TDS/Nitrogen Management
Plan for the Santa Ana River Basin
Groundwater Monitoring Requirements

Ambient Water Quality: Update
Point Statics for 20-Year Moving Average

1. Annualized Averages
2. At least 3 years of water quality (TDS or NO3-N) in 20 year period
3. Shapiro Wilk test for normality
4. Point Statistics – mean plus t*standard error of the mean
Method Shapiro-Wilk Test for Normality

- Annualized Averages
- Shapiro-Wilk test for normality to remove “Most Discordant Value” (MDV) iteratively until data is normalized
- Assumes “normal” data
- Bias towards low values
- No apparent limit on the number of iterations
- Rejects data that may correspond to event changes
Potential Bias on Bimodal data

Mean = 8.5

Remove 1 MDV

Mean = 6.8
Potential Bias on Bimodal data

Mean = 8.5

Mean = 5.6

Remove 2 MDV
Potential Bias on Bimodal data

Mean = 8.5

Mean = 4.2

Remove 3 MDV
Potential Bias on Bimodal data

Mean = 8.5

Mean = 3.1

Remove 4 MDV
Potential Bias on Bimodal data

Mean = 8.5

Remove 5 MDV

Mean = 2.1
Updated Shapiro Wilk

Mean = 4.8

Calculated Statistic = 6.8

No MDV Removed
Questions?
Criteria for Determining Point Statistics:

Identifying Outliers:
1. Limit S-W iterations to no more than 2 times
2. Median absolute difference: Nitrate-N > 5x; TDS > 10x

Checking for Normality:
1. Linear Normality: Pass = Point Statistic
2. Log Transform Normality: Pass = Point Statistic
3. Fail Both = ‘Average’

Outcome:
1. Fewer data points removed
2. Accounts for bimodal and non-linear trends
3. Does not significantly change contouring
1996 – 2015 AWQ Data

Remove MDV

Yes

Remove MTV <2 & Max C >1

No

Shapiro-Wilks Test

n < 3 or Detects = 0

Yes

Mean

No

Pass

Mean +SE UCL84

Fail

MDV 5x (NO3-N) /10x (TDS)

Yes

Remove

MTV <2 & Max C >1

No

S-W Log Transform

Pass

GM + GSE UCL84

Fail

Median
Annualized Nitrate Samples and Outliers
Removed

Annualized TDS Samples and Outliers
Removed