2010 Annual Bathymetric Monitoring Report for the Ponds within the Well Fields and Cones of Depression

Platte West Water Production Facilities Project

Prepared for

Metropolitan Utilities District
Omaha, Nebraska

January 2011

2010 ANNUAL BATHYMETRIC MONITORING REPORT FOR THE PONDS WITHIN THE WELL FIELDS AND CONES OF DEPRESSION

for the

Platte West Water Production Facilities Project

Prepared for:

Metropolitan Utilities District
Omaha, Nebraska

Prepared by:

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

Project Number: 56799

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TABLE OF CONTENTS

Page

APPENDICES

APPENDIX I – Douglas County Bathymetric Monitoring Data by Pond (Figures, Photographs, Data Sheets)

LIST OF FIGURES

Figure **Following Page**

1.0 INTRODUCTION

The Metropolitan Utilities District (District) in Omaha, Nebraska, completed the construction of the Platte West Water Production Facilities Project (Project) in 2008. The Project consists of two new water supply well fields, a new water treatment plant, various water transmission pipelines, and other appurtenant facilities in Saunders and Douglas Counties, Nebraska. Because of the Project's potential to impact wetlands and watercourses during construction and operation, the District submitted a Section 404 application for approval under the Clean Water Act to the U.S. Army Corps of Engineers (Corps), Omaha District. The Corps issued the Section 404 Individual Permit for the Project on May 16, 2003, which contains permit conditions that apply to the evaluation of water levels in existing ponds in Douglas and Saunders Counties (U.S. Army Corps of Engineers 2003). As part of the terms and conditions included in the Permit, Condition Number 80 of the Permit states:

> "In the period prior to construction and operation of the well field MUD (Metropolitan Utilities District) shall complete a detailed study of each pond within the Platte West well field cone of depression for the purpose of acquiring detailed bathymetric data for each pond. This data will be updated annually and used to assess any declines in pond levels and surface area resulting from well field pumping. The Corps will consider the use of remote sensing data techniques to monitor ponds if access is denied by private landowners or if the Corps determines that remote sensing data is comparable to data collected in the field."

To accomplish this monitoring effort, a Bathymetric Monitoring Plan was developed by Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell), approved by the Corps, and implemented in 2005 (Burns & McDonnell 2005). The ponds are located in Douglas, Saunders, and a small corner of Sarpy Counties. For the purposes of this report, the ponds in Sarpy County are included with those in Douglas County. Bathymetric maps were developed in September 2004 by measuring each pond's surface water area and water depth. Estimates of water storage capacity were also calculated. In 2005, the surface water elevation of each pond was measured to establish baseline seasonal surface water elevation trends. These surface water elevations were used to identify seasonal variation and water depths in each pond. Surface water elevations were originally measured using staff gauges installed in each pond. Shifts in several staff gauge positions occurred due to ice formation and movement during the 2004-2005 winter months. As a result of these weather-induced movements, permanent benchmarks were established near each pond, above the ordinary high water mark (OHWM), during the early summer of 2005. The OHWM is typically defined as the visible line on the shore or bank of a pond created by changes in surface water elevation during a year of normal precipitation or average climatic conditions. The elevation of each benchmark was determined using a survey-grade Global Positioning System (GPS). These permanent benchmarks became the primary method used to measure surface water elevations in all ponds.

The Bathymetric Monitoring Plan was designed to measure how surface water elevations typically change from season to season. By conducting baseline sampling before Project operations began, a range of seasonal and annual fluctuations in surface water elevation attributable to factors such as climate, soil hydrology, watershed runoff changes, land use activities, or other human influences were documented and recorded. This seasonal surface water elevation data will be used to identify any effect Project operation may potentially have on the surface water elevation of a specific pond.

Baseline surface water elevation trends and ranges were established for each pond. Baseline conditions cover the time period from September 2004 through March 2008. Any deviation in a given pond’s seasonal surface water elevation may be due to factors such as changes in adjacent land management activities, landowner activities, Project operations, climate, or other factors. These changes could result in physical effects that may alter groundwater availability, change pond surface water elevations, or affect surface water runoff from the contributing watershed. Individual landowners occasionally dredge or otherwise alter a pond, resulting in a change to the pond’s surface water area and elevation, water storage capacity, or other bathymetric characteristics. When a landowner significantly alters a pond by dredging, altering inflows, changing land uses, or other activities, the pond’s bathymetric characteristics (surface water area and water depth) will be resurveyed. These needs will be handled on a case-by-case basis with the concurrence of the landowner, the District, and the Corps.

Fluctuations in pond surface water elevations, regardless of cause, can influence aquatic organisms in many ways. Flooding can destroy some fish spawning habitat while creating new habitat for other fish. Additionally, low pond surface water elevations can limit available spawning habitat. As pond surface water elevation levels decrease during the summer months, water temperatures typically increase, and dissolved oxygen levels decrease, which may adversely affect many aquatic organisms. During winter months, lower water storage volumes have the potential to restrict the area in which fish can over-winter, likely affecting survivability. These fluctuations have the potential to lead to increased fish disease and excessive aquatic vegetation growth. Because of the potential to influence pond life, monitoring the fluctuations in pond surface water elevation is an important aspect of the Project.

This monitoring report summarizes the data collected during the 2010 monitoring efforts (March, August, September, and October) and provides some comparisons and statistical analysis of the water level elevations.

1.1 STUDY AREA

The Project includes the two new water supply well fields adjacent to the Platte River. The land surrounding or adjacent to the well fields is projected to potentially experience some groundwater drawdown during Project operation. Groundwater modeling is conducted annually to incorporate each year's data collected from the monitoring and production wells (HDR 2011). The groundwater model is able to predict the area of land surrounding the well fields that is expected to experience a one-foot drawdown of local groundwater during Project operation. These areas are designated as "cones of depression" and are larger than the well fields. The 2010 projected cones of depression are included in Figures 2-1 and 2-2.

At the request of the District, Burns & McDonnell contacted all landowners located within the originally modeled cones of depression (Burns & McDonnell 2005) to request permission to access their property; access to the well fields is always available since the District owns these land areas in fee title. Burns & McDonnell originally obtained permission to access 47 ponds to conduct the bathymetric surveys and monitor water level elevations. Currently, a total of 46 ponds are monitored annually.

2.0 SAMPLING METHODOLOGY

2.1 BATHYMETRIC MAPPING

The initial bathymetric mapping and baseline data collection were conducted in September 2004 for 45 ponds in the Platte West well fields and cones of depression in Douglas and Saunders Counties (Figures 2-1 and 2-2). Ponds located in Douglas and Sarpy Counties have a “DG” designation before the pond number. In Saunders County, ponds have a “SN” designation before the pond number. One pond (Pond SN-16) in Saunders County that had a very low water level in 2004 was not completely surveyed. Two additional ponds, Pond DG-11 in Douglas County and Pond SN-34 in Saunders County, were overlooked during the initial bathymetric surveys conducted in 2004. Bathymetric mapping of Ponds SN-16 and SN-34 was completed in September 2005 and annual monitoring has taken place annually since then. In addition, Pond DG-09 was added to the list of monitored ponds at the request of the landowner during the summer of 2006 and was first surveyed in October 2006.

Bathymetric mapping was completed using a boat-mounted, strip-chart recording sonar (Unimetrics model SH 20/20A) for all ponds except Ponds SN-16, SN-34, and DG-09. Ponds SN-16, SN-34, and DG-09 were mapped using a boat-mounted, integrated depth sounder with 1-cm precision (Seafloor System model Hydrolite). Both methods of bathymetric survey also used a Global Positioning System (GPS) with sub-meter accuracy. In most cases, each bathymetric cross-section was recorded as the boat was piloted across a pond at a constant speed using an electric motor. If a pond was too shallow to easily use the small boat and recording sonar, cross-section transects were waded on foot, and water depths were recorded at fixed intervals along the transect using a water depth pole. These bathymetric data were used to develop water depth contour maps (Burns & McDonnell 2005, 2006).

Using the collected bathymetric data, the total surface area and water storage volume (area capacity) for each pond were estimated. The relationship between an individual pond’s water depth and surface area in acres, and between the water depth and water storage capacity or volume in acre-feet, were then calculated and plotted (Burns & McDonnell 2005, 2006). Finally, the point at which each pond’s surface water elevation was equal to zero on the map has been adjusted to correspond to the measured OHWM of each pond. The OHWM was used because it is a repeatedly identifiable elevation for any pond.

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0 0.25 0.5 0.75 1 Miles

N

Source: Western Air Maps 2008 Aerial Photography
and 2010 NAIP Aerial Photography

Burns & McDonnell SINCE 1898

Figure 2-1
Locations of Monitoring Wells, Monitored Ponds
and Permanent Benchmarks in Douglas County
Platte West Water Production
Facilities Project
Douglas County, Nebraska

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0 0.25 0.5 0.75 1 Miles

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Source: Western Air Maps 2008 Aerial Photography

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Figure 2-2
Locations of Monitoring Wells, Monitored Ponds and Permanent Benchmarks in Saunders County
Platte West Water Production Facilities Project
Saunders County, Nebraska

The bathymetric field survey data from 2004 were adjusted to each pond's OHWM to provide a standard from which calculations to determine each pond's normal fluctuation in the surface water elevation (pre-well field operation), surface area, and water storage volume are based. In some cases, the OHWM for larger ponds was correlated with and confirmed using aerial photography.

2.2 WATER LEVEL ELEVATION MONITORING OF PONDS

2.2.1 Staff Gauge Monitoring Plan

Staff gauges were initially installed in each surveyed and mapped pond in 2004 to facilitate the seasonal acquisition of surface water elevations. In most cases, the staff gauges were calibrated to the OHWM. In early 2005, it became apparent that the staff gauges could undergo shifts in position or orientation due to a variety or combination of events, including pond freezing and thawing, ice movement during the winter months, siltation, or strong prevailing winds. During the period of 2006 to 2009, most of the staff gauges fell over or shifted due to winter weather conditions and were removed. In March 2010, all remaining staff gauges were manually removed.

2.2.2 Permanent Benchmark Monitoring Plan

To compensate for the shifting staff gauges, permanent benchmarks were established in June 2005 adjacent to each pond above the OHWM. The location and elevation of each permanent benchmark was recorded using a survey-grade GPS (Trimble 5700 RTK GPS unit). In some cases, one benchmark was used for multiple ponds that were in close proximity to each other. Each benchmark is a permanent concrete marker placed in the ground near the edge of the pond above the OHWM. Contact is established and maintained with each designated contact landowner, to the best extent practicable, to assist in documenting any modifications made to ponds that could affect the surface water elevations or water storage capacity.

Surface water elevations were measured four times annually (March, August, September, and October) using the permanent benchmarks according to the methods described in the 2005 Bathymetric Monitoring Report that was approved by the Corps (Burns & McDonnell 2006). These methods include using the established permanent benchmarks to measure surface water elevations with a surveyor's level mounted on a tripod and a telescoping 25-foot rod graduated in tenths of feet placed at the water's edge. The water level elevation at each pond is calculated by adding the height of the surveyor's level above the permanent benchmark (the "plus" value in the ledger) to the known benchmark elevation and then subtracting the height of the surveyor's level from the water’s edge (the “minus” value in the ledger) from that value. These height values are taken by viewing the measurement on the telescoping rod through the surveyor’s level placed on the benchmark and at the water’s edge, respectively.

2.2.3 Landowner Handouts

Landowners are provided with an annual summary of staff gauge readings, permanent benchmark elevation(s), and surface water level reading(s) of their pond(s) from the monitoring conducted. All pond elevation data will continue to be provided annually to each landowner for their individual pond(s) during Project operation.

2.3 HYDROLOGICAL MONITORING

Several different types of hydrological data are being collected and analyzed in addition to the pond water level elevations. This hydrological data is used to document the existing water table and the potential effect Project operation may have.

2.3.1 Groundwater Monitoring Wells

Permanent monitoring wells designed to measure groundwater levels before and during Project operation have been installed at specific locations in and around the Douglas County and Saunders County well fields and cones of depression (Figures 2-1 through 2-4). The location of these groundwater monitoring wells was recorded using GPS. Data loggers have been installed at the monitoring wells so that groundwater levels can be measured and recorded on a daily basis. Groundwater data from the monitoring wells will be correlated with the other hydrological data that is being collected to identify and evaluate if any Project-induced groundwater system changes are occurring.

2.3.2 Production Wells

The Project production wells that are pumped to provide raw water to the new water treatment facility are located in the Douglas County and Saunders County well fields (Figures 2-1 and 2-2). These water production wells are fitted with data loggers that measure and record the depth to the water table at each well head whether the well is actively being pumped or not. In addition, the rate at which each well is being pumped is measured in millions of gallons per day (MGD). The location of these water production wells was recorded using GPS. Groundwater data from the water production wells (production rate, drawdown, cone of depression, etc.) during Project operation will be correlated with the other hydrological data that is being collected to evaluate if Project-induced changes to ponds are occurring.

2.3.3 Other Hydrological Data

Additional hydrological data is also collected during the annual monitoring effort each year. This additional data includes monthly total precipitation, monthly average ambient air temperature, and stream gauge data for the Platte and Elkhorn Rivers.

2.4 DATA ANALYSIS

The baseline bathymetric monitoring and hydrological data has been accumulated along with information provided by individual landowners to provide information regarding normal variation in pond water levels. The baseline data will be compared to annual data collected each year during Project operation to determine if the Project is having an effect on pond water levels.

2.4.1 Bathymetric Monitoring Data

The 2010 bathymetric monitoring data reflects operational Project conditions for the ponds being monitored in the Project area. Data collected is used to determine the seasonal and annual variation in surface water elevation of the monitored ponds under pre-Project conditions and during Project operations. All of the bathymetric data is input into a Microsoft® Access database. This database is designed specifically for this Project to accommodate seasons and years of data.

The database can generate reports to be delivered in person during the monitoring efforts or mailed to landowners listing the following: surface water elevations for a given time frame, the upcoming monitoring schedule, and Burns & McDonnell's contact information. Additionally, a report can be generated that will list the data for internal QA/QC purposes. Fluctuations in surface water elevations measured with permanent benchmarks over time are plotted in graphical form for the time period of March through October 2010 (Appendices I and II). Data from March through October 2010 are also displayed in graphical form that shows these data relative to the maximum and minimum baseline surface water elevations.

2.4.2 Statistical Analysis

The 2010 Annual Bathymetric Monitoring Report is the first annual report that includes statistical analysis of the water level elevation data. Upon the completion of the 2010 monitoring efforts, a sufficient number of sampling efforts have taken place since operation began to allow for an evaluation of the water level elevation data using statistical analysis. To determine whether any observed changes in the water level elevation data are significant, a statistical analysis is conducted to compare the baseline data, which captured some of the natural variation in the pond water level elevations, to the operational data to determine if project operation is having any significant effect on the ponds.

A paired sample t-test was used to assess the statistical significance of the observed water level elevations in 2010 when compared to the baseline water level elevations collected. The statistical add-on package to Microsoft® Excel that was utilized for this analysis is the EZAnalyze program (www.ezanalyze.com). The paired sample t-test is able to compare water level elevation data obtained during project operation against the baseline water level elevation data. The averages of the baseline and operational data are compared and any difference is evaluated to determine if there is a significant difference between the two averages. A significant difference indicates a mathematical difference but not necessarily a biological change. For example, a significant difference in water level elevation of one foot between baseline and operational averages may have very little biological effect in a pond that is 20 feet deep. However, a one foot difference in water level elevation between baseline and operational averages, even though mathematically non-significant, may be biologically significant to a pond that is only three feet deep. The analysis of the pond water level elevation data will take into account both the mathematical significance of a difference as well as the biological significance of any difference in pond water level elevations.

2.4.3 Hydrological Data

Several different types of hydrological data have been collected by the District to supplement the bathymetric monitoring data. Groundwater data has been collected from groundwater monitoring wells placed in and around the well fields and the surrounding cones of depression. The Project production wells that provide raw water to the water treatment facility for Project operation are located in the Douglas County and Saunders County well fields (Figures 2-3 and 2-4). The rate at which each well is being pumped is measured in MGD. Groundwater data from the water production wells during Project operation are correlated with the other hydrological data that is being collected to evaluate if Project-induced changes to ponds are occurring.

Elkhorn River at Waterloo, Nebraska (U.S. Geological Survey (USGS) Stream Gauge No. 06800500) and Platte River at Venice, Nebraska (USGS Stream Gauge No. 06796550) stream gauge data were also obtained (USGS 2010a and 2010b). The installation of the Platte River stream gauge occurred as a result the Corps Section 404 Individual Permit conditions using funding provided by the District.

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Figure 2-3
Well Locations for the
Douglas County Well Field
Metropolitan Utilities District

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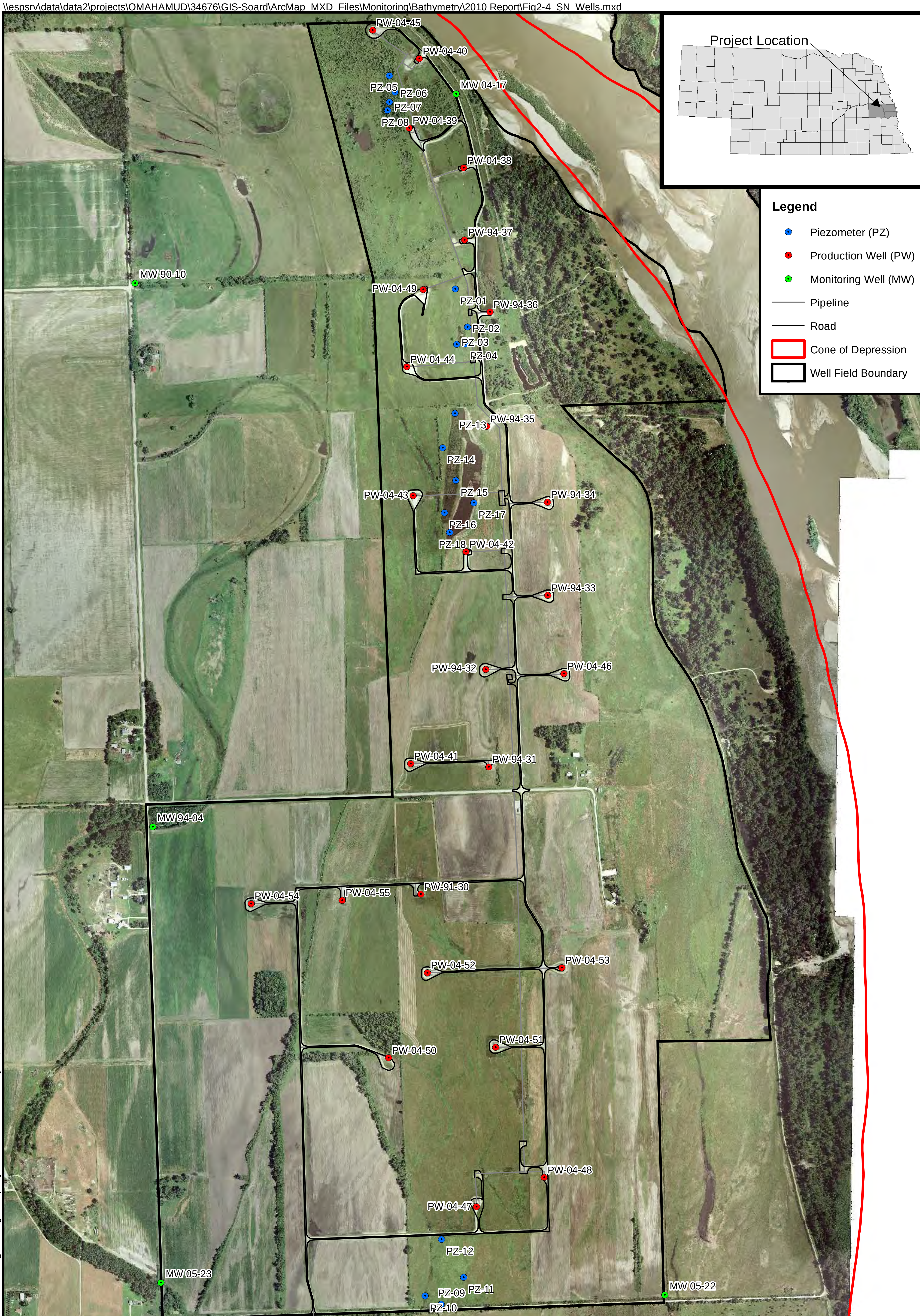

feet
0 250 500 1,000

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Source: Western Air Maps 2008 Aerial Photography
and 2010 NAIP Aerial Photography

Burns & McDonnell
SINCE 1898

Figure 2-4
Well Locations for the
Saunders County Well Field
Metropolitan Utilities District

Annual precipitation and ambient air temperature data collected by the National Weather Service at the Fremont Municipal Airport were obtained and analyzed to help explain variations in water levels that occur season-to-season and year-to-year in some or all of the ponds (Weather Underground 2010). Historical precipitation and ambient air temperature data (1971 through 2000) was obtained from the National Oceanic & Atmospheric Administration's (NOAA) National Climatic Data Center (NOAA 2010). Changes in the amount of precipitation or other hydrological data in any given year can affect water levels through direct accumulation in the pond and through surface water runoff.

3.0 RESULTS

3.1 PONDS MONITORED

The baseline monitoring effort documented the seasonal variation of 47 ponds within the Project cones of depression. Two of these ponds, SN-33 and SN-34, in Saunders County are no longer being monitored. Pond SN-33 is no longer monitored at the landowner's request. Pond SN-34 is no longer monitored because the landowner altered the pond so that it was connected to Pond SN-25 in 2008. For the period of post-operational monitoring included in this report, 30 of the 46 monitored ponds were located in Douglas County, 9 were located in Saunders County, and 6 were located in Sarpy County (Figures 2-1 and 2-2). As mentioned earlier, data for the 6 ponds in Sarpy County are included with the Douglas County data.

3.2 LANDOWNER ALTERATIONS

Discussions with individual landowners confirmed that ponds may occasionally be dredged or otherwise modified. Several alterations to the monitored ponds were again observed or reported by landowners in 2010. All of the alterations were done at the landowner's discretion without Burns & McDonnell's or the District's consultation. Notification of alterations or discovery of completed alterations occurred during routine landowner communications prior to or during monitoring visits.

- Ponds SN-24 and SN-25 were connected by the removal of a portion of the land that was the south shore of SN-24 and the north shore of Pond SN-25 during the period of July-August 2010. This results in a change to the data reporting as SN24 and SN-25 are now, effectively, the same pond.
- The landowner indicated that water was pumped from Pond SN-26 into Pond SN-25 in July 2010 for a period of "a few weeks".
- Pond DG-11 was excavated using a tracked excavator in March 2009 to increase the depth of the pond and remove cattails. An external pump, supplying a constant source of water, was operational during the non-freezing periods of 2009 and 2010. After the March 2010 monitoring effort, a 1.5-horsepower (HP) pump replaced a 2 HP pump.
- The benchmark for Pond DG-23A was removed by a tractor-pulled disc during landowner activities between the March and August 2010 monitoring events. As a result, no water level elevation data was recorded in August 2010. A new benchmark was installed prior to the September 2010 monitoring and the location and elevation of the new benchmark were

recorded with the RTK GPS unit. Bathymetric analysis included in this report was completed without August 2010 data for this pond.

3.3 BATHYMETRIC MONITORING RESULTS

Under baseline conditions, a majority of the ponds experienced surface water elevation trends that included relatively high March levels, a decrease in August and September, followed by an increase October. The water level elevation increase in October typically did not reach March extents. The following general trends in surface water elevations were observed in 2010:

- Many ponds experienced very high March surface water elevation readings, likely due to considerable snow melt
- In contrast to the generally observed baseline trend, the majority of surface water elevations decreased from September to October
- Numerous surface water elevations were taken that were outside of the recorded baseline elevation high and low range

Two general trends that several ponds followed were documented in 2010. The most frequently observed trend in 2010 included a high to very high March reading (relative to the baseline maximum or the remainder of the 2010 monitoring), a low reading recorded in August, followed by an increase in September, and a decrease in surface water level in October. This trend was observed in 30 of the monitored ponds and is referred to as the “2010 Majority Trend”.

The next most frequently observed trend during 2010, herein referred to as the “Steady Trend”, includes four ponds that experienced less than or equal to 0.5 foot of variation in surface water elevation during 2010 monitoring. The grouping of ponds by trends was completed by analyzing the water level elevation graphs included in Appendix I of this report.

3.3.1 Douglas County Region Pond Data

3.3.1.1 Pond DG-01

Pond DG-01 is located in northern Sarpy County and is included with the ponds from Douglas County for the purposes of the bathymetric monitoring (Figure 2-1). Pond DG-01 is located approximately 650 feet east of the Platte River. The trend in surface water elevation readings followed the 2010 Majority Trend. General trends in water elevations in Pond DG-01 usually follow patterns similar to those of the Platte River, and Groundwater Monitoring Well MW 06-29.

As described in Section 3.3, the Majority Trend includes a high March reading (1095.67 feet), a low reading recorded in August (1095.05 feet), followed by an increase in September, and a decrease in surface water level in October equaling the August low (Appendix I – Pond DG-01, Figures 1 and 2). The minimum and maximum baseline surface water elevations for Pond DG-01 were 1094.31 and 1096.07 feet, respectively. Differences between operational surface water elevation readings, taken during the 2009 and 2010 monitoring efforts, and baseline elevations, taken between August 2006 and March 2008, were not statistically significant for Pond DG-01 (Appendix I – Pond DG-01, Figure 4).

Based on the months monitored in 2010, Pond DG-01 generally followed the trends in mean water elevations for the Platte River, but not for precipitation. Additionally the surface water elevation readings observed in 2010 generally followed the Groundwater Monitoring Well MW 06-29 2010 readings (Appendix III, Sections A and C). Given the pond's proximity to the Platte River and its sandy substrate, there is likely a strong groundwater influence at this pond.

3.3.1.2 Pond DG-02

Pond DG-02 is located in northern Sarpy County and is included with the ponds from Douglas County for the purposes of the bathymetric monitoring (Figure 2-1). The pond is located approximately 350 feet east of the Platte River. Pond DG-02 is connected to Pond DG-03 by a culvert to the north when water levels are sufficient for flow (Appendix I – Pond DG-02, Figure 2). The landowner requested a second monitoring location be established on Pond DG-02 in 2010 due to seasonal low water conditions. All data reported is from the original recording location. The trend in 2010 surface water elevation was unique within 2010 monitoring efforts due to the low levels in March and August. General trends in the surface water elevations of Pond DG-02 can usually be roughly correlated to those of the Platte River and the nearby groundwater monitoring well (MW 06-29).

The March and August 2010 readings were 1095.18 feet and 1094.49 feet, respectively, and both were below the minimum baseline surface water elevation. The surface water elevation increased through September to the highest observed elevation of 2010 (1095.79 feet), before dropping slightly in October (Appendix I – Pond DG-02, Figure 1). The March and August 2010 surface water elevations were below the baseline minimum elevation (Appendix I – Pond DG-02, Figure 2). The minimum and maximum surface water elevations for Pond DG-02 were 1095.33 and 1096.73 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were statistically significant for Pond DG-02 in August 2010 (Appendix I – Pond DG02, Figure 4).

In 2010, the surface water elevations in Pond DG-02 corresponded with the Platte River levels but did not correspond with precipitation levels. The nearby groundwater monitoring well (MW 06-29) readings for 2010 also did not correspond to 2010 surface water elevations for Pond DG-02 (Appendix III, Sections A and C). DG-02 can be strongly influenced by water flow and surface water elevations in the Platte River. Given the proximity of Pond DG-02 to the Production Wells, fluctuations in pond water levels may be related to the water level of the Platte River as well as pumping rates of Production Wells PW 04-15 and PW 04-17 (Appendix III, Section B). However, Ponds DG-02 and DG-03 did not exhibit similar trends in 2010 despite being hydrologically connected. It is more likely that low winter temperatures caused an ice blockage of the culvert connecting these waterbodies. This would prevent direct water movement from Pond DG-03 to Pond DG02.

3.3.1.3 Pond DG-03

Pond DG-03 is located in northern Sarpy County and is included with the ponds from Douglas County for the purposes of the bathymetric monitoring (Figure 2-1). The pond is located approximately 600 feet east of the Platte River. Pond DG-03 is connected to the south to DG-02 by a culvert or tube when water levels are sufficient for flow (Appendix I – Pond DG-03, Figure 2). The trend in 2010 surface water elevation readings at Pond DG-03 was unique among 2010 monitoring efforts. Surface water level elevations of Pond DG-03 usually follow patterns similar to those of the Platte River and Groundwater Monitoring Well MW 06-29.

The surface water elevation at DG-03 increased from a low in March (1095.81 feet), through August, to a high in September (1096.72 feet), and then dropped again in October (Appendix I – DG-03, Figure 1). All surface water elevation readings fell within the range of the baseline surface water elevations (1094.70 and 1098.92 feet, respectively) (Appendix I – DG-03, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-03 (Appendix I – Pond DG-03, Figure 4).

In the months monitored in 2010, the surface water elevations in Pond DG-03 did not correspond with the Platte River levels but did correspond with precipitation levels. The nearby groundwater monitoring well (MW 06-29) 2010 readings also did not correspond to 2010 surface water elevations for Pond DG-03 (Appendix III, Sections A and C). Pond DG-03 can be influenced by surface water flows and ground water elevations from the Platte River. As previously mentioned, Ponds DG-02 and DG-03 did not exhibit similar surface water elevation trends in 2010. Given the proximity of Pond DG-03 to the Production Wells, fluctuations in pond water levels may likely be related to the pumping rates of Production Wells PW 04-1 and PW 04-17 (Appendix III, Section B).

3.3.1.4 Pond DG-04

Pond DG-04 is located in northern Sarpy County and is included with the ponds from Douglas County for the purposes of the bathymetric monitoring (Figure 2-1). It is located approximately 1200 feet east of the Platte River. The trend in surface water elevation readings, measured from the permanent benchmark at Pond DG-04, followed the 2010 Majority Trend. Surface water level elevations at Pond DG-04 usually follow patterns similar to those of the Platte River and the nearby groundwater monitoring well (MW 06-29).

The 2010 data revealed highest water elevation levels in March (1096.81 feet), a decrease in August, followed by an increase in September, and the lowest level recorded in October (1094.21 feet) (Appendix I – Pond DG-04, Figure 1). The March 2010 reading exceeded the maximum baseline elevation (Appendix I – Pond DG-04, Figure 2). The minimum and maximum baseline surface water elevations were 1093.16 and 1095.78 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-04 (Appendix I – Pond DG-04, Figure 4).

An overall trend, similar to the one recorded in 2010, was recorded at Pond DG-04 during baseline monitoring in 2006. The elevation spike in March is considerably higher than previously recorded and likely the result of greater-than-normal snow melt. The 2010 surface water elevation monitoring of Pond DG-04 generally followed the trends in mean water elevations for the Platte River, but not precipitation for 2010. Additionally the surface water elevation readings observed in 2010 generally followed the nearby groundwater monitoring well (MW 06-29) 2010 readings (Appendix III, Sections A and C). This pond is located within an agricultural watershed used for row-crop activities and access (i.e., county roads); therefore, considerable seasonal runoff can enter this pond and combine with the likely year-round groundwater influence

3.3.1.5 Pond DG-04A

Pond DG-04A is located in northern Sarpy County and is included with the ponds from Douglas County for the purposes of the bathymetric monitoring (Figure 2-1). It is located approximately 1800 feet from the Platte River and approximately 1900 feet from the Elkhorn River. The trend in surface water elevations readings, measured from the permanent benchmark at Pond DG-04A, approximately followed the 2010 Majority Trend. The general trend in surface water elevations at Pond DG-04A usually follows that of both the Platte and Elkhorn Rivers and the nearby groundwater monitoring well (MW 06-29).

The Majority Trend, as previously described, included water level elevations that were at their highest in March (1095.99 feet), decreasing in August. Pond DG-04A approximately followed the Majority Trend because the August reading (1093.86 feet) was not lower than the September reading (1093.57 feet). The lowest 2010 reading was in October (1093.11 feet) (Appendix I – Pond DG-04A, Figure 1). The surface water elevations in March 2010 exceeded the maximum baseline surface elevation (Appendix I – Pond DG-04A, Figure 2). The minimum and maximum baseline elevations for Pond DG-04A were 1092.19 and 1094.74 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-04A (Appendix I – Pond DG-04A, Figure 4).

Similar to readings from DG-04, the high surface water elevation in March was likely due to runoff from considerable snow melt. The 2010 surface water elevation monitoring of Pond DG-04A generally followed the trends in mean water elevations for the Platte and Elkhorn rivers, but not precipitation in 2010. Additionally, the surface water elevation readings observed in 2010 did not follow the nearby groundwater monitoring well (MW 06-29) 2010 readings (Appendix III, Sections A and C). This pond is within the same surface watershed as Pond DG-04 and may be subjected to similar circumstances.

3.3.1.6 Pond DG-04B

Pond DG-04B is located in northern Sarpy County and is included with the ponds from Douglas County for the purposes of the bathymetric monitoring (Figure 2-1). It is located approximately 1350 feet from the Platte River and approximately 2450 feet from the Elkhorn River. The trend in surface water elevation readings, measured from the permanent benchmark at Pond DG-04B, followed the 2010 Majority Trend. The general trend in surface water elevation usually follows that of both the Platte and Elkhorn Rivers and nearby groundwater monitoring well (MW 06-29).

Surface water elevations were at their highest levels in March (1096.74 feet), decreased to lower levels in August, slightly increased in September, and decreased in October to the lowest reading in 2010 (1094.21 feet) (Appendix I – Pond DG-04B, Figure 1). Similar to nearby Pond DG-04A, the surface water elevations in March 2010 exceeded the maximum baseline surface elevation (Appendix I – Pond DG-04B, Figure 2). The minimum and maximum baseline elevations for Pond DG-04B were 1092.72 and 1095.58 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-04B (Appendix I – Pond DG-04B, Figure 4).

The high March reading was likely the result of runoff from considerable snow melt. The 2010 surface water elevation monitoring of Pond DG-04B generally followed the trends in mean water elevations for the Platte and Elkhorn Rivers, but not for precipitation in 2010. Additionally, the surface water elevation readings observed in 2010 did not follow the groundwater monitoring well (MW 06-29) 2010 readings (Appendix III, Sections A and C). Similar to Pond DG-04 and Pond DG-04A, this pond likely experiences seasonal high runoff and changes resulting from groundwater fluctuations.

3.3.1.7 Pond DG-05

Pond DG-05 is one of the eastern-most monitored ponds in Douglas County (Figure 2-1). It is located approximately 3400 feet west of the Elkhorn River. The trend in surface water elevation readings, measured from the permanent benchmark at Pond DG-05, followed the 2010 Majority Trend. Trends in surface water elevations in this pond can usually be correlated to the nearby groundwater monitoring well (MW 90-06).

The March water level elevation was the highest recorded during the 2010 monitoring efforts (1099.03 feet). Surface water elevations decreased in August, followed by a slight increase in September, and decrease to the lowest recorded levels in 2010 in October (1097.70 feet) (Appendix I – Pond DG-05, Figure 1). Surface water elevations in 2010 fell within the range of baseline surface water elevations. The minimum and maximum baseline surface water elevations for Pond

DG-05 were 1096.42 and 1099.12 feet, respectively (Appendix I – Pond DG-05, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-05 (Appendix I – Pond DG-05, Figure 4).

The 2010 elevation decrease does not correspond to local precipitation data, which showed increased rainfall throughout the late spring and early summer months followed by a significant decline through the late summer into the fall. Additionally, the nearby groundwater monitoring well (MW 90-06) levels did correspond with Pond DG-05 trends in 2010 (Appendix III, Sections A and C). Given the high March surface water elevation reading, lack of correspondence between the precipitation data and Pond DG-05 water elevation levels, and the silty substrate of this pond, it is likely that this pond is strongly influenced by spring snow melt runoff and local groundwater influences.

3.3.1.8 Pond DG-09

Pond DG-09 is located approximately 3900 feet from the Elkhorn River (Figure 2-1). The trend noted in surface water elevation readings at Pond DG-09, followed the 2010 Majority Trend. Trends in surface water elevations in this pond usually follow the trend of the nearby groundwater monitoring well (MW 90-06).

Surface water elevations were highest in March (1101.98 feet), decreasing to the lowest 2010 reading in August (1100.32 feet), followed by an increase in September, and a decrease in October (Appendix I – Pond DG-09, Figure 1). Surface water elevation readings in 2010 fell within the range of baseline surface water elevations taken for DG-09 (Appendix I – Pond DG-09, Figure 2). The minimum and maximum baseline surface water elevations for Pond DG-09 were 1099.13 and 1102.11 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-09 (Appendix I – Pond DG-09, Figure 4).

The 2010 elevation decrease does not correspond to local precipitation and temperature data. However, the nearby groundwater monitoring well (MW 90-06) data does correspond with 2010 surface water elevation data at DG-09 (Appendix III, Sections A and C). Given a correlation to the trends of Groundwater Monitoring Well MW 90-06 and lack of correlation to precipitation and temperature data, it is likely that this pond is influenced primarily by groundwater as well as spring snow melt runoff.

3.3.1.9 Pond DG-11

Pond DG-11 is located approximately 1.2 miles northwest of the Elkhorn River (Figure 2-1). Photo documentation of Pond DG-11 was initiated in September 2009 at the request of the landowner. This pond is located between and approximately 1600 feet north of two groundwater monitoring wells (MW 90-06 and MW 94-12).

Pond DG-11 has not been monitored at a quantitative level. A permanent benchmark has not been installed. Currently, Pond DG-11 is being monitored by photographic documentation only at the landowner’s request during each monitoring effort. Photographs from the 2010 monitoring efforts are included in Appendix I – Pond DG-11, Figure 1. At present, attempts at correlations of qualitative photographic documentation of Pond DG-11 and data from the two nearby groundwater monitoring wells cannot be made.

3.3.1.10 Pond DG-13

Pond DG-13 is approximately 1.7 miles northwest of the Elkhorn River and 1.6 miles northeast of the Platte River (Figure 2-1). This pond is located between two groundwater monitoring wells (MW 90-06 and MW 94-01) and has shown correlations to one or both wells in the past. The trend noted in surface water elevation readings at Pond DG-13, followed the 2010 Majority Trend.

The highest surface water elevations were recorded in March 2010 (1107.23 feet). August readings were considerably lower than March, followed by an increase in September, and the lowest surface water elevation recorded in 2010 taken in October (1105.35 feet) (Appendix I – Pond DG-13, Figure 1). All of the surface water elevation readings taken in 2010 were within the range of the recorded baseline surface water elevations taken for Pond DG-13 (Appendix I – Pond DG-13, Figure 2). The minimum and maximum baseline readings for Pond DG-13 were 1104.15 and 1107.63 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-13 (Appendix I – Pond DG-13, Figure 4).

In 2010, precipitation levels did not directly correlate to the observed surface water elevation readings of Pond DG-13. The high March 2010 reading is likely the result of spring snow melt runoff entering Pond DG-13. Both groundwater monitoring wells (MW 90-06 and MW 94-01) followed a similar pattern to the surface water elevation for Pond DG-13 in 2010 (Appendix III, Sections A and C). These relationships indicate that this pond is likely influenced by surface water runoff and groundwater.

3.3.1.11 Pond DG-15

Pond DG-15 is in the north portion of the Douglas County cone of depression (Figure 2-1). This pond is approximately 2100 feet north of Groundwater Monitoring Well MW 05-26. The trend in surface water elevation at Pond DG-15 followed the 2010 Majority Trend.

Surface water elevation was highest in March 2010 (1113.10 feet). The August measurement was the lowest surface water elevation reading in 2010 (1109.38 feet). September water levels increased compared to August, followed by a decrease in October (Appendix I – Pond DG-15, Figure 1). The March 2010 surface water elevation exceeded the maximum baseline elevation; however the remaining 2010 readings fell within the range of the baseline surface water elevations (Appendix I – Pond DG-15, Figure 2). The minimum and maximum baseline surface water elevations for Pond DG-15 were 1108.27 and 1111.33 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-15 (Appendix I – Pond DG-15, Figure 4).

In 2010, precipitation levels did not directly correlate to the observed surface water elevation readings of Pond DG-15. As discussed with other ponds, the considerably higher March reading is likely a result of the introduction of surface water runoff from snow melt. The recorded water levels at Groundwater Monitoring Well MW 05-26 showed a pattern similar to the surface water elevation for Pond DG-13 (Appendix III, Sections A and C). These relationships indicate that this pond is likely influenced by surface water runoff and groundwater.

3.3.1.12 Pond DG-17

Pond DG-17 is one of the northern-most monitored ponds in the Douglas County (Figure 2-1). The Platte and Elkhorn rivers are 1.5 miles west and 2.6 miles southeast of this pond, respectively. Groundwater Monitoring Well MW 05-26 is approximately 4350 feet southwest of Pond DG-17. The trend in surface water elevation at Pond DG-17 included a summer decline followed by an increase in water level in the fall.

The surface water elevation was highest in March (1111.34 feet), decreased to a low in August (1109.68 feet), increased in September, and remained steady in October (Appendix I – DG-17, Figure 1). All surface water elevation readings fell within the maximum and minimum range of the baseline surface water elevations (1108.51 and 1111.57 feet, respectively) (Appendix I – DG-17, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-17 (Appendix I – Pond DG-17, Figure 4).

The trend observed in 2010 for Pond DG-17 has been observed in 2006 and 2007 as well. The observed surface water elevations of Pond DG-17 did not directly correlate with the precipitation levels in 2010. The increased March surface water elevation reading at Pond DG-17 was likely a result of considerable snow melt. Groundwater Monitoring Well MW 05-26 levels trended similarly to Pond DG-17 (Appendix III, Sections A and C); however, due to the distance between the well and the pond, drawing a relationship between the two is not likely warranted. It can be determined, based on the available data, that this pond is influenced by surface water and groundwater sources.

3.3.1.13 Pond DG-19

Pond DG-19 is located in close proximity to numerous other monitored ponds. Pond DG-19 is located approximately one mile east of the Platte River (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 2200 feet south of Pond DG-19. The trend in surface water elevation at Pond DG-19 included a decline in water level between spring and summer followed by highest observed 2010 levels in September and a decline in October.

The 2010 March surface water elevation decreased to a low in August (1109.99 feet), before reaching a high in September (1113.83 feet), and then decreasing in October (Appendix I – DG-19, Figure 1). All surface water elevation readings fell within the range of the minimum and maximum baseline surface water elevations except the September 2010 reading which was higher than the maximum baseline elevation (Appendix I – Pond DG-19, Figure 2). The minimum and maximum baseline surface water elevations for Pond DG-19 were 1107.78 and 1112.46 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-19 (Appendix I – Pond DG-19, Figure 4).

The observed surface water elevations of Pond DG-19 did not directly correlate with the precipitation levels in 2010. A direct correlation between DG-19 and Platte River stream gauge readings were not observed in 2010. Groundwater monitoring well (MW 05-26) data also is inconsistent with 2010 surface water elevation data at Pond DG-19 (Appendix III, Sections A and C). Given the lack of correlation to the trends of Groundwater Monitoring Well MW 90-06, precipitation, and temperature data, it is likely that this pond is influenced primarily by localized groundwater and runoff from the nearby roads and watershed.

3.3.1.14 Pond DG-20

As described previously, Pond DG-20 is in close proximity with several other monitored ponds (Figure 2-1) (See 3.3.3.13). DG-20 is hydrologically connected to Pond DG-20A during high water levels. Groundwater Monitoring Well MW 05-26 is approximately 1300 feet south of Pond DG-20. The trend in surface water elevation at Pond DG-20 followed the 2010 Majority Trend.

Observed surface water elevations were highest in March 2010 (1110.90 feet). The August measurement was the lowest reading in 2010 for Pond DG-20 (1109.25 feet), followed by a September increase, and a decrease in October (Appendix I – Pond DG-20, Figure 1). The surface water elevations fell within the range of the minimum and maximum baseline surface water elevations, except the March 2010 reading which was slightly above the maximum baseline elevation (Appendix I – Pond DG-20, Figure 2). The minimum and maximum baseline surface water elevations for Pond DG-20 were 1108.09 and 1110.87 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20 (Appendix I – Pond DG-20, Figure 4).

A trend similar to the one recorded in 2010 was recorded at Pond DG-20 in 2009. Precipitation levels do not appear to be directly correlated to the surface water elevation readings in 2010. The considerably higher March 2010 reading is likely the result of spring snow melt runoff entering Pond DG-20. The trends shown by the data for Groundwater Monitoring Well MW 05-26 do not correspond with 2010 surface water elevation data for Pond DG-20 (Appendix III, Sections A and C). These relationships indicate that this pond is likely influenced by seasonal surface water runoff and localized groundwater.

3.3.1.15 Pond DG-20A

As stated above, Pond DG-20A during Project is hydrologically connected to Pond DG-20 except during the low water events. Pond DG-20A has also been seasonally connected to Ponds DG-20C, DG-20D, and DG-20E during extreme high water events (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 1600 feet south of Pond DG-20A. The trend in surface water elevation at Pond DG-20A followed the 2010 Majority Trend.

The March 2010 surface water elevation reading for Pond DG-20A was the highest (1110.78 feet), followed by an August decline, a September increase, and the lowest reading in October (1109.18 feet) (Appendix I – Pond DG-20A, Figure 1). The March reading exceeded the maximum baseline surface water elevation. All other surface water elevation readings fell within the range of the minimum (1108.27 feet) and maximum (1110.73 feet) baseline surface water elevations, respectively (Appendix I – Pond DG-20A, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20A (Appendix I – Pond DG-20A, Figure 4).

There does not appear to be a direct relationship between the precipitation levels and the surface water elevation readings of Pond DG-20A in 2010. As has been suggested for other ponds, an increase in spring runoff from snow melt likely resulted in the higher March reading. Additionally, general trends in surface water elevations of Pond DG-20A do not mimic those of Ground Monitoring Well MW 05-26 (Appendix III, Sections A and C). Fluctuations in pond water levels could also be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). This pond may be reliant on seasonal surface water runoff and localized groundwater.

3.3.1.16 Pond DG-20B

Pond DG-20B is located adjacent to Pond DG-20A and Pond DG-20C (Figure 2-1). Groundwater connection between these ponds is likely, generally linking the surface water elevation of each pond. Groundwater Monitoring Well MW 05-26 is approximately 1750 feet south of Pond DG-20B. The trend in surface water elevation at Pond DG-20B followed the 2010 Majority Trend.

Observed surface water elevations in 2010 were highest in March (1110.83 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-20B (1109.12 feet). September water levels increased from August, followed by a decrease in October (Appendix

I – Pond DG-20B, Figure 1). All of the surface water elevation readings fell within the range of the minimum (1108.19 feet) and maximum (1110.73 feet) baseline surface water elevations except the March 2010 reading which slightly exceeded the maximum baseline elevation. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20B (Appendix I – Pond DG-20B, Figure 4).

Precipitation levels in 2010 did not appear to directly correlate to the surface water elevation readings of Pond DG-20B. The March 2010 reading is likely the result of the spring snow melt. The trends shown by the data for Groundwater Monitoring Well MW 05-26 do not correspond with Pond DG-20B surface water elevation data in 2010 (Appendix III, Sections A and C). The fluctuations in pond water levels may also be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). Similar to the ponds near Pond DG-20B, it may be reliant on seasonal surface water runoff and localized groundwater.

3.3.1.17 Pond DG-20C

Pond DG-20C is seasonally connected to Pond DG-20A and located adjacent to Pond DG-20B and DG-20D (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 1700 feet south of Pond DG-20C. The trend in surface water elevation at Pond DG-20C followed the 2010 Majority Trend.

Surface water elevations in 2010 were highest in March (1110.83 feet). The August water level reading decreased before rising in September and declining to the low 2010 recorded value in October (1109.28 feet) (Appendix I – Pond DG-20C, Figure 1). The March 2010 surface water elevation exceeded the maximum baseline elevation; however the remaining 2010 readings fell between the minimum (1108.17 feet) and maximum (1110.73 feet) baseline surface water elevations (Appendix I – Pond DG-20C, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20C (Appendix I – Pond DG-20C, Figure 4).

Precipitation levels do not appear to be directly correlated to the surface water elevation readings of Pond DG-20C. The March 2010 reading is likely the result of the spring snow melt. The trends shown by the data for Groundwater Monitoring Well MW 05-26 do not correspond with Pond DG-

20C surface water elevation data in 2010 (Appendix III, Sections A and C). The fluctuations in pond water levels may also be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). As described for ponds nearby, these relationships indicate that this pond is likely influenced by localized groundwater and seasonal surface water runoff.

3.3.1.18 Pond DG-20D

Pond DG-20D is seasonally connected to Pond DG-20A and Pond DG-20E. This pond is also adjacent to Pond DG-20C, and groundwater connection between the waterbodies is highly likely (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 1675 feet south of Pond DG-20D. The trend in surface water elevation at Pond DG-20D followed the 2010 Majority Trend.

The March 2010 surface water elevation for Pond DG-20D was the highest observed reading (1111.82 feet), followed by the low in August (1109.16 feet), an increase in September, and a decrease in October (Appendix I – Pond DG-20D, Figure 1). The March 2010 reading was above the maximum baseline surface water elevation (1110.73 feet). The remainder of the 2010 Pond DG-20D readings fell within the range of the minimum (1107.96 feet) and maximum baseline surface water elevations (Appendix I – Pond DG-20D, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20D (Appendix I – Pond DG-20D, Figure 4).

The 2010 elevation decrease does not directly correspond to 2010 precipitation data. Snowmelt and subsequent runoff was the likely cause of the increased water level elevation in March 2010. The trend shown by the data for Groundwater Monitoring Well MW 05-26 also does not correspond with Pond DG-20D surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). As described for ponds nearby, these relationships indicate that this pond is likely influenced by localized groundwater and seasonal surface water runoff.

3.3.1.19 Pond DG-20E

Pond DG-20E is seasonally connected to Pond DG-20A and Pond DG-20D (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 1575 feet south of Pond DG-20E. The trend in surface water elevation at Pond DG-20E followed the 2010 Majority Trend.

Observed surface water elevations in were highest in March 2010 (1111.75 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-20E (1109.11 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-20E, Figure 1). The March 2010 surface water elevation exceeded the maximum baseline elevation; however the remaining 2010 readings fell within the range of the baseline surface water elevations for Pond DG-20E (Appendix I – Pond DG-20E, Figure 2). The minimum and maximum surface water elevations for Pond DG-15 were 1108.07 and 1110.73 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20E (Appendix I – Pond DG-20E, Figure 4).

The 2010 water level elevation trend at Pond DG-20E does not directly correspond to the precipitation data. As has been suggested for other ponds, an increase in spring runoff from snow melt likely resulted in the higher March reading. The trend shown by the data for Groundwater Monitoring Well MW 05-26 also does not correspond with Pond DG-20E surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may also be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). Similar to nearby ponds, these relationships indicate that this pond is likely influenced by localized groundwater and seasonal surface water runoff.

3.3.1.20 Pond DG-20F

Pond DG-20F is located near Ponds DG-19 through DG-23A. However, this incised pond is relatively isolated within this area (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 1500 feet south of Pond DG-20F. The trend in surface water elevation at Pond DG-20F followed the 2010 Majority Trend.

The highest 2010 surface water elevation for Pond DG-20F was recorded in March (1110.68 feet), followed by the low in August (1108.97 feet), an increase in September, and a decrease in October (Appendix I – Pond DG-20F, Figure 1). The March 2010 reading was slightly above the maximum baseline surface water elevation (1110.64 feet). The remainder of the 2010 Pond DG-20F readings still fell within the range of the minimum (1107.07 feet) and maximum baseline surface water elevations (Appendix I – Pond DG-20F, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20F (Appendix I – Pond DG-20F, Figure 4).

Precipitation levels for 2010 do not appear to be directly correlated to the surface water elevation readings of Pond DG-20F. The March 2010 reading is likely the result of the spring snow melt. The trend shown by the data for Groundwater Monitoring Well MW 05-26 also does not correspond with Pond DG-20F surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond may be influenced by localized groundwater and seasonal surface water runoff.

3.3.1.21 Pond DG-20G

Pond DG-20G is in close proximity to Pond DG-20 and Pond DG-20A (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 1575 feet south of Pond DG-20G. The trend in surface water elevation at Pond DG-20G followed the 2010 Majority Trend.

The March 2010 surface water elevation for Pond DG-20G was the highest (1110.77 feet), followed by the low in August (1109.22 feet), an increase in September, and an equal low in October (Appendix I – Pond DG-20G, Figure 1). All recorded values in 2010 fell within the range of the minimum (1108.03 feet) and maximum (1110.78 feet) baseline surface water elevations (Appendix I – Pond DG-20G, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-20G (Appendix I – Pond DG-20G, Figure 4).

Precipitation levels in 2010 did not appear to directly correlate with the surface water elevation readings of Pond DG-20G. The March 2010 reading is likely the result of the spring snow melt. The trend shown by the data for Groundwater Monitoring Well MW 05-26 also does not correspond with Pond DG-20G surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond may be influenced by localized groundwater and seasonal surface water runoff.

3.3.1.22 Pond DG-21

Pond DG-21 is a relatively large pond in close proximity to numerous other ponds monitored within the Project. Pond DG-21 is hydrologically connected to Pond DG-23 except during extremely low water events (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 750 feet south of Pond DG-21. The trend in surface water elevation at Pond DG-21 followed the 2010 Majority Trend.

The observed surface water elevation was highest in March 2010 at DG-21 (1109.90 feet), then decreased to a low in August (1108.45 feet), increased in September, and decreased in October (Appendix I – DG-21, Figure 1). These values fell within the range of the minimum (1107.33 feet) and maximum (1110.21 feet) baseline surface water elevations, respectively (Appendix I – DG-21, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-21 (Appendix I – Pond DG-21, Figure 4).

Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond DG-21. Spring runoff from snowmelt likely resulted in the higher March reading. The trend shown by the data for Groundwater Monitoring Well MW 05-26 also did not correspond with Pond DG-21 surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond may be influenced by localized groundwater and seasonal surface water runoff.

3.3.1.23 Pond DG-22

Pond DG-22 is located adjacent to Pond DG-23 (Figure 2-1). An approximately 10-foot wide berm or levee separates the waterbodies. Groundwater movement or seepage between the ponds is a possibility. Groundwater Monitoring Well MW 05-26 is approximately 1100 feet south of Pond DG-22. The trend in surface water elevation at Pond DG-22 followed the 2010 Majority Trend.

The observed surface water elevation was highest in March 2010 at Pond DG-22 (1110.18 feet), decreased to a near low in August (1108.75 feet), increased in September, and decreased to a low in October (1108.74 feet) (Appendix I – DG-22, Figure 1). These values were within the range of the minimum (1107.53 feet) and maximum (1110.78 feet) baseline surface water elevations, respectively (Appendix I – DG-22, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-22 (Appendix I – Pond DG-22, Figure 4).

The trend recorded in 2010 for Pond DG-22 was previously recorded at this pond in 2009. Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond DG-22. The March 2010 reading is likely the result of the spring snow melt. The trend shown by the data for Groundwater Monitoring Well MW 05-26 also does not correspond with Pond DG-22 surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond may be influenced by localized groundwater and seasonal surface water runoff.

3.3.1.24 Pond DG-23

Pond DG-23 is located in close proximity to Ponds DG-22 and DG-21. Pond DG-23 is hydrologically connected to Pond DG-21 except during extremely low water events, as well as adjacent to Pond DG-22, separated by a narrow berm or levee (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 500 feet southeast of Pond DG-23. The trend in surface water elevation at Pond DG-23 followed the 2010 Majority Trend.

Observed surface water elevations in 2010 were highest in March (1110.20). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-23 (1108.52 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-23, Figure 1). These values fell within the range of the minimum (1107.33 feet) and maximum (1110.53 feet) baseline surface water elevations, respectively (Appendix I – Pond DG-23, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-23 (Appendix I – Pond DG-23, Figure 4).

Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond DG-23. An increase in spring runoff from snow melt likely resulted in the higher March reading. The trend shown by the data for the nearby groundwater monitoring well (MW 05-26) also does not correspond with Pond DG-23 surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of

Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond may be influenced by localized groundwater and seasonal surface water runoff.

3.3.1.25 Pond DG-23A

Pond DG-23A is located southeast of Ponds DG-21 through DG-23 (Figure 2-1). Groundwater Monitoring Well MW 05-26 is approximately 100 feet southeast of Pond DG-23. The trend in surface water elevation at Pond DG-23A approximately followed the 2010 Majority Trend.

The 2010 Pond DG-23A surface water elevation was highest in March (1109.58 feet). An August 2010 reading was not taken because the permanent benchmark was inadvertently removed (see Section 3.2), readings decreased from March to September, and decreased in to a low in October (1108.20 feet) (Appendix I – DG-23A, Figure 1). The trend is approximated to follow the 2010 Majority Trend because it is assumed, based on the data from numerous nearby ponds, that the August 2010 reading would have been lower than March or September. These observed readings fell within the minimum baseline surface water elevation (1107.09 feet) and maximum baseline surface water elevation (1109.62 feet), respectively (Appendix I – Pond DG-23A, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-23A (Appendix I – Pond DG-23A, Figure 4). .

Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond DG-23A. The high March 2010 reading is likely the result of spring snow melt. The trend shown by the data for the nearby groundwater monitoring well (MW 05-26) also does not correspond with Pond DG-23A surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-4 and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond may be influenced by localized groundwater seasonal surface water runoff.

3.3.1.26 Pond DG-26

Pond DG-26 is located in the Two Rivers State Recreation Area, a facility managed by the Nebraska Game and Park Commission. Pond DG-26 is approximately 900 feet east of the Platte River (Figure 2-1). No Project groundwater monitoring wells are located within 0.5 miles of Pond DG-26. The trend in surface water elevation at Pond DG-26 included a summer decrease from spring, and a fall increase from summer.

The surface water elevation was highest in March (1112.07 feet), decreased to a low in August (1110.76 feet), increased in September, and further increased in October (Appendix I – DG-26, Figure 1). The March 2010 reading was slightly above the maximum baseline surface water elevation (1111.96 feet). The remainder of the 2010 Pond DG-26 readings were between the minimum (1110.14 feet) and maximum baseline surface water elevations, respectively (Appendix I – Pond DG-26, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-26 (Appendix I – Pond DG-26, Figure 4).

The trend recorded in 2010 for Pond DG-26 was previously recorded at this pond in 2007 and 2008. The high March 2010 reading is likely the result of the spring snow melt. In 2010, , the observed surface water elevations in Pond DG-26 corresponded with the Platte River water levels but did not correspond with precipitation levels (Appendix III, Section C). Given the proximity to the Platte River and the silty substrate of this pond, it is likely that this pond is influenced by local seasonal runoff, the Platte River, and localized groundwater levels.

3.3.1.27 Pond DG-27

Pond DG-27 is located in the Two Rivers State Recreation Area and is approximately 500 feet east of the Platte River (Figure 2-1). No Project groundwater monitoring wells are located within 0.5 miles of Pond DG-27. The trend in surface water elevation at Pond DG-27 followed the 2010 Majority Trend.

The observed surface water elevation was highest in March 2010 at Pond DG-27 (1111.14 feet), then decreased to a low in August (1109.88 feet), increased in September, and decreased in October (Appendix I – Pond DG-27, Figure 1). The March 2010 value exceeded the maximum baseline surface water elevation; however the remaining readings fell within the range of the minimum (1109.34 feet) and maximum (1110.87 feet) baseline surface water elevations, respectively (Appendix I – DG-27, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-27 (Appendix I – Pond DG-27, Figure 4).

The trend recorded in 2010 for Pond DG-27 was previously recorded at this pond in 2006. The high March 2010 reading is likely the result of a high spring runoff from snow melt. In 2010, the observed surface water elevations in Pond DG-27 corresponded with the Platte River levels but did not correspond with precipitation levels (Appendix III, Section C). Given the proximity of Pond DG-27 to the Platte River and trends in surface water elevation being similar to those of the river, DG-27 is likely influenced considerably by the Platte River as well as by seasonal surface water influx and some local groundwater.

3.3.1.28 Pond DG-28

Pond DG-28 is located in the Two Rivers State Recreational Area and is approximately 1350 feet east of the Platte River (Figure 2-1). No Project groundwater monitoring wells are located within 0.5 miles of Pond DG-28. The trend in surface water elevation at Pond DG-28 followed the 2010 Steady Trend.

As described in Section 3.3, the Steady Trend includes those ponds that experienced less than or equal to 0.5 foot total change in surface water elevation during annual monitoring. The 2010 Pond DG-28 surface water elevation was highest in March (1107.40 feet), decreased in August, decreased to a low in September (1107.07 feet), and increased in October (Appendix I – Pond DG-28, Figure 1). The surface water elevations for Pond DG-28 in the months monitored fell within the range of baseline surface water elevations (Appendix I – Pond DG-28, Figure 2). The minimum and maximum baseline elevations for Pond DG-28 were 1106.34 and 1108.14 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-28 (Appendix I – Pond DG-28, Figure 4).

Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond DG-28. Water levels for the Platte River for the months monitored followed a similar pattern as the surface water elevation readings for Pond DG-28, however (Appendix III, Section C). Given the proximity of Pond DG-28 to the Platte River and trends in surface water elevation being similar to those of the river, Pond DG-28 is likely strongly influenced by the Platte River as well as by seasonal surface water influx and some local groundwater.

3.3.1.29 Pond DG-29

Pond DG-29 is located in the Two Rivers State Recreational Area and is approximately 1850 feet east of the Platte River (Figure 2-1). Groundwater Monitoring Well MW 90-07 is approximately

2050 feet southeast of Pond DG-29. The trend in surface water elevation at Pond DG-29 followed the 2010 Majority Trend.

Observed surface water elevations in 2010 were highest in March (1107.36 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-29 (1106.36 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-29, Figure 1). Similar to several other ponds in the area, 2010 surface water elevations fell within the range of baseline surface water elevations in all months (Appendix I – Pond DG-29, Figure 2). The minimum and maximum baseline elevations for Pond DG-29 were 1106.27 and 1107.93 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-29 (Appendix I – Pond DG-29, Figure 4).

In 2010, the observed surface water elevations in Pond DG-29 corresponded with the Platte River levels but did not correspond with precipitation levels (Appendix III, Section C). The trend shown by the data for Groundwater Monitoring Well MW 90-07 did approximately correspond with Pond DG-29 surface water elevation data in 2010 (Appendix III, Section A); however the distance between the waterbody and the well is considerable. Given the proximity of Pond DG-29 to the Platte River and trends in surface water elevation trending relatively similar to the river elevations, Pond DG-29 is may be influenced by the Platte River in addition to local groundwater elevation changes.

3.3.1.30 Pond DG-30

Pond DG-30 is located in the Two Rivers State Recreational Area and is approximately 1900 feet east of the Platte River (Figure 2-1). Ponds DG-30 and DG-31 are hydrologically connected except during extremely low water events. Groundwater Monitoring Well MW 90-07 is approximately 1175 feet east of Pond DG-30. The trend in surface water elevation at Pond DG-29 followed the 2010 Majority Trend.

Observed surface water elevations in 2010 were highest in March (1107.52 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-30 (1106.47 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-30, Figure 1). The observed surface water elevations for DG-30 were between the baseline surface water elevations (Appendix I – Pond DG-30, Figure 2). The minimum and maximum baseline elevations for Pond DG-30 were 1105.81 and 1107.57 feet, respectively Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were statistically significant for Pond DG-30 in August 2010 (Appendix I – Pond DG-30, Figure 4). It should be noted that while 2010 monitoring for Pond DG-30 was between the maximum and minimum baseline elevations, the analysis included 2009 and 2010 operational and compared these readings to those taken August 2006 through March 2008. The 2009 monitoring data for Pond DG-30 was below the minimum baseline elevation for three of four months monitored. Therefore, the statistical significance is likely due to the 2009 data.

In 2010, the observed surface water elevations in Pond DG-30 corresponded with the Platte River levels but did not correspond with precipitation levels (Appendix III, Section C). The trends shown by the data for Groundwater Monitoring Well MW 90-07 also corresponded with Pond DG-30 surface water elevation data in 2010 (Appendix III, Section A). Fluctuations in pond water levels may be related to the pumping rates of Production Wells PW 91-3, PW 04-4, PW 04-6, PW 04-7, and PW 04-8 (Appendix III, Section B). Given the proximity of Pond DG-30 to the Platte River and trends in surface water elevation being similar to river levels, Pond DG-30 is likely influenced by the Platte River as well as local ground water changes. The trends and water levels in Pond DG-30 and Pond DG-31 were nearly identical in 2010.

3.3.1.31 Pond DG-31

Pond DG-31 is located in Two Rivers State Recreational Area and is approximately 1500 feet east of the Platte River (Figure 2-1). Ponds DG-30 and DG-31 are hydrologically connected except during extreme low water events. Groundwater Monitoring Well MW 90-07 is approximately 975 feet east of Pond DG-31. The trend in surface water elevation at Pond DG-31 followed the 2010 Majority Trend.

Observed surface water elevations in 2010 were highest in March (1107.48 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-31 (1106.46 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-31, Figure 1). The surface water elevations for DG-31 in the months monitored fell within the range of baseline surface water elevations (Appendix I – Pond DG-31, Figure 2). The minimum and maximum baseline elevations for Pond DG-31 were 1105.83 and 1107.57 feet, respectively. Similar to Pond DG-30, differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were statistically significant for Pond DG-31 in 2009 (Appendix I – Pond DG-31, Figure 4). Similar to Pond DG-30, while 2010 surface water elevation readings for Pond DG-31 were between the maximum and minimum baseline elevations, the analysis included 2009 and 2010 operational data and compared these readings to those taken August 2006 through March 2008. The 2009 monitoring data for Pond DG-31 was below the minimum baseline elevation for three of four months monitored. Therefore, the statistical significance is likely due to the 2009 data.

In 2010, the observed surface water elevations in Pond DG-31 corresponded with the Platte River levels but did not correspond with precipitation levels (Appendix III, Section C). The trend shown by the data for Groundwater Monitoring Well MW 90-07 also corresponded with Pond DG-31 surface water elevation data in 2010 (Appendix III, Section A). Fluctuations in pond water levels may be related to the pumping rates of Production Wells PW 91-3, PW 04-4, PW 04-6, PW 04-7, and PW 04-8 (Appendix III, Section B). Given the proximity of Pond DG-31 to the Platte River and trends in surface water elevation mimicking those of the river level elevations, Pond DG-31 is likely influenced by the Platte River as well as local ground water changes. Ponds DG-30 and DG-31 were hydrologically connected during all monitoring events in 2010. The trends and water levels in Pond DG-30 and Pond DG-31 were nearly identical in 2010.

3.3.1.32 Pond DG-32

Pond DG-32 is located in Two Rivers State Recreational Area and is approximately 3100 feet east of the Platte River (Figure 2-1). Groundwater Monitoring Wells MW 90-07, MW 94-01, and MW 94-02 are approximately 120 feet west, 1800 feet east, and 1100 feet southeast of Pond DG-32, respectively. The trend in surface water elevation at Pond DG-32 followed the 2010 Majority Trend.

The observed surface water elevation at Pond DG-32 was highest in March 2010 (1107.00 feet), decreased in August, increased in September, and decreased to a low in October (1105.08 feet) (Appendix I – Pond DG-32, Figure 1). The March 2010 value slightly exceeded the maximum baseline surface water elevation; however the remaining readings fell within the range of the minimum (1104.75 feet) and maximum (1106.98 feet) baseline surface water elevations (Appendix I – DG-32, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-32 (Appendix I – Pond DG-32, Figure 4).

The trend recorded in 2010 for Pond DG-32 was previously recorded at this pond in 2006. In 2010, the observed surface water elevations at Pond DG-32 corresponded with the Platte River levels but did not correspond with precipitation levels (Appendix III, Section C). The trends shown by the data for Groundwater Monitoring Wells MW 90-07, MW 94-01, and MW 94-02 followed a similar trend as the Pond DG-32 surface water elevation data in 2010 suggesting a groundwater connection (Appendix III, Section A). Given the proximity of Pond DG-32 to the Platte River and the Production wells, fluctuations in pond water levels may be related to the pumping rates of nearby Production Wells PW 91-3, PW 04-4, PW 04-6, PW 04-7, and PW 04-8 (Appendix III, Section B). Additionally, the water level at DG-32 is likely influenced by the Platte River, groundwater connections, and seasonal surface water runoff.

3.3.1.33 Pond DG-34

Pond DG-34 is located approximately 1425 feet northeast of Groundwater Monitoring Well MW 94-01 and 1775 feet southeast of MW 05-26. Pond DG-34 is approximately 1.3 miles east of the Platte River (Figure 2-1). The trend in surface water elevation at Pond DG-34 followed the 2010 Majority Trend.

Surface water elevations in 2010 were highest in March (1107.54 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-34 (1105.63 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-34, Figure 1). Similar to several other ponds, 2010 surface water elevations fell within the range of baseline surface water elevations (Appendix I – Pond DG-34, Figure 2). The minimum and maximum baseline elevations for Pond DG-34 were 1105.03 and 1107.93 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-34 (Appendix I – Pond DG-34, Figure 4).

In 2010, the observed surface water elevations in Pond DG-34 did not correspond with precipitation levels (Appendix III, Section C). However, the trends shown by the data for Groundwater Monitoring Wells MW 94-01 and MW 05-26 did correspond with Pond DG-34 surface water elevation data in 2010 (Appendix III, Section A). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 91-3, PW 04-4, and PW 04-5 (Appendix III, Section B). These relationships indicate that this pond is likely influenced by groundwater and seasonal surface water runoff.

3.3.1.34 Pond DG-43

Pond DG-43 is located approximately 175 feet east of the Platte River (Figure 2-1). No Project groundwater monitoring wells are located within 0.5 miles of Pond DG-43. The trend in surface water elevation at Pond DG-43 followed the 2010 Steady Trend.

The observed surface water elevation at Pond DG-43 varied by only 0.38 foot during 2010 monitoring. The pond had a low water level elevation in August (1114.48 feet), and a high reading in September (1114.86 feet) (Appendix I – Pond DG-43, Figure 1). The observed surface water elevations for Pond DG-43 exceeded the maximum baseline surface water elevation in March and September and fell within the minimum (1109.97 feet) and maximum (1114.64 feet) surface water baseline elevations in August and October, respectively (Appendix I – Pond DG-43, Figure 2). The minimum and maximum baseline elevations for Pond DG-43 were 1110.0 feet and 1114.6 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were statistically significant for Pond DG-43 (Appendix I – Pond DG-43, Figure 4). Pond DG-43 water level elevations were actually significantly higher in elevation, likely due to the pond's close proximity to the Platte River, which was higher than normal in March 2010 and October 2009.

Precipitation levels in 2010 did not correlate directly to the observed surface water elevation readings of Pond DG-43. However, water levels at the Platte River for the months monitored did follow a similar pattern as the surface water elevation readings for Pond DG-43 (Appendix III, Section C). Given the close proximity of Pond DG-43 to the Platte River and trends in surface water elevation being similar to those of the river, DG-43 is strongly influenced by a groundwater connection with the Platte River.

3.3.1.35 Pond DG-45

Pond DG-45 is located approximately 575 feet south of Pond DG-46 and 2250 feet east of the Platte River (Figure 2-1). Pond DG-45 is hydrologically connected to Pond DG-46 via a small, intermittent stream. The stream continues to flow south from Pond DG-45. No Project groundwater monitoring wells are located within 0.5 miles of Pond DG-45. The trend in surface water elevation at Pond DG-45 included a decline followed by an increase in water level in the fall.

The observed surface water elevation decreased from March to a low in August (1110.65 feet), increased in September, and further increased to a high in October (1112.05 feet) (Appendix I – DG-45, Figure 1). The October 2010 reading was above the maximum baseline surface water elevation. The remainder of the 2010 Pond DG-45 readings were within the range of the minimum (1109.84 feet) and maximum (1111.38 feet) baseline surface water elevations (Appendix I – Pond DG-45, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-45 (Appendix I – Pond DG-45, Figure 4).

In 2010, the observed surface water elevations in Pond DG-45 did not correspond with the Platte River levels or precipitation levels (Appendix III, Section C). Given the proximity to the Platte River as well as the silty and sandy substrate of this pond, it is likely that this pond is influenced by local seasonal runoff and localized groundwater levels. However, the hydrologic connection to Pond DG-46 upstream likely has an effect on water levels as well. While Ponds DG-45 and DG-46 did not follow the same trends in 2010; the large size of Pond DG-46 could be the reason for the different trend. The 2010 October surface water elevation increase in Pond DG-45, above the maximum baseline surface water elevation, is mirrored by an October 2010 surface water elevation decrease in Pond DG-46.

3.3.1.36 Pond DG-46

Pond DG-46 is located approximately 575 north of Pond DG-45, and 1550 feet east of the Platte River (Figure 2-1). Pond DG-46 is hydrologically connected to Pond DG-45 by the outflow from Pond-46 into Pond DG-45 via a small, intermittent stream. No Project groundwater monitoring wells are located within 0.5 miles of Pond DG-45. The trend in surface water elevation at Pond DG-46 followed the 2010 Steady Trend.

The observed surface water elevation at Pond DG-46 varied by only 0.43 foot during 2010 monitoring. The pond had a high water level elevation in September (1114.08 feet), followed by a low reading in October (1113.65 feet) (Appendix I – Pond DG-46, Figure 1). All surface water elevations fell within the range of the minimum (1112.61 feet) and maximum (1115.40 feet) baseline surface water elevations (Appendix I – Pond DG-46, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond DG-46 (Appendix I – Pond DG-46, Figure 4).

Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond DG-46. However, 2010 water levels for the Platte River follow a similar pattern to the surface water elevation readings for Pond DG-46 (Appendix III, Section C). Given the proximity of Pond DG-46 to the Platte River as well as the large size of the waterbody, DG-46 may be influenced by the Platte River, and is likely influenced by seasonal surface water influx, along with some local groundwater. Additionally, usage of the “stops” or removable boards is an unknown variable. These padlocked devices are managed by the local homeowner’s association with keys issued to numerous individuals. It is possible to remove only sections of the boards. As mentioned for Pond DG-45, the hydrologically connected ponds did not follow the same trends in 2010.

3.3.1.37 Pond DG-52

Pond DG-52 is located east of Two Rivers State Recreational Area and within the Douglas County well field. Pond DG-52 is approximately 3150 feet east of the Platte River (Figure 2-1). Groundwater Monitoring Wells MW 90-07, MW 94-01, and MW 94-02 are approximately 775 feet west, 1350 feet northeast, and 850 feet south of Pond DG-52, respectively. The trend in surface water elevation at Pond DG-52 followed the 2010 Majority Trend.

Surface water elevations in 2010 were highest in March (1105.99 feet). The August measurement was the lowest surface water elevation reading in 2010 for Pond DG-52 (1103.24 feet). September water levels increased from August, followed by a decrease in October (Appendix I – Pond DG-52, Figure 1). Surface water elevations in August and October were below the minimum baseline elevation, while March and October fell within the range of baseline surface water elevations (Appendix I – Pond DG-52, Figure 2). The minimum and maximum baseline surface water elevations for Pond DG-52 were 1103.48 and 1106.62 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were statistically significant for Pond DG-52 in August 2010 (Appendix I – Pond DG-52, Figure 4). It should be noted that while 2010 monitoring for Pond DG-52 was within the maximum and minimum baseline elevations, the analysis included 2009 and 2010 operational data and compared these readings to those taken August 2006 through March 2008. The 2009 monitoring data for Pond DG-52 was below the minimum baseline elevation for three of four months monitored. Therefore, the statistical significance is likely due to the 2009 data.

There does not appear to be a direct relationship between the precipitation levels and the surface water elevation readings of Pond DG-52 in 2010. Snowmelt and subsequent runoff was the likely cause of the increase in surface water elevation in March 2010. The trends shown by the data for Groundwater Monitoring Well MW 90-07, MW 94-01, and MW 94-02 corresponded with Pond DG-52 surface water elevation data in 2010 (Appendix III, Sections A and C). Given the proximity of Pond DG-52 to the Platte River and the Production wells, fluctuations in pond water levels may likely be related to the pumping rates of nearby Production Wells PW 91-3, PW 04-4, PW 04-6, PW 04-7, PW 04-8, and PW 04-9 (Appendix III, Section B) as well as partially influenced by the Platte River and seasonal surface water runoff.

3.3.2 Saunders County Pond Data

3.3.2.1 Pond SN-03

Pond SN-03 is located to the west of the Platte River and the Saunders County well field. The Saunders County well field is located between Pond SN-03 and the Platte River, with the river approximately 3500 feet east of the pond. Groundwater Monitoring Well MW 90-10 is approximately 2500 feet northwest of Pond SN-03 (Figure 2-2). No standing water has been observed during monitoring in Pond SN-03 since September 2009. All monitoring events for 2010 were recorded as no water being present (Appendix II – Pond SN-03, Figures 1 and 2). The minimum and maximum baseline values were 1092.26 and 1095.56 feet, respectively.

This trend of no water for Pond SN-03 has only been documented during Project monitoring from September 2009 to October 2010. Correlations to precipitation and the Groundwater Monitoring Well MW 90-10 in 2010 are not possible. Because of the close proximity of Pond SN-03 to the Saunders County well field and its small size, it is possible that Pond SN-03 was influenced by the pumping rates of Production Wells PW 04-42, PW 04-43, PW 04-44, PW 04-49, and PW 94-35 (Appendix III, Section B).

3.3.2.2 Pond SN-04

Pond SN-04 is located approximately 2650 feet west of the Platte River and 2650 feet north of Pond SN-03. Groundwater Monitoring Well MW 90-10 is approximately 1500 feet southwest of Pond SN-04. The trend in surface water elevation at Pond SN-04 followed the 2010 Majority Trend.

The highest 2010 surface water elevation for Pond SN-04 was recorded in March (1097.36 feet), followed by a decrease in August, an increase in September, and a low in October (1096.43 feet) (Appendix II – Pond SN-04, Figure 1). All of the 2010 readings at Pond SN-04 fell between the minimum (1095.38 feet) and maximum (1099.83 feet) baseline surface water elevations (Appendix II – Pond SN-04, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were statistically significant for Pond SN-04 (Appendix I – Pond SN-04, Figure 4). The analysis included 2009 and 2010 operational data and compared these readings to those taken August 2006 through March 2008.

The trend recorded in 2010 for Pond SN-04 was previously recorded at this pond in 2009. Precipitation levels in 2010 did not appear to directly correlate to the surface water elevation readings of Pond SN-04. An increase in spring runoff from snow melt likely resulted in the slightly higher March reading. The trend shown by the data for Groundwater Monitoring Well MW 90-10 also does not correspond with Pond SN-04 surface water elevation data in 2010 (Appendix III, Sections A and C). Fluctuations in pond water levels may be related to pumping rates of Production Wells PW 04-38, PW 04-39, PW 04-40, PW 04-45, PW 04-49, and PW 94-37 (Appendix III, Section B). Given the silt substrate of this pond and its proximity to the Saunders County well field, it is likely that this pond is strongly influenced by groundwater levels and seasonal surface water runoff.

3.3.2.3 Pond SN-16

Pond SN-16 is located approximately 2 miles west of the Platte River (Figure 2-2). Groundwater Monitoring Well MW 94-03 is approximately 2600 feet northeast of Pond SN-16. The trend in surface water elevation at Pond SN-16 followed the 2010 Majority Trend.

The highest observed surface water elevation for Pond SN-16 was recorded in March 2010 (1081.90 feet), followed by a low in August (1079.01 feet), an increase in September, and a decrease in October (Appendix II – Pond SN-16, Figure 1). The March 2010 value exceeded the maximum baseline surface water elevation; however the remaining readings fell within the range of the minimum (1078.08 feet) and maximum (1081.63 feet) baseline surface water elevations, respectively (Appendix II – SN-16, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-16 (Appendix I – Pond SN-16, Figure 4).

Precipitation levels did not directly correlate to the surface water elevation readings of Pond SN-16 for 2010. The considerably higher March 2010 reading is likely the result of spring snow melt runoff entering Pond SN-16. The trend shown by the data for Groundwater Monitoring Well MW 94-03 does correspond with Pond SN-16 surface water elevation data in 2010 (Appendix III, Sections A and C). Given this correlation to the Groundwater Monitoring Well and Pond SN-16 having a silty substrate, it is likely that this pond has a groundwater influence as well as receives considerable seasonal surface water runoff.

3.3.2.4 Pond SN-17

Pond SN-17 is located approximately 1.2 miles west of the Platte River (Figure 2-2). Groundwater Monitoring Wells MW 94-03 and MW 94-07 are approximately 3100 feet north 2700 feet southwest of Pond SN-17, respectively. The trend in surface water elevation at Pond SN-17 followed the 2010 Majority Trend.

The highest 2010 surface water elevation for Pond SN-17 was recorded in March (1079.96 feet), followed by a decline in August, an increase in September, and a low in October (1077.45 feet) (Appendix II – Pond SN-17, Figure 1). All of the 2010 Pond SN-17 readings fell within the range of the minimum (1075.89 feet) and maximum (1079.99 feet) baseline surface water elevations (Appendix II – Pond SN-17, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-17 (Appendix I – Pond SN-17, Figure 4).

The trend recorded in 2010 for Pond SN-17 has not been previously recorded during baseline or operational monitoring at this pond. Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond SN-17. The trend in surface water elevation for SN-17 did correlate to Groundwater Monitoring Wells MW 94-03 and MW 94-07 (Appendix III, Sections A and C). Given the similarity in trends between the Groundwater Monitoring Wells and Pond SN-17, along with the pond's silty substrate, it is likely that SN-17 is influenced by groundwater as well as receives considerable seasonal surface water runoff.

3.3.2.5 Pond SN-23

Pond SN-23 is hydrologically connected to SN-24, and located on the same property as Ponds SN-24, SN-25, and SN-26 (Figure 2-2). Excavating equipment has been observed at this property since September 2005. This pond is extremely silty and supports a visible vegetative community of cattails (*Typha latifolia*). No Project groundwater monitoring wells are located within 0.5 miles of Pond SN-23. The trend in surface water elevation at Pond SN-23 included a summer decrease from spring, followed by a late summer high, and a fall decline.

The observed water level elevation at Pond SN-23 decreased from the March reading to a 2010 low reading in August (1087.45 feet). The water level elevation then reached a high in September (1089.12 feet) before decreasing in October (Appendix II – SN-23, Figure 1). The surface water elevation readings for March and September exceeded the maximum baseline surface water elevation, while August and October fell within the range of the minimum and maximum baseline surface water elevations (Appendix II – Pond SN-23, Figure 2). The minimum and maximum baseline surface water elevations for Pond SN-23 were 1085.75 and 1088.87 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-23 (Appendix I – Pond SN-23, Figure 4).

Precipitation levels in 2010 did not directly correlate to the surface water elevation readings of Pond SN-23 (Appendix III, Section C). The higher surface water elevation level in March is likely the result of runoff from spring snow melt. Of the ponds on the property, Pond SN-23 revealed a trend in 2010 similar to Pond SN-24 and Pond SN-25, but not Pond SN-26. Conversations with the landowner on-site during 2010 revealed that large-volume water pumping took place for an undetermined amount of time from Pond SN-26 to Pond SN-25 in July and August 2010. Because Ponds SN-23, SN-24, and SN-25 are hydrologically connected, any pumping or other alterations are likely to influence all ponds. Given the lack of correlation to 2010 precipitation data and the similar trends in the hydrologically connected ponds, it is likely the man-induced movement of water caused the September rise at SN-23.

3.3.2.6 Pond SN-24

Pond SN-24 is hydrologically connected to Pond SN-23 and Pond SN-25 (Figure 2-2). The connection to Pond SN-25 was a new development, made by the landowner during the summer 2010. This was accomplished by the removal of approximately 6 to 8 feet of the east-west levee between the ponds. No Project groundwater monitoring wells are located within 0.5 miles of Pond SN-24. The trend in surface water elevation at Pond SN-24 included a summer decrease from spring, followed by a late summer high, and fall decline.

The observed surface water elevation at Pond SN-24 decreased from the March reading to a 2010 low reading in August (1087.87 feet). The water level elevation then reached a high in September (1089.33 feet) before decreasing in October (Appendix II – SN-24, Figure 1). The surface water elevation in September exceeded the maximum baseline surface water elevation, while August and October levels fell between the minimum and maximum baseline surface water elevations, and March was essentially the same as the maximum (Appendix II – Pond SN-24, Figure 2). The minimum and maximum baseline surface water elevations for Pond SN-24 were 1086.21 and 1088.82 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-24 (Appendix I – Pond SN-24, Figure 4).

Precipitation levels in 2010 did not appear to be directly correlated to the surface water elevation readings of Pond SN-24 (Appendix III, Section C). The high surface water elevation level in March is likely the result of runoff from spring snow melt. As described for Pond SN-23 (see 3.3.4.5), the hydrological connections between Pond SN-23, Pond SN-24, Pond SN-25, and occasional pumping of water from Pond SN-26 likely explain the September rise in Pond SN-24.

3.3.2.7 Pond SN-25

Pond SN-25 is hydrologically connected to Pond SN-24, as described for Pond SN-24 (see 3.3.4.6). Pond SN-25 has undergone numerous alterations since September 2004. The alterations to this pond over the years have made it difficult to accurately determine the trends in surface water elevation. Additionally, as previously mentioned, interaction with the landowner on-site during 2010 revealed that large-volume water pumping took place for an undetermined amount of time from Pond SN-26 to Pond SN-25 in July and August 2010. No Project groundwater monitoring wells are located within 0.5 miles of Pond SN-25. The trend in surface water elevation at Pond SN-25 included a summer decrease from spring, followed by a late summer high, and a fall decline.

The observed surface water level at Pond SN-25 decreased from the March reading to a 2010 low reading in August (1086.67 feet). The water level elevation then reached a high in September (1088.86 feet) followed by a decrease in October (Appendix II – SN-25, Figure 1). The surface water elevation readings for March and September exceeded the maximum baseline surface water elevation, while August and October fell between the minimum and maximum baseline surface water elevations (Appendix II – Pond SN-25, Figure 2). The minimum and maximum baseline surface water elevations for Pond SN-25 were 1081.68 and 1088.41 feet, respectively. Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-25 (Appendix I – Pond SN-25, Figure 4).

Precipitation levels in 2010 did not directly correlate to the surface water elevation readings of Pond SN-25 (Appendix III, Section C). The high surface water elevation level in March is likely the result of runoff from spring snow melt. The breaching of the levee between Pond SN-24 and Pond SN-25, excavation of a chute or channel area on the east side of the pond complex, and large-volume intermittent water pumping from Pond SN-26 to Pond SN-25 in July and August 2010 has influenced the hydrology of the waterbody and made comparative analysis difficult. As described for Pond SN-23 and Pond SN-24 (see 3.3.4.5 and 3.3.4.6), the hydrological connections between Pond SN-23, Pond SN-24, Pond SN-25, and occasional pumping of water from Pond SN-26 likely explain the September rise in Pond SN-25.

3.3.2.8 Pond SN-26

Pond SN-26 is adjacent to Pond SN-25. Movement of groundwater between the ponds is likely given the close proximity. Observation of a large pump at SN-26 followed by on-site conversation with the landowner revealed that large-volume water pumping took place for an undetermined amount of time from Pond SN-26 to Pond SN-25 in July and August 2010. No Project groundwater monitoring wells are located within 0.5 miles of Pond SN-26. The trend in surface water elevation at Pond DG-46 included a summer decrease from spring, and a fall increase from summer.

The 2010 observed surface water elevation was highest in March (1088.20 feet), decreased to a low water level reading in August (1086.92 feet), increased in September, and further increased in

October (Appendix II – SN-26, Figure 1). All of the 2010 readings at Pond SN-26 were between the minimum (1085.14 feet) and maximum (1088.38 feet) baseline surface water elevations, respectively (Appendix II – Pond SN-26, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-26 (Appendix I – Pond SN-26, Figure 4).

Precipitation levels in 2010 did not directly correlate with the surface water elevation readings of Pond SN-26 (Appendix III, Section C). The high surface water elevation level in March is likely the result of runoff from spring snow melt. The August decrease may be accounted for by the pumping activities from Pond SN-26 to Pond SN-25, as explained by the landowner.

3.3.2.9 Pond SN-27

Pond SN-27 is a large and narrow pond located near the western boundary of the Saunders County cone of depression (Figure 2-2). No Project groundwater monitoring wells are located within 0.5 miles of Pond SN-27. The trend in surface water elevation at Pond SN-27 followed the 2010 Steady Trend.

The observed surface water elevation at Pond SN-27 varied by only 0.1 foot during 2010 monitoring. The pond had a high water level elevation in March of 1087.86 feet, before decreasing in August and September to a low 2010 reading of 1087.76 feet. A very slight increase in water level elevation was observed in October (Appendix II – Pond SN-27, Figure 1). All surface water elevations fell within the range of the minimum (1085.78 feet) and maximum (1088.83 feet) baseline surface water elevations (Appendix II – Pond SN-27, Figure 2). Differences between operational surface water elevation readings (taken during the 2009 and 2010 monitoring efforts) and baseline elevations (taken between August 2006 and March 2008) were not statistically significant for Pond SN-27 (Appendix I – Pond SN-27, Figure 4).

Precipitation levels in 2010 did not directly correlate to the surface water elevation readings of Pond SN-27 (Appendix III, Section C). Given the lack of similarity in trends to the precipitation data, distance between the pond and the Groundwater Monitoring Well for comparison, and overall size of the water body, it is can be hypothesized that this pond receives considerable seasonal surface water runoff and is influenced by localized groundwater.

3.4 HYDROLOGICAL MONITORING DATA

Hydrological data including precipitation, temperature, and stream elevation data from the Platte and Elkhorn Rivers were reviewed for 2010 and are included in Appendix III, Section C. These data were compared to the baseline data.

3.4.1 Precipitation

Precipitation from January through December 2010 was below the historical monthly average for 10 of the 12 months (Appendix III, Section C). Precipitation was significantly higher than the historical monthly average in June 2010. The monthly precipitation ranged from 0.24 to 8.59 inches. Historically, the amount of precipitation increases from January, to a peak in May, declines to a plateau in late summer, and declines further through December to the annual low point. The trend in 2010 essentially followed the historical trend; however, the peak level of precipitation was seen in June rather than May.

3.4.2 Ambient Air Temperatures

Average ambient air temperature from January 2010 through December 2010 fell within the expected monthly high and low temperature range based on the historical average (Appendix III, Section D). Average monthly temperatures ranged between 17 °F and 76 °F.

3.4.3 Stream Elevations

In general, stream elevations (and resulting flows) are highest in the spring and early summer and lowest in late summer and early fall (Appendix III, Section B).

In the winter of 2010, the mean stream elevation data of the Platte River was not consistent with the precipitation data in that water elevations were high and mean precipitation levels were at the lowest levels. This could be a result of blockages in the river formed by ice, or “ice dams”, downstream of the Venice Stream Gauge on the Platte River. These levels were likely sustained into March as a result of gradually increasing temperatures leading to increased snow melt runoff upstream of the Venice Stream Gauge. The Platte River mean water levels at this location experienced a rise in May and a peak in June, corresponding with precipitation. Additionally, the Platte River mean water levels corresponded with recorded precipitation amounts from the June peak through the remainder of 2010, including the lowest readings recorded in October.

Mean 2010 stream elevations in the Elkhorn River closely followed the trends in precipitation. The March rise in mean stream elevation can be associated with precipitation as well as an increase in temperature leading to increased snow melt runoff. Similar to the Platte River, a peak in mean water level correlated with higher precipitation levels, rising in May and peaking in June. The Elkhorn's mean stream elevation level and the precipitation level trended together through the remainder of 2010, with the lowest levels for each in October.

4.0 SUMMARY AND DISCUSSION

The goal of monitoring the 46 ponds in Douglas in Saunders Counties is to evaluate impacts of Project operations on pond surface water elevations. To facilitate this goal, a standardized monitoring procedure for monitoring the Project ponds was developed and implemented. This procedure can be complimented by additional information received during landowner contacts, discussion, and monitoring visits. The baseline monitoring data is represented by the surface water elevations collected from September 2004 through March 2008. Surface water elevation data has been collected since the fall of 2008 is considered post-operational. The 2010 data was evaluated and compared to the ranges and values established by the baseline surface water elevation data. This summary and discussion focuses on the 2010 monitoring efforts.

4.1 TRENDS IN POND SURFACE WATER ELEVATIONS

Seven trends were observed at the 45 ponds (pond 46 is Pond DG-11 and receives photographic monitoring only) where surface water elevations were recorded four times in 2010. Most ponds in Douglas County and a few in Saunders County followed the previously described 2010 Majority Trend. This trend has surface water elevations decreasing to the lowest observed level in August, increasing by September, and decreasing by October to the point of approaching August levels; the water levels at a few ponds varied slightly from this pattern. A total of 30 monitored ponds followed this 2010 Majority Trend. The October decline from September in surface water elevation was supported by precipitation data for the region (Appendix III, Section C). Trends in pond surface water elevations varied in Saunders County, likely due to the distance between the ponds.

In 2010, four ponds experienced a Steady Trend. This includes less than or equal to 0.5 foot of variation in surface water elevation during monitoring. The ponds included in this trend were Ponds DG-28, DG-43, DG-46, and SN-27. The ponds that share this trend are not hydrologically connected and vary in pond characteristics (i.e., size, watershed usage, proximity to the Platte River) (Figures 2-1 and 2-2). The Steady Trend observed in 2010 may likely be due to a variety of reasons. Pond DG-28 and Pond DG-43 are likely strongly influenced by a groundwater connection with the Platte River. Pond DG-46 has a potential groundwater connection to the Platte River, seasonal surface water influx within the watershed, as well as an unknown variable of a manual water control structure (i.e., “stops”). Pond SN-27 likely receives considerable seasonal surface water runoff and is influenced by localized groundwater.

Pond SN-03 is the only pond where no standing water was observed during 2010 monitoring events. Four ponds (Ponds DG-19, SN-23, SN-24, and SN-25) experienced a trend that included a decline in water level between spring and summer followed by a high observed in September and a decline in October. Four ponds (Ponds DG-17, DG-26, DG-45, and SN-26) were observed to have a trend of a summer decline followed by an increase in water level in the fall. One pond (Pond DG-02) experienced considerably low spring levels, followed by lower summer levels, with an increase later in the summer and fall. Lastly, one pond (Pond DG-03) showed a trend of lowest observed surface water elevation readings in the spring, increasing in the summer, and a decrease in the fall.

In some cases, observed surface water elevations were greater than the maximum baseline surface water elevations. Eighteen of these high readings occurred in March 2010 and were likely the result of surface water runoff due to greater-than-normal spring snow melt. Pond DG-02 and Pond DG-52 surface water elevations fell below the minimum baseline surface water elevation. This could potentially be related to the proximity of Pond DG-52 to the production wells. The low spring levels at Pond DG-02 may have been a result of ice blockage of the connecting culvert from Pond DG-03, therefore not allowing a direct flow of water during the winter months.

In particular, Production Wells PW 04-6 and PW 04-8 were pumped actively in winter and spring 2010, with PW 04-6 pumped through summer and fall 2010 (Appendix III, Section B). The nearest pond (Pond DG-52) had surface water elevation readings below the minimum baseline elevation readings in two of four monitored months (Appendix I – Pond DG-52, Figures 1 and 2).

In Saunders County, Pond SN-03 did not have water during 2010 monitoring. Pond SN-03 is located adjacent to the Saunders County well field. Due to the small size of the pond and location, pumping in the nearby well field may have impacted this pond. Additional factors beyond pumping may have contributed to the lack of surface water as well, such as livestock usage of the area and precipitation for the region in 2010 (i.e., 10 of 12 months below the historical average) (Appendix III, Section C).

The statistical analysis determined whether any observed changes in the water level elevation data are significant. Within the ponds monitored for surface water elevation in 2010 (i.e., 45 ponds, DG-11 excluded), six ponds showed a statistically significant different water level elevation between operational data compared to the August 2006 through March 2008 surface water baseline.

Five of the six pond levels determined to be different from a statistically significant standpoint (Ponds DG-02, DG-30, DG-31, DG-52, and SN-04) had considerably lower observational levels or were below the minimum baseline surface water elevations in 2009 or 2010. One pond level determined to be significantly different (Pond DG-43) had considerably higher observational levels or was above the maximum baseline surface water elevations in 2009 and 2010. The remaining 39 monitored ponds were not shown to have statistically significantly different readings taken during 2009 and 2010 compared to those between August 2006 and March 2008.

Continued monitoring at all of the ponds as well as continued evaluation of the other hydrological data and pumping data will assist in determining the impacts, if any, of pumping within the cones of depression. The trends in surface water elevations of the Platte and Elkhorn Rivers were similar to trends in some 2010 pond surface water elevations (where applicable). The trends of numerous ponds are similar to nearby groundwater monitoring well data. However, few pond surface water elevation levels trended with the 2010 precipitation data, as well as the production well data did not directly relate to any of the monitored ponds outside of the well field (i.e., except Pond DG-52). It, therefore, appears that the majority of the ponds being monitored are influenced by a combination of groundwater, connections to other ponds in isolated situations, and high surface water runoff events.

4.2 FUTURE MONITORING

As discussed earlier, there are several factors which may be influencing the hydrology of the ponds in the Project area. These include, but are not limited to, the Platte and Elkhorn Rivers, precipitation, irrigation wells, subsurface groundwater flow, and production well pumping. These potential influences, along with pond surface water elevations, will continue to be monitored as Project operation continues. As more data is gathered, fluctuations in surface water elevations, the surface area, and the water storage volume will be calculated and presented in future reports.

At this time, surface water elevations will continue to be monitored four times a year using the permanent benchmarks (March, August, September, and October) at each of the 45 ponds within the Project area. In addition to the 45 ponds that are being monitored using permanent benchmarks, DG-11 will be monitored photographically in the future at the request of the landowner.

Landowners who have provided access in the past will again be contacted prior to the scheduled monitoring dates to confirm that continued access to read the surface water elevations for their ponds will be granted. Contact with each landowner will also be maintained to document any modifications that have been made to their pond(s) that could affect the surface water elevation or water storage capacity. An up-to-date summary of the surface water elevations will continue to be provided to each landowner following each monitoring year.

4.3 CONCLUSION

This report presents the pond surface water elevations and trends for each pond from March through October 2010. This data was compared to the minimum and maximum baseline elevations of each pond, collected by Burns & McDonnell from September 2004 through March 2008. For the majority of the ponds, the fluctuations to date have been within the range of baseline conditions. As monitoring continues along with Project operations, the data presented in this report can be used to evaluate if Project operations are having an effect on individual ponds. These data may be used by the District to determine mitigation measures on a pond-by-pond basis, if it is determined that Project operations are having an effect on individual pond surface water level elevations.

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