

A Summary Of:

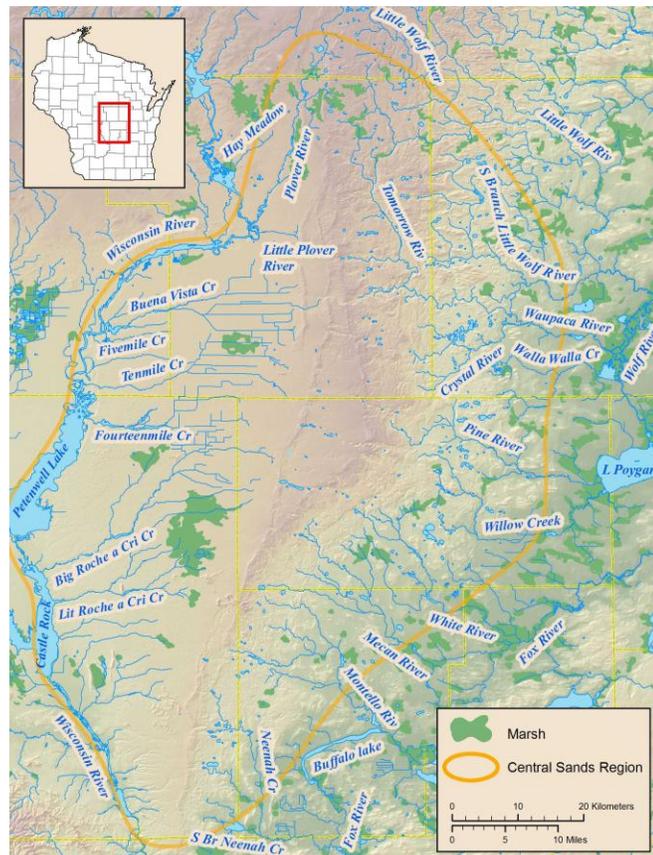
Irrigation Effects in the Northern Lake States: Wisconsin Central Sands Revisited

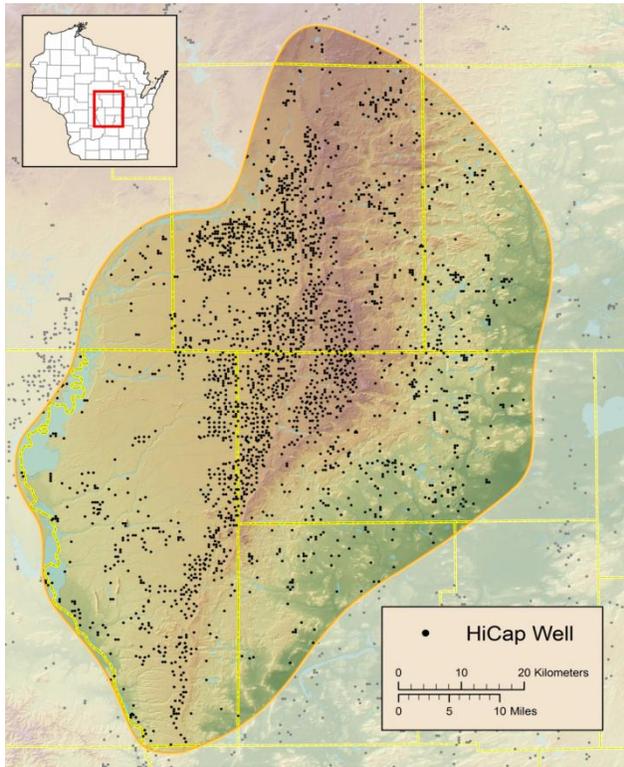
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Accepted to Ground Water Journal

This is a summary of an article accepted for publication in Ground Water Journal on the effects of groundwater pumping in central Wisconsin on lakes and streams. An Early Online version can be accessed from Wiley & Sons at <http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6584.2011.00836.x/full> . Hard copy publication is expected during 2012. This summary uses non-scientific language, and English instead of metric units.

Irrigated agriculture using groundwater has expanded greatly in the northern US lake states, including the central sands of Wisconsin, during the past half century. Because groundwater is strongly connected to surface waters, irrigation pumping decreases local stream baseflows and the water levels in aquifers, lakes, and wetlands. During the early phase of the irrigation expansion, the effects of pumping on central sands lakes and streams were explored in some well-known USGS studies by Weeks et al. (1965) and Weeks and Stangland (1971). These studies demonstrated that pumping could harm lakes and streams, and predicted the stressed water conditions that are apparent today. In this study, we revisited irrigation pumping effects on central sands hydrology. The effects have been substantial. Stream baseflows are commonly decreased by a third or more on average in many headwaters streams, and water levels are commonly lowered by more than three feet in places. Irrigation pumping explains why some surface waters have become impaired sometimes to the point of drying, with attendant losses of fisheries and other biota.

Wisconsin central sands region with its landforms and surface waters.





High capacity wells in central Wisconsin.

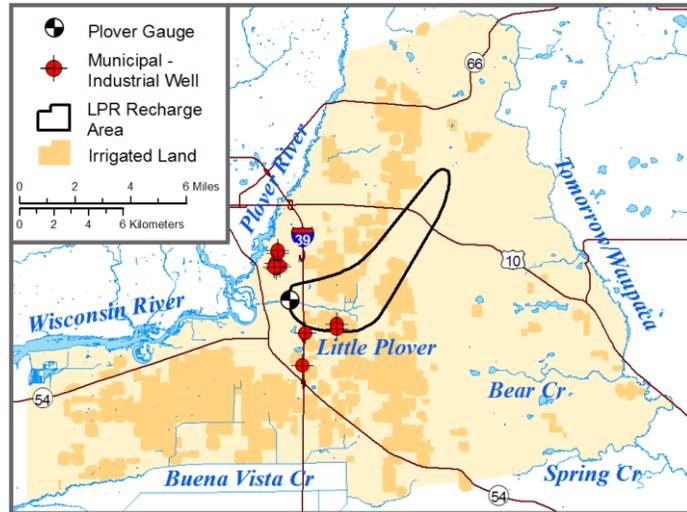
Little Plover dry-up, 2006.



Long Lake dry-up, 2007.

Little Plover Pumping Diversions

Irrigated land and municipal / industrial high capacity wells around the Little Plover.



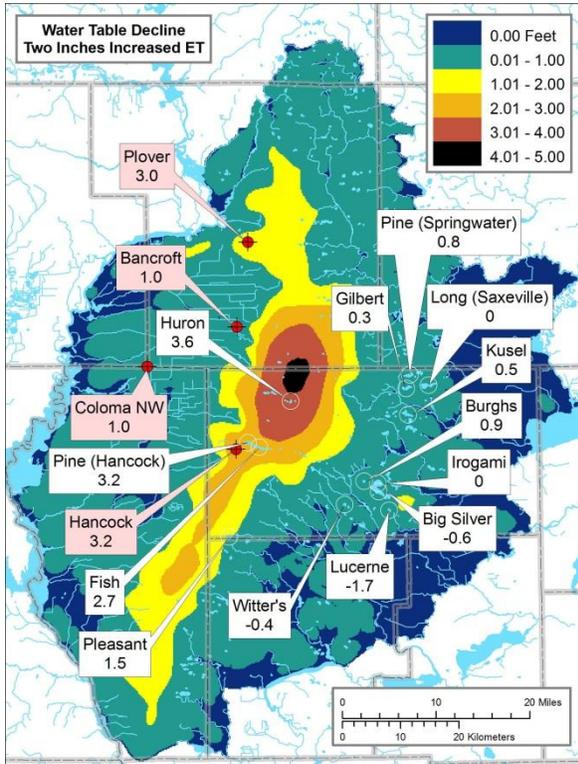
Little Plover pumping diversions first become detectable in the mid 1970s and grew over time. Diversions went from an average 1.3 cfs in 1977-1986 to more than 4 cfs after 2000. The 2005-2009 diversions amounted to half the expected baseflow discharge in the absence of pumping. Irrigation was the largest portion of the diversions, 63% in 2000-2009, with municipal and industrial making up the remainder.

Years	Observations*	Average Diversion (cfs)		
		Total	Irrigation	Nonirrigation
1977-1986	10	1.27	0.99	0.28
1995-1998	6	3.12	1.13	1.99
2002-2004	2	4.13	2.29	1.84
2005-2009	55	4.42	2.77	1.65

Pumping diversions from the Little Plover River.

* For 1977-86, years of observations. All others are individual observations.

Pumping -Induced Water Level Declines



Average water level drawdowns due to pumping in the central sands.

Boxes are estimated from water level records. Pink are monitoring wells, white are lakes. Map background colors are based on groundwater flow models.

Dry year drawdowns are significantly greater.

Percentage of average groundwater discharge to streams diverted by pumping.

