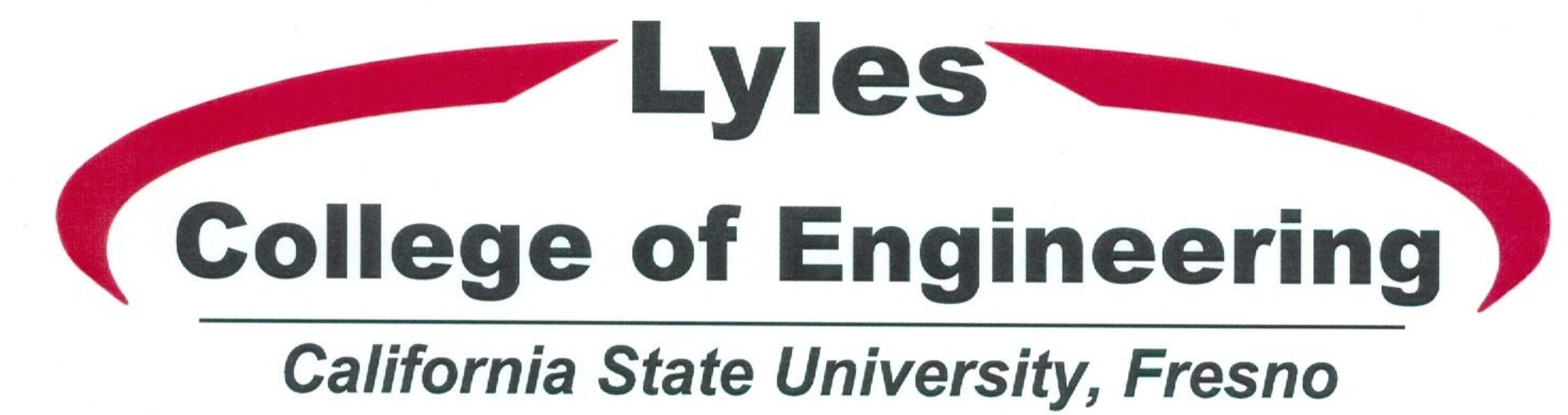




Civil Engineering

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

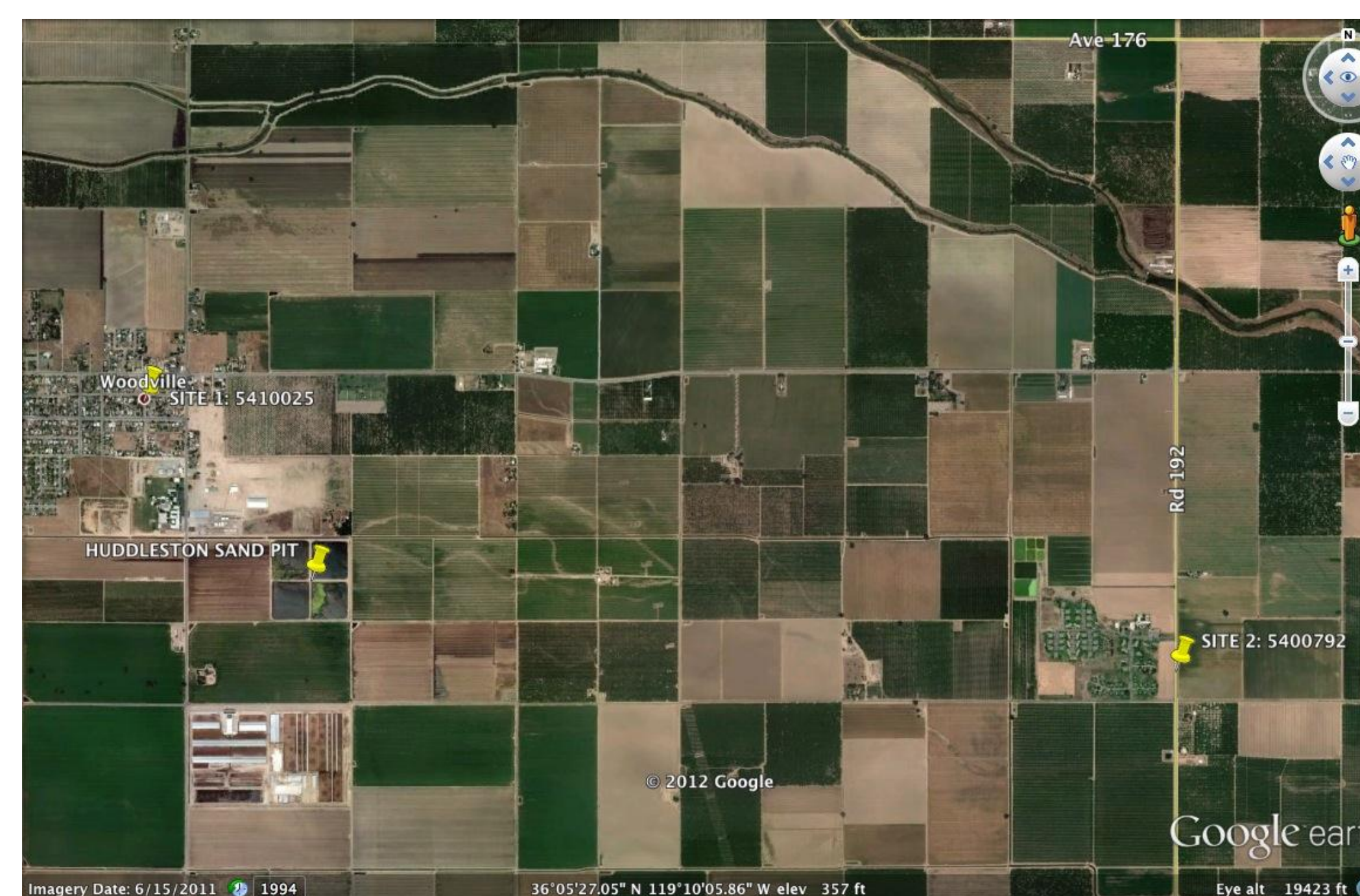
Water Balance/Percolation Calculation

DETENTION BASIN MASS BALANCE

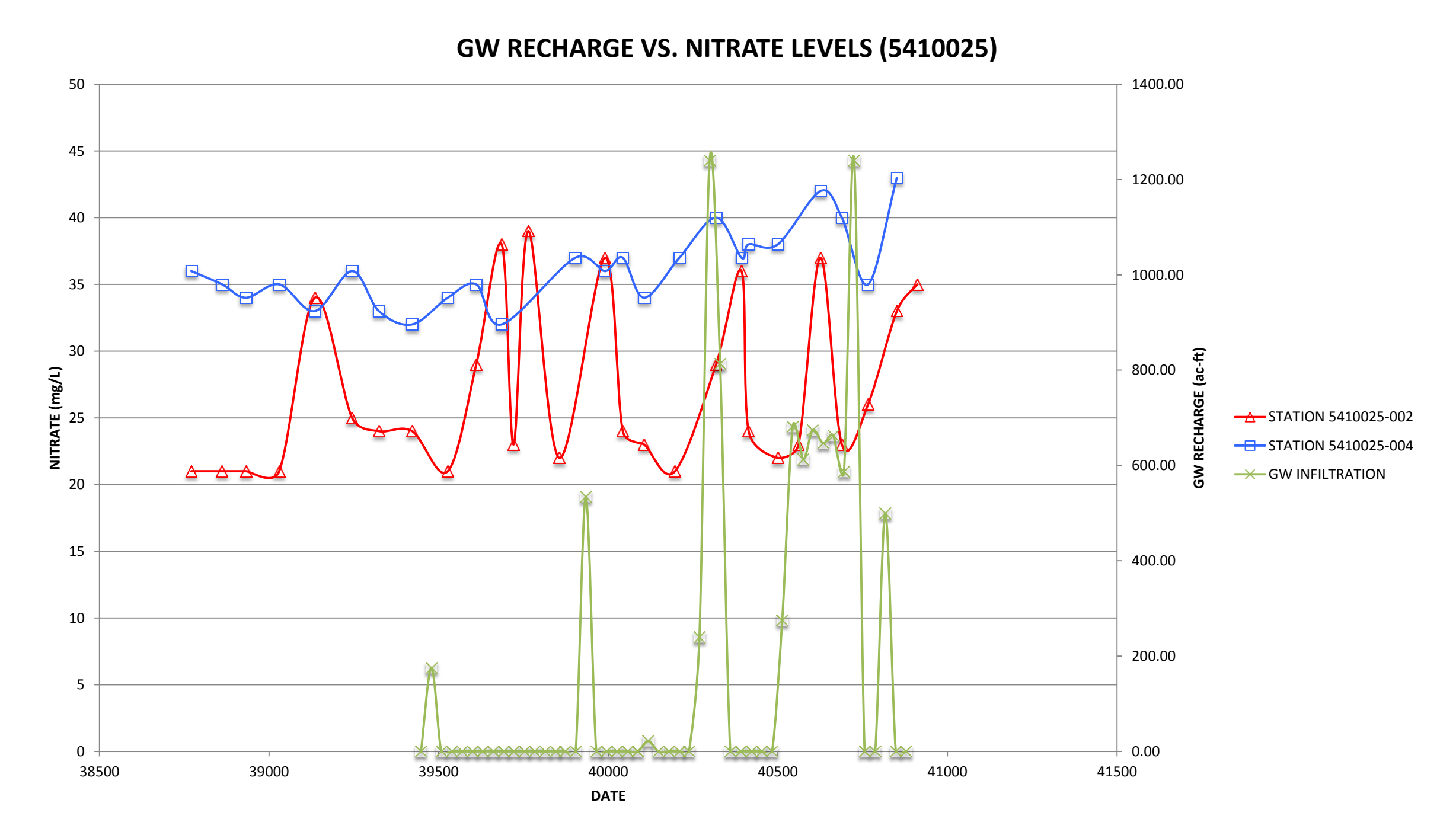
- E_{T0} VALUES ARE WEIGHTED DEPENDING ON THE TIME OF MONTH THE DETENTION BASIN RECEIVED WATER
- IF THE MAXIMUM POSSIBLE INFILTRATION OF THE BASIN WAS GREATER THAN INFLOW AND THE E_{T0} DEDUCTIONS, IT IS ASSUMED THE TOTAL WATER REMAINING INFILTRATED THE GROUND WATER AQUIFER
- USE A TYPICAL DESIGN INFILTRATION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

MONTH	0 (ac-ft)	E _T (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	3.40	267.26	0.00
May-10	1396.40	22.71	1373.69	100.00
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
TOTAL				8005.15

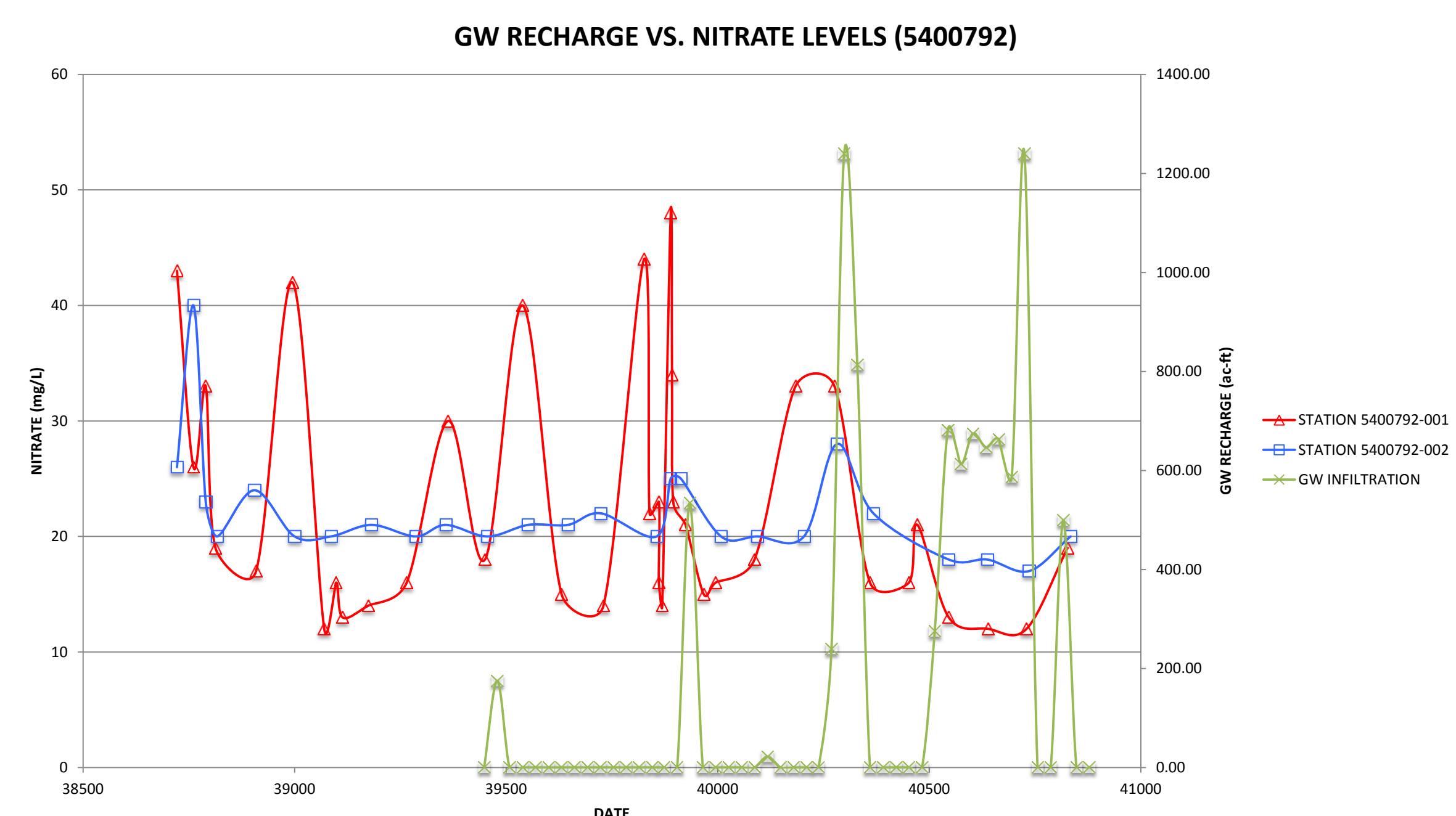
Site Locations



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

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