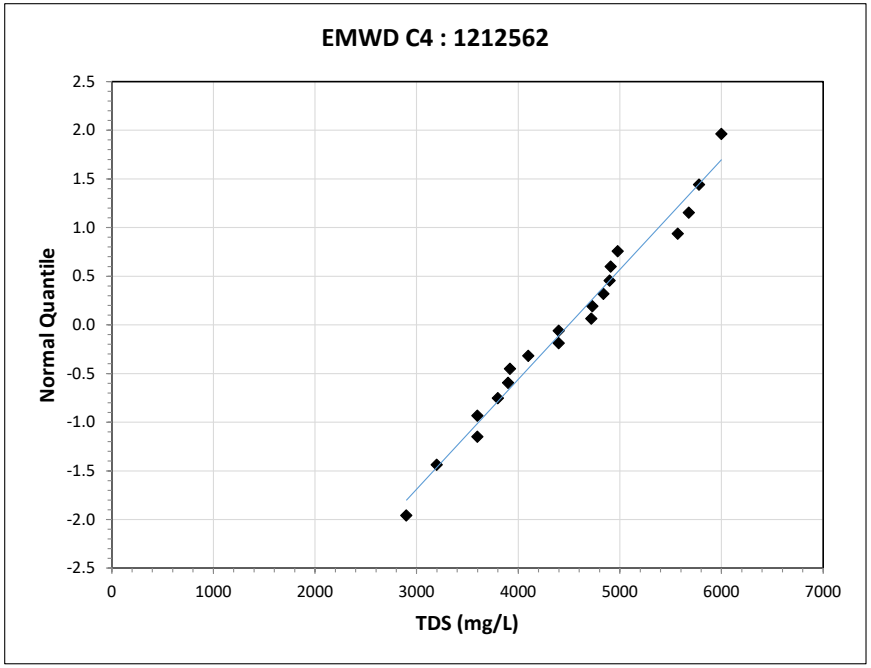


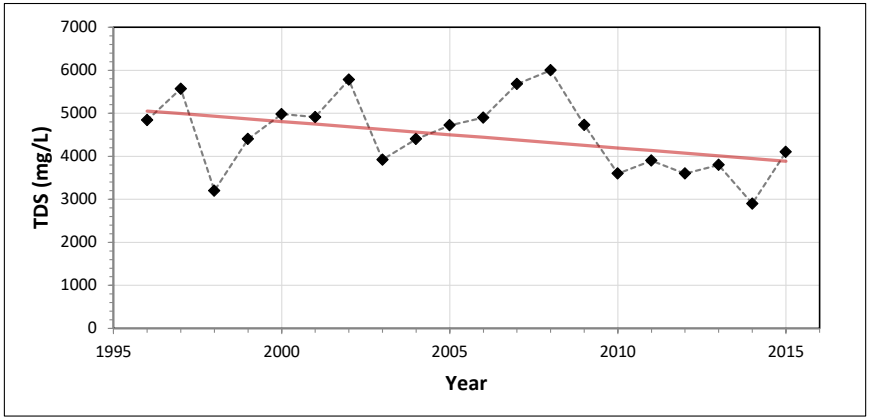
Statistics	
GMZ	Perris-South
Well Name : ID	EMWD C4 : 1212562
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.50
Annual Average Max	3.10
Annual Average Mean	2.23
Annual Average Stdev	0.41
Shapiro-Wilk W	0.920
Shapiro-Wilk p-value	0.098
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.09
Student t	1.02
Mean + t*SE (UCL84)	2.33
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	3
Var(S)	919
Intercept	2.15
Slope	0.00
p-value	NC
Significant Trend?	No





Statistics	
GMZ	Perris-South
Well Name : ID	EMWD C4 : 1212562
Analyte	TDS (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	2900
Annual Average Max	6000
Annual Average Mean	4497
Annual Average Stdev	871.70
Shapiro-Wilk W	0.971
Shapiro-Wilk p-value	0.777
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	194.92
Student t	1.02
Mean + t*SE (UCL84)	4696
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-52
Var(S)	948
Intercept	127523
Slope	-61.36
p-value	0.098
Significant Trend?	Decreasing





Attachment B15

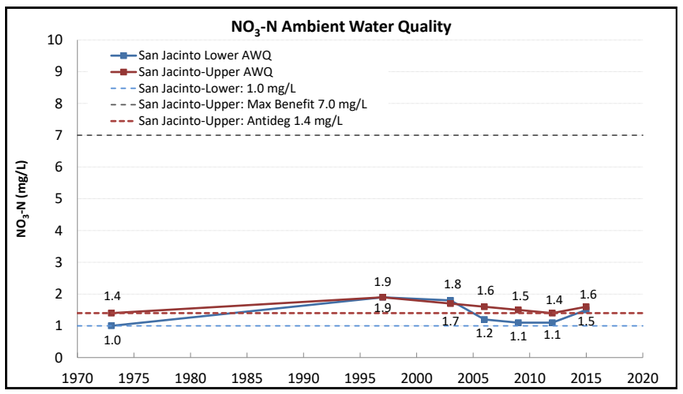
San Jacinto Upper and Lower Pressure GMZs

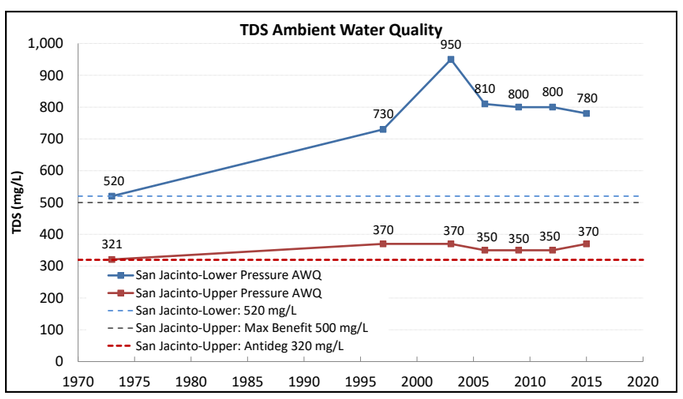
Attachment Contents:

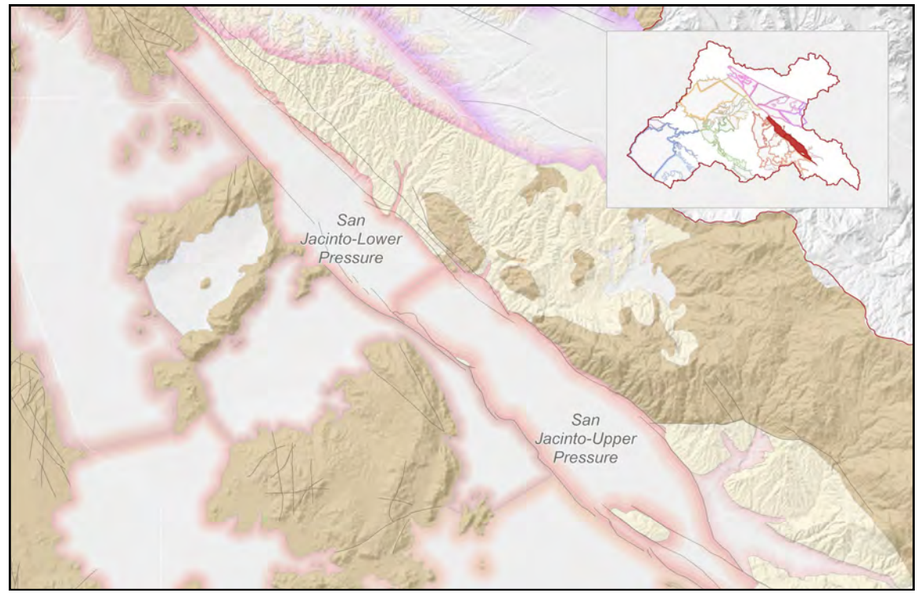
B15-1 Groundwater Storage and Elevation Contours Fall 2015
B15-2 NO_3-N Concentration and Contour Map
B15-3 TDS Concentration and Contour Map
B15-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B15-5 TDS Concentration Change (1993-2012 to 1996-2015)
B15-6 Key Well Analysis Charts

	Basin Analytics	San Jacinto-Lower Pressure	San Jacinto-Upper Pressure
Basin	GMZ Area (acres)	13,500	20,900
	Volume of Storage (acre-ft)	501,000	1,047,535
NO_3-N	Wells per GMZ	17	110
	Point Statistics per GMZ	3	33
	Total Mass (tons)	1,030	2,310
	1996-2015 AWQ	1.5	1.6
TDS	Wells per GMZ	17	110
	Point Statistics per GMZ	11	85
	Total Mass (tons)	534,000	528,000
	1996-2015 AWQ	780	370

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

San Jacinto-Lower

The nitrate objective for San Jacinto-Lower is 1.0 mg/L. The ambient nitrate concentration increased from 1.1 mg/L in 2012 to 1.5 mg/L in 2015, and there is no assimilative capacity. One out of the four key wells in San Jacinto-Lower GMZ has an increasing trend in nitrate concentrations, while the other three show no trends in the nitrate concentrations. One of the total 17 wells with nitrate values in San Jacinto-Lower will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

San Jacinto-Upper

The nitrate objective for San Jacinto-Upper "max benefit" is 7.0 mg/L and for San Jacinto-Upper "antideg" is 1.4 mg/L. The ambient nitrate concentration increased from 1.4 mg/L in 2012 to 1.6 mg/L in 2015, allowing for 5.4 mg/L of assimilative capacity. One out of the six key wells in San Jacinto-Upper GMZ has an increasing trend in nitrate concentrations, one has a decreasing trend, and the other four show no trends in the nitrate concentrations. Five of the total 110 wells with nitrate values in San Jacinto-Upper will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and four wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

San Jacinto-Lower

The TDS objective for San Jacinto-Lower is 520 mg/L. The ambient TDS concentration decreased from 800 mg/L in 2012 to 780 mg/L in 2015, and there is no assimilative capacity. One out of the four key wells in San Jacinto-Lower GMZ has an increasing trend in TDS concentration, two key wells show a decreasing trend, and the other one shows no trend in the TDS concentration. One of the total 17 wells with TDS values in San Jacinto-Lower will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
San Jacinto Lower Pressure	1210452	EMWD 42 Reche Canyon	8.1	Increasing	365	Decreasing
San Jacinto Lower Pressure	1210508	Fish & Game Bouris	0.1	No Trend	1,231	Decreasing**
San Jacinto Lower Pressure	1210526	Fish & Game Walker Duck Club	0.1	No Trend	1,205	No Trend
San Jacinto Lower Pressure	1210571	Fish & Game Cannery Feedlot	0.1	No Trend	494	Increasing**
San Jacinto Upper Pressure	1210776	Scott Dairy Yard	0.1	No Trend	285	No Trend
San Jacinto Upper Pressure	1210839	Haringa Dairy 04	0.1	No Trend	258	Decreasing
San Jacinto Upper Pressure	1210945	Record Potter/Record	0.1	No Trend	435	Increasing**
San Jacinto Upper Pressure	1211303	EMWD 14 Riverbed	0.3	Decreasing*	275	Increasing
San Jacinto Upper Pressure	1211323	Lauda Beebower Tree	0.1	No Trend	1,803	Increasing*
San Jacinto Upper Pressure	1211838	Kelley BCR 02	21.0	Increasing	722	Increasing

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B15-4 and B15-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
San Jacinto-Lower	1210453	EMWD 39 Robinson	Medium	5	10.9	Stat	Medium	5	311	Stat
San Jacinto-Lower	1210535	Fish & Game Operating	High	2	0.4	Ave	High	2	880	Ave
San Jacinto-Lower	1210558	21 Gun Club	Medium	2	0.1	Ave	Medium	2	693	Ave
San Jacinto-Upper	1210785	Lauda 03	Medium	1	0.1	Ave	Medium	1	230	Ave
San Jacinto-Upper	1210809	Haringa Dairy 03	High	3	0.2	Stat	High	3	227	Stat
San Jacinto-Upper Pressure	1210872	DeVuyst Sanderson/ Ramona	Medium	6	0.1	Ave	Medium	6	229	Stat
San Jacinto-Upper	1211120	Bandick, Larry	High	3	0.3	Stat	High	3	226	Stat
San Jacinto-Upper	1211245	EMWD 13 Esplanade	Medium	4	0.1	Ave	Medium	4	288	Stat
San Jacinto-Upper Pressure	1211255	City of San Jacinto Mistletoe	High	1	0.1	Ave	High	1	340	Ave
San Jacinto-Upper	1211260	EMWD 03 Seventh	Medium	1	0.1	Ave	Medium	1	450	Ave
San Jacinto-Upper Pressure	1211268	EMWD 09 Hewitt/ Evans	High	1	0.5	Ave	High	1	260	Ave
San Jacinto-Upper	1211285	EMWD 12 Mountain	High	2	0.1	Ave	High	2	296	Ave
San Jacinto-Upper	1211836	Blue Banner South	Medium	3	18.6	Stat	Medium	3	820	Stat
San Jacinto-Upper	1211913	Searl Jaylen (Friend)	Medium	2	28.0	Ave	Medium	2	825	Ave
San Jacinto-Upper	1211946	EMWD 24 Howard	Medium	3	0.1	Stat	Medium	3	424	Stat

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

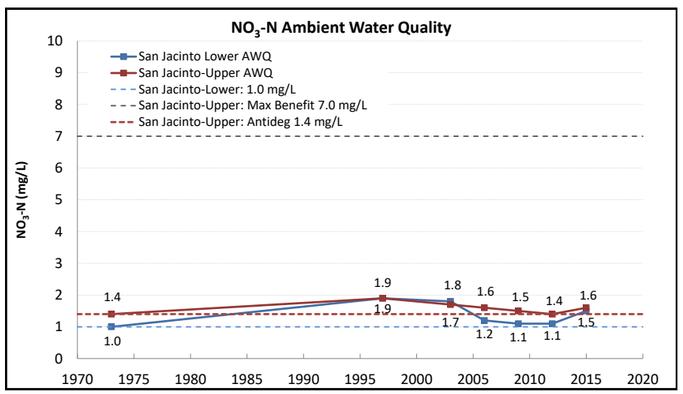
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B15-4 and B15-5 for NO_3-N and TDS well locations, respectively.

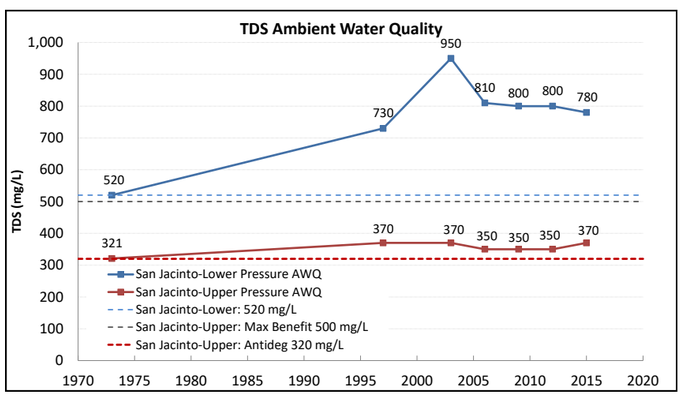
Attachment Contents:

B15-1 Groundwater Storage and Elevation Contours Fall 2015
B15-2 NO_3-N Concentration and Contour Map
B15-3 TDS Concentration and Contour Map
B15-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B15-5 TDS Concentration Change (1993-2012 to 1996-2015)
B15-6 Key Well Analysis Charts

	Basin Analytics	San Jacinto-Lower Pressure	San Jacinto-Upper Pressure
Basin	GMZ Area (acres)	13,500	20,900
	Volume of Storage (acre-ft)	501,000	1,047,535
NO_3-N	Wells per GMZ	17	110
	Point Statistics per GMZ	3	33
	Total Mass (tons)	1,030	2,310
	1996-2015 AWQ	1.5	1.6
TDS	Wells per GMZ	17	110
	Point Statistics per GMZ	11	85
	Total Mass (tons)	534,000	528,000
	1996-2015 AWQ	780	370

Table 1 - Basin Analytics





Total Dissolved Solids Continued

San Jacinto-Upper

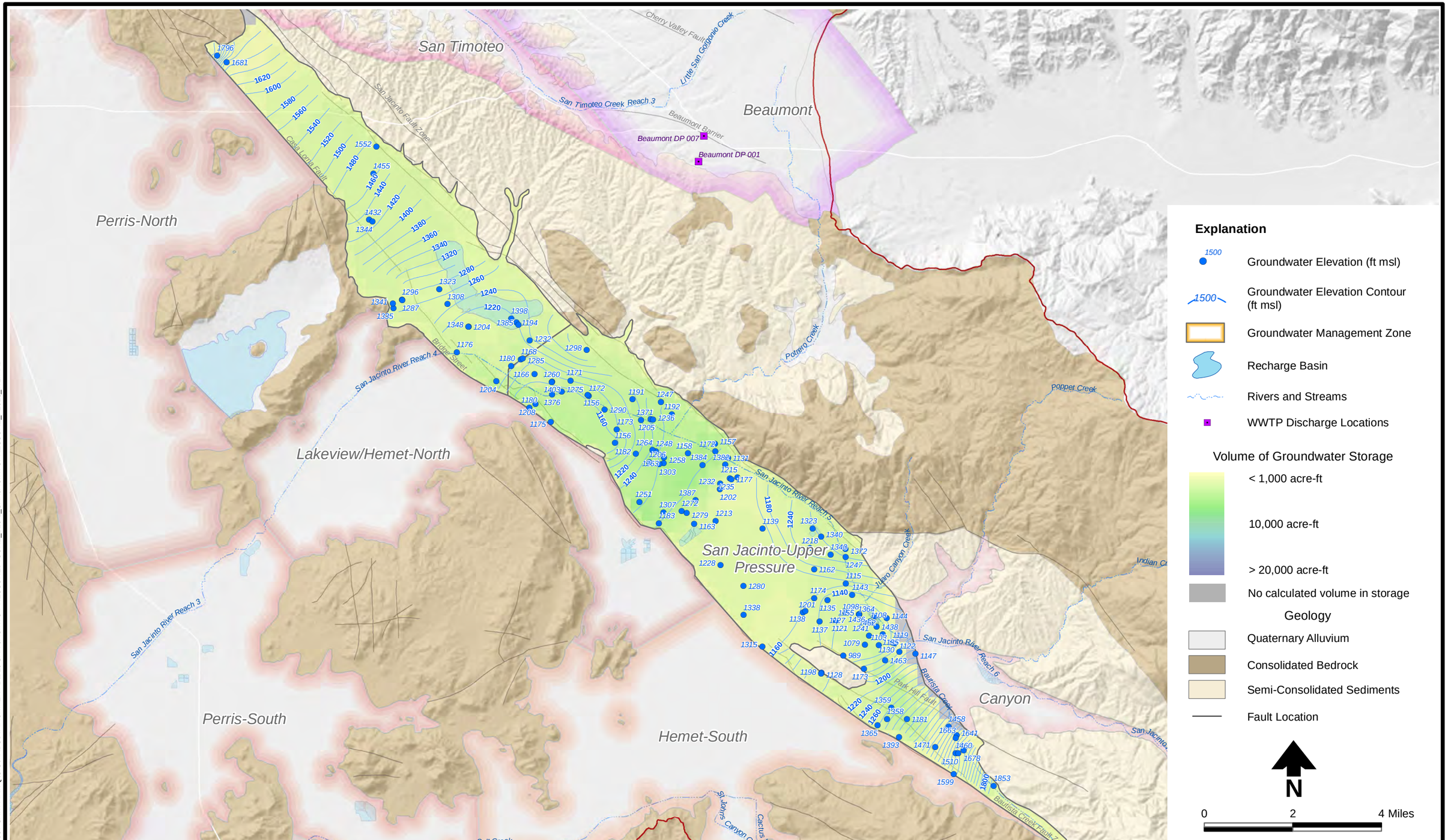
The TDS objective for San Jacinto-Upper "max benefit" is 500 mg/L and for San Jacinto-Upper "antideg" is 320 mg/L. The ambient TDS concentration increased from 350 mg/L in 2012 to 370 mg/L in 2015, allowing for 130 mg/L of assimilative capacity. Four out of the six key wells in San Jacinto-Upper GMZ have an increasing trend in TDS concentration, one key well shows a decreasing trend, and the other one shows no trend in the TDS concentration. Five of the total 110 wells with TDS values in San Jacinto-Upper will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, four wells that were sampled between 2014 and 2015 will be eligible to have statistics determined, if the wells are sampled again in the next AWQ recomputation period (1999-2018).

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
San Jacinto-Lower Pressure	1211335	List Bridge St. Farms West	New*	1	0.1	Ave	New*	1	630	Ave
San Jacinto-Upper Pressure	1211030	EMWD Alessandro West	New*	2	0.1	Ave	New*	2	265	Ave
San Jacinto-Upper Pressure	2000098	EMWD IRRP M-3D (Orange)	New*	2	0.1	Ave	New*	2	270	Ave
San Jacinto-Upper Pressure	2000099	EMWD IRRP M-3M (White)	New*	2	0.1	Ave	New*	2	385	Ave
San Jacinto-Upper Pressure	2000100	EMWD IRRP M-3S (Black)	New*	2	0.9	Ave	New*	2	305	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B15-4 and B15-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
San Jacinto Upper and Lower Pressure GMZs

Attachment B15-1

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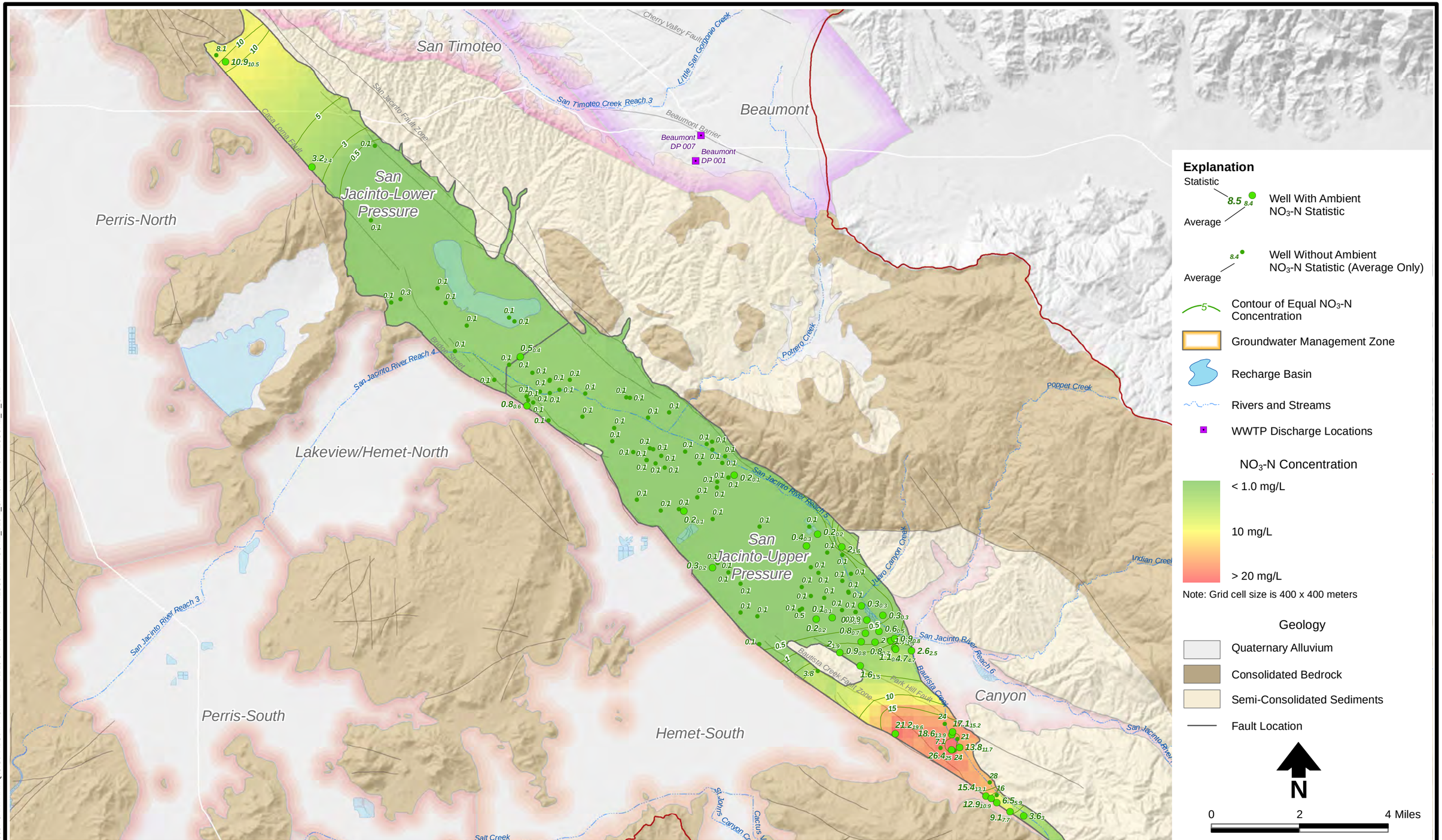

Source: SAWPA.net, January 2017

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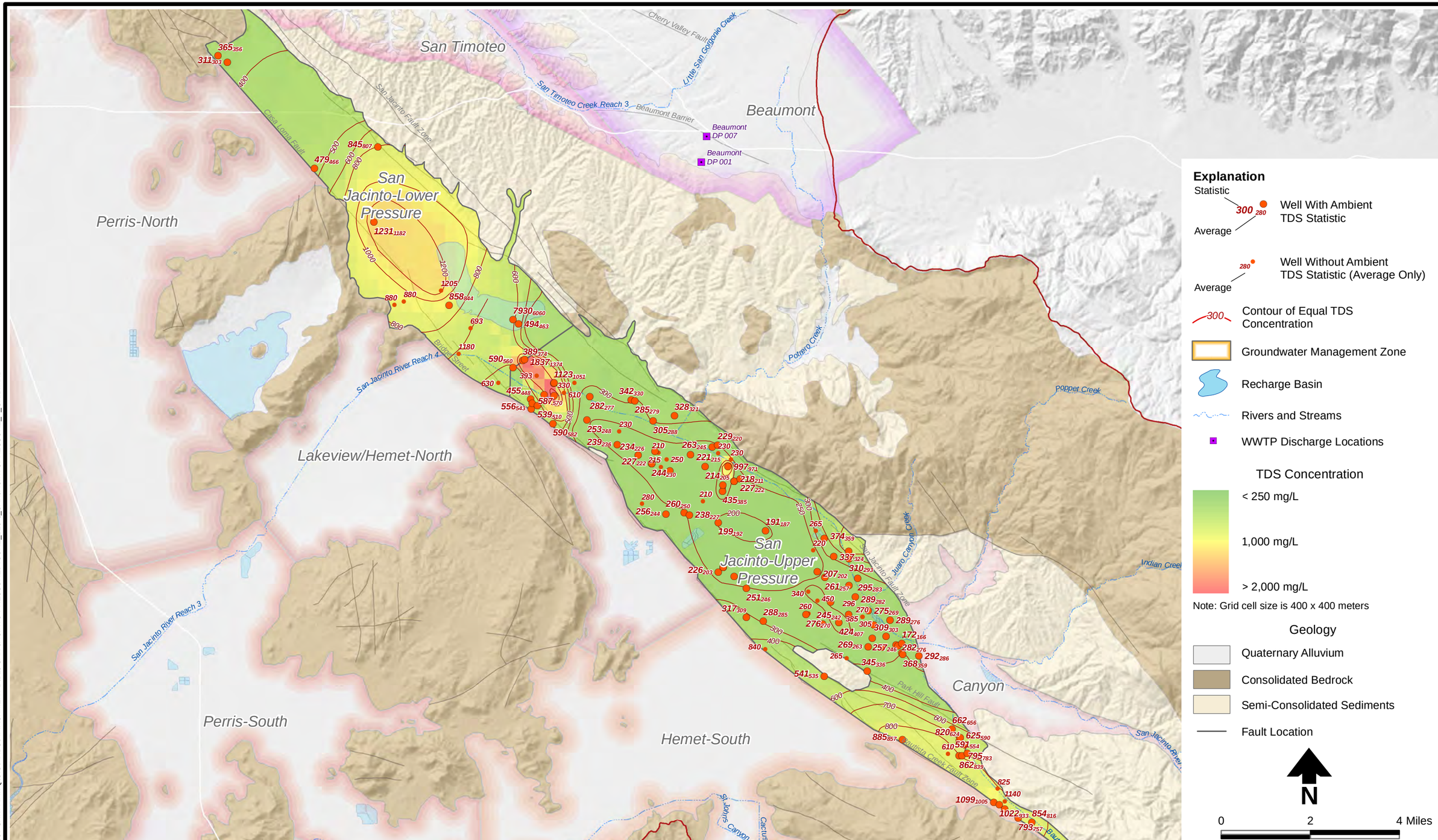
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
San Jacinto Upper and Lower Pressure GMZs

Attachment B15-2



Source: SAWPA.net, January 2017

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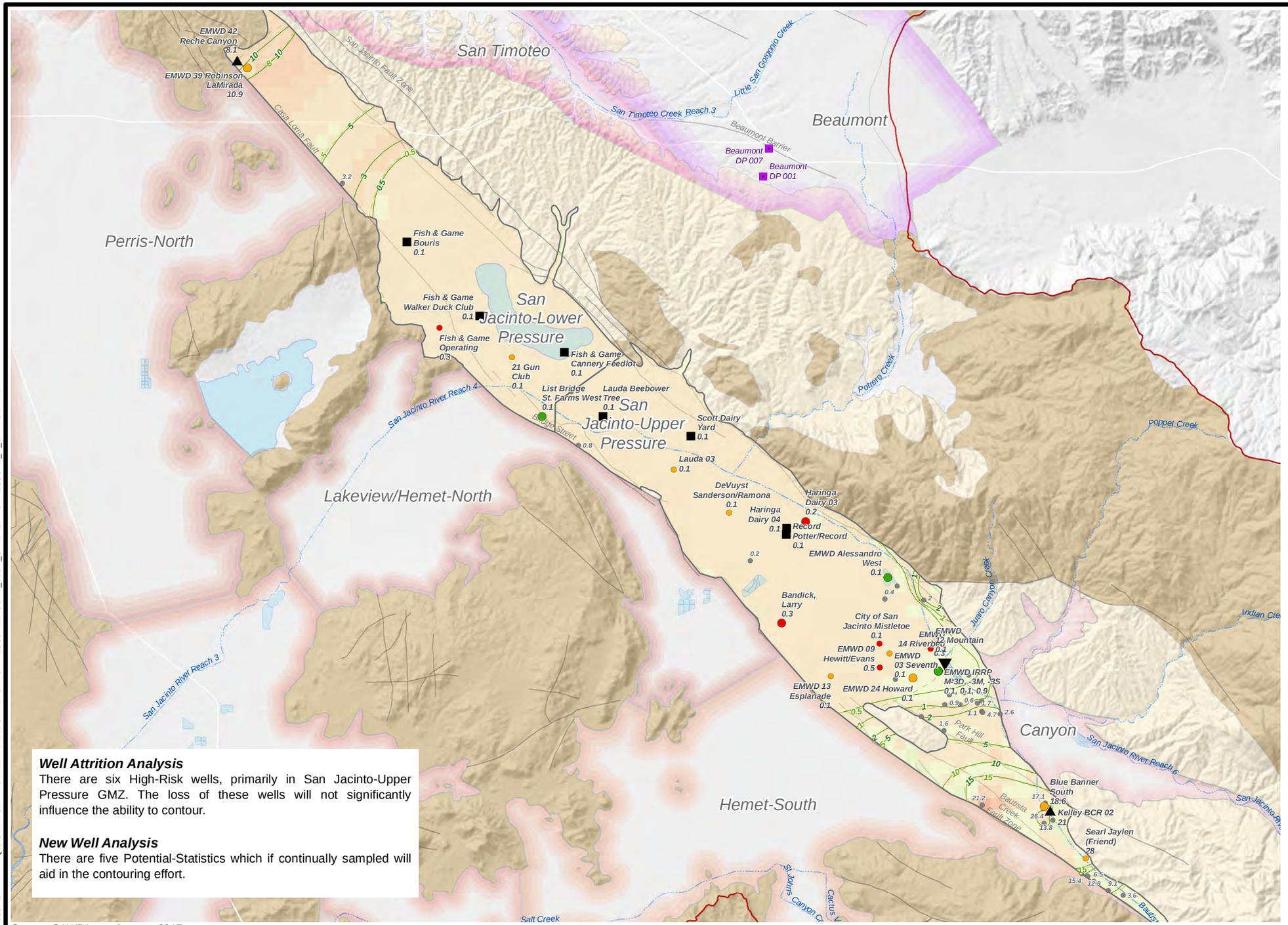
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
San Jacinto Upper and Lower Pressure GMZs

Attachment B15-3



Source: SAWPA.net, January 2017

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 2 4 Miles

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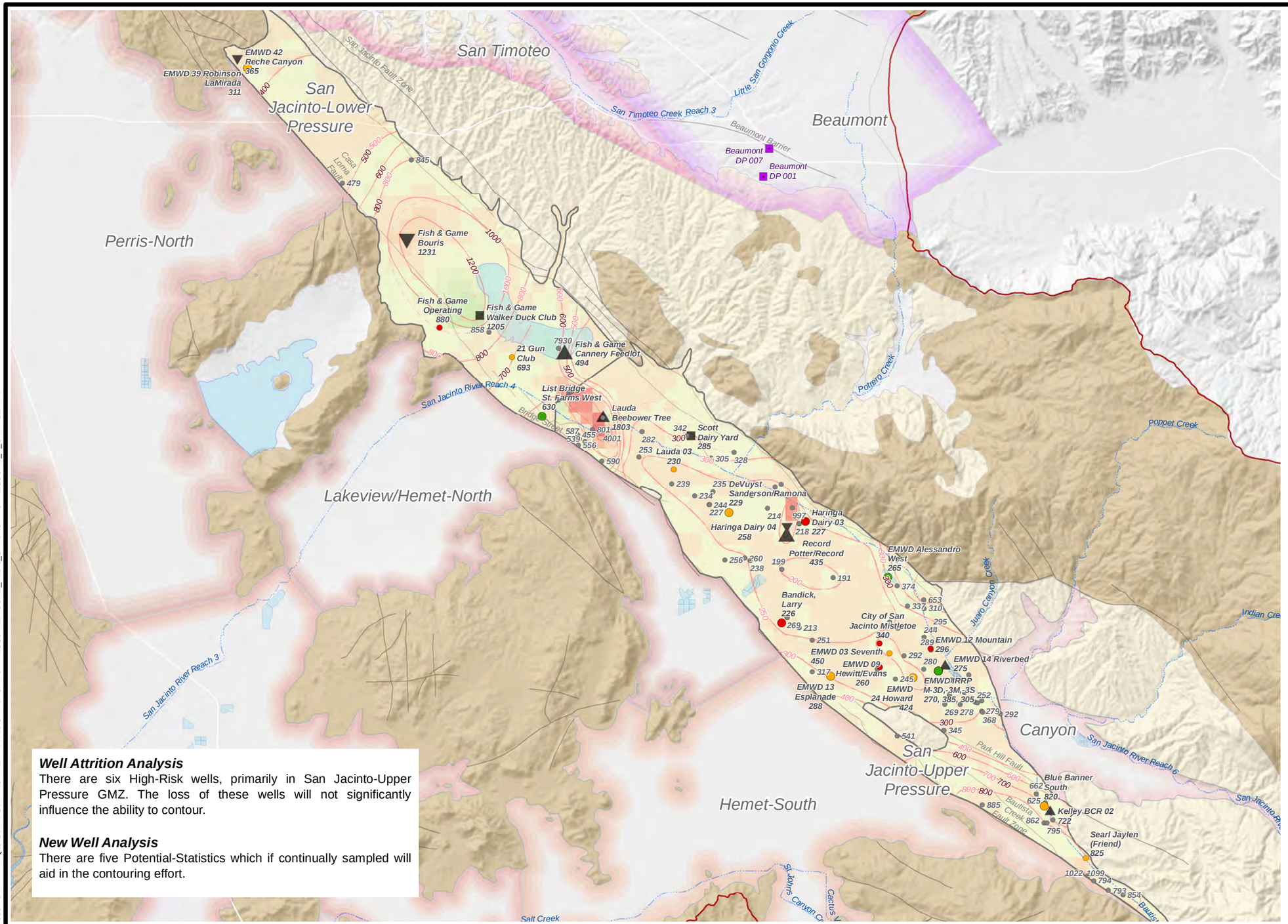
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
San Jacinto Upper and Lower Pressure GMZs

Attachment B15-4



Well Attrition Analysis
There are six High-Risk wells, primarily in San Jacinto-Upper Pressure GMZ. The loss of these wells will not significantly influence the ability to contour.

New Well Analysis
There are five Potential-Statistics which if continually sampled will aid in the contouring effort.

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 2 4 Miles

Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA AWQ\GIS\MXDS\ATTACHMENT B\B15 SAN JACINTO PRESSURE\FIGURE_B15-5_SANJACINTOPRESSURE_T_CHANGE.MXD

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
San Jacinto Upper and Lower Pressure GMZs

Attachment B15-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

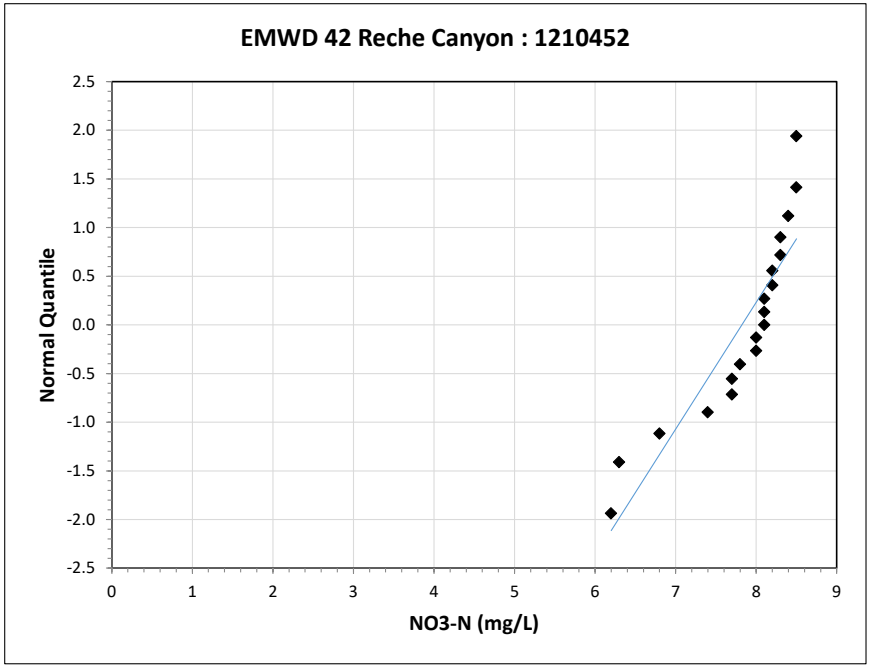
Mann-Kendall

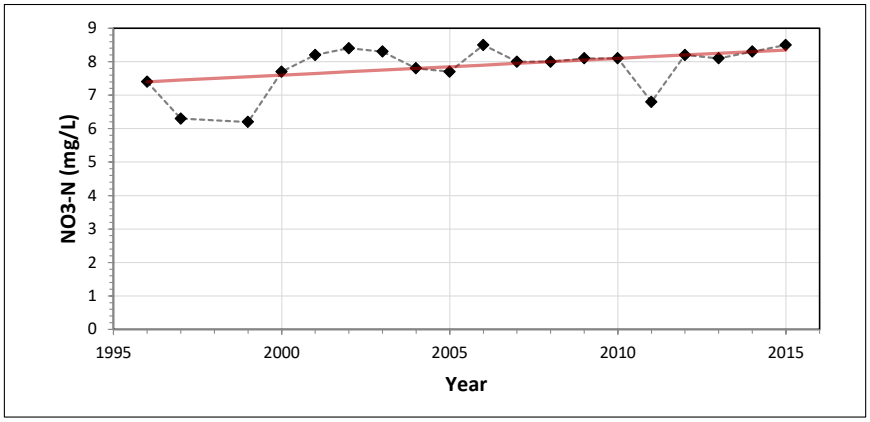
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

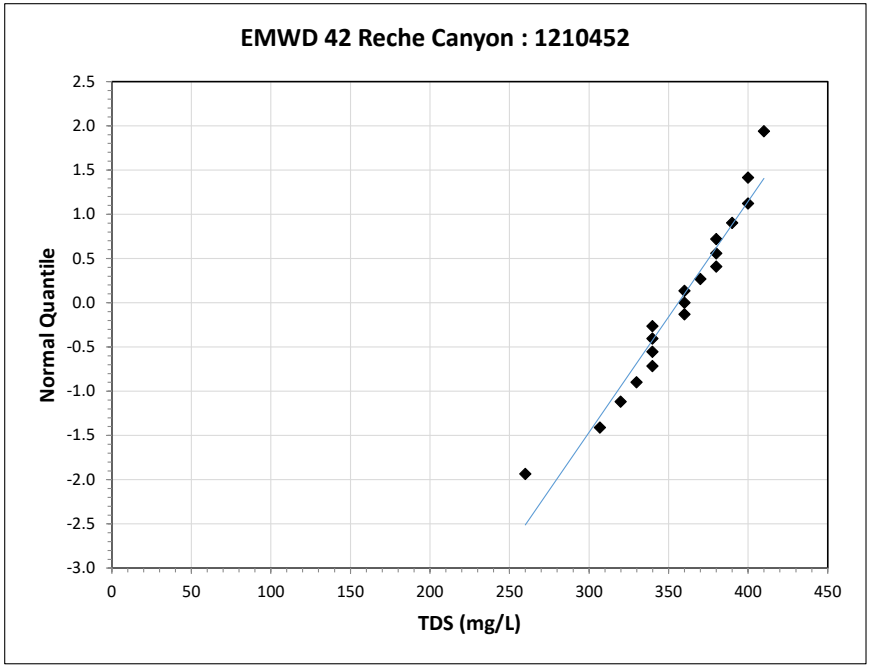
The significance of the trends is notated by * for significant and ** for very significant.

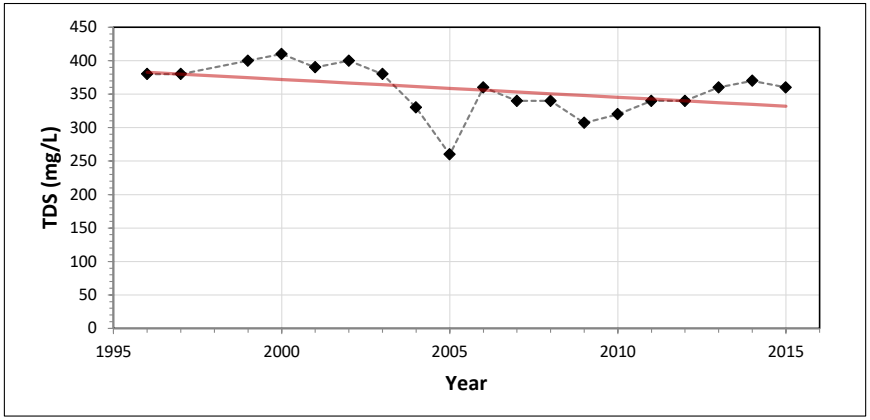
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	EMWD 42 Reche Canyon : 1210452
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	6.20
Annual Average Max	8.50
Annual Average Mean	7.82
Annual Average Stdev	0.69
Shapiro-Wilk W	0.809
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	6.20
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	6E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	8.10
Trend Analysis	**Theil-Sen**
Kendall S	65
Var(S)	808
Intercept	-92.40
Slope	0.05
p-value	0.024
Significant Trend?	Increasing



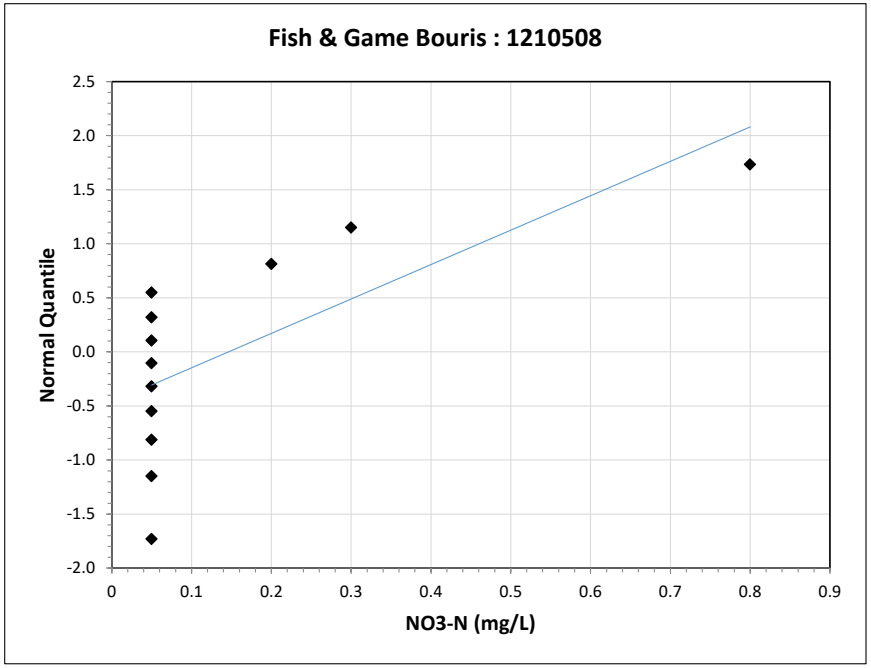


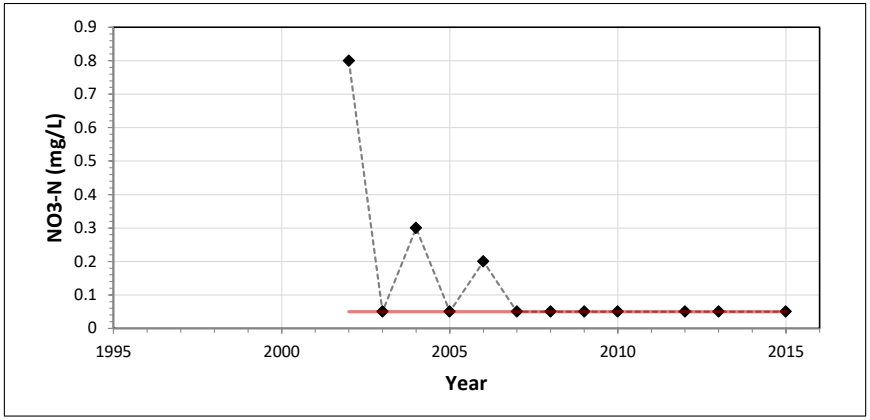
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	EMWD 42 Reche Canyon : 1210452
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	260
Annual Average Max	410
Annual Average Mean	356
Annual Average Stdev	36.91
Shapiro-Wilk W	0.945
Shapiro-Wilk p-value	0.319
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.47
Student t	1.02
Mean + t*SE (UCL84)	365
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-52
Var(S)	800
Intercept	5705
Slope	-2.67
p-value	0.071
Significant Trend?	Decreasing



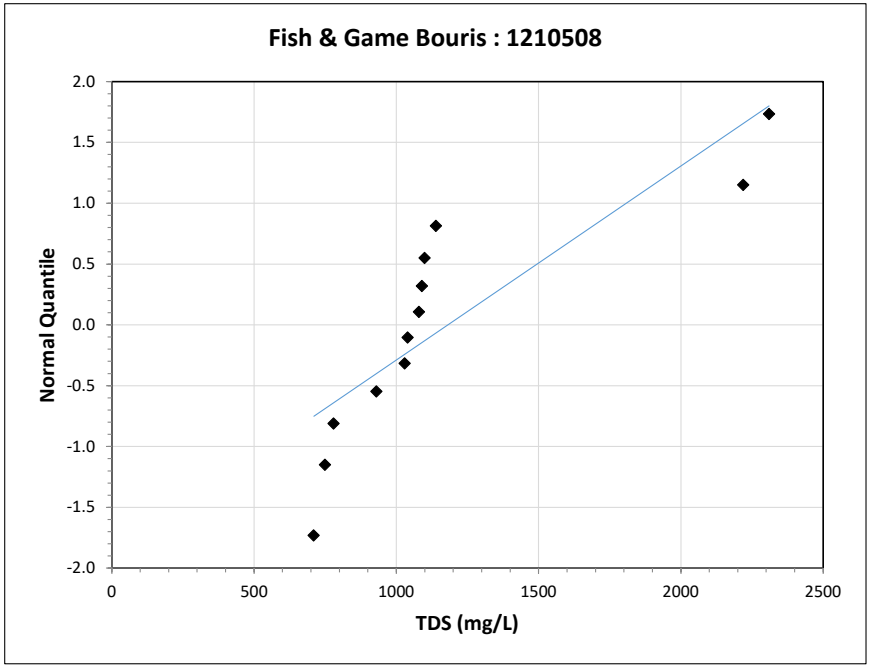


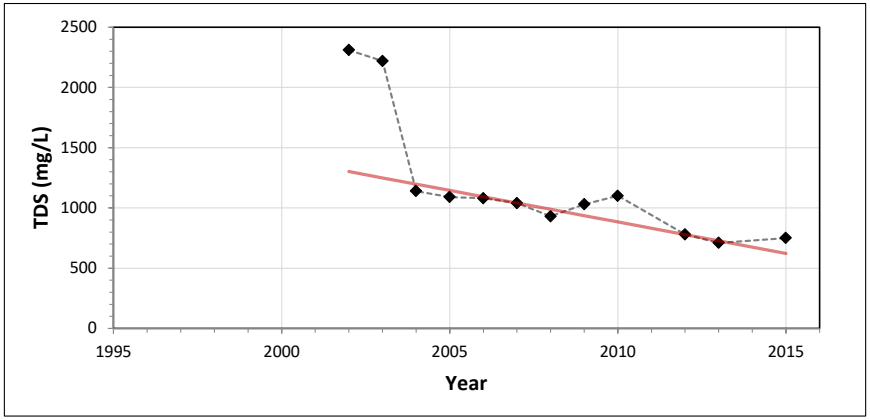
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	Fish & Game Bouris : 1210508
Analyte	NO3-N (mg/L)
Count	12
Count Detects	3
Sample Year Min	2002
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	0.80
Annual Average Mean	0.15
Annual Average Stdev	0.22
Shapiro-Wilk W	0.521
Shapiro-Wilk p-value	3E-5
Critical Alpha	0.01
Most Discordant Value	0.80
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-24
Var(S)	121
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



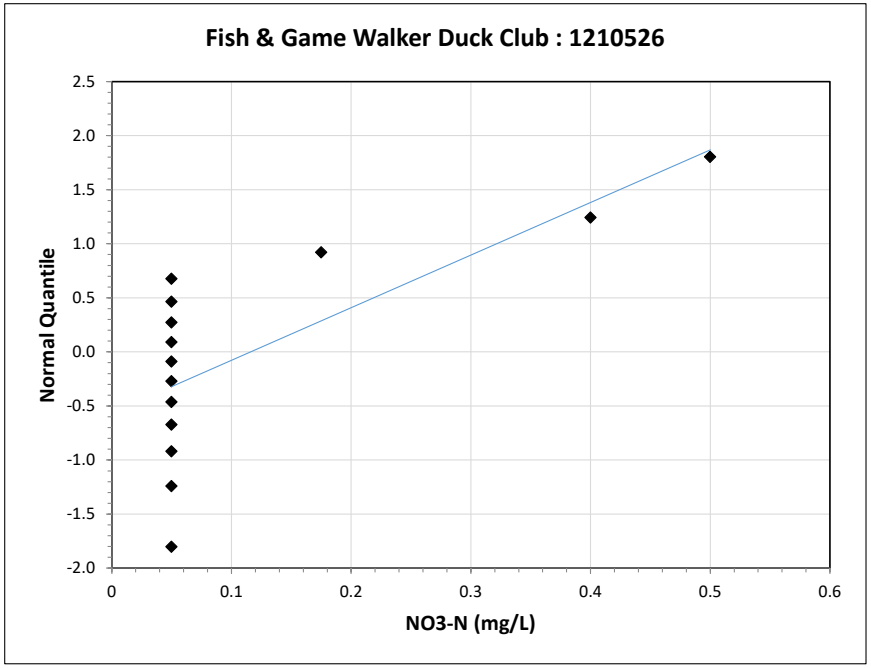


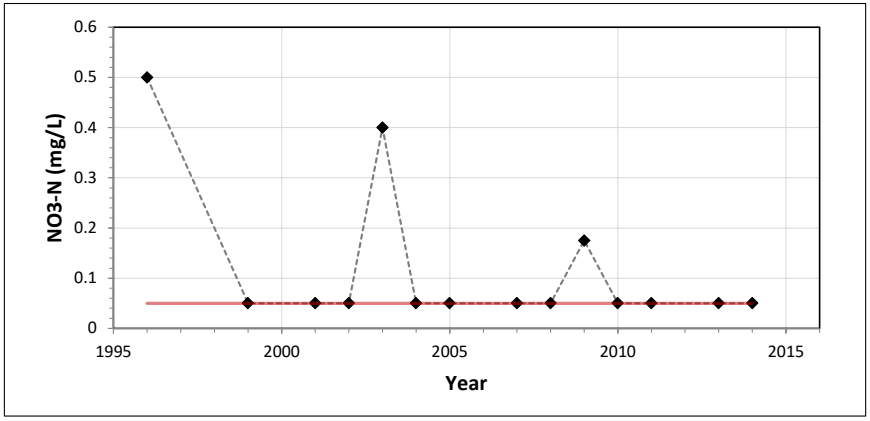
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	Fish & Game Bouris : 1210508
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	2002
Sample Year Max	2015
Annual Average Min	710
Annual Average Max	2310
Annual Average Mean	1182
Annual Average Stdev	527.00
Shapiro-Wilk W	0.720
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	2310
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.04
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.020
Geomean	1100
GM + t*GSE (UCL84)	1231
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-52
Var(S)	213
Intercept	105906
Slope	-52.25
p-value	5E-4
Significant Trend?	Decreasing**



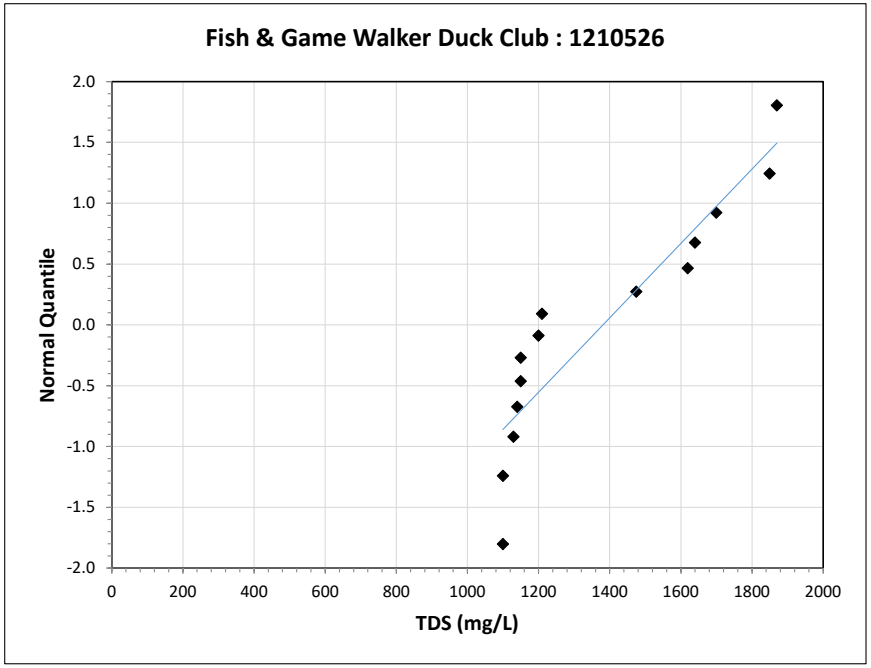


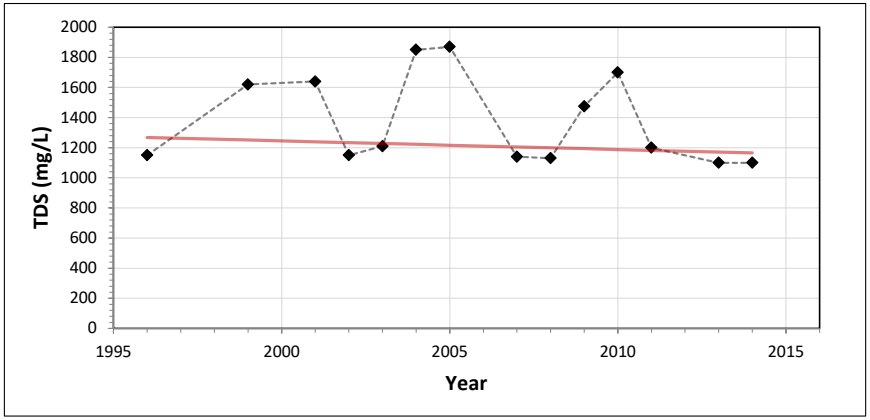
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	Fish & Game Walker Duck Club : 1210526
Analyte	NO3-N (mg/L)
Count	14
Count Detects	3
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.50
Annual Average Mean	0.12
Annual Average Stdev	0.15
Shapiro-Wilk W	0.525
Shapiro-Wilk p-value	9E-6
Critical Alpha	0.01
Most Discordant Value	0.50
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-16
Var(S)	169
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



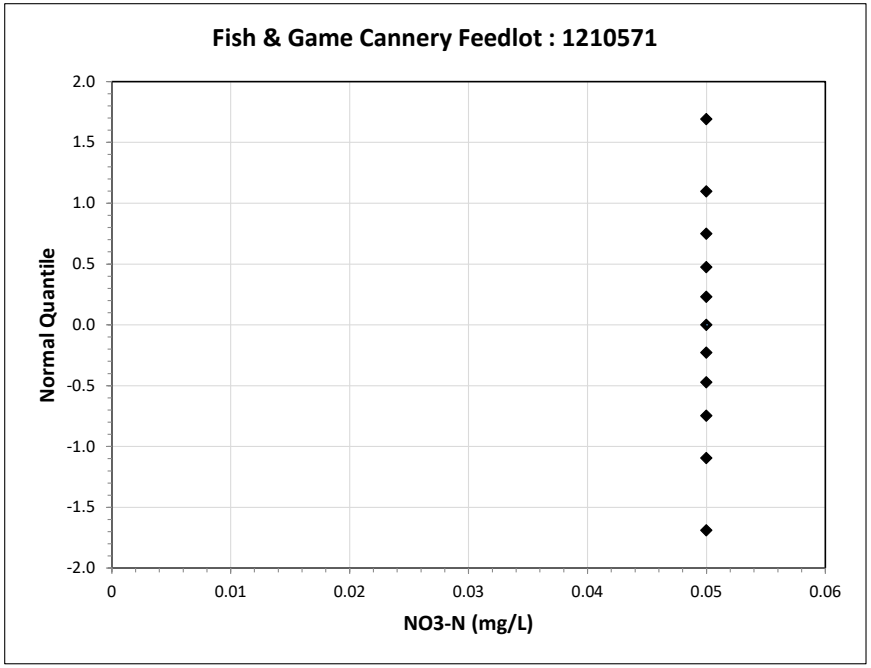


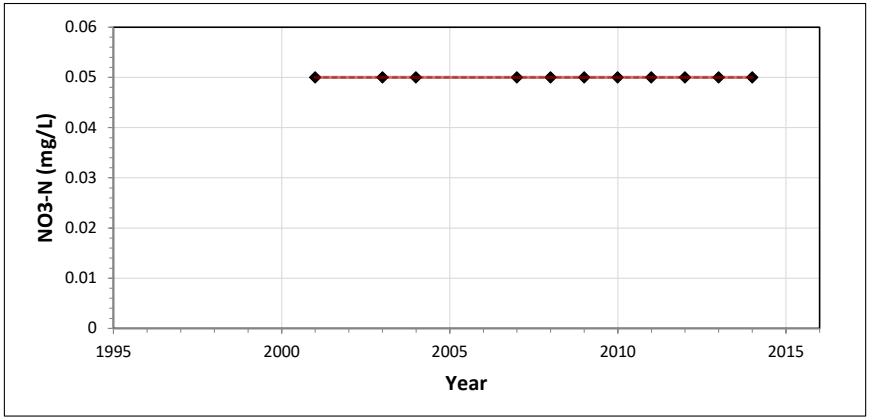
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	Fish & Game Walker Duck Club : 1210526
Analyte	TDS (mg/L)
Count	14
Count Detects	14
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	1100
Annual Average Max	1870
Annual Average Mean	1381
Annual Average Stdev	296.34
Shapiro-Wilk W	0.817
Shapiro-Wilk p-value	0.008
Critical Alpha	0.01
Most Discordant Value	1870
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.010
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	1205
Trend Analysis	**Theil-Sen**
Kendall S	-23
Var(S)	332
Intercept	12674
Slope	-5.71
p-value	0.227
Significant Trend?	No



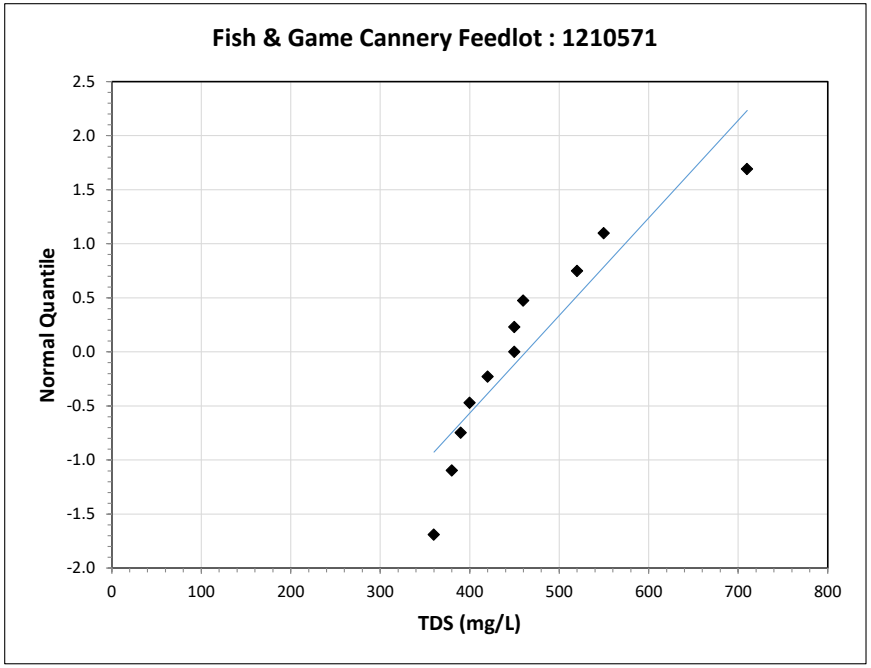


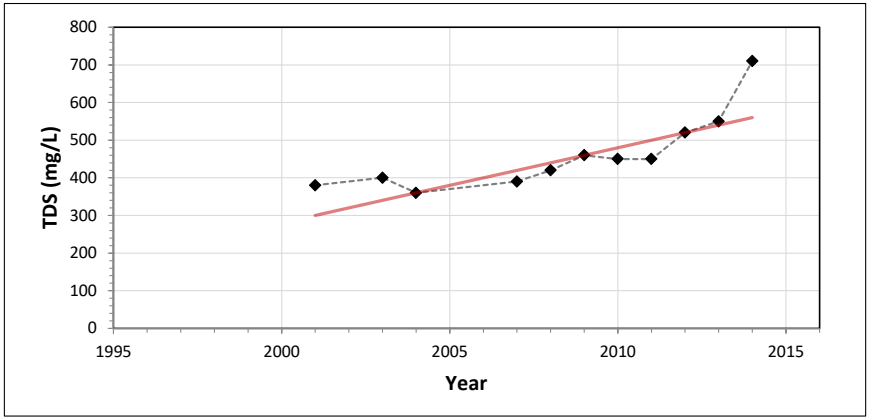
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	Fish & Game Cannery Feedlot : 1210571
Analyte	NO3-N (mg/L)
Count	11
Count Detects	0
Sample Year Min	2001
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.05
Annual Average Mean	0.05
Annual Average Stdev	NA
Shapiro-Wilk W	NA
Shapiro-Wilk p-value	NA
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	NA
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	0.00
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



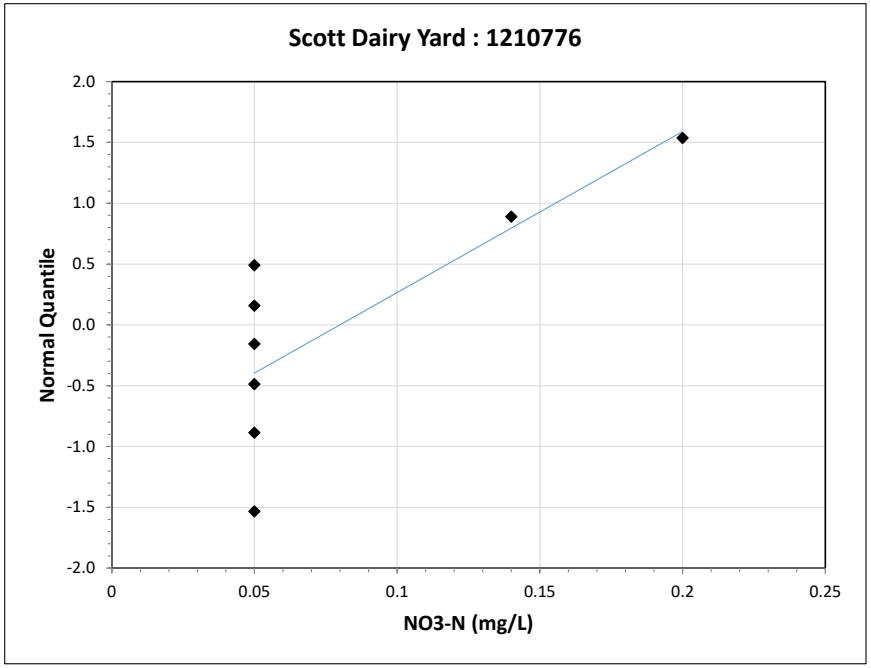


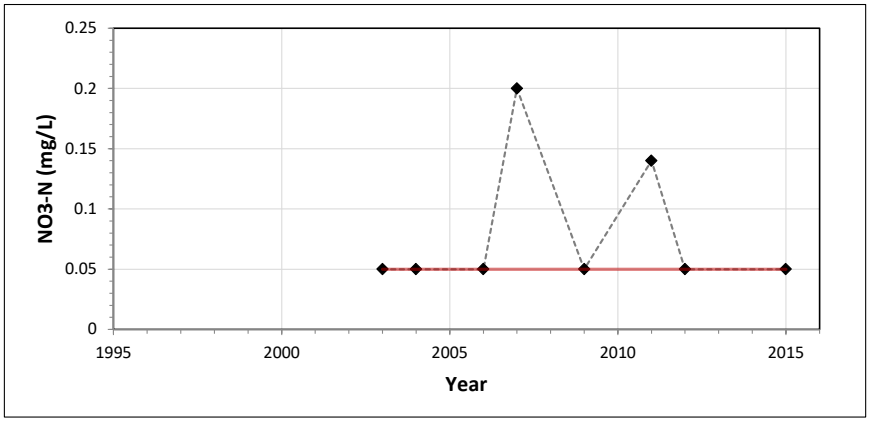
Statistics	
GMZ	San Jacinto-Lower Pressure
Well Name : ID	Fish & Game Cannery Feedlot : 1210571
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	2001
Sample Year Max	2014
Annual Average Min	360
Annual Average Max	710
Annual Average Mean	463
Annual Average Stdev	100.41
Shapiro-Wilk W	0.848
Shapiro-Wilk p-value	0.040
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	30.27
Student t	1.05
Mean + t*SE (UCL84)	494
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	44
Var(S)	164
Intercept	-39720
Slope	20.00
p-value	8E-4
Significant Trend?	Increasing**



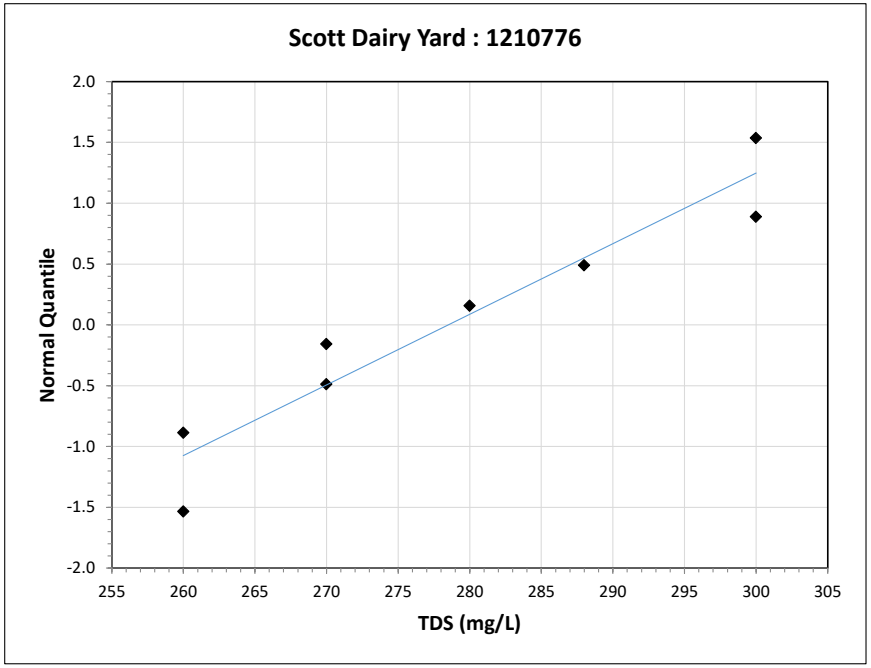


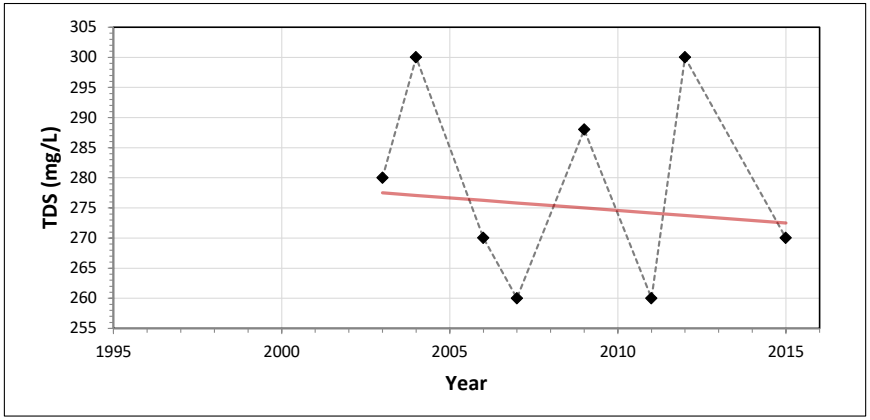
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Scott Dairy Yard : 1210776
Analyte	NO3-N (mg/L)
Count	8
Count Detects	2
Sample Year Min	2003
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	0.20
Annual Average Mean	0.08
Annual Average Stdev	0.06
Shapiro-Wilk W	0.607
Shapiro-Wilk p-value	2E-4
Critical Alpha	0.01
Most Discordant Value	0.20
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	1
Var(S)	37.00
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



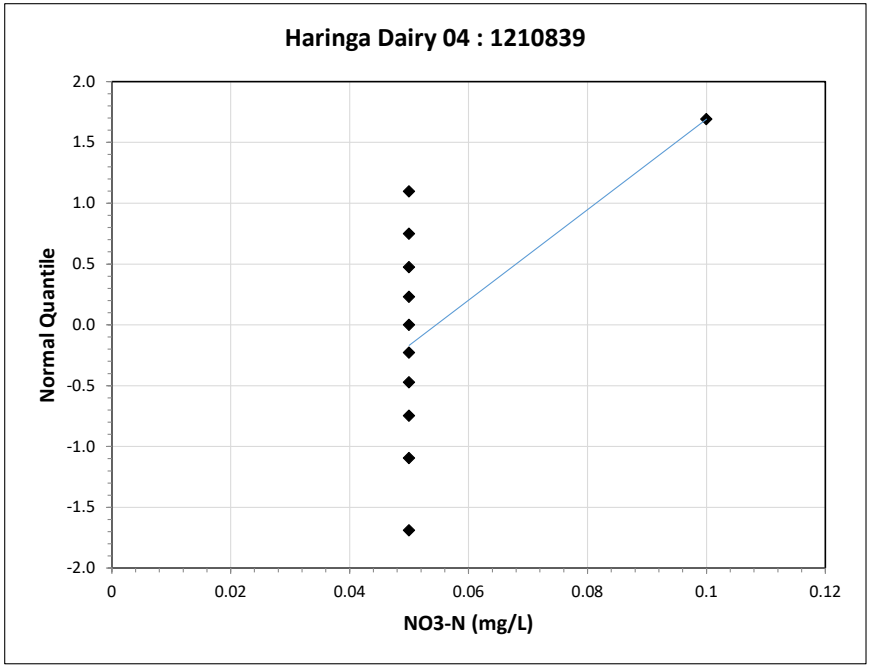


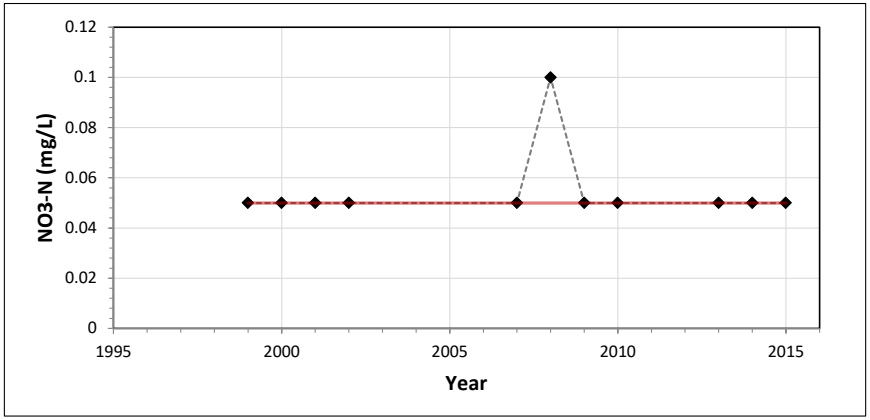
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Scott Dairy Yard : 1210776
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	2003
Sample Year Max	2015
Annual Average Min	260
Annual Average Max	300
Annual Average Mean	279
Annual Average Stdev	16.24
Shapiro-Wilk W	0.892
Shapiro-Wilk p-value	0.243
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.74
Student t	1.07
Mean + t*SE (UCL84)	285
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	62.33
Intercept	1112
Slope	-0.42
p-value	0.800
Significant Trend?	No



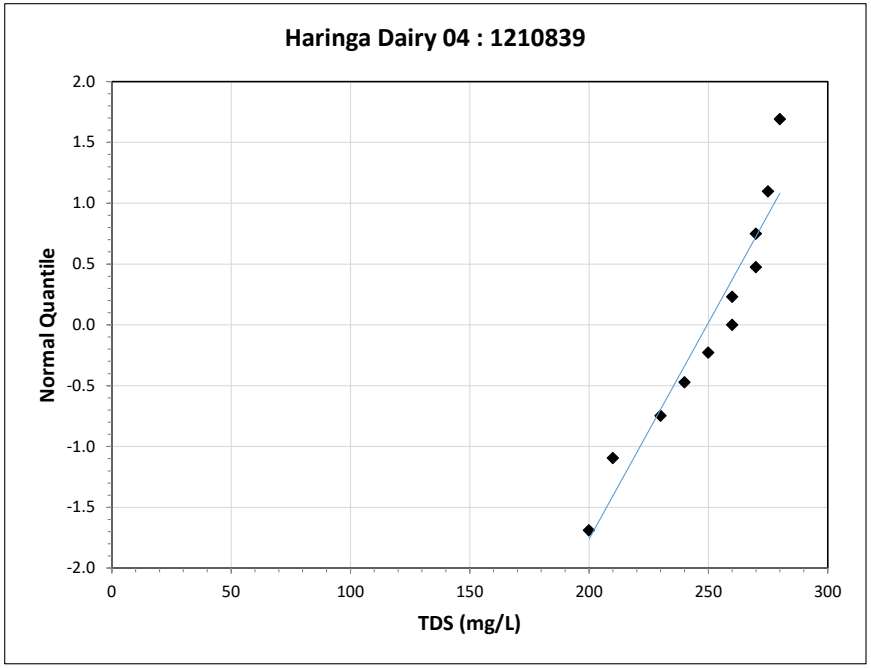


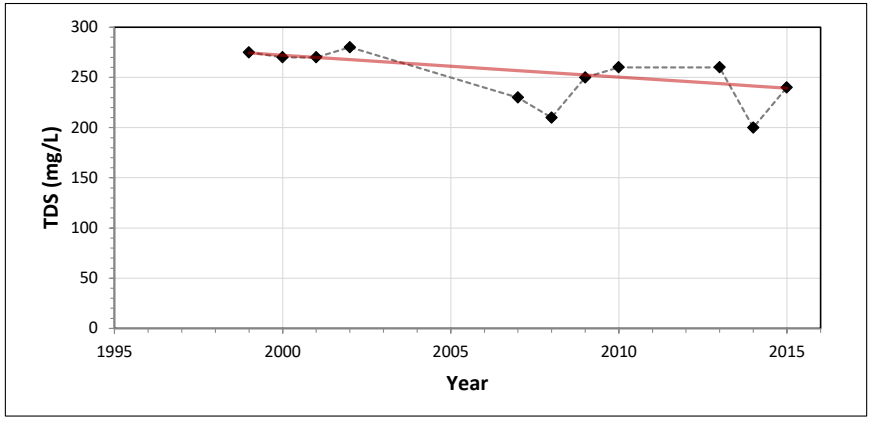
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Haringa Dairy 04 : 1210839
Analyte	NO3-N (mg/L)
Count	11
Count Detects	1
Sample Year Min	1999
Sample Year Max	2015
Annual Average Min	0.05
Annual Average Max	0.10
Annual Average Mean	0.05
Annual Average Stdev	0.02
Shapiro-Wilk W	0.345
Shapiro-Wilk p-value	2E-8
Critical Alpha	0.01
Most Discordant Value	0.10
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-8
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	0
Var(S)	40.00
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



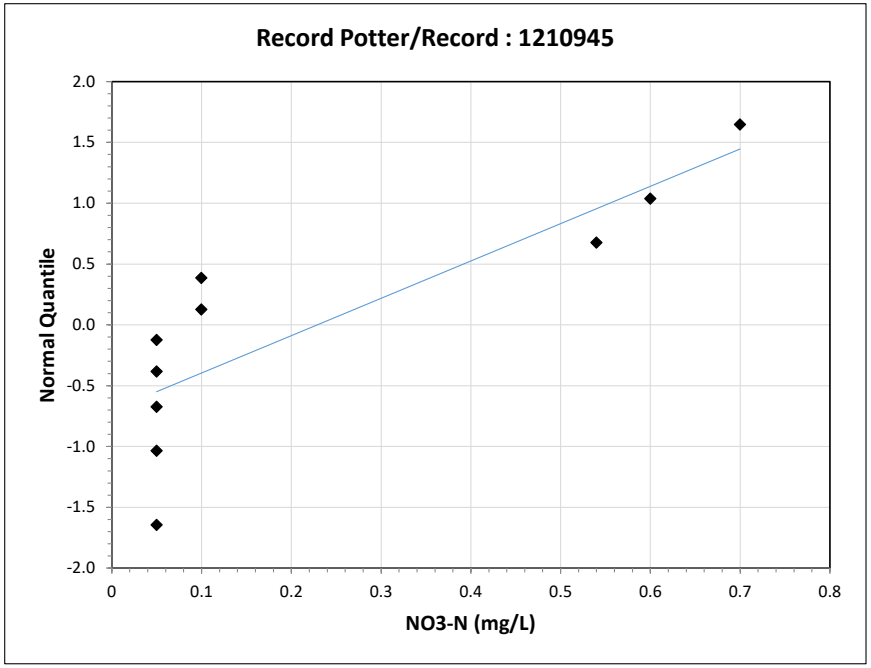


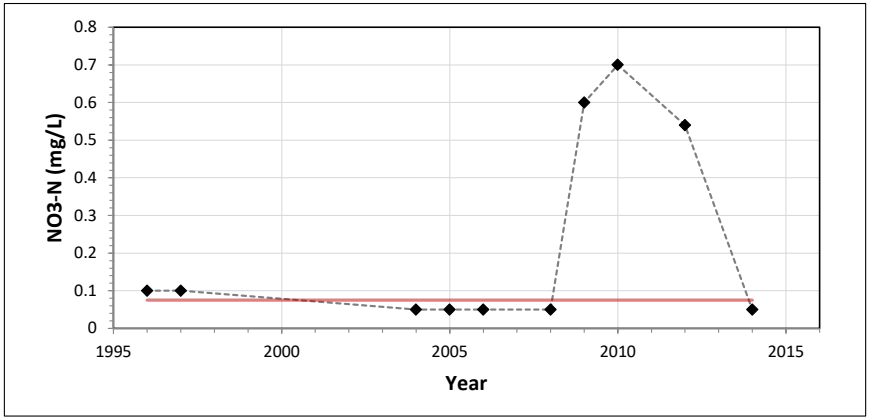
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Haringa Dairy 04 : 1210839
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	1999
Sample Year Max	2015
Annual Average Min	200
Annual Average Max	280
Annual Average Mean	250
Annual Average Stdev	26.69
Shapiro-Wilk W	0.907
Shapiro-Wilk p-value	0.226
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	8.05
Student t	1.05
Mean + t*SE (UCL84)	258
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-25
Var(S)	163
Intercept	4647
Slope	-2.19
p-value	0.060
Significant Trend?	Decreasing



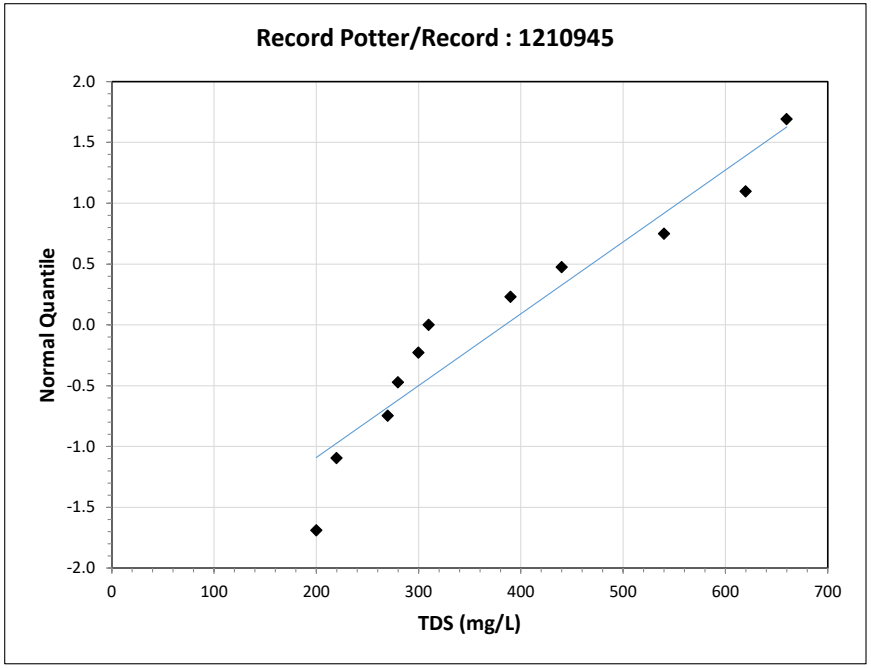


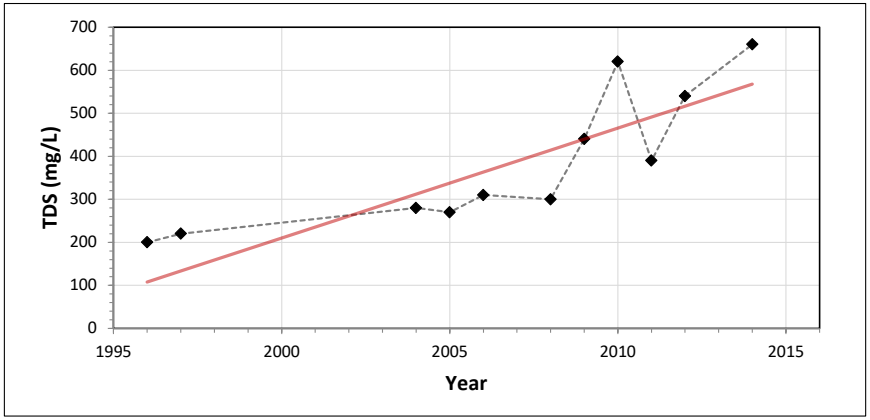
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Record Potter/Record : 1210945
Analyte	NO3-N (mg/L)
Count	10
Count Detects	5
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.70
Annual Average Mean	0.23
Annual Average Stdev	0.27
Shapiro-Wilk W	0.685
Shapiro-Wilk p-value	6E-4
Critical Alpha	0.01
Most Discordant Value	0.70
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.002
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.08
Trend Analysis	**Theil-Sen**
Kendall S	4
Var(S)	107
Intercept	0.08
Slope	0.00
p-value	NC
Significant Trend?	No



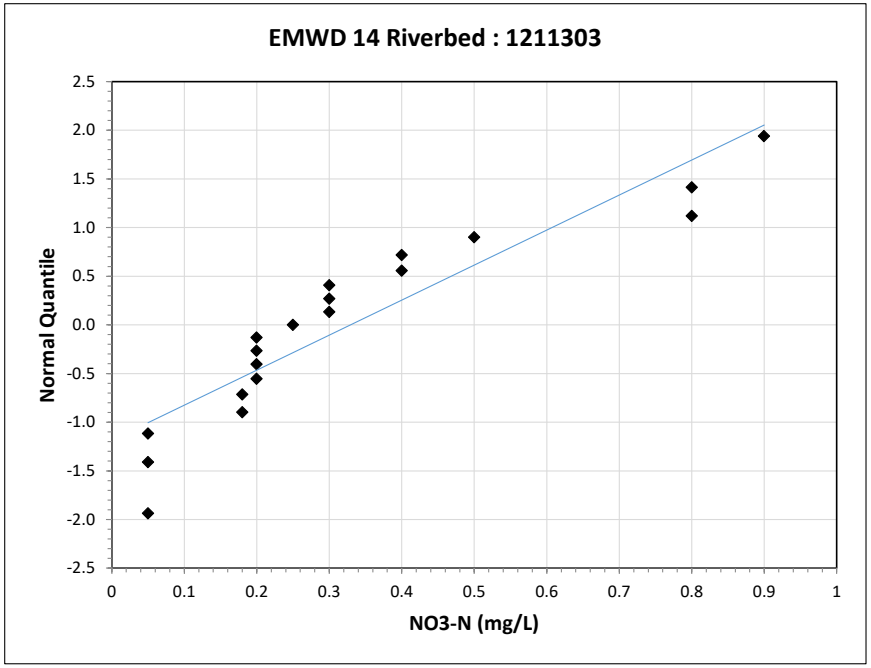


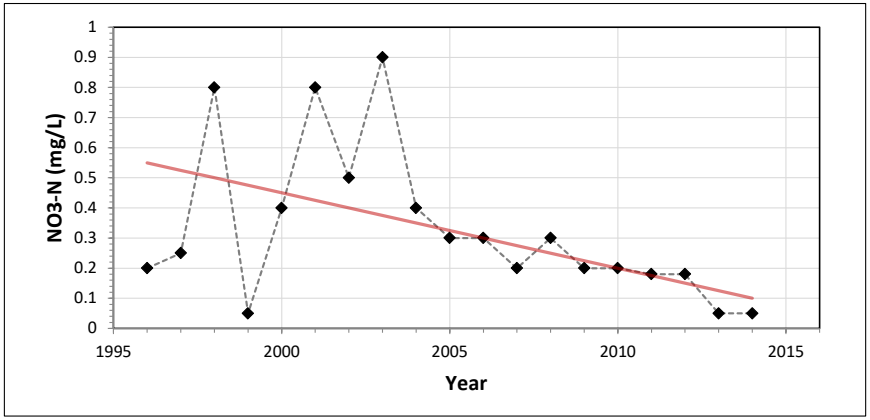
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Record Potter/Record : 1210945
Analyte	TDS (mg/L)
Count	11
Count Detects	11
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	200
Annual Average Max	660
Annual Average Mean	385
Annual Average Stdev	160.15
Shapiro-Wilk W	0.900
Shapiro-Wilk p-value	0.185
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	48.29
Student t	1.05
Mean + t*SE (UCL84)	435
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	45
Var(S)	165
Intercept	-50901
Slope	25.56
p-value	6E-4
Significant Trend?	Increasing**



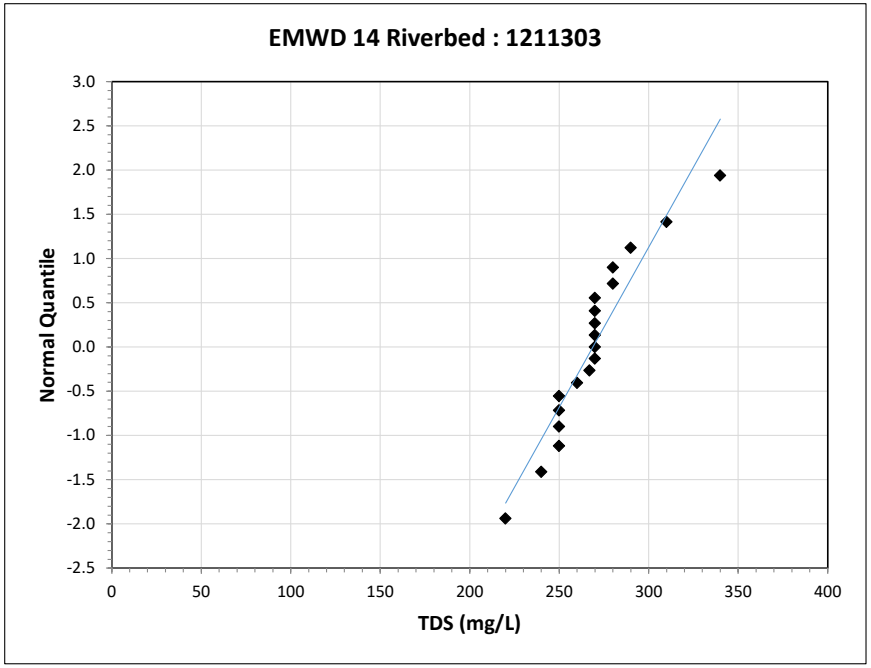


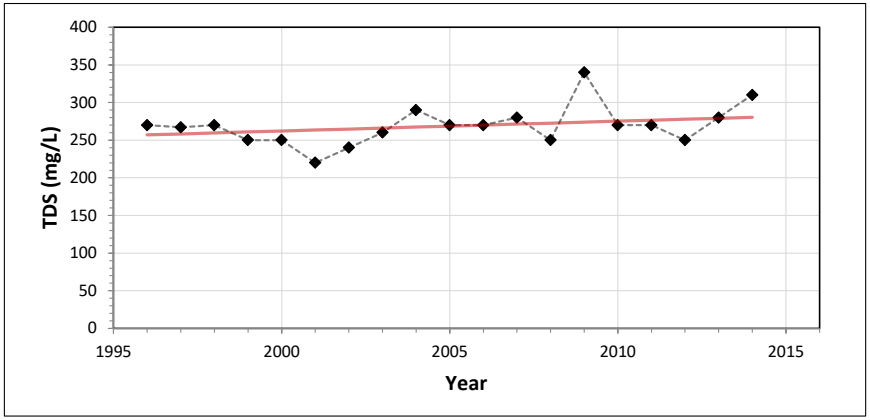
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	EMWD 14 Riverbed : 1211303
Analyte	NO3-N (mg/L)
Count	19
Count Detects	16
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.90
Annual Average Mean	0.33
Annual Average Stdev	0.25
Shapiro-Wilk W	0.841
Shapiro-Wilk p-value	0.005
Critical Alpha	0.01
Most Discordant Value	0.90
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.059
Geomean	0.24
GM + t*GSE (UCL84)	0.30
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-78
Var(S)	798
Intercept	50.45
Slope	-0.03
p-value	0.006
Significant Trend?	Decreasing*



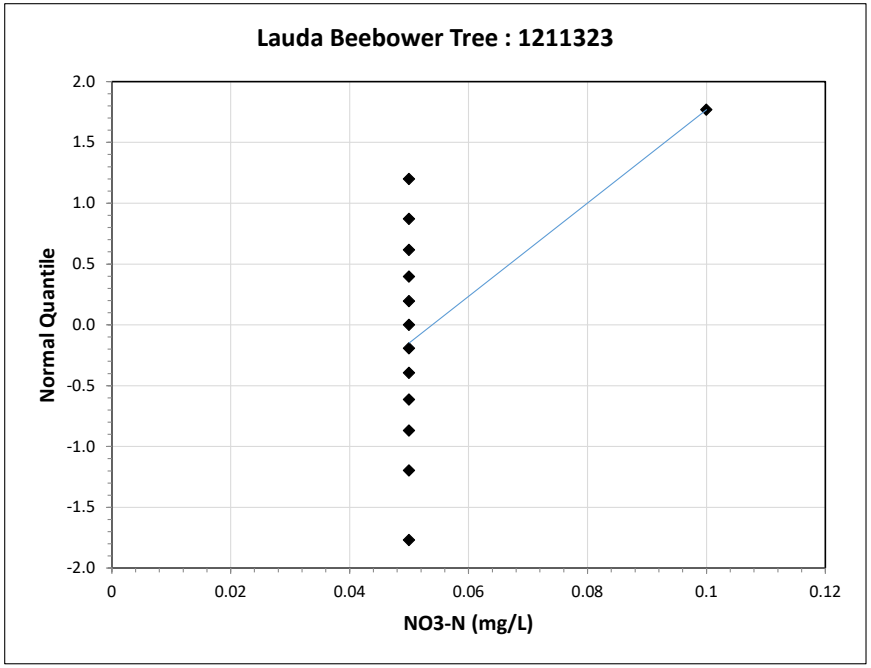


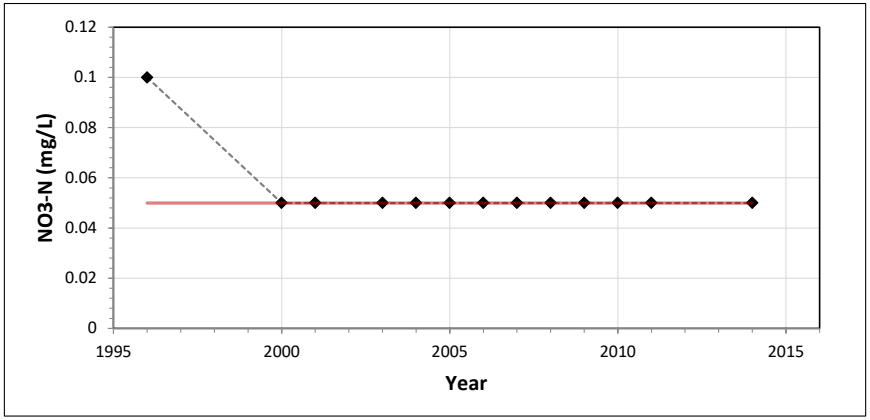
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	EMWD 14 Riverbed : 1211303
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	220
Annual Average Max	340
Annual Average Mean	269
Annual Average Stdev	26.01
Shapiro-Wilk W	0.911
Shapiro-Wilk p-value	0.076
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.97
Student t	1.02
Mean + t*SE (UCL84)	275
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	47
Var(S)	779
Intercept	-2338
Slope	1.30
p-value	0.099
Significant Trend?	Increasing



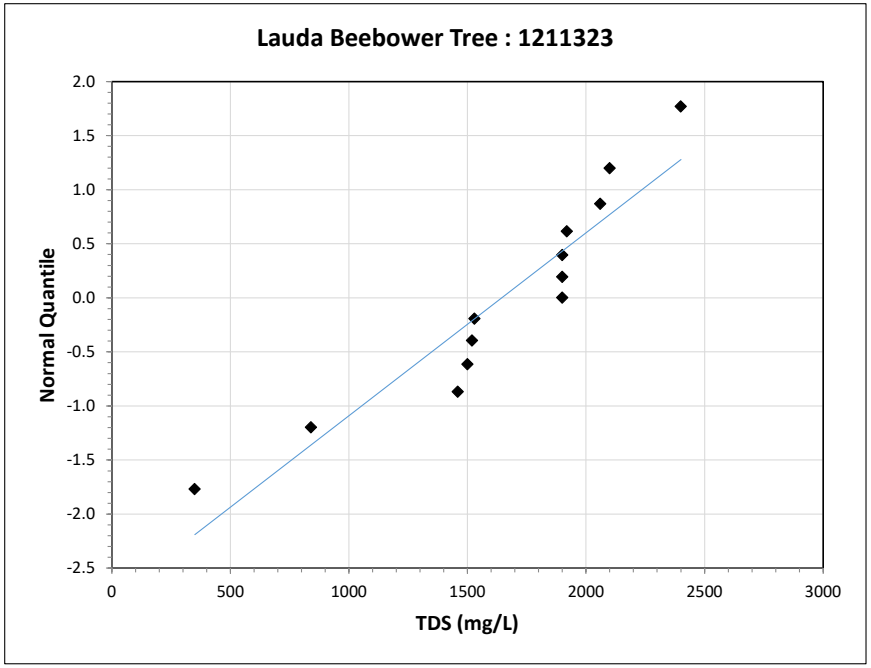


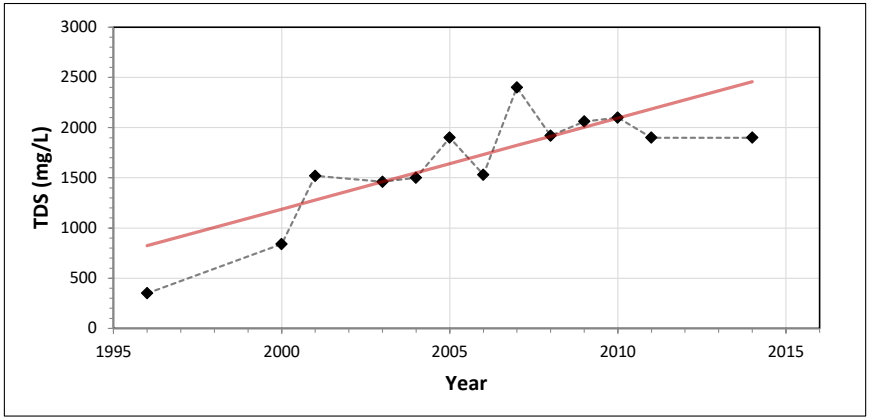
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Lauda Beebower Tree : 1211323
Analyte	NO3-N (mg/L)
Count	13
Count Detects	1
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	0.05
Annual Average Max	0.10
Annual Average Mean	0.05
Annual Average Stdev	0.01
Shapiro-Wilk W	0.311
Shapiro-Wilk p-value	5E-7
Critical Alpha	0.01
Most Discordant Value	0.10
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	5E-7
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-12
Var(S)	56.00
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



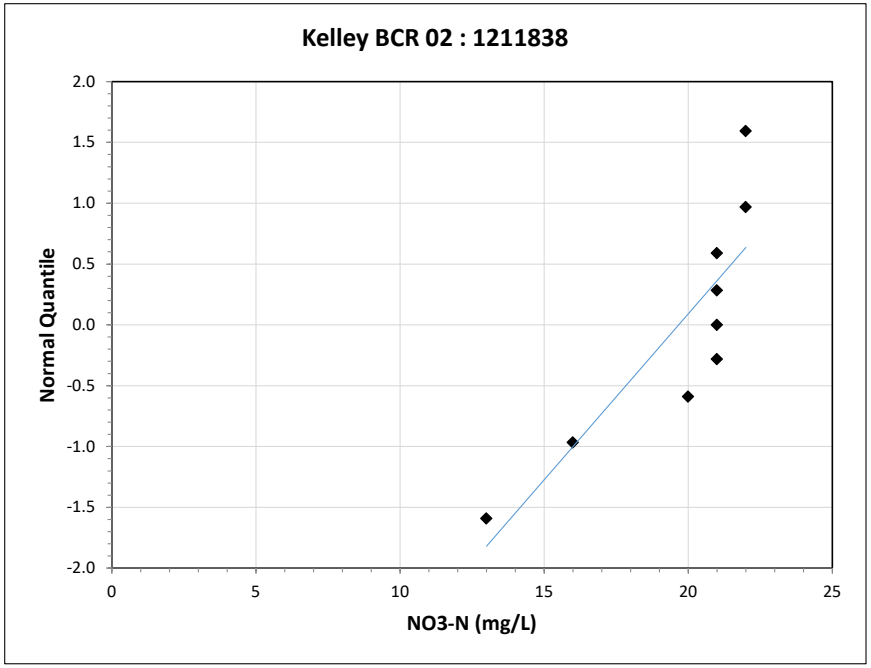


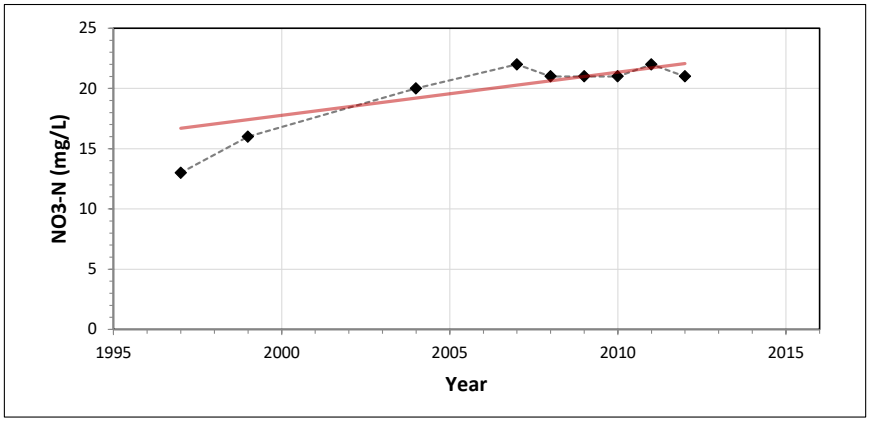
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Lauda Beebower Tree : 1211323
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	350
Annual Average Max	2400
Annual Average Mean	1645
Annual Average Stdev	549.93
Shapiro-Wilk W	0.888
Shapiro-Wilk p-value	0.093
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	152.52
Student t	1.04
Mean + t*SE (UCL84)	1803
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	47
Var(S)	265
Intercept	-180241
Slope	90.71
p-value	0.005
Significant Trend?	Increasing*



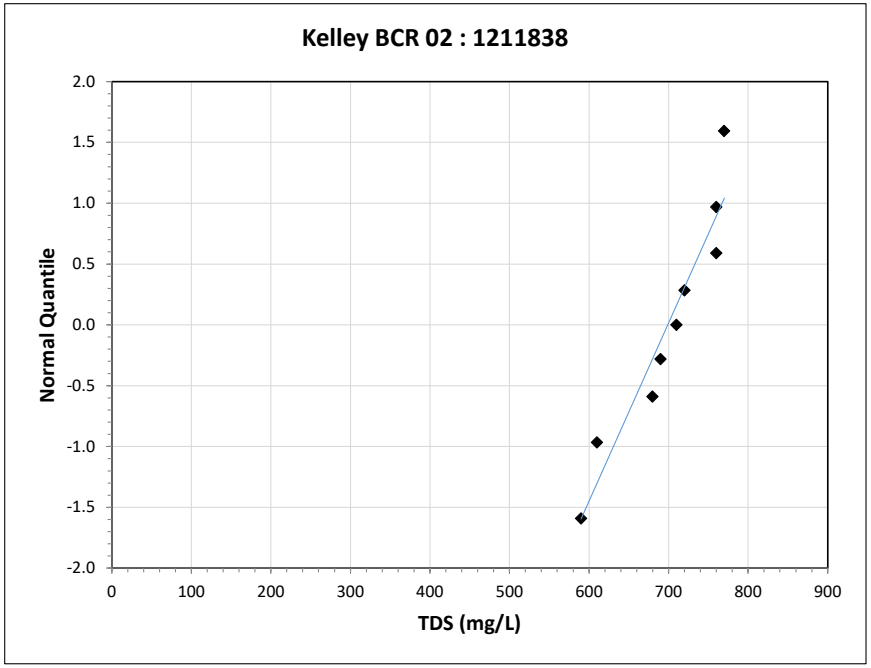


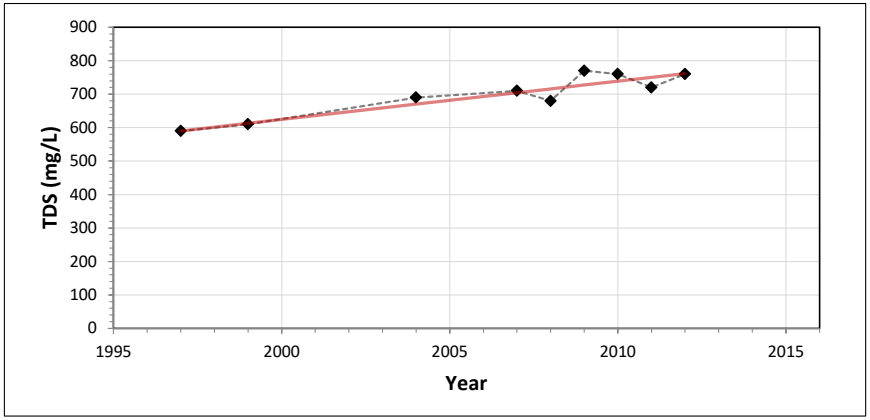
Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Kelley BCR 02 : 1211838
Analyte	NO3-N (mg/L)
Count	9
Count Detects	9
Sample Year Min	1997
Sample Year Max	2012
Annual Average Min	13.00
Annual Average Max	22.00
Annual Average Mean	19.67
Annual Average Stdev	3.08
Shapiro-Wilk W	0.729
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	13.00
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.001
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	21.00
Trend Analysis	**Theil-Sen**
Kendall S	19
Var(S)	82.33
Intercept	-700
Slope	0.36
p-value	0.047
Significant Trend?	Increasing





Statistics	
GMZ	San Jacinto-Upper Pressure
Well Name : ID	Kelley BCR 02 : 1211838
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	1997
Sample Year Max	2012
Annual Average Min	590
Annual Average Max	770
Annual Average Mean	699
Annual Average Stdev	64.51
Shapiro-Wilk W	0.902
Shapiro-Wilk p-value	0.265
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	21.50
Student t	1.06
Mean + t*SE (UCL84)	722
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	23
Var(S)	91.00
Intercept	-22247
Slope	11.44
p-value	0.021
Significant Trend?	Increasing





Attachment B16

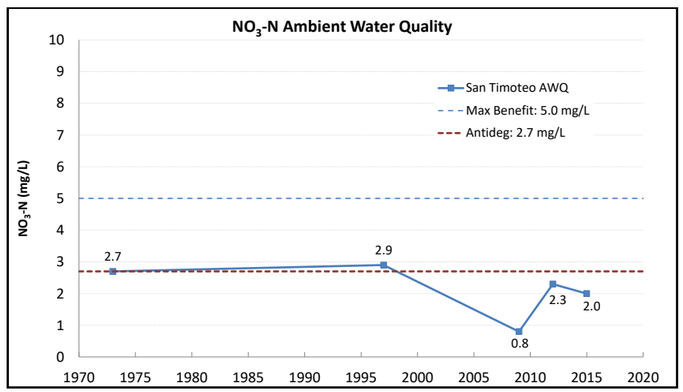
San Timoteo GMZ

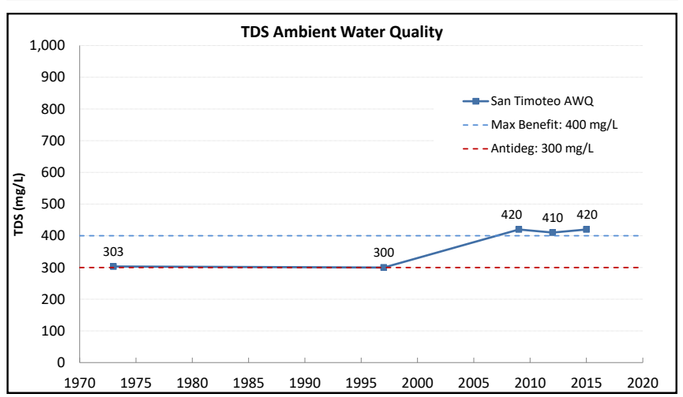
Attachment Contents:

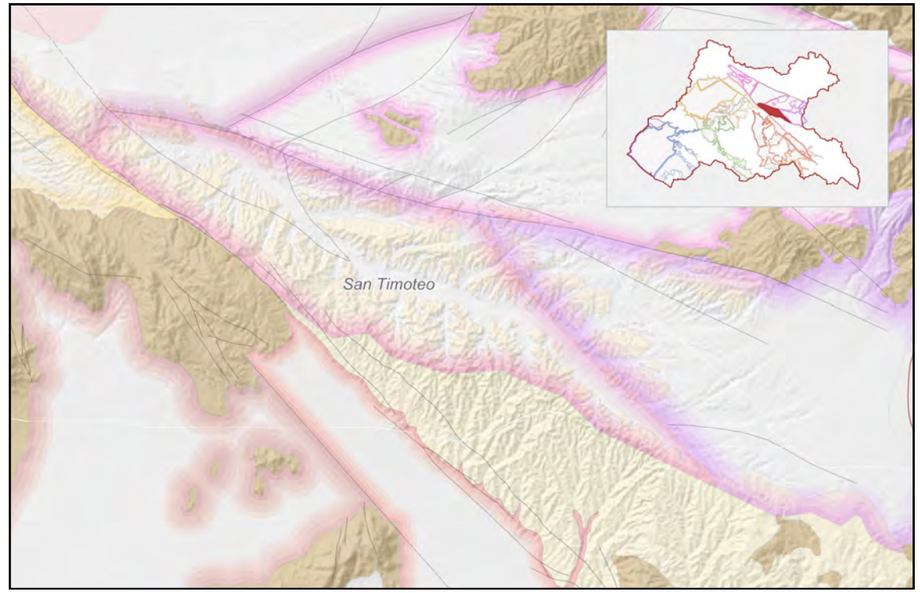
B16-1 Groundwater Storage and Elevation Contours Fall 2015
B16-2 NO_3-N Concentration and Contour Map
B16-3 TDS Concentration and Contour Map
B16-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B16-5 TDS Concentration Change (1993-2012 to 1996-2015)
B16-6 Key Well Analysis Charts

	Basin Analytics	San Timoteo
Basin	GMZ Area (acres)	18,100
	Volume of Storage (acre-ft)	672,000
NO_3-N	Wells per GMZ	33
	Point Statistics per GMZ	22
	Total Mass (tons)	1,810
	1996-2015 AWQ	2
TDS	Wells per GMZ	33
	Point Statistics per GMZ	30
	Total Mass (tons)	380,000
	1996-2015 AWQ	420

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for San Timoteo "max benefit" is 5.0 mg/L and for San Timoteo "antideg" is 2.7 mg/L. The ambient nitrate concentration decreased from 2.3 mg/L in 2012 to 2.0 mg/L in 2015, allowing for 3.0 mg/L of assimilative capacity. All six of the key wells show no trends in the nitrate concentrations. Two new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

Total Dissolved Solids (TDS)

The TDS objective for San Timoteo "max benefit" is 400 mg/L and for San Timoteo "antideg" is 300 mg/L. The ambient TDS concentration increased from 410 mg/L in 2012 to 420 mg/L in 2015, and there is no assimilative capacity. One out of the six key wells in San Timoteo GMZ has a decreasing trend in TDS concentrations, while the other five show no trends in the TDS concentrations. Two new wells with statistics were added to the 1996 to 2015 AWQ recomputation.

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
San Timoteo	1003044	GL-6	1.5	No Trend	285	No Trend
San Timoteo	1003079	Fishermen's Retreat 1	0.1	No Trend	590	No Trend
San Timoteo	1201539	1	28.7	No Trend	901	No Trend
San Timoteo	1205021	ST-05C	2.2	No Trend	330	Decreasing
San Timoteo	1221779	YVWD GWMW-3	0.1	No Trend	479	No Trend
San Timoteo	1222080	San Tim-2B/2	1.3	No Trend	223	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B16-4 and B16-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
San Timoteo	1207756	335645117024201	--	--	--	--	Medium	1	242	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

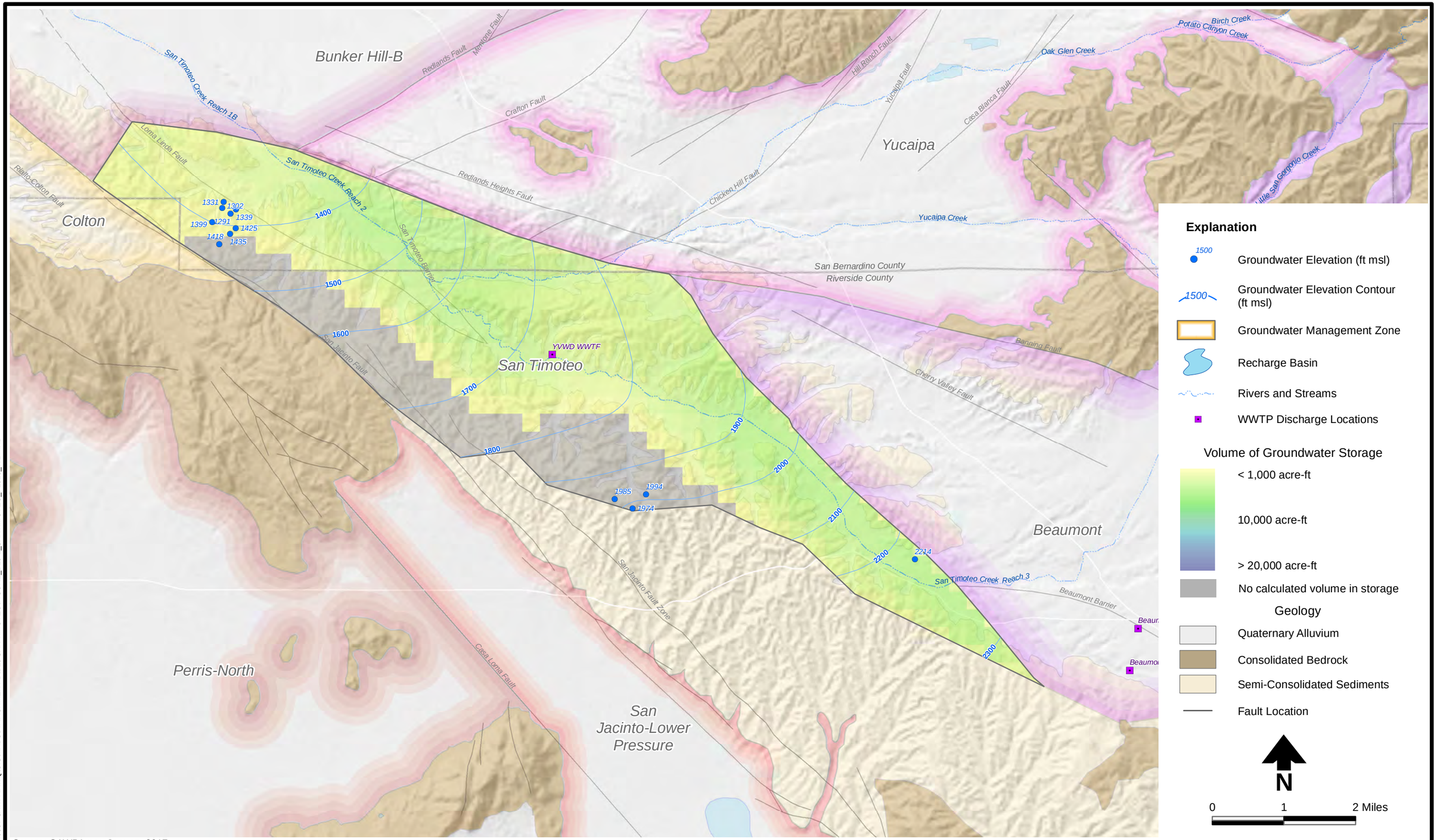
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B16-4 and B16-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
San Timoteo	1221782	YVWD GWMW-4	New	3	0.1	Stat	--	4	540	Stat
San Timoteo	1231772	ST-12	New	4	5.3	Stat	New	4	647	Stat
San Timoteo	2000368	ST-13	New	3	7.3	Stat	New	3	847	Stat

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B16-4 and B16-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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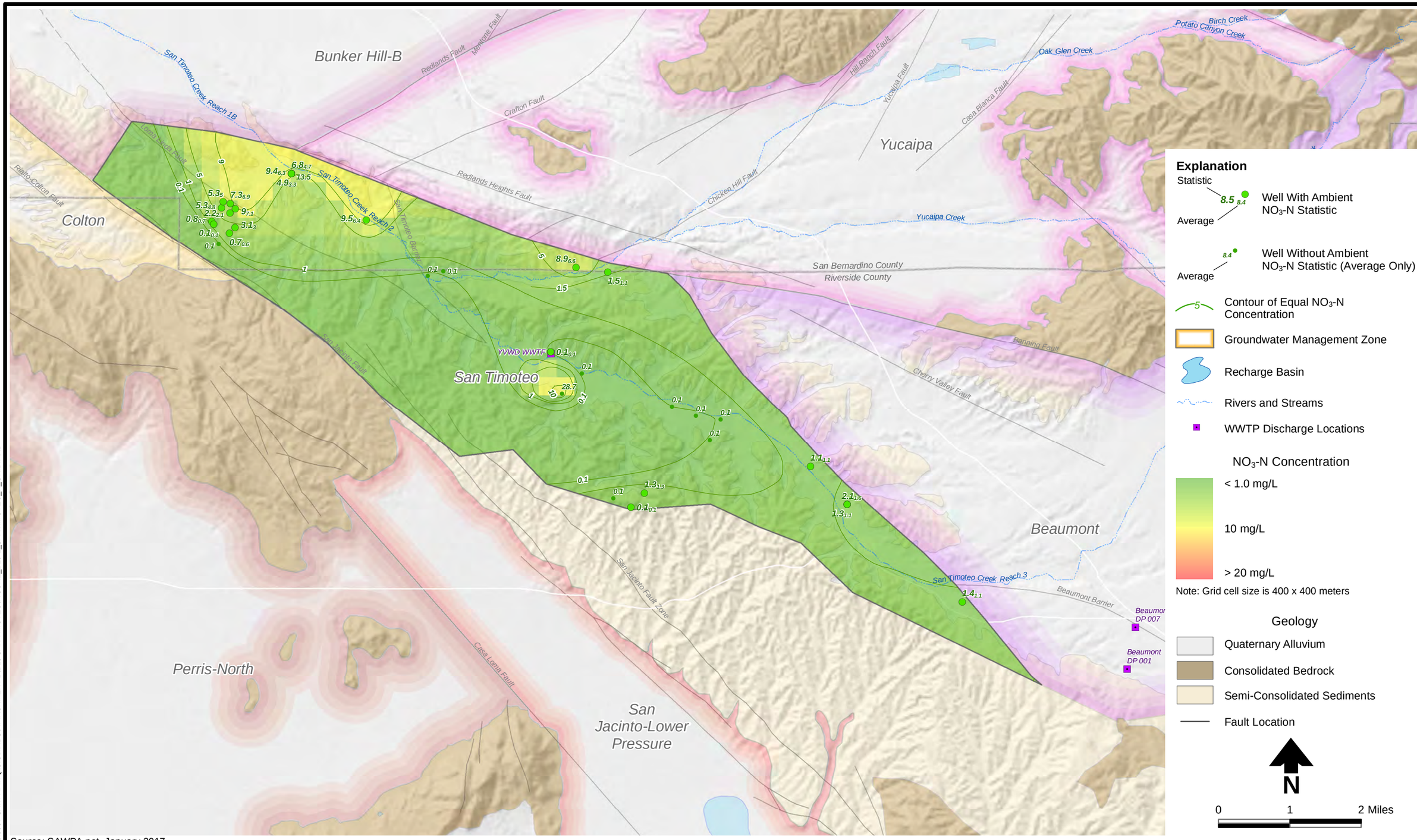
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
San Timoteo GMZ

Attachment B16-1



Source: SAWPA.net, January 2017

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
San Timoteo GMZ

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

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Attachment B16-2

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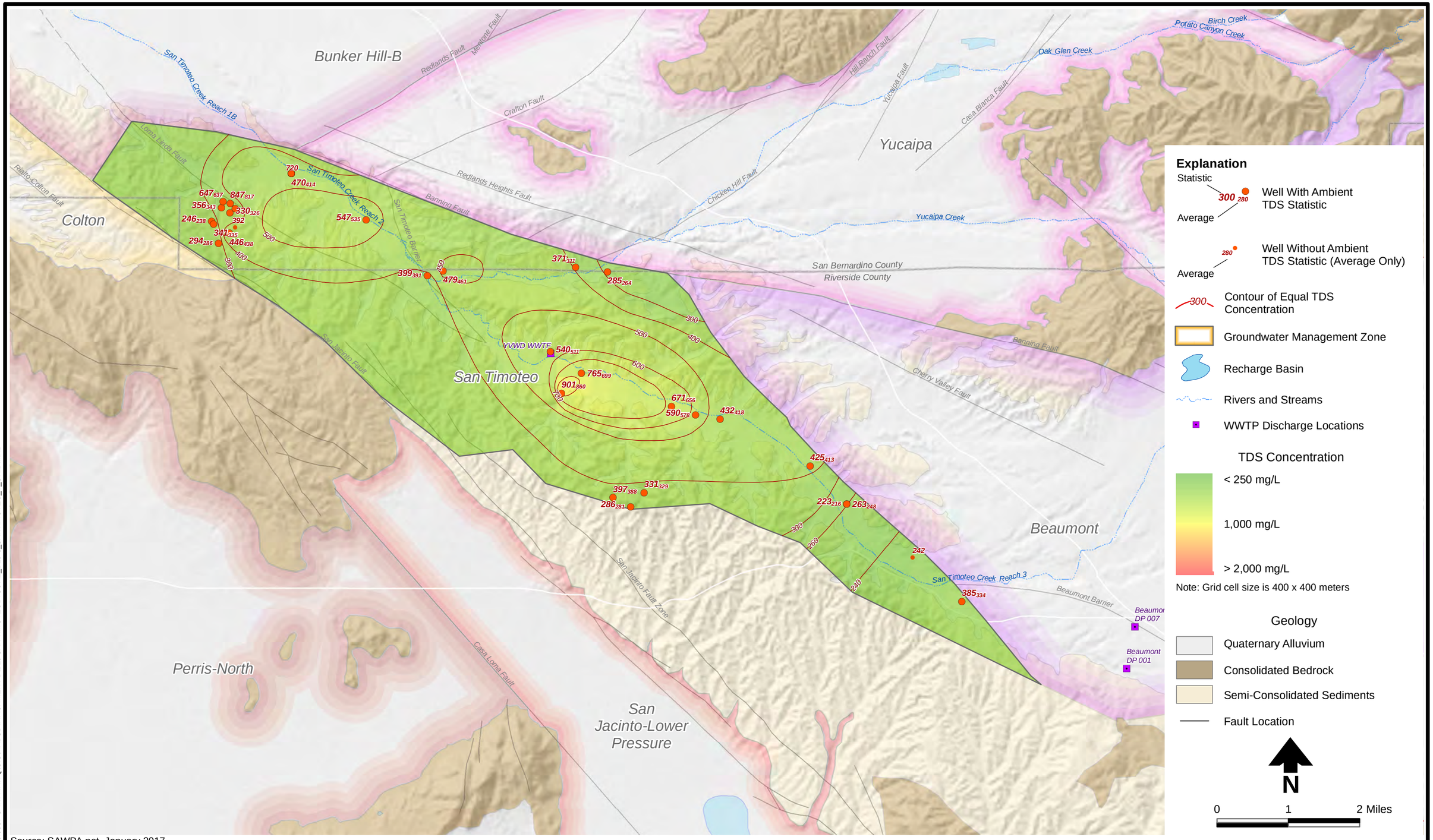

Source: SAWPA.net, January 2017

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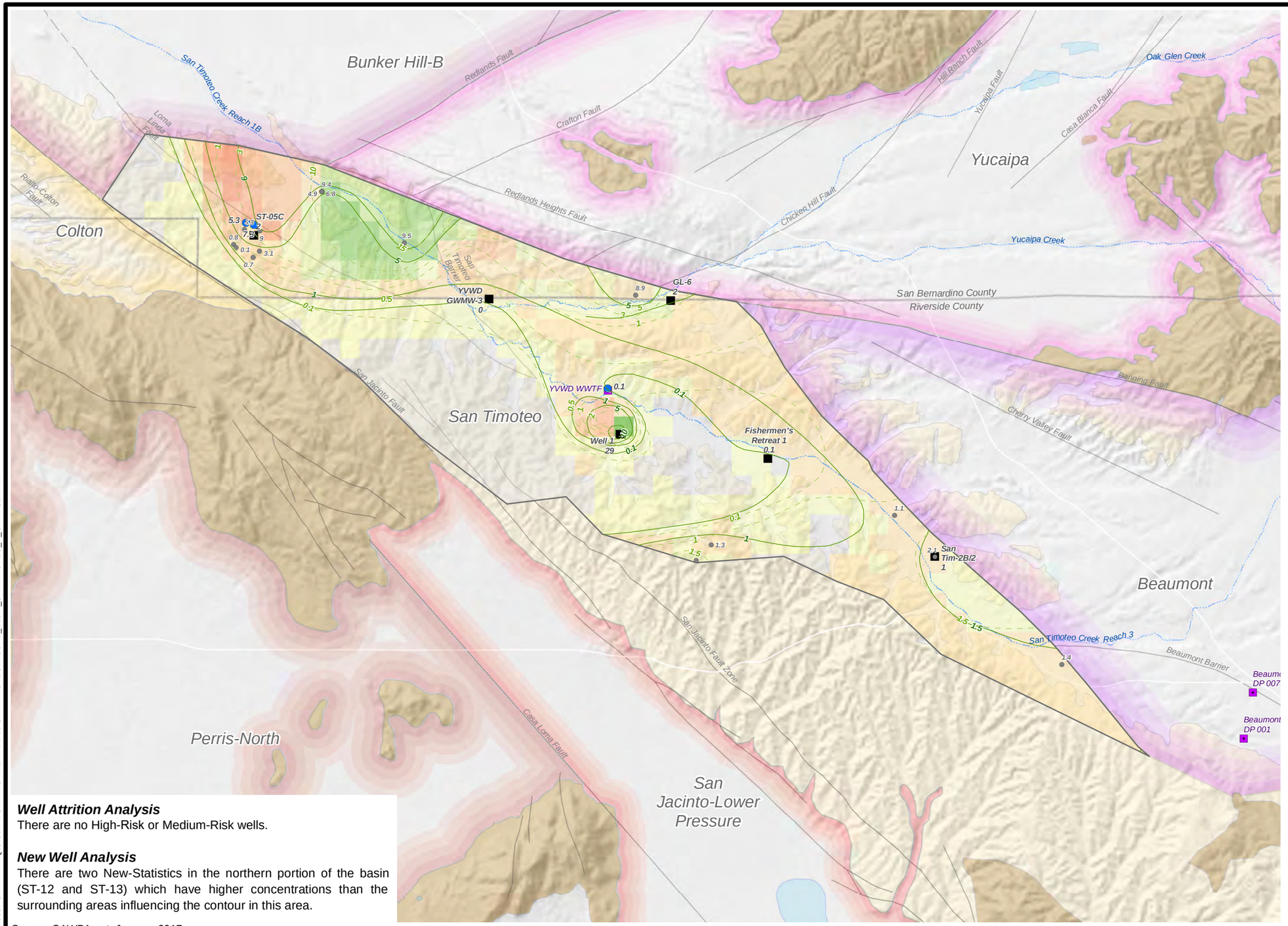
SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
San Timoteo GMZ

Attachment B16-3



Well Attrition Analysis
There are no High-Risk or Medium-Risk wells.

New Well Analysis
There are two New-Statistics in the northern portion of the basin (ST-12 and ST-13) which have higher concentrations than the surrounding areas influencing the contour in this area.

Source: SAWPA.net, January 2017

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 1 2 Miles

N

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
San Timoteo GMZ

Attachment B16-4

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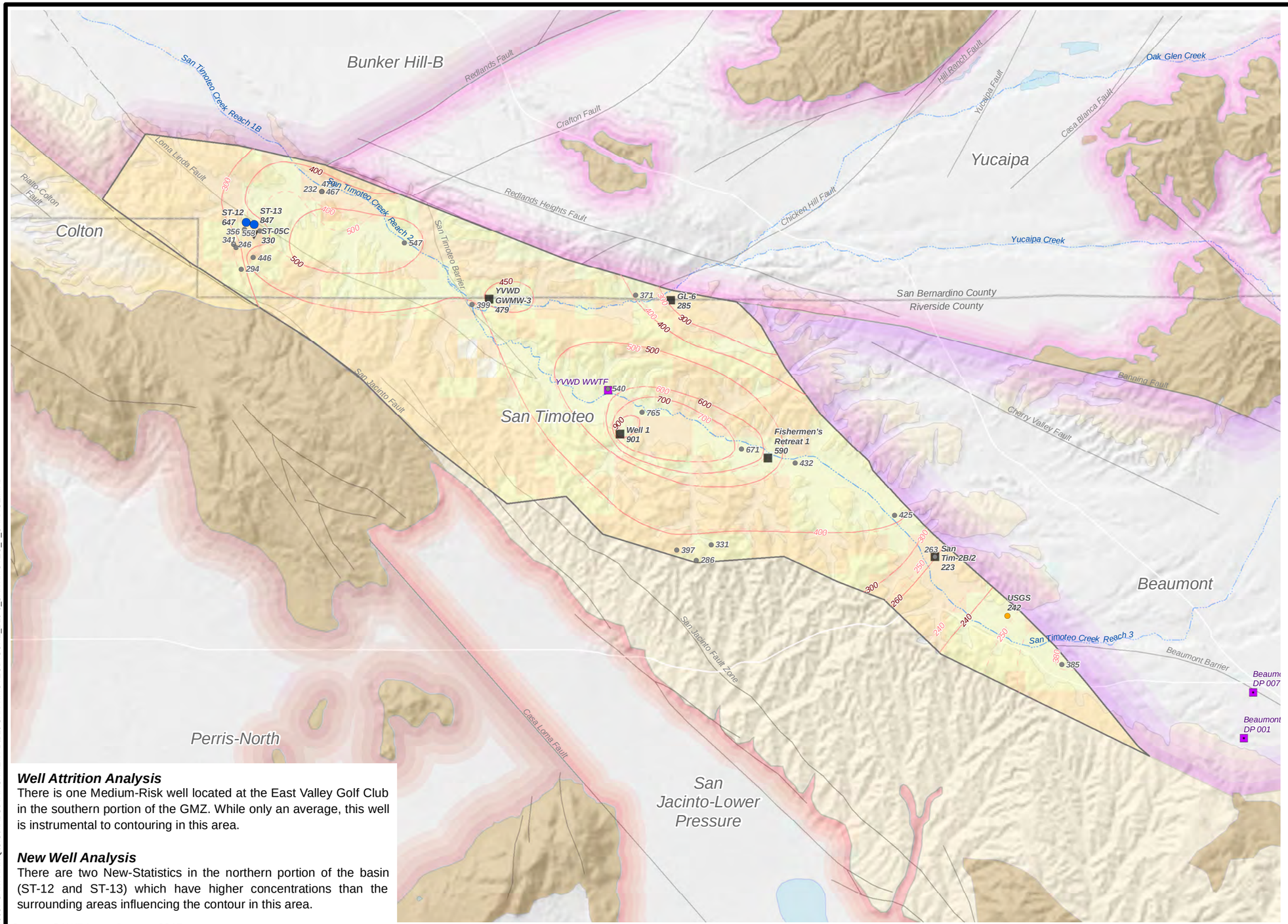


Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 1993-2012 TDS Contours
- 300 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 1 2 Miles

N

Well Attrition Analysis
There is one Medium-Risk well located at the East Valley Golf Club in the southern portion of the GMZ. While only an average, this well is instrumental to contouring in this area.

New Well Analysis
There are two New-Statistics in the northern portion of the basin (ST-12 and ST-13) which have higher concentrations than the surrounding areas influencing the contour in this area.

Source: SAWPA.net, January 2017

J:\PROJECTS\CA16.0087 SAWPA.AWQ\GIS\MXDS\ATTACHMENT B\B16 SAN TIMOTEO\FIGURE_B16-5_SANTIMOTEO_T_CHANGE.MXD

DBS&A
Daniel B. Stephens & Associates, Inc.
9/19/2017 CA16.0087

SAWPA Basin Monitoring Program Task Force

Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
San Timoteo GMZ

Attachment B16-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

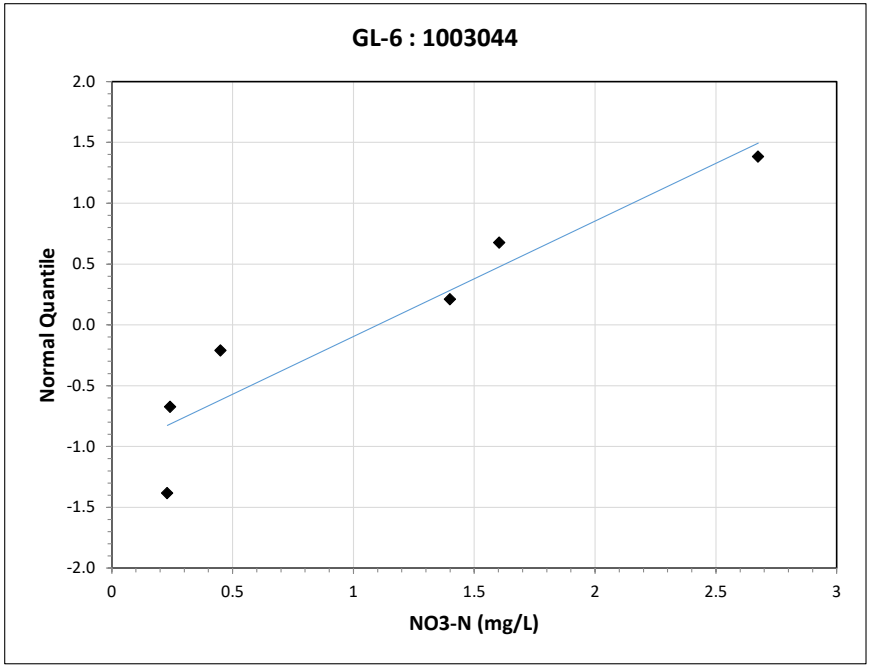
Mann-Kendall

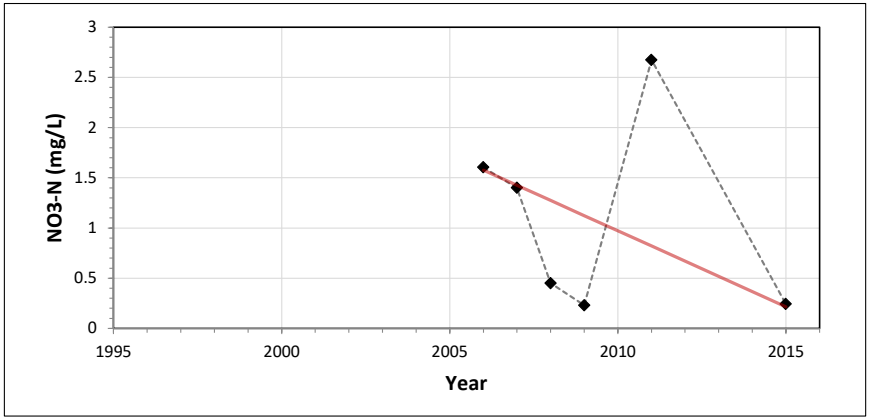
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

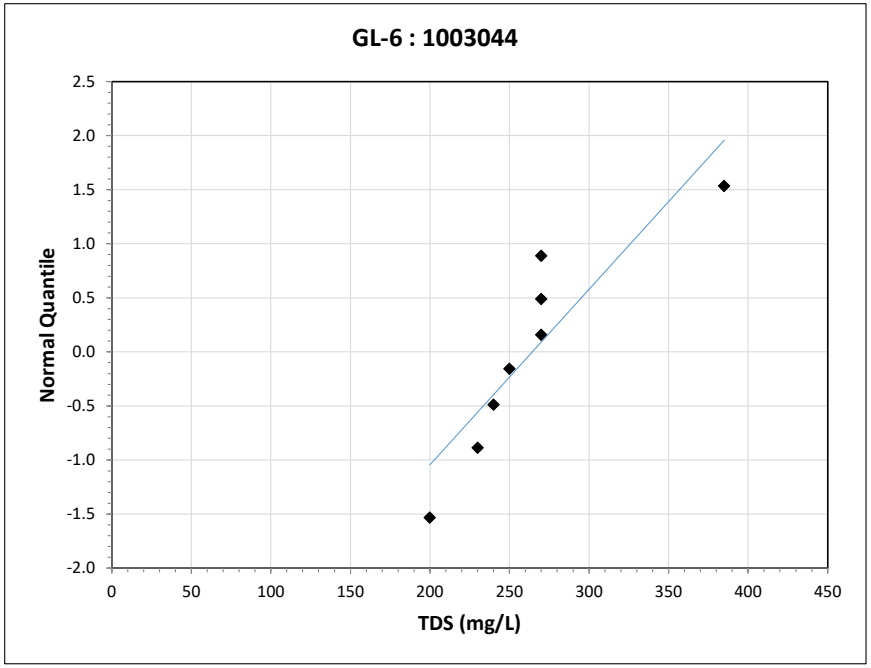
The significance of the trends is notated by * for significant and ** for very significant.

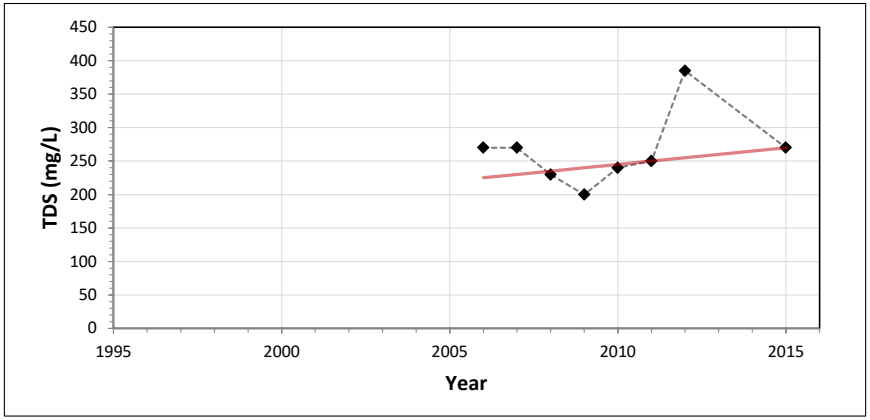
Statistics	
GMZ	San Timoteo
Well Name : ID	GL-6 : 1003044
Analyte	NO3-N (mg/L)
Count	6
Count Detects	6
Sample Year Min	2006
Sample Year Max	2015
Annual Average Min	0.23
Annual Average Max	2.68
Annual Average Mean	1.10
Annual Average Stdev	0.97
Shapiro-Wilk W	0.876
Shapiro-Wilk p-value	0.253
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.40
Student t	1.10
Mean + t*SE (UCL84)	1.54
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-5
Var(S)	28.33
Intercept	305
Slope	-0.15
p-value	0.452
Significant Trend?	No



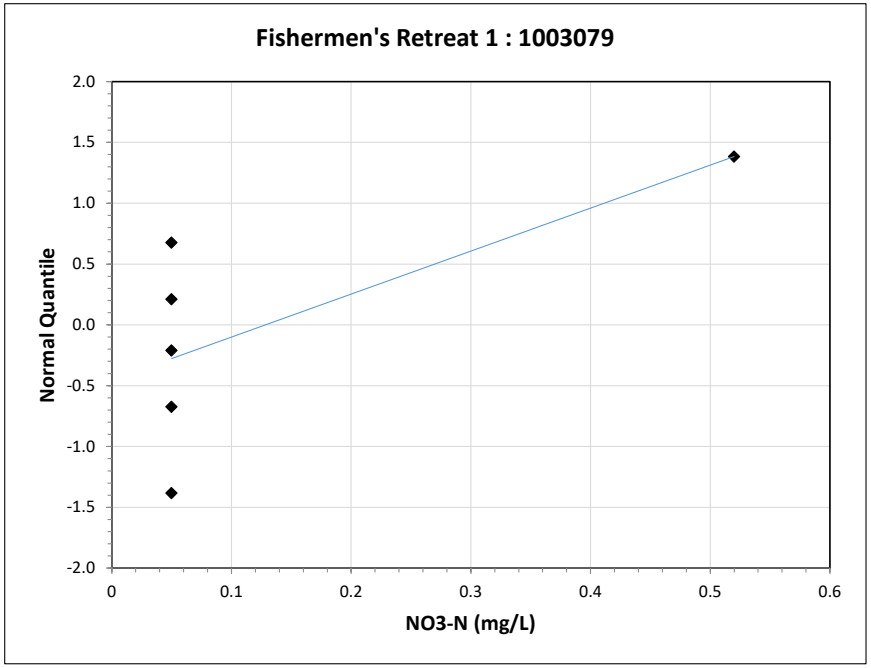


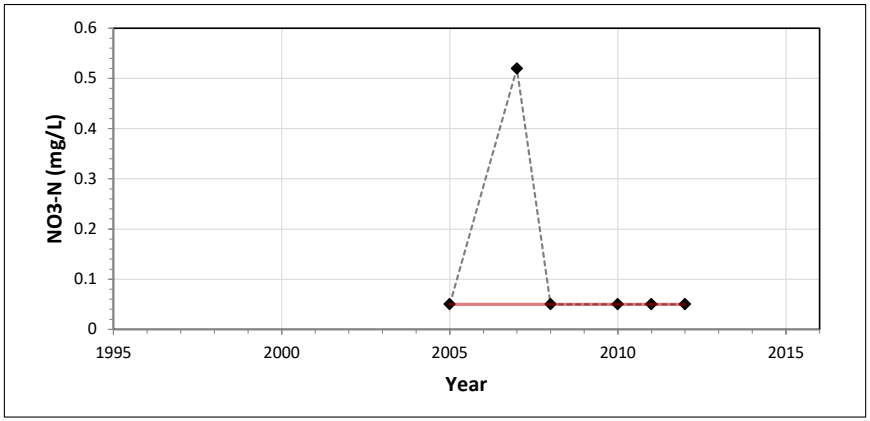
Statistics	
GMZ	San Timoteo
Well Name : ID	GL-6 : 1003044
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	2006
Sample Year Max	2015
Annual Average Min	200
Annual Average Max	385
Annual Average Mean	264
Annual Average Stdev	54.47
Shapiro-Wilk W	0.826
Shapiro-Wilk p-value	0.054
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	19.26
Student t	1.07
Mean + t*SE (UCL84)	285
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	5
Var(S)	61.67
Intercept	-9805
Slope	5.00
p-value	0.610
Significant Trend?	No



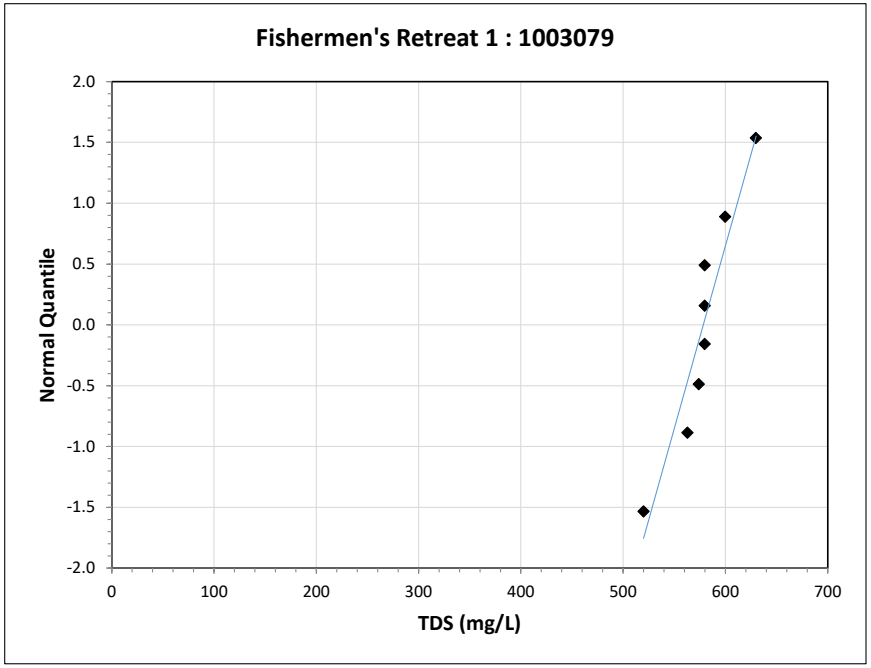


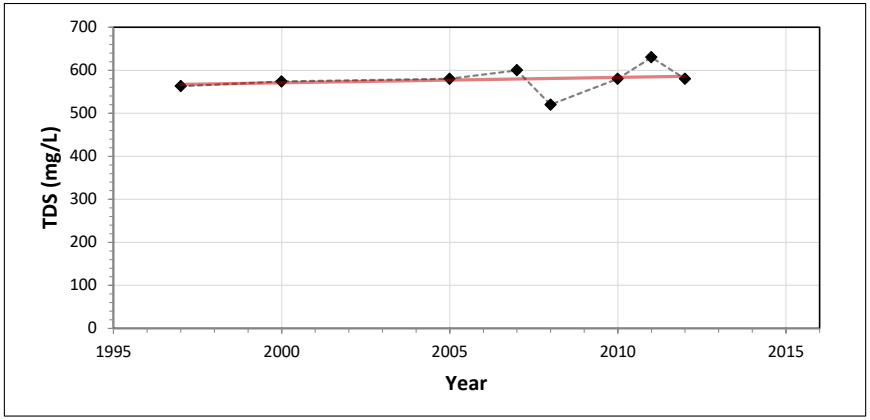
Statistics	
GMZ	San Timoteo
Well Name : ID	Fishermen's Retreat 1 : 1003079
Analyte	NO3-N (mg/L)
Count	6
Count Detects	1
Sample Year Min	2005
Sample Year Max	2012
Annual Average Min	0.05
Annual Average Max	0.52
Annual Average Mean	0.13
Annual Average Stdev	0.19
Shapiro-Wilk W	0.496
Shapiro-Wilk p-value	2E-5
Critical Alpha	0.01
Most Discordant Value	0.52
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	2E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	11.67
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



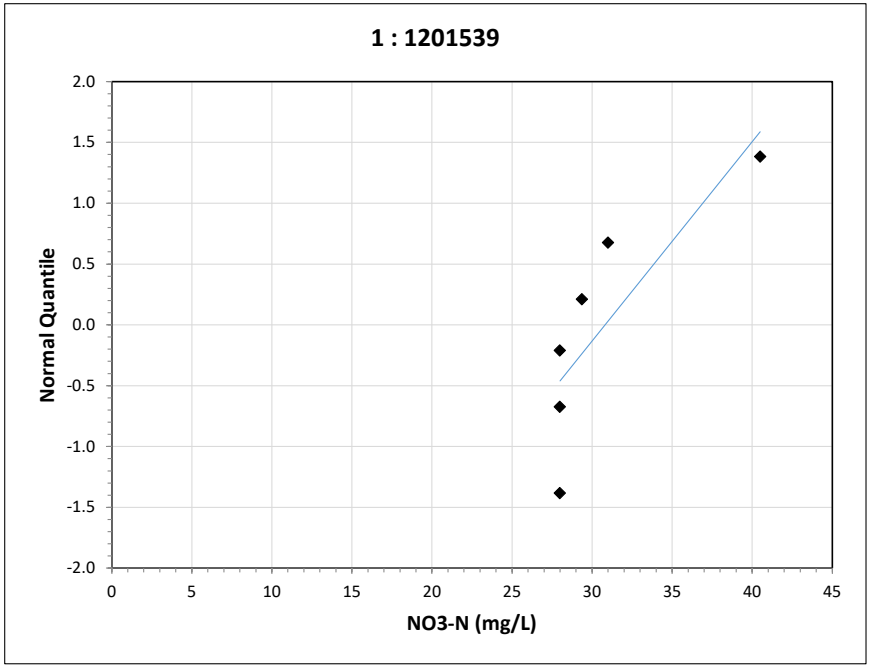


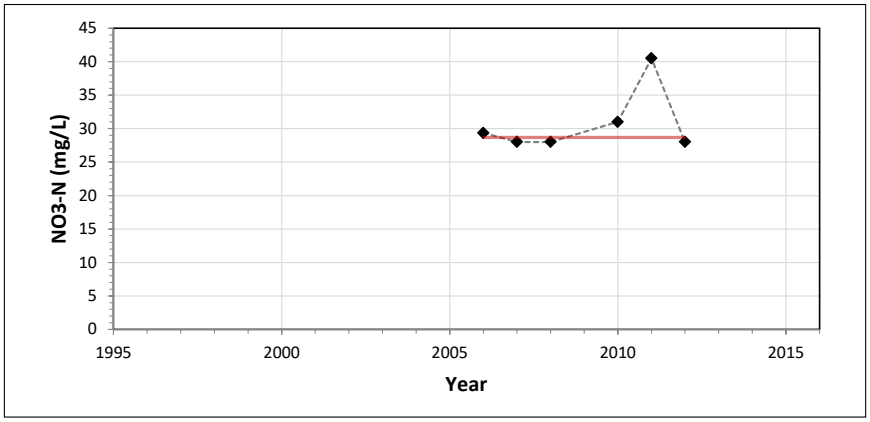
Statistics	
GMZ	San Timoteo
Well Name : ID	Fishermen's Retreat 1 : 1003079
Analyte	TDS (mg/L)
Count	8
Count Detects	8
Sample Year Min	1997
Sample Year Max	2012
Annual Average Min	520
Annual Average Max	630
Annual Average Mean	578
Annual Average Stdev	31.18
Shapiro-Wilk W	0.924
Shapiro-Wilk p-value	0.467
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	11.02
Student t	1.07
Mean + t*SE (UCL84)	590
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	11
Var(S)	61.67
Intercept	-1937
Slope	1.25
p-value	0.203
Significant Trend?	No



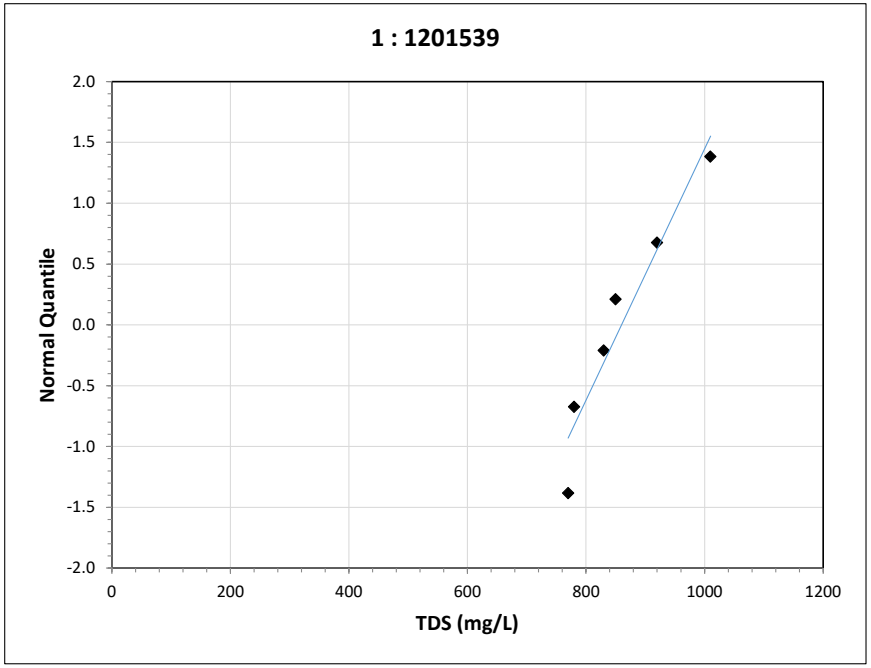


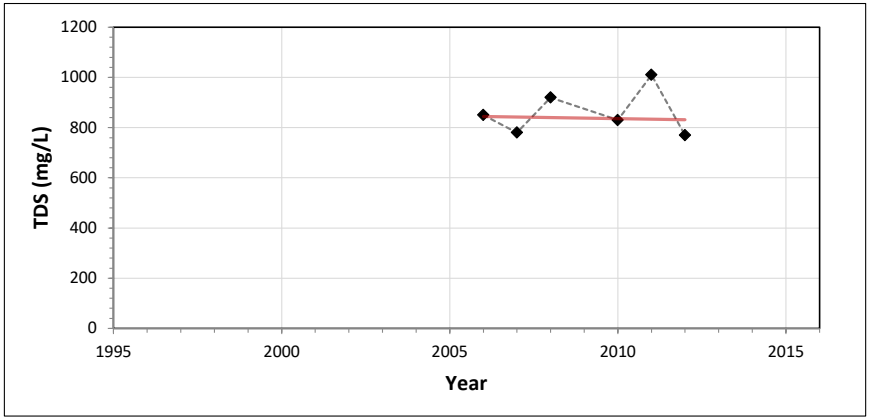
Statistics	
GMZ	San Timoteo
Well Name : ID	1 : 1201539
Analyte	NO3-N (mg/L)
Count	6
Count Detects	6
Sample Year Min	2006
Sample Year Max	2012
Annual Average Min	28.00
Annual Average Max	40.50
Annual Average Mean	30.81
Annual Average Stdev	4.89
Shapiro-Wilk W	0.677
Shapiro-Wilk p-value	0.003
Critical Alpha	0.01
Most Discordant Value	40.50
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.006
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	28.68
Trend Analysis	**Theil-Sen**
Kendall S	2
Var(S)	24.67
Intercept	28.68
Slope	0.00
p-value	NC
Significant Trend?	No



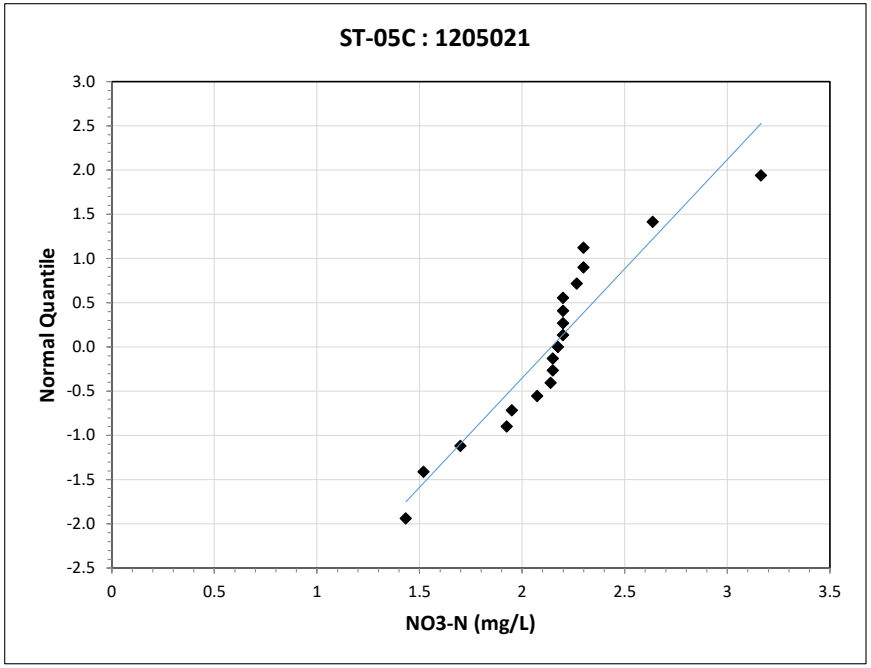


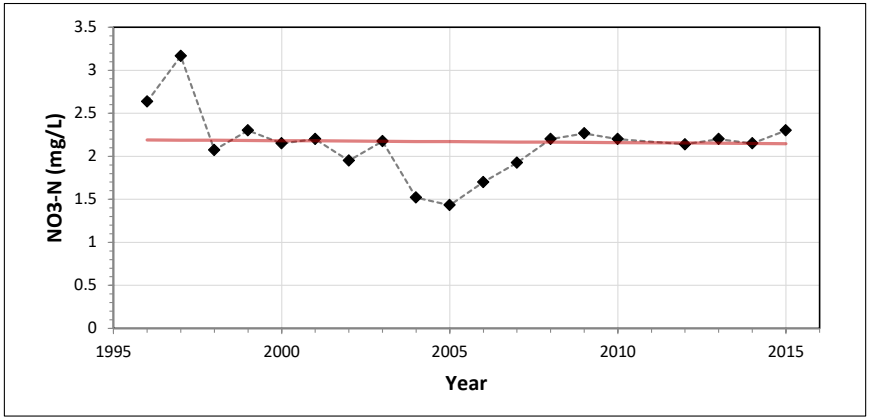
Statistics	
GMZ	San Timoteo
Well Name : ID	1 : 1201539
Analyte	TDS (mg/L)
Count	6
Count Detects	6
Sample Year Min	2006
Sample Year Max	2012
Annual Average Min	770
Annual Average Max	1010
Annual Average Mean	860
Annual Average Stdev	91.21
Shapiro-Wilk W	0.918
Shapiro-Wilk p-value	0.488
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	37.24
Student t	1.10
Mean + t*SE (UCL84)	901
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-1
Var(S)	28.33
Intercept	4856
Slope	-2.00
p-value	1.000
Significant Trend?	No



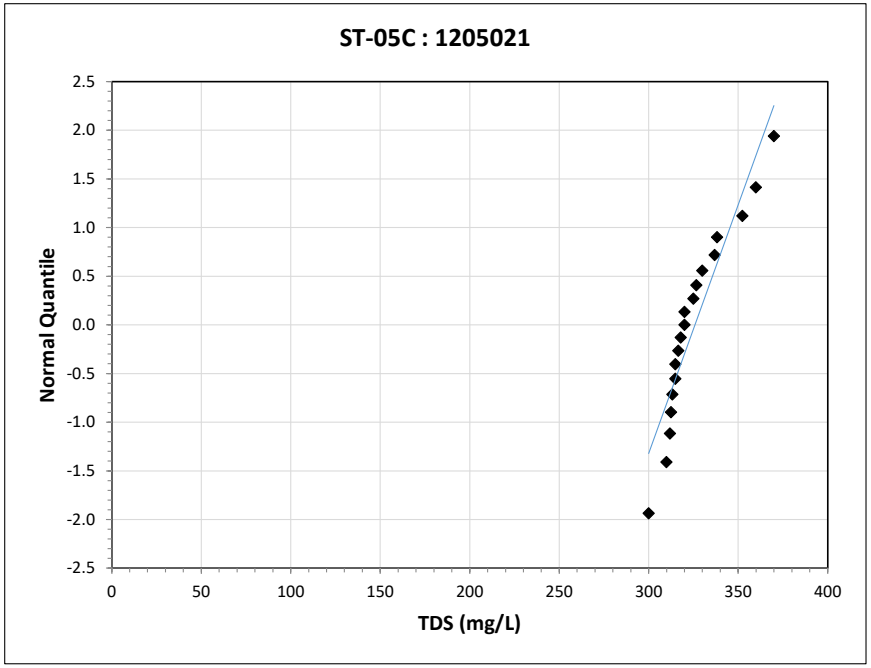


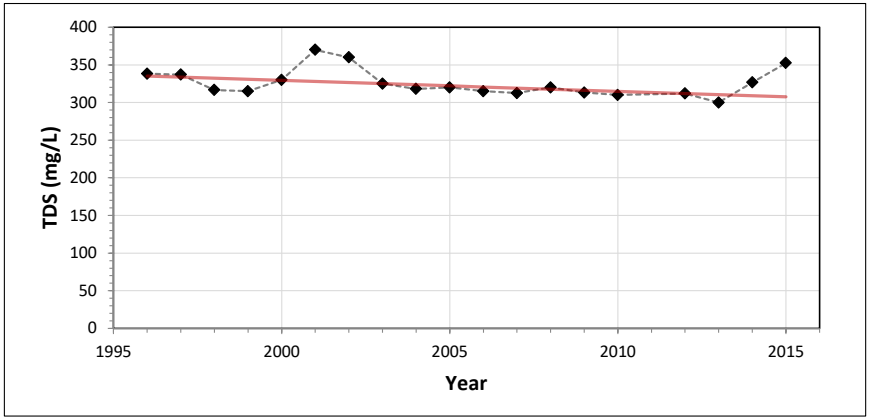
Statistics	
GMZ	San Timoteo
Well Name : ID	ST-05C : 1205021
Analyte	NO3-N (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.43
Annual Average Max	3.16
Annual Average Mean	2.14
Annual Average Stdev	0.38
Shapiro-Wilk W	0.887
Shapiro-Wilk p-value	0.029
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.09
Student t	1.02
Mean + t*SE (UCL84)	2.23
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-8
Var(S)	813
Intercept	6.72
Slope	0.00
p-value	0.806
Significant Trend?	No



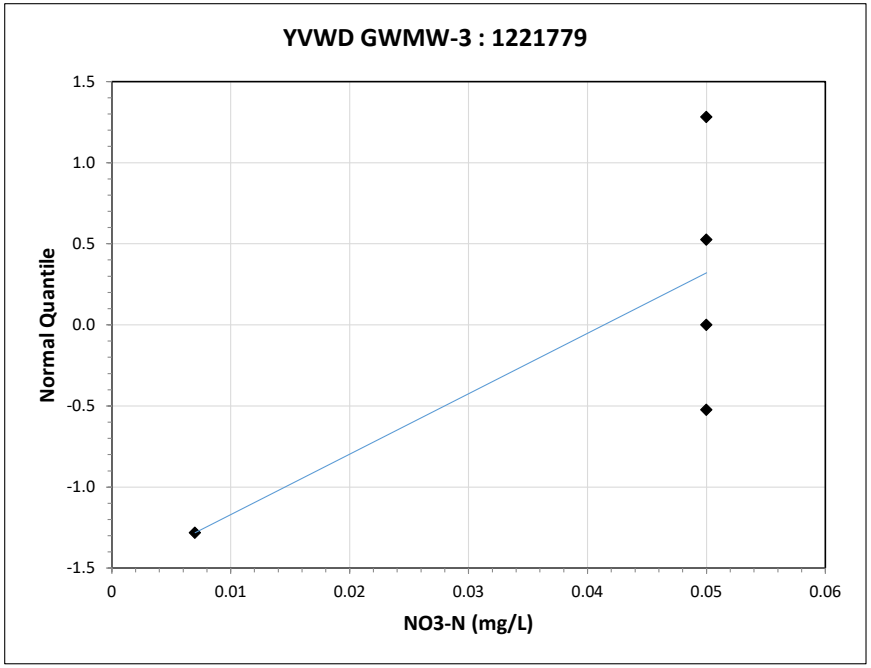


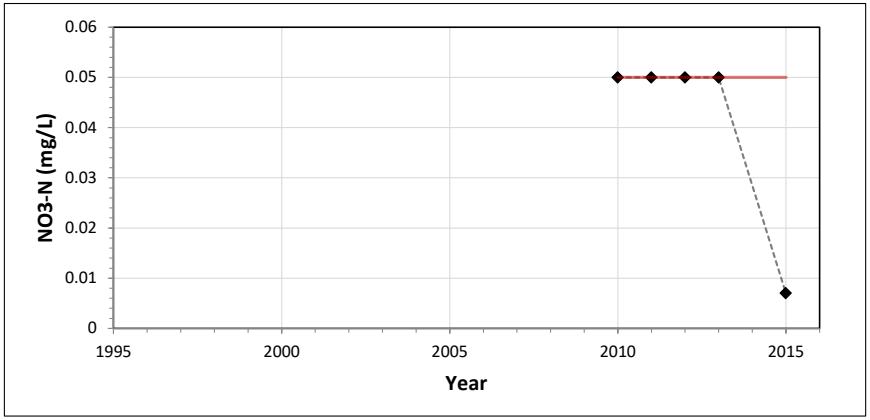
Statistics	
GMZ	San Timoteo
Well Name : ID	ST-05C : 1205021
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	300
Annual Average Max	370
Annual Average Mean	326
Annual Average Stdev	18.29
Shapiro-Wilk W	0.884
Shapiro-Wilk p-value	0.025
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	4.20
Student t	1.02
Mean + t*SE (UCL84)	330
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-61
Var(S)	815
Intercept	3218
Slope	-1.44
p-value	0.036
Significant Trend?	Decreasing



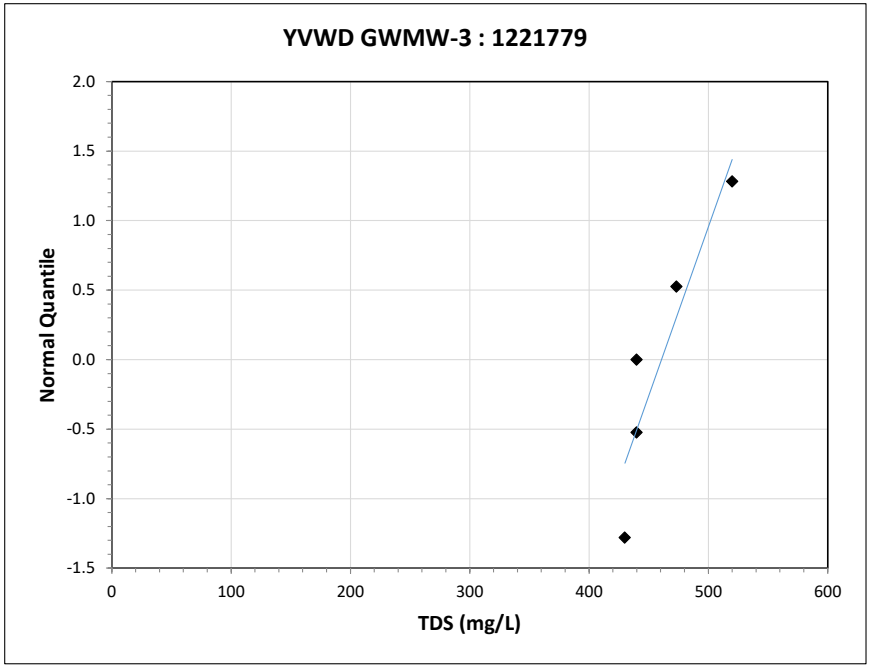


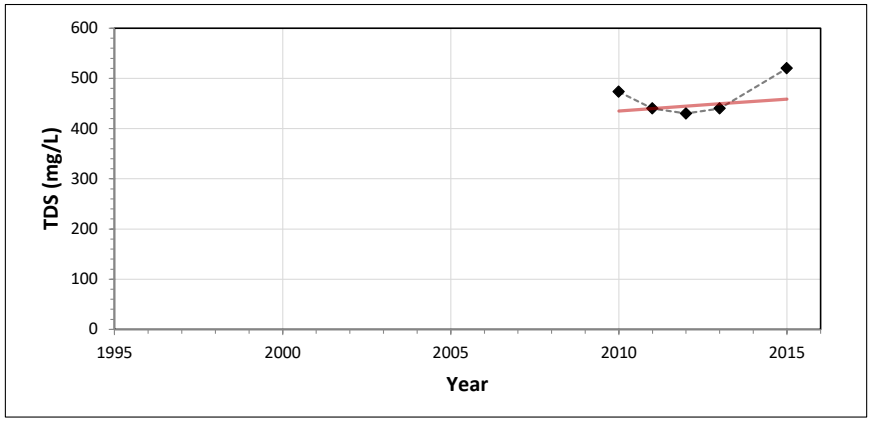
Statistics	
GMZ	San Timoteo
Well Name : ID	YVWD GWMW-3 : 1221779
Analyte	NO3-N (mg/L)
Count	5
Count Detects	1
Sample Year Min	2010
Sample Year Max	2015
Annual Average Min	0.01
Annual Average Max	0.05
Annual Average Mean	0.04
Annual Average Stdev	0.02
Shapiro-Wilk W	0.552
Shapiro-Wilk p-value	1E-4
Critical Alpha	0.01
Most Discordant Value	0.01
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	1E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	0.05
Trend Analysis	**Theil-Sen**
Kendall S	-1
Var(S)	13.00
Intercept	0.05
Slope	0.00
p-value	NC
Significant Trend?	No



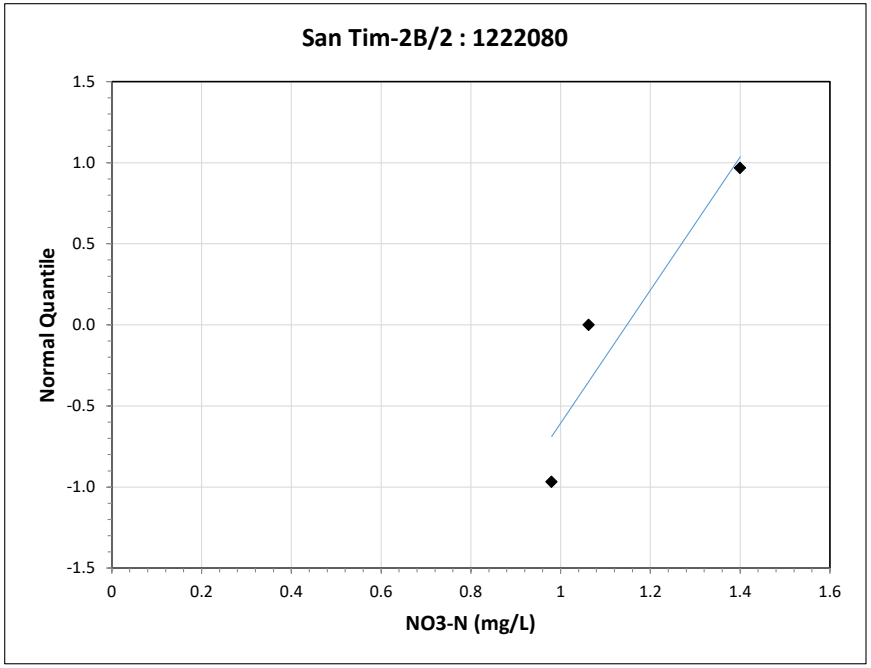


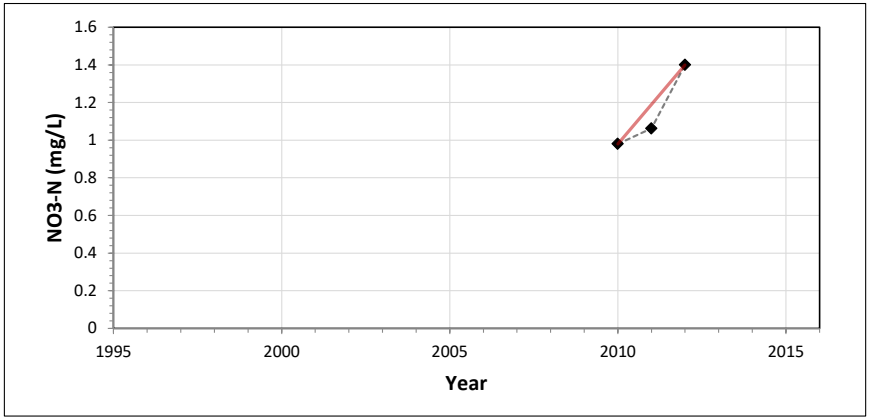
Statistics	
GMZ	San Timoteo
Well Name : ID	YVWD GWMW-3 : 1221779
Analyte	TDS (mg/L)
Count	5
Count Detects	5
Sample Year Min	2010
Sample Year Max	2015
Annual Average Min	430
Annual Average Max	520
Annual Average Mean	461
Annual Average Stdev	37.00
Shapiro-Wilk W	0.841
Shapiro-Wilk p-value	0.168
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	16.55
Student t	1.13
Mean + t*SE (UCL84)	479
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	1
Var(S)	15.67
Intercept	-8945
Slope	4.67
p-value	1.000
Significant Trend?	No



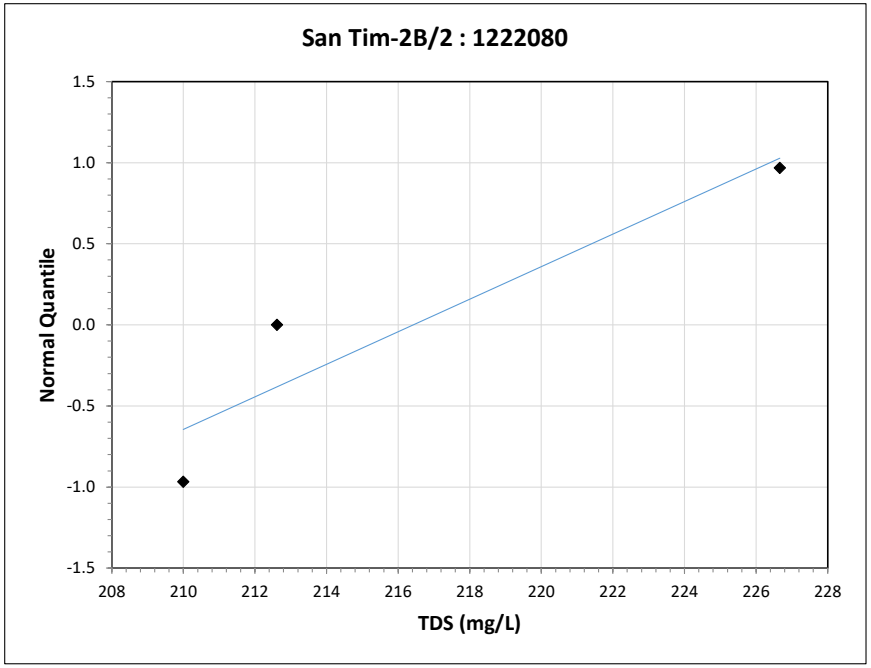


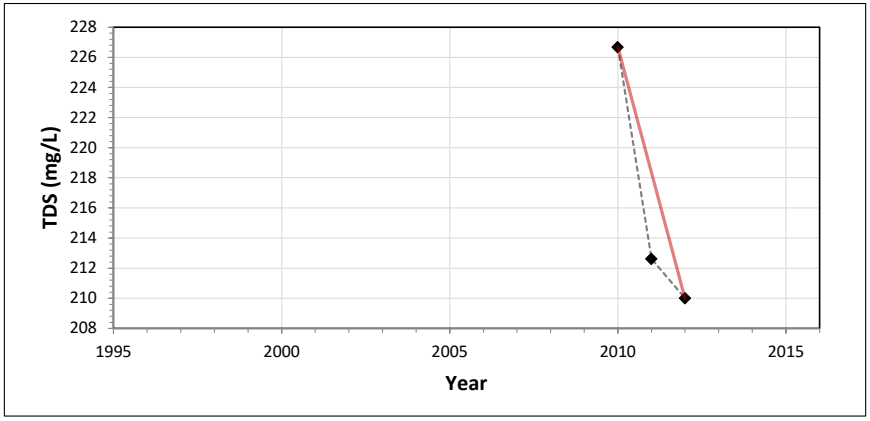
Statistics	
GMZ	San Timoteo
Well Name : ID	San Tim-2B/2 : 1222080
Analyte	NO3-N (mg/L)
Count	3
Count Detects	3
Sample Year Min	2010
Sample Year Max	2012
Annual Average Min	0.98
Annual Average Max	1.40
Annual Average Mean	1.15
Annual Average Stdev	0.22
Shapiro-Wilk W	0.891
Shapiro-Wilk p-value	0.396
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.13
Student t	1.31
Mean + t*SE (UCL84)	1.32
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	3
Var(S)	3.67
Intercept	-421
Slope	0.21
p-value	0.296
Significant Trend?	No





Statistics	
GMZ	San Timoteo
Well Name : ID	San Tim-2B/2 : 1222080
Analyte	TDS (mg/L)
Count	3
Count Detects	3
Sample Year Min	2010
Sample Year Max	2012
Annual Average Min	210
Annual Average Max	227
Annual Average Mean	216
Annual Average Stdev	8.96
Shapiro-Wilk W	0.864
Shapiro-Wilk p-value	0.292
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.17
Student t	1.31
Mean + t*SE (UCL84)	223
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	3.67
Intercept	16977
Slope	-8.33
p-value	0.296
Significant Trend?	No





Attachment B17

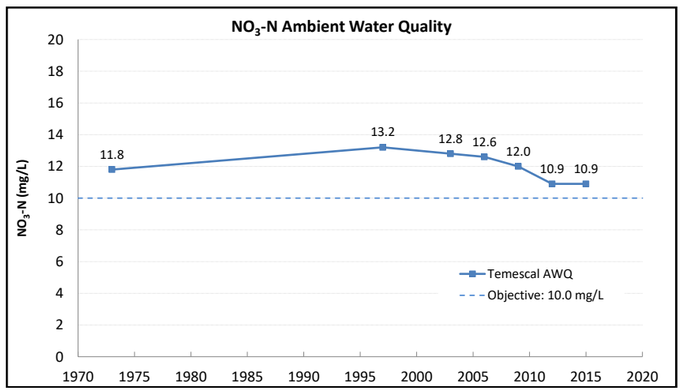
Temescal GMZ

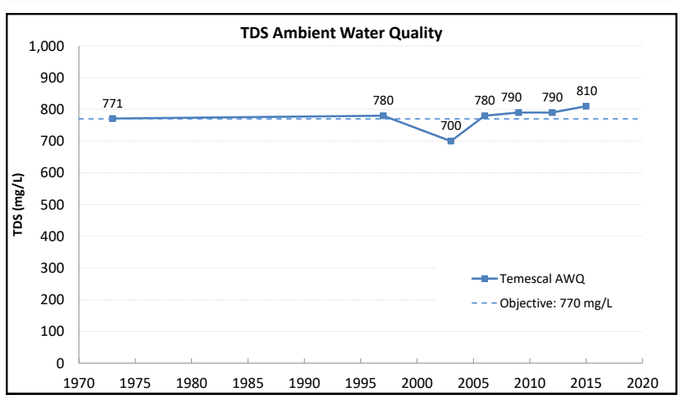
Attachment Contents:

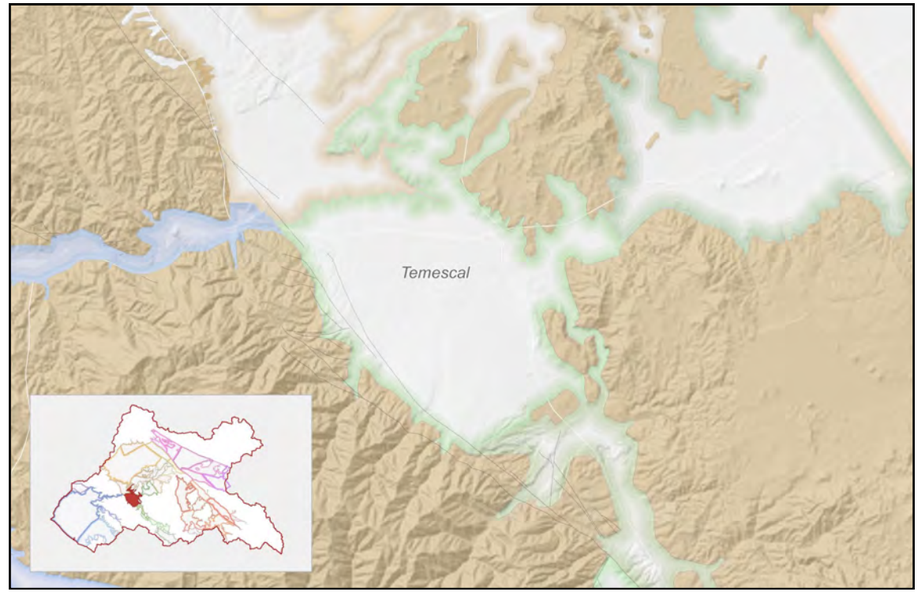
B17-1 Groundwater Storage and Elevation Contours Fall 2015
B17-2 NO_3-N Concentration and Contour Map
B17-3 TDS Concentration and Contour Map
B17-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B17-5 TDS Concentration Change (1993-2012 to 1996-2015)
B17-6 Key Well Analysis Charts

	Basin Analytics	Temescal
Basin	GMZ Area (acres)	18,000
	Volume of Storage (acre-ft)	397,000
NO_3-N	Wells per GMZ	43
	Point Statistics per GMZ	34
	Total Mass (tons)	5,900
	1996-2015 AWQ	10.9
TDS	Wells per GMZ	43
	Point Statistics per GMZ	34
	Total Mass (tons)	439,000
	1996-2015 AWQ	810

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Temescal is 10.0 mg/L. The ambient nitrate concentration was unchanged from 10.9 mg/L in 2012 to 10.9 mg/L in 2015, and there is no assimilative capacity. One out of the four key wells in Temescal GMZ has a decreasing trend in nitrate concentrations while the other three show no trends in the nitrate concentrations. One of the total 43 wells with nitrate values in Temescal will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

Total Dissolved Solids (TDS)

The TDS objective for Temescal is 770 mg/L. The ambient TDS concentration increased from 790 mg/L in 2012 to 810 mg/L in 2015, and there is no assimilative capacity. One out of the four key wells in Temescal GMZ have an increasing trend in TDS concentrations, while the other three show no trends in the TDS concentrations. One of the total 43 wells with TDS values in Temescal will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and one well that was sampled between 2014 and 2015 will be eligible to have statistics determined, if the well is sampled again in the next AWQ recomputation period (1999-2018).

GMZ	Well ID	Well Name	NO_3-N	NO_3-N	TDS	TDS
Temescal	1004640	COR 13	21.6	No Trend	734	Increasing*
Temescal	1004914	COR 15	7.3	No Trend	859	No Trend
Temescal	1004949	COR 14	16.6	Decreasing	734	No Trend
Temescal	1232130	COR 11A	10.3	No Trend	782	No Trend

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B17-4 and B17-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Temescal	1004631	COR 17	--	7	6.3	Stat	Medium	5	847	Stat
Temescal	1004635	COR 07	--	7	15.1	Stat	Medium	6	835	Stat
Temescal	1004636	COR 06	--	7	19.0	Stat	Medium	6	797	Stat
Temescal	1004912	COR 09	--	7	12.8	Ave	Medium	6	745	Stat
Temescal	1004916	3727A	--	--	--	--	High	1	432	Ave
Temescal	1004917	COR 12	Medium	1	13.1	Ave	Medium	1	839	Ave
Temescal	1004918	NA_1004918	High	1	16.5	Ave	--	--	--	--

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

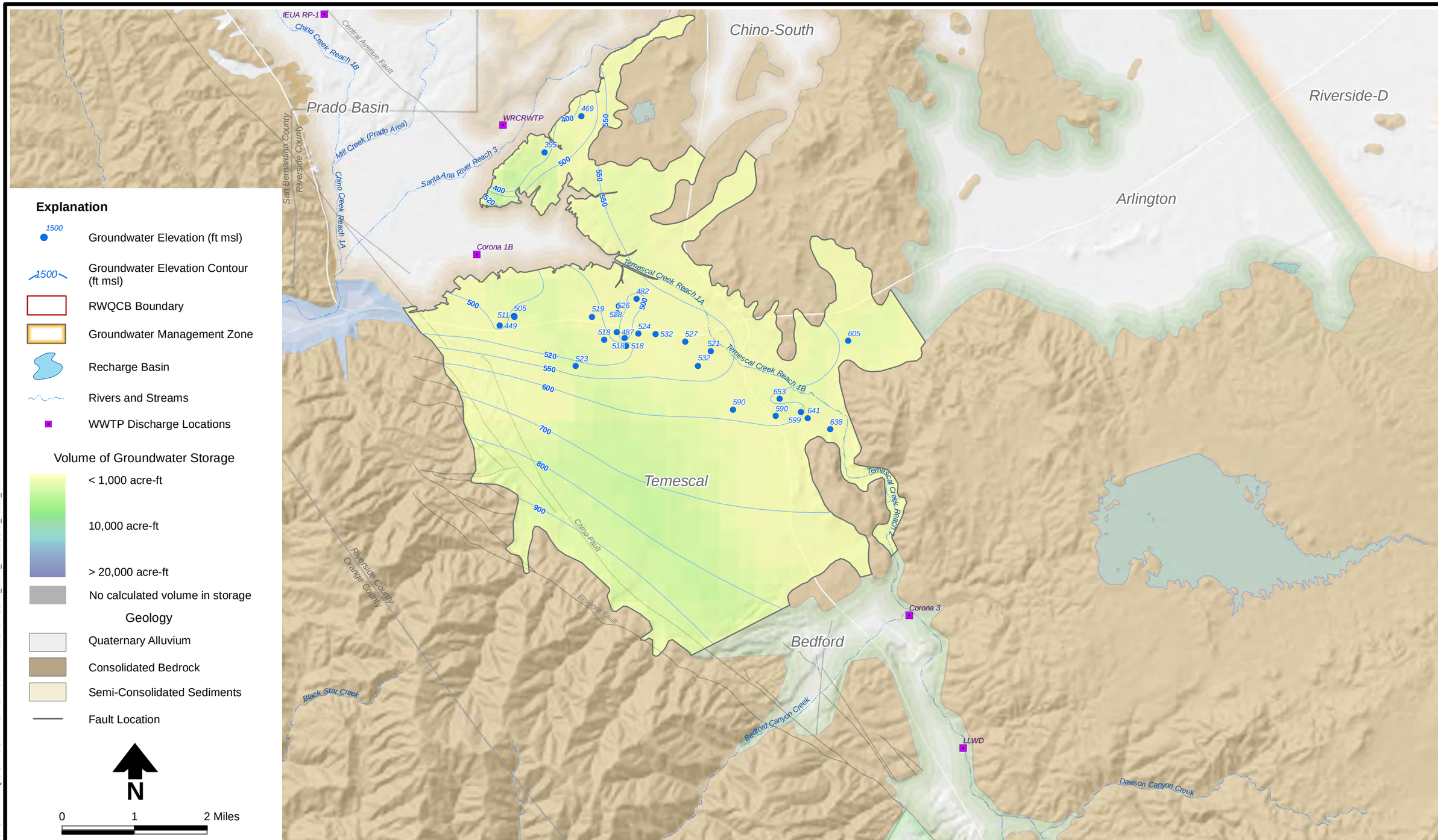
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium-Risk wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B17-4 and B17-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Status	Years[1]	Value[2]	Method	Status	Years[1]	Value[2]	Method
Temescal	1232817	Navy Irrigation Well A (NOR 04)	New*	1	0.1	Ave	--	--	--	--
Temescal	2000005	COR 31	--	--	--	--	New*	2	1,354	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B17-4 and B17-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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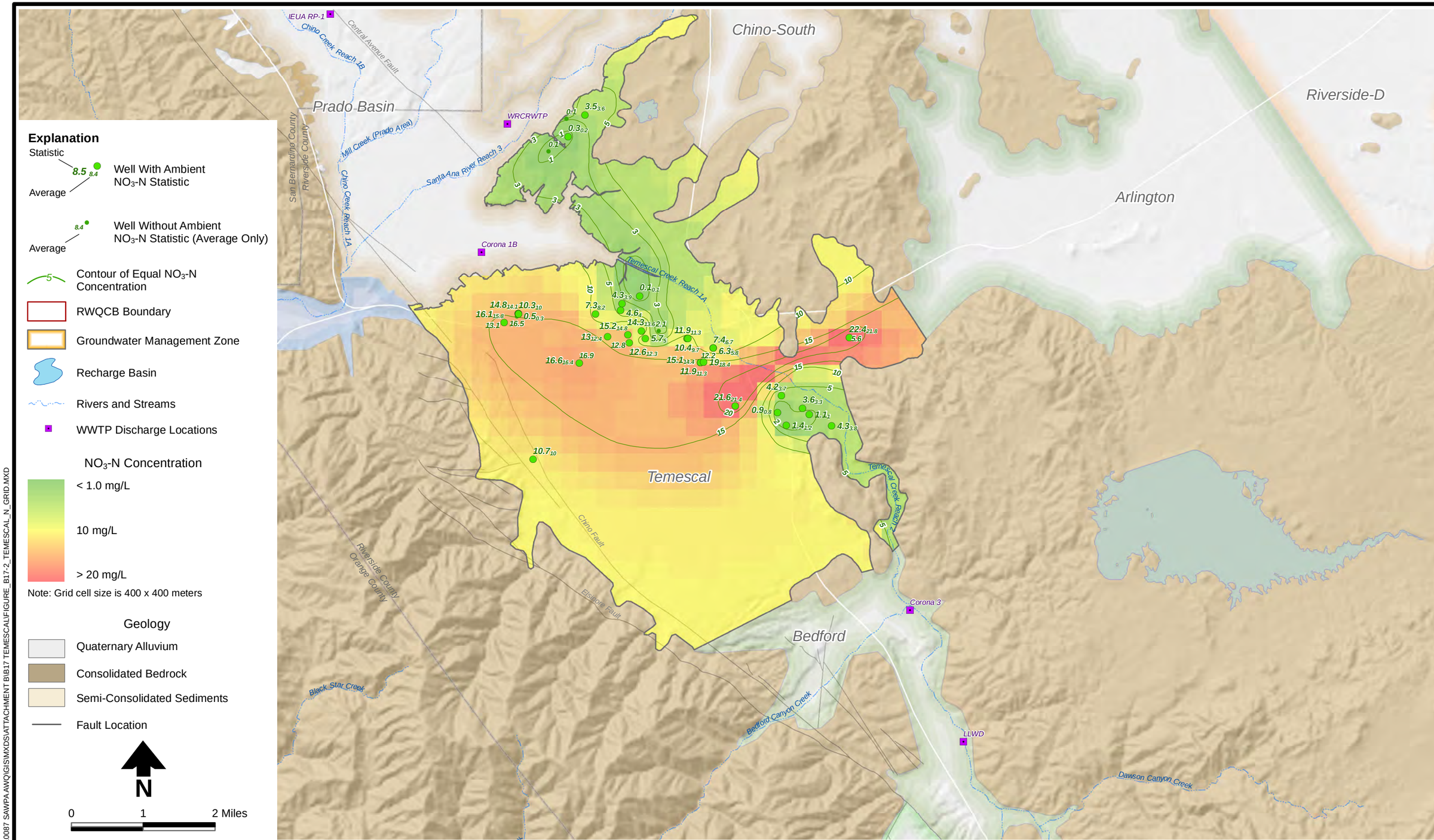
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Temescal GMZ

Attachment B17-1



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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Temescal GMZ

Attachment B17-2

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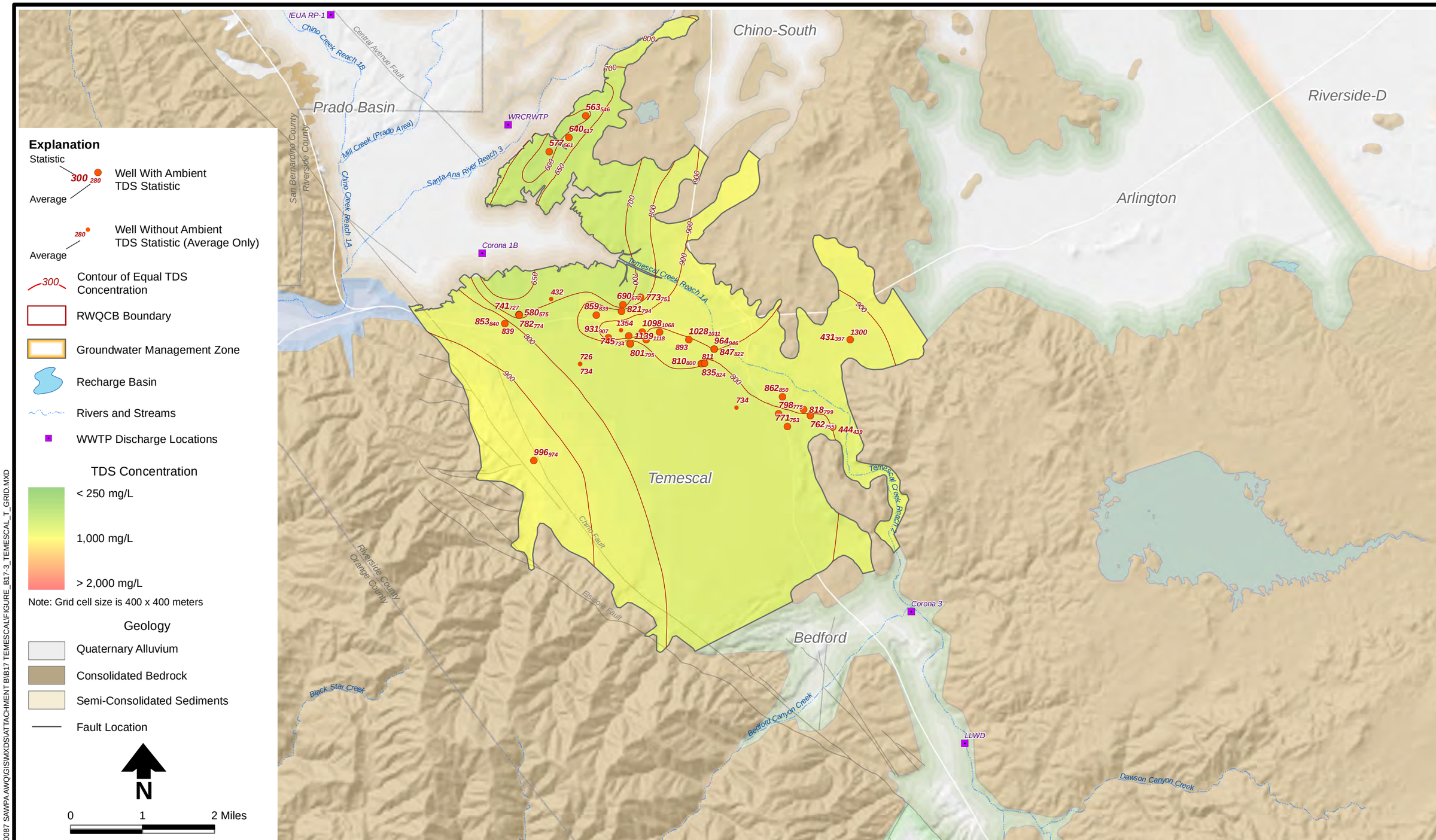

Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Temescal GMZ

Attachment B17-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

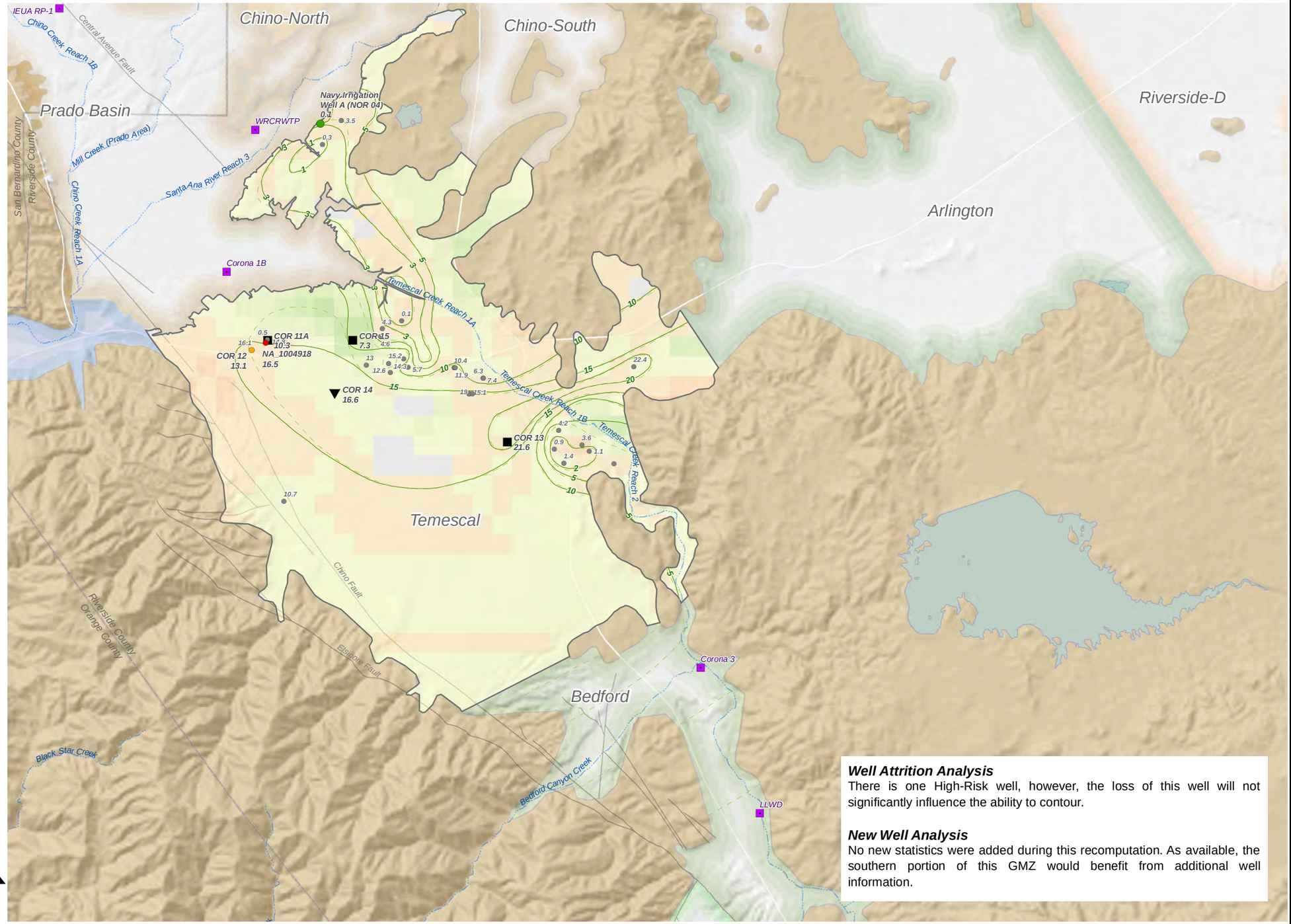
Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 1 2 Miles

N



Well Attrition Analysis

There is one High-Risk well, however, the loss of this well will not significantly influence the ability to contour.

New Well Analysis

No new statistics were added during this recomputation. As available, the southern portion of this GMZ would benefit from additional well information.

Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Temescal GMZ

Attachment B17-4

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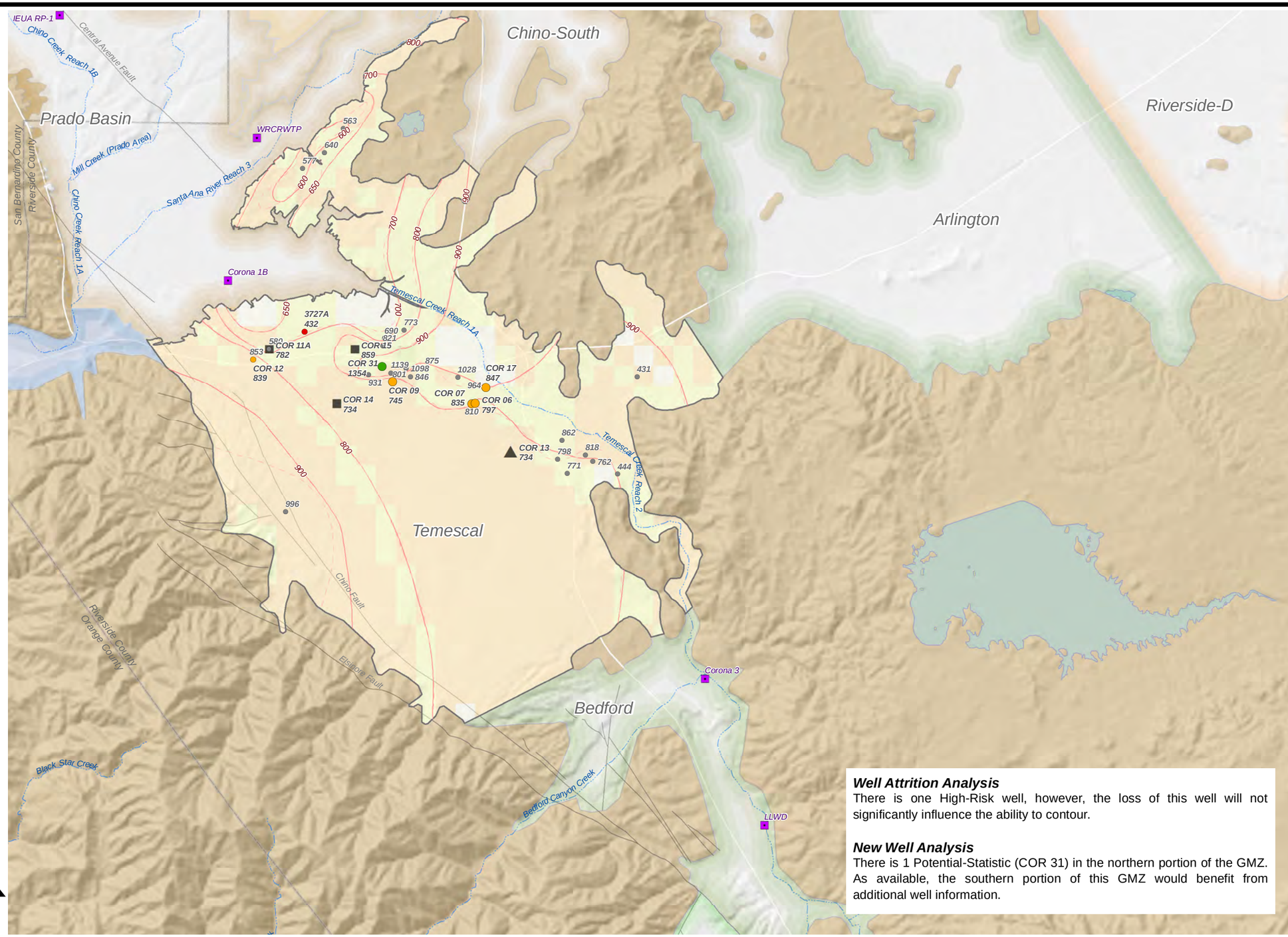

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 300 — 1993-2012 TDS Contours
- 300 — 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

0 1 2 Miles

N

Source: SAWPA.net, January 2017

Well Attrition Analysis
There is one High-Risk well, however, the loss of this well will not significantly influence the ability to contour.

New Well Analysis
There is 1 Potential-Statistic (COR 31) in the northern portion of the GMZ. As available, the southern portion of this GMZ would benefit from additional well information.

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Recomputation of Ambient Water Quality
for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Temescal GMZ

Attachment B17-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

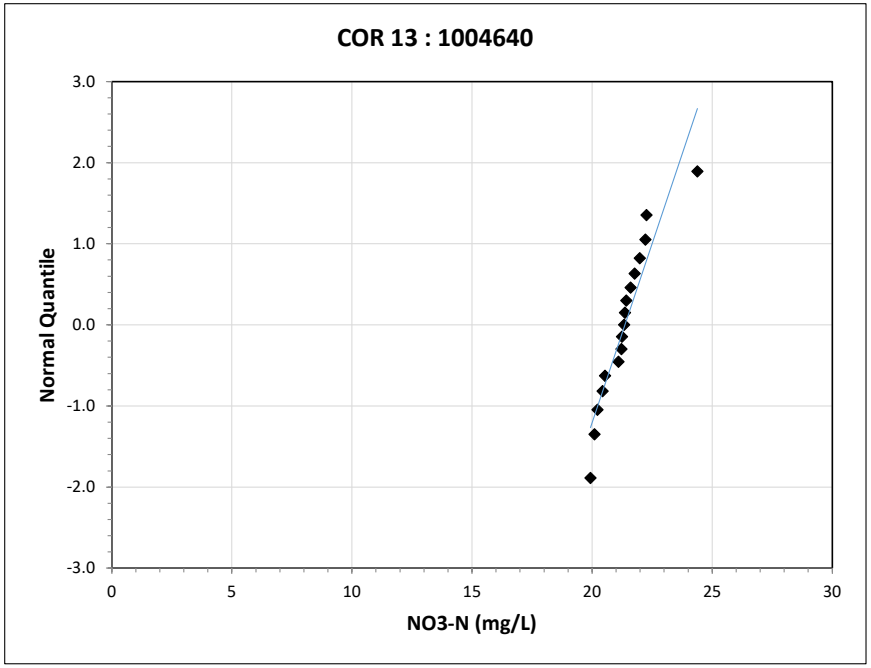
Mann-Kendall

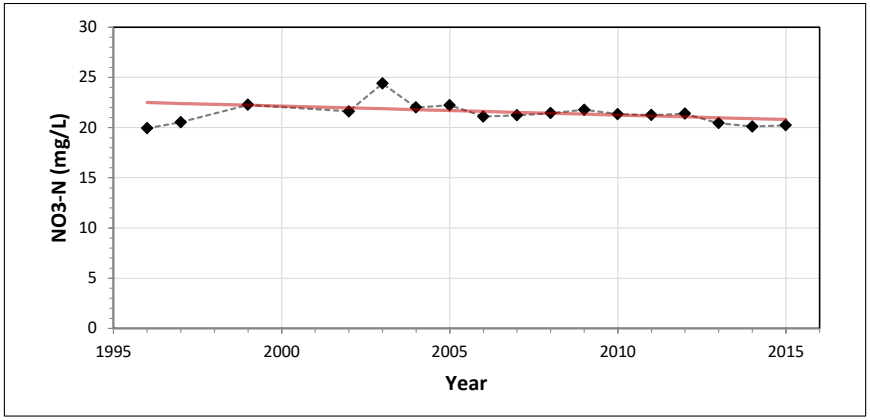
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

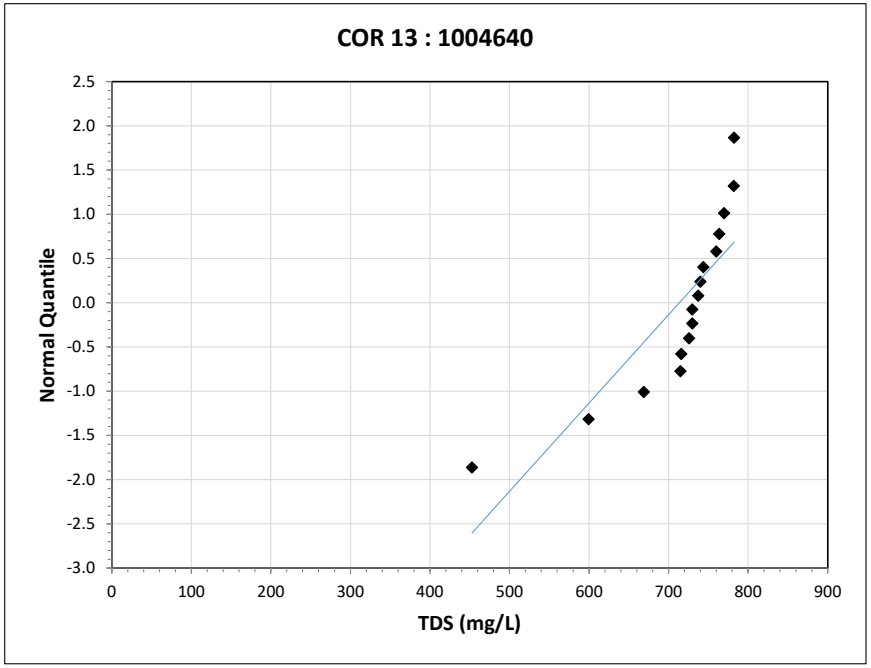
The significance of the trends is notated by * for significant and ** for very significant.

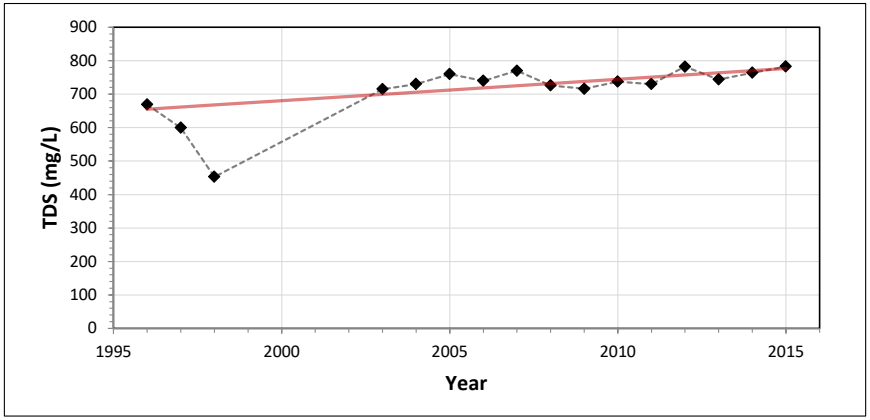
Statistics	
GMZ	Temescal
Well Name : ID	COR 13 : 1004640
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	19.94
Annual Average Max	24.39
Annual Average Mean	21.37
Annual Average Stdev	1.06
Shapiro-Wilk W	0.895
Shapiro-Wilk p-value	0.055
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.26
Student t	1.03
Mean + t*SE (UCL84)	21.63
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-38
Var(S)	589
Intercept	200
Slope	-0.09
p-value	0.127
Significant Trend?	No



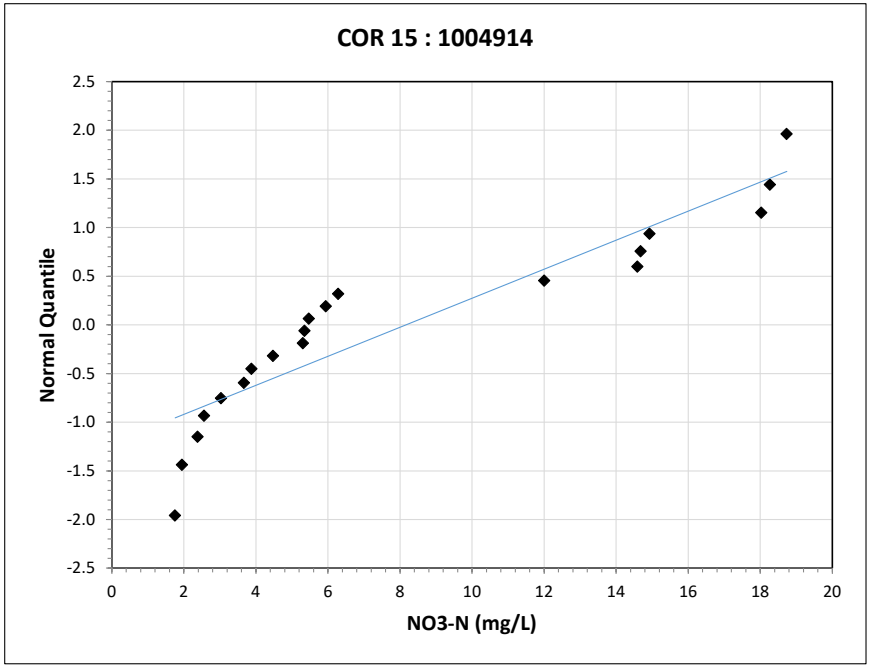


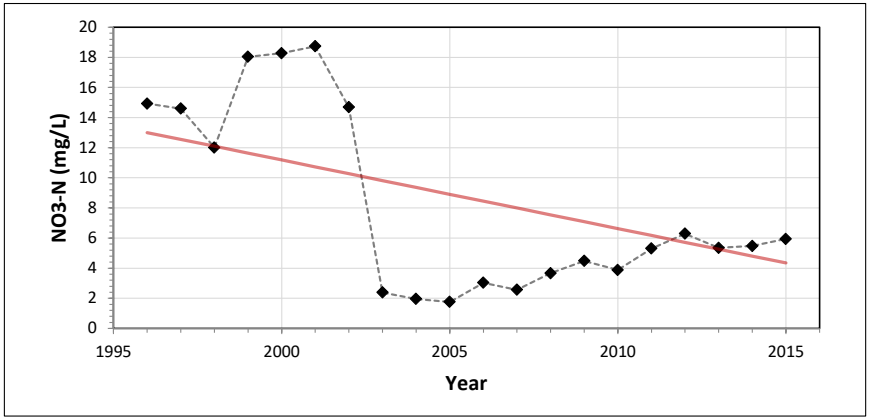
Statistics	
GMZ	Temescal
Well Name : ID	COR 13 : 1004640
Analyte	TDS (mg/L)
Count	16
Count Detects	16
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	453
Annual Average Max	783
Annual Average Mean	714
Annual Average Stdev	82.91
Shapiro-Wilk W	0.710
Shapiro-Wilk p-value	2E-4
Critical Alpha	0.01
Most Discordant Value	453
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	5E-5
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	734
Trend Analysis	**Theil-Sen**
Kendall S	69
Var(S)	492
Intercept	-12153
Slope	6.42
p-value	0.002
Significant Trend?	Increasing*



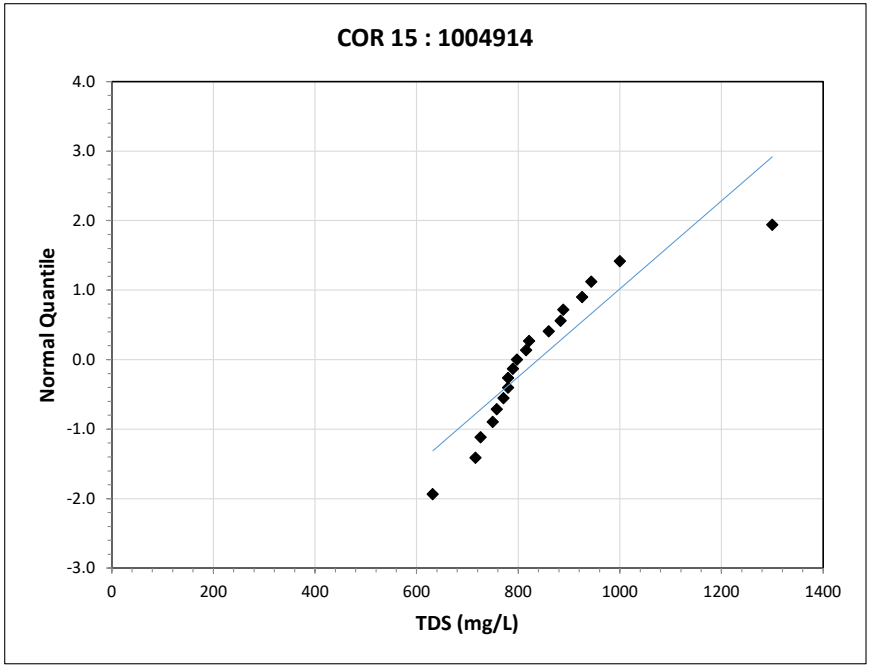


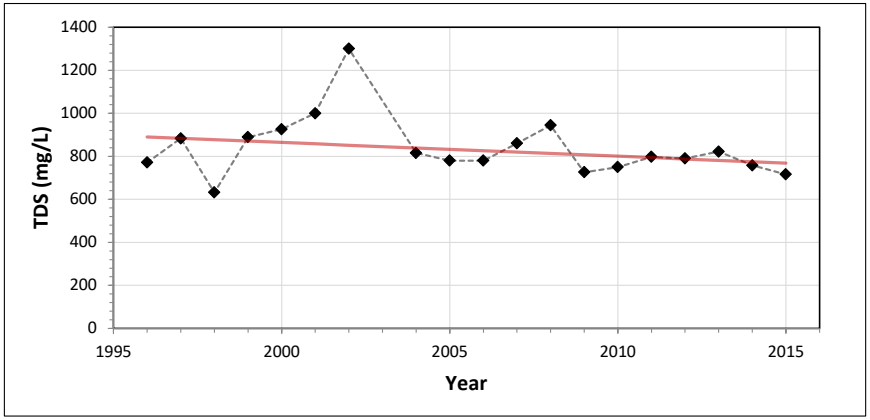
Statistics	
GMZ	Temescal
Well Name : ID	COR 15 : 1004914
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	1.76
Annual Average Max	18.74
Annual Average Mean	8.17
Annual Average Stdev	6.12
Shapiro-Wilk W	0.829
Shapiro-Wilk p-value	0.002
Critical Alpha	0.01
Most Discordant Value	18.74
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.087
Geomean	6.13
GM + t*GSE (UCL84)	7.35
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-22
Var(S)	950
Intercept	922
Slope	-0.46
p-value	0.496
Significant Trend?	No



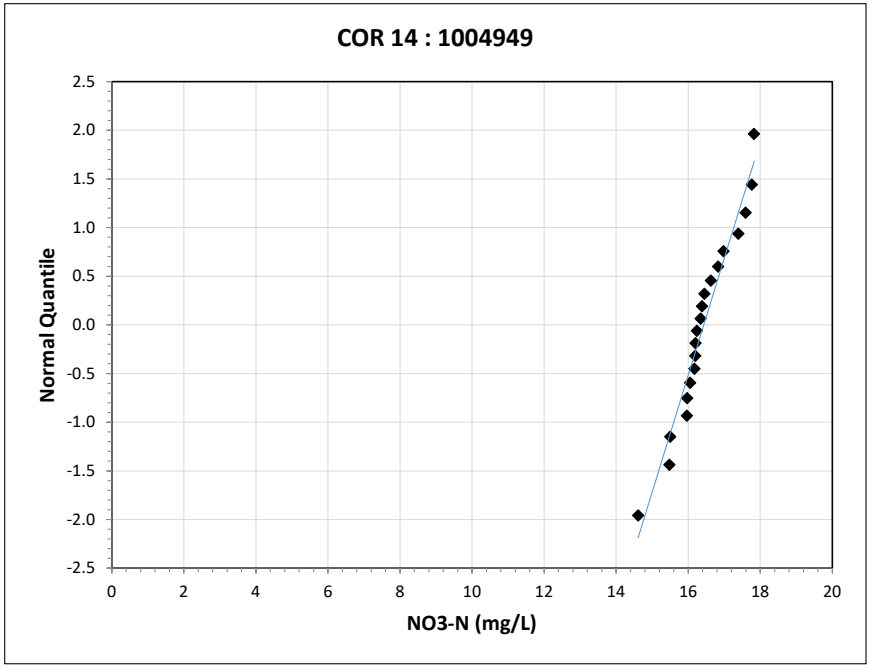


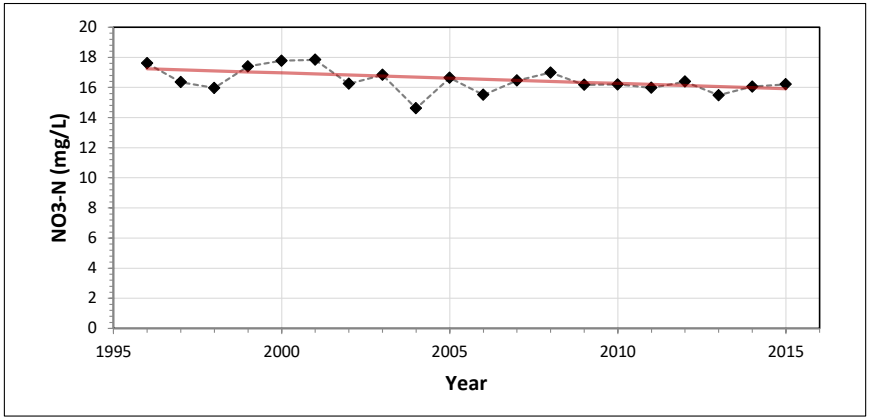
Statistics	
GMZ	Temescal
Well Name : ID	COR 15 : 1004914
Analyte	TDS (mg/L)
Count	19
Count Detects	19
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	632
Annual Average Max	1300
Annual Average Mean	839
Annual Average Stdev	142.16
Shapiro-Wilk W	0.836
Shapiro-Wilk p-value	0.004
Critical Alpha	0.01
Most Discordant Value	1300
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	1.02
Mean + t*SE (UCL84)	NA
SW p-value Logs	0.079
Geomean	829
GM + t*GSE (UCL84)	859
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-36
Var(S)	816
Intercept	13642
Slope	-6.39
p-value	0.220
Significant Trend?	No



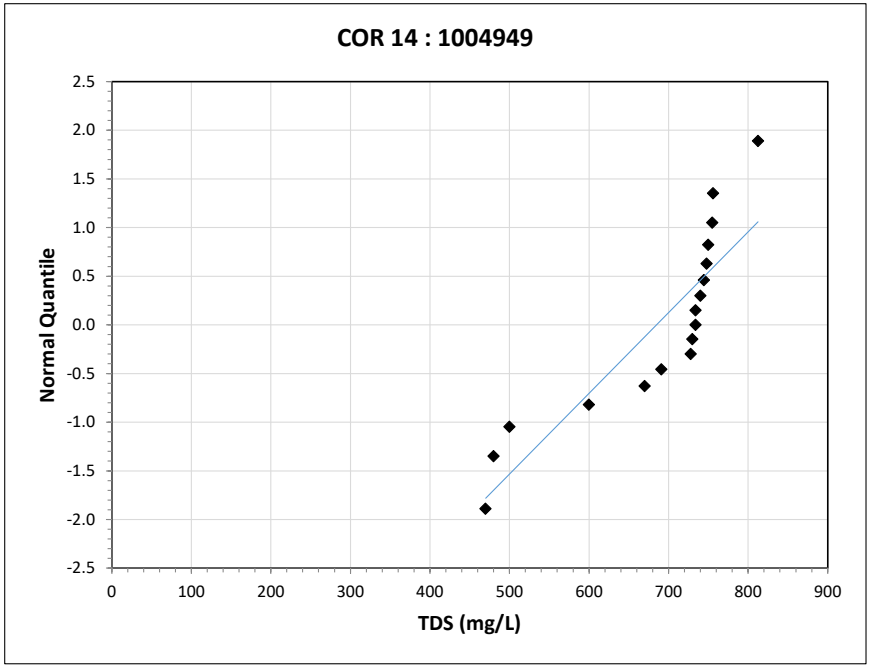


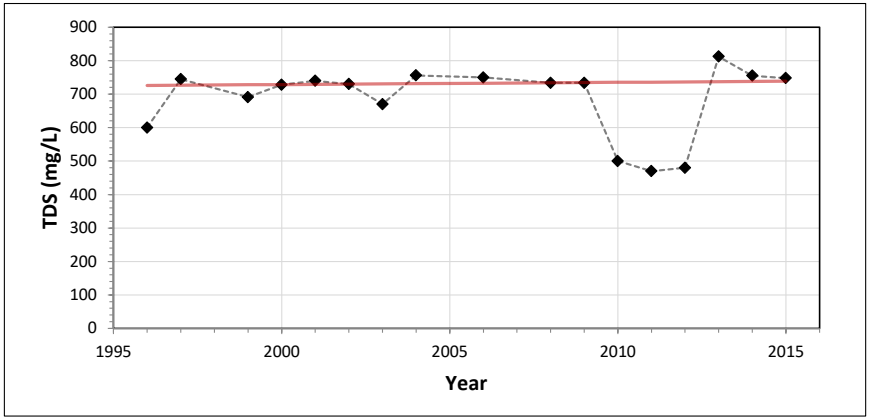
Statistics	
GMZ	Temescal
Well Name : ID	COR 14 : 1004949
Analyte	NO3-N (mg/L)
Count	20
Count Detects	20
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	14.62
Annual Average Max	17.83
Annual Average Mean	16.44
Annual Average Stdev	0.81
Shapiro-Wilk W	0.955
Shapiro-Wilk p-value	0.443
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.02
Mean + t*SE (UCL84)	16.62
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-60
Var(S)	950
Intercept	157
Slope	-0.07
p-value	0.056
Significant Trend?	Decreasing



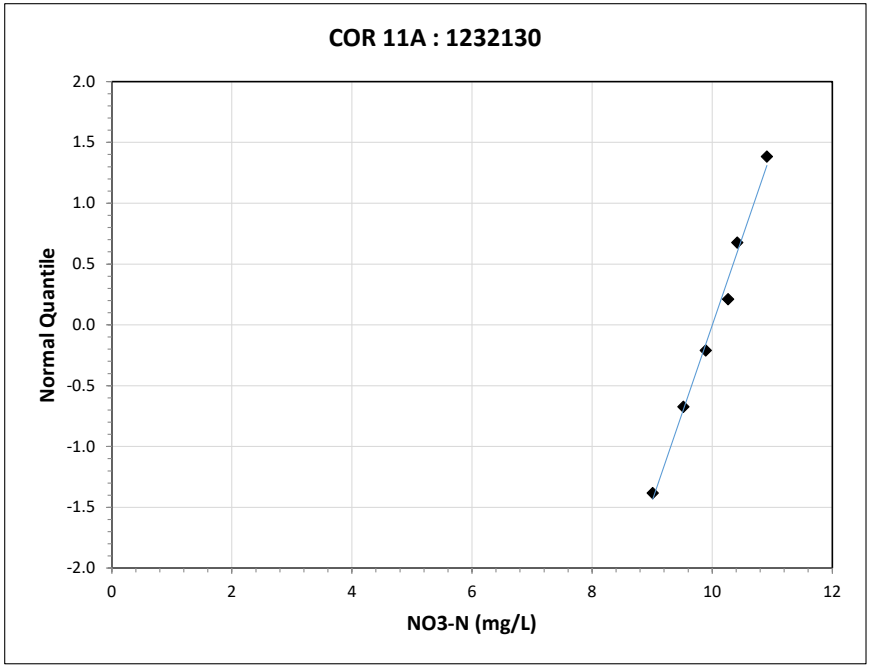


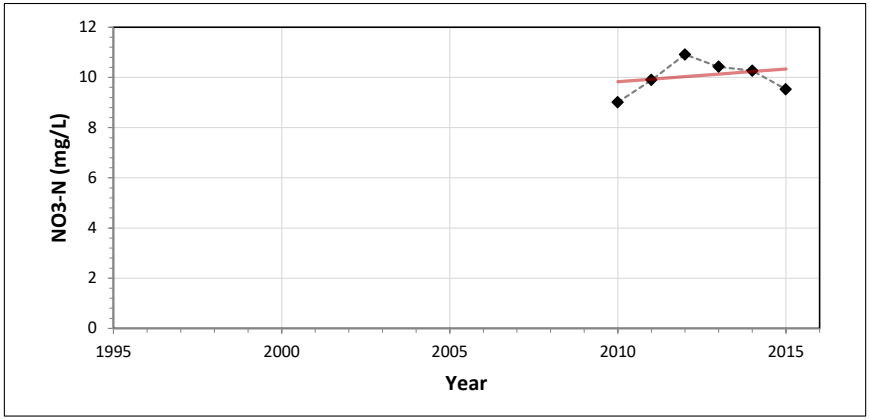
Statistics	
GMZ	Temescal
Well Name : ID	COR 14 : 1004949
Analyte	TDS (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2015
Annual Average Min	470
Annual Average Max	813
Annual Average Mean	685
Annual Average Stdev	105.95
Shapiro-Wilk W	0.778
Shapiro-Wilk p-value	0.001
Critical Alpha	0.01
Most Discordant Value	470
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	NA
Student t	NA
Mean + t*SE (UCL84)	NA
SW p-value Logs	4E-4
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	734
Trend Analysis	**Theil-Sen**
Kendall S	15
Var(S)	588
Intercept	-605
Slope	0.67
p-value	0.564
Significant Trend?	No



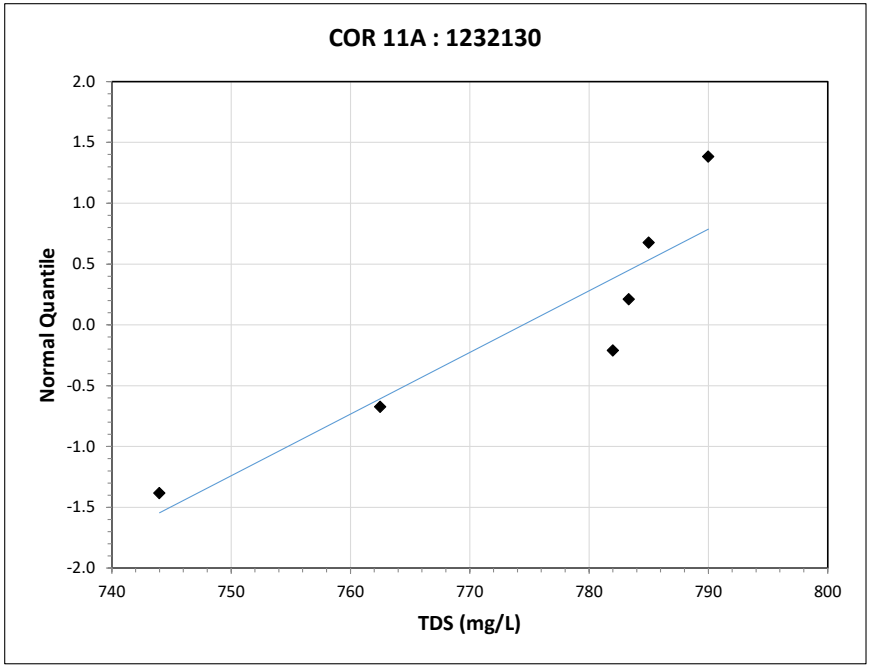


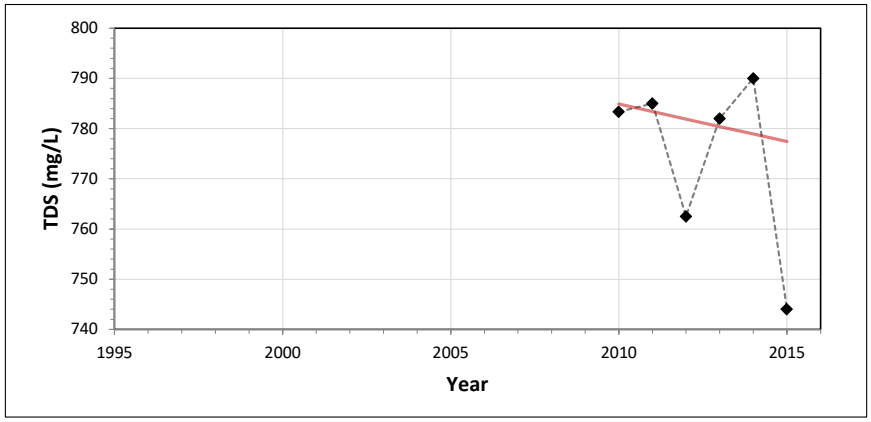
Statistics	
GMZ	Temescal
Well Name : ID	COR 11A : 1232130
Analyte	NO3-N (mg/L)
Count	6
Count Detects	6
Sample Year Min	2010
Sample Year Max	2015
Annual Average Min	9.01
Annual Average Max	10.91
Annual Average Mean	10.01
Annual Average Stdev	0.68
Shapiro-Wilk W	0.989
Shapiro-Wilk p-value	0.987
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.28
Student t	1.10
Mean + t*SE (UCL84)	10.31
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	1
Var(S)	28.33
Intercept	-196
Slope	0.10
p-value	1.000
Significant Trend?	No





Statistics	
GMZ	Temescal
Well Name : ID	COR 11A : 1232130
Analyte	TDS (mg/L)
Count	6
Count Detects	6
Sample Year Min	2010
Sample Year Max	2015
Annual Average Min	744
Annual Average Max	790
Annual Average Mean	774
Annual Average Stdev	17.66
Shapiro-Wilk W	0.832
Shapiro-Wilk p-value	0.111
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.21
Student t	1.10
Mean + t*SE (UCL84)	782
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-3
Var(S)	28.33
Intercept	3800
Slope	-1.50
p-value	0.707
Significant Trend?	No





Attachment B18

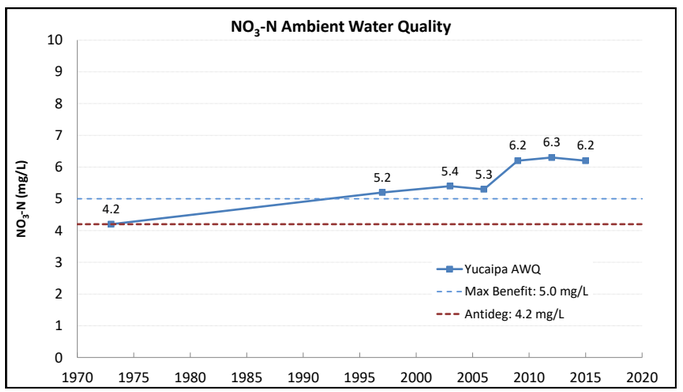
Yucaipa GMZ

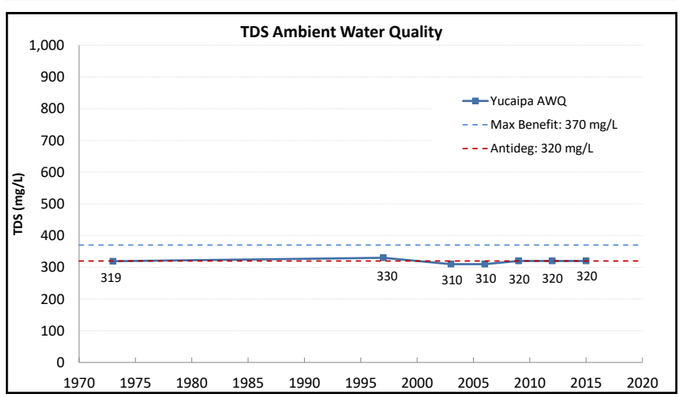
Attachment Contents:

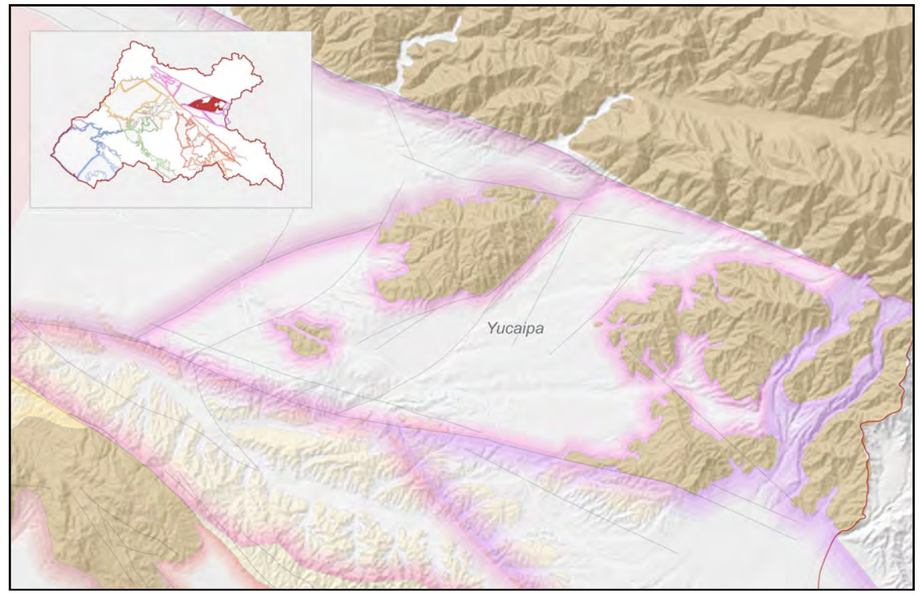
B18-1 Groundwater Storage and Elevation Contours Fall 2015
B18-2 NO_3-N Concentration and Contour Map
B18-3 TDS Concentration and Contour Map
B18-4 NO_3-N Concentration Change (1993-2012 to 1996-2015)
B18-5 TDS Concentration Change (1993-2012 to 1996-2015)
B18-6 Key Well Analysis Charts

	Basin Analytics	Yucaipa
Basin	GMZ Area (acres)	25,500
	Volume of Storage (acre-ft)	693,000
NO_3-N	Wells per GMZ	94
	Point Statistics per GMZ	64
	Total Mass (tons)	5,800
	1996-2015 AWQ	6.2
TDS	Wells per GMZ	92
	Point Statistics per GMZ	65
	Total Mass (tons)	301,000
	1996-2015 AWQ	320

Table 1 - Basin Analytics







Nitrate as Nitrogen (Nitrate or NO_3-N)

The nitrate objective for Yucaipa "max benefit" is 5.0 mg/L and for Yucaipa "antideg" is 4.2 mg/L. The ambient nitrate concentration decreased from 6.3 mg/L in 2012 to 6.2 mg/L in 2015, and there is no assimilative capacity. Two out of the five key wells in Yucaipa GMZ have an increasing trend in nitrate concentrations, one well shows a decreasing trend, and the other two show no trends in the nitrate concentrations. Three of the total 94 wells with nitrate values in Yucaipa will not be eligible for the next AWQ recomputation if the well is not sampled prior to 2018. One new well with statistics was added to the 1996 to 2015 AWQ recomputation.

Total Dissolved Solids (TDS)

The TDS objective for Yucaipa "max benefit" is 370 mg/L and for Yucaipa "antideg" is 320 mg/L. The ambient TDS concentration was unchanged from 320 mg/L in 2012 to 320 mg/L in 2015, allowing for 50 mg/L of assimilative capacity. Three out of the five key wells in Yucaipa GMZ have an increasing trend in TDS concentrations, while the other two show no trends in the TDS concentrations. Three of the total 92 wells with TDS values in Yucaipa will not be eligible for the next AWQ recomputation if not sampled prior to 2018. No new wells with statistics were added to the 1996 to 2015 AWQ recomputation, and one well that was sampled between 2014

GMZ	Well ID	Well Name	NO_3-N (mg/L)	NO_3-N Trend	TDS (mg/L)	TDS Trend
Yucaipa	1000765	YVWD 37	5.5	Increasing	336	No Trend
Yucaipa	1000809	YVWD 18	3.1	No Trend	267	Increasing*
Yucaipa	1001231	Redlands 10	11.5	Decreasing*	340	No Trend
Yucaipa	1002987	WHWC 02A	4.0	Increasing**	309	Increasing
Yucaipa	1003011	YVWD 12	5.9	No Trend	328	Increasing

* significant trend **very significant trend

Table 2 - Key Interpretive Wells

Mann-Kendall trend analyses on the annualized average concentrations for wells that have been identified as key interpretive wells was used to determine the significance of the trends in well concentrations. See Key Well Analysis Charts for more details. See Attachment B18-4 and B18-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Attrition			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Yucaipa	1000700	YVWD 13	High	3	6.1	Stat	--	1	237	Ave
Yucaipa	1000766	NA_1000766	--	7	4.7	Stat	Medium	2	353	Ave
Yucaipa	1002918	YVWD 60	Medium	2	0.1	Ave	Medium	1	244	Ave
Yucaipa	1002980	WHWC 06	--	5	15.8	Stat	High	1	512	Ave
Yucaipa	1002990	WHWC 05A	High	2	3.6	Ave	High	1	271	Ave
Yucaipa	1003003	NA_1003003	High	2	3.3	Ave	High	2	292	Ave
Yucaipa	1003025	NA_1003025	--	6	5.2	Stat	Medium	3	314	Stat
Yucaipa	1207008	WHWC 02	Medium	1	2.9	Ave	Medium	1	280	Ave
Yucaipa	1207886	340003116582501	--	--	--	--	Medium	2	252	Ave

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable

Table 3 - Well Attrition Analysis

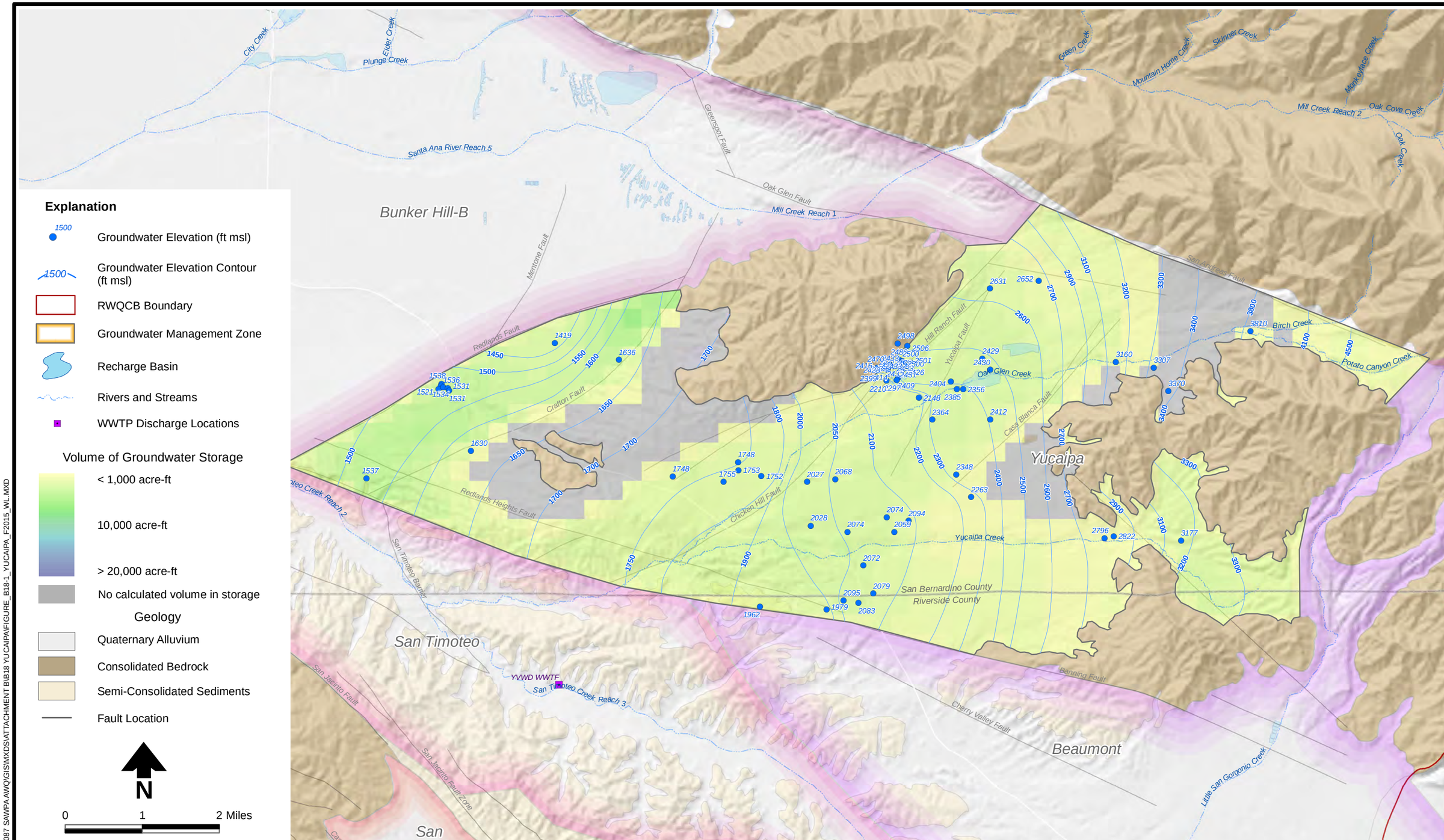
The well locations above have been identified as locations likely to be lost in future AWQ recomputation studies. High-Risk wells will be lost during the 1999-2018 study period if not sampled before 2018. Medium Risk-wells will be lost during the 2002-2021 study period if not sampled before 2021. See Attachment B18-4 and B18-5 for NO_3-N and TDS well locations, respectively.

Well Information			NO_3-N Well Attrition				TDS Well Additions			
GMZ	Well ID	Well Name	Risk	Years[1]	Value[2]	Method	Risk	Years[1]	Value[2]	Method
Yucaipa	1221784	WHWC 14	--	8	2.3	Stat	New	3	295	Stat
Yucaipa	2000363	17	New	3	6.2	Stat	New*	1	195	Average

[1] number of years with samples [2] final value used to contour well concentrations -- not applicable
new=1996-2015 statistic new*=1999-2018 potential statistic

Table 4 - New Well Analysis

New well information is routinely added to the AWQ database. Wells with the first sample taken between 2010-2013 meet the minimum number of annualized averages requirement to become a new point statistic. Table 4 identifies wells that have become point statistics during this study period (1996-2015). Wells with the first sample taken between 2014-2015 are identified as potential point statistics and it is highly recommended that these wells continue to be sampled. See Attachment B18-4 and B18-5 for NO_3-N and TDS well locations, respectively.



Source: SAWPA.net, January 2017

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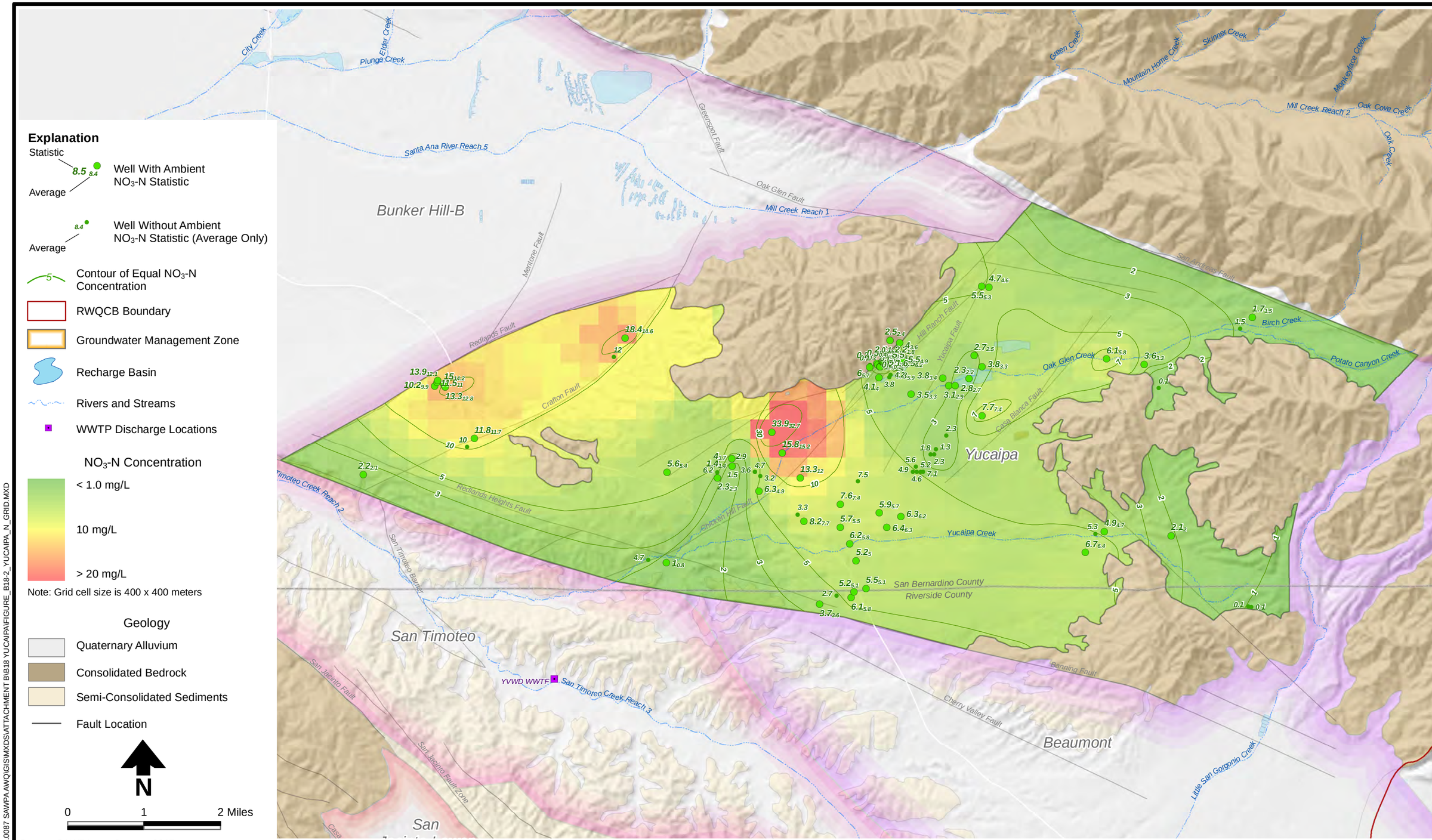
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

Groundwater Storage and Elevation Contours Fall 2015
Yucaipa GMZ

Attachment B18-1



Source: SAWPA.net, January 2017

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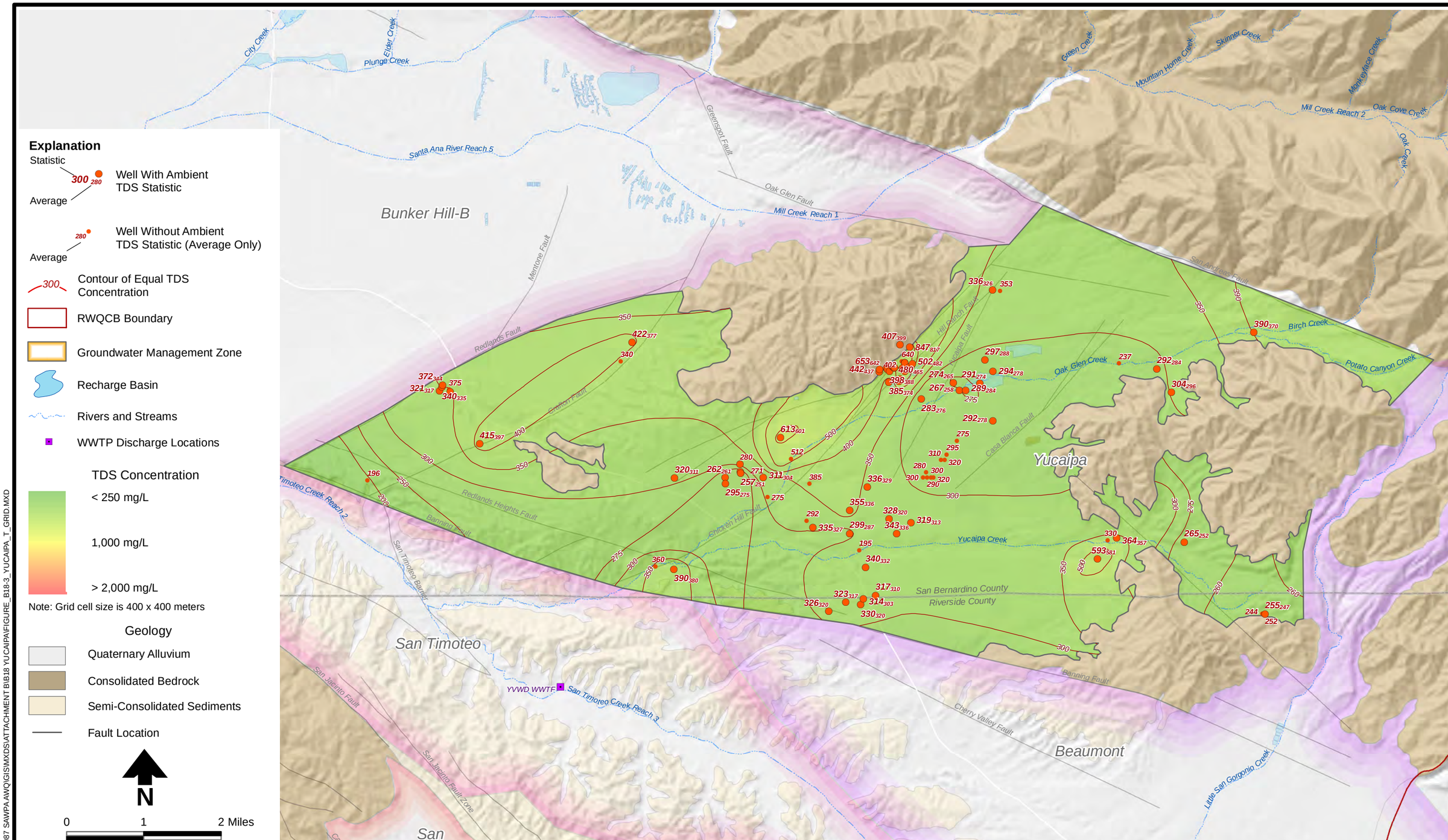
Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration and Contour Map
Yucaipa GMZ

Attachment B18-2



Source: SAWPA.net, January 2017

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration and Contour Map
Yucaipa GMZ

Attachment B18-3

Explanation

- 1996-2015 Point Statistic

NO_3-N: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 NO_3-N Contours
- 1996-2015 NO_3-N Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

NO_3-N Concentration Change
(1993-2012 to 1996-2015)

- > 10 mg/L Increase
- No Change
- > 10 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

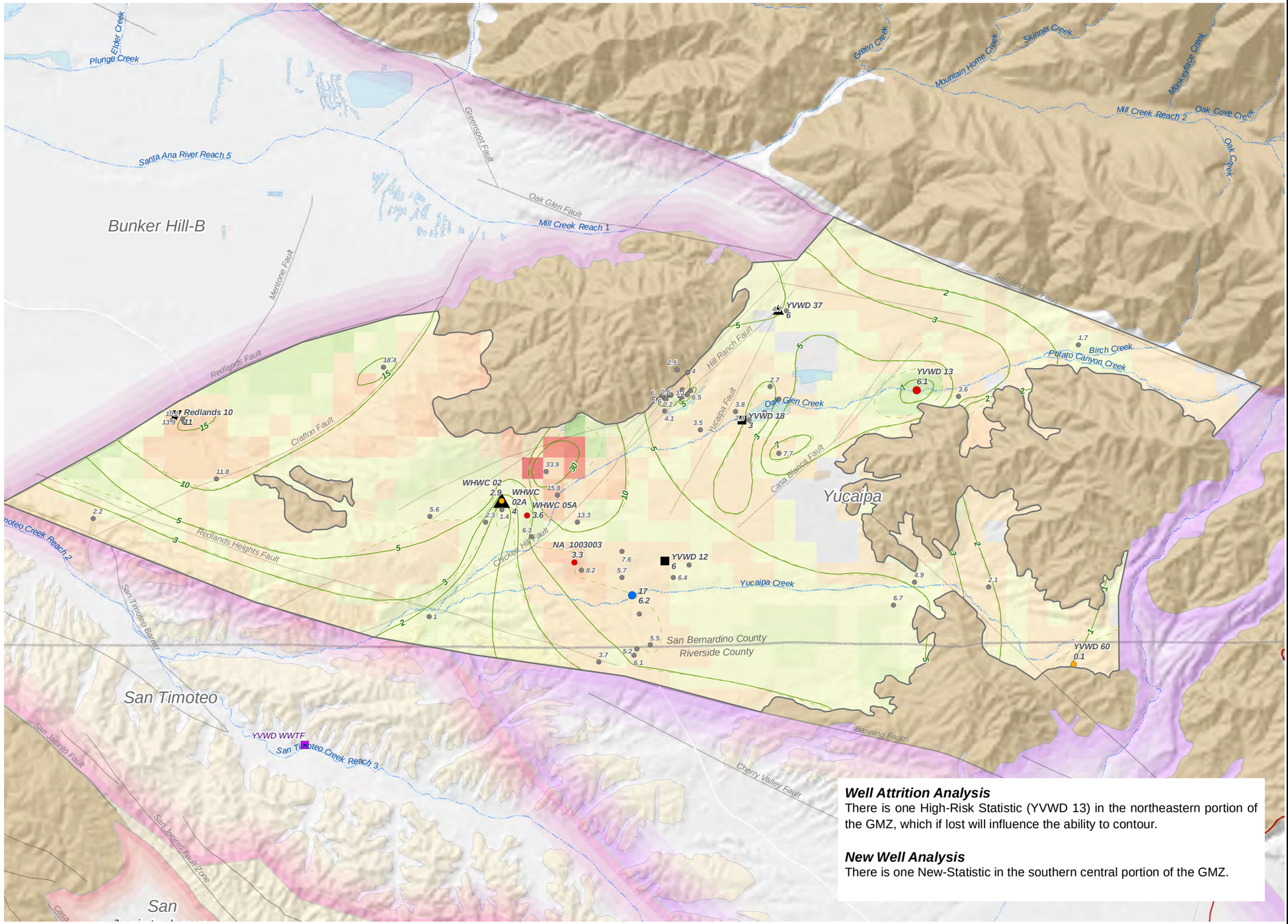
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis
There is one High-Risk Statistic (YVWD 13) in the northeastern portion of the GMZ, which if lost will influence the ability to contour.

New Well Analysis
There is one New-Statistic in the southern central portion of the GMZ.

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

NO_3-N Concentration Change (1993-2012 to 1996-2015)
Beaumont GMZ

Attachment B2-4

Explanation

- 1996-2015 Point Statistic

TDS: Key Well 20-Year Trend

- Very Significantly Increasing
- Significantly Increasing
- Increasing
- No Trend
- Decreasing
- Significantly Decreasing
- Very Significantly Decreasing

Well Attrition Analysis

- High-Risk Statistic/Average
- Medium-Risk Statistic/Average

New Well Analysis

- New-Statistic
- Potential-Statistic
- 1993-2012 TDS Contours
- 1996-2015 TDS Contours
- Groundwater Management Zone
- Recharge Basin
- Rivers and Streams
- WWTP Discharge Locations

TDS Concentration Change
(1993-2012 to 1996-2015)

- > 1,000 mg/L Increase
- No Change
- > 1,000 mg/L Decrease

Note: Grid cell size is 400 x 400 meters

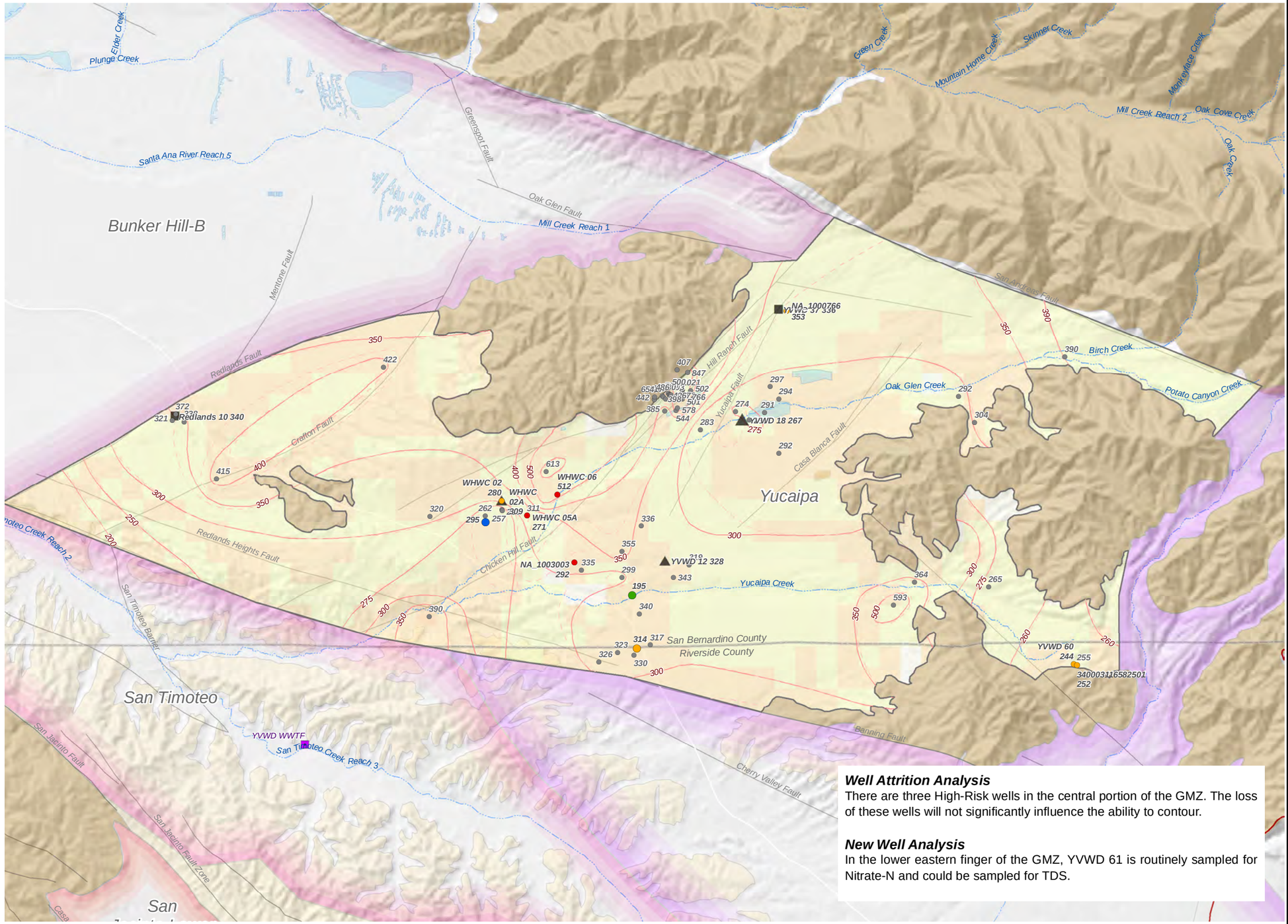
Geology

- Quaternary Alluvium
- Consolidated Bedrock
- Semi-Consolidated Sediments
- Fault Location

N

0 1 2 Miles

Source: SAWPA.net, January 2017



Well Attrition Analysis

There are three High-Risk wells in the central portion of the GMZ. The loss of these wells will not significantly influence the ability to contour.

New Well Analysis

In the lower eastern finger of the GMZ, YVWD 61 is routinely sampled for Nitrate-N and could be sampled for TDS.

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Recomputation of Ambient Water Quality for the Period 1996 to 2015

AMBIENT WATER QUALITY (1996 TO 2015)

TDS Concentration Change (1993-2012 to 1996-2015)
Yucaipa GMZ

Attachment B18-5

Key Well Analysis and Charts

For consistency, key interpretive wells identified in WEI (2014) were used in this study. Key interpretive wells are used to help understand the long-term trends in water quality at given locations. In this section, statistical information is presented for each key well in the groundwater management zone (GMZ) and serve two purposes: (1) to show examples of the Shapiro-Wilk tests which were performed on every well, and (2) to determine the 20-year trends of the annualized averages for the key wells using Mann-Kendall analysis.

Shapiro-Wilk

The water quality point statistic for a given well is based on a 20-year moving average of total dissolved solids (TDS) and nitrate. For this ambient water quality (AWQ) recomputation, the 20-year period is from January 1, 1996 to December 31, 2015. When there is more than one water quality sample result in a given calendar year, these values are averaged. Thus, only one value per year, the annualized average, will be used in the computation of AWQ. This technique is a form of temporal declustering. A well may have a maximum of 20 annualized averages where data exist for each year of the recomputation period, but a well must have a minimum of three annualized average values to be eligible to have a point statistic computed.

The Shapiro-Wilk test for normality and outlier testing was recommended and adopted by the Nitrogen/TDS Task Force at the June 15, 1999 meeting. For this test, the mean, standard deviation, and the statistic W were calculated. The calculated W was compared with a critical W found in reference tables to determine if the population in the dataset is normally distributed. If the dataset is not normally distributed, then the most discordant value (MDV) is discarded and a new W is calculated:

$$W = \frac{\left(\sum_{i=1}^{n} a_{i,n} \cdot x_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_{avg}\right)^2}$$

where $a_{i,n}$ = coefficient based on the order of the observation, i, and the number of observations, n (e.g., Gibbons, 1994)

x_i = ith observation

x_{avg} = mean of n observations

In the 2015 current AWQ recomputation, the Shapiro-Wilk test was employed, but with three enhancements:

- Removal of outliers—MDVs—only occurred for values that were significantly greater than the median: 5 times (5x) for nitrate and 10x for TDS. This captures the original intent of the outlier test, which was to identify decimal placement errors or nitrate/nitrate as N conversion errors.
- Up to two MDVs, but not more, could be removed from a given dataset.
- If there is no MDV, but the dataset fails the Shapiro-Wilk test, or if two MDVs were removed and a third potential MDV is identified, then the dataset is log transformed and undergoes the Shapiro-Wilk test on the log-transformed data.

The charts in this section show the results of the Shapiro-Wilk test after MDVs have been removed. The annualized averages are plotted on a quantile-quantile (Q/Q) probability plot (upper right) and the annualized averages are plotted on a time series (lower right).

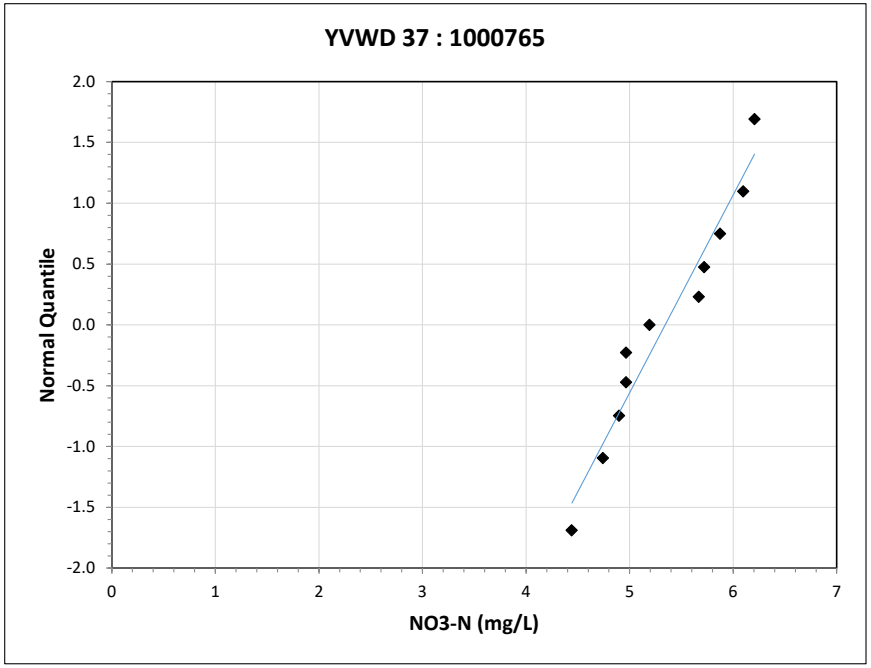
Mann-Kendall

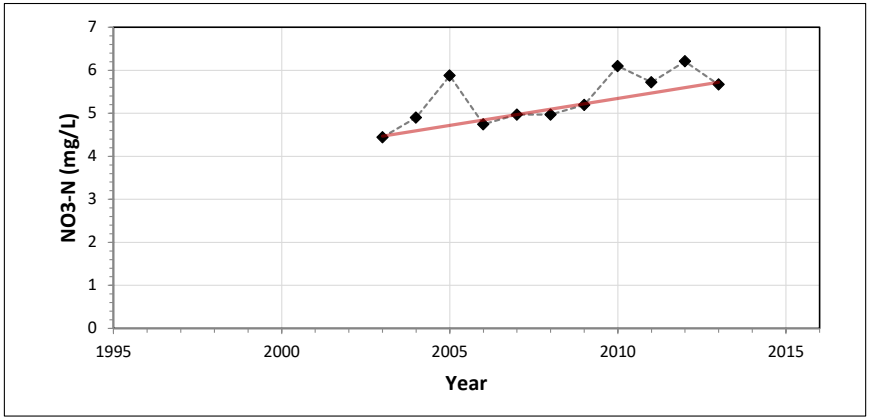
The Mann-Kendall test was employed to analyze data collected over time to determine whether there are consistently increasing or decreasing trends. The Mann-Kendall test is non-parametric and allows for missing data, irregularly spaced measurement periods, and non-detect values (Gibbons and Coleman, 2001). In the test, the values are ordered by sample date and the signs (+/–) are recorded for all of the possible differences between a given value and every value that preceded it in the time series. The Mann-Kendall statistic "S" is defined as the number of positive differences (+) minus the number of negative differences (–). S and n, the number of sample dates, together define a probability (p-value) that defines possible trends as one of the following:

- Not calculated (either p-value = 0 or n =1)
- Very significantly increasing (p-value ≤ 0.001, positive slope)
- Significantly increasing (p-value ≤ 0.01, positive slope)
- Increasing (p-value ≤ 0.1, positive slope)
- No trend (p-value > 0.1 or slope = 0)
- Decreasing (p-value ≤ 0.1, negative slope)
- Significantly decreasing (p-value ≤ 0.01, negative slope)
- Very significantly decreasing (p-value ≤ 0.001, negative slope)

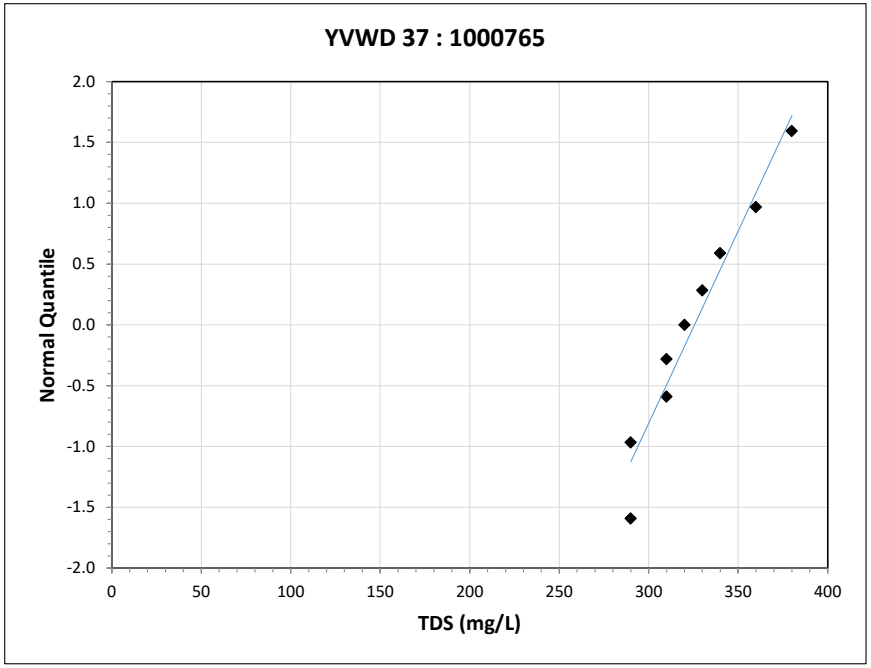
The significance of the trends is notated by * for significant and ** for very significant.

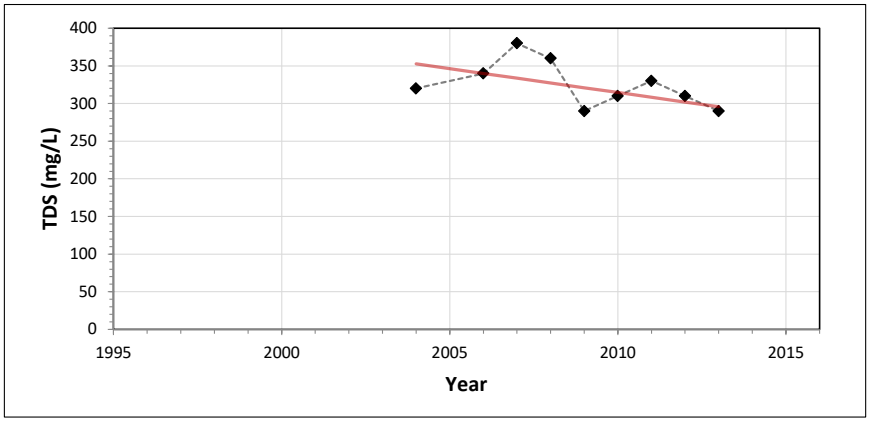
Statistics	
GMZ	Yucaipa
Well Name : ID	YVWD 37 : 1000765
Analyte	NO3-N (mg/L)
Count	11
Count Detects	11
Sample Year Min	2003
Sample Year Max	2013
Annual Average Min	4.44
Annual Average Max	6.21
Annual Average Mean	5.34
Annual Average Stdev	0.59
Shapiro-Wilk W	0.936
Shapiro-Wilk p-value	0.471
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.18
Student t	1.05
Mean + t*SE (UCL84)	5.53
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	32
Var(S)	164
Intercept	-246
Slope	0.13
p-value	0.015
Significant Trend?	Increasing



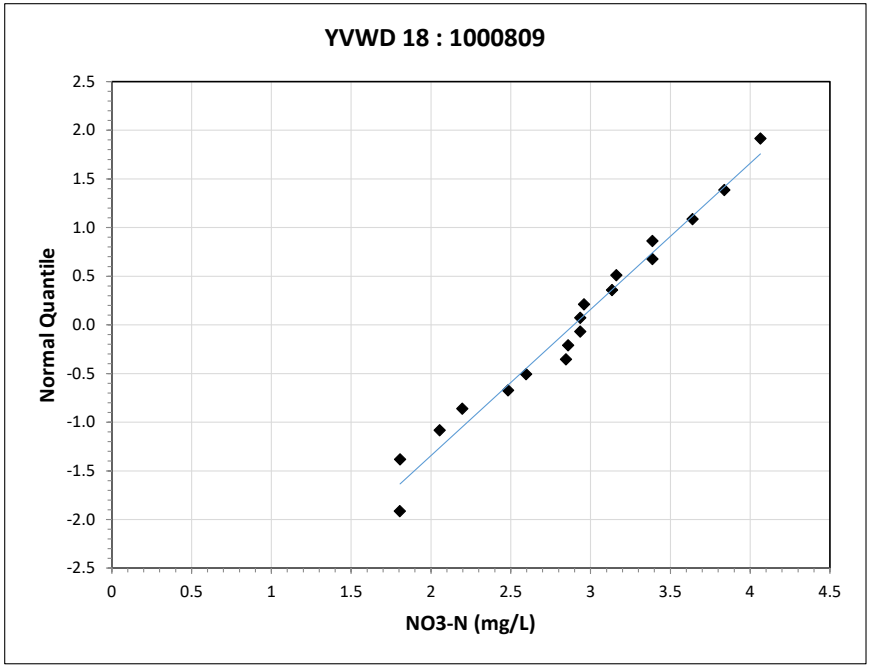


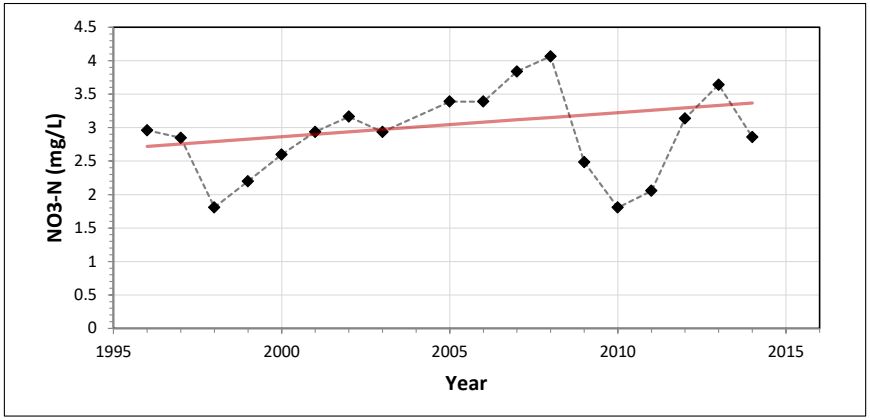
Statistics	
GMZ	Yucaipa
Well Name : ID	YVWD 37 : 1000765
Analyte	TDS (mg/L)
Count	9
Count Detects	9
Sample Year Min	2004
Sample Year Max	2013
Annual Average Min	290
Annual Average Max	380
Annual Average Mean	326
Annual Average Stdev	30.46
Shapiro-Wilk W	0.940
Shapiro-Wilk p-value	0.582
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	10.15
Student t	1.06
Mean + t*SE (UCL84)	336
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-14
Var(S)	90.00
Intercept	13045
Slope	-6.33
p-value	0.171
Significant Trend?	No



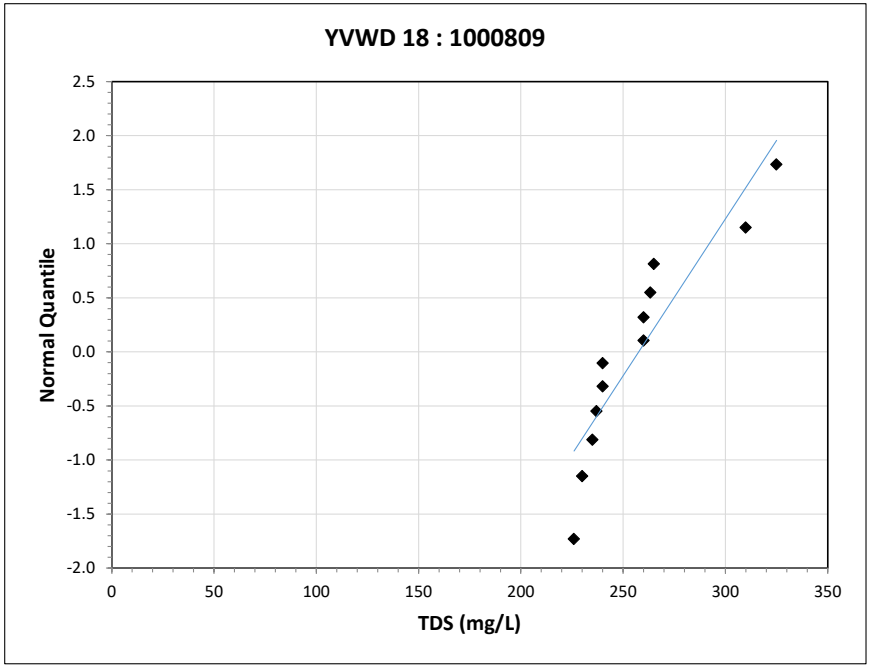


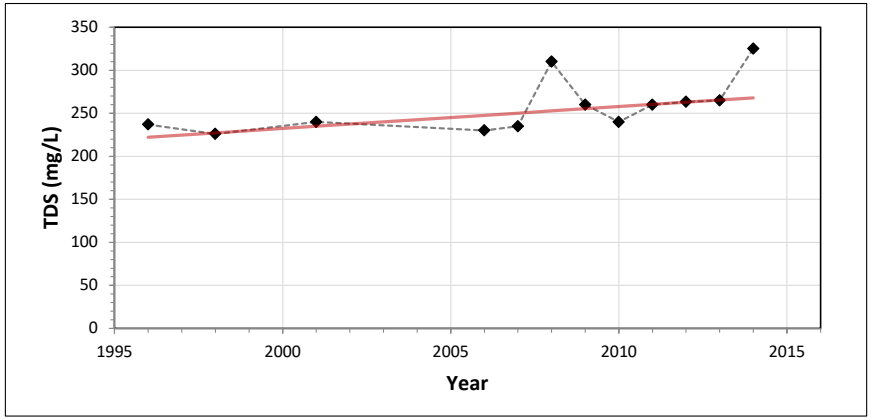
Statistics	
GMZ	Yucaipa
Well Name : ID	YVWD 18 : 1000809
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	1.81
Annual Average Max	4.06
Annual Average Mean	2.89
Annual Average Stdev	0.65
Shapiro-Wilk W	0.968
Shapiro-Wilk p-value	0.753
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.15
Student t	1.02
Mean + t*SE (UCL84)	3.05
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	27
Var(S)	695
Intercept	-69.02
Slope	0.04
p-value	0.324
Significant Trend?	No



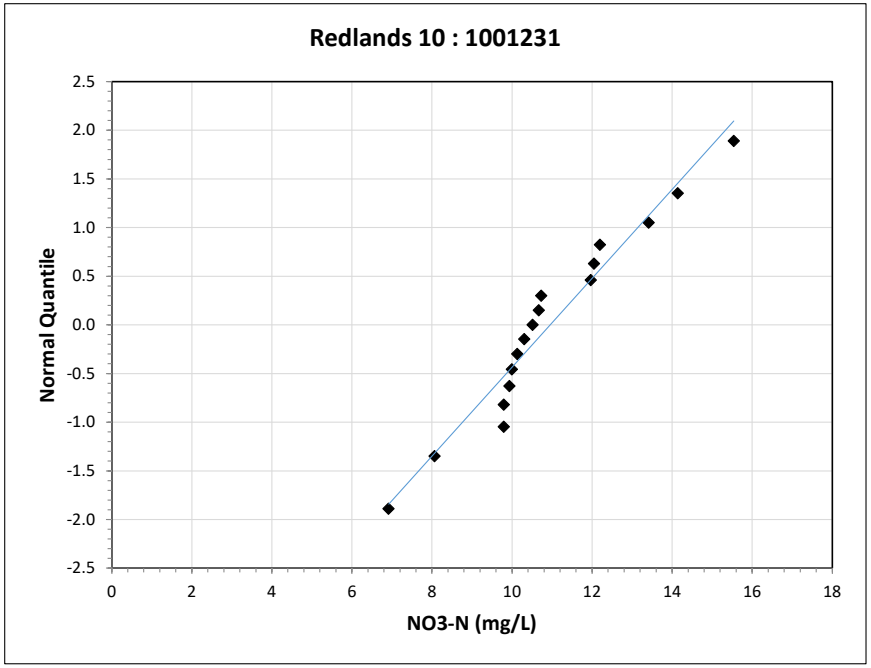


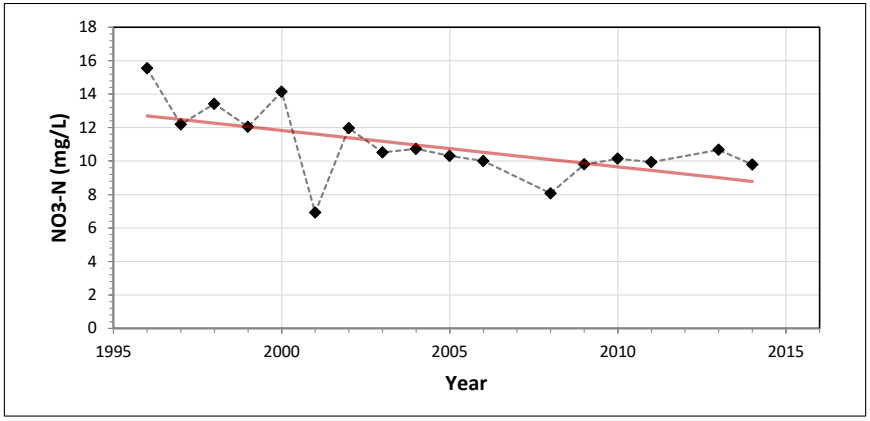
Statistics	
GMZ	Yucaipa
Well Name : ID	YVWD 18 : 1000809
Analyte	TDS (mg/L)
Count	12
Count Detects	12
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	226
Annual Average Max	325
Annual Average Mean	258
Annual Average Stdev	31.19
Shapiro-Wilk W	0.834
Shapiro-Wilk p-value	0.023
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	9.00
Student t	1.04
Mean + t*SE (UCL84)	267
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	42
Var(S)	211
Intercept	-4868
Slope	2.55
p-value	0.005
Significant Trend?	Increasing*



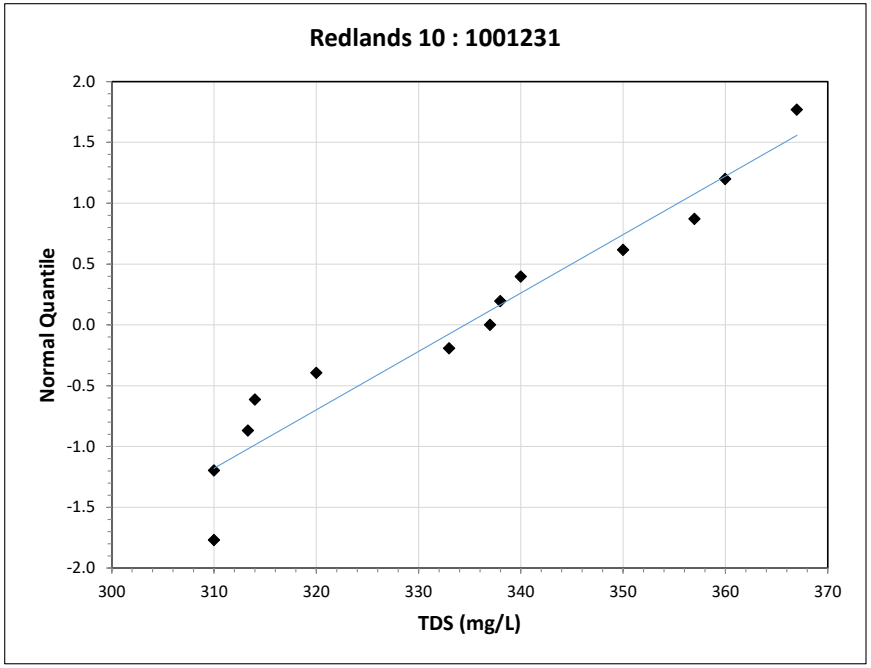


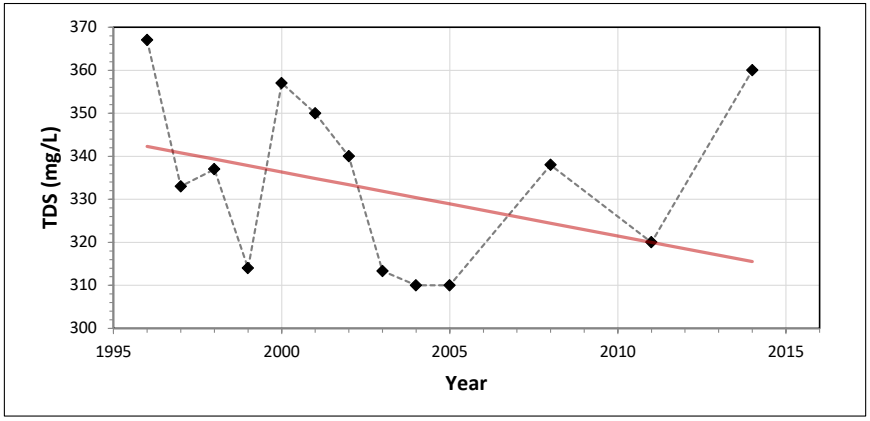
Statistics	
GMZ	Yucaipa
Well Name : ID	Redlands 10 : 1001231
Analyte	NO3-N (mg/L)
Count	17
Count Detects	17
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	6.92
Annual Average Max	15.54
Annual Average Mean	10.95
Annual Average Stdev	2.12
Shapiro-Wilk W	0.953
Shapiro-Wilk p-value	0.504
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.51
Student t	1.03
Mean + t*SE (UCL84)	11.48
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-76
Var(S)	589
Intercept	447
Slope	-0.22
p-value	0.002
Significant Trend?	Decreasing*



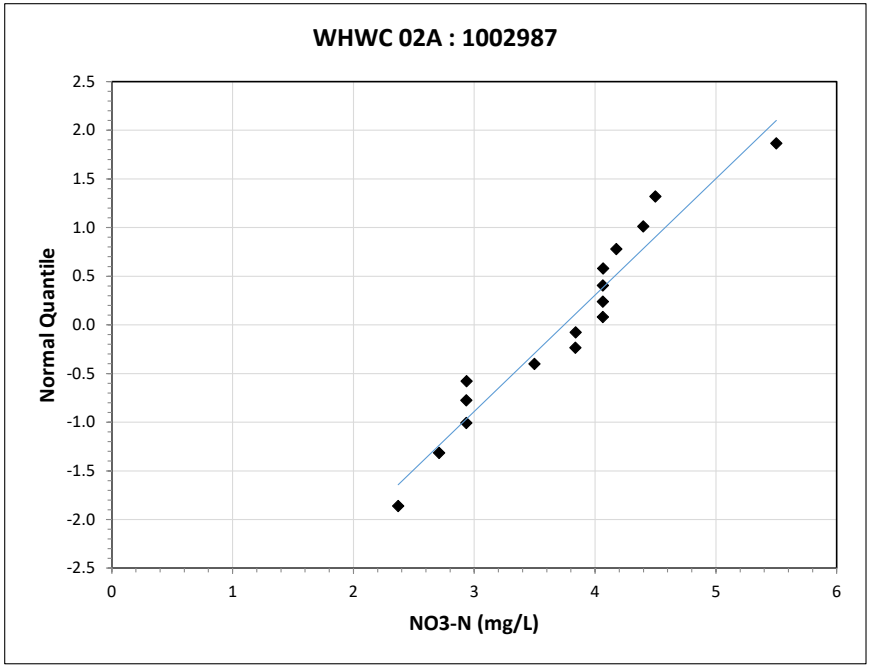


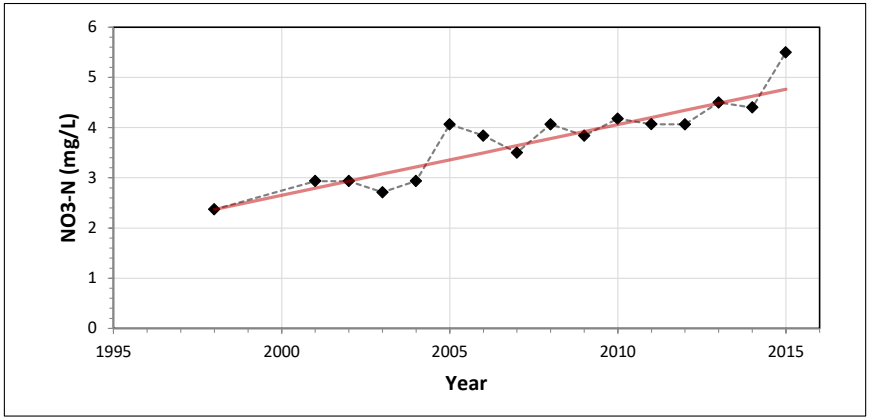
Statistics	
GMZ	Yucaipa
Well Name : ID	Redlands 10 : 1001231
Analyte	TDS (mg/L)
Count	13
Count Detects	13
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	310
Annual Average Max	367
Annual Average Mean	335
Annual Average Stdev	19.96
Shapiro-Wilk W	0.919
Shapiro-Wilk p-value	0.247
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	5.54
Student t	1.04
Mean + t*SE (UCL84)	340
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-15
Var(S)	268
Intercept	3311
Slope	-1.49
p-value	0.392
Significant Trend?	No



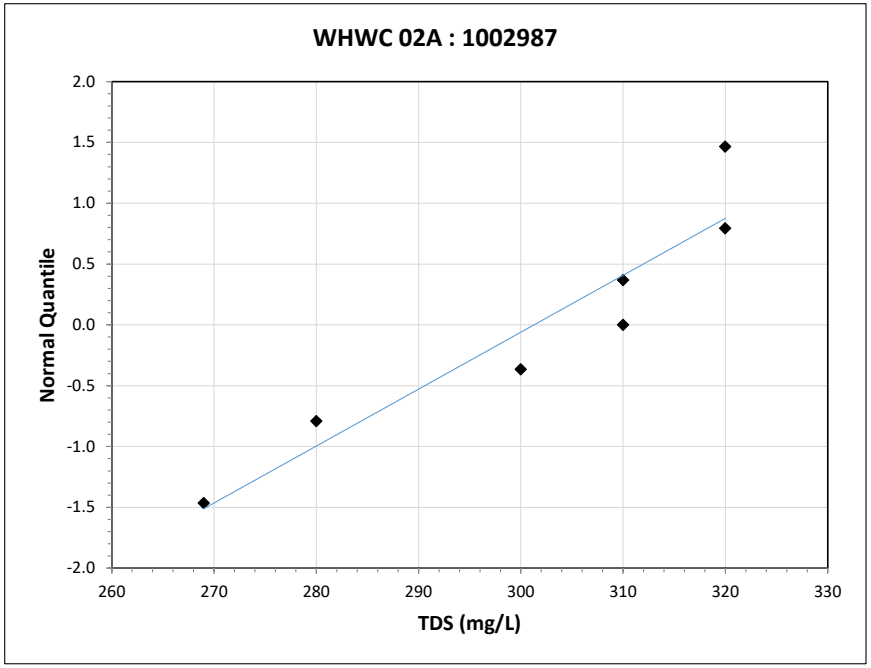


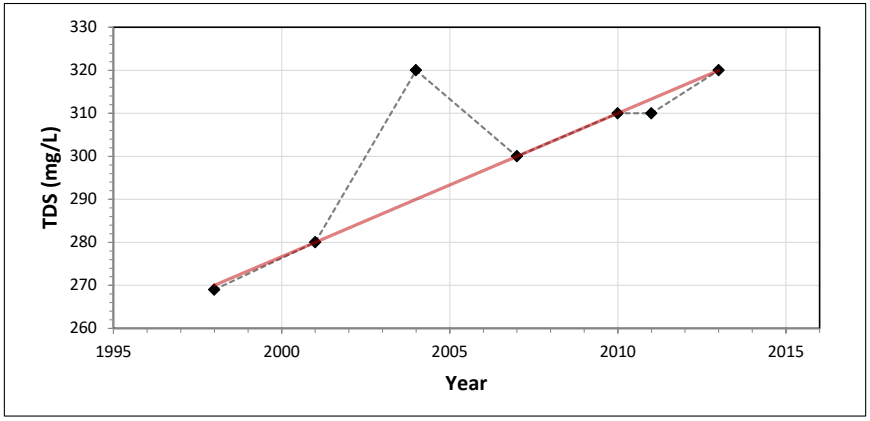
Statistics	
GMZ	Yucaipa
Well Name : ID	WHWC 02A : 1002987
Analyte	NO3-N (mg/L)
Count	16
Count Detects	16
Sample Year Min	1998
Sample Year Max	2015
Annual Average Min	2.37
Annual Average Max	5.50
Annual Average Mean	3.74
Annual Average Stdev	0.80
Shapiro-Wilk W	0.942
Shapiro-Wilk p-value	0.373
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.20
Student t	1.03
Mean + t*SE (UCL84)	3.95
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	90
Var(S)	491
Intercept	-279
Slope	0.14
p-value	6E-5
Significant Trend?	Increasing**



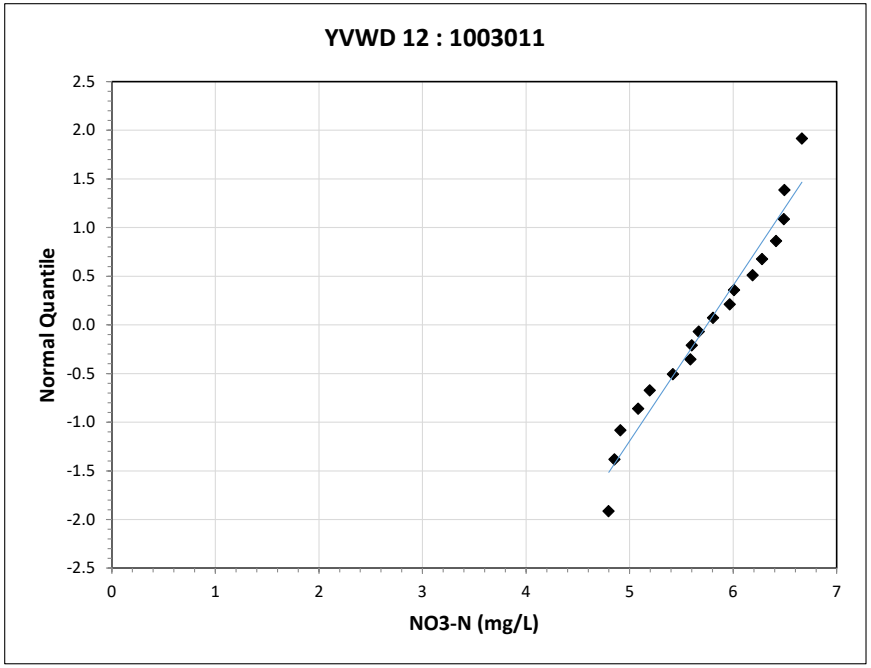


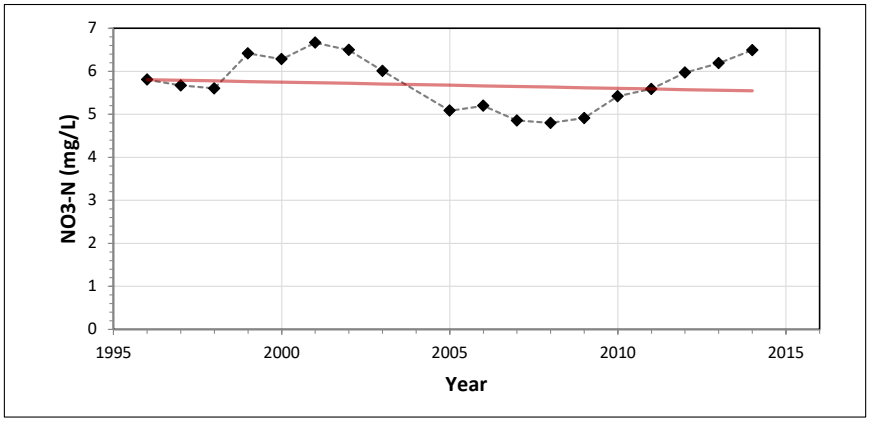
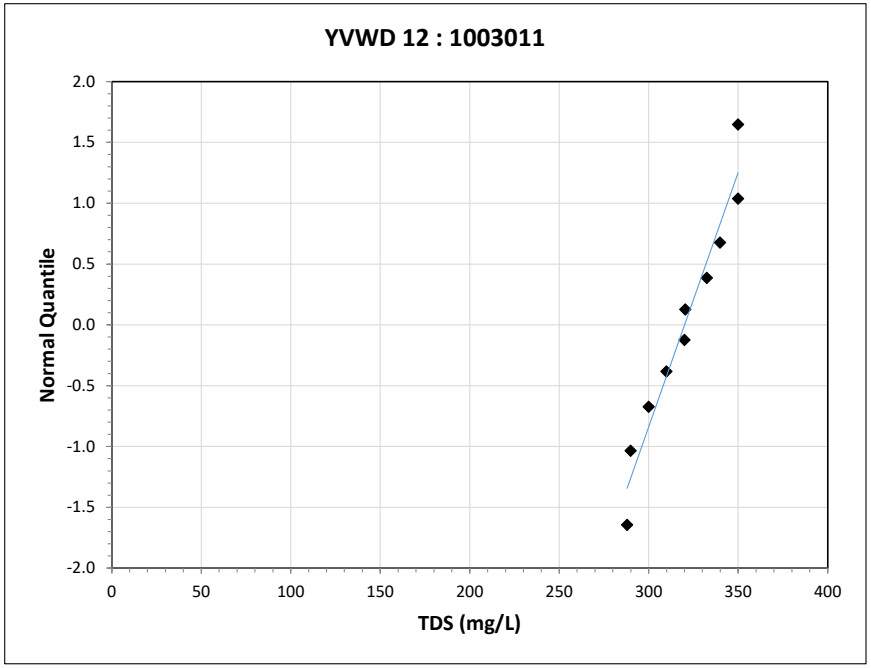
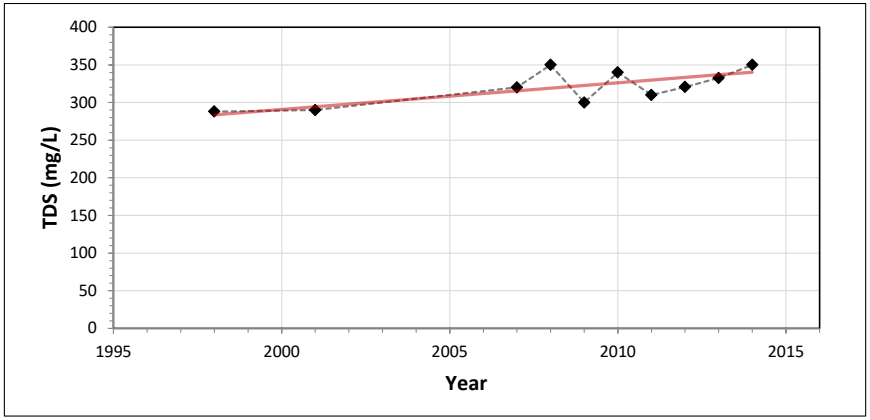
Statistics	
GMZ	Yucaipa
Well Name : ID	WHWC 02A : 1002987
Analyte	TDS (mg/L)
Count	7
Count Detects	7
Sample Year Min	1998
Sample Year Max	2013
Annual Average Min	269
Annual Average Max	320
Annual Average Mean	301
Annual Average Stdev	19.79
Shapiro-Wilk W	0.874
Shapiro-Wilk p-value	0.201
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.48
Student t	1.08
Mean + t*SE (UCL84)	309
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	13
Var(S)	42.33
Intercept	-6390
Slope	3.33
p-value	0.065
Significant Trend?	Increasing





Statistics	
GMZ	Yucaipa
Well Name : ID	YVWD 12 : 1003011
Analyte	NO3-N (mg/L)
Count	18
Count Detects	18
Sample Year Min	1996
Sample Year Max	2014
Annual Average Min	4.80
Annual Average Max	6.66
Annual Average Mean	5.75
Annual Average Stdev	0.61
Shapiro-Wilk W	0.943
Shapiro-Wilk p-value	0.332
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	0.14
Student t	1.02
Mean + t*SE (UCL84)	5.89
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	-13
Var(S)	697
Intercept	34.66
Slope	-0.01
p-value	0.649
Significant Trend?	No





Statistics	
GMZ	Yucaipa
Well Name : ID	YVWD 12 : 1003011
Analyte	TDS (mg/L)
Count	10
Count Detects	10
Sample Year Min	1998
Sample Year Max	2014
Annual Average Min	288
Annual Average Max	350
Annual Average Mean	320
Annual Average Stdev	23.05
Shapiro-Wilk W	0.930
Shapiro-Wilk p-value	0.445
Critical Alpha	0.01
Most Discordant Value	NA
Pearson	NA
Slope	NA
Intercept	NA
MDV	Max Abs Diff : Median
MDV Diff Crit	1
SE of Mean	7.29
Student t	1.05
Mean + t*SE (UCL84)	328
SW p-value Logs	NA
Geomean	NA
GM + t*GSE (UCL84)	NA
Median	NA
Trend Analysis	**Theil-Sen**
Kendall S	24
Var(S)	124
Intercept	-6793
Slope	3.54
p-value	0.039
Significant Trend?	Increasing