Multi-Scale Monitoring of Potential Groundwater Withdrawal Impacts Using Delineation Methodology; Lower Platte River, Nebraska

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SWS Annual Meeting • June 5, 2012
Cones of Depression
Local Landscape
• Eastern Great Plains Wet-Meadow, Prairie, and Marsh
  – Common species found in the wet-meadow/prairie community include:
    • Prairie cordgrass (*Spartina pectinata*)
    • Switchgrass (*Panicum virgatum*)
    • Big bluestem (*Andropogon gerardii*)
    • Indianagrass (*Sorghastrum nutans*)

Source: Rolfsmeier and Steinauer. 2010. *Terrestrial Ecological Systems and Natural Communities of Nebraska*. Nebraska Natural Heritage Program, Nebraska Game and Parks Commission
Platte River Communities

• Eastern Great Plains Wet-Meadow, Prairie, and Marsh
  – Common species found in the wetter areas typically include:
    • Sedges (*Carex* sp.)
    • Bulrushes (*Scirpus* sp.)
    • Cattails (*Typha* sp.)
    • Blue vervain (*Verbena hastata*)
    • Hemp dogbane (*Apocynum cannabinum*)

Source: Rolfsmeier and Steinauer. 2010. *Terrestrial Ecological Systems and Natural Communities of Nebraska*. Nebraska Natural Heritage Program, Nebraska Game and Parks Commission
Project 404 Permit

- Section 404 Individual Permit Issued May 2003
  - The Permit included over 80 conditions
- 2 types of wetland impacts
  - Direct - construction treatment plant and facilities
  - Indirect - drawdown of local water table during Project operation
  - 14.6 acres of wetland impacts estimated in the EIS (direct and indirect)
Permit Conditions

• Permit Condition 37 states:
  – The purpose of the monitoring is to identify any changes in the existing or future wetlands or aquatic sites impacted as the result of project development and operation.

• Impacts due to Groundwater Withdrawal
Monitoring Goals

• The monitoring plan states that monitoring is to occur two times per year until:
  
  “the Corps determines that any impacts to wetlands as a result of Project operation are not likely to occur or that long-term wetland monitoring should be either decreased, increased, or stopped.”

• Impact detection through multi-scale, multi-temporal monitoring plan
Interrelationships

Vegetation Data

Prevalence Index

Species Diversity Species Richness C-Value FQI

Project Impact
• Yes or No?

Look at Other Factors
• Hydrology
• Aerial Photography

Statistical Significance
Monitoring

- Initiated in June 2005
  - Baseline Monitoring
    - June 2005 through June 2008
  - Operational Monitoring
    - August 2008 to Present
Monitoring in the Cones of Depression

- Groundwater Monitoring in the CoD:
  - Monitoring Well Data

- Surface Water Monitoring in the CoD:
  - Pond Water Level
  - Local Precipitation and Temperature Data
  - Stream Gauge

- Aerial Photography
- Vegetation (potential)
Monitoring in the Well Fields

- Groundwater Monitoring in the Well Fields:
  - Production Well Data
  - Shallow Groundwater Piezometers
- Aerial Photography
- Vegetation
# Production & Monitoring Well Data

## Table 1 2011 Production Well Pumping Rates, Total Million Gallons Per Day (MGD) - Douglas County Wellfield

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**Monthly Totals, MG**

- January: 295.89
- February: 231.92
- March: 206.35
- April: 213.30
- May: 261.25
- June: 370.74
- July: 509.09
- August: 447.78
- September: 540.07
- October: 274.18

**Daily Averages, MGD**

- January: 9.54
- February: 8.28
- March: 6.66
- April: 7.11
- May: 8.43
- June: 12.36
- July: 16.42
- August: 14.44
- September: 18.00
- October: 8.84
Shallow Groundwater Piezometer

- 18 Piezometers Installed
- 7 foot, sand-point wells
- Levels measured ~monthly during the growing season
- Data graphed over time
- Included in Annual Reports
Pond Water Levels

• Annual Monitoring (Baseline and Operational)
  – 47 ponds monitored
  – 4 times yearly (March, August, September, October)
  – Annual Report
Local Precipitation & Temperature Data

- Taken at Fremont, NE
- Monthly Averages compared to historical data
Stream Gauge Data

Taken at:
Platte River, Venice, NE
(USGS Gauge #06796500)

Elkhorn River, Ashland, NE
(USGS Gauge #06801000)

Figure 3  2011 Monthly Mean Stream Elevation of the Platte River near Venice, NE

Natural Color

- Multi-Temporal data
- Obtained annually 2005-2009
- Obtained every-other-year after 2009
Aerial Photography

– Color Infrared (CIR)
  • Multi-Temporal data
  • Obtained annually 2005-2009
  • Obtained every-other-year after 2009
Wetland Vegetation

- Sample plot monitoring along transects using wetland delineation methodology
- 7 monitored wetlands (primary wetlands)
  - 3 PEM, 3 PFO, 1 PSS
  - Data entered and stored in a Microsoft Access Database
  - Annual Report
Wetland Monitoring

• Standard Annual Wetland Monitoring:
  — Vegetation monitoring in all primary wetlands twice per year
  — Remote monitoring in secondary wetlands using aerial photography
  — CIR Aerial photography obtained every year
  — Piezometer readings at least 5 times per year

• Data Analysis
Monitoring Goals

• **What are we doing with all the data?**
  
  – Reminder: the permit states that monitoring is to occur two times per year until:
    
    • “the Corps determines that any impacts to wetlands as a result of Project operation are not likely to occur or that long-term wetland monitoring should be either decreased, increased, or stopped.”

• Criteria needed to measure indirect impacts

• Triggers or “Thresholds” were developed
Project Thresholds

Standard Monitoring

Data Analysis

Sampling Effort #2

Data Analysis

No Impact

**Potential Impact**

Sampling Effort #3 Increase Intensity

Data Analysis

**Wetland Impact**

Sampling Effort #2

Data Analysis

No Impact Occurring
Monitoring Intensity

• Begin at Standard Annual Wetland Monitoring
• If 3 consecutive monitoring efforts show no impact ( RequestMethod), reduce level of effort
  – 3 levels of reduced monitoring established
• If 3 consecutive monitoring efforts show possible impact (RequestMethod), increase level of effort
• At reduced levels of monitoring, fewer “flags” are needed to move from one level to the next
Interrelationships

Vegetation Data

Prevalence Index

Species Diversity
Species Richness
C-Value
FQI

Species Diversity

Look at Other Factors

- Hydrology
- Aerial Photography

Project Impact
- Yes or No?

Statistical Significance
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