NEBRASKA

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DEPT. OF ENVIRONMENTAL QUALITY

March 14, 2017

Scott Coburn
Director of Natural Gas and Pipelines Department
Nebraska Public Service Commission
300 The Atrium
1200 N Street
Lincoln, NE 68509-4927

RE: NDEQ Major Oil Pipeline issues as required under 291 NAC 9 § 023.05

Dear Mr. Coburn;

The Nebraska Department of Environmental Quality (NDEQ) has reviewed the February 16, 2017 application submitted by TransCanada Keystone Pipeline, LP (Keystone).

The application provides adequate information for the assessment of the environmental and regulatory areas under NDEQ's purview (see Attached) with the exception of a description, location and logistics associated with a possible Construction Camp as described in NDEQ's January 2013 Final Evaluation Report (FER). The Construction Camp will require wastewater service with construction and NPDES permits from NDEQ and drinking water service requiring a possible permit from the Nebraska Department of Health and Human Services. If primary or backup power generation is needed, an NDEQ air permit may be required.

The NDEQ finds that the Preferred Route identified in the application will have minimal environmental impacts in Nebraska. This finding is based on a review of the mitigation commitments and reclamation procedures identified in the application and is consistent with NDEQ's FER analysis and the U.S. Department of State's 2014 Final Supplemental Environmental Impact Statement.

NDEQ does not anticipate additional budgetary requirements will be needed unless a report is requested by the Nebraska Public Service Commission. If a report is requested, NDEQ will determine a budget for its preparation.

Attached is a list of items NDEQ considered when reviewing this application.

Sincerely,

Jim Macy
Director

RECEIVED
MAR 14 2017
Nebraska
Public Service Commission

Attachment

Jim Macy, Director
Department of Environmental Quality
P.O. Box 98922
1200 N Street, Suite 400
Lincoln, Nebraska 68509-8922
OFFICE 402-471-2186 FAX 402-471-2909
ndeq.moreinfo@nebraska.gov
deq.ne.gov

NDEQ ATTACHMENT

Enabling Legislation

Nebraska Environmental Protection Act (NEPA) - Neb. Rev. Stat. 81-1501, et seq.

Applicable NDEQ Regulations

Title 117 - Nebraska Surface Water Quality Standards
Title 118 - Ground Water Quality Standards and Use Classification
Title 119 - Rules and Regulations Pertaining to the Issuance of Permits under the National Pollutant Discharge Elimination System
Title 122 – Rules and Regulations for Underground Injection and Mineral Production Wells
Title 123 - Rules and Regulations for the Design, Operation and Maintenance of Wastewater Works
Title 124 - Rules and Regulations for the Design, Operation and Maintenance of On-Site Wastewater Treatment Systems
Title 126 - Rules and Regulations Pertaining to the Management of Waste
Title 128 - Nebraska Hazardous Waste Regulations
Title 129 - Nebraska Air Quality Regulations
Title 132 - Integrated Solid Waste Regulations
Title 198 - Rules and Regulations Pertaining to Agricultural Chemical Containment

Supporting Documents

NDEQ's January 2013 Final Evaluation Report (FER) to Governor Heineman

TransCanada, September 5, 2012 Preferred Route Submission to the State of Nebraska

Keystone XL Project Construction, Mitigation, and Reclamation Plan, April 2012, Rev. 4.

Keystone XL Construction/Reclamation Unit Specifications

Soil Permeability Study and Distance-to-Groundwater Survey, Keystone XL Pipeline Project - Nebraska Preferred Route, April 2014

Additional Commitments and Mitigation Measures made to the State of Nebraska by TransCanada (letter dated October 18, 2012).

TransCanada Keystone XL Pipeline Mitigation Commitment regarding pipeline leak detection technology (letter dated December 30, 2013).

U.S. Department of State (DOS) 2014 Final Supplemental Environmental Impact Statement (FSEIS)

DOS 2011 Final Environmental Impact Statement (FEIS)

Chapman, et. al. 2001, Ecoregions of Nebraska and Kansas (color poster with map, descriptive text, summary tables, and photographs): Reston Virginia, US Geological Survey

The Groundwater Atlas of Nebraska, Resource Atlas No. 4b/2013, Conservation and Survey Division, University of Nebraska Lincoln

NDEQ Wellhead Protection Area Maps

NDEQ Remediation Site Locations

Nebraska Department of Natural Resource Well Registration Information Database

National Academy of Sciences Transportation Review Board - Special Report 311

NEBRASKA

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Pete Ricketts, Governor

April 20, 2017

Matthew J. Effken
Legal Council
Nebraska Public Service Commission
300 The Atrium
1200 N Street
Lincoln, NE 68509-4927

RE: NDEQ Major Oil Pipeline issues as required under 291 NAC 9 § 023.05

Dear Mr. Effken;

The Nebraska Department of Environmental Quality (NDEQ) has reviewed the February 16, 2017 application submitted by TransCanada Keystone Pipeline, LP (Keystone). The application provides adequate information for the assessment of the environmental and regulatory areas under NDEQ's purview.

In addition to our letter dated March 14, 2017, the NDEQ also finds that the Alternate Route identified in the application will have minimal environmental impacts in Nebraska. This finding is based on a review of the mitigation commitments and reclamation procedures identified in the application and is consistent with NDEQ's January 2013 Final Evaluation Report analysis and the U.S. Department of State's 2014 Final Supplemental Environmental Impact Statement.

NDEQ does not anticipate additional budgetary requirements will be needed unless a report is requested by the Nebraska Public Service Commission. If a report is requested, NDEQ will determine a budget for its preparation.

Attached is a list of items NDEQ considered when reviewing this application.

Sincerely,

Jim Macy
Director

Attachment

RECEIVED
APR 20 2017
Natural Gas Dept.

Department of Environmental Quality
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NDEQ ATTACHMENT

Enabling Legislation

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Title 123 - Rules and Regulations for the Design, Operation and Maintenance of Wastewater Works
Title 124 - Rules and Regulations for the Design, Operation and Maintenance of On-Site Wastewater Treatment Systems
Title 126 - Rules and Regulations Pertaining to the Management of Waste
Title 128 - Nebraska Hazardous Waste Regulations
Title 129 - Nebraska Air Quality Regulations
Title 132 - Integrated Solid Waste Regulations
Title 198 - Rules and Regulations Pertaining to Agricultural Chemical Containment

Supporting Documents

NDEQ's January 2013 Final Evaluation Report (FER) to Governor Heineman

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NDEQ Remediation Site Locations

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National Academy of Sciences Transportation Review Board - Special Report 311

NEBRASKA

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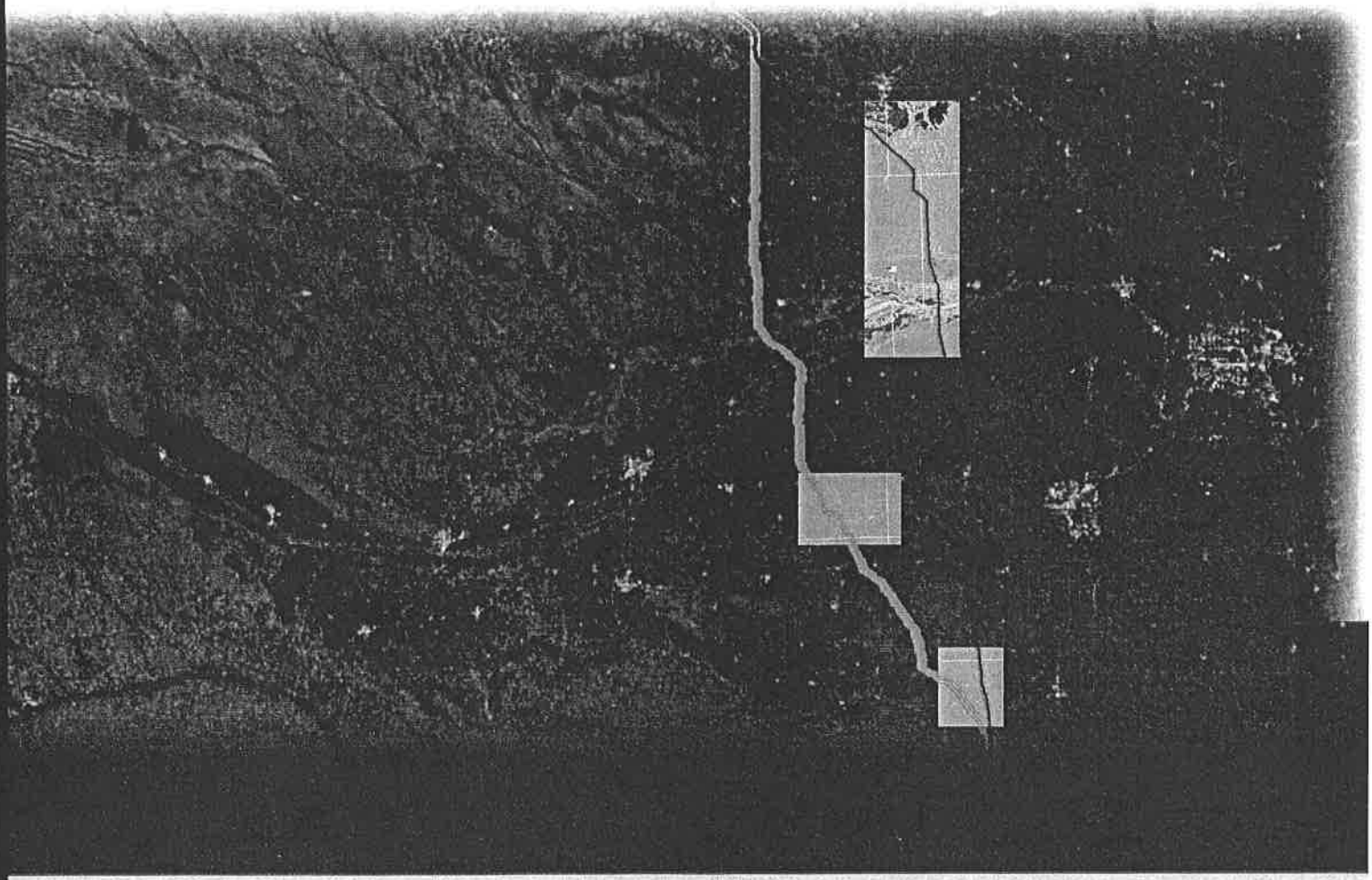

KEYSTONE XL ANALYSIS

REPORT TO THE NEBRASKA PUBLIC SERVICE COMMISSION

July 2017

NEBRASKA

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July 21, 2017

Matthew J. Effken
Legal Counsel
Nebraska Public Service Commission
300 The Atrium
1200 N Street
Lincoln, NE 68509-4927

RE: NDEQ Major Oil Pipeline issues as required under 291 NAC 9 § 023.05

Per your request of May 24, 2017, the Nebraska Department of Environmental Quality (NDEQ) is pleased to present our report detailing our analysis of the final 79 miles of the Preferred Route into Steel City and the Mainline Alternate Route as received in the February 16, 2017 application submitted by TransCanada Keystone Pipeline, LP (Keystone). The application provided NDEQ adequate information for the assessment of the environmental and regulatory areas under NDEQ's jurisdiction.

The analysis included in this report supports our finding that either the Preferred Route or the Keystone Mainline Alternative identified in the application will have minimal environmental impacts in Nebraska. This finding is further supported by the mitigation commitments and reclamation procedures identified in the application and is consistent with NDEQ's January 2013 Final Evaluation Report analysis and the U.S. Department of State's 2014 Final Supplemental Environmental Impact Statement.

NDEQ will submit application analysis and report costs in the coming weeks for reimbursement.

Sincerely,

Jim Macy
Director

Jim Macy, Director
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BACKGROUND

On February 16, 2017 the Nebraska Department of Environmental Quality (NDEQ) received an application for a major oil pipeline in Nebraska. The application stated: *"TransCanada Keystone Pipeline, LP (Keystone), pursuant to the Major Oil Pipeline Siting Act, submits this application for approval of the Preferred Route as defined in this application. For the reasons stated in this application, Keystone requests an order from the Nebraska Public Service Commission pursuant to Neb. Rev. Stat. § 57-1408 finding that the Preferred Route is in the public interest and authorizing Keystone to act under Neb. Rev. Stat. § 57-1101. In addition to its application, Keystone submits the written testimony of Tony Palmer, Meera Kothari, John Beaver, Sandra Barnett, Michael Portnoy, Jon Schmidt, Paul Fuhrer, and Dr. Ernie Goss. Keystone also provides its executed agreement to pay expenses assessed in accordance with the provisions of the Major Oil Pipeline Siting Act."*

On February 21, 2017, the NDEQ received a letter from the Public Service Commission (PSC) requesting input from the NDEQ with regard to the Keystone application, pursuant to the Major Oil Pipeline Siting Act (MOPSA), for a major oil pipeline within the State of Nebraska. The PSC requested that input be received not later than March 20, 2017. Following an analysis along the Preferred Route of geology, soils and sediment, groundwater, surface water, air, and hazardous materials, the NDEQ submitted a letter to the PSC on March 14, 2017 indicating *"The NDEQ finds that the Preferred Route identified in the application will have minimal environmental impacts in Nebraska."* This finding was based on a review of the mitigation commitments and reclamation procedures identified in the application and was consistent with NDEQ's January 2013 Final Evaluation Report (FER) and the U.S. Department of State's (DOS) 2014 Final Supplemental Environmental Impact Statement (FSEIS). Keystone's **Construction, Mitigation, and Reclamation Plan** (CMRP), April 2012, Revision 4 is included with this most recent application but was originally reviewed in 2012 for the FER.

In April, the NDEQ received a request from the PSC for an analysis of potential environmental impacts with respect to installation of the proposed Keystone XL pipeline along the Mainline Alternative as submitted in the February 16, 2017 application. On April 20, 2017, the NDEQ responded to the PSC request by stating *"the NDEQ also finds that the Alternate Route identified in the application will have minimal environmental impacts in Nebraska."*

On May 24, 2017, the NDEQ received a formal request from the PSC for a report detailing NDEQ's analysis pursuant to MOPSA, *Neb Rev. Stat* §§ 57-1401 - 57-1413.

Please see NDEQ's FER and DOS's FSEIS for additional background information regarding the following sections detailing NDEQ's analysis. Chapter 4 and Appendix E of NDEQ's FER are particularly relevant.

GENERAL

On January 2013, the NDEQ published its Final Evaluation Report that analyzed all aspects of the Preferred Route from milepost 601.8, near the Nebraska – South Dakota border, to milepost 796.3, approximately 7 miles north of Bradshaw. This report outlines the steps the NDEQ took with respect to any new facilities on this portion of the Preferred Route as well as the subsequent 79 miles to Steel City from milepost 796.3 to milepost 875. NDEQ also analyzed the proposed Mainline Alternative which splits from the Preferred Route at approximately milepost 710.5 in Antelope County and travels southeasterly where it turns southward and parallels the Keystone 1 thirty-inch pipeline, 50-feet to its west, with the exception of a major route departure westward around the Wellhead Protection Areas of Staplehurst, Seward, Goehner, Tamora, and Milford. The Preferred and Alternate Routes merge just past Preferred Route milepost 868.

NDEQ performed a geographic information system (GIS) comparison of the proposed Preferred Route with respect to data received in 2012 and 2015. NDEQ noted several small alignment adjustments (micro-routing) with respect to the previous applications to avoid wells, pipes, road intersections, better manage stream crossings or other. The largest of which was noted in Boyd County where a reroute was made to better manage a stream crossing of approximately 1550 feet. NDEQ's FER, Section 2.1.1 recognized micro-routing could occur and stated: *"NDEQ understands that Keystone would make minor adjustments to the proposed pipeline alignment during final design based on additional information obtained from field surveys or landowners."* These minor route variations could be implemented to address specific landowner concerns, avoid certain features (such as structures, wells, or irrigation systems), minimize impacts to environmental resources, or facilitate construction in such areas as steep terrain or water body crossings."

Alignment maps were developed for both the Preferred Route and the Mainline Alternative to perform analysis on each media type under NDEQ's purview. Details of this analysis follows.

GEOLOGY

The geology has not changed since the FER was issued. FER Appendix E, E.1-1 and Attachment B as well as resources denoted in Supporting Documents were utilized for analysis of geology along the proposed Preferred and Mainline Alternate Routes. In addition, UNL Conservation and Survey Cross-Sections and Test Holes were reviewed for the following counties: Polk, York, Fillmore, Saline, Jefferson, Madison, Platte, Butler and Seward. Review of this material confirmed that the geology outlined in the FER underlies the proposed Preferred and Mainline Alternate Routes.

FER, Appendix E.1, page 7 lists bedrock geology along much of the Preferred Route. The southern portion of the Preferred Route and Mainline Alternative traverses several formations not listed in this Appendix. Descriptions are as follows:

Greenhorn Limestone

The Greenhorn Limestone is a gray fossiliferous limestone up to 30 feet thick (Condon, 2005; USGS 2012a).

Graneros Shale

The Graneros Shale is gray shale interbedded with silt and limestone in the lower portions. It is generally less than 50 feet thick (Condon, 2005; USGS 2012a).

Dakota Sandstone

The Dakota Sandstone is part of the Dakota Group and is a sandstone interbedded with shale and lenses of sand cemented with iron oxide. The sandstone can be up to 350 feet thick (Condon, 2005; USGS 2012a).

FER, Appendix E.1, page 8 lists geology by county along much of the Preferred Route. The southern portion of the Preferred Route and Mainline Alternative traverses several counties not listed in this Appendix. Descriptions are as follows:

Madison County

The surficial geology in Madison County includes loess mantled alluvial sand and gravel for the majority of the county, with loess mantled till (clay loam till) in the southeastern portion and alluvial deposits of the Elkhorn River (Appendix 2.1). The bedrock geology consists mainly of Ogallala Group sediments with the Niobrara Formation in the northeast and southeast corners (Figure B-2).

Stanton Country

The surficial geology in Stanton County includes loess mantled till (clay loam till) for the majority of the county with loess mantled alluvial sand and gravel along with alluvial deposits of the Elkhorn River (Appendix 2.1). The bedrock geology consists of remnants of Ogallala Group sediments with the Niobrara Formation and Carlile Shale in areas where the Ogallala Group has been eroded (FER Figure B-2).

Platte Country

The surficial geology in Platte County includes loess mantled alluvial sand and gravel for the majority of

the county, with loess mantled till (clay loam till) in the northeastern portion and alluvial deposits of the Platte River valley (Appendix 2.1). The bedrock geology consists mainly of the Niobrara Formation and Carlile Shale with a small area of Ogallala Group sediments on the western edge (FER Figure B-2).

Colfax Country

The surficial geology in Colfax County includes loess mantled till (clay loam till) in the northern portion and alluvial deposits of the Platte River valley in the southern portion (Appendix 2.1). The bedrock geology consists of the Niobrara Formation starting on the western edge followed by the Carlile Shale, Greenhorn/Graneros and the Dakota Group on the eastern edge (FER Figure B-2).

Butler Country

The surficial geology in Butler County includes loess mantled till (clay loam till) for the majority of the county, with loess mantled alluvial sand and gravel in the very southwestern portion and alluvial deposits of the Platte River on the northern border (Appendix 2.1). The bedrock geology consists mainly of the Carlile Shale starting on the western edge followed by the Greenhorn/Graneros and the Dakota Group on the eastern edge (FER Figure B-4).

Seward Country

The surficial geology in Seward County includes loess mantled alluvial sand and gravel and loess mantled till (clay loam till) (Appendix 2.1). The bedrock geology consists mainly of Dakota Group sediments with remnants of the Carlile Shale and Greenhorn/Graneros (FER Figure B-4).

Fillmore Country

The surficial geology in Fillmore County includes loess mantled alluvial sand and gravel and loess mantled till (clay loam till) (Appendix 2.1). The bedrock geology consists of the Niobrara Formation starting on the western edge followed by the Carlile Shale, Greenhorn/Graneros and the Dakota Group on the eastern edge (FER Figure B-4).

Saline Country

The surficial geology in Saline County includes loess mantled alluvial sand and gravel and loess mantled till (clay loam till) (Appendix 2.1). The bedrock geology consists mainly of Dakota Group sediments with remnants of the Carlile Shale and Greenhorn/Graneros (FER Figure B-42).

Jefferson Country

The surficial geology in Jefferson County includes a wide range of depositional environments including loess mantled alluvial sand and gravel, loess mantled till (clay loam till), alluvial deposits of the Big Sandy Creek, and loess mantled colluvium (Appendix 2.1). The bedrock geology consists mainly of Dakota Group sediments (FER Figure B-4).

SOILS AND SEDIMENT

Soils for both the Preferred Route and Mainline Alternate Route were analyzed using USDA, NRCS SSURGO Data from 2014. The three primary factors reviewed were the Wind Erodibility Group (WEG), Soil Erosion T-Factor, and Soil Erosion Hazard (Off-Road, Off-Trail) based on Erosion K-Factor. The Department also considered the Appendix D (CMRP) and Appendix F (Construction/Reclamation Units) in Keystone's current application. See Soils and Sediment Appendix 3 for maps depicting each erosion analysis.

A WEG consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. Most portions of the proposed routes with highly susceptible wind erodibility were reviewed extensively and presented in the FER. These areas and are typically found north of the intersection of the two proposed routes and along the Platte River. Several areas of more highly erodible soils which were not previously reviewed are located along the Mainline Alternate Route in Madison County and north and south of the Platte River crossing. Those areas will require similar mitigation and reclamation procedures as those needed along the Preferred Route and detailed in the CMRP.

The T-Factor is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is tons per acre per year with 1 ton/year indicating a very fragile production region and 5 tons/year indicating the least fragile.

The Soil Erosion Hazard (Off-Road, Off-Trail) rating is an interpretation of the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slop and soil erosion factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining or other kinds of disturbance such as pipeline construction. Slight indicates that erosion is unlikely under ordinary climatic conditions. Moderate indicates that some erosion is likely and that erosion-control measures may be needed. Severe indicates that erosion is very likely and that erosion-control measures, including re-vegetation of bare areas, are advised. Very severe indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

There is little difference in soil erosion characteristics between the Preferred Route and that of the Mainline Alternative. Based on this analysis and procedures presented in the CMRP, NDEQ finds soil erosion will be minimized if the mitigation and reclamation procedures submitted in the application are managed properly. Either Route can comply with NDEQ's Construction Stormwater NPDES permit requirements. See FER, Chapter 4.2.3 for additional information regarding erosion reduction.

GROUNDWATER

Nebraska Administrative Code: Title 118

NDEQ's Groundwater Unit reviewed both the Preferred Route and the Mainline Alternate Route for wells within ½-mile of the proposed routes and most recent Wellhead Protection Area maps. Facilities were identified which could be impacted due to proposed pipeline construction activities. The following steps were used for identification:

Registered water wells, from 2012 through November 2016, within one-half mile of the alignment were reviewed for impacts in the Preferred Route alignment. Data were received from the Nebraska Department of Natural Resources (NDNR) and imported into ARC GIS for analysis. Micro-alignment adjustments were used to avoid wells installed in the Preferred Route alignment right-of-way and the alignment adjusted around them. All registered wells were reviewed for the portions of the line not reviewed in the FER. Depth to groundwater, well construction details, and geologic information were reviewed (Appendix 4).

Wellhead Protection Maps were analyzed and compared in GIS with the proposed alignments. The operating Keystone 1 & proposed Keystone XL pump station in Steel City remains located in the well head protection area.

The Preferred Route and the Mainline Alternate Route pass through nine Natural Resources Districts (NRDs). The local hydrogeology and regulatory requirements for six of the NRDs (Lower Niobrara, Upper Elkhorn, Lower Loup, Lower Platte North, Central Platte and Upper Big Blue) was discussed previously in the FER. Local hydrogeology and regulatory requirements for the remaining three NRDs (Lower Elkhorn, Lower Big Blue and Little Blue) is discussed below.

Lower Elkhorn NRD

The Mainline Alternate Route passes through Madison, Stanton, Platte and Colfax counties in the Lower Elkhorn NRD. This route continues through an area in Madison County that is underlain by the Ogallala Group. The Ogallala Group has been eroded away in the southeast portion of Madison County and is no longer present under the route in portions of Stanton and Platte Counties completely absent in Colfax County. The general hydrogeology near the route in this NRD is complex due to a wide range of depositional environments from eolian to glacial. The principal aquifer includes unconsolidated sediments of Quaternary age and the Ogallala Group where present. Areas where glacial sediments are present, the aquifer tends to be less reliable. (FER Appendix E.3)

Saturated Thickness (feet)	Depth to Groundwater (feet below ground surface)	Transmissivity (gallons per day per foot)	Specific Yield (%)
0-400	>200	20,000-250,000	5-20

Well construction in the Lower Elkhorn NRD would require a Well Construction Permit for a well that pumps over 50 gal/min. This permit would allow groundwater to be used for an approved beneficial use.

Saturated Thickness (feet)	Depth to Groundwater (feet below ground surface)	Transmissivity (gallons per day per foot)	Specific Yield (%)
0-400	>200	20,000-250,000	5-20

Groundwater is used for a variety of purposes including domestic, irrigation, industrial, and livestock. The main use of groundwater is for irrigation. (NDNR 2005)

Lower Big Blue

The Preferred Route and the Mainline Alternate Route pass through Saline and Jefferson counties in the Lower Big Blue NRD. The general hydrogeology near the route in this NRD is complex due to a wide range of depositional environments from eolian to glacial. The principal aquifer includes unconsolidated sediments of Quaternary age, including paleovalley aquifers where present. Areas where glacial sediments are present, the aquifer tends to be less reliable. The bedrock aquifers are considered secondary aquifers and are Cretaceous in age. (FER Appendix E.3)

Well construction in the Lower Big Blue NRD would require a Well Construction Permit for a well that pumps over 50 gal/min. if the well meets specific scoring criteria. This permit would allow groundwater to be used for an approved beneficial use.

Saturated Thickness (feet)	Depth to Groundwater (feet below ground surface)	Transmissivity (gallons per day per foot)	Specific Yield (%)
0-400	0-200	20,000-300,000	5-25

Groundwater is used for a variety of purposes including domestic, irrigation, industrial, and livestock. The main use of groundwater is for irrigation. (NDNR 2005)

Little Blue

The Preferred Route and the Mainline Alternate Route pass through Jefferson counties in the Little Big Blue NRD. The general hydrogeology near the route in this NRD is very similar to the Lower Big Blue NRD. The principal aquifer includes unconsolidated sediments of Pliocene to Quaternary age where present. Areas where glacial sediments are present, the aquifer tends to be less reliable. The bedrock aquifers are considered secondary aquifers and are Cretaceous in age. (FER Appendix E.3)

The Little Blue NRD has a stay on drilling wells that that pump over 50 gal/min. in the Preferred Route and Mainline Alternate Route. (NDNR 2005)

Saturated Thickness (feet)	Depth to Groundwater (feet below ground surface)	Transmissivity (gallons per day per foot)	Specific Yield (%)
0-400	0 - >200	20,000-300,000	5-25

Groundwater is used for a variety of purposes including domestic, irrigation, industrial, and livestock. The main use of groundwater is for irrigation. (NDNR 2005)

Potential Impacts and Mitigation

Potential impacts to groundwater and mitigation for the Preferred Route and Mainline Alternate Routes will be similar to those found in FER.

SURFACE WATER

Nebraska Administrative Code: Title 117

Both proposed pipeline routes would cross multiple streams during construction and operation of the pipeline. Based on Keystone's application Table 2-1, Comparison of the Preferred Route to the Two Proposed Alternatives, it was noted that the Preferred Route would only cross 21 perennial streams (flowing waters) whereas the Mainline Alternative would cross 31 perennial Streams even though the hydrology category shows the overall number of stream crossing will be higher for the Preferred Route. NDEQ counted 25 crossings of streams by the Preferred Route as classified by Title 117, Nebraska Surface Water Quality Standards and 34 by the Mainline Alternative. NDEQ found total crossings of streams listed in the National Hydrography Dataset, most of which are ephemeral and intermittent streams, would be 246 for the Preferred Route and 230 for the Mainline Alternative.

Crossing ephemeral or intermittent streams avoids a number of temporary impacts and mitigation/reclamation measures that are needed for perennial streams. Keystone's CMRP (Application Appendix D) details measures and techniques to appropriately mitigate and reclaim stream crossings. It is NDEQ's observation that fewer perennial stream crossings would reduce surface water impacts.

Wastewater discharges to waters of the State require National Pollutant Discharge Elimination System (NPDES) permits under Nebraska Administrative Code Title 119; *Rules and Regulations Pertaining to the Issuance of Permits under the National Pollutant Discharge Elimination System*. Keystone has acknowledged needing Hydrostatic, Construction Stormwater, and Dewatering NPDES permits as part of the construction. These NPDES permits will require adequate measures to protect Nebraska's surface water quality.

AIR

Nebraska Administrative Code: Title 129

NDEQ's air division reviewed both the Preferred Route and the Mainline Alternate Route from both the construction and operations standpoints given that air impacts along the proposed construction corridor would include mechanized equipment emissions, fugitive emissions, and emissions generated to power the living facilities at the construction camp. Operational emissions would include power for pump stations and main line valves. A more extensive description of impacts is found in NDEQ's January 2013 FER Section 4.16.2.

Based on the proposed construction activities, NDEQ anticipates emergency engine generators would fall below the 294 horsepower limit where no air permit would be necessary. NDEQ expects that Keystone will propose a connection to Nebraska's power grid to provide power for the construction camp as discussed in NDEQ's FER. If larger engine generators are proposed, the Department will review each application individually for impacts per Title 129 requirements.

From an air impact standpoint, minimal difference exists between the current application and NDEQ's January 2013 FER. The current application describes nearly identical and acceptable construction and mitigation plans for the Preferred Route and that of the Mainline Alternate Route.

Note: Given that the Mainline Alternative is approximately 2% longer than the Preferred Route, the potential of additional fugitive construction emissions is possible. The addition of a sixth pumping station along Mainline Alternative, due to the longer length, will require additional energy inputs. This additional energy production and consumption will cause additional emissions.

Nebraska is currently in attainment status for the National Ambient Air Quality Standard (NAAQS) statewide. It is unlikely NAAQS modeling would be necessary for the engine sizes anticipated for Keystone's power needs but would be performed if needed.

Because NDEQ's Title 129 regulates Air Quality in Nebraska, Keystone is required to apply for a permit when equipment and projects fall under the purview of the regulations. Additional requirements may be applied at that time to maintain the quality of Nebraska's environment per the Nebraska Environmental Protection Act.

Additional information pertaining to air quality and potential impacts is in NDEQ's 2013 FER Chapter 4, Section 4.19 and Appendix E.19.

HAZARDOUS MATERIALS

Nebraska Administrative Code: Title 128 and Title 132

NDEQ's Remediation Section reviewed both the Preferred Route and the Mainline Alternate Route for sites and facilities within the Resource Conservation and Recovery Act (RCRA), Integrated Waste Management (IWM), Superfund, Brownfields, and Remedial Action Plan (RAP) Programs. Sites were identified within one mile of the proposed pipeline construction corridors that could be impacted due to proposed pipeline construction activities. The following steps were used for identification:

NDEQ information technology (IT) staff generated a list of all known remediation sites and facilities located in Counties traversed by the proposed pipeline construction which included Keya Paha, Boyd, Holt, Antelope, Boone, Nance, Merrick, Polk, York, Fillmore, Saline, Jefferson, Madison, Stanton, Platte, Colfax, Butler, and Seward.

NDEQ next narrowed the site and facility list to only those sites located within one mile of the proposed alignment using GIS. Ten sites were located within one mile of the proposed Preferred Route and ten sites were located within one mile of the proposed Mainline Alternative starting where the Mainline Alternate splits from the Preferred Route (approximately milepost 710.5). These sites and facilities were examined and compared for impacts to the sites from the pipeline and possible interference with pipeline construction. Facility and site operational history was examined to determine the known/potential environmental impact and media of concern. For site and facilities with either known or potential groundwater impacts, depth to groundwater and groundwater flow direction were examined for possible down gradient impacts or off-site areas of concern.

Based review of available data, NDEQ has determined that no sites or facilities would be adversely impacted by either of the pipeline construction proposals.

Additional information pertaining to hazardous materials impacts is found in NDEQ's 2013 FER Chapter 4, Section 4.19 and in Appendix E.19.

See Hazardous Materials Appendix 5 for additional data.

FINDINGS

The application provides adequate information for the assessment of the environmental and regulatory areas under NDEQ's purview with the exception of a description, location and logistics associated with a possible Construction Camp as described in NDEQ's January 2013 Final Evaluation Report (FER). The Construction Camp will require wastewater service with construction and NPDES permits from NDEQ and drinking water service requiring a possible permit from the Nebraska Department of Health and Human Services. If primary or backup power generation is needed, an NDEQ air permit may be required.

NDEQ's findings are based on:

- NDEQ's extensive 2012 analysis documented in our January 2013 Final Evaluation Report which included specific mitigation commitments made by Keystone to the State of Nebraska found in Section 5.4;
- The U.S. Department of State's 2014 Final Supplemental Environmental Impact Statement;
- Keystone's CMRP found in application Appendix D;
- Keystone's Construction Reclamation Units found in application Appendix F;
- Additional new analysis performed by NDEQ staff and outlined in this report; and
- On-going permitting authority by NDEQ to protect Nebraska's Air, Land, and Water resources prior to, during, and following construction of the proposed pipeline by Keystone.

The NDEQ concludes that both the Preferred Route and Mainline Alternative will have minimal permanent environmental impacts in Nebraska. Either route can likely be constructed and operated according to the rules and regulations under NDEQ's authority.

APPENDICES

1. Correspondence with the Public Service Commission
2. Geologic Information
3. Soils & Sediments Information
4. Groundwater Information
5. Hazardous Materials Information
6. References

APPENDIX - 1

PUBLIC SERVICE COMMISION CORRESPONDANCE

1.1 Letter from PSC to NDEQ – February 17, 2017
1.2 Letter to PSC from NDEQ – March 14, 2017
1.3 Letter from PSC to NDEQ – March 27, 2017
1.4 Letter to PSC from NDEQ – April 20, 2017
1.5 Letter from PSC to NDEQ – May 23, 2017
1.6 Email to PSC from NDEQ – May 19, 2017
1.7 Attachment to May 19, 2017 Email
1.8 Attachment to May 19, 2017 Email

Appendix 1.1

Nebraska Public Service Commission

300 The Atrium, 1200 N Street, Lincoln, NE 68508
Post Office Box 94927, Lincoln, NE 68509-4927
Website: psc.nebraska.gov
Phone: (402) 471-3101
Fax: (402) 471-0254

NEBRASKA CONSUMER HOTLINE:
1-800-526-0017

RECEIVED
FEB 2 1 2017
Nebraska Dept of Environmental Quality
By: DEQ#123

February 17, 2017

Jim Macy
Nebraska Dept of Environmental Quality
1200 "N" Street Suite 400
P.O. Box 98922
Lincoln NE 68509

RE: Application of TransCanada Keystone Pipeline, L.P.: Docket No. OP-0003

Dear Mr. Macy,

On February 16, 2017, TransCanada Keystone Pipeline, L.P. ("TransCanada") filed an application with the Nebraska Public Service Commission ("Commission") seeking approval of a proposed route for the Keystone XL Pipeline, pursuant to the Nebraska Major Oil Pipeline Siting Act, *Neb. Rev. Stat.* §§ 57-1401 – 57-1413 ("MOPSA"). Under MOPSA, TransCanada was required to file a copy of the application with your agency.

MOPSA also provides that the Commission has the option to request from your agency a report, based on your agency's area of expertise, relating to the impact of the pipeline on any area within your agency's jurisdiction, including opinions regarding the advisability of approving denying or modifying the location of the proposed route of the pipeline. *Neb. Rev. Stat.* § 57-1407(3).

The Commission has adopted rules and regulations for the processing and review of major oil pipelines under MOPSA. *See* 291 NAC 9 § 023. The regulations provide that each agency which received a copy of the TransCanada application shall file with the Commission within 30 days of receipt, a list of potential issues within such agency's area of expertise relating to the impact and proposed route of the pipeline, along with an estimated budget for completion of a report addressing those issues. 291 NAC 9 § 023.05.

The Commission will review each agency's proposed list of issues and request preparation of those reports which it determines will assist the Commission in its review of the TransCanada application. Please note that all reasonable and necessary expenses incurred by your agency to prepare such a report, including the use of any hired consultants, are assessable to TransCanada and will be reimbursed to your agency.

Therefore, please prepare a proposed issue list and budget on behalf of your agency and provide them to the Commission no later than March 20, 2017. We appreciate your assistance and cooperation in this matter. Please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

Matthew J. Effken
Legal Counsel
Nebraska Public Service Commission
matt.effken@nebraska.gov
402-471-3306

Appendix 1.1

57-1407. Commission; duties; public meetings; agency reports; approval by commission; considerations.

...

(3) If requested by the commission, the following agencies shall file a report with the commission, prior to the hearing on the application, regarding information within the respective agencies' area of expertise relating to the impact of the major oil pipeline on any area within the respective agencies' jurisdiction, including in such report opinions regarding the advisability of approving, denying, or modifying the location of the proposed route of the major oil pipeline: The Department of Environmental Quality, the Department of Natural Resources, the Department of Revenue, the Department of Roads, the Game and Parks Commission, the Nebraska Oil and Gas Conservation Commission, the Nebraska State Historical Society, the State Fire Marshal, and the Board of Educational Lands and Funds. The agencies may submit a request for reimbursement of reasonable and necessary expenses incurred for any consultants hired pursuant to this subsection.

Source:Laws 2011, First Spec. Sess., LB1, § 8.

291 NAC 9 § 023.02B. Filing and Notice

Applications must be filed with the Executive Director at the Nebraska Public Service Commission. Pipeline carriers shall file an original paper copy of the application in addition to an electronic copy and five (5) paper copies.

291 NAC 9 § 023.02B1.

Pipeline carriers shall also file a copy of the application with the following agencies:

023.02B1(a) Department of Environmental Quality

023.02B1(b) Department of Natural Resources

023.02B1(c) Department of Revenue

023.02B1(d)Department of Roads

023.02B1(e)Game and Parks Commission
023.02B1(f) Nebraska Oil and Gas Conservation Commission

023.02B1(g)Nebraska State Historical Society

023.02B1(h)State Fire Marshal, and

023.02B1(j) Board of Educational Lands and Funds

291 NAC 9 § 023.05. Agency Reports

Within thirty (30) days of the filing of the application, the agencies references in subsection 023.02B1 shall file with the Commission a list of potential issues and an estimated budget for the completion of a report addressing those issues. If requested by the Commission, the agencies referenced in subsection 023.02B1 shall file a report with the Commission, prior to the hearing on the application, regarding information within the respective agencies' area of expertise relating to the impact of the major oil pipeline on any area within the respective agencies' jurisdiction, including in such report opinions regarding the advisability of approving, denying, or modifying the location of the proposed route of the major oil pipeline.

023.05A The report shall be filed with the Commission at least ten (10) days prior to the hearing or as required by the Hearing Officer.

023.05B The agencies may submit a request for reimbursement of reasonable and necessary expenses incurred for any consultants hired pursuant to subsection 023.12.

Appendix 1.2

NEBRASKA

Good Life. Great Environment.

DEPT. OF ENVIRONMENTAL QUALITY

March 14, 2017

Pete Ricketts, Governor

Scott Coburn
Director of Natural Gas and Pipelines Department
Nebraska Public Service Commission
300 The Atrium
1200 N Street
Lincoln, NE 68509-4927

RE: NDEQ Major Oil Pipeline issues as required under 291 NAC 9 § 023.05

Dear Mr. Coburn;

The Nebraska Department of Environmental Quality (NDEQ) has reviewed the February 16, 2017 application submitted by TransCanada Keystone Pipeline, LP (Keystone).

The application provides adequate information for the assessment of the environmental and regulatory areas under NDEQ's purview (see Attached) with the exception of a description, location and logistics associated with a possible Construction Camp as described in NDEQ's January 2013 Final Evaluation Report (FER). The Construction Camp will require wastewater service with construction and NPDES permits from NDEQ and drinking water service requiring a possible permit from the Nebraska Department of Health and Human Services. If primary or backup power generation is needed, an NDEQ air permit may be required.

The NDEQ finds that the Preferred Route identified in the application will have minimal environmental impacts in Nebraska. This finding is based on a review of the mitigation commitments and reclamation procedures identified in the application and is consistent with NDEQ's FER analysis and the U.S. Department of State's 2014 Final Supplemental Environmental Impact Statement.

NDEQ does not anticipate additional budgetary requirements will be needed unless a report is requested by the Nebraska Public Service Commission. If a report is requested, NDEQ will determine a budget for its preparation.

Attached is a list of items NDEQ considered when reviewing this application.

Sincerely,

Jim Macy
Director

Attachment

Jim Macy, Director
Department of Environmental Quality
PO Box 98922
1200 N Street, Suite 400
Lincoln, Nebraska 68509-8922
office 402-471-2186 fax 402-471-2909
ndeq.moreinfo@nebraska.gov
deq.ne.gov

20170024201

Appendix 1.3

Nebraska Public Service Commission

300 The Atrium, 1200 N Street, Lincoln, NE 68508
Post Office Box 94927, Lincoln, NE 68509-4927
Website: psc.nebraska.gov
Phone: (402) 471-3101
Fax: (402) 471-0254

NEBRASKA CONSUMER HOTLINE:
1-800-526-0017

March 27, 2017

Jim Macy, Director
Nebraska Department of Environmental Quality
1200 N Street, Suite 400
Lincoln, NE 68509

Re: Application of TransCanada Keystone Pipeline, L.P.: Docket No. OP-0003

Dear Mr. Macy:

Thank you for your letter dated March 14, 2017, responding to the Public Service Commission's inquiry regarding the above referenced Docket pursuant to 291 NAC 9 § 023.05. The Commission is reviewing your letter and will be in touch to follow up with your agency as necessary.

In the meantime, please be aware that Scott Coburn, Director of Natural Gas and Pipelines for the Public Service Commission has recused himself from any participation in this Docket or other issues involving TransCanada. Please direct any future correspondence to Nichole Mulcahy, Deputy Director of Natural Gas/Legal Counsel, Nebraska Public Service Commission.

If you have any questions, please do not hesitate to give me a call.

Sincerely,

Matthew J. Efiken
Legal Counsel
Nebraska Public Service Commission
matt.efiken@nebraska.gov
402-471-3306

MJE:rp

Appendix 1.4

NEBRASKA

Good Life. Great Environment

DEPT. OF ENVIRONMENTAL QUALITY

April 20, 2017

Pete Ricketts, Governor

Matthew J. Effken
Legal Council
Nebraska Public Service Commission
300 The Atrium
1200 N Street
Lincoln, NE 68509-4927

RE: NDEQ Major Oil Pipeline issues as required under 291 NAC 9 § 023.05

Dear Mr. Effken;

The Nebraska Department of Environmental Quality (NDEQ) has reviewed the February 16, 2017 application submitted by TransCanada Keystone Pipeline, LP (Keystone). The application provides adequate information for the assessment of the environmental and regulatory areas under NDEQ's purview.

In addition to our letter dated March 14, 2017, the NDEQ also finds that the Alternate Route identified in the application will have minimal environmental impacts in Nebraska. This finding is based on a review of the mitigation commitments and reclamation procedures identified in the application and is consistent with NDEQ's January 2013 Final Evaluation Report analysis and the U.S. Department of State's 2014 Final Supplemental Environmental Impact Statement.

NDEQ does not anticipate additional budgetary requirements will be needed unless a report is requested by the Nebraska Public Service Commission. If a report is requested, NDEQ will determine a budget for its preparation.

Attached is a list of items NDEQ considered when reviewing this application.

Sincerely,

Jim Macy
Director

Attachment

20170035448

Department of Environmental Quality
PO Box 98922
1200 N Street, Suite 400
Lincoln, Nebraska 68509-8922

deq.ne.gov

Jim Macy, Director
office 402-471-2186 fax 402-471-2909
[illegible]

Nebraska Public Service Commission

COMMISSIONERS:
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CRYSTAL RHOADES
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TIM SCHRAM

EXECUTIVE DIRECTOR:
JEFFREY C. PURSLEY

300 The Atrium, 1200 N Street, Lincoln, NE 68508
Post Office Box 94927, Lincoln, NE 68509-4927
Website: psc.nebraska.gov
Phone: (402) 471-3101
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NEBRASKA CONSUMER HOTLINE:
1-800-526-0017

RECEIVED

MAY 2 1 2017

Nebraska Dept of Environmental Quality
By: ____ DEQ#158 ____

May 23, 2017

Jim Macy
Nebraska Dept of Environmental Quality
1200 "N" Street Suite 400
P.O. Box 98922
Lincoln NE 68509

RE: Request for Report on Application of TransCanada Keystone Pipeline, L.P., Docket No. OP-0003

Dear Mr. Macy:

On February 16, 2017, TransCanada Keystone Pipeline, L.P. ("TransCanada") filed an application with the Nebraska Public Service Commission ("Commission") seeking approval of a proposed route for the Keystone XL Pipeline, pursuant to the Nebraska Major Oil Pipeline Siting Act, *Neb. Rev. Stat.* §§ 57-1401 – 57-1413 ("MOPSA"). Under MOPSA, TransCanada was required to file a copy of the application with your agency.

MOPSA also provides that the Commission has the option to request from your agency a report, based on your agency's area of expertise, relating to the impact of the pipeline on any area within your agency's jurisdiction, including opinions regarding the advisability of approving denying or modifying the location of the proposed route of the pipeline. *Neb. Rev. Stat.* § 57-1407(3).

In response to our request to consider the preferred route and alternate Keystone I route contained within the application, your agency sent letters on March 14, 2017 and April 20, 2017, stating the agency found minimal environmental impact in Nebraska from either route. In both letter you offered to prepare a report detailing this analysis if requested.

This letter is a formal request for your agency to prepare a report as indicated in your letters of March 14 and April 20, 2017. When you determine a budget to comply with this request, please let us know. Please have the report prepared and filed with the Commission no later than July 28, 2017, but as soon as practical would be appreciated. I look forward to hearing from you and please don't hesitate to contact us if you have any questions or concerns.

Sincerely,

Tim Schram

Tim Schram, Chair
Nebraska Public Service Commission

TS/NM/bz

20170052730

Appendix 1.6

The following email chain was the result of a question from PSC to NDEQ concerning the origin of the Sandhills definition used in the FER. In December 2011, NDEQ selected the peer reviewed **Ecoregions of Nebraska and Kansas** Level IV map as most comprehensive, because it incorporated vegetation, topography, soils, geology and other environmental aspects to define its boundaries. This map was a multi-year, multi-agency, multi-discipline effort that provided regional ecosystem labeling for the State. Major contributors to this document include the US EPA, USDA Forest Service, USDA Natural Resources Conservation Service, US Geological Survey, NDEQ, Nebraska Game & Parks, Kansas Biological Survey, Kansas Geological Survey, Kansas Department of Health and Environment, and Kansas Wildlife Parks.

For additional information visit: http://ecologicalregions.info/htm/ksne_eco.htm

Appendix 1.6

From: Macy, Jim
To: Schram, Tim; Barry, Douglas; Miesbach, David; Ellison, Matt
Subject: FW: question on report
Date: Friday, May 19, 2017 1:15:43 PM
Attachments: epa_reg7 ecoregions level 3-4.pdf
ne ks ecoregion citations.pdf

Tim/Matt

Doug provided more info – so the study was with data collected over many years and some on site field work by DEQ. David and Doug can help if you have additional questions.

From: Barry, Douglas
Sent: Friday, May 19, 2017 1:08 PM
To: Miesbach, David; Macy, Jim
Cc: Bender, John
Subject: RE: question on report

Jim,

If Tim is referring to the large Level III & IV study entitled "Ecoregions of EPA Region 7" that concluded December 2010, it was a multi-agency, multi-university, multi-discipline study that took place over many years. The 100 plus citations are at the bottom of the smaller pdf I attached. The aquifer is shown on the map pdf as items 44a, b, c, & d. Hope that helps. Doug

From: Miesbach, David
Sent: Thursday, May 18, 2017 3:09 PM
To: Macy, Jim; Barry, Douglas
Subject: RE: question on report

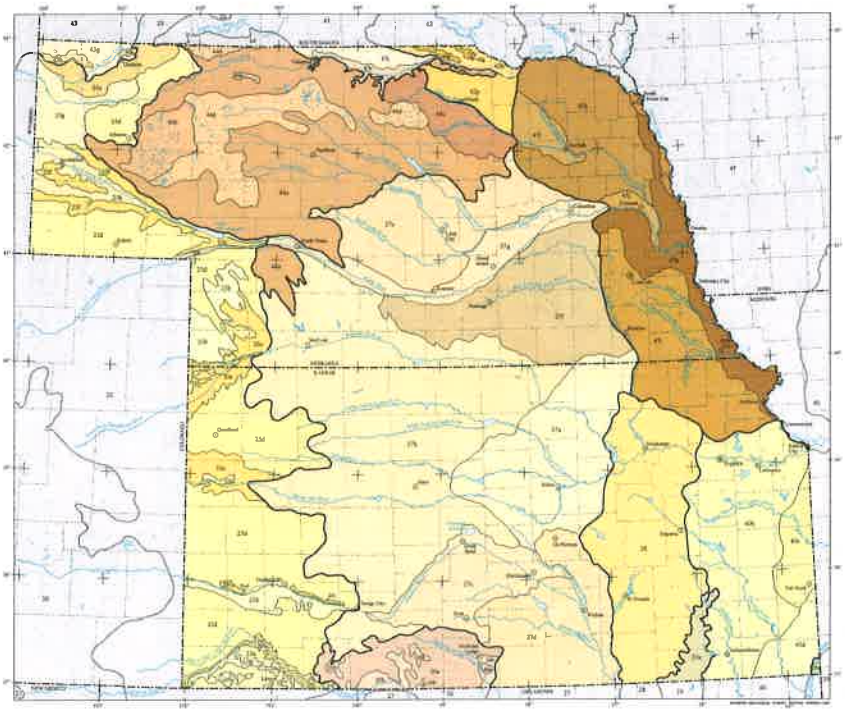
I made site visits to areas (Merrick, Holt, Boyd & Keya Paha counties) where there were groundwater concerns in May, June, August, & September 2012.

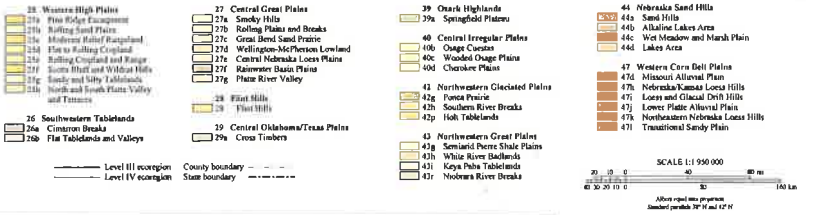
From: Macy, Jim
Sent: Thursday, May 18, 2017 2:30 PM
To: Barry, Douglas; Miesbach, David
Subject: question on report

Met with PSC informally today. Tim asked what time of year we did the aquifer study – do you know – the HDR report

Appendix 1.7

Ecoregions of Nebraska and Kansas





PRINCIPAL AUTHORS Shannon S. Chapman (Dynamac Corporation), James M. Omernik (US EPA), Jerry A. Freeouf (USFS), Donald G. Huggins (KBS), James R. McCauley (KGS), Craig C. Freeman (KBS), Gerry Steinauer (NGPC), Robert F. Angelo (KDHE), and Richard L. Schlepp (USDA, NRCS)

COLLABORATORS AND CONTRIBUTORS Steven R. Wallace (NDEQ), Kenneth R. Bazata (NDEQ), Sharon W. Wellman (USDA, NRCS-National Soil Survey Center (NSSC)), William J. Wahman (USDA, NRCS-NSSC), Roger Kanable (USDA, NRCS), Steven C. Schainost (NGPC), Craig Engelhard (USDA, NRCS), James W. Merchant (Center for Advanced Land Management Information Technologies (CALMIT), University of Nebraska, Lincoln (UNL)), Virginia L. McGuire (USGS), Chris Mammoliti (KDWP), James L. Stybendeck (UNL), David A. Mortensen (UNL), Theresa Wardle (Nebraska Forest Service), David T. Lewis (UNL), Robert F. Duffendak Jr. (Nebraska Conservation and Survey Division Nebraska Geological Survey) and Jeffrey A. Comstock (GAO Corporation)

This project is as partially supported by funds from the U.S. Environmental Protection Agency's Office of Water, Biological Criteria Program

CITING THIS POSTER: Chapman, Shannon S., Omernik, James M., Freeouf, Jerry A., Huggins, Donald G., McCauley, James R., Freeman, Craig C., Steinauer, Gerry, Angelo, Robert F., and Schlepp, Richard L., 2001, Ecoregions of Nebraska and Kansas (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,950,000)

Literature Cited

Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds., 1994, Ecoregions and subregions of the United States (map): Supplementary table of map unit descriptions compiled and edited by McNab, W.H. and Bailey, R.G.): Washington, D.C., U.S. Department of Agriculture - Forest Service, scale 1:7,500,000

Commission for Environmental Cooperation Working Group, 1997, Ecological regions of North America - toward a common perspective: Montreal, Quebec, Commission for Environmental Cooperation, 71 p.

Gallant, A.L., Whittier, T.R., Larsen, D.P., Omernik, J.M., and Hughes, R.M., 1989, Regionalization as a tool for managing environmental resources: Corvallis, Oregon, U.S. Environmental Protection Agency EPA/600/3-89/060, 152 p.

Griffith, G.E., Omernik, J.M., Wilton, T.F., and Pierson, S.M., 1994, Ecoregions and subregions of Iowa - a framework for water quality assessment and management: The Journal of the Iowa Academy of Science, v. 101, no. 1, p. 5-13.

Omernik, J.M., 1987, Ecoregions of the conterminous United States (map supplement): Annals of the Association of American Geographers, v. 77, no. 1, p. 118-125, scale 1:7,500,000.

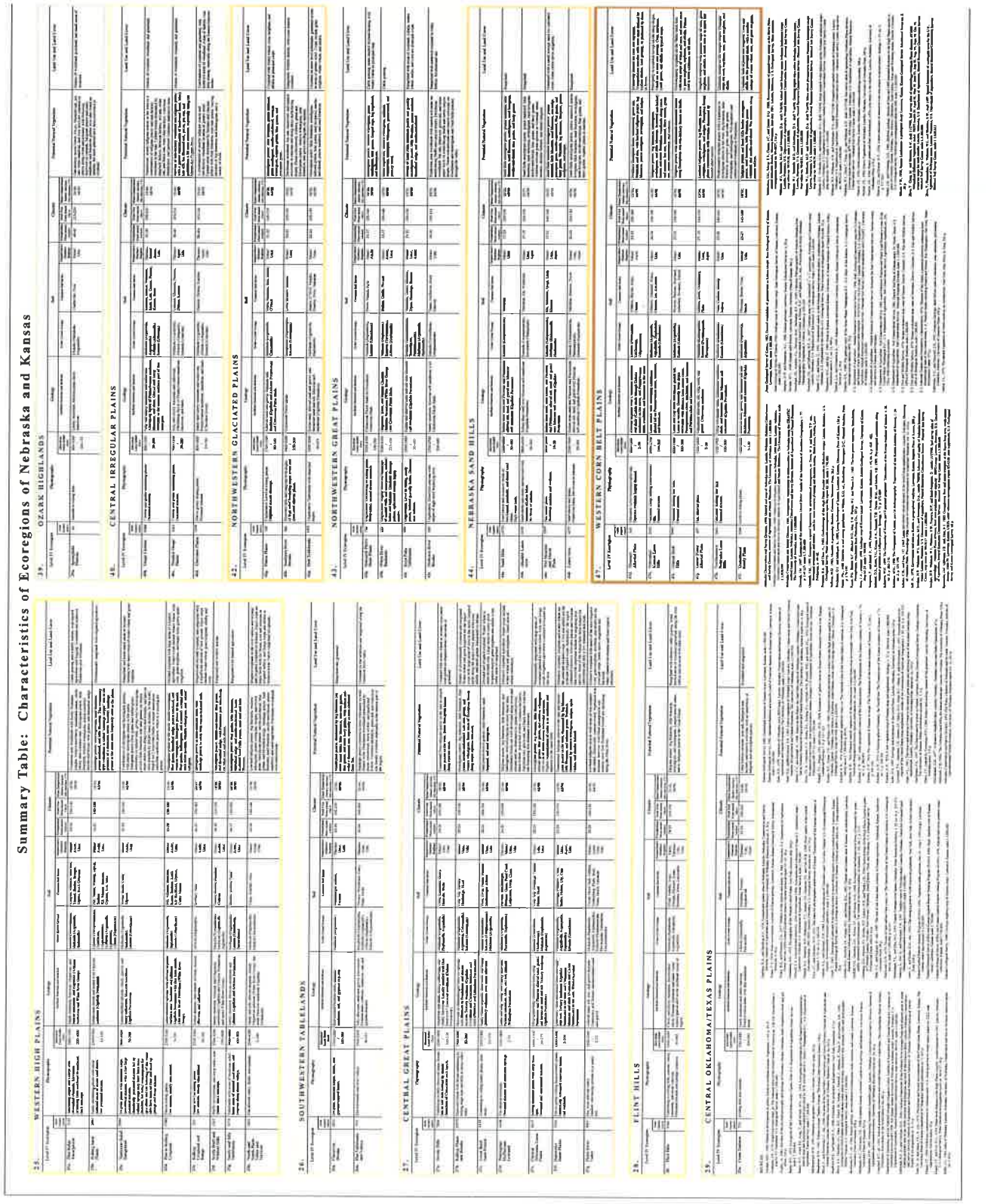
Omernik, J.M., 1995, Ecoregions - a framework for environmental management, in Davis, W.S. and Simon, T.P., eds., Biological assessment and criteria - tools for water resource planning and decision making: Boca Raton, Florida, Lewis Publishers, p. 49-62.

U.S. Department of Agriculture - Soil Conservation Service, 1981, Land resource regions and major land resource areas of the United States: Agriculture Handbook 296, 156 p.

U.S. Environmental Protection Agency, 2000, Level III ecoregions of the continental United States (revision of Omernik, 1987): Corvallis, Oregon, U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, May 14, 1:, various scales.

Wilken, E., 1986, Terrestrial ecozones of Canada: Ottawa, Environment Canada, Ecological Land Classification Series no. 19, 26 p.

Appendix 1.8

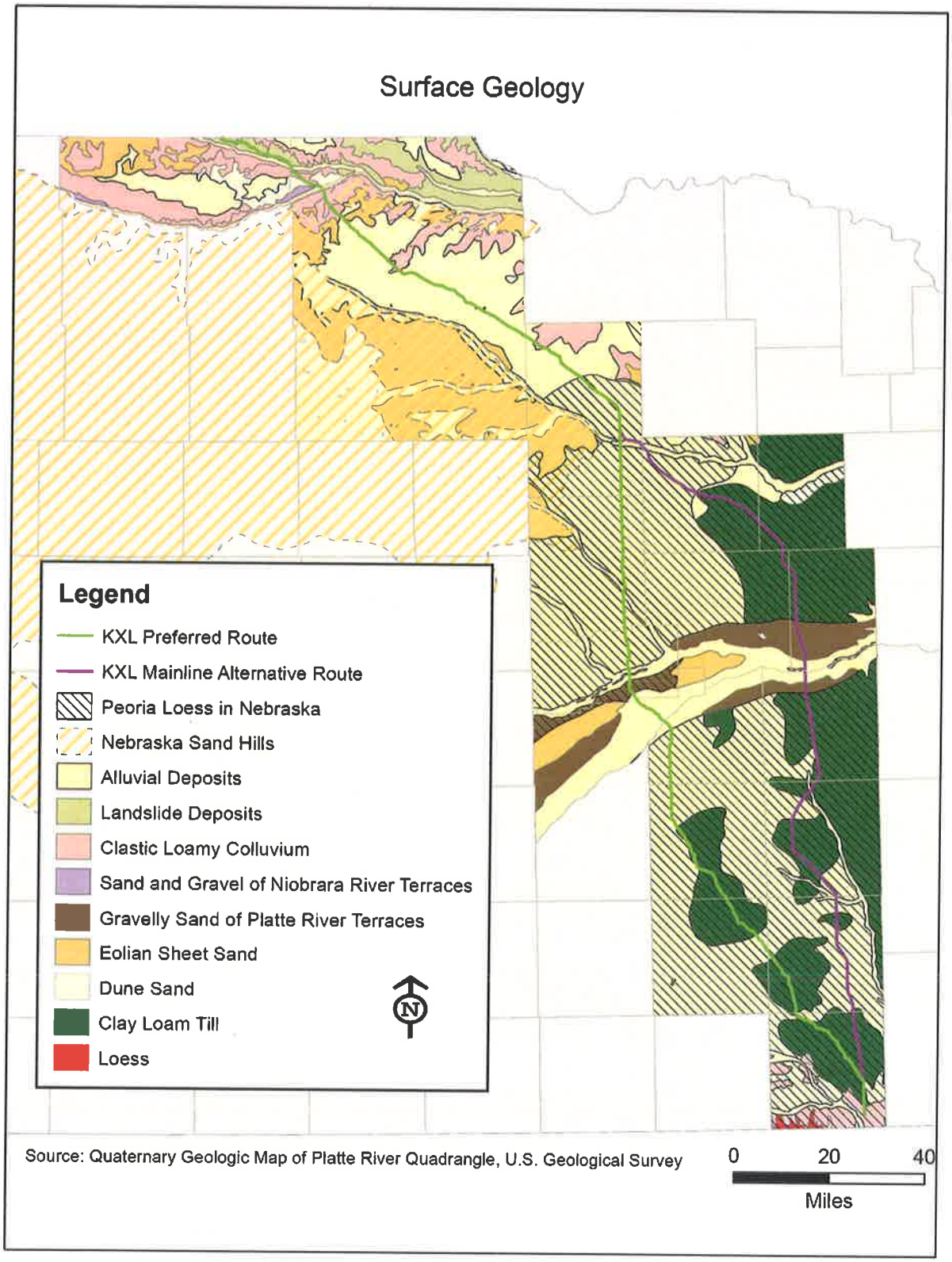

Summary Table: Characteristics of Ecoregions of Nebraska and Kansas

APPENDIX - 2

GEOLOGY

2.1 Surface Geology

Appendix 2.1


Surface Geology
Legend
KXL Preferred Route
KXL Mainline Alternative Route
Peoria Loess in Nebraska
Nebraska Sand Hills
Alluvial Deposits
Landslide Deposits
Clastic Loamy Colluvium
Sand and Gravel of Niobrara River Terraces
Gravelly Sand of Platte River Terraces
Eolian Sheet Sand
Dune Sand
Clay Loam Till
Loess
N
Source: Quaternary Geologic Map of Platte River Quadrangle, U.S. Geological Survey
0
20
40
Miles

APPENDIX - 3

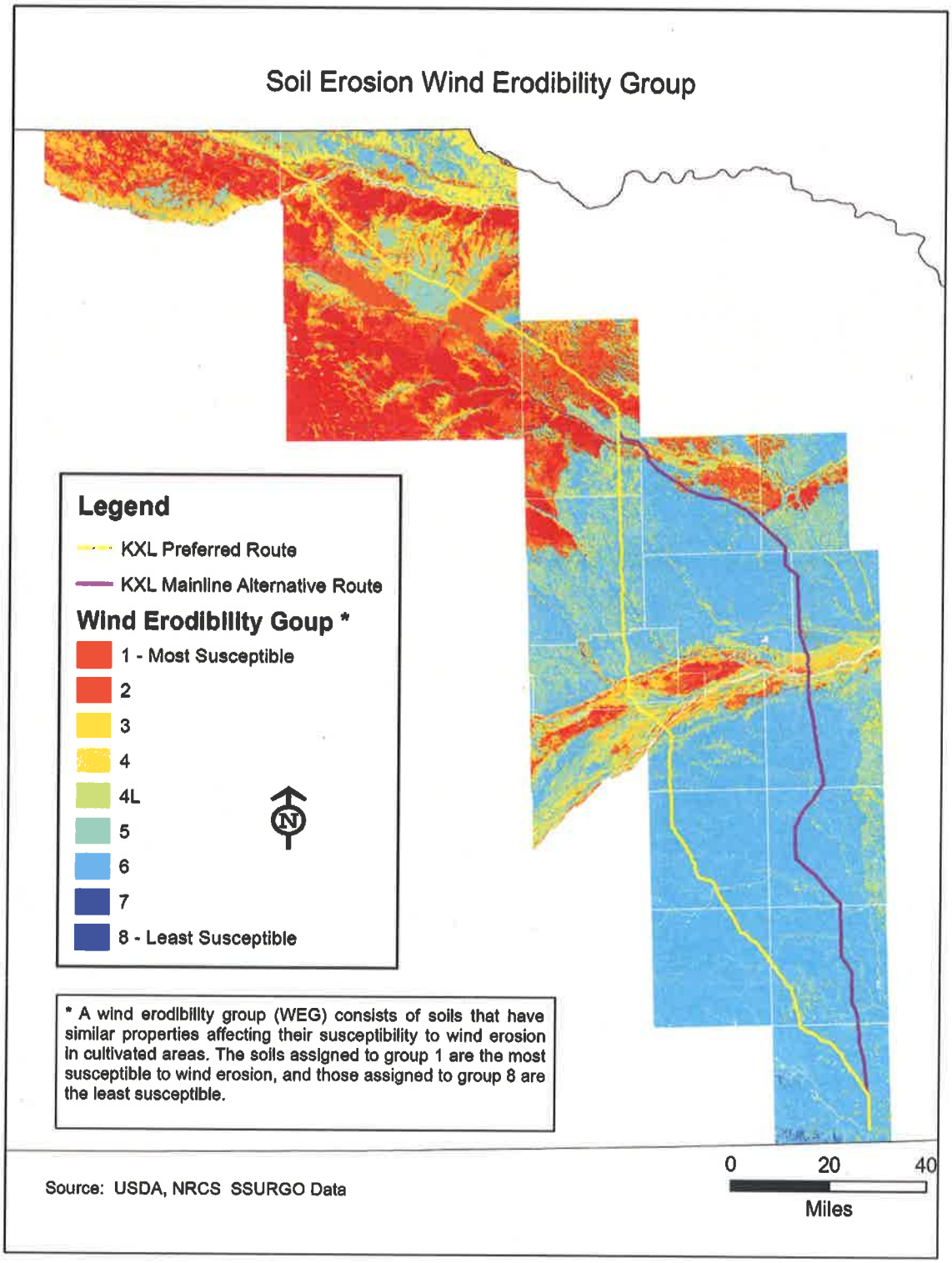
SOILS & SEDIMENTS

3.1 Soil Erosion Wind Erodibility Group

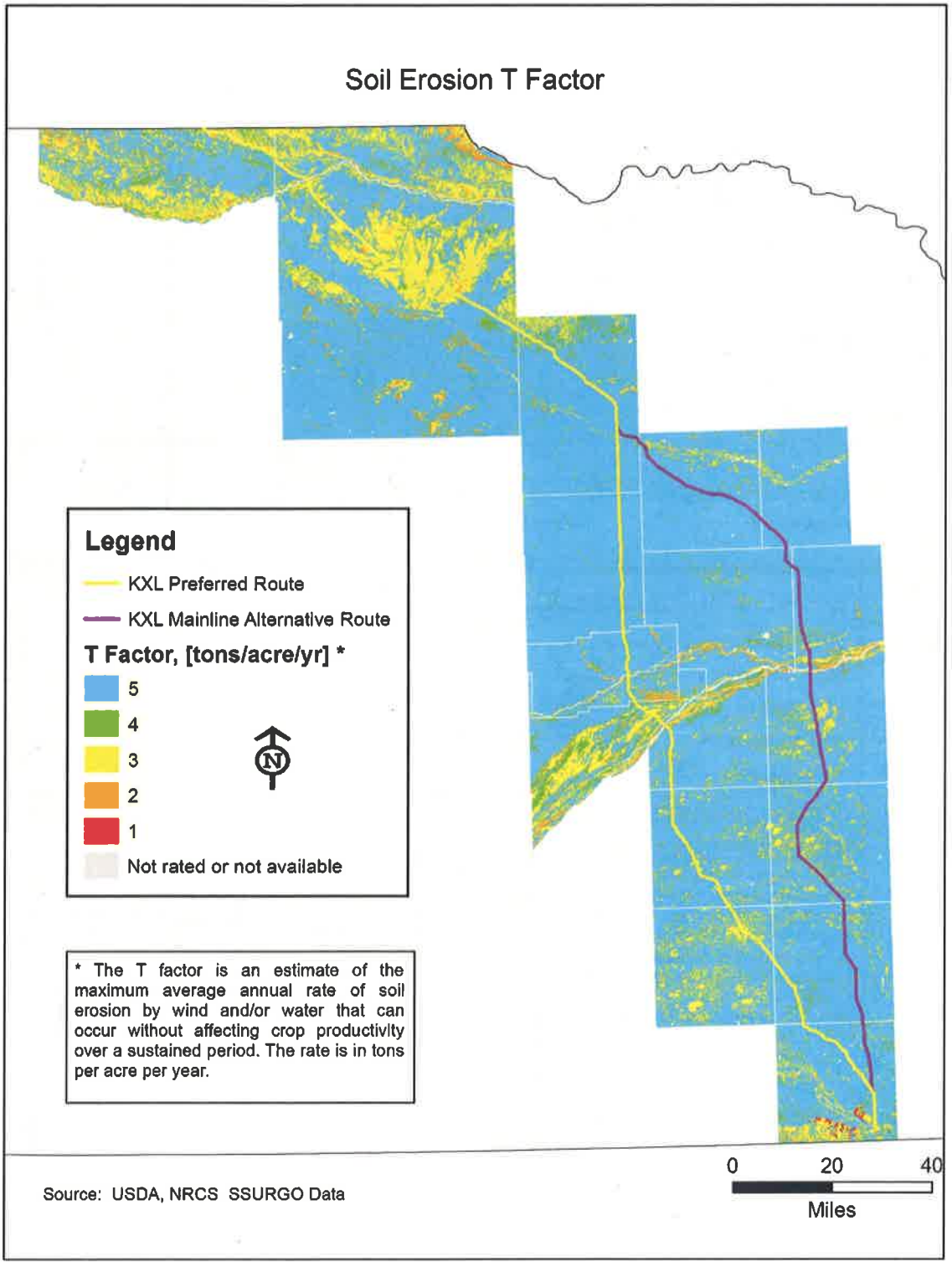
3.2 Soil Erosion T Factor

3.3 Off-Road, Off-Trail Erosion Hazard

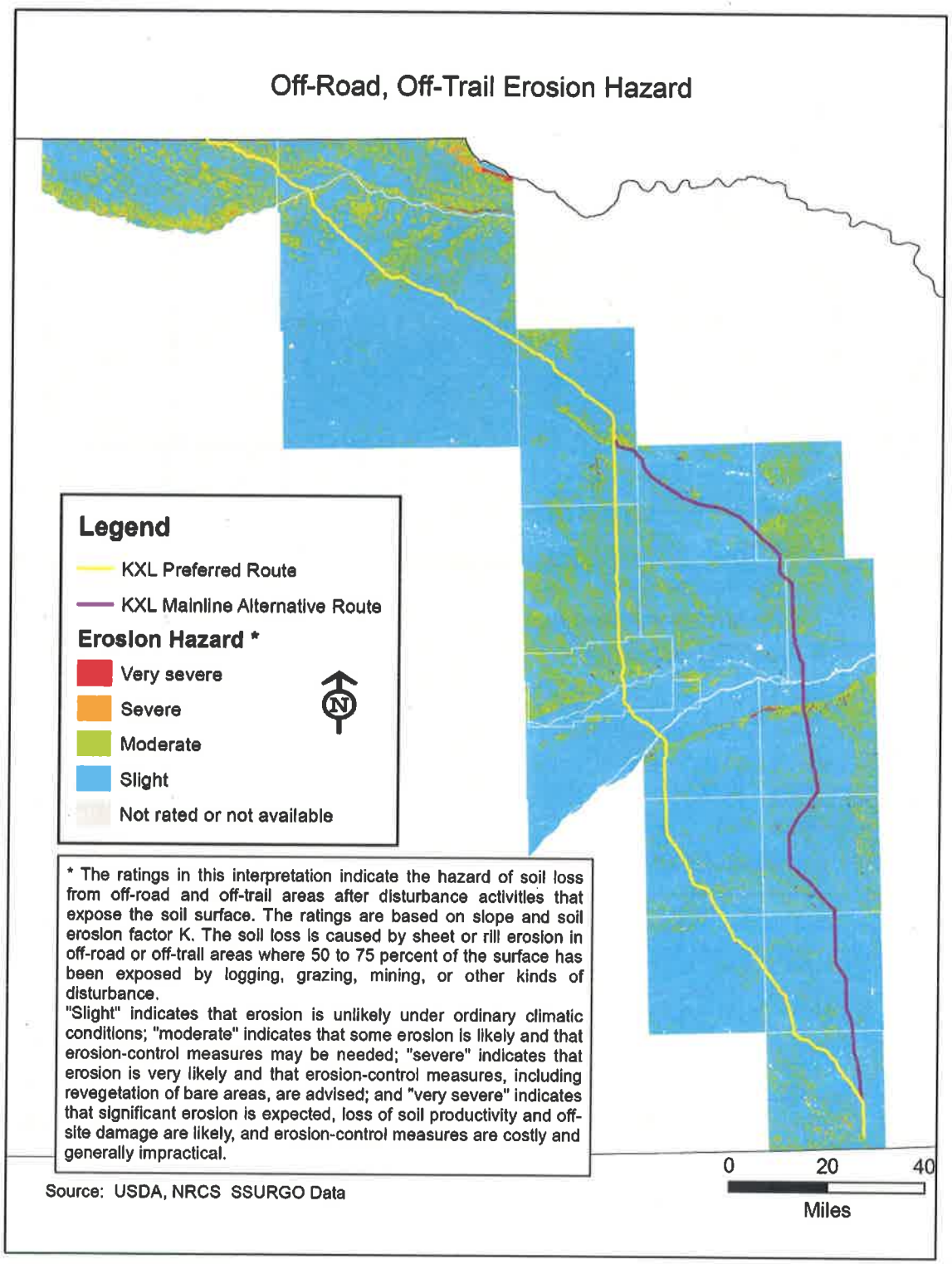
Appendix 3.1


Soil Erosion Wind Erodibility Group
Legend
KXL Preferred Route
KXL Mainline Alternative Route
Wind Erodibility Goup *
1 - Most Susceptible
2
3
4
4L
5
6
7
8 - Least Susceptible
N
* A wind erodibility group (WEG) consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.
Source: USDA, NRCS SSURGO Data
0
20
40
Miles

Appendix 3.2


Soil Erosion T Factor
Legend
KXL Preferred Route
KXL Mainline Alternative Route
T Factor, [tons/acre/yr] *
5
4
3
2
1
Not rated or not available
N
* The T factor is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.
Source: USDA, NRCS SSURGO Data
0
20
40
Miles

Appendix 3.3


Off-Road, Off-Trail Erosion Hazard
Legend
KXL Preferred Route
KXL Mainline Alternative Route
Erosion Hazard *
Very severe
Severe
Moderate
Slight
Not rated or not available
N
* The ratings in this interpretation indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance.
"Slight" indicates that erosion is unlikely under ordinary climatic conditions; "moderate" indicates that some erosion is likely and that erosion-control measures may be needed; "severe" indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and "very severe" indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.
Source: USDA, NRCS SSURGO Data
0
20
40
Miles

APPENDIX - 4

GROUNDWATER

4.1 Static Groundwater Levels

4.2 Water Wells Assessed Within 1 mi. of Preferred Route – Keya Paha Co. to Polk Co.

4.3 Water Wells Assessed Within ¼ mi. of Preferred Route – Keya Paha Co. to Polk Co.

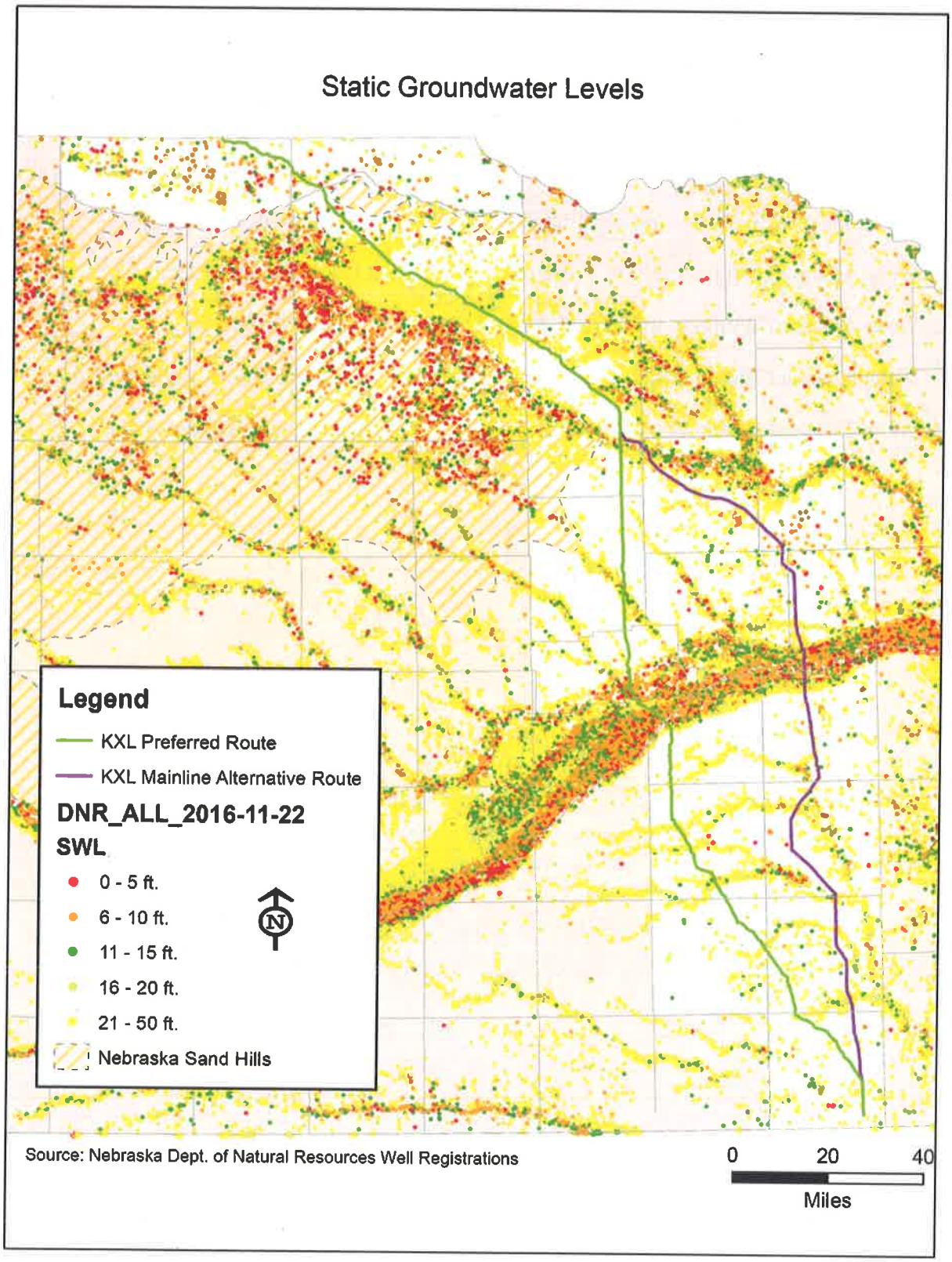
4.4 Water Wells Assessed Within 1 mi. of Preferred Route – Polk Co. to Jefferson Co.

4.5 Water Wells Assessed Within ¼ mi. of Preferred Route – Polk Co. to Jefferson Co.

4.6 Water Wells Assessed Within 1 mi. of Mainline Alternative – Antelope Co. to Jefferson Co.

4.7 Water Wells Assessed Within ¼ mi. of Preferred Route – Antelope Co. to Jefferson Co.

Appendix 4.1


Static Groundwater Levels
Legend
KXL Preferred Route
KXL Mainline Alternative Route
DNR_ALL_2016-11-22
SWL
0 - 5 ft.
6 - 10 ft.
11 - 15 ft.
16 - 20 ft.
21 - 50 ft.
Nebraska Sand Hills
N
Source: Nebraska Dept. of Natural Resources Well Registrations
0
20
40
Miles

1-mile corridor (Preferred Route, 2012-2016)

	DTW <10 feet	DTW 10-24 feet	DTW 25-50 feet	% of wells DTW <10 feet	% of wells DTW <24 feet	% of wells DTW <50 feet
Antelope	2	2	5	5.13%	10.26%	23.08%
Boone	0	0	3	0.00%	0.00%	15.00%
Boyd	4	9	4	23.53%	76.47%	100.00%
Keya Paha	0	0	0	0.00%	0.00%	0.00%
Holt	1	0	26	2.63%	2.63%	71.05%
Merrick	15	6	1	68.18%	95.45%	100.00%
Nance	8	2	0	47.06%	58.82%	58.82%
Polk	0	0	1	0.00%	0.00%	10.00%
TOTALS	**30**	**19**	**40**			

	Well Types												
	Com.	Domestic	GW Exchanger	Heat Pump	Irrigation	Injection	Observation/Level	Other	Public Water Supply	MW	Lvsck	Unk	TOTALS
Antelope	1	2	0	0	30	0	0	0	0	0	5	1	**39**
Boone	0	5	0	0	12	0	0	0	0	2	1	0	**20**
Boyd	0	0	0	0	15	0	0	0	0	0	2	0	**17**
Keya Paha	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Holt	0	2	0	0	26	0	0	0	0	0	10	0	**38**
Merrick	0	0	0	0	21	0	0	0	0	0	1	0	**22**
Nance	0	1	0	0	13	0	0	0	0	0	3	0	**17**
Polk	0	1	0	0	9	0	0	0	0	0	0	0	**10**
TOTALS	**1**	**11**	**0**	**0**	**126**	**0**	**0**	**0**	**0**	**2**	**22**	**1**	**163**

1/4-mile corridor (Preferred Route, 2012-2016)

	DTW <10 feet	DTW 10-24 feet	DTW 25-50 feet	% of wells DTW <10 feet	% of wells DTW 10-24 feet	% of wells DTW 25-50 feet
Antelope	2	0	2	16.67%	16.67%	33.33%
Boone	0	0	0	0.00%	0.00%	0.00%
Boyd	0	1	0	0.00%	100.00%	100.00%
Keya Paha	0	0	0	0.00%	0.00%	0.00%
Holt	0	0	6	0.00%	0.00%	46.15%
Merrick	7	1	0	77.78%	88.89%	88.89%
Nance	0	0	1	0.00%	0.00%	25.00%
Polk	0	0	0	0.00%	0.00%	0.00%
TOTALS	**9**	**2**	**9**			

	Well Types							
	Domestic	GW Exchanger	Irrigation	Observation/Level	Public Water Supply	Monitoring	Livestock	TOTALS
Antelope	0	0	11	0	0	0	1	**12**
Boone	0	0	1	0	0	0	0	**1**
Boyd	0	0	1	0	0	0	0	**1**
Keya Paha	0	0	0	0	0	0	0	**0**
Holt	1	0	12	0	0	0	0	**13**
Merrick	0	0	9	0	0	0	0	**9**
Nance	0	0	3	0	0	0	1	**4**
Polk	0	0	2	0	0	0	0	**2**
TOTALS	**1**	**0**	**39**	**0**	**0**	**0**	**2**	**42**

1-mile corridor (Preferred Route, lower)

	DTW <10 feet	DTW 10-24 feet	DTW 25-50 feet	% of wells DTW <10 feet	% of wells DTW <24 feet	% of wells DTW <50 feet
Fillmore	0	9	1	0.00%	5.17%	5.75%
Jefferson	0	0	14	0.00%	0.00%	6.73%
Polk	1	15	10	0.58%	9.25%	15.03%
Saline	0	3	8	0.00%	0.00%	0.00%
York	1	45	49	0.17%	7.64%	15.78%
TOTALS	**2**	**72**	**82**			

Water Well Construction Standards (1986)

Wells constructed prior to 1986	Wells constructed after 1986
634*	2118*
23%	77%

*This is the entire preferred route from Keya Paha to Jefferson County

	Well Types												
	Com.	Domestic	GW Exchanger	Heat Pump	Irrigation	Injection	Other	Observation/Level	Public Water Supply	MW	Lvsck	Unk	TOTALS
Fillmore	0	18	0	0	151	0	0	2	0	0	3	0	**174**
Jefferson	0	24	0	0	176	0	0	0	1	1	6	0	**208**
Polk	0	14	0	0	153	0	0	0	0	4	2	0	**173**
Saline	0	8	0	0	23	0	1	0	0	4	2	0	**38**
York	1	52	2	0	404	39	8	47	2	33	12	2	**602**
TOTALS	**1**	**116**	**2**	**0**	**907**	**39**	**9**	**49**	**3**	**42**	**25**	**2**	**1195**

1/4-mile corridor (Preferred Route, lower)

	DTW <10 feet	DTW 10-24 feet	DTW 25-50 feet	% of wells DTW <10 feet	% of wells DTW 10-24 feet	% of wells DTW 25-50 feet
Fillmore	0	0	0	0.00%	0.00%	0.00%
Jefferson	0	0	0	0.00%	0.00%	0.00%
Polk	0	0	0	0.00%	0.00%	0.00%
Saline	0	0	0	0.00%	0.00%	0.00%
York	0	0	2	0.00%	0.00%	28.57%
TOTALS	**0**	**0**	**2**			

	Well Types							
	Domestic	GW Exchanger	Irrigation	Observation/Level	Public Water Supply	Monitoring	Livestock	TOTALS
Fillmore	0	0	5	0	0	0	0	5
Jefferson	2	0	4	0	0	0	0	6
Polk	0	0	2	0	0	0	0	2
Saline	0	0	2	0	0	1	0	3
York	0	0	6	0	0	0	1	7
TOTALS	**2**	**0**	**19**	**0**	**0**	**1**	**1**	**23**

Water Well Construction Standards (1986)

Wells constructed prior to 1986	Wells constructed after 1986
7*	57*
11%	89%

*This is the entire preferred route from Keya Paha to Jefferson County

1-mile corridor (Mainline Alternative Route)

	DTW <10 feet	DTW 10-24 feet	DTW 25-50 feet	% of wells DTW <10 feet	% of wells DTW <24 feet	% of wells DTW <50 feet
Antelope	1	14	6	2.78%	41.67%	58.33%
Butler	15	32	40	7.35%	23.04%	42.65%
Colfax	65	29	60	22.97%	33.22%	54.42%
Jefferson	0	0	2	0.00%	0.00%	2.27%
Madison	21	34	40	9.21%	24.12%	41.67%
Platte	0	2	2	0.00%	13.33%	26.67%
Saline	2	17	35	0.93%	8.84%	25.12%
Seward	2	15	20	0.51%	4.30%	9.37%
Stanton	2	3	2	14.29%	35.71%	50.00%
TOTALS	**108**	**146**	**207**			

Water Well Construction Standards (1986)

Wells constructed prior to 1986	Wells constructed after 1986
652	826
44%	56%

	Well Types												
	Com.	Domestic	GW Exchanger	Heat Pump	Irrigation	Injection	Other	Observation/Level	Public Water Supply	MW	Lvsck	Unk	TOTALS
Antelope		9			19					3	5		**36**
Butler		45			151			1	1		6		**204**
Colfax	2	38			160	1	31	1	3	34	12	1	**283**
Jefferson		12			74						2		**88**
Madison		39		1	154				1	20	12	1	**228**
Platte		9			1						5		**15**
Saline		36	3		169				2	3	2		**215**
Seward		60	4	1	322		1		4		3		**395**
Stanton		10			2					2			**14**
TOTALS	**2**	**258**	**7**	**2**	**1052**	**1**	**32**	**2**	**11**	**62**	**47**	**2**	**1478**

1/4-mile corridor (Mainline Alternative Route)

	DTW <10 feet	DTW 10-24 feet	DTW 25-50 feet	% of wells DTW <10 feet	% of wells DTW <24 feet	% of wells DTW <50 feet
Antelope	1	6	4	5.26%	36.84%	57.89%
Butler	5	9	21	7.81%	21.88%	54.69%
Colfax	12	5	11	23.08%	32.69%	53.85%
Jefferson	0	0	0	0.00%	0.00%	0.00%
Madison	4	5	11	7.55%	16.98%	37.74%
Platte	0	0	0	0.00%	0.00%	0.00%
Saline	0	3	11	0.00%	6.00%	28.00%
Seward	0	5	2	0.00%	6.33%	8.86%
Stanton	0	1	0	0.00%	33.33%	33.33%
TOTALS	22	34	60			

	Well Types							
	Domestic	GW Exchanger	Irrigation	Observation/Level	Public Water Supply	Monitoring	Livestock	TOTALS
Antelope	3		16					19
Butler	18		43	1	1		1	64
Colfax	8		40				4	52
Jefferson	5		22			1	1	29
Madison	11		39				3	53
Platte	1		1					2
Saline	11	2	35			1	1	50
Seward	18		60				1	79
Stanton	3							3
TOTALS	78	2	256	1	1	2	11	351

Water Well Construction Standards (1986)

Wells constructed prior to 1986	Wells constructed after 1986
159	192
45%	55%

APPENDIX - 5

HAZARDOUS MATERIALS

5.1 Waste Facilities Examined for Preferred Route

5.2 Waste Facilities Examined for Mainline Alternative

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
1416	TIGT Albion Compressor Sta	Boone	RCR	NED986375442
1419	Central Valley Ag	Boone	RCR	NEP000000139
1420	Wolf Memorial Good Samaritan	Boone	IWM	SW0205
1435	Palmer's Paint & Body Shop	Boone	RCR	NED986386720
1476	Creative Window Designs	Boone	RCR	NE0000048785
1514	Ron Stock Farm	Boone	IWM	C0884
1516	St Edward Public Schools	Boone	RCR	NER000512202
1573	Azonic Products Inc	Boone	RCR	NED058056680
1627	Boone Central Schools	Boone	RCR	NER000510958
1629	Albion Operations Center	Boone	IWM	SW0184
1629	Albion Operations Center	Boone	RCR	NED986369056
1660	B & G Body Shop Inc	Boone	RCR	NED986387645
53543	Kayton International Inc	Boone	RCR	NEX000501338
58421	Country Partners Cooperative	Boone	IWM	070501-GW-0837
61676	Grape & Son Produce	Boone	IWM	SW0539
62840	Albion Landfill North	Boone	IWM	NP00114
62841	Albion Landfill South	Boone	IWM	NP00115
62842	Primrose Landfill	Boone	IWM	NP00116
62843	Cedar Rapids Landfill	Boone	IWM	NP00117
62844	St Edward Landfill	Boone	IWM	NP00118
62845	Petersburg Landfill	Boone	IWM	NP00119
63922	Central Nebraska Implement	Boone	RCR	NER000000950
64676	Cedar Rapids Compost Site	Boone	IWM	NP00618
64709	Albion Transfer Station	Boone	IWM	NP00010
65201	C & S Convenience Store LLC	Boone	IWM	082498-99-0003
66029	Fangman Livestock	Boone	IWM	C0937
68321	JSMM Farms LLC	Boone	IWM	C0858
70853	Country Partners Cooperative	Boone	SF	SFN00021
73157	Cedar Rapids Partners Finish	Boone	IWM	NP00696
74108	LaVerne Dresch Residence	Boone	RCR	NEP000000310
74416	Joe & Mishael Patzel Farm	Boone	IWM	NP00826
76454	GT Sales & Service Inc	Boone	IWM	1033101-99-0000
80471	Cedar Rapids Public Schools	Boone	RCR	NER000503623
85731	Hunt Property	Boone	IWM	C0151
85814	Valero Renewable Fuels Company	Boone	RCR	NER000506345
86119	Marion Staub Farm	Boone	IWM	C0241

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
86904	USDA Grain Bin	Boone	SF	SFN00305
86911	USDA Grain Bin	Boone	SF	SFN00311
86925	USDA Grain Bin	Boone	SF	SFN00323
87909	Matson Auto	Boone	IWM	C0361
88548	Mike Prothman Property	Boone	IWM	C0395
88675	Mike's Auto Repair	Boone	RCR	NEX000505958
90307	Daniel Bloom Farm	Boone	IWM	C0509
90517	Albion FMGP Site	Boone	BF	BF0077
94485	Joe & Kandy Leslie Property	Boone	IWM	C0666
97860	Jerry Shanle Property	Boone	IWM	C0077
104427	Billy Bob's Bar & Grill	Boone	BF	BF0298
107654	St Edward Community Building	Boone	BF	BF0321
108380	Daniel Braun Farm	Boone	IWM	C1224
2200	Naper Supply & Repair	Boyd	RCR	NED000809376
62847	Bristow Landfill	Boyd	IWM	NP00120
62848	Butte Landfill	Boyd	IWM	NP00121
62849	Lynch Landfill	Boyd	IWM	NP00122
62850	Naper Landfill	Boyd	IWM	NP00123
62851	Spencer Landfill	Boyd	IWM	NP00124
62852	Monowi Landfill	Boyd	IWM	NP00125
63356	Rustgo Co	Boyd	RCR	NER000501452
85466	Eiler Property	Boyd	IWM	C0072
86007	Ponca Creek Kennels	Boyd	IWM	C0213
18703	Kinder Morgan Interstate Gas	Fillmore	RCR	NEP000000957
22133	Fillmore County Hospital	Fillmore	IWM	C1221
22135	L J Webb Construction	Fillmore	RCR	NED048023659
22136	Bioiberica Nebraska Inc	Fillmore	RCR	NED009835950
22138	D & D Wright LLC	Fillmore	RCR	NED981697212
22143	Exeter-Milligan High School	Fillmore	RCR	NER000509240
22145	Horizontal Boring & Tunneling	Fillmore	IWM	SW0094
22164	Jeff & Lora Andrews Property	Fillmore	IWM	C0063
22184	Geneva Implement Company	Fillmore	RCR	NED035027838
22186	Geneva Milling Co	Fillmore	IWM	C1220
22194	Plains Equipment Group	Fillmore	RCR	NED062244470
22228	Kassik Milling Co	Fillmore	IWM	C0365
22228	Kassik Milling Co	Fillmore	RCR	NED007276181
22236	Johnson Feed Mill Inc	Fillmore	RCR	NED035177229
22241	Shickley Public School	Fillmore	RCR	NER000509810

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
22282	Geneva Terminal	Fillmore	IWM	SW0372
22282	Geneva Terminal	Fillmore	RCR	NED000640110
22301	Nichols Collision Center Inc	Fillmore	RCR	NE0000117945
22332	Donrich Machine Shop	Fillmore	RCR	NED986384691
22353	Fairmont State Airfield	Fillmore	BF	BF0052
22353	Fairmont State Airfield	Fillmore	SF	NE3210090020
22379	Farmers Cooperative	Fillmore	IWM	C0364
22388	Nick's Farm Store	Fillmore	IWM	SW0144
22388	Nick's Farm Store	Fillmore	RCR	NED051254944
22390	Roads Dept Geneva Yard	Fillmore	RCR	NER000501288
22407	Geneva Motors Inc	Fillmore	RCR	NE0000938118
22412	IPSCO Tubulars Inc	Fillmore	IWM	SW0365
22412	IPSCO Tubulars Inc	Fillmore	RCR	NED986386811
51831	Deepes Garage	Fillmore	RCR	NED084617968
57714	Fairmont Wastewater Treatment	Fillmore	RCR	NED000640102
57714	Fairmont Wastewater Treatment	Fillmore	SF	NED000640102
61206	Cornhusker Farms Home	Fillmore	IWM	C0335
61206	Cornhusker Farms Home	Fillmore	RCR	NED058445925
61349	Farmland Truck Terminal	Fillmore	RCR	NED981697014
62748	Nebraska Ecology Inc Landfill	Fillmore	IWM	NE0120197
62748	Nebraska Ecology Inc Landfill	Fillmore	IWM	NE0204072
62984	Exeter Landfill	Fillmore	IWM	NP00271
62985	Geneva Landfill	Fillmore	IWM	NP00272
62986	Grafton Landfill	Fillmore	IWM	NP00273
62989	Milligan Landfill	Fillmore	IWM	NP00274
62990	Shickley Landfill	Fillmore	IWM	NP00275
63285	Ohiowa Landfill	Fillmore	IWM	NP00276
63578	A-1 Body & Glass	Fillmore	RCR	NED981697063
63580	M C Industries Inc	Fillmore	RCR	NED986387405
64517	Fairmont Landfill	Fillmore	IWM	NP00277
64594	Ong Landfill	Fillmore	IWM	NP00278
70827	USDA Grain Bin	Fillmore	SF	SFN00025
71835	USDA Grain Bin	Fillmore	SF	NE0002329126
72098	USDA Grain Bin	Fillmore	SF	NE0002322691
73119	Fairmont Moving Target Range	Fillmore	SF	NEN000703427
86026	Flint Hills Resources Fairmont	Fillmore	IWM	C1083
86026	Flint Hills Resources Fairmont	Fillmore	IWM	NP00840
86026	Flint Hills Resources Fairmont	Fillmore	IWM	SW0557

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
86026	Flint Hills Resources Fairmont	Fillmore	RCR	NER000511972
86225	David Wood Farm	Fillmore	IWM	C0258
86478	Geneva Industrial West Site	Fillmore	BF	BF0023
86479	Geneva Industrial East Site	Fillmore	BF	BF0024
86897	Implement Dealership	Fillmore	BF	BF0042
86962	Douglas Petroshus Residence	Fillmore	IWM	C0324
87306	Milligan Public Library	Fillmore	RCR	NEX000505032
87332	Elaine Korbelik Farm	Fillmore	IWM	C0344
90104	Norma Jean Lang Farm	Fillmore	RCR	NEN000705805
90104	Norma Jean Lang Farm	Fillmore	SF	NEN000705330
90104	Norma Jean Lang Farm	Fillmore	SF	NEN000705805
93581	Most Farms	Fillmore	IWM	NP00735
94484	James Burton Mobile Home Court	Fillmore	IWM	C0667
106304	Dennis & Kelly True Acreage	Fillmore	IWM	C1145
106486	Tallgrass Interstate Gas Trans	Fillmore	RCR	NER000512244
26356	Brewster Oil Company	Holt	IWM	SW0535
26362	Green Acres	Holt	IWM	SW0525
26362	Green Acres	Holt	IWM	05110-KSA-1440
26385	Galyen Petroleum Co	Holt	IWM	NOTIFICATIONS
26397	Mitchell Equipment Inc	Holt	RCR	NED986375467
26399	Olson Industries Inc	Holt	IWM	C0367
26399	Olson Industries Inc	Holt	IWM	NOTIFICATIONS
26399	Olson Industries Inc	Holt	RCR	NEP000000830
26399	Olson Industries Inc	Holt	RCR	NER000501841
26416	Ewing Motor Co	Holt	RCR	NED035017276
26466	Central Valley Ag	Holt	RCR	NED980687503
26468	Husker Used Trucks & Parts Inc	Holt	IWM	C0338
26473	Plains Equipment Group	Holt	RCR	NED062257142
26481	Niobrara Valley EMC	Holt	IWM	SW0428
26481	Niobrara Valley EMC	Holt	RCR	NED035154558
26493	B G & S Transmissions	Holt	RCR	NED981728249
26531	Cubby's Cenex	Holt	IWM	072898-NM-0900
26559	Premier Auto	Holt	IWM	SW0541
26584	Reiman's Body Shop	Holt	RCR	NED986375301
26660	John Prouty Construction Inc	Holt	IWM	C0945
26660	John Prouty Construction Inc	Holt	IWM	NP00728
26698	Roads Dept O'Neill Yard	Holt	IWM	SW0463
26751	Gokie's Fast Mart	Holt	IWM	SW0084

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
26771	Central Valley Ag	Holt	IWM	SW0538
26777	Ewing City Hall	Holt	IWM	C0542
26789	Agriliance Agronomy	Holt	RCR	NEP000000250
26849	William Krotter Co	Holt	RCR	NE0000615179
54015	West Holt Public Schools	Holt	RCR	NER000507491
54077	Miller Motor Co	Holt	IWM	SW0546
58101	Willowdale Farms LLC	Holt	IWM	C0674
59050	Curry Grain	Holt	RCR	NEP000000143
59168	WAPA O'Neill Substation	Holt	RCR	NE1890090003
59931	AT&T Microwave Tower	Holt	RCR	NED980516785
59938	Olson Center Pivot Irrigation	Holt	RCR	NED039928189
59940	Mitchell Engines	Holt	RCR	NED094692951
59941	Paul F Seger Farm	Holt	RCR	NED981708779
60726	Holt County Highway Dept	Holt	IWM	C0389
60726	Holt County Highway Dept	Holt	RCR	NED981719081
62301	Knife River Midwest LLC 05	Holt	RCR	NEP000000140
62763	Midplains Waste Management	Holt	IWM	NE0203751
62763	Midplains Waste Management	Holt	IWM	NE0203769
63049	Atkinson Landfill West	Holt	IWM	NP00356
63050	Atkinson Landfill East	Holt	IWM	NP00357
63051	City of O'Neill C & D	Holt	IWM	NE0204277
63051	City of O'Neill C & D	Holt	IWM	NP00027
63051	City of O'Neill C & D	Holt	IWM	NP00358
63052	Ewing Landfill North	Holt	IWM	NP00359
63053	Chambers Landfill	Holt	IWM	NP00360
63054	Inman Landfill South	Holt	IWM	NP00361
63055	Page Landfill	Holt	IWM	NP00362
63056	Stuart Landfill	Holt	IWM	NP00363
63906	United Parcel Service	Holt	RCR	NER000001511
63975	R & D Manufacturing LLC	Holt	IWM	NE0203891
64153	AZZ Galvanizing - Nebraska LLC	Holt	IWM	SW0527
64153	AZZ Galvanizing - Nebraska LLC	Holt	RCR	NER000501114
64269	Elkhorn River Farms LLC	Holt	IWM	C0175
64269	Elkhorn River Farms LLC	Holt	RCR	NEX000007500
64311	City of O'Neill Recycling Ctr	Holt	IWM	NE0203947
64311	City of O'Neill Recycling Ctr	Holt	IWM	NE0204111
64574	Stuart Landfill West	Holt	IWM	NP00364
64612	Ewing Landfill South	Holt	IWM	NP00365

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
64613	Inman Landfill North	Holt	IWM	NP00366
64672	Inman Transfer Station	Holt	IWM	NP00028
65582	Brewster Oil Company	Holt	IWM	SW0556
67406	Brower Construction Co	Holt	RCR	NEP000000657
71019	Farmers Pride Bulk Fuel	Holt	IWM	060299-CT-1410
71745	Cobb Motors Inc	Holt	IWM	SW0165
71745	Cobb Motors Inc	Holt	IWM	070391-MF-1330
71764	Laursen Ranch	Holt	IWM	C0995
71777	USDA Grain Bin	Holt	SF	SFN00004
71960	Truck Wright Services Inc	Holt	IWM	C0002
71960	Truck Wright Services Inc	Holt	SF	SFN00079
71964	USDA Grain Bin	Holt	SF	SFN00082
73689	Midwest Machine	Holt	RCR	NER000500314
73921	Cole Redi Mix LLC	Holt	IWM	C0366
78275	O'Neill High School	Holt	RCR	NER000512392
83954	O'Neill Public Schools	Holt	RCR	NER000503649
85781	Curt's Repair	Holt	IWM	C0156
86416	Green Plains Atkinson LLC	Holt	IWM	C0642
86416	Green Plains Atkinson LLC	Holt	RCR	NER000511105
86439	Gary Ferris Salvage Yard	Holt	IWM	C0266
86621	Duke Hobbs Property	Holt	IWM	C0281
88021	Harry Hood Residence	Holt	IWM	C0386
88022	Ron & Lola Jonas Residence	Holt	IWM	C0369
88023	Dale's Repair	Holt	IWM	C0370
88024	O'Neill Auto Supply Inc	Holt	IWM	C0371
88552	Anthony Schindler Acreage	Holt	IWM	C0487
89259	Ed Schmuecker Property	Holt	IWM	C0454
90509	O'Neill Dry Cleaner	Holt	BF	BF0076
93357	Larry Ackles Salvage Yard	Holt	IWM	C0631
97152	Kinder Morgan Interstate Gas	Holt	RCR	NEP000000949
97484	Spencer Training Site	Holt	SF	SFN00347
106016	Lonnie Franssen Ranch	Holt	IWM	C1124
107364	William Krotter Co Hardware	Holt	RCR	NER000512400
27081	Farmers Cooperative	Jefferson	RCR	NER000500322
27086	Loveland Products Inc	Jefferson	IWM	SW0003
27086	Loveland Products Inc	Jefferson	RCR	NED000610550
27089	Meridian Public School	Jefferson	RCR	NER000509646
27146	Fairbury Jr-Sr High School	Jefferson	RCR	NER000509141

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
27197	Wal Mart 0418-01	Jefferson	RCR	NER000505289
27206	Farmers Cooperative C-Store	Jefferson	IWM	08054-BHI-0900
27214	Plymouth Industries	Jefferson	IWM	SW0157
27214	Plymouth Industries	Jefferson	RCR	NER000003806
27217	Wells Implement Inc	Jefferson	RCR	NED986387363
27237	Riverside Chev Olds Cad Buick	Jefferson	RCR	NED035018811
27295	Weed Control Authority	Jefferson	RCR	NED000610642
27309	Auto Value	Jefferson	RCR	NER000501494
27355	Endicott Clay Products Co	Jefferson	RCR	NED007285216
27400	Black Hills Energy	Jefferson	RCR	NEP000000880
31027	TransCanada Keystone Pipeline	Jefferson	RCR	NER000509547
40908	Tri County Public School	Jefferson	RCR	NER000512186
58932	Chicago Rock Island & Pacific	Jefferson	IWM	SW0036
60010	Rhine Repair	Jefferson	RCR	NED035018241
60012	Lofings Repair	Jefferson	RCR	NED981697097
62637	Union Pacific Railroad Line	Jefferson	IWM	NP00805
62637	Union Pacific Railroad Line	Jefferson	RCR	NER000507368
62770	Fairbury MSW Transfer Station	Jefferson	IWM	NE0203301
62802	Fairbury Landfill	Jefferson	IWM	NE0055085
63065	Diller Landfill	Jefferson	IWM	NP00377
63066	Endicott Landfill	Jefferson	IWM	NP00378
63067	Steele City Landfill	Jefferson	IWM	NP00379
63068	J & A Strope Landfill	Jefferson	IWM	NP00380
63290	Daykin Landfill	Jefferson	IWM	NP00381
63292	Plymouth Landfill	Jefferson	IWM	NP00382
63293	Reynolds Landfill	Jefferson	IWM	NP00383
64611	Jansen Landfill	Jefferson	IWM	NP00384
64639	Harbine Landfill	Jefferson	IWM	NP00385
66036	Phoenix Swine Inc	Jefferson	IWM	C0096
70657	USDA Grain Bin	Jefferson	SF	SFN00040
70794	Harbine State Bank	Jefferson	RCR	NEX000006114
70829	USDA Grain Bin	Jefferson	SF	SFN00027
70844	Haake Trucking Inc	Jefferson	SF	NESFN0703511
71837	USDA Grain Bin	Jefferson	SF	NED986384634
73436	Gladstone PWS Site	Jefferson	SF	NED986384634
79933	Moellenberndt Construction	Jefferson	IWM	C0615
85318	James Katz Farm	Jefferson	SF	NED000640144
85345	Haddan Excavating Inc	Jefferson	IWM	C0054

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
85465	Schultz Auto Recycling & Sales	Jefferson	IWM	C0071
86103	Fairbury FMGP Site	Jefferson	BF	BF0018
86132	Plymouth Industries LLC	Jefferson	RCR	NER000503201
86525	Wal Mart SuperCenter 0418-02	Jefferson	RCR	NER000505446
91619	Dustin Kenning Farm	Jefferson	IWM	C0560
93173	Lonnie Weichel Property	Jefferson	IWM	C0623
93881	Fairbury Readiness Center	Jefferson	RCR	NER000507319
94310	Kurt Ruhnke Farm	Jefferson	RCR	NEX000507418
96011	Consolidated Sand & Gravel	Jefferson	RCR	NED986385730
96710	Cindy Lottman Farm	Jefferson	IWM	NP00758
96782	Dave Banahan Trckng & Excavtg	Jefferson	IWM	C0749
99894	Steve & Beth Block Property	Jefferson	IWM	C0880
100542	Merle Watts Property	Jefferson	IWM	C0948
102413	Steele Flats Wind Energy Ctr	Jefferson	RCR	NER000511337
104606	Brad Schoenrock Property	Jefferson	IWM	C1091
106126	Don Itzen Farm	Jefferson	IWM	C1134
106156	C & C Processing Inc	Jefferson	IWM	C1137
63077	Burton Landfill	Keya Paha	IWM	NP00395
63078	Springview Landfill	Keya Paha	IWM	NP00396
81031	Ralo Inc	Keya Paha	RCR	NEX000501171
24673	TIGT Grand Island Compressor	Merrick	RCR	NER000511436
36208	Cascata Homes	Merrick	IWM	C01080
36208	Cascata Homes	Merrick	RCR	NER000500140
36231	Bill's Volume Sales Inc	Merrick	RCR	NED042579003
36239	Trinity Car Care	Merrick	IWM	C0420
36253	Ace Used Cars	Merrick	RCR	NED981696982
36261	Cable Nebraska LLC	Merrick	RCR	NED034997957
36272	Mustard Motor Company	Merrick	IWM	NP00761
36272	Mustard Motor Company	Merrick	RCR	NED054302179
36300	Grosshans Inc	Merrick	RCR	NED986387702
36311	Central City Transfer Station	Merrick	IWM	NE0203475
36311	Central City Transfer Station	Merrick	IWM	NE0204323
36319	Nebraska Christian Schools	Merrick	RCR	NER000511287
36403	Central City High School	Merrick	RCR	NER000511030
36423	Midwest Rebuilders	Merrick	IWM	SWO522
36423	Midwest Rebuilders	Merrick	RCR	NED122103856
55039	Archer Supply Inc	Merrick	IWM	C0421
55185	Central City Elementary School	Merrick	IWM	C1211

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
55219	Knight Asphalt Inc	Merrick	RCR	NED986369817
57677	Central City Wastewater Trtmnt	Merrick	IWM	NP00089
57831	Silver Creek Wastewater Trtmnt	Merrick	IWM	C0530
59975	Hilder Implement Inc	Merrick	RCR	NED034998062
60983	Central City Mall	Merrick	RCR	NEP00000097
63108	Central City Landfill North	Merrick	IWM	NP00338
63109	Palmer Landfill West	Merrick	IWM	NP00441
63111	Silver Creek Landfill	Merrick	IWM	NP00442
63608	WAPA Grand Island Substation	Merrick	RCR	NE0890090004
64038	Flatwater Materials Inc	Merrick	RCR	NED986368959
64493	Palmer Landfill East	Merrick	IWM	NP00443
65198	Skyhawk Transport Inc	Merrick	RCR	NED986373967
71823	Wegner Monument Company	Merrick	RCR	NEX000007575
73053	GI Precision Bombing Range 01	Merrick	SF	SFN00247
73120	Fairmont Prcsn Bombing Range 2	Merrick	SF	NEN000703220
73531	USDA Grain Bin	Merrick	SF	SFN00148
82836	Green Plains Central City LLC	Merrick	RCR	NER000505917
84750	Mobile Manor Park	Merrick	IWM	C0525
85152	Republican Nonpareil	Merrick	RCR	NEX000502609
85788	Central City Viaduct Site	Merrick	SF	SFN00257
86102	Central City FMGP Site	Merrick	BF	BF0017
86226	Bader Memorial Park	Merrick	IWM	C1256
86456	Knights Mobile Home Park	Merrick	IWM	021998-OK-1400
87047	Performance Plus Liquids Inc	Merrick	RCR	NEX000506584
90507	Van Housen Logging	Merrick	IWM	C0512
91509	Tom Ummel Residence	Merrick	IWM	C0551
93861	Nite Crawlers Bar & Grill	Merrick	IWM	NP00772
94321	Russ & Janet Mace Residence	Merrick	IWM	C0648
97822	Covenant Doors & Millwork Inc	Merrick	RCR	NEX000508689
98543	Jimmy Williams Mobile Home Res	Merrick	IWM	NP00785
98841	Kinder Morgan Interstate Gas	Merrick	RCR	NEP000000953
102239	Eberl Plumbing & Drain Inc	Merrick	IWM	C0997
104801	Bryan Foxhoven Acreage	Merrick	IWM	NP00841
106722	Sunheat International Corp	Merrick	RCR	NER000512301
108826	Tim Reimers Construction	Merrick	IWM	C1245
36594	Frontier Co-op Company	Nance	SF	SFN00029
36629	R & A Automotive	Nance	RCR	NER000001446
36699	Keith Repair	Nance	RCR	NED084629591

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
36724	Frontier Co-op Company	Nance	RCR	NED059745463
36738	H & F Body Shop	Nance	RCR	NED122016249
36741	Smith Body Repair & Paint	Nance	IWM	C0204
36741	Smith Body Repair & Paint	Nance	RCR	NEX000502666
59072	Nance County Highway Dept	Nance	RCR	NED980743264
59321	ATC Microwave Tower	Nance	RCR	NED980516769
63112	Belgrade Landfill	Nance	IWM	NP00449
63113	Fullerton Landfill	Nance	IWM	NP00450
63114	Genoa Landfill	Nance	IWM	NP00451
63852	Silver Creek Comm Site 487L	Nance	RCR	NE6571990039
64700	Fullerton Transfer Station	Nance	IWM	NP00033
84327	Private Residence	Nance	IWM	C0024
86170	Don Borowiak Residence	Nance	IWM	CO255
86905	Preferred Sands of Genoa LLC	Nance	IWM	NP00777
86905	Preferred Sands of Genoa LLC	Nance	RCR	NER000509414
89100	B & T Salvage	Nance	IWM	C0430
91507	Randy Mohr Acreage	Nance	IWM	C0552
91714	Allen Nelson Residence	Nance	SF	NEN000705867
92459	USDA Grain Bin West	Nance	SF	NEN000705867
104631	Rod Wetovick Farm	Nance	IWM	C1086
14399	Olson Service	Polk	IWM	C0896
39671	Annie Jeffrey Memorial Hosp	Polk	IWM	SW0657
39752	Burg Auto Repair Inc	Polk	RCR	NED981700651
39817	Central Valley Ag	Polk	RCR	NER000507574
39841	WAW Construction Inc	Polk	IWM	C0419
39843	Stromsburg Radiator	Polk	RCR	NED097348684
58195	Shelby Wastewater Treatment	Polk	IWM	NP00779
58738	Osceola Terminal	Polk	RCR	NED000640136
59184	Tonniges Chevrolet Inc	Polk	RCR	NED981696990
59185	Simplot Soilbuilders	Polk	RCR	NED000687210
59185	Simplot Soilbuilders	Polk	SF	NED000687210
62809	Osceola Transfer Station	Polk	IWM	NE0203351
63152	Osceola Landfill	Polk	IWM	NP00497
63153	Polk Landfill	Polk	IWM	NP00498
63154	Shelby Landfill	Polk	IWM	NP00499
63155	Stromsburg Landfill	Polk	IWM	NP00500
64762	CRD Inc Polk County Landfill	Polk	IWM	NP00653
65948	Holden Foundation Seeds	Polk	RCR	NER000005686

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
66943	Jerome Scholz Livestock	Polk	IWM	NP00733
74907	A Rue Cattle Co	Polk	IWM	C0750
79952	Raymond Wagner Livestock	Polk	IWM	NOTIFICATIONS
81094	Stromsburg Civic Center	Polk	RCR	NER000503672
83628	Ellsworth Service	Polk	IWM	121996-GW-1145
86349	High Plains Community Schools	Polk	RCR	NER000503607
86927	USDA Grain Bin	Polk	SF	SFN00325
87307	Ansel Fredrickson Property	Polk	RCR	NED000086363
88354	Robert Davis Property	Polk	IWM	C0388
90810	Lee Hanson Farm	Polk	IWM	C0522
93298	Mark Schott Farm	Polk	IWM	C0161
104891	John Wombacher Acreage	Polk	IWM	C1098
13440	Darin & Wendy Keller Farm	Saline	IWM	C0882
40818	Bunge Milling Inc	Saline	RCR	NED007263916
40819	Smithfield Farmland Corp	Saline	IWM	NOTIFICATIONS
40819	Smithfield Farmland Corp	Saline	RCR	NER000504894
40821	Doane University	Saline	RCR	NEX000501833
40834	All Car Care	Saline	RCR	NED981696925
40856	Crete Veterinary Clinic	Saline	SF	NED082731647
40857	Crist Inc	Saline	RCR	NE0000317008
40890	Plains Equipment Group	Saline	RCR	NED068637891
40902	Crete Machine	Saline	RCR	NED035009315
40910	Farmers Cooperative	Saline	IWM	C0376
40925	Culligan Water Conditioning	Saline	IWM	SW0217
40928	Farmers Union Cooperative Co	Saline	SF	NED000687103
40937	J & J Mobil	Saline	IWM	041597-GW-0745
40940	Young's Welding & Repair	Saline	RCR	NED068656735
40983	Crete Service Center Inc	Saline	RCR	NED037663812
40986	Douglas Manufacturing Co	Saline	RCR	NED007262405
40998	Wilber Manufacturing Co Inc	Saline	RCR	NED007285547
41000	Malco Products Inc	Saline	IWM	SW0005
41000	Malco Products Inc	Saline	RCR	NED007262579
41002	Wilber Clatonia Public Schools	Saline	RCR	NER000509539
41055	Rasmussen Stewart Ford Inc	Saline	RCR	NED986387496
41069	Crete Landfill North	Saline	IWM	NE0054666
41069	Crete Landfill North	Saline	IWM	NP00036
41165	Crete Berean Church	Saline	RCR	NED007262462
41166	Nestle Purina PetCare Company	Saline	IWM	NP00681

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
41166	Nestle Purina PetCare Company	Saline	RCR	NED040603441
41199	Crete Middle & High Schools	Saline	RCR	NER000509299
52172	Farmers Cooperative	Saline	RCR	NEP000000090
59926	Farmers Cooperative	Saline	IWM	C0747
59994	Get the Picture Video Store	Saline	RCR	NED981700628
59995	Skala's OK Tire Store Inc	Saline	RCR	NED114439821
62791	Sanitation Systems TS	Saline	IWM	NE0203131
62791	Sanitation Systems TS	Saline	IWM	NE0204315
62808	Wilber Landfill West	Saline	IWM	NE0055018
63189	Crete Landfill South	Saline	IWM	NP00516
63190	De Witt Landfill	Saline	IWM	NP00517
63190	De Witt Landfill	Saline	SF	NED980633226
63191	Slepicka Brothers Landfill	Saline	IWM	NP00518
63193	Western Landfill	Saline	IWM	NP00520
63194	Swanton Landfill	Saline	IWM	NP00521
63306	De Witt C&D Landfill	Saline	IWM	NP00523
64495	Wilber Landfill East	Saline	IWM	NP00524
64652	Dorchester Burn Site	Saline	IWM	C0782
64668	Bow Club	Saline	IWM	NP00525
65006	Atlas F Missile Site 09	Saline	BF	BF0050
65006	Atlas F Missile Site 09	Saline	SF	NEN000703244
66065	Farmers Cooperative Bulk Plant	Saline	IWM	110698-NM-0830
66147	Spohn Farms	Saline	IWM	122398-GW-0850
70656	USDA Grain Bin	Saline	SF	SFN00091
70832	USDA Grain Bin	Saline	SF	SFN00102
74180	Tobias Landfill	Saline	IWM	NP00522
79980	David Muff Farm	Saline	IWM	C0901
83406	Sid Dillon Crete Inc	Saline	RCR	NED102313251
85229	Ronnie Zoubek Residence	Saline	IWM	C0043
86121	Larry Rue Residence	Saline	IWM	C0236
86122	Sapphire Motors	Saline	IWM	C0237
86123	Lumir Lisec Farm	Saline	IWM	C0238
86666	Oliva & Studt Acreage	Saline	IWM	C0288
86791	Wal Mart SuperCenter 4322	Saline	RCR	NER000505610
86928	USDA Grain Bin	Saline	SF	SFN00326
88947	Leroy Hier Property	Saline	IWM	C0413
90309	Robert Slama Farm	Saline	IWM	C0506
91044	Naomi Shively Automotive Shop	Saline	IWM	C0534

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
92002	NOVEL Chemical Solutions Inc	Saline	RCR	NER000507020
96488	E J Brown Acreage	Saline	IWM	C0734
47639	Heartland Community High Schl	York	RCR	NER000509687
47642	Shaffer Trucking	York	IWM	SW0206
47642	Shaffer Trucking	York	RCR	NED058964883
47643	UTC Aerospace Systems	York	IWM	SW0354
47643	UTC Aerospace Systems	York	RCR	NED980973580
47646	Klute Inc	York	RCR	NED986387918
47650	Central Valley Ag	York	RCR	NED981495773
47680	Neville Construction Co	York	IWM	C0728
47680	Neville Construction Co	York	RCR	NED045278280
47696	Hy-Tech Auto Service	York	RCR	NED981696917
47706	C & L Machine & Engine Works	York	RCR	NED122014160
47716	Cornhusker Classics Auto Body	York	RCR	NED981719040
47741	John Kohl Auto Center	York	RCR	NED986382570
47759	Hurlbut's Inc	York	RCR	NED981700321
47761	Mycogen Seeds	York	RCR	NER000004135
47771	Lyman's General Repair	York	RCR	NED132352907
47781	Region V Services	York	RCR	NED035201821
47790	Penner's Tire & Auto Inc Shop	York	IWM	SW0153
47805	Sahling Kenworth Inc	York	RCR	NED107597775
47827	Perennial Public Power Dist	York	RCR	NED008910978
47828	York Cold Storage Co	York	RCR	NED009816323
47843	MVP Midwest Vehicle Pro	York	RCR	NED981697113
47852	York College	York	RCR	NER000501254
47853	Fuel Mart 642	York	IWM	SW0244
47858	Redman Homes	York	RCR	NER000008474
47858	Redman Homes	York	SF	NEN000704390
47879	Farmers Cooperative	York	RCR	NEP000000113
47897	YASWA Landfill	York	IWM	NE0054372
47897	YASWA Landfill	York	IWM	NE0203408
47897	YASWA Landfill	York	IWM	NE0204455
47897	YASWA Landfill	York	IWM	NP00631
47897	YASWA Landfill	York	RCR	NET320010184
47897	YASWA Landfill	York	RCR	NEX000004564
47989	Tracy Enterprises MRF	York	IWM	NE0203629
47989	Tracy Enterprises MRF	York	IWM	SW0650
48007	Beaver Creek Products LLC	York	RCR	NED007493646
48053	York Equipment Inc	York	IWM	SW0211

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
48053	York Equipment Inc	York	RCR	NED040906414
48064	Wy-Ad Utility Contractors	York	IWM	SW0286
48064	Wy-Ad Utility Contractors	York	RCR	NER000001297
48067	Autocraft	York	RCR	NED986369346
48069	Roads Dept York Yard	York	RCR	NED000687251
48069	Roads Dept York Yard	York	SF	NED000687251
48073	NPPD York Operations Center	York	IWM	SW0423
48073	NPPD York Operations Center	York	RCR	NED000809434
48089	Farmers Cooperative	York	IWM	C0399
48120	Central Valley Ag	York	IWM	SW0401
48120	Central Valley Ag	York	SF	NESFN0703510
48138	York General & The Hearthstone	York	IWM	NP00873
48138	York General & The Hearthstone	York	RCR	NER000000513
48146	Lincoln Center	York	RCR	NED024392235
48160	US Postal Service	York	IWM	SW0241
50715	Ash Trail Inc	York	IWM	C0888
52227	Kroy Industries Inc	York	RCR	NEX000005983
52236	DuPont Pioneer	York	RCR	NED986387835
52257	York County Courthouse	York	IWM	C0183
52260	York High School	York	RCR	NER000509331
59094	Green Plains York LLC	York	IWM	C1207
59094	Green Plains York LLC	York	RCR	NER000000471
59246	Magellan Pipeline Company LP	York	RCR	NET320010317
59247	Plains Equipment Group	York	RCR	NED035203132
59248	Snider Motors	York	RCR	NED981697162
59250	York Vacuum Center	York	RCR	NED118697143
59251	Power Service Inc	York	RCR	NED981723299
59252	Cyclonaire Corp	York	RCR	NED980966741
61893	York County Highway Dept	York	IWM	NP00687
61893	York County Highway Dept	York	IWM	SW0627
61893	York County Highway Dept	York	RCR	NED981697105
63271	Benedict Landfill South	York	IWM	NP00607
63272	Benedict Landfill North	York	IWM	NP00608
63273	Tracy Enterprises Landfill	York	IWM	NP00609
63274	Henderson Landfill	York	IWM	NP00610
63275	Mc Cool Junction Landfill	York	IWM	NP00611
63861	Even Temp Inc	York	RCR	NED062256177
63935	Champion Home Builders Co	York	RCR	NER000003509

Appendix 5.1 Waste Facilities Examined for Preferred Route

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
64335	York Dump	York	IWM	NP00612
64489	Air Products & Chemicals Inc	York	IWM	SW0332
64631	Waco Landfill	York	IWM	NP00613
65008	Haz Tech	York	RCR	NER000004085
65104	Carquest of York	York	RCR	NER000004184
65106	Blue Beacon of York Truck Wash	York	IWM	SW0518
65107	TA York Stopping Center 362	York	RCR	NEX000511907
65199	Omega Transportation Company	York	RCR	NED981697246
67355	William Obermier Livestock	York	IWM	C0287
71799	Driewer Inc	York	RAP	36-336-4952
71799	Driewer Inc	York	SF	NED986387009
71799	Driewer Inc	York	SF	NEN000705971
72107	USDA Grain Bin	York	RAP	36-336-4941
72107	USDA Grain Bin	York	SF	SFN00104
72118	Atlas F Missile Site 10	York	SF	NESFN0703245
72336	Southeast York Landfill	York	SF	SFN00378
72816	York Gas & Electric Co	York	BF	BF0100
72816	York Gas & Electric Co	York	SF	NED986373645
75326	Northern Agri Services Inc	York	RCR	NEX000510198
75685	Fred Erks Livestock	York	IWM	VERDELL ERKS
82736	St Johns Lutheran Chr & School	York	IWM	C0008
82904	Kopcho Subdivision	York	IWM	NP00782
84720	Wal Mart SuperCenter 0350-00	York	RCR	NER000502756
85412	Christian Unity Press	York	RCR	NEX000502740
86775	Sprouse Sanitation	York	IWM	C0293
89647	NPPD Mc Cool Substation	York	IWM	NP00719
91839	Brandon Brown Residence	York	RCR	NEN000705931
96346	Kopchos Compost Site	York	IWM	C0720
97123	Agri-Products Inc	York	RCR	NER000508580
98813	Michael Stinson Residence	York	IWM	C0846
100408	Kinder Morgan Interstate Gas	York	RCR	NEP000000958

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
3873	Henningsen Foods Inc	Butler	IWM	C0848
3875	Timpte Inc	Butler	IWM	SW0481
3875	Timpte Inc	Butler	RCR	NED986382448
3877	Frontier Co-op Company	Butler	IWM	C1267
3877	Frontier Co-op Company	Butler	SF	NED980632566
3882	Bruno Co-op Grain Association	Butler	IWM	C1141
3882	Bruno Co-op Grain Association	Butler	SF	NED981713829
3898	Miley Chevrolet Olds	Butler	RCR	NED107595563
3918	Shelter Insurance Co	Butler	IWM	SW0064
3921	Roth Aerial Spraying Inc	Butler	RCR	NED080217847
3944	Trowbridge Motors Inc	Butler	RCR	NED035011733
3949	Kobza Motors Inc	Butler	RCR	NED981697071
3972	Banner Press	Butler	RCR	NED080210420
3975	Northside Inc	Butler	RCR	NED044102333
4016	David City Municipal Power	Butler	IWM	C0228
4048	David City Junior Senior High	Butler	IWM	SW0049
4053	David City Manufacturing Co	Butler	RCR	NED986368207
53588	Commodity Processors Inc	Butler	IWM	C0801
53603	David City Shop	Butler	IWM	051899-NW-11130
53794	Blue River Repair	Butler	IWM	SW0031
58454	David City Grain	Butler	SF	NED050152099
59998	Plains Equipment Group	Butler	RCR	NE0000092809
61019	Central Valley Ag	Butler	IWM	SW0400
61019	Central Valley Ag	Butler	IWM	07260-KAM-1500
61038	Heartland Tower Inc	Butler	RCR	NED980517486
17140	Gerald Osmera Farm	Butler	IWM	C0895
62743	Butler County Landfill Inc	Butler	IWM	NE0202967
62743	Butler County Landfill Inc	Butler	IWM	NE0203785
62743	Butler County Landfill Inc	Butler	IWM	NE0203963
62743	Butler County Landfill Inc	Butler	IWM	NE0055263
62743	Butler County Landfill Inc	Butler	IWM	NE0204137
62743	Butler County Landfill Inc	Butler	IWM	SW0559
62865	Abie Landfill	Butler	IWM	NP00142
62867	Bellwood Landfill	Butler	IWM	NP00143
62868	Brainard Landfill	Butler	IWM	NP00144
62869	Bruno Landfill	Butler	IWM	NP00145
62871	David City Landfill	Butler	IWM	NP00146
62872	Dwight Landfill	Butler	IWM	NP00147

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
64696	Dawson Farm & Ranch LLC	Butler	IWM	NP00082
65730	John Vandenberg Farm	Butler	IWM	011199-99-0000
65757	Pheasant Oak Tasting Room	Butler	IWM	SW0606
71786	USDA Grain Bin	Butler	SF	NE0002455699
73671	DNA Atlas Site	Butler	SF	NEN000703251
74972	David City Manufacturing Co	Butler	RCR	NED981704166
80800	Benchmark Biolabs	Butler	IWM	NP00688
85469	Brian Juranek Farm	Butler	IWM	C0075
85730	Countryside Service	Butler	IWM	C0150
85859	Joe Kment Farm	Butler	IWM	C0169
85896	Allen Dedrick Residence	Butler	IWM	C0191
86128	Dump Site	Butler	IWM	C0231
86129	Smokehouse	Butler	IWM	C0229
86130	Shockley Trucking	Butler	IWM	C0234
86487	Pat Romshek Farm	Butler	IWM	C0276
86618	Jonathan Eaton Property	Butler	IWM	NP00706
86619	Sand Bar	Butler	IWM	NP00704
86620	Joshua Slonecker Residence	Butler	IWM	NP00705
86620	Joshua Slonecker Residence	Butler	IWM	C0812
87210	John Manley Residence	Butler	IWM	C0337
87849	Bellwood Burn Site	Butler	IWM	NP00784
88293	CTF Service Inc	Butler	IWM	C0387
88293	CTF Service Inc	Butler	RCR	NEX000505776
93037	Duane Ratkovec Farm	Butler	IWM	C0610
94132	Goodyear Building	Butler	BF	BF0134
94311	Don Mansavage Residence	Butler	IWM	C0650
98484	Surprise Chautauqua Park	Butler	IWM	NP00776
98767	Alan Schmidt Residence	Butler	IWM	C0841
98854	Chuck & Patricia Oborny Farm	Butler	IWM	C0844
100045	Roy Harris Property	Butler	IWM	C0911
101405	Ulysses Potable Water	Butler	IWM	C0971
102582	Ray's Oil Co Garage	Butler	IWM	SW0161
104995	Miller Garage	Butler	IWM	C1104
107571	Andrew Buresh Acreage	Butler	IWM	C1196
108443	Charles & Saunn Case Acreage	Butler	IWM	C1236
108820	Tyson Buresh Transport Parking	Butler	IWM	C1244
6148	Clarkson Public Schools	Colfax	RCR	NER000510883
6258	Reinecke Motor Co	Colfax	RCR	NED035170547

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
6263	Schuyler Central High School	Colfax	RCR	NER000503656
6272	Cargill Meat Solutions Corp	Colfax	IWM	C1153
6272	Cargill Meat Solutions Corp	Colfax	RCR	NE0000568089
6296	Frontier Co-op Company	Colfax	RCR	NEP000000050
6312	Cooperative Supply Inc	Colfax	RCR	NEP000000022
39527	Columbus Terminal	Colfax	IWM	SW0371
39545	Cooperative Supply Inc	Colfax	IWM	C1182
53578	Vacin Inc	Colfax	RCR	NED986381986
58648	Leigh Shipping	Colfax	IWM	NOTIFICATIONS
59235	Kubicek Cleaners	Colfax	RCR	NED981720824
61018	A Glenn Kluck Feedlots Home	Colfax	IWM	SW0662
62921	Howells Landfill	Colfax	IWM	NP00201
62922	Leigh Landfill	Colfax	IWM	NP00202
62923	Schuyler Landfill	Colfax	IWM	NP00203
62924	Clarkson Landfill	Colfax	IWM	NP00204
63842	Cutting Edge	Colfax	RCR	NED009815234
64689	Midamco Compost	Colfax	IWM	NP00084
64694	Century Farms Corporation	Colfax	IWM	NP00078
64695	Melvin & Kitty Bailey Farm	Colfax	IWM	NP00079
74203	Kluthe Pig Company	Colfax	RCR	NEX000508895
75421	Robert D Faltys Livestock	Colfax	IWM	C0904
82467	Howells Public Schools	Colfax	RCR	NER000504126
92392	Jay Jedlicka Livestock	Colfax	IWM	C0581
92458	USDA Grain Bin	Colfax	SF	NEN000705875
92460	Lopez Auto Sales	Colfax	RCR	NEX000507160
92460	Lopez Auto Sales	Colfax	SF	NEN000705873
95097	Schuyler Industrial Park	Colfax	BF	BF0144
100274	Divis Farm	Colfax	IWM	C0917
104512	Black Hills Energy	Colfax	RCR	NER000511782
106299	Rosa Ortiz Hernandez Residence	Colfax	IWM	C0074
109309	Jason Divis Property	Colfax	IWM	C1259
35130	Covidien LP	Madison	IWM	SW0176
35130	Covidien LP	Madison	RCR	NED042580670
35130	Covidien LP	Madison	RCR	NED084626100
35130	Covidien LP	Madison	SF	NED084626100
35131	MS Global - Norfolk	Madison	RCR	NER000512152
35134	Norfolk Regional Center	Madison	IWM	C0109
35143	COE Cattle Co Inc	Madison	IWM	NP00822

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
35145	Reeves Automotive Service	Madison	RCR	NED035094937
35147	Central Transport Co	Madison	IWM	NED007291461
35147	Central Transport Co	Madison	RCR	NED007291461
35148	Dudley Dry Cleaners/Launderers	Madison	RCR	NED035093178
35157	Northeast Community College	Madison	RCR	NED980327589
35160	Eisenmann Supplies Inc	Madison	RCR	NER000000943
35162	Flexmag Industries Inc	Madison	IWM	SW0294
35162	Flexmag Industries Inc	Madison	RCR	NED020184412
35162	Flexmag Industries Inc	Madison	SF	NED020184412
35165	Associated Wholesale Grocers	Madison	IWM	SW0284
35170	Vishay Dale Electronics Inc	Madison	BF	BF0020
35170	Vishay Dale Electronics Inc	Madison	IWM	SW0318
35170	Vishay Dale Electronics Inc	Madison	RAP	36-336-4922
35170	Vishay Dale Electronics Inc	Madison	RCR	NED035093053
35170	Vishay Dale Electronics Inc	Madison	SF	NED035093053
35185	Hinken Inc	Madison	RCR	NED007297690
35191	Arkfeld Manufacturing & Distr	Madison	RCR	NED007257652
35201	Bill's Body Shop Inc	Madison	RCR	NED048021570
35225	Classen Fab Inc	Madison	RCR	NEX000503474
35228	Colonial Research Chemical	Madison	RCR	NED056839442
35229	Pallet Supply Co	Madison	IWM	C0418
35238	Don's Auto Repair Inc	Madison	RCR	NED021635032
35278	Heckman Top & Body Co	Madison	RCR	NED986381630
35288	Carquest Auto Parts of Norfolk	Madison	RCR	NER000500124
35291	Cornhusker Imports	Madison	RCR	NED986385557
35296	Kayton International Inc	Madison	BF	BF0284
35317	Love Signs Inc	Madison	RCR	NED986385805
35329	Marr's Body Shop	Madison	RCR	NED986375020
35338	Norfolk Aviation	Madison	RCR	NE0000001487
35358	Norfolk Implement Inc	Madison	RCR	NED088626122
35366	Norfolk Transmission & Muffler	Madison	RCR	NED986383206
35380	Cornhusker Auto Center Inc	Madison	RCR	NED986381747
35389	Pollard's Pumping & Cleaning	Madison	RCR	NED082542481
35401	Renner Auto Body	Madison	RCR	NED986387900
35413	Shaffer Pontiac-Buick Inc	Madison	RCR	NED986382240
35422	Game & Parks District 3 Office	Madison	RCR	NEP000000825
35451	Madison County Weed Control	Madison	RCR	NED000766758
35463	Holiday Auto Sales	Madison	IWM	031398-08-1300

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
35485	Madison Body Shop Inc	Madison	RCR	NED986385235
35492	Big Country Auto	Madison	RCR	NED035081322
35496	Pfeifer Auto Body Inc	Madison	RCR	NED986369882
35532	Clark Brothers Transfer Inc	Madison	RCR	NED002873149
35548	Nucor Corporation	Madison	IWM	SW0468
35548	Nucor Corporation	Madison	RCR	NER000003038
35559	Wattier's Auto Body & Repair	Madison	RCR	NED986387926
35608	Nebraska Machinery Co	Madison	RCR	NED041771064
35611	Courtesy Ford Lincoln Sales	Madison	RCR	NED122016033
35619	Nebraska Harvestore Systems	Madison	SF	NED035094671
35620	Marathon Press Inc	Madison	RCR	NED986381937
35635	Watertown Monument Company	Madison	RCR	NED986382554
35653	Battle Creek Farmers Co-op	Madison	IWM	SW0016
35668	Norfolk Terminal	Madison	IWM	SW0514
35668	Norfolk Terminal	Madison	RCR	NED000640128
35668	Norfolk Terminal	Madison	SF	SFN00122
35733	Morrissey Motor Company	Madison	RCR	NE0000118943
35752	Andrews Van Lines Garage	Madison	RCR	NED981716483
35773	Ampride	Madison	IWM	C0300
35781	Roads Dept Norfolk Yard	Madison	IWM	SW0462
35781	Roads Dept Norfolk Yard	Madison	IWM	SW0649
35781	Roads Dept Norfolk Yard	Madison	RCR	NEP000000890
35800	Performance Transmission	Madison	RCR	NER000000067
35817	Gillette/Nebraska Dairies Inc	Madison	IWM	SW0396
35830	Central Sand & Gravel Co 92	Madison	IWM	C0116
35851	Busco Inc	Madison	RCR	NED007297633
35853	Larry L Behnke CPA	Madison	IWM	C0769
35890	NPPD Norfolk Regional Office	Madison	RCR	NED040601676
35941	Roll-N-Wheel Truck Stop	Madison	IWM	NP00718
35966	Elkhorn Valley Equipment	Madison	RCR	NED981698137
35987	Union Pacific Railroad	Madison	IWM	NP00614
35987	Union Pacific Railroad	Madison	RCR	NER000507277
35989	Norfolk Motor Company	Madison	RCR	NED981728223
36014	Harvest Church	Madison	RCR	NED009870288
36107	Tyson Fresh Meats Inc	Madison	RCR	NED062261623
36130	Elkhorn Rural Public Power	Madison	IWM	SW0057
36165	Black Hills Energy	Madison	BF	BF0091

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
36165	Black Hills Energy	Madison	RCR	NED986385615
36183	Faith Regional West Campus	Madison	RCR	NER000506493
53804	Global Equipment Company Inc	Madison	IWM	SW0291
53804	Global Equipment Company Inc	Madison	RCR	NED986386860
53804	Global Equipment Company Inc	Madison	SF	SFN00363
53809	Tyson Fresh Meats Inc	Madison	BF	BF0245
53809	Tyson Fresh Meats Inc	Madison	IWM	SW0266
53812	Big Red Printing Inc	Madison	RCR	NER000512541
53867	Contitech USA Inc	Madison	IWM	SW0345
53867	Contitech USA Inc	Madison	RCR	NED000802843
53936	Quality Cleaners	Madison	RCR	NE0000575399
57780	City of Norfolk Waste Facility	Madison	IWM	NE0203122
57780	City of Norfolk Waste Facility	Madison	IWM	SW0497
57780	City of Norfolk Waste Facility	Madison	IWM	C0110
57780	City of Norfolk Waste Facility	Madison	RCR	NED082537697
57781	Norfolk East Potable Water	Madison	SF	NE0000548057
58129	Transcontinental Cold Storage	Madison	RCR	NER000005017
58130	Affiliated Carriers	Madison	RCR	NED986374650
58132	Southern Drive Trailer Court	Madison	IWM	C0969
58706	David J Joseph Co	Madison	IWM	NP00043
58847	Taco Bell	Madison	RCR	NED058847716
58868	TMC Transportation	Madison	RCR	NED078009701
58870	Dean's Auto Repair	Madison	RCR	NED115068165
58874	Theisen Brothers Inc	Madison	RCR	NED007293178
58879	Wal Mart	Madison	RCR	NE0001012210
59158	Pathology Medical Services PC	Madison	RCR	NED981123680
59163	MP Global Products LLC	Madison	RCR	NED035094978
59165	Roxi's Elegant Bridal	Madison	RCR	NED094696622
59166	Norfolk Street & Parks Div	Madison	RCR	NED981700669
60160	Henkel Oil Company	Madison	IWM	NP00720
60169	CenturyLink	Madison	RCR	NEP000000370
60170	United Parcel Service	Madison	RCR	NED981700701
60173	Wis-Pak of Norfolk Inc	Madison	RCR	NED986375657
61865	National Auto Sales Inc	Madison	IWM	SW0540
61898	US Bank	Madison	RCR	NEP000000091
61914	Fastenal Company	Madison	SF	SFN00174
62752	Buds Sanitary Service	Madison	IWM	NE0203246
62752	Buds Sanitary Service	Madison	IWM	NE0121193

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
62752	Buds Sanitary Service	Madison	IWM	NE0204013
62797	CRD Inc Norfolk Landfill	Madison	IWM	NE0054828
62797	CRD Inc Norfolk Landfill	Madison	SF	NED986373913
63104	Battle Creek Landfill	Madison	IWM	NP00435
63105	Madison Landfill	Madison	IWM	NP00436
63106	Meadow Grove Landfill	Madison	IWM	NP00437
63107	Newman Grove Landfill	Madison	IWM	NP00438
63338	Bleyhl Construction Landfill	Madison	IWM	NE0054615
63858	Will's Paint & Body Inc	Madison	RCR	NED080208564
64344	Norfolk USARC	Madison	RCR	NER000003640
64492	Tilden Landfill	Madison	IWM	NP00439
65205	Graham Tire Co of Norfolk Inc	Madison	RCR	NED020196580
66880	Murphy Stock Farms Inc	Madison	IWM	NP00820
70786	Peoples Natural Gas	Madison	RCR	NEP000000668
71121	Labyrinth Processing Tech	Madison	RCR	NEX000501460
71842	Larry Hofmann Farm	Madison	IWM	NP00722
72819	Riverside Boulevard Drum Site	Madison	RCR	NEP000000360
72819	Riverside Boulevard Drum Site	Madison	SF	NE0000096636
73903	Greg Weidner Livestock	Madison	IWM	C0893
73935	Alter Nebraska Corporation	Madison	IWM	C0921
77264	Matteo Sand & Gravel Inc	Madison	IWM	C0857
77312	Iowa-Nebraska Light FMGP Site	Madison	BF	BF0090
77312	Iowa-Nebraska Light FMGP Site	Madison	SF	NED986373678
79812	SurgiCenter of Norfolk	Madison	RCR	NEX000500991
83482	NE ARNG OMS-7	Madison	RCR	NER000502146
83646	Norfolk Auto Supply Inc	Madison	RCR	NER000502021
83946	Madison City Hall	Madison	IWM	C0397
84182	Holland M-Bar-D	Madison	RCR	NEX000502971
84267	Nebraska Machinery Co	Madison	RCR	NEX000502195
84534	Elkhorn Valley Ethanol LLC	Madison	IWM	C0641
84534	Elkhorn Valley Ethanol LLC	Madison	RCR	NER000507475
85579	LFP Enterprises Inc	Madison	RCR	NEX000503417
85580	Val Planner Property	Madison	IWM	C0114
85582	Classen Manufacturing	Madison	IWM	C0115
85583	Dale Clausen Residence	Madison	IWM	C0117
85584	Glenn Scheffler Farm	Madison	IWM	C0118
85585	Lorren Olson Residence	Madison	IWM	C0119
86006	Dennis Fowlkes Residence	Madison	IWM	C0206

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
86388	Target Store 0856	Madison	RCR	NER000503946
86720	Kinder Morgan Interstate Gas	Madison	RCR	NEP000000909
86721	Kinder Morgan Interstate Gas	Madison	RCR	NEP000000910
86728	Stadium Sports	Madison	RCR	NED981702665
86825	Midway Filling Station	Madison	IWM	SW0548
86878	Kyle McFarlane Residence	Madison	IWM	C0316
86907	USDA Grain Bin	Madison	SF	SFN00307
86919	USDA Grain Bin	Madison	SF	SFN00317
86920	USDA Grain Bin	Madison	SF	SFN00318
86973	King Farms	Madison	IWM	C0377
87825	Madison County Property	Madison	IWM	C0358
88355	Chad Reeves Acreage	Madison	IWM	C0386
88684	Gary Tillotson MRF	Madison	IWM	C0249
89871	Norfolk Dry Cleaner	Madison	BF	BF0072
89871	Norfolk Dry Cleaner	Madison	SF	SFN00294
92624	Gene & Jeanette Reeves Farm	Madison	IWM	C0593
92624	Gene & Jeanette Reeves Farm	Madison	SF	SF00332
94062	Rob Pfeifer Residence	Madison	IWM	SW0634
94064	Central Equipment & Supply Co	Madison	IWM	C0849
94986	Olson's Pest Technician	Madison	RCR	NEX000507533
96291	Sherwin-Williams Co 3222	Madison	RCR	NER000508424
97151	Kinder Morgan Interstate Gas	Madison	RCR	NEP000000948
97236	Edgetown Properties LLC	Madison	IWM	NE0204510
98468	Kohlhof Trucking	Madison	RCR	NEX000508804
100458	Jim Hupp Property	Madison	BF	BF0300
100458	Jim Hupp Property	Madison	IWM	C0933
100633	Jake's Bar	Madison	IWM	C0034
100665	Dennis & Ruth Kuchar Farm	Madison	IWM	C0940
101581	Kevin Wedekind Farm	Madison	IWM	C0968
102002	CVS Pharmacy 10293	Madison	RCR	NER000511485
102884	Jolin Heller Residence	Madison	IWM	C1013
104162	Tractor Supply Co 0343	Madison	RCR	NER000510610
104406	Gary & Betty Uttecht Farm	Madison	IWM	C1072
108021	Tallgrass Interstate Gas Trans	Madison	RCR	NER000512509
108857	John's Disposal	Madison	IWM	C1248
38714	Vishay Dale Electronics Inc 14	Platte	RCR	NEX000506246
38715	Shell Valley Companies Inc	Platte	RCR	NED986385334
38715	Shell Valley Companies Inc	Platte	RCR	NED986385326

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
38719	BD Medical Systems	Platte	RCR	NED007263197
38723	Columbus Hydraulics Co LLC	Platte	RCR	NED007267859
38775	Central Community College	Platte	RCR	NED980743611
38931	Lakeview High School	Platte	RCR	NER000504159
39073	Beller & Backes Inc	Platte	RCR	NED986386878
39149	Sapp Bros Columbus	Platte	RCR	NEP000000905
39156	Platte County Weed Authority	Platte	RCR	NED000766741
39312	Tri Valley Cooperative	Platte	SF	SFN00251
39350	US 30 Speedway	Platte	IWM	C0134
39419	Virg's Garage	Platte	RCR	NED981716509
39491	Platte County Highway Dept	Platte	RCR	NER000505149
39498	Hubbard Feeds Inc	Platte	RCR	NEX000004739
39525	ADM Alliance Nutrition Inc	Platte	RCR	NER000501148
39590	LaBenz Trucking Inc	Platte	RCR	NED078015278
53521	Vishay Dale Electronics Inc 02	Platte	IWM	SW0319
53521	Vishay Dale Electronics Inc 02	Platte	RCR	NED000822817
53534	Tran-Tec Corp	Platte	RCR	NED055071799
53667	Central Valley Ag	Platte	RCR	NEP000000150
53676	Lindsay Manufacturing Company	Platte	IWM	SW0384
53676	Lindsay Manufacturing Company	Platte	IWM	NOTIFICATIONS
53676	Lindsay Manufacturing Company	Platte	RCR	NED068645696
53676	Lindsay Manufacturing Company	Platte	SF	NED068645696
57686	Columbus Wastewater Treatment	Platte	IWM	SW0043
57965	Vishay Dale Electronics Inc 08	Platte	RCR	NED986381705
57977	Carl Aerni Landfill	Platte	IWM	NE0054909
57977	Carl Aerni Landfill	Platte	SF	NED986369478
58429	FLEXcon Company Inc	Platte	IWM	SW0339
58429	FLEXcon Company Inc	Platte	RCR	NED986387850
59988	Saunders Archery Target Co	Platte	RCR	NED035004837
59989	United Parcel Service	Platte	RCR	NED981700727
59990	US 30 Laundry & Dry Cleaning	Platte	RCR	NED981720303
60655	Paraclipse	Platte	IWM	SW0152
60655	Paraclipse	Platte	RCR	NEX000005645
61045	CVS Pharmacy 10441	Platte	RCR	NER000512269
61048	Rapid Lube	Platte	IWM	081693-JF-0000
61201	Tractor Supply Co 0304	Platte	RCR	NER000510560
61248	Metz Baking Remediation Site	Platte	SF	SFN00171

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
61281	Buffalo Equipment Company	Platte	IWM	SW0337
61281	Buffalo Equipment Company	Platte	RCR	NED007287725
38796	Columbus Middle School	Platte	RCR	NER000503706
38808	Columbus High School	Platte	IWM	C0055
39501	Educational Service Unit 07	Platte	RCR	NED986381473
38701	Industrial Engineering Co	Platte	RCR	NER000000380
38702	Torin Products Inc	Platte	RCR	NED087074092
38706	Columbus Metals Industries	Platte	RCR	NEX000510750
38708	Midwest Transmission Rebuilder	Platte	RCR	NER000003772
38711	NPPD Columbus General Office	Platte	IWM	SW0424
38711	NPPD Columbus General Office	Platte	RCR	NED000477372
38713	Mid-American Research Chemical	Platte	RCR	NED051254092
38716	Orion Corp of Nebraska	Platte	RCR	NED986375715
38718	CAMACO Columbus Manufacturing	Platte	IWM	SW0304
38718	CAMACO Columbus Manufacturing	Platte	RCR	NED980325559
38724	Behlen Mfg Co	Platte	IWM	SW0301
38724	Behlen Mfg Co	Platte	RCR	NED007268790
38745	Anderson Auto Body	Platte	RCR	NED986386274
38753	B & W Manufacturing Co Inc	Platte	RCR	NED007266745
38770	Blazer Manufacturing Corp	Platte	RCR	NED980973572
38799	Columbus Motor Company	Platte	RCR	NED986370070
38840	Duo Lift Manufacturing Co Inc	Platte	IWM	C0887
38840	Duo Lift Manufacturing Co Inc	Platte	RCR	NEX000505875
38847	Ernst Toyota Jeep	Platte	IWM	SW0333
38847	Ernst Toyota Jeep	Platte	RCR	NED035003128
38913	Engquist's Advanced Auto Body	Platte	RCR	NED981700339
38936	Liberty Cleaners & Launderers	Platte	RCR	NED981720428
38936	Liberty Cleaners & Launderers	Platte	SF	NED986366532
38958	Total Car Care	Platte	RCR	NED164464893
38961	Miller Radiator & Machine Shop	Platte	SF	NED135505873
38984	Performance Paint & Body Shop	Platte	RCR	NED981726532
39047	Village Wash House	Platte	SF	NED097345581
39096	Paige Electric Co LP	Platte	RCR	NE0000180851
39102	Eagles Home	Platte	RCR	NED986370286
39131	Douglas Holdings LLC	Platte	IWM	SW0292
39131	Douglas Holdings LLC	Platte	RAP	36-336-4947
39131	Douglas Holdings LLC	Platte	RCR	NED099564684
39131	Douglas Holdings LLC	Platte	SF	NEN000705408

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
39144	R & S Track Maintenance Inc	Platte	RCR	NEX000509075
39145	Matulka Auto Sales & Collision	Platte	RCR	NED986368363
39151	Superior Industries Inc	Platte	IWM	SW0352
39151	Superior Industries Inc	Platte	RCR	NED065119349
39168	Animal Health International	Platte	RCR	NER000512830
39196	Jay's Body Shop	Platte	RCR	NED986382299
39209	Pro Auto Body	Platte	RCR	NED986382521
39251	Central Valley Ag	Platte	IWM	SW0062
39251	Central Valley Ag	Platte	IWM	070395-PH-1520
39285	ADM Corn Processing	Platte	IWM	SW0413
39285	ADM Corn Processing	Platte	RCR	NED986387942
39305	Bill's Tire Outlet Inc	Platte	RCR	NED119773745
39367	D & K Enterprises	Platte	IWM	C0032
39378	Vishay Dale Electronics Inc 04	Platte	IWM	SW0338
39378	Vishay Dale Electronics Inc 04	Platte	RCR	NED007267024
39496	Trowbridge Motor Company	Platte	RCR	NED047046081
39503	One Hour Martinizing	Platte	RCR	NED986374684
39544	Ernst Chevrolet Oldsmobile	Platte	RCR	NED986387934
39575	ABF Freight System Inc	Platte	RCR	NED986386282
39576	Carquest Auto Parts	Platte	RCR	NER000003533
39602	Loup Power Dist Tailrace Park	Platte	IWM	C0133
39619	Columbus Irrigation Equipment	Platte	RCR	NED068655281
53418	Al's Automotive Repair	Platte	IWM	C0131
53461	Graham's Upholstery	Platte	RCR	NED981700636
53507	Sherwin-Williams Co	Platte	RCR	NED000829788
53515	Ultra Graphics	Platte	RCR	NER000000216
53520	Big Red Printing	Platte	RCR	NED007265184
53524	Columbus Recycling Center	Platte	IWM	SW0105
53524	Columbus Recycling Center	Platte	RCR	NED058964040
53524	Columbus Recycling Center	Platte	SF	NED058964040
62767	Columbus MSW Transfer Station	Platte	IWM	NE0203114
62767	Columbus MSW Transfer Station	Platte	IWM	NP00815
62767	Columbus MSW Transfer Station	Platte	IWM	NE0204595
62801	Columbus Landfill	Platte	IWM	NP00490
63156	Creston Landfill	Platte	IWM	NP00491
63157	Duncan Landfill	Platte	IWM	NP00492
63158	Humphrey Landfill	Platte	IWM	NP00493
63160	Platte Center Landfill	Platte	IWM	NP00494

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
63163	Sand Draw Disposal Landfill	Platte	IWM	NP00495
63164	Clarence Albracht Landfill	Platte	IWM	NP00496
63547	GreyStone Inc	Platte	IWM	SW0607
63547	GreyStone Inc	Platte	RCR	NED986381929
63549	Automatic Equipment Mfg Co	Platte	RCR	NED007266844
63650	Cargill Value Added Meats	Platte	IWM	SW0233
63650	Cargill Value Added Meats	Platte	RCR	NER000003855
63889	Valmont Newmark Inc	Platte	RCR	NER000003020
63972	Central Sand & Gravel Co	Platte	RCR	NER000000273
64338	Columbus USARTC	Platte	RCR	NER000003582
64728	Fagen Inc	Platte	IWM	SW0061
65141	FAA Columbus SSC Facility	Platte	IWM	SWO510
65141	FAA Columbus SSC Facility	Platte	RCR	NEX000004408
65159	Columbus Auto Mart	Platte	RCR	NED035002682
65886	Creston Fertilizer Co Inc	Platte	RCR	NER000511733
67111	Keith Pillen Livestock Home	Platte	IWM	C0574
68737	10th Street Superfund Site	Platte	RCR	NED981713837
68737	10th Street Superfund Site	Platte	SF	NED981713837
69522	Fastenal Company	Platte	RCR	NED980969141
69684	McGuire Graphics	Platte	RCR	NEX000005603
71135	Vishay Dale Electronics Inc 06	Platte	IWM	NP00684
71135	Vishay Dale Electronics Inc 06	Platte	RCR	NED007265382
71315	Spray Innovations Inc	Platte	RCR	NED981507858
71817	USDA Grain Bin	Platte	SF	NED986381853
71950	USDA Grain Bin	Platte	SF	NEN000705944
71955	USDA Grain Bin	Platte	SF	SFN00071
72804	Kavich Iron & Metal Scrap Yard	Platte	SF	NED986366540
73007	BD Pharmaceutical Systems	Platte	RCR	NER000500967
73375	Minnegasco Inc FMGP Site	Platte	BF	BF0082
73375	Minnegasco Inc FMGP Site	Platte	SF	NED986375087
73687	Performance Printing Inc	Platte	RCR	NEX000007914
73729	Three Eagles Communications	Platte	IWM	SW39507
74295	Duncan Burn Site	Platte	IWM	NP00770
74930	Eugene Olmer Livestock	Platte	IWM	C0741
74975	Lehr Feedlot	Platte	IWM	C0772
74976	Mark F Stock Livestock	Platte	IWM	C1173
83540	Watershed Inc Truck Wash	Platte	IWM	C0132
83540	Watershed Inc Truck Wash	Platte	RCR	NEX000507244

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
84254	USDA Grain Bin	Platte	SF	SFN00046
84319	Columbus Readiness Center	Platte	RCR	NER000508879
84762	Wal Mart SuperCenter 0774-02	Platte	RCR	NER000502724
85667	John Boruch Residence	Platte	IWM	C0141
85668	Larry & Shirly Enquist Farm	Platte	IWM	C0142
85732	Tommy Gdowski Property	Platte	IWM	C0152
86425	Holy Family Schools	Platte	RCR	NER000504035
86491	David Korte Farm	Platte	IWM	C0280
87455	Koch Excavating Co	Platte	IWM	C0350
88477	Nebraska Central Railroad	Platte	IWM	C0390
88726	Acme Equipment & Rental	Platte	IWM	C0402
88727	Castle Construction Inc	Platte	IWM	C0407
96499	Northern Natural Gas Company	Platte	RCR	NEP000000944
98556	Platte Center Burn Site	Platte	IWM	C0567
104058	O'Reilly Auto Parts Store 0681	Platte	RCR	NER000511717
105024	Becton Dickinson & Co R&D Fac	Platte	RCR	NER000511956
106393	Larry Korger Property	Platte	IWM	C1152
107577	Charles Bronson Acreage	Platte	IWM	C1198
109346	Bruce & Connie Schneider Farm	Platte	IWM	C1260
44867	Tenneco Inc	Seward	RCR	NED065111445
44868	Southeast Community College	Seward	IWM	SW0457
44868	Southeast Community College	Seward	RCR	NED076973304
44869	Concordia University	Seward	RCR	NED986388098
44874	Central Valley Ag	Seward	IWM	C0375
44902	Teepee Motel & Campground	Seward	IWM	C0497
44914	Milford Elementary School	Seward	IWM	SW0234
44949	Easy Chemical & Manufacturing	Seward	SF	NED007290372
44957	Trackside Storage	Seward	IWM	NP00841
44964	Herpolsheimer's Inc	Seward	RCR	NER000503284
44991	Rolfsmeier Motors Inc	Seward	RCR	NER000503276
45002	Plains Power & Equipment Inc	Seward	RCR	NE0000092791
45004	Seward Motor Freight Inc	Seward	IWM	SW0074
45004	Seward Motor Freight Inc	Seward	RCR	NED051254191
45005	Bus Maintenance Facility	Seward	IWM	SW0174
45005	Bus Maintenance Facility	Seward	RCR	NED981697188
45006	Seward High School	Seward	RCR	NER000509344
45010	St John Lutheran Church	Seward	IWM	092793-NM-1335
45023	Staplehurst Oil Co	Seward	IWM	041493-DB-0831

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Facility ID	Facility Name	County	Program	Program ID
45028	Fehlhafer's Inc	Seward	RCR	NED047041439
45039	Husker Express Inc	Seward	RCR	NED981697170
45151	Seward County Weed District	Seward	RCR	NEX000005173
45199	Greenhorn Lime Products Co	Seward	IWM	C0253
45240	Roads Dept Seward Yard	Seward	RCR	NEP000000918
45253	Seward Country Club	Seward	RCR	NEX000007526
45255	Pioneer Hi-Bred Intl Inc	Seward	RCR	NER000000612
45261	Subway Motors	Seward	RCR	NED065118051
45275	G&P Development Inc Landfill	Seward	IWM	NE0203971
45275	G&P Development Inc Landfill	Seward	IWM	NP00044
45275	G&P Development Inc Landfill	Seward	RCR	NEX000504944
51660	Central Valley Ag	Seward	IWM	C1140
51938	Main Street Market	Seward	RCR	NEX000005579
52073	Nebraska Equipment Inc	Seward	RCR	NED981697279
57827	Seward Waste & Potable Water	Seward	IWM	SW0175
58330	Hughes Brothers Inc	Seward	IWM	SW0360
58330	Hughes Brothers Inc	Seward	RCR	NED007273279
58508	Central Valley Ag	Seward	SF	SFN00045
58852	Farmers Co-op Assn	Seward	RCR	NEX000505040
59142	Heartland Auto Body Inc	Seward	RCR	NE0000971747
59243	Meyer Ford	Seward	RCR	NE0000073916
59244	Seward Auto Service	Seward	RCR	NED981697196
59276	Dunkin Residence	Seward	RCR	NED037658697
59345	Bill Alexander Farm	Seward	IWM	C0584
60123	Eagle Landing	Seward	RCR	NED981696891
63214	Seward Landfill	Seward	IWM	NP00076
63215	Garland Landfill	Seward	IWM	NP00546
63216	Staplehurst Ulysses Landfill	Seward	IWM	NP00547
63217	Utica Landfill	Seward	IWM	NP00548
63802	Memorial Hospital Inc	Seward	RCR	NED076984533
63856	Brower Construction Co	Seward	RCR	NE0000588608
64615	Tamora Landfill	Seward	IWM	NP00549
64698	John Grasmick Farm	Seward	IWM	NP00050
64763	Bee Landfill	Seward	IWM	NP00654
65185	Lindner Painting Inc	Seward	IWM	SW0118
65185	Lindner Painting Inc	Seward	RCR	NEX000004507
65529	Seward County Highway Dept	Seward	BF	BF0135

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
65529	Seward County Highway Dept	Seward	SF	NEN000703416
66039	David Bledso Rental Property	Seward	IWM	C1158
70640	Ruby USDA Grain Bin	Seward	SF	NEN000703898
71743	KapStone Container Corporation	Seward	RCR	NER000008334
71905	USDA Grain Bin	Seward	RAP	36-336-4940
71905	USDA Grain Bin	Seward	SF	SFN00095
71952	Milford USDA Grain Bin	Seward	IWM	SW0411
71952	Milford USDA Grain Bin	Seward	RAP	36-336-4937
71952	Milford USDA Grain Bin	Seward	SF	NE0001327717
72095	USDA Grain Bin	Seward	SF	SFN00092
72723	David Beckler Livestock	Seward	IWM	C0957
73652	Tamora PWS Site	Seward	SF	NED986384626
73731	Beaver Crossing Burn Site	Seward	IWM	NP00773
74586	Burkey Farms Headquarters Site	Seward	IWM	SW0267
75647	Deloris Scott Farm	Seward	IWM	C1151
75852	Terry Hackbart Livestock	Seward	IWM	C0935
80976	Centennial Jr-Sr High School	Seward	RCR	NER000510859
83113	Winfield Solutions LLC	Seward	RCR	NER000501247
83382	Larry Janousek Residence	Seward	IWM	C0159
84947	Wal Mart SuperCenter 0885-01	Seward	RCR	NER000502708
85897	D & M Equipment Inc	Seward	IWM	C0189
85898	Armand & Zoe Richert Acreage	Seward	IWM	C0188
85899	John Culver Residence	Seward	IWM	C0190
85900	Fenton Daleness Residence	Seward	IWM	C0187
86127	James Vavak Residence	Seward	IWM	C0230
86276	Denis Christjaener Residence	Seward	IWM	C0261
86488	Hymark Towing Garage	Seward	IWM	C0277
86979	T & S Service	Seward	IWM	C0329
86979	T & S Service	Seward	RCR	NEX000504993
88215	Tomes Industries Inc	Seward	RCR	NEX000505248
93353	Campbell Farm	Seward	IWM	C0630
94658	Triangle Court Inc	Seward	IWM	C0671
96899	Eugenia Jeary Farm	Seward	IWM	C0771
98593	Meyer Trucking & Repair	Seward	RCR	NEX000508846
103367	Blaine & Sharon Clowser Farm	Seward	IWM	C1026
103632	Larry Zimbelmann Farm	Seward	IWM	C1037
104065	O'Reilly Auto Parts Store 2100	Seward	RCR	NER000511675

Appendix 5.2 Waste Facilities Examined for Mainline Alternative

Yellow shaded facilities are within 1 mile of route

Facility ID	Facility Name	County	Program	Program ID
104802	America's Fiberglass Animals	Seward	IWM	NP00841
35677	Nucor Steel	Stanton	IWM	SW0642
35677	Nucor Steel	Stanton	RCR	NED087069050
36052	Frit Industries	Stanton	RCR	NEX000005561
45748	Oswald Farm Supply	Stanton	RCR	NED035161850
45774	L & L Trucking	Stanton	RCR	NED085823599
45775	Kuehn Auto Body & Car Sales	Stanton	RCR	NE0000317750
45777	Farmers Co-op	Stanton	RCR	NED035161892
45826	Stanton County Weed Control	Stanton	RCR	NED000766766
62779	NNSWC Landfill	Stanton	IWM	NE0223572
62779	NNSWC Landfill	Stanton	IWM	SWMP
63232	Pilger Landfill	Stanton	IWM	NP00561
63456	Pilger Transfer Station	Stanton	IWM	NE0203882
63456	Pilger Transfer Station	Stanton	IWM	C1081
64621	Stanton Landfill	Stanton	IWM	NP00562
65162	Doernemann Construction	Stanton	IWM	NE0204153
65574	Labyrinth Processing Tech	Stanton	RCR	NEX000008298
71702	Con Bernbeck Livestock North	Stanton	IWM	C1009
73057	Stanton Prcsn Bombing Range 01	Stanton	SF	SFN00287
86922	USDA Grain Bin	Stanton	SF	SFN00320
86926	Stanton USDA Grain Bin	Stanton	SF	SFN00324
89916	Larry Sweigard Property	Stanton	IWM	C0494
92007	Werner Blank Farm	Stanton	IWM	C0576
96490	Joseph & Rhonda Jindra Farm	Stanton	IWM	C0737
97088	Kinder Morgan Interstate Gas	Stanton	RCR	NEP000000947
105946	Barry Wolff Acreage	Stanton	IWM	C1121
106108	Tallgrass Interstate Gas Trans	Stanton	RCR	NER000512095

APPENDIX - 6

REFERENCES

DEQ Titles and supporting documents listed in the attachment to the PSC letter:

- Title 117 - Nebraska Surface Water Quality Standards
- Title 118 - Ground Water Quality Standards and Use Classification
- Title 119 - Rules and Regulations Pertaining to the Issuance of Permits under the National Pollutant Discharge Elimination System
- Title 122 – Rules and Regulations for Underground Injection and Mineral Production Wells
- Title 123 - Rules and Regulations for the Design, Operation and Maintenance of Wastewater Works
- Title 124 - Rules and Regulations for the Design, Operation and Maintenance of On-Site Wastewater Treatment Systems
- Title 126 - Rules and Regulations Pertaining to the Management of Waste
- Title 128 - Nebraska Hazardous Waste Regulations
- Title 129 - Nebraska Air Quality Regulations
- Title 132 - Integrated Solid Waste Regulations
- Title 198 - Rules and Regulations Pertaining to Agricultural Chemical Containment

Supporting Documents

- NDEQ's January 2013 Final Evaluation Report (FER) to Governor Heineman
- TransCanada, September 5, 2012 Preferred Route Submission to the State of Nebraska
- Keystone XL Project Construction, Mitigation, and Reclamation Plan, April 2012, Rev. 4.
- Keystone XL Construction/Reclamation Unit Specifications
- Soil Permeability Study and Distance-to-Groundwater Survey, Keystone XL Pipeline Project - Nebraska Preferred Route, April 2014
- Additional Commitments and Mitigation Measures made to the State of Nebraska by TransCanada (letter dated October 18, 2012).
- TransCanada Keystone XL Pipeline Mitigation Commitment regarding pipeline leak detection technology (letter dated December 30, 2013).
- U.S. Department of State (DOS) 2014 Final Supplemental Environmental Impact Statement (FSEIS)

- DOS 2011 Final Environmental Impact Statement (FEIS)
- Chapman, et. al. 2001, Ecoregions of Nebraska and Kansas (color poster with map, descriptive text, summary tables, and photographs): Reston Virginia, US Geological Survey
- The Groundwater Atlas of Nebraska, Resource Atlas No. 4b/2013, Conservation and Survey Division, University of Nebraska Lincoln
- NDEQ Wellhead Protection Area Maps
- NDEQ Remediation Site Locations
- Nebraska Department of Natural Resource Well Registration Information Database
- National Academy of Sciences Transportation Review Board - Special Report 311

Level III and IV Ecoregions of EPA Region 7

December 2010

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for environmental resource management. This map depicts revisions and subdivisions of ecoregions, compiled originally at a relatively small scale (U.S. EPA 2010, Omernik 1987). Compilation of this map, performed at the larger 1:250,000-scale, is part of several collaborative projects primarily between the U.S. Environmental Protection Agency (EPA) National Health and Environmental Effects Research Laboratory (NHEERL), the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), U.S. EPA Region VII, and state environmental resource agencies (Chapman et al. 2001, 2002; Griffith et al. 1994). Collaboration and consultation also occurred with other state and federal agencies, including the U.S. Forest Service and U.S. Geological Survey, in an effort to obtain consensus regarding alignments of ecological regions.

The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. Explanations of the methods used to define the ecoregions are given in Omernik (1995, 2000, 2004).

Regional collaborative projects such as these state efforts, where the goal is to reach consensus among resource management agencies, comprise a step toward developing a common framework of ecological regions. A common spatial framework would allow integrated ecosystem-type resource management across agencies having different responsibilities and interests for the same geographic areas. Reaching that objective requires recognition of the differences in the conceptual approaches and mapping methodologies that have been used to develop the most commonly used existing ecoregion-type frameworks, including those developed by the U.S. Forest Service, the U.S. EPA, and the NRCS. Collaborative projects at the state and regional level, where some agreement has been reached among multiple resource management agencies, are a step toward attaining consensus and consistency in ecoregion frameworks for the entire nation.

Comments or questions should be addressed to James Omernik, USGS, c/o U.S. EPA-NHEERL, 200 SW 35th Street, Corvallis, OR 97333, (541) 754-4458, email: omernik.james@epa.gov, or to Glenn Griffith, Dynamac Inc., c/o U.S. EPA, 200 SW 35th Street, Corvallis, OR 97333, (541) 754-4465, email: griffith.glenn@epa.gov.

Literature Cited:

Chapman, S.S., J.M. Omernik, J.A. Freeouf, D.G. Huggins, J.R. McCauley, C.C. Freeman, G. Steinauer, R.T. Angelo, and R.L. Schlepp. 2001. Ecoregions of Nebraska and Kansas. (2 sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:1,950,000.

Chapman, S.S., J.M. Omernik, G.E. Griffith, W.A. Schroeder, T.A. Nigh, and T.F. Wilton. 2002. Ecoregions of Iowa and Missouri. (2 sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:1,800,000.

Griffith, G.E., J.M. Omernik, T.F. Wilton, and S.M. Pierson. 1994. Ecoregions and subregions of Iowa: a framework for water quality assessment and management. The Journal of the Iowa Academy of Science 101(1):5-13.

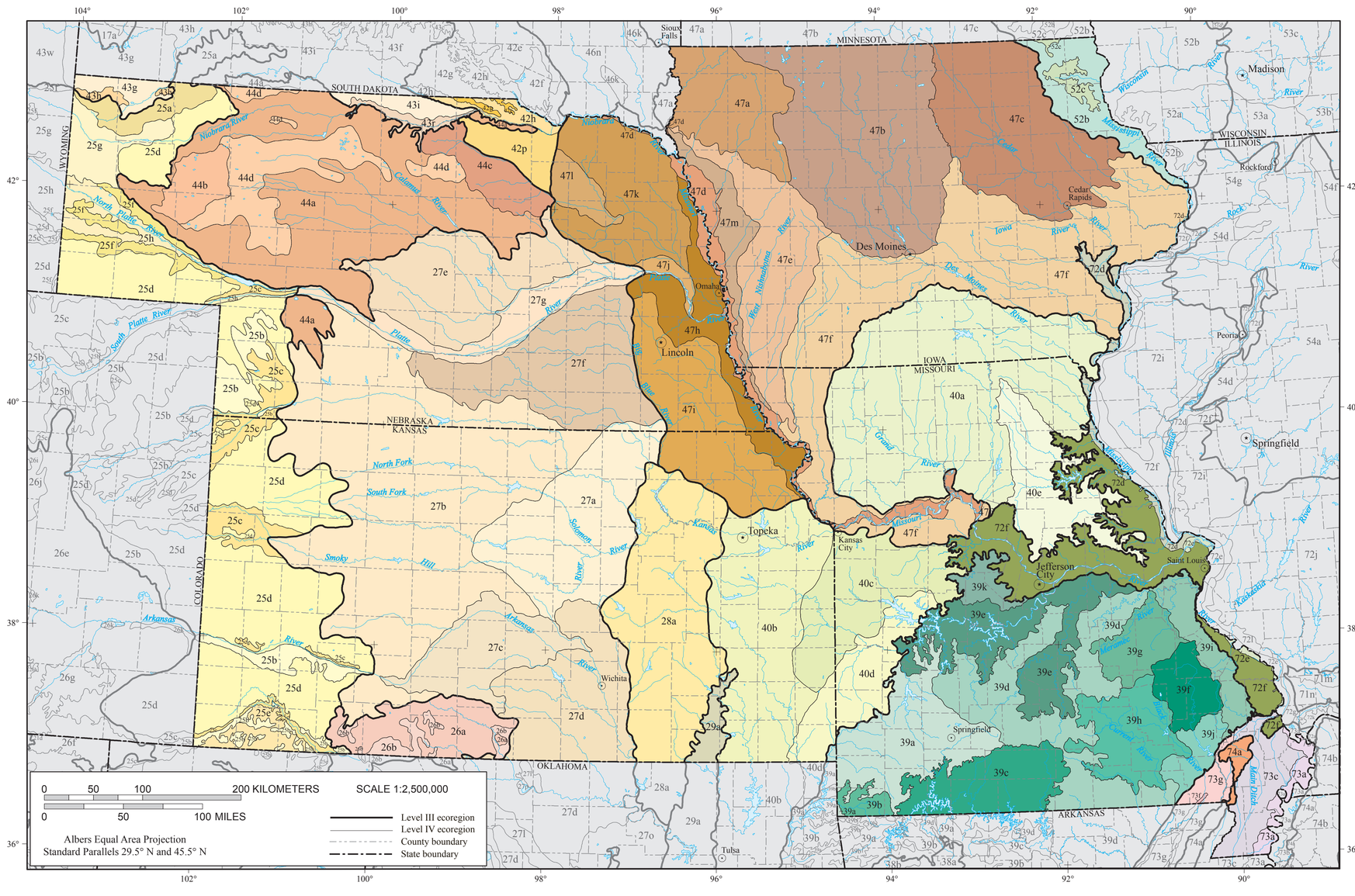
Omernik, J.M. 1987. Ecoregions of the conterminous United States. Map Supplement (scale 1:7,500,000). Annals of the Association of American Geographers 77(1):118-125.

Omernik, J.M. 1995. Ecoregions: A spatial framework for environmental management. In: Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. W.S. Davis and T.P. Simon (eds.). Lewis Publishers, Boca Raton, FL. pp. 49-62.

Omernik, J.M. 2004. Perspectives on the nature and definition of ecological regions. Environmental Management 34(Supplement 1):s27-s38.

Omernik, J.M., S.S. Chapman, R.A. Lillie, and R.T. Dumke. 2000. Ecoregions of Wisconsin. Transactions of the Wisconsin Academy of Science, Arts and Letters 88(2000):77-103.

U.S. Environmental Protection Agency. 2010. Level III Ecoregions of the Continental United States, Map M-1 (revision of Omernik, 1987). U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR.



25 High Plains
- 25a Pine Ridge Escarpment
- 25b Rolling Sand Plains
- 25c Moderate Relief Plains
- 25d Flat to Rolling Plains
- 25e Canadian/Cimarron High Plains
- 25f Pine Bluffs and Hills
- 25g Sandy and Silty Tablelands
- 25h Platte River Valley and Terraces

26 Southwestern Tablelands
- 26a Canadian/Cimarron Breaks
- 26b Flat Tablelands and Valleys

27 Central Great Plains
- 27a Smoky Hills
- 27b Rolling Plains and Breaks
- 27c Great Bend Sand Prairie
- 27d Prairie Tableland
- 27e Central Nebraska Loess Plains
- 27f Rainwater Basin Plains
- 27g Platte River Valley

28 Flint Hills
- 28a Flint Hills

29 Cross Timbers
- 29a Northern Cross Timbers

39 Ozark Highlands
- 39a Springfield Plateau
- 39b Dissected Springfield Plateau-Elk River Hills
- 39c White River Hills
- 39d Central Plateau
- 39e Osage/Gasconade Hills
- 39f St. Francois Knobs and Basins
- 39g Meramec River Hills
- 39h Current River Hills
- 39i Eastern Ozark Border
- 39j Black River Hills Border
- 39k Prairie Ozark Border

40 Central Irregular Plains
- 40a Loess Flats and Till Plains
- 40b Osage Cuestas
- 40c Wooded Osage Plains
- 40d Cherokee Plains
- 40e Claypan Prairie

42 Northwestern Glaciated Plains
- 42g Ponca Plains
- 42h Southern River Breaks
- 42p Holt Tablelands

43 Northwestern Great Plains
- 43g Semiarid Pierre Shale Plains
- 43h White River Badlands
- 43i Keya Paha Tablelands
- 43r Niobrara River Breaks

44 Nebraska Sand Hills
- 44a Sand Hills
- 44b Alkaline Lakes Area
- 44c Wet Meadow and Marsh Plain
- 44d Lakes Area

47 Western Corn Belt Plains
- 47a Loess Prairies
- 47b Des Moines Lobe
- 47c Eastern Iowa and Minnesota Drift Plains
- 47d Missouri Alluvial Plain
- 47e Steeply Rolling Loess Prairies
- 47f Rolling Loess Prairies
- 47h Nebraska/Kansas Loess Hills
- 47i Loess and Glacial Drift Hills
- 47j Lower Platte Alluvial Plain
- 47k Northeastern Nebraska Loess Hills
- 47l Transitional Sandy Plain
- 47m Western Loess Hills

52 Driftless Area
- 52b Blufflands and Coulees
- 52c Rochester/Paleozoic Plateau Upland

72 Interior River Valleys and Hills
- 72d Upper Mississippi Alluvial Plain
- 72e Middle Mississippi Alluvial Plain
- 72f River Hills

73 Mississippi Alluvial Plain
- 73a Northern Holocene Meander Belts
- 73c St. Francis Lowlands
- 73f Western Lowlands Holocene Meander Belts
- 73g Western Lowlands Pleistocene Valley Trains

74 Mississippi Valley Loess Plains
- 74a Bluff Hills

Summary Table: Characteristics of Ecoregions of Nebraska and Kansas

25. WESTERN HIGH PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
25a. Pine Ridge Escarpment	1135	Alternating ridges and valleys with entrenched channels. Elevations increasing from northeast to southeast. Rock outcrops.	3400-5200 / 200-1000	Sandy residuum, Miocene, Oligocene, and Eocene sandstone, and claystone (Arikaree Formation and White River Group).	Entisols (Torriorthents), Mollisols (Argiustolls, Haplustolls)	Canyon, Alliance, Rosebud, Tasssel, Busher, Bridget, Oglala, Rock Outcrops	Mesic/ Aridic, Ustic	14-16	130-140	10/36; 58/90	Ponderosa pine woodlands with Rocky Mountain juniper, western snowberry, skunkbush sumac, choke cherry, and Arkansas rose. Mixedgrass prairie: little bluestem, western wheatgrass, prairie sandreed, needle-and-thread, blue grama, and threadleaf sedge.	Cattle grazing and wildlife habitat, with limited agriculture and logging. Grassland and scattered Ponderosa pine woodland.
25b. Rolling Sand Plains	2661	Sandy undulating plains with small scattered areas of active sand dunes. Few perennial streams.	2500-3500 / 10-100	Eolian sand sheets and dunes over Miocene sandstone (Ogallala Formation).	Entisols (Torripsamments, Ustorthents, Ustipsamments), Mollisols (Argiustolls, Haplustolls), Alfisols (Haplustalfs)	NE: Valent, Woodly, Jayem, Sarben KS: Manter, Santana, Optima, Eva, Vona	Mesic/ Aridic, Ustic	16-21	140-180	14/44; 63/94	Sandsage prairie: sand sagebrush, sand bluestem, prairie sandreed, and little bluestem. This community type sometimes is called "sandsage steppe" due to the presence of a dominant shrub, however, sandsage prairie is the name most frequently used in the plains.	Predominantly rangeland with irrigated agriculture.
25c. Moderate Relief Rangeland	3084	Irregular plains with moderate slope. Intermittent streams, with a few large perennial streams. Historically, perennial streams fed by isolated springs may have been more abundant, but water consumption for agriculture and the lowering of the water table have reduced flow and dried up springs and many streams.	2900-4000 / 50-200	Loess-mantled uplands. Sandy, gravely and loamy colluvium. Miocene sandstone (Ogallala Formation).	Mollisols (Argiustolls, Haplustolls), Entisols (Ustorthents)	Kuma, Keith, Colby, Ulysses	Mesic/ Aridic, Ustic	16-20	150-160	14/42; 62/94	Combination of shortgrass and mixedgrass prairies, with mostly mixedgrass prairie in the north. Shortgrass prairie (blue grama and buffalograss) dominates on upland sites, giving way to mixedgrass prairie (little bluestem, side-oats grama) on slopes, more mesic sites along rivers and streams, and also on sites overlain by thicker loess deposits. In the south, largely on Cretaceous chalks, a unique association called the chalkflat prairie, which is a mixedgrass prairie.	Rangeland and some small areas of dryland farming with major crops of winter wheat and grain sorghum.
25d. Flat to Rolling Cropland	17882	Flat to rolling plains. Few streams, mostly intermittent.	2700-5100 / 5-150	Loess-mantled uplands with alluvial deposits. Northern area: Sandstone and siltstone (Ogallala Formation) with thin loess mantle. Also some Brule Formation (White River Group).	Mollisols (Argiustolls, Haplustolls), Entisols (Ustorthents)	NE: Alliance, Rosebud, Kuma, Santana, Keith KS: Richfield, Ulysses, Colby, Manter	Mesic/ Aridic, Ustic	15-20	130-180	14/46; 62/96	Mixedgrass prairie in the north: needle-and-thread, blue grama, threadleaf sedge, prairie sandreed, and western wheatgrass. Shortgrass prairie to the south: blue-grama, buffalograss, and scattered, isolated sites with alkali sacaton, western wheatgrass, and 'inland' saltgrass.	Dryland cropland with large areas of irrigated agriculture. Major crops include winter wheat, with corn, grain sorghum, and sugar beets grown under irrigation.
25e. Rolling Cropland and Range	765	Nearly level to rolling plains. Few streams, mostly intermittent.	2700-3500 / 10-100	Eolian deposits; thin mantle of loess, loessial alluvium, and colluvium.	Alfisols (Haplustalfs)	Dalhart, Vona	Mesic/ Aridic, Ustic	16-20	170-185	20/47; 66/96	Shortgrass prairie in loess-mantled areas with sandsage prairie in areas with coarse-textured soils.	Irrigated and dryland cropland, and rangeland with a significant amount of bare ground. Major crops include winter wheat, grain sorghum, alfalfa, and corn.
25f. Scotts Bluff and Wildcat Hills	1367	Bluffs, escarpments, and steep valley side slopes. Rock outcrops.	3700-5200 / 150-1000	Sandy residuum. Miocene and Oligocene sandstones (Ogallala and Arikaree Formations, and upper White River Group).	Entisols (Torriorthents), Mollisols (Haplustolls, Argiustolls),	Tassel, Busher, Rosebud, Canyon	Mesic/ Aridic, Ustic	14-18	125-130	12/38; 58/90	Mixedgrass prairie: needle-and-thread, blue grama, and threadleaf sedge, with Ponderosa pine woodlands on ridge tops and side slopes.	Rangeland and wildlife habitat.
25g. Sandy and Silty Tablelands	1674	Tablelands with areas of moderate relief. Some areas of isolated sand dunes, and canyons along stream valleys.	3900-4800 / 100-300	Sandy residuum. Miocene sandstone and siltstone (Ogallala and Arikaree Formations).	Mollisols (Haplustolls), Entisols (Ustorthents, Torriorthents)	Busher, Sarben, Tassel	Mesic/ Aridic, Ustic	14-17	120-130	10/36; 58/90	Mixedgrass prairie: blue grama, little bluestem, threadleaf sedge, and needle-and-thread. Some scattered Sand Hills prairie, sand reed and little bluestem.	Rangeland with limited agriculture.
25h. North and South Platte Valley and Terraces	1562	Flat alluvial valley, bluffs, and uplands.	3300-4500 / 2-100	Sandy and silty alluvial deposits. Mostly Oligocene siltstone (White River Group), but some Miocene sandstone (Ogallala Formation).	Mollisols (Haplustolls), Entisols (Torriorthents)	Tripp, Mitchel, Alice	Mesic/ Aridic Ustic	14-18	130-140	12/38; 58/90	Lowland tallgrass prairie: big bluestem, western wheatgrass, prairie cordgrass, sedges, and switch grass. Mixedgrass prairie: needle-and-thread, blue grama, and threadleaf sedge. Sandsage prairie: little bluestem, sand bluestem, needle-and-thread, prairie sandreed, and sand sagebrush. Floodplain woodlands with cottonwoods.	Irrigated cropland in the river valleys and dryland and irrigated cropland on terraces. Major crops are sugar beets with dry beans, corn and potatoes in irrigated valleys, and forage crops and alfalfa in terraced areas. Native rangeland on uplands.

26. SOUTHWESTERN TABLELANDS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
26a. Cimarron Breaks	2812	Irregular, dissected slopes, bluffs, and gypsum-capped buttes.	1700-2500 / 100-300	Red-colored Permian shale, siltstone, sandstone, salt, and gypsum deposits.	Mollisols (Argiustolls)	Shellabarger, Albion, Farnum	Thermic/ Ustic, Udic	20-28	190-200	22/46; 69/96	Mixedgrass prairie, dominated by big bluestem (on more mesic sites), little bluestem, side-oats grama, blue grama, and some hairy grama, with eastern red-cedar a dominant tree, especially in sites sheltered from fire.	Rangeland and grassland.
26b. Flat Tablelands and Valleys	779	Flat tablelands and river valleys.	1500-2200 / 10-125	Silty alluvium, sand and gravel, red-colored Permian shale, siltstone, sandstone, salt, and gypsum deposits.	Inceptisols (Haplustepts), Mollisols (Argiustolls), Alfisols (Haplustalfs), Entisols (Ustipsamments)	Vernon, Woodward, Carey, Pratt, Tivoli	Thermic/ Ustic, Udic	20-28	190-200	22/46; 69/96	Sandsage prairie common in sites with sandy or well-drained soils. Floodplain woodlands dominated by plains cottonwood, black willow, and peach-leaf willow. Common hackberry, green ash, and American elm locally common, especially in the eastern part of the region.	Cropland on flat tabletops and rangeland along the Cimarron River valley.

27. CENTRAL GREAT PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
27a. Smoky Hills	7834	Undulating to hilly dissected plain. Broad belt of low hills formed by mature dissection of Cretaceous rock layers.	1200-1800 / 100-250	Sandstone and shale, loamy colluvium, and chalky limestone. Locally mantled with thin loess over Cretaceous sandstone (Dakota Formations).	Mollisols (Argiustolls, Haplustolls, Argiudolls)	Crete, Lancaster, Geary, Hedville, Wells	Mesic/ Udic, Ustic	24-28	165-180	18/42; 68/94	Transitional from tallgrass prairie in the east to mixed-grass prairie in the west. Some floodplain forests along riparian areas.	Cropland with winter wheat as primary crop (more corn grown in irrigated areas) and areas of grassland.
27b. Rolling Plains and Breaks	24739	Dissected plains with broad undulating to rolling ridge tops and hilly to steep valley sides.	1700-3200 / 50-200	Holocene to Illinoian-aged loess on uplands with alluvium in floodplains and stream terraces. Tertiary sandstone (Ogallala Formation) and Cretaceous limestone and shale (Niobrara and Greenhorn Formations).	Mollisols (Haplustolls, Argiustolls, Calciustolls), Entisols (Ustorthents)	Coly, Uly, Harney, Holdredge, Hord	Mesic/ Ustic, Udic	20-24	150-190	16/42; 58/94	Mixedgrass prairie: big bluestem, little bluestem, blue grama, needle-and-thread, side-oats grama, and western wheatgrass. Some areas of floodplain forests along major riparian corridors.	Mosaic of predominantly cropland and rangeland. Winter wheat and grain sorghum are the major crops with large areas of corn in the north. Irrigated areas along the major rivers planted with corn, alfalfa, and small grains. Rangeland on breaks.
27c. Great Bend Sand Prairie	4118	Undulating to rolling sandy plains, dune areas.	1500-2400 / 10-175	Sandy eolian deposits, dune sand, and loamy Quaternary sediments over sandy alluvium.	Alfisols (Haplustalfs), Entisols (Ustipsamments), Mollisols (Argiustolls)	Pratt, Tivin, Naron, Farnum, Shellabarger, Albion	Mesic/ Ustic, Udic	20-26	180-190	20/44; 68/96	Sand prairie-bunch grasses: sand bluestem, sand dropseed, and sand reedgrass.	Dryland and irrigated cropland. Winter wheat is main dryland crop. Large areas of center pivot irrigation support grain sorghum and alfalfa crops. Some areas of rangeland.
27d. Wellington-McPherson Lowland	6058	Flat alluvial lowlands. Perennial streams and numerous springs.	1100-1800 / 2-75	Loess and silty, sandy, and clayey alluvium. Permian sandstone, shale, and salt deposits (Wellington Formation).	Mollisols (Argiustolls, Paleustolls, Haplustolls)	Farnum, Shellabarger, Bethany, Grant, Pond Creek, Ladysmith, Irwin, Clime	Thermic, Mesic/ Ustic, Udic	24-32	185-200	22/44; 69/96	Tallgrass prairie: big bluestem, little bluestem, and Indiangrass, with switchgrass in more mesic sites. Floodplain forests are well developed along rivers and streams and are dominated by plains cottonwood, black willow, peach-leaf willow, common hackberry, American elm, green ash, and black walnut, with bur oak becoming less abundant westward.	Extensive cropland agriculture. Major crops include winter wheat and grain sorghum. Small area of cotton cultivation.
27e. Central Nebraska Loess Plains	6617	Rolling dissected plains with deep loess layer. Perennial and intermittent streams.	1600-3100 / 50-275	Deep Quaternary calcareous loess, early Pleistocene and Pliocene alluvial sand, gravel, and lacustrine sand and silt. Tertiary sandstone (Ogallala Formation).	Entisols (Ustorthents, Ustifluvents), Mollisols (Haplustolls, Argiustolls)	Coly, Uly, Holdrege, Holder, Hobbs, Hord	Mesic/ Udic, Ustic	20-25	135-150	10/36; 62/90	Mixedgrass prairie: big bluestem, little bluestem, sideoats grama, blue grama, and western wheatgrass with areas of recent eastern red-cedar intrusion. Highest concentration of cedar is in northwest and adjacent to the Sand Hills.	Predominantly rangeland with large areas of cropland planted in winter wheat, corn, and forage crops. Irrigation agriculture continues to expand in this area.
27f. Rainwater Basin Plains	7370	Flat to gently rolling loess-covered plains. Historically, extensive rainwater basins, and wetlands.	1300-2400 / 5-100	Quaternary loess and mixed loess and sandy alluvium. Tertiary sandstone (Ogallala Formation) in the west and Cretaceous limestone and shale (Niobrara and Carlile Formations) to the east. Wind-excavated depressions.	Mollisols (Argiustolls, Argialbolls, Argiaquolls, Haplustolls), Entisols (Ustorthents)	Hastings, Fillmore, Crete, Butler, Holder, Uly, Coly	Mesic/ Ustic, Aquic, Udic	22-28	150-170	14/38; 65/92	Transitional: tallgrass prairie to the east and mixed-grass prairie in the west, dominated by big bluestem, little bluestem, and sideoats grama. Wetlands dominated by western wheatgrass, sedges, spike rushes, and slender bulrush.	Extensive cropland. Sorghum and winter wheat are the principal dryland crops. Corn and alfalfa are the principal irrigated crops. Historically, the region contained extensive rainwater basins and wetlands that provide important habitat for migrating bird species. Most of the basins have been drained for cultivation and only a few remnants still exist.
27g. Platte River Valley	3061	Flat, wide alluvial valley. Shallow, interlacing streams on a sandy bed.	1300-2900 / 2-75	Alluvial sand, silt, clay, and gravel deposits. Quaternary and Tertiary unconsolidated sand and gravel.	Mollisols (Haplustolls, Argiustolls, Endoaquolls), Entisols (Psammaquents, Fluvaquents, Ustorthents, Ustipsamments)	Cozad, Hord, Hall, Gibbon, Gothenburg, Platte, Boel, Wann, Hersh, Valentine	Mesic/ Aquic, Ustic, Udic	18-28	140-170	12/36; 64/92	Lowland tallgrass prairie with areas of wet meadow and marsh. Historically, riparian woody vegetation was minimal, however, with flood management and reduced river flow floodplain forests are increasing along the Platte River.	Extensive cropland with much of the area irrigated. Corn, grain sorghum, soybeans, and alfalfa are the principal crops. Some native rangeland and haylands. Many channelized streams and flood control structures.

28. FLINT HILLS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
28. Flint Hills	9783	Undulating to rolling hills, cuestas, cherty limestone, and shale outcrops. Perennial streams and springs common.	1000-1600 / 50-400	Cherty and clayey residuum. Interbedded cherty Permian limestone and shale. Some limited glacial drift in the northeast corner of region.	Mollisols (Haplustolls, Argiustolls, Natrustolls, Argiudolls)	Clime, Labette, Sogn, Dwight, Florence, Eram, Kenoma, Irwin, Ladysmith	Mesic, Thermic/ Udic, Ustic	28-35	160-190	22/42; 68/96	Tallgrass prairie: big bluestem, little bluestem, switchgrass, and Indiangrass. Largest area of intact, native, tallgrass prairie in the Great Plains.	Rangeland with extensive cattle grazing. Some limited areas of cropland agriculture along the river valleys and in areas with little relief.

29. CENTRAL OKLAHOMA/TEXAS PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
29a. Cross Timbers	775	Rolling hills and uplands.	700-1000 / 100-200	Sandy residuum and shale outcrops. Pennsylvanian shale with thin sandstone strata.	Alfisols (Haplustalfs, Paleustalfs)	Steedman, Niotaze, Stephenville	Thermic/ Udic, Aquic	32-36	190-205	24/46; 69/94	Cross timbers savanna: post oak, blackjack oak, hickory, and eastern red-cedar with an understory of tallgrass and mixedgrass species.	Woodland and rangeland.

39. OZARK HIGHLANDS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
39a. Springfield Plateau	56	Smooth to rolling hills.	800-1000 / 100-175	Loamy residuum. Mississippian cherty limestone.	Ultisols (Paleudults, Fragiudults)	Clarksville, Nixa	Mesic/ Udic	40-42	215-220	26/46; 68/93	Oak-hickory mixed forest. Pecan, Shumard oak, pin oak, white sassafras, and river birch are common in places along rivers and streams, with flowering dogwood on uplands. Tallgrass prairie and some sandstone and limestone glades were also found on uplands, but most prairies have been converted to cropland.	Mosaic of woodland, grassland, and small areas of cropland.

40. CENTRAL IRREGULAR PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
40b. Osage Cuestas	8988	Cuestas and gentle undulating plains. Perennial streams.	800-1200 / 50-200	Silty and clayey residuum and colluvium. Alternating layers of Pennsylvanian sandstone, limestone, and shale. Glacial drift fairly abundant in the extreme northern part of this ecoregion.	Mollisols (Argiudolls, Argiaquolls), Alfisols (Albaqualfs), Entisols (Udarents)	Kenoma, Martin, Woodson, Eram, Lula, Dennis, Parsons, Kanima, Bates	Thermic, Mesic/ Aquic, Udic	32-38	190-220	24/44; 68/94	Transitional: mostly tallgrass prairie in the west to a combination of tallgrass prairie and oak-hickory woodland in the east. Upland forests dominated by shagbark hickory, bitternut hickory, red oak, white oak, and black oak, with Ohio buckeye, American bladderpod, and pawpaw common understory trees.	Mosaic of cropland, woodland, and grassland.
40c. Wooded Osage Plains	1565	Cuestas and gentle undulating plains. Perennial streams.	900-1100 / 50-200	Silty and clayey residuum and colluvium. Alternating layers of Pennsylvanian sandstone, limestone, and shale.	Mollisols (Argiudolls), Alfisols (Albaqualfs), Entisols (Udarents)	Catoosa, Clareson, Parsons, Dennis, Kanima	Thermic/ Aquic, Udic	38-40	195-210	23/44; 68/93	Mixture of oak-hickory woodland and tallgrass prairie with a greater concentration of hardwood forest. Much like 40b, but Shumard oak, pecan, pin oak, and persimmon a bit more common, especially along the Marais des Cygnes River.	Mosaic of woodland, cropland, and grassland.
40d. Cherokee Plains	1308	Flat to gently sloping plains. Perennial streams.	800-1000 / 10-100	Sandy and clayey residuum and colluvium. Pennsylvanian sandstone, limestone, and shale (Cherokee Group).	Mollisols (Argiudolls), Alfisols (Albaqualfs), Entisols (Udarents)	Parsons, Dennis, Kanima	Thermic/ Aquic, Udic	38-40+	195-210	25/45; 68/93	A combination of mostly tallgrass prairie and oak-hickory woodland in areas of greater relief. Upland areas dominated by hardpan and claypan prairie with little bluestem, side-oats grama, varying amounts of big bluestem and Indiangrass, and a variety of forbs.	Combination of cropland and grassland, with scattered areas of woodland. Areas of historic coal strip mining, especially along the Kansas-Missouri border.

42. NORTHWESTERN GLACIATED PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
42g. Ponca Plains	143	Unglaciated. Level to rolling plains. Preglacial stream drainage.	1700-1900 / 80-140	Alluvial sand and gravel. Miocene soft sandstone (Ogallala and Arikaree Formations) and Cretaceous Pierre Shale.	Mollisols (Argiustolls, Calciustolls)	Onita, Reliance, Ree, Jansen, O'Neill	Mesic/ Ustic	21-22	145-155	10/32; 64/92	Mixedgrass prairie: little bluestem, prairie sandreed, green needlegrass, needle-and-thread, western wheatgrass, sideoats grama, blue grama, and porcupine grass.	Cropland with winter wheat, corn, sorghum, and alfalfa as principal crops.
42h. Southern River Breaks	586	Dissected hills and canyons with slopes of high relief bordering major rivers and associated alluvial plains.	1400-2000 / 250-500	Cretaceous Pierre Shale.	Inceptisols (Haplustepts), Entisols (Ustorthents)	Labu, Bristow, Sansarc	Mesic/ Ustic	20-23	145-155	10/32; 64/92	Deciduous woodland: bur oak, basswood, and eastern red-cedar in canyons and along steep north-facing slopes. Plains cottonwood, willows, green ash. Mixedgrass prairie: western wheatgrass, little bluestem, and green needlegrass on uplands.	Rangeland, wildlife habitat, with some limited cropland.
42p. Holt Tablelands	1401	Unglaciated. Tablelands with dissected slopes.	1500-2000 / 50-475	Eolian sand, alluvial sand and gravel, and lacustrine sand and silt. Miocene soft sandstone (Ogallala Formation).	Mollisols (Argiustolls, Haplustolls)	Jansen, O'Neill, Meadin, Dunday, Pivot, Valentine	Mesic/ Ustic	20-24	145-150	10/32; 62/90	Mixedgrass prarie: little bluestem, switchgrass, sideoats grama, blue grama, sand dropseed, needle-and-thread, prairie sandreed, and sand bluestem.	Cropland on more level tablelands; grassland occurs in areas of greater relief. Crops include grain sorghum, winter wheat, and alfalfa.

43. NORTHWESTERN GREAT PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
43g. Semiarid Pierre Shale Plains	759	Unglaciated. Undulating to rolling plains. Steep-sided, incised stream channels.	3200-4100 / 100-300	Cretaceous Pierre Shale to Greenhorn Granerous Shale.	Vertisols (Haplusterts), Entisols (Ustorthents)	Pierre, Samsil, Kyle	Mesic/ Aridic	15-17	135-140	10/36; 58/90	Mixedgrass prairie: western wheatgrass, green needlegrass, blue grama, fringed sage, big sagebrush, and buffalograss.	Cattle grazing, some limited dryland farming with winter wheat as principal crop.
43h. White River Badlands	223	Unglaciated. Highly dissected landscape of eroded walls and escarpments, isolated buttes and badlands. Dendritic drainage pattern; ephemeral streams highly erosive.	3100-4100 / 225-450	Oligocene, Brule, and Eocene Chadron claystone formations (White River Group) over Cretaceous Pierre Shale.	Vertisols (Haplusterts), Entisols (Torriorthents), Alfisols (Haplustalfs)	Bufton, Orella, Norrest	Mesic/ Aridic, Ustic	15-17	130-140	10/35; 60/91	Silver sagebrush, western wheatgrass, saltbush, rabbitbrush, thickspike wheatgrass, greasewood, and poverty weed.	Cattle grazing.
43i. Keya Paha Tablelands	680	Unglaciated. Level to rolling, sandy plains, isolated gravelly buttes. Dissected near streams.	1900-2400 / 20-400	Eolian and alluvial sand and silt over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments, Torriothents, Psammaquents), Mollisols (Argiustolls, Haplustolls)	Valentine, Tassel, Elsmere, Tryon, Hennings, Ronson	Mesic/ Ustic, Aridic	19-20	130-155	10/32; 62/90	Mosaic of Sand Hills transition prairie and gravelly mixedgrass prairie: little bluestem, prairie sandreed, threadleaf sedge, and needle-and-thread.	Rangeland with areas of cropland. Alfalfa, winter wheat, millet, and corn are principal crops.
43r. Niobrara River Breaks	490	Unglaciated. Dissected canyons with slopes of high relief bordering river.	1700-2700 / 200-600	Sandy residuum. Miocene soft sandstone over Cretaceous Pierre Shale.	Entisols (Torriorthents, Ustipsamments)	Tassel, McKelvie, Rock Outcrop	Mesic/ Ustic	19-20	130-155	10/32; 62/90	Ponderosa pine woodlands with eastern red-cedar on south-facing bluffs and canyon slopes. Deciduous woodlands: bur oak, basswood, green ash, and some paper birch on north-facing bluffs and lower canyon slopes. Plains cottonwoods and eastern red-cedar on floodplains and mixedgrass and Sand Hills prairies through the valley.	Rangeland with scattered cropland in valley bottom. Recreational use.

44. NEBRASKA SAND HILLS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
44a. Sand Hills	14726	Sand sheets and extensive fields of barchanoid, parabolic, and domal sand dunes. High water table.	2200-3900 / 50-400	Eolian dune sand and Pliocene and Pleistocene alluvial silt, sand, and gravel over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments)	Valentine	Mesic/ Ustic	17-23	120-150	10/35; 60/90	Sand Hills mixedgrass prairie: prairie sandreed, little bluestem, sand bluestem, switchgrass, sand lovegrass, needle-and-thread, blue grama, and hairy grama.	Rangeland.
44b. Alkaline Lakes Area	1438	Sand sheets and dunes interspersed with numerous alkaline lakes. No rivers or streams.	3800-4100 / 50-300	Eolian dune sand over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments), Inceptisols (Halaquepts)	Valentine, Els, Wildhorse	Mesic/ Ustic, Aquic	17-19	120-135	12/37; 60/90	Sand Hills mixedgrass prairie: prairie sandreed, little bluestem, sand bluestem, switchgrass, sand lovegrass, needle-and-thread, blue grama, and hairy grama. Alkaline tolerant grass species in wetlands: alkali sacaton, alkaline bulrush, and inland saltgrass.	Rangeland.
44c. Wet Meadow and Marsh Plain	1899	Flat, sandy plain. Numerous marshes and wetlands.	1900-2400 / 10-50	Eolian dune sand, sand sheets, and Pliocene and Pleistocene alluvial silt, sand, and gravel over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments), Mollisols (Endoaquolls, Haplustolls)	Els, Valentine, Ipage, Loup, Elsmere	Mesic/ Ustic, Aquic	17-21	140-145	10/33; 62/90	Sand Hills transition mixedgrass prairie: prairie sandreed, little bluestem, sand bluestem, sun sedge, porcupine grass, needle-and-thread, blue grama, and hairy grama. Wetlands: big bluestem, bluejoint, prairie cordgrass, and sedges.	Grassland with a small acreage used for cultivated crops. Some center-pivot irrigation.
44d. Lakes Area	4277	Sand sheets and dunes. Numerous lakes, few rivers or streams.	2300-3900 / 50-200	Eolian dune sand and Pliocene and Pleistocene alluvial silt, sand, and gravel over Miocene soft sandstone (Ogallala Formation).	Entisols (Ustipsamments, Psammaquents), Mollisols (Haplustolls)	Valentine, Elsmere, Tryon	Mesic/ Ustic, Aquic	20-24	120-150	10/36; 60/90	Sand Hills mixedgrass prairie: prairie sandreed, prairie lovegrass, little bluestem, sand bluestem, switchgrass, sand lovegrass, needle-and-thread, blue grama, and hairy grama. Aquatic plants in marshes.	Rangeland.

47. WESTERN CORN BELT PLAINS

Level IV Ecoregion	Area (square miles)	Physiography	Elevation/ Local Relief (feet)	Geology: Surficial Material and Bedrock	Soil: Order (Great Group)	Soil: Common Soil Series	Soil: Temperature / Moisture Regimes	Climate: Precipitation Mean annual (inches)	Climate: Frost Free Mean annual (days)	Climate: Mean Temperature January min/max; July min/max, (°F)	Potential Natural Vegetation	Land Use and Land Cover
47d. Missouri Alluvial Plain	559	Glaciated. Level floodplain alluvium. Riparian wetlands largely drained.	800-1200 / 2-50	Alluvial deposits over Cretaceous sandstone and shale (Carlile shale through Dakota sandstone) in the north, and Pennsylvanian shale, sandstone, and limestone to the south.	Entisols (Fluvaquents, Udifluvents, Udipsamments)	Albaton, Haynie, Sarpy, Onawa	Mesic/ Aquic	23-35	135-180	15/35; 66/91	Northern floodplain forest: cottonwood, green ash, boxelder, and elm, with lowland tallgrass prairie: big bluestem, prairie cordgrass, switchgrass, and sedges.	Intensively farmed for corn and soybeans. Transportation corridor with most areas drained by surface ditches, land grading, or protected by dams or levees.
47h. Nebraska/ Kansas Loess Hills	3333	Glaciated. Deep, rolling loess-covered hills. Perennial streams.	1000-1500 / 100-300	Loess mantle with underlying calcareous glacial till on Pennsylvanian shale, sandstone, and limestone.	Mollisols (Argiudolls, Argialbolls, Hapludolls), Entisols (Udorthents)	Fillmore, Marshall, Ponca, Monona, Ida, Askarben	Mesic/ Udic	26-34	150-190	16/38; 66/92	Tallgrass prairie: big bluestem, Indiangrass, switchgrass, and little bluestem. Scattered oak-hickory forests and some floodplain woodlands along rivers and streams: bur oak, basswood, black walnut, green ash, plains cottonwoods, and willows.	Principally in cropland except on the steep slopes, which are in trees and pasture. Corn, soybeans, small grains, and alfalfa are typical crops.
47i. Glacial Drift Hills	6460	Glaciated. Rolling low hills. Perennial streams.	1000-1600 / 100-300	Loess and clay loam calcareous glacial till. Loess is variable. Generally loess depth decreases with distance from source rivers. Pennsylvanian shale, sandstone, and limestone and Permian shale and limestone.	Mollisols (Argiudolls), Entisols (Udorthents)	Wymore, Pawnee, Burchard, Askarben, Steinauer, Morrel	Mesic/ Udic	27-35	150-190	14/34; 66/92	Tallgrass prairie with cottonwood-dominated forests along floodplains and oak-hickory forests on bluffs.	Predominately cropland on the flatter loess hills with main crops of wheat and corn, and some areas in grain sorghum, soybeans, and alfalfa. Pasture land is more extensive on till soils.
47j. Lower Platte Alluvial Plain	437	Flat, alluvial plain.	1100-1400 / 2-50	Calcareous alluvium, silt, clay, sand, and gravel. Cretaceous sandstone.	Mollisols (Endoaquolls), Entisols (Psammaquents, Fluvaquents)	Gibbon, Zook, Gothenburg, Platte	Mesic/ Udic, Aquic	27- 29	160-170	13/34; 65/91	Lowland tallgrass prairie: big bluestem, prairie cordgrass, switchgrass, and sedges. Floodplain forests: plains cottonwoods with marshes dominated by aquatic plant species.	Irrigated cropland with primary crops of corn, grain sorghum, and alfalfa. A small area is in native hay meadows.
47k. Northeastern Nebraska Loess Hills	5401	Glaciated. Rolling low hills. Perennial streams.	1100-1900 / 100-300	Deep calcareous loess. Cretaceous sandstone, shale, and limestone. Some Miocene soft sandstone (Ogallala Formation).	Mollisols (Haplustolls), Entisols (Ustorthents)	Nora, Crofton, Moody, Judson	Mesic/ Udic	23-28	140-165	10/32; 64/90	Predominately tallgrass prairie with a transition to mixedgrass prairie in the west: big bluestem, little bluestem, porcupine grass, side-oats grama, switchgrass, and Indiangrass. Wet meadows and cottonwood woodland in floodplains.	Cropland, except on the steeper slopes. Principal crops are corn, soybeans, oats, grain sorghum, and alfalfa.
47l. Transitional Sandy Plain	1044	Level to rolling plains.	1400-2000 / 5-150	Alluvial sand, gravel, and lacustrine silt and sediments. Miocene soft sandstone (Ogallala Formation).	Mollisols (Haplustolls, Argiustolls)	Thurman, Boelus, Nora, Bazile	Mesic/ Udic	23-27	145-160	10/32; 64/40	Tallgrass prairie and Sand Hills border mixedgrass prairie: sand bluestem, little bluestem, prairie sandreed, and needle-and-thread. Wet meadows along stream valleys.	Cropland, both dryland and irrigated. Corn and alfalfa are the principal crops, with a smaller acreage of winter wheat, oats, and grain sorghum.

SOURCES:

Abrams, M.D., 1986, Historical development of gallery forests in northeast Kansas: Vegetation, v. 65, p. 29-37.

Anderson, J.R., 1970, Major land uses (map), *in*: The National Atlas of the United States of America, pp. 158-159. Revised from a map by F.J. Marschner, U.S. Geological Survey, scale 1:7,500,000.

Aughey, S., 1880, Sketches of the physical geography and geology of Nebraska: Omaha, Nebraska, Daily Republican book and job office, 318 p.

Bailey, R.G., 1976, Ecoregions of the United States (map): Ogden, Utah, U.S. Department of Agriculture, Forest Service, scale 1:7,500,000.

Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds., 1994, Ecoregions and subregions of the United States (supplementary table of map unit descriptions compiled and edited by W.H. McNab and R.G. Bailey): Washington D.C., U.S. Department of Agriculture, Forest Service, scale 1:7,500,000.

Baltensperger, B.H., 1985, Nebraska, a geography: Boulder, Colorado, Westview press, 310 p.

Baughman, R.W., 1961, Kansas in maps: Topeka, Kansas, The Kansas State Historical Society, 104 p.

Bleed, A., and Flowerday, C., eds., 1990, An atlas of the Sand Hills: Conservation and Survey Division, Institute of Agriculture and Natural Resources, Lincoln, Nebraska, University of Nebraska, Resource Atlas no. 5a, 265 p.

Bradford, H.E., and Spidel G. A., 1940, Nebraska: Its geography and agriculture: New York, Macmillan, 375 p.

Bryce, S.A., Omernik, J.A., Pater, D.E., Ulmer, M., Schaar, J., Freeouf, J., Johnson, R., Kuck, P., and Azevedo, S.H., 1998, Ecoregions of North Dakota and South Dakota (color poster with map, descriptive text, summary table and photographs): Reston, Virginia, U.S. Geological Survey, (map scale 1:1,500,000).

Buchanan, R.C., ed., 1984, Kansas geology, an introduction to landscapes, rocks, minerals, and fossils: Lawrence, Kansas, University Press of Kansas, 208 p.

Buchanan, R.C., McCauley, J.R., 1988, Roadside Kansas, a traveler's guide to its geology and landmarks: Lawrence, Kansas, University Press of Kansas, 365 p.

Buckwalter, D.W., 1983, Monitoring Nebraska's Sandhills Lakes: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Resource report no. 10, 42 p.

Coupland, R.T., ed., 1993, Natural grasslands, introduction and western hemisphere: Amsterdam, The Netherlands, Elsevier Science Publishers, Ecosystems of the world series v. 8a, 401 p.

Department of Agronomy and the National Drought Mitigation Center, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln (draft) 1998, Soil organic matter provinces of Nebraska croplands (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service, map series no. 98-0101, scale 1:1,000,000.

Diffendal, R.F., Jr., and Voorhies, M.R., 1994, Geologic framework of the Niobrara River drainage basin and adjacent areas in South Dakota generally east of the 100th meridian west longitude and west of the Missouri River: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources University of Nebraska, Nebraska Geological Survey Report of investigations no. 9, 13 p.

Dort, W., Jr. and Jones, J.K., Jr., eds., 1970, Pleistocene and recent environments of the Central Great Plains: Lawrence, Kansas, The University Press of Kansas, Department of Geography special publication no. 3, 433 p.

Dugan, J.T,. 1984, Hydrologic characteristics of Nebraska soils: U.S. Geological Survey water supply paper no. 2222, map supplements, various scales, 19 p.

Dugan, J.T., and Cox, D.A., 1994, Water level changes in the High Plains Aquifer - predevelopment to 1993: Lincoln, Nebraska, U.S. Geological Survey, Water resources investigations report no. 94-4157, 60 p.

Elder, J.A., 1969, Soils of Nebraska: Lincoln, Nebraska, University of Nebraska, Conservation and Survey Division, resource report no. 2, 60 p.

Engberg, R.A., and Spalding R.F., 1978, Groundwater quality atlas of Nebraska: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Resource Atlas no. 3, 39 p.

Evans, C.S., 1995, From sea to prairie, a primer of Kansas geology: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 6, 60 p.

Evans, K.E., and Probasco G.E., 1977, Wildlife of the prairies and plains: St. Paul, Minnesota, U.S. Department of Agriculture, Forest Service, North Central Experiment Station, General technical report NC-29, 18 p.

Fenneman, N.E., 1931, Physiography of the Western United States: New York, McGraw-Hill, 534 p.

Freeouf, J. A. (compiled and edited by), 1996 (revised June 1998), Ecoregions and subregions of region 2 - subsection (map): Lakewood, Colorado, U.S. Department of Agriculture, Forest Service, scale 1:500,000.

Frensel, S.A., Swanson, R.B., Huntsinger, T.L., Stamer, J.K., Emmons, P.J., and Zelt, R.B., 1998, Water quality in the central Nebraska basins, 1992-1995: Lincoln, Nebraska, U.S. Geological Survey, circular no. 1163, 33 p.

Frye, J.C., and Schoewe, W.H., 1953, The basis for physiographic subdivision of Kansas: Transactions of the Kansas Academy of Science. v. 56, no. 2, p. 246-252.

Gallant, A.L., and Omernik, J.M., 1989, Ecological subregions of Colorado (map): Corvallis, Oregon, U.S. Evironmental Protection Agency. Environmental Research Laboratory, scale 1:1,400,000.

Gogel, T., 1981, Discharge of saltwater from Permian rocks to major stream aquifer systems in central Kansas: Lawrence, Kansas, Kansas Geological Survey and U.S. Geological Survey, University of Kansas, Chemical quality series no. 9, (map supplement) 59 p.

Goodin, D.G., Mitchell, J.E., Knapp, M.C., and Bivens, R.E., 1995, Climate and weather atlas of Kansas, an introduction: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 12, 24 p.

Griffith, G.E., Omernik, J.M., Wilton, T.F., and Pierson, S.M., 1994, Ecoregions and subregions of Iowa, a framework for water quality assessment and management: The Journal of the Iowa Academy of Sciences, v. 101, no. 1, p. 5-13.

Gutentag, E.D., Heimes, F.J., Krothe, N.C., Luckey, R.R., and Weeks, J.B., 1984, Geohydrology of the High Plains Aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming: U.S. Geological Survey Professional Paper 1400-B, 63 p.

Ham, G.E., and Higham, R., eds., 1987, The rise of the wheat state, a history of Kansas agriculture: Manhattan, Kansas, Sunflower University Press, 94 p.

Hammond, E.H., 1970, Classes of land surface form (map), *in*: The National Atlas of the United States of America: U.S. Geological Survey, scale 1:7,500,000, p. 62-63.

Huntzinger, T.L., and Ellis, M.J., 1993, Central Nebraska river basins, Nebraska: Water Resources Bulletin, v. 29, no. 4, p. 533-573.

Jiuming, L., Eve, D., and Merchant, J.W., 1997, Satellite view of Nebraska (map): Lincoln, Nebraska, Center for Advanced Land Management Information Technologies (CALMIT), scale 1:1,000,000.

Joern, A., and Keller, K.H., eds., 1995, The changing prairie, North American grasslands: New York, New York, Oxford University Press, 244 p.

Kansas Applied Remote Sensing Program (KARS), 1996, Vegetation index greeness, July 21 - Aug 3, 1995 (map): Lawrence, Kansas, scale (approximate) 1:1,300,000.

Kansas Biological Survey (KBS) and Kansas Applied Remote Sensing Program (KARS), 1998, Draft: Satellite view of Kansas (map): Lawrence, Kansas, scale 1:750,000.

Kansas Biological Survey (KBS) and Kansas Applied Remote Sensing Program (KARS), 1991, Kansas land cover patterns (map): Lawrence, Kansas, scale 1:750,000.

Kansas Geological Survey, 1988, Geologic highway map of Kansas (map): Lawrence, Kansas, scale 1:1,000,000.

Kansas Geological Survey, 1982, Geothermal resources of Kansas (map): Lawrence, Kansas, scale 1:500,000.

Kansas Geological Survey, 1982, Saturated thickness and specific yield of Cenozoic deposits in Kansas (map): Lawrence, Kansas, scale 1:1,000,000.

Kaul, R.B., 1975, Vegetation of Nebraska, circa 1850 (map): Lincoln, Nebraska, Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Kaul, R.B., and Rolfsmeier, S.B., 1993, Native vegetation of Nebraska (map): Lincoln, Nebraska, Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Keech, C.F., and Bentall, R., 1988, Dunes on the Plains, the Sand Hills region of Nebraska: Lincoln, Nebraska, Conservation and Survey Division, Institute of Agriculture and Natural Resources, The University of Nebraska, resource report no. 4, 18 p.

Keys, J.E. Jr., Carpenter, C.A., Hooks, S.L., Koenig, F.G., McNab, W.H., Russell, W.E., and Smith, M.L., 1995, Ecological units of the eastern United States - first approximation: Atlanta, Georgia, U.S. Department of Agriculture, Forest Service, Technical Publication R8-TP 21, scale 1:3,500,000.

Knight, C.L., Briggs, J.M., and Nellis, M.D., 1994, Expansion of gallery forest on Konza Prairie Research Natural Area, Kansas: Landscape Ecology v. 9, p. 117-125.

Krothe, N.C., Oliver, J.W., and Weeks, J.B., 1982, Dissolved solids and sodium in water from the high plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming (map): Denver, Colorado, U.S. Geological Survey, Atlas HA-658, scale 1:2,500,000.

Küchler, A.W., 1970, Potential natural vegetation (map), *in*: The National Atlas of the United States of America: U.S. Geological Survey, scale 1:7,500,000, p. 89-91.

Küchler, A.W., 1964, Potential natural vegetation of the conterminous United States (map and manual): New York, New York, American Geographical Society Special publication no. 36, scale 1:3,168,000.

Küchler, A.W., 1967, Some geographic features of the Kansas prairie: The Transactions of the Kansas Academy of Science, v. 70, no. 3, p. 388-401.

Küchler, A.W., 1969, The vegetation of Kansas on maps: The Transactions of the Kansas Academy of Science, v. 72, no.1, p. 141-166.

Küchler, A.W., 1970, A biogeographical boundary, the Tastchl line: The Transactions of the Kansas Academy of Science. v. 73, no. 3, p. 298-301.

Küchler, A.W., 1974, A new vegetation map of Kansas (map and supplement): Ecology, v. 55, p. 586-604, scale 1:800,000.

Licht, D.S., 1997, Ecology and economics of the Great Plains: Lincoln, Nebraska, University of Nebraska press, 225 p.

Loveland, T.R., Merchant, J.W., Brown, J.F., Ohlen, D.O., Reed, B.C., Olsen, P., and Hutchinson, J., 1995, Seasonal land-cover regions of the United States (map supplement): Annals of the Association of American Geographers, v. 85, no. 2, p. 339-335.

Lugn, A.L., 1962, The origin and sources of loess in the central great plains and adjoining areas of the central lowland (map supplement): Lincoln, Nebraska, University of Nebraska Press, series no. 26, 105 p.

Macfarlane, P.A., 1997, The Dakota aquifer system in Kansas: Lawrence, Kansas, Kansas Geological Survey, Geologic Extension, The University of Kansas, Public information circular no. 7, 5 p.

Malin, J.C., (edited by Swierenga, R.P.), 1984, History and ecology, studies of the grassland: Lincoln, Nebraska, University of Nebraska press, 376 p.

McCarraher, D.B., 1977, Nebraska's Sandhills lakes: Lincoln, Nebraska., Nebraska Game and Parks Commission, 67 p.

McIntosh, C.B., 1996, The Nebraska Sand Hills, the human landscape: Lincoln, Nebraska, The University of Nebraska Press, 238 p.

Nebraska Conservation and Survey Division, 1993, Flat Water, a history of Nebraska and its water: Lincoln, Nebraska, Institute of Agriculture and Natural Resources, University of Nebraska, Resource report No. 12, 291 p.

Nebraska Conservation and Survey Division, 1990, General soil map of Nebraska (map): Lincoln, Nebraska, Nebraska Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Nebraska Conservation and Survey Division, 1990, Center-pivot irrigation systems in Nebraska, 1988 (map): Lincoln, Nebraska, Nebraska Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Nebraska Conservation and Survey Division, 1991, Groundwater vulnerability to contamination in Nebraska using the DRASTIC method (map): Lincoln, Nebraska, Nebraska Conservation and Survey Division, Institute of Agricultural and Natural Resources, The University of Nebraska, scale 1:1,000,000.

Omernik, J.M., 1987, Ecoregions of the conterminous United States: Annals of the Association of American Geographers. v. 77, p. 118-125, scale 1:7,500,000.

Omernik, J.M., 1995, Ecoregions: a spatial framework for environmental management, *in*: Davis, W. S. and Simon, T.P., eds., Biological assessment and criteria - tools for water resource planning and decision making: Boca Raton, Florida, Lewis Publishers, p. 49–62.

Pettijohn, R.A., and Chen, H., 1983, Geohydrology of the High Plains Aquifer system in Nebraska (maps): Lincoln, Nebraska., U.S. Geological Survey, Water resources investigations open file report 82-502, scale 1:750,000.

Rafferty, M.D., 1983, Missouri, a geography: Boulder, Colorado, Westview Press, 262 p.

Reichman, O.J., and Mulligan, S., 1995, Living landscapes of Kansas: Lawrence, Kansas, University Press of Kansas, 154 p.

Risser, P.G., 1988, Diversity in and among grasslands, *in* Wilson, E.O., ed., Biodiversity: Washington D.C., National Academy Press, p. 176-180.

Risser, P.G., Birney, E.C., Blocker, H.D., May, S.W., Parton, W.J., and Wiens J.A., 1981, The true prairie ecosystem: Stroudsburg, Pennsylvania, Hutchinson Ross Publishing Co., 557 p.

Ross, J. A., compiler, 1991, Geologic map of Kansas (map): Lawrence, Kansas, Kansas Geological Survey, University of Kansas, Map M-23, scale 1:500,000.

Sampson, F., and Knopf, F., 1994, Prairie conservation in North America: BioScience, v. 44, no. 6, p. 418 - 422.

Schimel, D.S., Kittel, T.G., Knapp, A.K., Seastedt, T.R., Parton, W.M., and Brown, V.B., 1991, Physiological interactions along resource gradients in a tallgrass prairie: Ecology, v. 72, p. 672-684.

Schoewe, W.H., 1949, The Geography of Kansas, part II physical geography: Transactions of the Kansas Academy of Science, v. 52, no. 3, p. 261-333.

Schoewe, W.H., 1953, The Geography of Kansas, part III hydrogeography: Transactions of the Kansas Academy of Science, v. 56, no. 2, p. 131-190.

Schultz, C.B., and Frye, J.C., 1965, Loess and related eolian deposits of the world (map supplements): Lincoln, Nebraska, University of Nebraska Press, Proceedings VIIth congress of International Association for Quaternary Research, vol. 12, 316 p.

Self, H., 1978, Environment and man in Kansas, a geographical analysis: Lawrence, Kansas, Regents Press of Kansas, 288 p.

Sinclair, H.R., Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., (draft) 7/08/98, Inherent soil quality of Nebraska landscapes (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0117, scale 1:1,000,000.

Sinclair, H.R., Waltman, W.J., Waltman, S.W., Terpstra, H.P., and Reed-Margetan, D., (draft) 11/27/98, Soil survey atlas of agroecology - Northern Plains division; Root zone available water capacity - SRPG (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:3,500,000.

Spinazola, J.M., Gillespie, J.B., and, Hart, R.J., 1985, Groundwater flow and solute transport in the Equus beds area, south-central Kansas, 1940-79: Lawrence, Kansas, USGS water resources investigations report 85-4336, map supplement, U.S. Geological Survey and Kansas Geological Survey, 68 p.

State Geological Survey of Kansas, 1967, General availability of groundwater in Kansas (map): State Geological Survey of Kansas, Lawrence, Kansas, scale 1:500,000.

State Geological Survey of Kansas, 1964, Geologic map of Kansas (map): State Geological Survey of Kansas, Lawrence, Kansas, scale 1:500,000.

Steeples, D.W. and Buchanan, R.C., 1983, Kansas geomaps: Lawrence, Kansas, Educational Series no. 6, 30 p.

Stevens, W.C., 1948, Kansas wild flowers: Lawrence, Kansas, University Press of Kansas, 461 p.

Swinehart, J.B., Souders, V.L., DeGraw, H.M., Diffendal, R.F., Jr., 1985, Cenozoic Paleogeography of western Nebraska from Paleogeography of west-central United States, *in* Flores, R.M., and Kaplan, S.S., eds., Proceedings of Rocky Mountain Paleogeography Symposium 3: Denver, Colorado, p. 209–229.

Swinehart, J.B., and Diffendal, R.F., Jr., 1997, Geologic map of the Scottsbluff 1° x 2° quadrangle, Nebraska and Colorado (map): Lincoln, Nebraska, U.S. Department of the Interior, U.S. Geological Survey, Map I-2545, scale 1:250,000.

Tanner, D.Q., and Steele, G., 1991, Groundwater quality in the Nemaha natural resources district, southeastern Nebraska: Lincoln, Nebraska, U.S. Department of the Interior, U.S. Geological Survey, Water resources investigations report 90-4184, 52 p.

Thompson, M.C., and Ely, C. 1989. Birds in Kansas, Lawrence Kansas: University of Kansas Museum of Natural History, Public education series v. 1, no. 11, 404 p.

Tolsted, L.L., and Swineford, A., 1986, Kansas rocks and minerals: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 2, 64 p.

Trimble, D.E., 1980, The geologic story of the Great Plains: Washington D.C., U.S. Dept. of the Interior, U.S. Geological Survey, Geologic survey bulletin 1493, 55 p.

U.S. Department of Agriculture - Natural Resources Conservation Service, 1998, draft: Ecological framework map tile 5 (Nebraska and Kansas) Major land resource area concepts - STATSGO vs. MLRA (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center in cooperation with CALMIT - University of Nebraska, scale 1:1,000,000.

U.S. Department of Agriculture - Natural Resources Conservation Service (formerly the Soil Conservation Service). Various county soil surveys of Kansas and Nebraska.

U.S. Department of Agriculture - Soil Conservation Service, 1981, Land Resource Regions and Major Land Resource Areas of the United States: Washington D.C., U.S. Department of Agriculture, Soil Conservation Service, Agriculture Handbook no. 296, 156 p. with folded map in pocket.

U.S. Department of Agriculture - Soil Conservation Service, 1986, General Soil Map of Kansas (map): Ft. Worth, Texas, U.S. Department of Agriculture, Soil Conservation Service - National Mapping Division, scale 1: 1,000,000.

U.S. Fish and Wildlife Service, 1978, Stream evaluation map, state of Kansas: Denver, Colorado, U.S. Fish and Wildlife Service, Office of Biological Sciences, scale 1:500,000.

U.S. Fish and Wildlife Service, 1978, Stream evaluation map, state of Nebraska: Denver, Colorado, U.S. Fish and Wildlife Service, Office of Biological Sciences, scale 1:500,000.

U.S. National Oceanic and Atmospheric Administration, 1974, Climates of the States; a practical reference containing basic climatological data of the United States, v. II, Western States, including Alaska and Hawaii: Port Washington, New York, Water Information Center, 975 p.

Unklesbay, A.G., and Vineyard, J.D., 1992, Missouri Geology, three billion years of volcanoes, seas, sediments, and erosion: Columbia, Missouri, University of Missouri Press, 189 p.

Vankat, J.L., 1979, The natural vegetation of North America, an introduction: New York, John Wiley & Sons, 261 p.

Verstraeten, I.M., Sibray, S.S., Cannia, J.C., and Tanner, D.Q., 1995, Reconnaissance of ground-water quality in the North Platte natural resources district, Western Nebraska, June-July 1991: Lincoln, Nebraska, U.S. Geological Survey, Water resources investigations report no. 94-4057, 114 p.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/16/98, Annual water balance across Nebraska landscapes (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0120, scale 1:1,000,000.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/16/98, Growing degree days across Nebraska landscapes (map):, Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0121, scale 1:1,000,000.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/16/98, Mean annual precipitation across Nebraska landscapes (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0119, scale 1:1,000,000.

Waltman, W.J., Svoboda, M.D., and Mortensen, D.A., draft 7/24/98, Mean summer water balance across Nebraska croplands (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0125, scale 1:1,000,000.

Waltman, W.J., Waltman, S.W., and Mortensen, D.A., draft 7/22/98, Irrigated and rainfed croplands of Nebraska (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, map series no. 98-0125, scale 1:1,000,000.

Waltman, W.J., Zhou,Y., Craig, M., and Waltman, S.W., draft 11/27/98, Soil survey atlas of agroecology-Northern Plains division, Growing degree days base 50°F 1961-1990 (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:3,500,000.

Weaver, J.E., 1954, North American Prairie: Lincoln, Nebraska, Johnsen publishing company, 348 p.

Weaver, J.E., 1965, Native Vegetation of Nebraska: Lincoln, Nebraska, University of Nebraska Press, 185 p.

Weaver, J.E., 1968, Prairie plants and their environment; a fifty-year study in the Midwest: Lincoln, Nebraska, University of Nebraska Press, 276 p.

Weaver, J.E., and Bruner, W.E., 1954, Nature and place of transition from true prairie to mixed prairie: Ecology, v. 35, no. 2, p. 117-126.

Weeks, J.B., and Gutentag, E.D., 1981, Bedrock geology, altitude of base and 1980 saturated thickness of the High Plains aquifer in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming (maps): Denver, Colorado, U.S. Geological Survey, Hydrologic investigations atlas HA-648, scale 1:2,500,000.

Wilson. F.W., 1978, Kansas Landscapes- a geological diary: Lawrence, Kansas, Kansas Geological Survey, Educational Series no. 5, 58 p.

Zhou, Y., Craig, M., and Waltman, S.W., draft 11/27/98, Soil survey atlas of agroecology-Northern Plains division, AVHRR Normalized Difference Vegetative Index- NDVI March 91, April 91, May 91, June 91, July 91, Aug. 91, Sept. 91, Oct. 91 (separate maps for each month): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:3,500,000.

Zhou, Y., Narumalani, S., Waltman, W.J., and Waltman, S.W., draft 1997, Spatial framework of ecological units for the U.S., Agrozones of Nebraska (map): Lincoln, Nebraska, U.S. Department of Agriculture, Natural Resources Conservation Service - National Soil Survey Center, scale 1:1,632,613.