Basin Management Objective
Butte County
Sub Area – VINA
Calendar Year -2006

Butte County Water Advisory Committee Member – Steve Dilg

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Description of the Vina Sub Area: Vina is uniquely vulnerable to overdraft for several reasons and may be the "canary in the mine" of groundwater sustainability for Butte County.

1) Lack of collection area for precipitation: The North Butte/South Tehama area is influenced by the Sierra/Cascade Ridge which is close to the valley and is rarely breached. Much of N.E. California drains north to the Pit River or south to the North Fork of the Feather. Lake Almanor feeds the Feather River, not Deer Creek.

2) Lack of water available for recharge: Cohasset Ridge further exacerbates this situation in that Chico Creek and Butte Creek are diverted south. Creeks in Vina head below 4000 feet and have small catchments with little or no snow pack. Only Deer Creek and Big Chico Creek flow year round. (*Exhibit A shows the USGS estimates of the total drainage and total watershed area for the creeks that cross the recharge zone in Vina and the graph compares those total flows with the Feather River.)*

3) Limited knowledge about the quantity, location or mechanism of aquifer recharge. Dr Karen Hoover (CSUC) has estimated that the total recharge from Deer Creek to be less than 1800 acre feet per year. This is only 0.007% of the total flow.

4) Surface water substitution is not an easy option: The seasonal nature of the streams flowing across the Vina sub area means that there is no obvious source for surface water.

5) Northern Butte County is subject to massive development pressure. When un-irrigated land is developed to housing or irrigated crops, consumption levels most likely will be increased. The eastern edges of the aquifer would suffer the most impacts from depressurization of the aquifer from unsustainable pumping.

Aquifer Systems Identified In Sub Area:
Quaternary Alluvium
Basin Deposits
Modesto Formation
Riverbank Formation
Upper Tuscan (Formation Unit C) Aquifer System
Lower Tuscan (Formation Unit B) Aquifer System

Management Objective –
Our objective is to maintain the groundwater surface elevation during the peak summer irrigation season (July and August) in all aquifer systems at a level that will assure an adequate and affordable irrigation groundwater supply. It is the intent of this management objective to assure a sustainable agricultural supply of good quality water now and into the future, and to assure the water supply can be utilized without injuring groundwater quality or inducing land subsidence. The management objective is also to assure a groundwater supply of adequate quality and quantity from all aquifer systems for domestic users in the sub-area.

Location of Basin Management Objective Key Wells:
Groundwater Levels – See attached map of monitoring wells
Groundwater Quality – To be completed in 2007
Land Subsidence – See attached map of monitoring wells

Groundwater Levels – Groundwater levels are provisionally identified in order to meet County deadlines. County staff and DWR need to provide additional information regarding well log data, including geophysical data (e.g. resistivity, gamma ray, location depth of well, casing screen level) in order to verify well characteristics. See pages 2-2 and 2-3 of the Basin Management Objective Development Packet created by CDM.

The Vina Stakeholders are extremely concerned about the lack of information about the geology and well construction of the monitoring wells delineated by the DW&RC. If such information is not obtainable for a particular well, that well should be removed from the monitoring list. (*Exhibit B compares data sets from two wells in the Chico Urban Area and displays the level of information necessary to begin to form meaningful determinations about groundwater management.)*

Groundwater Quality- Identification of areas to be investigated include:
1) Nitrate contamination caused by septic tank density.

2) The Chico Municipal Airport. This airport was used by the U.S. Army Air Corps during WWII. This means that solvents were used to clean aircraft engines and discarded without the modern safeguards. There are also the legacy businesses such as Chico Aerial Applicators which involved washing agricultural chemicals from aircraft hoppers.

3) James Brothers Rail Car Cleaning Station: This operation is located on Anita Road at the Union Pacific tracks. The removal and recoating of hopper car linings and the washing and cleaning of hopper cars may involve a number of chemicals of concern. The disposal of these materials should also be investigated.

4) There are a number of agricultural chemicals with historic use that should be studied and tests made for residue or groundwater contamination.

Groundwater Level Monitoring Network(s):
Department of Water Resources
Butte County Department of Water and Resource Conservation

Groundwater Quality Network(s):

Regional Water Quality Control Board
Butte County Department of Environmental Health
Department of Toxic Substance Control

Land Subsidence Monitoring Network(s):

Department of Water Resources
Butte County Department of Water and Resource Conservation

Monitoring Frequency:

Groundwater Levels – Department of Water Resources - semiannually (fall and spring). Butte County Department of Water and Resource Conservation – July and August in accordance with Chapter 33 of the Butte County Code.

Groundwater Quality – To be completed in 2007

Land Subsidence – Department of Water Resources – Continuously

Well Numbering System(s):

Groundwater Levels – Department of Water Resources (State Well Numbering System). Butte County Department of Water and Resource Conservation (State Well Numbering System).

Groundwater Quality – To be completed in 2007

Land Subsidence – Department of Water Resources (State Well Numbering System)

Well ID	Aquifer System	Well Type	Stage 1 & 2Alert (Spring Avg minus 1 standard deviation) Elev. (ft)	Stage 3Alert (Spring Avg minus 2 standard deviations) Elev. (ft)
23N01W09J01M	Modesto Formation	Irrigation	165.07	164.24
23N01E33A01M	Lower Tuscan	Irrigation	153.12	148.15
22N01E02P01M	Upper Tuscan	Irrigation	144.89	143.66
23N02W25C01M	Alluvium	Irrigation	135.71	131.94
22N01W05M01M	Alluvium	Irrigation	133.17	129.64
23N01W36P01M	Basin Deposits	Domestic	139.18	132.39
23N01W14R01M			159.37	155.39

* - See Staff Report for description of method.
** - See attached hydrographs.

Basin Management Objective Key Wells and Compliance Methodology for Groundwater Levels in the Alluvial Aquifer.

Well ID	Aquifer System	Well Type	Stage 1 & 2Alert (Spring Avg minus 1 standard deviation) Elev. (ft)	Stage 3Alert (Spring Avg minus 2 standard deviations) Elev. (ft)
22N01E09B01M	Modesto Formation	Domestic	144.30	141.34
22N01E20K01M	Modesto Formation	Domestic	132.97	127.19
23N01E18A01M	Upper Tuscan	Domestic	169.32	165.24
23N01W27L01M	Modesto Formation	Domestic	141.22	135.87
23N01E29P02M	Upper Tuscan	Domestic	151.20	146.31

* - See Staff Report for description of method.
** - See attached hydrographs.

Basin Management Objective Key Wells and Compliance Methodology for Groundwater Quality. To Be Completed in 2007

Well ID	Aquifer System	Well Type	Stage 1 & 2Alert (Spring Avg minus 1 standard deviation) Elev. (ft)	Stage 3Alert (Spring Avg minus 2 standard deviations) Elev. (ft)
20N01E29B01M			96.46	95.32
22N01E02P01M	Upper Tuscan	Irrigation	144.89	143.66
23N01E29P02M	Upper Tuscan	Domestic	151.20	146.31

* - See Staff Report for description of method.
** - See attached hydrographs.

Basin Management Objective Key Wells and Compliance Methodology for Land Subsidence.
Land Subsidence is continuously monitored by the Department of Water Resources and Butte County Department of Water and Resource Conservation in the closest sub area at State Well number 21N01W24B01M, located within the M&T sub area.

BMO Alert Stage Definitions:

The Vina Sub Area will use the following guidelines in the management of the groundwater resources. The groundwater level and land subsidence management objectives are intended to trigger predetermined voluntary Ground Water Management Actions, as defined below, to remedy declining ground water levels that are not recovering to compliance levels for each index well. The groundwater quality BMO management actions will be defined in 2007.

Groundwater Levels:

Average spring level is defined as the level using all the available data for the years prior to, and including 2006.

Stage 1: The first year that spring groundwater levels falls one standard deviation below the average spring groundwater level established for that well.

Stage 2: Stage 2 is reached if spring groundwater levels, for a second consecutive year, remain one standard deviation below the average groundwater level established for the well.

Stage 3: Stage 3 is reached if the spring groundwater levels falls two standard deviations below the average spring groundwater level. Or, if at any time the water elevation falls below 80% of the average spring elevation.

Groundwater Quality: BC DW&RC plans for this to be done in 2007, however the Vina Stakeholders group believes that specific contaminants must be identified and historic information gathered beginning immediately.

Land Subsidence:
Stage 1. When the annual elastic subsidence exceeds the average annual elastic subsidence measured over the period of record of the extensometer.

Stage 2. When the annual elastic subsidence exceeds the maximum recorded elastic subsidence over the period of record for the extensometer.

Stage 3. When inelastic subsidence occurs.

BMO Compliance Evaluation Procedure:

Compliance with the BMO will be determined by the Butte County Water Commission's Technical Advisory Committee following the spring measurement period. The groundwater surface elevation at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Butte County Water Commission will perform this evaluation and report the results of the evaluation to the Butte County Water Advisory Committee and Water Commission.

Ground Water Management Actions:

Stage 1. Groundwater management actions to be undertaken following a Stage 1 noncompliance shall be informational. The Butte County Water Advisory Committee (WAC) and Water Commission (WC) will be advised of the noncompliance. At the recommendation of the Water Advisory Committee and the Water Commission public notification of the noncompliance may be initiated.

Stage 2. Groundwater management actions to be undertaken following a Stage 2 noncompliance shall be investigational. Upon identification of the Stage 2 noncompliance the noncompliance will be reported to the WAC and the WC. Following review and concurrence, the WAC shall direct the TAC to initiate an investigation to determine the cause(s) of the noncompliance and make recommendations as how to correct the noncompliance. The TAC shall report their findings and recommendations back to the WAC and WC within 30 days.

Stage 3. Groundwater management actions to be undertaken following a Stage 3 noncompliance shall be actionable. Upon identification of the Stage 3 noncompliance, the noncompliance will be reported to the WAC and the WC. Following review and concurrence, the WAC shall direct the TAC to initiate an investigation to determine the cause(s) of the noncompliance and make recommendations as how to correct the noncompliance. The TAC shall report back their findings and recommendations back to the WAC and WC within 30 days. The WAC will then work with the locals in the sub area to implement needed water management activities necessary to correct the problem. Such water management activities shall include, but not limited to, voluntary water conservation measures, redistribution of groundwater extraction, reduction of groundwater extraction, or other measure(s) identified and approved by the WAC, WC, and the Butte County Board of Supervisors.

Future Monitoring Recommendations:

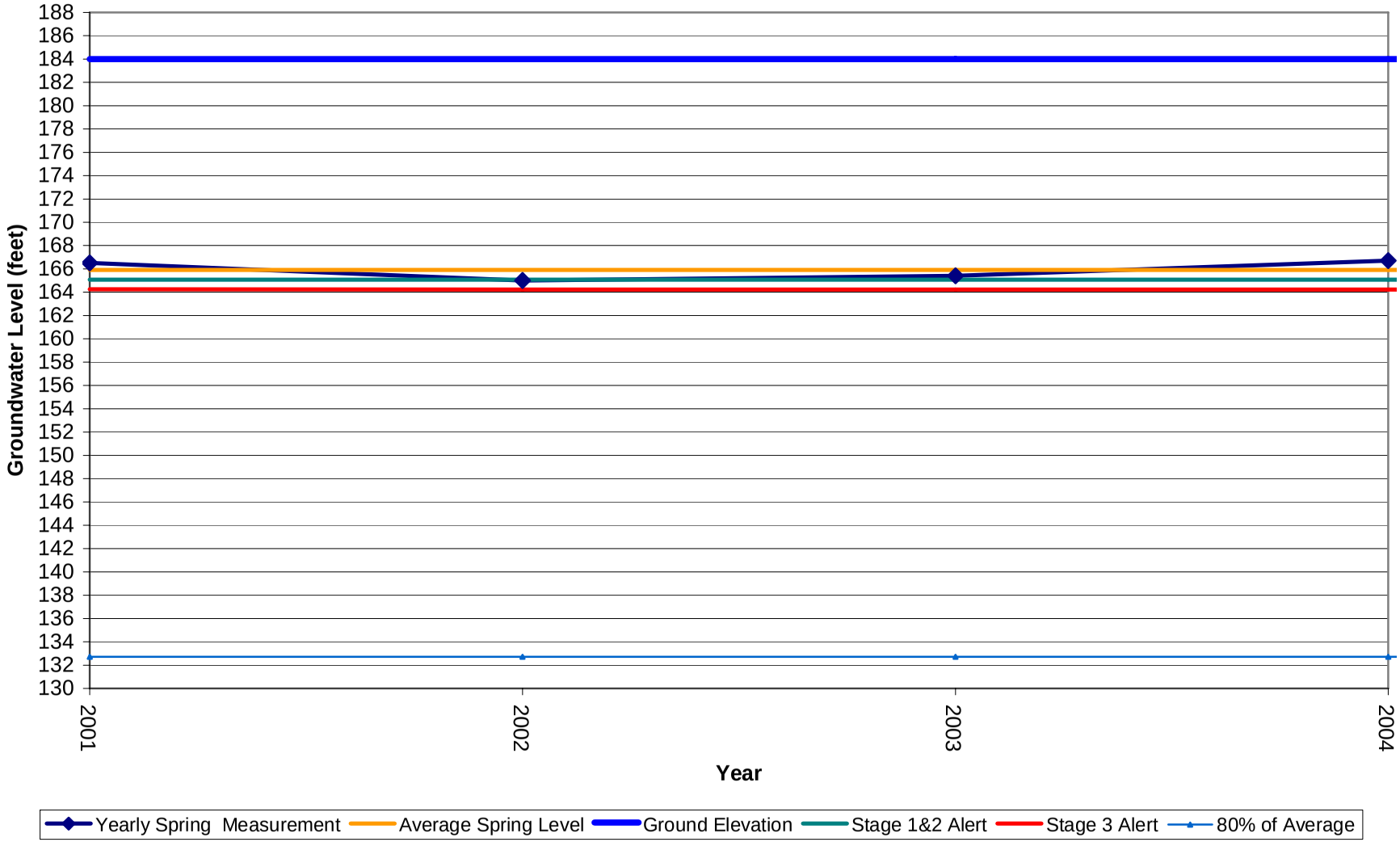
Efforts will be made to identify well characteristics of several domestic wells that could be added to the existing monitoring well network in sub-area to allow development of management objectives for the alluvial aquifer system. Initiate data collection for development of groundwater quality management objective in 2007.

Supporting Data:

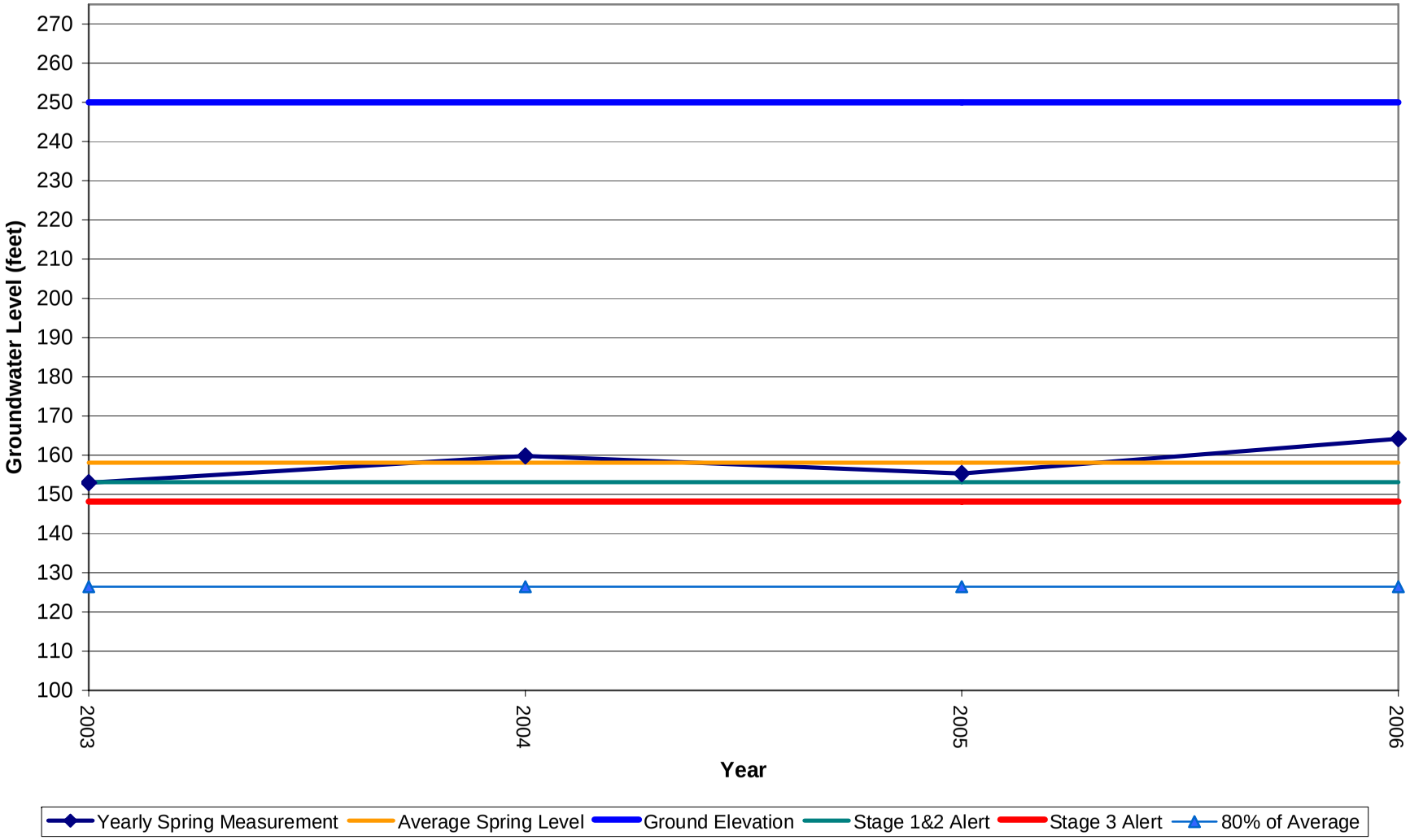
Exhibit A USGS drainage and total watershed areas for creeks between Deer Creek and Big Chico Creek

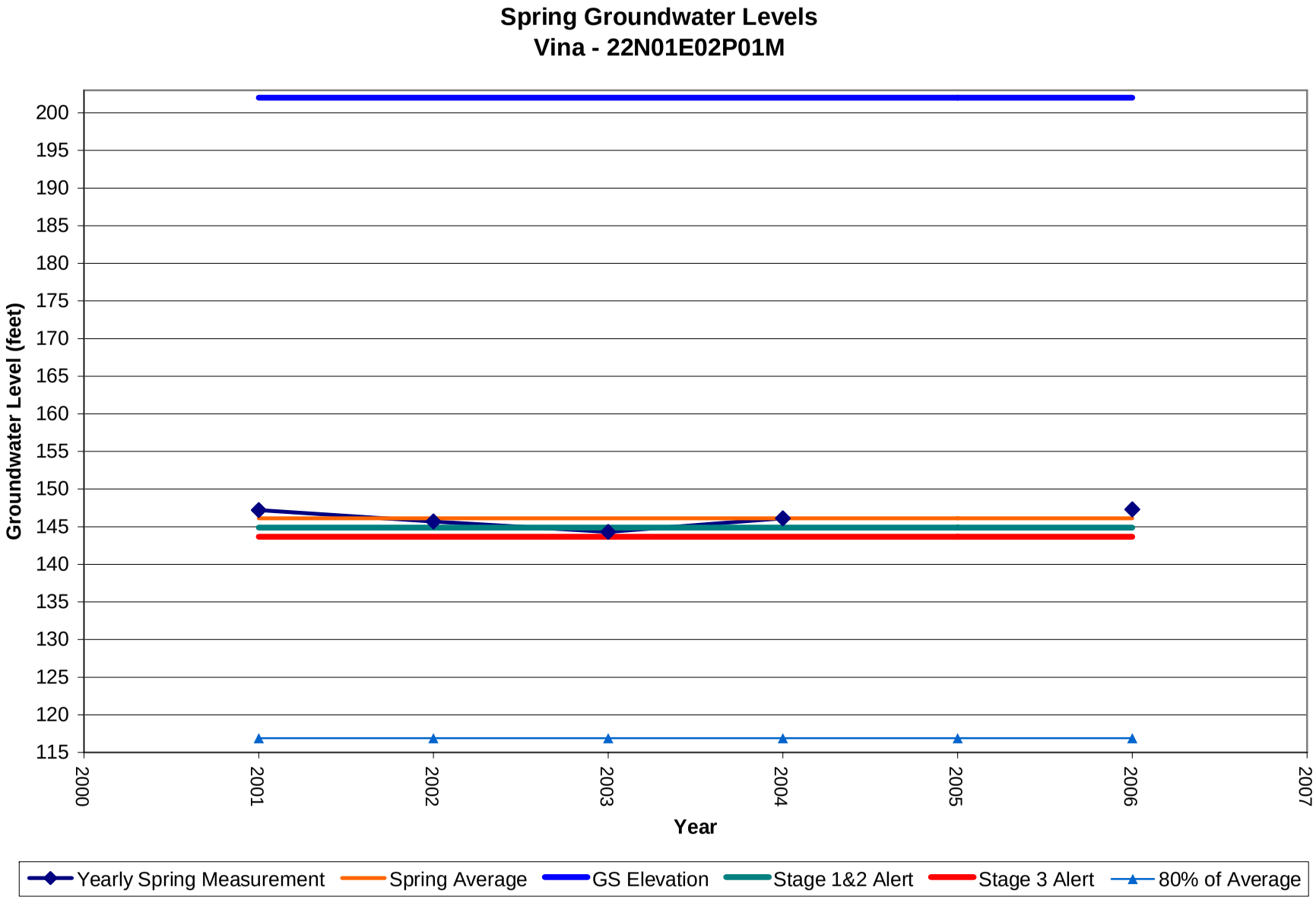
Exhibit B Comparison of data sets from two wells in the Chico Urban Area.

Spring Groundwater Levels
Vina - 23N01W09J001M



Spring Groundwater Levels
Vina - 23N01E33A01M




Spring Groundwater Levels
Vina - 22N01E02P01M
Groundwater Level (feet)
200
195
190
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165
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150
145
140
135
130
125
120
115
2000
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2004
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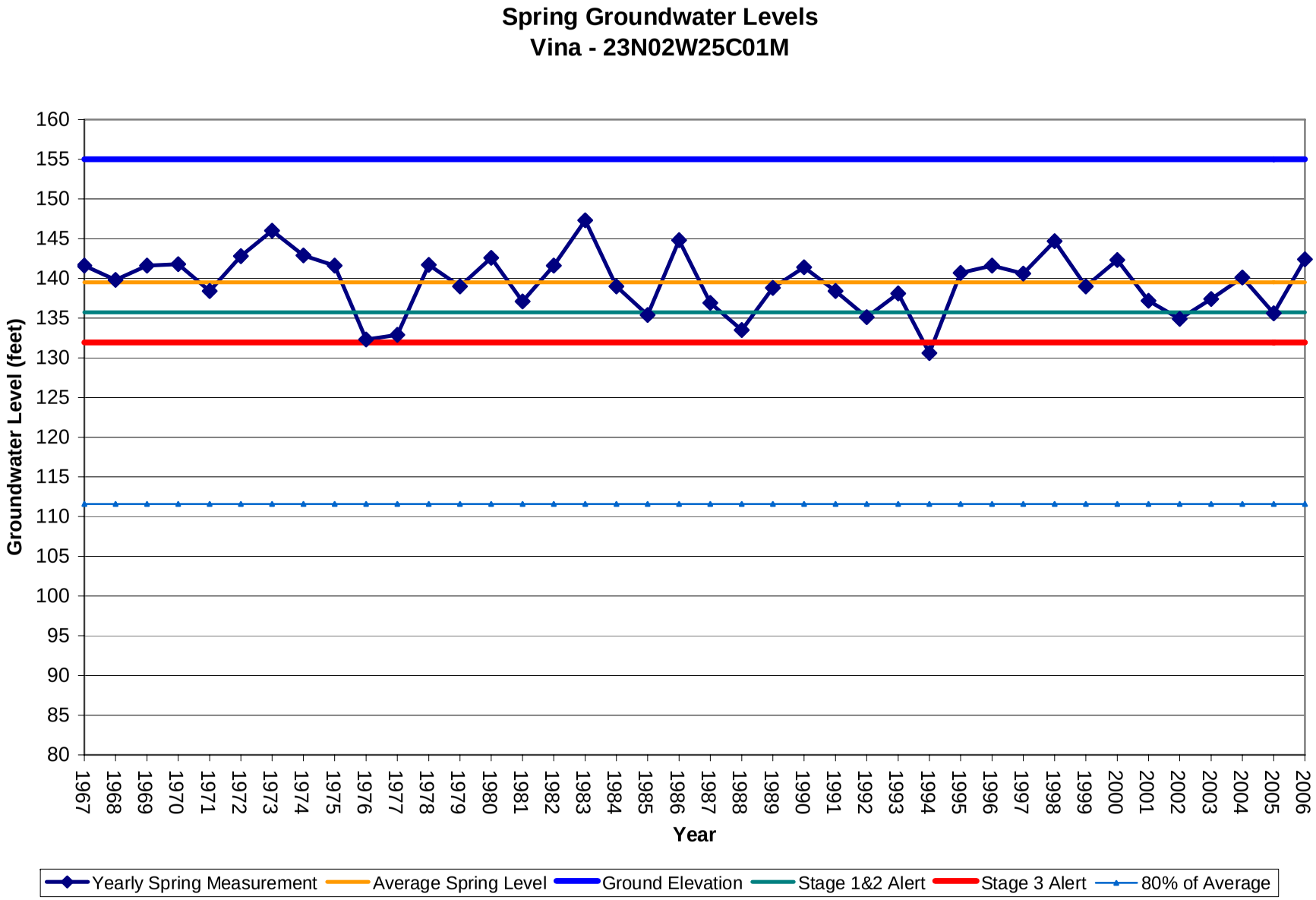
2007
Year
Yearly Spring Measurement
Spring Average
GS Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Spring Groundwater Levels
Vina - 23N02W25C01M
Groundwater Level (feet)
160
155
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105
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1967
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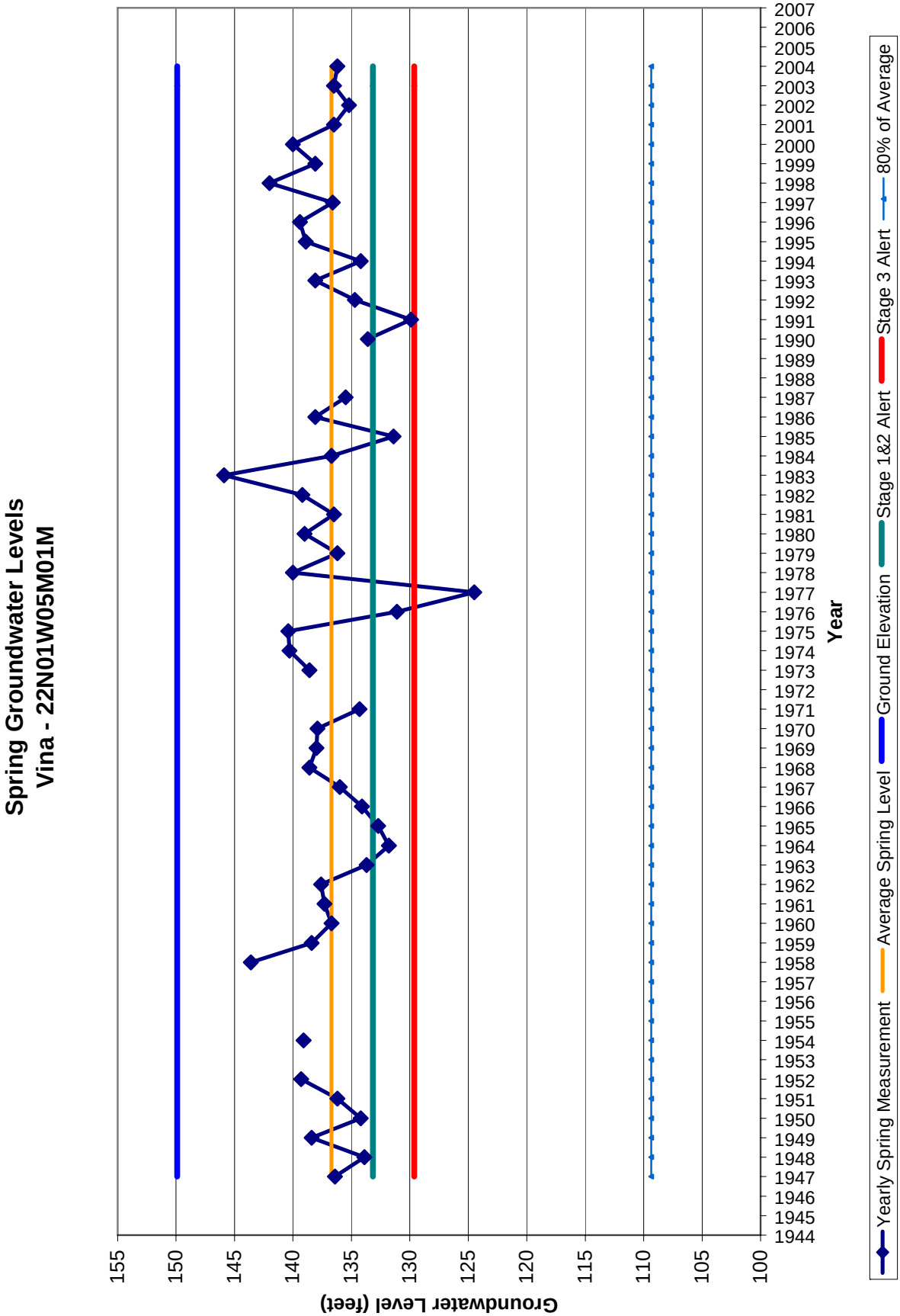
Year
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Spring Groundwater Levels
Vina - 22N01W05M01M
Groundwater Level (feet)
155
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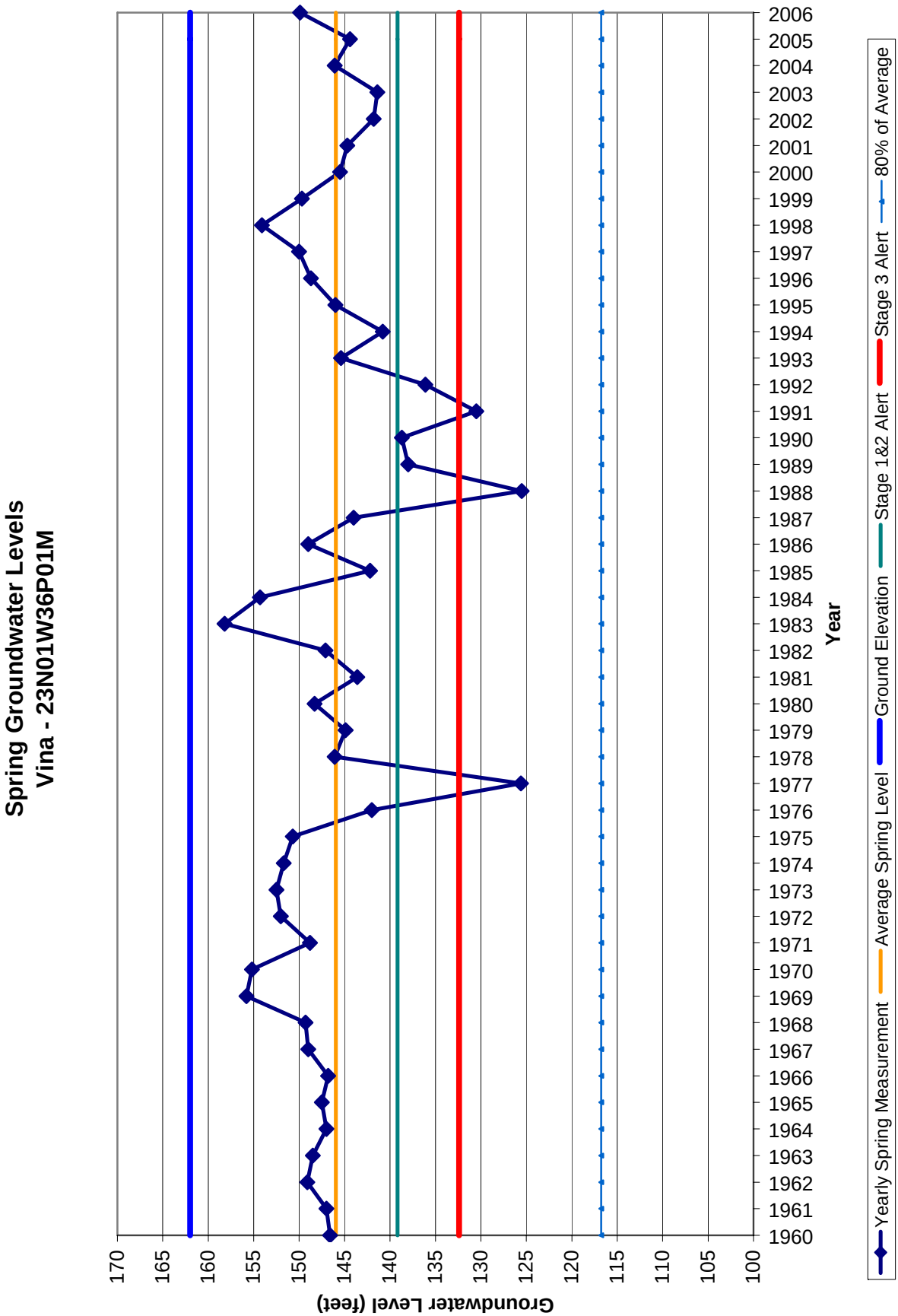
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average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Groundwater Level (feet)
170
165
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120
115
110
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Year
2006
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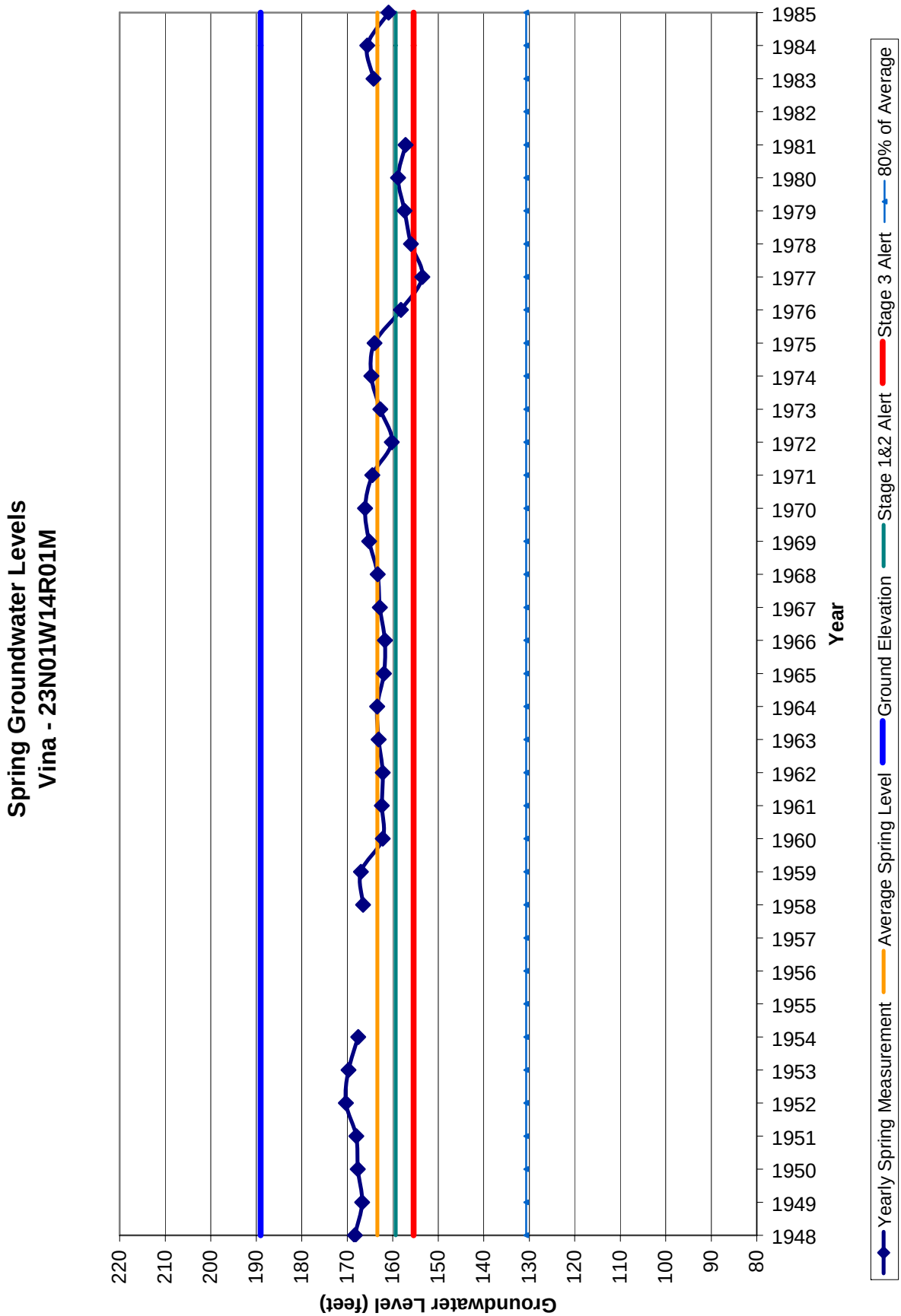
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Spring Groundwater Levels
Vina - 23N01W14R01M
Groundwater Level (feet)
220
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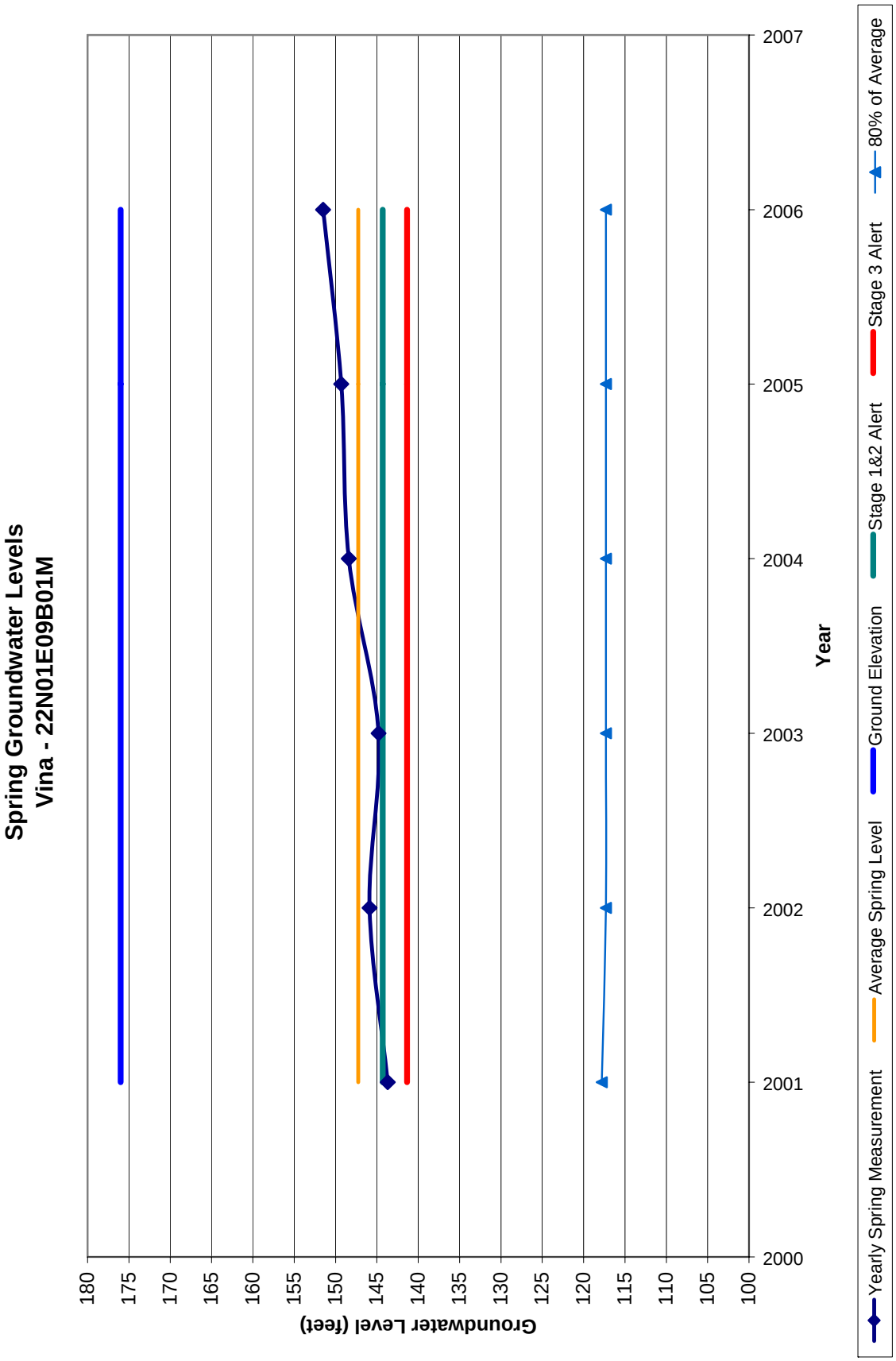
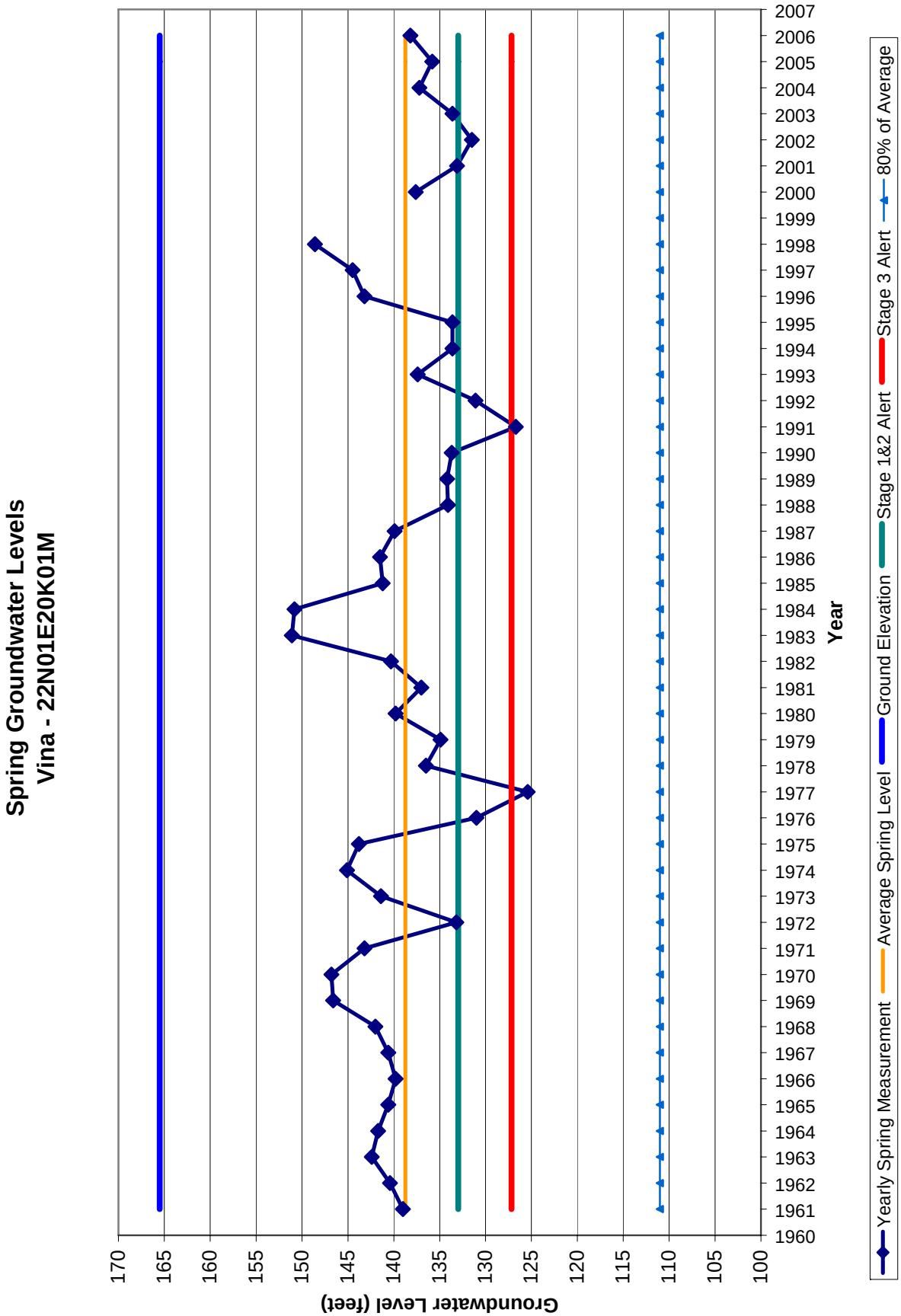
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average

SELECTED ALLUVIAL WELLS:




Spring Groundwater Levels
Vina - 22N01E20K01M
Groundwater Level (feet)
170
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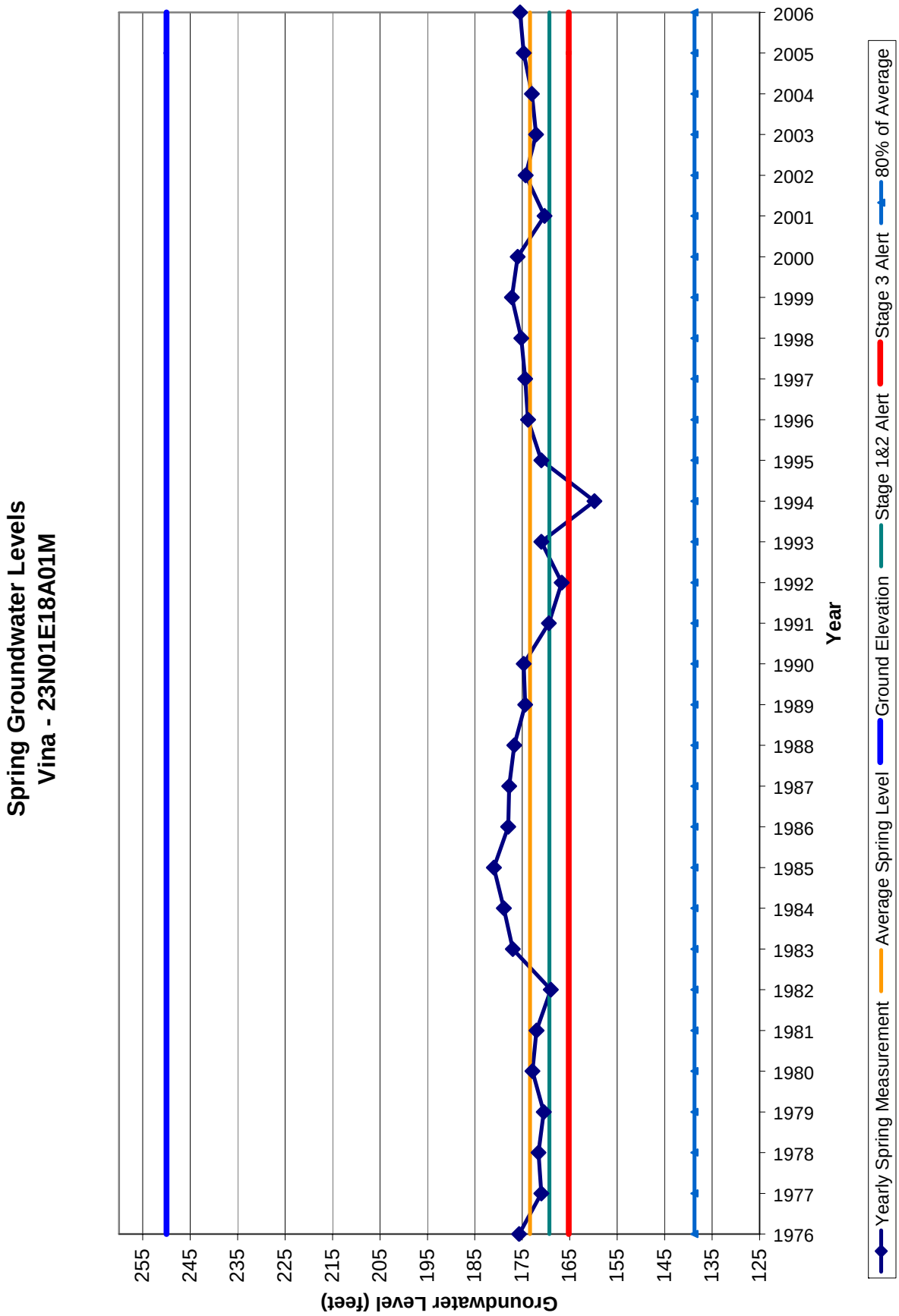
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Spring Groundwater Levels
Vina - 23N01E18A01M
Groundwater Level (feet)
255
245
235
225
215
205
195
185
175
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155
145
135
125
Year
2006
2005
2004
2003
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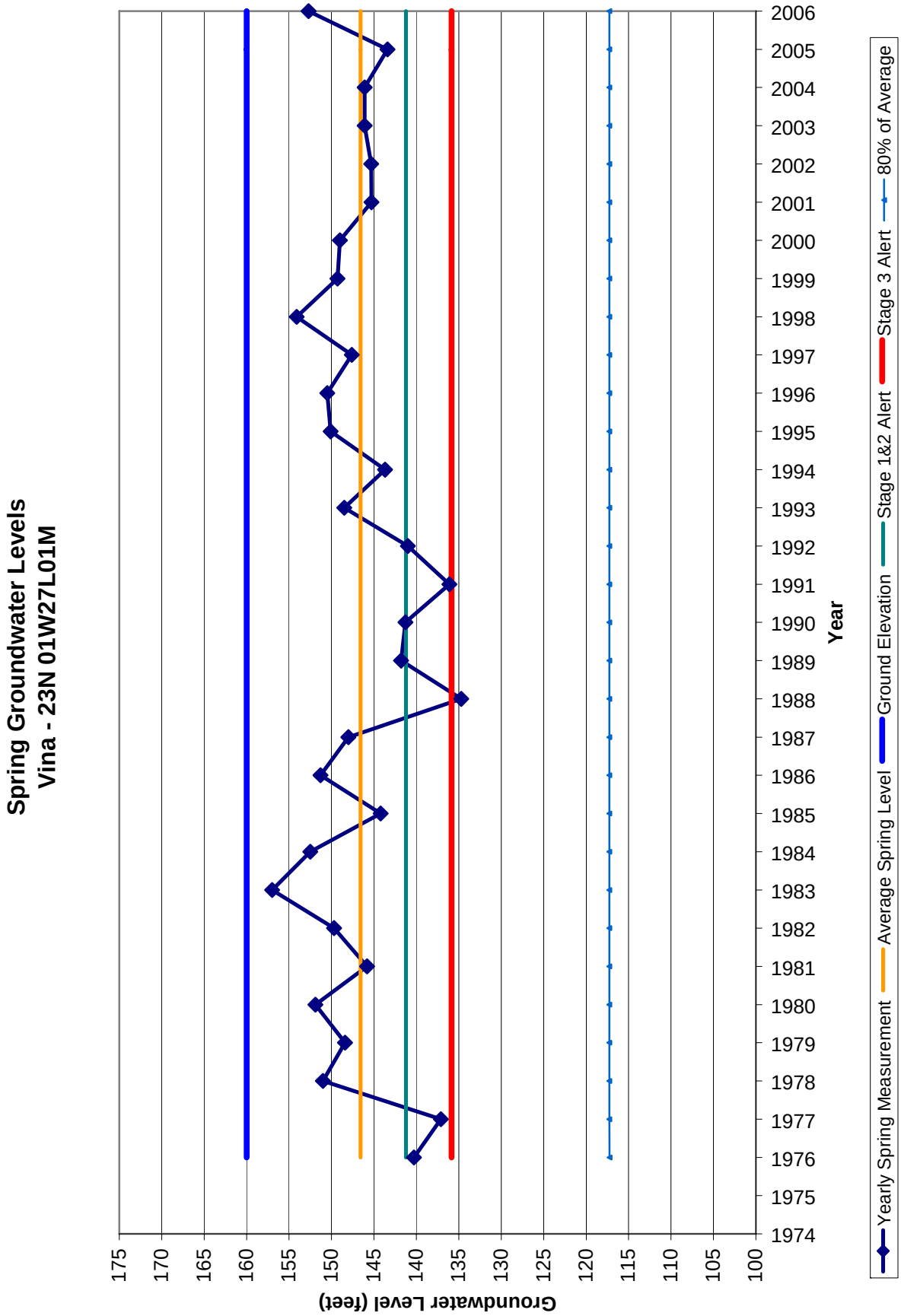
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Spring Groundwater Levels
Vina - 23N 01W27L01M
Groundwater Level (feet)
175
170
165
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125
120
115
110
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Year
2006
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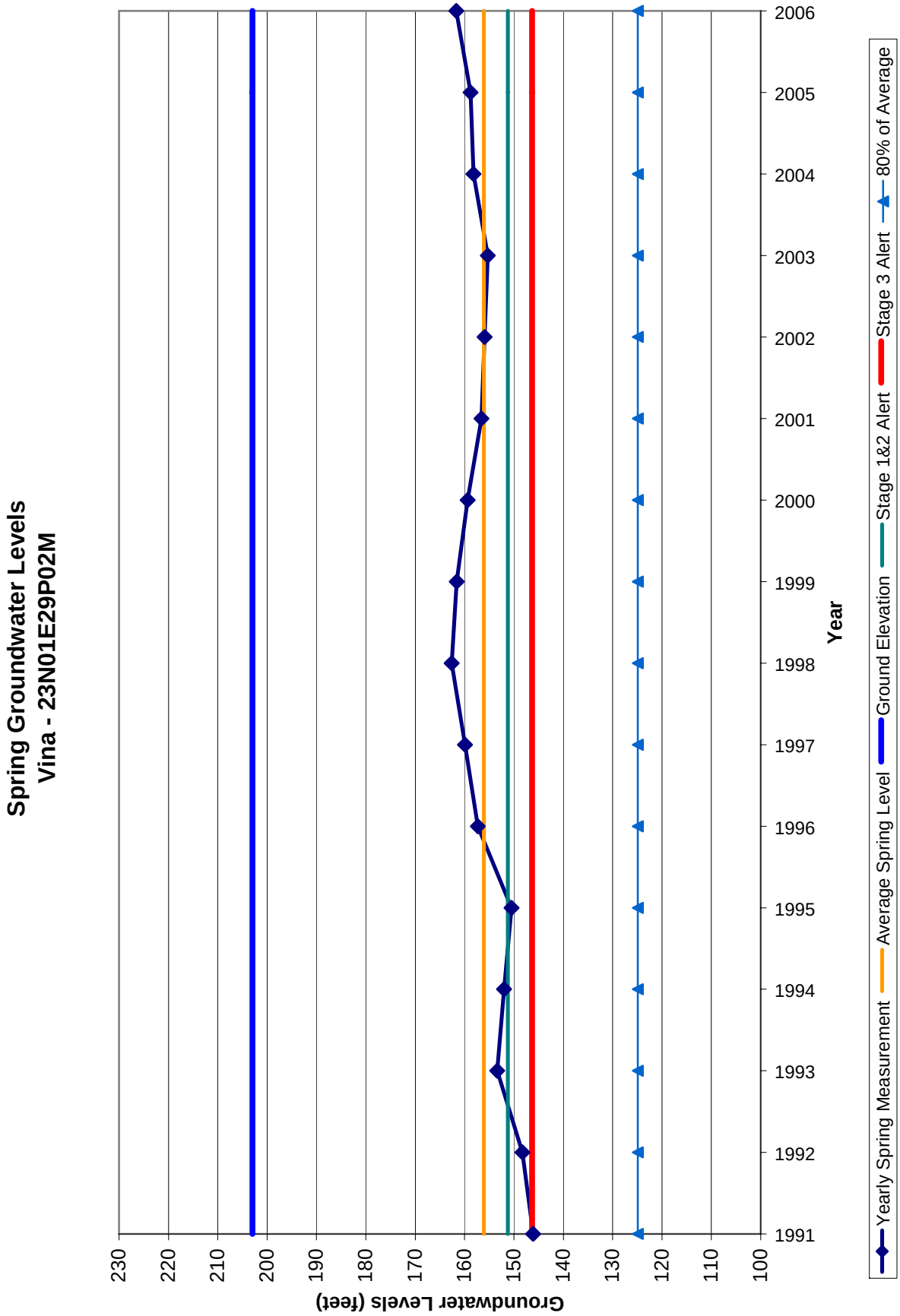
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Spring Groundwater Levels
Vina - 23N01E29P02M
Groundwater Levels (feet)
230
220
210
200
190
180
170
160
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130
120
110
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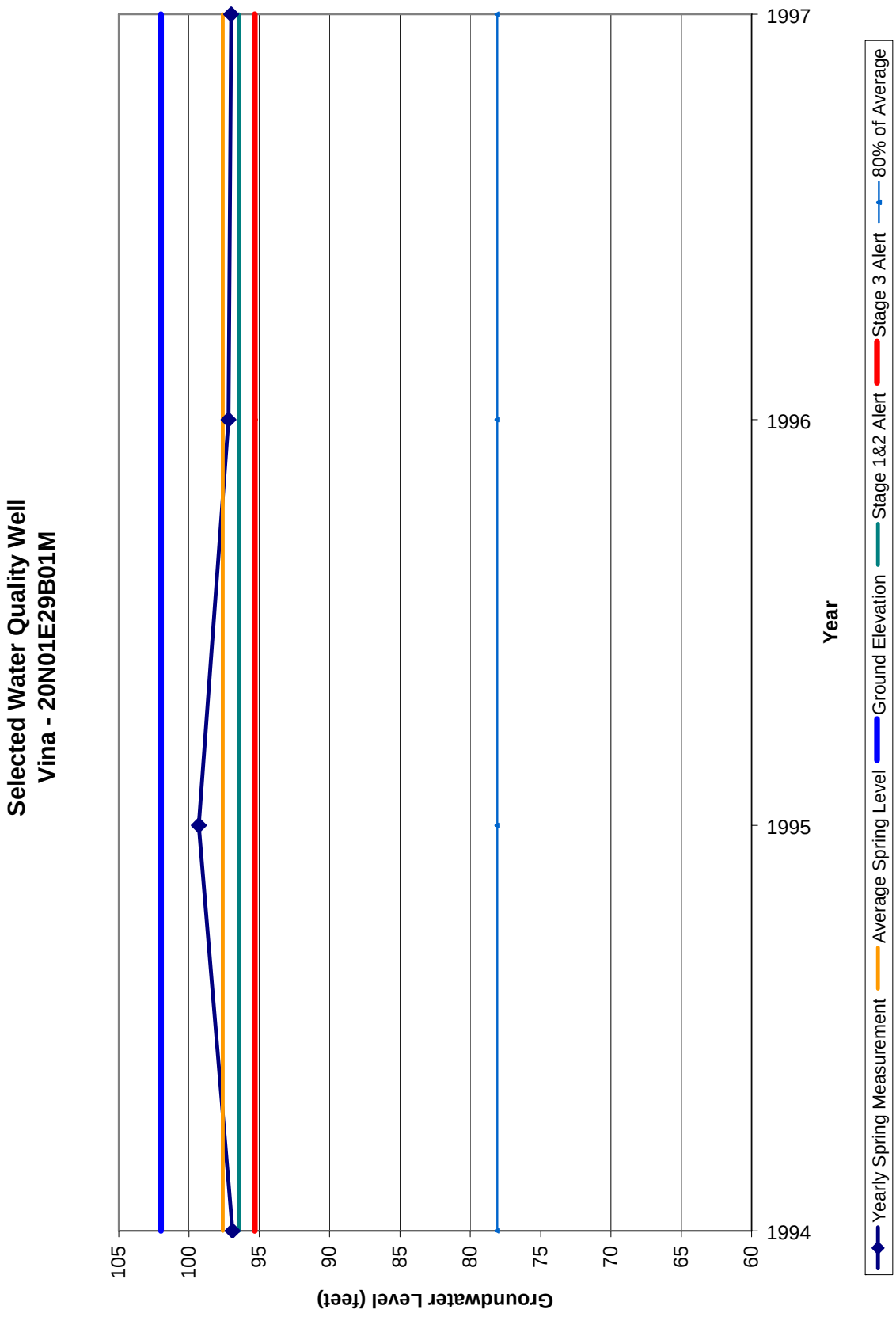
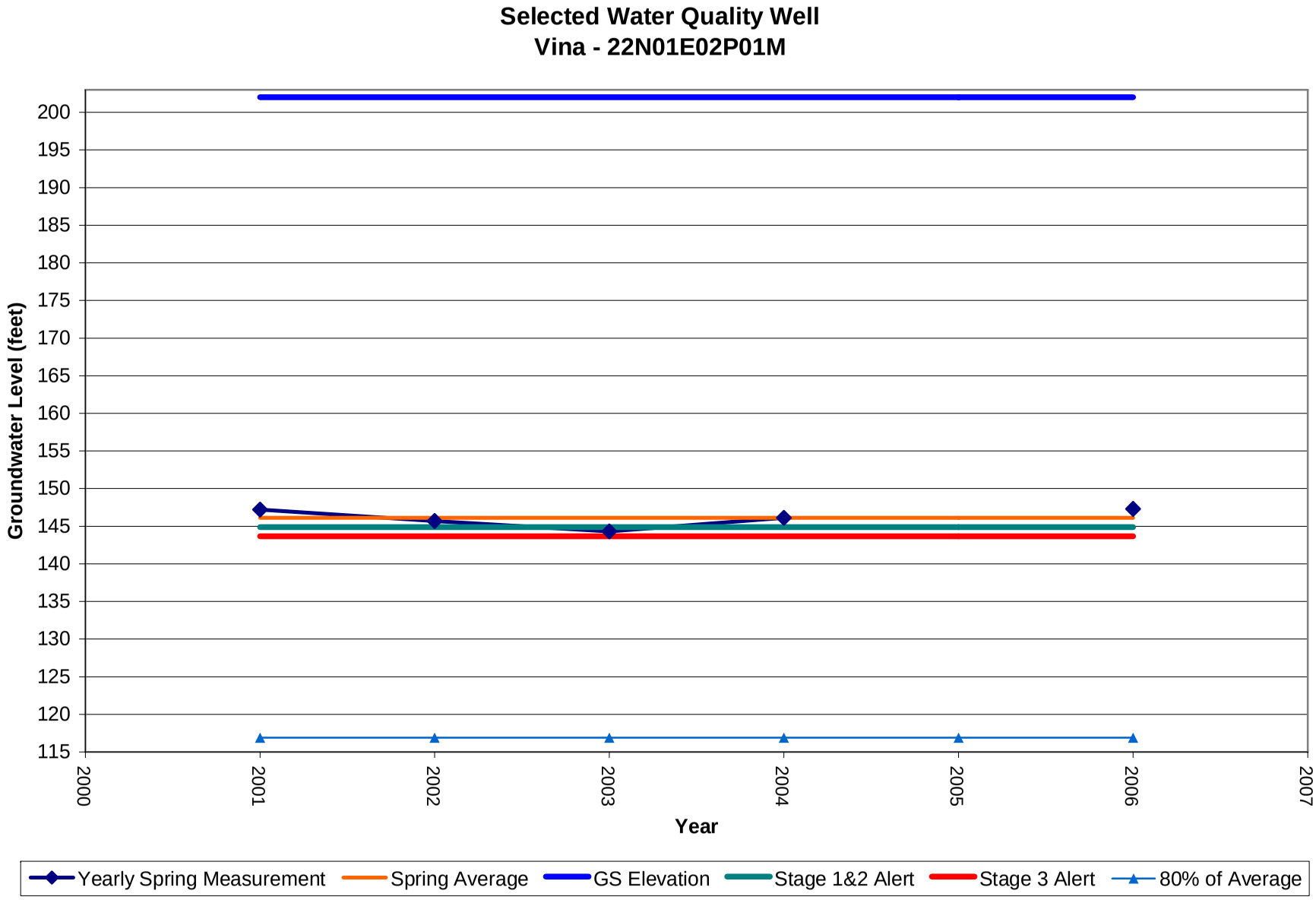
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average

SELECTED WATER QUALITY WELLS:




Selected Water Quality Well
Vina - 22N01E02P01M
Groundwater Level (feet)
200
195
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150
145
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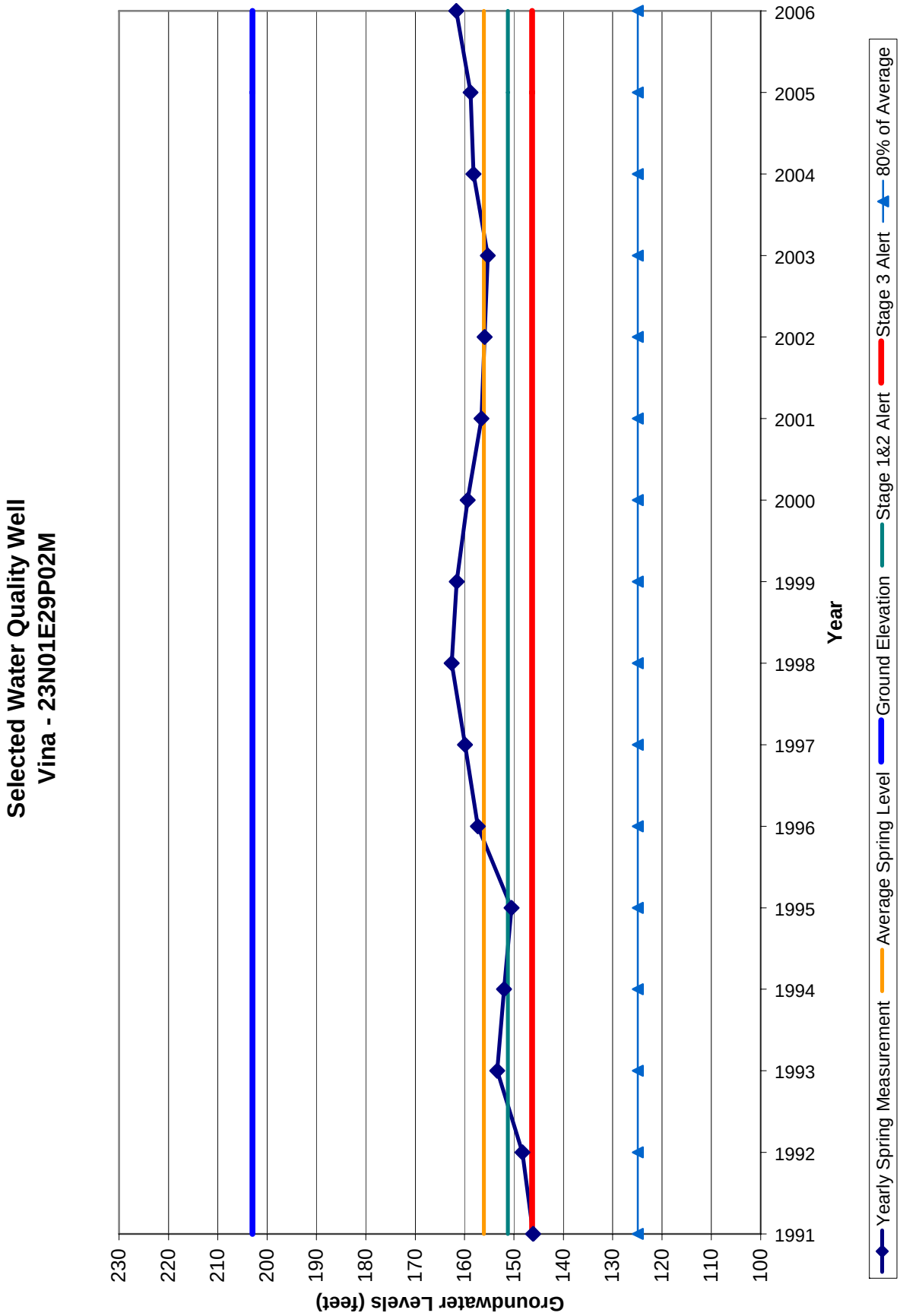
Year
Yearly Spring Measurement
Spring Average
GS Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average


Selected Water Quality Well
Vina - 23N01E29P02M
Groundwater Levels (feet)
230
220
210
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110
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Year
2006
2005
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2001
2000
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1998
1997
1996
1995
1994
1993
1992
1991
Yearly Spring Measurement
Average Spring Level
Ground Elevation
Stage 1&2 Alert
Stage 3 Alert
80% of Average

VINA Sub Area – Exhibit A USGS average runoff and total watershed drainage for creeks between Deer Creek and Big Chico Creek.

USGS Index Number	Basin	@ location	Drainage (sq. mi)	Elev	avg rain	avg snwpk	avg runoff	avg rechrg
384000	**Big Chico**	**Butte**	**72.4**				**104,000**	
384350	Mud Ck	"	48.9				45,720	
E-80	Rock Ck	"	19.6				5,100	
E-81	Pine	Teh/But	49				23,000	
E-82	Zimmershed	Tehama	2.7				400	
E-83	Campbell	"	10.6				2,000	
E-84	Singer	"	12.2				2,100	
E-85	unnamed	"	1.85				260	
E-86	---do.---	"	1.31				80	
383500	**Deer Ck**	**"**	**208**				**227,500**	**1,784***
TOTALS			**354.16**				**306,160**	

(*)Abstract presented by Dr. Karin Hoover CSUC to the Geological Society of America 2005

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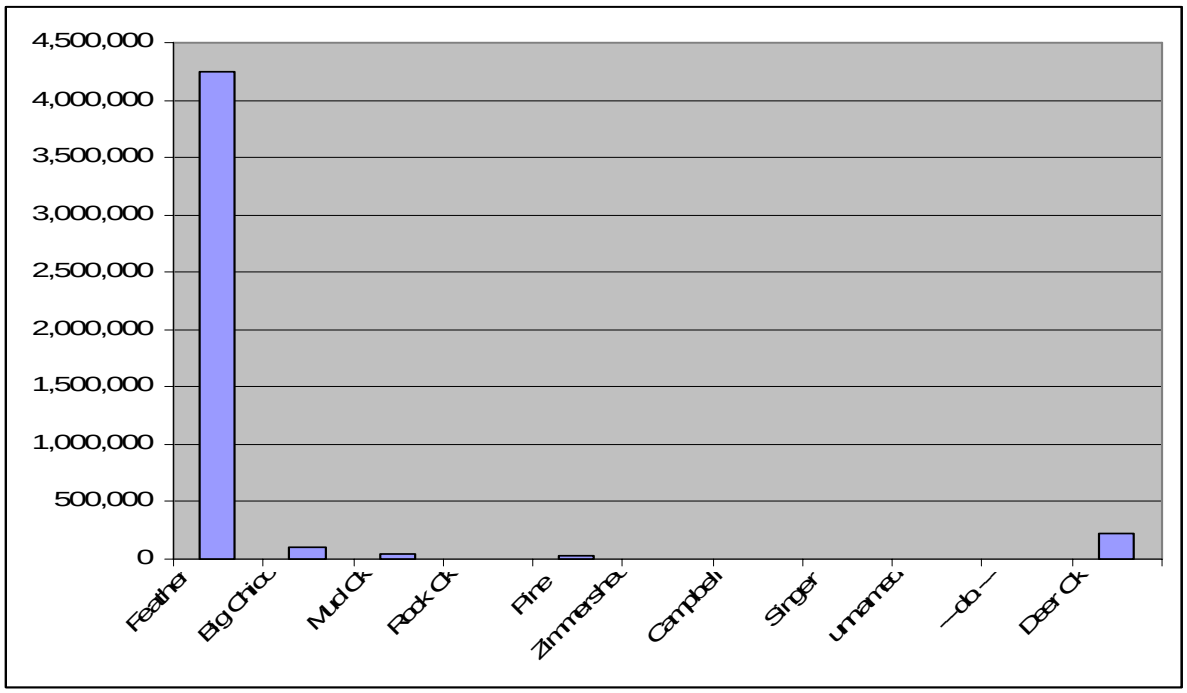
Below, comparison of creek flows over Vina recharge and Feather River flows.



VINA Sub Area – Exhibit B Comparison of Available Data: Two Wells in the Chico Urban Area (Fig.A)

Well #111C (on the left) shows the geology and actual aquifers (in blue) which combined with well screening data allows the determination of which, or how many aquifers supply water to the well.

Well #17E01M (on the right) is a monitoring well for the BMO determination, however it has only a single data point (water level): this is insufficient for establishing effective protection of the aquifer. Wells without geology and well screen location data should be removed from the monitoring list.

Fig. A – Two wells in the Chico Urban Area

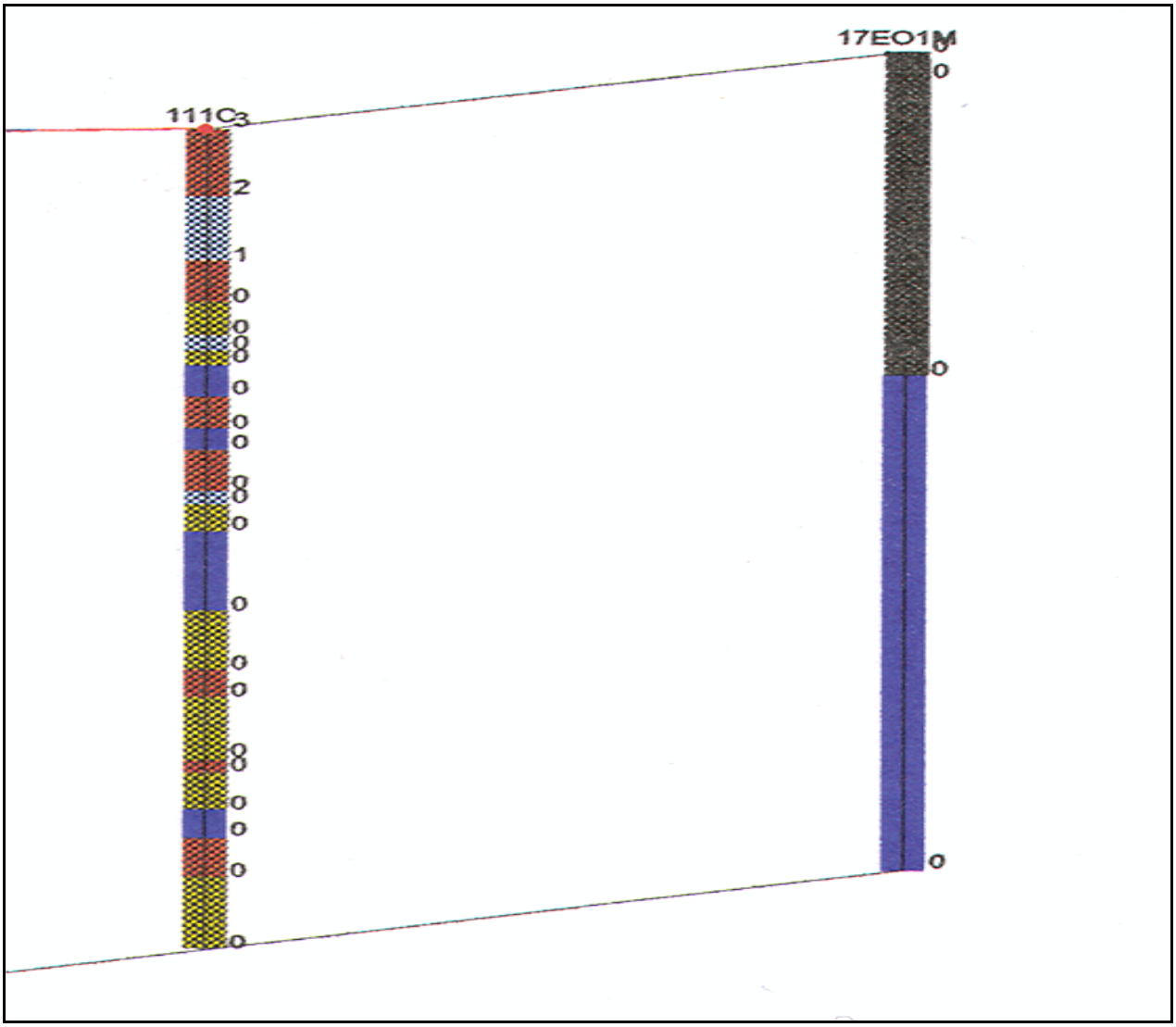


Fig B – Data available for #111C

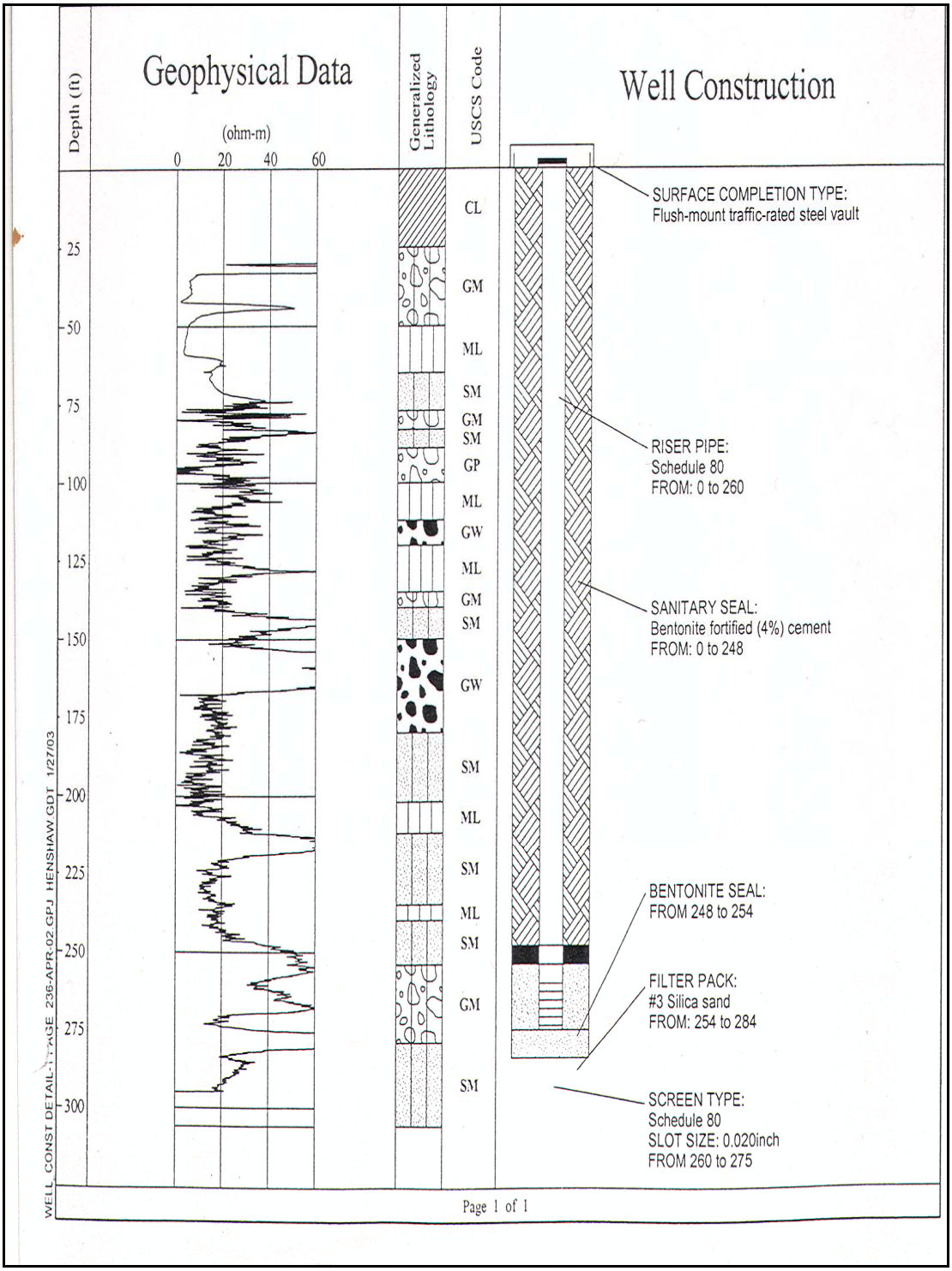


Fig. C – Water level data for #17E01M. A profound change occurred, but we are unable to determine what happened. Possibilities include a mistake in measuring, or recording measurements, or one of the aquifer levels was confined and has been depleted.

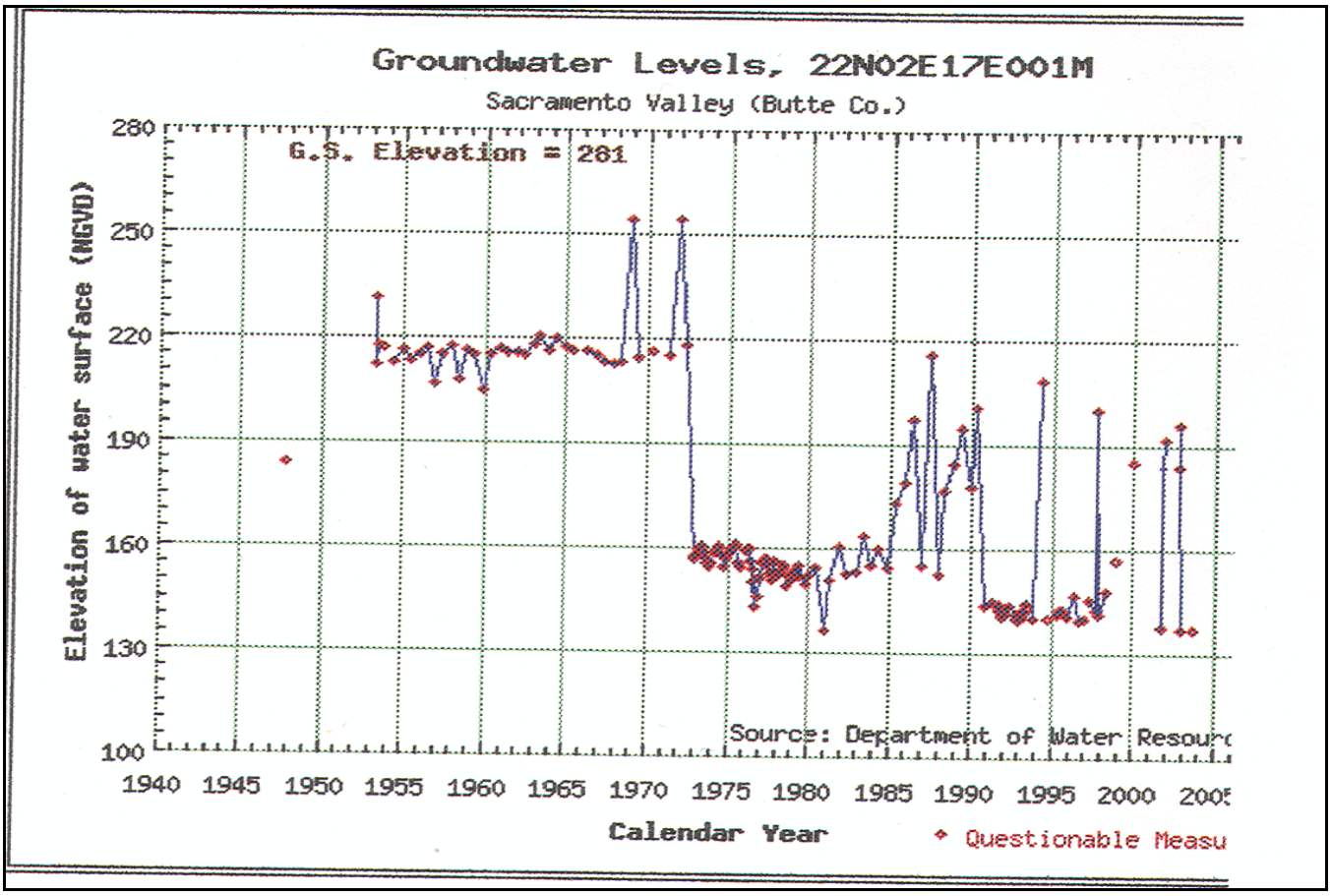


Fig. D – Linking geologic data can identify aquifer formations and aquitards. Notice that an aquifer FORMATION is NOT identical with an AQUIFER. An aquifer formation may contain several levels of water, or none at any location. This is why any estimate of the amount of water contained in any aquifer may not be very accurate.