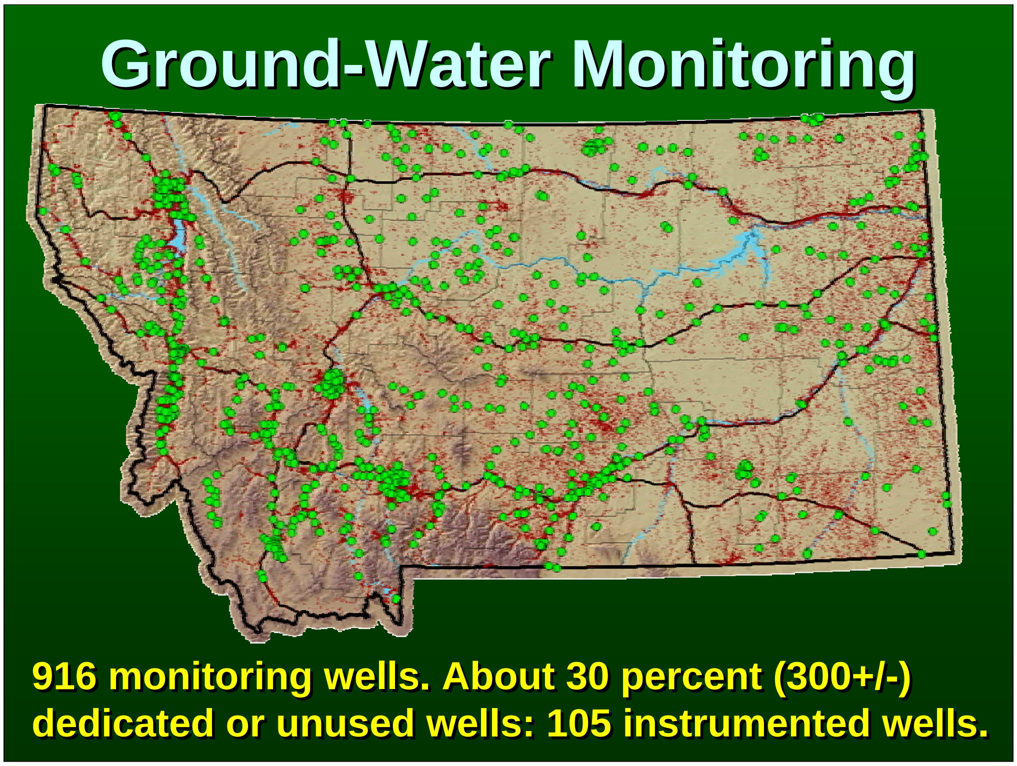

Well 109142: 07S 01W 23 ABBA-Madison County

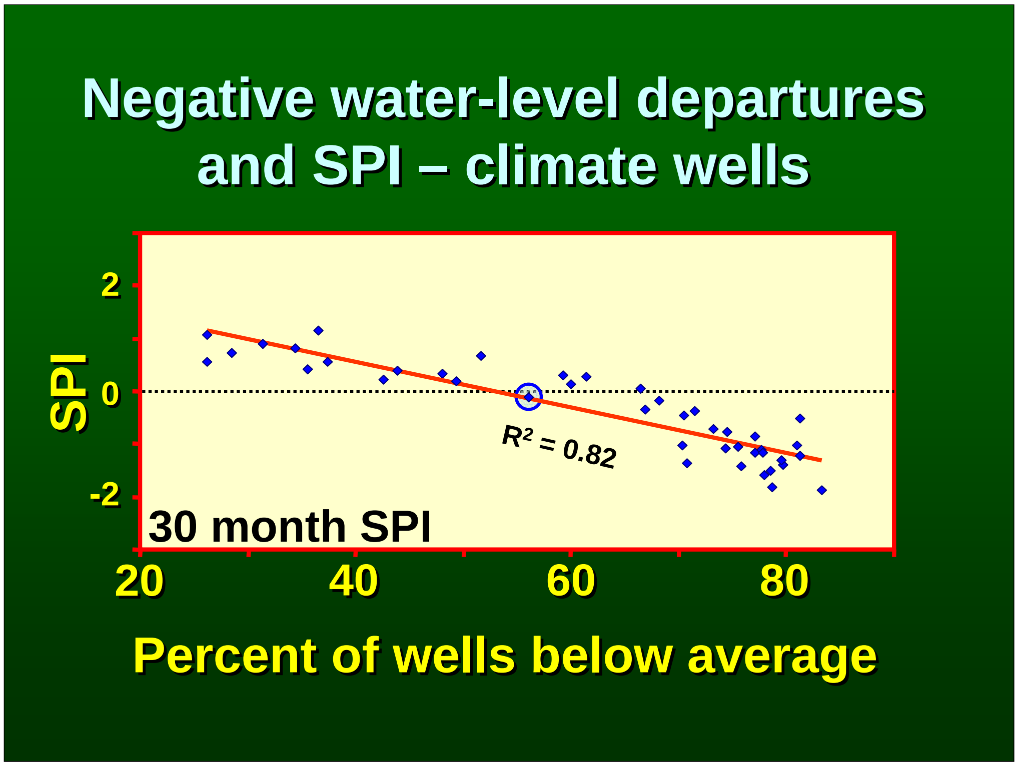
Water Levels and Climate

Tom Patton

August 17, 2006



Montana’s state wide monitoring network contains more than 900 wells. Wells are measured quarterly and sampled every 8-10 years. There are about 100 recorders on network wells from which hourly to daily measurements are obtained. The distribution of network wells approximates the distribution of wells in Montana.

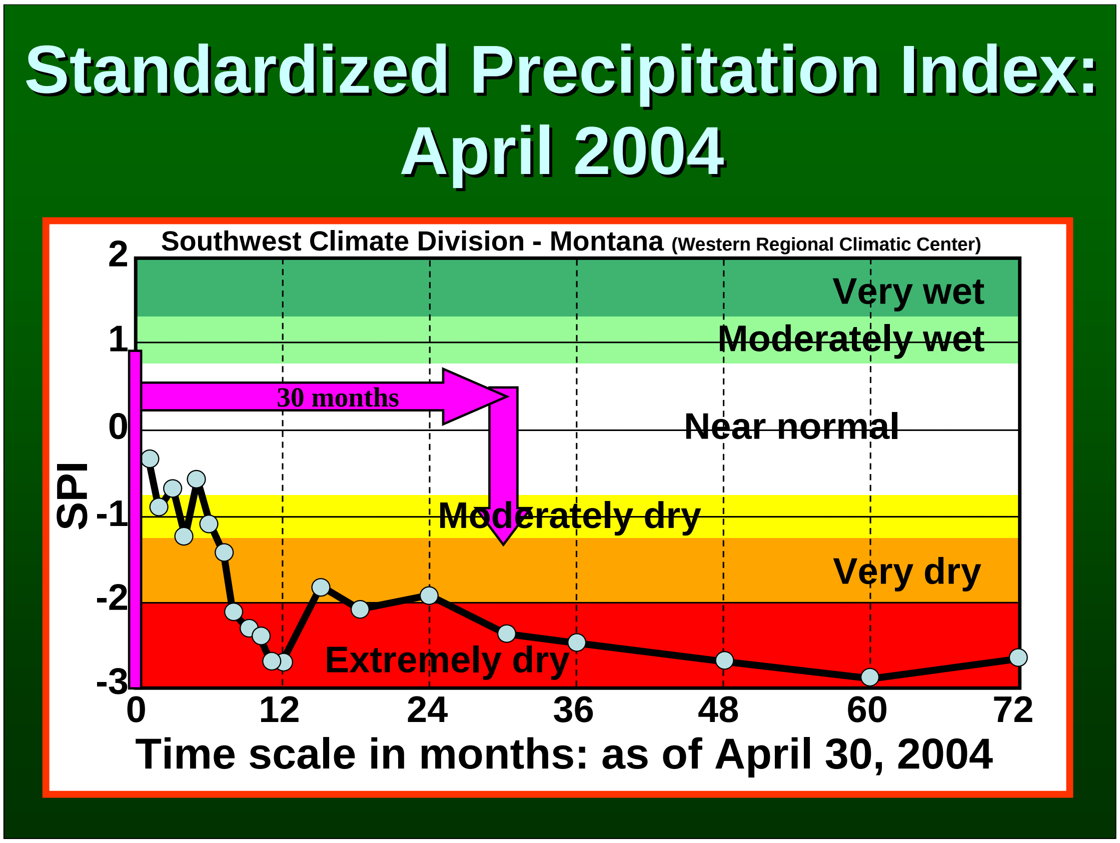


The Standardized Precipitation Index (SPI) is a way of measuring departures from average precipitation for periods between 1 and 72 months.

Negative SPI’s are dry and positive SPI’s are wet.

Water-level departures from quarterly averages in monitoring network wells correlate with the 30 month statewide SPI.

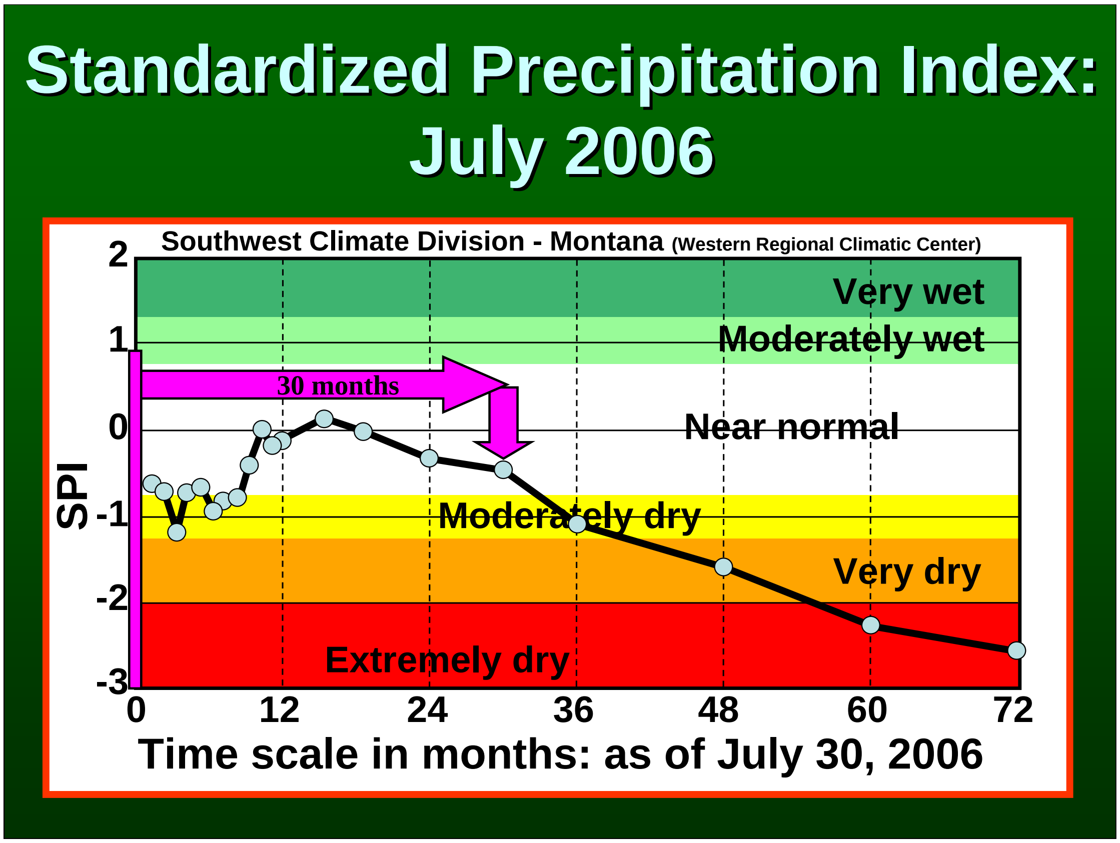
The most recent comparison is highlighted by the circle.



Standardized Precipitation Index

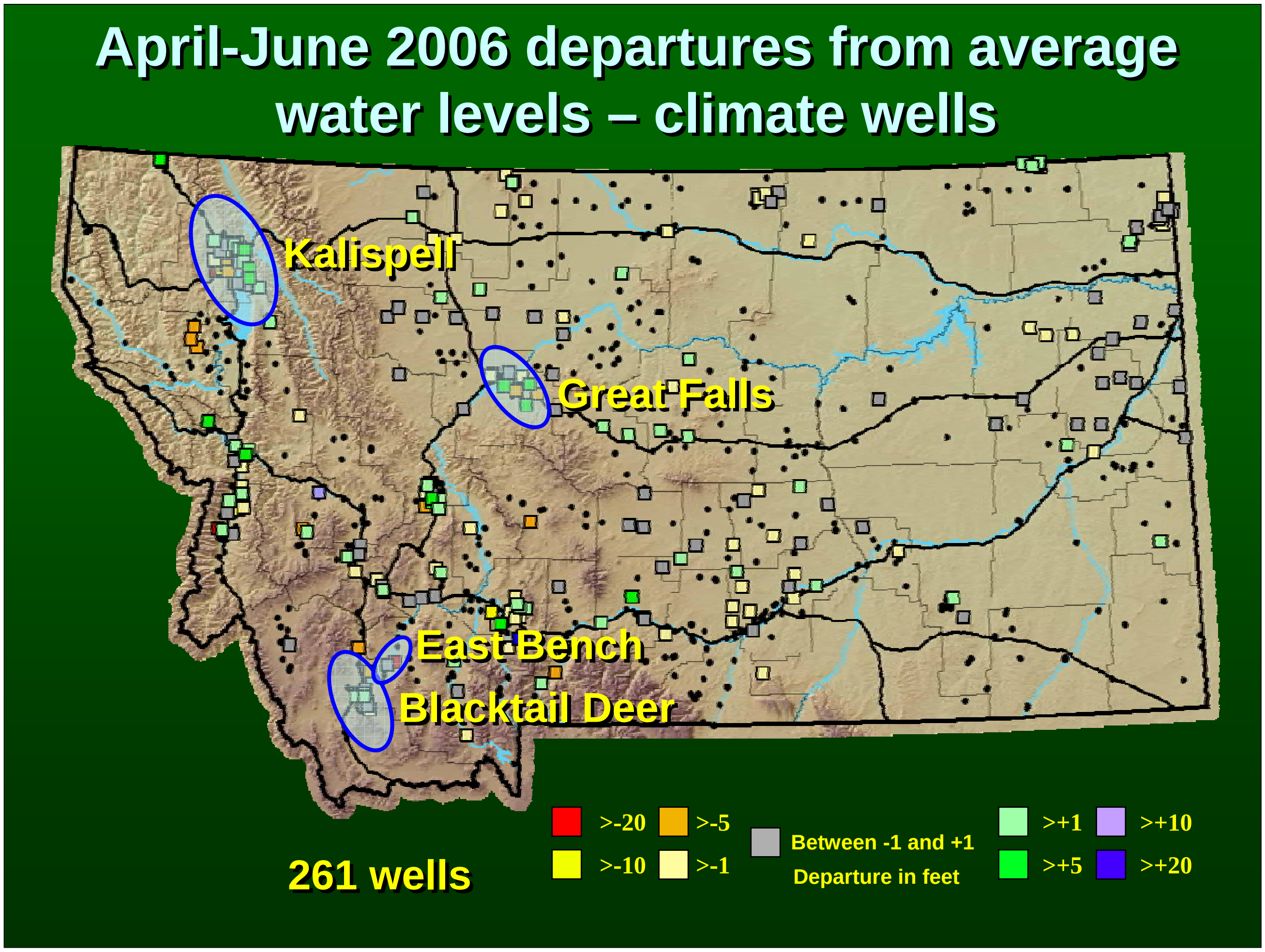
The Standardized Precipitation Index (SPI) measures the relative wetness or dryness from average for various periods of time. The SPI is useful for evaluating drought impacts at different time scales.

The image on this page shows the SPI for the Southwest climate division calculated as of April 2004. Compare the 30-month value to the current Southwest climate division SPI on the next slide.



Current SPI

The current Southwest climate division SPI shows that the 30-month SPI has improved from about -2.4 (extremely dry- previous page) to about -0.5 (near normal).

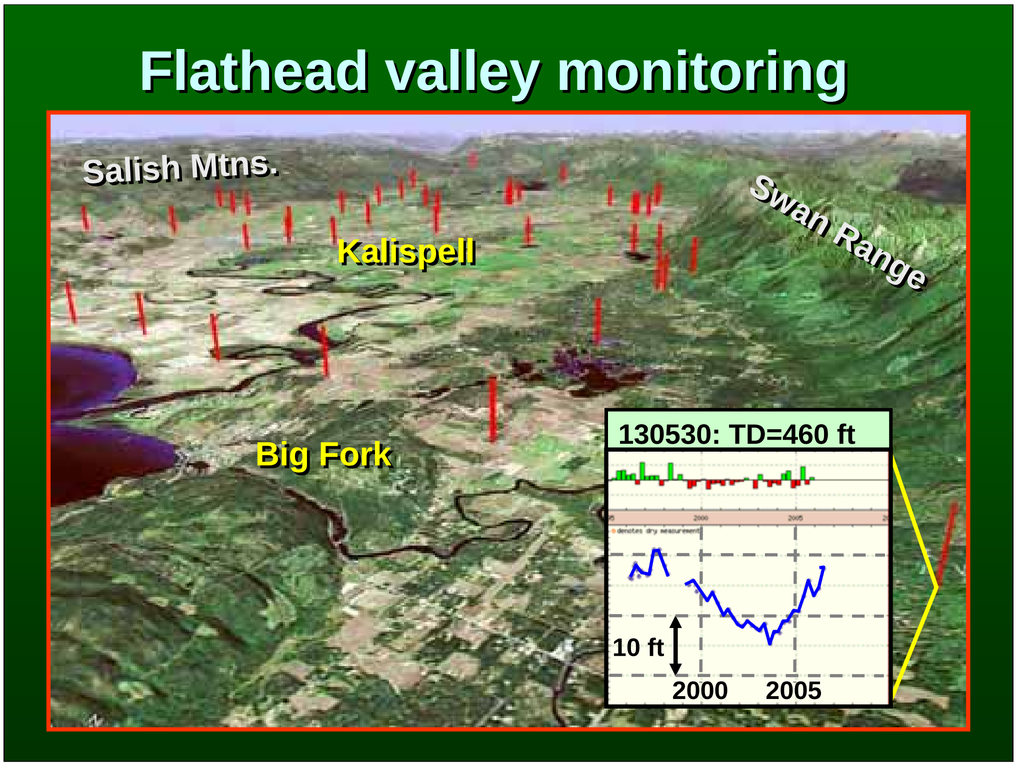


Departures from water-level averages in wells

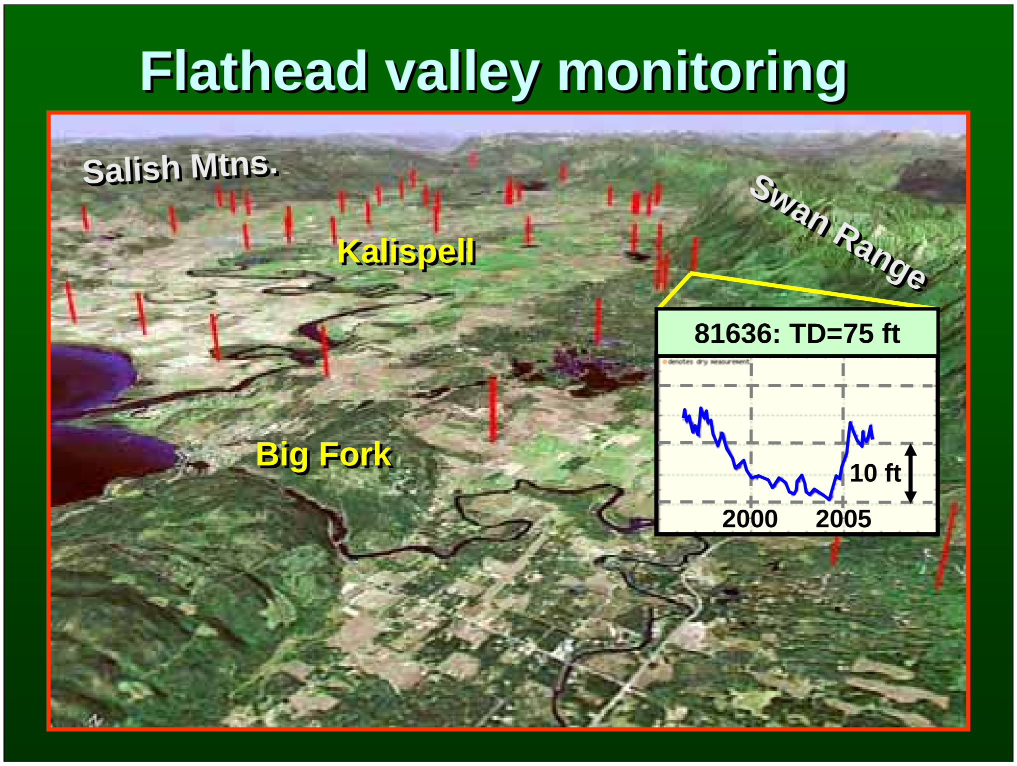
Most network wells with negative departures (yellow, orange, and red) are west of about Great Falls. The small black dots are locations of network wells where measurements were collected, but where departures were not calculated.

Wells where departures were not calculated include those with too short of a period of record, and those that exhibit a lack of response to climate on the current time scale.

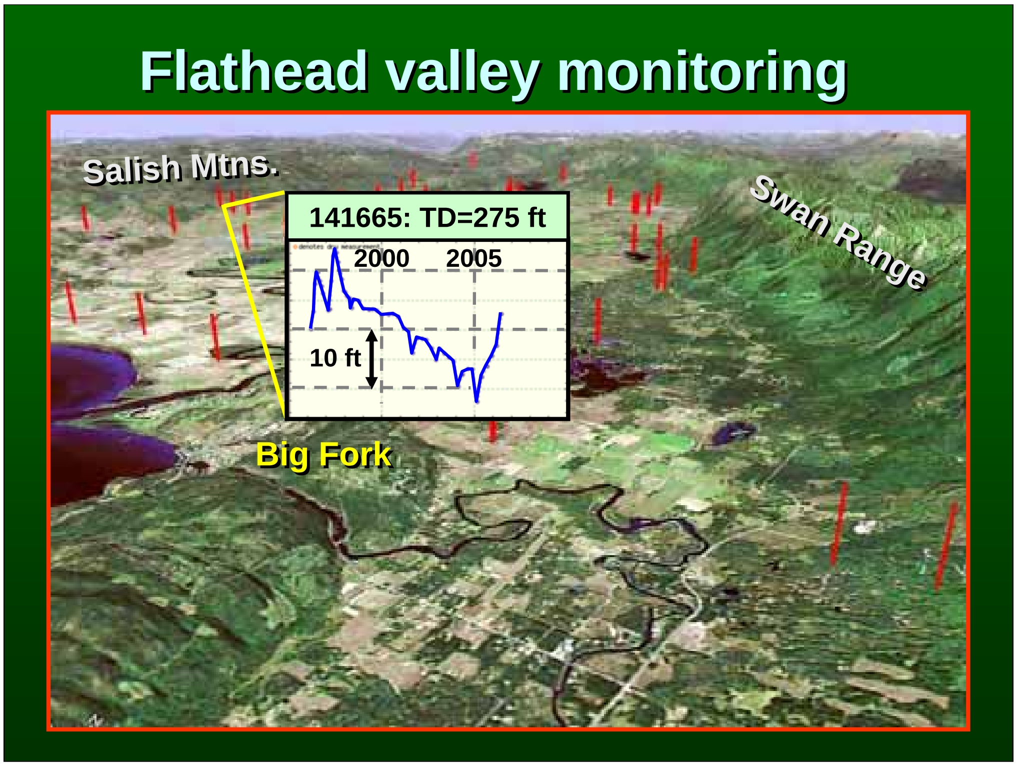
Hydrographs for the Kalispell Valley, Blacktail Deer Creek area, East Bench in the Jefferson River Valley, and near Great Falls are on the next slides.



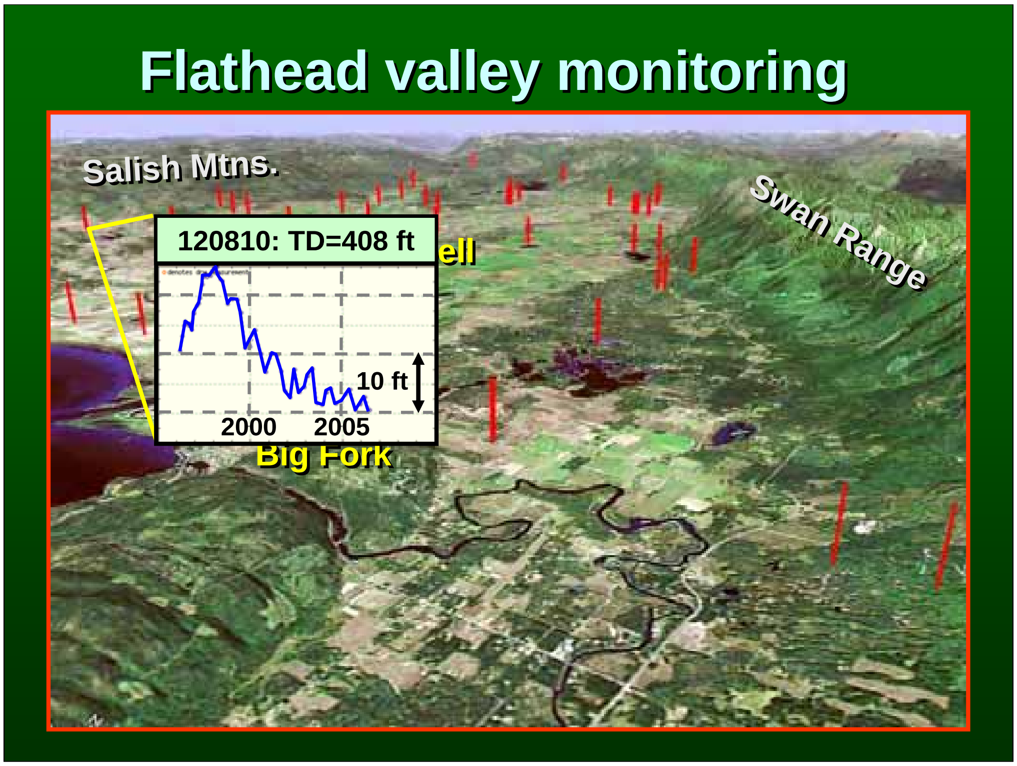
On the east side of the Kalispell Valley, water levels in many wells began rising in 2003. Water levels are nearing altitudes recorded in 1995-1996. The correspondence to climate is shown by the precipitation departure graph above the hydrograph.



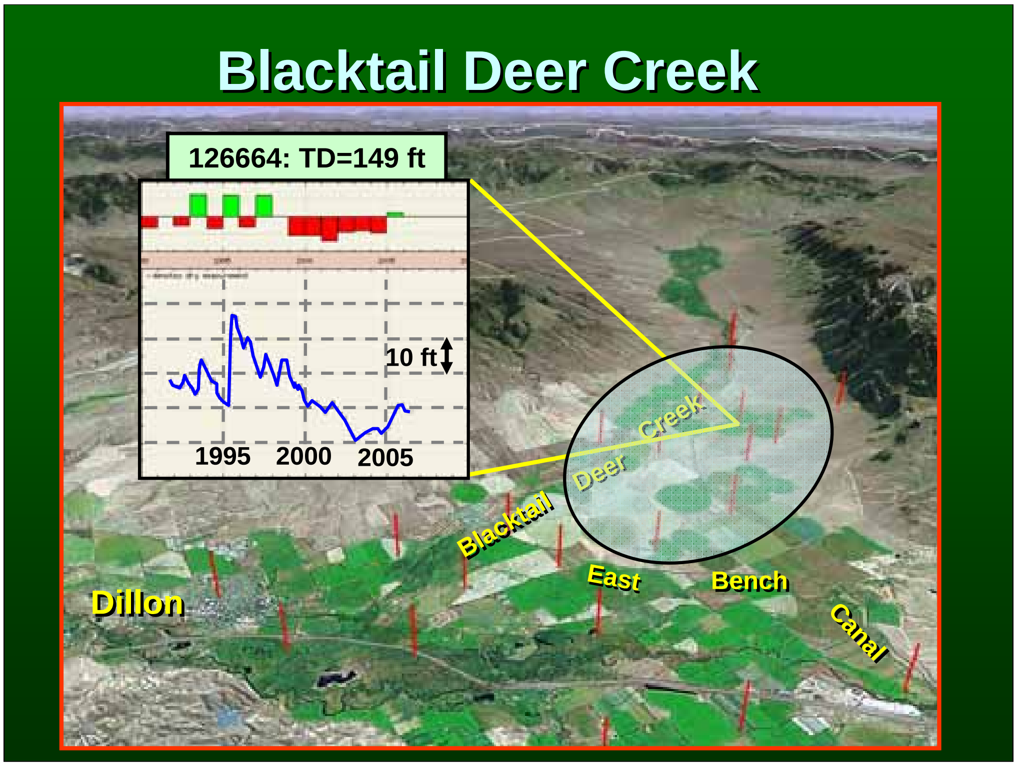
A second well located several miles to the north on the east side of the Kalispell Valley also shows that water levels began rising in 2003.



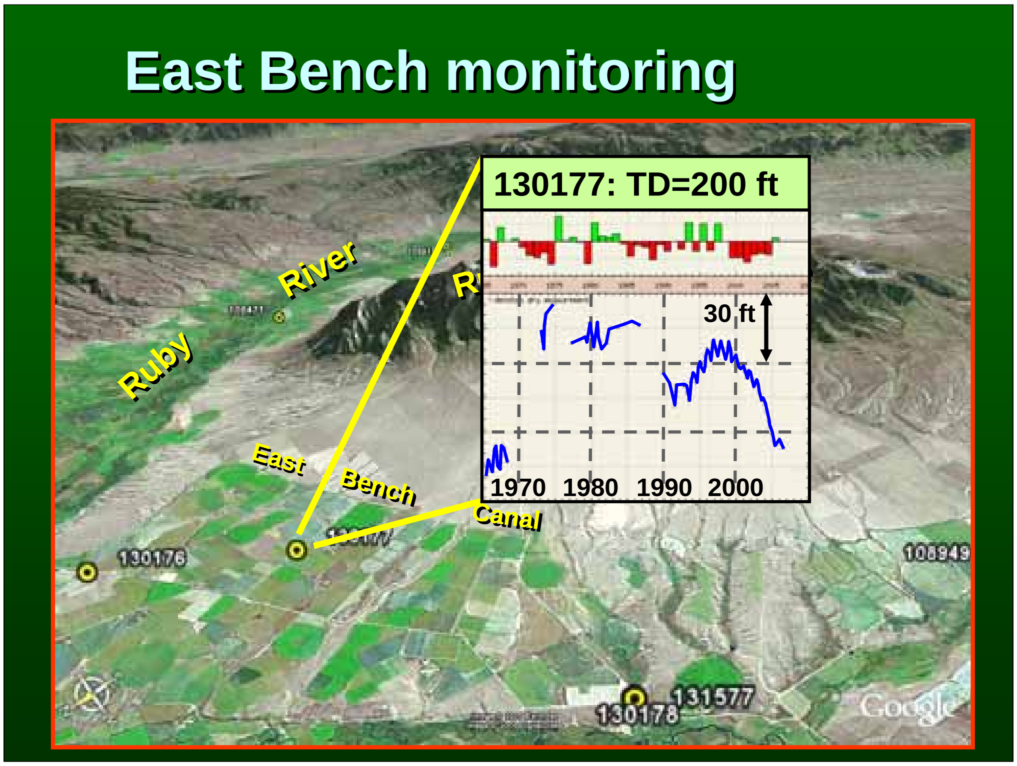
Water level recovery did not begin on the west side of the Kalispell Valley until early 2005.



Water levels in the lower Ashley Creek Valley west of Kalispell have not recovered.

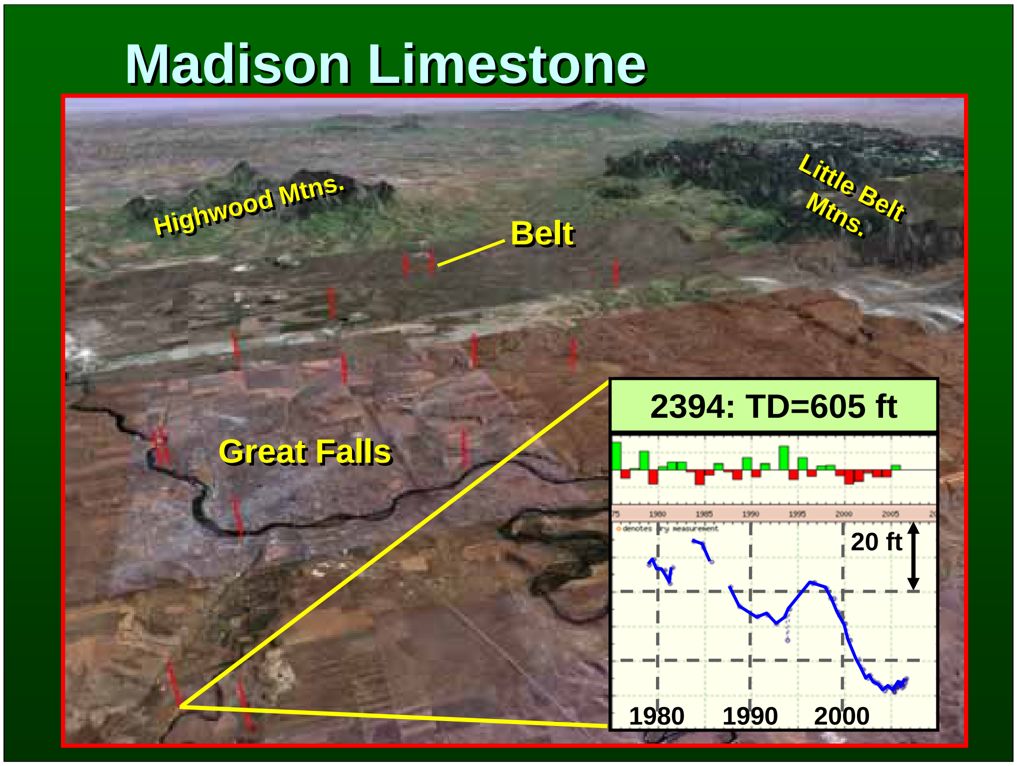


The oval area shows where about 10 ft of water-level recovery has occurred in the Blacktail Deer Creek area near Dillon. Ground-water in this area supports irrigation, as well as domestic and stock watering use.

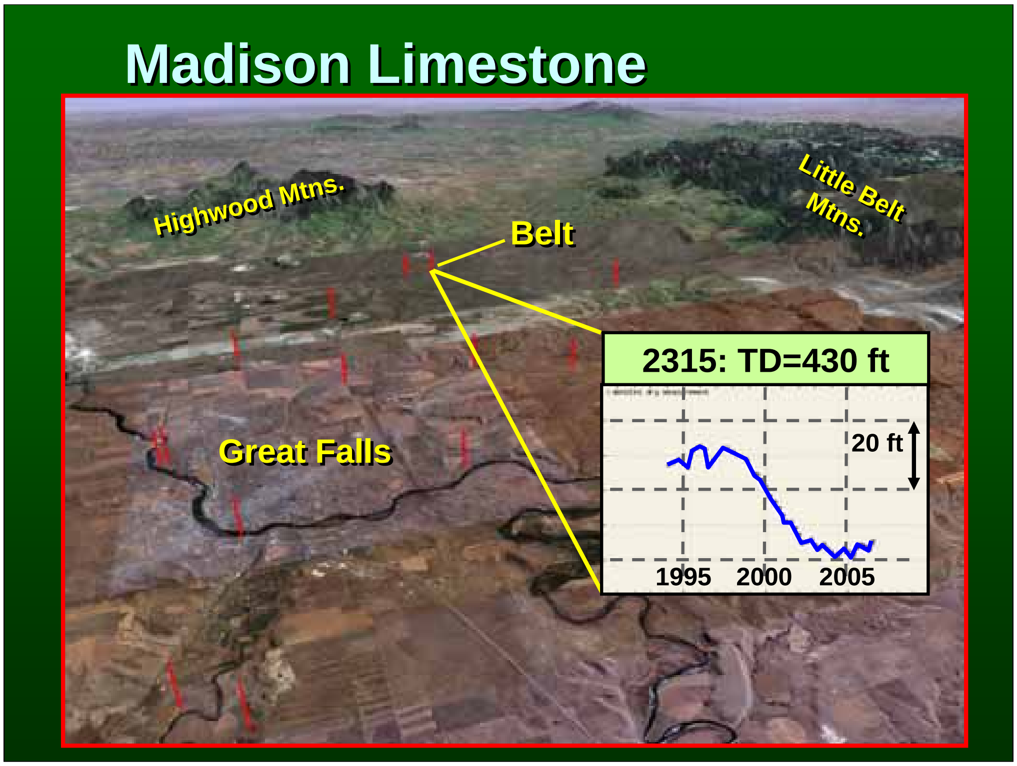


Monitoring wells in the East Bench project on the east side of the Jefferson River Valley have not recovered. Irrigation was limited by low storage in Clark Canyon reservoir for several years, resulting in limited ground-water recharge.

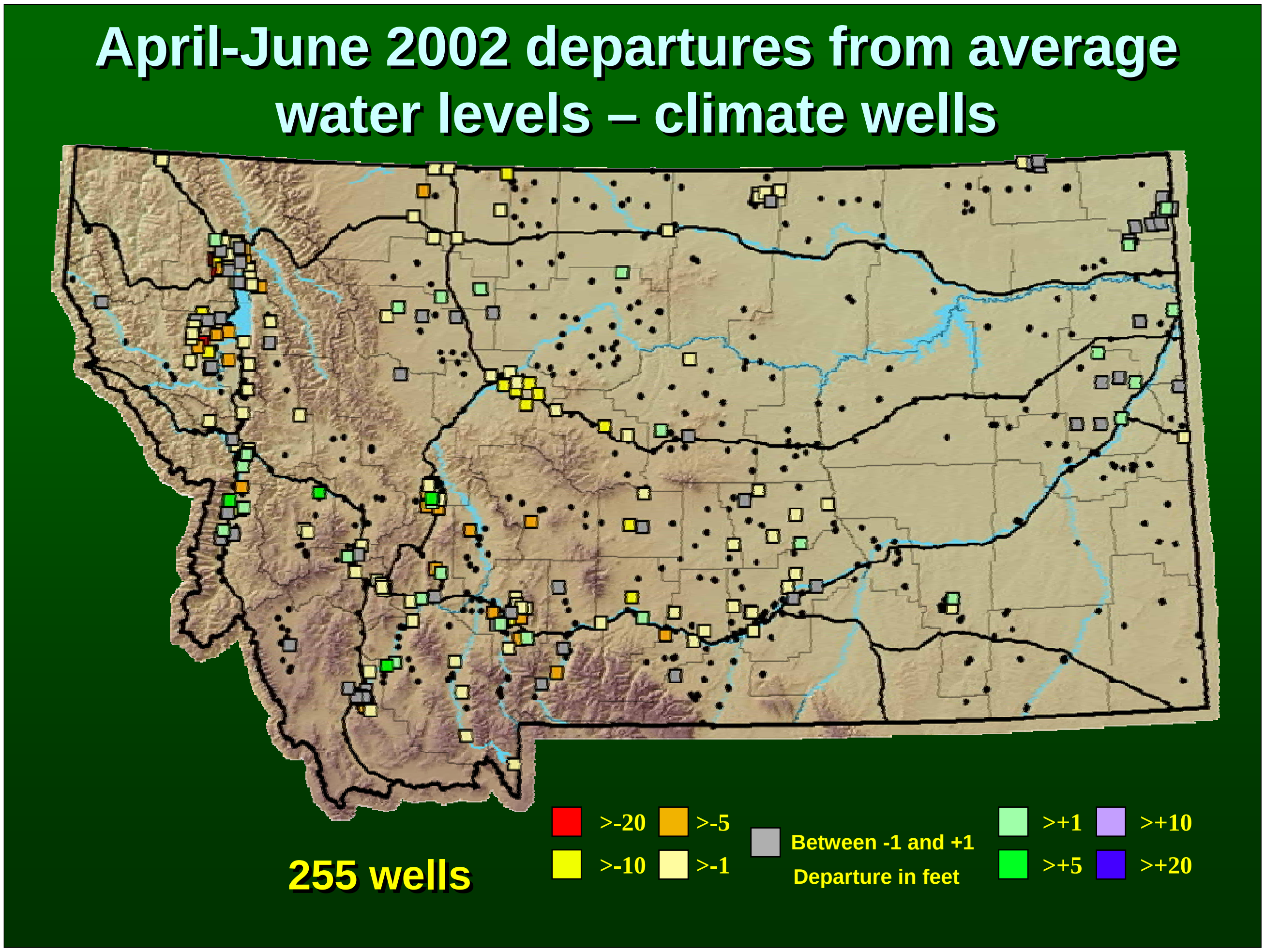
Water levels could also be impacted by conversion of flood to sprinkler irrigation methods.



The Madison Limestone is 300-600 ft below land surface near Great Falls. It is widely used to supply good-quality water to wells. Water levels fell about 30 ft between 1997 and 2003. Since 2003, water levels have stabilized and have risen several ft.



Comparison of this graph for a well at Belt with the graph on the previous slide shows that water-level change in the Madison aquifer is regional. Water levels fell up to 30 ft since 1997. Since 2003 water levels have risen slightly.

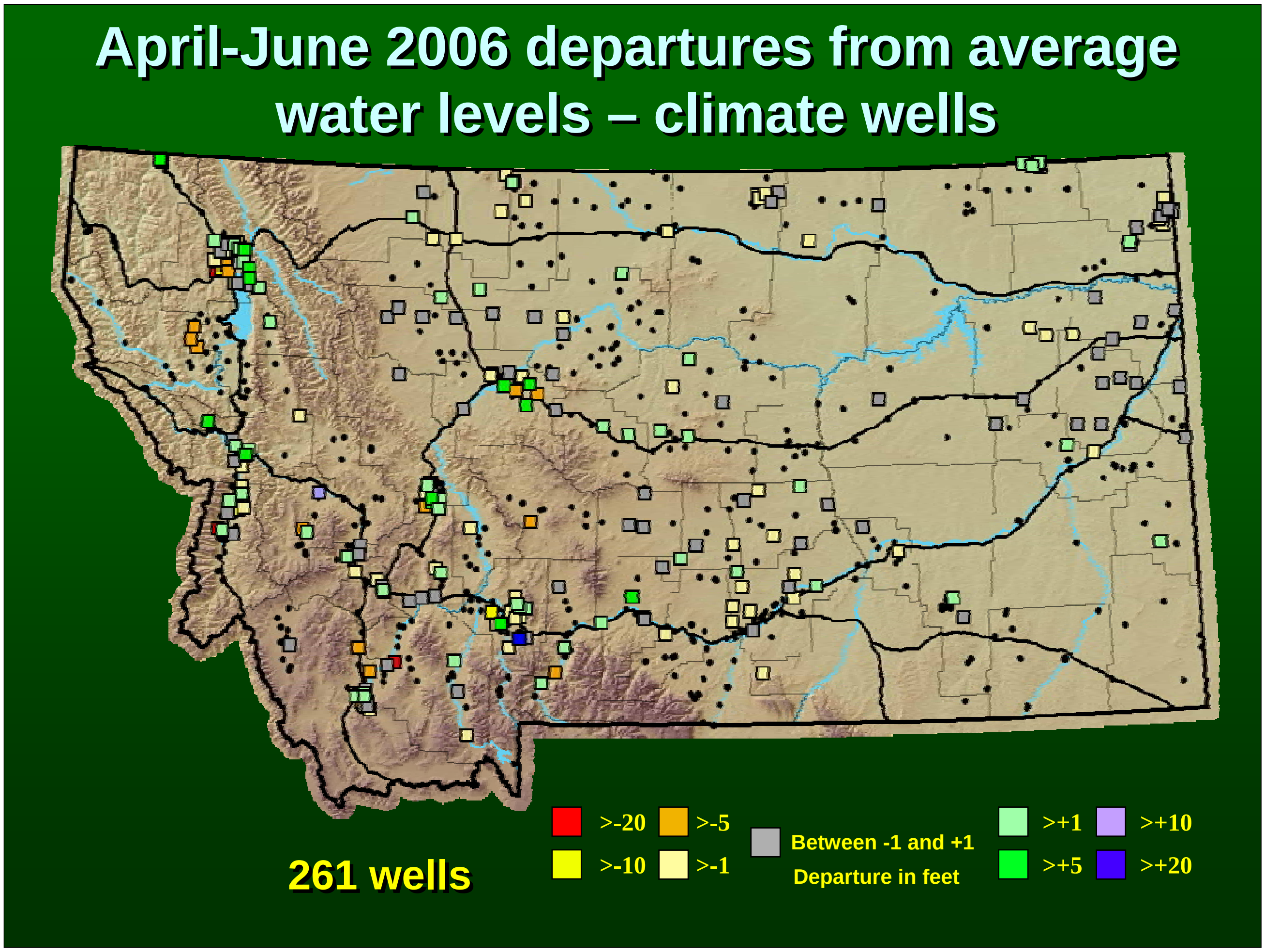


Departures from water-level averages in wells

This image from summer 2002 shows that water-level departures in the Great Falls, Kalispell Valley, and Dillon areas were often in the yellow and orange categories.

The small black dots are locations of network wells where measurements were collected but where departures were not calculated. Wells where departures were not calculated include those with too short of a period of record, and those that exhibit a lack of response to climate on the current time scale.

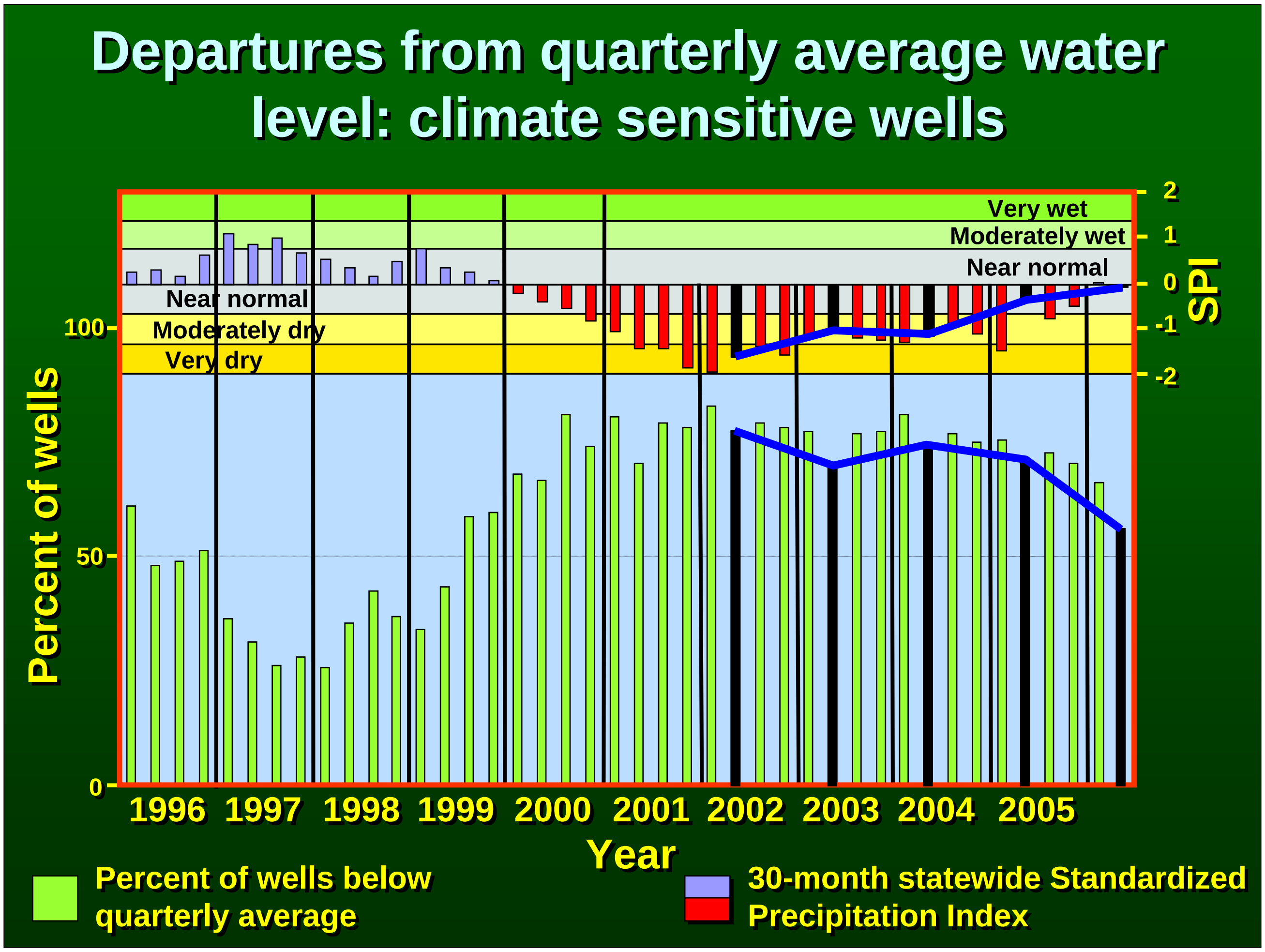
Compare this image to the next slide with data from summer 2006.



Departures from water-level averages in wells

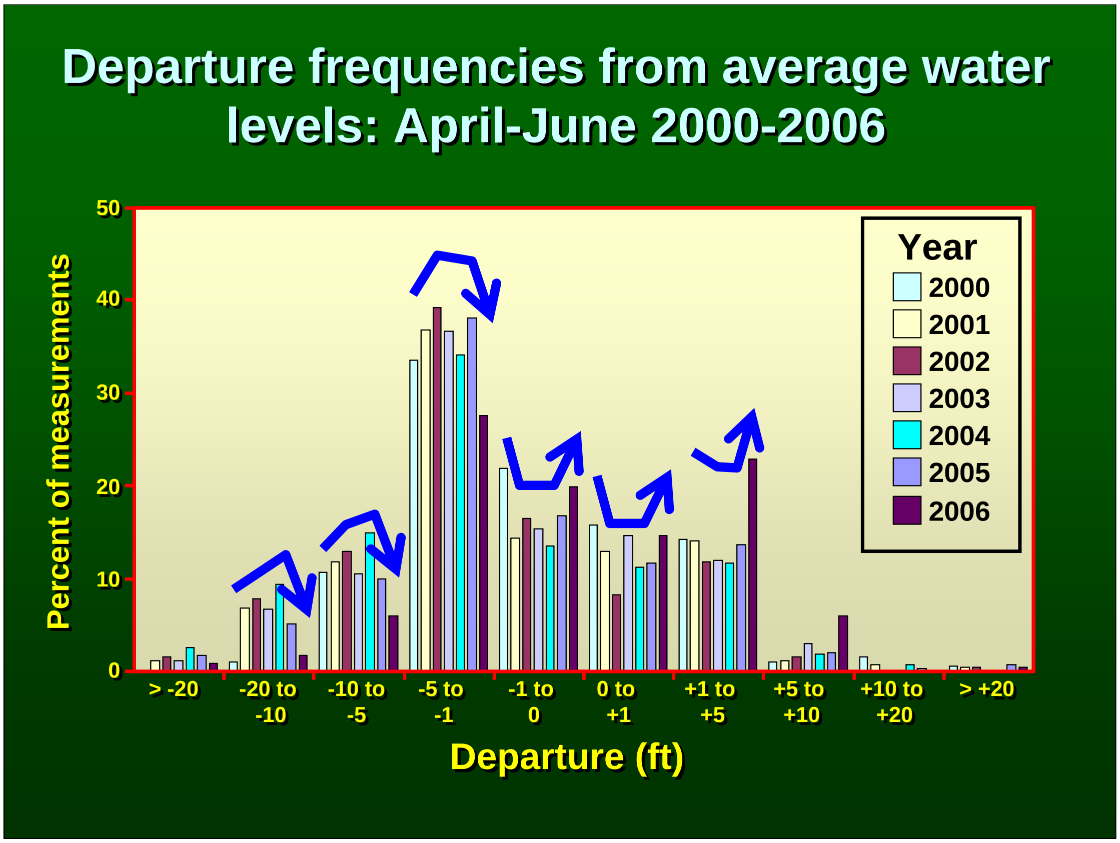
Comparison to the summer 2002 data in the previous slide shows that current water-level departures in the Great Falls, Kalispell, and Dillon area are not as large as they were in 2002.

The small black dots are locations of network wells where measurements were collected but where departures were not calculated. Wells where departures were not calculated include those with too short of a period of record, and those that exhibit a lack of response to climate on the current time scale.



Percentage of climate sensitive wells below quarterly averages

The percentage of network wells below their quarterly average appears to correspond closely with the 30-month Standardized Precipitation Index. Examination of the percentages of wells below their quarterly averages for the April-June quarters since 2002 shows a general decrease. At the same time the 30-month SPI has increased to near normal.



Frequency of departures

Frequency histograms of departures from quarterly water-level averages show that the most common departure is between -1 and -5 ft. Histograms for the April-June period of years 2000-2006 are shown. The heavy arrows show that as the drought intensified in 2001-2003 the numbers of wells in each negative category increased. As the drought released in 2003-2006 the numbers of wells in these categories decreased. Correspondingly, the numbers of wells in positive categories were generally lowest when the drought was most intense.

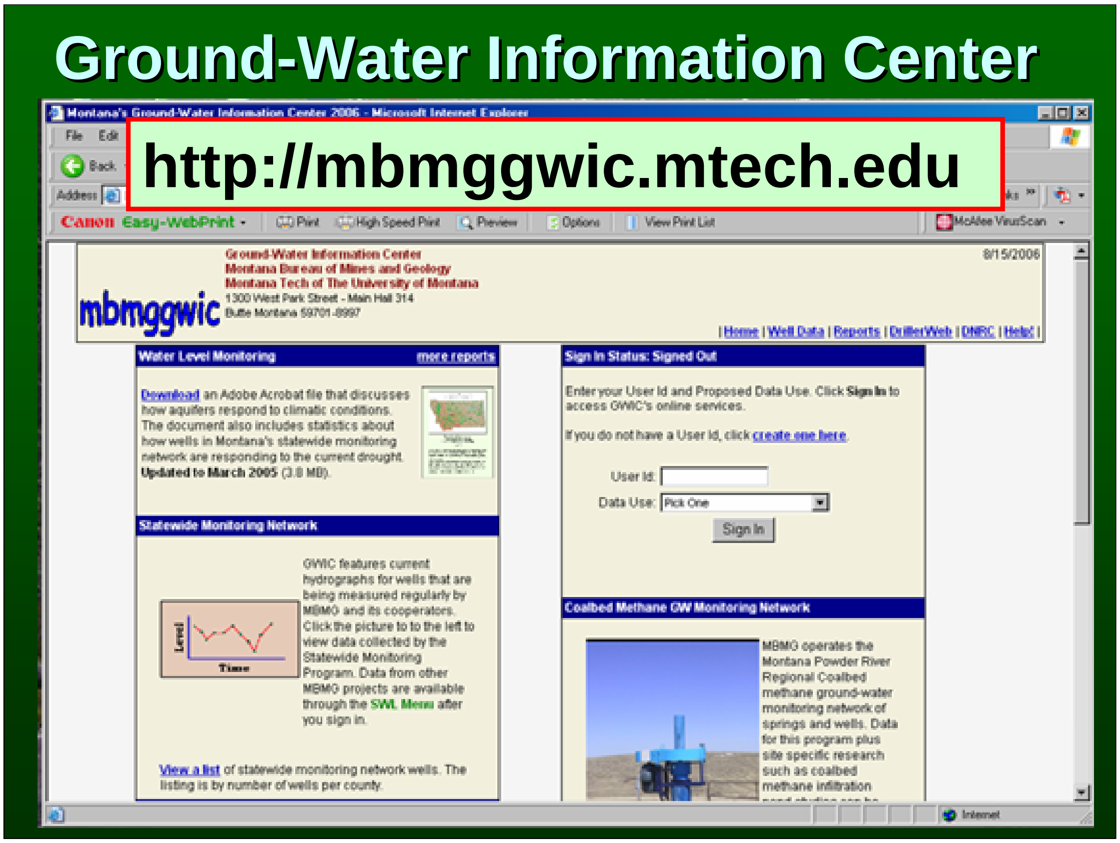
If the monitoring network is a reasonable representation of wells in Montana, it demonstrates that most climate sensitive wells should be between 1 and 5 ft below their quarterly averages.

Summary

Water levels in monitoring network:

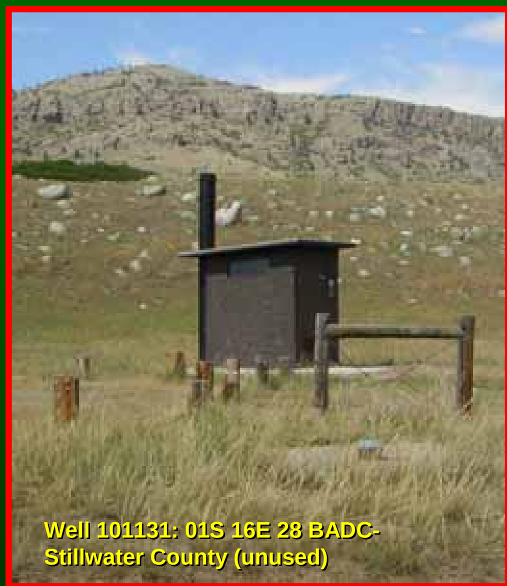
- React to climate by generally rising or falling depending on how wet or dry it has been for the preceding 30+/- months.

- Significant recovery has occurred in some areas such as the Kalispell Valley.



Data availability

Water-level data and much other ground-water data are available from the Ground-Water Information Center (GWIC) website at http://mbmggwic.mtech.edu.



Montana Ground-Water Assessment

Tom Patton

August 17, 2006

The well is in the grassy area in the foreground.