Groundwater modeling analysis

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Model development for data request

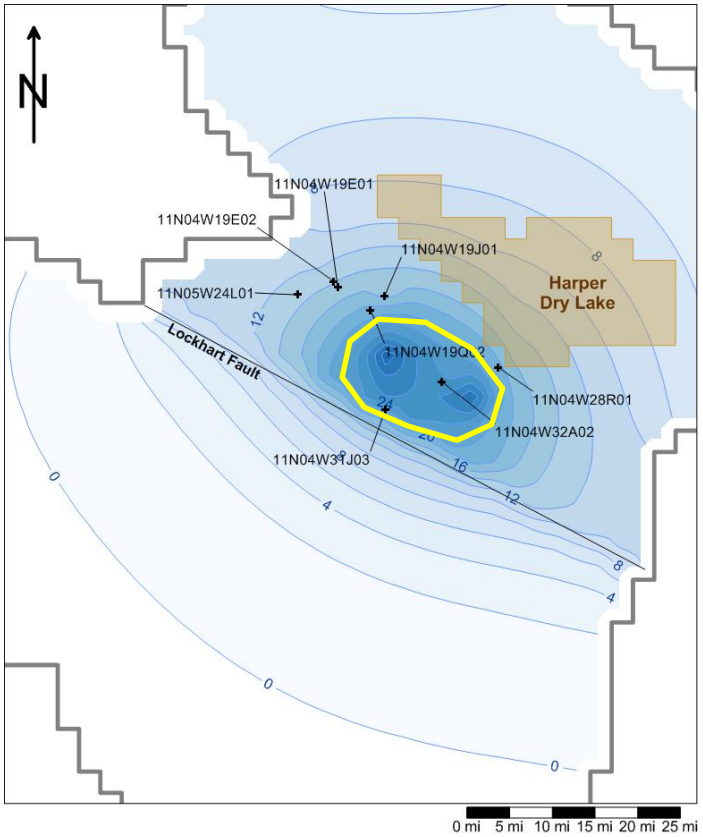
- Layne responded to original data request by adapting the Stamos model of the Mojave basin
- Model was calibrated by USGS to the transient data for 1931-1992, validated to 1998
- Layne extended the model time to 2050, ran 3 predictive scenarios:
  - No additional pumping
  - Addition of Abengoa pumping
  - Addition of Abengoa pumping, plus 10% increase in other Harper Valley wells

Review of updated model

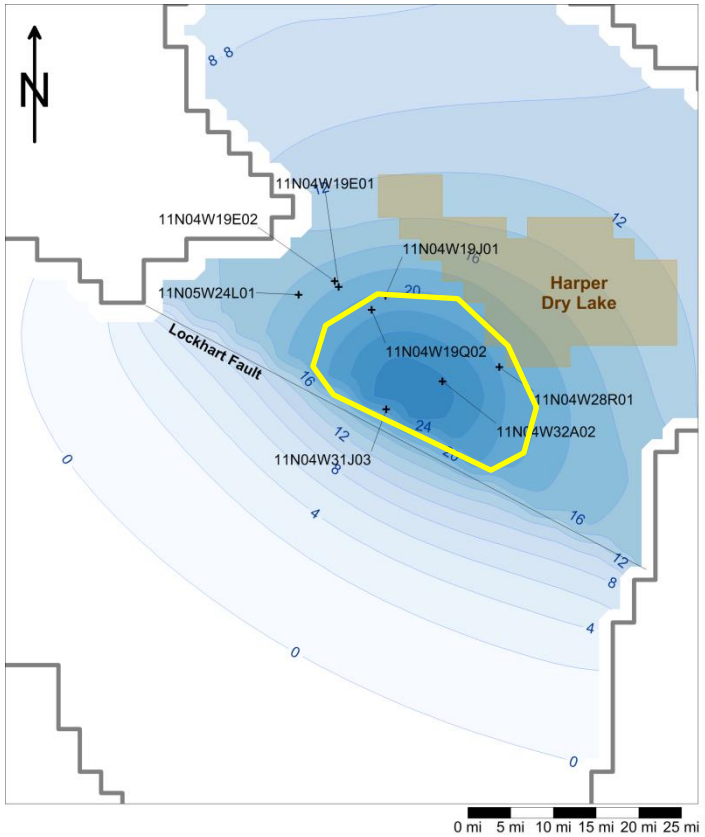
- Review of the updated USGS model identified two issues related to the conversion of the Stamos model
  - The steady-state 1931 model files included a 60 cfs recharge well (the text of USGS WRIR 01-4002 reported 10 cfs)
  - The first stress period length was improperly converted by Groundwater Vistas
- Neither of these issues were expected to significantly change the model results
- The change to the steady-state 1931 model only affects initial conditions for the transient predictive runs

2042 difference results

Before review



Corrected 1931 initial condition



Issue: Travel times (DR 22)

- CEC requested that the pathline plot for groundwater travel (Figure 22 A-2) trajectories from Harper Dry Lake be modified to identify travel times
  - Model has been modified
  - Internal errors from Groundwater Vistas have prevented completion of this task at this time
  - We will respond as soon as possible
  - We provide the Stamos travel time plot for comparison

Pathline analysis for 1931 ambient conditions; 1000 years between dots

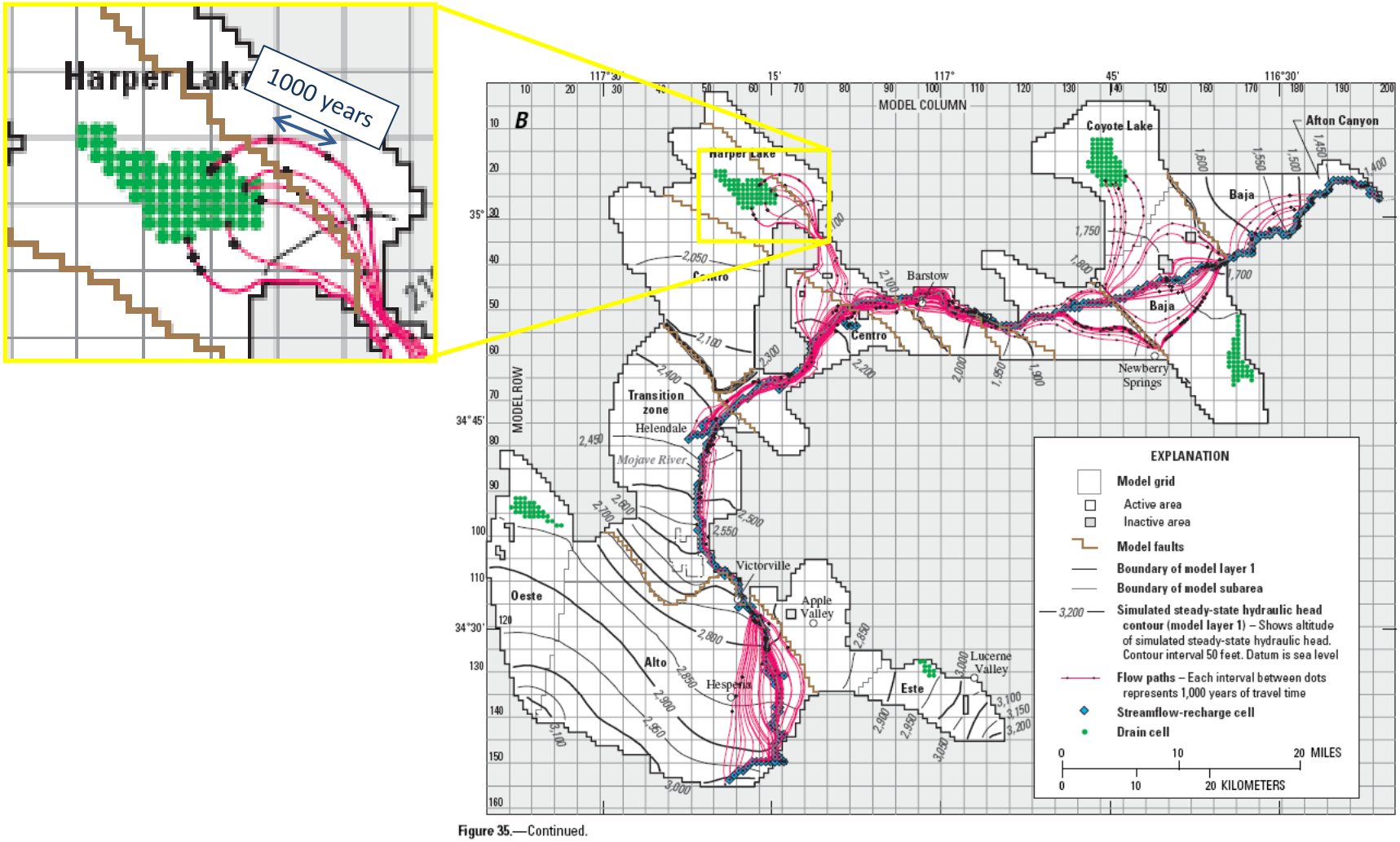
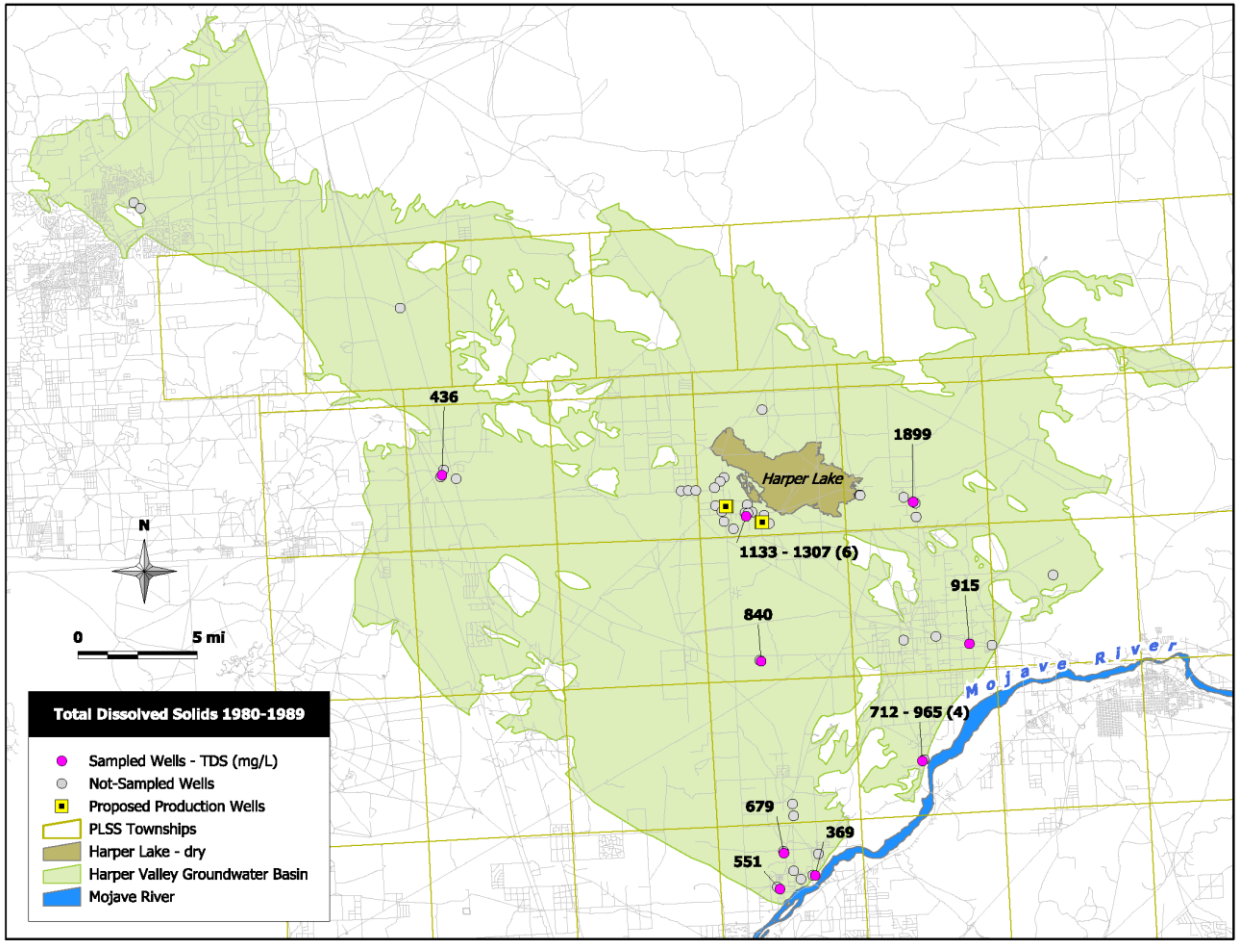


Figure 35.—Continued.

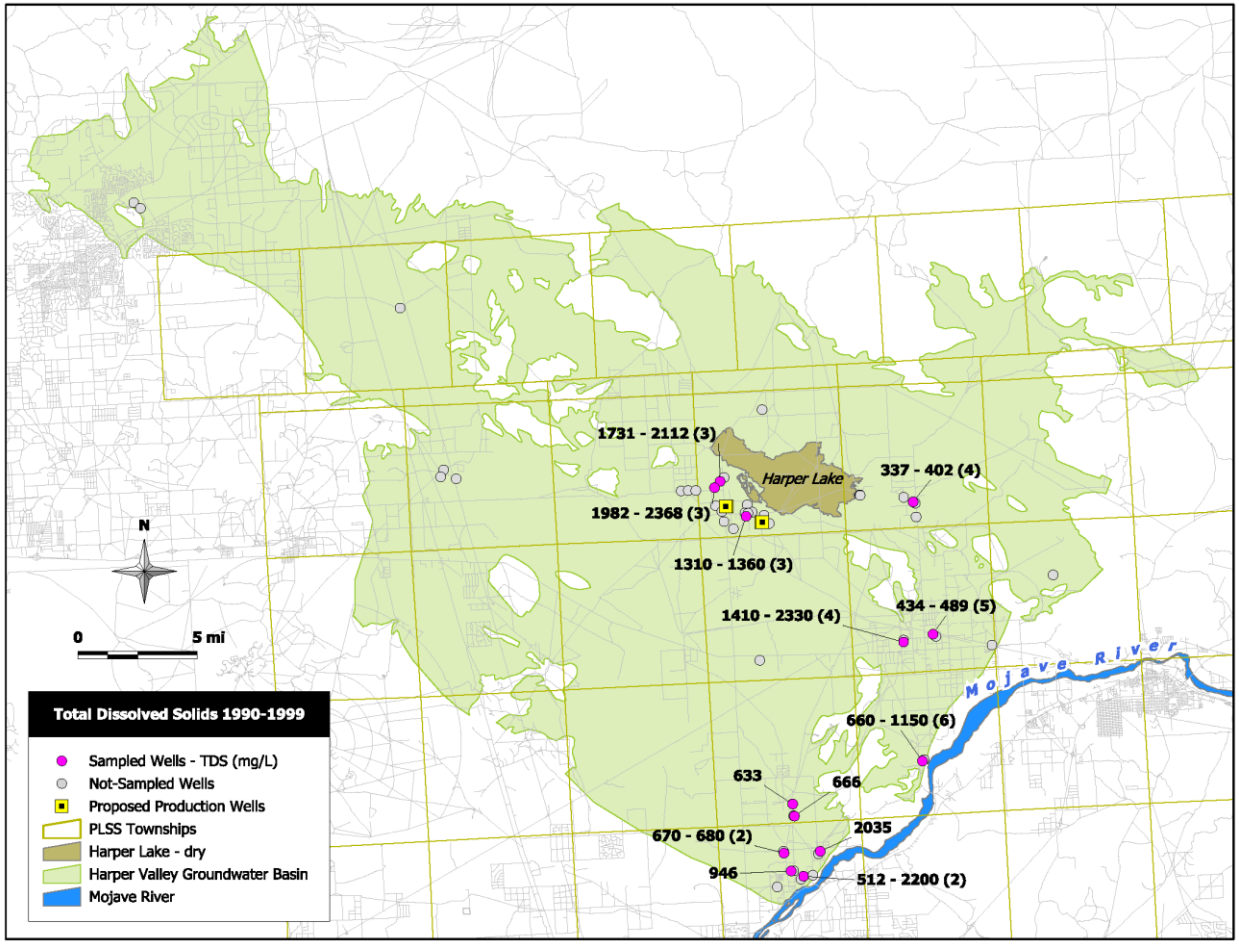
Issue: Predicting TDS in wells (DR 21)

- CEC requested specific predictions of TDS in the Abengoa wells
- Major concern was whether TDS exceeds the 1500 mg/l threshold
- We examined the available data for three decades: 1980s, 1990s, 2000s
  - Summarized the range of measurements at specific wells over each decade
  - Superimposed the summary on a map of HVGB

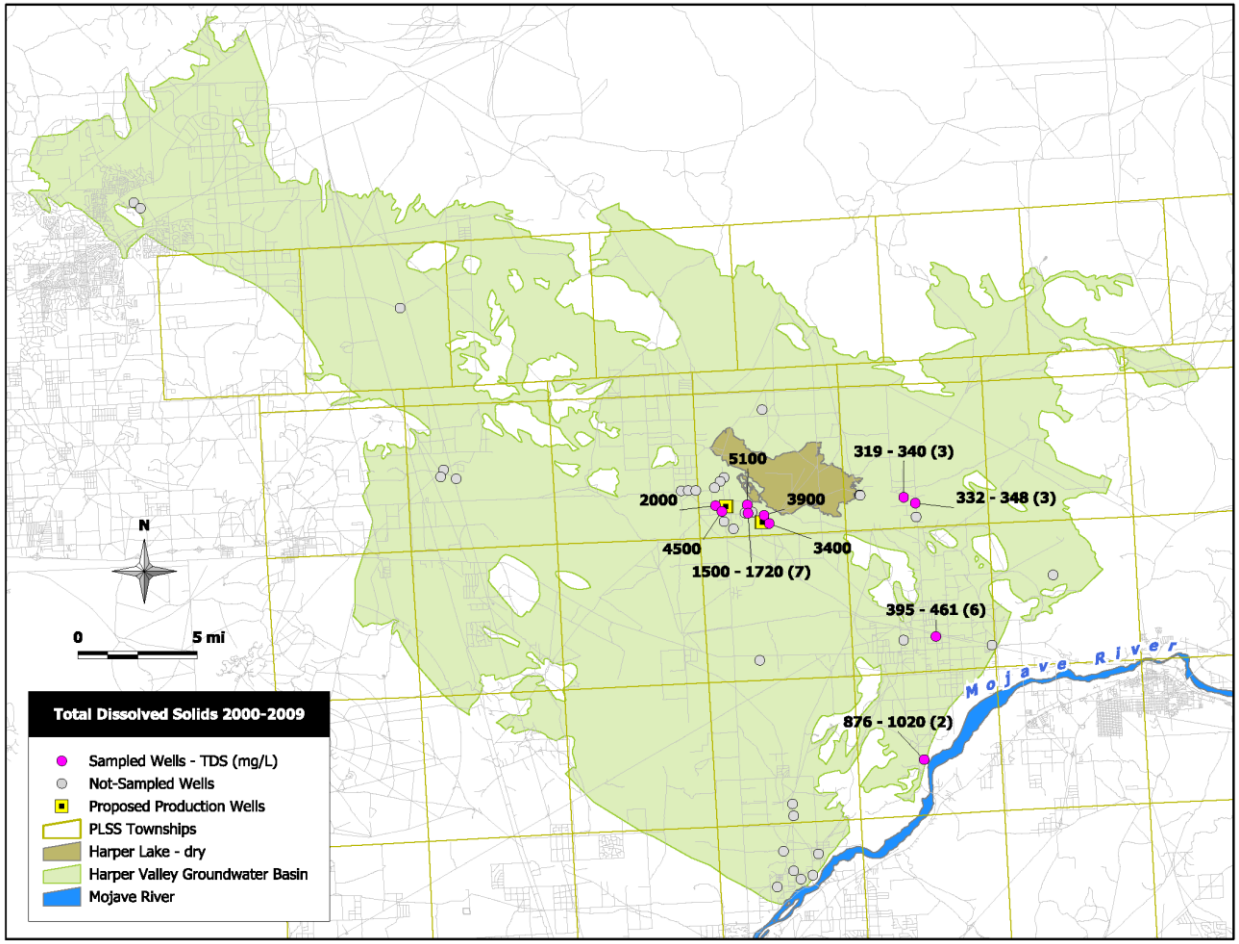
In the 1980s, nearby measurements ranged from 1133-1307 mg/l



In the 1990s, nearby measurements ranged from 1310-2368 mg/l



In the 2000s, nearby measurements ranged from 1500-5100 mg/l



Water-quality trends

- In general, measured TDS concentrations in the vicinity of the Abengoa site have increased over the 1980-2010 time period
  - Specific predictions are complicated
  - Not all wells were sampled over the entire time period
  - No reported measurements near the project site with TDS < 1500 mg/l over the 2000-2010 time period
- It is unlikely that the Abengoa wells will produce water with TDS < 1500 mg/l

Issue: Water budget (DR 31)

- Reviewers and Layne had slightly differing areas of interest for the water budget comparisons
  - John Fio provided a ZONBUD file for use in budget computations
  - We have extracted budget values from the predictive runs using the provided budget file

Zone budget for Zone 16 (flows in cfs)

```
Flow Budget for Zone 16 at Time Step   4 of Stress Period 224
---------------------------------------------------------------

               Budget Term     Flow (L**3/T)
               ----------------------------

                           IN:
                           ---
                   STORAGE =   0.77225
                CONSTANT HEAD =    0.0000
                    WELLS =    1.4523
                   DRAINS =    0.0000
                  RECHARGE =   0.27240
                     ET =    0.0000
               STREAM LEAKAGE =    0.0000
              STREAM FLOW OUT  =    0.0000
              HEAD DEP BOUNDS =    0.0000
              Zone  15 to  16 =    7.7133

                  Total IN =    10.210

                           OUT:
                           ----
                   STORAGE =    2.6279
                CONSTANT HEAD =    0.0000
                    WELLS =    7.5800
                   DRAINS =    0.0000
                  RECHARGE =    0.0000
                     ET =    0.0000
               STREAM LEAKAGE =    0.0000
              STREAM FLOW OUT  =    0.0000
              HEAD DEP BOUNDS =    0.0000
              Zone  16 to  15 =    0.0000

                 Total OUT =    10.208
                IN - OUT =   0.22587E-02
          Percent Discrepancy =                0.02
```