2013 RECHARGE REPORT

June 2013

NEBRASKA GROUNDWATER RECHARGE:
2012-2013 Phelps County Canal Recharge Report

PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

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1. INTRODUCTION

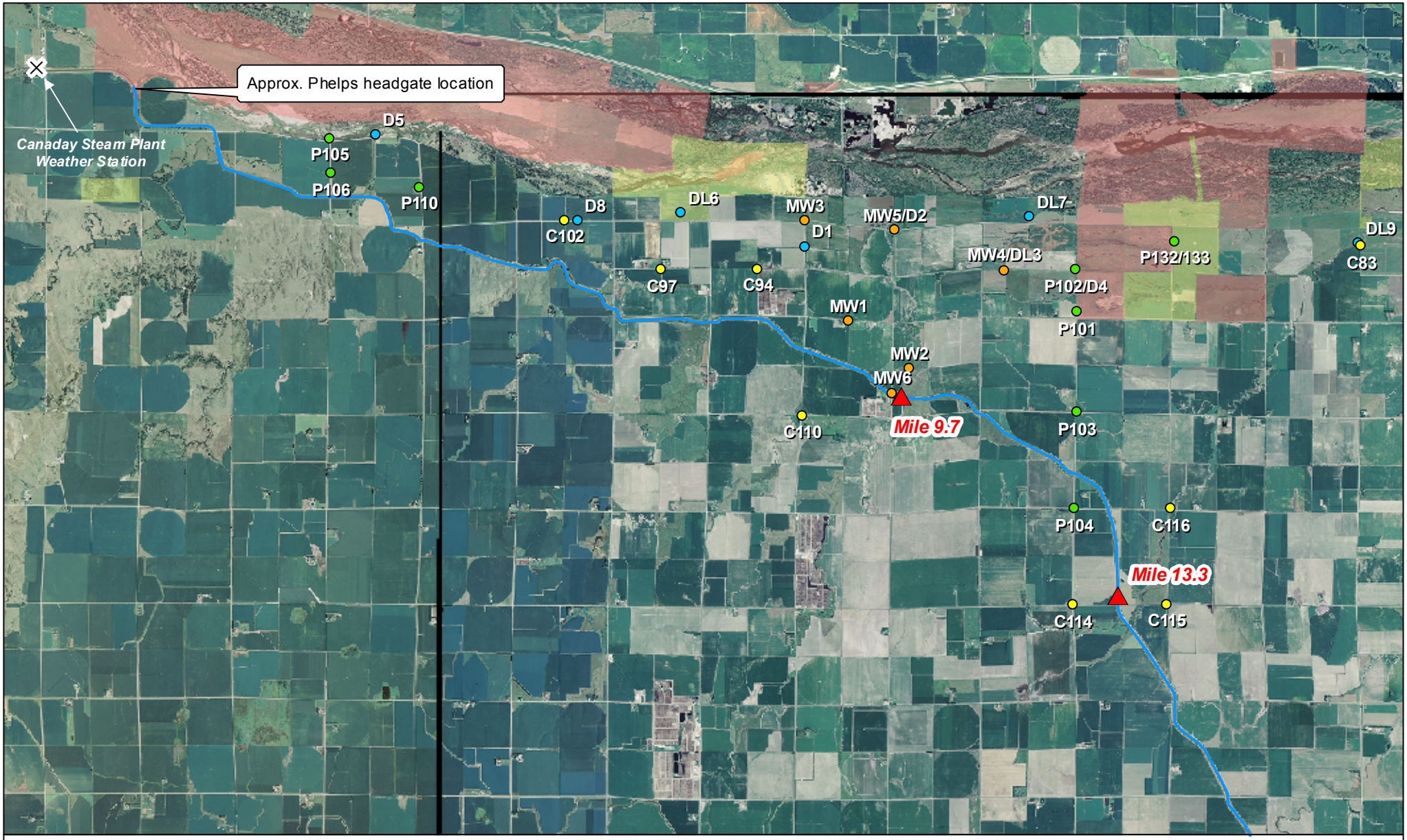
1.1. Background

This report has been prepared by the Executive Director's Office (ED Office) of the Platte River Recovery Implementation Program (Program) to summarize the second season of groundwater recharge operations in the Phelps County Canal. Groundwater recharge in the Phelps County Canal is being implemented as part of the Nebraska Groundwater Recharge project, which was classified as a Tier 1 Water Action Plan (WAP) project[1]. The Program completed a Pre-Feasibility Study[2] in 2010 and a Feasibility Study[3] in 2012 to support the advancement of the Nebraska Groundwater Recharge WAP Project.

The 2010 Pre-Feasibility Study evaluated several canals as potential recharge locations in the Central Platte region, in addition to the Gothenburg and Dawson County Canal sites listed in the WAP. Based on the findings of the Pre-Feasibility Study, the Gothenburg, Dawson County and Phelps County Canals were identified as the most feasible groundwater recharge sites. The Gothenburg Canal and the Phelps County Canal 9.7[4] sites were recommended for additional analyses for the feasibility phase, as these recharge locations were projected to provide a combination of higher yields and lower unit costs. Based on the findings of the 2010 Pre-Feasibility Study, the Program's Water Advisory Committee (WAC) and Governance Committee (GC) supported advancing the groundwater recharge project into the feasibility phase with a focus on the Phelps County Canal for a pilot-scale demonstration project. It was decided that other sites, such as the Gothenburg Canal, may be evaluated further at a later date but not as part of the demonstration project.

The 2012 Feasibility Study included a pilot-scale demonstration recharge project completed in the Phelps County Canal during the 2011-2012 non-irrigation season (also referred to as the recharge season). The Phelps County Canal is located within Central Nebraska Public Power and Irrigation District's (CNPPID) system in Phelps and Gosper Counties, Nebraska (**Figure 1**).

[1] The Reconnaissance-Level WAP is in Attachment 5 (Water Plan) of the Final Platte River Recovery Implementation Program Document dated October 24, 2006.
[2] "Platte River Recovery Implementation Program: Nebraska Ground Water Recharge Pre-Feasibility Study" dated August 2010 by the ED Office, WAC, Hahn Water Resources LLC and Ann Bleed and Associates Inc.
[3] "Pilot-Scale Recharge Report for Nebraska Groundwater Recharge Feasibility Study, Platte River Recovery Implementation Program" dated July 2012 by EA Engineering, Science and Technology, Inc. and Daniel B. Stephens & Associates, Inc.
[4] 9.7 refers to the approximate distance in miles in the Phelps County Canal from the canal headgate. There is a check structure in the canal at this location, which enables the canal to function similarly to a recharge basin above this point by impounding water behind the check structure.



PLATTE RIVER

Legend

- Mile 9.7 and 13.3
- PRRIP Monitoring Well
- CNPPID Monitoring Well
- TBNRD Monitoring Well
- Drain Gauge - Level Recorder
- Phelps County Canal
- Program Lands
- Other Conservation Lands

N

0 0.5 1 2 Miles

FIGURE 1

GROUNDWATER RECHARGE MONITORING SITES

Date: 05/10/2013

By: SWS

The demonstration project involved recharging excess flows[5] in the Phelps County Canal down to Mile Post 9.7 as well as in a constructed recharge basin between late September 2011 and early January 2012. The 2012 Feasibility Study, which was approved at the September 2012 GC meeting, recommended advancing the Phelps County Canal groundwater recharge project, which makes use of the existing canal for recharge, but postponing the concept of a constructed recharge basin as it is less feasible due to land availability and construction costs.

Given the success of the pilot-scale groundwater recharge project, a second year of recharge operations were implemented during the 2012-2013 non-irrigation season. CNPPID was also willing to participate in another year of recharge operations in the Phelps County Canal. The project involved recharging Environmental Account (EA) water from Lake MConaughy in the canal down to Mile Post 13.3 between mid-December 2012 and mid-March 2013.

There were two key differences in canal recharge operations during the 2012-2013 season in comparison to the 2011-2012 recharge season, which should be considered when comparing the results of the monitoring data. During the first season of recharge (2011-2012), recharge operations occurred early in the non-irrigation season (September-January); however, in the second year of recharge operations (2012-2013), recharge occurred later in the season (December-March), when colder average temperatures were experienced at the Phelps County Canal site. In addition, recharge operations during the 2011-2012 season terminated at Mile Post 9.7 and the 2012-2013 season terminated at Mile Post 13.3.

The purpose of this report is to summarize the collected data and results of the second year of groundwater recharge operations, and to compare the results from the two years of operations. This report does not address the accretions to the Platte River from recharge operations in association with Water Action Plan project scoring towards the Program's First Increment Milestone. The accretions that occur during periods of U.S Fish and Wildlife Service's target flow shortages will be addressed in a different document.

The 2012-2013 recharge operations would not have been possible without cooperation from several key organizations including CNPPID, Tri-Basin Natural Resource District (TBNRD), Nebraska Department of Natural Resources (NDNR), U.S. Fish and Wildlife Service and the Program through consultation with the WAC and support from the ED Office staff and Special Advisors.

1.2. Summary of Feasibility Study and 2011-2012 Operations

Recharge Operations

Deliveries into the Phelps County Canal for the purpose of groundwater recharge were made for a total of 99 days from September 28, 2011 to January 5, 2012. A total of 5,558

[5] Excess flows are considered unappropriated flows greater than the U.S. Fish and Wildlife Service target flows and the Central Platte NRD/Nebraska Game and Parks Commission instream flows.

acre-feet (AF) were delivered to the Phelps County Canal through the flume located at Mile Post 1.6. Approximately 19 AF of this volume was diverted into a recharge basin that was constructed adjacent to the canal near Mile Post 8.7. Delivery rates through the flume at Mile Post 1.6 measured up to almost 200 cubic feet per second (cfs) during the initial filling of the canal and generally stabilized around 30 cfs until the delivery rate declined in December (**Figure 2**).

Figure 2: 2011-2012 Daily Delivery Rates through the Mile Post 1.6 Flume

After adjusting the deliveries through Mile Post 1.6 to account for evaporative losses, headgate losses[6], and gains from precipitation, it was estimated that a total of 5,439 AF were recharged along the bed and banks of the Phelps County Canal between Mile Posts 1.6 and 9.7. The infiltration rate in the canal ranged from 0.28 to 0.75 feet/day with an overall average of approximately 0.6 feet/day. The infiltration rate in the constructed recharge basin ranged from 0.22 to 0.77 feet/day with an overall average of 0.28 feet/day.

Wintertime recharge operations did not encounter any major operational constraints. An ice cap formed on the canal and recharge basin from early December through the end of the demonstration project, which allowed recharge to continue during periods with freezing temperatures.

[6] Headgate losses were caused by seepage through the check structure at Mile Post 9.7; estimated to be approximately 0.5 cfs based on CNPPID staff observations.

Monitoring

Six new monitoring wells were constructed by the Program and equipped with recording pressure transducers as part of the Feasibility Study to document the groundwater level response to recharge operations. Data collected by TBNRD at the "Overton Transect Wells" and "Elm Creek Transect Wells" sites was also reviewed to expand the spatial distribution of the groundwater level analysis.

Water levels were also monitored at nine drain sites (Figure 1). Four drain sites were equipped with recording pressure transducers to allow for continuous monitoring, while the remaining five drain sites were equipped with staff gages to allow for intermittent observations.

The 2011-2012 operations were conducted during a period when groundwater levels were unusually high compared to historic levels. Recharge operations increased groundwater levels, with more pronounced effects at monitoring wells located closer to the Phelps County Canal. Recharge was terminated in early January to observe recovery of the groundwater levels prior to the start of irrigation deliveries. The flow in drains may have responded to the pilot-scale recharge operations; however, the connection between the groundwater levels and the drain water levels remains unclear.

2. 2012-2013 METHODS & PROCEDURES

2.1. Overview

Given the favorable results of the 2011-2012 pilot-scale project, and the willingness of CNPPID, the 2012-2013 recharge operations were extended from Mile Post 9.7 to the next downstream canal check location at Mile Post 13.3[7]. Extending the length of canal with recharge increases the surface area for infiltration, which allows more water to be recharged and increases the cumulative volume of river accretions. Recharge basins were not utilized during 2012-2013, as the basin that was used during the demonstration project has been restored, and the Feasibility Study recommended forgoing operations in recharge basins until land was more affordable.

As described below in Section 2.2, the monitoring network was expanded for the 2012-2013 recharge season to better document responses to recharge in sensitive areas and between Mile Posts 9.7 and 13.3. Temporary permits were obtained from the NDNR to allow for the recharge of both excess flows and EA water, as dry conditions were expected to limit the availability of excess flows. Temporary water service agreements were also negotiated with CNPPID to allow for the recharge of both water sources in the Phelps County Canal during the 2012-2013 non-irrigation season.

[7] Mile Post 13.3 is a canal check location that allows the canal to act similarly to a recharge basin above that point.

2.2. Monitoring

Monitoring Wells

Continuous water level data continued to be collected for the Program's six monitoring wells that were constructed and instrumented for the pilot-scale demonstration project. Water level data for the Overton and Elm Creek Transect Wells sites also continued to be provided by TBNRD. Eight existing CNPPID monitoring wells were equipped with new recording pressure transducers in 2012-2013 to expand the monitoring network and collect additional data in sensitive areas, and between Mile Posts 9.7 and 13.3. As shown on Figure 1, the network of Program, TBNRD and CNPPID monitoring wells used in 2012-2013 provided detailed data for the entire length of canal with recharge and allowed for an analysis of the effects of recharge at varying distances from the canal, both in the Platte River floodplain and on the terrace.

Drains

Stage was continuously monitored at four drain sites: DL-3, DL-6, DL-7, and DL-9 (sites shown in Figure 1). Weekly staff gage readings were recorded at the five remaining drain sites that were also monitored during the demonstration project: D-1, D-2, D-4, D-5, and D-8 (sites shown in Figure 1). As recommended in the Feasibility Study, discharge measurements were not made in the drains during the 2012-2013 recharge season because additional discharge measurements were not expected to significantly improve stage-discharge relationships due to the low flow velocities and channel obstructions from vegetation, ice, and beaver dams.

2.3. Permitting

CNPPID obtained two temporary permits from NDNR in 2012-2013 to allow for the recharge of both excess flows and EA water in the Phelps County Canal. Appropriation No. A-18595 is a temporary permit to appropriate excess flows at a maximum rate of 350 cfs during the non-irrigation season in the Platte River for groundwater recharge in the Phelps County Canal; the water supply is unappropriated flow, or flows in excess of U.S. Fish and Wildlife target flows and instream flows. Appropriation No. A-18987 was approved as a temporary permit to appropriate EA water that was released from storage in Lake McConaughy under appropriation A-2374 for groundwater recharge in the Phelps County Canal; this permit allowed for the release of up to 6,000 AF from Lake McConaughy. Both permits were approved in November 2012 and are valid for one year. The approved permits are included as **Appendix A**.

Operational Thresholds and Outreach

Operational thresholds were developed in coordination with the U.S. Fish & Wildlife Service to serve as project termination triggers in accordance with the Program's "good neighbor policy". It was decided that two Program monitoring wells, MW-1 and MW-2, would serve as the operational threshold monitoring sites[8]:

[8] See memo from ED Office to U.S. Fish & Wildlife Service regarding "Use of Environmental Account Water for Groundwater Recharge" dated November 26, 2012.

1. Potential termination of recharge operations would be discussed with U.S. Fish and Wildlife Service, CNPPID, and the Program's Nebraska Groundwater Recharge Workgroup if the groundwater levels in Program monitoring wells MW-1 and MW-2 reach their initial elevations for 2011-2012 operations of 2,312.8 feet and 2,312.4 feet, respectively. These two wells are located near the lands where high groundwater was reported during the 2011-2012 recharge period, and their groundwater levels showed a noticeable response to the pilot project recharge operations.
2. If groundwater levels in any of the Program monitoring wells consistently approach their initial elevation for 2011-2012 operations, then potential termination of recharge operations to prevent waterlogged fields would be discussed with U.S. Fish and Wildlife Service, CNPPID, and the Program's Nebraska Groundwater Recharge Workgroup. Recharge operations would not be terminated because of short-term water level increases in response to precipitation events.

CNPPID hosted a meeting to discuss the proposed monitoring plan and operational thresholds with interested landowners along the Phelps County Canal on January 9, 2013. Over 60 landowners along the canal were invited to the meeting. Attendees noted that they appreciated the informational meeting and no major concerns were reported.

2.4. Staffing

The continuous monitoring data being collected at six Program wells, nine TBNRD wells, eight CNPPID wells, and four drain sites were downloaded and analyzed on a monthly basis. Monthly data from the Program monitoring wells and drain sites were downloaded by the Program's ED Office. CNPPID downloaded monthly data from their wells and provided the data to the ED Office. CNPPID also operated the Phelps County Canal for the recharge project and installed the new monitoring equipment in the eight CNPPID wells after completing a field inspection of the proposed wells and determining they were suitable for monitoring purposes. TBNRD downloaded their monitoring well data and provided it to the ED Office.

The ED Office analyzed the monthly monitoring well and drain data with assistance from Bill Hahn, ED Office Special Advisor. The ED Office compiled the monitoring well data and distributed information to the Nebraska Groundwater Recharge Workgroup on a monthly basis. For the wells with operational thresholds, the ED Office compared monthly hydrographs of water level elevations to the operational thresholds to determine whether the thresholds were exceeded. The ED Office presented mid-project and final updates to the WAC at the February 2013 and May 2013 meetings, respectively.

3. 2012-2013 RECHARGE RESULTS AND DISCUSSION

3.1. Recharge Water Balance

Recharge operations were intended to begin in September 2012; however, the start of deliveries was delayed due to maintenance activities on the Kingsley Dam and the Keystone Canal, which prohibited the release of EA water from Lake McCouaughy. Additionally, there were no excess flows available for recharge during this time period. Water delivery into the Phelps County Canal for groundwater recharge commenced December 10, 2012 and continued through March 11, 2013, for a total of 92 days. CNPPID indicated that recharge operations could have continued later had it not been for a condition of approval in Appropriation No. A-18987 that required EA water remaining in the Phelps County Canal at the start of the irrigation season to be re-accounted for as releases from CNPPID's storage account and credited back to the EA.

The volume of water recharged through the bed and banks of the Phelps County Canal in 2012-2013 was calculated according to the methodology that was used in the Feasibility Study. The rate of recharge to the alluvial aquifer was calculated as the volume of water delivered through the flume at Mile Post 1.6, less evaporation[9] from the water surface while impounded in the canal, plus precipitation falling onto the water surface while impounded in the canal. In contrast to the Feasibility Study, no adjustments were made in 2012-2013 to account for headgate losses through the check structure at Mile Post 13.3 because CNPPID has reported that leakage through this structure is negligible.

Diversions to Recharge

All water diverted into the Phelps County Canal for groundwater recharge during 2012-2013 was EA water that was released from Lake McConaughy under Appropriation No. A-18987, as there were no sustained periods with excess flows available over the operating period. A total of 4,314 AF of water was released from the EA in Lake McConaughy for recharge purposes. After transit losses, a total of 4,089 AF were delivered to the Phelps County Canal through the flume located at Mile Post 1.6. Delivery rates through the flume at Mile Post 1.6 measured up to almost 150 cfs during the initial filling of the canal and then stabilized around 18 cfs for the remainder of the recharge operations (**Figure 3)**.

[9] For the 2012-2013 recharge season, no evaporation was assessed as the average monthly temperatures were below freezing.

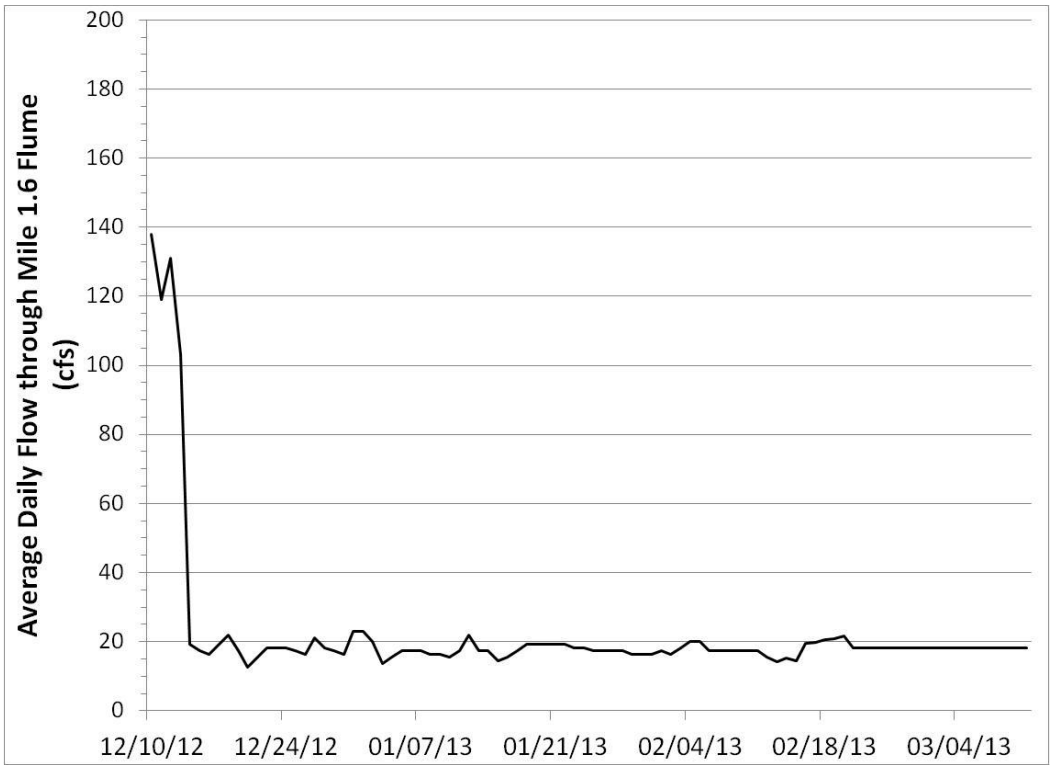


Figure 3: 2012-2013 Daily Delivery Rate through the Mile Post 1.6 Flume

During the Feasibility Study, there were some anomalies in the diversion data believed to be related to measurement uncertainty at the Mile Post 1.6 flume. During the 2012-2013 recharge season, CNPPID regularly cleaned the flume to remove debris that could have affected lower stage readings in the 30-foot Parshall flume. NDNR made three discharge measurements over the course of the 2012-2013 recharge season and determined that a stage shift of -0.04 feet was warranted for the computation of discharge values less than 100 cfs. Given the minimal shift required for the stage readings in the 30-foot flume in 2012-2013, the measuring device appears capable of providing an acceptable level of accuracy with ongoing maintenance.

Evaporation

Evaporation was calculated using a modified methodology from the Feasibility Study. The Feasibility Study recharge calculations assessed evaporative losses in all months using gross evaporation rates from the Natural Resources Conservation Service for Phelps County; however, in 2012-2013 evaporative losses were only assessed when mean temperatures at the Canaday Steam Plant weather station (Station No. 251450) were above 32°F, which did not occur in the 2012-2013 recharge months. It was assumed evaporation was negligible during below-freezing temperatures since an ice cap formed on the canal. CNPPID confirmed that an ice cap was in place for nearly the entire duration of the operating season. **Table 1** is a summary of the mean air temperatures experienced during the period of recharge.

Table 1. Summary of Mean Air Temperatures during Recharge Operations

Month	Days with Recharge	Mean Temperature[1] °F
Dec-12	22	22.8
Jan-13	31	26.8
Feb-13	28	30
Mar-13	11	31.5
Total	92	-

[1]Based on weather data from the Canaday Steam Plant (Station No. 251450) from12/10/2012 to 3/11/2013. Mean air temperatures based on daily data for days when recharge operations occurred during the month.

Precipitation

In contrast to the Feasibility Study, an on-site rain gauge was not deployed during 2012-2013 recharge season. Therefore, precipitation data from the Canaday Steam Plant was obtained to complete the water balance calculations. The Canaday Steam Plant station is located south of Lexington, Nebraska, approximately one mile west of the Phelps County Canal headgate (shown in Figure 1). There were a total of 2.3 inches of precipitation measured over the duration of the recharge period from December 10th through March 11th. As with the Feasibility Study, monthly precipitation inputs were calculated based on an average canal width of 85 feet. The monthly precipitation and mean air temperatures at Canaday are included in **Appendix B.**

Water Balance Summary

The total volume of water delivered through the flume at Mile Post 1.6 during the 2012-2013 recharge season was 4,089 AF (**Table 2**). Due to below average monthly freezing temperatures over the duration of the recharge season and the continuous ice cap, no evaporative losses were assessed. The 2.3 inches of precipitation measured at the Canaday Steam Plant station contributed an additional 23 AF of recharge along the canal surface between Mile Posts 1.6 and 13.3, for a total recharge volume of 4,113 AF in that section of the Phelps County Canal (Table 2). A summary of the daily recharge calculations, including the flume measurement and flow calculations performed by CNPPID, are provided in **Appendix C**. Appendix C also contains graphical information showing the 2011 through 2013 recharge deliveries.

Table 2. 2012-2013 Recharge Water Balance Summary between Mile Post 1.6 and 13.3 (All values in acre-feet)

Month	Volume Delivered through Flume	Evaporation	Precipitation	Volume Recharged
Dec	1,615	0	8	1,624
Jan	1,078	0	1	1,078
Feb	999	0	13	1,012
Mar	397	0	1	398
Total	4,089	0	23	4,113

3.2. Canal Recharge Rates

Canal recharge rates and infiltration rates were also calculated from the water balance data, as these statistics may be useful for planning purposes and project scoring analyses. Daily recharge and infiltration rates were calculated using a water balance approach based on the rate of flow delivered into the Phelps County Canal through Mile Post 1.6 plus precipitation onto the canal surface, less evaporative losses. After the initial filling of the canal was completed on December 13th, the average daily recharge rate between Mile Posts 1.6 and 13.3 ranged from 13.6 cfs to 22.9 cfs, with an overall average of 18.0 cfs. When normalized by the length of canal with recharge between Mile Posts 1.6 and 13.3 (11.7 miles), the unit daily recharge rates ranged from 1.2 cfs/mile to 2.0 cfs/mile, with an overall average of 1.5 cfs/mile (**Figure 4**).

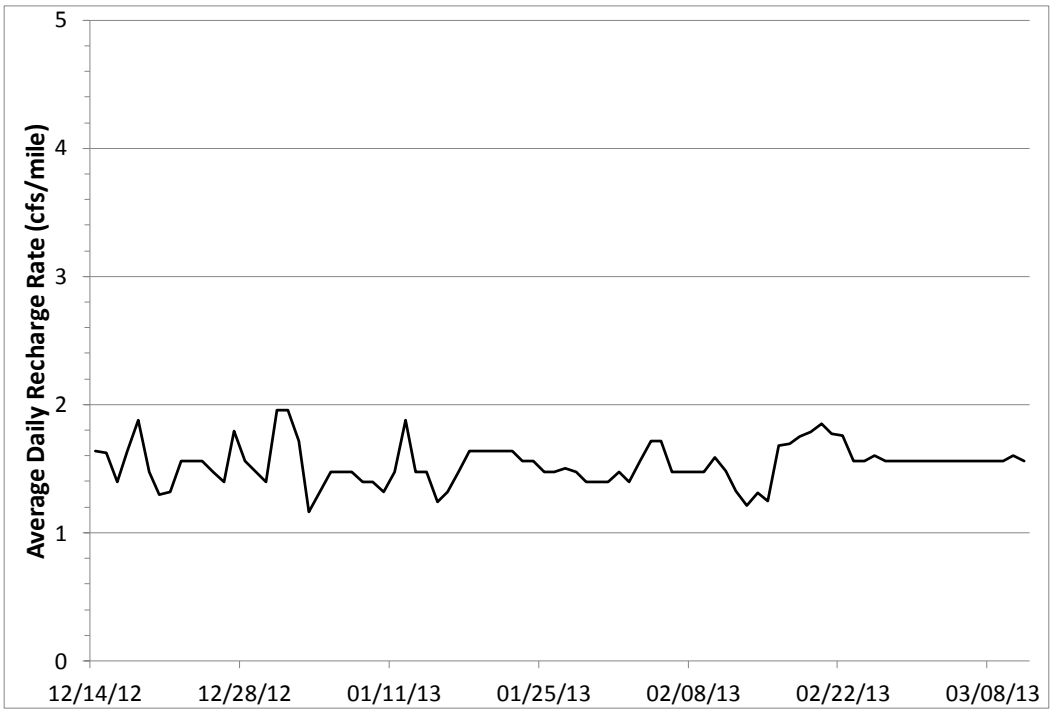


Figure 4: 2012-2013 Daily Unit Recharge Rates in the Phelps County Canal

The normalized recharge rates were used to compare the 2012-2013 results with the 2011-2012 results since recharge operations were conducted for different canal lengths. In the first year of recharge, from 2011-2012, operations were conducted from Mile Post 1.6 to 9.7 (8.1 miles) and the unit daily recharge rates ranged from 1.4 cfs/mile to 3.9 cfs/mile, with an overall average of 3.1 cfs/mile. The infiltration rates for the two seasons of recharge were also calculated for each one-mile section of canal using an average canal width of 85 feet. As shown in **Table 3**, the unit recharge rates and infiltration rates were lower in 2012-2013 than what was observed during the 2011-2012 recharge season.

Table 3. Comparison of Unit Recharge Rates and Infiltration Rates between Recharge Seasons

Period	Parameter	Units	Minimum	Average	Maximum
2011-2012	Unit Recharge Rate	(cfs/mile/day)	1.4	3.1	3.9
	Infiltration Rate*	(feet/day)	0.3	0.6	0.8
2012-2013	Unit Recharge Rate	(cfs/mile/day)	1.2	1.5	2.0
	Infiltration Rate*	(feet/day)	0.2	0.3	0.4

*Based on the unit recharge rates for each canal mile using a canal width of 85 feet.

Two potential reasons for the discrepancy in rates between years are related to: (1) lower hydraulic conductivity values due to a higher viscosity water associated with colder water temperatures; and (2) lower hydraulic conductivity soils between Mile Posts 9.7 and 13.3 as compared to between Mile Posts 1.6 and 9.7. The effects of these two factors are described further in the following two sections.

3.2.1. Water Temperature

The viscosity of water increases as the temperature of water decreases (Sengers and Kamgar-Parsi, 1984). Hydraulic conductivity decreases with an increase in viscosity, which means that hydraulic conductivity also decreases with colder water temperatures (Hillel, 2004). An example of the effects of water temperature on hydraulic conductivity is shown on **Figure 5**. A soil medium with a hydraulic conductivity of 1.0 feet/day with water at 68 °F has a hydraulic conductivity of only 0.56 feet/day when the water is at 32 °F, or a reduction of 44%.

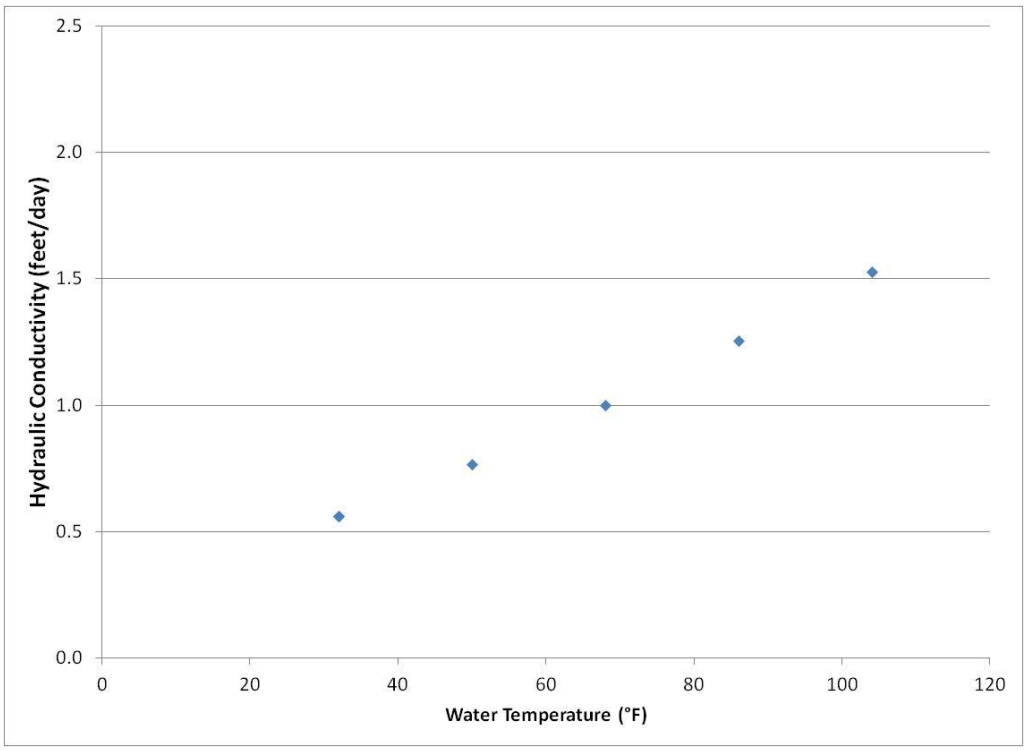


Figure 5: Example Effects of Water Temperature on Hydraulic Conductivity

Data collected in the Phelps County Canal during the 2011-2012 recharge season showed that water temperatures varied from about 64 °F in early October to about 37 °F in early December. The water temperature data for the Phelps County Canal generally coincides with water temperatures for the Platte River at the Overton, NE station. In December 2011, the Phelps County Canal water temperatures remained at a constant level due to the formation of an ice cap that insulated the canal (**Figure 6**).

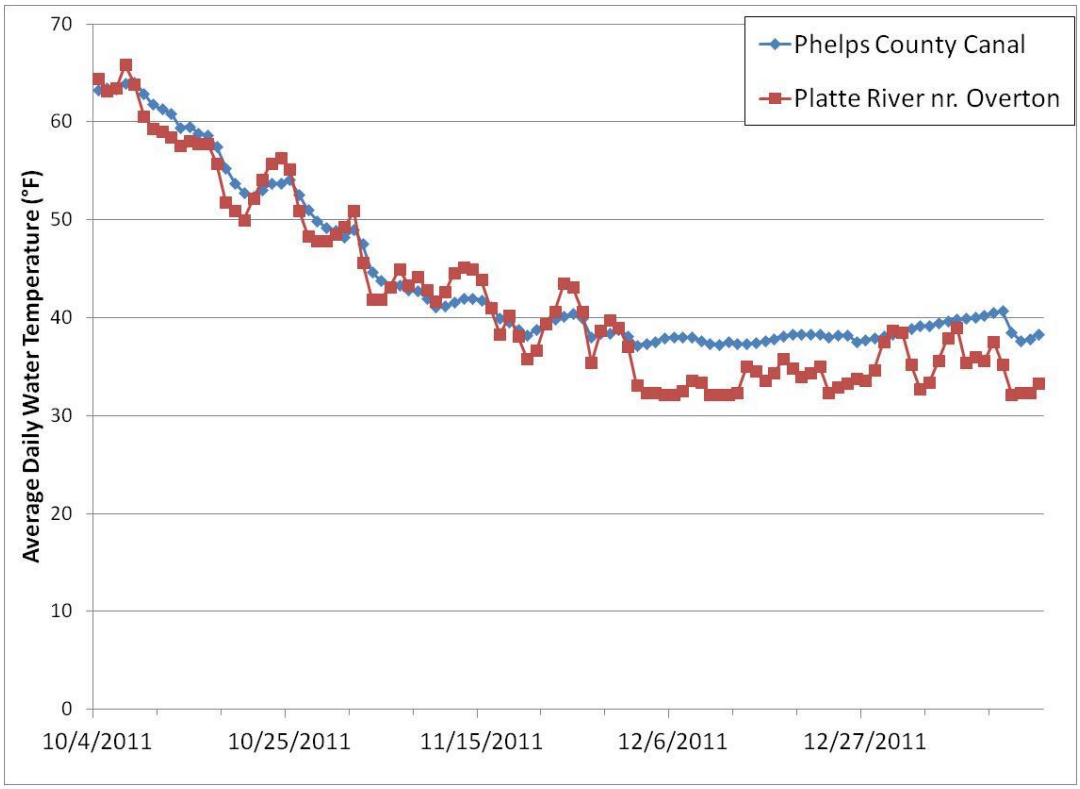


Figure 6: Comparison of Water Temperatures in Phelps County Canal vs. Platte River near Overton

Calculated infiltration rates decreased from about 0.75 feet/day to 0.37 feet/day, or a reduction of about 49%, during the period of ice capping in the canal when temperatures were lower (**Figure 7**). This indicates that the 2011-2012 reduction in infiltration rates during the recharge season may largely be explained by the decrease in hydraulic conductivity due to lower water temperatures.

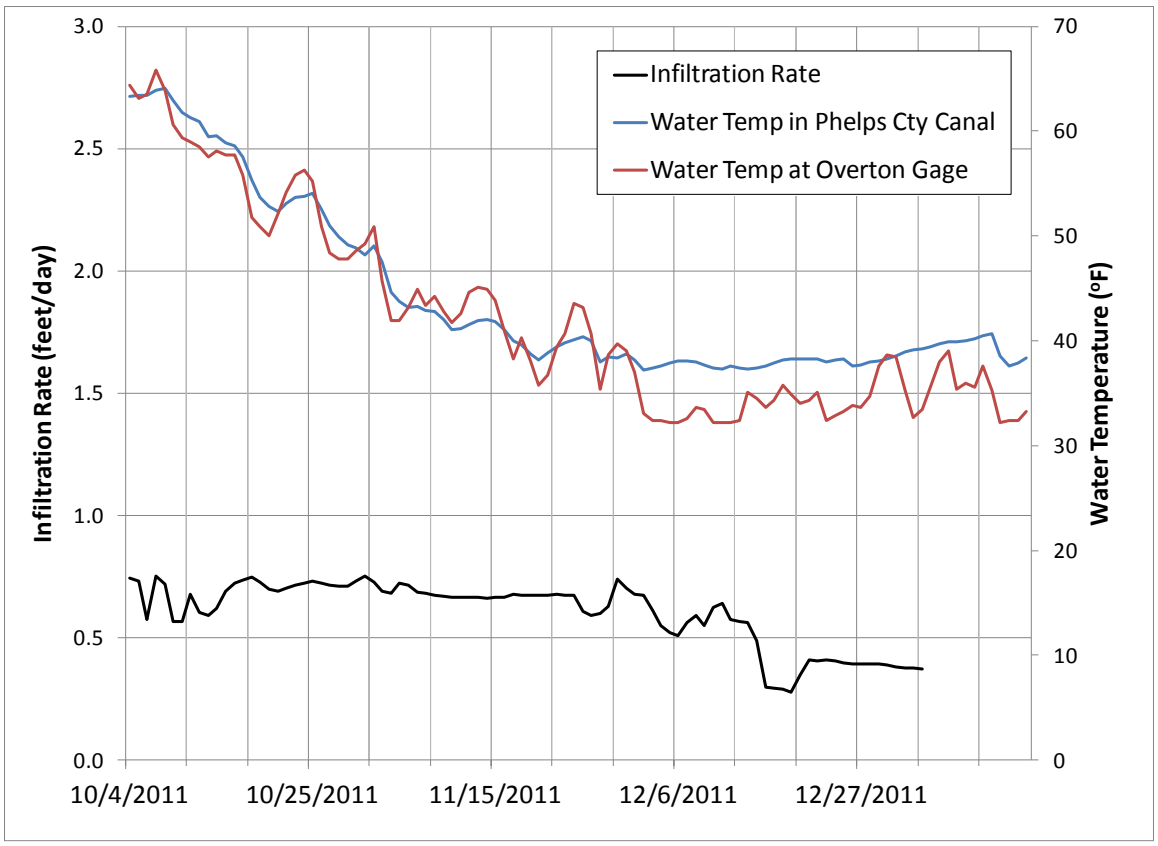


Figure 7: Calculated Average Daily Infiltration Rates and Water Temperatures during 2011-2012 Recharge Operations

The 2011-2012 recharge operations were conducted from late September to early January, while the 2012-2013 operations were conducted from mid-December through mid-March. Water temperatures were measured in the Phelps County Canal during 2011-2012; however, a temperature probe was not deployed in 2012-2013. A comparison of water temperatures measured in the Phelps County Canal during the 2011-2012 recharge season and corresponding measurements from the Platte River near Overton, Nebraska gaging station (USGS #06768000) shows that there was general agreement in measurements between the two sites (Figure 6)[10]. This indicates that water temperatures collected from the Platte River near the Overton gage during the 2012-2013 season provide a reasonable approximation of water temperatures in the Phelps County Canal.

The calculated infiltration rate during the 2012-2013 recharge season was consistently about 0.3 feet/day (**Figure 8**). This is about one-half the average infiltration rate of 0.6 feet/day during the 2011-2012 season, and approximately 25% lower than infiltration rate of 0.4 feet/day at the end of the 2011-2012 season when there were colder water temperatures. Therefore, it appears other factors may also influence the difference in calculated infiltration rates between years, such as varying soil properties between Mile Posts 1.6 and 9.7 as compared to between Mile Posts 9.7 and 13.3.

[10] Note that the higher temperatures in the Phelps County Canal after early December are believed to be related to insulation from the ice cap.

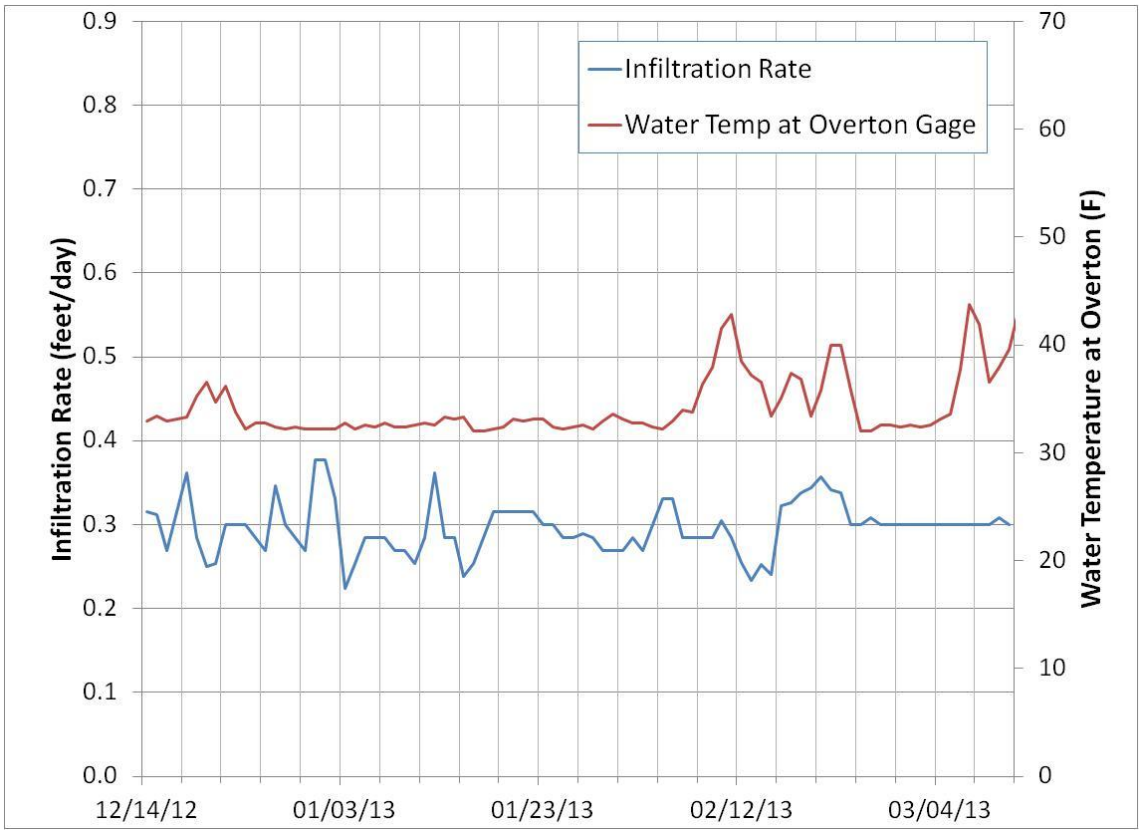


Figure 8: Calculated Average Daily Infiltration Rates and Water Temperatures during 2012-2013 Recharge Operations

3.2.2. Soil Properties

The soils in the vicinity of the Phelps County Canal are mostly well-drained silt loams with high available water capacities, based on data from the Natural Resources Conservation Service's Web Soil Survey. The hydraulic conductivity of the soil in the vicinity of the Phelps County Canal from the headgate to Mile Post 9.7 is approximately 3.1 feet per day for a depth of 60 inches, based on weighted averages of the soil types. The average hydraulic conductivity of the soils in the vicinity of the canal from Mile Post 9.7 to 13.3 is about 2.4 feet per day, which is approximately 23% lower than the average from the headgate to Mile Post 9.7. These rates do not represent the soil properties in the aquifer pathway from the canal to the river, only the rates in the near vicinity of the canal for the top 5 feet of soil. The rates are also based on soil mapping surveys by the Natural Resources Conservation Service, which do not necessarily reflect locally collected field data. However, the soil hydraulic conductivity may have contributed to the differences in the observed infiltration rates between the 2011-2012 season and the 2012-2013 season, as CNPPID has indicated observed lower infiltration rates below Mile Post 9.7 in the canal.

3.2.3. Additional Weather Data

Daily weather data for precipitation, wind speed, solar radiation, soil temperature, relative humidity, maximum and minimum temperatures and evapotranspiration rates were available for the Lexington, NE weather station from the High Plains Regional Climate Center. Weather data was obtained to evaluate whether there were noticeable differences in weather patterns between the 2011-2012 and the 2012-2013 recharge seasons. The air and soil temperatures appear to be consistently lower during the 2012-2013 recharge season than during the previous recharge season, which may have contributed to the lower infiltration rates observed in 2012-2013. Daily data summaries are provided in **Appendix D**. There does not appear to be clear major differences, other than soil and air temperatures, in weather patterns between the 2012-2013 recharge season and the 2011-2012 recharge season.

3.3. Groundwater Level Response

The initial groundwater levels at the start of the 2012-2013 recharge season were much lower in comparison to the initial elevations during the first year of recharge. The lower elevations are attributed to below average precipitation and runoff that were experienced in 2012 as well as the interrelated increase in groundwater pumping in the months preceding the 2012-2013 recharge operations.

3.3.1. Program Wells

Groundwater levels in the six Program monitoring wells at the commencement of the 2012-2013 recharge season were 0.6 to 4.4 feet lower than at the beginning of the 2011-2012 recharge operations, as shown in **Table 4**.

Table 4. Summary of Pre-Recharge Water Levels in Program Monitoring Wells

Date*	Initial Water Level Elevations (feet)					
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
9/27/2011	2312.7	2312.4	2304.4	2292.3	2298.7	2320.1
12/9/2012	2310.2	2309.7	2303.4	2291.7	2297.9	2315.7
Difference	*-2.5*	*-2.7*	*-1.0*	*-0.6*	*-0.8*	*-4.4*

*These are the days before the deliveries into recharge began.

In general, the monitoring wells located on the terrace near the canal (MW-1, MW-2, and MW-6) show a more pronounced response to recharge operations than wells located in the floodplain (MW-3, MW-4, and MW-5). The water levels observed in the Feasibility Study in 2011-2012 increased by approximately 1 to 3 feet in the terrace wells MW-1, MW-2 and MW-6, which is consistent with the increase in water levels for these wells during the 2012-2013 recharge period. After both recharge seasons, the water level elevations in these wells appear to decline after the cessation of recharge operations. MW-6 is located adjacent to the canal and showed the quickest and largest increase in water level elevation among the terrace wells during recharge operations, with an increase in water level by 3.0 feet during the recharge season, as shown in **Figure 9**.

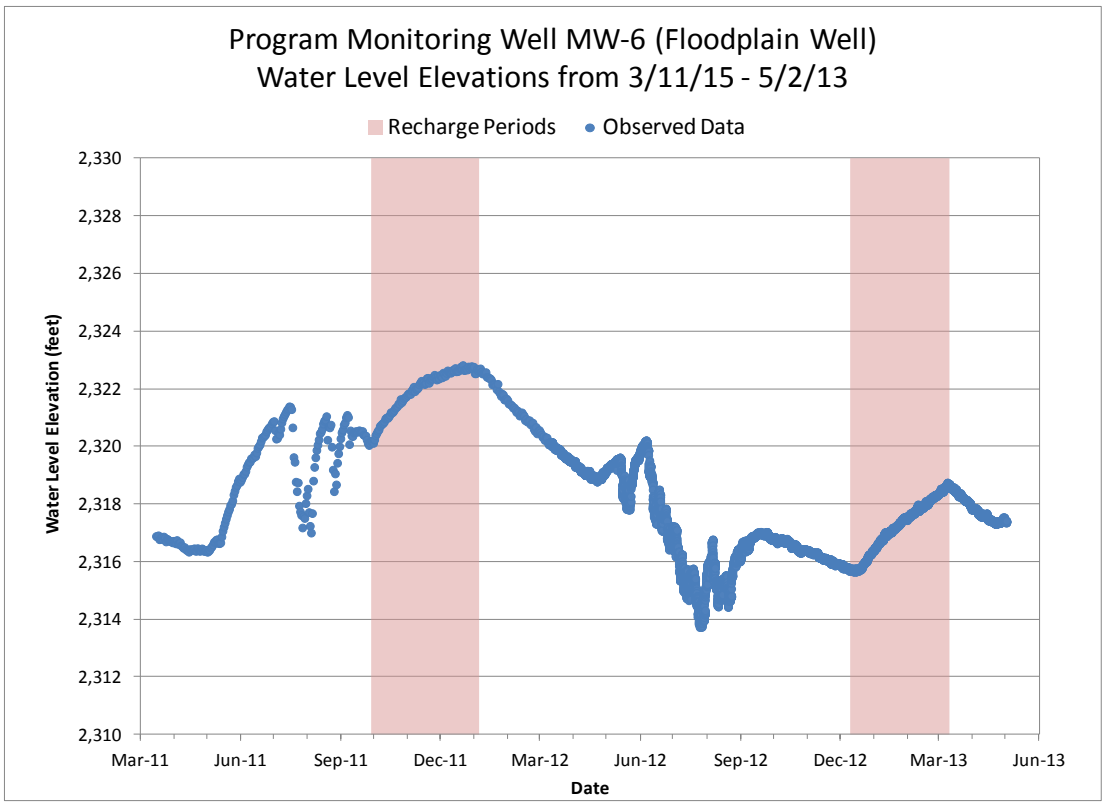


Figure 9: MW-6 Water Level Elevation

MW-1 and MW-2, both terrace wells, did not reach their water level operational thresholds during the 2012-2013 recharge season. The thresholds are 2,312.8 feet for MW-1 and 2,312.4 feet for MW-2; both of these wells experienced levels continuously below their operational thresholds, as shown in **Figures 10 and 11**. There were no major issues of high groundwater levels reported by landowners during the 2012-2013 season.

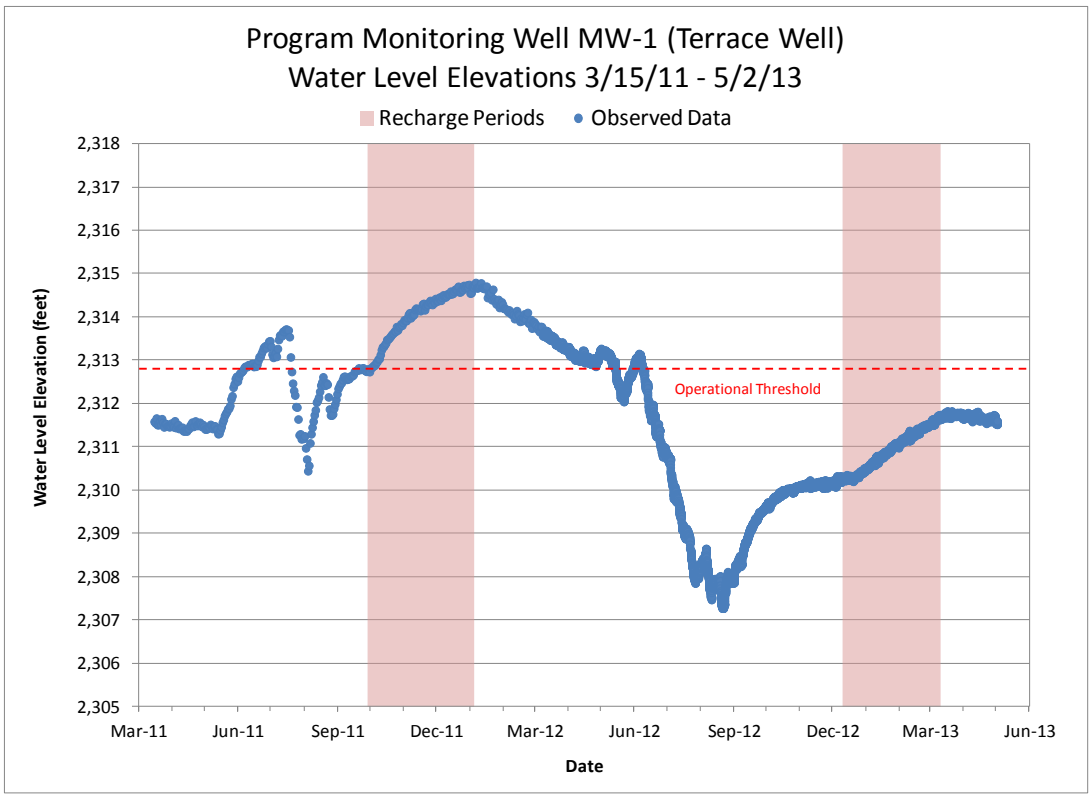


Figure 10: MW-1 Water Level Elevation

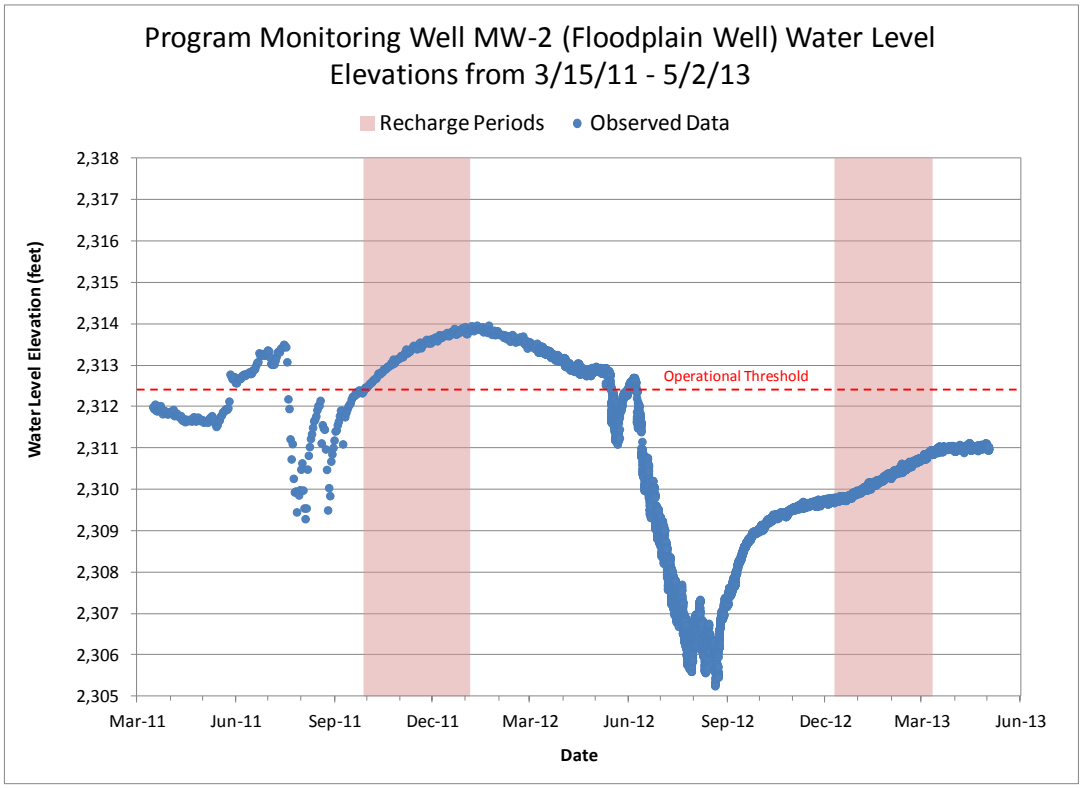


Figure 11: MW-2 Water Level Elevation

In general, over the 2012-2013 recharge period the groundwater levels in the Program monitoring wells M-1 through M-6 increased by 0.5 to 3.0 feet during the recharge season. **Appendix E** includes graphs of the water levels for the wells located in the floodplain from March 2011 through February 2013. Appendix E also contains a summary table of the increase in water level elevations during the recharge period.

3.3.2. CNPPID Wells

The eight CNPPID monitoring wells were equipped with recording pressure transducers on September 13, 2012. The water level in monitoring well C-83 was below the bottom of the well and the sensor for the period of recharge, meaning the well was dry. Monitoring wells C-94, C-97 and C-102 are located in close proximity to the canal and sensitive lands identified during the Feasibility Study. The groundwater levels in these wells increased by 1.1 to 1.9 feet during the recharge period, as shown in **Figure 12**.

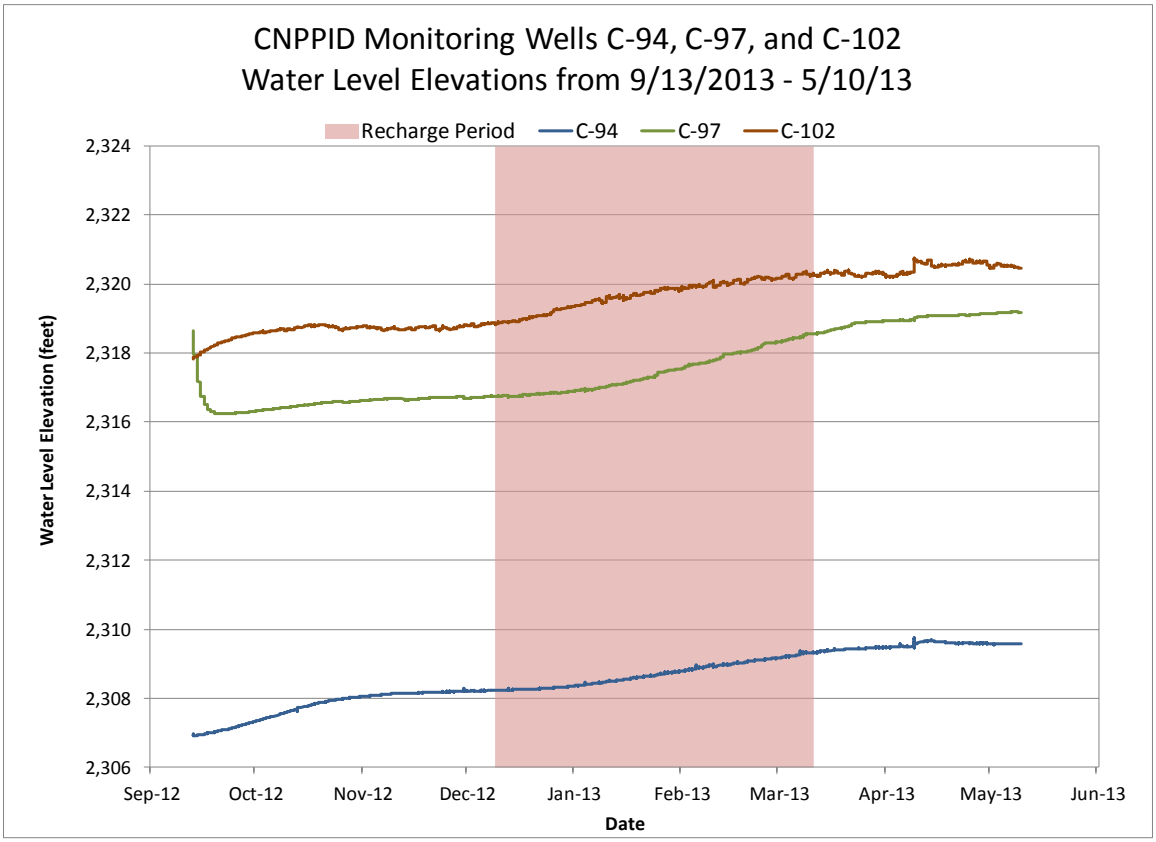


Figure 12: C-94, C-97 and C-102 Water Level Elevations

Monitoring wells C-110 and C-114 are located upgradient of the Phelps Canal and were not influenced by 2012-2013 recharge operations. Monitoring wells C-115 and C-116 are located downstream of the canal near Mile Post 13.3. The water level sensor in monitoring well C-115 was inoperable from October 26, 2012 through January 28, 2013; however, the data prior to and following the outage showed a limited response to recharge. There appeared to be a minimal response in well C-116 during the recharge period. Well responses for C-110, C-114, C-115 and C-116 are provided in **Appendix F**.

In addition, a summary table of the groundwater level elevations for all of the CNPPID wells described above is included in Appendix F.

3.3.3. TBNRD Wells

Groundwater level data were provided for nine monitoring wells owned and operated by TBNRD. Three of the wells (P-105, P-106, P-110) are included in the group of "Overton Transect Wells", while the remaining six (P-101 through P-104, P-132, P-133) are part of the "Elm Creek Transect Wells". The three Overton Transect Wells that were monitored during the 2012-2013 recharge operations are located in the floodplain between the canal and the river. Monitoring wells P-106 and P-110 are located closer to the Phelps County Canal and responded to recharge operations, while well P-105 is located closer to the Platte River and the groundwater level at that location is influenced by river stage. The groundwater levels in P-106 and P-110 rose by over 2.0 feet during the recharge period. The groundwater level in these wells had a more pronounced response to recharge than nearby Program and CNPPID wells. The Overton Transect Well water level elevation data is illustrated in **Figure 13**.

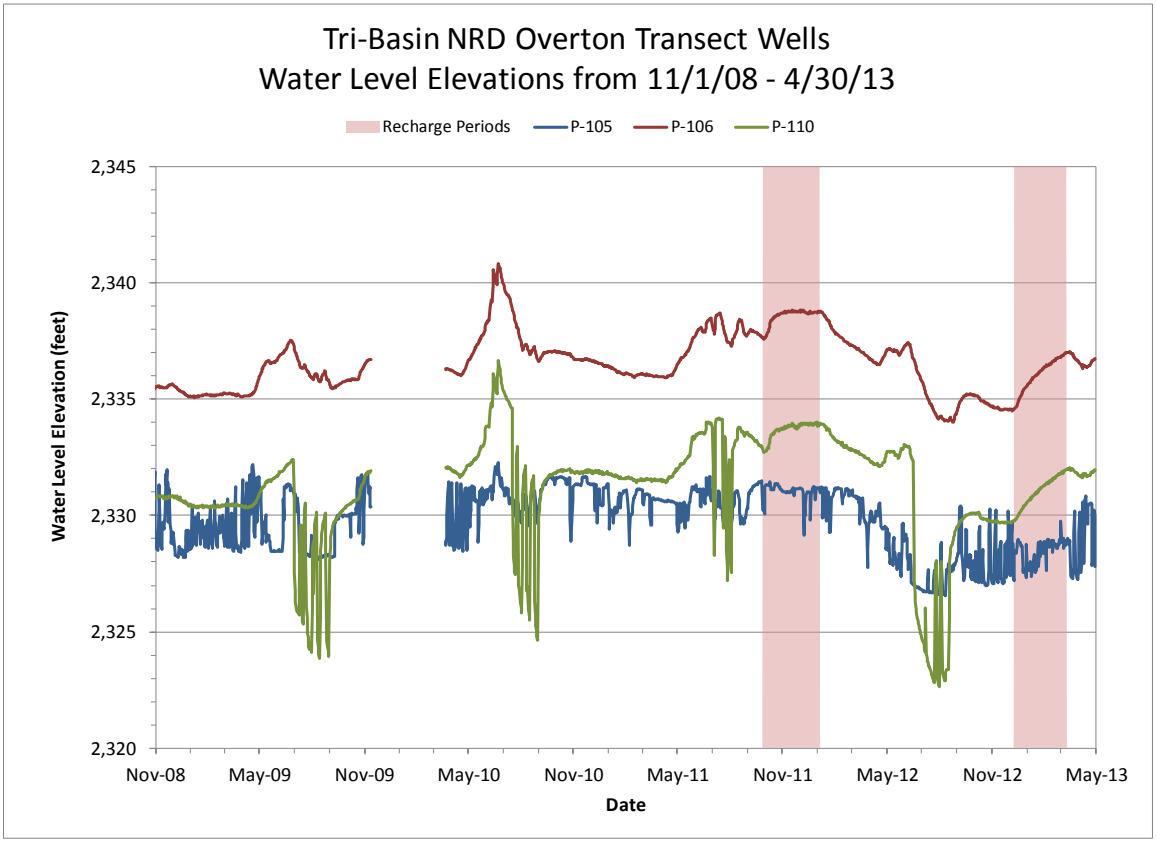


Figure 13: Overton Transect Well Water Level Elevations

The water levels in the Elm Creek Transect Wells monitored down gradient of the Phelps County Canal increased during recharge operations in 2012-2013. Well P-104, which is located about 0.5 miles upgradient of the canal, did not respond to recharge operations. The Elm Creek Transect Well water level elevations are shown in **Figure 14**.

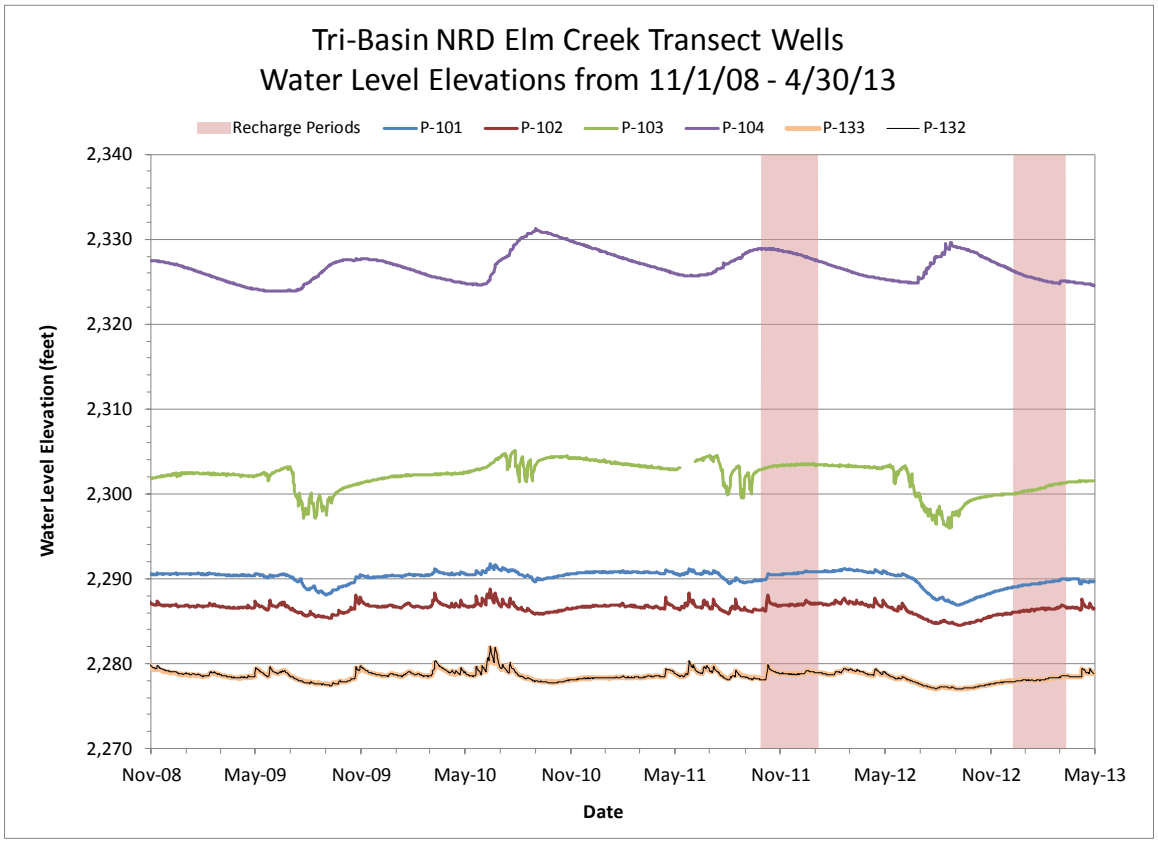


Figure 14: Elm Creek Transect Well Water Level Elevations

Data from the Elm Creek and Overton Transect Wells for October 2008 through present show that groundwater levels experienced in the years prior to recharge operations are typically higher than the groundwater levels observed during the first two years of recharge. The changes in water level elevations in the TBNRD wells during the 2012-2013 recharge period are provided in the tables located in **Appendix G**.

3.4. Drains

Stage was continuously monitored in DL-3 (Peterson Ditch), DL-6 (North Phelps County Drain), DL-7 (Batie Ditch), and DL-9 (Peterson Ditch), while weekly staff gage readings were recorded at the remaining five drain sites (D-1, D-2, D-4, D-5 and D-8). The continuous stage data suggest that recharge operations may have affected drain water levels; however, there were ongoing data issues that were attributed to the effects of ice damming or beaver dams. The drain water level graphs show an increasing trend in water level elevations during the recharge project, although it is unclear whether the recharge operations played a dominant role in the trend. At this time, there are no significant conclusions that can be drawn from the patterns of observed data to attribute recharge operations to increased drain levels. Bill Hahn, ED Office Special Advisor, indicated additional years of drain monitoring may be required to gain a better understanding of the connection between canal diversions and drain water levels. For some of the drains, there does appear to be annual increases in water levels during the beginning of the irrigation

season when water is diverted into the Phelps County Canal. The increase in drain levels during the irrigation season seems to occur sometime after the typical commencement of irrigation deliveries, which may indicate there is a lag period for canal diversions to contribute to drain responses, although more data is needed to confirm this observation. Due to the dynamic nature of the system, other factors may impact the drain levels such as irrigation by landowners and river stage during this period. There also appears to be seasonal variations in drain levels, making it challenging to identify the connection with recharge operations. Drain level monitoring data are presented in the graphs in **Appendix H**.

4. CONCLUSIONS

The 2012-2013 winter recharge operations were successful in confirming groundwater responses to recharge in the Phelps County Canal. Similar to the Feasibility Study in 2011-2012, the monitoring wells in the vicinity of the Phelps County Canal showed an increase in groundwater levels by approximately 1feet to 3 feet during the 2012-2013 recharge season. In general, the hydrogeologic system of the Platte River and Phelps County Canal is complex and due to the dynamic nature of influences on the system, recharge operations will likely yield different results each season. The positive results during the first two years of recharge operations support the continuation of recharge in the Phelps County Canal as a WAP project. No major complications were encountered during the 2012-2013 operations, however CNPPID noted the canal walls may require some stabilization in the future, such as riprap, in order to protect the canal walls from ice formation as some canal sloughing was observed this year.

Given the success of the past two years of recharge operations in the Phelps County Canal, the ED Office recommends continuing recharge operations and monitoring, negotiating a longer-term agreement with CNPPID, and supporting CNPPID in obtaining associated permits as required by the NDNR. It is also recommended that the Nebraska Groundwater Recharge Workgroup collaborate with the ED Office to determine the monitoring efforts that will be implemented during future recharge operations. The data from the Feasibility Study and the 2012-2013 recharge season operations will be used to assist the GC in determining a project score toward the Program's Milestone of reducing shortages to U.S. Fish and Wildlife Service target flows by at least an average of 50,000 AF per year.

5. REFERENCES

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APPENDIX A:

NDNR PERMITS FOR 2012-2013 OPERATIONS

STATE OF NEBRASKA

DEPARTMENT OF NATURAL RESOURCES

APPROVAL OF APPLICATION A-18987

WATER DIVISION 1-A

BACKGROUND

1. On January 1, 2007, work officially commenced on the Platte River Recovery and Implementation Program (PRRIP or Program). PRRIP's goals include reducing shortages to U.S. Fish and Wildlife Service target flows and providing additional land habitat for endangered species in the Lexington to Chapman reach of the Platte River. In order to meet these goals, each signatory to PRRIP has adopted depletions plans to address the mitigation of the adverse impacts of certain new water-related activities on streamflows in the Platte River. In addition to focus on new depletion, Nebraska's New Depletion Plan provides that the State of Nebraska will mitigate existing surface water and groundwater uses in order to return to a July 1, 1997, level of water-use development. Portions of the shortages to target flows are intended to be offset through water conservation and water supply projects identified by the PRRIP Governance Committee in the Water Action Plan, which provides guidance in implementing the water component of the Program. A goal of the first thirteen-year increment of the Program is to attempt to retime and improve flows in the central Platte River so as to reduce shortages to target flows by an average of 130,000 to 150,000 acre-feet (AF) per year, as measured at Grand Island.

2. On August 13, 2009, integrated management plans (IMPs) were adopted by order of the Department, pursuant to *Neb. Rev. Stat.* § 46-718(2), for the following natural resources districts (NRDs): the North Platte NRD, the South Platte NRD, the Twin Platte NRD, the Central Platte NRD, and the Tri-Basin NRD. As part of the surface water controls adopted by the Department pursuant to *Neb. Rev. Stat.* § 46-716(1)(b), the moratorium on issuing new surface water appropriations was continued.

3. On September 11, 2009, a Basin-Wide Integrated Management Plan (BWIMP) for the overappropriated area of the Platte River Basin was adopted by order of the Department. The BWIMP was also adopted by the following NRDs: the North Platte NRD, the South Platte NRD, the Twin Platte NRD, the Central Platte NRD, and the Tri-Basin NRD. These NRDs are collectively referred to in the BWIMP as the "Platte River Basin NRDs."

4. On August 27, 2012, the Central Nebraska Public Power and Irrigation District (Petitioner), filed petition VAR-2397 for Leave to File or Consider an Application for a Permit to Appropriate Water within a Moratorium Area or Stay Area. The petition requests leave to file an application for a temporary permit to appropriate storage water for the purpose of groundwater recharge via the Phelps Canal.

5. On November 13, 2012, the Department granted CNPPID leave to file an application for a permit to appropriate water within a moratorium area by petition VAR-2397.

6. On November 19, 2012, Don Kraus, P.E., General Manager of CNPPID filed in the Department application A-18987 for a temporary permit to appropriate water from storage for the purpose of groundwater recharge via the Phelps Canal.

7. Temporary permits may not be granted for a term of more than one year.

CONCLUSIONS:

1. Construction of Kingsley Reservoir, the Tri-County Diversion Dam and Canal, and the Phelps Canal has been completed.

2. Applicant intends to release water stored under appropriation A-2374 and divert the same into existing facilities during the non-irrigation season.

3. The temporary diversion project proposed by application A-18987 is supported by PRRIP and the U.S. Fish and Wildlife Service.

ORDER

IT IS HEREBY ORDERED that application A-18987 is APPROVED subject to the following limitations and conditions:

1. The source of water is Kingsley Reservoir, storage appropriation A-2374.

2. The water shall be used for the purpose groundwater recharge via the existing Phelps Canal in support of PRRIP goals.

3. The priority date is November 19, 2012.

4. A maximum volume of 6,000 acre-feet of water may be released from Kingsley Reservoir (storage appropriation A-2374) pursuant to this appropriation, the same amount less transit losses may be diverted at a maximum rate of 350 cubic feet per second, into the headgate of the Tri-County Canal located in Section 8, Township 13 North, Range 29 West of the 6th P.M. in Lincoln County.

5. Water available under storage use appropriation A-18987 is accrued from the Environmental Account of storage appropriation A-2374. The amount of water available is governed by the accounting procedures referenced in appropriation files for A-17695.

6. The water diverted under appropriation A-18987 shall be used for groundwater recharge via CNPPID's Phelps Canal during the non-irrigation season.

7. The water under appropriation A-18987 may be diverted after the end of the 2012 irrigation season and prior to the beginning of the 2013 irrigation season, and after the end of the 2013 irrigation season

and up the date this permit expires, if all conditions of this Order are met. Appropriator must coordinate with Department personnel to determine the end and beginning of the irrigation season for the purpose of administering this permit.

8. The water diverted under A-18987 through the Tri-County Canal and Phelps Canal system may not be used for direct irrigation by CNPPID's customers. The water diverted under A-18987 may only flow through the headgate, canal and lateral system. Any water diverted for the purpose authorized under this permit that does not seep into the groundwater aquifer shall be returned to the river at established spills and drains. If at the time irrigation season commences water released under this appropriation has not yet recharged groundwater, and remains in the Phelps Canal, that volume of water shall be re-accounted as storage releases for irrigation and accredited back to the Environmental Account.

DEADLINES

1. If a relinquishment is not submitted first, then appropriation A-18987 will EXPIRE one year from the date of this Order, and appropriation A-18987 will be CANCELLED without further action by the Department as of that date.

2. Within six months after the final date of diversion under this temporary permit, the appropriator shall file in the Department a map that depicts where the water was routed, accompanied by a description of the specific amounts of water released under this appropriation, time of releases, amounts and locations of diversions, less losses in transit, for the purpose of recharge and distinguish it from diversions for power production and any other recharge appropriations, including all data provided to any other entities for this project.

ADDITIONAL INFORMATION

Failure to comply with all laws and regulations pertaining to surface water appropriations, any orders issued by the Director of the Department of Natural Resources, or the provisions of this Approval may result in the cancellation of the appropriation, temporary closing of the appropriation, administrative penalty, criminal prosecution, or any combination thereof.

This appropriation is not a guarantee that water will be available. Nebraska law gives priority to senior appropriations. This appropriation may be closed if there is insufficient water to satisfy senior appropriations.

DEPARTMENT OF NATURAL RESOURCES

November 29, 2012

Brian P. Dunnigan, P.E., Director

The applicant and any person with sufficient legal interest who has been or may be substantially affected by this order may request a contested case hearing in accordance with the *Neb. Admin. Procedures Act* §§ 84-901 et. seq. RRS and the Department's *Rules of Practice and Procedure Title 454 Neb.*

A copy of this approval was posted on the Department's website and provided to the Department's field office in Bridgeport, Nebraska. A copy of this approval was mailed on November 29, 2012, to the following:

Don Kraus, P.E., General Manager
Central Nebraska Public Power and
Irrigation District
P.O. Box 740
Holdrege, Nebraska 68949-0740

STATE OF NEBRASKA

DEPARTMENT OF NATURAL RESOURCES

APPROVAL OF APPLICATION A-18959

WATER DIVISION 1-A

BACKGROUND

1. On July 14, 2004, the Department of Natural Resources (Department) issued a formal moratorium on all new surface water appropriations in the Platte River Basin upstream of the confluence with the Loup River near Columbus, Nebraska. The moratorium included all tributary streams above the Loup River confluence including the North and South Platte Rivers and tributaries.

2. On January 1, 2007, work officially commenced on the Platte River Recovery and Implementation Program (PRRIP or Program). PRRIP's goals include reducing shortages to U.S. Fish and Wildlife Service target flows and providing additional land habitat for endangered species in the Lexington to Chapman reach of the Platte River. In order to meet these goals, each signatory to PRRIP has adopted depletions plans to address the mitigation of the adverse impacts of certain new water-related activities on streamflows in the Platte River. In addition to focus on new depletion, Nebraska's New Depletion Plan provides that the State of Nebraska will mitigate existing surface water and groundwater uses in order to return to a July 1, 1997, level of water-use development. Portions of the shortages to target flows are intended to be offset through water conservation and water supply projects identified by the PRRIP Governance Committee in the Water Action Plan, which provides guidance in implementing the water component of the Program. A goal of the first thirteen-year increment of the Program is to attempt to retime and improve flows in the central Platte River so as to reduce shortages to target flows by an average of 130,000 to 150,000 acre-feet (AF) per year, as measured at Grand Island.

3. On August 13, 2009, integrated management plans (IMPs) were adopted by order of the Department, pursuant to *Neb. Rev. Stat.* § 46-718(2), for the following natural resources districts (NRDs): the North Platte NRD, the South Platte NRD, the Twin Platte NRD, the Central Platte NRD, and the Tri-Basin NRD. As part of the surface water controls adopted by the Department pursuant to *Neb. Rev. Stat.* § 46-716(1)(b), the moratorium on issuing new surface water appropriations was continued.

4. On September 11, 2009, a Basin-Wide Integrated Management Plan (BWIMP) for the overappropriated area of the Platte River Basin was adopted by order of the Department. The BWIMP was also adopted by the following NRDs: the North Platte NRD, the South Platte NRD, the Twin Platte NRD, the Central Platte NRD, and the Tri-Basin NRD. These NRDs are collectively referred to in the BWIMP as the "Platte River Basin NRDs."

5. On July 13, 2012, The Central Nebraska Public Power and Irrigation District (CNPPID), filed petition VAR-2370 for Leave to File or Consider an Application for a Permit to Appropriate Water within a Moratorium Area or Stay Area. The petition requested leave to file an application for a temporary permit to appropriate water for the purpose of groundwater recharge via the Phelps Canal.

6. On August 7, 2012, the Department granted leave to file an application for a permit to appropriate water by approving petition VAR-2370.

7. On August 14, 2012, Don Kraus, P.E., General Manager of CNPPID filed in the Department application A-18959 for a temporary permit to appropriate water for the purpose of groundwater recharge via the Phelps Canal.

8. Temporary permits may not be granted for a term of more than one year.

CONCLUSIONS:

1. Construction of the Tri-County and Phelps Canals has been completed.

2. Applicant has demonstrated there may be unappropriated water in the Platte River during the non-irrigation season.

3. The temporary diversion project proposed by application A-18959 is supported by PRRIP and the U.S. Fish and Wildlife Service.

4. Diversions would occur under the proposed project during the non-irrigation season; therefore, no adverse impacts to existing water users are expected.

5. This project is being implemented pursuant to PRRIP and will only divert water when U.S. Fish and Wildlife Service target flows are exceeded. As such, this project does not constitute a new depletion that requires an offset.

ORDER

IT IS HEREBY ORDERED that application A-18959 is APPROVED subject to the following limitations and conditions:

1. The source of water is the Platte River.

2. The water shall be used for the purpose groundwater recharge via the existing Phelps Canal.

3. The priority date is August 14, 2012.

4. When the specified conditions of this appropriation are met, water may be diverted, at a maximum rate of 350 cubic feet per second, into the headgate of the Tri-County Canal located in Section 8, Township 13 North, Range 29 West of the 6th P.M. in Lincoln County.

5. The water under appropriation A-18959 may be diverted after the end of the 2012 irrigation season, prior to the beginning of the 2013 irrigation season, and after the 2013 irrigation season if applicable, if all conditions of this Order are met. Appropriator must coordinate with Department personnel to determine the end and beginning of the irrigation season for the purpose of administering this permit.

6. This appropriation is subject to all regular water administration. No diversion shall occur if the Department determines that, at the time of intended diversion, there is no unappropriated water available in the Platte River or if the appropriation is out of priority.

7. In addition to regular water administration, no diversion of water under this permit may occur if the U.S. Fish and Wildlife Service-specified target flows are not being met, averaged on a daily basis, at the time of the intended diversion, which are specified on **Table A** on page 5. Appropriator must coordinate with the Department's field office in charge of water administration to confirm that this condition is met prior to diversion of water under this appropriation.

8. The Department reserves the right to make adjustments to the amounts listed on Attachment A.

9. The water diverted under appropriation A-18959 through the Tri-County Canal will flow through the canal system and will be used for groundwater recharge via CNPPID's Phelps Canal during the non-irrigation season.

10. The water diverted under A-18959 through the Tri-County Canal and Phelps Canal system may not be used for direct irrigation by CNPPID's customers. The water diverted under A-18959 may only flow through the headgate, canal and lateral system. Any water diverted for the purpose authorized under this permit that does not seep into the groundwater aquifer shall be returned to the river at established spills and drains.

11. If a relinquishment is not submitted first, then appropriation A-18959 will EXPIRE one year from the date of this Order, and appropriation A-18959 will be CANCELLED without further action by the Department as of that date.

12. Within six months after the final date of diversion under this temporary permit, the appropriator shall file a map that depicts where the water was routed, will provide in-depth quantitative analysis to the Department of the recharge achieved by utilizing the Phelps Canal, including all data provided to the Program pursuant to the "Water Service Agreement-Recharge from Excess Flows Between The Central Nebraska Public Power and Irrigation District and Platte River Implementation Program", and detailed drawings of diversion works that are exclusively used for the purpose of this application.

ADDITIONAL INFORMATION

Failure to comply with all laws and regulations pertaining to surface water appropriations, any orders issued by the Director of the Department of Natural Resources, or the provisions of this Approval may result in the cancellation of the appropriation, temporary closing of the appropriation, administrative penalty, criminal prosecution, or any combination thereof.

This appropriation is not a guarantee that water will be available. Nebraska law gives priority to senior appropriations. This appropriation may be closed if there is insufficient water to satisfy senior appropriations.

DEPARTMENT OF NATURAL RESOURCES

November 29, 2012

Brian P. Dunnigan, P.E., Director

The applicant and any person with sufficient legal interest who has been or may be substantially affected by this order may request a contested case hearing in accordance with the *Neb. Admin. Procedures Act* §§ 84-901 et. seq. RRS and the Department's *Rules of Practice and Procedure Title 454 Neb. Admin. Code* Chapter 7. The request must be received by the Department at its Lincoln office (Nebraska State Office Building, 4th Floor, 301 Centennial Mall South, P.O. Box 94676, Lincoln, Nebraska 68509-4676) within 30 days of the date of the Approval and be accompanied by a filing fee of $10.

A copy of this approval was posted on the Department's website and provided to the Department's field office in Bridgeport, Nebraska. A copy of this approval was mailed on November 29, 2012, to the following:

Don Kraus, P.E., General Manager
Central Nebraska Public Power and
Irrigation District
P.O. Box 740
Holdrege, Nebraska 68949-0740

Table A - Desired Minimum Discharge of the Platte River in cfs

Measured at the Grand Island Stream Gage Relevant to Appropriation A-18959

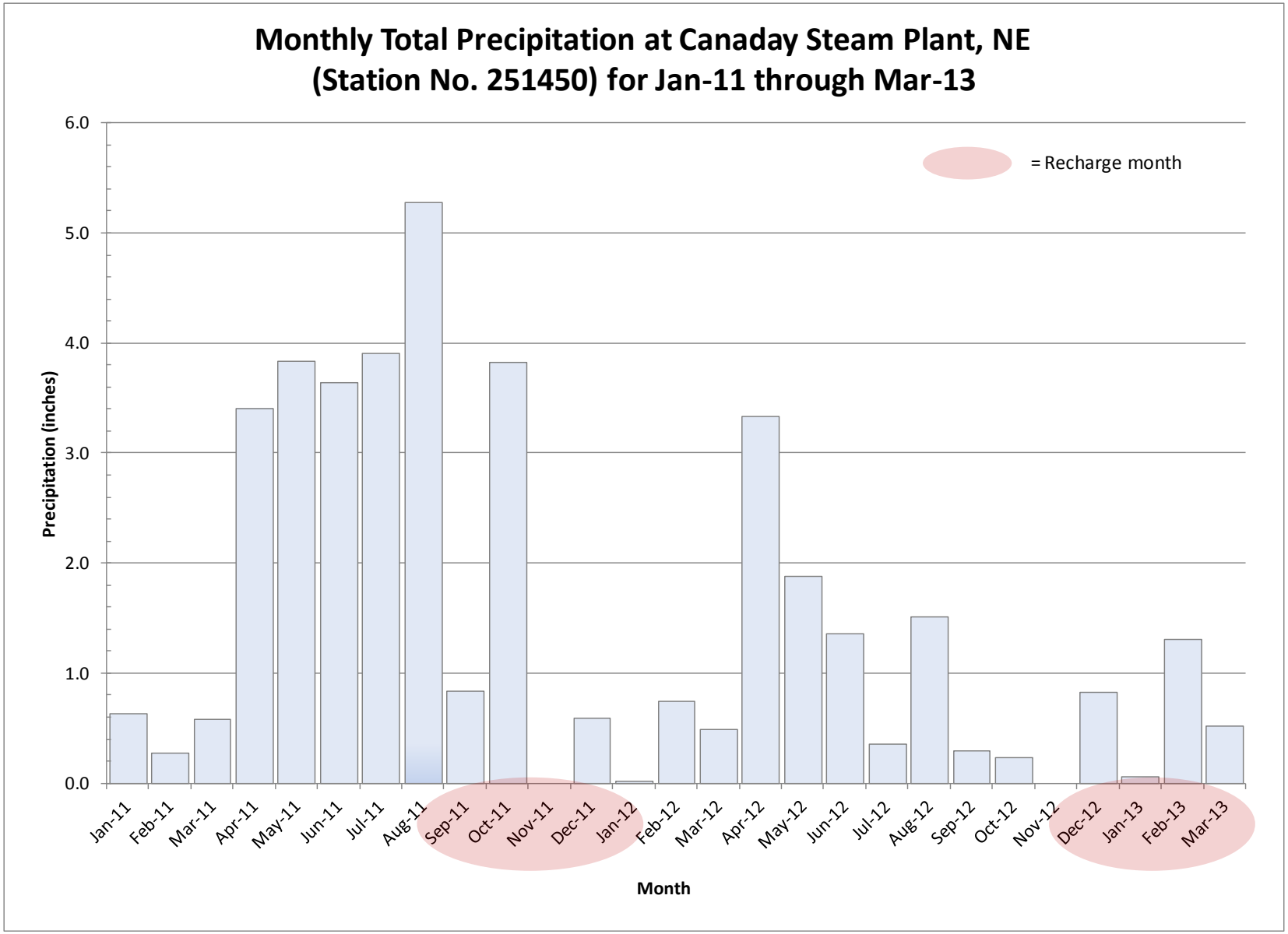
Period	PRRIP Target Flows Grand Island		
	Wet*	**Normal***	**Dry***
January 1 - January 31	1,000	1,000	600
February 1 - February 14	1,800	1,800	1,200
February 15 - February 28	3,350	3,350	2,250
March 1 - March 15	3,350	3,350	2,250
March 16 - March 22	1,800	1,800	1,200
March 23 - March 31	2,400	2,400	1,700
April 1 - April 14	2,400	2,400	1,700
April 15 - May 3	2,400	2,400	1,700
May 4 - May 10	2,400	2,400	1,700
May 11- May 19	1,200	1,200	800
May 20 - May 31	3,700	3,400	800
June 1 - June 20	3,700	3,400	**1,000****
June 21 - June 23	1,200	1,200	**1,000****
June 24 - July 31	1,200	1,200	**1,000****
August 1 - August 22	1,200	1,200	800
August 23 - August 31	1,200	1,200	800
September 1 - September 15	1,200	1,200	800
September 16 - September 30	1,000	1,000	600
October 1 - October 11	2,400	1,800	**1,350****
October 12 - November 10	2,400	1,800	**1,500****
November 11 - November 15	2,400	1,800	1,300
November 16 - December 31	1,000	1,000	600

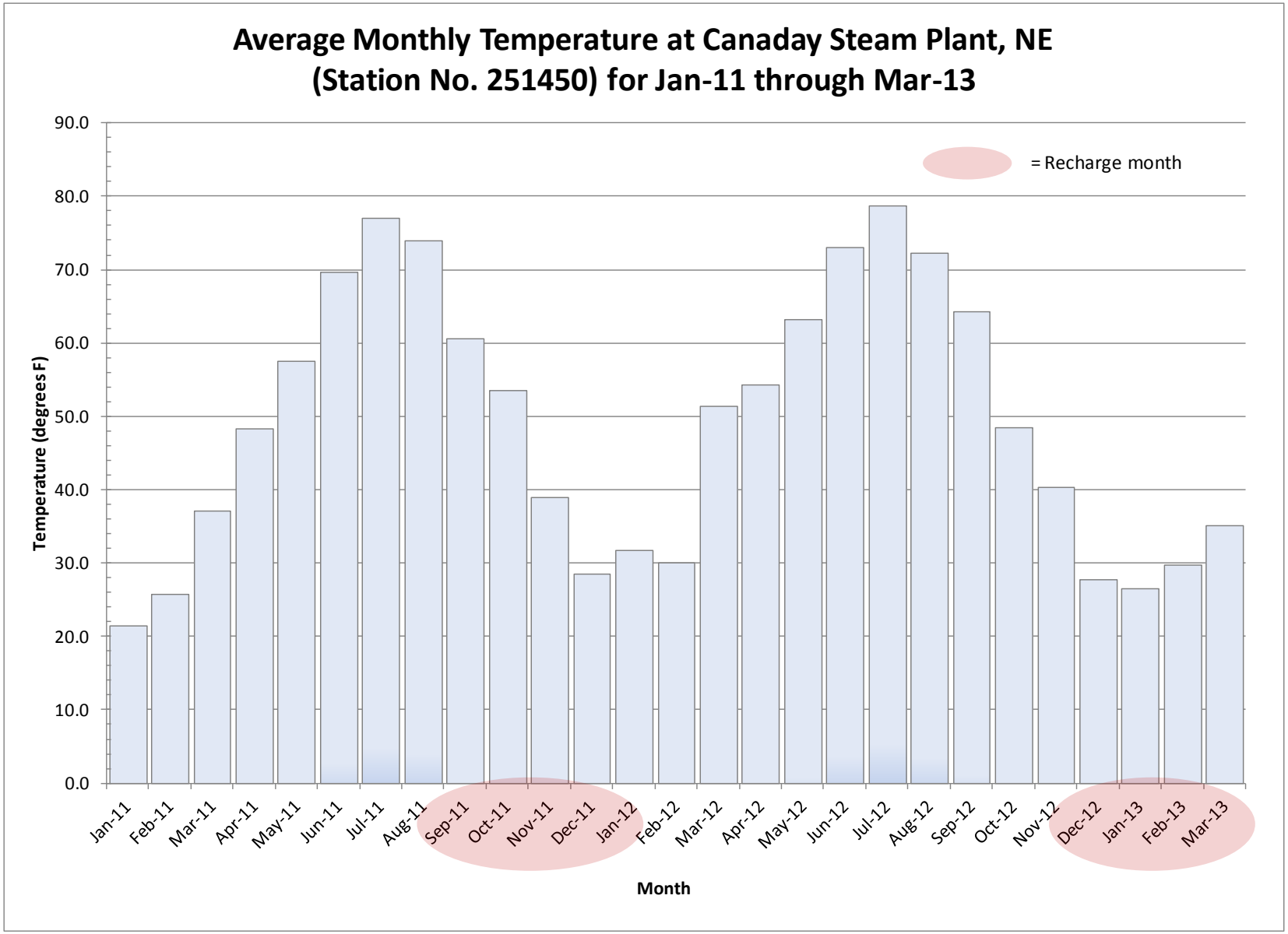
* The current Hydrologic Condition, (Wet Normal or Dry) determined by PRRIP can be found at: *http://platteriverprogram.org/PubsAndData/Pages/CurrentHydrologicCondition.aspx*

**Represents the minimum discharge required by instream flow appropriation, which is greater than PRRIP Target Flows, and senior to A-18959

APPENDIX B:

PRECIPITATION AND TEMPERATURE AT CANADAY STEAM PLANT


Monthly Total Precipitation at Canaday Steam Plant, NE
(Station No. 251450) for Jan-11 through Mar-13
= Recharge month
Precipitation (inches)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Jan-12
Feb-12
Mar-12
Apr-12
May-12
Jun-12
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Month


Average Monthly Temperature at Canaday Steam Plant, NE
(Station No. 251450) for Jan-11 through Mar-13
= Recharge month
Temperature (degrees F)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Jan-12
Feb-12
Mar-12
Apr-12
May-12
Jun-12
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Month

APPENDIX C:

SUMMARY OF DIVERSIONS INTO RECHARGE FROM 2012-2013

SUMMARY OF DAILY RECHARGE

Date	Volume of Water Diverted into Recharge (AF)	Cumulative Volume of Water Diverted into Recharge (AF)	Evaporation (AF)	Precipitation (AF)	Recharge Rate (AF)	Recharge Rate (cfs)	Unit Recharge Rate (cfs/mile)
12/4/2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/5/2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/6/2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/7/2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/8/2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/9/2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/10/2012	273.7	273.7	0.0	0.0	273.7	138.0	11.8
12/11/2012	236.0	509.8	0.0	0.0	236.0	119.0	10.2
12/12/2012	259.8	769.6	0.0	0.0	259.8	131.0	11.2
12/13/2012	204.3	973.9	0.0	0.0	204.3	103.0	8.8
12/14/2012	38.0	1011.9	0.0	0.6	38.5	19.4	1.7
12/15/2012	34.3	1046.2	0.0	1.4	35.7	18.0	1.5
12/16/2012	32.4	1078.6	0.0	0.2	32.7	16.5	1.4
12/17/2012	38.0	1116.6	0.0	0.0	38.0	19.1	1.6
12/18/2012	43.5	1160.1	0.0	0.0	43.5	22.0	1.9
12/19/2012	34.3	1194.4	0.0	0.0	34.3	17.3	1.5
12/20/2012	25.1	1219.5	0.0	0.0	25.1	12.7	1.1
12/21/2012	30.6	1250.1	0.0	0.0	30.6	15.4	1.3
12/22/2012	36.1	1286.3	0.0	0.2	36.4	18.3	1.6
12/23/2012	36.1	1322.4	0.0	0.0	36.1	18.2	1.6
12/24/2012	36.1	1358.5	0.0	0.0	36.1	18.2	1.6
12/25/2012	34.3	1392.8	0.0	0.0	34.3	17.3	1.5
12/26/2012	32.4	1425.3	0.0	0.0	32.4	16.4	1.4
12/27/2012	41.7	1466.9	0.0	0.0	41.7	21.0	1.8
12/28/2012	36.1	1503.1	0.0	0.0	36.1	18.2	1.6
12/29/2012	34.3	1537.4	0.0	0.0	34.3	17.3	1.5
12/30/2012	32.4	1569.8	0.0	0.0	32.4	16.4	1.4
12/31/2012	45.4	1615.2	0.0	0.0	45.4	22.9	2.0
1/1/2013	45.4	1660.6	0.0	0.0	45.4	22.9	2.0
1/2/2013	39.8	1700.5	0.0	0.0	39.8	20.1	1.7
1/3/2013	26.9	1727.4	0.0	0.0	26.9	13.6	1.2
1/4/2013	30.6	1758.0	0.0	0.0	30.6	15.4	1.3
1/5/2013	34.3	1792.3	0.0	0.0	34.3	17.3	1.5
1/6/2013	34.3	1826.6	0.0	0.0	34.3	17.3	1.5
1/7/2013	34.3	1860.9	0.0	0.0	34.3	17.3	1.5
1/8/2013	32.4	1893.3	0.0	0.0	32.4	16.4	1.4
1/9/2013	32.4	1925.7	0.0	0.0	32.4	16.4	1.4
1/10/2013	30.6	1956.3	0.0	0.3	30.9	15.6	1.3
1/11/2013	34.3	1990.6	0.0	0.1	34.4	17.3	1.5
1/12/2013	43.5	2034.2	0.0	0.0	43.5	22.0	1.9
1/13/2013	34.3	2068.5	0.0	0.0	34.3	17.3	1.5
1/14/2013	34.3	2102.7	0.0	0.0	34.3	17.3	1.5
1/15/2013	28.8	2131.5	0.0	0.0	28.8	14.5	1.2
1/16/2013	30.6	2162.1	0.0	0.0	30.6	15.4	1.3
1/17/2013	34.3	2196.4	0.0	0.0	34.3	17.3	1.5
1/18/2013	38.0	2234.4	0.0	0.0	38.0	19.1	1.6
1/19/2013	38.0	2272.4	0.0	0.0	38.0	19.1	1.6
1/20/2013	38.0	2310.3	0.0	0.0	38.0	19.1	1.6
1/21/2013	38.0	2348.3	0.0	0.0	38.0	19.1	1.6
1/22/2013	38.0	2386.3	0.0	0.0	38.0	19.1	1.6
1/23/2013	36.1	2422.4	0.0	0.0	36.1	18.2	1.6
1/24/2013	36.1	2458.6	0.0	0.0	36.1	18.2	1.6
1/25/2013	34.3	2492.8	0.0	0.0	34.3	17.3	1.5
1/26/2013	34.3	2527.1	0.0	0.0	34.3	17.3	1.5
1/27/2013	34.3	2561.4	0.0	0.3	34.6	17.5	1.5
1/28/2013	34.3	2595.7	0.0	0.1	34.4	17.3	1.5
1/29/2013	32.4	2628.1	0.0	0.0	32.4	16.4	1.4
1/30/2013	32.4	2660.6	0.0	0.0	32.4	16.4	1.4
1/31/2013	32.4	2693.0	0.0	0.0	32.4	16.4	1.4
2/1/2013	34.3	2727.3	0.0	0.0	34.3	17.3	1.5
2/2/2013	32.4	2759.7	0.0	0.0	32.4	16.4	1.4
2/3/2013	36.1	2795.9	0.0	0.0	36.1	18.2	1.6
2/4/2013	39.8	2835.7	0.0	0.0	39.8	20.1	1.7

SUMMARY OF DAILY RECHARGE

Date	Volume of Water Diverted into Recharge (AF)	Cumulative Volume of Water Diverted into Recharge (AF)	Evaporation (AF)	Precipitation (AF)	Recharge Rate (AF)	Recharge Rate (cfs)	Unit Recharge Rate (cfs/mile)
2/5/2013	39.8	2875.5	0.0	0.0	39.8	20.1	1.7
2/6/2013	34.3	2909.8	0.0	0.0	34.3	17.3	1.5
2/7/2013	34.3	2944.1	0.0	0.0	34.3	17.3	1.5
2/8/2013	34.3	2978.4	0.0	0.0	34.3	17.3	1.5
2/9/2013	34.3	3012.7	0.0	0.1	34.4	17.3	1.5
2/10/2013	34.3	3046.9	0.0	0.0	34.3	17.3	1.5
2/11/2013	34.4	3081.3	0.0	0.0	34.4	17.3	1.5
2/12/2013	30.8	3112.1	0.0	0.0	30.8	15.5	1.3
2/13/2013	28.2	3140.2	0.0	0.0	28.2	14.2	1.2
2/14/2013	30.5	3170.7	0.0	0.0	30.5	15.4	1.3
2/15/2013	28.9	3199.6	0.0	0.0	28.9	14.6	1.2
2/16/2013	38.9	3238.5	0.0	0.0	38.9	19.6	1.7
2/17/2013	39.4	3277.9	0.0	0.0	39.4	19.8	1.7
2/18/2013	40.7	3318.6	0.0	0.0	40.7	20.5	1.8
2/19/2013	41.5	3360.0	0.0	0.0	41.5	20.9	1.8
2/20/2013	43.0	3403.0	0.0	0.0	43.0	21.7	1.9
2/21/2013	36.1	3439.1	0.0	0.0	36.1	18.2	1.6
2/22/2013	36.1	3475.3	0.0	0.0	36.1	18.2	1.6
2/23/2013	36.1	3511.4	0.0	0.5	36.6	18.4	1.6
2/24/2013	36.1	3547.5	0.0	0.0	36.1	18.2	1.6
2/25/2013	36.1	3583.7	0.0	0.1	36.2	18.3	1.6
2/26/2013	36.1	3619.8	0.0	0.0	36.1	18.2	1.6
2/27/2013	36.1	3655.9	0.0	0.0	36.1	18.2	1.6
2/28/2013	36.1	3692.1	0.0	0.0	36.1	18.2	1.6
3/1/2013	36.1	3728.2	0.8	0.0	35.4	17.8	1.5
3/2/2013	36.1	3764.3	0.8	0.0	35.4	17.8	1.5
3/3/2013	36.1	3800.4	0.8	0.0	35.4	17.8	1.5
3/4/2013	36.1	3836.6	0.8	0.0	35.4	17.8	1.5
3/5/2013	36.1	3872.7	0.8	0.0	35.4	17.8	1.5
3/6/2013	36.1	3908.8	0.8	0.0	35.4	17.8	1.5
3/7/2013	36.1	3945.0	0.8	0.0	35.4	17.8	1.5
3/8/2013	36.1	3981.1	0.8	0.0	35.4	17.8	1.5
3/9/2013	36.1	4017.2	0.8	2.4	37.8	19.0	1.6
3/10/2013	36.1	4053.3	0.8	0.0	35.4	17.8	1.5
3/11/2013	36.1	4089.5	0.8	0.1	35.5	17.9	1.5

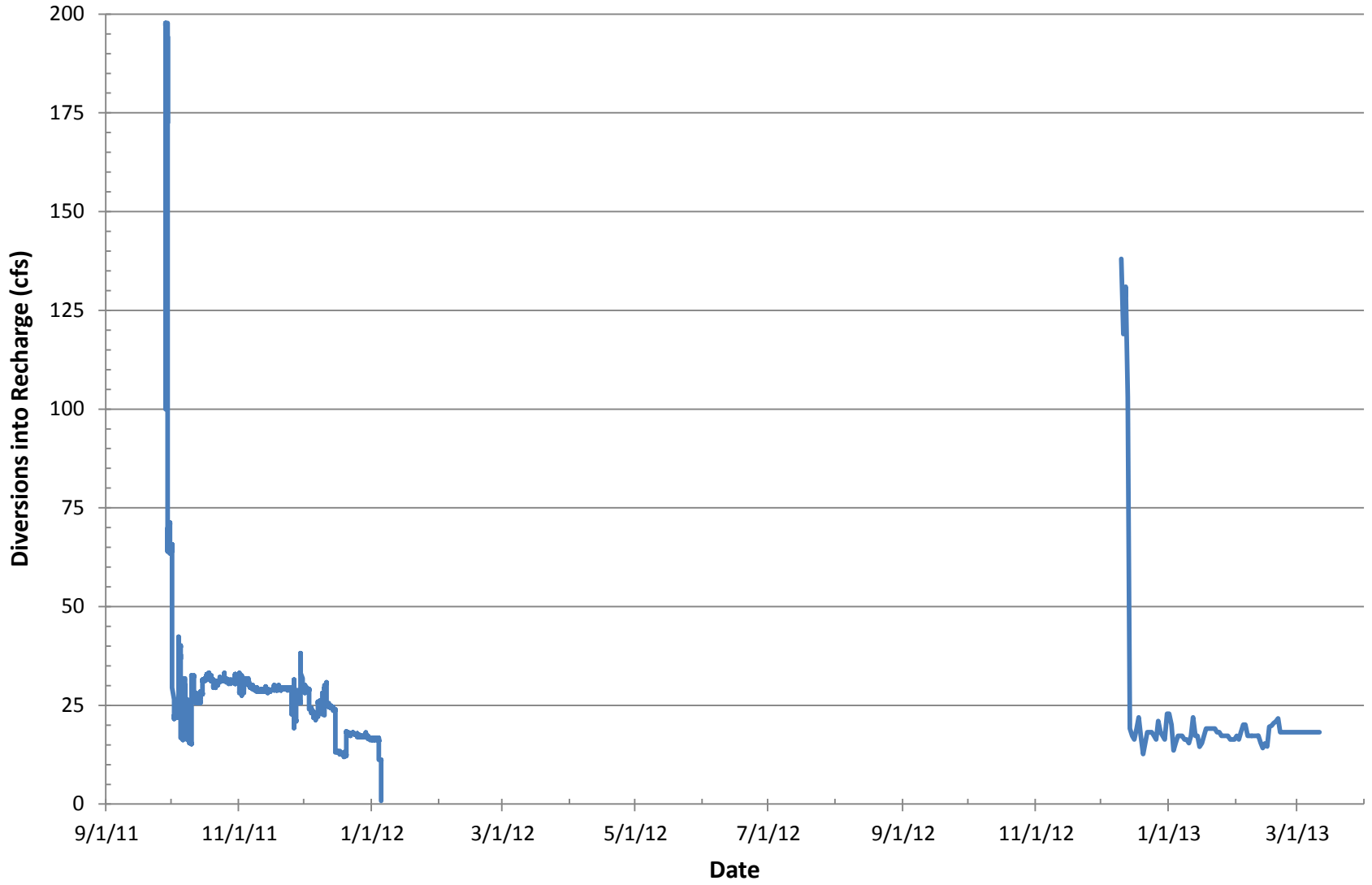
SUMMARY OF DAILY CANAL FLOW ADJUSTMENTS

Day	Month	Phelps Canal Flow (cfs)	Measured Head, h_a (ft)	Adjusted Head, h_a' (ft)	Adjusted Flow, Q' (cfs)
			$h_a = (Q/113.13)^{(1/1.6)}$	$h_a' = h_a - 0.04$ (For Q < 100)	$Q' = 113.13h_a'^{1.6}$
12/4/2012	12	0	0.00	0.00	0.0
12/5/2012	12	0	0.00	0.00	0.0
12/6/2012	12	0	0.00	0.00	0.0
12/7/2012	12	0	0.00	0.00	0.0
12/8/2012	12	0	0.00	0.00	0.0
12/9/2012	12	0	0.00	0.00	0.0
12/10/2012	12	138	1.13	1.13	138.0
12/11/2012	12	119	1.03	1.03	119.0
12/12/2012	12	131	1.10	1.10	131.0
12/13/2012	12	103	0.94	0.94	103.0
12/14/2012	12	23	0.37	0.33	19.1
12/15/2012	12	21	0.35	0.31	17.3
12/16/2012	12	20	0.34	0.30	16.4
12/17/2012	12	23	0.37	0.33	19.1
12/18/2012	12	26	0.40	0.36	22.0
12/19/2012	12	21	0.35	0.31	17.3
12/20/2012	12	16	0.29	0.25	12.7
12/21/2012	12	19	0.33	0.29	15.4
12/22/2012	12	22	0.36	0.32	18.2
12/23/2012	12	22	0.36	0.32	18.2
12/24/2012	12	22	0.36	0.32	18.2
12/25/2012	12	21	0.35	0.31	17.3
12/26/2012	12	20	0.34	0.30	16.4
12/27/2012	12	25	0.39	0.35	21.0
12/28/2012	12	22	0.36	0.32	18.2
12/29/2012	12	21	0.35	0.31	17.3
12/30/2012	12	20	0.34	0.30	16.4
12/31/2012	12	27	0.41	0.37	22.9
1/1/2013	1	27	0.41	0.37	22.9
1/2/2013	1	24	0.38	0.34	20.1
1/3/2013	1	17	0.31	0.27	13.6
1/4/2013	1	19	0.33	0.29	15.4
1/5/2013	1	21	0.35	0.31	17.3
1/6/2013	1	21	0.35	0.31	17.3
1/7/2013	1	21	0.35	0.31	17.3
1/8/2013	1	20	0.34	0.30	16.4
1/9/2013	1	20	0.34	0.30	16.4
1/10/2013	1	19	0.33	0.29	15.4
1/11/2013	1	21	0.35	0.31	17.3
1/12/2013	1	26	0.40	0.36	22.0
1/13/2013	1	21	0.35	0.31	17.3
1/14/2013	1	21	0.35	0.31	17.3
1/15/2013	1	18	0.32	0.28	14.5
1/16/2013	1	19	0.33	0.29	15.4
1/17/2013	1	21	0.35	0.31	17.3
1/18/2013	1	23	0.37	0.33	19.1
1/19/2013	1	23	0.37	0.33	19.1
1/20/2013	1	23	0.37	0.33	19.1
1/21/2013	1	23	0.37	0.33	19.1
1/22/2013	1	23	0.37	0.33	19.1

SUMMARY OF DAILY CANAL FLOW ADJUSTMENTS

Day	Month	Phelps Canal Flow (cfs)	$h_a = (Q/113.13)^{(1/1.6)}$	$h_a' = h_a - 0.04$ (For $Q < 100$)	$Q' = 113.13h_a'^{1.6}$
1/23/2013	1	22	0.36	0.32	18.2
1/24/2013	1	22	0.36	0.32	18.2
1/25/2013	1	21	0.35	0.31	17.3
1/26/2013	1	21	0.35	0.31	17.3
1/27/2013	1	21	0.35	0.31	17.3
1/28/2013	1	21	0.35	0.31	17.3
1/29/2013	1	20	0.34	0.30	16.4
1/30/2013	1	20	0.34	0.30	16.4
1/31/2013	1	20	0.34	0.30	16.4
2/1/2013	2	21	0.35	0.31	17.3
2/2/2013	2	20	0.34	0.30	16.4
2/3/2013	2	22	0.36	0.32	18.2
2/4/2013	2	24	0.38	0.34	20.1
2/5/2013	2	24	0.38	0.34	20.1
2/6/2013	2	21	0.35	0.31	17.3
2/7/2013	2	21	0.35	0.31	17.3
2/8/2013	2	21	0.35	0.31	17.3
2/9/2013	2	21	0.35	0.31	17.3
2/10/2013	2	21	0.35	0.31	17.3
2/11/2013	2	21	0.35	0.31	17.3
2/12/2013	2	19	0.33	0.29	15.5
2/13/2013	2	18	0.31	0.27	14.2
2/14/2013	2	19	0.33	0.29	15.4
2/15/2013	2	18	0.32	0.28	14.6
2/16/2013	2	24	0.37	0.33	19.6
2/17/2013	2	24	0.38	0.34	19.8
2/18/2013	2	24	0.38	0.34	20.5
2/19/2013	2	25	0.39	0.35	20.9
2/20/2013	2	26	0.40	0.36	21.7
2/21/2013	2	22	0.36	0.32	18.2
2/22/2013	2	22	0.36	0.32	18.2
2/23/2013	2	22	0.36	0.32	18.2
2/24/2013	2	22	0.36	0.32	18.2
2/25/2013	2	22	0.36	0.32	18.2
2/26/2013	2	22	0.36	0.32	18.2
2/27/2013	2	22	0.36	0.32	18.2
2/28/2013	2	22	0.36	0.32	18.2
3/1/2013	3	22	0.36	0.32	18.2
3/2/2013	3	22	0.36	0.32	18.2
3/3/2013	3	22	0.36	0.32	18.2
3/4/2013	3	22	0.36	0.32	18.2
3/5/2013	3	22	0.36	0.32	18.2
3/6/2013	3	22	0.36	0.32	18.2
3/7/2013	3	22	0.36	0.32	18.2
3/8/2013	3	22	0.36	0.32	18.2
3/9/2013	3	22	0.36	0.32	18.2
3/10/2013	3	22	0.36	0.32	18.2
3/11/2013	3	22	0.36	0.32	18.2

Diversions into the Phelps County Canal for Recharge Operations from 9/28/2011 through 3/11/2013

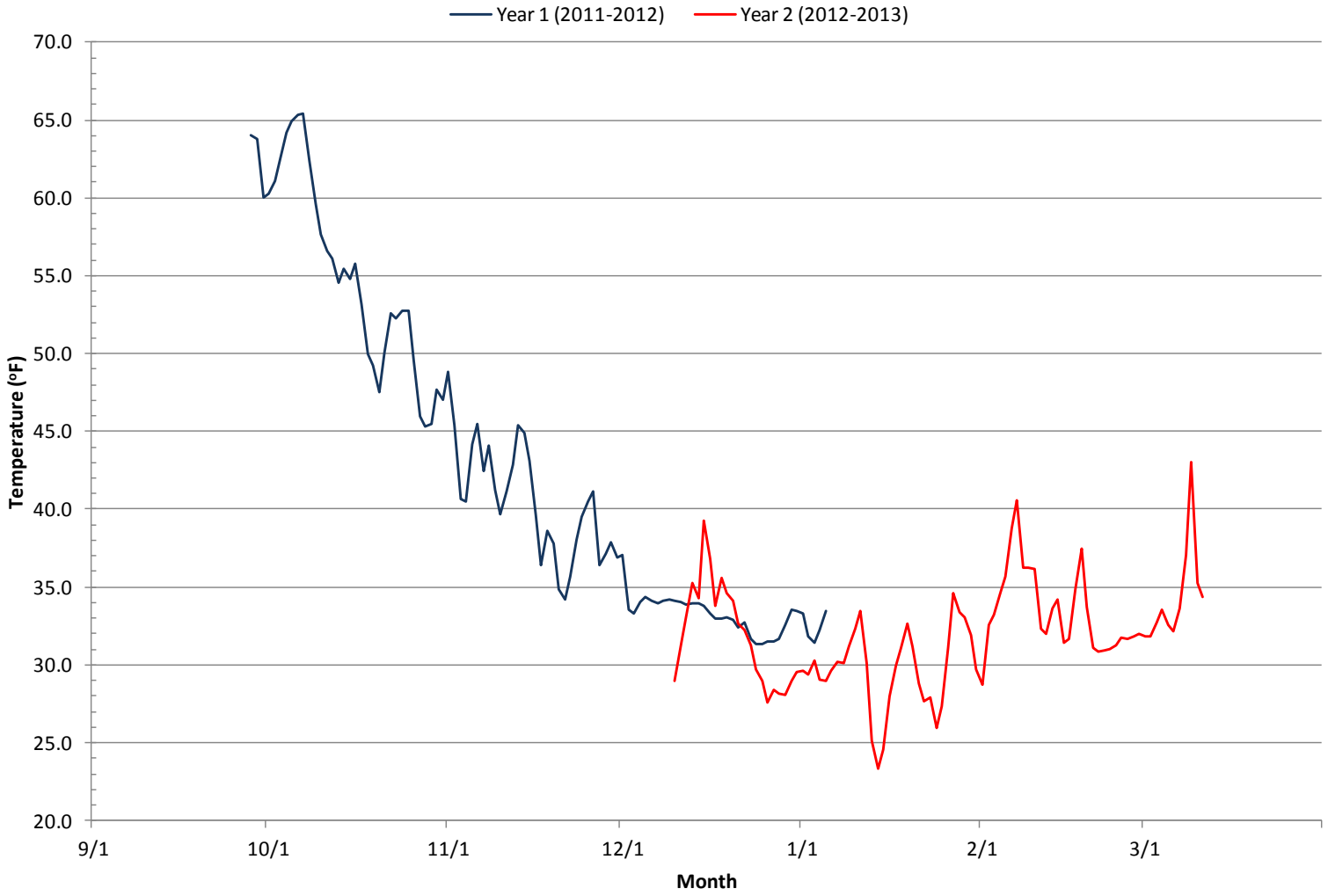


APPENDIX D:

ADDITIONAL WEATHER DATA AT LEXINGTON, NE STATION

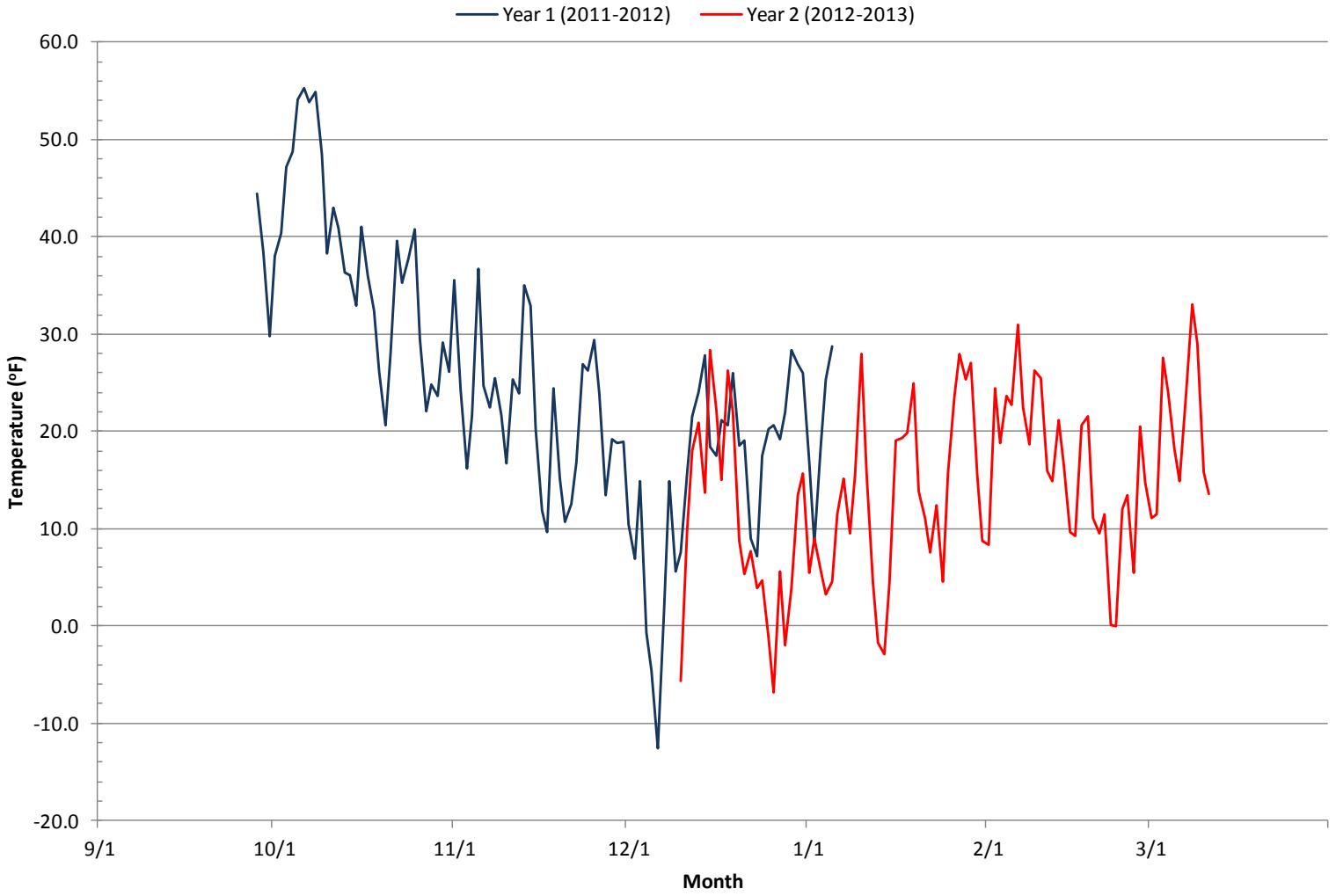
Data from High Plains Regional Climate Center

Daily Average Soil Temperature at Lexington, NE during Program Recharge Periods



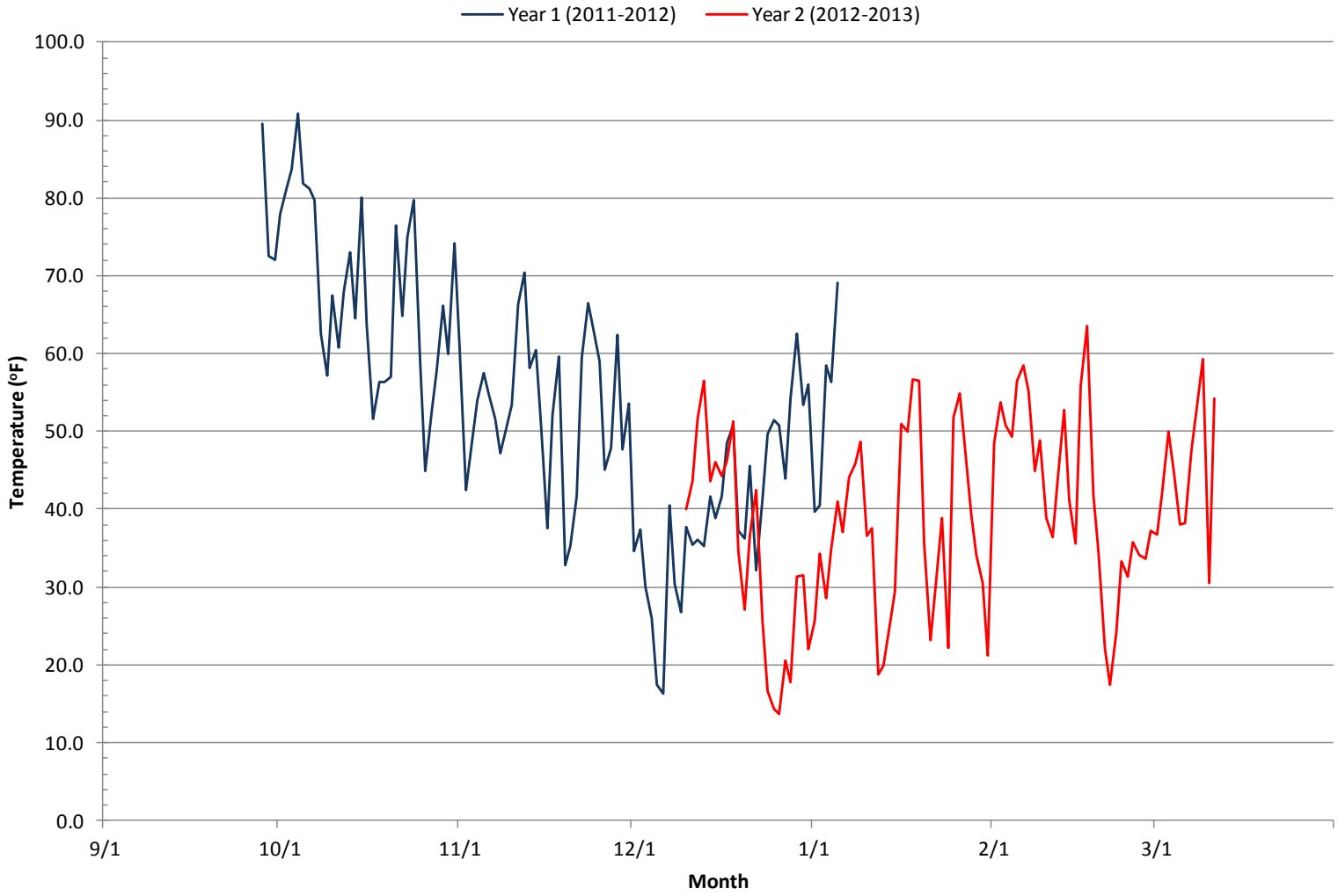
Data from High Plains Regional Climate Center

Daily Minimum Average Temperatures at Lexington, NE during Program Recharge Periods



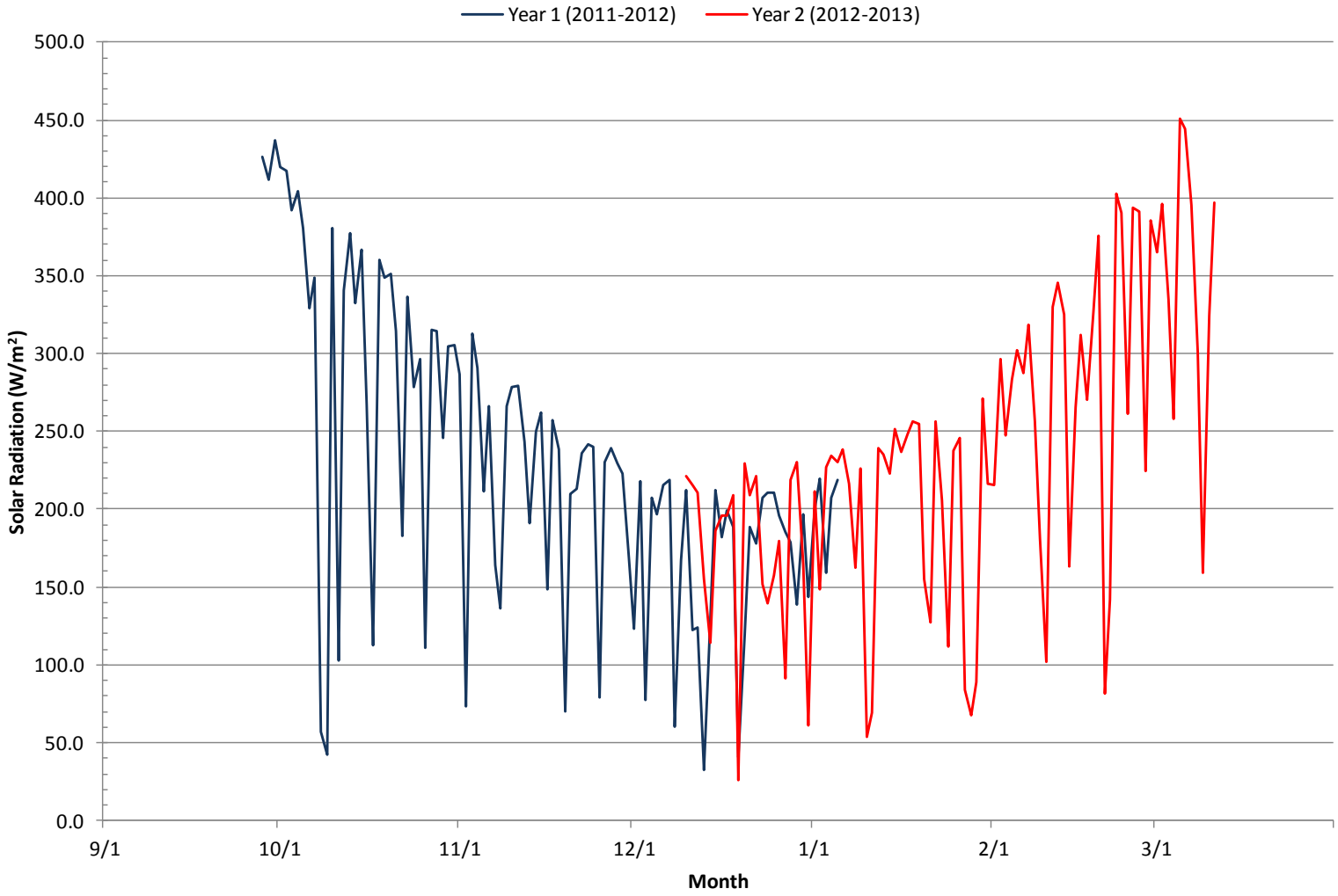
Data from High Plains Regional Climate Center

Daily Maximum Average Temperatures at Lexington, NE during Program Recharge Periods



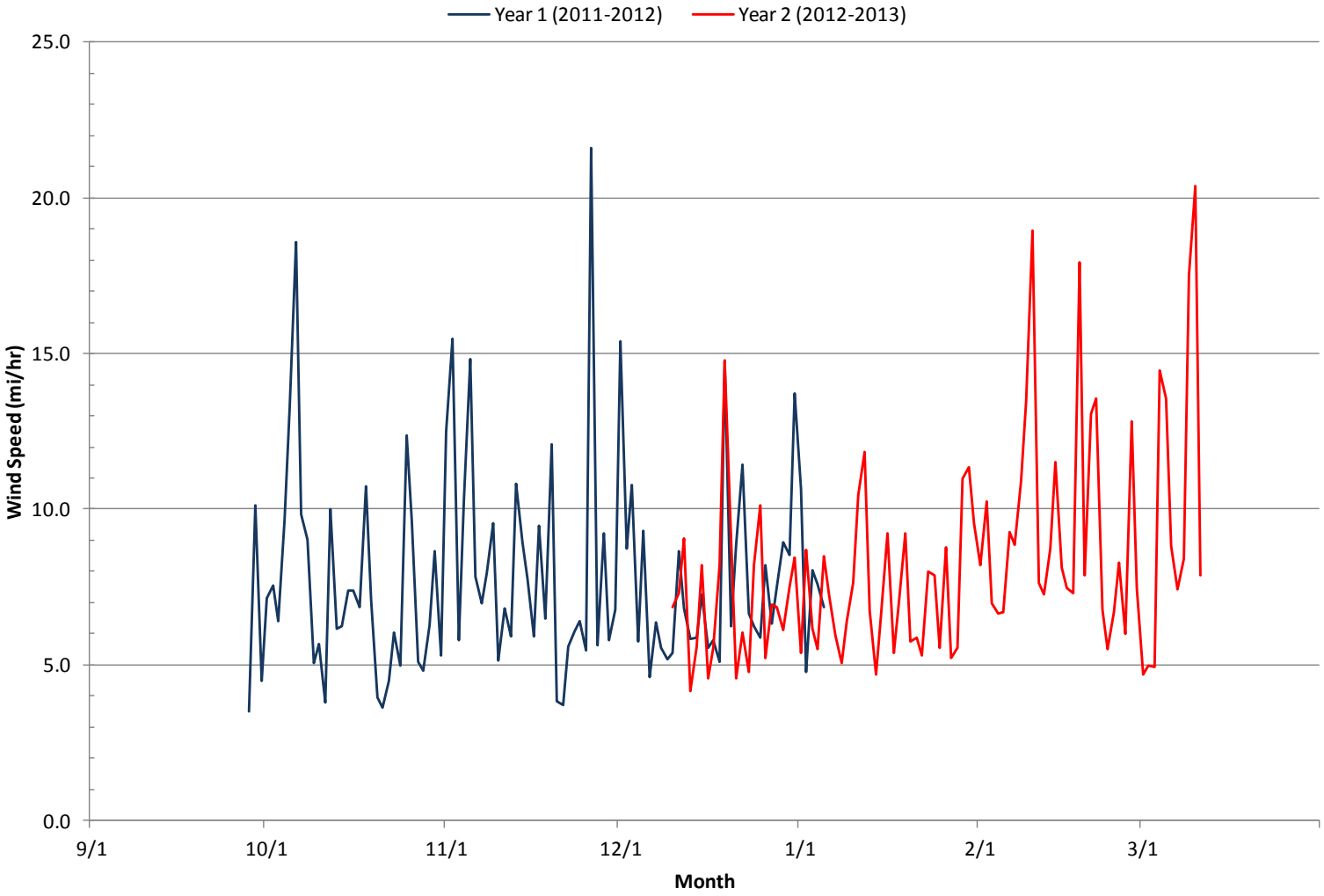
Data from High Plains Regional Climate Center

Daily Average Solar Radiation at Lexington, NE during Program Recharge Periods

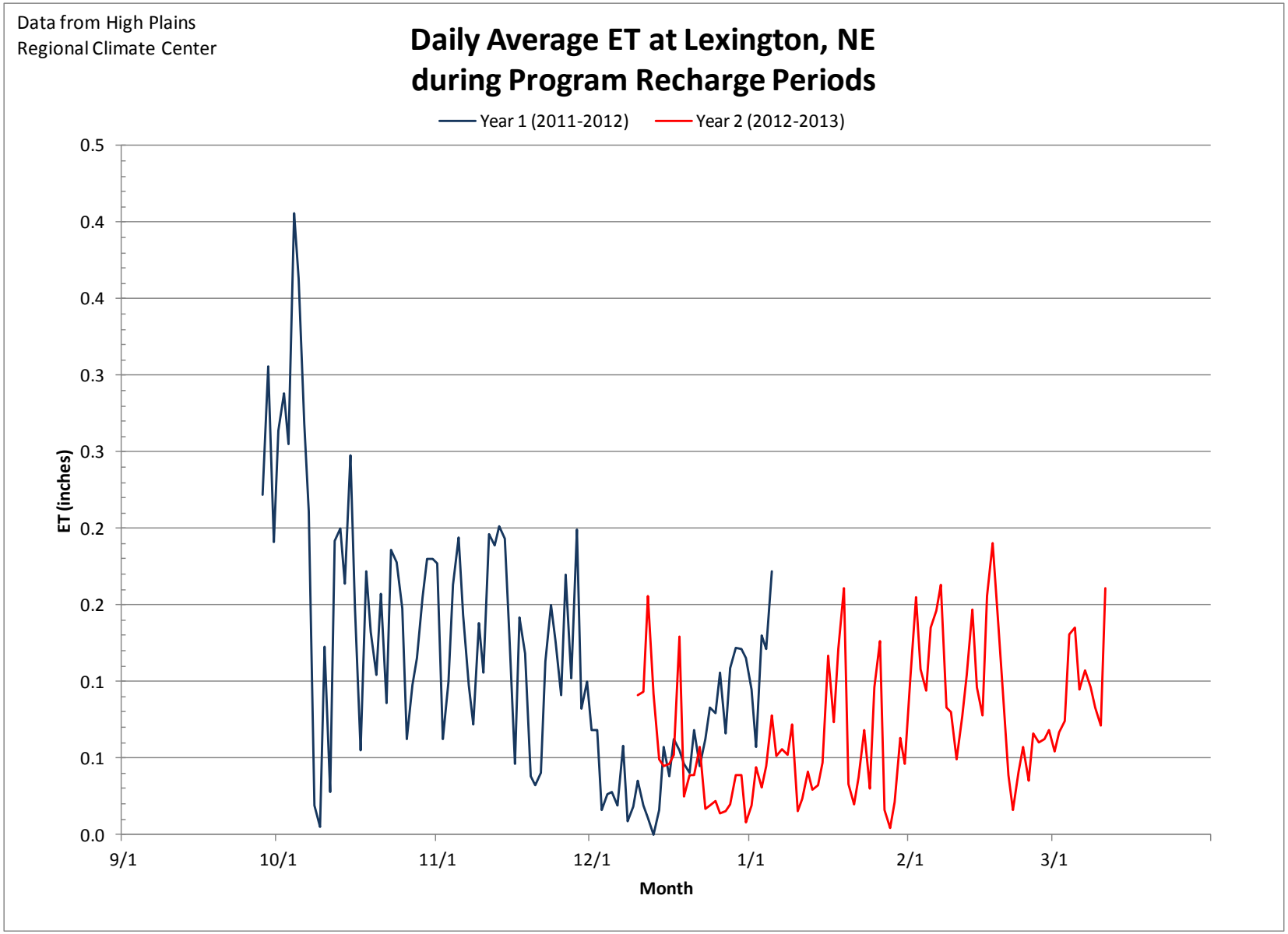


Data from High Plains Regional Climate Center

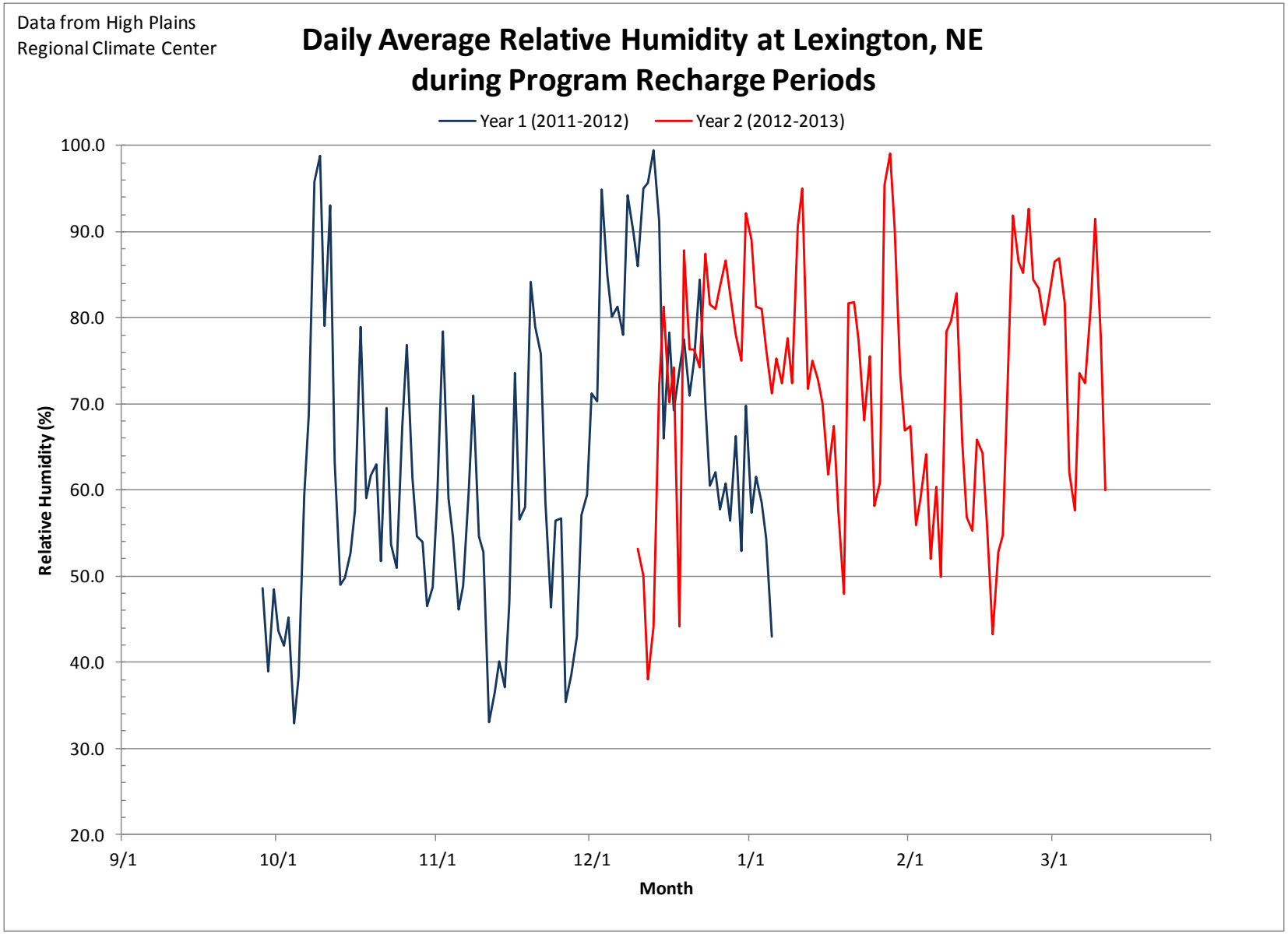
Daily Average Wind Speed at Lexington, NE during Program Recharge Periods



Data from High Plains Regional Climate Center

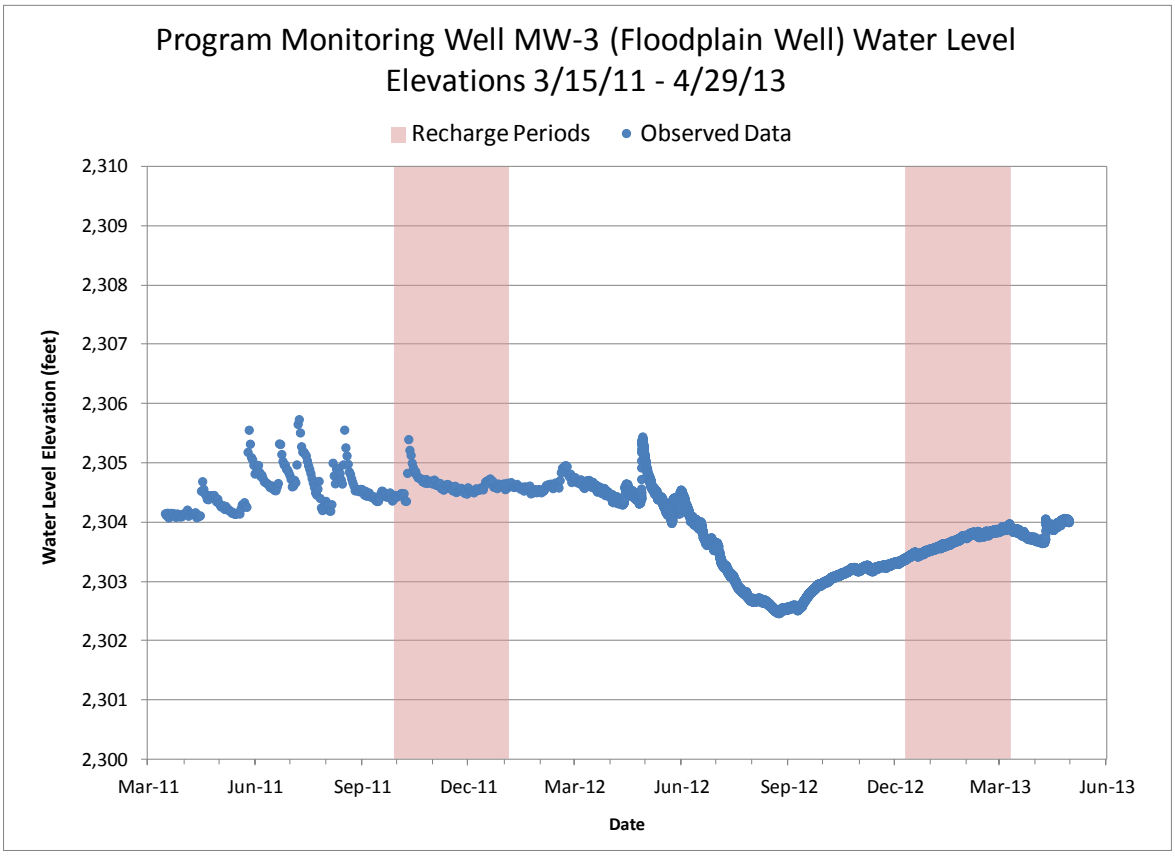


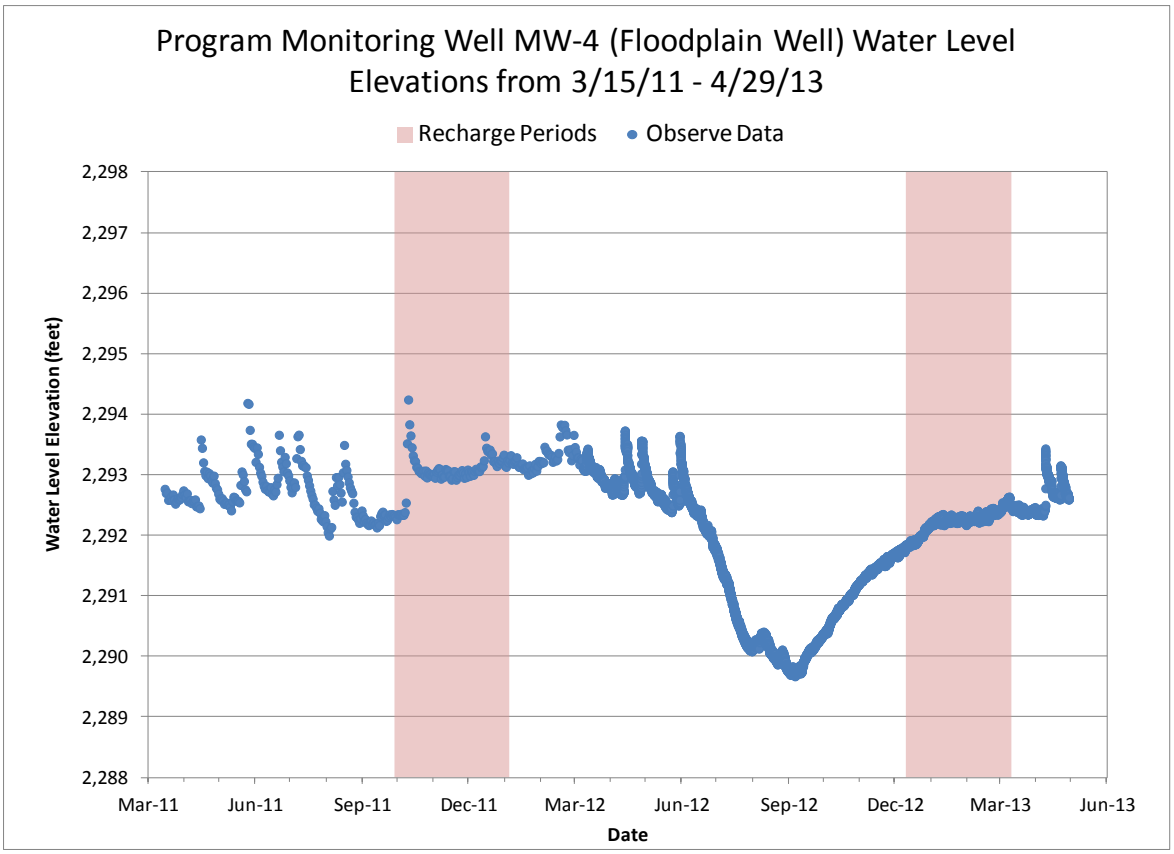
Data from High Plains Regional Climate Center



APPENDIX E:

PROGRAM MONITORING WELL DATA


Program Monitoring Well MW-3 (Floodplain Well) Water Level Elevations 3/15/11 - 4/29/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,310
2,309
2,308
2,307
2,306
2,305
2,304
2,303
2,302
2,301
2,300
Mar-11
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Mar-13
Jun-13
Date


Program Monitoring Well MW-4 (Floodplain Well) Water Level Elevations from 3/15/11 - 4/29/13
Recharge Periods
Observe Data
Water Level Elevation (feet)
2,298
2,297
2,296
2,295
2,294
2,293
2,292
2,291
2,290
2,289
2,288
Mar-11
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Mar-13
Jun-13
Date

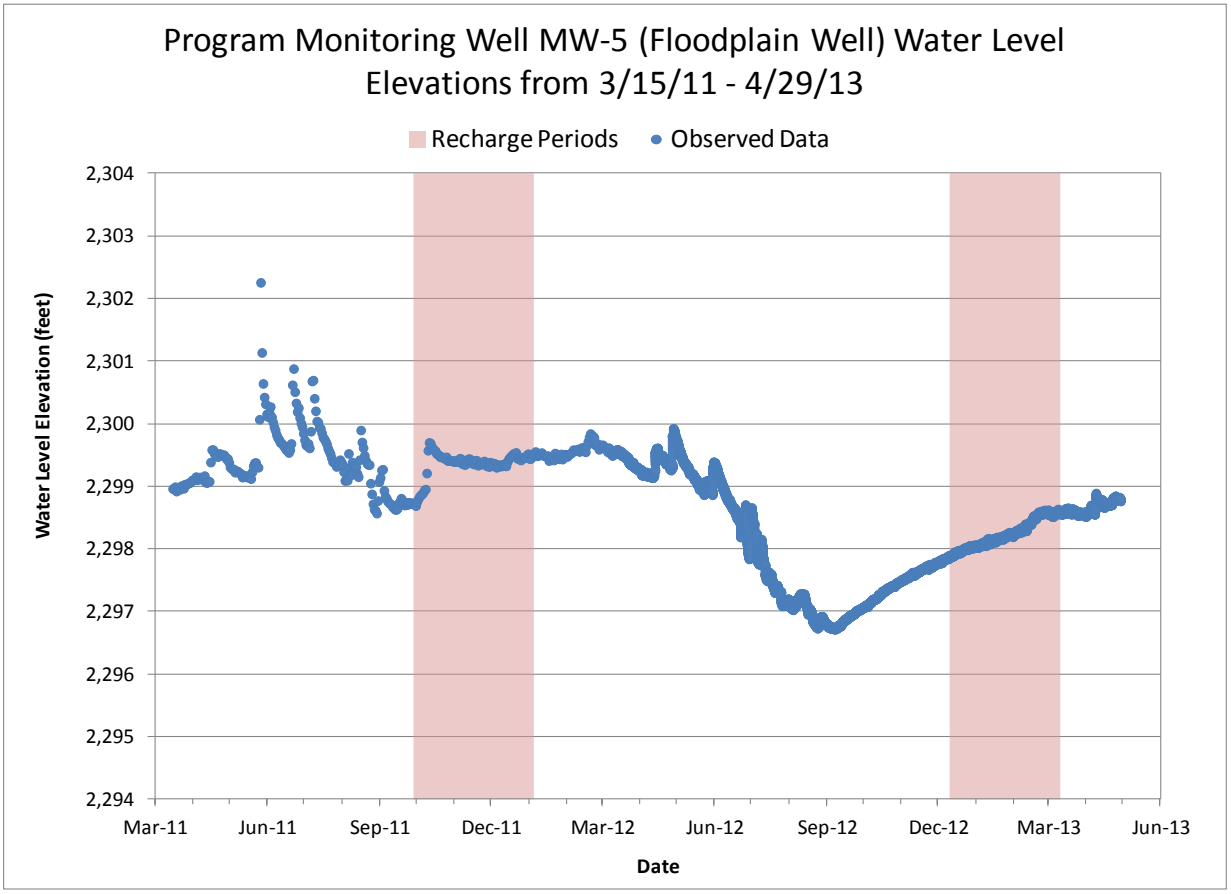


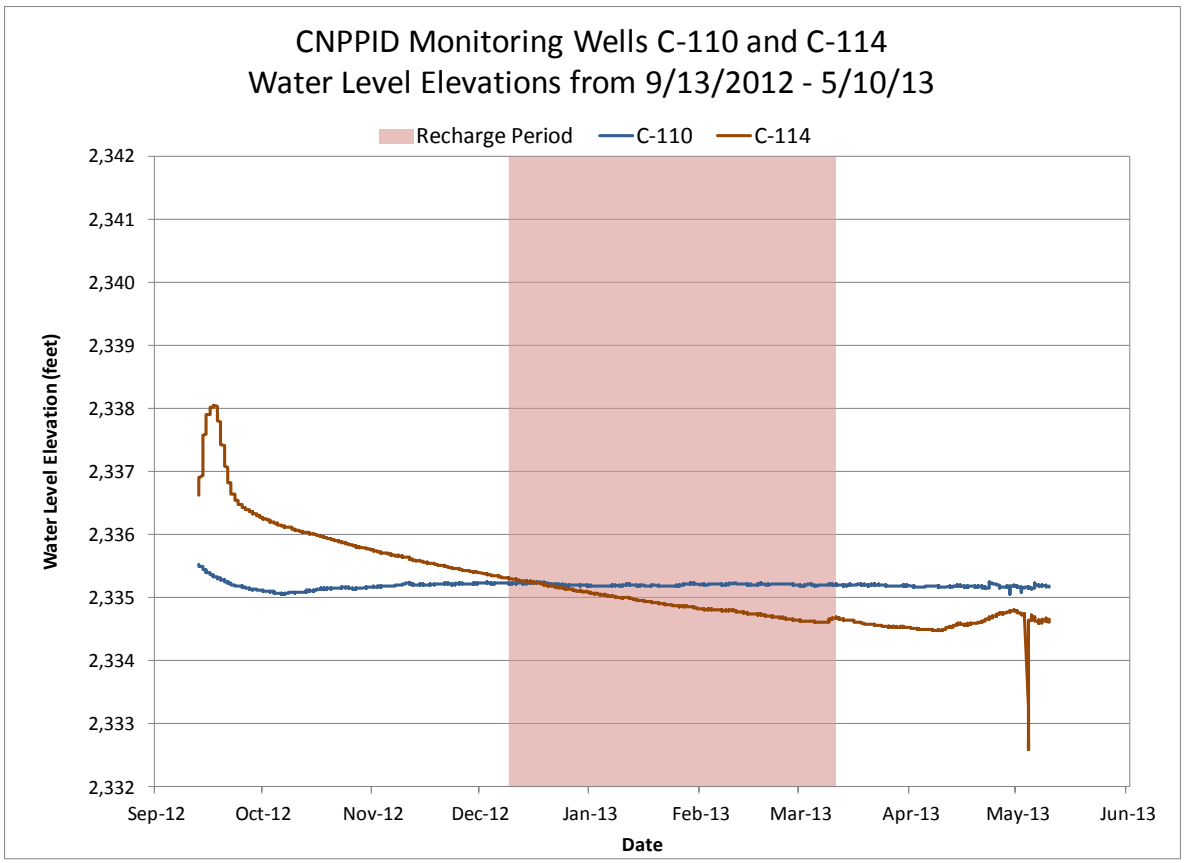
Table E-1. Water Levels in Program Monitoring Wells During Recharge Period

Date	Water Level Elevations (feet)					
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
12/9/2012	2310.2	2309.7	2303.4	2291.7	2297.9	2315.7
3/11/2013	2311.7	2310.9	2303.9	2292.5	2298.6	2318.7
Increase in level	*1.5*	*1.2*	*0.5*	*0.8*	*0.7*	*3.0*

*Recharge occurred 12/10/2012 through 3/11/2013.

APPENDIX F:

CNPPID MONITORING WELL DATA


CNPPID Monitoring Wells C-110 and C-114
Water Level Elevations from 9/13/2012 - 5/10/13
Recharge Period
C-110
C-114
Water Level Elevation (feet)
2,342
2,341
2,340
2,339
2,338
2,337
2,336
2,335
2,334
2,333
2,332
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Date

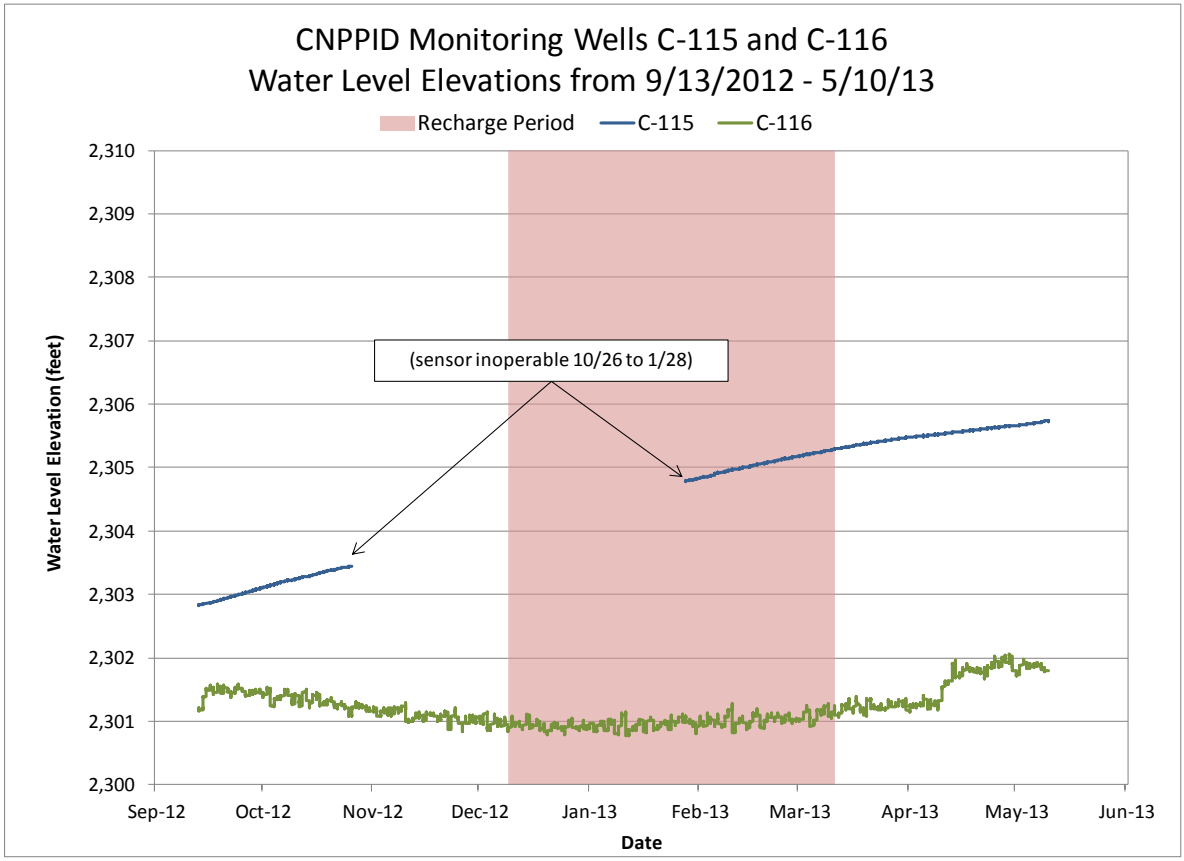

CNPPID Monitoring Wells C-115 and C-116
Water Level Elevations from 9/13/2012 - 5/10/13
Recharge Period
C-115
C-116
(sensor inoperable 10/26 to 1/28)
Water Level Elevation (feet)
2,310
2,309
2,308
2,307
2,306
2,305
2,304
2,303
2,302
2,301
2,300
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Date

Table F-1. Water Levels in CNPPID Monitoring Wells During Recharge Period

Date	Water Level Elevations (feet)							
	C-83[A]	C-94	C-97	C-102	C-110	C-114	C-115	C-116
12/9/2012	2263.8	2308.2	2316.7	2318.9	2335.2	2335.3	no data	2300.9
3/11/2013	n/a	2309.3	2318.6	2320.3	2335.2	2334.7	2305.3	2301.2
Change in level	-	*1.1*	*1.9*	*1.4*	*0.0*	*-0.6*	-	*0.3*

*Recharge occurred 12/10/2012 through 3/11/2013.

[A]Water level was below the sensor during the period of recharge.

APPENDIX G:

TRI-BASIN NRD MONITORING WELL DATA

Table G-1. Water Levels in TBNRD Elm Creek Wells During Recharge Period.

Date	Water Level Elevations (feet)					
	P-101	P-102	P-103	P-104	P-132	P-133
12/9/2012	2289.0	2286.0	2300.0	2326.3	2277.9	2278.0
3/11/2013	2290.0	2286.7	2301.3	2325.1	2278.6	2278.5
Change in level	*1.0*	*0.7*	*1.3*	*-1.2*	*0.7*	*0.5*

*Recharge occurred 12/10/2012 through 3/11/2013.

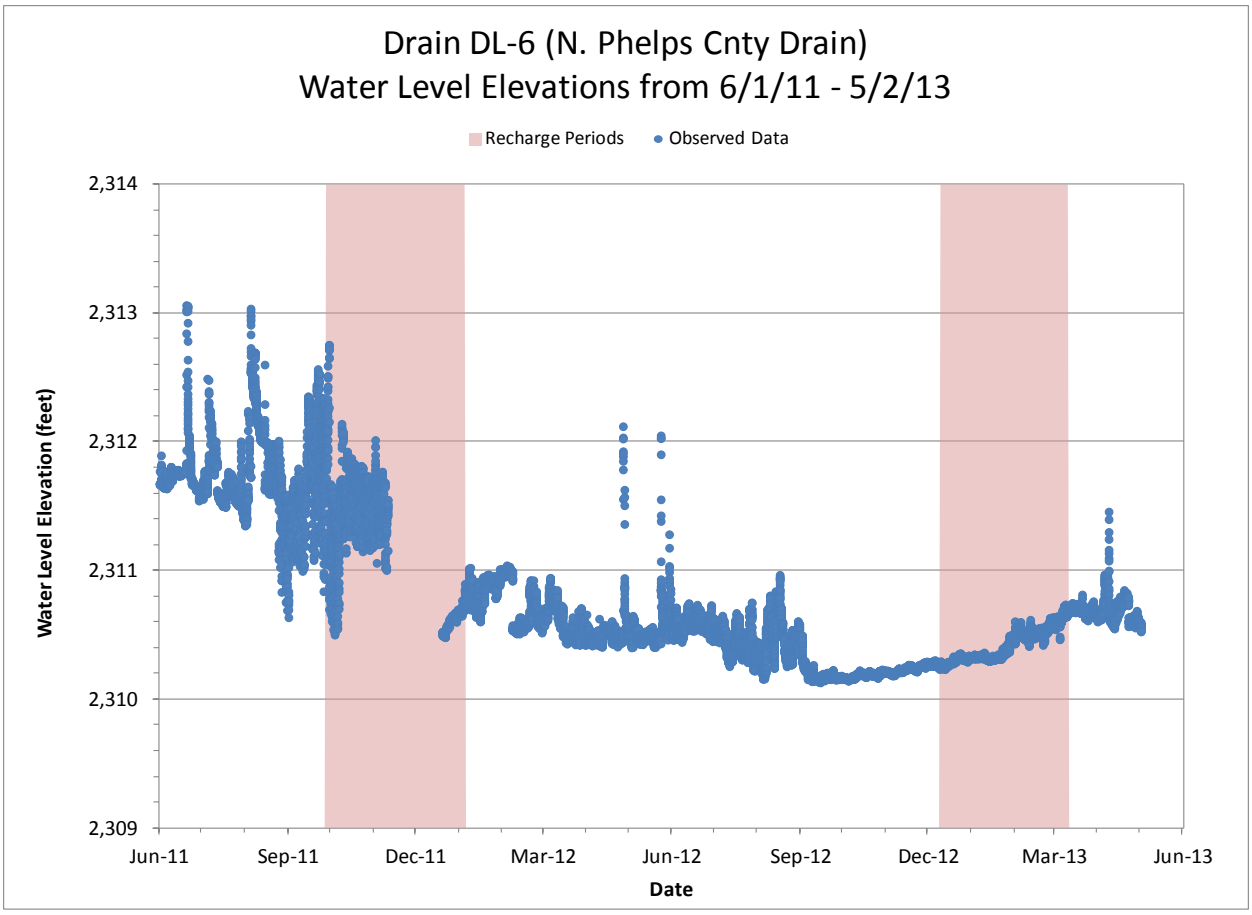
Table G-2. Water Levels in Tri-Basin NRD Overton Wells During Recharge Period

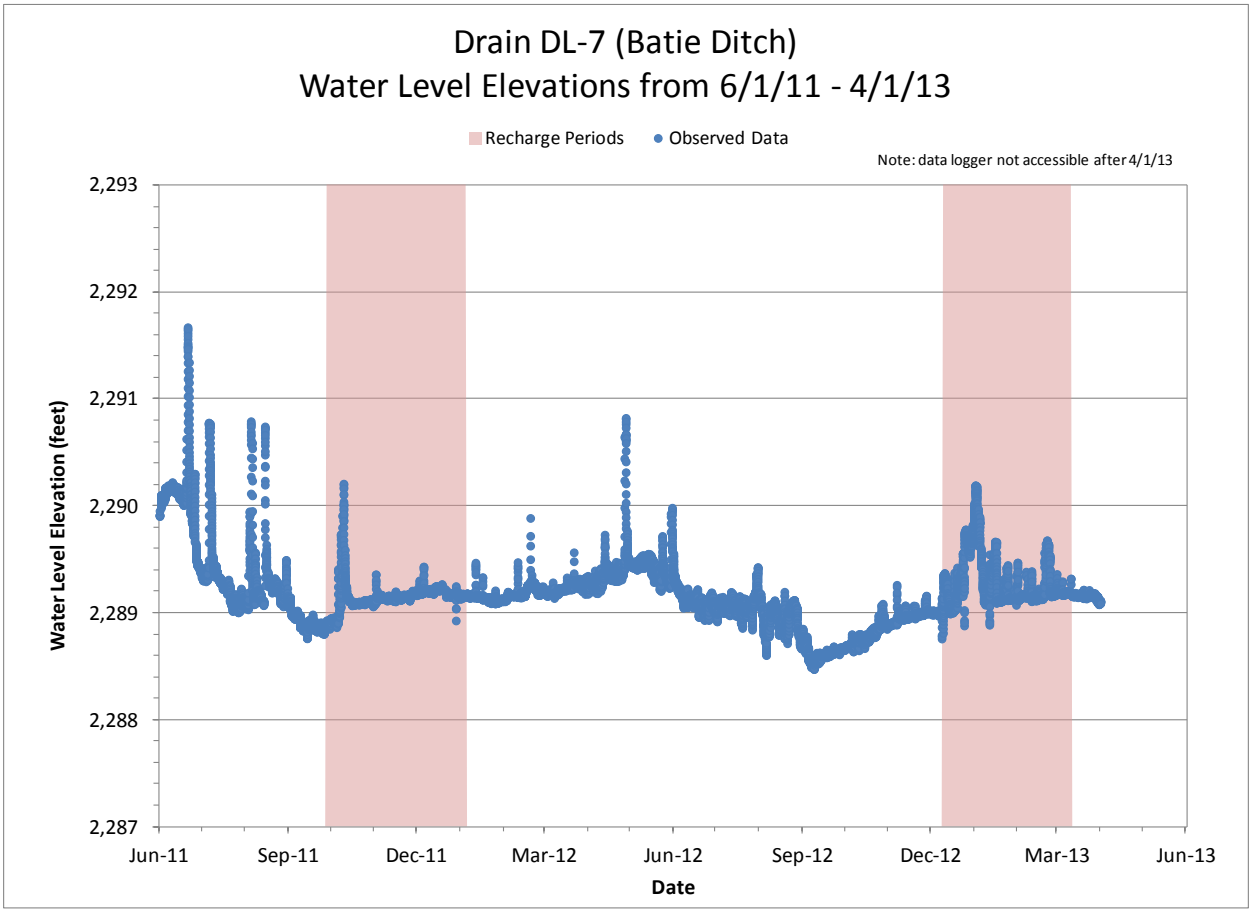
Date	Water Level Elevations (feet)		
	P-105	P-106	P-110
12/9/2012	2327.2	2334.6	2329.7
3/11/2013	2328.8	2337.0	2332.0
Increase in level	*1.6*	*2.4*	*2.3*

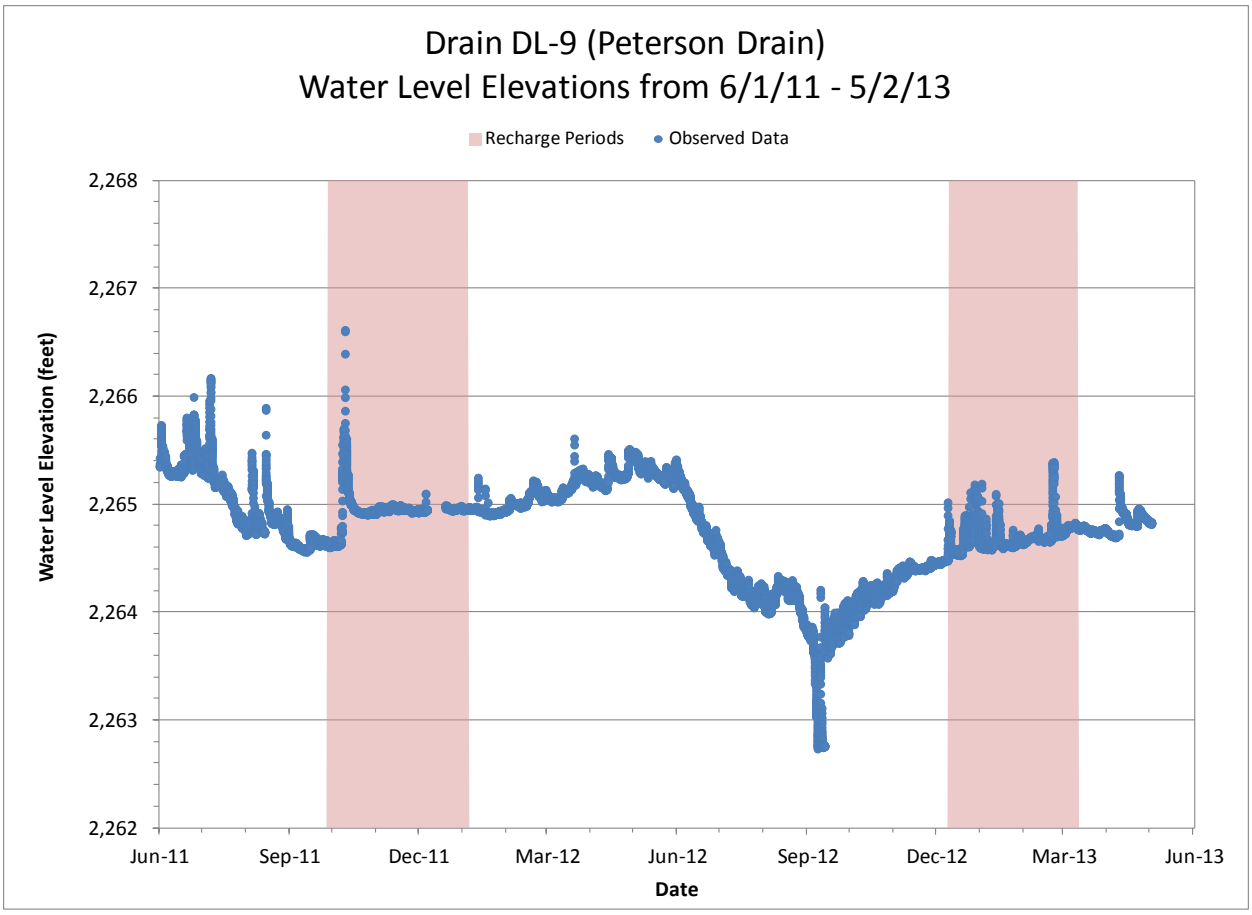
*Recharge occurred 12/10/2012 through 3/11/2013.

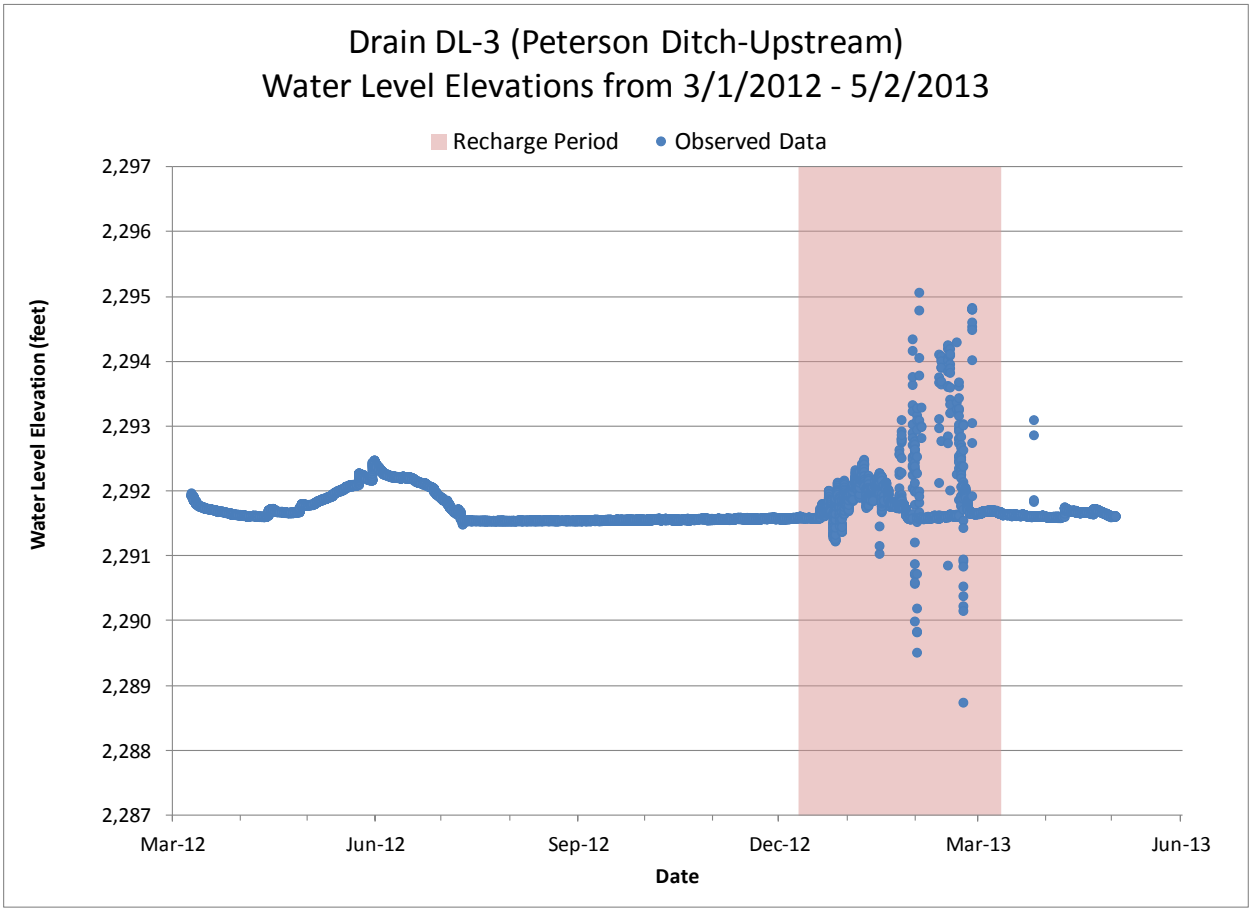
APPENDIX H:

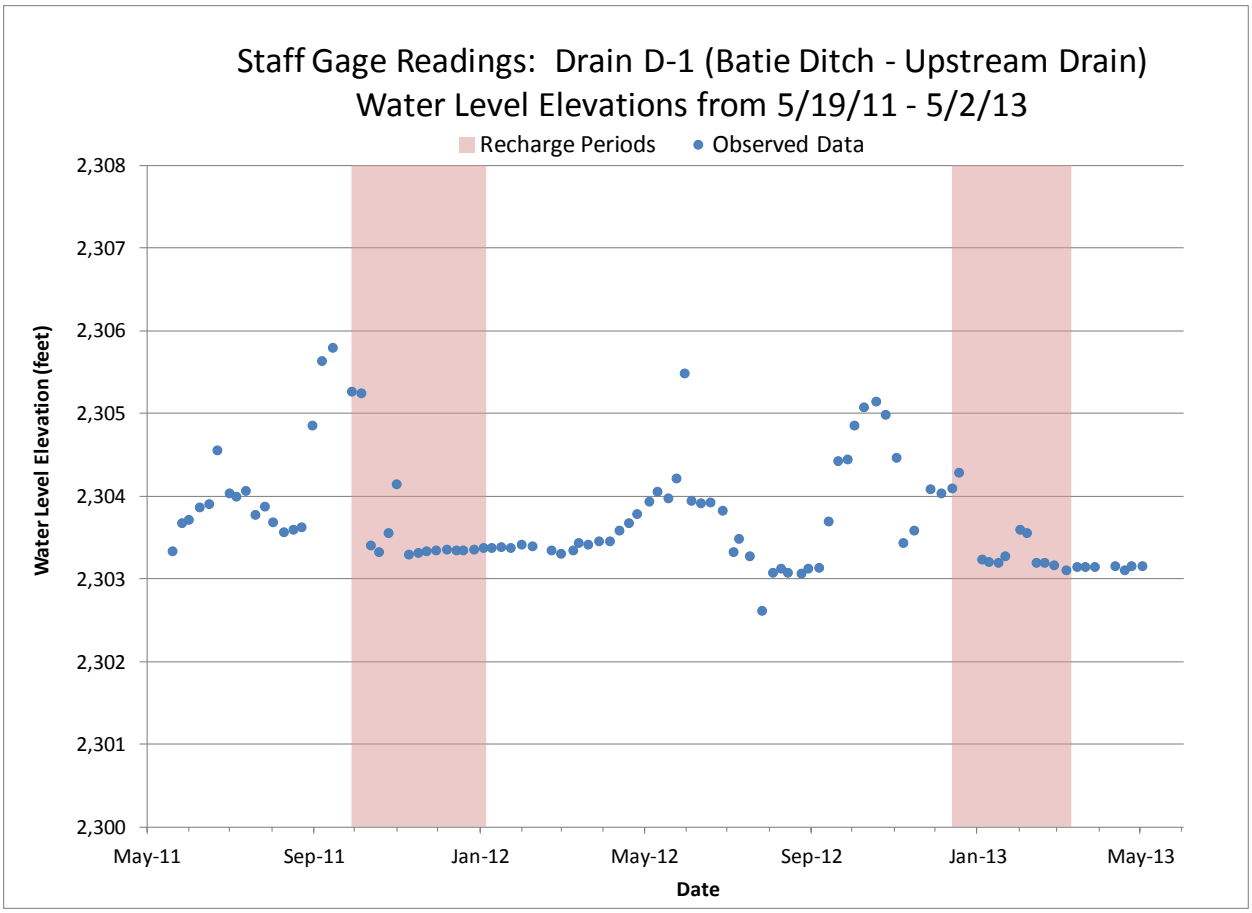
PROGRAM DRAIN MONITORING DATA

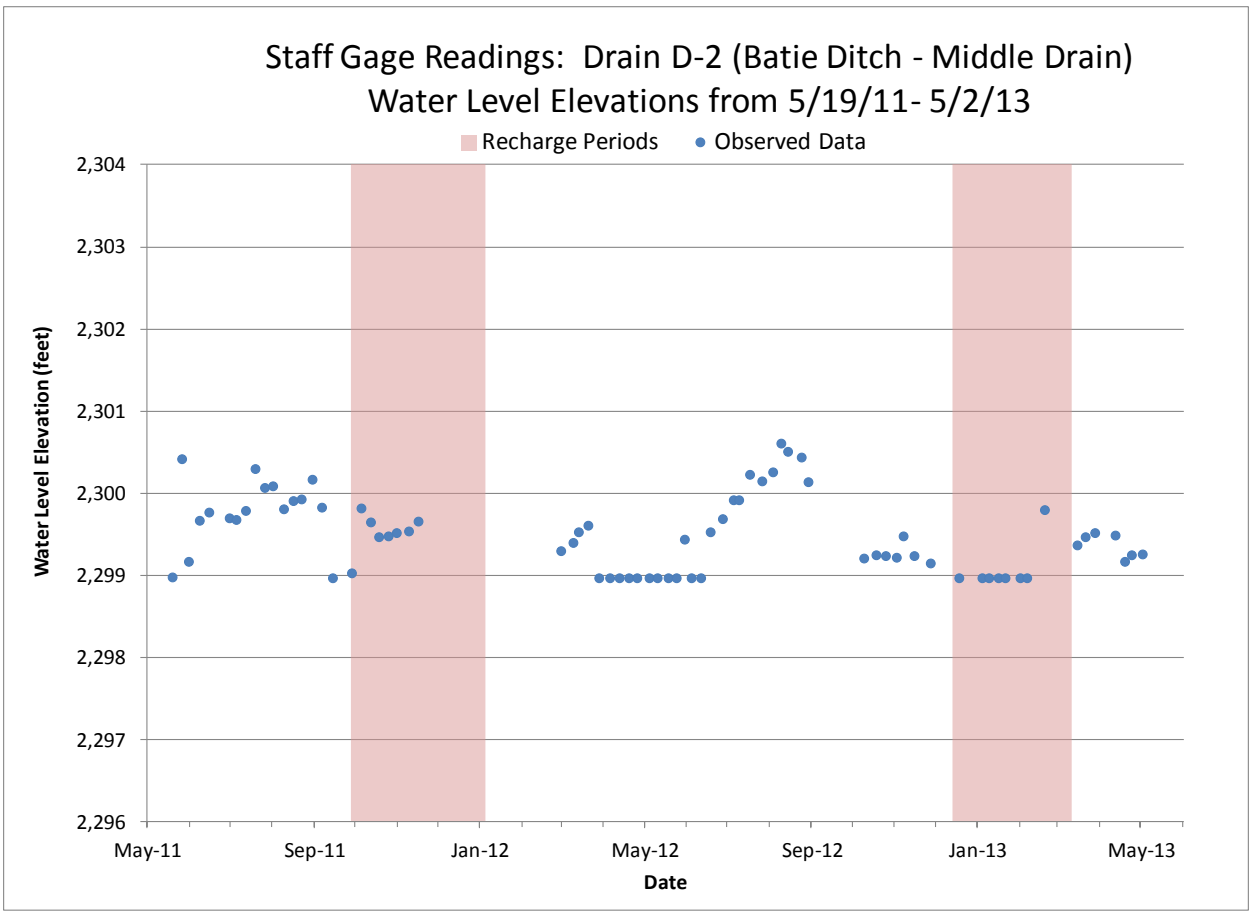

Drain DL-6 (N. Phelps Cnty Drain)
Water Level Elevations from 6/1/11 - 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,314
2,313
2,312
2,311
2,310
2,309
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Mar-13
Jun-13
Date

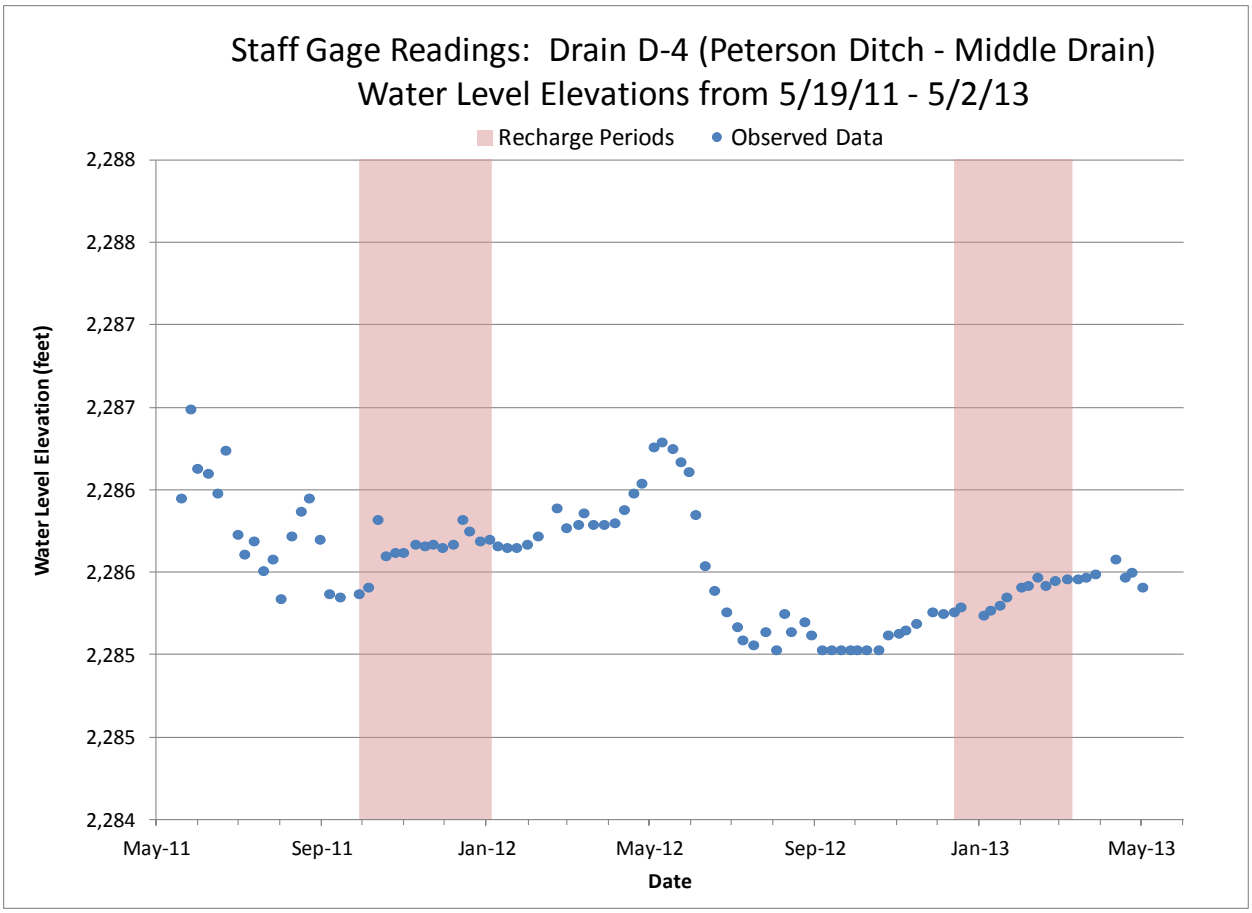

Drain DL-7 (Batie Ditch)
Water Level Elevations from 6/1/11 - 4/1/13
Recharge Periods
Observed Data
Note: data logger not accessible after 4/1/13
Water Level Elevation (feet)
2,293
2,292
2,291
2,290
2,289
2,288
2,287
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Mar-13
Jun-13
Date

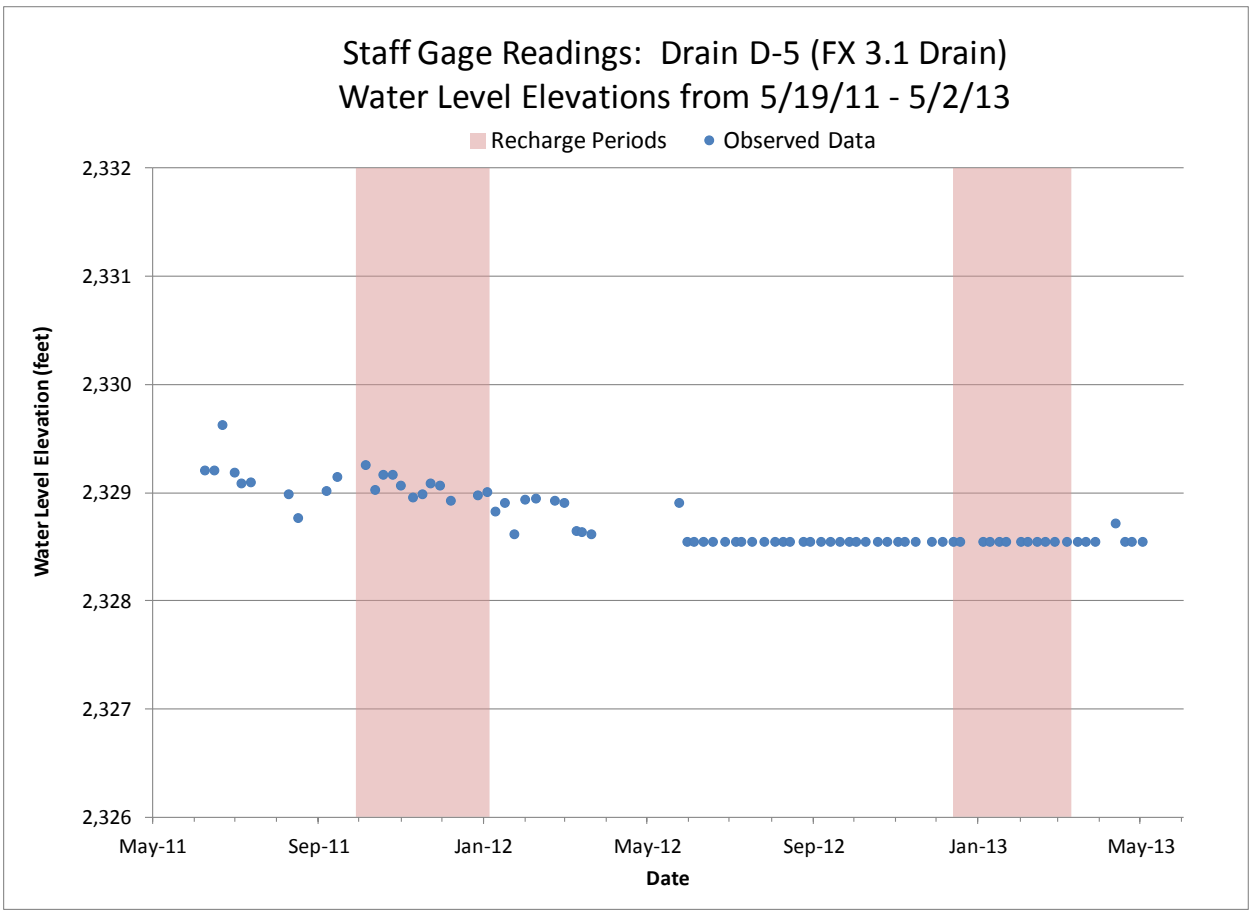

Drain DL-9 (Peterson Drain)
Water Level Elevations from 6/1/11 - 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,268
2,267
2,266
2,265
2,264
2,263
2,262
Jun-11
Sep-11
Dec-11
Mar-12
Jun-12
Sep-12
Dec-12
Mar-13
Jun-13
Date

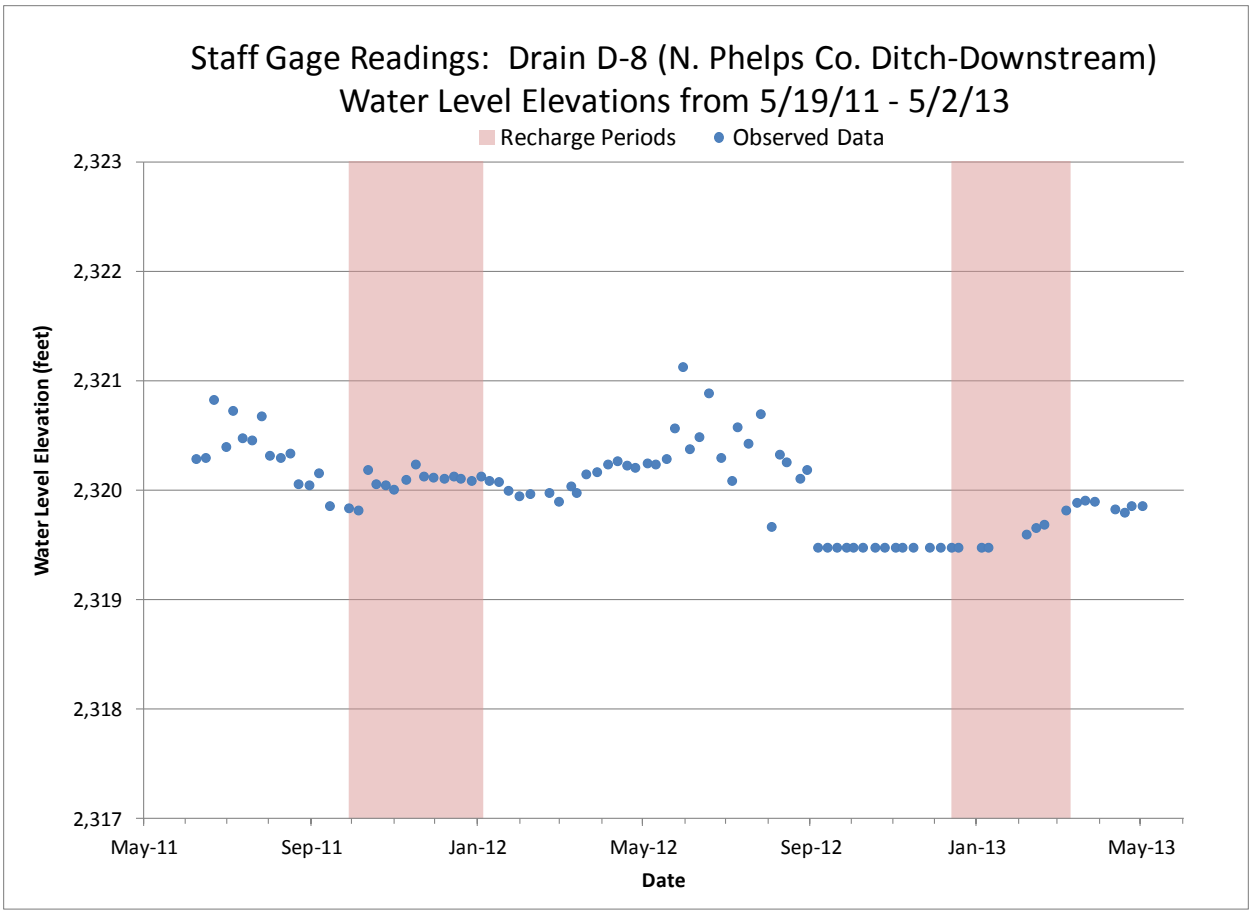

Drain DL-3 (Peterson Ditch-Upstream)
Water Level Elevations from 3/1/2012 - 5/2/2013
Recharge Period
Observed Data
Water Level Elevation (feet)
2,297
2,296
2,295
2,294
2,293
2,292
2,291
2,290
2,289
2,288
2,287
Mar-12
Jun-12
Sep-12
Dec-12
Mar-13
Jun-13
Date


Staff Gage Readings: Drain D-1 (Batie Ditch - Upstream Drain)
Water Level Elevations from 5/19/11 - 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,308
2,307
2,306
2,305
2,304
2,303
2,302
2,301
2,300
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Date


Staff Gage Readings: Drain D-2 (Batie Ditch - Middle Drain)
Water Level Elevations from 5/19/11- 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,304
2,303
2,302
2,301
2,300
2,299
2,298
2,297
2,296
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Date


Staff Gage Readings: Drain D-4 (Peterson Ditch - Middle Drain)
Water Level Elevations from 5/19/11 - 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,288
2,288
2,287
2,287
2,286
2,286
2,285
2,285
2,284
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Date


Staff Gage Readings: Drain D-5 (FX 3.1 Drain)
Water Level Elevations from 5/19/11 - 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,332
2,331
2,330
2,329
2,328
2,327
2,326
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Date


Staff Gage Readings: Drain D-8 (N. Phelps Co. Ditch-Downstream)
Water Level Elevations from 5/19/11 - 5/2/13
Recharge Periods
Observed Data
Water Level Elevation (feet)
2,323
2,322
2,321
2,320
2,319
2,318
2,317
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Date