GROUNDWATER LEVELS IN WISCONSIN, ANNUAL SUMMARY 1994

Alexander Zaporozec
(Compilation of data: Michael Baumann)

1995

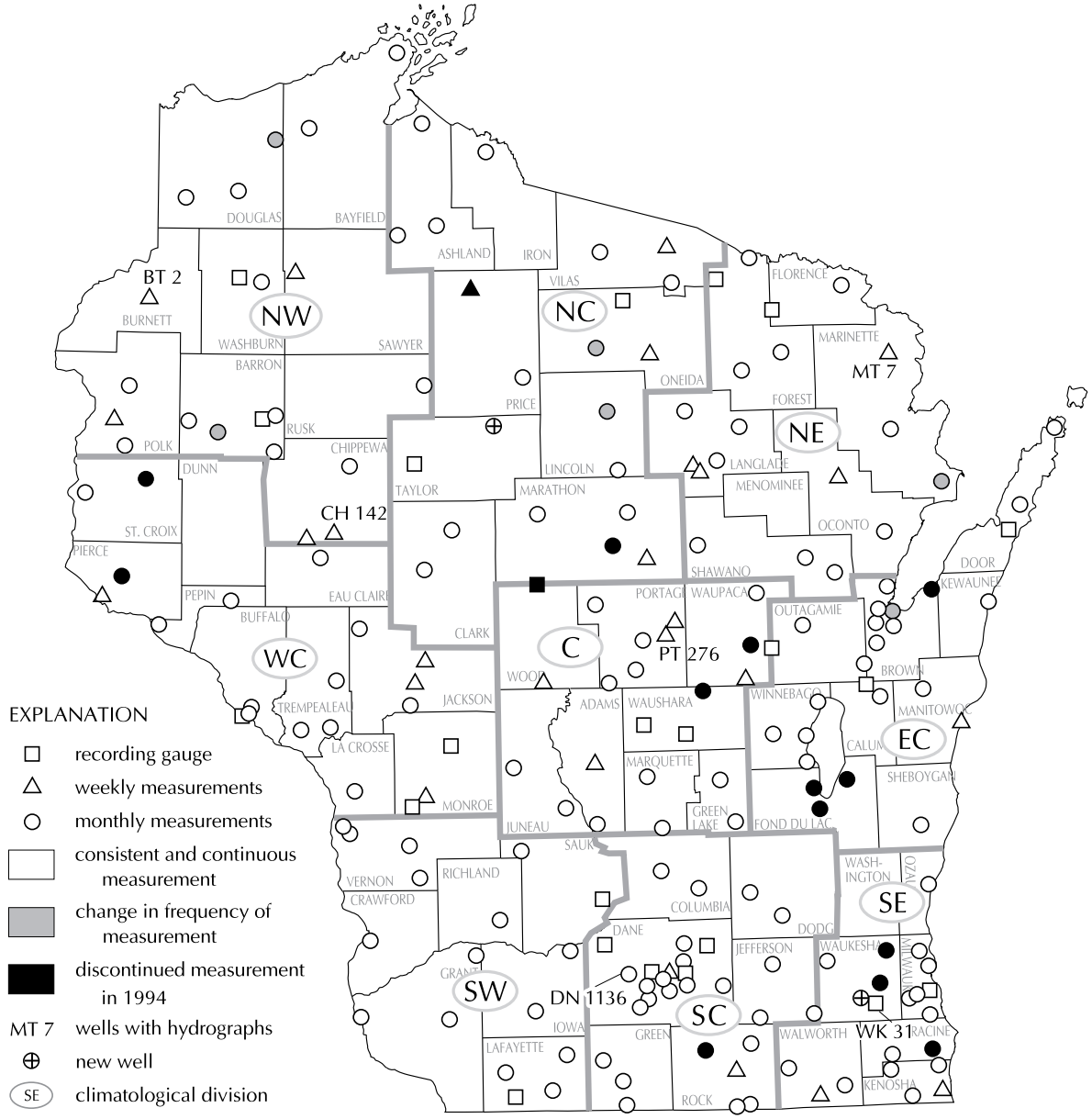

Figure 1. *Location of observation wells in Wisconsin, 1994.*

In cooperation with

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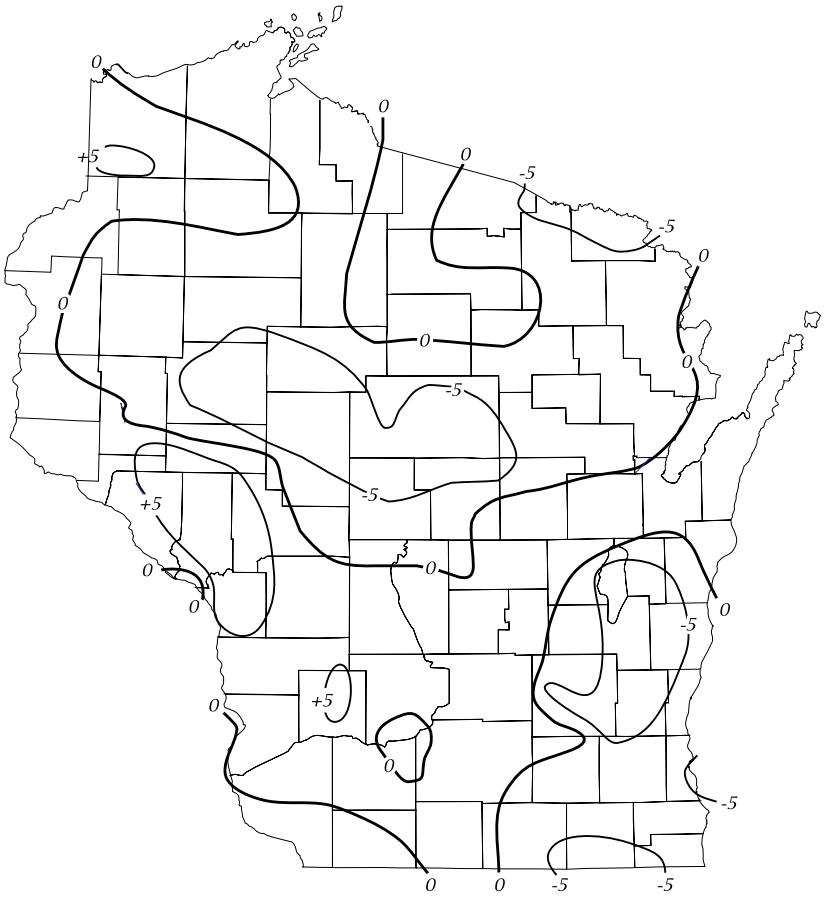

Figure 2. *Departure from normal precipitation in inches, 1994 (from Knox, 1995).*

The Wisconsin Geological and Natural History Survey (WGNHS) and the U.S. Geological Survey (USGS) have jointly operated a network of observation wells in Wisconsin since 1946. In 1994 measurements were taken in 184 observation wells in all counties except Dunn, Menominee, and Washington. Two wells were added and 14 wells were discontinued during 1993–94. Locations of wells are shown in figure 1.

In response to the wet years 1993 and 1991 (112% and 122% of normal precipitation, respectively; Knox, 1994, 1992), water levels in many observation wells rose quickly during 1993. Record high levels were reached on 25 percent of the wells in the observation network. Effects of the excess moisture were still apparent in early 1994, when eight additional wells established new record high levels. These wells were located primarily in the west-central and southwestern divisions; these divisions also received above-normal precipitation in 1994 (fig. 2)—the fifth consecutive year with above-normal precipitation.

The high water levels recorded in 1993 had only a relatively short duration because 1994 was an average year for precipitation: 31.2 in. (98% of normal precipitation; Knox, 1995). Although most of Wisconsin received near-normal precipitation, parts of the north-central, east-central, and southeastern divisions were dry, receiving less than 85 percent of normal precipitation (fig. 2).

During 1994, water levels in the northwest and north-central divisions remained about the same as in 1993 or declined only slightly (fig. 3). Generally, the magnitude of water-level declines increased from the northwest to the southeast. Most observation wells in the northwestern half of the state recorded declines of less than 0.6 ft. In a broad strip through the central and northeastern divisions, declines were less than 1 ft. Only in the southeastern third of the state did water levels decline more than 2 ft. Water levels dropped most in those wells that reached record-high levels in 1993. Declines of more than 3 ft were measured in wells in Iowa, Lafayette, Green, Green Lake, Waupaca, and Door Counties (fig. 3).

Areas in which water levels in wells were higher in 1994 than in 1993 were isolated and scattered around the state (fig. 3). Generally, water levels rose only slightly (from 0.5 to 1.5 ft) in these wells. Greater rises (2 ft and more) were primarily found in the southwestern and south-central parts of the state, which have received above-normal precipitation for the last five years, especially in wells in Trempeleau, Vernon, Dane, and Green Counties (fig. 3).

Water levels in the deep sandstone aquifer in areas of large withdrawals of groundwater (Brown, Milwaukee, Waukesha, Racine, and Kenosha Counties and central Dane County) continued in their gradual decline, and the area of influence expanded slightly (fig. 3). On the average, the annual decline of water levels in observation wells in Brown County is 3 ft; in Milwaukee-Racine-Kenosha area, 4 ft; and in Waukesha County, 5 ft.

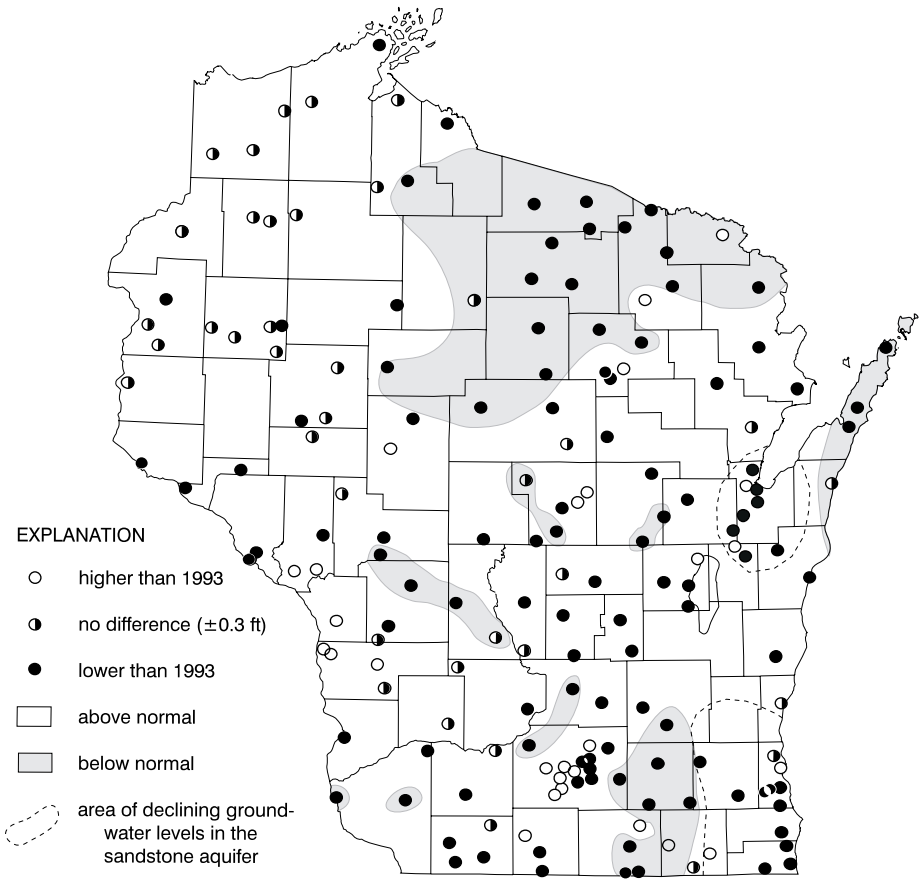

Figure 3. *Average water level changes from 1993 to 1994.*

Although the amount of water available for recharge was less in 1994 than in 1993, water levels in most observation wells in Wisconsin remained above long-term average levels in 1994. Because of high soil moisture at the beginning of the year, the amount of recharge was sufficient to keep water levels above normal in 75 percent of the observation wells. Below-normal water levels were recorded in 23 percent of the observation wells, primarily in north-central Wisconsin but also in parts of the central and south-central divisions (fig. 3).

Seasonal fluctuations of water levels in 1994 were irregular. A typical seasonal fluctuation cycle begins with minimum levels at the end of winter (February and March) as a result of several months of frozen soil, which does not allow recharge. Water levels rise rapidly in the spring because of recharge from snowmelt or spring rains (with peaks in April and May) and then gradually decline throughout the summer because of limited recharge. Most available moisture usually evaporates or is used by plants. Lowest levels generally occur at the end of the growing season in September. A secondary rise occurs as a result of fall rains (October).

Figure 4 shows the composite frequency of occurrence of the extreme annual water levels in Wisconsin observation wells in 1994, arranged by climatological divisions (for boundaries, see fig. 1). The distribution in figure 4 does not include wells in areas of heavy pumping in the east-central and southeastern divisions because their seasonal fluctuations are affected by withdrawal patterns.

In 1994 seasonal fluctuations did not follow the normal trends because they were influenced by high precipitation in 1993 and the irregular distribution of precipitation in 1994. In most wells the highest water levels were recorded in January and the lowest in December. Spring water levels peaked later than usual, in May, because the spring rains did not come until April; March was very dry. The secondary peak in the fall was small (in only 9% of

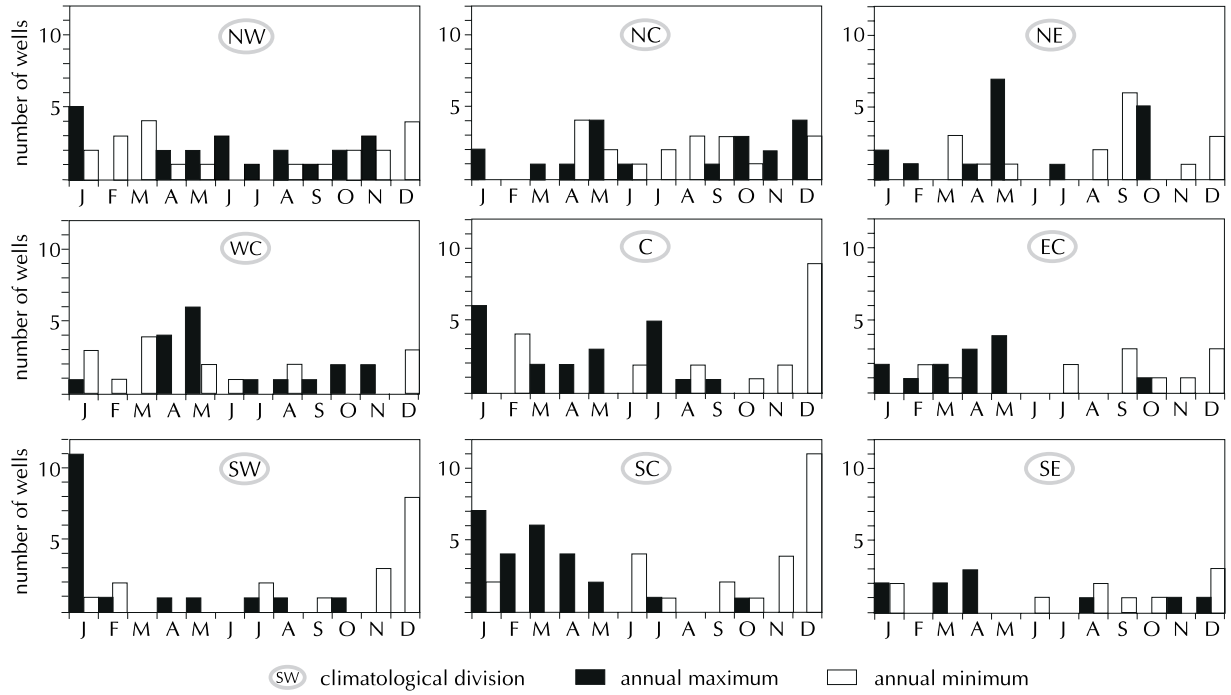

Figure 4. *Distribution of the annual maximum and minimum water levels in 1994 (wells in areas affected by heavy pumping in the EC, SE, and SC divisions were excluded).*

wells) and was recorded in October, after heavy September rains. The end-of-winter and end-of-summer lows were inconspicuous because of gradually declining water levels throughout the year.

Water levels fluctuate not only seasonally but also from year to year in response to trends in precipitation, which is the source of groundwater recharge. Well hydrographs (fig. 5) show the long-term trends—from the high levels in 1986 after a period of several wet years, to low levels in 1990–91 caused by drought in 1988–89, and back to high levels in 1993. ■

References

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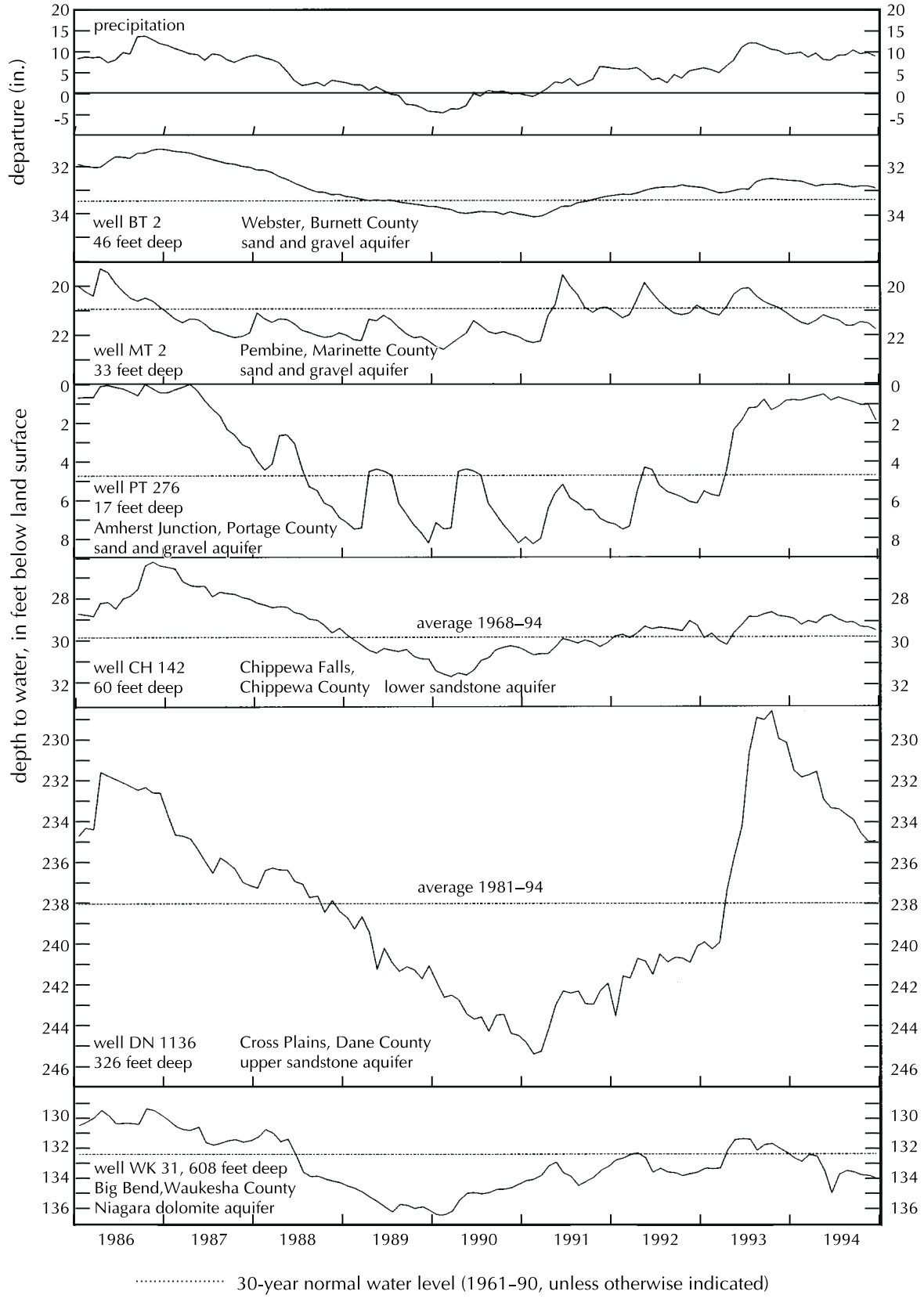

Figure 5. *Cumulative departure from normal monthly precipitation in Wisconsin and fluctuations of water levels in selected key wells. (Locations of wells are shown in fig. 1.)*

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