

# 2012 Groundwater Monitoring Report: Nichols, Snelling, and Quarry Island Fens

Prepared for:  
Lower Minnesota River Watershed District



December 31, 2012

Prepared by:  
Dakota County Soil and Water Conservation District



## ***Introduction***

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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 2012.

### **2012 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](http://climate.umn.edu/ground_water_level/ground_water_level_data_lmrwd.htm)
- Maintenance was performed on several wells to replace caps and fire guards.
- Minnesota DNR changed the name of several wells:  
WN1 >>> WT-1  
WN2 >>> WT-2  
WN3 >>> WT-3  
WN4 >>> WT-4  
WN5 >>> WT-5

## ***Weather Summary***

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Groundwater levels are often influenced by recent precipitation, especially in relatively shallow wells, similar to those monitored in the LMRWD. The 2010-2012 average monthly precipitation was 2.48 inches and has been relatively consistent on an annual basis, with larger amounts occurring during summer and early fall (Figure 1). When compared against 50 year precipitation records (Figure 2), the 2012 total precipitation amount (29.60 inches) was slightly wetter than the 50 year average (29.05 inches).

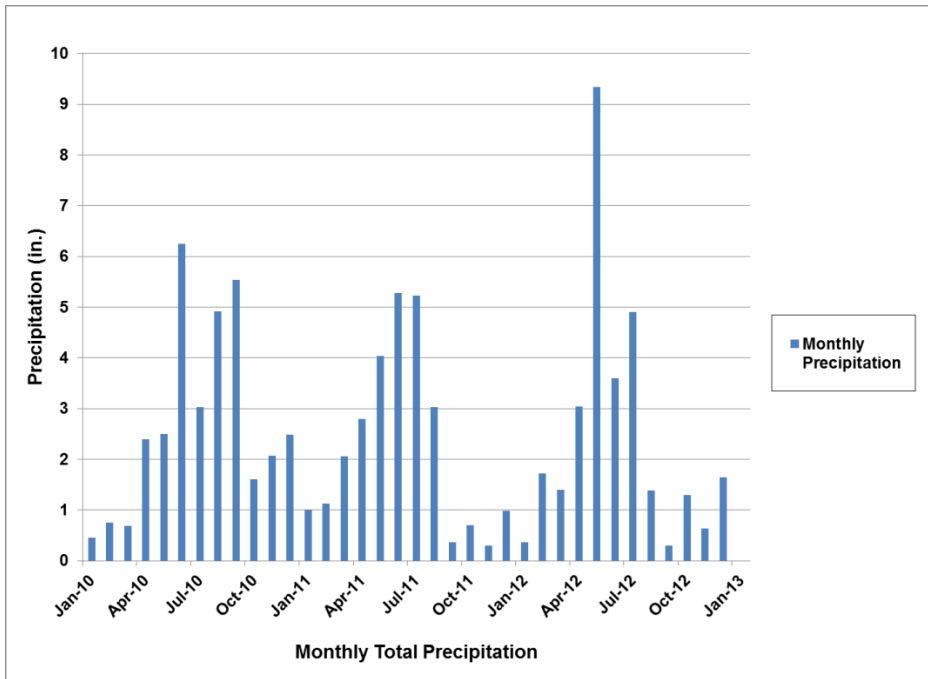


Figure 1. 2010-2012 Minneapolis/ St. Paul International Airport Monthly Precipitation Results

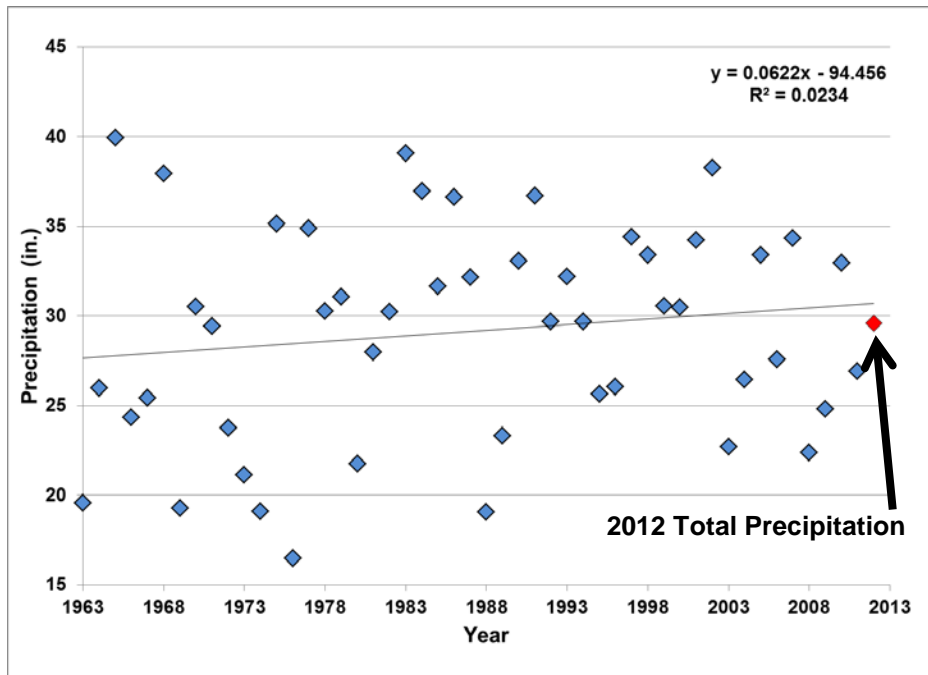


Figure 2. Minneapolis/St.Paul International Airport 50 Year (1963-2012) Annual Precipitation Record

## Quarry Island Fen Monitoring Results

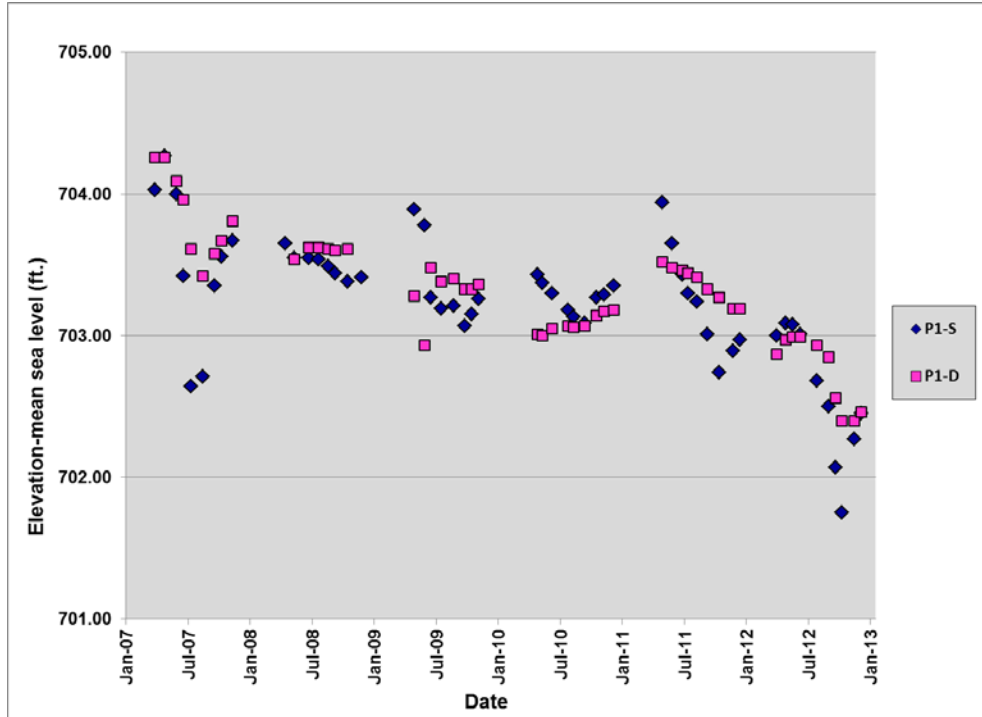


Figure 3. 2007-2012 Quarry Island Fen Well Monitoring Results

## Snelling Fen Monitoring Results

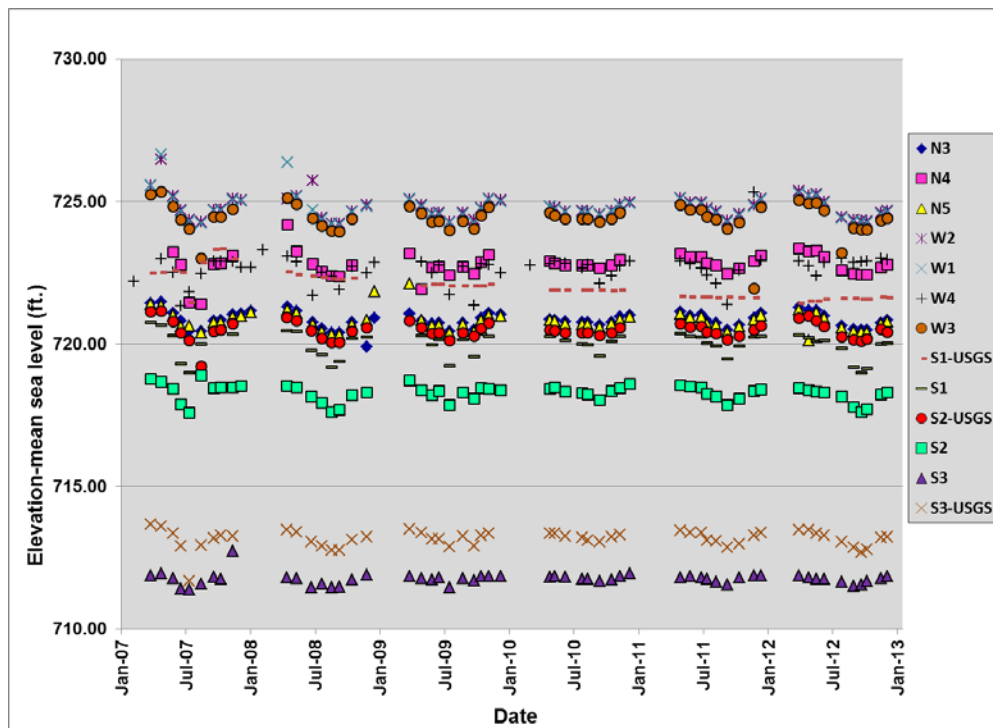


Figure 4. 2007-2012 Snelling Fen Well Monitoring Results

## Nichols Fen Monitoring Results

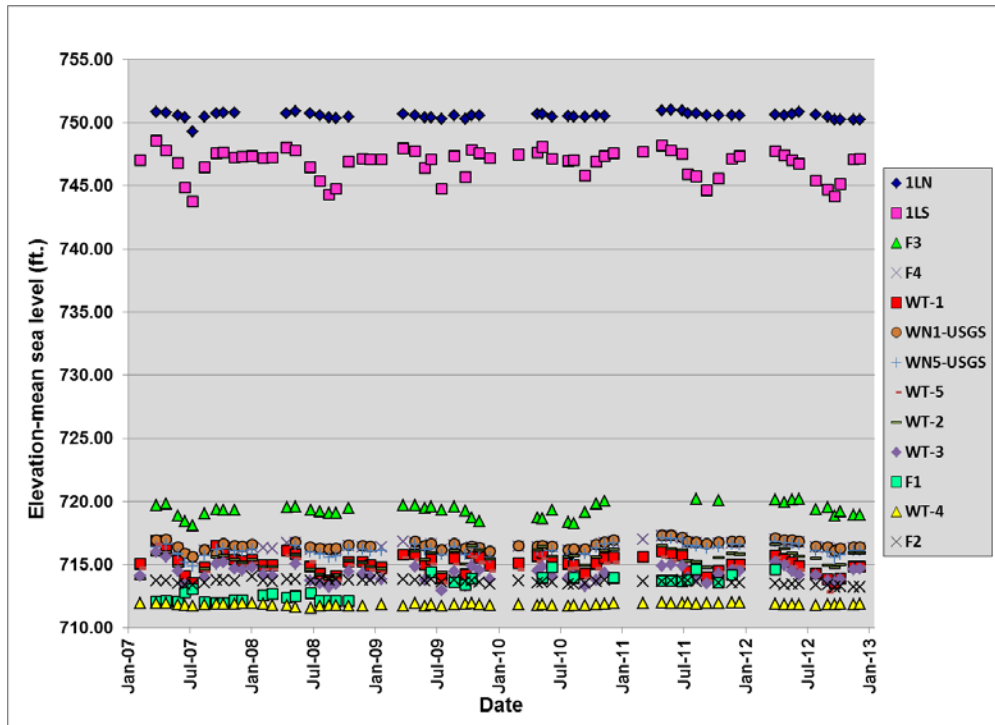


Figure 5. 2007-2012 Nichols Fen Well Monitoring Results

## Discussion

Water elevations among the 2007-2012 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 0.7158.

Based upon this analysis, water elevations in fen wells are mixed and do not demonstrate any obvious trends ( $R^2$  values were low). Due to these low  $R^2$  values, all trends should be considered weak. However, three of the fen wells are beginning to exhibit slight trends. One of the Quarry Island fen wells (P1-D) is beginning to exhibit a slight downward trend ( $R^2=0.6679$ ). One of the Fort Snelling fen wells (S1-USGS) is beginning to exhibit a slight downward trend ( $R^2=0.7002$ ). One of the Nichols fen wells (F1) is beginning to exhibit a slight upward trend ( $R^2=0.7158$ ). Additional monthly measurements are needed to expand upon existing baseline data and to provide for a stronger trend analysis in future reports. Figures detailing monthly measurements for individual wells are located in Appendix 2.

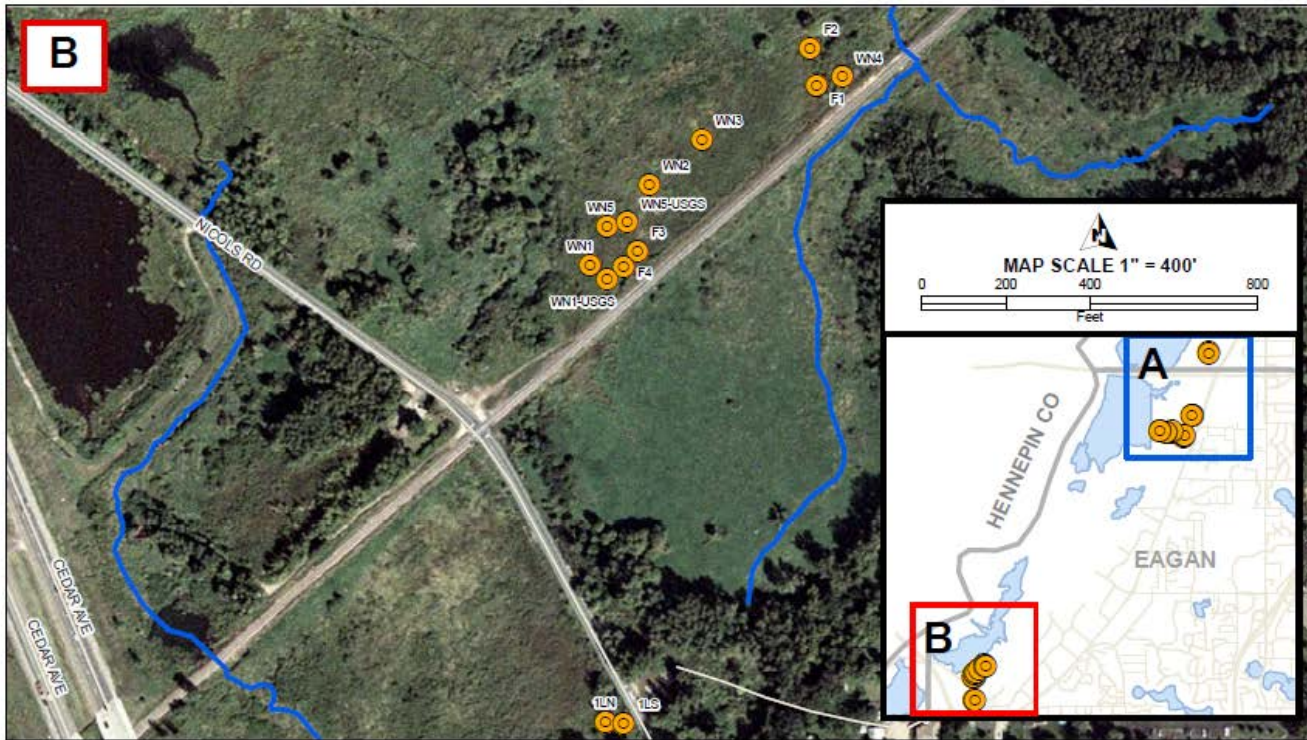
Table 1. 2007-12 Fen Well Regression Analysis

Quarry Island Fen Trends		
Well	2007-12 Trend	$R^2$ (Trend Fit)
P1-S	-	.3987
P1-D	-	.6679
Fort Snelling Fen Trends		
Well	2007-12 Trend	$R^2$ (Trend Fit)
N3	-	.0043
N4	+	.024
N5	-	.0462
W2	-	.0389
W1	-	.0446
W4	+	.0598
W3	-	.0226
S1-USGS	-	.7002
S1	-	.0296
S2-USGS	-	.0011
S2	-	.035
S3	-	.00006
S3-USGS	+	.0025
Nichols Fen Trends		
Well	2007-11 Trend	$R^2$ (Trend Fit)
1LN	+	.00007
1LS	-	.0162
F3	+	.051
F4	+	.1042
WT1	-	.0591
WN1-USGS	+	.1167
WN5-USGS	+	.1357
WT-5	-	.0389
WT-2	+	.1595
WT-3	-	.0016
F1	+	.7158
WT-4	+	.0366
F2	-	.3285

### Suggestions for future monitoring:

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





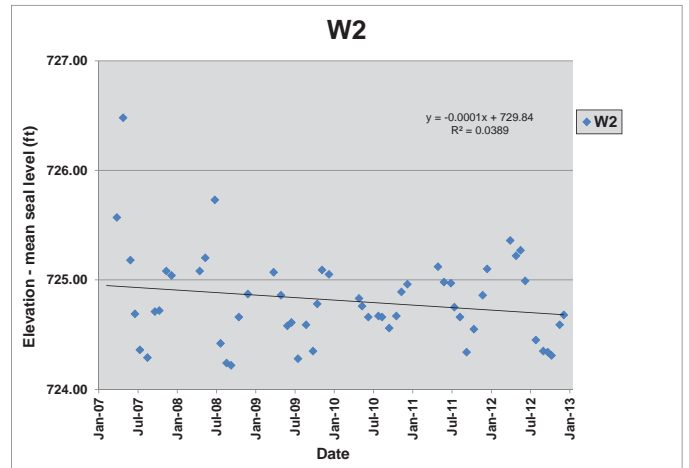
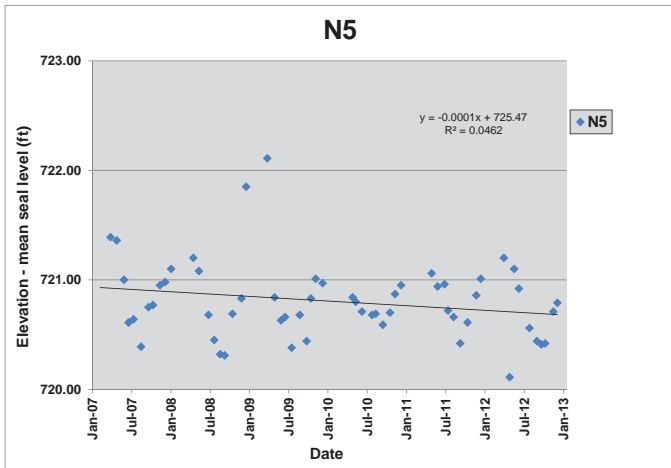
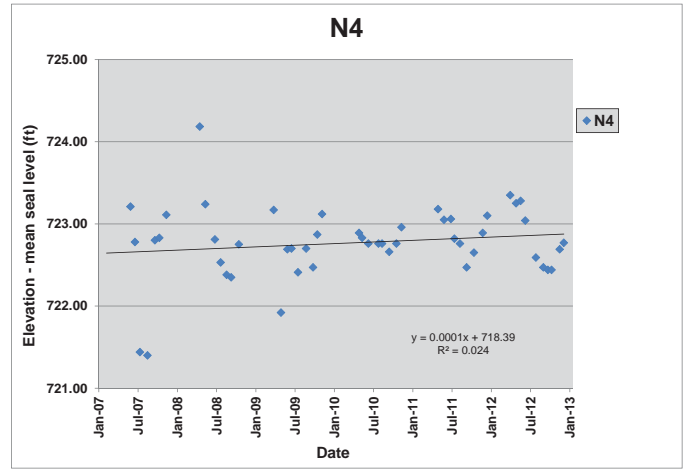
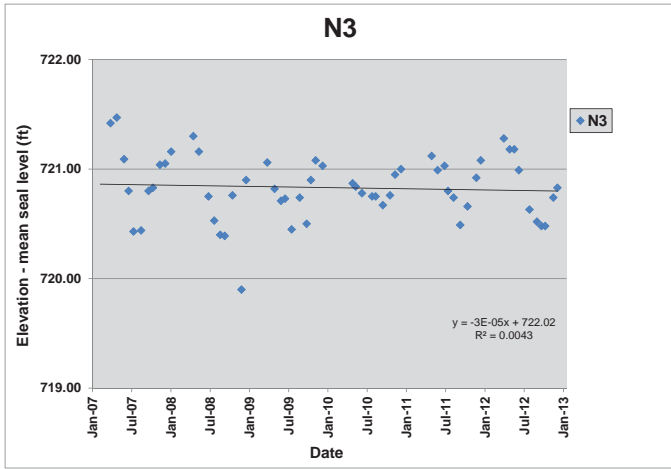
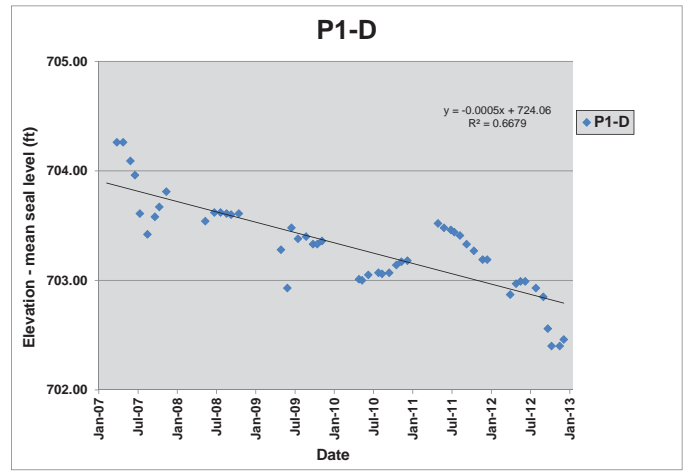
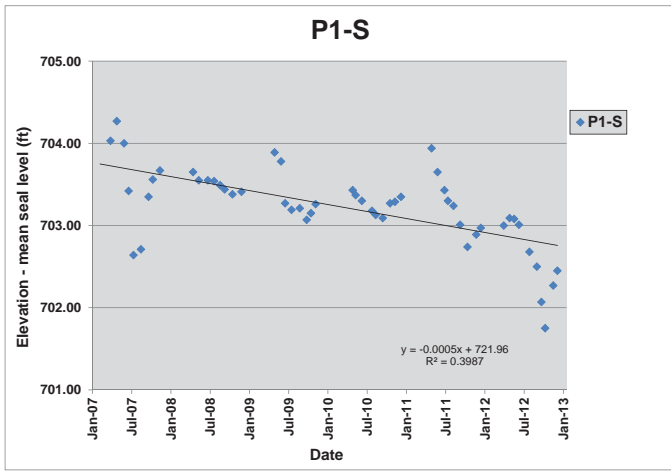
**Legend**  
 Monitoring Sites

**Appendix 1**  
**FEN WELL MONITORING LOCATIONS**

Image Source: 2006 Dakota County

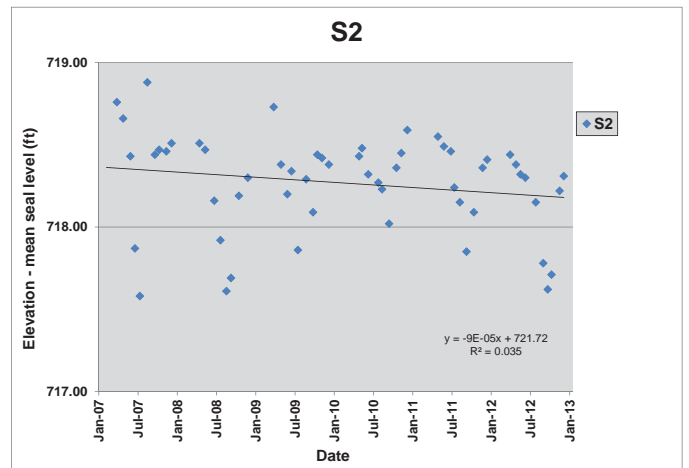
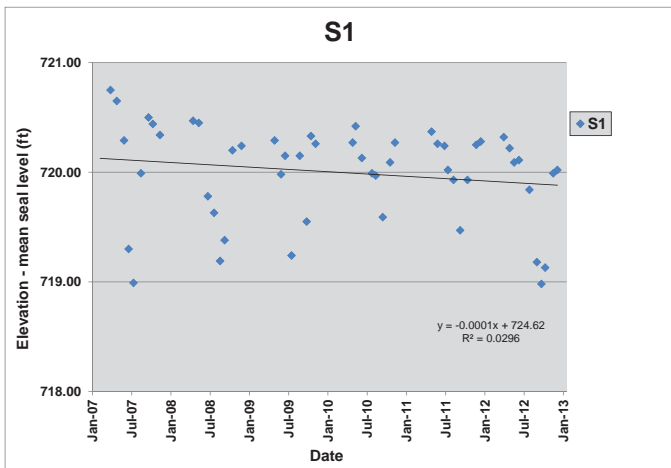
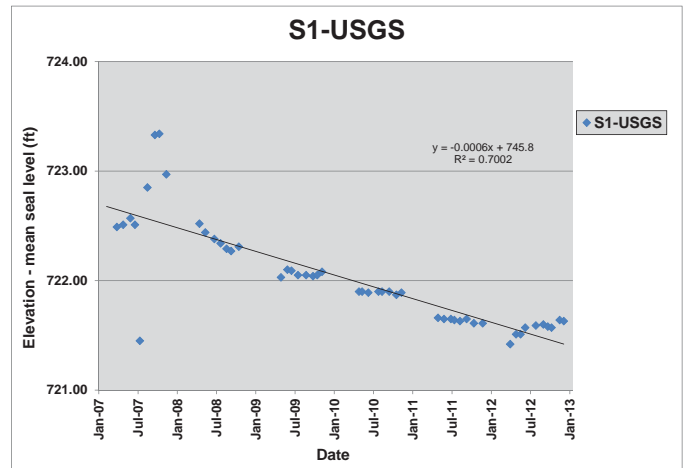
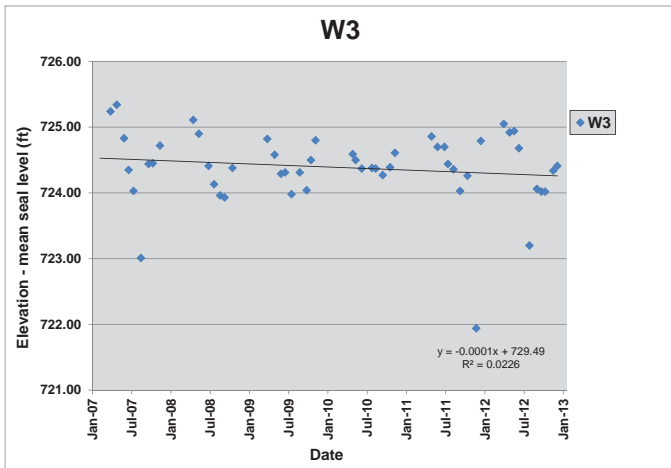
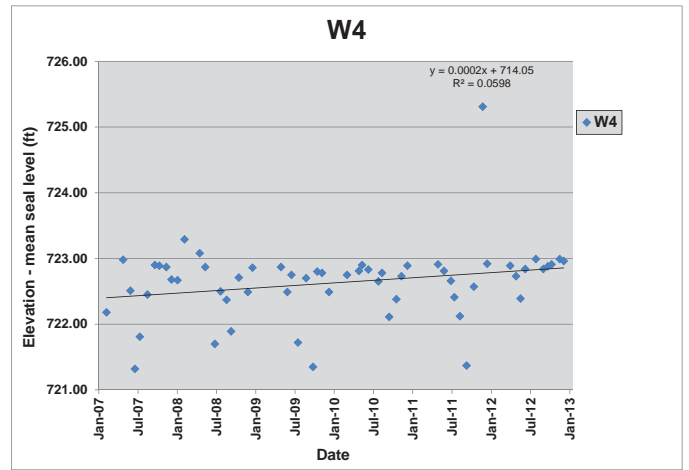
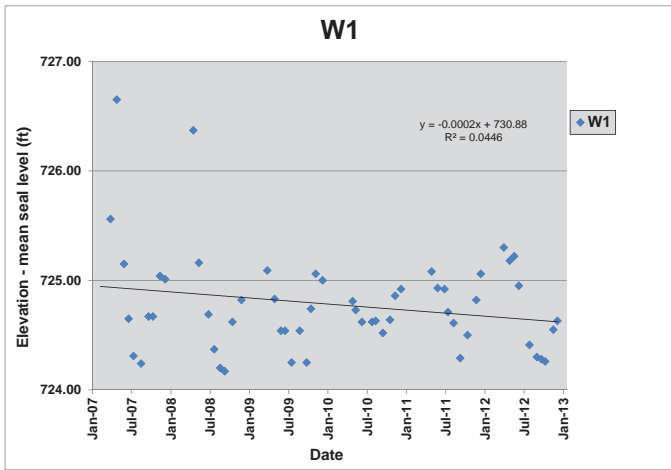
This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data located in various City, County, and State Offices and other sources, affecting the area shown, and is to be used for reference purposes only. Dakota County SWCD is not responsible for any inaccuracies herein contained. If discrepancies are found please contact the Dakota County Soil & Water Conservation District at 651.480.7777.

# Appendix 2: Individual Well Monitoring Results

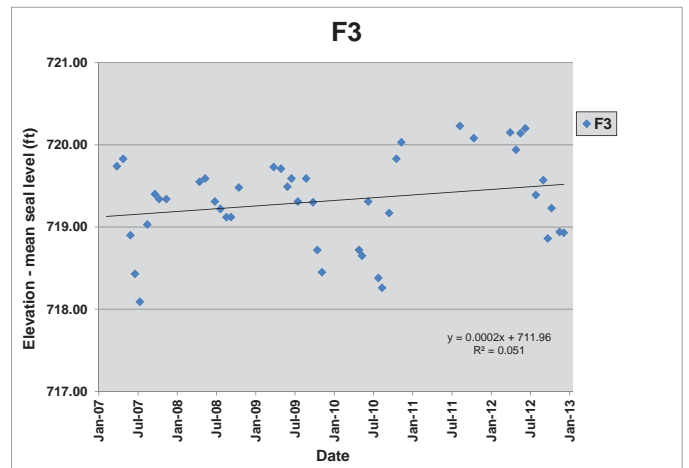
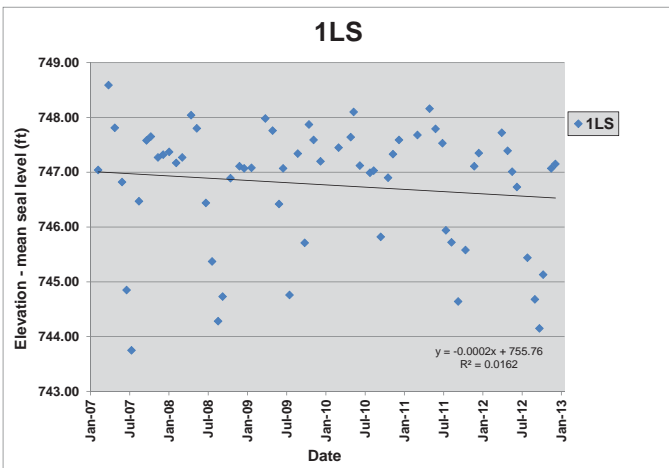
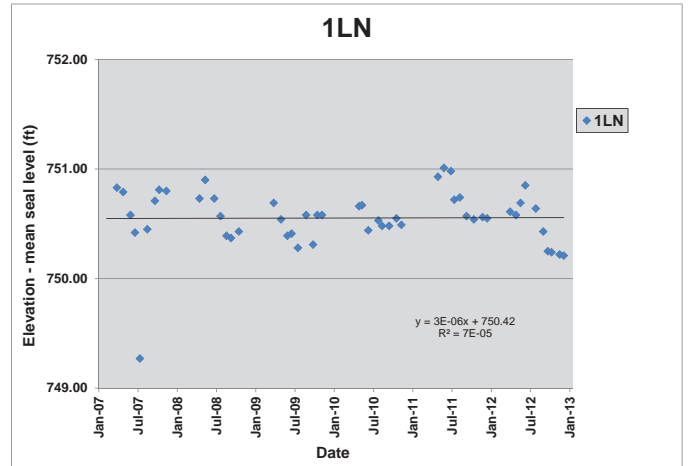
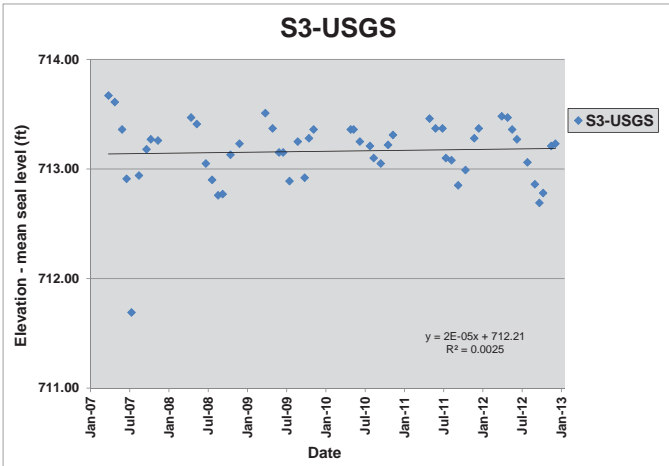
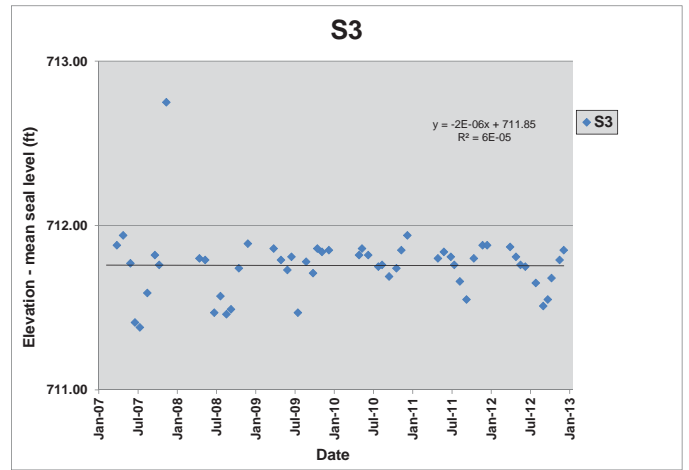
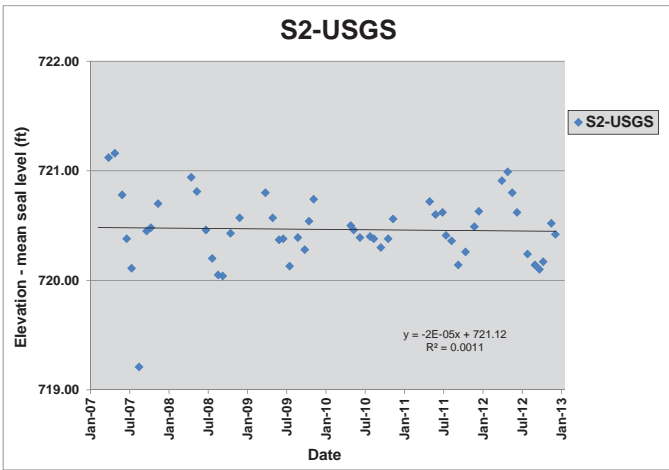




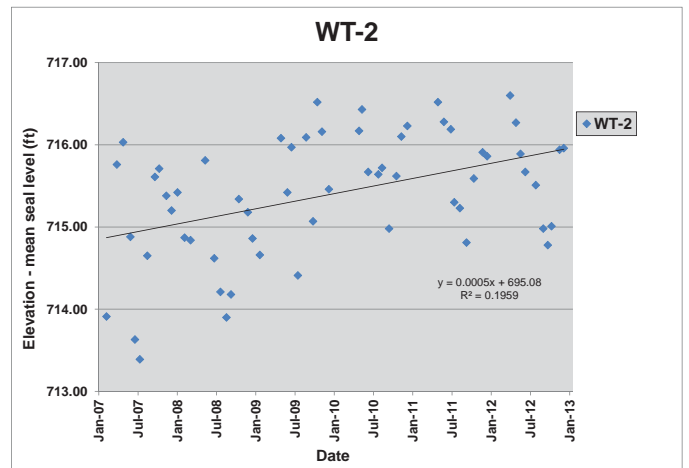
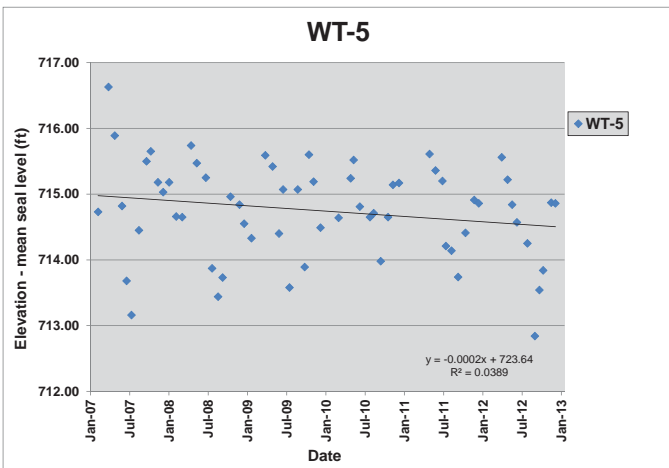
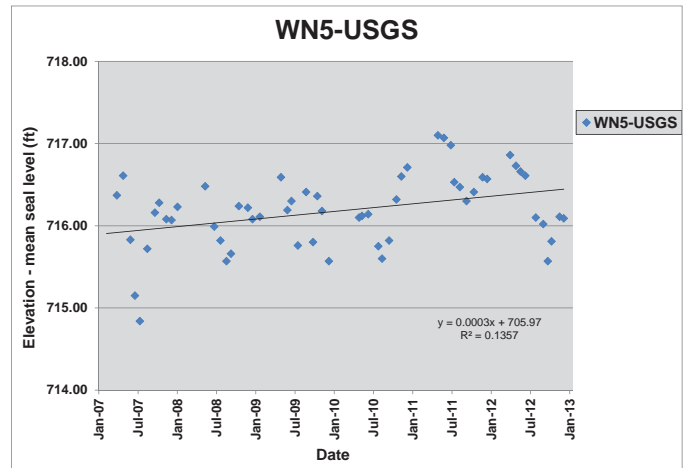
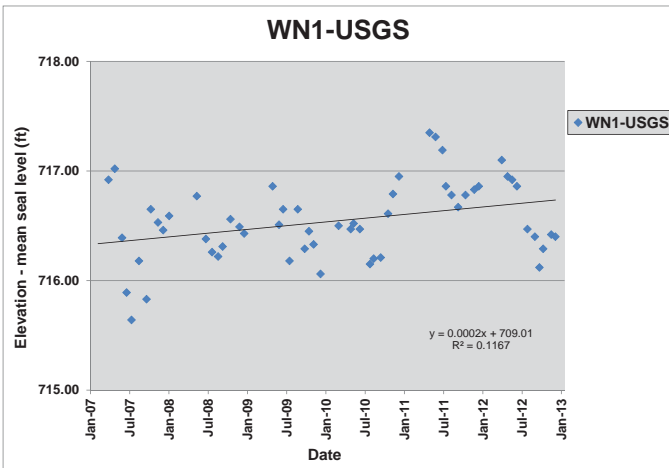
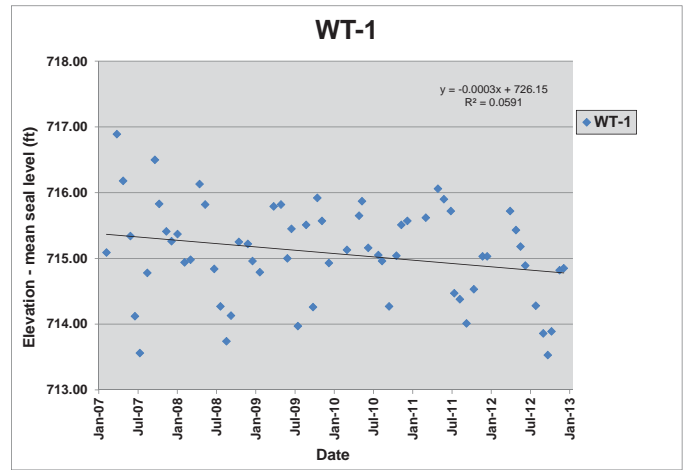
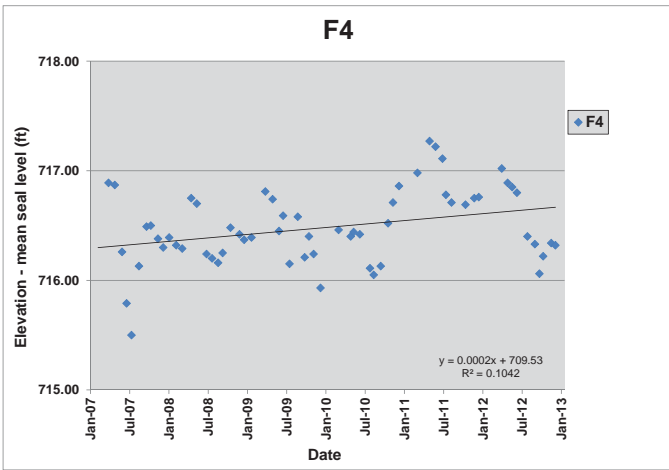
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