Summary of First-Year Operations and Performance of the Utica Aquifer and North Lake Basin Wetlands Restoration Project in October 2004–November 2005

prepared by
Environmental Science Division
Argonne National Laboratory
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by
Applied Geosciences and Environmental Management Section
Environmental Science Division, Argonne National Laboratory

December 2005
Contents

Notation ................................................................................................................................................ iv

1 Introduction ........................................................................................................................................ 1-1

2 Overview of the Aquifer Restoration Facilities at Utica ................................................................. 2-1
   2.1 Wells GWEX1–GWEX3 and the Spray Irrigation Treatment Units .................................................. 2-1
   2.2 Well GWEX4 and the Conventional Air Stripper ......................................................................... 2-2

3 Overview of System Operations ....................................................................................................... 3-1
   3.1 Operation of Wells GWEX1–GWEX3 and the Spray Irrigation Treatment Units ....................... 3-1
   3.2 Operation of Well GWEX4 and the Conventional Air Stripper ................................................... 3-2

4 Groundwater Production Results ..................................................................................................... 4-1
   4.1 Production by Wells GWEX1–GWEX3 ......................................................................................... 4-1
   4.2 Production by Well GWEX4 ......................................................................................................... 4-1

5 Groundwater Treatment Results ....................................................................................................... 5-1
   5.1 Results for Wells GWEX1–GWEX3, with Treatment by Spray Irrigation ................................. 5-2
   5.2 Results for Well GWEX4, with Treatment by Air Stripping ....................................................... 5-5
   5.3 Estimated Removal of Carbon Tetrachloride from the Utica Aquifer ....................................... 5-5

6 Operation, Maintenance, and System Modifications ....................................................................... 6-1
   6.1 Wells GWEX1–GWEX3 and the Spray Irrigation Treatment Units ............................................. 6-1
   6.2 Well GWEX4 and the Air Stripping Unit ...................................................................................... 6-2
   6.3 Installation and Sampling of Monitoring Wells ........................................................................... 6-2
   6.4 First-Year Operating and Maintenance Costs ........................................................................... 6-3

7 Summary ............................................................................................................................................ 7-1

8 References .......................................................................................................................................... 8-1

Appendix A: Well Registration Forms ................................................................................................. A-1

Figures

2.1 Locations of the restoration facilities, contaminant plume, and permanent monitoring wells at Utica ........................................................................................................... 2-3

2.2 Spray irrigation unit in operation at Utica ................................................................................... 2-4
Tables

2.1 Summary of construction details for GWEX wells at Utica ........................................ 2-1

4.1 GWEX operation and groundwater production data for the first year of restoration at Utica ........................................................................................................ 4-2

5.1 Analytical results for carbon tetrachloride in untreated groundwater samples and treated effluent samples ........................................................................... 5-3

5.2 Values for pH in untreated groundwater samples and treated effluent samples ............ 5-4

5.3 Estimation of carbon tetrachloride removed from the Utica aquifer ............................... 5-6

6.1 Well construction data and analytical results for carbon tetrachloride in groundwater samples from the permanent monitoring wells ........................................... 6-3

6.2 Summary of first-year operating and maintenance costs for the Utica restoration project ...................................................................................................................... 6-4
## Notation

<table>
<thead>
<tr>
<th>Notation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGL</td>
<td>below ground level</td>
</tr>
<tr>
<td>CCC</td>
<td>Commodity Credit Corporation</td>
</tr>
<tr>
<td>°F</td>
<td>degree(s) Fahrenheit</td>
</tr>
<tr>
<td>ft</td>
<td>foot (feet)</td>
</tr>
<tr>
<td>gal</td>
<td>gallon(s)</td>
</tr>
<tr>
<td>gpm</td>
<td>gallon(s) per minute</td>
</tr>
<tr>
<td>GWEX</td>
<td>groundwater extraction</td>
</tr>
<tr>
<td>hr</td>
<td>hour(s)</td>
</tr>
<tr>
<td>µg/L</td>
<td>microgram(s) per liter</td>
</tr>
<tr>
<td>mph</td>
<td>mile(s) per hour</td>
</tr>
<tr>
<td>MW</td>
<td>monitoring well</td>
</tr>
<tr>
<td>NDEQ</td>
<td>Nebraska Department of Environmental Quality</td>
</tr>
<tr>
<td>NGPC</td>
<td>Nebraska Game and Parks Commission</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>USDA</td>
<td>U.S. Department of Agriculture</td>
</tr>
<tr>
<td>VOC</td>
<td>volatile organic compound</td>
</tr>
</tbody>
</table>
1 Introduction

This document summarizes the performance of the groundwater restoration systems installed by the Commodity Credit Corporation of the U.S. Department of Agriculture (CCC/USDA) at the former CCC/USDA grain storage facility in Utica, Nebraska, during the initial period of system operation, from October 29, 2004, until November 31, 2005.

In the project at Utica, the CCC/USDA is cooperating with multiple state and federal agencies to remove carbon tetrachloride contamination from a shallow aquifer underlying the town and to provide supplemental treated groundwater for use in the restoration of a nearby wetlands area. Argonne National Laboratory has assisted the CCC/USDA by providing technical oversight for the aquifer restoration effort and facilities during this review period.

This document presents overviews of the aquifer restoration facilities (Section 2) and system operations (Section 3), then describes groundwater production results (Section 4), groundwater treatment results (Section 5), and modifications and costs during the review period (Section 6). Section 7 summarizes the first year of operation.
2 Overview of the Aquifer Restoration Facilities at Utica

The principal components of the groundwater restoration systems at Utica are shown in Figure 2.1. The facilities consist of two main operating units, as described below. The facilities include four groundwater extraction (GWEX) wells. Table 2.1 summarizes construction details for these wells. The well registration forms are in Appendix A.

2.1 Wells GWEX1–GWEX3 and the Spray Irrigation Treatment Units

Extraction wells GWEX1–GWEX3, located in the northern portion of the town, are used to extract contaminated groundwater from the upgradient portion of the contaminant plume. The wells are linked by a distribution system that selectively carries untreated groundwater to either of two discharge points in the northern and southern subbasins of the North Lake Basin Wildlife Management Area (Figure 2.1). At each discharge point, the water is treated to remove carbon tetrachloride by using a custom spray irrigation treatment unit (Figure 2.2). The three extraction wells are operated simultaneously to maintain a critical operating pressure at each treatment unit.

Wells GWEX1–GWEX3 are operated intermittently during the year, subject to local weather conditions and in consultation with the Nebraska Game and Parks Commission (NGPC). NGPC owns most of the property occupied by the wetlands and has administrative and technical responsibility for management of the wildlife area.

| TABLE 2.1 Summary of construction details for GWEX wells at Utica. |
|-------------------|-------------------|-------------------|-------------------|
| Well          | Depth (ft BGL) | Screen Interval | Gravel Pack Interval | Casing Diameter (in.) |
| GWEX1          | 132             | 106–126         | 97–132             | 8                 |
| GWEX2          | 148             | 110–145         | 106–148             | 8                 |
| GWEX3          | 146             | 105–140         | 101–146             | 8                 |
| GWEX4          | 150             | 115–145         | 110–150             | 6                 |
2.2 Well GWEX4 and the Conventional Air Stripper

Extraction well GWEX4 is located near the downgradient toe of the carbon tetrachloride plume and is operated continuously as a containment well. Groundwater produced from GWEX4 is treated by using a conventional (shallow-tray) air stripping technique, and the effluent is discharged to the surface for reinfiltration into the shallow Utica aquifer.
FIGURE 2.1 Locations of the restoration facilities, contaminant plume, and permanent monitoring wells at Utica.
FIGURE 2.2  Spray irrigation unit in operation at Utica.
3 Overview of System Operations

3.1 Operation of Wells GWEX1–GWEX3 and the Spray Irrigation Treatment Units

Routine operation of wells GWEX1–GWEX3 and the spray irrigation treatment units began on November 22, 2004. The wells were pumped intermittently, under automated control, during 11 of the 13 months during the review period. The daily operation of the spray treatment units is governed primarily by weather conditions; to ensure effective removal of the carbon tetrachloride and to prevent excessive drift of the resulting spray discharge, a minimum air temperature of 40°F and sustained winds of less than 15 mph are required for operation.

Wells GWEX1–GWEX3 and the treatment units were not operated in late May 2005 and all of June and July 2005, because heavy storms in early May caused rapid, widespread flooding throughout the Utica area and persistent high water levels in the North Lake Basin and on surrounding private properties. The pumping was curtailed at the request of the NGPC, in response to concerns expressed by the neighboring property owners regarding the continued flooding.

For reasons including apparent power supply fluctuations and outages, unexpected shutdowns of the wells and the spray treatment units occurred sporadically during the review period. Investigations to determine the quality of the electrical power supplied by the local utility company led to adjustments to the drive units for the well pumps that reduced the frequency of shutdowns. Occasional pumping interruptions have continued, however. Investigation into the cause(s) of these shutdowns were still in progress at the end of the review period.

Treated groundwater from the spray irrigation systems was selectively routed to both the north and south subbasins at the request of the NGPC. Groundwater was discharged exclusively to the north subbasin during the winter of 2004 and early spring of 2005, then to both subbasins during the remainder of the review period.
3.2 Operation of Well GWEX4 and the Conventional Air Stripper

Operation of well GWEX4 and the associated air stripper began on October 29, 2004. GWEX4 operated continuously during the review period, with only two brief interruptions of less than one day each. The interruptions were as follows:

- On August 12, 2005, the equipment was temporarily shut down to permit the local utility company to repair power supply connections to the well house.

- On October 26, 2005, the system was shut down for routine inspection and cleaning of the shallow-tray air stripping unit.

Treated groundwater from well GWEX4 is discharged to an open ditch that serves as part of Utica’s storm drainage system. The ditch borders a county road leading eastward from the town, as well as an adjacent private farm property. During the review period, Argonne received no reports of drainage or other problems associated with discharge from GWEX4.
4 Groundwater Production Results

The volumes of groundwater extracted from the Utica aquifer, treated, and discharged are summarized in Table 4.1.

4.1 Production by Wells GWEX1–GWEX3

Wells GWEX1–GWEX3 are equipped with electronically controlled pump drive units linked to digital flow meters that automatically and continuously adjust the flow from each well to maintain user-specified pumping rates. The programmed flow rates for these wells were as follows:

- GWEX1, 50 gpm
- GWEX2, 180–200 gpm
- GWEX3, 125 gpm

The selected rates were achieved, within ±1 gpm, throughout the review period.

Wells GWEX1–GWEX3 were pumped for approximately 1,560 hr during the review period and discharged approximately 34.6 million gallons (106 acre-feet) of treated water to the North Lake Basin wetlands. Approximately 64% of the total production was routed to the northern wetlands subbasin, at the request of the NGPC.

4.2 Production by Well GWEX4

Measured groundwater pumping rates (determined from an inline flow meter) at GWEX4 ranged from approximately 51 gpm to 64 gpm. Periodically, the rates were adjusted manually to compensate for a very slow decline in the flow rate from the well over time. The groundwater volumes pumped in any one complete month (Table 4.1) ranged from approximately 2.1 million gallons to 2.7 million gallons. A total of 31.7 million gallons (97.5 acre-feet) of groundwater was treated and discharged during the review period, at a net average pumping rate of approximately 56 gpm.
TABLE 4.1  GWEX operation and groundwater production data for the first year of restoration at Utica.\(^a\)

<table>
<thead>
<tr>
<th>Month</th>
<th>GWEX1</th>
<th>GWEX2</th>
<th>GWEX3</th>
<th>Operating Time GWEX1–3(^c) (hr)</th>
<th>Volume Discharged to Wetlands (gal)</th>
<th>Groundwater Produced by Wells GWEX1–GWEX3(^b) (gal)</th>
<th>Operating Time GWEX4(^d) (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2004</td>
<td>–(^e)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>263,520</td>
<td>–</td>
</tr>
<tr>
<td>Nov 2004</td>
<td>130,800</td>
<td>470,880</td>
<td>327,000</td>
<td>43.6</td>
<td>928,680</td>
<td>–</td>
<td>2,687,040</td>
</tr>
<tr>
<td>Dec 2004</td>
<td>151,800</td>
<td>546,480</td>
<td>379,500</td>
<td>50.6</td>
<td>1,077,780</td>
<td>–</td>
<td>2,660,544</td>
</tr>
<tr>
<td>Jan 2005</td>
<td>21,000</td>
<td>75,600</td>
<td>52,500</td>
<td>7.0</td>
<td>149,100</td>
<td>–</td>
<td>2,544,480</td>
</tr>
<tr>
<td>Feb 2005</td>
<td>288,900</td>
<td>1,040,040</td>
<td>722,250</td>
<td>96.3</td>
<td>2,051,190</td>
<td>–</td>
<td>2,298,240</td>
</tr>
<tr>
<td>Mar 2005</td>
<td>585,300</td>
<td>2,107,080</td>
<td>1,463,250</td>
<td>195.1</td>
<td>4,155,630</td>
<td>–</td>
<td>2,620,368</td>
</tr>
<tr>
<td>Apr 2005</td>
<td>407,944</td>
<td>1,631,776</td>
<td>1,019,860</td>
<td>135.9</td>
<td>1,780,680</td>
<td>–</td>
<td>2,397,600</td>
</tr>
<tr>
<td>May 2005</td>
<td>243,933</td>
<td>975,733</td>
<td>609,833</td>
<td>81.3</td>
<td>1,829,500</td>
<td>–</td>
<td>2,410,560</td>
</tr>
<tr>
<td>Jun 2005</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2,332,800</td>
</tr>
<tr>
<td>Jul 2005</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2,332,800</td>
</tr>
<tr>
<td>Aug 2005</td>
<td>200,827</td>
<td>803,307</td>
<td>502,067</td>
<td>66.9</td>
<td>1,506,200</td>
<td>–</td>
<td>2,096,460</td>
</tr>
<tr>
<td>Sept 2005</td>
<td>899,880</td>
<td>3,599,520</td>
<td>2,249,700</td>
<td>300.0</td>
<td>3,644,514</td>
<td>3,104,586</td>
<td>2,273,000</td>
</tr>
<tr>
<td>Oct 2005</td>
<td>1,201,093</td>
<td>4,804,373</td>
<td>3,002,733</td>
<td>400.5</td>
<td>2,648,411</td>
<td>6,359,789</td>
<td>4,555,905</td>
</tr>
<tr>
<td>Nov 2005</td>
<td>546,267</td>
<td>2,185,067</td>
<td>1,365,667</td>
<td>182.1</td>
<td>4,097,000</td>
<td>–</td>
<td>2,379,375</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4,677,744</td>
<td>18,239,856</td>
<td>11,694,360</td>
<td>1,559.3</td>
<td>22,039,185</td>
<td>12,572,775</td>
<td>31,752,692</td>
</tr>
</tbody>
</table>

\(^a\) Combined total production: 66,364,652 gal. Total production to wetlands: 34,611,960 gal.

\(^b\) Routine operation of GWEX1–GWEX3 and the spray irrigation treatment units began on November 22, 2004.

\(^c\) Wells GWEX1–GWEX3 operate simultaneously.

\(^d\) Routine operation of GWEX4 and the air stripping unit began on October 29, 2004.

\(^e\) Unit not in operation.
5 Groundwater Treatment Results

Treated groundwater at Utica is discharged under a National Pollutant Discharge Elimination System (NPDES) Permit, number NE0137456, issued by the Nebraska Department of Environmental Quality (NDEQ) on October 1, 2004.

To comply with the NPDES permit, samples of treated groundwater are collected monthly

• At the outlet of the air stripping unit at GWEX4 and

• From the spray discharge at each of the irrigation treatment units (during months of operation).

The samples are analyzed to determine the residual concentrations of carbon tetrachloride in the treated groundwater and the pH of the effluent. The results of these analyses are reported to the NDEQ quarterly.

The discharges of treated groundwater at Utica are considered by the NDEQ to contribute to the surface waters of the state. On this basis, NDEQ has specified the following compliance limits for the outfall from each treatment unit:

• A target maximum residual carbon tetrachloride concentration of 44.2 µg/L

• An acceptable pH range of 6.5 to 9.0

In conjunction with the compliance sampling, Argonne collects monthly samples of the untreated groundwater from each extraction well. The samples are analyzed for volatile organic compounds (VOCs) to enable estimation of the following:

• Carbon tetrachloride removal efficiencies for the treatment units

• Quantities of carbon tetrachloride removed from the contaminated aquifer
The results of the sampling and analyses during the review period are summarized in Tables 5.1 and 5.2.

### 5.1 Results for Wells GWEX1–GWEX3, with Treatment by Spray Irrigation

The concentrations of carbon tetrachloride found in the untreated groundwater from extractions wells GWEX2 and GWEX3 remained fairly stable and showed no clear trends throughout the first year of pumping (Table 5.1). Carbon tetrachloride concentrations in the produced water from GWEX2 ranged from 57 µg/L to 118 µg/L; the concentrations at GWEX3 ranged from 88 µg/L to 196 µg/L.

Well GWEX1, which is located in the upgradient portion of the identified plume, was constructed to intercept carbon tetrachloride contamination in the upper portion of the Utica aquifer, near the former CCC/USDA grain storage facility. Carbon tetrachloride was not detected in the untreated groundwater from GWEX1 in the first four months of its operation (November 2004–February 2005; Table 5.1); however, contamination began to appear at increasing levels in March–early May 2005, before pumping temporarily ceased during the summer months (see Section 3.1). The concentrations of carbon tetrachloride detected at this well have risen steadily since pumping began again in August 2005. A maximum carbon tetrachloride concentration of 74 µg/L was detected at GWEX1 in November 2005.

The groundwater produced from wells GWEX1–GWEX3 is combined into a single stream for conveyance to the wetlands via a common pipeline. This combined flow is also sampled monthly, as an indicator of the weighted average concentration of carbon tetrachloride in the untreated groundwater supplied to the spray irrigation treatment units. The measured concentrations in the combined flow showed minimal variation during the review period, ranging from 100 µg/L to 122 µg/L.

Treated groundwater sprayed from the irrigation units is collected for analysis at the following four locations at the treatment site during each sampling event:

- Beneath the center point of the “west” irrigation span
- Beneath the center point of the “center” irrigation span
## TABLE 5.1 Analytical results for carbon tetrachloride in untreated groundwater samples and treated effluent samples.

| Month     | GWEX1 | GWEX2 | GWEX3 | Mixeda | GWEX1 | GWEX2 | GWEX3 | Mixeda | Westb | Centerb | Eastb | Maxc | GWEX1 | GWEX2 | GWEX3 | Mixeda | Westb | Centerb | Eastb | Maxc | GWEX4 | Stripper |
|-----------|-------|-------|-------|--------|--------|-------|-------|-------|--------|-------|--------|-------|------|--------|-------|-------|--------|-------|--------|-------|------|-------|----------|
| Nov 2004  | NDd   | 103   | 160   | 115    | ND     | 2.3   | ND    | ND    | ND     | –     | –      | –     | –    | –     | –     | –     | 77–94f | ND     |
| Dec 2004  | ND    | 108–118 | 98   | 112    | 2.2    | 1.2   | ND    | 1.6   | –      | –     | –      | –     | –    | 88–95 | ND     |
| Jan 2005  | ND    | 90    | 175–196 | 103    | 1.9    | 1.6–1.7 | 1.6   | 1.3   | –      | –      | –      | –      | –    | 74–88 | ND     |
| Feb 2005  | ND    | 104   | 133–142 | 101    | 2.0    | 7.2   | 5.6–6 | ND    | –      | –      | –      | –     | –    | 88–94 | ND     |
| Mar 2005  | 2.5   | 135   | 118–143 | 111    | 1.5    | ND–1.4 | 0.9 J| 1.6   | ND     | –      | –      | –     | –    | 89–92 | ND     |
| Apr 2005  | 20    | 83–87 | 120   | 100–102 | 1.8    | 0.4   | 0.7 J| 1.2   | 4.0–4.2 | 0.4 J–0.5 J | 0.8 J | 5.1–5.3 | 87–91 | ND |
| May 2005  | 22    | 98–104 | 121   | 103    | –      | –     | –    | –     | 0.4 J  | 0.7 J  | 0.8 J  | 0.6 J–0.8 J | 65–77 | ND |
| Jun 2005  | –     | –     | –     | –      | –     | –     | –    | –     | –      | –      | –      | –     | –    | 65–68 | ND     |
| Jul 2005  | –     | –     | –     | –      | –     | –     | –    | –     | –      | –      | –      | –     | –    | 66–72 | ND     |
| Aug 2005  | 6.4   | 97–100 | 144   | 117    | 0.8 J  | 6.1–6.2 | 0.8 J | ND    | –      | –      | –      | –     | –    | 56–58 | ND     |
| Sep 2005  | 37    | 108   | 170–183 | 115    | 0.7 J  | 0.7 J  | 0.3 J | 0.3 J | 1.8–1.9 | 0.2 J  | 0.4 J  | ND    | 62–67 | ND     |
| Oct 2005  | 51    | 57–61 | 88    | 101    | 1.4    | 0.4 J | 1.6   | 1.8   | 1.2    | 0.3 J  | 0.5 J  | 0.5 J–0.6 J | 55–57 | ND |
| Nov 2005  | 74    | 109–114 | 166   | 114–122 | 5.0    | 4.0   | 1.7   | 0.7 J | –      | –      | –      | –     | –    | 53     | ND     |

- **a** Analytical results for samples from the combined flows of GWEX1–GWEX3.
- **b** Samples of spray collected below the center point of the respective irrigation span.
- **c** Samples of spray collected at the estimated location of maximum spray outfall.
- **d** ND, not detected at a method detection limit of 0.1 µg/L.
- **e** Unit not in operation.
- **f** Ranges of values represent both primary samples and quality control replicates and duplicates.
- **g** Qualifier J indicates an estimated concentration below the quantitation limit of 1 µg/L for the purge-and-trap method.
### TABLE 5.2  Values for pH in untreated groundwater samples and treated effluent samples.

<table>
<thead>
<tr>
<th>Month</th>
<th>GWEX1</th>
<th>GWEX2</th>
<th>GWEX3</th>
<th>Mixeda</th>
<th>North Spray Unitb</th>
<th>South Spray Unitb</th>
<th>GWEX4 Untreated</th>
<th>Stripper Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 2004</td>
<td>NRc</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>7.7</td>
<td>–</td>
<td>6.28–6.67e</td>
<td>7.76–8.06</td>
</tr>
<tr>
<td>Dec 2004</td>
<td>6.80</td>
<td>6.76</td>
<td>6.72</td>
<td>6.80</td>
<td>7.6</td>
<td>–</td>
<td>8.23</td>
<td>7.01</td>
</tr>
<tr>
<td>Jun 2005</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>6.90–6.93</td>
</tr>
<tr>
<td>Jul 2005</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>6.92–6.95</td>
</tr>
</tbody>
</table>

* a Values for samples from the combined flows of GWEX1–GWEX3.

* b Average value for spray samples collected at one or more locations at the discharge site.

* c NR, not recorded.

* d Unit not in operation.

* e Ranges indicate pH values over the sampling period each month.

- Beneath the center point of the “east” irrigation span
- At a fourth location visually chosen to reflect the estimated site of maximum spray outfall (“max” value; position varying from month to month; based on prevailing wind and spray conditions at the time of sampling)

The results summarized in Table 5.1 show that, with only a few exceptions, the concentrations of all spray samples collected during the review period were below the maximum contaminant level of 5.0 µg/L promulgated by the U.S. Environmental Protection Agency for carbon tetrachloride in drinking water. The maximum carbon tetrachloride level identified for a single sample in spray discharged from the irrigation treatment units was 7.2 µg/L. The average concentration of carbon tetrachloride in the treated groundwater discharged to the wetlands was 1.45 µg/L. The concentrations of carbon tetrachloride in all spray samples were below the
maximum target concentration (44.2 µg/L) allowed under the NPDES permit, by roughly an order of magnitude.

The results of the groundwater and spray sample analyses suggest the following minimum carbon tetrachloride removal efficiency values for the spray irrigation treatment process:

- More than 94% (based on data for individual samples)
- Approximately 99% (based on the average concentration delivered to the wetlands during the review period)

The results of pH measurements recorded for samples of the treated spray discharge are presented in Table 5.2. In all cases, the observed pH levels (7.01 to 8.18) were within the acceptable range (6.5 to 9.0) specified under the NPDES permit.

5.2 Results for Well GWEX4, with Treatment by Air Stripping

Carbon tetrachloride concentrations in the untreated groundwater produced by GWEX4 were relatively stable (53 µg/L to 95 µg/L) during the review period; however, a possible trend of gradually decreasing levels is suggested in the data of Table 5.1. Carbon tetrachloride was not detected in the effluent from the air stripping unit throughout the review period, indicating a carbon tetrachloride removal efficiency of > 99% for this process. Measured pH levels in all samples of the air stripper effluent (7.01 to 8.35; Table 5.2) were within the acceptable range (6.5 to 9.0) specified under the NPDES permit.

5.3 Estimated Removal of Carbon Tetrachloride from the Utica Aquifer

The groundwater production and carbon tetrachloride concentration data presented in Tables 4.1 and 5.1, respectively, can be used to estimate the total quantity of carbon tetrachloride extracted by wells GWEX1–GWEX4 from October 29, 2004, to November 31, 2005. The results of these calculations, summarized in Table 5.3, indicate that approximately 23 kg (3.8 gal) of carbon tetrachloride was removed from the Utica aquifer during the review period.
### TABLE 5.3  Estimation of carbon tetrachloride removed from the Utica aquifer.\(^a\)

<table>
<thead>
<tr>
<th>Month</th>
<th>GWEX1–GWEX3</th>
<th></th>
<th>GWEX4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GWEX1–GWEX3</td>
<td>GWEX4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Groundwater Extracted</td>
<td>Carbon Tetrachloride</td>
<td>Groundwater Extracted</td>
<td>Carbon Tetrachloride</td>
</tr>
<tr>
<td></td>
<td>(gal)</td>
<td>(L)</td>
<td>Concentration(^b) Removed</td>
<td>(µg/L)</td>
</tr>
<tr>
<td>Oct 2004</td>
<td>–(^c)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Nov 2004</td>
<td>928,680</td>
<td>3,515,982.5</td>
<td>115</td>
<td>0.4</td>
</tr>
<tr>
<td>Dec 2004</td>
<td>1,077,780</td>
<td>4,080,475.1</td>
<td>112</td>
<td>0.5</td>
</tr>
<tr>
<td>Jan 2005</td>
<td>149,100</td>
<td>564,492.6</td>
<td>103</td>
<td>0.1</td>
</tr>
<tr>
<td>Feb 2005</td>
<td>2,051,190</td>
<td>7,765,805.3</td>
<td>101</td>
<td>0.8</td>
</tr>
<tr>
<td>Mar 2005</td>
<td>4,155,630</td>
<td>15,733,215</td>
<td>111</td>
<td>1.7</td>
</tr>
<tr>
<td>Apr 2005</td>
<td>3,059,580</td>
<td>11,583,570</td>
<td>103</td>
<td>0.7</td>
</tr>
<tr>
<td>May 2005</td>
<td>1,829,500</td>
<td>6,926,487</td>
<td>101</td>
<td>0.8</td>
</tr>
<tr>
<td>Jun 2005</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Jul 2005</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Aug 2005</td>
<td>1,506,200</td>
<td>5702473.2</td>
<td>117</td>
<td>0.7</td>
</tr>
<tr>
<td>Sept 2005</td>
<td>6,749,100</td>
<td>25552093</td>
<td>115</td>
<td>2.9</td>
</tr>
<tr>
<td>Oct 2005</td>
<td>9,008,200</td>
<td>34105045</td>
<td>101</td>
<td>3.4</td>
</tr>
<tr>
<td>Nov 2005</td>
<td>4,097,000</td>
<td>15511242</td>
<td>118</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>14.2</td>
<td>9.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Total carbon tetrachloride removed from the aquifer: 23.2 kg.

\(^b\) Concentration in untreated "mixed" samples of the combined flow from wells GWEX1–GWEX3.

\(^c\) Unit not in operation.
6 Operation, Maintenance, and System Modifications

6.1 Wells GWEX1–GWEX3 and the Spray Irrigation Treatment Units

No repairs or maintenance were required on extraction wells GWEX1–GWEX3 during the review period.

Maintenance and repairs for the spray irrigation units and the groundwater delivery system included the following:

- Periodic field inspection of the units and all operating parameters.

- Replacement (under warranty) of numerous pneumatic valves, used to selectively control the operation of the spray heads. The valves were damaged by freezing during the initial setup of the irrigation units.

- Replacement of the electronic valve actuators used to control the irrigation span drain-back system. The actuators were damaged as a result of the basin flooding that took place in May 2005.

- Repair (under warranty) of the base station remote system computer, to correct damage resulting from a lightning strike through the telephone wiring. Additional surge protection was also installed.

- Adjustment of the pump motor variable frequency drives, to reduce their sensitivity to line power quality.

- Replacement of a malfunctioning manual pipeline valve that controls the flow of groundwater to the north spray unit.

- Ongoing investigation to diagnose the cause(s) of sporadic, unexpected shutdowns of the wells and treatment units.
Several modifications of the spray irrigation and groundwater delivery systems were made during the review period. These updates include the following:

- Replacement of the radio hardware required for remote control and monitoring of the spray irrigation units, to permit the use of government-specific radio frequencies.

- Redesign and reconstruction of the drain-back valve vault at the south spray irrigation site, to prevent water damage in the event of future flooding.

### 6.2 Well GWEX4 and the Air Stripping Unit

Well GWEX4 required no maintenance or repairs during the review period.

Maintenance of the shallow-tray air stripper was limited to the following:

- Periodic field inspection of the unit and all operating parameters.

- Replacement of a view port on one of the aeration trays.

- Routine cleaning of the unit after approximately one year of operation. Inspection of the unit at that time revealed minimal silting or buildup of precipitates; these were removed by pressure washing.

### 6.3 Installation and Sampling of Monitoring Wells

At the beginning of the aquifer restoration program, only three permanent monitoring wells at the Utica site could be used for the sampling of groundwater for VOCs analyses. Preexisting wells SB48, SB71, and SB72 (Figure 2.1) were constructed primarily for measurement of groundwater levels and do not penetrate the more contaminated zones of the groundwater column identified in detailed vertical-profile sampling (Argonne 2000). To improve monitoring coverage, four additional permanent monitoring wells (MW1–MW4; Figure 2.1) were installed at strategic locations along the plume migration pathway in August 2005. A
proposed fifth monitoring well (Figure 2.2 of Argonne 2004) was not installed because of access issues.

Table 6.1 summarizes construction data for the new and preexisting monitoring wells, as well as the results of groundwater sampling and analyses for VOCs to date. No clear trends in the patterns of carbon tetrachloride levels at the monitoring wells were apparent during the review period. Well registration forms for the new monitoring wells (installed in 2005) are in Appendix A.

### TABLE 6.1 Well construction data and analytical results for carbon tetrachloride in groundwater samples from the permanent monitoring wells.

<table>
<thead>
<tr>
<th>Well</th>
<th>Depth (ft BGL)</th>
<th>Screened Interval</th>
<th>Carbon Tetrachloride (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB48</td>
<td>98.5</td>
<td>83.5–93.5</td>
<td>ND&lt;sup&gt;a&lt;/sup&gt;, ND, ND, ND, –&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>SB71</td>
<td>94.2</td>
<td>84.0–94.0</td>
<td>1.3, 1.2, 1.0, ND, –, 0.3&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>SB72</td>
<td>122.3</td>
<td>82.6–112.6</td>
<td>5.5–5.7&lt;sup&gt;d&lt;/sup&gt;, 4.3–6.2, 5.1–5.6, 1.9–3.4, –, 3.6</td>
</tr>
<tr>
<td>MW1</td>
<td>105.0</td>
<td>85.0–100.0</td>
<td>–, –, –, –, 38.0, 79.0</td>
</tr>
<tr>
<td>MW2</td>
<td>115.0</td>
<td>90.0–110.0</td>
<td>–, –, –, –, 8.6–8.8, 9.3</td>
</tr>
<tr>
<td>MW3</td>
<td>125.0</td>
<td>100.0–120.0</td>
<td>–, –, –, –, 57.0, 36.0</td>
</tr>
<tr>
<td>MW4</td>
<td>125.0</td>
<td>100.0–120.0</td>
<td>–, –, –, –, 34.0, 33.0–34.0</td>
</tr>
</tbody>
</table>

<sup>a</sup> ND, not detected at a method detection limit of 0.1 µg/L.

<sup>b</sup> Well not sampled.

<sup>c</sup> Qualifier J indicates an estimated concentration below the quantitation limit of 1 µg/L for the purge-and-trap method.

<sup>d</sup> Ranges of values include quality control samples.

### 6.4 First-Year Operating and Maintenance Costs

First-year operating and maintenance costs are summarized in Table 6.2. These costs include one-time expenses associated with installation of new monitoring wells. Other expenses were related to unexpected technical problems and spring flooding that necessitated modification and rebuilding of the actuator system to withstand future flooding. Costs in subsequent years are expected to be lower.
TABLE 6.2  Summary of first-year operating and maintenance costs for the Utica restoration project.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Management</td>
<td>18,127</td>
</tr>
<tr>
<td>Logistics Support</td>
<td>64,145</td>
</tr>
<tr>
<td>Remediation Monitoring</td>
<td>170,880</td>
</tr>
<tr>
<td>Monitoring Network Establishment</td>
<td>11,707</td>
</tr>
<tr>
<td>Technical Oversight</td>
<td>17,727</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>282,586</strong></td>
</tr>
</tbody>
</table>
7 Summary

A combined total of approximately 66.4 million gallons of contaminated groundwater was extracted and treated during the first 13 months of operation of the aquifer restoration systems at Utica. Approximately 52% of the total volume treated (106 acre-feet) was used to supplement the natural water entering the North Lake Basin Wildlife Management Area.

Groundwater modeling studies performed by Argonne during the development of the aquifer restoration approach for Utica (Argonne 2000) indicated that, on average, the extraction of approximately 97 million gallons of groundwater per year would be required to achieve cleanup of the aquifer in approximately 10–15 years. The total actual groundwater produced during the review period represents approximately 68% of this average annual target.

Sampling and analysis of the effluent water from the air stripping and spray irrigation treatment units indicated that these systems functioned at a minimum efficiency of 94% during the review period. Carbon tetrachloride concentrations in all discharges of treated water at the site were below the permitted maximum target (44.2 µg/L) by roughly an order of magnitude.

Calculations based on the volumes and measured carbon tetrachloride concentrations of the groundwater extracted during the review period indicated that approximately 23 kg (3.8 gal) of carbon tetrachloride was removed from the Utica aquifer.

The costs incurred by Argonne for operating and maintenance of the aquifer restoration effort at Utica during the review period were approximately $283,000.
8 References


Appendix A:

Well Registration Forms
GWEX-1
STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES
WATER WELL REGISTRATION

Registration Date 5-7-2005
Owner Code No. 51127
Sequence No. 160852
Registration No. 611367
Receipt No. 118031
UPPER BIG BLUE

1. a. Well Owner’s First Name
   Last Name
b. Company Name USDA / FSA
c. Correspondent Name
   Address Mail Stop 4725, Room 4725, South Building
   City, Washington
   State, Zip
   Telephone

2. a. Contractor’s License No 19193
   Contractor’s Name Michael Magnin
   Contractor’s Email Address mmagnin@boartlongyear.com
b. Drilling Firm Name Boart Longyear
   Address P.O. Box 355
   City, State, Zip
   Telephone
   Drilling Firm’s Email Address shalasker@boartlongyear.com

3. a. Well location 
   
   b. Natural Resources District
   Upper Big Blue
   
   c. The well is feet from the (section line and feet from the (section line
      or Latitude Degree Minute Second
      Longitude Degree Minute Second
   
   d. Street address and subdivision, if applicable
   
   e. Location of water use, if applicable (give legal descriptions)
   
   f. If for irrigation, the land to be irrigated is acres.
   
   g. Well reference letter(s), if applicable

4. Permits
   Management Area Permit Number G-097200
   Geothermal Permit Number
   Municipal Permit Number
   Well Spacing Permit Number
   Other Permit Number
   Surface Water Permit Number
   Industrial Permit Number
   Transfer Out-Of-State Permit Number
   Conduct Permit Number
   NDOW
   NDNR
   SSHS
   HSS

5. Purpose of well (indicate one)
   Aquaculture
   Commercial/Industrial
   Dewatering (over 90 days)
   Domestic
   Ground Heat Exchange
   Groundwater Source Heat Pump
   Irrigation
   Injection
   Livestock
   Monitoring
   Observation
   Public Water Supply (with pump) (quad M)
   Recovery
   Other
   (followed)

6. Wells in a Series.
   a. Is this a well a part of a series? No
      Yes, go to part b of this section
      No, go to part 7 of this application
   b. If one or more of the wells in the series is currently registered, give the well registration number G-097200
   c. How many wells in the series are you registering at this time?

7. Replacement and abandoned well information.
   a. Is this a well a replacement well? Yes
      No
   b. Registration number of abandoned well
   c. Replacement well is feet from abandoned well.
   d. Abandoned well last operated
   e. Original well pump column size
   f. Completion of original well abandonment
   g. Location of water use of abandoned well

AUG 02 2004
DEPARTMENT OF NATURAL RESOURCES
8. Pump Information.
   a. Is pump installed at this time: [ ] Yes [ ] No
   Is pump installed by well owner in section 1? [ ] Yes [ ] No Is pump installed by contractor in section 2? [ ] Yes [ ] No
   If pump installed by pump installer, please fill out license number below
   b. Pump installer's License No. [ ] Pump installer's Name
   Pump installer's Firm Name
   Pump installer's Firm Address
   City ____________________ State _______ Zip ____________________ Telephone ____________________
   c. Pumping rate: ___________ gallons per minute [ ] Measured [ ] Estimated
   d. Drop pipe diameter: ___________ inches
   e. Length of drop pipe: ___________ feet
   f. Pumping equipment installed: [ ] (a) [ ] (b) [ ] (c) [ ] (d) [ ] (e) [ ] (f) [ ] (g) Pump Brand
   g. This well is designed and constructed to pump less than 50 gpm [ ] Yes [ ] No

9. Well Construction Information.
   a. Total well depth: ___________ feet.
   b. Static water level: ___________ feet.
   c. Pumping water level: ___________ feet.
   d. Well Construction began: ___________ / ___________ / ___________ 2004
   e. Well Construction completed: ___________ / ___________ / ___________ 2004
   f. Bore hole diameter in inches: Top: ___________ Bottom: ___________
   g. Casing and Screen Joints are: [ ] Welded [ ] Glued [ ] Threaded [ ] Other

10. Well Construction (Casing & Screen): a, c, d, e, & g measurements should be in inches to three decimal places

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0.0</td>
<td>106.0</td>
<td>Casing</td>
<td>7.981</td>
<td>8.625</td>
<td>3.220</td>
<td>Low Carbon</td>
<td>A53-B</td>
<td></td>
</tr>
<tr>
<td>106.0</td>
<td>126.0</td>
<td>Screen</td>
<td>7.981</td>
<td>8.625</td>
<td>3.220</td>
<td>Low Carbon</td>
<td>A53-B</td>
<td></td>
</tr>
<tr>
<td>126.0</td>
<td>132.0</td>
<td>Casing</td>
<td>7.981</td>
<td>8.625</td>
<td>3.220</td>
<td>Low Carbon</td>
<td>A53-B</td>
<td></td>
</tr>
</tbody>
</table>

11. Grout and Gravel Pack

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Grout or Gravel Pack</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0.0</td>
<td>94.0</td>
<td>Grout</td>
</tr>
<tr>
<td>94.0</td>
<td>97.0</td>
<td>Bentonite</td>
</tr>
<tr>
<td>97.0</td>
<td>132.0</td>
<td>Gravel Pack</td>
</tr>
</tbody>
</table>

12. Geologic Materials Logged

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Description</th>
<th>Depth in Feet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0.0</td>
<td>132.0</td>
<td>Glacial Drift</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>(Additional sheets may be submitted)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

[Signature]
Water Well Contractor's Signature 7-30-04

[Signature]
Well Owner's Signature

Date
If Contractor is unknown or Deceased

APPLICATION FOR A PERMIT TO CONSTRUCT A WATER WELLS IN THE
UPPER BIG BLUE NATURAL RESOURCES DISTRICT

1. TYPE OF PERMIT REQUESTED: (Check appropriate item(s)
   New ☐, Late ☐, Supplemental withdrawal (See Permit Restrictions - No. 5)
   Is this application for a series of wells? ☐ YES ☐ NO. If YES, How many wells? 2

2. NAME AND ADDRESS OF LANDOWNER:
   U.S.D.A./F.S.A.
   Mail Stop 4725, Rm 4725, South Building
   1400 Independence Ave., SW; Washington, DC
   Phone (202) 720-5104

3. NAME AND ADDRESS OF WELL DRILLER:
   Boart-Longyear Company
   101 Alderson Street
   Schofield, WI 54476
   Phone (800) 236-4903

4. PURPOSED USE OF WELL: (Check one)
   ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Livestock ☐ Public Water Supply
   Other (specify) ☐ Groundwater Extraction

5. IDENTIFY THE LOCATION OF THE PROPOSED WELL:
   Section 20, Township 11 North, Range 1 East, Seward, County.
   State Registration No. 3484A (Required for replacement well and late or supplemental permits).
   The well will be located 600 feet from the North/South section line and will be 100 feet from the East/West section line.

6. REPLACEMENT AND ABANDONED INFORMATION:
   Will this well replace a well that is or will be permanently abandoned? ☐ YES ☐ NO.
   Data that the original well was last operated on: The replacement well will be 20 feet from the original well.
   Will the replacement well provide water to the same tract of land as the original well? ☐ YES ☐ NO.

7. WELL AND LAND APPLICATION SKETCH:
   The box at the right represents one square mile, (1 section), indicate with an "X", the proposed location of the well(s), outline and cross-hatch the proposed water use area.

8. IRRIGATION OR OTHER LAND APPLICATION OF WATER:
   How many acres will this well apply water to? Less than 100
   Type of irrigation (water distribution) system is proposed?
   ☐ Center pivot ☐ Gated pipe ☐ Other (specify) ☐ Stationary 3 Span

9. PREVIOUS IRRIGATION OR OTHER LAND APPLICATION:
   Are any of the acres identified in question 8 served by another well now?
   ☐ YES ☐ NO. If YES, How many acres?
   ☐ YES, What is the current distribution system? ☐ Center pivot ☐ Gated pipe
   ☐ Other (specify) ☐

10. GROUND WATER TRANSFER:
    (See Permit Restrictions - No. 5)
    ☐ YES ☐ NO.
    If YES, enter the legal description of the water use area.
    Section 17, Township 11 North, Range 1 East

11. COMMINGLED, COMBINED, CLUSTERED, OR JOINED WELLS:
    (See Permit Restrictions - No. 4)
    Will the proposed well be connected to another well(s) or be used to supplement an existing water use from another well(s)?
    ☐ YES ☐ NO. If YES, list the State Registration No(s). of other well(s)

Continue on other side
Well Identification: GWEX-1

12. SPECIFICATIONS OF INTENDED WELL AND PUMP:
   Estimated pumping capacity: 50 gallons per minute. Estimated total well depth: 131 feet.
   Well casing diameter: 8 inches. Pump column diameter: 2 inches.

13. ANNUAL WITHDRAWAL: (See Permit Restrictions - No. 6)
   Is the total annual groundwater withdrawal of all well(s) on this parcel of land estimated to be five hundred (500) acre feet or more? □ YES □ NO
   If the existing well(s) on this parcel of land currently withdraw five hundred (500) acre feet or more annually, will the proposed well increase the total groundwater withdrawal by two hundred and fifty (250) acre feet or more? □ YES □ NO

14. LANDOWNER CERTIFICATION: Please read permit restrictions listed below.

   I, hereby, certify that I am familiar with the information contained in this application and, that to the best of my knowledge and belief, the information is complete and accurate. I understand and will comply with the permit restrictions and the District’s rules and regulations related to the construction and operation of this well.

Date: 3/24/04 Signature of Landowner: [Signature]

CONTRACTING OFFICER, USDA

This form must be completed in full and be accompanied by a non-refundable $50.00 filing fee ($250.00 for a late permit) payable to the Upper Big Blue NRD, 105 Lincoln Avenue, York, Nebraska 68467. An incomplete application will be returned for correction. A returned application must be resubmitted within 30 days or the filing fee is forfeited.

PERMIT RESTRICTIONS

1. This application must be signed by the landowner, his/her power of attorney or be accompanied by a notarized statement, signed by the landowner, authorizing the another person's signature.

2. This permit shall remain in force for one (1) year from the date approved.

3. If the well authorized by this permit has a capacity of more than fifty (50) gallons per minute, it must be constructed at least one thousand (1000) feet from any existing well with a capacity of more than fifty (50) gallons per minute that is under different ownership. If a well that is less than one thousand (1000) feet from a well under separate ownership is being replaced, the replacement well may not be more than fifty (50) feet closer to the well under separate ownership than the one it is replacing.

4. When water wells are commingled, combined, clustered, or joined and have a combined total capacity of more than fifty (50) gallons per minute, each water well shall comply with well spacing as provided in Restriction No. 3.

5. A well shall not be used to transfer groundwater to a government survey section that is not adjacent to the tract of land in which the well is located. Transfers of ground water from the tract on which the well is located shall be limited to an acreage equal to the acreage in that tract unless such transfers occurred prior to July 1, 1980.

6. If the total proposed annual groundwater withdrawal from this parcel of land exceeds five hundred (500) acre feet (163 million gallons) or if existing well(s) currently withdraw five hundred (500) acre feet or more and the proposed well will increase the total withdrawal by two hundred and fifty (250) acre feet (81.5 million gallons) or more, a hydrologic evaluation must be submitted with this application in accordance with District Rule 5, Ch. 5.

7. All wells permitted by the District on or after March 1, 2004 must be equipped with a flow meter prior to operation.

Ground Water Management Area rules and regulations are subject to change. A copy of District Rule 5 is available upon request. Prior to construction or operation, the permittee should contact the NRD office if he or she has any questions about the rules and regulations.

NRD USE ONLY

COMMENTS:

Date Approved: 3/12/04 NRD Representative: [Signature]

March 2004
March 18, 2005

USDA/FSA
Mail Stop 4725
Room 4725 - South Building
1400 Independence Avenue
Washington, DC 20024

Subject: Late Recovery Wells Permit

Dear Sirs:

The NRD has approved the enclosed late well permit for the series of two wells, GWEX-1 and GWEX-3, located in Section 29-T11N-R1E, Seward County of the Upper Big Blue Natural Resources District Groundwater Management Area. It has been approved subject to all the restrictions listed on the permit and subject to the Management Area rules and regulations.

We will forward a copy of the well permit to the Nebraska Department of Natural Resources. If you have any questions feel free to call me at the NRD.

Sincerely,

Rod DeBuhr
Water Department Manager

:sh

Copy - Scott Thalacker, Boart-Longyear, Little Falls, MN
Department of Natural Resources
File
GWEX-2
Submit to:
Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676

For Department Use Only

Date Filed: 3-30-2005  Sequence No. 113578  Registration No. G-097200
Owner Code No. 51227  Receipt No.  NRD

1. Well Owner (Required) USDA/FSA
   Work Telephone Number (202) 720-5104
   Home Telephone Number ()
   Address  Mail Stop 4725, Rm 4725, South Building, 1400 Independence Ave., SW
   City  Washington, D.C.  State  D.C.  Zip Code 20250 0513

2. Contractor (Required) TCM Construction, Inc.
   Telephone Number (402) 475-5030
   Address 141 M Street
   Pump Installer License No. 39446
   City Lincoln  State NE  Zip Code 68508

3. Water Well Registration No. G-097200
   (CWPX-2)
   IDENTIFY WHAT NEEDS TO BE CORRECTED: Change use of well to recovery.

4. LOCATION OF WELL (Information in ITEMS 4A and 4B are required)
   LIST LEGAL:
   A. Well location: 40° 42' 52.9" N, 96° 44' 52.6" W
   B. The well is 1350 feet from the (NE § 1) section line and 3400 feet from the (SW § 4) section line.

5. LOCATION OF WELL
   LIST LEGAL CORRECT LEGAL AND/OR FOOTAGE:
   A. Well location: 40° 42' 52.9" N, 96° 44' 52.6" W
   B. The well is 1350 feet from the (NE § 1) section line and 3400 feet from the (SW § 4) section line.
   C. Latitude Degree: Minute: Second: 
   D. Longitude Degree: Minute: Second: 
   E. Street address and subdivision, if applicable
   F. Block Lot

6. Number of acres irrigated:
   A. Location of water use (give legal description)

7. Change of use (select from this category)
   - Domestic
   - Ground Heat Exchanger
   - Ground Water Source Heat Pump
   - Industrial
   - Injection
   - Irrigation
   - Livestock
   - Monitoring
   - Observation
   - Public Water Supply (with spacing (46-638))
   - Public Water Supply (without spacing)
   - Recovery
   - Other
   (indicate use)

   A. Well was used for: Monitoring
   B. New gallons per minute: 200
   C. New use is: Recovery
   D. Date of Change: 3/21/05

8. Wells in a Series.
   A. Is this well a part of a series? Yes
   B. If one or more of the wells in the series is currently registered, give the well registration number (s):
10. Well Construction Information:
   A. Total well depth ___________ ft.
   B. Static water level ___________ ft.
   C. Pumping water level ___________ ft.
   D. Well Construction began on ___________ year.
   E. Well Construction completed on ___________ year.
   F. Borehole diameter in inches Top 10 in; Bottom 10 in.
   G. Casing and Screen sizes are N/A.

11. Well Construction (Casing & Screen): a-d, e, f, & g measurements should be in inches to three decimal places

<table>
<thead>
<tr>
<th>A</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
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<td>Placement Depth in Feet</td>
<td>Casing or Screen Diameter</td>
<td>Outside Diameter</td>
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<td>Type of Material</td>
<td>Screen Slot Size</td>
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</table>

12. Grout and Gravel Pack:
   Placement Depth in Feet | Grout or Gravel Pack | Material Description |
<table>
<thead>
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<th></th>
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13. Geologic Materials Laid
   Depth in Feet | Description |
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</tbody>
</table>

14. REQUIRED: State Reason for Change: Wall is now used to extract contaminated groundwater only. The wall is removed from the Village’s Public Water Supply system.

15. I, an individual, have submitted all information on this registration, and to the best of my knowledge it is true.

[Signature] 3/21/05  Water Well Owner’s Signature  7/24/05  
[Signature] 3/21/05  
[Signature] 7/24/05  
Steve Gilmore
WELL NAME: Extraction #2  
JOB NO: 3410-2122  
WELL DIAMETER: 8"  
LOCATION: Utica, NE  
MEASUREMENTS BELOW FROM TOP OF CASING:  
TOTAL DEPTH: 148.28'  
DATE: 5/25/2004  
DEPTH TO WATER BEFORE DEVELOPMENT: 84.34'  
DEVELOPED BY: M. Hansen  
DEPTH TO WATER AFTER DEVELOPMENT: 84.08'  
G-097200  

DESCRIPTION OF DEVELOPMENT METHOD
(Check One)

- [ ] Surged with Bailers & Bailed
- [x] Surged with Bailers & Pumped
- [ ] Surged with Block & Bailed
- [ ] Surged with Block & Pumped
- [ ] Other

CAN THIS WELL BE PURGED DRY?  [x] Yes [ ] No

VOLUME OF WATER IN FILTER PACK AND WELL CASING: 166 Gallons
VOLUME OF WATER REMOVED FROM WELL: 50.996 Gallons
CLARITY OF WATER BEFORE DEVELOPMENT: Dark Brown, Muddy
CLARITY OF WATER AFTER DEVELOPMENT: Clear
VOLUME OF WATER ADDED: 300 Gallons
SOURCE OF WATER ADDED: Utica Municipal

TIME SPENT FOR DEVELOPMENT: 1 Minutes
START: ______ A.M.  END: ______ A.M.

COMMENTS:
**REGISTERED GROUNDWATER WELLS DATA RETRIEVAL**

Note:
Information on Public Water Supply Wells is not available through this interface. Contact the Department of Natural Resources (Data Bank) at 402-471-2363 for more information.

Criteria: RegistrationNumber - G-097200

1 Stations met this criteria.

<table>
<thead>
<tr>
<th>Registration# Permit Number</th>
<th>Use Status</th>
<th>County Name</th>
<th>NRD Name</th>
<th>Well Location Footage Longitude</th>
<th>Completion Date Filling Date Abandoned Date Times Replaced</th>
<th>Acres Irrig Gallons/Min Static Level Pumping Level</th>
<th>Pump Col Dia Pump Depth Well Depth</th>
<th>Owner's Name and Address</th>
</tr>
</thead>
</table>

Data copy of requested wells as Bar(l) delimited file.
Data copy of Geo Logs for requested wells as Bar(l) delimited file.
Data copy of Casing Screen for requested wells as Bar(l) delimited file.
Data copy of Grout Gravel for requested wells as Bar(l) delimited file.
Legend and Notes
2 Caseing and Screen records available for Registration Number G-097200

<table>
<thead>
<tr>
<th>FromDepth</th>
<th>ToDepth</th>
<th>CaseOrScreen</th>
<th>InsideDiam</th>
<th>OutsideDiam</th>
<th>CaseThickness</th>
<th>Material</th>
<th>ScrnSlotSize</th>
<th>ScreenTname</th>
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<tr>
<td>0</td>
<td>110</td>
<td>casing</td>
<td>8</td>
<td></td>
<td>0.375</td>
<td>Steel</td>
<td></td>
<td></td>
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<tr>
<td>110</td>
<td>145</td>
<td>screen</td>
<td>8</td>
<td>8.875</td>
<td></td>
<td>Steel</td>
<td>0.035</td>
<td>Continuous</td>
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</table>
Nebraska Department of Natural Resources  
Data Bank  
Processed: 12/9/2005 3:47:01 PM

3 Grout Gravel information available for Registration Number G-097200

<table>
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<tr>
<th>FromDepth</th>
<th>ToDepth</th>
<th>GroutOrGravel</th>
<th>Material</th>
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<tr>
<td>4</td>
<td>102</td>
<td>grout</td>
<td>Bentonite Neat Cement</td>
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<tr>
<td>102</td>
<td>106.8</td>
<td>grout</td>
<td>Bentonite Chips</td>
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<tr>
<td>106.8</td>
<td>148.3</td>
<td>gravel</td>
<td></td>
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</tbody>
</table>
Nebraska Department of Natural Resources
Data Bank

13 Logs Available for Registration Number G-097200, Well ID 113572

<table>
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<th>Depth From</th>
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<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>4</td>
<td>Dark Brown Organics</td>
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<tr>
<td>4</td>
<td>40</td>
<td>Brown Silty Clay</td>
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<tr>
<td>40</td>
<td>45</td>
<td>Sand &amp; Gravel</td>
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<tr>
<td>45</td>
<td>50</td>
<td>Silty Sand with Some Gravel</td>
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<tr>
<td>50</td>
<td>86</td>
<td>Sand, Fine, Silty with Trace Clay &amp; Manganese</td>
</tr>
<tr>
<td>86</td>
<td>101</td>
<td>Sand &amp; Gravel</td>
</tr>
<tr>
<td>102</td>
<td>108</td>
<td>Sand, Fine</td>
</tr>
<tr>
<td>108</td>
<td>110</td>
<td>Sand &amp; Gravel</td>
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<tr>
<td>110</td>
<td>132</td>
<td>Sand, Fine</td>
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<tr>
<td>132</td>
<td>136</td>
<td>Sand, Medium</td>
</tr>
<tr>
<td>136</td>
<td>148</td>
<td>Sand, Fine</td>
</tr>
<tr>
<td>148</td>
<td>150</td>
<td>Sand &amp; Gray Clay</td>
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<tr>
<td>150</td>
<td>152</td>
<td>Gray Clay</td>
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</tbody>
</table>
### State of Nebraska

#### Department of Natural Resources

**Water Well Registration**

**Registration Date:** 5-1-2005  
**Sequence No.:** 160353  
**Registration No.:** 4-133677

**Owner Code No.:** 511217  
**Receipt No.:** 318034-02  
**Area Name:** Big Bluff NRD

#### 1. Owner Information
- **Well Owner’s First Name:**  
- **Last Name:**  
- **Company Name:** USDA / FSA  
- **Contractor’s Name:** Michael Maginn
- **Address:** Mail Stop 4725, Room 4725, South Building  
- **City:** Washington  
- **State:** DC  
- **Zip:** 20024  
- **Telephone:**
- **Contractor’s Email Address:** mmaginn@boatlongyear.com

#### 2. Drilling Firm Information
- **Drilling Firm Name:** Boat Longyear  
- **Address:** P.O. Box 355  
- **City:** Little Falls  
- **State:** MN  
- **Zip:** 56345  
- **Telephone:** 320-632-6552  
- **Drilling Firm’s Email Address:** sspalocke@boatlongyear.com

#### 3. Well Information
- **Well location:** SE ¼ of the NW ¼ of Section 29, Township 11, North, Range 1, E 3 W 1  
- **County:** Seward
- **Natural Resources District:** Upper Big Blue
- **Well:**  
  - **Latitude:** 2,550  
  - **Longitude:** 2,550  
- **Number of Wells:** 1  
- **Lot:** Lot 1
- **Block:** 1
- **Well Reference letter:** GNEX-3  
- **Water District:** PWSID

#### 4. Permits
- **Management Area Permit Number:** G-097200
- **Geothermal Permit Number:**  
- **Municipal Permit Number:**  
- **Well Spacing Permit Number:**  
- **Surface Water Permit Number:**  
- **Industrial Permit Number:**  
- **Transfer Out-Of-State Permit Number:**  
- **Other Permit Number:** NDRO

#### 5. Purpose of Well
- **Agri:**  
- **Groundwater Source Heat Pump:**  
- **Recovery:**  
- **Commercial/Industrial:**  
- **Dewatering:**  
- **Domestic:**  
- **Livestock:**  
- **Monitoring:**  
- **Observation:**  
- **Public Water Supply:**  
- **Irrigation:**  
- **Injection:**  
- **Public Water Supply (with spring 60-90):**

#### 6. Wells in Series
- **Is this well a part of a series?** Yes  
- **If yes to part b of this section, give the well registration number:** G-097200
- **If one or more of the wells in the series is currently registered, give the well registration number:**

#### 7. Replacement and Abandoned Well Information
- **Is this well a replacement well?** Yes
- **Registration number of abandoned well:**  
- **Original replacement well:**  
- **Abandoned well last operated:**
- **Completion of original well abandonment:**

**AUG 02 2004**

**Department of Natural Resources**
8. Pump Information.
   a. Is pump installed at this time: [ ] Yes [ ] No
   Is pump installed by well owner in section 1? [ ] Yes [ ] No Is pump installed by contractor in section 2? [ ] Yes [ ] No
   If pump installed by pump installer, please fill out license number below.
   b. Pump Installer's License No. _______________________

9. Well Construction Information.
   a. Total well depth: 146.0 feet.
   b. Static water level: 82.0 feet.
   c. Pumping water level: _______ feet.
   d. Well Construction began (month, day, year): 5/25/2004
   e. Well Construction completed (month, day, year): _______ / _______ / _______
   f. Bore hole diameter in inches: Top: 6.00 Bottom: 6.00
   g. Casing and Screen Joints are _______ Welded [ ] Glued [ ] Threaded [ ] Other

10. Well Construction (Casing & Screen) - c, d, e, & g measurements should be in inches to three decimal places
    | Placement Depth in Feet | Casing or Screen | Inside Diameter | Outside Diameter | Wall Thickness | Screen Slot Size | Type of Material | Trade Name |
    | From | To | | | | | |
    | 0.0 | 105.0 | Casing | 7.981 | 8.625 | 3.220 | Low Carbon | A53-B |
    | 105.0 | 140.0 | Casing | 7.900 | 8.700 | 0.040 | Stainless | Johnson Screen |
    | 140.0 | 146.0 | Casing | 7.981 | 8.625 | 3.220 | Low Carbon | A53-B |

11. Grout and Gravel Pack
    | Placement Depth in Feet | Grout or Gravel Pack | Material Description |
    | From | To | |
    | 0.0 | 97.0 | Grout | Neat Cement |
    | 97.0 | 101.0 | Bentonite | Baroid 3/8" Chips |
    | 101.0 | 146.0 | Gravel Pack | 12/20 Sand |

12. Geologic Materials Logged
    Depth in Feet | Description | Depth in Feet | Description |
    | From | To | |
    | 0.0 | 146.0 | Glacial Drift | |

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

[Signature] 7-30-04
Water Well Contractor's Signature  Date

[Signature]  __________________________
Well Owner's Signature  Date
if Contractor is unknown or Deceased
APPLICATION FOR A PERMIT TO CONSTRUCT A WATER WELL IN THE UPPER BIG BLUE NATURAL RESOURCES DISTRICT

1. TYPE OF PERMIT REQUESTED: (Check appropriate item(s))
   ☑ New ☐ Late ☐ Supplemental withdrawal (See Permit Restrictions - No. 6)
   Is this application for a series of wells? ☑ YES ☐ NO. If YES, how many wells?

2. NAME AND ADDRESS OF LANDOWNER:
   USDA/FSA
   Mail Stop 4725, Rm 4725, South Building
   1400 Independence Ave. SW, Washington, DC
   Phone (202) 720-5104

3. NAME AND ADDRESS OF WELL DRILLER:
   Boart-Longyear Company
   101 Alderson Street
   Schofield, WI 54476
   Phone (800) 236-4983

4. PURPOSED USE OF WELL: (Check one)
   ☑ Domestic ☐ Industrial ☐ Irrigation ☐ Livestock ☐ Public Water Supply
   ☐ Other (specify) ☐ Groundwater Extraction

5. IDENTIFY THE LOCATION OF THE PROPOSED WELL:
   (See Permit Restrictions - Nos. 3 & 4)
   Section 29 Township 11 North, Range 1 East Seward County
   State Registration No. ____________________________ (Required for replacement well and late or supplemental permits)
   The well will be located ______ feet from the North/South section line and will be ______ feet from the East/West section line.

6. REPLACEMENT AND ABANDONED INFORMATION: (See Permit Restrictions - No. 3)
   Will this well replace a well that is or will be permanently abandoned? ☑ YES ☐ NO.
   Data that the original well was last operated on ________________
   The replacement well will be ________ feet from the original well.
   Will the replacement well provide water to the same tract of land as the original well? ☑ YES ☐ NO.

7. WELL AND LAND APPLICATION SKETCH:
   The box at the right represents one square mile, (1 section). Indicate with an "X", the proposed location of the well(s), outline and cross-hatch the proposed water use area.

8. IRRIGATION OR OTHER LAND APPLICATION OF WATER:
   How many acres will this well supply water to? Less than 100
   Type of irrigation (water distribution) system is proposed?
   ☐ Center pivot ☐ Gated pipe ☐ Other (specify) ☐ Stationary 3 Span

9. PREVIOUS IRRIGATION OR OTHER LAND APPLICATION:
   Are any of the acres identified in question 8 served by another well now? ☑ YES ☐ NO.
   If YES, how many acres? __________
   What is the current distribution system? ☐ Center pivot ☐ Gated pipe ☐ Other (specify)

10. GROUND WATER TRANSFER: (See Permit Restrictions - No. 6)
    Is the proposed well to be used to transfer water outside of the legal description listed above? ☑ YES ☐ NO.
    If YES, enter the legal description of the water use area, Quarter, Section __________ Township ______ North, Range ______ East/West

11. COMMINGLED, COMBINED, CLUSTERED, OR JOINED WELLS: (See Permit Restrictions - No. 4)
    Will the proposed well be connected to another well(s) or be used to supplement an existing water use from another well(s)? ☑ YES ☐ NO.
    If YES, list the State Registration No(s). of other well(s) __________

Continue on other side

MAY 16 2005

[Signature]

DEPARTMENT OF NATURAL RESOURCES
12. SPECIFICATIONS OF INTENDED WELL AND PUMP

- Estimated pumping capacity: 50 gallons per minute. Estimated total well depth: 131 feet.
- Well casing diameter: 8 inches. Pump column diameter: 2 inches.

13. ANNUAL WITHDRAWAL: (See Permit Restrictions - No. 8)

Is the total annual ground water withdrawal of all well(s) on this parcel of land estimated to be five hundred (500) acre feet or more? □ YES □ NO

If the existing well(s) on this parcel of land currently withdraw five hundred (500) acre feet or more annually, will the proposed well increase the total ground water withdrawal by two hundred and fifty (250) acre feet or more? □ YES □ NO

14. LANDOWNER CERTIFICATION: Please read permit restrictions listed below.

I, hereby, certify that I am familiar with the information contained in this application and, to the best of my knowledge and belief, the information is complete and accurate. I understand and will comply with the permit restrictions and the District's rules and regulations related to the construction and operation of this well.

Data: 3/24/04

Signature of Landowner: [Signature]

This form must be completed in full and be accompanied by a non-refundable $50.00 filing fee ($250.00 for a late permit) payable to the Upper Big Blue NRD, 105 Lincoln Avenue, York, Nebraska 68467. An incomplete application will be returned for correction. A returned application must be resubmitted within 30 days or the filing fee is forfeited.

PERMIT RESTRICTIONS

1. This application must be signed by the landowner, his/her power of attorney or be accompanied by a notarized statement, signed by the landowner, authorizing the another person's signature.

2. This permit shall remain in force for one (1) year from the date approved.

3. If the well authorized by this permit has a capacity of more than fifty (50) gallons per minute, it must be constructed at least one thousand (1000) feet from any existing well with a capacity of more than fifty (50) gallons per minute that is under different ownership. If a well that is less than one thousand (1000) feet from a well under separate ownership is being replaced, the replacement well may not be more than fifty (50) feet closer to the well under separate ownership than the one it is replacing.

4. When water wells are commingled, combined, clustered, or joined and have a combined total capacity of more than fifty (50) gallons per minute, each water well shall comply with well spacing as provided in Restriction No. 3.

5. A well shall not be used to transfer ground water to a government survey section that is not adjacent to the tract of land in which the well is located. Transfers of ground water from the tract on which the well is located shall be limited to an acreage equal to the acreage in that tract unless such transfers occurred prior to July 1, 1980.

6. If the total proposed annual ground water withdrawal from this parcel of land exceeds five hundred (500) acre feet (163 million gallons) or if existing well(s) currently withdraw five hundred (500) acre feet or more and the proposed well will increase the total withdrawal by two hundred and fifty (250) acre feet (81.5 million gallons) or more, a hydrologic evaluation must be submitted with this application in accordance with District Rule 5, Ch. 5.

7. All wells permitted by the District on or after March 1, 2004 must be equipped with a flow meter prior to operation.

Ground Water Management Area rules and regulations are subject to change. A copy of District Rule 5 is available upon request. Prior to construction or operation, the permittee should contact the NRD office if he or she has any questions about the rules and regulations.

NRD USE ONLY

COMMENTS:

Date Approved: 3/27/04

NRD Representative: [Signature]

March 2004
March 18, 2005

USDA/FSA
Mail Stop 4725
Room 4725 - South Building
1400 Independence Avenue
Washington, DC 20204

Subject: Late Recovery Wells Permit

Dear Sirs:

The NRD has approved the enclosed late well permit for the series of two wells, GWEX-1 and GWEX-3, located in Section 29-T11N-R1E, Seward County of the Upper Big Blue Natural Resources District Groundwater Management Area. It has been approved subject to all the restrictions listed on the permit and subject to the Management Area rules and regulations.

We will forward a copy of the well permit to the Nebraska Department of Natural Resources. If you have any questions feel free to call me at the NRD.

Sincerely,

Rod DeBuhr
Water Department Manager

[Signature]

Copy - Scott Thalacker, Boart-Longyear, Little Falls, MN
Department of Natural Resources
File
GWEX-4
**STATE OF NEBRASKA**  
**DEPARTMENT OF NATURAL RESOURCES**  
**WATER WELL REGISTRATION**

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<th>NOL Status</th>
<th>Accepted</th>
<th>Well Status</th>
<th>A</th>
<th>Registration Code</th>
<th>G-133386</th>
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<tr>
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<td>51127</td>
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<tr>
<td>Seq Num</td>
<td>167373</td>
<td></td>
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<tr>
<td>NOL Date</td>
<td>04/27/2005</td>
<td></td>
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<tr>
<td>Call Up Code</td>
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<td></td>
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<tr>
<td>Call Date</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**FOR DEPARTMENT USE ONLY**

**Fee Paid**  
$110.00 DNR Cash Fund  
$70.00 HHSS Fee  
$0.00 HHSS-DNR Cash Fund  

**Gut Billings**  
10242

| 04272005 - 167373 | -WWRF |

**1a Owner’s Name**  
**b Company Name**  
USDA / FSA / CCC  
**c Correspondent Name**  
**Attention Name**  

**Address**  
1400 Independence Avenue SW, Room 4719  
City: Washington  
State DC Zip Code: 20250 - 0513  
Phone: 202 - 720-5295

**2a HHSS Contractor Lic ID:** 436960  
**Contractor’s License No:** 36452  
**Contractor’s Business Name:** Layne-Western, a division of Layne Christensen Co.  
**Contractor’s Email Address:** dlfreeze@laynechristensen.com  
**2b Drilling Firm Name:**  
**Address:** P.O. Box 597  
City: Valley  
State NE Zip Code: 68064  
Phone: 402 - 359-2042  
**Drilling Firms Email Address:** 1072@laynechristensen.com

**3a Well Location**  
**b Township:** 29  
**c N/S Section:** 20  
**d E/W Section:** 1  
**e W/O Line:**  
**f Block:**  
**g Lot:**  
**h Acres:**  
**i Proposed LWR:**

**4 Permits**  
**Permits Number**  
**Permits**  
**Management Area Permit**  
**Surface Water**  
**Geothermal**  
**Industrial**  
**Industrial Transfer Notice**  
**Permits Number**  
**Date**  
**Transfer Out-Of-State**  
**Well Spacing**  
**Conduct Water**  
**Municipal**  
**Other**

**5 Purpose of Well**  
**Notes**

**6 Wells in a Series**  
**a Is this well a part of a series?**  
**b If one or more of the wells in the series is currently registered, give the well registration number**

**c How many wells in the series are you registering at this time?**

**7 Replacement and abandoned well information**  
**a Is this well a replacement well?**

**b Registration number of abandoned well**

**c Replacement well is**  
**feet from abandoned well.**

**d Abandoned well last operated**
Section 8: Pump Information

a. Is pump installed at this time? ☐
   Is pump installed by well owner in section 1? ☐
   Is pump installed by contractor in section 2? ☐
   Else installed by pump installer.

b. HHSS Installer's License ID:
   Pump Installer's License No. ☐
   Pump Installer's Name ☐
   Pump Installer's Email Address ☐
   Pump Installer's Firm Name ☐
   Pump Installer's Firm Address ☐
   City: ☐
   State: ☐
   Zip Code: ☐
   Phone: ☐

   Pump Installer's Firm Email Address ☐

   Pumping Rate: ☐
   gallons per minute ☐
   measured or estimated ☐

   Drop pipe diameter: ☐
   inches ☐
   feet. ☐

   f. Pumping equipment installed: ☐
      Pump Brand: ☐

   Length of drop pipe: ☐
   feet. ☐

   This well will be used to pump less than 50 gpm: ☐

Section 9: Well Construction Information

a. Total well depth: 150.0 feet. ☐
   Static Water Level: ☐
   feet. ☐

b. Pumping Water Level: ☐
   feet. ☐

   Well construction began: 10/31/1997 ☐

   Bore hole diameter in inches: Top: 12.00 ☐
   Bottom: 12.00 ☐


   Casing and Screen Joints: Welded ☐
   Other ☐

Section 10: Well Construction (Casing and Screen)

<table>
<thead>
<tr>
<th>From Depth</th>
<th>To Depth</th>
<th>Inside Diam</th>
<th>Outside Diam</th>
<th>Thickness</th>
<th>Screen Slot Size</th>
<th>Material</th>
<th>Trade name</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>115.0</td>
<td>6.00</td>
<td>6.625</td>
<td>.313</td>
<td>steel</td>
<td></td>
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<tr>
<td>115.0</td>
<td>145.0</td>
<td>6.00</td>
<td>6.625</td>
<td>.313</td>
<td>.020 SST</td>
<td>Houston</td>
<td></td>
<td></td>
</tr>
<tr>
<td>145.0</td>
<td>150.0</td>
<td>6.00</td>
<td>6.625</td>
<td>.313</td>
<td>.000 SST</td>
<td>Houston</td>
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</tbody>
</table>

Section 11: Well Construction (Grout and Gravel)

<table>
<thead>
<tr>
<th>NOL ID</th>
<th>From Depth</th>
<th>To Depth</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>111161076323</td>
<td>0.0</td>
<td>105.0</td>
<td>cement</td>
</tr>
<tr>
<td>111161076323</td>
<td>105.0</td>
<td>110.0</td>
<td>bentonite chips</td>
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<tr>
<td>111161076323</td>
<td>110.0</td>
<td>150.0</td>
<td>Central Sand C Pack</td>
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</table>

Section 12: Geologic Material Logged

<table>
<thead>
<tr>
<th>NOL ID</th>
<th>From Depth</th>
<th>To Depth</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>111161076323</td>
<td>0.0</td>
<td>4.0</td>
<td>dark brown organics</td>
</tr>
<tr>
<td>111161076323</td>
<td>4.0</td>
<td>40.0</td>
<td>brown silty clay</td>
</tr>
<tr>
<td>111161076323</td>
<td>40.0</td>
<td>45.0</td>
<td>sand and gravel</td>
</tr>
<tr>
<td>111161076323</td>
<td>45.0</td>
<td>50.0</td>
<td>silty sand with some gravel</td>
</tr>
<tr>
<td>111161076323</td>
<td>50.0</td>
<td>86.0</td>
<td>fine sand, silty with trace of clay</td>
</tr>
<tr>
<td>111161076323</td>
<td>86.0</td>
<td>101.0</td>
<td>sand and gravel</td>
</tr>
<tr>
<td>111161076323</td>
<td>101.0</td>
<td>108.0</td>
<td>fine sand</td>
</tr>
<tr>
<td>111161076323</td>
<td>108.0</td>
<td>110.0</td>
<td>sand and gravel</td>
</tr>
<tr>
<td>111161076323</td>
<td>110.0</td>
<td>132.0</td>
<td>fine sand</td>
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<td>111161076323</td>
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<td>136.0</td>
<td>medium sand</td>
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<td>136.0</td>
<td>148.0</td>
<td>fine sand</td>
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<tr>
<td>111161076323</td>
<td>148.0</td>
<td>150.0</td>
<td>sand and gray clay</td>
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</tbody>
</table>
APPLICATION FOR A PERMIT TO CONSTRUCT A WATER WELL IN THE UPPER BIG BLUE NATURAL RESOURCES DISTRICT

**Well ID:** GWEX-4

<table>
<thead>
<tr>
<th>NRD USE ONLY</th>
<th>PERMIT No. UBB-1</th>
<th>3505</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE RECEIVED</td>
<td>4-1-05</td>
<td></td>
</tr>
</tbody>
</table>

1. TYPE OF PERMIT REQUESTED: (Check appropriate item(s))
   - ☑ New
   - ☐ Late
   - ☐ Supplemental withdrawal (See Permit Restrictions - No. 6)
   Is this application for a series of wells? ☐ YES ☐ NO. If YES, How many wells?

2. NAME AND ADDRESS OF LANDOWNER:
   - USDA / FSA
   - 1400 Independence Ave SW, Mail Stop 4725, Rm 4725 PO Box 597
   - Washington, DC 20250-4725
   - Phone: 202-720-5104

3. NAME AND ADDRESS OF WELL DRILLER:
   - Layne-Western
   - Valley, NE 68064-0597
   - Phone: 402-359-2042

4. PURPOSE USE OF WELL: (Check one) ☑ Domestic ☐ Industrial ☐ Irrigation ☐ Livestock ☐ Public Water Supply ☐ Other (specify) ☑ Groundwater Extraction

5. IDENTIFY THE LOCATION OF THE PROPOSED WELL: (See Permit Restrictions - Nos. 3 & 4)
   - Section: 20
   - Township: 11
   - North, Range: 1
   - East
   - Seward County, State Registration No. (Required for replacement well and late or supplemental permit(s)).
   - The well will be located ______ feet from the SE corner of section 32 and ______ feet from the SW corner of section 31.

6. REPLACEMENT AND ABANDONED INFORMATION: (See Permit Restrictions - No. 3)
   - Will this well replace a well that is or will be permanently abandoned? ☑ YES ☐ NO.
   - The replacement well will be ______ feet from the original well.
   - Will the replacement well provide water to the same tract of land as the original well? ☑ YES ☐ NO.

7. WELL AND LAND APPLICATION SKETCH:
   - The box at the right represents one square mile. (1 section). Indicate with an "X", the proposed location of the well(s), outline and cross-hatch the proposed water use area.

8. IRRIGATION OR OTHER LAND APPLICATION OF WATER:
   - How many acres will this well apply water to?
   - Type of irrigation (water distribution) system is proposed?
     - ☑ Center pivot ☐ Gated pipe ☐ Other (specify)

9. PREVIOUS IRRIGATION OR OTHER LAND APPLICATION:
   - Are any of the acres identified in question 8 served by another well now? ☑ YES ☐ NO. If YES, how many acres?
   - What is the current distribution system? ☑ Center pivot ☐ Gated pipe ☐ Other (specify)

10. GROUND WATER TRANSFER: (See Permit Restrictions - No. 5)
    - Is the proposed well to be used to transfer water outside of the legal description listed above? ☑ YES ☐ NO.
    - If YES, enter the legal description of the water use area.

11. COMMINGLED, COMBINED, CLUSTERED, OR JOINED WELLS: (See Permit Restrictions - No. 4)
    - Will the proposed well be connected to another well(s) or be used to supplement an existing water use from another well(s)? ☑ YES ☐ NO.
    - If YES, list the State Registration No(s) of other well(s)

---

Received Time Apr. 27, 8:48AM

Department of Natural Resources
12. SPECIFICATIONS OF INTENDED WELL AND PUMP:

- Estimated pumping capacity: 70 gallons per minute. Estimated total well depth: 150 feet.
- Well casing diameter: 6 inches. Pump column diameter: 2 inches.

13. ANNUAL WITHDRAWAL: (See Permit Restrictions - No. 6)

- Is the total annual ground water withdrawal of all well(s) on this parcel of land estimated to be five hundred (500) acre feet or more? □ YES □ NO
- If the existing well(s) on this parcel of land currently withdraws or more than five hundred (500) acre feet annually, will the proposed well increase the total ground water withdrawal by two hundred and fifty (250) acre feet or more? □ YES □ NO

14. LANDOWNER CERTIFICATION: Please read permit restrictions listed below.

I, hereby certify that I am familiar with the information contained in this application and, to the best of my knowledge and belief, the information is complete and accurate. I understand and will comply with the permit restrictions and the District's rules and regulations related to the construction and operation of this well.

Date: [Sign here] 4/21/05

Signature of Landowner: [Signature]

(See Permit Restrictions - No. 1 & 2)

This form must be completed in full and accompanied by a non-refundable application fee ($50.00 or a late permit payables to the Upper Big Blue NRD, 421 Lincoln Avenue, York, Nebraska 68467. An incomplete application will be returned for correction. A returned application must be resubmitted within 30 days or the fee is forfeited.

PERMIT RESTRICTIONS

1. This application must be signed by the landowner, his/her power of attorney or be accompanied by a notarized statement, signed by the landowner, authorizing another person's signature.

2. This permit shall remain in force for one (1) year from the date approved.

3. If the well authorized by this permit has a capacity of more than fifty (50) gallons per minute, it must be constructed at least one thousand (1000) feet from any existing well with a capacity of more than fifty (50) gallons per minute that is under different ownership. If a well that is less than one thousand (1000) feet from a well under separate ownership is being replaced, the replacement well may not be more than fifty (50) feet closer to the well under separate ownership than the one it is replacing.

4. When water wells are commingled, combined, quarantined, or joined and have a combined total capacity of more than fifty (50) gallons per minute, each water well shall comply with well spacing as provided in Restriction No. 3.

5. A well shall not be used to transfer ground water to a government survey section that is not adjacent to the tract of land in which the well is located. Transfers of ground water from the tract on which the well is located shall be limited to an acreage equal to the acreage in that tract unless such transfers occur prior to July 1, 1990.

6. If the total proposed annual ground water withdrawal from the parcel of land exceeds five hundred (500) acre feet (163 million gallons) or if existing well(s) currently withdraw five hundred (500) acre feet or more and the proposed well will increase the total withdrawal by two hundred and fifty (250) acre feet (84.5 million gallons) or more, a hydrologic evaluation must be submitted with this application in accordance with District Rule 5, Ch. 3.

7. All wells permitted by the District on or after March 1, 2004 must be equipped with a flow meter prior to operation.

Ground Water Management Area rules and regulations are subject to change. A copy of District Rule 5 is available upon request. Prior to construction or operation, the permittee should contact the NRD office at or by whom they have any questions about the rules and regulations.

NRD USE ONLY

COMMENTS:

Date Approved: 4-21-05

NRD Representative: [Signature]

March 2004

[Stamp: Received Time Apr. 27, 9:56AM]
To:  dlfreese@laynechristensen.com; 1072@laynechristensen.com
Re: Well Registered

April 27, 2005

CONTRACTOR: Daniel L. Freese

CONTRACTORS FIRM:
Layne-Western, a division of Layne Christensen Co.
P.O. Box 597
Valley, NE 68064

LOCATION OF WELL:
NW1/4SE1/4 of Section 29
Township 11 North, Range 1 E
Seward County

OWNER: USDA / FSA / CCC

NOL ID: 1111610763323351
SEQUENCE NUMBER: 167373

The above well has been registered with the Nebraska Department of Natural Resources. Its registration number is G-133386. The registered well information can be reviewed at the Department website: http://dndata.dnr.state.ne.us/wellssql

We thank you for your cooperation. If you have any questions or comments, please let us know.

Sincerely,
Christine Southwick
Staff Assistant, Ground Water.
Nebraska Department of Natural Resources
Lincoln, NE 68509
(402) 471-4084
MW1
### STATE OF NEBRASKA
#### DEPARTMENT OF NATURAL RESOURCES
##### WATER WELL REGISTRATION

**FOR DEPARTMENT USE ONLY**

<table>
<thead>
<tr>
<th>Registration Date</th>
<th>Sequence No.</th>
<th>Registration No.</th>
<th>Owner Code No.</th>
<th>Receipt No.</th>
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<td>170488</td>
<td>G-136469</td>
<td>S127</td>
<td>UPPER BIG BLUE NRD</td>
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</tbody>
</table>

1. **a.** Well Owner's First Name
   - Last Name

2. **a.** Contractor's License No. 19193
   - Contractor's Name: Mike Magan
   - Contractor's Email Address: magan@waterleaguer.com
   - Drilling Firm Name: Boast Leaguer
   - Drilling Firm's Email Address: info@boastleaguer.com

3. **a.** Well location: NED 3/4 of the NE 3/4 of Section 30, Township 11, 19W
   - Natural Resources District: Upper Big Blue
   - The well is 249 feet from the NE 1/4 SW 1/4 section line and 95 feet from the section line
     (circle one)
   - Latitude Degree: 40° Minute: 54' Second: 3.96"
   - Longitude Degree: 97° Minute: 20' Second: 59.64"
   - Location of water use, if applicable
   - Street address and subdivision, if applicable
   - If for irrigation, the land to be irrigated is
   - Well reference letter(s), if applicable

4. **Permits**
   - Management Area Permit Number
   - Geothermal Permit Number
   - Municipal Permit Number
   - Well Spacing Permit Number
   - HHSS
   - Surface Water Permit Number
   - Industrial Permit Number
   - Transfer Out-Of-State Permit Number
   - Conduct Permit Number
   - Other Permit Number
   - NDBQ

5. **Purpose of well (indicate one)**
   - Aquaculture
   - Commercial/Industrial
   - Dewatering (over 90 days)
   - Domestic
   - Ground Heat Exchanger
   - Groundwater Source Heat Pump
   - Irrigation
   - Injection
   - Livestock
   - Monitoring
   - Observation
   - Public Water Supply (well spacing 46-630)
   - Public Water Supply
   - Recovery
   - Other

6. **Wells in a Series.**
   - If this well a part of a series? [ ] Yes go to part b of this section [X] No go to part 7 of this application
   - If one or more of the wells in the series is currently registered, give the well registration number
   - How many wells in the series are you registering at this time?

7. **Replacement and abandoned well information.**
   - If this well a replacement well? [X] Yes [ ] No
   - Registration number of abandoned well
   - If not registered, date abandoned well was constructed:
   - Replacement well is ________ feet from abandoned well.
   - Abandoned well last operated:
   - Original well pump column size:
   - Location of water use of abandoned well
   - Completion of original well abandonment:
   - /a. /b. /c. /d. /e. /f. /g.
8. Pump Information.
   a. Is pump installed at this time? Yes ☑️ No ☐
   b. Pump Installer's License No. _____________________________
   c. Pump Installer's Name _____________________________
   d. Pump Installer's Email Address _____________________________
   e. Pump Installer's Firm Name _____________________________
   f. Pump Installer's Firm Address _____________________________
   g. City _____________________________ State _____________________________ Zip. _____________________________ Telephone _____________________________
   h. If pump installed by pump installer, please fill out license number below
   i. Pumping rate _______________ gallons per minute Yes ☑️ No ☐
   j. Measured ☑️ Estimated ☐
   k. Drop pipe diameter _______________ inches Yes ☑️ No ☐
   l. Length of drop pipe _______________ feet Yes ☑️ No ☐
   m. Pumping equipment installed _______________ Yes ☑️ No ☐
   n. Pump Brand _____________________________
   o. This well is designed and constructed to pump less than 50 gpm Yes ☑️ No ☐

9. Well Construction Information.
   a. Total well depth _______________ feet Yes ☑️ No ☐
   b. Static water level _______________ feet Yes ☑️ No ☐
   c. Pumping water level _______________ feet Yes ☑️ No ☐
   d. Well Construction began _______________ Yes ☑️ No ☐
   e. Well Construction completed Yes ☑️ No ☐
   f. Bore hole diameter in inches Top _______________ Yes ☑️ No ☐
   g. Bottom _______________ Yes ☑️ No ☐
   h. Casing and Screen Joints are Welded ☑️ Glued ☐ Threaded ☑️ Other ☐

10. Well Construction (Casing & Screen) - c, d, e, & g measurements should be in inches to three decimal places

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Casing or Screen Diameter Inside</th>
<th>Outside Diameter</th>
<th>Wall Thickness</th>
<th>Screen Slot Size</th>
<th>Type of Material</th>
<th>Trade Name</th>
</tr>
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<tbody>
<tr>
<td>From 0' to 85.0'</td>
<td>Casing</td>
<td>2.067</td>
<td>2.375</td>
<td>.154</td>
<td>PVC</td>
<td>Boart Longyear</td>
</tr>
<tr>
<td>85.0' to 105.0'</td>
<td>Screen</td>
<td>2.067</td>
<td>2.375</td>
<td>.154</td>
<td>PVC</td>
<td>Boart Longyear</td>
</tr>
</tbody>
</table>

11. Grout and Gravel Pack

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Grout or Gravel Pack</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0' to 79.0'</td>
<td>Bentonite Grout</td>
<td>Baroid Aqua Guard Grout 30% Solids</td>
</tr>
<tr>
<td>79.0' to 83.0'</td>
<td>Bentonite Chips</td>
<td>Baroid 5% Holzoglu</td>
</tr>
<tr>
<td>83.0' to 108.0'</td>
<td>Sand &amp; 20'</td>
<td>Red Flint Sand &amp; Gravel #20 well Slag Sand</td>
</tr>
</tbody>
</table>

12. Geologic Materials Logged

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Description</th>
<th>Depth in Feet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0' to 5'</td>
<td>Gravel</td>
<td>From 5' to 490'</td>
<td>Brown Silty Clay</td>
</tr>
<tr>
<td>490' to 1080'</td>
<td>Brown Medium to Fine Sand</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

Water Well Contractor's Signature: _____________________________ Date: 5/26/05
Well Owner's Signature: _____________________________ Date: _____________________________

If Contractor is unknown or Deceased: _____________________________
MW2
# STATE OF NEBRASKA
## DEPARTMENT OF NATURAL RESOURCES
### WATER WELL REGISTRATION

**FOR DEPARTMENT USE ONLY**

<table>
<thead>
<tr>
<th>Registration Date</th>
<th>10-3-2005</th>
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<tbody>
<tr>
<td>Sequence No.</td>
<td>170 489</td>
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<tr>
<td>Registration No.</td>
<td>G-136 591</td>
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<tr>
<td>Owner Code No.</td>
<td>S11 27</td>
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<tr>
<td>Receipt No.</td>
<td>UPPER BIG BLUE</td>
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<tr>
<td>NRD</td>
<td></td>
</tr>
</tbody>
</table>

1. **a.** Well Owner’s First Name __________________________ Last Name __________________________
   **b.** Company Name __________________________
   **c.** Correspondent Name __________________________
   **d.** Address Stop 0513 Room 4735 1400 Independence Ave SW
   **e.** City __________________________ State __________________________ Zip __________
   **f.** Telephone __________________________

2. **a.** Contractor’s License No. 19935 Contractor’s Name __________________________
   **b.** Contractor’s Email Address __________________________
   **c.** Drilling Firm Name __________________________
   **d.** Drilling Firm’s Email Address __________________________
   **e.** Address 101 Allison Street
   **f.** City __________________________ State __________________________ Zip __________
   **g.** Telephone __________________________

3. **a.** Well location NE 1/4 of the SW 1/4 of Section 29, Township 11 North, Range 16 West, Seward County.
   **b.** Natural Resources District __________________________
   **c.** The well is 2481 feet from the (N E 2) section line and 2578 feet from the (E N 2) section line.
   **d.** Street address and subdivision, if applicable __________________________
   **e.** Location of water use, if applicable (give legal descriptions) __________________________
   **f.** If for irrigation, the land to be irrigated is __________ acres.
   **g.** Well reference letter(s), if applicable __________________________

4. **a.** Permits Management Area Permit Number __________________________
   **b.** Surface Water Permit Number __________________________
   **c.** Industrial Permit Number __________________________
   **d.** Geothermal Permit Number __________________________
   **e.** Transfer Out-Of-State Permit Number __________________________
   **f.** Municipal Permit Number __________________________
   **g.** Conduct Permit Number __________________________
   **h.** Well Spacing Permit Number __________________________
   **i.** Other Permit Number __________________________

5. **a.** Purpose of well (indicate one) __________________________
   **b.** Aquaculture __________________________
   **c.** Commercial/Industrial __________________________
   **d.** Dewatering (over 90 days) __________________________
   **e.** Domestic __________________________
   **f.** Ground Heat Exchanger __________________________
   **g.** Groundwater Source Heat Pump __________________________
   **h.** Irrigation __________________________
   **i.** Injection __________________________
   **j.** Livestock __________________________
   **k.** Monitoring __________________________
   **l.** Observation __________________________
   **m.** Public Water Supply (with or without pressure) __________________________
   **n.** Recovery __________________________
   **o.** Other __________________________

6. **a.** Wells in a Series?
   **b.** If yes or more of the wells in the series is currently registered, give the well registration number __________________________
   **c.** How many wells in the series are you registering at this time? __________________________

7. **a.** Replacement and abandoned well information.
   **b.** Is this a well replacement well? [ ] Yes [ ] No __________________________
   **c.** Registration number of abandoned well __________________________
   **d.** If not registered, date abandoned well was constructed ______/____/____
   **e.** Replacement well is _______ feet from abandoned well. __________________________
   **f.** Abandoned well last operated ______/____/____
   **g.** Original well pump column size ______ inches. __________________________
   **h.** Completion of original well abandonment on ______/____/____
   **i.** Location of water use of abandoned well __________________________
8. Pump Information.
   a. Is pump installed at this time [ ] Yes [x] No
   Is pump installed by well owner in section 7? [ ] Yes [x] No
   If pump installed by pump installer, please fill out license number below
   b. Pump Installer’s License No. ______________________
      Pump Installer’s Name ______________________
      Pump Installer’s E-mail Address ______________________
      Pump Installer’s Firm Name ______________________
      Pump Installer’s Firm Address ______________________
      City ______________________ State ________ Zip ________
   c. Pumping rate ________ gallons per minute [ ] Measured [ ] Estimated
   d. Drop pipe diameter ________ inches [ ] Length of drop pipe ________ feet
   e. Pumping equipment installed (a) _____ (b) _____
   f. Pump Brand ______________________
   h. This well is designed and constructed to pump less than 50 gpm [ ] Yes [x] No

9. Well Construction Information.
   a. Total well depth ________ feet
   b. Static water level ________ feet
   c. Pumping water level ________ feet
   d. Well Construction began ________ months ________ years ________
   e. Well Construction completed ________ months ________ years ________
   f. Bore hole diameter in inches Top ________ Bottom ________
   g. Casing and Screen Joints are [ ] Welded [ ] Glued [ ] Threaded [x] Other

10. Well Construction (Casing & Screen) - c, d, e, & g measurements should be in inches to three decimal places

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Casing or Screen</th>
<th>Inside Diameter</th>
<th>Outside Diameter</th>
<th>Wall Thickness</th>
<th>Screen Slot Size</th>
<th>Type of Material</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0' to 90.0'</td>
<td>Casing</td>
<td>2.067</td>
<td>2.375</td>
<td>.154</td>
<td></td>
<td>PVC</td>
<td>Beast longyear</td>
</tr>
<tr>
<td>90.0' to 115.0'</td>
<td>Screen</td>
<td>2.067</td>
<td>2.375</td>
<td>.154</td>
<td>.010</td>
<td>PVC</td>
<td>Beast longyear</td>
</tr>
</tbody>
</table>

11. Grout and Gravel Pack

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Grout or Gravel Pack</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0' to 85.0'</td>
<td>Bedrock Grout</td>
<td>Portland Aggregates Grout 30% Solid</td>
</tr>
<tr>
<td>85.0' to 88.0'</td>
<td>Bedrock Chips</td>
<td>Boxed 3% Gravel</td>
</tr>
<tr>
<td>88.0' to 117.0'</td>
<td>Sand &amp; Gravel</td>
<td>Red Flint Sand &amp; Gravel 20% well slat Sand</td>
</tr>
</tbody>
</table>

12. Geologic Materials Logged

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 0' to .5'</td>
<td>Top Soil</td>
</tr>
<tr>
<td>.5' to 32.0'</td>
<td>Gray Silty Clay</td>
</tr>
<tr>
<td>32.0 to 117.0'</td>
<td>Brown Fine-Medium Sand</td>
</tr>
</tbody>
</table>

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

[Signature]

Water Well Contractor’s Signature Date

Well Owner’s Signature Date

If Contractor is unknown or Deceased
STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES
WATER WELL REGISTRATION

FOR DEPARTMENT USE ONLY

Registration Date 10-3-2005 Sequence No. 170490 Registration No. G-136592
Owner Code No. 51127 Receipt No. UPPER BIG BLUE NRD

1. a. Well Owner’s First Name __________ Last Name __________
   b. Company Name __________
   c. Correspondent Name __________ Attention __________
      Address __________ City __________ State __________ Zip __________
      Telephone __________
2. a. Contractor’s License No. 9193 Contractor’s Name__M.J. Magin__
      Contractor’s Email Address __________
      Address __________ City __________ State __________ Zip __________
      Telephone __________
3. a. Well location SE 1/4 of the NE 1/4 of Section 29, Township 11 North, Range 1
   b. Natural Resources District __________
   c. The well is __________ feet from the NE 1/4 section line and __________
      feet from the SE 1/4 section line
      or Latitude Degree __________ Minute __________ Second __________
      Longitude Degree __________ Minute __________ Second __________
      Block __________ Lot __________
   d. Street address and subdivision, if applicable __________
   e. Location of water use, if applicable (give legal descriptions) __________
   f. If for irrigation, the land to be irrigated is __________ acres.
   g. Well reference letter(s), if applicable __________

4. Permits
   Management Area Permit Number __________
   Geothermal Permit Number __________
   Municipal Permit Number __________
   Well Spacing Permit Number __________
   Surface Water Permit Number __________
   Industrial Permit Number __________
   Transfer Out-Of-State Permit Number __________
   Conduct Permit Number __________
   Other Permit Number __________
   HNSS __________

5. Purpose of well (indicate one) __________
   Aquaculture __________
   Commercial/Industrial __________
   Dewatering (over 90 days) __________
   Domestic __________
   Ground Heat Exchanger __________
   Groundwater Source Heat Pump __________
   Irrigation __________
   Injection __________
   Livestock __________
   Monitoring __________
   Observation __________
   Public Water Supply (wells used for public water supply) __________
   Other __________

6. Wells in a Series
   a. Is this well a part of a series? ______ Yes ________ No ________
      If Yes go to part b of this section
   b. If one or more of the wells in the series is currently registered, give the well registration number __________
   c. How many wells in the series are you registering at this time? __________

7. Replacement and abandoned well information.
   a. Is this well a replacement well? ______ Yes ________ No ________
   b. Registration number of abandoned well __________
   c. Replacement well is __________ feet from abandoned well.
   d. Abandoned well last operated __________
   e. Original well pump column size __________ inches.
   f. Completion of original well abandonment on __________
   g. Location of water use of abandoned well __________
8. Pump Information.
   a. Is pump installed at this time? [ ] Yes [X] No
   b. Pump installed by well owner in section 17? [ ] Yes [X] No
   c. Is pump installed by contractor in section 27? [ ] Yes [X] No
   If pump installed by pump installer, please fill out license number below:
   Pump Installer's License No. ___________________________
   Pump Installer's Name ___________________________
   Pump Installer's Email Address ___________________________
   Pump Installer's Firm Name ___________________________
   Pump Installer's Firm Address ___________________________
   City __________________ State __________ Zip __________ Telephone ___________________________
   Pump Installer’s Firm Email Address ___________________________
   c. Pumping rate _______ gallons per minute [ ] Measured [ ] Estimated
   d. Drop pipe diameter _______ inches
   e. Length of drop pipe _______ feet
   f. Pumping equipment installed _______ [ ] Metal [ ] Plastic [ ] Other
   g. Pump Brand ___________________________
   h. This well is designed and constructed to pump less than 50 gpm [ ] Yes [ ] No

9. Well Construction Information.
   a. Total well depth _______ feet
   b. Static water level _______ feet
   c. Well construction began _______ [month] _______ _______ _______ _______ _______ _______ _______
   d. Well Construction completed _______ [month] _______ _______ _______ _______ _______ _______ _______
   e. Bore hole diameter in inches Top _______ Bottom _______
   f. Casing and Screen Joint are [ ] Welded [ ] Glued [ ] Threaded [X] Other

10. Well Construction (Casing & Screen) — a, c, d, e, & g measurements should be in inches to three decimal places

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Casing or Screen Diameter</th>
<th>Inside Diameter</th>
<th>Outside Diameter</th>
<th>Wall Thickness</th>
<th>Screen Slot Size</th>
<th>Type of Material</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>From</td>
<td>To</td>
<td>From</td>
<td>To</td>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>0</td>
<td>100.0'</td>
<td>2.067</td>
<td>2.375</td>
<td>0.354</td>
<td>0.010</td>
<td>PVC</td>
<td>Bond Lengyear</td>
</tr>
<tr>
<td>100.0'</td>
<td>125.0'</td>
<td>2.067</td>
<td>2.375</td>
<td>0.154</td>
<td>0.010</td>
<td>PVC</td>
<td>Bond Lengyear</td>
</tr>
</tbody>
</table>

11. Grout and Gravel Pack

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Grout or Gravel Pack</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>93.0'</td>
<td>Borehole Grout</td>
</tr>
<tr>
<td>93.0'</td>
<td>128.0'</td>
<td>Borehole Chips</td>
</tr>
<tr>
<td>128.0'</td>
<td></td>
<td>Sand #20</td>
</tr>
</tbody>
</table>

12. Geologic Materials Logged

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>0</td>
<td>0.5' Topsoil</td>
</tr>
<tr>
<td>0.5'</td>
<td>44.0' Brown Silty Clay</td>
</tr>
<tr>
<td>44.0'</td>
<td>128.0' Brown Fine to Medium Sand</td>
</tr>
</tbody>
</table>

(Additional sheets may be submitted)

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

[Signature]
Water Well Contractor's Signature     Date 8/16/05

Well Owner's Signature

If contractor is unknown or deceased
### STATE OF NEBRASKA
#### DEPARTMENT OF NATURAL RESOURCES

#### WATER WELL REGISTRATION

**FOR DEPARTMENT USE ONLY**

**Registration Date:** 10-3-2005  **Sequence No.:** 170491  **Registration No.:** G-136593

**Owner Code No.:** 51127  **Receipt No.:** UPPER BIG BLUE NRD

---

#### 1. Owner Information

<table>
<thead>
<tr>
<th>a. Well Owner’s First Name</th>
<th>Last Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b. Company Name</th>
<th>USDA/FSA/CEP</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>c. Correspondent Name</th>
<th>Steve Gilmore</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Address</th>
<th>5th Flrm 4715 1000 Independence Ave SW</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>City</th>
<th>Washington DC</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>Zip 20250</th>
</tr>
</thead>
</table>

**Telephone:** 202-770-3104

---

#### 2. Contractor Information

<table>
<thead>
<tr>
<th>a. Contractor’s License No.</th>
<th>19173</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Contractor’s Name</th>
<th>Mike Magin</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Contractor’s Email Address</th>
<th><a href="mailto:magin@amplifying.com">magin@amplifying.com</a></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Address</th>
<th>101 Addison St</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>City</th>
<th>State</th>
<th>Zip 54476</th>
</tr>
</thead>
</table>

**Telephone:** 202-770-3104

---

#### 3. Well Location Information

<table>
<thead>
<tr>
<th>a. Well Location</th>
<th>NE 3/4 of the SW 3/4 of Section 29, Township 11 North, Range 1 E of the 6th Principal Meridian, Seward County.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>b. Natural Resources District</th>
<th>Upper Big Blue</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>c. The well is</th>
<th>2451 feet from the (N 62') section line and 2597 feet from the (E 13') section line</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>or Latitude Degree</th>
<th>Minute</th>
<th>Second</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°</td>
<td>53'</td>
<td>04&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Longitude Degree</th>
<th>Minute</th>
<th>Second</th>
</tr>
</thead>
<tbody>
<tr>
<td>97°</td>
<td>20'</td>
<td>47&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d. Street address and subdivision, if applicable</th>
<th>Lot</th>
</tr>
</thead>
</table>

| e. Location of water use, if applicable (give legal description) | |

<table>
<thead>
<tr>
<th>f. If for irrigation, the land to be irrigated is</th>
<th>acres</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>g. Well reference letter(s), if applicable</th>
<th>M W 4</th>
</tr>
</thead>
</table>

**HHSS PWSID:**

---

#### 4. Permits

<table>
<thead>
<tr>
<th>Management Area Permit Number</th>
<th>Surface Water Permit Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermal Permit Number</td>
<td>Industrial Permit Number</td>
</tr>
<tr>
<td>Municipal Permit Number</td>
<td>Transfer Out-Of-State Permit Number</td>
</tr>
<tr>
<td>Well Spacing Permit Number</td>
<td>Conduct Permit Number</td>
</tr>
<tr>
<td>HHSS Permit Number</td>
<td>Other Permit Number</td>
</tr>
<tr>
<td>HHSS Permit Number</td>
<td>NDEQ</td>
</tr>
</tbody>
</table>

---

#### 5. Purpose of Well (Indicate one)

<table>
<thead>
<tr>
<th>Domestic</th>
<th>Commercial/Industrial</th>
<th>Dewatering (over 90 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Heat Exchanger</td>
<td>Groundwater Source Heat Pump</td>
<td>Irrigation Injection</td>
</tr>
<tr>
<td>Livestock</td>
<td>Monitoring</td>
<td>Observation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public Water Supply (without storage)</th>
<th>Recovery</th>
<th>Other</th>
</tr>
</thead>
</table>

---

#### 6. Wells in a Series

<table>
<thead>
<tr>
<th>a. Is this well a part of a series?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

| b. If one or more of the wells in the series is currently registered, give the well registration number | |

| c. How many wells in the series are you registering at this time? | |

---

#### 7. Replacement and Abandoned Well Information

<table>
<thead>
<tr>
<th>a. Is this well a replacement well?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>b. Registration number of abandoned well</th>
<th>If not registered, date abandoned well was constructed:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>c. Replacement well is</th>
<th>feet from abandoned well.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>d. Abandoned well last operated:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>e. Original well pump column size:</th>
<th>inches.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>f. Completion of original well abandonment on:</th>
</tr>
</thead>
</table>

| g. Location of water use of abandoned well | |

---
8. Pump Information.
   a. Is pump installed at this time? □ Yes □ No
   Is pump installed by well owner in section? □ Yes □ No
   Is pump installed by contractor in section? □ Yes □ No
   If pump installed by pump installer, please fill out license number below
   Pump Installer’s License No.
   Pump Installer’s Name
   Pump Installer’s Email Address
   Pump Installer’s Firm Name
   Pump Installer’s Firm Address
   City ____________________________ State __________ Zip __________ Telephone __________
   Pump Installer’s Firm Email Address
   c. Pumping rate __________ gallons per minute □ Measured □ Estimated
   d. Drop pipe diameter __________ inches
   e. Length of drop pipe __________ feet
   f. Pumping equipment installed (y/n): □ Y □ N
   g. Pump Brand __________
   h. This well is designed and constructed to pump less than 50 gpm □ Yes □ No

9. Well Construction Information.
   a. Total well depth __________ feet
   b. Static water level __________ feet
   c. Pumping water level __________ feet
   d. Well Construction began __________
   e. Well Construction completed (month) __________
   f. Bore hole diameter in inches (Top) __________ (Bottom) __________
   g. Casing and Screen Joints are □ Welded □ Glued □ Threaded □ Other

10. Well Construction (Casing & Screen)- c, d, e, & g measurements should be in inches to three decimal places

<table>
<thead>
<tr>
<th>Placement Depth in Feet</th>
<th>Casing or Screen Inside Diameter</th>
<th>Outside Diameter</th>
<th>Wall Thickness</th>
<th>Screen Slot Size</th>
<th>Type of Material</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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11. Grout and Gravel Pack

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<tbody>
<tr>
<td>From</td>
<td>To</td>
<td></td>
</tr>
</tbody>
</table>

12. Geologic Materials Logged

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<tr>
<th>Depth in Feet</th>
<th>Description</th>
<th>Depth in Feet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. I am familiar with the information submitted on this registration, and to the best of my knowledge it is true.

   Water Well Contractor’s Signature: __________________________ Date: __________
   Well Owner’s Signature: __________________________ Date: __________
   If Contractor is unknown or Deceased

   Property Manager’s Signature: __________________________ Date: __________