

444008092423201 Local number PI 98-14 114N16W23BCAA Prairie Island 0000612781

Sand and gravel aquifers (glaciated regions)
Pleistocene Series

Goodhue County, MN

LOCATION.--Lat 44°40'07.66", long 92°42'31.69" referenced to North American Datum of 1983, in NE ¼ SW ¼ NW ¼ sec.23, T.114 N., R.16 W., Goodhue County, MN, Hydrologic Unit 07040001, 4 miles south and 7 miles east of Hastings, Minnesota. The land surface at the site is 688.16 plus-or-minus 0.01 feet above the North American Vertical Datum of 1988.

GROUNDWATER RECORDS

WELL CHARACTERISTICS.--Depth 20.2 ft. Upper casing diameter 2 in; top of first opening 15 ft, bottom of last opening 20 ft. The hole for well PI 98-14 was drilled with an 8.25-inch-diameter power auger to a depth of 22 feet on Sep. 03, 1998. The well is constructed of a 5-foot-long, 2.04-inch-diameter, schedule-40 PVC, 0.010-inch slotted, flush-threaded screen attached to about 18 feet of 2.04-inch-diameter, schedule-40 PVC casing. This casing had a stick-up of 2.93 feet above land surface on Sep. 3, 1998.

DATUM.--Land-surface datum is 688.16 ft above North American Vertical Datum of 1988. Measuring point: MP is top of casing, not protection post, 2.93 ft above land-surface datum, Sep. 03, 1998, to present. Water levels are in feet above sea level and depth below land surface. Water-level elevations are accurate to plus-or-minus 0.01 feet, based on an optical survey from 1st-vertical-order benchmarks. Elevation of the measuring point is 691.09 ft. above North American Vertical Datum of 1988.

PERIOD OF RECORD.--Hourly water level measurements were recorded from Apr. 20, 2006 to Jun. 09, 2006. Hourly water level measurements were recorded with intermittent gaps in the record from Jun 10, 2006 to Aug. 20, 2006. Hourly water level measurements were recorded from Aug. 21, 2006 to Sept. 29, 2007. Hourly water level measurements were recorded from Nov. 09, 2007 to Aug. 24, 2009. Hourly water level measurements were recorded from Oct. 09, 2009 to the present.

From Apr. 20, 2006 to the present, water level has been measured hourly by a pressure transducer. The period during Sep. 30, 2007 at 03:00 CDT to Nov. 08, 2007 at 14:00 CST is missing because the transducer stopped working. The period during Aug. 25, 2009 at 04:00 CDT to Oct. 08, 2009 at 16:00 CDT is missing because the transducer thermister stopped working. All other remaining breaks in hourly water level measurements (above) were a result of station failure during those time periods.

GAGE.--Water level is measured with a Design Analysis H-310 submersible pressure transducer accurate to 0.01 feet. Shelter temperature and battery voltage are measured by a Campbell Scientific, Inc. CR206 data logger, which also records all data hourly. The data logger is housed in a 10-inch X 12-inch grey fiberglass shelter attached to the well casing. The gage is powered by a 10W solar panel and is telemetered by telephone.

COOPERATION.--Well PI 98-14 is operated in cooperation with the Prairie Island Indian Community.

REMARKS.--Measured groundwater levels are precise to two decimal places, not the 3 decimal places reported. Differences between subsequent groundwater levels are precise to 3 decimal places, however. Three-decimal place precision is useful at this site for hydrologic analyses such as estimation of groundwater recharge and evapotranspiration.

EXTREMES FOR PERIOD OF RECORD.--Maximum hourly water level: 5.642 feet below land surface (682.518 feet NAVD88) on Apr. 15, 2011 at 15:00 CST;
Minimum hourly water level: 15.788 feet below land surface (672.372 feet NAVD88) on Mar.05, 2010 at 10:00 CST;

Maximum daily-average water level: 5.665 feet below land surface (682.495 feet NAVD88) on Apr. 15, 2011; Minimum daily-average water level: 15.784 feet below land surface (672.376) feet NAVD88) on Mar. 05, 2010.

EXTREMES FOR CURRENT YEAR.--Maximum hourly water level: 5.642 feet below land surface (682.518 feet NAVD88) on Apr. 15, 2011 at 15:00 CDT;
Minimum hourly water level: 15.206 feet below land surface (672.954 feet NAVD88) on Feb. 15, 2011 at 11:00 CST and Feb. 16, 2011 at 01:00 CST;

Maximum daily-average water level: 5.665 feet below land surface (682.495 feet NAVD88) on Apr. 15, 2011; Minimum daily-average water level: 15.204 feet below land surface (672.956 feet NAVD88) on Feb. 15, 2011.

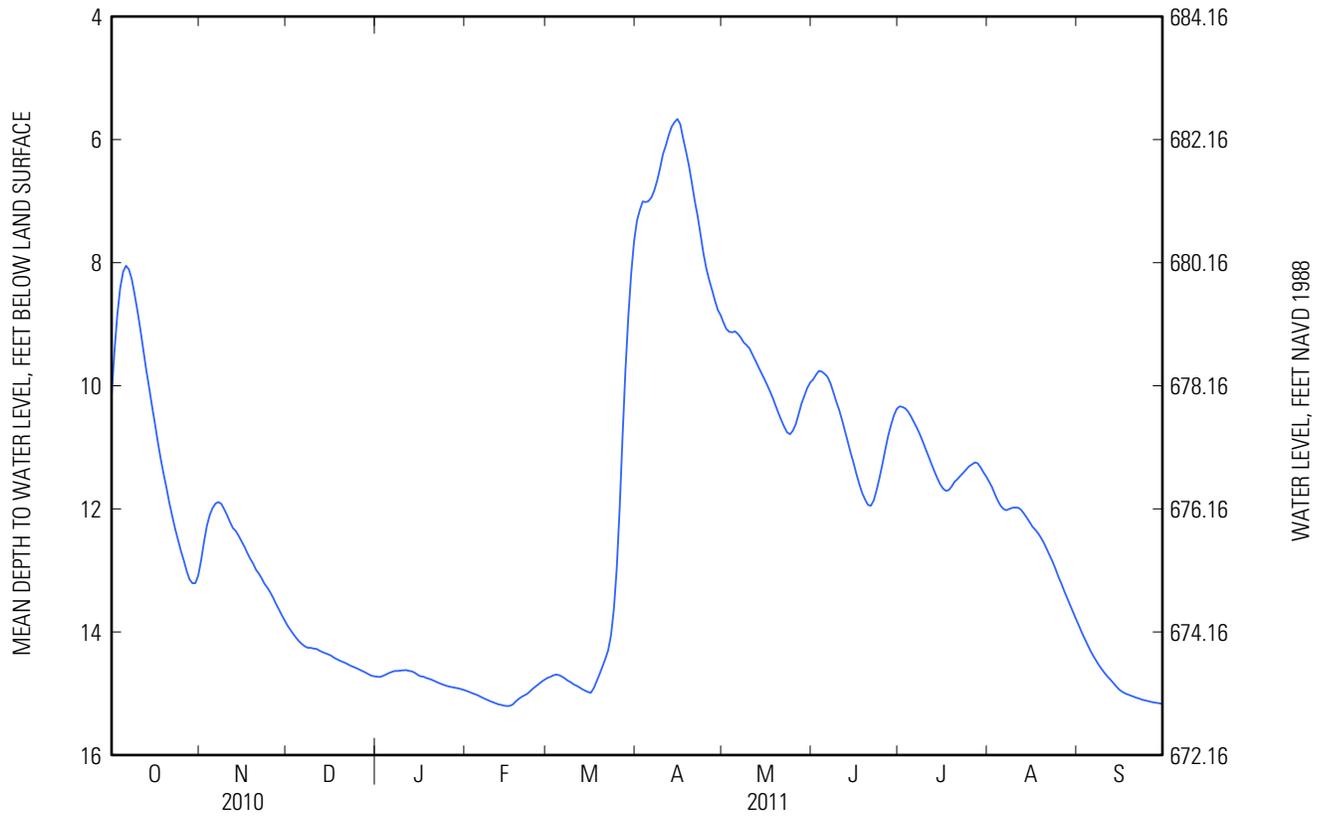
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DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	10.161	12.842	13.900	14.727	14.958	14.746	7.317	8.977	9.898	10.334	11.560	13.889
2	9.438	12.543	13.969	14.732	14.977	14.730	7.143	9.081	9.823	10.345	11.649	13.999
3	8.841	12.279	14.037	14.714	14.996	14.705	7.005	9.123	9.757	10.370	11.764	14.101
4	8.406	12.099	14.099	14.693	15.013	14.692	7.016	9.131	9.770	10.426	11.868	14.200
5	8.148	11.986	14.155	14.669	15.032	14.701	6.999	9.117	9.806	10.506	11.952	14.298
6	8.050	11.914	14.199	14.651	15.057	14.724	6.940	9.159	9.856	10.598	12.003	14.384
7	8.109	11.889	14.235	14.634	15.079	14.754	6.826	9.220	9.957	10.688	12.022	14.462
8	8.269	11.918	14.257	14.634	15.101	14.790	6.665	9.298	10.102	10.791	12.001	14.539
9	8.519	12.004	14.259	14.628	15.121	14.815	6.465	9.341	10.254	10.905	11.983	14.605
10	8.793	12.101	14.270	14.623	15.140	14.850	6.237	9.395	10.388	11.029	11.979	14.668
11	9.092	12.211	14.276	14.620	15.158	14.872	6.095	9.493	10.550	11.147	11.980	14.725
12	9.417	12.310	14.303	14.632	15.176	14.898	5.927	9.587	10.728	11.269	12.014	14.775
13	9.741	12.358	14.326	14.640	15.185	14.929	5.792	9.687	10.906	11.388	12.074	14.828
14	10.026	12.436	14.345	14.662	15.198	14.953	5.718	9.784	11.086	11.498	12.142	14.883
15	10.326	12.525	14.362	14.695	15.204	14.975	5.665	9.879	11.250	11.598	12.213	14.934
16	10.609	12.611	14.384	14.720	15.200	14.989	5.751	9.978	11.433	11.669	12.291	14.969
17	10.907	12.714	14.416	14.726	15.177	14.915	5.984	10.082	11.596	11.707	12.340	14.996
18	11.181	12.808	14.441	14.747	15.129	14.804	6.197	10.194	11.743	11.695	12.401	15.015
19	11.427	12.886	14.465	14.761	15.089	14.690	6.424	10.321	11.846	11.636	12.474	15.034
20	11.655	12.987	14.485	14.779	15.055	14.566	6.701	10.444	11.934	11.560	12.559	15.050
21	11.900	13.051	14.504	14.800	15.030	14.442	6.992	10.560	11.949	11.518	12.659	15.069
22	12.115	13.129	14.529	14.821	15.005	14.299	7.241	10.666	11.864	11.464	12.761	15.082
23	12.320	13.219	14.553	14.842	14.962	14.054	7.538	10.756	11.695	11.415	12.862	15.101
24	12.501	13.282	14.572	14.858	14.919	13.628	7.843	10.787	11.497	11.363	12.979	15.111
25	12.681	13.359	14.592	14.875	14.882	12.960	8.091	10.730	11.276	11.310	13.106	15.123
26	12.835	13.447	14.615	14.888	14.845	11.990	8.279	10.624	11.040	11.279	13.214	15.135
27	13.007	13.547	14.637	14.897	14.807	10.830	8.442	10.459	10.815	11.246	13.335	15.145
28	13.145	13.638	14.661	14.907	14.776	9.752	8.614	10.288	10.636	11.259	13.447	15.152
29	13.208	13.730	14.686	14.915	---	8.875	8.769	10.161	10.482	11.323	13.560	15.159
30	13.208	13.816	14.710	14.928	---	8.174	8.855	10.034	10.375	11.404	13.671	15.172
31	13.086	---	14.720	14.942	---	7.650	---	9.948	---	11.477	13.782	---
Mean	10.681	12.721	14.386	14.754	15.045	13.637	6.984	9.881	10.810	11.168	12.472	14.787
Max	13.208	13.816	14.720	14.942	15.204	14.989	8.855	10.787	11.949	11.707	13.782	15.172
Min	8.050	11.889	13.900	14.620	14.776	7.650	5.665	8.977	9.757	10.334	11.560	13.889

	Calendar Year 2010	Water Year 2011
Mean	13.624	12.265
High	7.544	5.665
Low	15.784	15.204

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WATER-QUALITY RECORDS

PERIOD OF RECORD.--Hourly water level measurements were recorded from Apr. 20, 2006 to Jun. 09, 2006. Hourly water level measurements were recorded with intermittent gaps in the record from Jun 10, 2006 to Aug. 20, 2006. Hourly water level measurements were recorded from Aug. 21, 2006 to Aug. 24, 2009. Hourly water level measurements were recorded from Oct. 09, 2009 to the present.

The period during Aug. 25, 2009 at 04:00 CDT to Oct. 08, 2009 at 16:00 CDT is missing because the transducer thermister stopped working. The remaining breaks in hourly water level measurements (above) were a result of station and/or transducer failure during those time periods.

PERIOD OF DAILY RECORD.--

WATER TEMPERATURE: Apr. 21, 2006 to the present. The period on Nov. 07, 2007 during 05:00 - 17:00 CST was estimated based on surrounding values because the transducer was being changed. The period during Aug. 25, 2009 at 04:00 CDT to Sep. 30, 2009 at 23:00 CDT is missing because the transducer thermister stopped working.

REVISED RECORDS.--The entire water temperature record was reevaluated and adjusted to a calibration measurement on Sept. 26, 2011. The record is no longer adjusted to all previous calibration measurements because the technique and instruments used were not adequate to accurately measure the water temperature. The record is considered accurate to +/- 0.1°C after Oct. 01, 2009. Before that time, the record is considered accurate to +/- 0.2°C because a gap in the record around that time and the installation of a new transducer increases uncertainty.

INSTRUMENTATION.--Water temperature is measured with a Design Analysis H-310 submersible pressure transducer accurate to 0.1°C. Record is currently uncalibrated while sufficient calibration data is being collected.

COOPERATION.--Well PI 98-14 is operated in cooperation with the Prairie Island Indian Community.

REMARKS.--All previously published water temperature data between Oct. 01, 2008 and September 30, 2010 were changed slightly due the discovery of an inaccurate water thermistor. This thermistor was used to calibrate the water temperature record against, but after further analysis/comparison, the thermistor was determined to be a poor piece of calibration equipment. This thermistor has since been discontinued and the Minnesota Water-Science Center is currently testing a more accurate water thermistor to calibrate the water temperature record against. These have been corrected in the USGS data base, but will not be republished in this report series. Contact the USGS Minnesota Water-Science Center for all corrected data.

EXTREMES FOR PERIOD OF RECORD.--WATER TEMPERATURE: Maximum hourly: 13.1°C during Oct. 17, 2010 at 22:00 CDT - Nov. 25, 2010 at 00:00 CST; Minimum hourly: 8.2°C on Apr. 09, 2007 at 22:00 CDT, Apr. 28, 2007 at 07:00 CDT.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURE: Maximum: 13.1°C during Oct. 18 - Nov. 24, 2010; Minimum: 8.2°C during Apr. 09 - 28, 2007.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURE: Maximum hourly: 13.1°C during Oct. 17, 2010 at 22:00 CDT - Nov. 25, 2010 at 00:00 CST; Minimum hourly: 8.9°C on Apr. 28, 2011 at 23:00 CDT and Apr. 29, 2011 at 02:00 CDT;

Maximum daily-average: 13.1°C during Oct. 18 - Nov. 24, 2010; Minimum daily-average: 9.0°C during Apr. 19 - May 14, 2011.

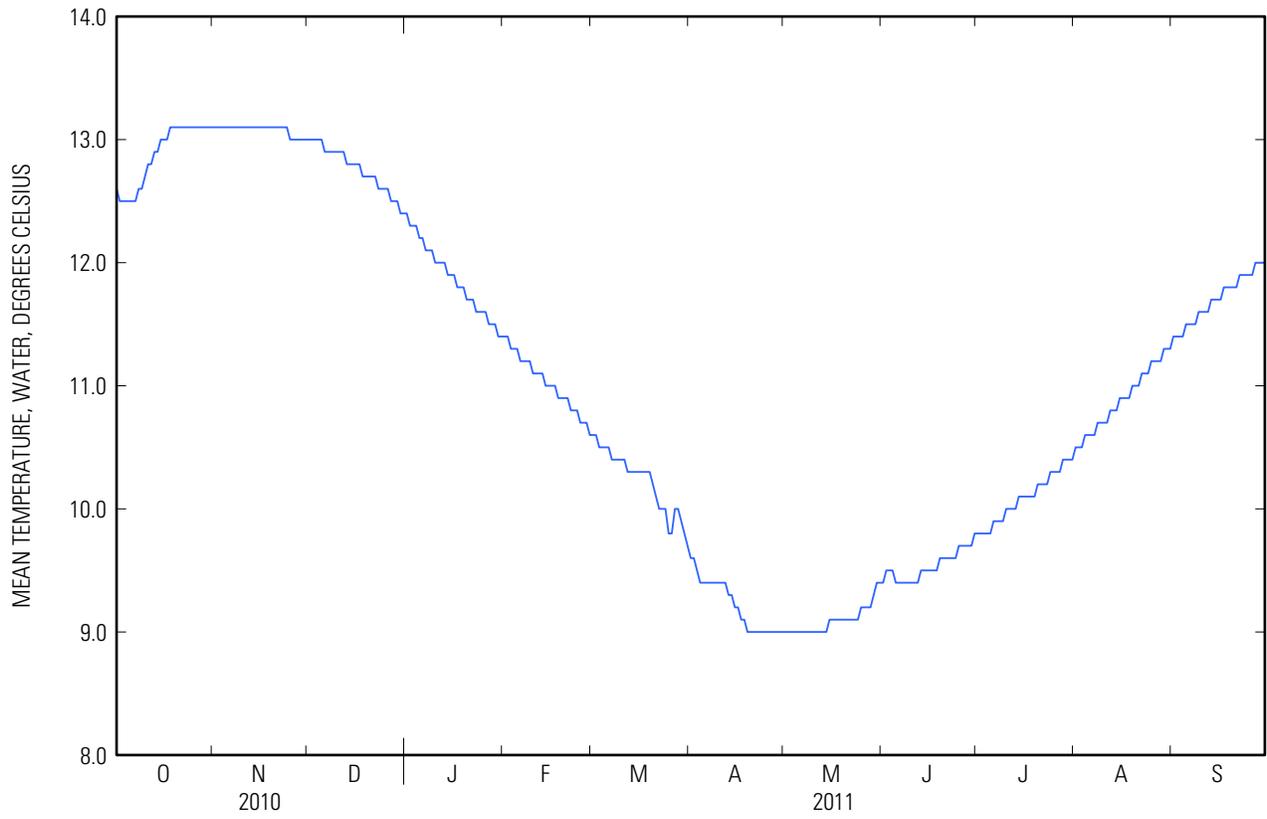
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TEMPERATURE, WATER, DEGREES CELSIUS
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	12.6	13.1	13.0	12.4	11.4	10.6	9.6	9.0	9.4	9.8	10.5	11.4
2	12.5	13.1	13.0	12.3	11.4	10.6	9.6	9.0	9.5	9.8	10.5	11.4
3	12.5	13.1	13.0	12.3	11.3	10.5	9.5	9.0	9.5	9.8	10.5	11.4
4	12.5	13.1	13.0	12.3	11.3	10.5	9.4	9.0	9.5	9.8	10.6	11.4
5	12.5	13.1	13.0	12.2	11.3	10.5	9.4	9.0	9.4	9.8	10.6	11.5
6	12.5	13.1	12.9	12.2	11.2	10.5	9.4	9.0	9.4	9.9	10.6	11.5
7	12.5	13.1	12.9	12.1	11.2	10.4	9.4	9.0	9.4	9.9	10.6	11.5
8	12.6	13.1	12.9	12.1	11.2	10.4	9.4	9.0	9.4	9.9	10.7	11.5
9	12.6	13.1	12.9	12.1	11.2	10.4	9.4	9.0	9.4	9.9	10.7	11.6
10	12.7	13.1	12.9	12.0	11.1	10.4	9.4	9.0	9.4	10	10.7	11.6
11	12.8	13.1	12.9	12.0	11.1	10.4	9.4	9.0	9.4	10.0	10.7	11.6
12	12.8	13.1	12.9	12.0	11.1	10.3	9.4	9.0	9.4	10.0	10.8	11.6
13	12.9	13.1	12.8	12.0	11.1	10.3	9.3	9.0	9.5	10.0	10.8	11.7
14	12.9	13.1	12.8	11.9	11.0	10.3	9.3	9.0	9.5	10.1	10.8	11.7
15	13.0	13.1	12.8	11.9	11.0	10.3	9.2	9.1	9.5	10.1	10.9	11.7
16	13.0	13.1	12.8	11.9	11.0	10.3	9.2	9.1	9.5	10.1	10.9	11.7
17	13.0	13.1	12.8	11.8	11.0	10.3	9.1	9.1	9.5	10.1	10.9	11.8
18	13.1	13.1	12.7	11.8	10.9	10.3	9.1	9.1	9.5	10.1	10.9	11.8
19	13.1	13.1	12.7	11.8	10.9	10.3	9.0	9.1	9.6	10.1	11.0	11.8
20	13.1	13.1	12.7	11.7	10.9	10.2	9.0	9.1	9.6	10.2	11.0	11.8
21	13.1	13.1	12.7	11.7	10.9	10.1	9.0	9.1	9.6	10.2	11.0	11.8
22	13.1	13.1	12.7	11.7	10.8	10.0	9.0	9.1	9.6	10.2	11.1	11.9
23	13.1	13.1	12.6	11.6	10.8	10.0	9.0	9.1	9.6	10.2	11.1	11.9
24	13.1	13.1	12.6	11.6	10.8	10.0	9.0	9.1	9.6	10.3	11.1	11.9
25	13.1	13.0	12.6	11.6	10.7	9.8	9.0	9.2	9.7	10.3	11.2	11.9
26	13.1	13.0	12.6	11.6	10.7	9.8	9.0	9.2	9.7	10.3	11.2	11.9
27	13.1	13.0	12.5	11.5	10.7	10	9.0	9.2	9.7	10.3	11.2	12.0
28	13.1	13.0	12.5	11.5	10.6	10	9.0	9.2	9.7	10.4	11.2	12.0
29	13.1	13.0	12.5	11.5	---	9.9	9.0	9.3	9.7	10.4	11.3	12.0
30	13.1	13.0	12.4	11.4	---	9.8	9.0	9.4	9.8	10.4	11.3	12.0
31	13.1	---	12.4	11.4	---	9.7	---	9.4	---	10.4	11.3	---
Mean	12.9	13.1	12.8	11.9	11.0	10.2	9.2	9.1	9.5	10.1	10.9	11.7
Max	13.1	13.1	13.0	12.4	11.4	10.6	9.6	9.4	9.8	10.4	11.3	12.0
Min	12.5	13.0	12.4	11.4	10.6	9.7	9.0	9.0	9.4	9.8	10.5	11.4

	Calendar Year 2010	Water Year 2011
Mean	11.0	11.0
Max	13.1	13.1
Min	8.5	9.0

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CLIMATOLOGICAL RECORDS

PERIOD OF RECORD.--Hourly precipitation measurements are recorded from Aug. 24, 2006 at 12:00 CDT to the present.

INSTRUMENTATION.--A tipping-bucket rain gage was added to the station on Aug. 24, 2006, which measures and records precipitation total hourly by a Campbell Scientific, Inc. CR205 data logger and is accurate to 0.01 inches. The rain gage is unheated and uncovered during the winter. Thus precipitation data during freezing periods (about December through early April) result from melting of snow during warm periods and do NOT represent actual precipitation.

EXTREMES FOR PERIOD OF RECORD.--PRECIPITATION: Maximum hourly total recorded: 1.69 in., Aug. 16, 2011 at 23:00 CDT; Maximum daily total: 3.68 inches on Aug. 19, 2007.

EXTREMES FOR CURRENT YEAR.--PRECIPITATION: Maximum hourly precipitation, 1.69 in., Aug. 16, 2011 at 23:00 CDT

Maximum daily precipitation, 2.14 in., Aug. 16, 2011.

**PRECIPITATION, TOTAL, INCHES
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY SUM VALUES**

[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.01	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.25	0.13	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
3	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.02	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.00
9	0.00	0.00	0.00	0.00	0.00	0.17	0.05	0.51	0.00	0.01	0.00	0.00
10	0.00	0.14	0.01	0.00	0.00	0.00	0.11	0.00	0.22	0.76	0.00	0.00
11	0.00	0.00	0.01	0.03	0.00	0.03	0.00	0.03	0.00	0.27	0.00	0.00
12	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00
13	0.00	1.23	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
14	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.10	0.74	0.06	0.01	0.00
15	0.00	0.00	0.00	0.00	0.00	0.01	0.10	0.00	0.19	1.93	0.00	0.00
16	0.00	0.01	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	2.14	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.32
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.02	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.25	0.04	0.16	0.00	0.00	0.01	0.09
21	0.00	0.04	0.00	0.00	0.00	0.00	0.14	0.88	1.90	0.00	0.00	0.03
22	0.00	0.00	0.16	0.00	0.03	1.66	0.13	0.67	0.88	0.00	0.00	0.01
23	0.00	0.00	0.01	0.00	0.14	0.05	0.01	0.00	0.03	0.58	0.12	0.00
24	0.17	0.02	0.00	0.00	0.01	0.17	0.00	0.00	0.00	0.00	0.00	0.00
25	e0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	0.00	0.00	0.00
26	0.49	0.00	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00	0.00	e0.03
27	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.17	0.00	1.25	0.00	0.02
28	0.00	0.05	0.01	0.00	0.03	0.00	0.13	0.27	0.00	0.00	0.00	0.00
29	0.00	0.60	0.15	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.02
30	0.00	0.00	0.13	0.00	---	0.00	0.28	0.03	0.00	1.01	0.10	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.00	---	0.01	0.12	---
Total	1.01	2.30	0.51	0.03	0.27	2.39	2.75	3.25	5.24	6.19	2.64	0.65
Mean	0.03	0.08	0.02	0.00	0.01	0.08	0.09	0.10	0.17	0.20	0.09	0.02
Max	0.49	1.23	0.16	0.03	0.14	1.66	1.22	0.88	1.90	1.93	2.14	0.32
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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	Calendar Year 2010	Water Year 2011
Total	36.56	27.23
Mean	0.10	0.07
Max	2.66	2.14
Min	0.00	0.00

