2011 Groundwater Monitoring Report: Nichols, Snelling, and Quarry Island Fens

Prepared for:
Lower Minnesota River Watershed District

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Introduction

A series of calcareous fens and trout streams run parallel to the Minnesota River, along the northwestern edge of Dakota County, between I-494 and Cedar Avenue (Appendix 1). Groundwater monitoring wells have been installed in these fens to determine if groundwater, originating from upland areas, is providing enough cool groundwater to recharge these valuable natural resources.

Several government agencies, including the United States Geological Survey, the Minnesota Department of Natural Resources (MNDNR), the Metropolitan Council, and the Ft. Snelling State Park have been involved in monitoring groundwater resources in this area. However, in recent years very little monitoring has taken place. In order to continue documenting groundwater levels, the Lower Minnesota River Watershed District (LMRWD) contracts with the Dakota County Soil and Water Conservation District (SWCD) to collect monthly "depth to water" measurements, for a network of 28 monitoring wells located in the area. This report summarizes the well measurements made in 2011.

2011 Activities

- Monthly "depth to water" measurements were collected at all wells.
- All data are made available on the Minnesota Climatology Workgroup Website http://climate.umn.edu/ground_water_level/ground_water_level_data_lmrwd.htm

Weather Summary

Groundwater levels are often influenced by recent precipitation, especially in relatively shallow wells, similar to those monitored in the LMRWD. When compared against 50 year precipitation records (Figure 1), the 2011 total precipitation amount (26.91 inches) was drier than the 50 year average (29.06 inches). Reduced precipitation may account for slight decreases in recent well measurements (Figures 2-4).

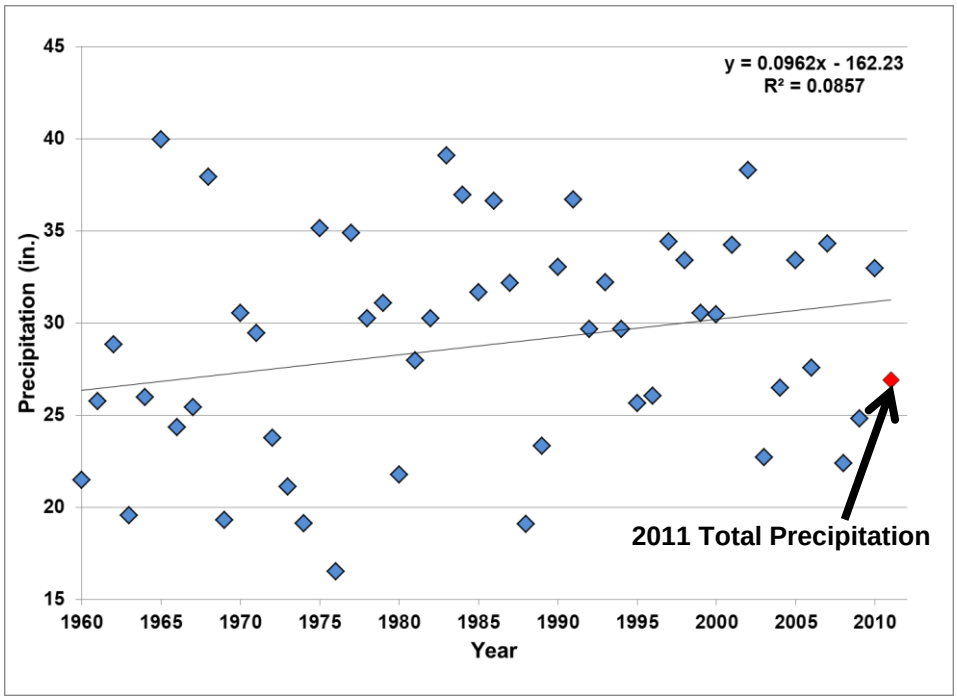

Figure 1. Minneapolis/St.Paul International Airport 50 Year (1960-2011) Annual Precipitation Record

Quarry Island Fen Monitoring Results

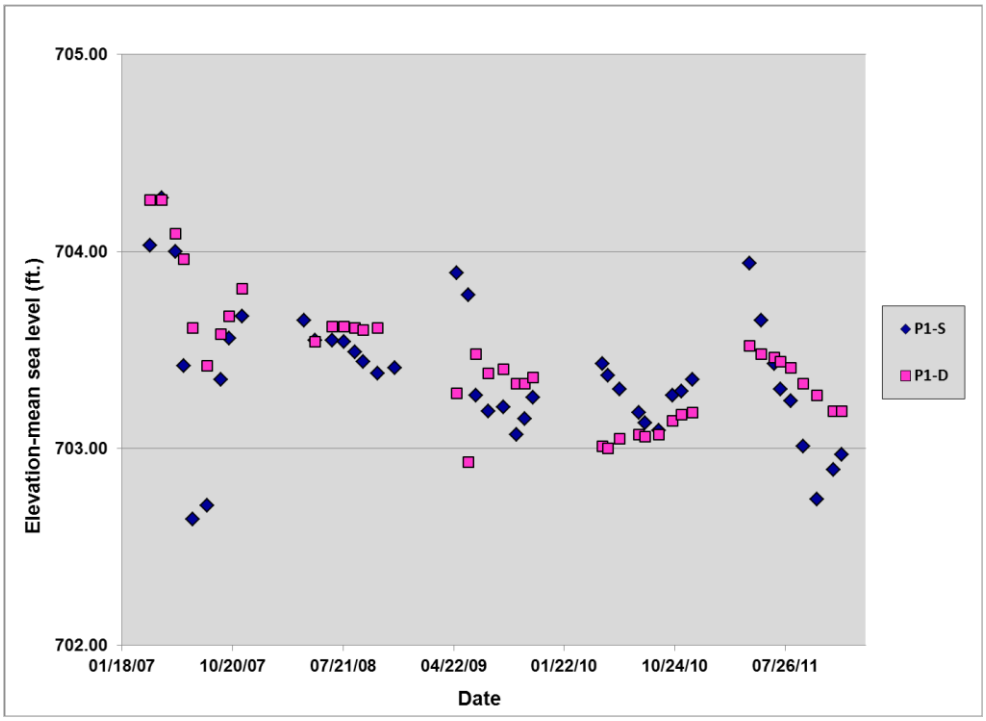

Figure 2. 2007-2011 Quarry Island Fen Well Monitoring Results

Snelling Fen Monitoring Results

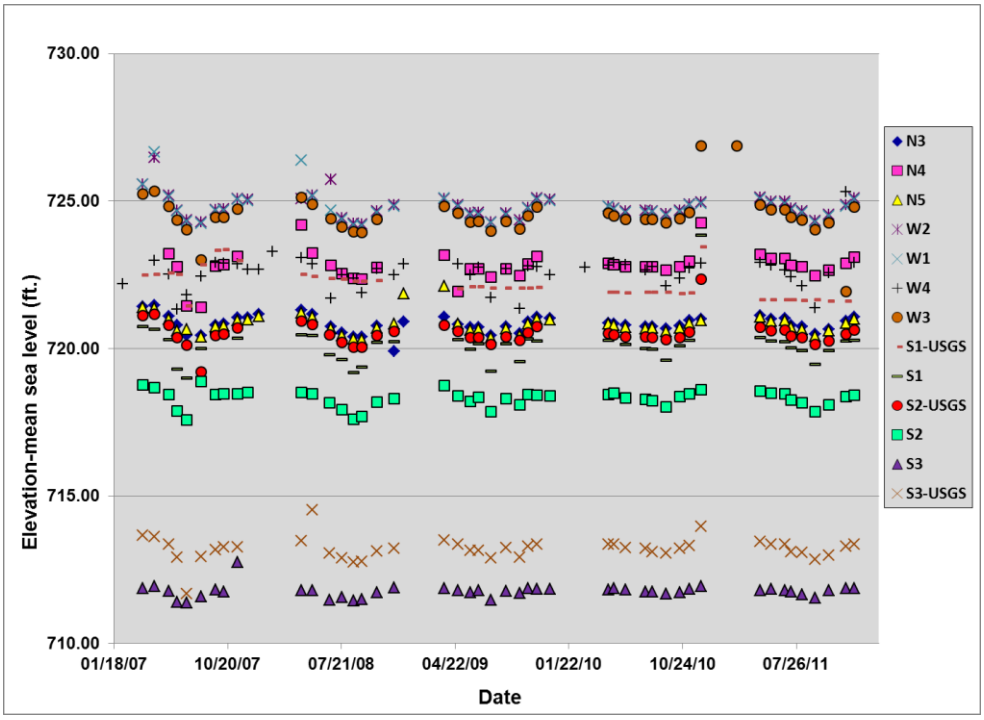

Figure 3. 2007-2011 Snelling Fen Well Monitoring Results

Nichols Fen Monitoring Results

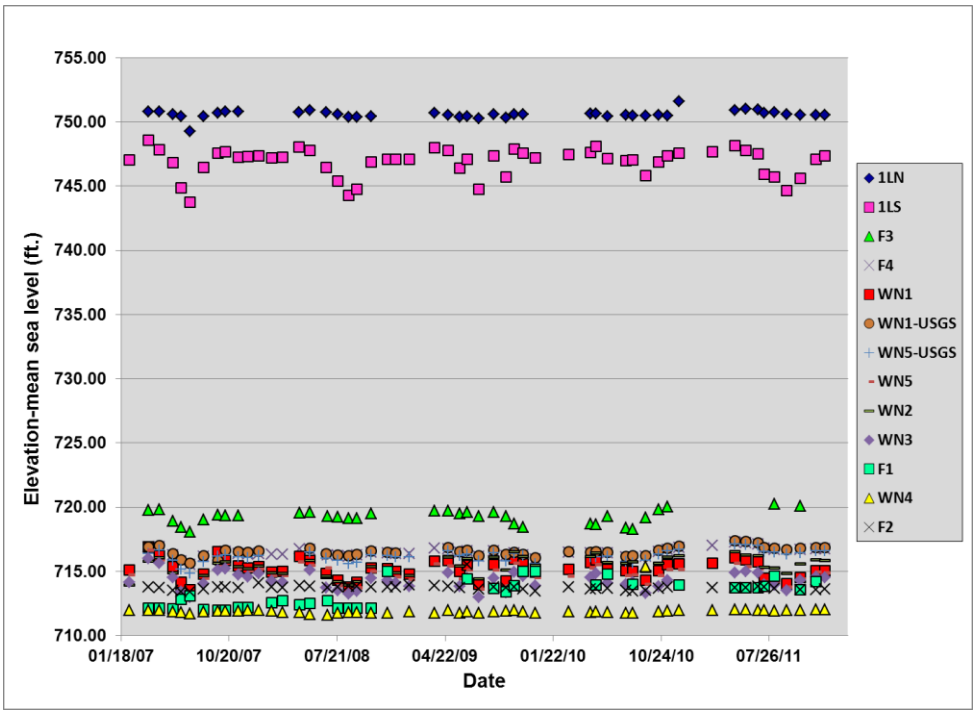

Figure 4. 2007-2011 Nichols Fen Well Monitoring Results

Discussion

Water elevations among the 2007-2011 monitoring years have been relatively consistent and follow similar annual patterns in the Snelling and Nichols fens (Figures 4-5). Water elevations in the shallow wells of the Quarry Island Fen appear to be less consistent and slightly decreasing (Figure 3). In general, water elevations decrease during dry summer months, and rebound as precipitation increases in the fall. Although monthly fen well measurements do not closely mirror recent precipitation patterns, measurements do reflect general precipitation trends, especially during summertime periods of low rainfall.

Due to the brief period of record for this monitoring effort, a limited regression analysis was performed on the datasets for each well. A trend line was fitted to monthly data from each well to determine if water levels are increasing (+) or decreasing (-) (Table 1). A "goodness of fit" test was completed for all trend lines, with R^2 values ranging from 0 to 0.537. Due to these low R^2 values, all trends should be considered weak.

Based upon this analysis, water elevations in fen wells are mixed and do not demonstrate any obvious trends (low R^2 values). However, one of the Nichols fen wells (F1) is beginning to exhibit a slight upward trend (R^2=0.537). Additional monthly measurements are needed to expand upon existing baseline data and to provide for a stronger trend analysis in future reports.

Table 1. 2007-11 Fen Well Regression Analysis

Quarry Island Fen Trends		
Well	2007-11 Trend	R^2 (Trend Fit)
P1-S	-	0.1523
P1-D	-	0.489
Fort Snelling Fen Trends		
Well	2007-11 Trend	R^2 (Trend Fit)
N3	-	0.0053
N4	+	0.0487
N5	-	0.0172
W2	-	0.0412
W1	-	0.0456
W4	+	0.0311
W3	+	0.0001
S1-USGS	-	0.4276
S1	+	0.012
S2-USGS	+	0.002
S2	-	0.0013
S3	+	0.0053
S3-USGS	+	0.0074
Nichols Fen Trends		
Well	2007-11 Trend	R^2 (Trend Fit)
1LN	+	0.0504
1LS	+	0.0003
F3	+	0.0238
F4	+	0.1938
WN1	-	0.009
WN1-USGS	+	0.2067
WN5-USGS	+	0.2366
WN5	-	0.0098
WN2	+	0.2431
WN3	-	0.0109
F1	+	0.537
WN4	+	0.0317
F2	-	0.0081

Suggestions for future monitoring:

- Continue collecting monthly measurements to help identify annual and long term fen well groundwater elevation trends.

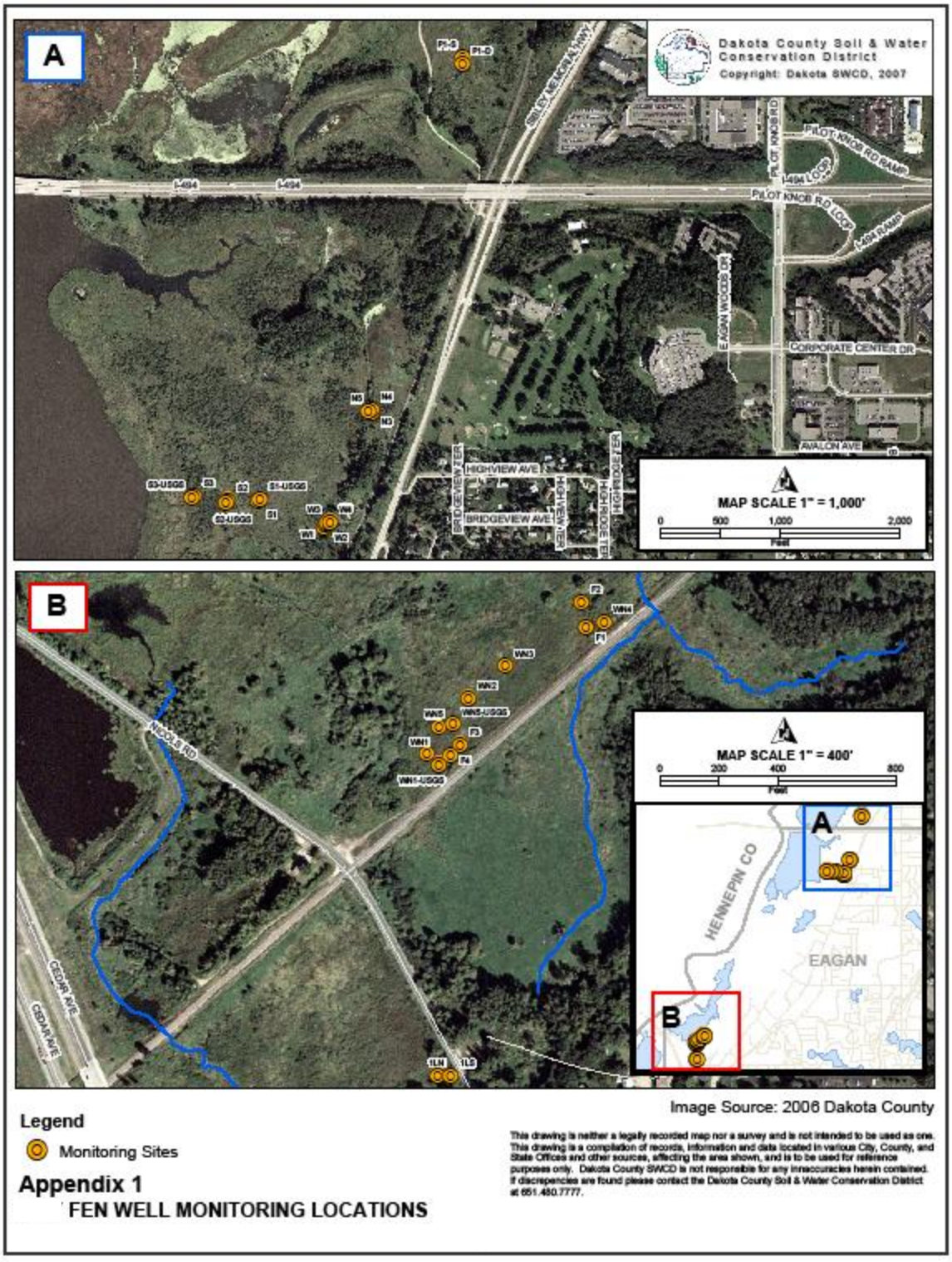

Image Source: 2006 Dakota County

Legend

Monitoring Sites

Appendix 1

FEN WELL MONITORING LOCATIONS