September 4, 2014

Coachella Valley
Salt and Nutrient Management Plan
Stakeholder Meeting No. 2

DESERT WATER

WATER DISTRICT

Indio Water Authority
Your Water. Our Responsibility.

CITY OF COACHELLA
INCORPORATED 1946

MWH

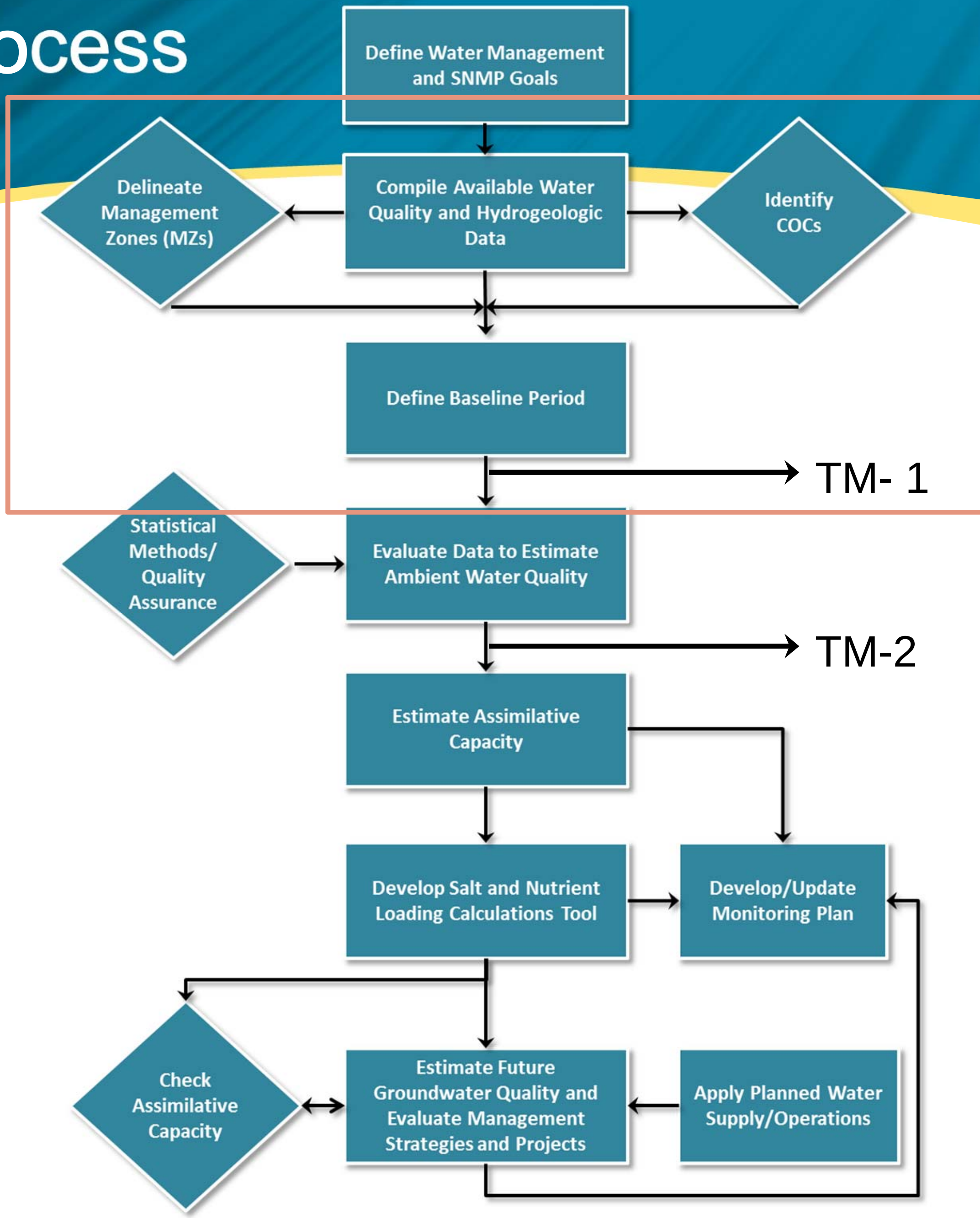
Agenda

- Introductions
- Review purpose
- Presentation (45 minutes)
- Stakeholder input and questions (30 minutes)

Today's Purpose

- Review the following:
  - Plan Development Process
  - Regulatory Framework
  - Initial Basin Characterization
  - Groundwater Quality Data Summary
  - Ambient Water Quality Methods
    - Example
  - Next Steps

SNMP Process



Regulatory Framework

Review of Regulatory Framework

- Recycled Water Policy (2009)
  - Potential quality concerns associated with recycled water use
  - Protection of beneficial uses
  - Streamlined recycled water permitting

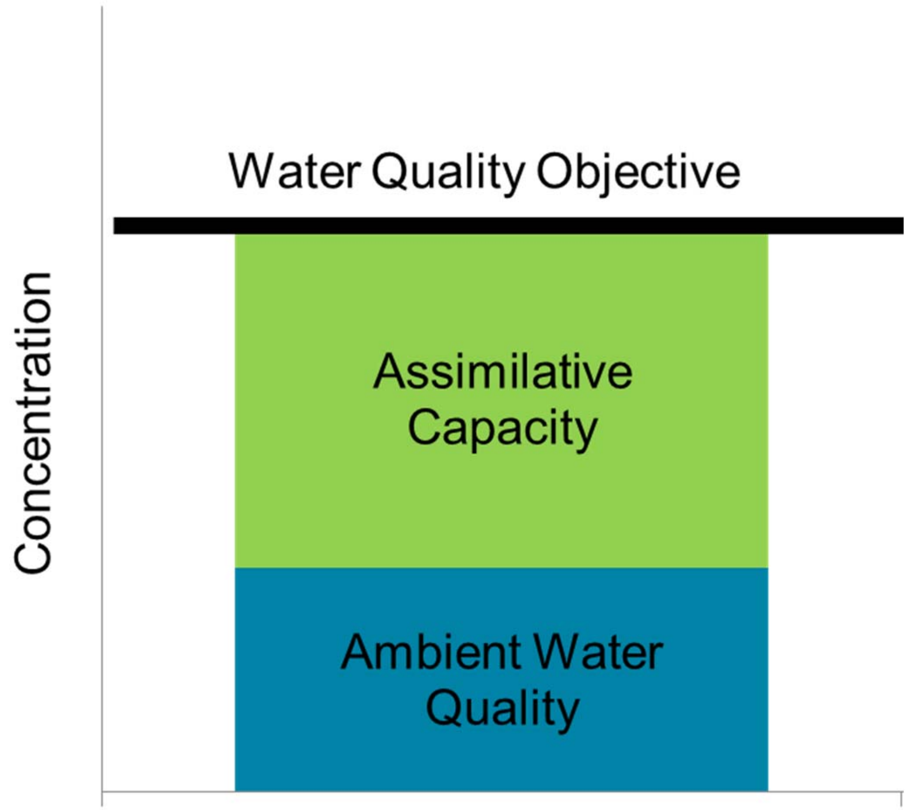
- Porter-Cologne Act
- Basin Plan
- Resolution 68-16 (State anti-degradation policy)

Definitions

Ambient Water Quality – *The representative concentration of a water quality constituent within a groundwater basin or management zone*

Assimilative Capacity – *the ability of a water body to receive waste waters without deleterious effects and without negative impact to beneficial uses*

Example of Assimilative Capacity

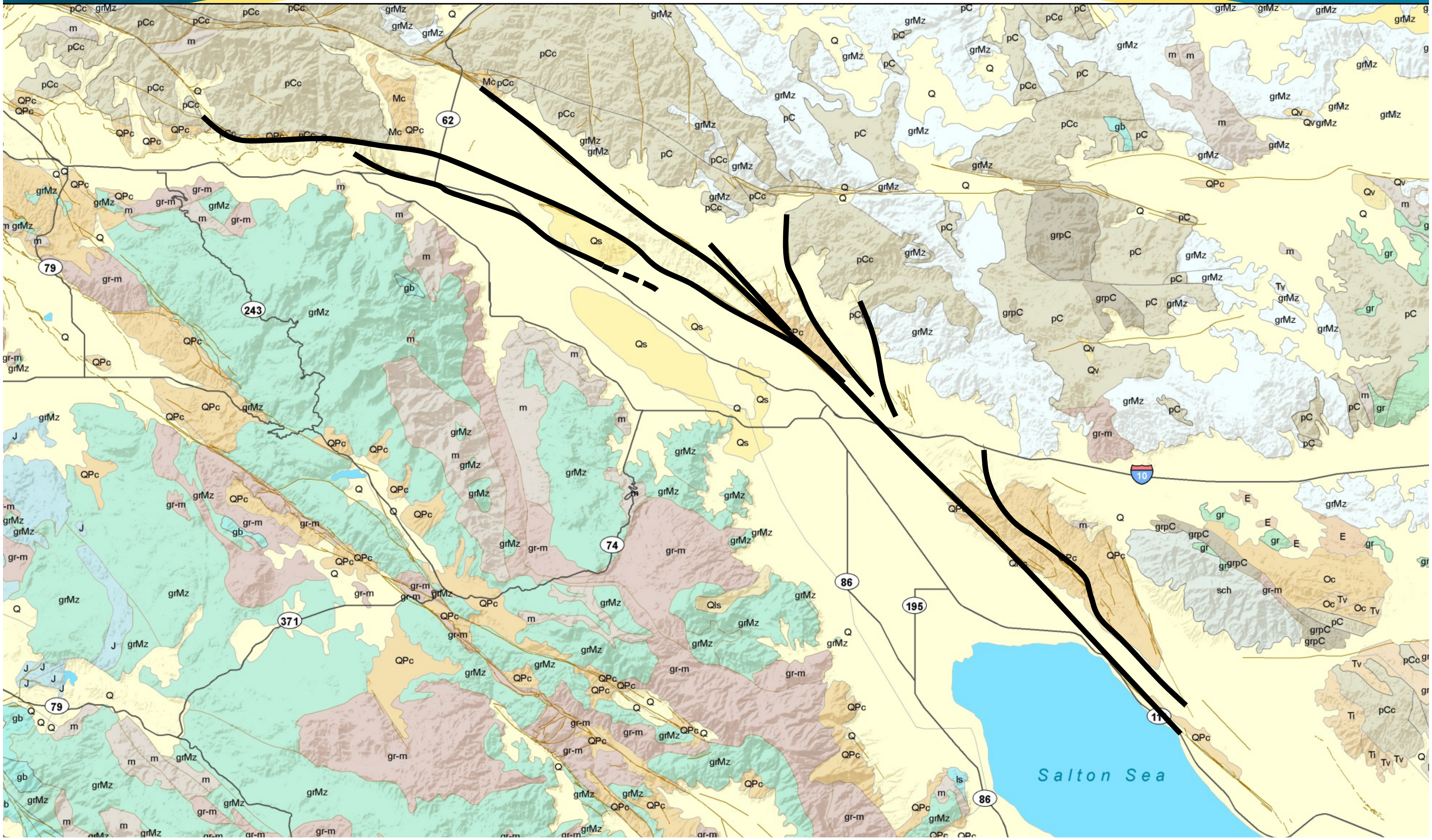


Initial Basin Characterization

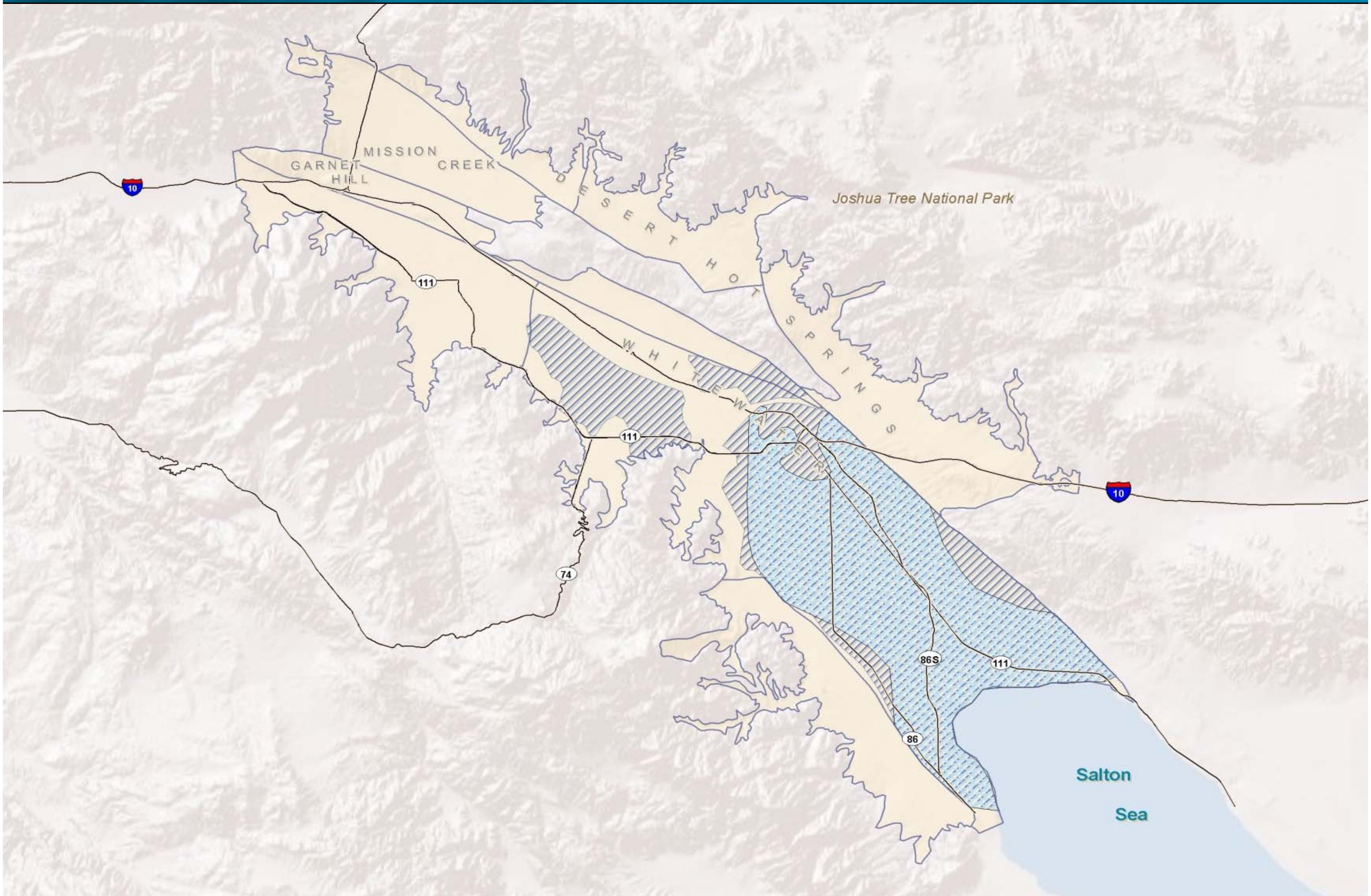
Initial Basin Characterization

- Review:
  - Geology
  - Hydrology
  - Groundwater balance
  - Well locations
  - Water quality

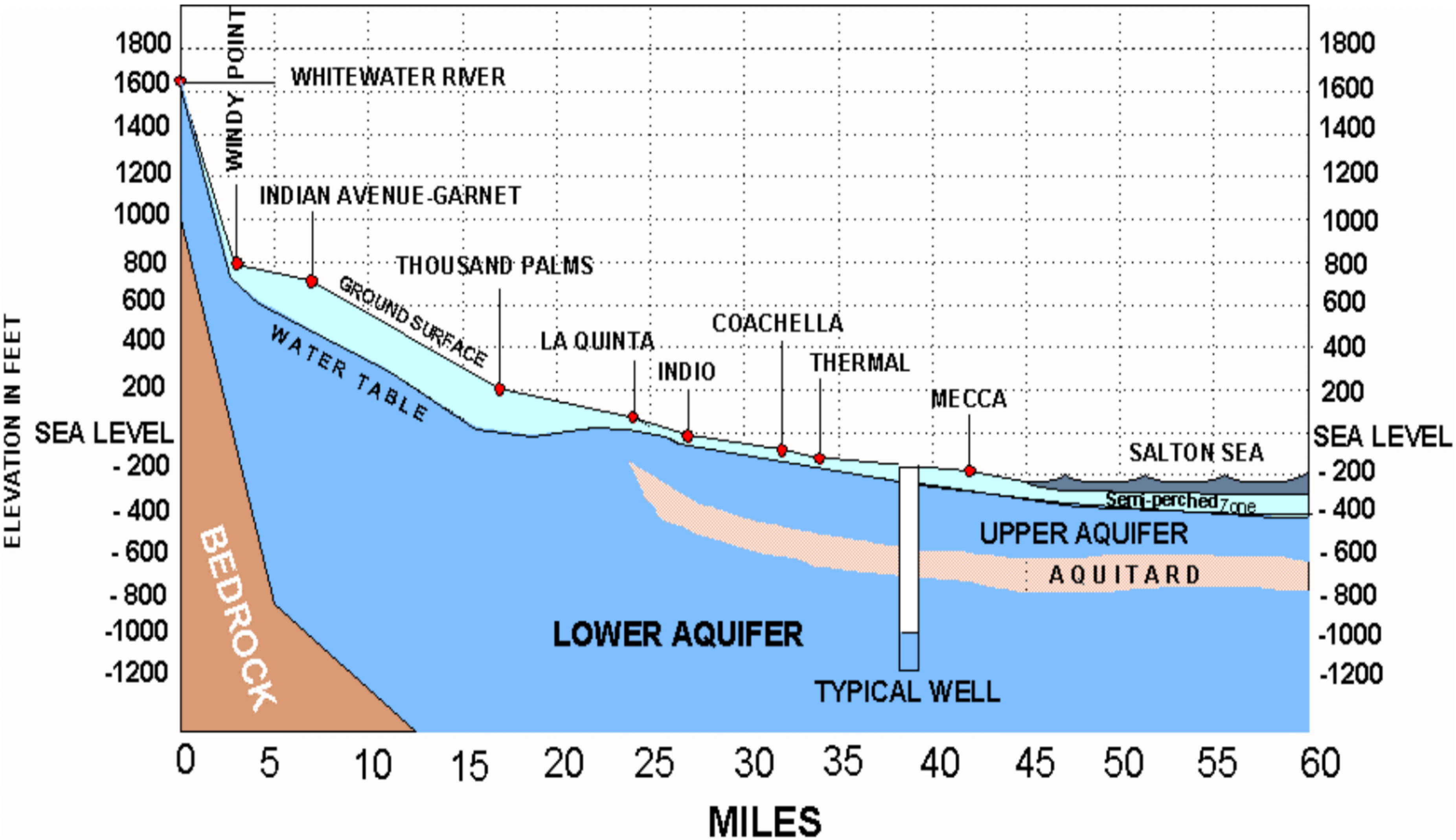
Geology of the Coachella Valley

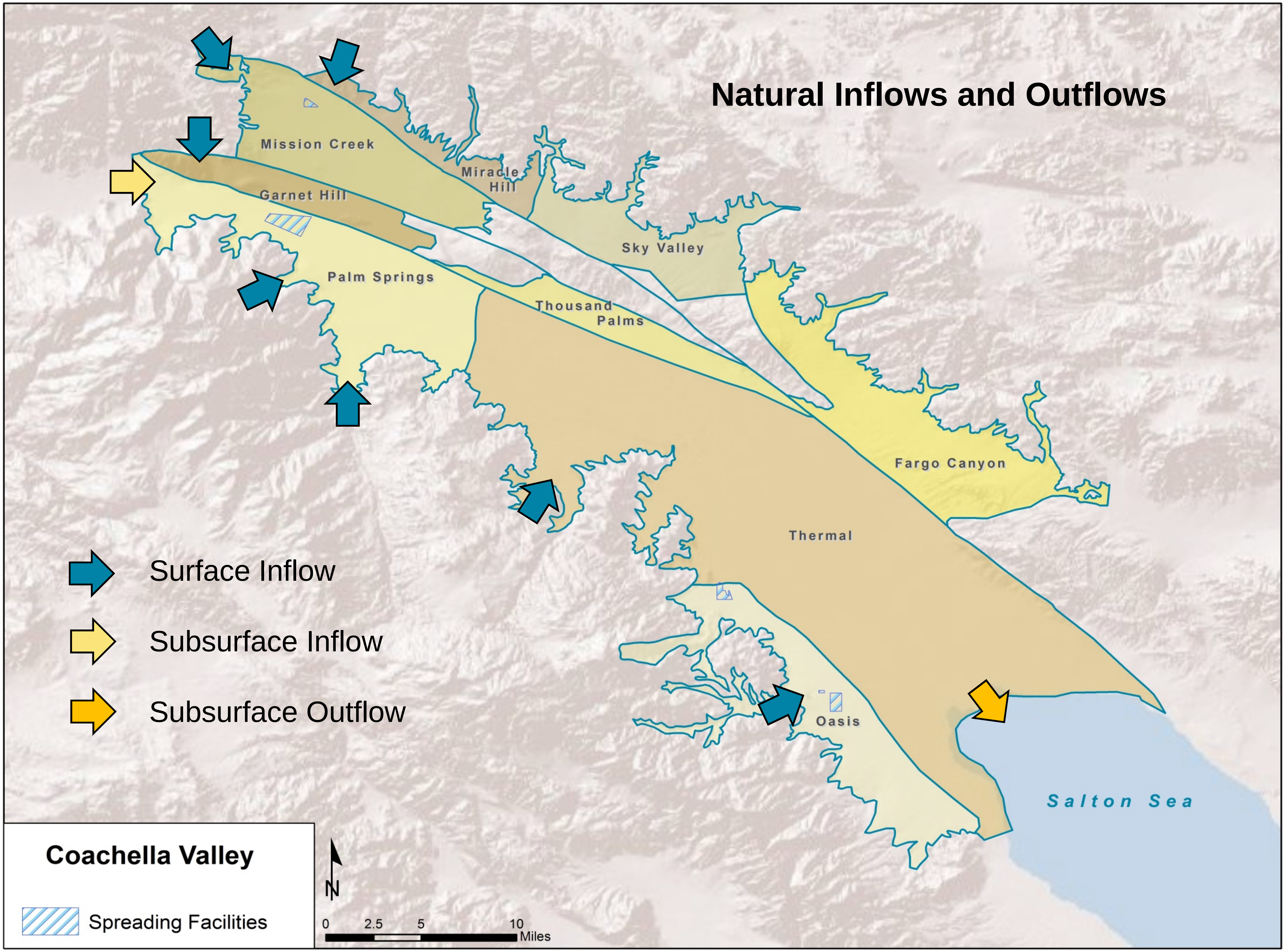


Confining Layer and Semi-perched Extent

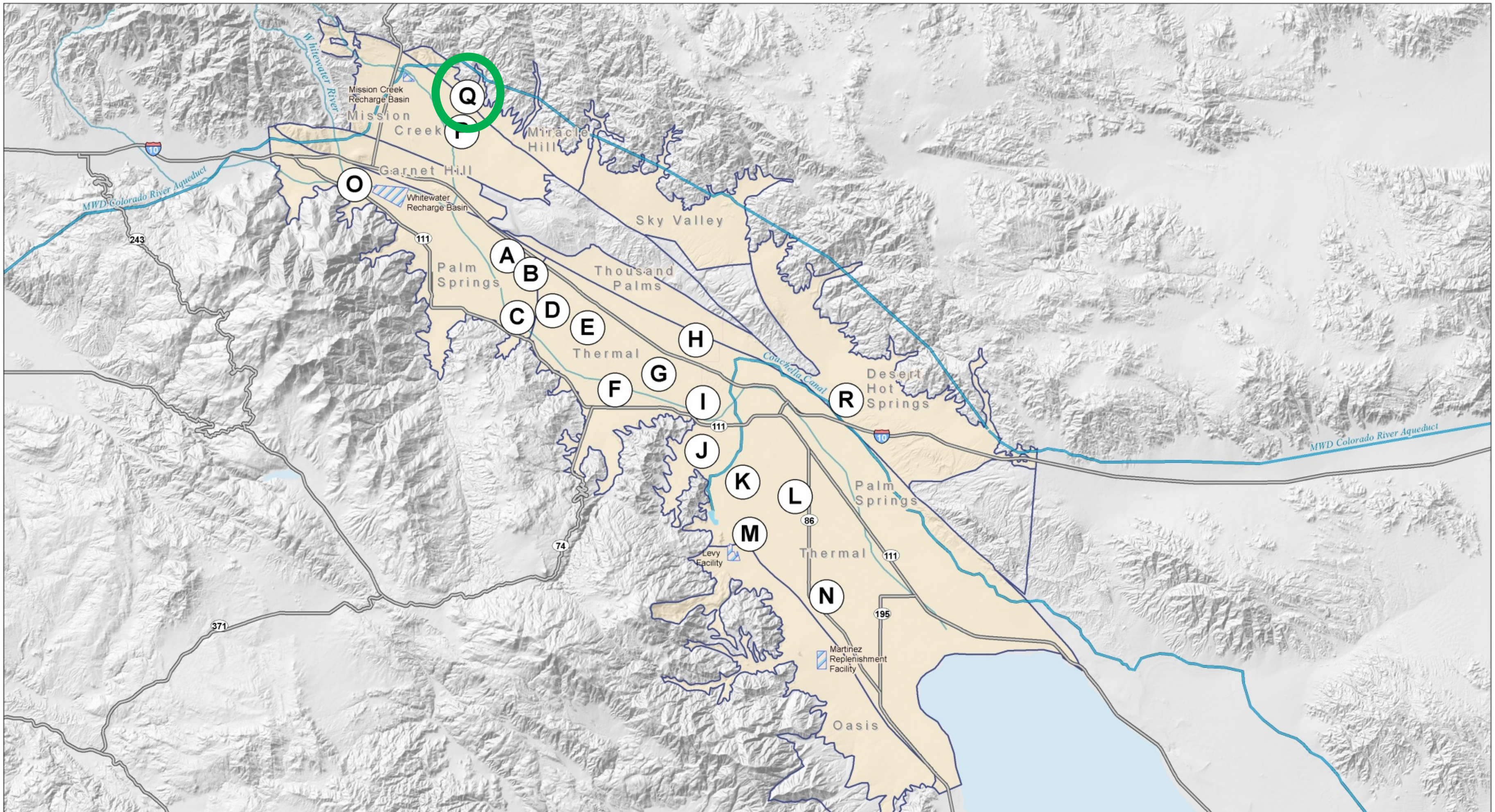


General Down Valley Cross-Section





Natural Inflows and Outflows
Mission Creek
Miracle Hill
Garnet Hill
Sky Valley
Palm Springs
Thousand Palms
Fargo Canyon
Thermal
Oasis
Salton Sea
Surface Inflow
Subsurface Inflow
Subsurface Outflow
Coachella Valley
Spreading Facilities
N
0
2.5
5
10
Miles



Key to Features

Highway	Minor Drainage	Spreading Facility	Management Zone
Ⓐ Group Name	Canal / Aqueduct	Water Body	

N

0 5 10 Miles

Document: C:\Users\silberjm\Desktop\CVWD\AppedixGroups.mxd

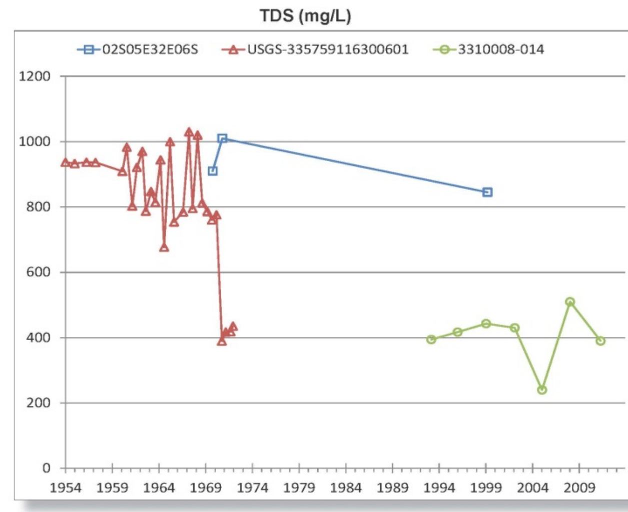
Date: July 24, 2014

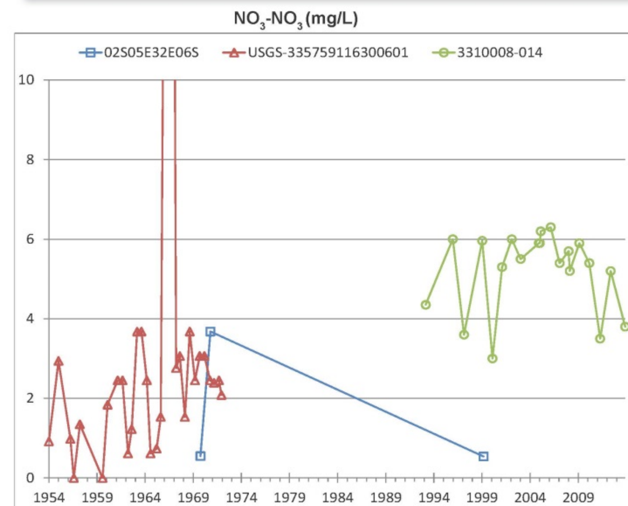
Well Trend Group Name

MWH

Appendix A-1

This map has been designed to print size 11'' by 17''.





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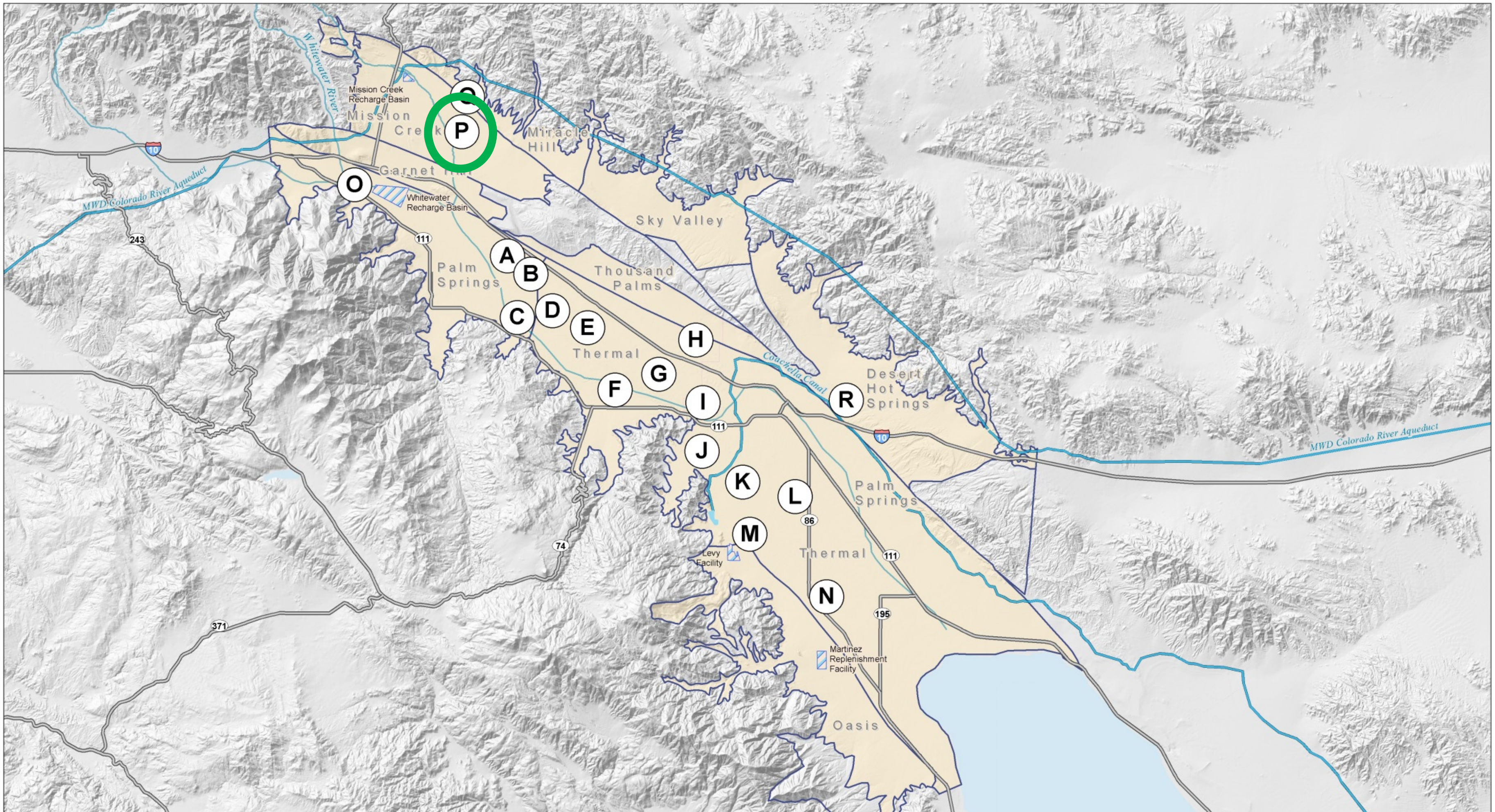
Appendix A-18

Desert Hot Springs Group Q



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N

0 5 10 Miles

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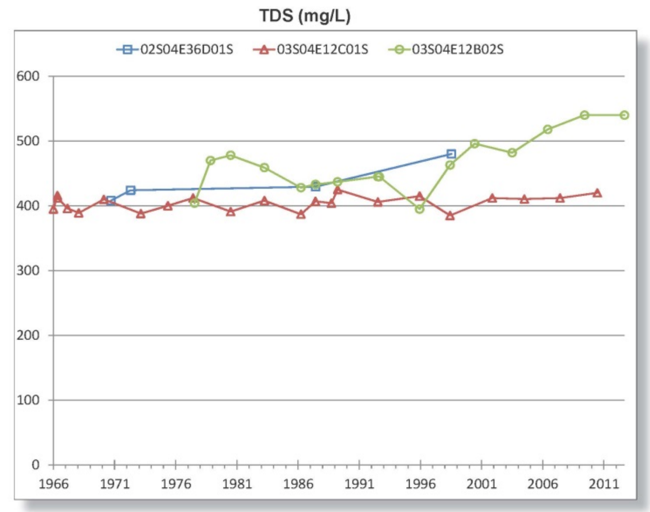
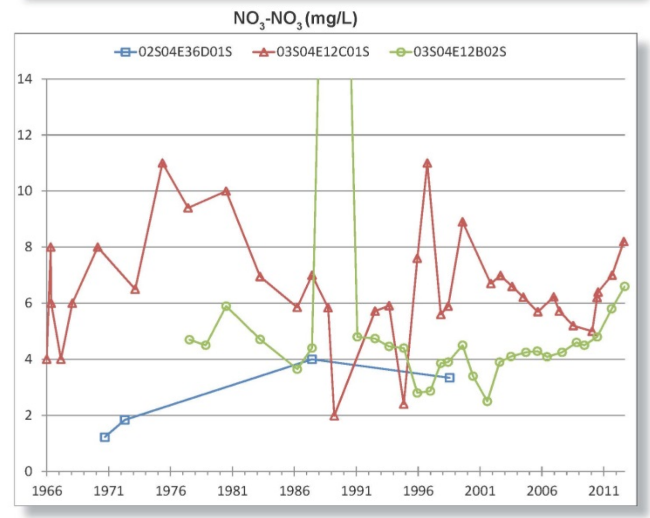
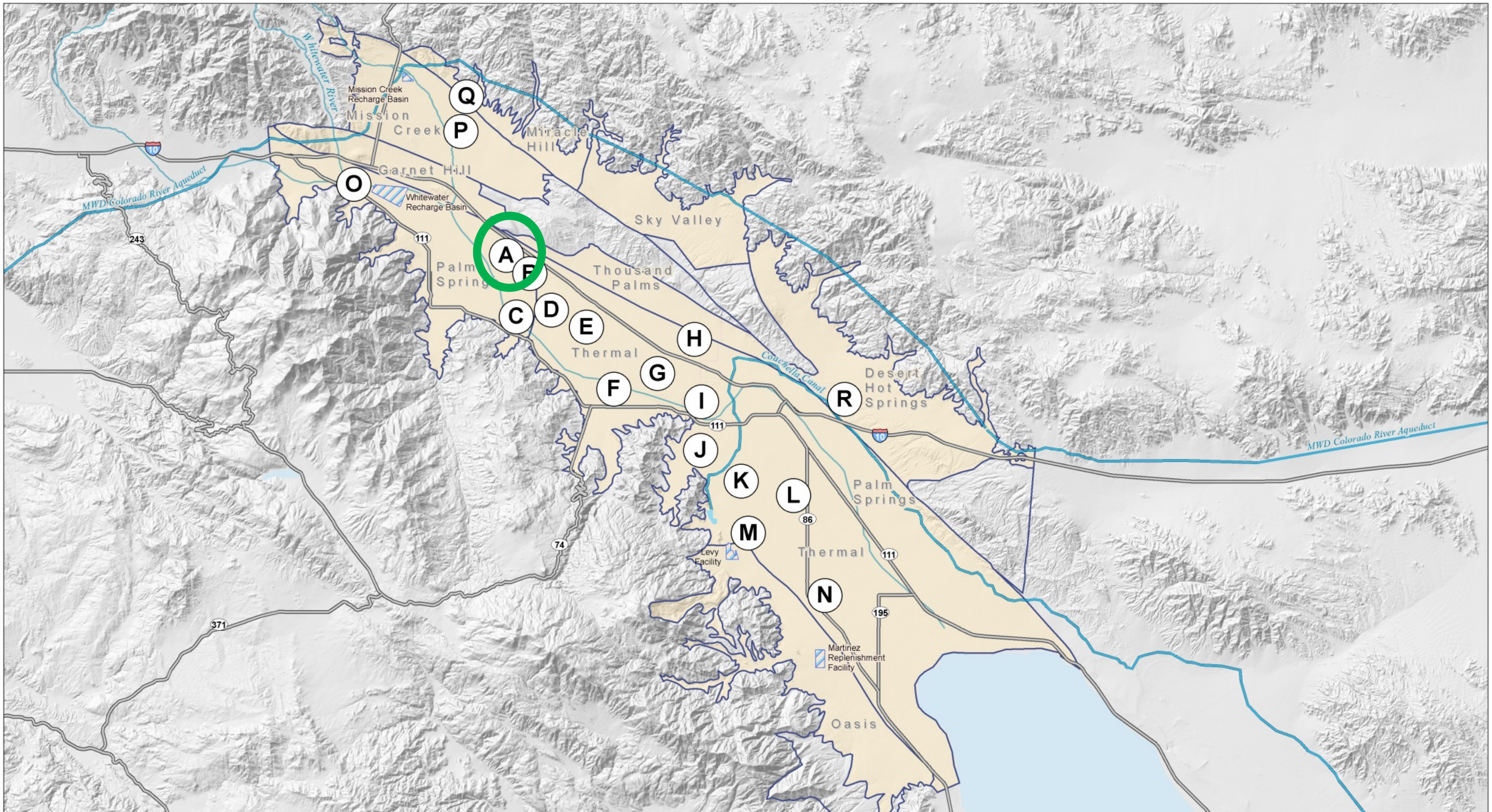




Appendix A-17

Mission Creek Group P



Key to Features

Highway	Minor Drainage	Spreading Facility	Management Zone
Group Name	Canal / Aqueduct	Water Body	

0 5 10 Miles

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Date: July 24, 2014

Well Trend Group Name

MWH

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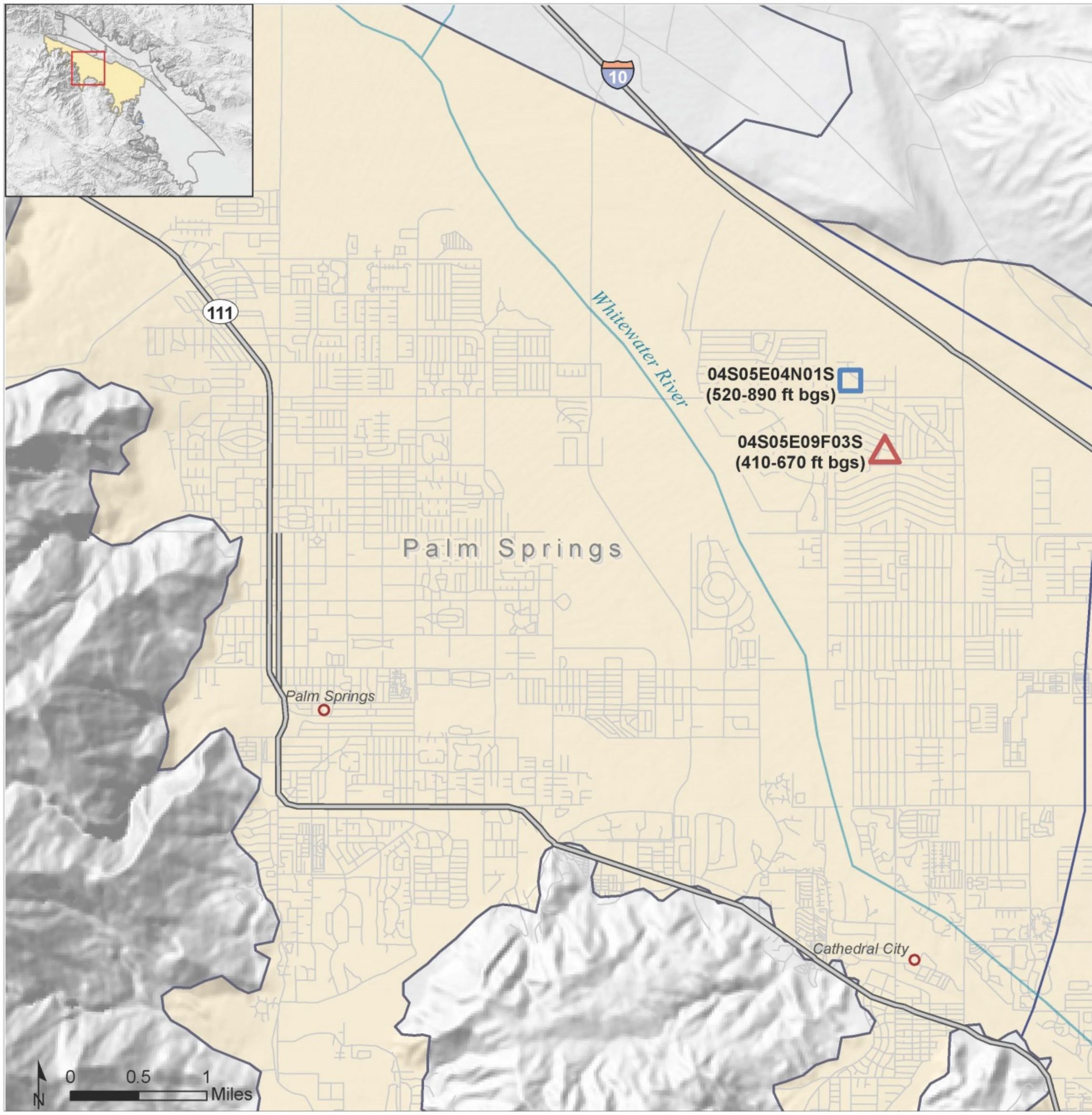

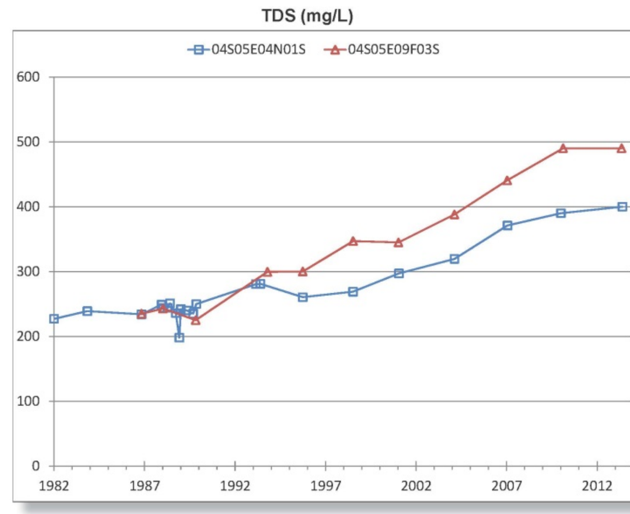

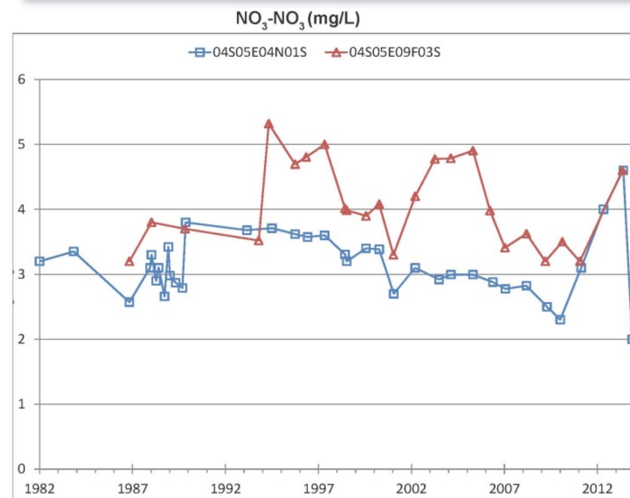

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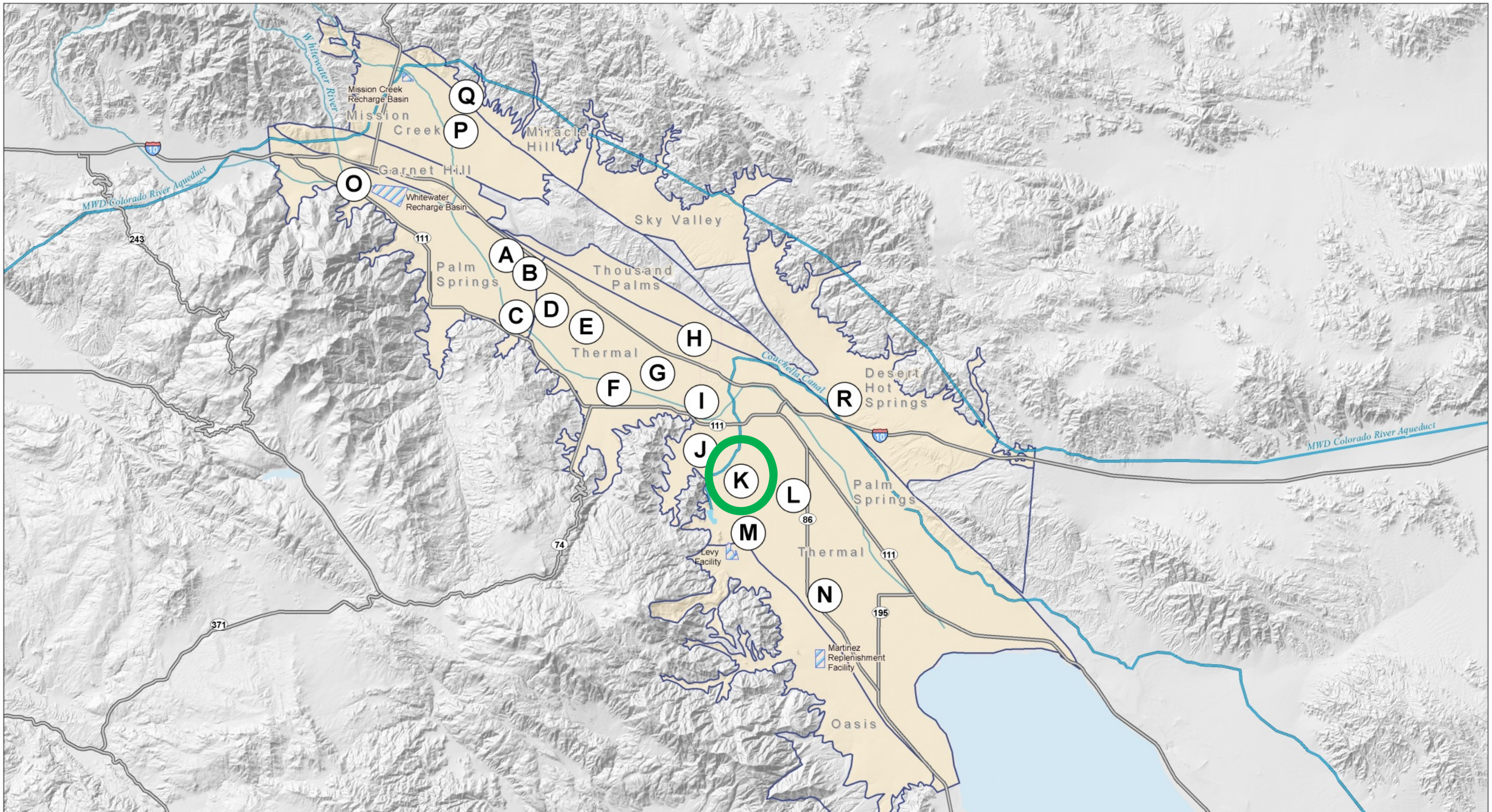
Appendix A-2

Upper Valley Group A



Key to Features

Highway	Minor Drainage	Spreading Facility	Management Zone
Ⓐ Group Name	Canal / Aqueduct	Water Body	

N 0 5 10 Miles

Document: C:\Users\silberjm\Desktop\CVWD\AppedixGroups.mxd

Date: July 24, 2014

Well Trend Group Name

MWH

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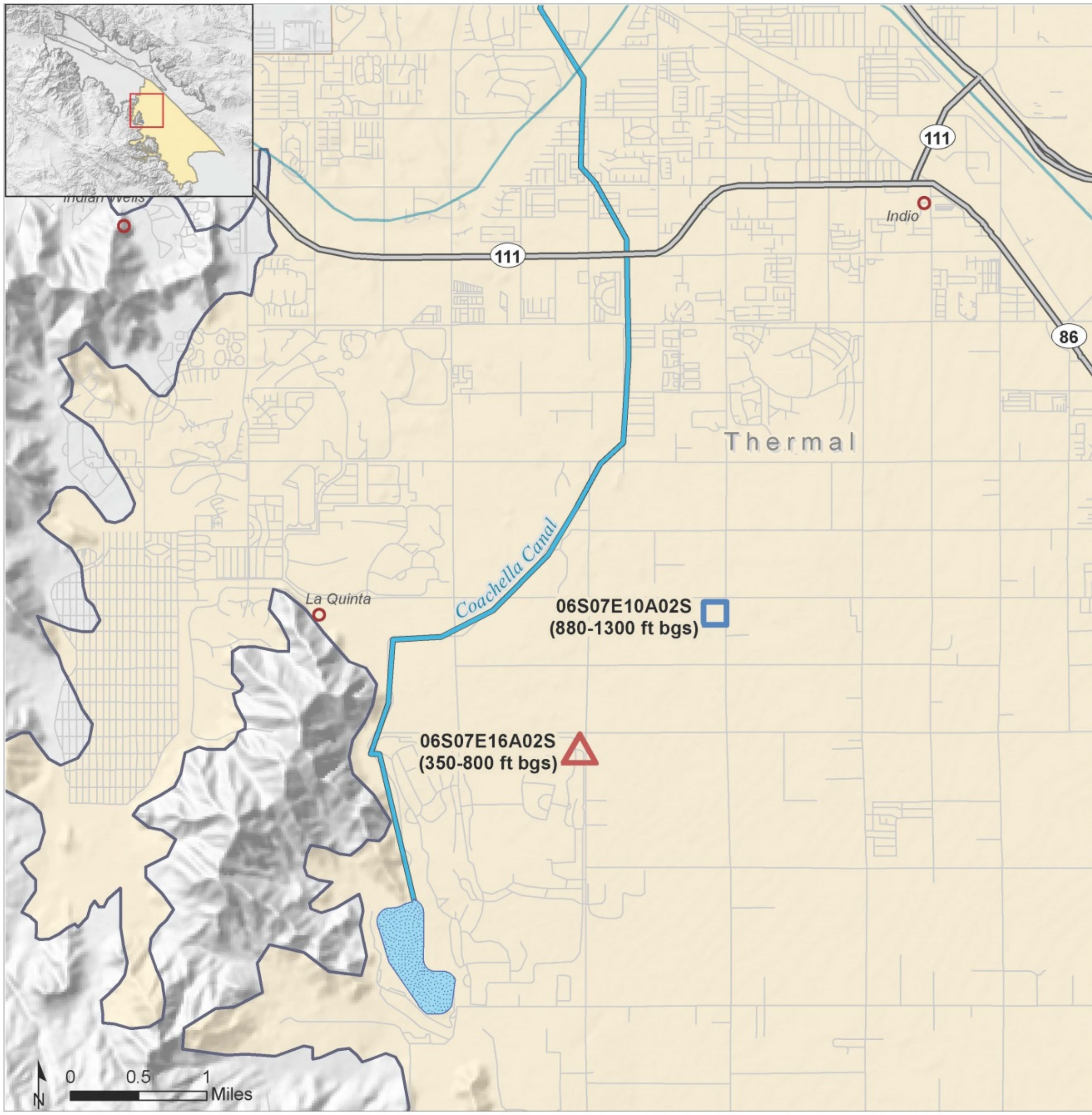
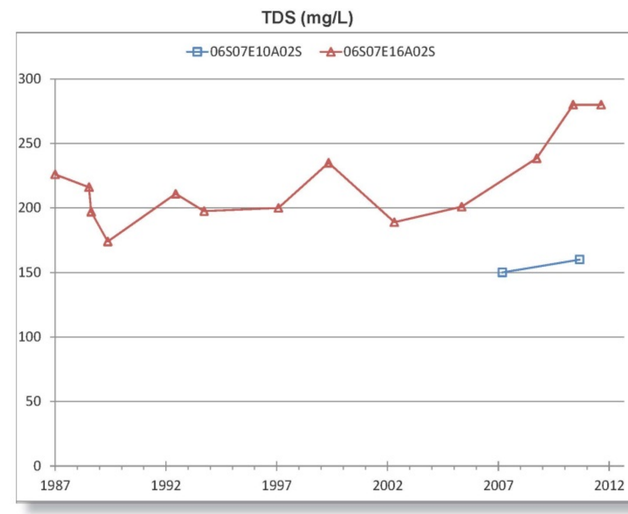
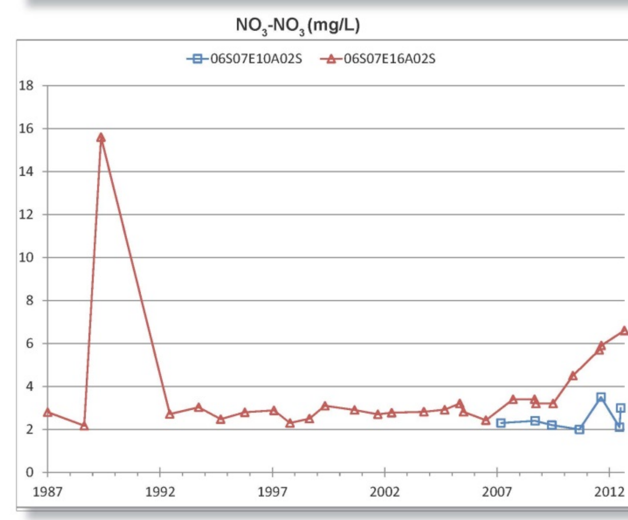
This map has been designed to print size 11'' by 17''.







Appendix A-12

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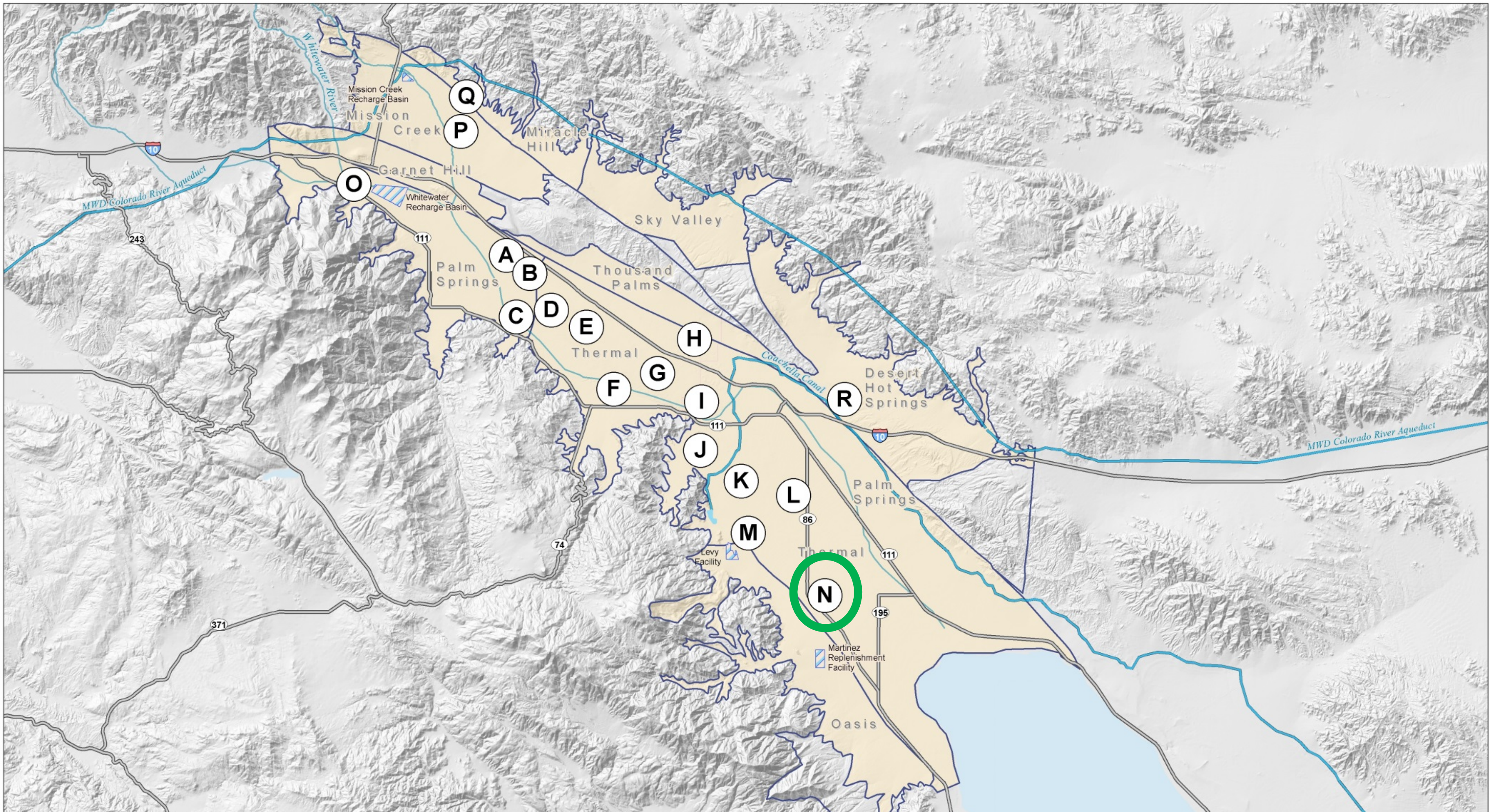
Lower Valley Group K



Key to Features

Highway
Minor Drainage
Spreading Facility
Management Zone
Group Name
Canal / Aqueduct
Water Body

N 0 5 10 Miles

Well Trend Group Name

Document: C:\Users\silberjm\Desktop\CVWD\AppedixGroups.mxd

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MWH

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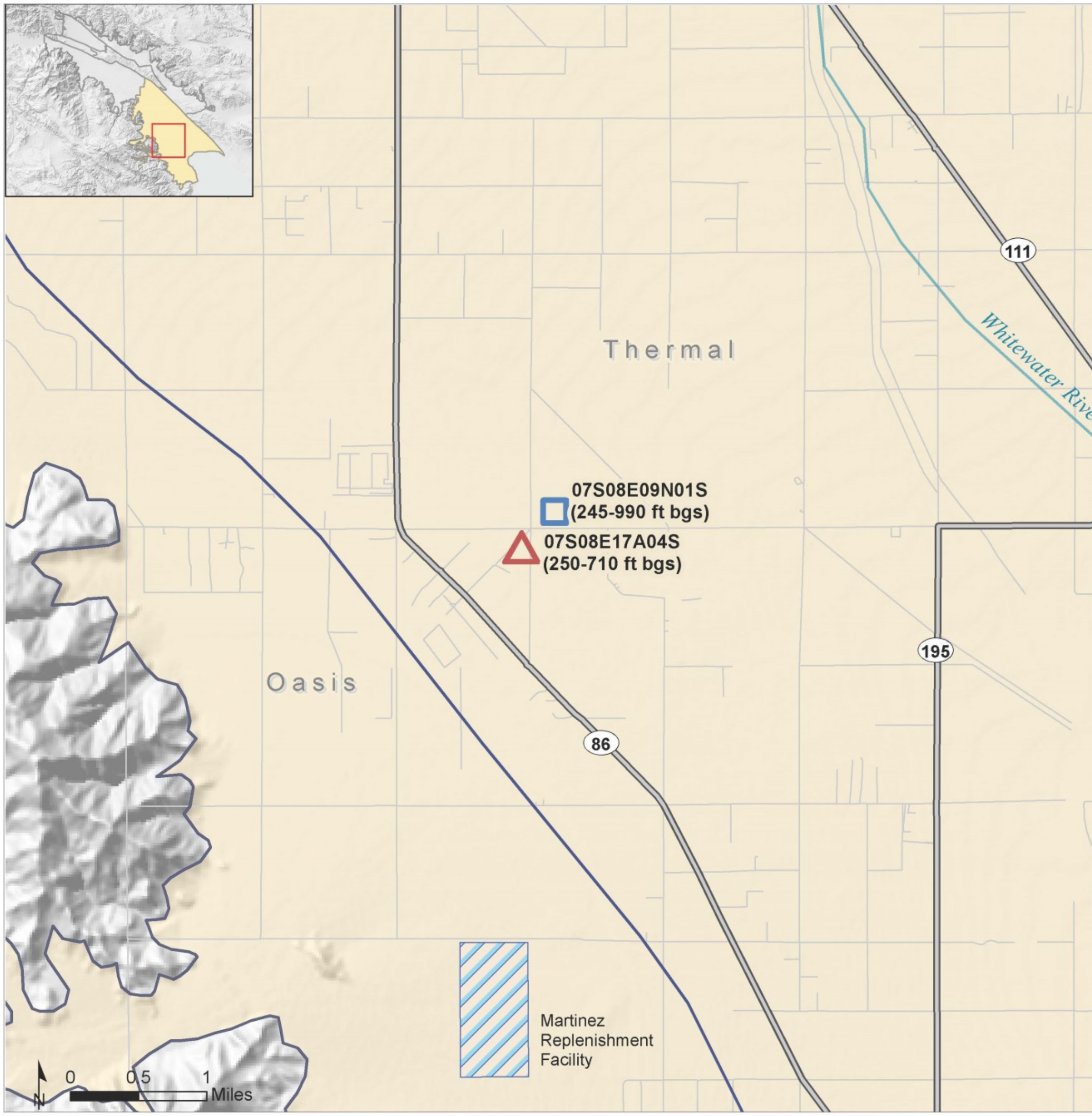

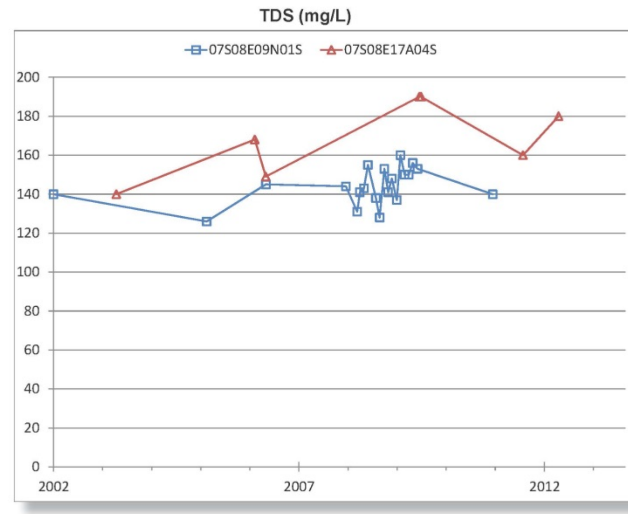

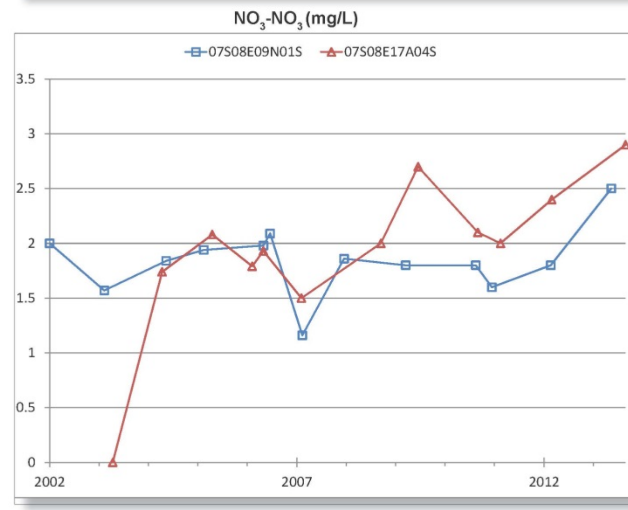

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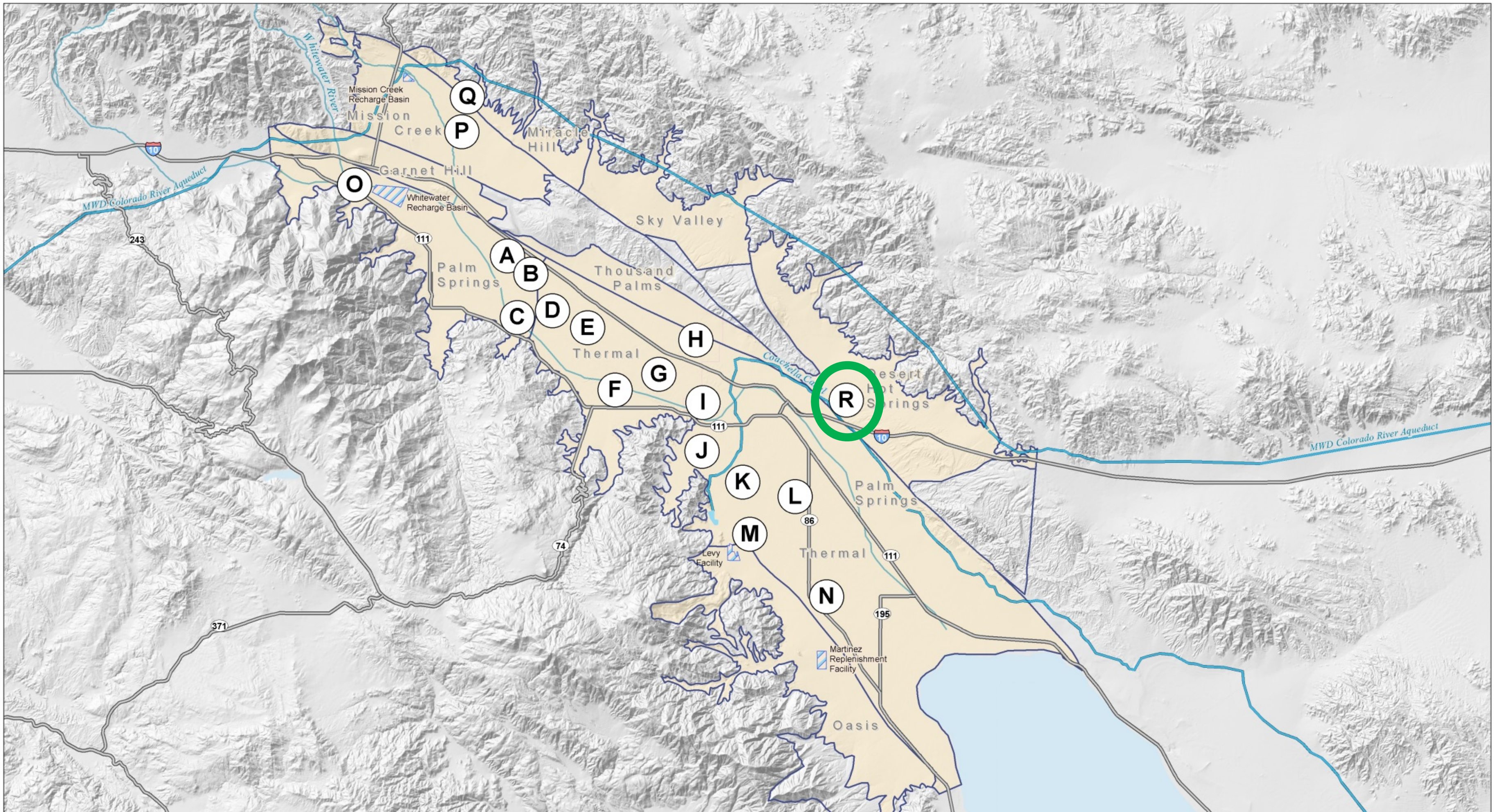
Appendix A-15

Lower Valley Group N



Key to Features

Highway		Minor Drainage		Spreading Facility		Management Zone	
Group Name		Canal / Aqueduct		Water Body			

0 5 10 Miles

Document: C:\Users\silberjm\Desktop\CVWD\AppedixGroups.mxd

Date: July 24, 2014

Well Trend Group Name

MWH

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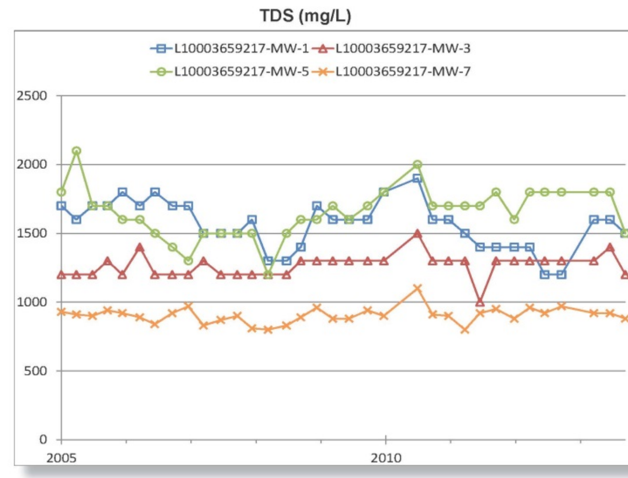
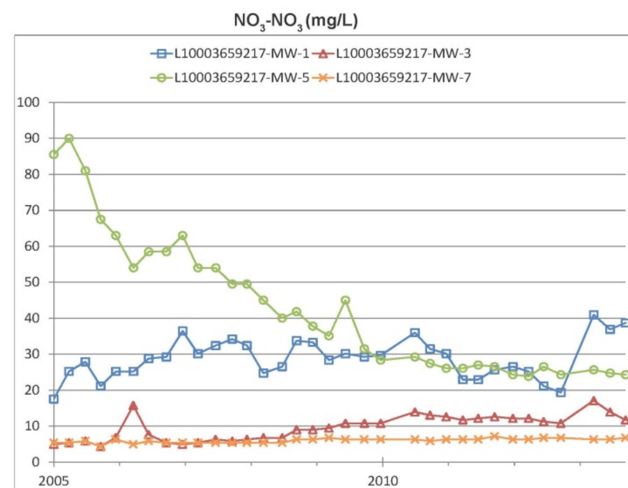




Appendix A-19

Desert Hot Springs Group R

Groundwater Quality Data Summary

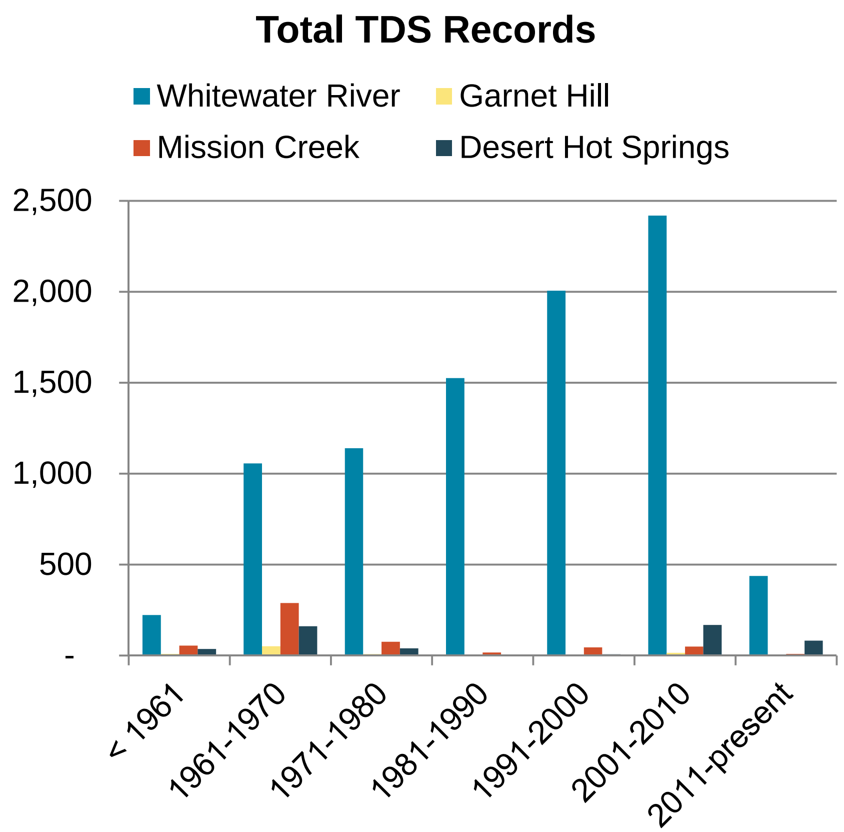
Data Sources

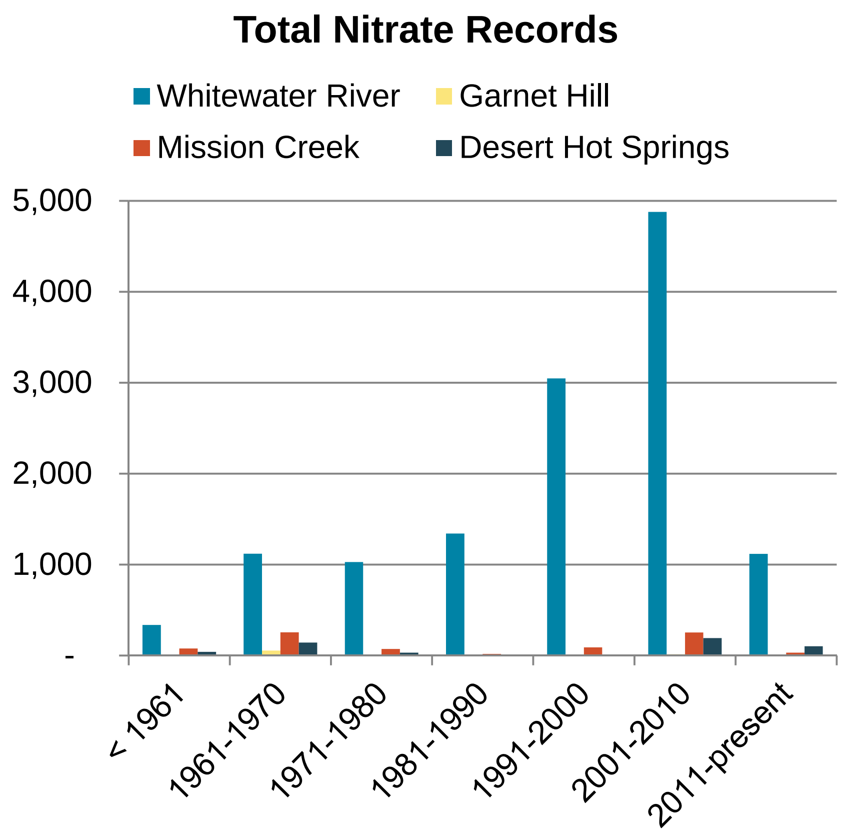
- State Water Resources Control Board
  - GeoTracker GAMA
- Coachella Valley Water District
- Desert Water Agency
- Indio Water Authority
- City of Coachella
- Mission Springs Water District

Data Distribution: Number of Wells with Data

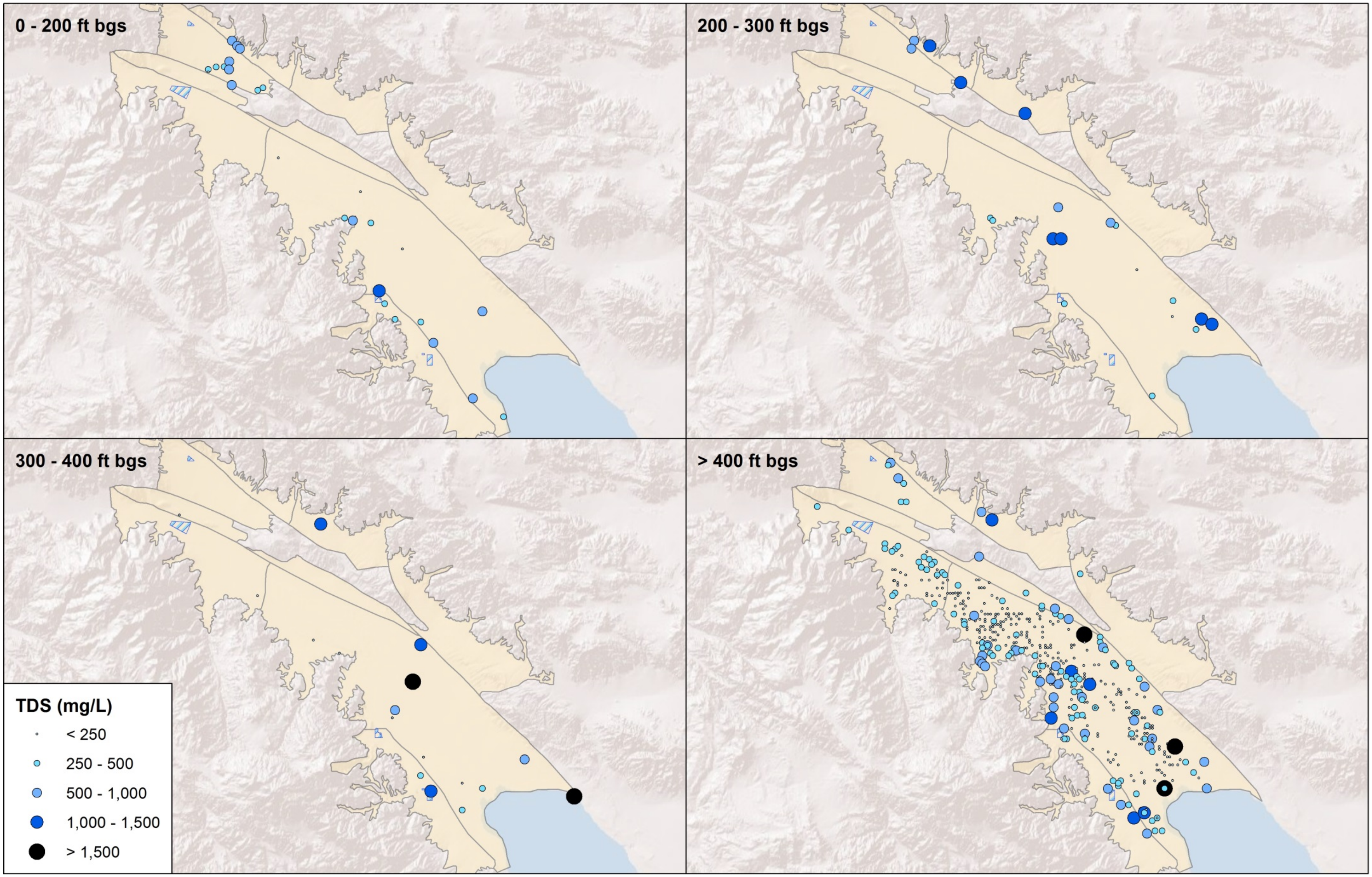
Subbasin Subarea	Wells with Water Quality Data	
	Count	Percent of Wells with Screen Interval Records
Whitewater River	**1,701**	**69**
Oasis	149	70
Palm Springs	133	59
Thermal	1,369	70
Thousand Palms	50	66
Mission Creek	**115**	**41**
Garnet Hill	**17**	**53**
Desert Hot Springs	**76**	**38**
Fargo Canyon	20	45
Miracle Hill	38	29
Sky Valley	18	50
Total	**1,909**	**66**

Data Distribution: Temporal

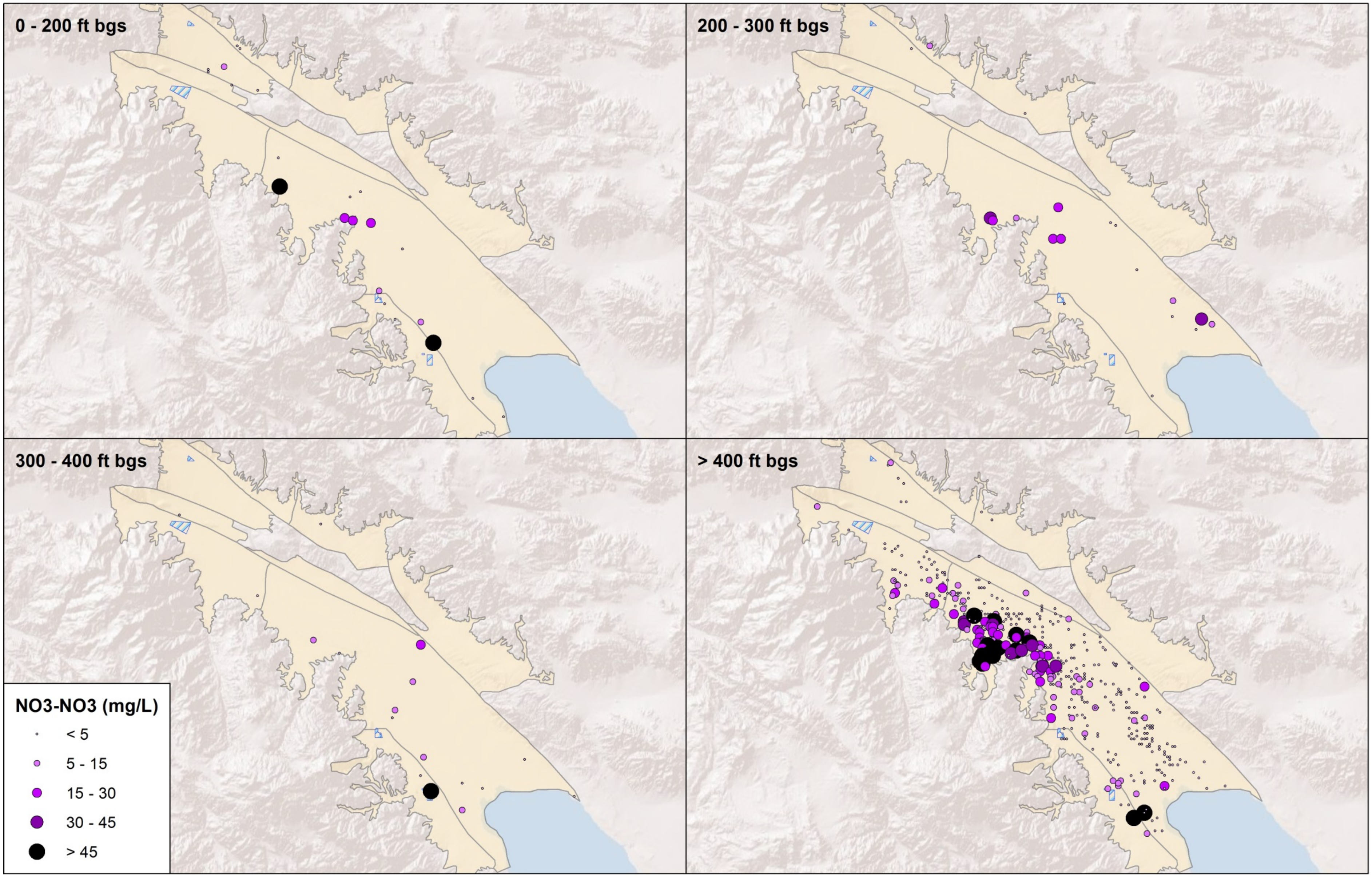




Water Quality: TDS

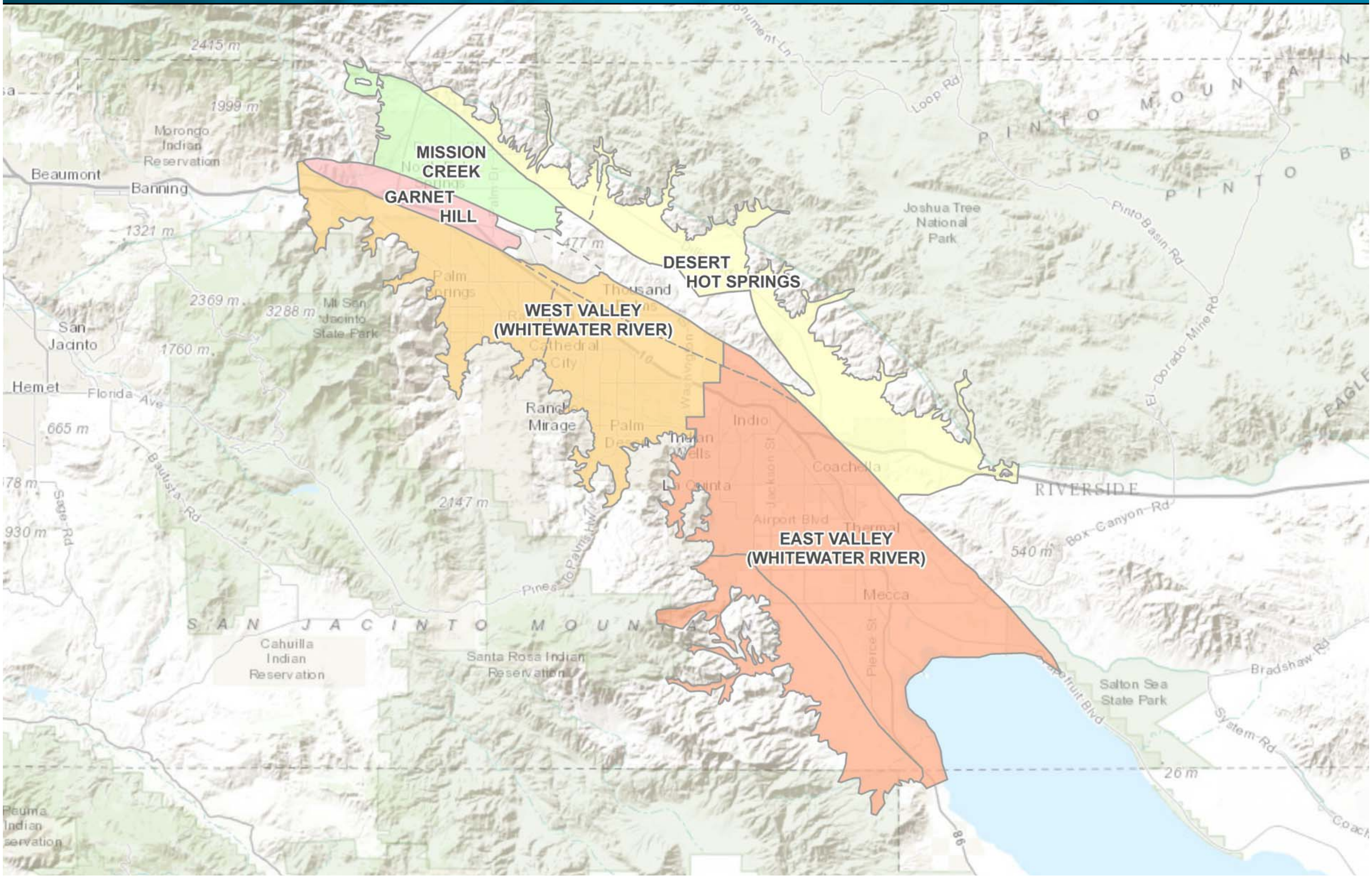


Water Quality: Nitrate (as Nitrate)



Ambient Water Quality Methods

Management Zones



AWQ Approach

- Baseline Period
  - 1991 – 2010
  - Data availability and spatial distribution
- AWQ Calculation
  - Filtering:
    - Temporal filter
    - Spatial filter
  - Method 1: Volume-weighted method when spatial distribution and representative data is available
  - Method 2: Statistical summary when data are lacking

Data Filtering

PROBLEM	SOLUTION
Several sources of data	**Duplicate removal**
Reporting of non-detects	**Treat as 0s**
Sampling frequency (Frequency Bias)	**Temporal filter**
Periods of record (Age Bias)	**Temporal filter**
Clustering (Position Bias)	**Spatial filter**

Temporal Filter – Frequency Bias

- Nitrate sampled every 3 years
- In 1994 exceedance triggers more frequent sampling
- When two samples show Nitrate below MCL, resets to usual sampling schedule
- Over the baseline period, there are a total of 15 records, 9 of which are in 1994, inducing a bias

Date	Nitrate
1991	20
Jan 1994	**60**
Feb 1994	**58**
Mar 1994	**58**
Apr 1994	**55**
May 1994	**50**
Jun 1994	**51**
Jul 1994	**48**
Aug 1994	**42**
Sep 1994	**41**
1997	35
2000	32
2003	33
2006	28
2009	28

Temporal Filter – Frequency Bias

- Using the median of a year to generate *yearly medians* minimizes this bias
- The reduced dataset is now more representative of water quality over the baseline period

Date	Nitrate
1991	20
1994	**51**
1997	35
2000	32
2003	33
2006	28
2009	28

Temporal Filter – Age Bias

- Two drinking water wells
- Well #1 not sampled between 1994 and 2006
- Well #2 sampled over entire baseline period
- Using all the data will give Well #2 more weight than Well #1 in the overall AWQ, inducing a bias

Date	Yearly Median TDS	
	Well #1	Well #2
1991	750	250
1994	770	260
1997		250
2000		230
2003		300
2006	780	310
2009	720	310

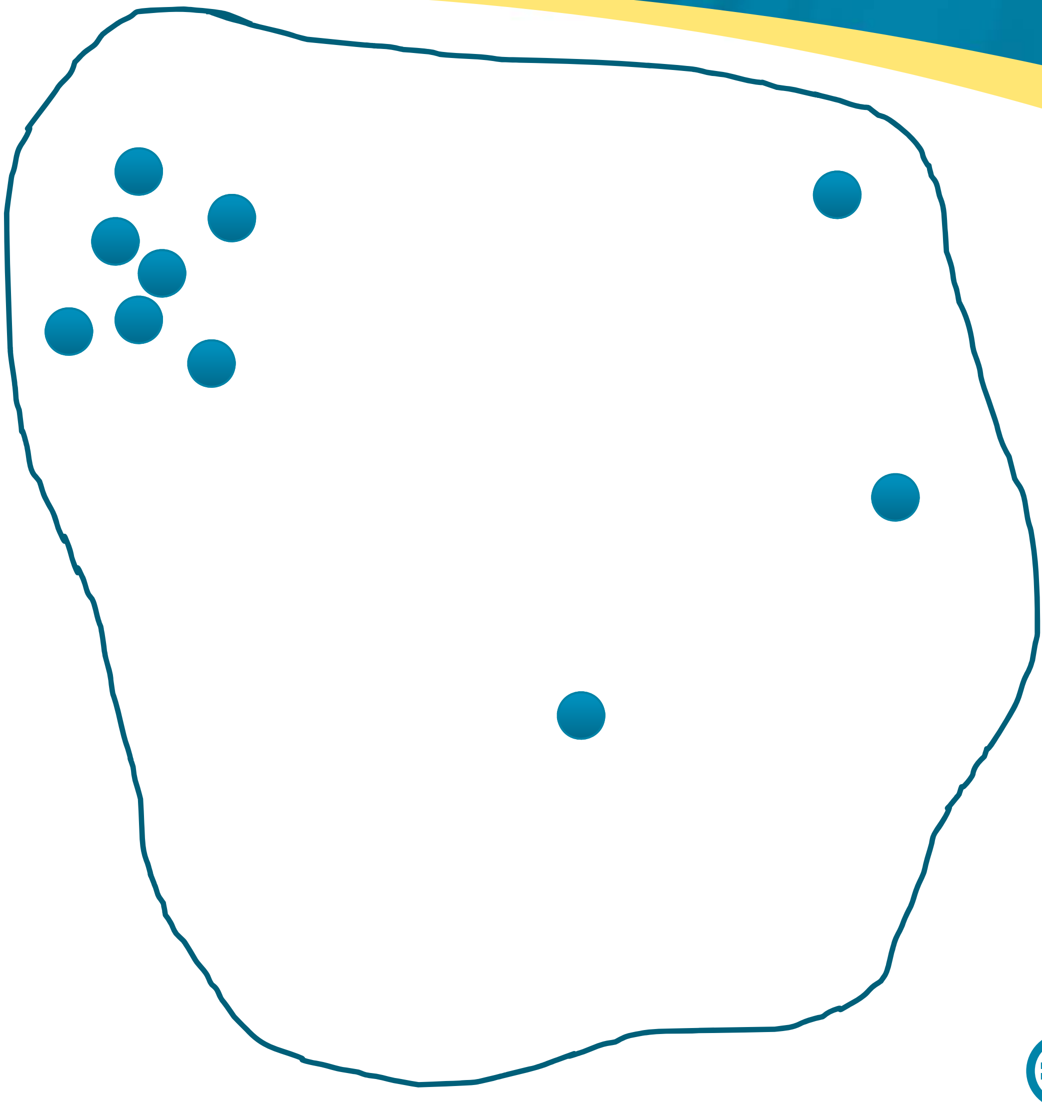
Temporal Filter – Age Bias

- Using the median of all yearly medians within the baseline period to generate *baseline well concentrations* minimizes this bias
- Each well now contributes equally to AWQ

Date	Yearly Median TDS	
	Well #1	Well #2
1991	750	250
1994	770	260
1997		250
2000		230
2003		300
2006	780	310
2009	720	310
MEDIAN	**760**	**260**

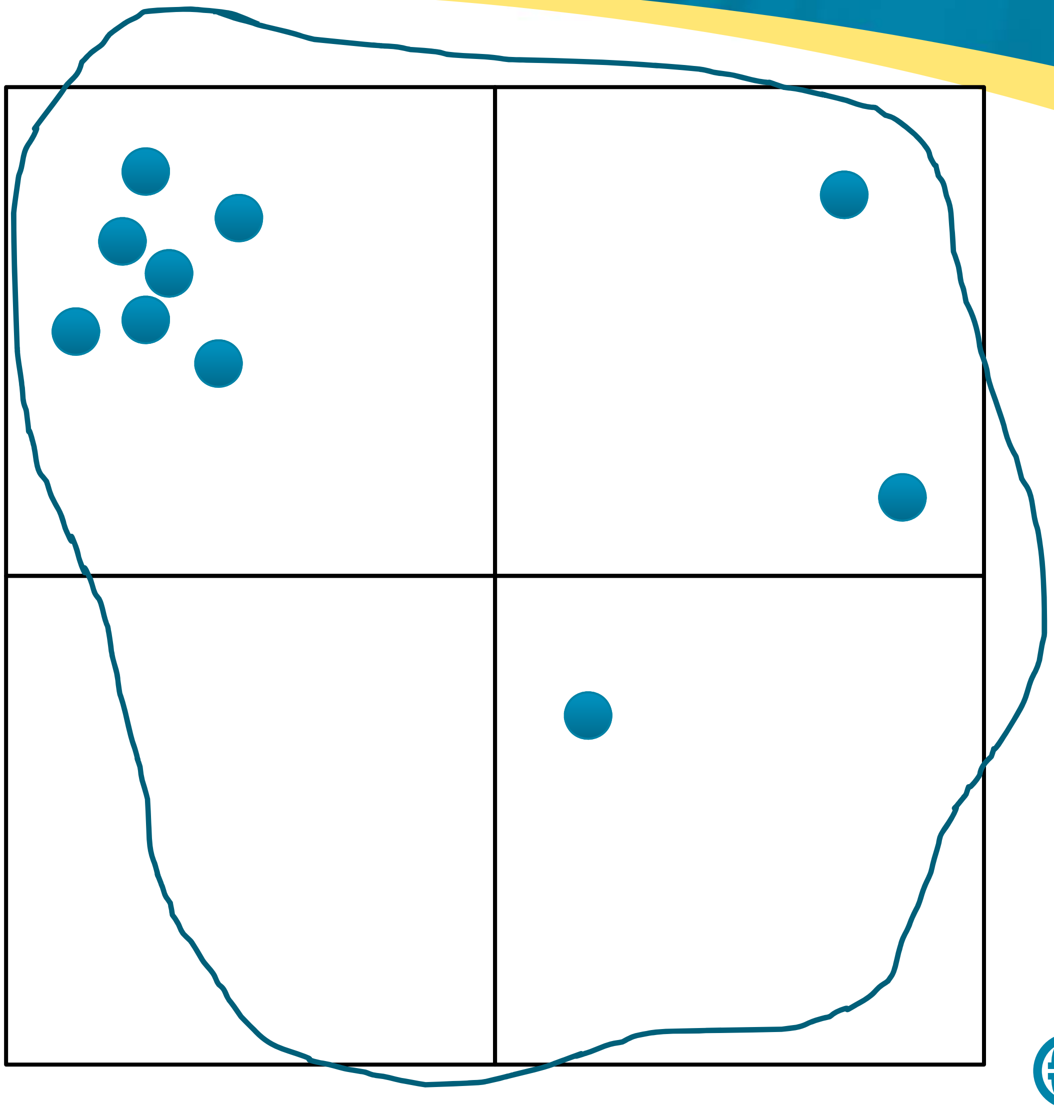
Spatial Filter – Position Bias

- Groundwater wells are typically drilled in areas where favorable conditions exist
- This example induces a bias favoring the water quality found in the cluster of wells to the NW



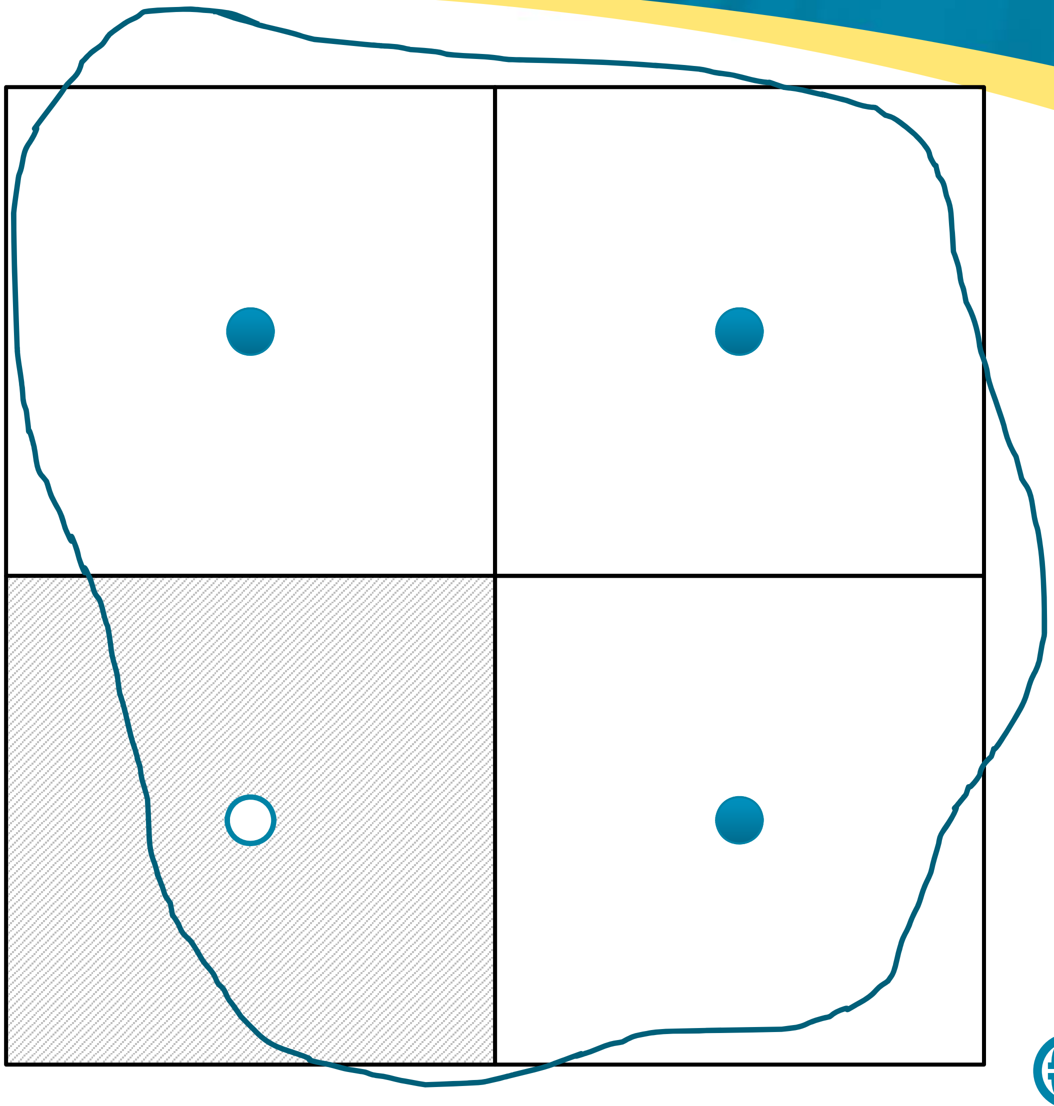
Spatial Filter – Position Bias

- Discretizing the domain allows grouping of wells in similar locations



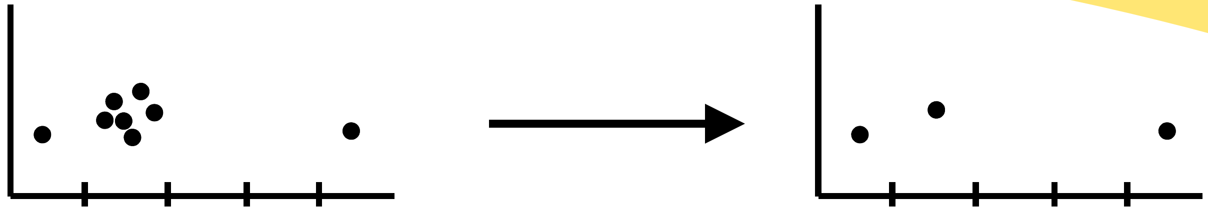
Spatial Filter – Position Bias

- Discretizing the domain allows grouping of wells in similar locations
- Using the mean of the baseline well concentrations for wells in a grid cell to generate a *cell mean* minimizes this bias



Temporal and Spatial Filtering

Temporal Filter 1:



Temporal and Spatial Filtering

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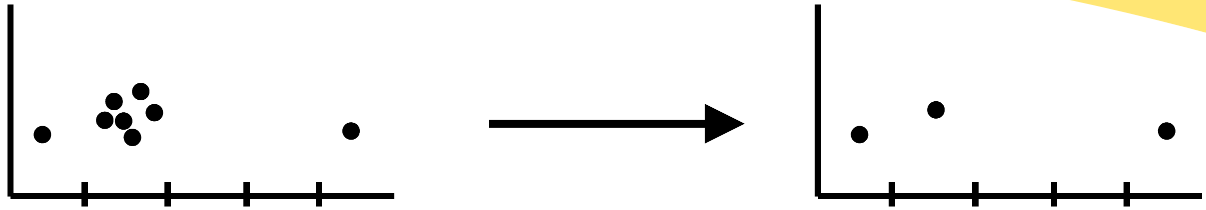
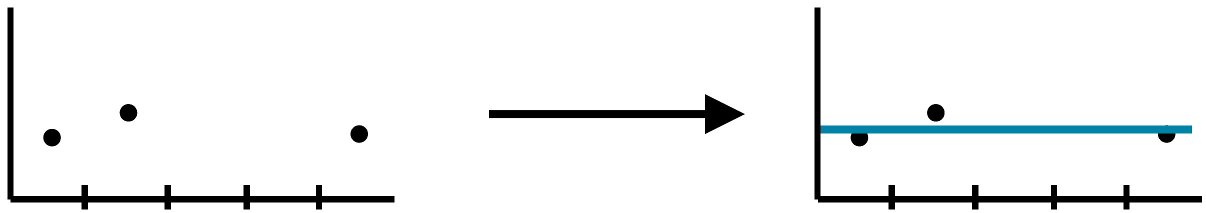


Temporal Filter 2:



Temporal and Spatial Filtering

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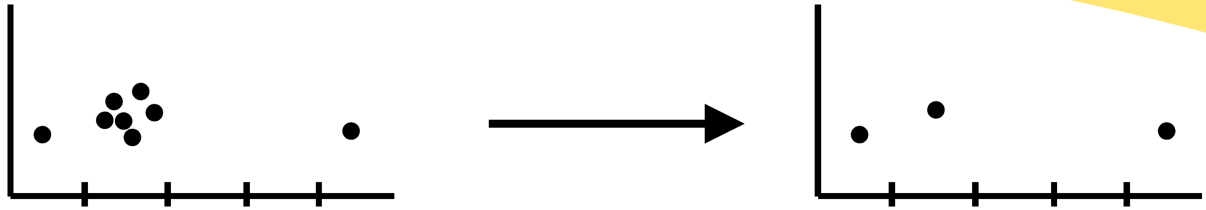
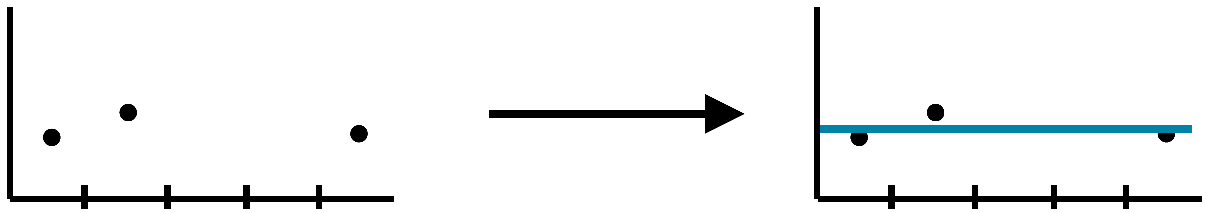
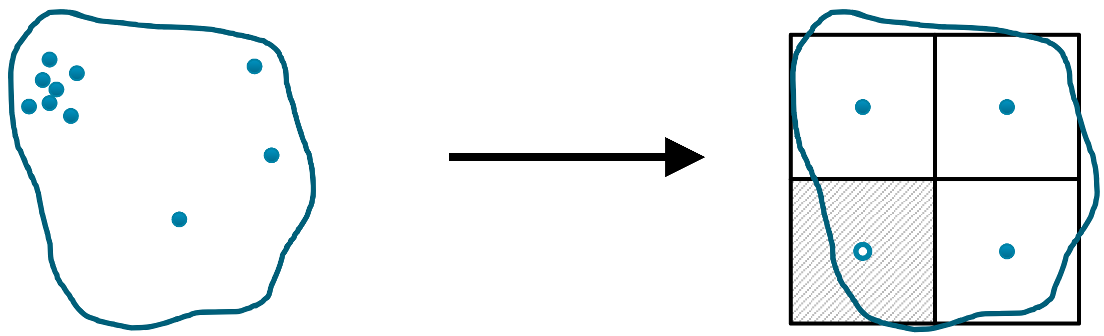


Temporal Filter 2:



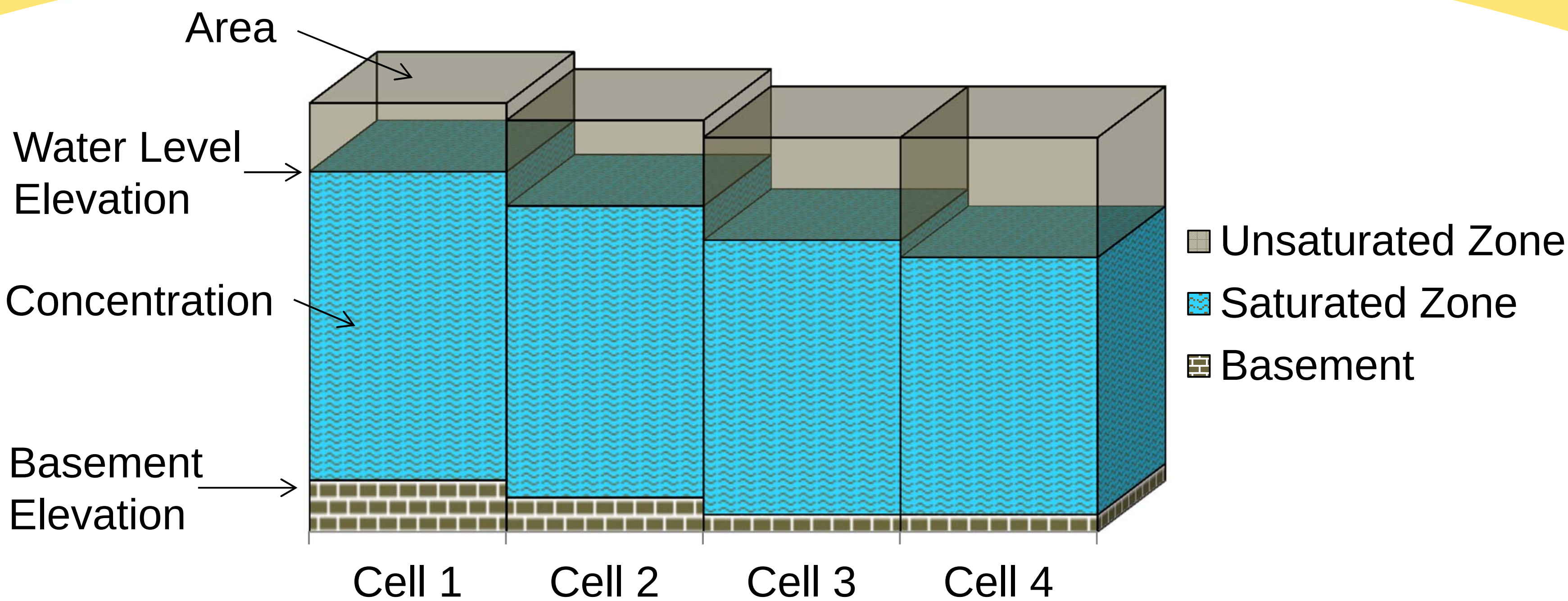
Spatial Filter:



Ambient Water Quality Methods

- Method 1: Volume-weighted average
  - Considers water in storage and distribution of data points
  - Requires reasonable distribution data
- Method 2: Statistical
  - Big picture statistical summary
- Both Methods
  - Spatial and temporal filters are applied to eliminate weighting by wells or locations with high data frequency

Method 1: Volume-weighted



$$Volume_T = \sum_{i=1}^{n} SY_i \times Area_i \times (Avg\ Water\ Level\ Elevation_i - Basement\ Elevation_i)$$

where i = Cell i
SY_i = Specific Yield of Cell I

Volume-Weighted Average Calculation

$$Concentration_{Avg} = \frac{1}{Volume_T}\sum_{i=1}^{n} Volume_i \times Concentration_i$$

Where:

$$Volume_i = SY_i \times Area_i \times (Avg\ Water\ Level\ Elevation_i - Basement\ Elevation_i)$$

SY_i = Specific Yield of Cell i

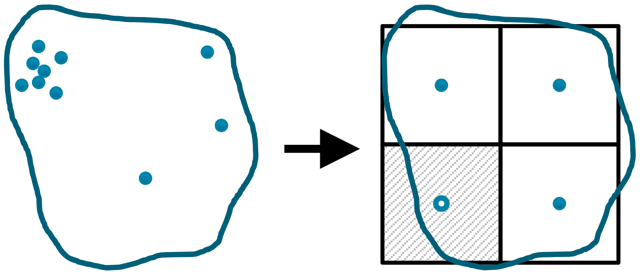
$Area_i$ = Area of Cell i

$Volume_T = \sum_{i=1}^{n} Volume_i$

$Concentration_i$ = Average Concentration in Cell i

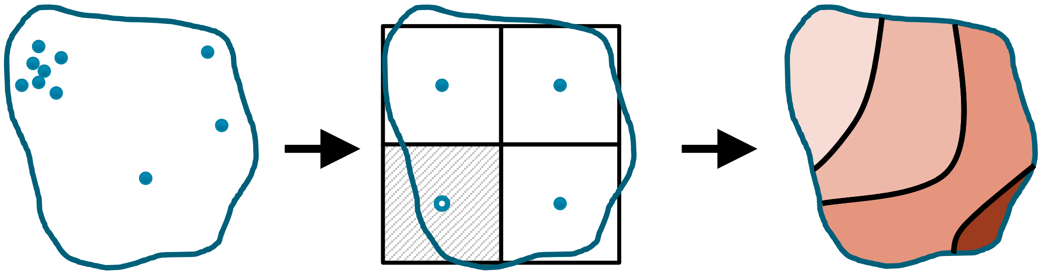
Note: each cell is assigned a concentration, based on actual data or approximated

Method 1: Contouring



Method 1: Contouring

- To get concentrations for all cells, the cell means are contoured:
  - Depending on the availability of data, depth ranges may be contoured separately to account for water quality variance with depth



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- To get concentrations for all cells, the cell means are contoured:
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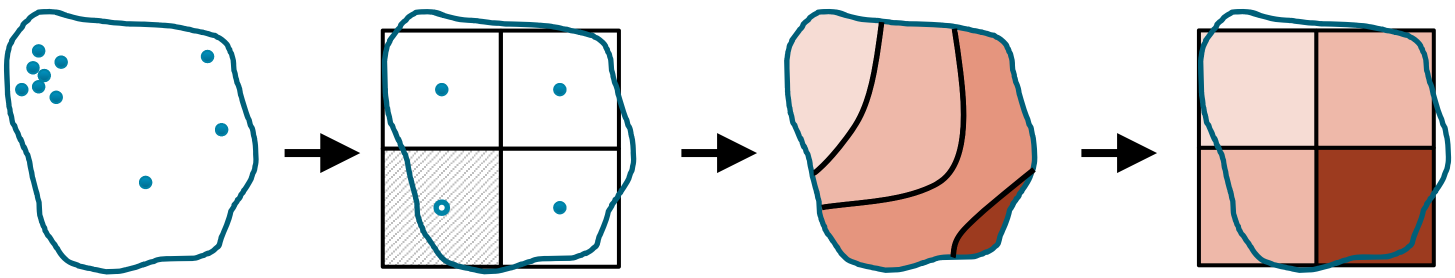

- The contours are used to approximate water quality for each cell

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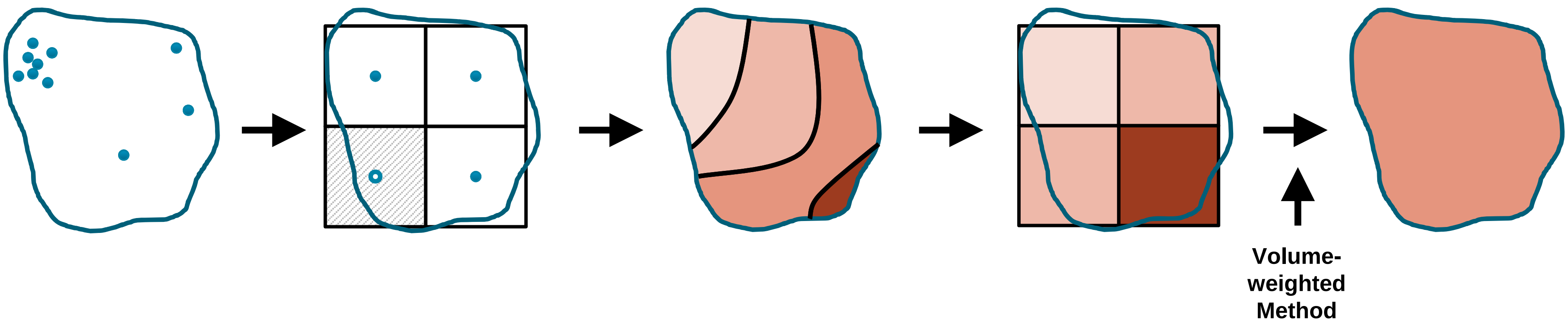


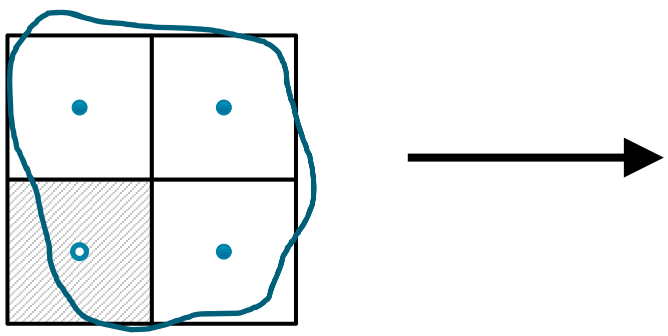
- The contours are used to approximate water quality for each cell
- Ambient water quality for a management zone is then calculated using the volume-weighted method – each cell's water quality contributes proportionally to the volume of water within it

Method 1: Advantages/Disadvantages

- Provides a single water quality value
- Easy to determine regulatory compliance
- Useful in areas with good well/aquifer data (storage capacity, water levels, water quality)
- Contoured results may infer more certainty than actually exists
- Multiple aquifer zones or vertical variation will complicate the analysis

Method 2: Statistical Range

- Following temporal/spatial filters



- Depending on statistical summary, an AWQ may be a range of water quality based on:
  - Confidence Interval
  - Other prescribed range

Method 2: Advantages/Disadvantages

- Based only on actual data
- Can be applied when there is limited well/aquifer data
  - AWQ for an entire Management Zone may be driven by very few data or data clustered only in certain areas
- Can provide a reasonable range for AWQ
- Does not consider aquifer properties

Next Steps

Next Steps

- Stakeholder comments by September 18
- Complete AWQ Analysis
- Stakeholder Meeting No.3 – October 15
- Complete TM-2
- Complete Salt/Nutrient Loading Tool
- Evaluate Assimilative Capacity
- Compile Projects and Develop Strategies
- Review Projects and Strategies
  - Stakeholder Meeting No.4 – January 7
- Complete SNMP