GROUNDWATER STATUS REPORT

Prepared for

BUTTE COUNTY WATER COMMISSION

by

BUTTE BASIN WATER USERS ASSOCIATION

February 21, 2002

Table of Contents

Forward	1
Summary	2
Introduction	2
Measurement Frequency and Period of Record	3
Well Locations	4
Land Subsidence	4
Precipitation	5
Surface Water Deliveries	5
Groundwater Level Trends	6
Sub-area Breakdown	8
Appendix A	19
Appendix B	21

FOREWORD

In November 1996, the voters in Butte County voted in "AN ORDINANCE TO PROTECT THE GROUNDWATER RESOURCES IN BUTTE COUNTY". One of the stated purposes of the Ordinance was that "The groundwater underlying Butte County is a significant water resource which must be reasonably and beneficially used and conserved for the benefit of the overlying land by avoiding extractions which harm the Butte Basin aquifer, causing exceedance of the safe yield or a condition of overdraft."

Prior to 2000, Butte County Code, Chapter 33, required that the Groundwater Status Report be delivered to the County by January 15th of each year. During 2000, the Butte County Board of Supervisors amended Chapter 33 to require the Groundwater Status Report be delivered by February 21st of each year.

Section 3.01 – "Groundwater Planning Process" requires that the Butte Basin Water Users Association prepare a groundwater status report based upon the data gathered and analyzed pursuant to Section 3.02 – "Groundwater Monitoring". The Groundwater Status Report is in response to this requirement.

The Department of Water Resources Northern District in Red Bluff supplied monitoring information and hydrographs that are used in this report and we would like to thank them for their cooperation and support in supplying this information. We also used the Department of Water Resources "Sacramento Valley Basin Groundwater Levels – Butte County" publication dated February 1993 as a reference and guide in preparing this report.

The purpose of this report is to summarize groundwater level data collected by Butte County and DWR up to and through October 2001. The report presents locations of wells, information related to groundwater level trends and hydrographs depicting groundwater levels over time. It is our intent that this information be used to provide a better basis for understanding groundwater trends in Butte County.

_____

Gene Harris, Chairman
Butte Basin Water Users Association

SUMMARY

Based upon the water level measurements taken in 2001, the following points can be made relative to the status of groundwater in Butte County:

- No long-term depletion of groundwater in storage is occurring within the County.
- Groundwater levels during the year 2001 water year did not fluctuate within the County beyond historical ranges.
- After two years of subsidence monitoring, no land subsidence was detected in the County.
- An annual groundwater level fluctuation of 5 to 15 feet occurred within the Chico urban area during the year 2001.
- Long-term comparison of spring-to-spring groundwater levels in the Chico urban area indicates an overall decline of 10 to 15 feet in groundwater levels since the 1950s, with most of the decline occurring during the 1987-94 drought. The long-term decline in groundwater levels have stabilized since 1995.
- Seasonal groundwater fluctuations during the year 2001 were within historical ranges.

INTRODUCTION

This report is a compilation of information related to the monitoring activities in Butte County and includes groundwater hydrographs from "key wells" within each sub-area, hydrographs from the two extensometers measuring land subsidence and groundwater elevation contour maps for spring, summer and fall 2000 measurements. Groundwater hydrographs for the remaining monitored wells are available on the DWR website at http:\\wwwdpla.water.ca.gov/nd.

Most of the material contained in this report was excerpted from a draft report titled Butte County Groundwater Analysis, dated December 2000, which was prepared by the Department of Water Resources, Northern District. This was done to achieve a level of consistency between the findings of the BBWUA, and those of the Butte County Inventory Analysis which was prepared cooperatively by Butte County Department of Water and Resource Conservation, their consultant, Camp, Dresser and McKee, Inc. and the Department of Water Resources.

MEASUREMENT FREQUENCY AND PERIOD OF RECORD

Groundwater level monitoring in the Sacramento Valley portion of Butte County is currently being conducted by a number of different private and public agencies. Historically, the Department of Water Resources has maintained the most comprehensive, long-term groundwater level-monitoring grid, with approximately 210 different wells monitored over the last 50 years in the Sacramento Valley portion of Butte County. Within this period of time, the annual size of the monitoring grid has fluctuated from as few as 50 wells, to about 180 wells, depending upon the activity of special studies in the area. Until 1989, the majority of these wells were measured twice per year, during the spring and fall. Beginning in 1990 the groundwater level monitoring was increased to monthly, before returning to a semi-annual measurement in 1995. In 1997, the Butte County Department of Water Resource and Conservation, in cooperation with the Department of Water Resources, began to expand the number and frequency of groundwater level monitoring in the valley portion of Butte County. The current monitoring grid has 88 wells and consists of a mixture of domestic and irrigation wells, along with several dedicated observation wells. Approximately 14 of the 88 wells are equipped to continuously monitor and record changes in groundwater levels. The remaining wells are measured four times per year, during March, July, August and October. The current Butte County groundwater level-monitoring grid is shown in Appendix A.

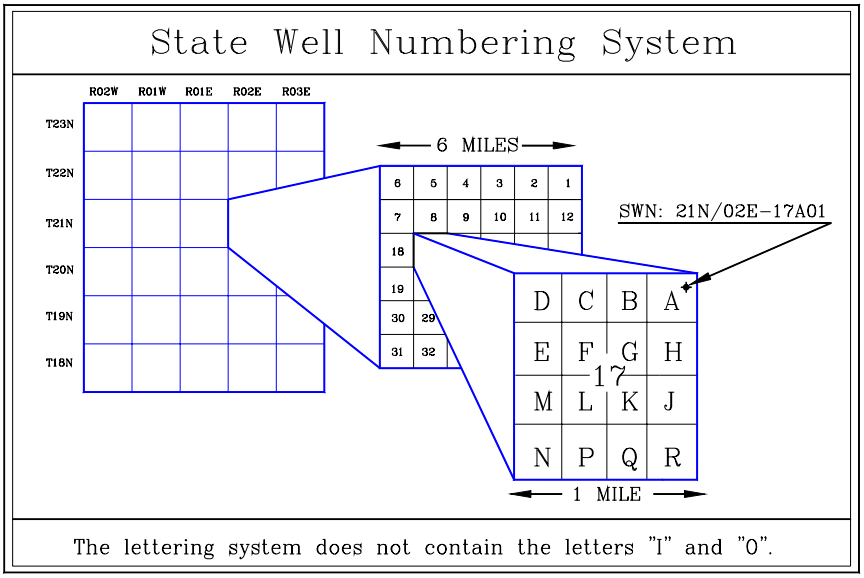
In addition to the groundwater level monitoring conducted by Butte County and Department of Water Resources, California Water Service Company currently measures monthly groundwater levels in approximately 60 municipal groundwater supply wells in the Chico Urban area. California Water Service wells are typically deep wells that draw from the middle to lower portion of the aquifer system.

The Groundwater Ordinance specifies that groundwater level measurements be taken at least four (4) times per year, during the months of March, July, August and October. Butte County and DWR staff has followed this monitoring schedule since 1997. These additional measurements are shown on the hydrographs contained in this report and on the DWR website. The U. S. Bureau of Reclamation and USGS are not currently measuring water levels in Butte County, but have historically.

Since 1997, fourteen (14) additional wells have been added to the Butte County and Department of Water Resource base groundwater monitoring grid and a total of fourteen (14) of the monitoring wells are equipped with continuous monitoring devices.

WELL LOCATIONS

Locations of Butte County monitoring wells, including continuously monitored wells and extensometers, are shown in Appendix A. The well locations are approximate, but are estimated to be within 500 feet. The monitoring wells are numbered using the state well numbering system. The state well numbering system identifies each well by its location according to the township, range, section and tract system. The figure below illustrates the State Well Numbering system.



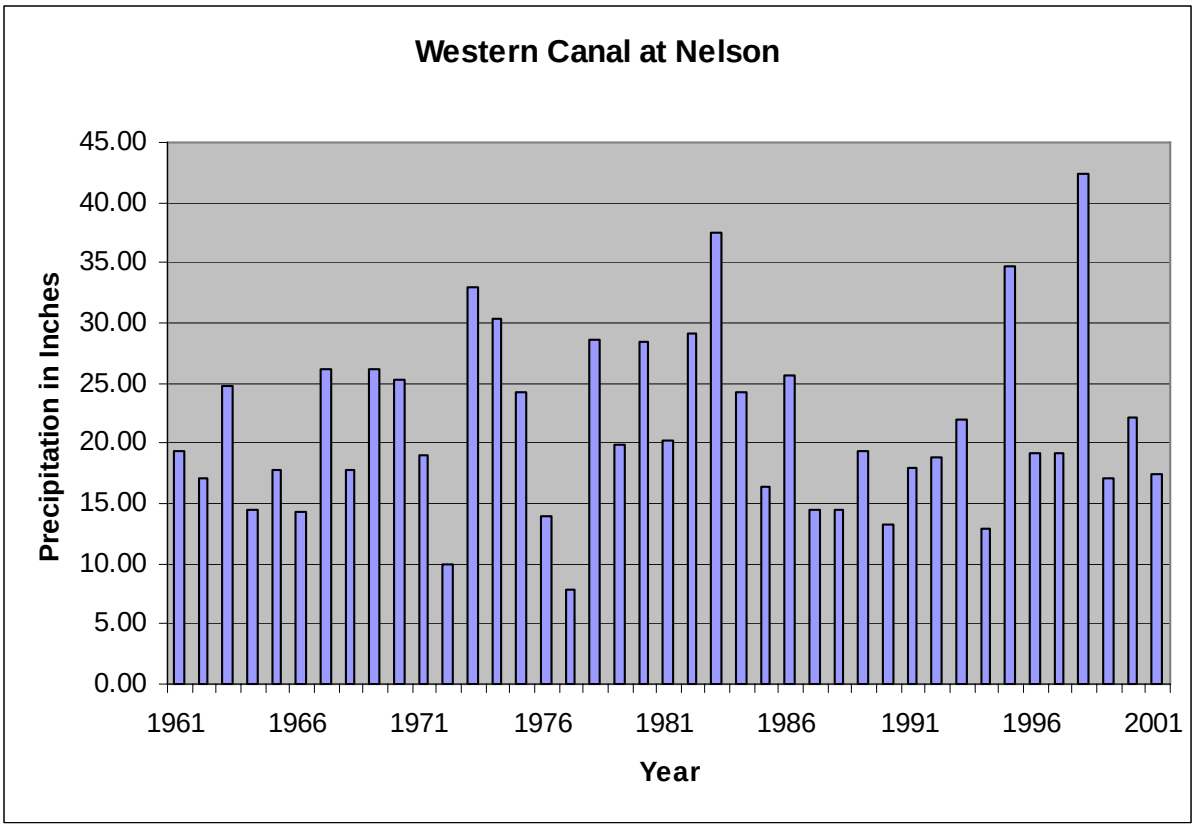
LAND SUBSIDENCE

The locations of the two extensometers that measure land subsidence within the County are shown in Appendix A. These extensometers were installed during 1999. Records from these extensometers are shown in Appendix B.

The Technical Advisory Committee of the Butte County Water Commission determined the areas within the basin where the geology might lend itself to land subsidence. Based upon these determinations, additional extensometers in these areas may be installed in the future as funding permits.

PRECIPITATION

Precipitation for the water year that ended on September 30, 2001 at the Western Canal at Nelson Station was 17.41", which is 3.11" below the 79-year average of 20.52". The figure period below represents the total annual precipitation at the Western Canal Station for the 40-year period 1961 to 2001.



SURFACE WATER DELIVERIES

Surface water is an important component to aquifer recharge in the Butte Basin. During 2001 water year over a million acre feet of water was delivered to Western Canal Water District and the Joint Water Districts. The 2001 water deliveries were slightly less than was delivered in 2000, however it represents nearly a 100% increase since 1991. The increased water use is primarily the result of water needed for rice straw decomposition. Summarized below are the deliveries to Western Canal Water District and the Joint Board Water Districts for the years 1991 to 2001 in acre feet.

Water Year	Western Canal Water District	Joint Board Water Districts	Total
1991	185,147	344,768	529,915
1992	198,595	349,036	547,631
1993	214,534	515,292	729,827
1994	224,754	586,622	811,377
1995	210,117	568,481	778,598
1996	257,183	615,004	872,187
1997	275,675	658,540	934,214
1998	229,521	590,727	820,248
1999	293,402	690,847	984,248
2000	325,374	707,018	1,032,392
2001	303,074	718,489	1,021,562

GROUNDWATER LEVEL TRENDS

Groundwater levels fluctuate annually in response to extraction, recharge from precipitation, stream percolation, infiltration of applied irrigation water and subsurface inflow and outflow. Levels are usually highest in the spring and lowest during irrigation in the summer months. Longer-term fluctuations occur when discharge exceeds or is less than recharge over several seasons. Changes in groundwater levels are determined from well measurements. Hydrographs are graphical plots of the measurements and illustrate annual changes, long term changes linked to increased or decreased groundwater extraction, or variations associated with wet or dry climatic conditions.

Precipitation, applied water, local creeks and rivers and the Thermalito Afterbay recharge groundwater in Butte County. Groundwater generally flows from northeast to southwest. Prior to 1997, data points for each of the hydrographs generally consisted of 2 annual measurements. Since 1997, 4 measurements are recorded each year and show a greater fluctuation.

Listed below are groundwater level assessments for key wells in each sub-area. These wells were chosen as being representative of changes in groundwater level within each sub-area. It should also be noted that the sub-areas used in this Report are different than those used in last year's report, but are consistent with the sub-unit areas used in Butte County's Water Inventory Analysis.

When reviewing these hydrographs, note that the solid circles (dots) indicate a static groundwater level measurement while the red symbols indicate a measurement that has been qualified as questionable. The Department of Water Resources assigns a numerical code to all questionable groundwater level measurements in an effort to help increase the accuracy of data analysis. Questionable measurement codes are used to differentiate between static versus pumping groundwater level measurements, and/or identify if nearby wells are pumping during the measurement. A key to explain the various types of questionable measurement codes is show on each hydrograph.

The accuracy of the groundwater levels shown on these graphs is 0.1 feet on the depth scale and within 1 USGS topographic map contour interval on the elevation scale. Typically in Butte Basin the contour interval is 5 feet.

When interpreting changes in groundwater levels over time, care should be used to compare only those measurements taken during similar times of the year. Prior to 1990, much of the groundwater level data for Butte County consisted of only spring and fall data. Since 1990, summer measurements have been collected for many of the monitoring wells. When using a hydrograph to compare multiple years of groundwater level data, comparison of the spring measurements is recommended. Discontinuities or breaks in a hydrograph represent missing measurements.

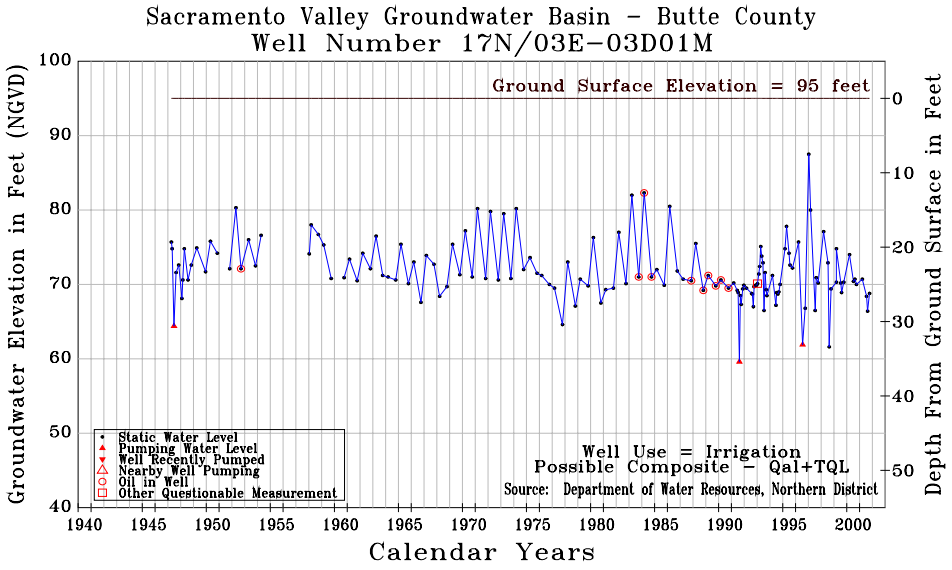
- North Yuba Sub-Area (Well Number 17N/03E-03D01M)
- Thermalito Sub-Area (Well Number 18N/03E-21G01M)
- Western Canal Sub-Area (Well Number 20N/01E-35C01M)
- Richvale Sub-Area (Well Number 19N/01E-28R01M)
- Pentz Sub-Area (Well Number 21N/02E-26F01M)
- Esquon Sub-Area (Well Number 20N/02E-09L01M)
- Butte Sink Sub-Area (Well Number 17N/01E-17F01M)
- Butte Sub-Area (Well Number 17N/03E-16N01M)
- Biggs-West Gridley Sub-Area (Well Number 18N/02E-16F01M)
- M & T Sub-Area (Well Number 22N/01E-29R01M)
- Durham-Dayton Sub-Area (Well Number 20N/02E-06Q01M)
- Vina Sub-Area (Well Number 23N/01W-09E01M)
- Cherokee Sub-Area (Well Number 20N/02E-13E02M)
- Llano Seco Sub-Area (Well Number 20N/01W-26H02)
- California Water Service Sub-Area (Well Numbers 1-04 and 33-01)

Additional hydrographs for wells monitored in Butte County are available on the DWR web site at http:\\wwwdpla.water.ca.gov/nd.

North Yuba Sub-Area (Well Number 17N/03E-03D01M):

The figure below is a hydrograph for well 17N/03E-03D01M, located in the western portion of the North Yuba Sub-area. The area surrounding the well is characterized by rural, agricultural land use supported by the application of both surface and groundwater. The well is an active irrigation well drawing water from the upper and middle portions of the aquifer system, with a groundwater level measurement record dating back to the late 1940s. The groundwater level in this well was monitored on a semi-annual basis until 1991, on a monthly basis from the 1991 to approximately 1995, and is currently being measured four times per year, March, July, August and October.

This figure shows that the seasonal fluctuation in groundwater levels is about 5 to 10 feet during years of normal precipitation and 10 to 15 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels show about a 10-foot decline in groundwater levels associated with 1976-77 and 1986-94 droughts, followed by recovery to pre-drought levels. Overall comparison of spring-to-spring groundwater levels indicates that the upper to middle aquifer system in this area has changed little since the1940s.



.

Groundwater Hydrograph for Well 17N/03E-03D01M

Groundwater levels during the 2001 water year in this well were slightly lower than during the 2000 water year because of drier than normal water year.

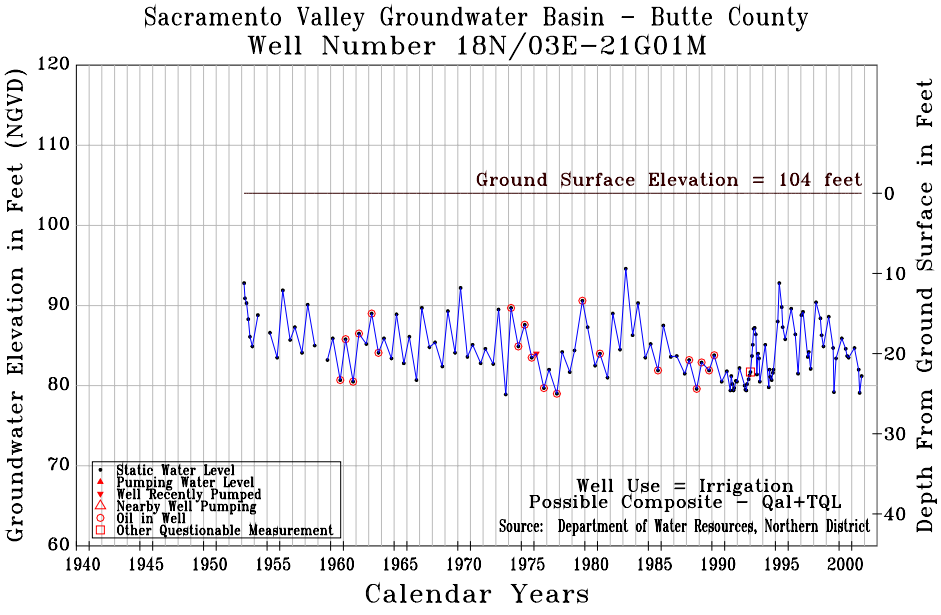
Thermalito Sub-Area (Well Number 18N/03E-21G01M):

The figure below is a hydrograph for well 18N/03E-21G01M, located in the southern portion of the Thermalito Sub-area, approximately one-mile west of the Feather River. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists of orchard crops supported primarily by groundwater extraction. This well is an active irrigation well producing

groundwater from the shallow to intermediate portion of the aquifer system. The groundwater level measurement record dates back to the late 1940s. Groundwater levels in this well were monitored on a semi-annual basis to 1991, and on a monthly basis from 1991 to about 1994. Since 1994, this well has been monitored four times a year during March, July, August and October.

This figure shows an interesting spring to summer fluctuation in groundwater levels between normal and drought years. The range of spring to summer fluctuation in groundwater levels is about 5 to 8 feet during years of normal precipitation, but then decreases during years of drought to about 2 to 5 feet. A closer look at the hydrograph shows that the decrease in spring to summer fluctuation is the result of a drop in spring groundwater levels, while the summer levels remain constant. The drop in spring groundwater levels indicates that the aquifer system in this area does not fully recharge during years of drought. The quick drop, then relatively constant draw down during drought years, indicates that the aquifer system in this area is likely being recharged from a steady source of surface water; in this case the Feather River. During drought years, groundwater levels drop relatively quickly until they reach the point where the aquifer is interconnected with the Feather River. The hydrograph indicates that, in this area, the surface water – groundwater interconnection takes place at about 23 feet below ground surface, or at an elevation of about 80 feet above mean sea level.

Long-term comparison of spring-to-spring groundwater levels show an overall decline of 5 to 8 feet during the 1976-77 and 1986-94 droughts, followed by recovery to pre-drought levels. Further long-term comparison of spring-to-spring groundwater levels during normal years indicates very little change since the late 1950s.



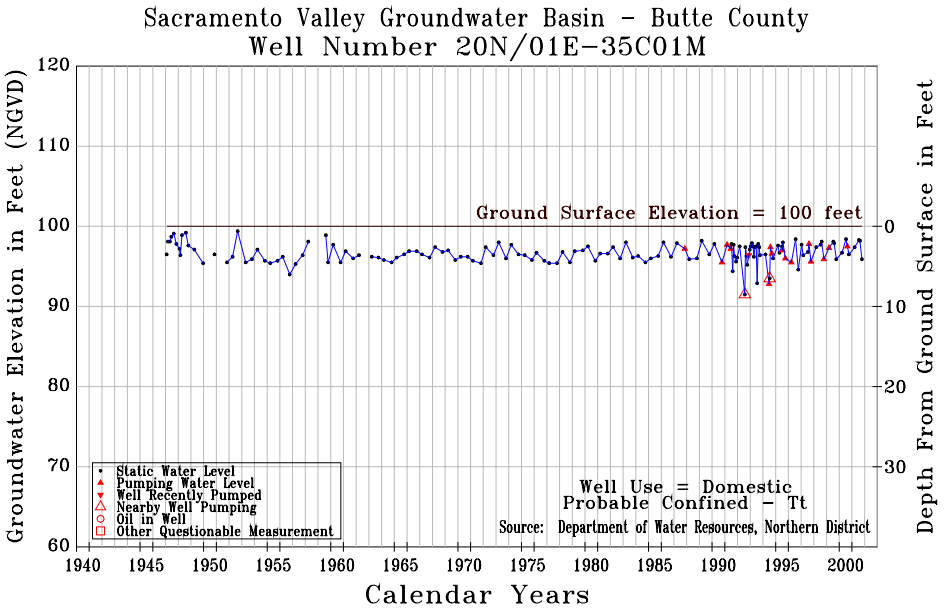
Groundwater Hydrograph for Well 18N/03E-21G01M

Groundwater levels during the 2001 water year were near historic low levels in this well because of drier than normal water year, although no long-term depletion of groundwater in storage is occurring at this time.

Western Canal Sub-Area (Well Number 20N/01E-35C01M):

The figure below is a hydrograph for an active irrigation well 20N/01E-35C01M, located in the central portion of the Western Canal Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists of rice production supported by surface water in normal years and a mixed source in drought years. The well is constructed in the upper portion of the aquifer for domestic use. The groundwater level measurement record dates back to the mid-1960s. Groundwater levels in this well were monitored on a semi-annual basis until 1991 and on a monthly basis from 1991 to about 1994. Since 1994, this well has been monitored four times a year during March, July, August and October.

The figure shows that the spring to summer fluctuation in groundwater levels averages only 2 to 3 feet during years of normal precipitation and 4 to 8 feet during years of drought. Summer groundwater level monitoring indicates that the upper aquifer recharges during summer months due to flood irrigation for rice production. In areas of flood irrigation, it is important that domestic wells have an adequate annular seal in order to restrict potential contamination from surface sources and maintain a high quality source of domestic groundwater. Long-term comparisons of spring-to-spring groundwater levels show almost no change in groundwater levels associated with the 1976-77 drought and only a small decline associated with the 1986-94 drought. Further long-term analysis of spring-to-spring groundwater levels indicates very little change in groundwater levels since the late 1940s.



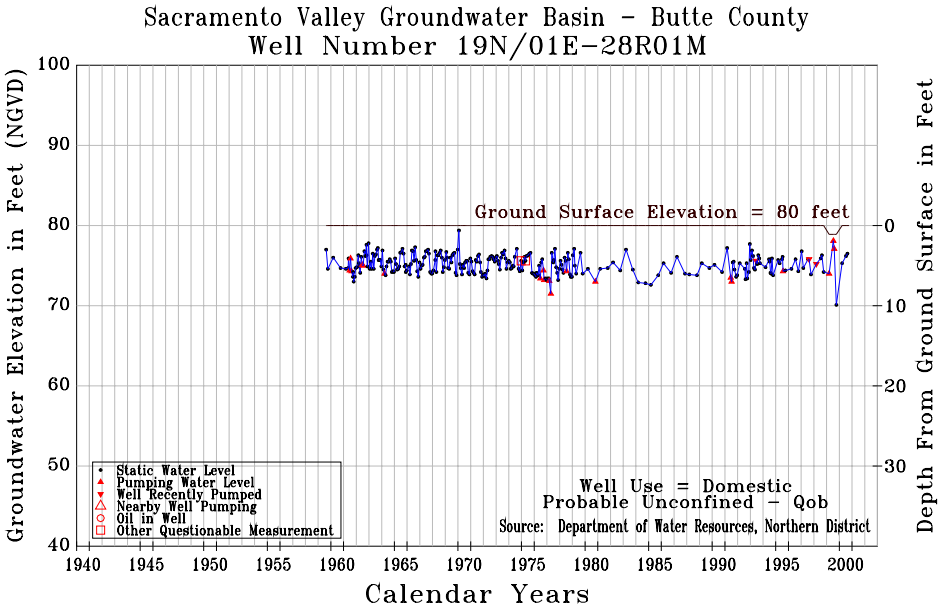
Groundwater Hydrograph for Well 20N/01E-35C01M

Groundwater levels in this well were unaffected by the drier than normal water year.

Richvale Sub-Area (Well Number 19N/01E-28R01M):

The figure below is a hydrograph for well 19N/01E-28R01M, located in the western portion of the Richvale Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists of rice production supported by surface water in normal years and a mixed source in drought years. The well is an active domestic well constructed in the upper portion of the aquifer, with a groundwater level measurement record dating back to the late-1950s. Groundwater levels in this well were monitored on a monthly basis from 1959 to 1979, on a semi-annual basis (spring and fall) from 1979 to 1991 and on a monthly basis again from 1991 to about 1994. Since 1994, this well has been monitored four times a year during March, July, August and October.

The figure shows that the spring to summer fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 3 to 4 feet during years of normal precipitation and 4 to 5 feet during years of drought. Close examination of the spring to summer fluctuations indicates that the upper aquifer recharges during summer months due to flood irrigation for rice production. In areas of flood irrigation, it is important that domestic wells have an adequate annular seal in order to restrict potential contamination from surface sources and maintain a high quality source of domestic groundwater. Long-term comparison of spring-to-spring groundwater levels show almost no change in groundwater levels associated with either the 1976-77 and or the 1986-94 droughts. Further long-term analysis of spring-to-spring groundwater levels indicates very little change in groundwater levels since the late 1950s.



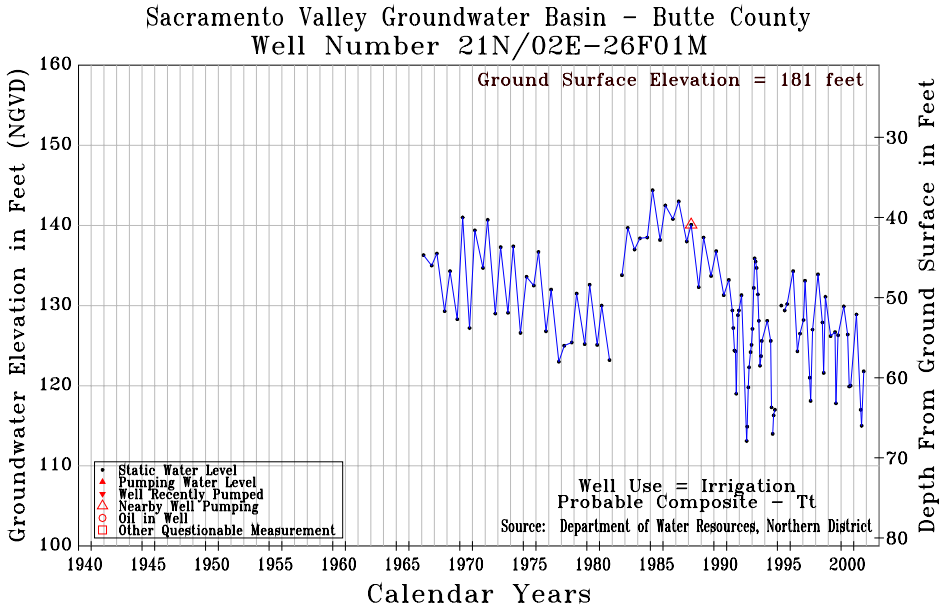
Groundwater Hydrograph for Well 19N/01E-28R01M

Monitoring groundwater levels at this well have been discontinued and a new representative well for this area needs to be selected. This is an area that historically has used little groundwater so it is not anticipated that problems exist in this area.

Pentz Sub-Area (Well Number 21N/02E-26F01M):

The figure below is a hydrograph for an active irrigation well 21N/02E-26F01M, located just west of Highway 99, at the intersection of Durham-Pentz Road. Within a two-mile radius of the well, groundwater is used to support agricultural production of orchard and row crops, and small-scale industrial uses associated with a beverage distribution plant. The well is a deep irrigation well with shallow casing, and a groundwater level measurement record dating back to the mid-1960s. Groundwater levels in this well represent a mixture of the unconfined and confined portions of the aquifer system. The groundwater levels in this well were monitored on a semi-annual basis (spring and fall) until 1991 and on a monthly basis from 1991 to about 1994. Since 1994, this well has been monitored four times a year during March, July, August and October.

The figure shows that the average seasonal fluctuation in groundwater levels averages about 5 to 10 feet during years of normal precipitation and up to 20 feet during years of drought. Long-term comparison of spring to spring groundwater levels show a small decline in groundwater levels associated with the 1976-77 drought, followed by a larger decline associated with the 1986-94 drought. Groundwater levels in this well appear to recover from the 1986-94 drought to groundwater levels similar to those of the early 1980s. However, further long-term analysis of spring-to-spring groundwater levels indicates a 5 to 10 foot decline in groundwater levels since the late 1960s.



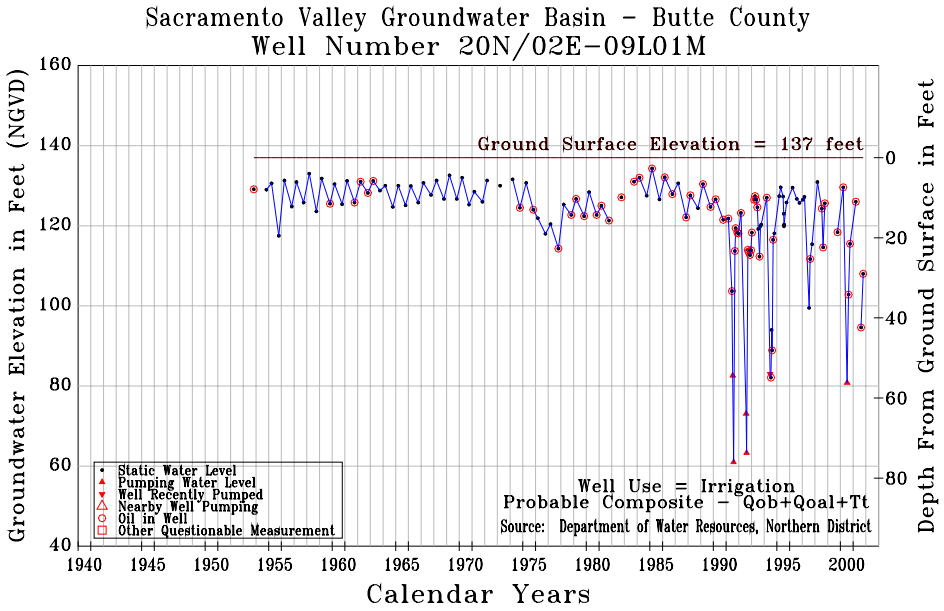
Groundwater Hydrograph for Well 21N/02E-26F01M

Groundwater levels during the 2001 water year were near historic low levels in this well because of drier than normal water year. It appears that there is some short-term depletion of groundwater in storage occurring. It is anticipated that this condition will reverse itself during periods of higher than normal periods of precipitation.

Esquon Sub-Area (Well Number 20N/02E-09L01M):

The figure below is a hydrograph for an active irrigation well 20N/02E-09L01M, located in the southern portion of the Esquon Sub-area. The area surrounding the well consists primarily of rice production using both surface and groundwater. The well is a deep irrigation well with shallow casing, and a groundwater level measurement record dating back to the 1950s. Groundwater levels in this well represent a mixture of the unconfined and confined portions of the aquifer system. The groundwater levels in this well were monitored on a semi-annual basis until 1991, and on a monthly basis from 1991 to about 1994. Since 1994, this well has been monitored four times a year during March, July, August and October

The figure shows that the spring to summer fluctuation in groundwater levels averages 10 to 20 feet during years of normal precipitation, and up to 40 feet during the 1994 drought. Long-term comparison of spring to spring groundwater levels show a small decline in groundwater levels associated with the 1976-77 drought, followed by a similar decline associated with the 1986-94 drought. Groundwater levels in this well appear to recover from the 1986-94 drought to groundwater levels similar to those of the early 1980s. However, further long-term analysis of spring-to-spring groundwater levels indicates about a 5-foot decline in groundwater levels since the late 1950s.



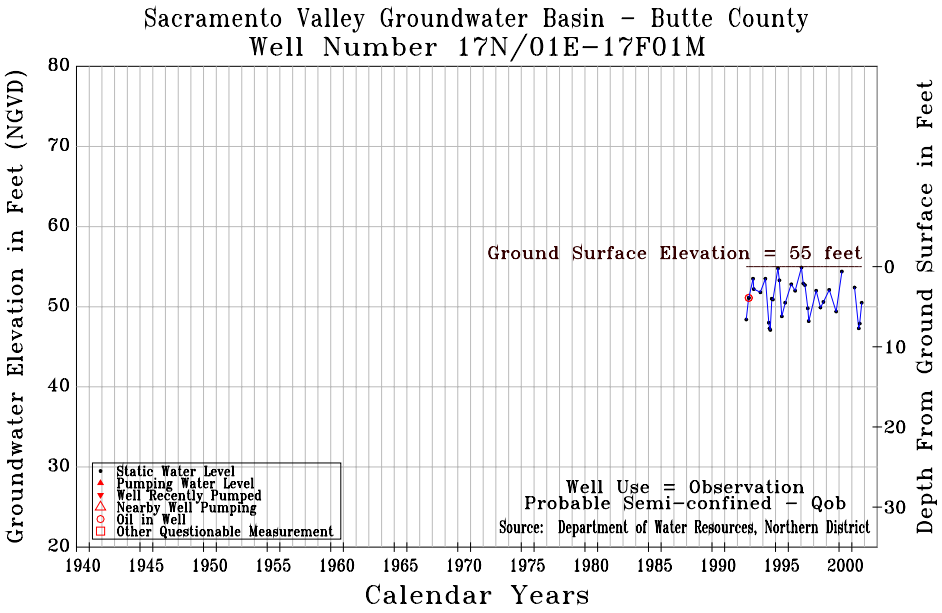
Groundwater Hydrograph for Well 20N/02E-09L01M

Groundwater levels during the 2001 water year in this well were lower than during the 2000 water year because of drier than normal water year. It is not apparent that long-term depletion of groundwater in storage is occurring.

Butte Sink Sub-Area (Well Number 17N/01E-17F01M):

The figure below is a hydrograph for well 17N/01E-17F01M, located in the northwestern portion of the Butte Sink Sub-area. The land use surrounding this well is characterized as native riparian and agricultural. Agricultural cultivation in this area consists of rice production supported primarily by surface water. Surface water is also used as the primary source for flooding of native riparian land for waterfowl habitat. This well is a dedicated monitoring well constructed in the upper to middle portions of the aquifer, with a groundwater level measurement record dating back to 1992. The groundwater levels in this well were monitored on a monthly basis from 1992 to 1995, and are currently monitored four times a year during March, July, August and October.

The figure shows that the spring to summer fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 3 to 5 feet during years of normal precipitation and 5 to 8 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels show little change in spring groundwater levels from 1986-94 drought. Further long-term analysis of spring-to-spring groundwater levels is not possible due to the short monitoring history.



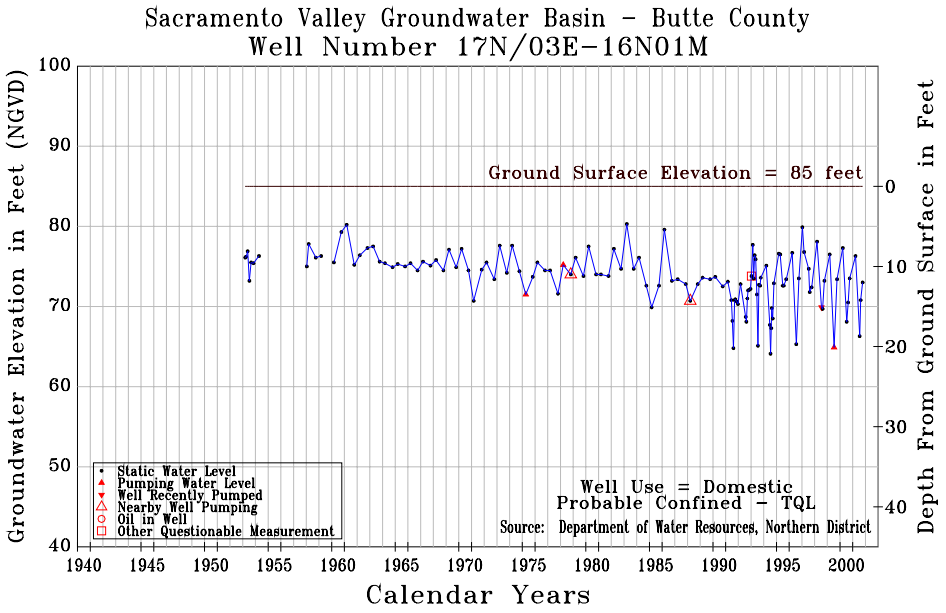
Groundwater Hydrograph for Well 17N/01E-17F01M

Groundwater levels in this well were unaffected by the drier than normal water year.

Butte Sub-Area (Well Number 17N/03E-16N01M):

The figure below is a hydrograph for well 17N/03E-16N01M, located in the southeastern portion of the Butte Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists primarily of orchard crops supported by groundwater. The well is an active domestic well constructed over the upper and middle portions of the aquifer, with a groundwater level measurement record dating back to the mid-1950s. The groundwater levels in this well were monitored on a semi-annual basis until approximately 1991, on a monthly basis from approximately 1991 to 1995, and are currently monitored four times a year during March, July, August and October.

The figure shows that the spring to summer fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 3 to 6 feet during years of normal precipitation and 5 to 10 feet during years of drought. Long-term comparisons of spring-to-spring groundwater levels show a small drop in spring groundwater levels associated with the 1976-77 and the 1986-94 droughts, followed by recovery to normal levels. Further long-term analysis of spring-to-spring groundwater levels indicates very little change in groundwater levels since the 1950s.



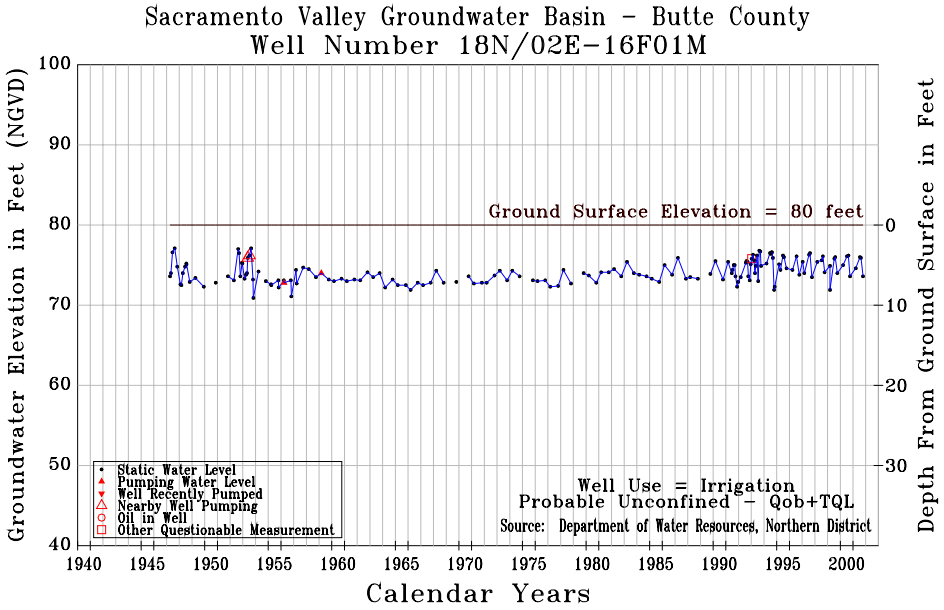
Groundwater Hydrograph for Well 17N/03E-16N01M

Groundwater levels during the 2001 water year in this well were slightly lower than during the 2000 water year because of drier than normal water year. There appears to be a short-term decline in spring groundwater levels since 1996. This decline is not serious and will probably correct itself during periods of greater than normal precipitation.

Biggs-West Gridley Sub-Area (Well Number 18N/02E-16F01M):

The figure below is a hydrograph for well 18N/02E-16F01M, located in the north-central portion of the Biggs-West Gridley Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists primarily of rice production supported by a mixed water source. The well is an active irrigation well constructed in the upper portion of the aquifer, with a groundwater level measurement record dating back to the late 1940s. Groundwater levels in this well were monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to about 1994 and on a semi-annual basis from 1994 to 1996. Since 1996, this well has been monitored four times a year during March, July, August and October.

The figure shows that the spring to summer fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 1 to 2 feet during years of normal precipitation and 2 to 4 feet during years of drought. Close examination of the spring to summer fluctuations indicate that groundwater levels rise during the summer months as the upper aquifer recharges due to flood irrigation for rice production. Long-term comparison of spring-to-spring groundwater levels show almost no change in groundwater levels associated with either the 1976-77 and or the 1986-94 droughts. Further long-term analysis of spring-to-spring groundwater levels indicates very little change in groundwater levels since the late 1940s.



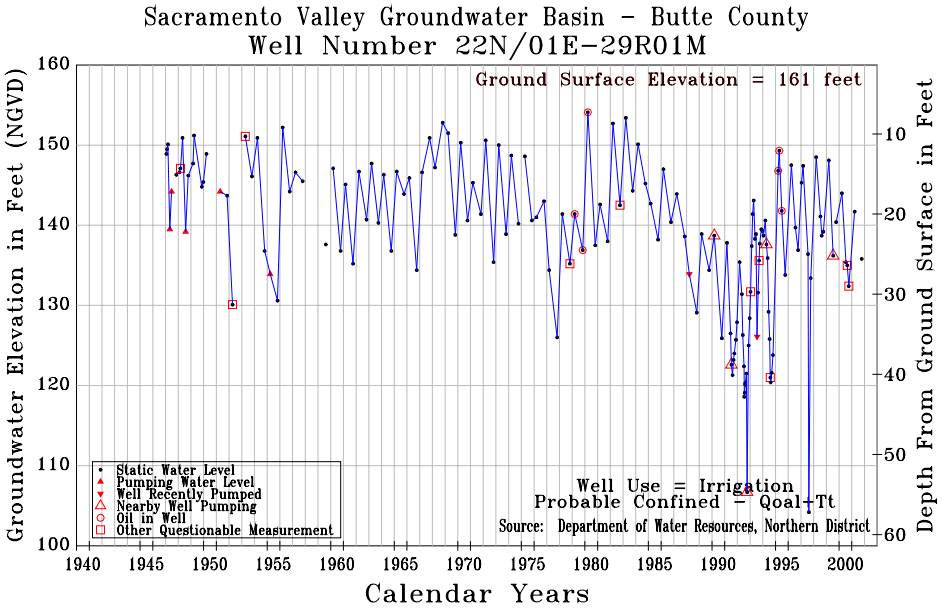
Groundwater Hydrograph for Well 18N/02E-16F01M

Groundwater levels in this well were unaffected by the drier than normal water year.

M & T Sub-Area (Well Number 22N/01E-29R01M):

The figure below is a hydrograph for well 22N/01E-29R01M, located just south of Big Chico Creek in the northern portion of the M&T Sub-area. The well is surrounded by agricultural orchard production, supported by groundwater extraction. This well is an active irrigation well of intermediate depth, with a groundwater level measurement record dating back to the late-1940s. Groundwater levels in this well represent the confined portion of the aquifer. The groundwater levels in this well were monitored on a semi-annual basis until 1991 and on a monthly basis from 1991 to about 1994. Since 1994, the groundwater levels have been monitored four times a year during March, July, August and October.

The figure shows that the average seasonal fluctuation in groundwater levels is about 10 feet during years of normal precipitation and up to 20 feet during years of drought. Long-term comparison of spring to spring groundwater levels show a small decline in groundwater levels associated with the 1976-77 drought, followed by a larger decline associated with the 1986-94 drought. Overall comparison of spring to spring groundwater levels associated with this confined portion of the aquifer system, during years of normal precipitation, have changed little since the early 1960s.



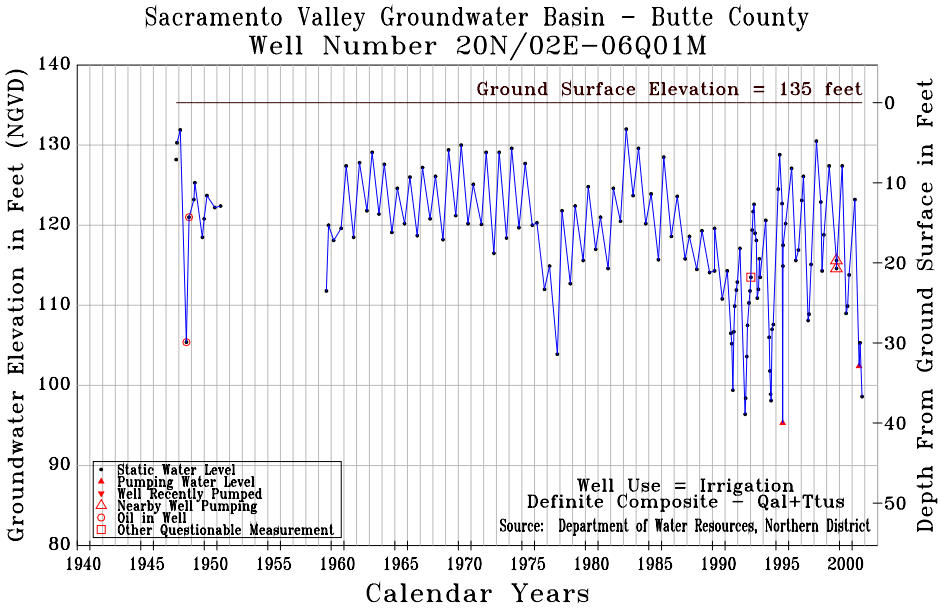
Groundwater Hydrograph for Well 22N/01E-29R01M

Groundwater levels during the 2001 water year in this well were slightly lower than during the 2000 water year because of drier than normal water year. There appears to be a short-term decline in spring groundwater levels since 1996. This decline is not serious and will probably correct itself during periods of greater than normal precipitation.

Durham-Dayton Sub-Area (Well Number 20N/02E-06Q01M):

The figure below is a hydrograph for well 20N/02E-06Q01M, located two miles south of Durham, adjacent to Butte Creek. This area marks a change in agricultural water uses from groundwater to the north and surface water use to the south. The well is a deep irrigation well with shallow casing, and a groundwater level measurement record dating back to the late-1940s. Groundwater levels in this well represent a mixture of the unconfined and confined portions of the aquifer system. The groundwater levels in this well were monitored on a semi-annual basis until 1991 and on a monthly basis from 1991 to about 1994. Since 1994, this well has been monitored four times a year during March, July, August and October.

The figure shows a seasonal fluctuation in groundwater levels of about 10 to 15 feet during years of normal precipitation and up to 20 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels show a decline and recovery of groundwater levels associated with the 1976-77 and 1986-94 drought. Overall, comparison of spring to spring groundwater levels associated with this composite portion of the aquifer system, during years of normal precipitation, have changed little since the early 1970s.



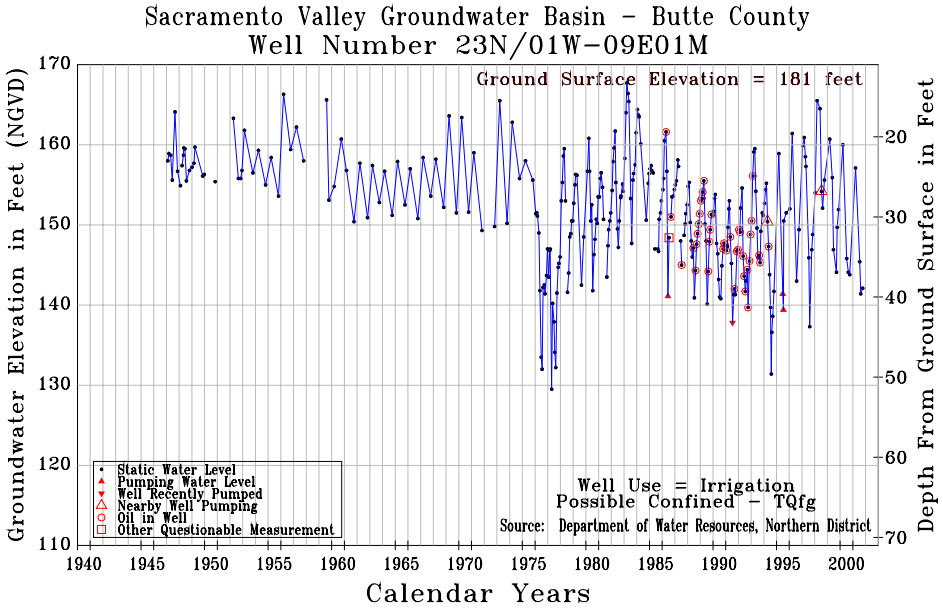
Groundwater Hydrograph for Well 20N/02E-06Q01M

Groundwater levels during the 2001 water year were near historic low levels in this well because of drier than normal water year, although it appears that there is no long-term depletion of groundwater in storage occurring at this time.

Vina Sub-Area (Well Number 23N/01W-09E01M):

The figure below is a hydrograph for well 23N/01W-09E01M, in the northern Vina Sub-area. The area surrounding this well is characterized by rural, agricultural land use supported by groundwater. This well is an irrigation well constructed in the confined portion of the aquifer system, with a groundwater level measurement record dating back to the mid-1940s. The groundwater levels in this well were monitored on a semi-annual basis until the mid-1970s, on a monthly basis from the mid-1970s to 1996, and are currently monitored four times a year during March, July, August and October.

The figure shows the seasonal and long-term changes in groundwater levels over time. At first glance it appears that the annual fluctuation in groundwater levels has increased since 1976. However, prior to 1976, summer groundwater level data were not collected. Comparison of the seasonal fluctuation of groundwater levels using spring-fall data indicates little change since the 1960s.



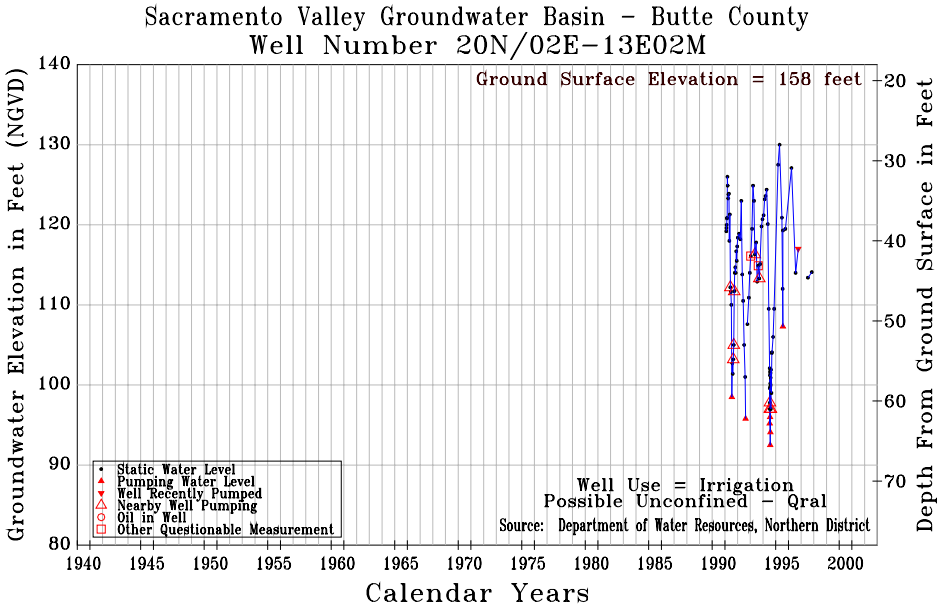
Groundwater Hydrograph for Well 23N/01W-09E01M

Groundwater levels during the 2001 water year in this well were slightly lower than during the 2000 water year because of drier than normal water year conditions.

Cherokee Sub-Area (Well Number 20N/02E-13E02M):

The figure below is a hydrograph for well 20N/02E-13E02M, located in the western portion of the Cherokee Sub-area. The area surrounding this well is characterized by agricultural production of orchard, rice and row crops supported by both groundwater and surface water. This well is a shallow irrigation well constructed in the unconfined portion of the aquifer system. The groundwater levels in this well were monitored on a monthly basis from 1991 to 1995, and four times a year during March, July, August and October from 1995 to 1996.

Due to active pumping within the monitoring well and nearby pumping of surrounding wells, the seasonal fluctuation of static groundwater levels are difficult to accurately determine. In general, this figure shows that the spring to summer fluctuation in groundwater levels average about 10 to 12 feet during years of normal precipitation (1993 and 1995) and up to 25 feet during years of drought. Insufficient groundwater level measurement data exist to evaluate the long-term groundwater level trends in this area.



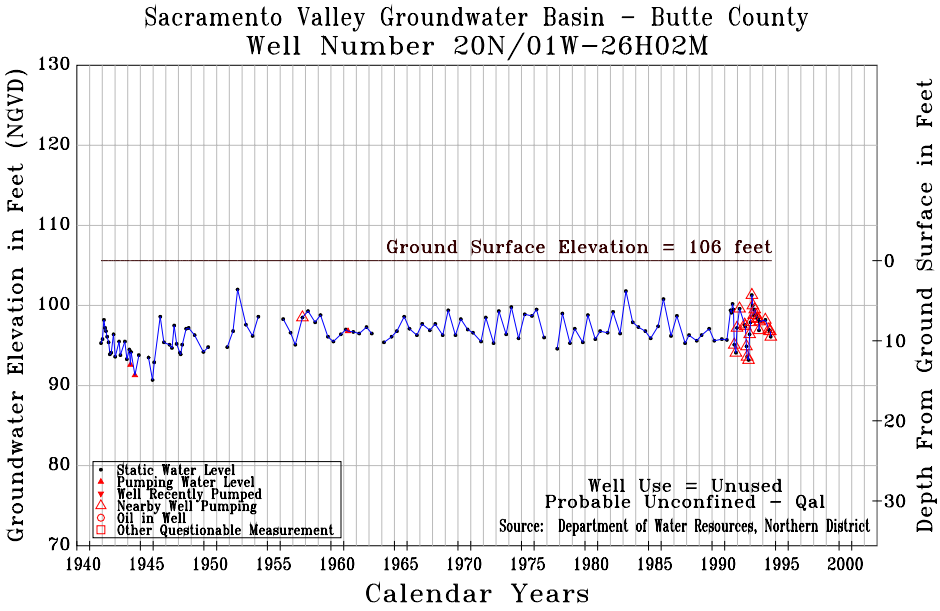
Groundwater Hydrograph for Well 20N/02E-13E02M

Monitoring groundwater levels at this well have been discontinued and a new representative well for this area needs to be selected.

Llano Seco Sub-Area (Well Number 20N/01W-26H02M):

The figure below is a hydrograph for well 20N/01W-26H02M, located in the southern portion of the Llano Seco Sub-area. The area surrounding this well is characterized by rural agricultural land use, supported primarily by the application surface water. This well is an unused irrigation well constructed in the unconfined portion of the aquifer system, with a groundwater level measurement record dating back to the early 1940s. The groundwater levels in this well were monitored on a semi-annual basis until 1991 and on a monthly basis from 1991 to about 1994, when it was eliminated from the monitoring grid.

The figure shows that the average seasonal fluctuation in groundwater levels is about 3 to 5 feet during years of normal precipitation. Long-term comparison of spring-to-spring groundwater levels show little if any decline in groundwater levels associated with the 1976-77 and 1986-94 droughts. Overall comparison of spring-to-spring groundwater levels show that there has been very little change in the unconfined aquifer system, in this portion of the Llano Seco Sub-area, since the early 1940s.



Groundwater Hydrograph for Well 20N/01W-26H02M

Monitoring groundwater levels at this well have been discontinued and a new representative well for this area needs to be selected. This is an area that historically has used little groundwater so it is not anticipated that problems exist in this area.

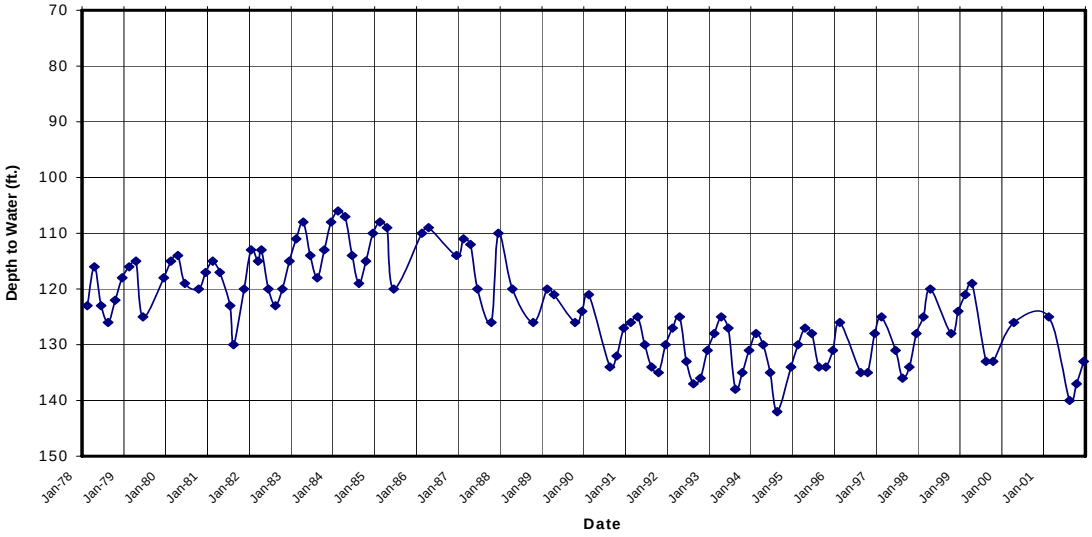
California Water Service Sub-Area (Well Numbers 1-04 and 33-01):

Groundwater hydrographs for the California Water Service monitoring wells were developed using static groundwater level data, provided by California Water Service Company. Although the groundwater level measurements presented in the California Water Service hydrographs were collected when the wells were off (static groundwater levels), it should be noted that the effects from the recent pumping of these production wells could result in groundwater level readings that are deeper than stable static conditions. Hydrographs from three representative wells in the California Water Service Sub-area are shown below.

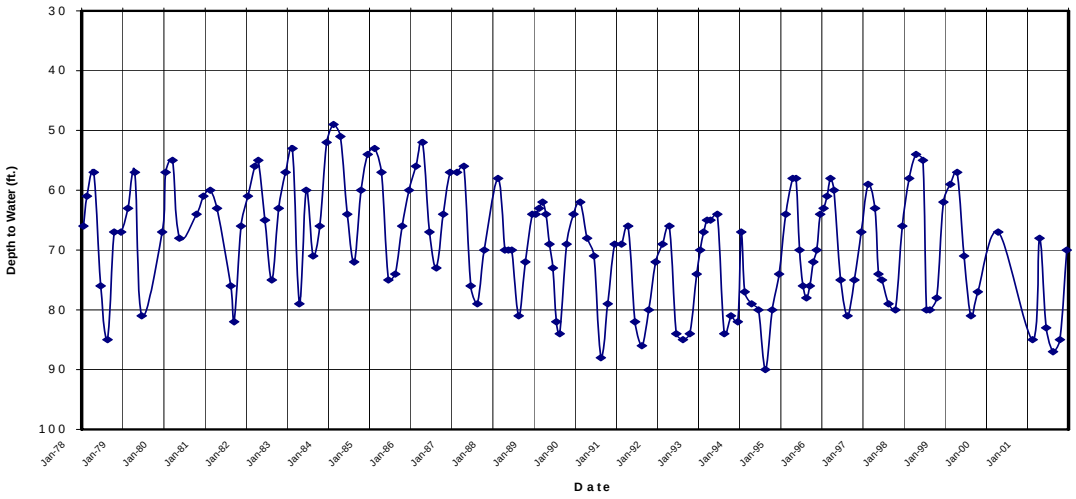
Overall analysis of the seasonal fluctuation of groundwater levels in the California Water Service wells indicates a rather consistent seasonal fluctuation of 15 to 20 feet during normal years. Analysis of seasonal groundwater levels during drought years shows a wide range of fluctuation depending upon the individual well. Many wells show little or no seasonal change between wet, normal and dry years, while other wells show large differences. The wide range of response to seasonal change in normal versus drought years is likely due to the wide range of operational scenarios that can be imposed upon these municipal wells.

Overall analysis of these hydrographs indicate that groundwater levels in the California Water Sub-area have declined an average of 12 feet between 1978 and 2000, with most of the decline occurring during the 1987-1994 drought. Analysis of the hydrographs also indicates that groundwater levels in the California Water Service wells have stabilized since the drought in 1995.

Although the long-term trend of groundwater levels shows a decline in the California Water Sub-area, it does not necessarily mean that groundwater levels will continue to decline into the future. In municipal service areas it is typical for groundwater levels to experience an initial drop as the demand increases or drought conditions occur. After the initial decline, groundwater levels will commonly reach a new equilibrium with the existing production demand, thereby limiting further declines in groundwater levels.



Hydrograph for California Water Service Well 33-01
Ground Surface Elevation = 258 feet



Hydrograph for California Water Service Well 1-04
Ground Surface Elevation = 204 feet