



## INTERDEPARTMENTAL MEMORANDUM

TO: Butte County Water Commission

FROM: Kristen Hard, Manager – Program Development  
Water and Resource Conservation

SUBJECT: Cumulative Groundwater Quality Trend Monitoring update

DATE: October 2, 2007

### **INTRODUCTION and BACKGROUND**

The Butte County Department of Water and Resource Conservation (DW&RC) recently conducted groundwater quality trend monitoring of ten wells within the county. This year we added wells in the Chico Urban Area and Pentz sub-inventory units to the monitoring grid. Because this is the first year of data collection, the data will be reported in tabular format until there is sufficient data to create graphical displays for comparison. Unfortunately, we were unable to obtain a sample in the Durham/Dayton sub-inventory unit this year. Access was not feasible due to an early almond harvest. Staff will continue working with the Technical Advisory Committee (TAC) to secure additional sampling locations as needed to enhance the monitoring grid. As stated in Chapter 33A, the parameters monitored were temperature, pH, Electrical Conductivity. Total Dissolved Solids were also recorded. These parameters encompass the basic characteristics to consider when evaluating water for evidence of saline intrusion.

### **METHODOLOGY and ANALYSIS**

This year, using funds from our AB303 grant, we purchased our own Hach sensION multi-parameter meter to do the testing with. This is the same meter being used by Glenn County for their monitoring efforts, and Tehama County is in the process of purchasing the same meter. This collaboration will ensure that we are collecting, analyzing and reporting data in the same manner, which will allow for greater confidence in comparing data across county lines. The sites visited were on private land and the wells are typically used for agricultural purposes (irrigating orchards, rice, or pasture), but the Thermalito sample represent supply for domestic use. Again, the sampling grid spans from north of the Chico Urban Area (Vina sub-unit), west towards the Sacramento River (M & T sub-unit), east towards the foothills (Pentz sub-unit), and south towards Gridley (Biggs-West Gridley sub-unit).

As in previous years, we are fortunate to have the support and permission from the local property owners who allowed access to their wells. We have provided them with the preliminary results from this year's monitoring for their general knowledge.

The data collected this summer is comparable to data collected in the five preceding years. To date, temperature has been consistent in all wells. For example, the overall observed

average water temperatures from our wells this summer was approximately 19.23 °C (66.61 °F), with the low temp being in the Thermalito area and the high being in the Pentz sub-inventory unit. Temperature is an important parameter because it affects chemical reactions that may occur in groundwater. Other parameters such as pH remained stable and rarely deviated even a single pH unit.

Total dissolved solids measures water quality suitability for public, industrial, and agricultural uses and electrical conductivity measures the ability of a solution to conduct an electrical current. Readings for total dissolved solids and electrical conductivity varied more than pH and temperature. However, the readings we observed were well within the secondary water quality thresholds established by State and Federal regulatory agencies.

The US Environmental Protection Agency (US EPA) establishes drinking water quality standards using two categories; Primary Standards and Secondary Standards. Primary Standards are based on health considerations and Secondary Standards are based on taste, odor, color, corrosivity, foaming, and staining properties of water. Examples of secondary water quality thresholds are summarized in Table 1 below:

**Table 1. US EPA Secondary Standards for measured parameters**

Parameter	Secondary Standard or Secondary WQ Threshold	Range of Observed 2007 Readings	Notes re: Butte County Study
pH	6.5 to 8.5	6.9 – 7.9	Within range of secondary water quality thresholds.
Total Dissolved Solids (TDS)	< 500 ppm – drinking water < 450 ppm – ag water	105 - 232	Within range of secondary water quality thresholds
Electrical Conductivity (EC)	< 900 uS – drinking water < 700 uS – ag water	218 - 480	Within range of secondary water quality thresholds

Water quality data collected from the specific wells are presented in tables on the attached pages.

**CONCLUSION**

This is the sixth season the DW&RC collected groundwater quality information. At this time we do not have sufficient information to make valid assumptions regarding any trends in water quality changes. Overall, the results of the water quality sampling indicate that groundwater in the basin is of high-quality, free of saline intrusion and is in good health. This data will help the DW&RC in building a foundation that serves to establish baseline levels of these parameters across the county so that any future changes in water quality can be detected and further investigation and monitoring can subsequently be developed.

Further information on water quality standards for different constituents can be found at [www.swrcb.ca.gov](http://www.swrcb.ca.gov) or in the *Compilation of Water Quality Goals*, published by the State Water Resources Control Board. Otherwise, if you have questions please contact Kristen at 538-6265.

**Table 2. Cumulative Temperature Measurements in degrees Celsius**

<b>Groundwater Temperature - 2002 through 2007</b>							
Sub-area	State Well Number	2002 Temp °C	2003 Temp °C	2004 Temp °C	2005 Temp °C	2006 Temp °C	2007 Temp °C
Biggs-West Gridley	18NO2E35R01M	18.5	18.5	18.1	20.5	18.2	18.20
Cherokee	20N02E24QO1M	22.4	21.9	21.2	21.4	21.1	20.70
Chico Urban Area	22N02E17						18.40
Durham Dayton	21N01E15EO2M	18.8	19.9	21.8	20.4	17.4	
Esquon	20N02E09M02M	19.7	18.9	19.6	20.1	20.7	19.00
M & T	22N01E15DO2M	17.6	18.2	17.8	19.2	18.6	18.00
Pentz	21N03E29						22.20
*Pentz-Butte Valley	21N03E26EO1M	27	26.4	26.7	23.2		
Thermalito	19NO4E06E02M	18.3	17.9	17.1	17.1	18.4	17.70
Vina	23N01E29LO3M	19.6	20.3	19.2	19.2	19.6	18.90
Western Canal (east)	20N02E15RO1M	18.4	18.2	19.9	20.5	18.8	18.60
Western Canal (west)	20N01E15D01M	19	18.1	19.8	20.8	18.5	20.60

\* The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

**Table 3. Average and Range of Temperature – 2002 through 2007**

Sub-area	Average	Range
Biggs-West Gridley	18.67	18.1-20.5
Cherokee	21.45	20.7-22.4
Durham Dayton	19.66	17.4-21.8
Esquon	19.67	18.9-20.7
M & T	18.23	17.6-19.2
Thermalito	17.75	17.1-18.4
Vina	19.47	19.2-20.3
Western Canal (east)	19.07	18.2-20.5
Western Canal (west)	19.47	18.1-20.8

° Celsius	° Fahrenheit
0	32
5	41
10	50
15	59
20	68
21	69.8
22	71.6
23	73.4
24	75.2
25	77
30	86

**Table 4. Cumulative pH Measurements**

<b>Groundwater pH - 2002 through 2007</b>							
Sub-area	State Well Number	2002 pH	2003 pH	2004 pH	2005 pH	2006 pH	2007 pH
Biggs-West Gridley	18NO2E35R01M	7.6	7.5	7.5	7.0	7.6	7.6
Cherokee	20N02E24QO1M	7.5	7.5	7.1	7.4	7.4	7.3
Chico Urban Area	22N02E17						6.9
Durham Dayton	21N01E15EO2M	7.7	7.2	7.6	7.6	7.5	
Esquon	20N02E09M02M	7.3	7.5	7.1	7.4	7.5	7.4
M & T	22N01E15DO2M	7.2	7.5	6.9	7.8	7.9	7.6
Pentz	21N03E29						7.6
*Pentz-Butte Valley	21N03E26EO1M	7.1	6.9	7.29	6.24		
Thermalito	19NO4E06EO2M	7.0	6.5	7.1	7.1	7.9	7.4
Vina	23N01E29LO3M	7.5	7.6	6.9	6.2	7.7	7.5
West.Canal (east)	20N02E15RO1M	7.0	6.6	6.8	6.9	7.3	6.9
West.Canal (west)	20N01E15D01M	7.8	8.1	7.1	6.9	7.9	7.9

\* The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

**Table 5. Average and Range of pH – 2002 through 2007**

Sub-area	Average	Range
Biggs-West Gridley	7.6	7.0-7.6
Cherokee	7.4	7.1-7.5
Durham Dayton	7.5	7.2-7.7
Esquon	7.4	7.1-7.5
M & T	7.7	6.9-7.9
Thermalito	7.5	6.5-7.9
Vina	7.5	6.2-7.7
Western Canal (east)	7.0	6.6-7.3
Western Canal (west)	7.8	6.9-8.1

**Table 6. Cumulative EC Measurements in microsiemens**

<b>Groundwater EC - 2002 through 2007</b>							
Sub-area	State Well Number	2002 EC	2003 EC	2004 EC	2005 EC	2006 EC	2007 EC
Biggs-West Gridley	18NO2E35R01M	346	370	323	361	351	382
Cherokee	20N02E24QO1M	222	232	215	266	242	267
Chico Urban Area	22N02E17						280
Durham Dayton	21N01E15EO2M	315	348	259	340	322	
Esquon	20N02E09M02M	388	526	470	557	507	480
M & T	22N01E15DO2M	418	551	678	504	465	451
Pentz	21N03E29						218
*Pentz-Butte Valley	21N03E26EO1M	195	186	211	240	195	
Thermalito	19NO4E06E02M	132	164	149	150	152	242
Vina	23N01E29LO3M	197	225	180	216	192	224
Western Canal (east)	20N02E15RO1M	447	344	400	524	492	471
Western Canal (west)	20N01E15D01M	464	248	407	501	309	477

\* The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

**Table 7. Average and Range of EC – 2002 through 2007**

Sub-area	Average	Range
Biggs-West Gridley	363	323 - 382
Cherokee	250	215 - 267
Durham Dayton	319	259 - 348
Esquon	492	388 - 557
M & T	476	418 - 678
Thermalito	186	132 - 242
Vina	207	180 - 225
Western Canal (east)	470	344 - 524
Western Canal (west)	396	248 - 501

**Table 8. Cumulative TDS Measurements in mg/L** (1 mg/L = 1 ppm for dilute aqueous solutions)

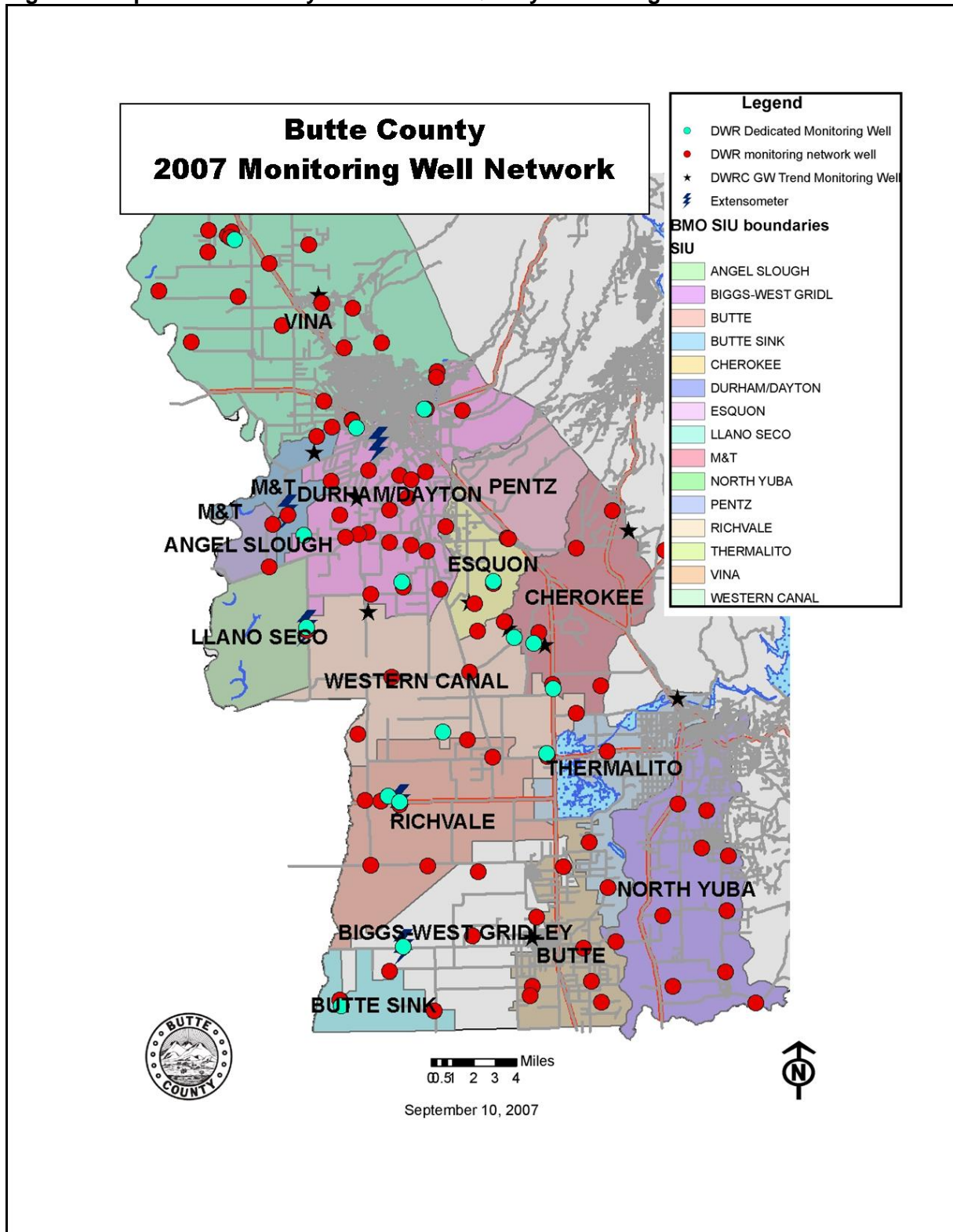
<b>Groundwater TDS - 2002 through 2007</b>							
Sub-area	State Well Number	2002 TDS	2003 TDS	2004 TDS	2005 TDS	2006 TDS	2007 TDS
Biggs-West Gridley	18NO2E35R01M	172	184	163	180	169	184
Cherokee	20N02E24QO1M	111	115	109	132	116	128
Chico Urban Area	22N02E17						136
Durham Dayton	21N01E15EO2M	161	175	130	169	155	
Esquon	20N02E09M02M	194	265	235	278	244	232
M & T	22N01E15DO2M	209	279	340	251	225	218
Pentz	21N03E29						105
*Pentz-Butte Valley	21N03E26EO1M	100	93	105	120		
Thermalito	19NO4E06E02M	67	82	73	75	73	116
Vina	23N01E29LO3M	96	109	90	107	90	108
Western Canal (east)	20N02E15RO1M	223	172	203	262	246	228
Western Canal (west)	20N01E15D01M	232	123	206	250	155	230

\* The distance between the Pentz-Butte Valley well no longer monitored and the new Pentz well is approximately 2.4 miles.

**Table 9. Average and Range of TDS – 2002 through 2007**

Sub-inventory unit	Average	Range
Biggs-West Gridley	171	163 - 184
Cherokee	116	109 - 132
Durham Dayton	157	130 - 175
Esquon	244	194 - 278
M & T	243	209 - 340
Thermalito	74	67 - 82
Vina	94	90 - 190
Western Canal (east)	234	172 - 262
Western Canal (west)	174	123 - 250

Figure 1. Map of Butte County Groundwater Quality Monitoring Locations



## Biggs-West Gridley

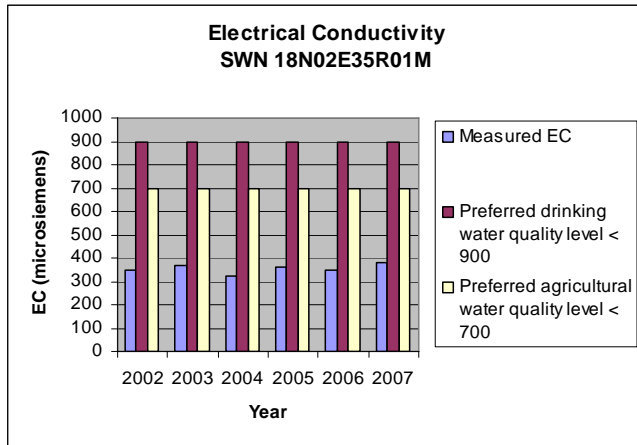


Figure 2. Biggs-West Gridley well monitored for EC by DW&RC

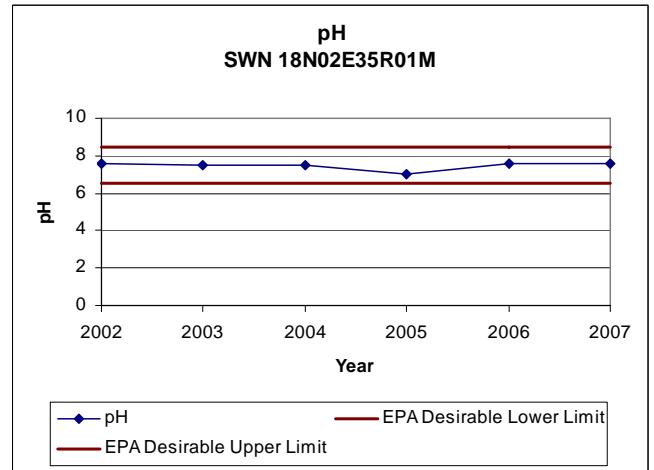


Figure 3. Biggs-West Gridley well monitored for pH by DW&RC

## Cherokee

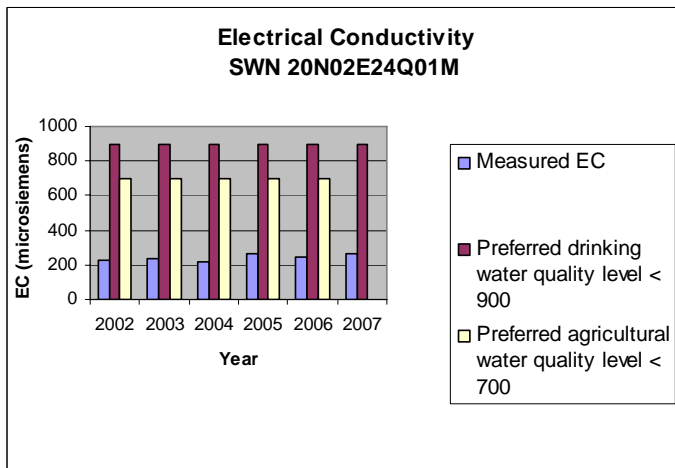


Figure 12. Cherokee well monitored for EC by DW&RC

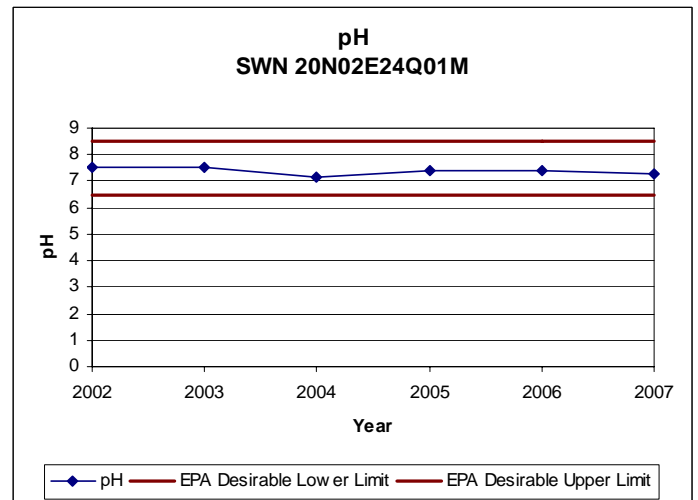


Figure 13. Cherokee well monitored for pH by DW&RC



## Durham-Dayton

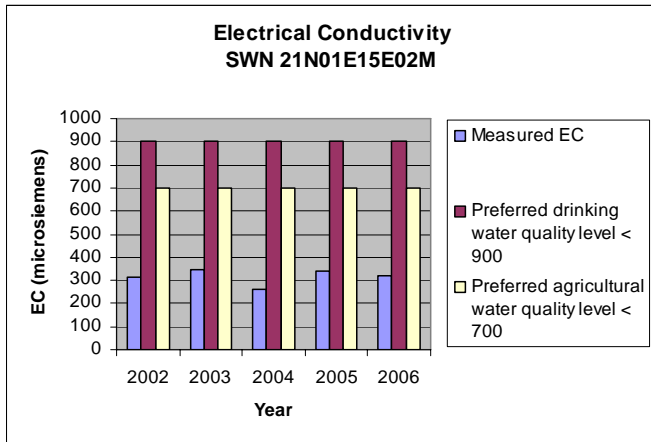


Figure 14. Durham Dayton well monitored for EC by DW&RC

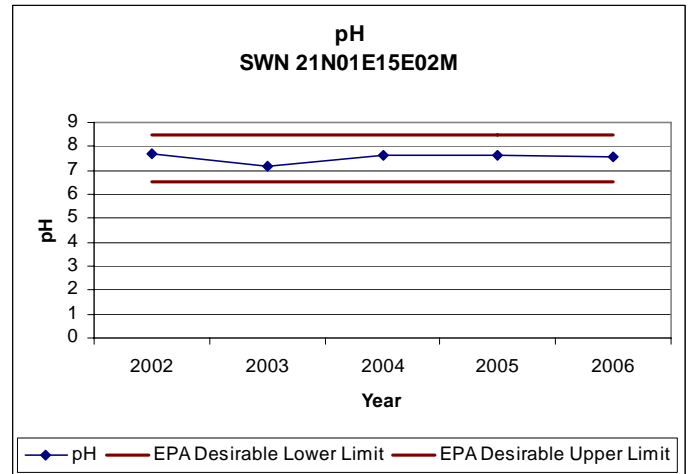


Figure 15. Durham Dayton well monitored for pH by DW&RC

## Esquon

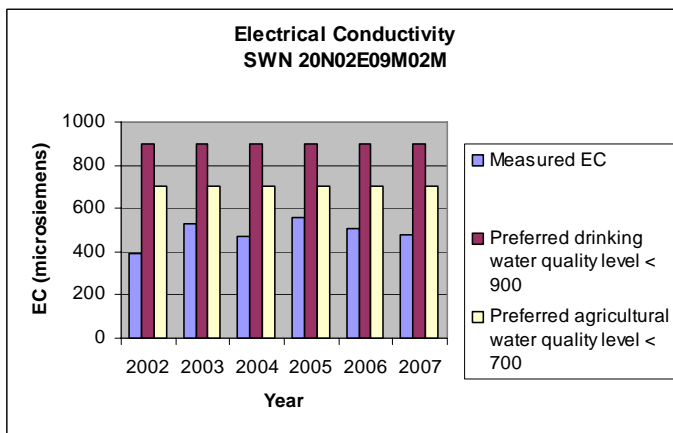


Figure 8. Esquon well monitored for EC by DW&RC

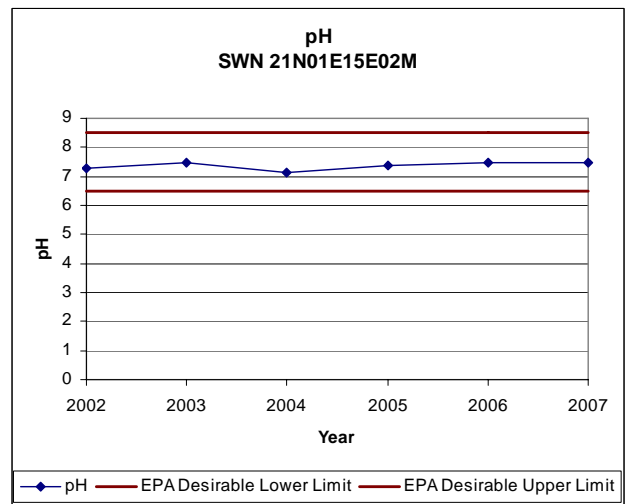


Figure 9. Esquon well monitored for pH by DW&RC

## M&T

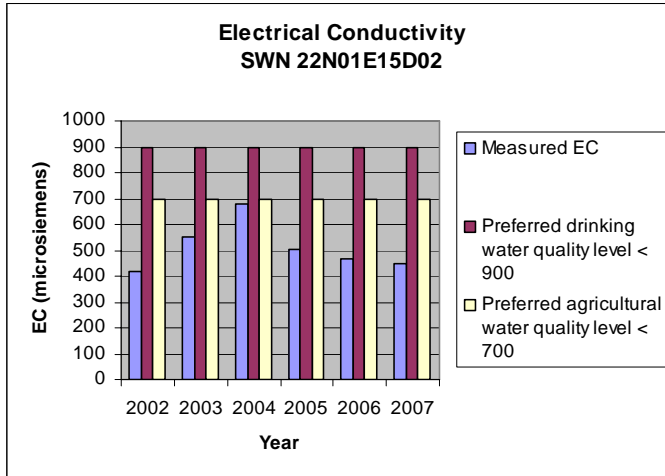


Figure 18. M&T well monitored for EC by DW&RC

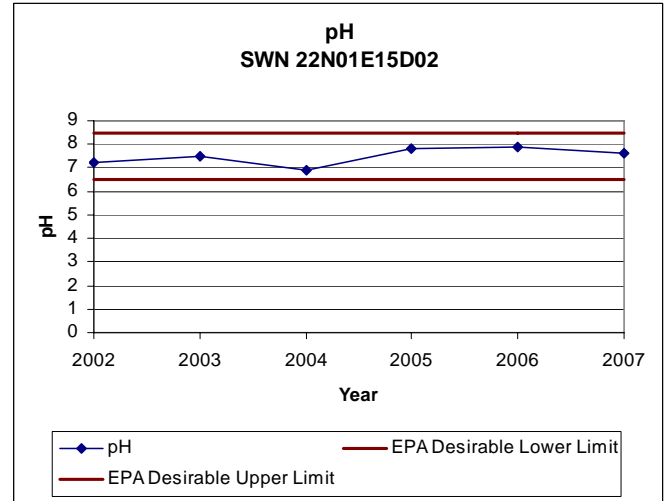


Figure 19. M&T well monitored for pH by DW&RC

## Pentz

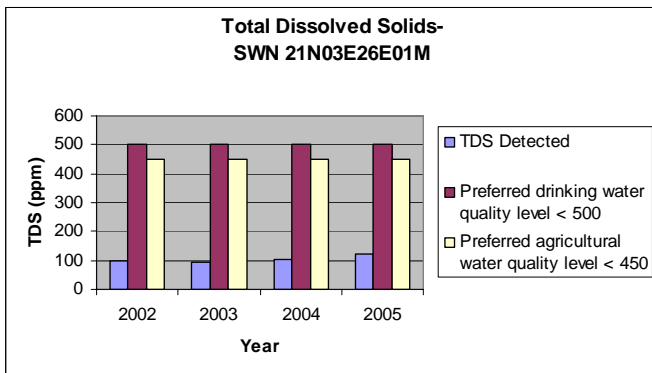


Figure 16. Pentz well monitored by DW&RC

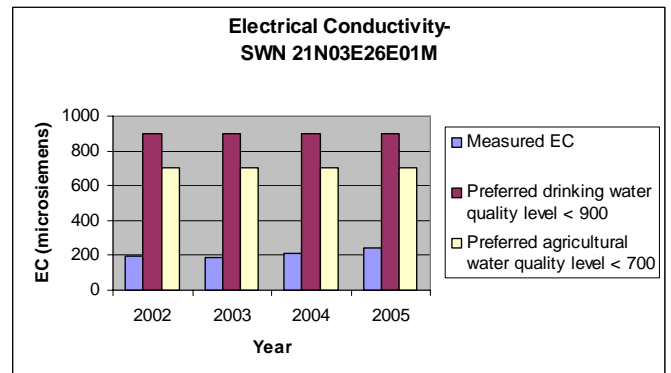


Figure 17. Pentz well monitored by DW&RC

## Thermalito

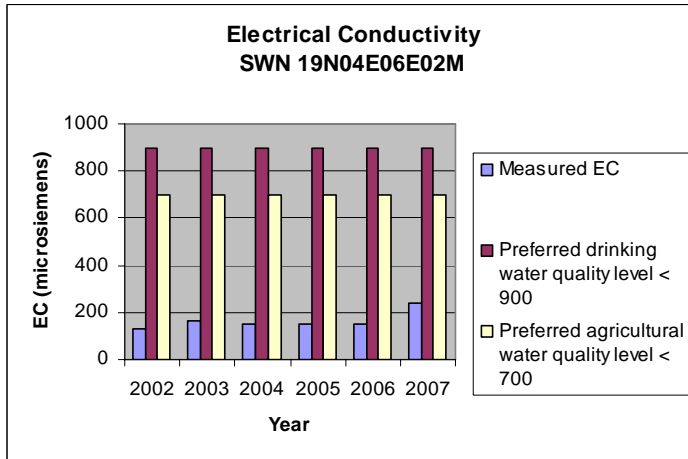


Figure 4. Thermalito well monitored for EC by DW&RC

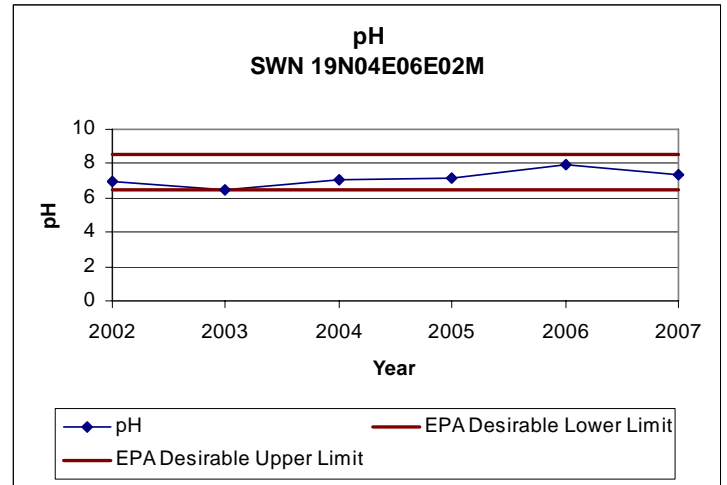


Figure 5. Thermalito well monitored for pH by DW&RC

## Vina

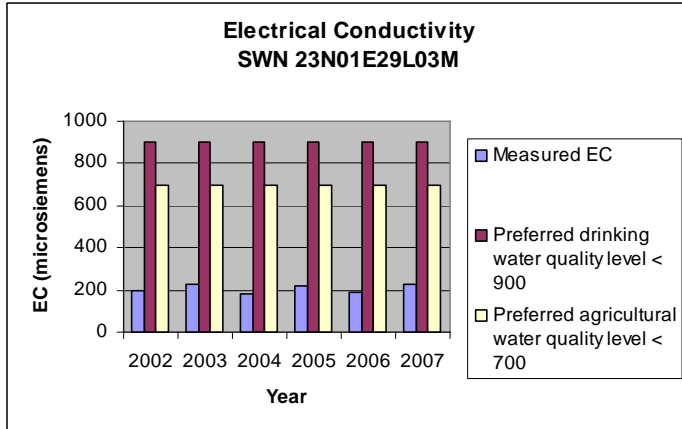


Figure 20. Vina well monitored for EC by DW&RC

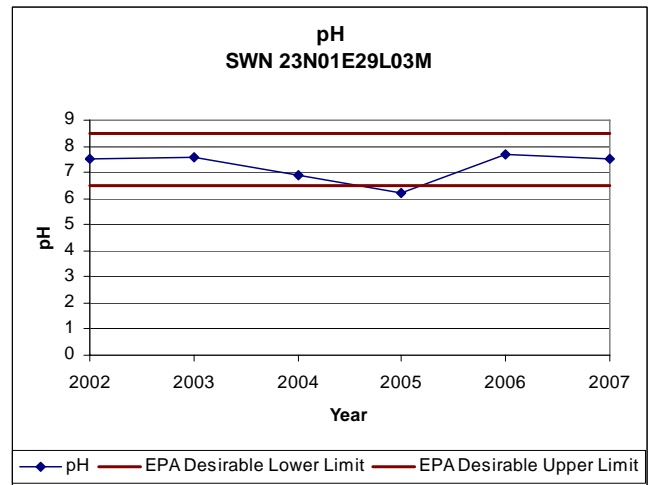


Figure 21. Vina well monitored for pH by DW&RC

## Western Canal (east)

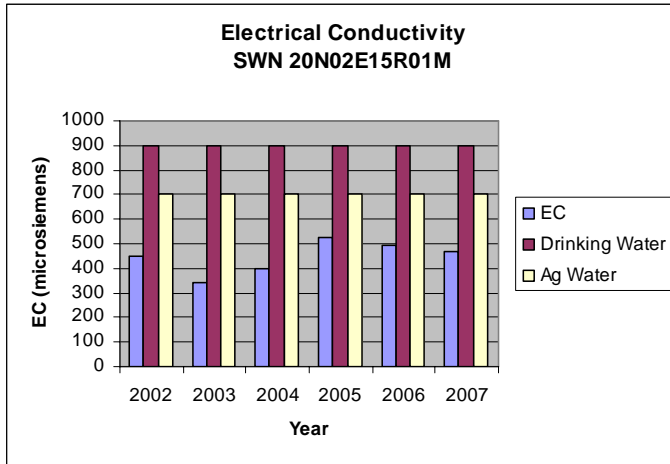


Figure 10. Western Canal (east) well monitored for EC by DW&RC

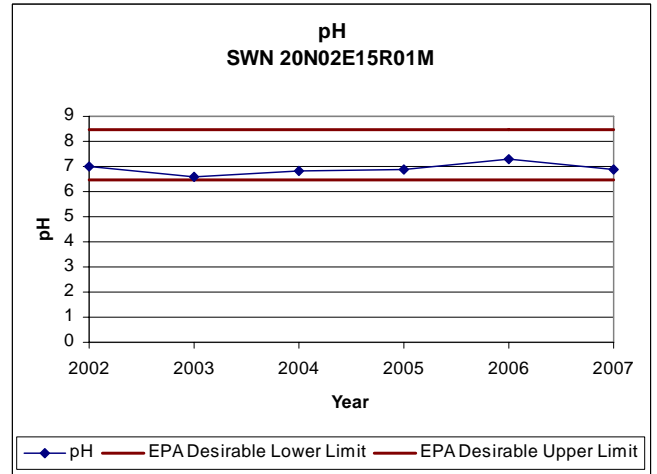


Figure 11. Western Canal (east) well monitored for pH by DW&RC

## Western Canal (west)

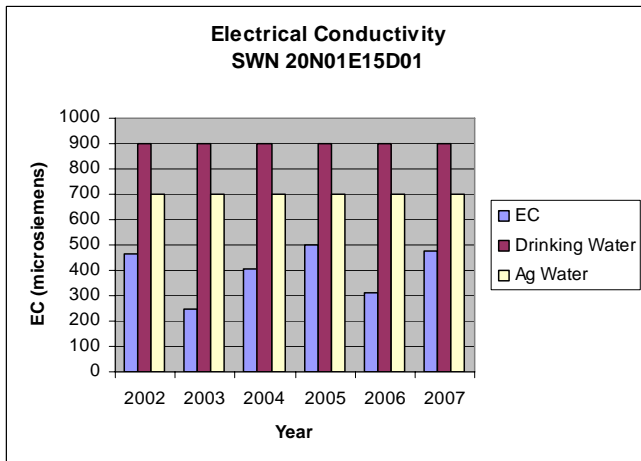


Figure 6. Western Canal (west) well monitored for EC by DW&RC

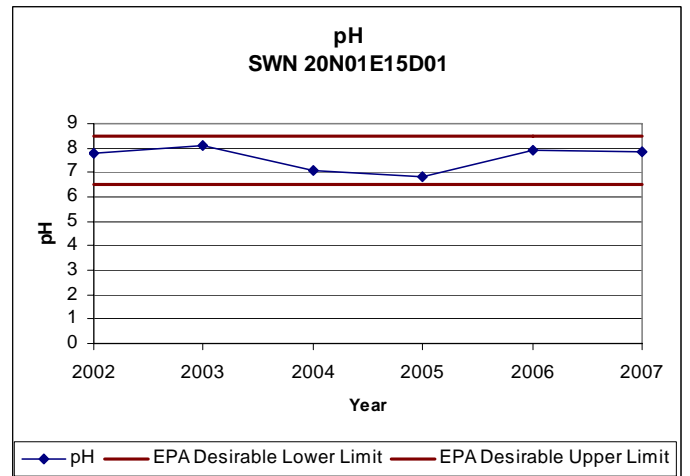


Figure 7. Western Canal (west) well monitored for pH by DW&RC