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Summary of Groundwater Level Monitoring 2006-2012, Agate Fossil Beds National Monument

Dataloggers were installed in three wells at Agate Fossil Beds National Monument in October 2006. These dataloggers record pressure and temperature at half-hour intervals. The pressure readings are converted to depth to water. The monitoring wells are; the former water-supply well for the park, the windmill well at the Bone Cabin, and a well at the Kelly Homestead.

The wells all show the same annual pattern of water table fluctuation. The water table is highest in mid-May after infiltration of snowmelt and spring rains and prior to the start of growing season when plants begin to consume water by evapotranspiration. The water table reaches its lowest elevation around the end of August at the end of the growing season.

The hydrograph for the Bone Cabin Windmill is affected by pumping of the well. When the well is pumped, the water level is drawn down to about 15 feet below the top of the well casing. The other two wells are not pumped.

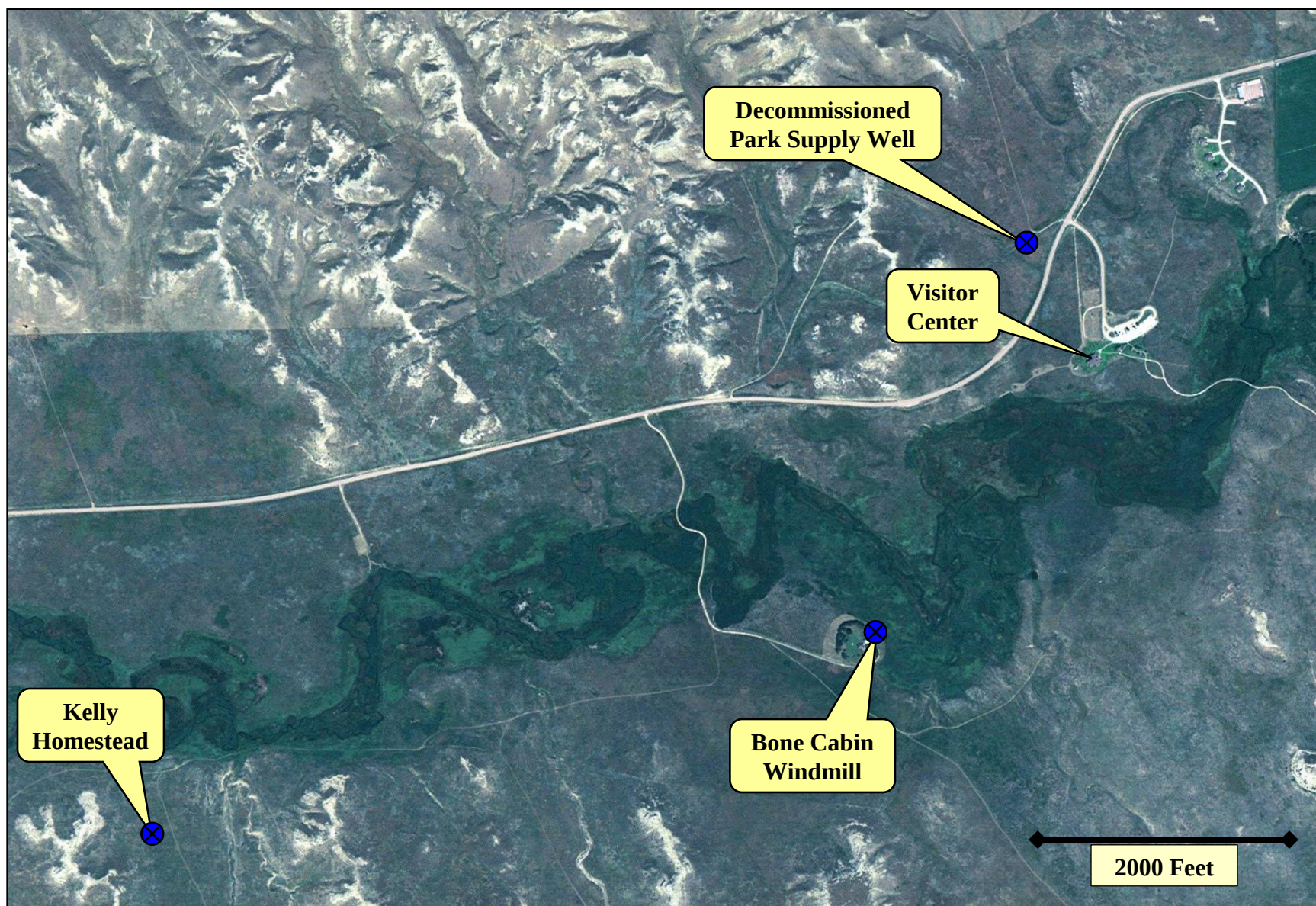
The Palmer Hydrologic Drought Index (PHDI) is a good indicator of wet or dry conditions. When the index is a positive number, it indicates wetter than normal conditions. Negative numbers indicate drought conditions. A graph of the PHDI for the Nebraska Panhandle is attached to this report. The area was experiencing a mild drought when groundwater level monitoring started in October 2006. The mild drought continued until Spring 2009. The period from Spring 2009 to Spring 2012 was generally wetter than normal. The area began experiencing severe drought conditions in Spring 2012.

Water levels at the Bone Cabin Windmill Well are not significantly affected by drought conditions. The well is completed in shallow alluvial sediments with the groundwater level mostly controlled by the seasonal increase of evapotranspiration by vegetation in the river valley. Groundwater levels are generally about 7 feet below the top of the casing in the winter and 8-10 feet below the top of the well casing in the summer. In the wetter summers of 2009, 2010, and 2011, the ground water level was about 8 feet below the top of the well casing. In the drier summers of 2007, 2008, and 2012, the groundwater level is closer to about 10 feet below the top of the well casing.

The Kelly Homestead Well is located in the beginning of the upland area, south of the river valley. It is more distant from the river and the water table is deeper at this location (because the

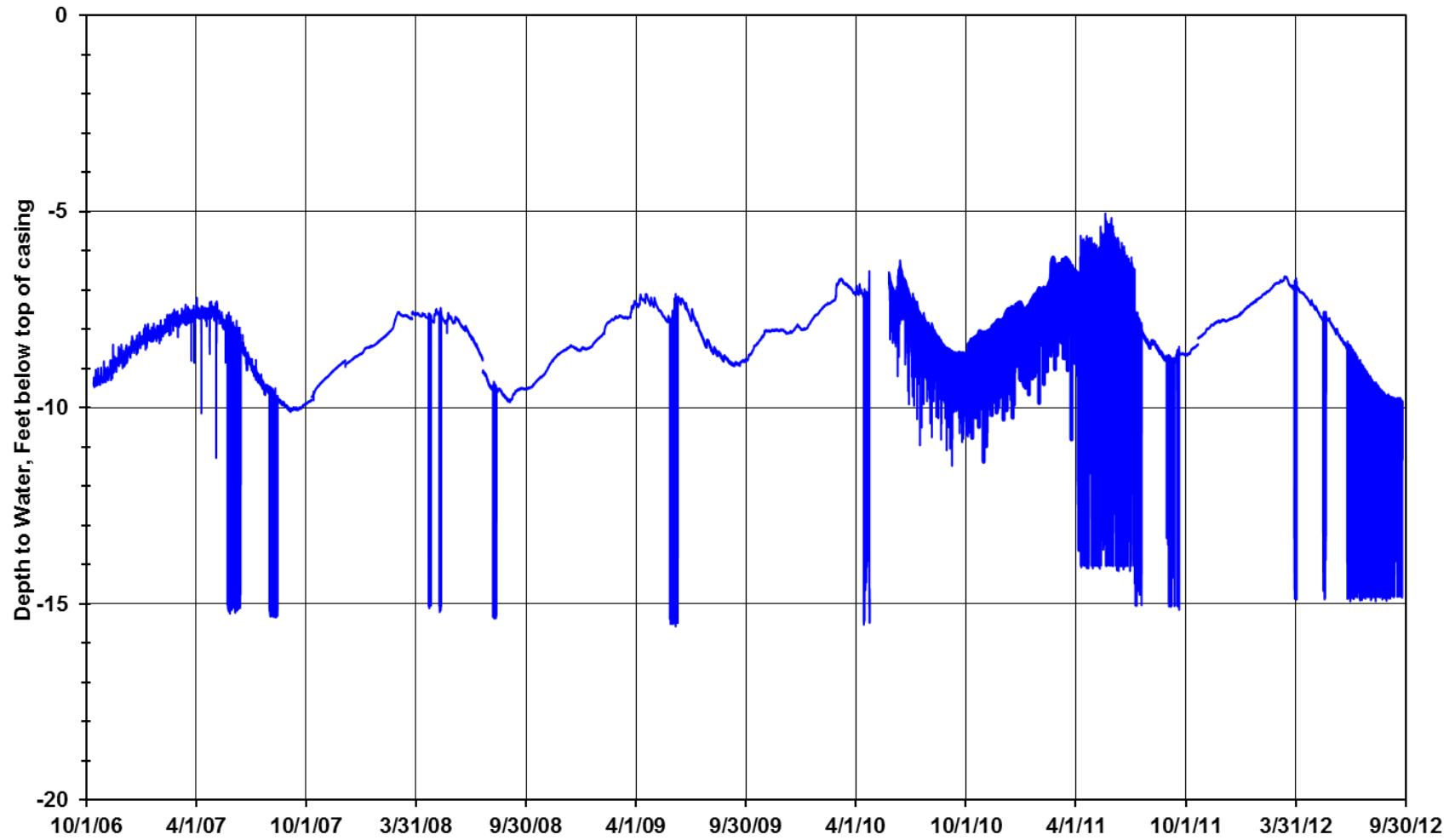
topography is higher above the water table). Thus, there is less seasonal fluctuation of the water table due to evapotranspiration. In general, the depth to water ranges from about 49-51 feet below ground surface. There is a very small difference between wet and dry summers. The depth to groundwater was about 50 feet below the top of the well casing during the wetter summers of 2009, 2010, and 2011. During the drier summers of 2007, 2008, and 2012 the groundwater level was closer to 51 feet below the top of the well casing.

The decommissioned park supply well is located along the northern margin of the river valley, adjacent to the upland area. It is 240 feet deep and is completed in the Arickaree Formation. The current water-supply well for the park and a neighboring irrigation well are also completed in the Arickaree Formation. The larger seasonal fluctuation of water levels in the decommissioned well may be partly attributed to its distance from the river and associated saturated sediments, completion in a deeper geologic formation (rather than the alluvium), and the pumping from two nearby wells. The water level in the decommissioned water supply well ranges from about 37-42 feet below the top of the well casing. The depth to groundwater was greater (about 41-42 feet below the top of the well casing) during the drier summers of 2007, 2008, and 2012. The depth to groundwater was less during (about 38-39 feet below the top of the well casing) during the wetter summers of 2009, 2010, and 2011.

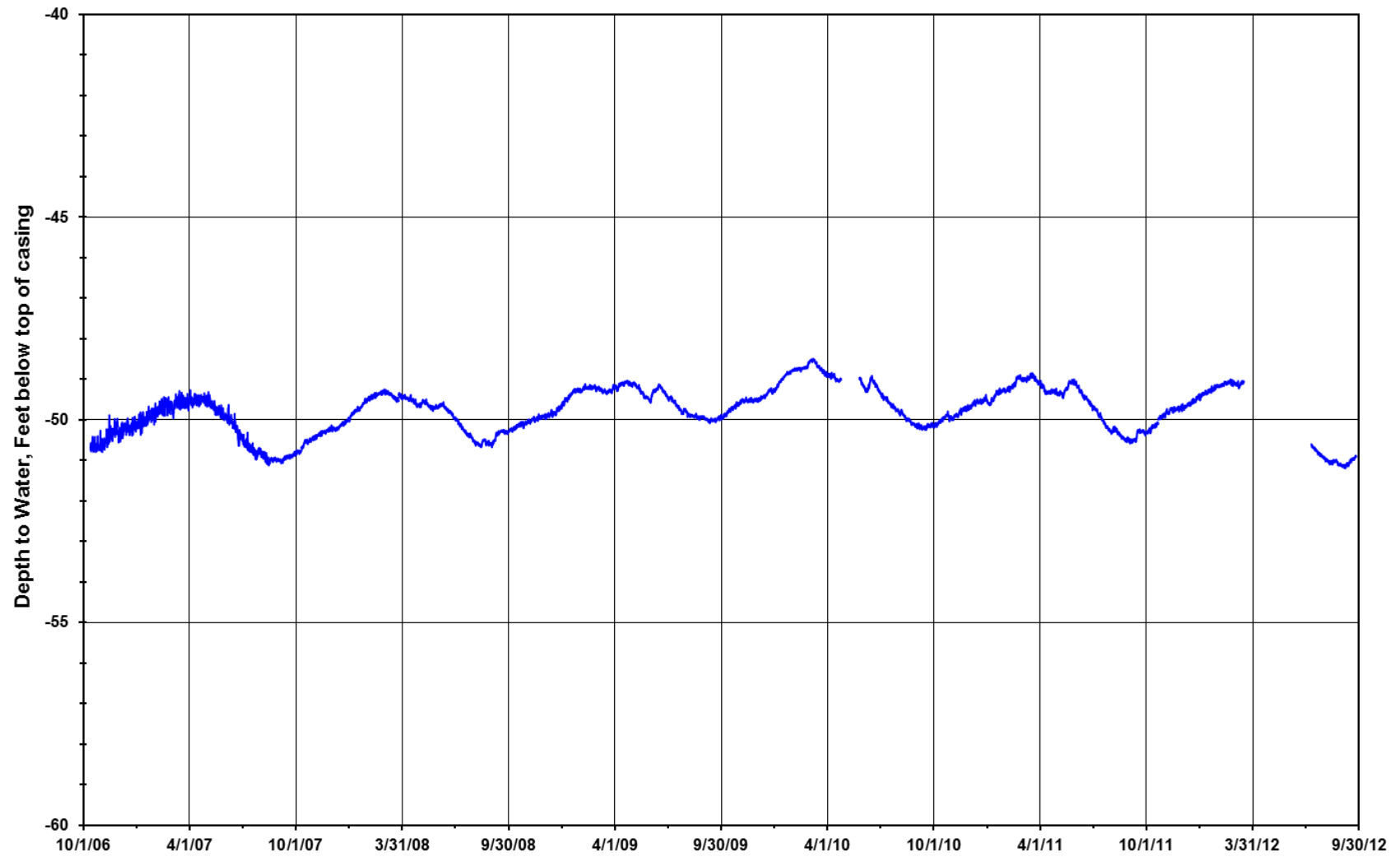


Locations of groundwater monitoring wells at Agate Fossil Beds National Monument

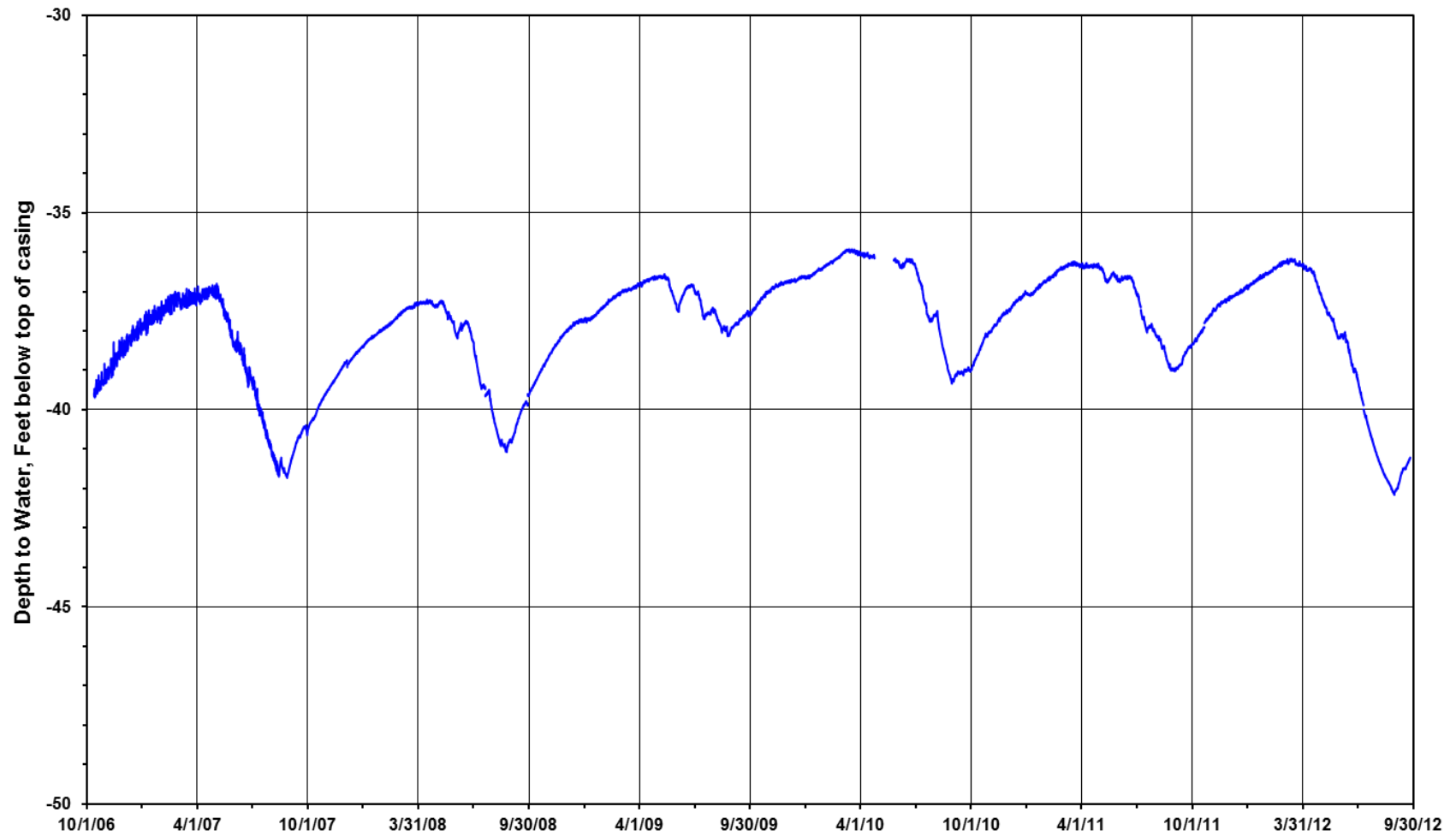
Bone Cabin Windmill Well
Agate Fossil Beds National Monument



Kelly Homestead Well
Agate Fossil Beds National Monument



**Decommissioned Park Supply Well
Agate Fossil Beds National Monument**



Palmer Hydrologic Drought Index Panhandle area of Nebraska

