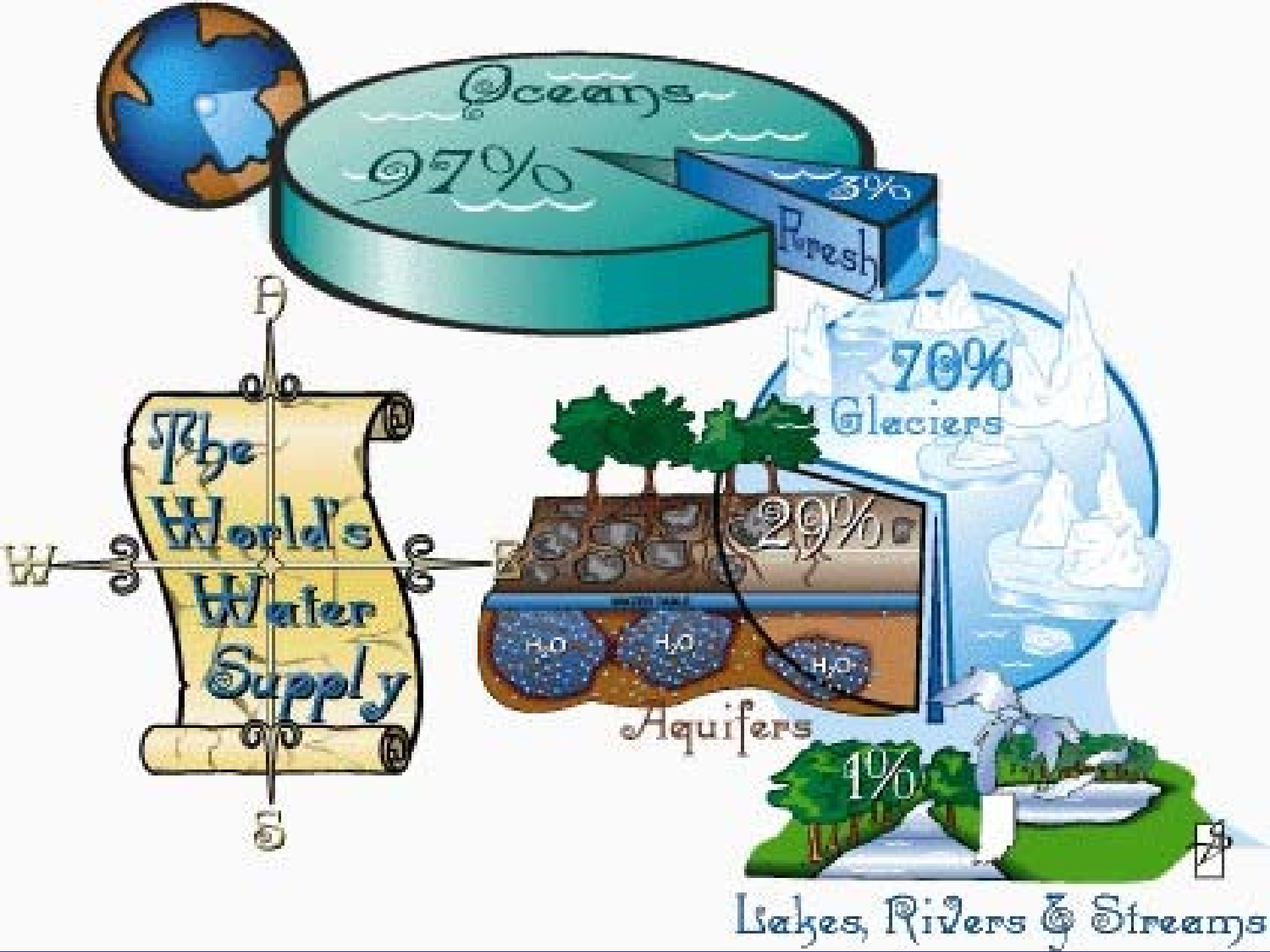
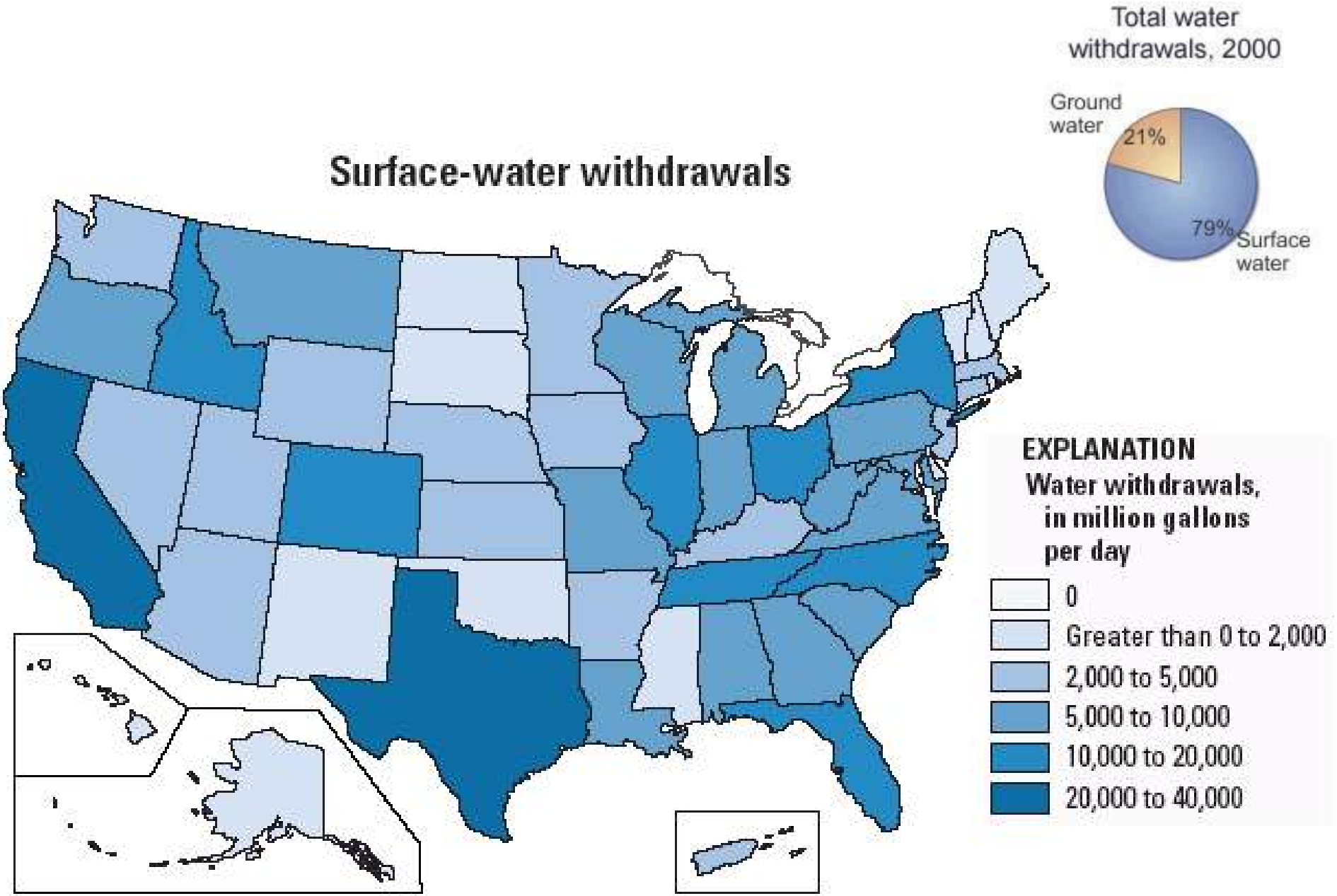
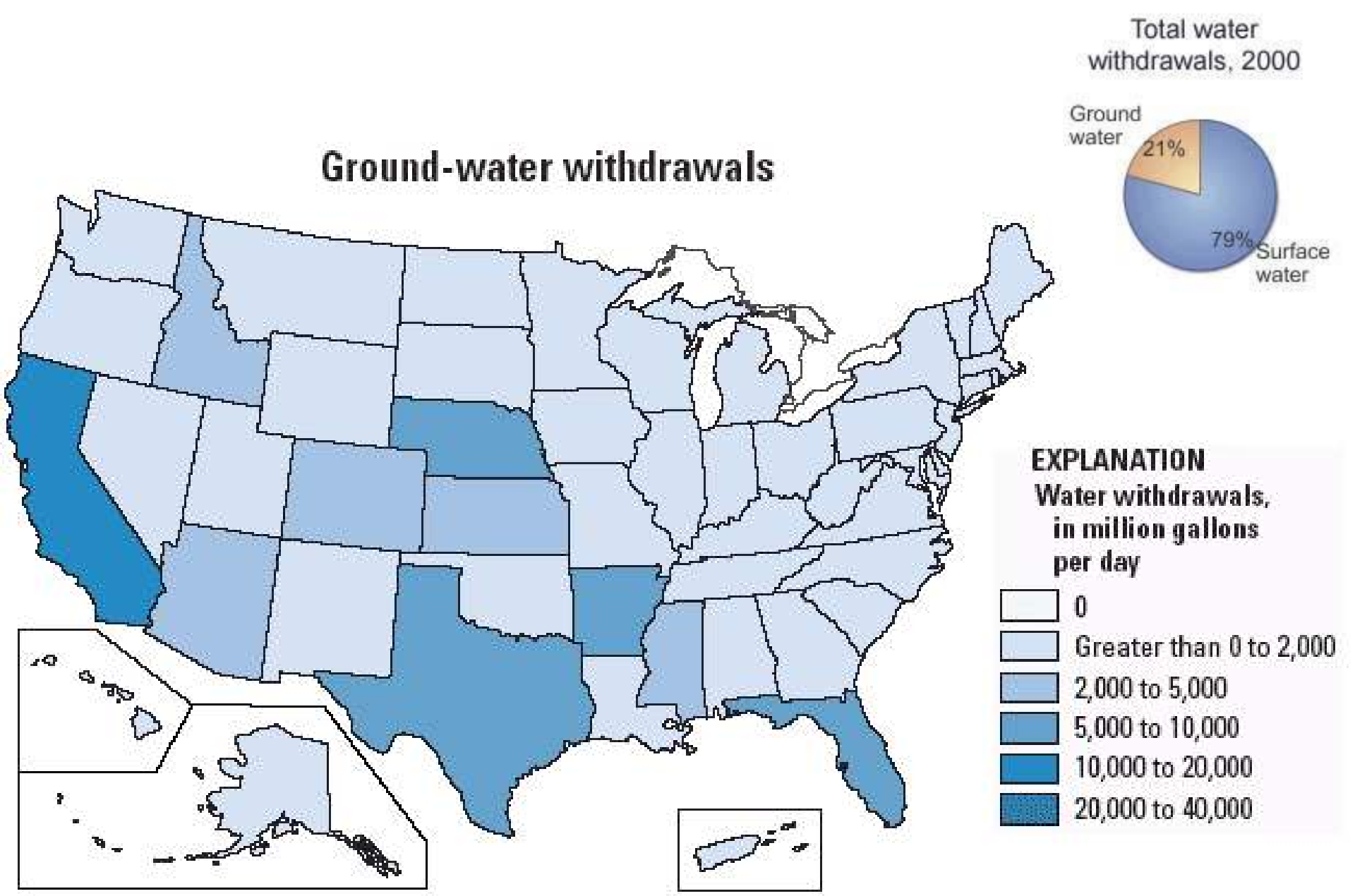
Groundwater Management in the Modesto Sub-Basin


Oceans
97%
3%
Fresh
70%
Glaciers
The World's Water Supply
N
W
E
S
29%
Aquifers
1%
Lakes, Rivers & Streams


Total water withdrawals, 2000
Ground water
21%
79%
Surface water
Surface-water withdrawals
EXPLANATION
Water withdrawals, in million gallons per day
0
Greater than 0 to 2,000
2,000 to 5,000
5,000 to 10,000
10,000 to 20,000
20,000 to 40,000


Ground-water withdrawals
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Water withdrawals, in million gallons per day
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Greater than 0 to 2,000
2,000 to 5,000
5,000 to 10,000
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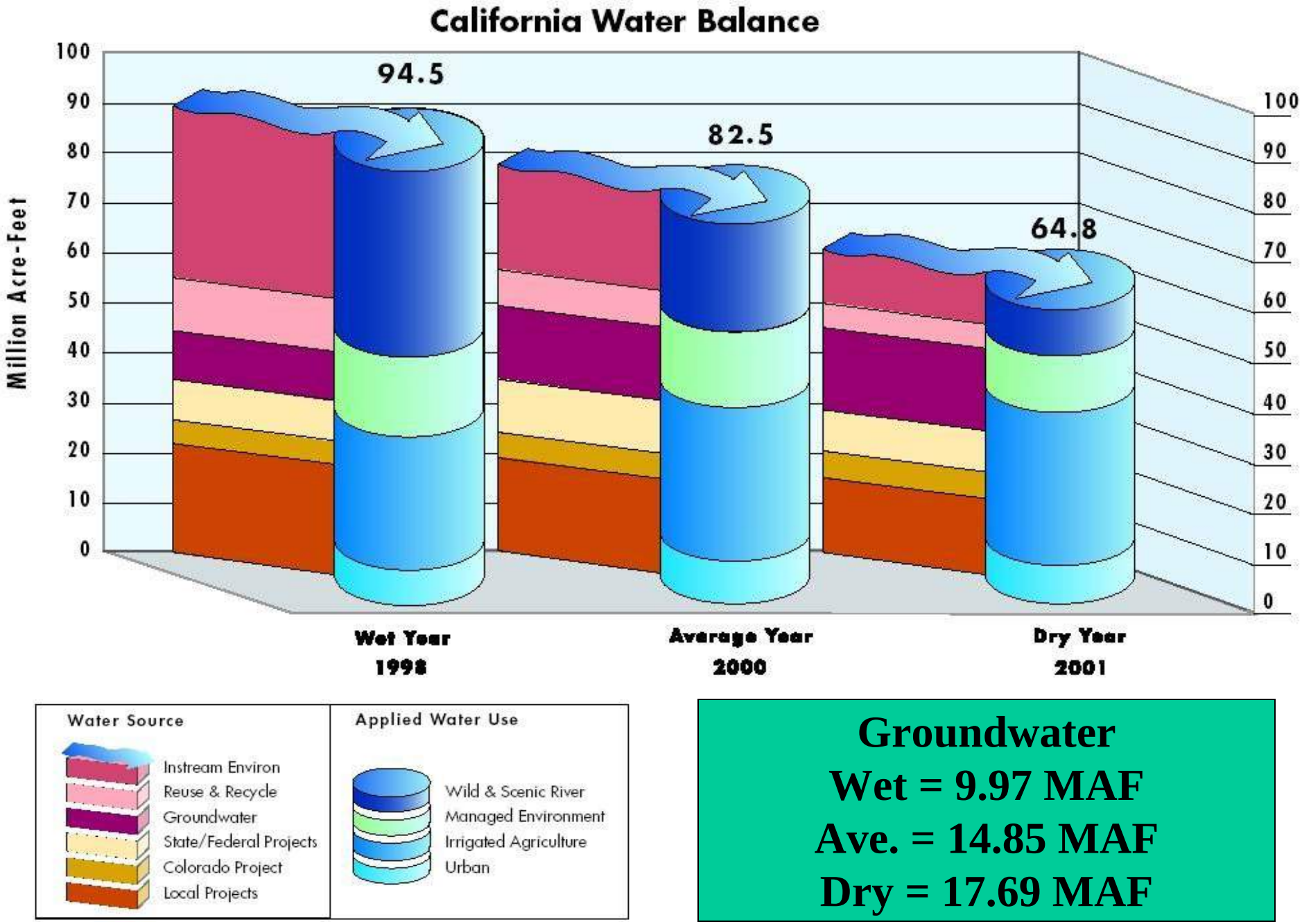
20,000 to 40,000

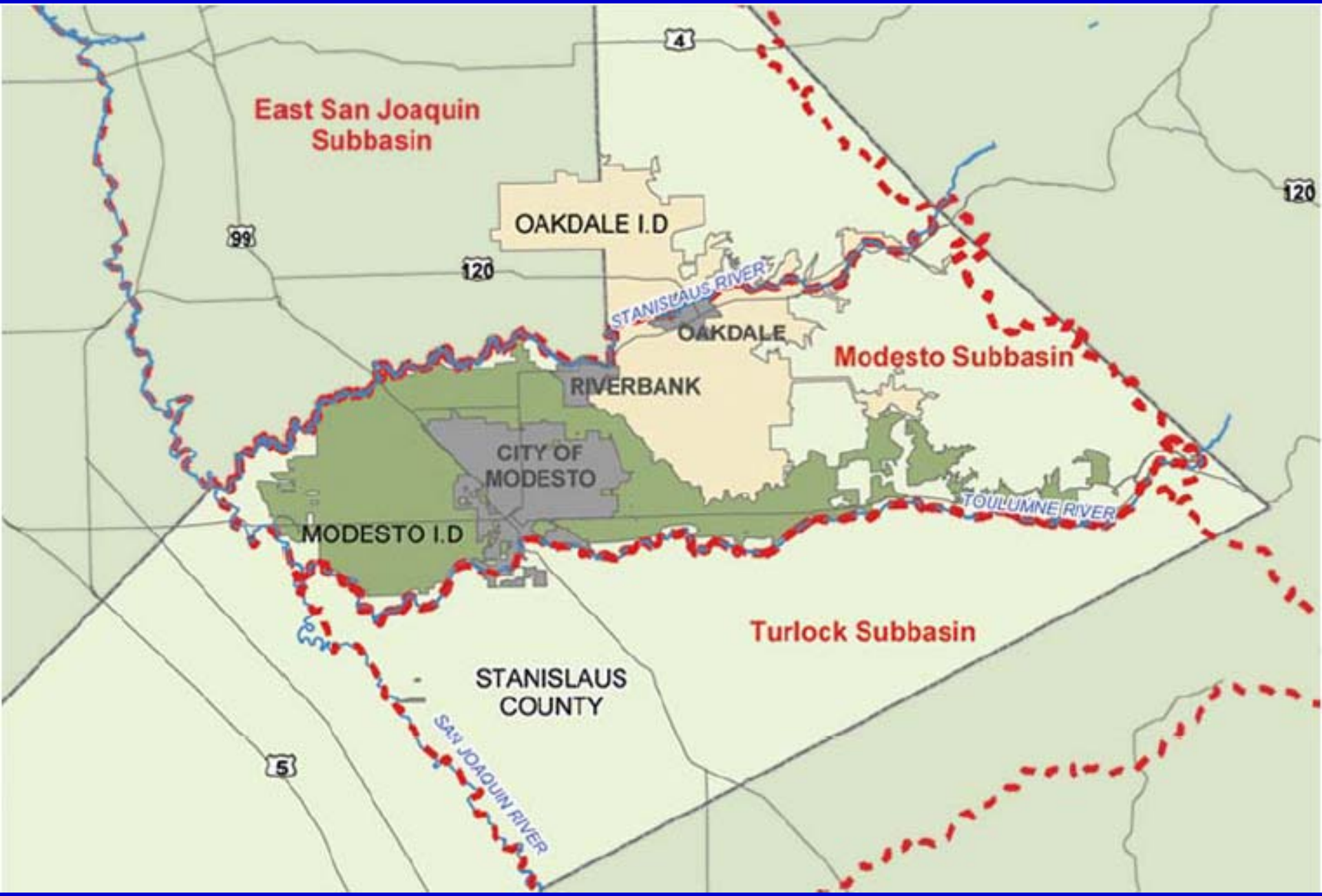


Groundwater
Wet = 9.97 MAF
Ave. = 14.85 MAF
Dry = 17.69 MAF

Stanislaus & Tuolumne Rivers Groundwater Basin Association (STRGBA)

- Formational MOU (limited authority, volunteer cooperation, information gathering, public information)

- Cities of Modesto, Riverbank and Oakdale
- Stanislaus County
- Oakdale Irrigation District
- Modesto Irrigation District


East San Joaquin Subbasin
OAKDALE I.D
4
120
99
120
STANISLAUS RIVER
OAKDALE
Modesto Subbasin
RIVERBANK
CITY OF MODESTO
TOULUMNE RIVER
MODESTO I.D
Turlock Subbasin
STANISLAUS COUNTY
SAN JOAQUIN RIVER
5

Long Term Goals for the Modesto Area

Issues:

- Rapid population growth
- Conversion of agricultural land to urban
- Climate variability
- Increased GW use
- Vulnerable aquifer

Goals:

- Optimized water management to provide adequate supply
- Sustainability of ground-water quality

Management Strategies

- Increase Local & Regional Water Supply & Water Use Efficiency
- Promote Groundwater Recharge & Management
- Support Water Conservation
- Implement Watershed Management Programs

Groundwater Management Plan (GWMP)

- Uniform data gathering
- Identification & Prioritization of Problem Areas
- Options for recommended actions
- Approval & Implementation of Programs, Plans and Projects

Basin Management Objectives and Plan Elements

- Manage & Optimize Wellfield Operations
- Identify and Map Basin Recharge Areas
- Develop a calibrated, three-dimensional groundwater model of the basin
- Groundwater monitoring (levels and quality)
  - Volunteer cooperation
  - Sensitive to protection of privacy

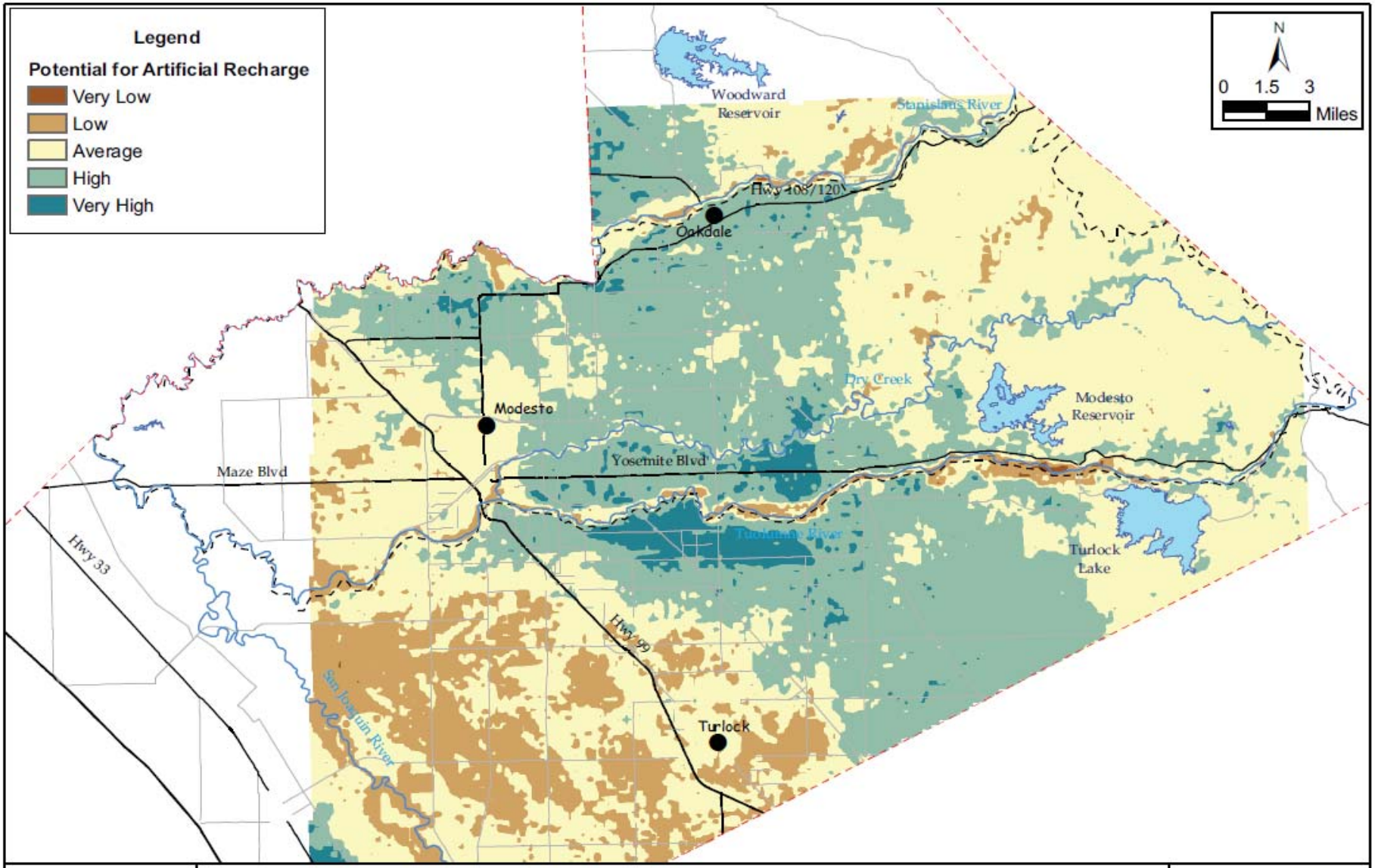
Wellfield Optimization Program

- DWR Funded (local groundwater assistance grants)
  - Agricultural and Public Supply wells

  - Water Conservation
  - Water Quality Management
  - Energy & Water Use Efficiency
  - Preventative Maintenance Program
  - Basin Management Objectives
  - Real-time SCADA Decision Support System

Recharge Mapping

- The primary data source USGS Study completed for STRGBA “Hydrogeological Characterization of the Modesto Area”
  - This report was built on previous work and includes a substantial amount of new information
- Performed with DWR funding (no local $)
- Used various criteria such as physical characteristics and anthropogenic conditions to create map layers



WRIME

Potential for Artificial Recharge

STRGBA Recharge Analysis

February 2007

Figure 10

United States Geological Survey Studies (USGS)

Basin-wide/Regional Computer Model (MODFLOW)

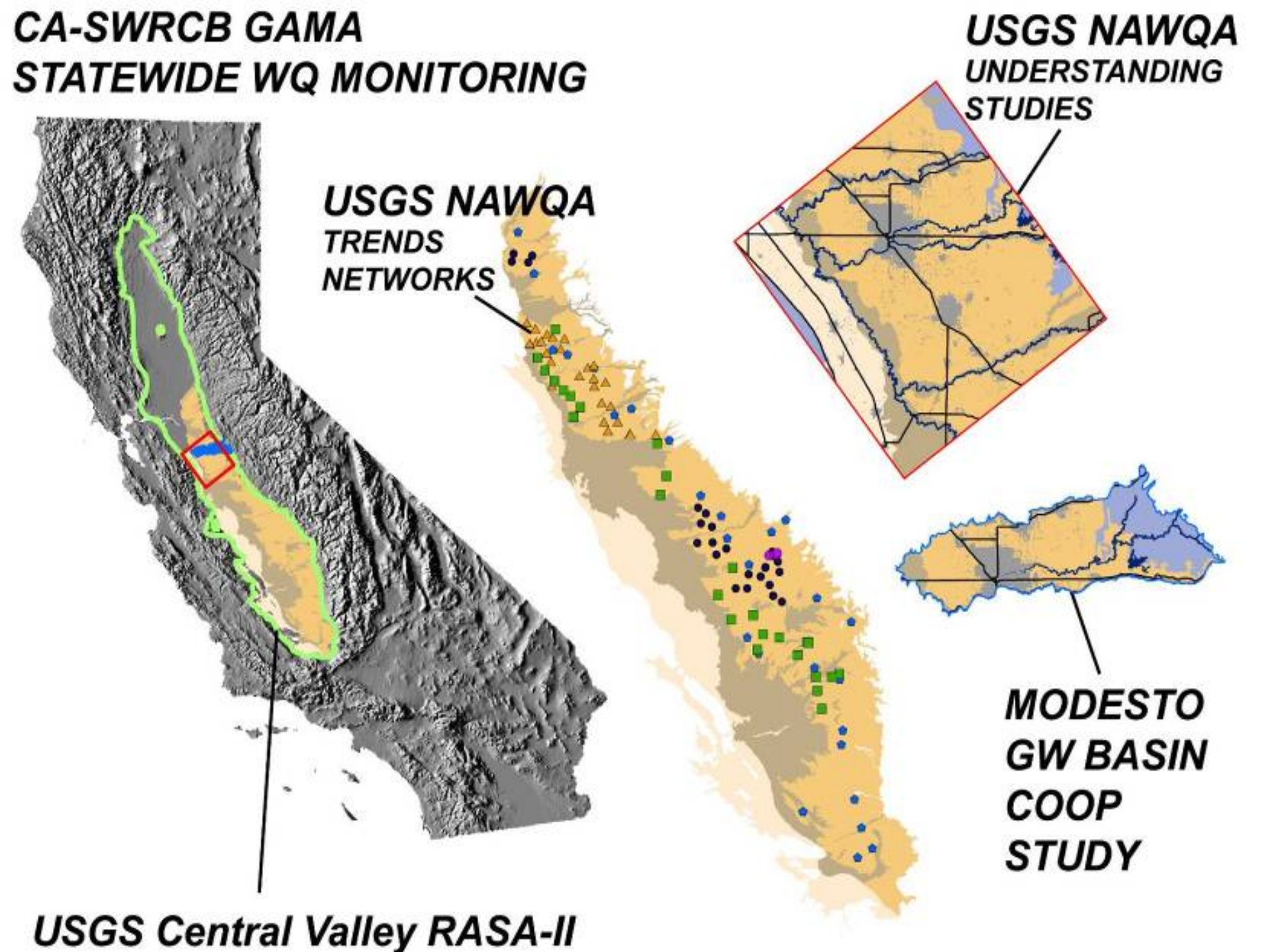
- Model calibration is complete
- Peer Review documentation in progress

“Crystal Ball” Scenario Testing:

- Groundwater Extraction Impacts
- Groundwater Flow Patterns
- Groundwater-Surface Water (river) interactions
- Not a water quality tracking model

Model Benefits

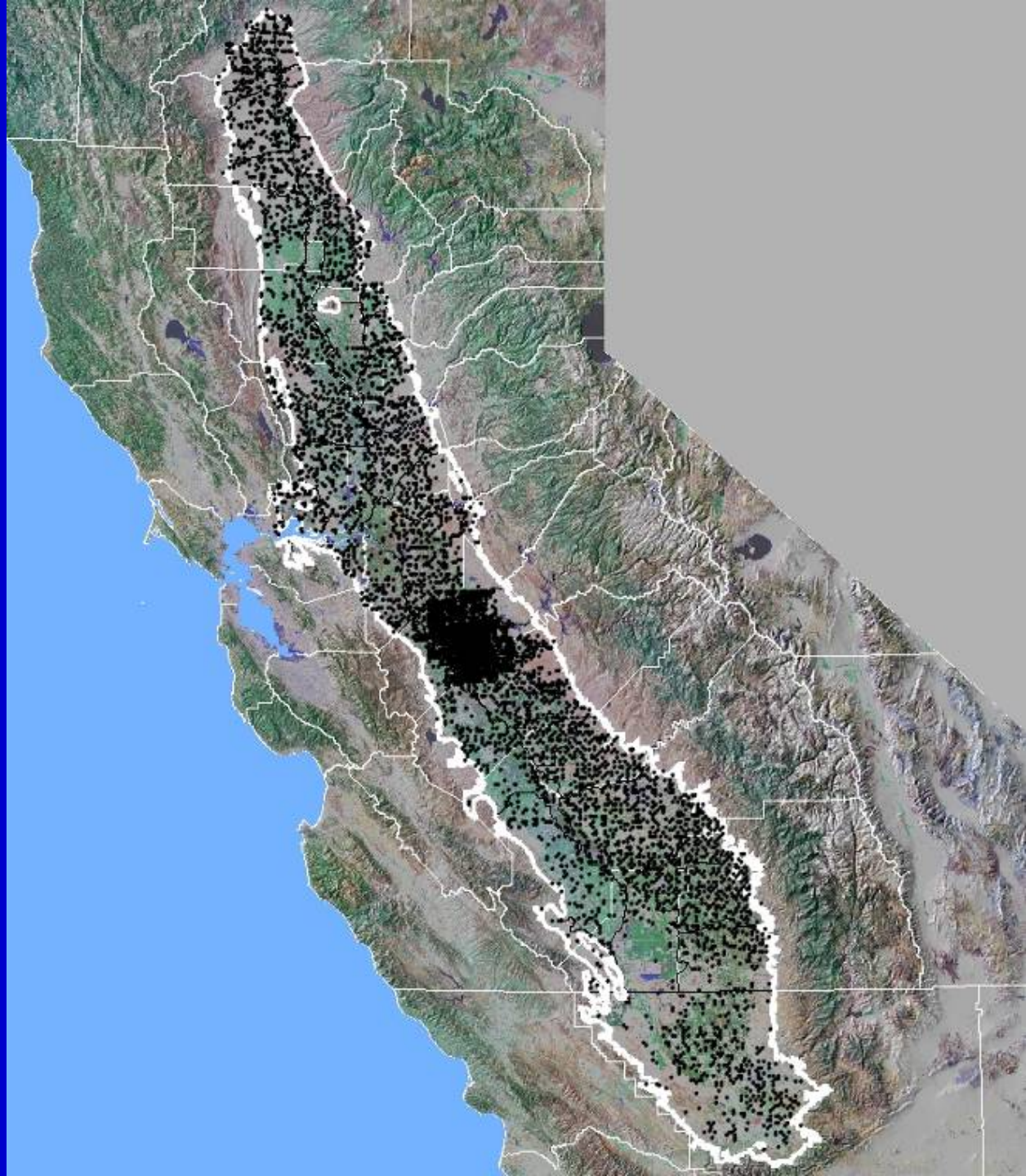
- Enhance opportunities for conjunctive use
- *Plan and design for future supply*
- Identify and protect prime recharge areas
- Mitigate risk of migration of contaminated groundwater
- *Evaluate impacts of proposed groundwater development*
- Optimize existing wellfield operations

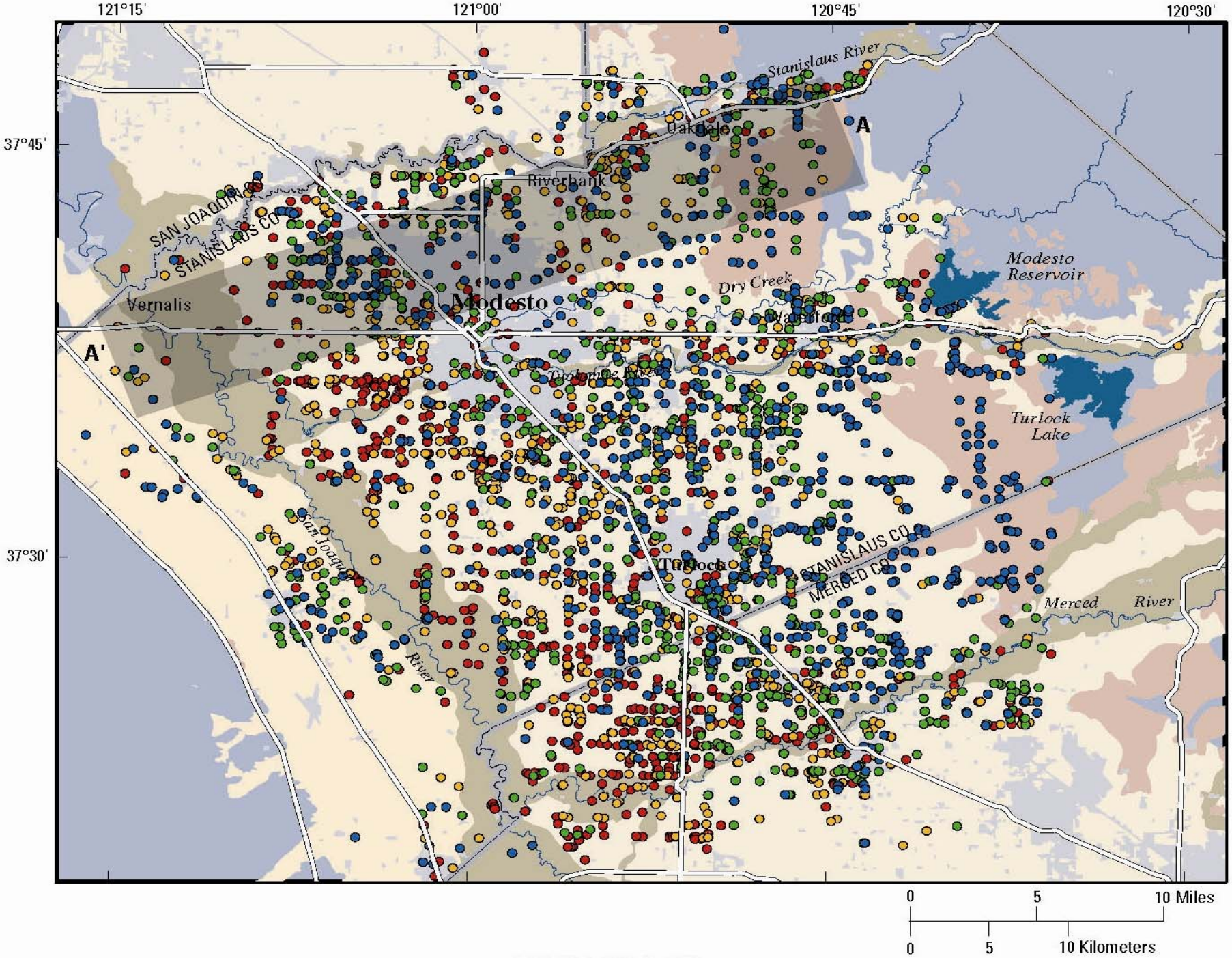

CA-SWRCB GAMA
STATEWIDE WQ MONITORING
USGS NAWQA
UNDERSTANDING
STUDIES
USGS NAWQA
TRENDS
NETWORKS
MODESTO
GW BASIN
COOP
STUDY
USGS Central Valley RASA-II

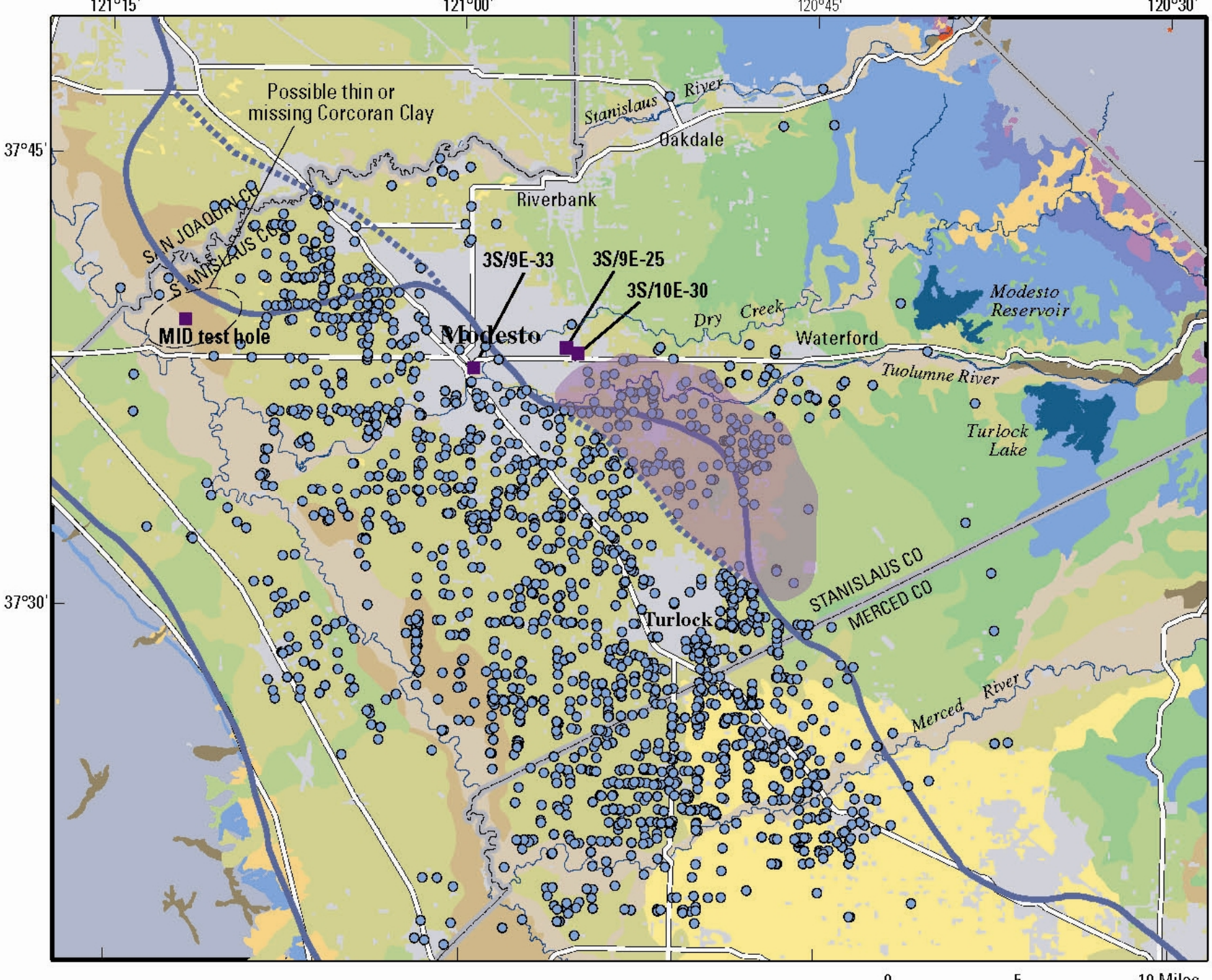
Database:

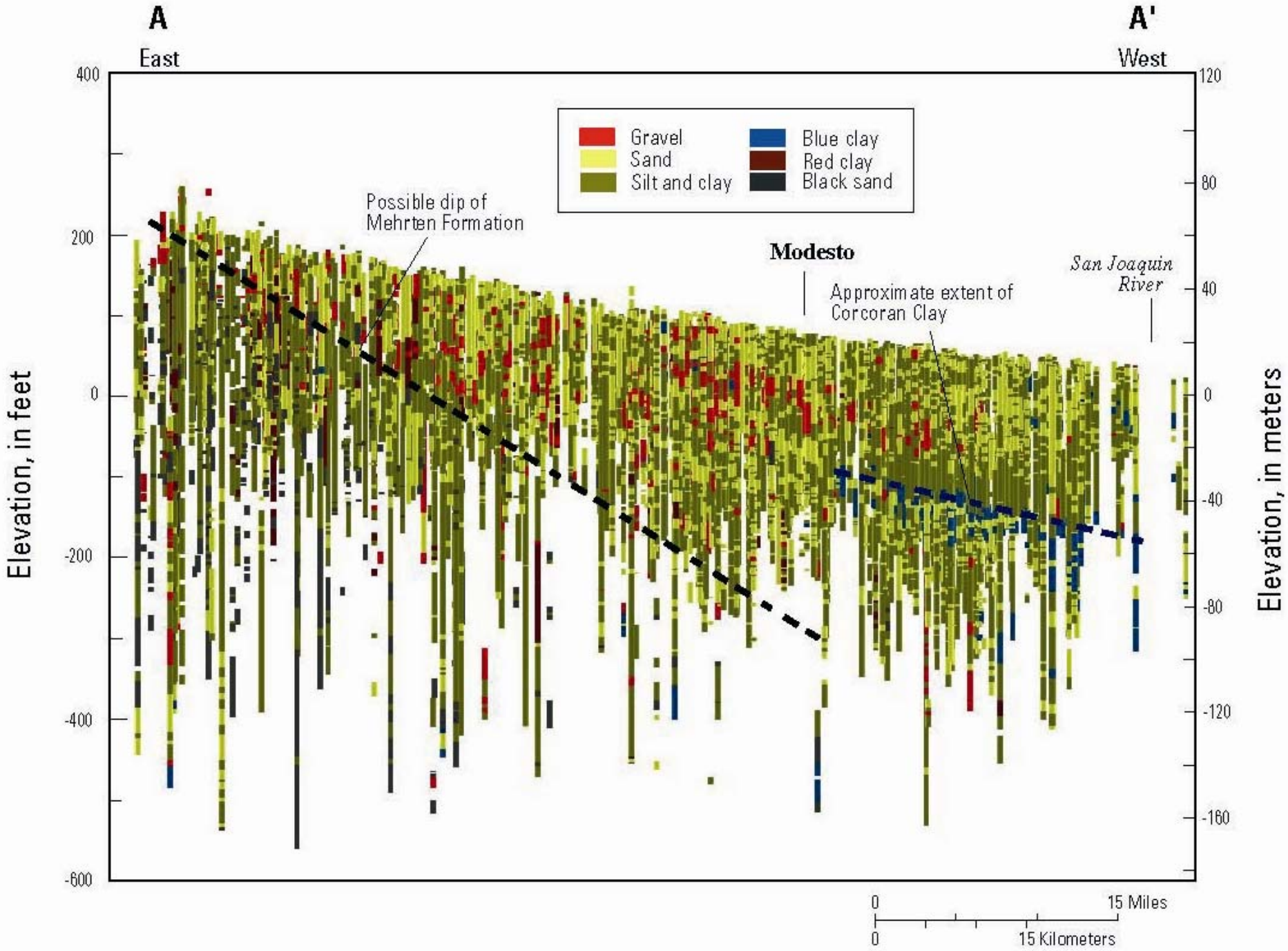
Hydrogeologic properties based on textural analysis

Digitized 8488 well logs



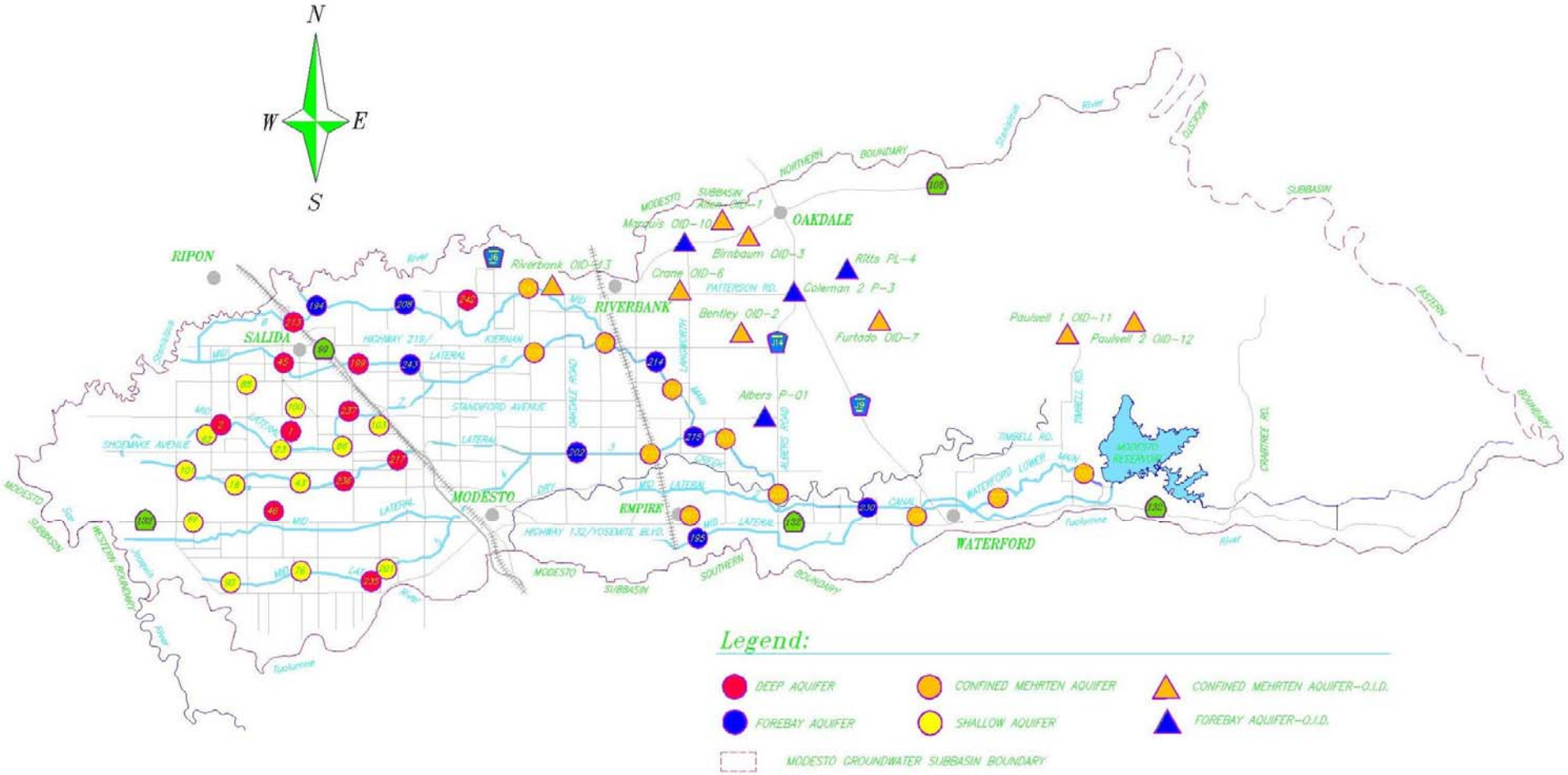

121°15'
121°00'
120°45'
120°30'
37°45'
37°30'
Stanislaus River
Oakdale
A
Riverbank
SAN JOAQUIN CO
STANISLAUS CO
Modesto Reservoir
Dry Creek
Vernalis
Modesto
Waterford
A'
Tuolumne River
Turlock Lake
San Joaquin
River
Turlock
STANISLAUS CO
MERCED CO
Merced
River
0
5
10 Miles
0
5
10 Kilometers

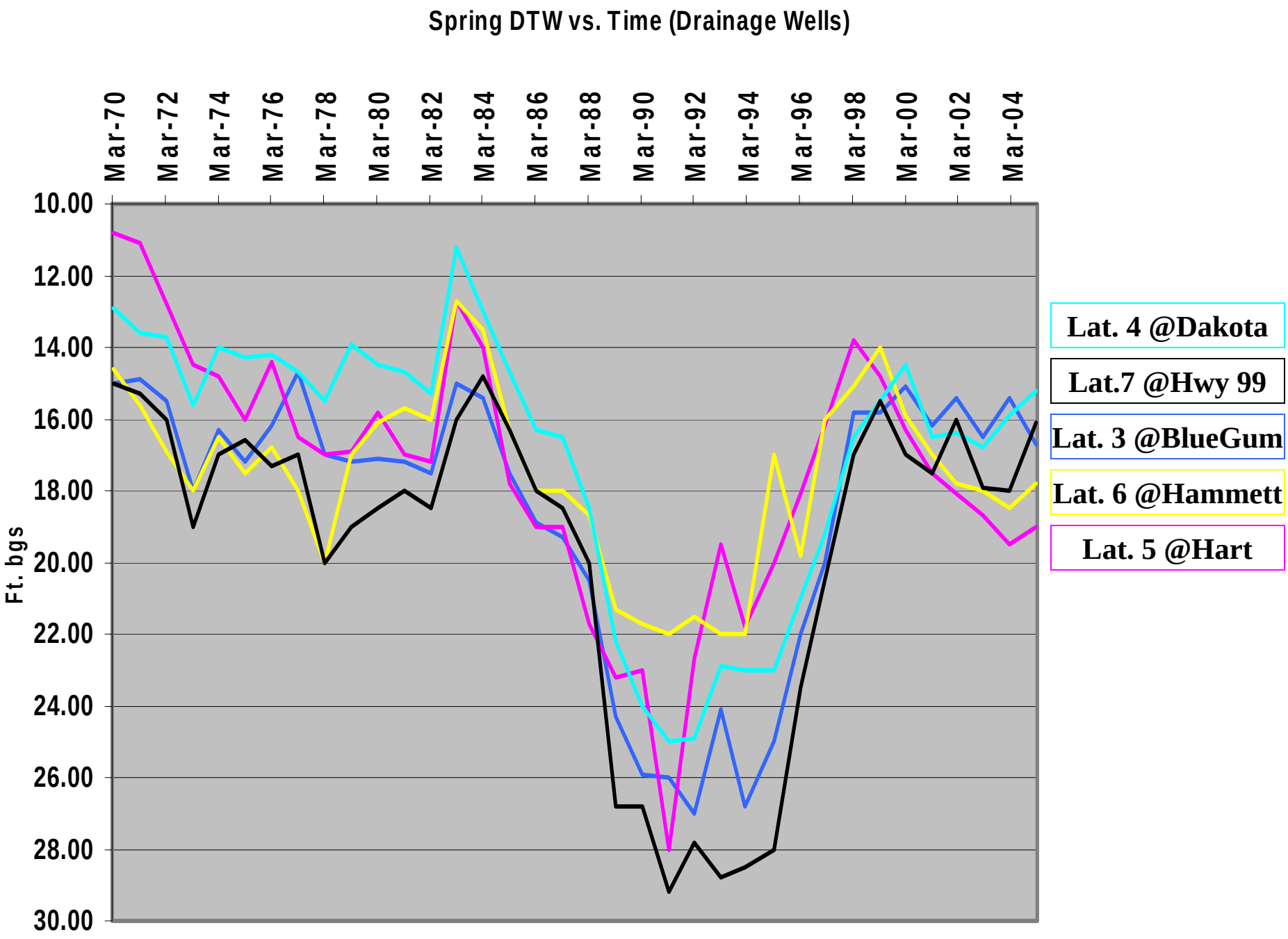

121°15'
121°00'
120°45'
120°30'
37°45'
37°30'
Possible thin or missing Corcoran Clay
Stanislaus River
Oakdale
Riverbank
SAN JOAQUIN CO
STANISLAUS CO
3S/9E-33
3S/9E-25
3S/10E-30
MID test hole
Modesto
Dry Creek
Waterford
Modesto Reservoir
Tuolumne River
Turlock Lake
STANISLAUS CO
MERCED CO
Turlock
Merced River
0
5
10 Miles

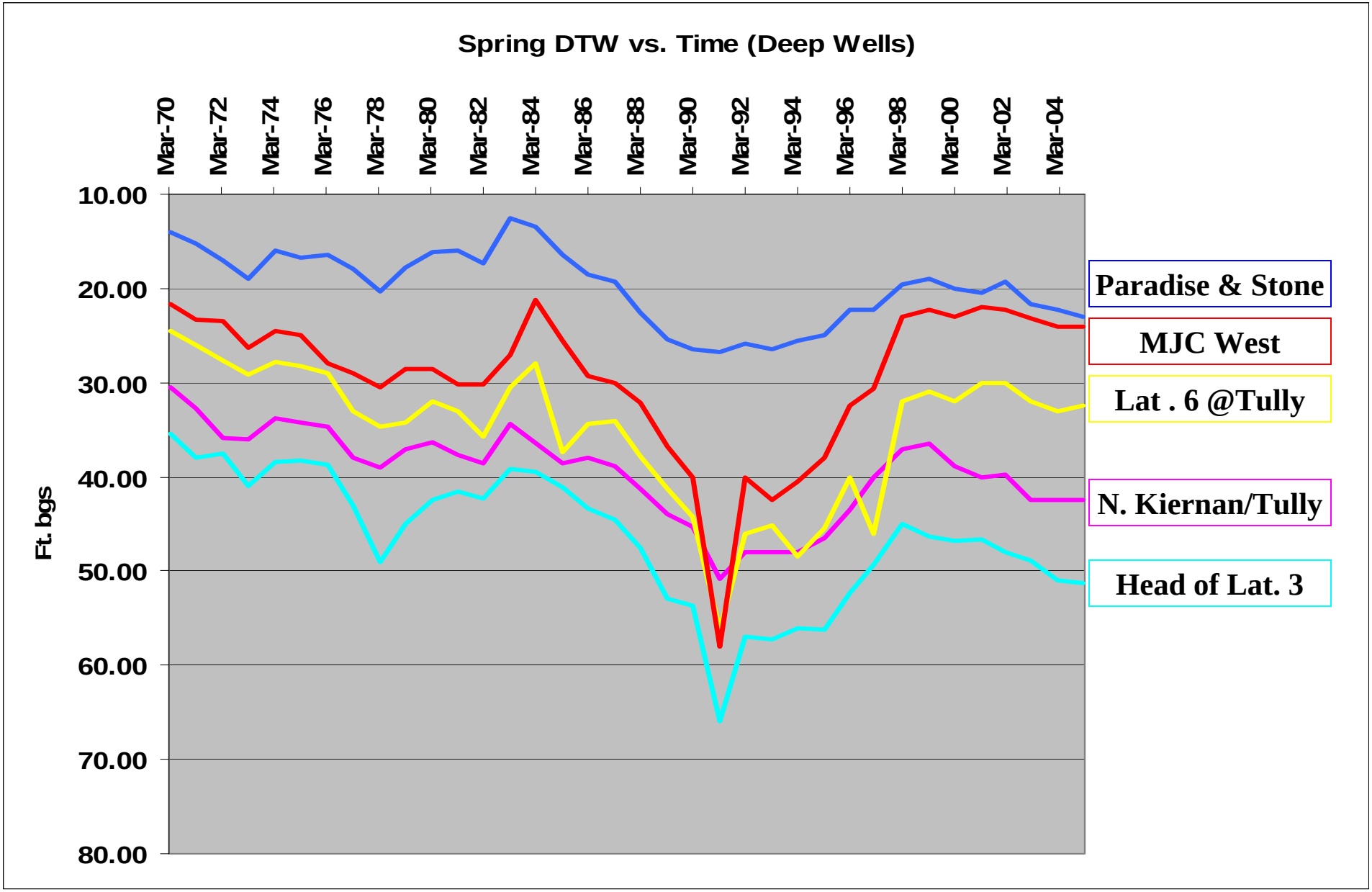

A
East
A'
West
Gravel
Sand
Silt and clay
Blue clay
Red clay
Black sand
Possible dip of
Mehrten Formation
Modesto
Approximate extent of
Corcoran Clay
San Joaquin
River
Elevation, in feet
Elevation, in meters
400
200
0
-200
-400
-600
120
80
40
0
-40
-80
-120
-160
0
15 Miles
0
15 Kilometers

Groundwater Level Monitoring

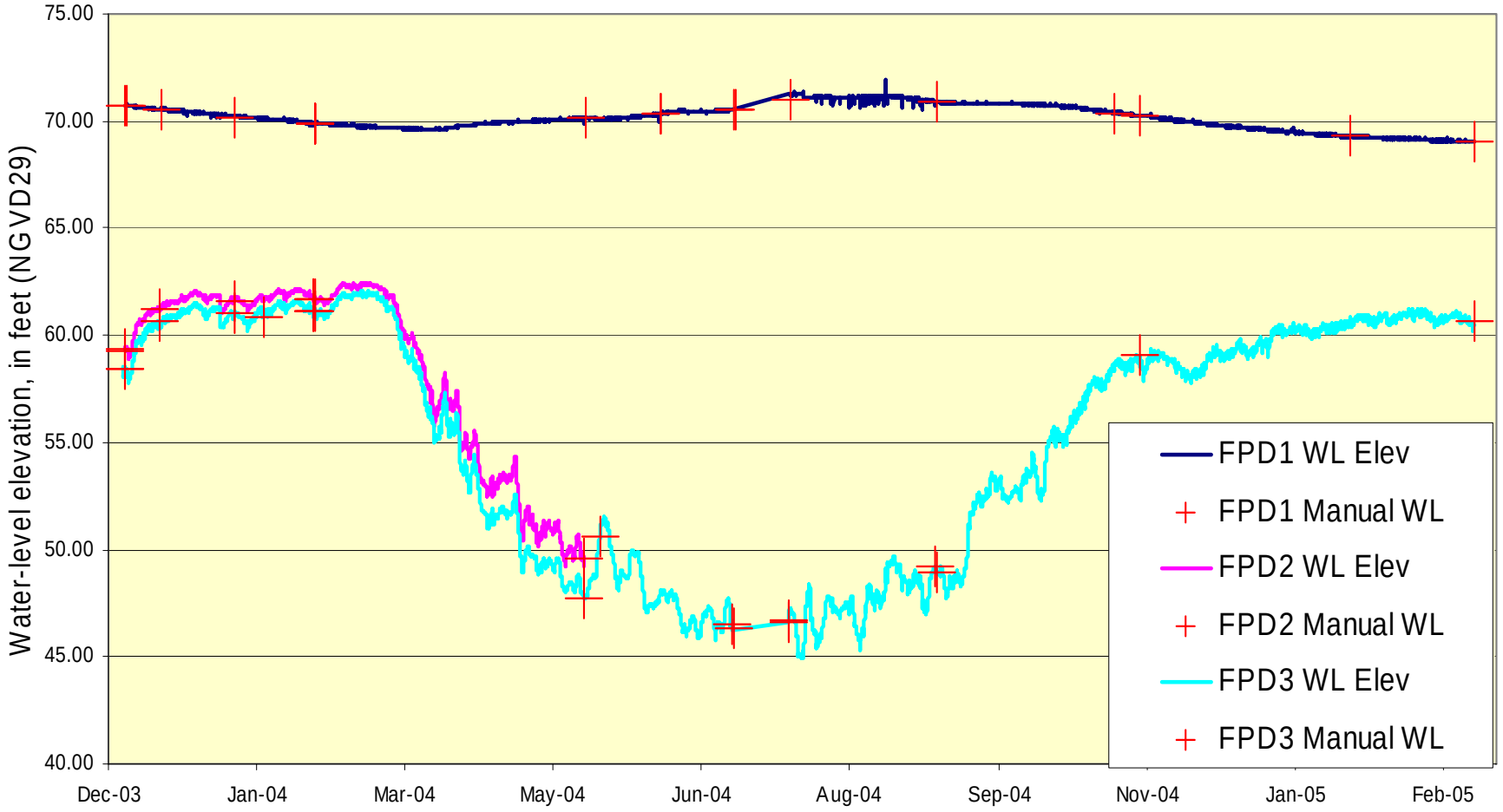
- Standardized measurement protocols and reporting formats among members
- Compiled monitor wells into centralized database
- STRGBA member agencies share data (spring and fall measurements)
- Data Gaps existing in eastern basin


N
W
E
S
RIPON
SALIDA
RIVERBANK
OAKDALE
MODESTO
EMPIRE
WATERFORD
MODESTO RESERVOIR
Riverbank OID-13
Albers OID-1
Marquis OID-10
Birnbaum OID-3
Ritts PL-4
Crane OID-6
Coleman 2 P-3
Bentley OID-2
Furtado OID-7
Paulsell 1 OID-11
Paulsell 2 OID-12
Albers P-01
NORTHERN BOUNDARY
SUBBASIN
MODESTO SUBBASIN
WESTERN BOUNDARY
SOUTHERN BOUNDARY
EASTERN BOUNDARY
HIGHWAY 219/
KIERNAN
LATERAL
STANDIFORD AVENUE
SHOEMAKE AVENUE
HIGHWAY 132/YOSEMITE BLVD.
PATTERSON RD.
ORCHARD AVENUE
LAWRENCE
ALBERS ROAD
TIMBELL RD.
CRABTREE RD.
WATERFORD LOWER MAIN CANAL
Stanislaus River
Tuolumne River
Legend:
DEEP AQUIFER
FOREBAY AQUIFER
CONFINED MEHRTEN AQUIFER
SHALLOW AQUIFER
CONFINED MEHRTEN AQUIFER-O.I.D.
FOREBAY AQUIFER-O.I.D.
MODESTO GROUNDWATER SUBBASIN BOUNDARY

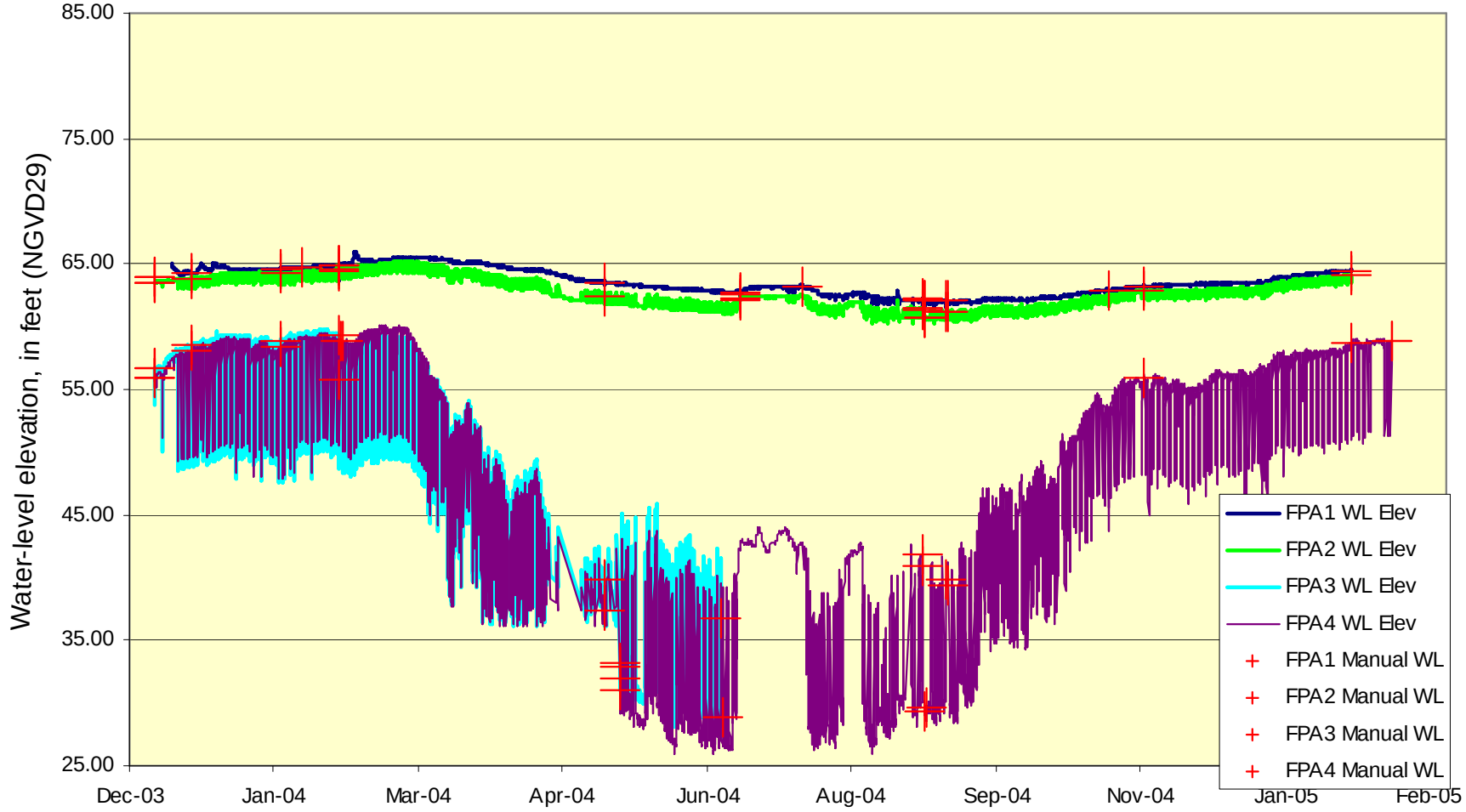

Spring DTW vs. Time (Drainage Wells)
Mar-70
Mar-72
Mar-74
Mar-76
Mar-78
Mar-80
Mar-82
Mar-84
Mar-86
Mar-88
Mar-90
Mar-92
Mar-94
Mar-96
Mar-98
Mar-00
Mar-02
Mar-04
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
26.00
28.00
30.00
Ft. bgs
Lat. 4 @Dakota
Lat.7 @Hwy 99
Lat. 3 @BlueGum
Lat. 6 @Hammett
Lat. 5 @Hart


Spring DTW vs. Time (Deep Wells)
Mar-70
Mar-72
Mar-74
Mar-76
Mar-78
Mar-80
Mar-82
Mar-84
Mar-86
Mar-88
Mar-90
Mar-92
Mar-94
Mar-96
Mar-98
Mar-00
Mar-02
Mar-04
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
Ft. bgs
Paradise & Stone
MJC West
Lat . 6 @Tully
N. Kiernan/Tully
Head of Lat. 3

Water level elevation – Ag (north of Modesto)



Water level elevation – urban (adj to MOD25)



What we don’t know

- Aquifer system “Safe Yield”
  - Sustainability question
- Groundwater/Surface Water relations
  - Induced infiltration?
- Incised valley-fill deposit (relic Tuolumne riverbed?)
  - Location/connections with aquifer, preferred travel paths?
- Eastern Stanislaus County groundwater mining impacts
  - What is sustainable/What are alternatives?

Ongoing Planning Activities

- Continue water level data collection program (CASGEM)
- Continue to work with USGS
  - Scenario analysis
- Continue to implement other elements of the GWMP
  - Explore funding sources (e.g. DWR)
- Continue Public Education and distribution of information to policy makers

QUESTIONS
&
DISCUSSION