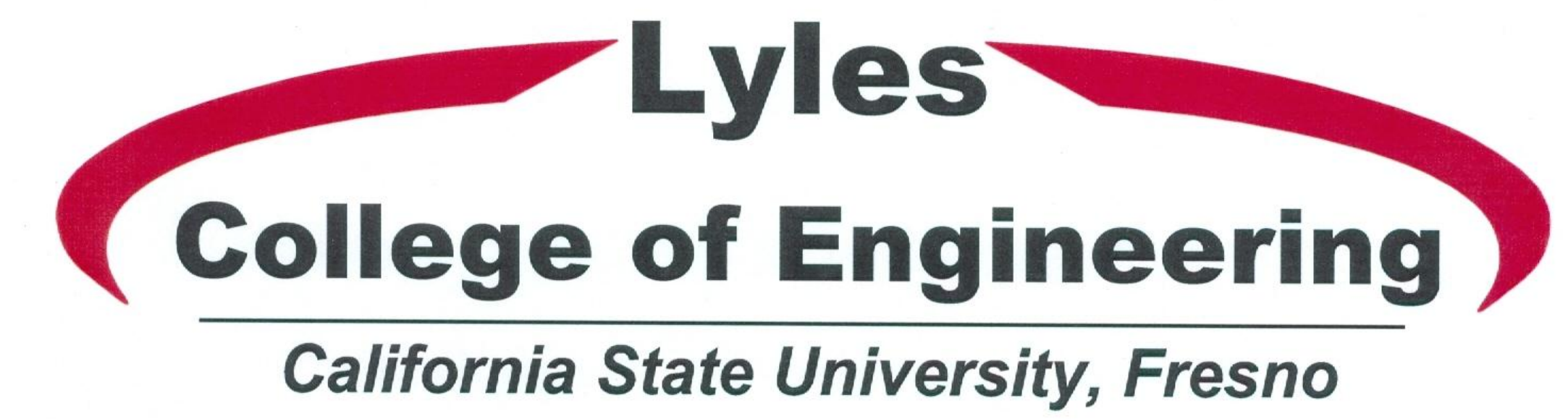




# Civil Engineering

## Recharge Effects on Nitrate Levels

Students: David Halopoff  
Advisors: Dr. Lubo Liu



### Abstract

- THE NUMBER OF WELLS THAT EXCEEDED THE HEALTH LIMIT FOR NITRATES JUMPED FROM NINE IN 1980 TO 648 IN 2007 (SCOTT, 2010)
- IN THE SAN JOAQUIN VALLEY 35 PERCENT OF THE RESIDENTS EXPERIENCE PROBLEMATIC NITRATE LEVELS IN THEIR DRINKING WATER (SCOTT, 2011)
- DRINKING NITRATE CONTAMINATED WATER CAN CAUSE BLUE BABY DISEASE AND LEAD TO CANCER
- IRRIGATION DISTRICTS ARE BEGINNING TO IMPLEMENT LARGE DETENTION BASINS TO STORE EXTRA IRRIGATION WATER
- THE EXTRA IRRIGATION WATER IS ALLOWED TO SIT IN THE DETENTION BASINS TO PERCOLATE/INFILTRATE INTO THE GROUNDWATER AQUIFERS
- IRRIGATION WATER CAN CONTAIN WATER FROM MULTIPLE SOURCES (CANALS, LAKES, RIVERS, RUNOFF, ETC)
- THIS PROCESS IS CURRENTLY NOT REGULATED AND THE QUALITY OF WATER BEING PERCOLATED IS UNKNOWN
- CURRENTLY THE AGRICULTURE AND DAIRY SECTORS ARE BEING BLAMED FOR THE CURRENT NITRATE PROBLEMS
- IRRIGATION DISTRICTS PERCOLATING LARGE AMOUNTS OF NITRATE CONTAMINATED WATER CAN POSE MAJOR PROBLEMS

### Project

- FOCUS IS BEING PLACED ON A DETENTION/PERCOLATION BASIN FOR LOWER TULE RIVER IRRIGATION DISTRICT
    - HUDDLESTON SAND PIT
    - LOCATED APPROXIMATELY 0.75 MILES FROM THE CENTER OF WOODVILLE, CALIFORNIA
    - OCCUPIES 40 AC
  - USE MASS BALANCE TO DETERMINE THE AMOUNT OF WATER INFILTRATED INTO THE GROUNDWATER AQUIFER
  - OBTAIN PUBLIC WATER SYSTEM WATER QUALITY DATA FROM CAL-DPH FOR SITES NEAR WOODVILLE, CA
  - CORRELATE THE TRENDS OF NITRATE CONTAMINATION TO THE RATES OF WATER INFILTRATION IN THE DETENTION BASIN
  - DETERMINE IF THE IRRIGATION DISTRICT'S RECHARGE EFFORTS ARE POSITIVELY OR NEGATIVELY EFFECTING THE NITRATE LEVELS NEAR THE DETENTION BASIN
- FACTORS:
- THE NITRATE CONCENTRATION OF THE WATER IN THE DETENTION BASIN IS UNKNOWN
  - THE SOIL QUALITY THAT THE WATER IS MOVING THROUGH IS UNKNOWN
  - THE LOCATIONS OF WELL TESTING SITES ARE NOT OPEN TO THE PUBLIC DUE TO CALIFORNIA WATER LAWS; FOR THE STUDY THE WATER DISTRIBUTION SYSTEM'S ADDRESS IS BEING USED

### Site Descriptions

- SITE 1:  
CITY OF WOODVILLE – 2 WELLS
- 5410025-002
  - 5410025-004
  - USE THE CENTER OF WOODVILLE, CA FOR GEOGRAPHIC REPRESENTATION
- SITE 2:  
WOODVILLE FARM LABOR CENTER – 2 WELLS
- 5400792-001
  - 5400792-002
  - USE 16153 RD 192 WOODVILLE, CA 93257 FOR GEOGRAPHIC REPRESENTATION
- A TOTAL OF 116 NITRATE TEST RESULTS SINCE JANUARY 2006

- HUDDLESTON SAND PIT:
- LOCATED IN AN OLD RIVER BED, SOIL TYPE IS PRIMARILY SANDY LOAM
  - USE LOWER TULE RIVER IRRIGATION DISTRICT RECORDS FOR INFLOWS INTO THE DETENTION BASIN FROM 2008-2011

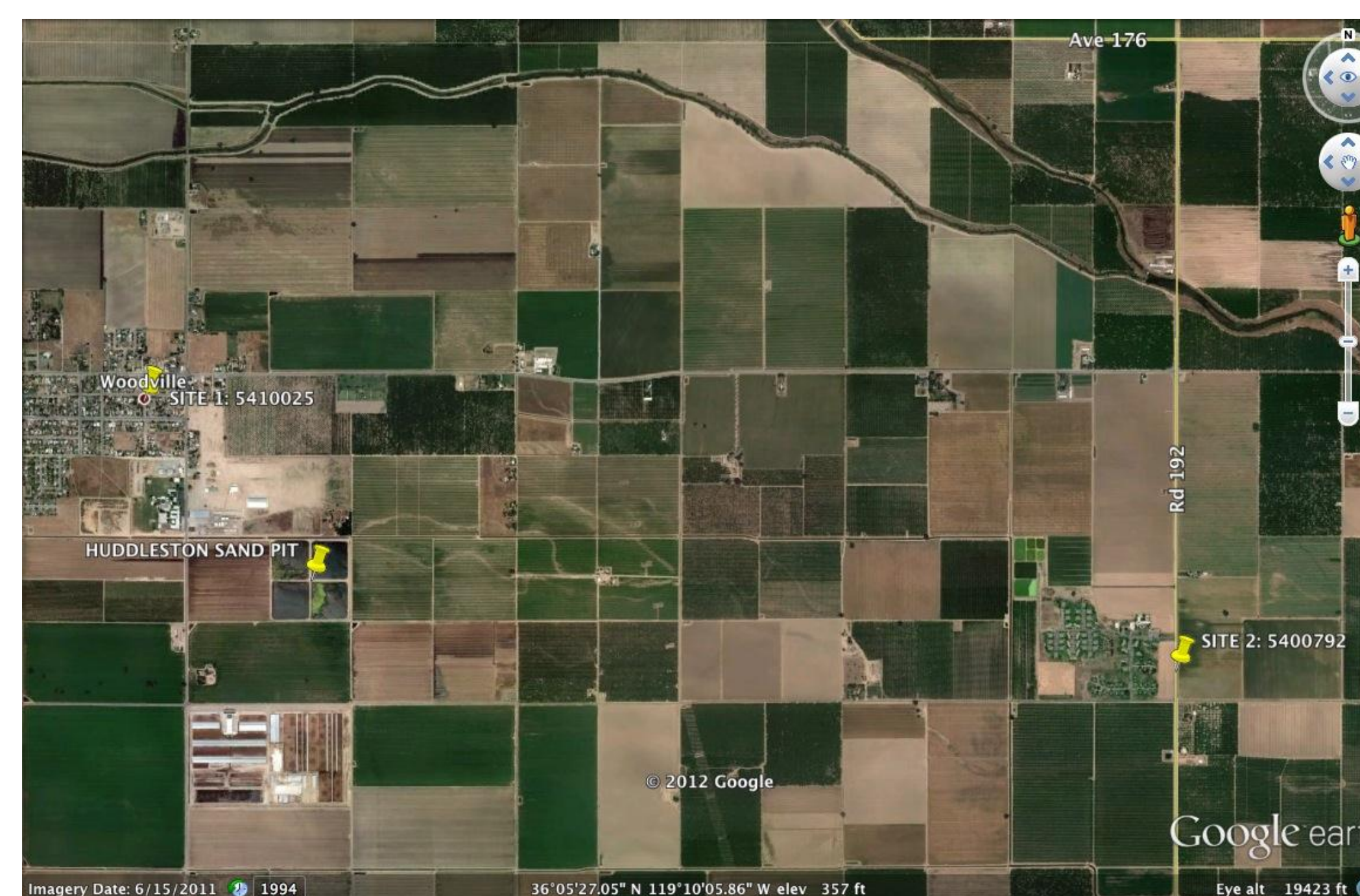
### Water Balance/Percolation Calculation

#### DETENTION BASIN MASS BALANCE

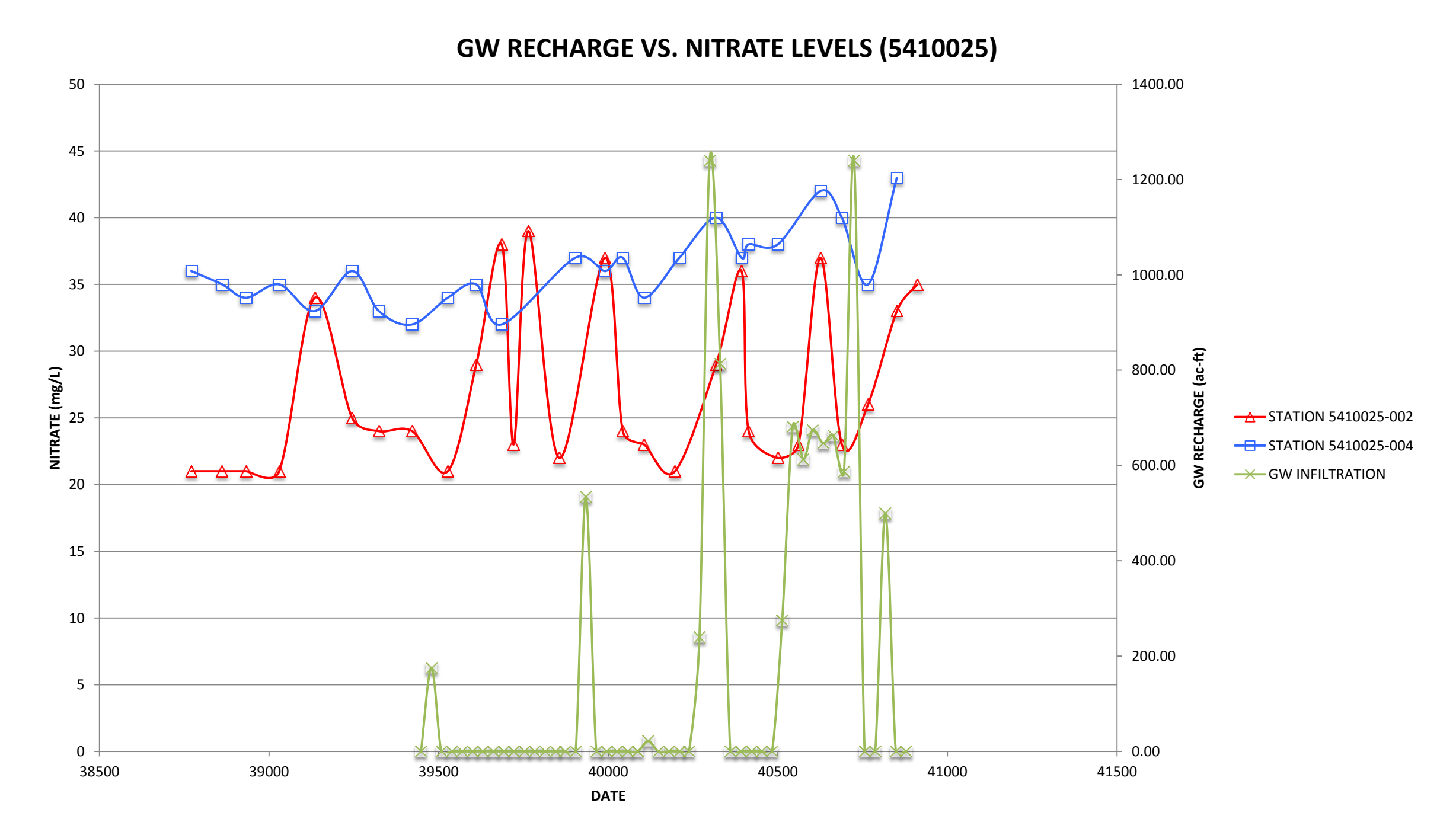
- E<sub>T0</sub> VALUES ARE WEIGHTED DEPENDING ON THE TIME OF MONTH THE DETENTION BASIN RECEIVED WATER
- IF THE MAXIMUM POSSIBLE INFILTRATION OF THE BASIN WAS GREATER THAN INFLOW AND THE E<sub>T0</sub> DEDUCTIONS, IT IS ASSUMED THE TOTAL WATER REMAINING INFILTRATED THE GROUND WATER AQUIFER
- USE A TYPICAL DESIGN INFILTRATION RATE FOR SANDY LOAM OF 0.5 IN/HR (BANNERMAN, 2004)
- USE CALIFORNIA IRRIGATION MANAGEMENT INFORMATION SYSTEM (CIMIS) E<sub>T0</sub> VALUES FOR ZONE 12

MONTH	0 (ac-ft)	E <sub>T</sub> (ac-ft)	INF (ac-ft)	I (ac-ft)
Jan-08	0.00	0.00	0.00	0.00
Feb-08	176.40	1.40	175.00	0.00
Mar-08	0.00	0.00	0.00	0.00
Apr-08	0.00	0.00	0.00	0.00
May-08	0.00	0.00	0.00	0.00
Jun-08	0.00	0.00	0.00	0.00
Jul-08	0.00	0.00	0.00	0.00
Aug-08	0.00	0.00	0.00	0.00
Sep-08	0.00	0.00	0.00	0.00
Oct-08	0.00	0.00	0.00	0.00
Nov-08	0.00	0.00	0.00	0.00
Dec-08	0.00	0.00	0.00	0.00
Jan-09	0.00	0.00	0.00	0.00
Feb-09	0.00	0.00	0.00	0.00
Mar-09	0.00	0.00	0.00	0.00
Apr-09	0.00	0.00	0.00	0.00
May-09	551.40	5.07	546.33	0.00
Jun-09	0.00	0.00	0.00	0.00
Jul-09	0.00	0.00	0.00	0.00
Aug-09	0.00	0.00	0.00	0.00
Sep-09	0.00	0.00	0.00	0.00
Oct-09	0.00	0.00	0.00	0.00
Nov-09	27.70	5.61	22.09	0.00
Dec-09	0.00	0.00	0.00	0.00
Jan-10	0.00	0.00	0.00	0.00
Feb-10	0.00	0.00	0.00	0.00
Mar-10	0.00	0.00	0.00	0.00
Apr-10	270.66	1.40	269.26	0.00
May-10	1396.40	22.71	1373.69	102.91
Jun-10	0.00	0.00	0.00	0.00
Jul-10	0.00	0.00	0.00	0.00
Aug-10	0.00	0.00	0.00	0.00
Sep-10	0.00	0.00	0.00	0.00
Oct-10	0.00	0.00	0.00	0.00
Nov-10	0.00	0.00	0.00	0.00
Dec-10	276.51	1.24	275.27	0.00
Jan-11	685.75	4.13	681.62	0.00
Feb-11	619.39	6.53	612.86	0.00
Mar-11	685.71	11.97	673.74	0.00
Apr-11	669.63	17.90	651.73	0.00
May-11	685.71	22.73	662.98	0.00
Jun-11	612.87	26.90	585.97	0.00
Jul-11	343.33	8.06	335.27	0.00
Aug-11	0.00	0.00	0.00	0.00
Sep-11	0.00	0.00	0.00	0.00
Oct-11	506.40	6.80	499.60	0.00
Nov-11	0.00	0.00	0.00	0.00
Dec-11	0.00	0.00	0.00	0.00
<b>TOTAL</b>	<b>8005.15</b>			

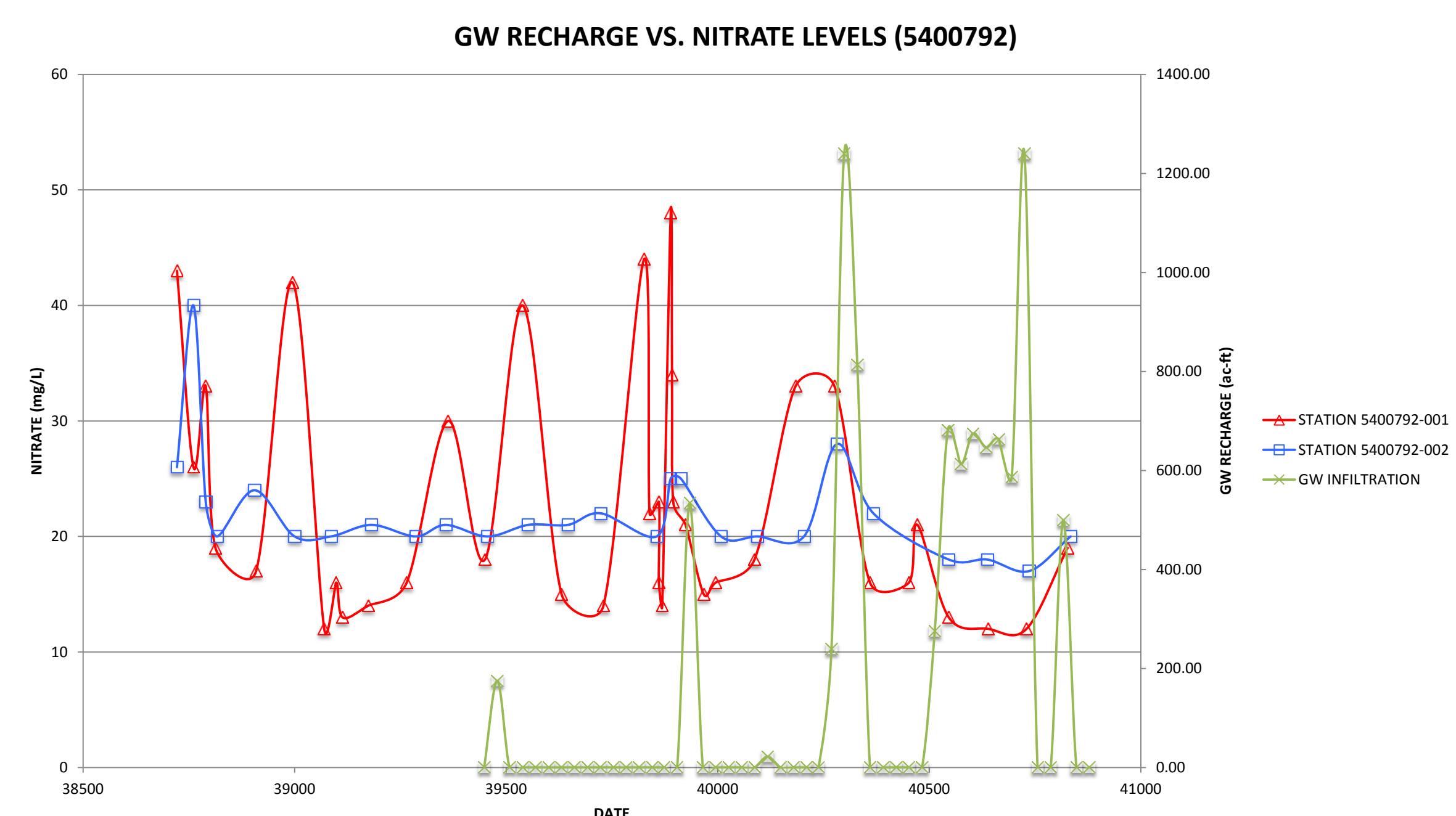
### Site Locations



### Recharge Effects



### Recharge Effects



### Conclusion

- SINCE 2008 LOWER TULE RIVER IRRIGATION HAS RECHARGED ABOUT 8100 AC-FT OF WATER INTO THE GROUND WATER AQUIFER NEAR WOODVILLE, CA
- SITE 1: 5410025
  - WHEN COMPARING THE GROUND WATER RECHARGE TO THE NITRATE LEVELS THE RECHARGE EFFORTS HAVE A POSITIVE EFFECT ON THE NITRATE LEVELS IN BOTH WELLS
  - AFTER THE INFILTRATION PEAKS THE NITRATE LEVELS DROP FOR A SHORT AMOUNT OF TIME BEFORE RETURNING TO NORMAL LEVELS FOR EACH RESPECTIVE WELL
- SITE 2: 5400792
  - WHEN COMPARING THE GROUND WATER RECHARGE TO THE NITRATE LEVELS THE RECHARGE EFFORTS HAVE AN EXTREME POSITIVE EFFECT OF THE NITRATE LEVELS
  - THE NITRATE LEVELS FOR WELL 5400792-001 HAVE SIGNIFICANTLY DROPPED SINCE THE IMPLEMENTATION OF THE DETENTION BASIN
  - THE NITRATE LEVELS FOR WELL 5400792-002 HAVE ALSO SLIGHTLY DROPPED SINCE THE IMPLEMENTATION OF THE DETENTION BASIN

**THE GROUND WATER RECHARGE EFFORTS OF LOWER TULE RIVER IRRIGATION DISTRICT HAVE POSITIVELY EFFECTED THE NITRATE LEVELS NEAR WOODVILLE, CA**

### References

Scott, J. (2010). Nitrate contamination spreading in California communities. Retrieved 01, 20, 2012, from <http://californiawatch.org/nitrate-contamination-spreading-california-communities>

Scott, J. (2011). Report Warns of increased nitrate risk in drinking water. Retrieved 01, 20, 2012, from <http://californiawatch.org/dailyreport/report-warns-increased-nitrate-risk-drinking-water-9287>

Bannerman, R. (2004). Site Evaluation for Stormwater Infiltration. Retrieved 04, 21, 2012, from <http://dnr.wi.gov/runoff/stormwater/post-constr/SiteEvaluation.pdf>