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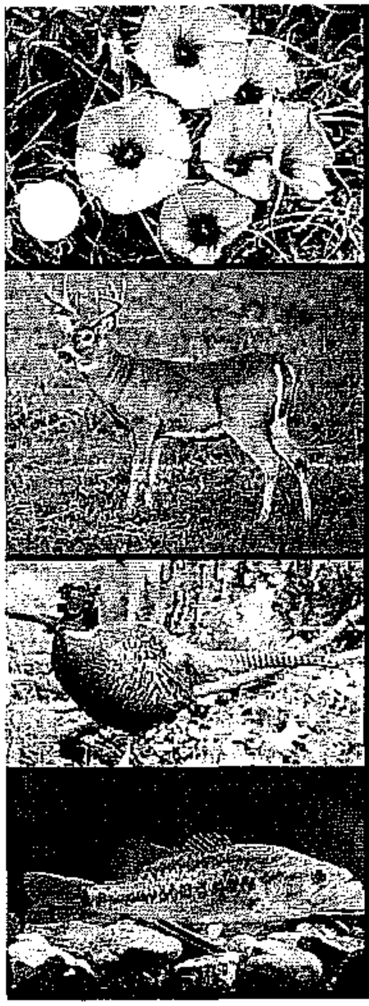

Draft Environmental Impact Statement

Keystone Oil Pipeline Project
Applicant for Presidential Permit: TransCanada Keystone Pipeline, LP

August 10, 2007

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United States Department of State
Draft Environmental Impact Statement

For the

KEYSTONE OIL PIPELINE PROJECT

Applicant for Presidential Permit:
TransCanada Keystone Pipeline, LP

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Cooperating Agencies

Advisory Council on Historic Preservation (ACHP)
Environmental Protection Agency (EPA)
Natural Resource Conservation Service (NRCS)
Rural Utilities Service (RUS)
U.S. Army Corps of Engineers (USACE)
U.S. Department of Agriculture – Farm Service Agency (USDA - FSA)
U.S. Department of Energy (DOE)
U.S. Fish and Wildlife Service (USFWS)

Assisting Agencies

Bureau of Indian Affairs (BIA)
Council on Environmental Quality (CEQ)
Department of Homeland Security (DHS)
Department of Transportation-Federal Highway Administration (FHWA)
Department of Transportation-Office of Pipeline Safety (DOT-OPS)
Federal Energy Regulatory Commission (FERC)
National Park Service (NPS)
Western Area Power Administration (WAPA)

August 10, 2007

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LIST OF ACRONYMS

μS/cm	microSiemens per centimeter
ACHP	Advisory Council on Historic Preservation
AEUB	Alberta Energy and Utilities Board
amsl	above mean sea level
ANSI	American National Standards Institute
APE	area of potential effect
API	American Petroleum Institute
ARG	American Resources Group, Ltd.
ASME	American Society of Mechanical Engineers
BA	biological assessment
BACT	best available control technology
bbl	barrels
bgs	below ground surface
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BO	biological opinion
bpd	barrels per day
CAA	Clean Air Act
CAPP	Canadian Association of Petroleum Producers
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNEB	Canadian National Energy Board
COA	Conservation Opportunity Area
COE	U.S. Army Corps of Engineers
CORE	Coker and Refinery Expansion

LIST OF ACRONYMS (CONTINUED)

CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
DHS	U.S. Department of Homeland Security
DNV	Det Norske Veritas
DOE	U.S. Department of Energy
DOS	U.S. Department of State
DOT	U.S. Department of Transportation
EIA	U.S. Energy Information Administration
EIS	environmental impact statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FR	Federal Register
FSA	Farm Service Agency
FWCA	Fish and Wildlife Coordination Act
FWP	Farmable Wetlands Program
GLO	General Land Office
gpm	gallons per minute
HCA	high-consequence area
HDD	horizontal directional drill
I-	Interstate-
IDNR	Illinois Department of Natural Resources

LIST OF ACRONYMS (CONTINUED)

KDWP	Kansas Department of Wildlife and Parks
Keystone Project	Keystone Pipeline Project
Keystone	TransCanada Keystone Pipeline, L.P.
kV	kilovolt
kW	kilowatt
LWCF	Land and Water Conservation Fund
MDC	Missouri Department of Conservation
Metcalf	Metcalf Archaeological Consultants
mg/L	milligrams per liter
Mitigation Plan	Keystone's Construction Mitigation and Reclamation Plan
MLV	mainline valve
MP	milepost
NDGFD	North Dakota Game and Fish Department
NEPA	National Environmental Policy Act
NGPC	Nebraska Game and Parks Commission
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NPDES	National Permit Discharge Elimination System
NPMS	National Pipeline Mapping System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OKDWC	Oklahoma Department of Wildlife Conservation
OPS	Office of Pipeline Safety
ORV	off-road vehicle

TABLE OF CONTENTS (CONTINUED)

LIST OF ACRONYMS (CONTINUED)

Overthrust	Questar Overthrust Pipeline Company
PA	Programmatic Agreement
PADD	Petroleum Administration for Defense District
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PCE	primary constituent element
PDVSA	*Petroleos de Venezuela, S. A.*
PHMSA	Pipeline and Hazardous Materials Safety Administration
ppm	parts per million
PS	pump station
psig	pounds per square inch, gauge
PWS	public water supply
RCRA	Resource Conservation and Recovery Act
REX	Rockies Express Western Phase Project
Rockies Express	Rockies Express Pipeline, LLC
ROW	right-of-way
RTU	remote terminal unit
RUS	Rural Utilities Service
RV	recreational vehicle
SATG	Section 106 Agency/Tribal Group
SCADA	Supervisory Control and Data Acquisition
SDGFP	South Dakota Game, Fish and Parks
SHPO	State Historic Preservation Officer
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SWCA	SWCA Environmental Consultants
SWPPP	Stormwater Pollution Prevention Plan

LIST OF ACRONYMS (CONTINUED)

TAC	Tribal Advisory Committee
TDS	total dissolved solids
THPO	Tribal Historic Preservation Officer
TPH	total petroleum hydrocarbons
TransColorado	TransColorado Gas Transmission Company
TSS	total suspended solids
UPS	uninterruptible power supply
US-	U.S. Highway-
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
VSS	volatile suspended solids
Western	Western Area Power Administration
WCSB	Western Canadian Sedimentary Basin
WMA	Wildlife Management Area
WRP	Wetlands Reserve Program

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ES.1 INTRODUCTION

TransCanada Keystone Pipeline, L.P. (Keystone) has applied to the U.S. Department of State (DOS) for a Presidential Permit at the border of the United States for the proposed construction, connection, operation, and maintenance of a pipeline and associated facilities for importation of crude oil from Canada. DOS receives and considers applications for Presidential Permits for such oil pipelines pursuant to the authority delegated to it by the President of the United States under Executive Order (EO) 13337 as amended (69 Federal Register [FR] 25299). DOS has determined that issuance of a Presidential Permit would constitute a major federal action that may have a significant impact upon the environment within the context of the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] § 4321 et seq.).

DOS, as the lead agency for the environmental impact statement (EIS), discussed the appropriate level of participation required with other federal agencies that will be required to issue permits associated with the proposed Keystone Project. The following federal agencies have elected to participate as cooperating agencies in the process:

- Advisory Council on Historic Preservation
- U.S. Environmental Protection Agency
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- Farm Service Agency
- U.S. Department of Energy
- Western Area Power Administration
- Rural Utility Service

The following agencies have agreed to provide technical assistance to the environmental review:

- U.S. Department of Transportation – Office of Pipeline Safety
- U.S. Department of Transportation – Federal Highway Administration
- Federal Energy Regulatory Commission
- Department of Homeland Security
- Council on Environmental Quality
- National Park Service
- Bureau of Indian Affairs

State agencies also were consulted to ensure that their needs for state permitting analyses would be assessed in the EIS. Potentially affected Native American tribes with interests along the proposed pipeline corridor were invited to be part of the public scoping and DOS consultation process.

ES.2 PROPOSED ACTION

Keystone proposes to construct and operate a crude oil pipeline and related facilities to transport Western Canadian Sedimentary Basin (WCSB) crude oil from an oil supply hub near Hardisty, Alberta, Canada to destinations in the Midwest United States. In total, the Keystone Project would consist of the Mainline Project (approximately 1,845 miles of pipeline, including about 767 miles in Canada and 1,078 miles in the United States) and the Cushing Extension (293.5 miles of pipeline in the United States). Including the Cushing Extension, the total length of pipeline in the United States would be 1,371.4 miles. The Keystone Project initially would have the nominal transport capacity of 435,000 barrels per day (bpd) of crude oil from the oil supply hub near Hardisty to an existing terminal and refinery at Wood River, Illinois, and an existing terminal at Patoka, Illinois. Additional pumping capacity could be added to increase the average throughput to 591,000 bpd if warranted by future shipper demand and market conditions.

In the United States, the Mainline Project would comprise a 1,023-mile segment of 30-inch-diameter pipe from the Canadian border to Wood River, Illinois and an approximately 56-mile segment of 24-inch-diameter pipe between Wood River and Patoka, Illinois. The Cushing Extension would consist of 293.5 miles of 36-inch-diameter pipe extending from Steele City, Nebraska to Cushing, Oklahoma. Construction of the Cushing Extension could occur if warranted by future shipper demand and market conditions. This EIS describes and evaluates the U.S. portion of the proposed Keystone Project, including both the Mainline Project and Cushing Extension, and the additional facilities required to increase throughput capacity to 591,000 bpd.

The Proposed Route was developed because of shipper interest in providing crude oil transportation to storage terminals and pipeline interconnections in Cushing, Oklahoma. The objective of the Proposed Route was to meet the original Project objective of delivering crude oil to Wood River and Patoka, Illinois as well as delivering oil to Cushing, Oklahoma. To accomplish the objective of delivering crude oil to Wood River and Patoka, and eventually to Cushing, the Proposed Route follows the shortest route possible between the Canadian border and Cushing. The route crosses the U.S./Canada border at Pembina County North Dakota, and follows a southerly track through North Dakota, South Dakota, and Nebraska (see Figure 2.1-1). At Steele City on the Nebraska/ Kansas border, the Mainline Project of the Proposed Route turns east through the northeast corner of Kansas and crosses Missouri to terminals at Wood River and Patoka, Illinois. The Cushing Extension continues south from Steele City through Kansas to Ponca City and Cushing, Oklahoma. This route would facilitate access to Cushing while preserving access to the original markets in Illinois, and would provide collocation opportunities along the existing Platte pipeline.

The length of pipeline proposed within each affected state is listed in Table ES-1.

TABLE ES-1
Miles of Pipeline by State for the Keystone Project

	ND	SD	NE	KS	MO	IL	OK	Total
Mainline Project	216.9	218.9	213.7	98.8	273.1	56.5	0.0	1,078.0
Cushing Extension	0.0	0.0	2.4	210.1	0.0	0.0	81.0	293.5
Keystone Project total	**216.9**	**218.9**	**216.1**	**308.9**	**273.1**	**56.5**	**81.0**	**1,371.4**

Keystone would construct the 30- and 36-inch-diameter pipelines within a 110-foot-wide corridor, consisting of a temporary 60-foot-wide construction right-of-way (ROW) and a 50-foot-wide permanent

ROW. In Illinois, the 24-inch-diameter pipeline segment would be constructed within a 95-foot-wide corridor, consisting of a temporary 45-foot-wide construction ROW and a 50-foot-wide permanent ROW.

Ownership of lands that would be crossed by the proposed Keystone Project is identified in Table ES-2.

TABLE ES-2
Ownership of Land Crossed by the Keystone Project (miles)

	Federal	Tribal	State	Private	Total
Mainline Project					
North Dakota	0.0	0.0	0.8	216.1	216.9
South Dakota	0.0	0.0	0.5	218.4	218.9
Nebraska	0.0	0.0	0.0	213.7	213.7
Kansas	0.0	0.0	0.0	98.8	98.8
Missouri	0.1	0.0	1.9	271.1	273.1
Illinois	3.0	0.0	0.0	53.5	56.5
Mainline Project subtotal	*3.1*	*0.0*	*3.2*	*1,071.6*	*1,077.9*
Cushing Extension					
Nebraska	0.0	0.0	0.0	2.4	2.4
Kansas	3.6	0.0	0.0	206.6	210.2
Oklahoma	0.0	0.0	3.6	77.3	80.9
Cushing Extension subtotal	*3.6*	*0.0*	*3.6*	*286.3*	*2,931.5*
Keystone Project total	**6.7**	**0.0**	**6.8**	**1,357.9**	**1,371.4**

ES.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

The primary purpose of the proposed pipeline is to transport crude oil from the WCSB across the border to meet the growing demand by refineries and markets in the United States. The need for the Project is dictated by:

- Increasing WCSB heavy crude oil supply and uncertain availability of oil from world supplies;
- U.S. demand for crude oil, particularly in the Midwest and Gulf States supported by the Keystone Mainline and Cushing Extension; and
- Pipeline capacity available to ship WCSB crude oil.

ES.3.1 Increasing Western Canadian Sedimentary Basin Crude Oil Supply

According to Oil and Gas Journal, Canada has 179 billion barrels of proven oil reserves, with 174 billion of those reserves in oil sands located in the WCSB. The Alberta Energy and Utilities Board also estimates that 174 billion barrels of proven reserves are recoverable from Canada's oil sands. The province of Alberta is now widely accepted as having the second largest reserves in the world, second only to Saudi Arabia.

Crude oil production from the entire WCSB, including oil sands and conventional production, is now at 2.3 million bpd. According to CNEB, conventional crude oil production in the WCSB is expected to decline but because of rapidly growing oil sands production total WCSB production will rise to 3.9 million bpd by 2015.

ES.3.2 Uncertainty of World Oil Supplies

Global oil production capacity and consumption remain tightly balanced after 3 years of rapid demand growth in Asia, the United States, and the Middle East. DOS and industry analysts project that it will remain so into the medium term. The ability and willingness of major oil and gas producers to step up investment in order to meet rising global demand are particularly uncertain. Political instability in several of the United States' top 11 suppliers is also expected to increase demand for crude oil from Canada. Canada's expected production increases, coupled with the adverse factors affecting other major U.S. suppliers make it likely that an ever larger share of U.S. oil imports will be sourced from this stable and nearby supplier. Even if the share of total imported oil in overall U.S. demand remains the same or declines slightly in coming years, as expected, DOS expects that heavy oil imports from the WCSB will continue to increase.

ES.3.3 U.S. Crude Oil Market Demand

According to the U.S. Energy Information Administration (EIA), U.S. consumption of liquid fuels (crude oil and refined products) is projected to total 26.9 million bpd in 2030, an increase of 6.2 million bpd over the 2005 total. Most of this increased demand is expected to be met with crude oil imports. Canada has traditionally been the United State's largest supplier of oil due to its reliability and proximity to U.S. markets. Canada's share of U.S. oil imports has risen from 15 to 16 percent over the last 10 years, while the whole of the Western Hemisphere now accounts for 41 percent of U.S. oil imports. Demand for the proportion of heavy to light crude used by U.S. refiners has increased over the last 20 years as world supplies of light crude have diminished in proportion to supplies of heavy and extra-heavy crude. Many U.S. refiners have completed or are in the process of completing retrofits to handle the heavier types of crude in response to this change in the world supply. In recent years, crude oil imports from Venezuela (most of which are of heavy grade) have declined. The heavy crude oil that Keystone will deliver to U.S. refiners is ideally suited to replace the loss of these types of crude and meet the expected increase in demand.

ES.3.4 Mainline Project and Cushing Extension Demand

In December 2005, Keystone provided shippers an opportunity to participate in the Keystone Project by entering into contractual commitments for pipeline capacity. Shippers committed to binding contracts for 340,000 bpd. These binding commitments demonstrate the need for incremental pipeline capacity and access to Canadian crude supplies, and represent a commitment to utilize the Keystone Project. Keystone expects that the remainder of the excess capacity will be utilized by non-contract shippers at the tariff rate approved by the Federal Energy Regulatory Commission (FERC) (ENSR 2006a). Potential shippers also have expressed strong interest in a proposed pipeline extension to the Cushing market area. TransCanada conducted an Open Season process for the Mainline Project which ran from November 4 to December 1, 2005. As a result of the Open Season, TransCanada has secured firm, long-term contracts totaling 340,000 bpd, with an average duration of 18 years. Keystone anticipates that existing contracts will be renewed and additional contracts will be entered into such that the average contract term will continue beyond 18 years. This reasoning is based on the amount of crude oil reserves in the WCSB and the expected increase in production from the oil sands (TransCanada 2007c). A binding Open Season for the Cushing Extension closed at noon on March 14, 2007 (ENSR 2006a).

ES.3.5 Pipeline Capacity from the Western Canadian Sedimentary Basin

Nearly all of the 1.9 million bpd of crude oil imported from Canada in 2006 came from the WCSB, and all of that was transported through three major pipeline systems: Enbridge, Kinder Morgan Express, and Kinder Morgan Trans Mountain. Total capacity from the WCSB for crude oil to U.S. markets now stands at 2.4 million bpd. However, the majority of WCSB crude continues to be sold into the U.S. Midwest where a large proportion of U.S. refining capacity is located, and an increasing amount is forwarded on to refiners in the U.S. Gulf Coast to offset declines in offshore production. These two districts are directly and indirectly served by the Enbridge system and Kinder Morgan Express, which together have a capacity of 2.1 million bpd. Total capacity for heavy oil on the Enbridge and Kinder Morgan Express systems now stands at 1.2 million bpd. In 2006, approximately 1 million bpd of heavy crude was exported from the WCSB to the United States via these two pipelines.

Even with modifications to existing systems and de-bottlenecking efforts that are underway by Enbridge, it is likely that crude oil exports from the WCSB to the United States will exceed available pipeline capacity in 2009, necessitating the construction of a new pipeline to facilitate continued importation of crude oil.

Exactly how much more capacity will be needed in the short term to mid term can be estimated. Given CNEB projections of an additional 1.6 million bpd of WCSB production over the current level by 2015, expected increased U.S. demand, and a similar proportion continued to be consumed by Canada (30 percent), an additional 1.1 million bpd of pipeline capacity would be needed by 2015 to accommodate U.S. crude oil imports from the WCSB. This increase in capacity would justify construction of Keystone's planned 450,000-bpd pipeline, and would necessitate additional pipeline construction to meet the remaining 700,000 bpd of capacity.

ES.4 PUBLIC INVOLVEMENT PROCESS

On October 4, 2006, DOS issued a Notice of Intent (NOI) to prepare an EIS. The NOI informed the public about the proposed action, announced plans for scoping meetings, invited public participation in the scoping process, and solicited public comments for consideration in establishing the scope and content of the EIS. The NOI was published in the Federal Register and distributed to affected landowners, Federal agencies, Native American tribes, State agencies, Municipalities and counties, elected officials, non-governmental organizations, the media, and other interested individuals. DOS held 13 separate scoping meetings in the vicinity of the Proposed Route to provide opportunity for public comment on the scope of the EIS. Meetings were held in Michigan and Lisbon, North Dakota; Clark and Yankton, South Dakota; Stanton and Seward, Nebraska; St. Charles and Carrolton, Missouri; Collinsville, Illinois; Seneca, Abilene, and El Dorado, Kansas; and Morrison, Oklahoma. The official scoping period ended on November 30, 2006; however, any comments received after this date were considered in this Draft EIS.

DOS received verbal, written, and electronic comments during the scoping comment period. All verbal comments formally presented at the meetings were recorded and transcribed. Additional written comments were received on comment forms provided to the public at the meetings and in letters. Table ES-3 summarizes the issues identified and comments received during the public scoping process for the Keystone Project. For each comment, the table references the section in this Draft EIS that addresses the concern. Details are provided in the Scoping Summary Report (Appendix A).

TABLE ES-3
Issues Identified and Comments Received during the Public Scoping Process for the Keystone Pipeline Project

Issue	Comment	Section Where Comment/Issue Is Addressed in Draft EIS
Purpose and Need	Need for the Mainline Project and the Cushing Extension, expected life of the pipeline, agency involvement, and required approvals.	1.2
Project Description	Distance to adjacent structures, construction methods, abandonment plans, sources of Keystone Project materials, construction schedule, maintenance and inspection plans and procedures, expected service life of the pipeline, right-of-way (ROW) revegetation, pipeline temperature, protection measures, operations, construction impacts to adjacent areas, powering, pipeline security, hydrostatic testing, and pump stations.	2.0
Alternatives	Selection of alternatives, route adjustments, use of abandoned rail ROWs, route selection, routes that avoid sensitive areas, Kinder Morgan and Enbridge Pipelines, shipping refined products instead of a crude oil pipeline, renewable energy sources, seasonal avoidance of construction in agricultural areas, collocation with other ROWs, and adding a new refinery along the Mainline Project rather than constructing the Cushing Extension.	4.0
Geology	Potential rock slope instability and effects of earthquakes and fault lines.	3.1
Soils and Sediments	Soil compaction and settlement, topsoil segregation during construction, replacement of top soils after construction and abandonment, soil erosion, streambank erosion, pipeline effects on soil temperature, and soil instability.	3.2
Water Resources	Impacts on springs, aquifers, and water wells; water supply contingencies in the event of a spill; impacts to septic systems and sewage treatment facilities; stream channel erosion; impacts to dikes, dams, and reservoirs; runoff during construction; effects on drain tiles and drainage systems; and impacts on flood protection.	3.3
Wetlands	Impacts and mitigation measures, stabilization during construction, enforcement of wetland protection requirements.	3.4
Terrestrial Vegetation	Impacts on prairies and woodlands, impacts of pipeline temperature on vegetation and crops, revegetation of affected area, impacts on crop growth, invasive and noxious weeds, use of herbicides near organic farms, and effects on old-growth trees.	3.5
Fish and Wildlife	Impacts on game animals and their habitats; and impacts on deer, turkey, frogs, toads, bald eagles, beaver, pheasants, and quail.	3.6 and 3.7

ES.5 ALTERNATIVES CONSIDERED

Alternatives to the Keystone Project were analyzed to determine whether they would be reasonable and environmentally preferable to the proposed action. A No Action Alternative, system alternatives, major route alternatives, route variations, and aboveground facility site alternatives were considered in the Draft EIS. Identification of alternatives to the proposed project incorporated public comments and input received from federal, state, and local regulatory agencies.

ES.5.1 No Action Alternative

Under the No Action Alternative, the Keystone Project would not be constructed and operated and issuance of a DOS Presidential Permit for the specific action of building and operating the Keystone pipeline would not be required. While this alternative would eliminate the environmental impacts directly associated with the Keystone Project, it would not meet the proposed action's purpose and need, which involves both supply and demand components.

Without the Keystone Project, the increasing supply of crude oil from the WCSB would not have a ready conduit for export to available refineries and markets in the United States. Additional export pipeline capacity above supply requirements also is required to avoid potential situations where short-term supply exceeds export pipeline capacity.

U.S. demand for petroleum products has increased, while domestic U.S. crude oil supplies continue to decline. The No Action Alternative would not provide the United States with a relatively stable and secure source of North American crude oil for Midwest and Gulf Coast markets, thereby continuing U.S. dependence on Middle Eastern oil supplies.

While the increasing demand for refined crude oil products could be met by other projects or alternatives, it is purely speculative to predict the resulting effects and actions that could be taken by local governments and other suppliers or refineries in the region, as well as any associated direct and indirect environmental impacts of these actions. In addition, each of these actions may result in environmental impacts that are less than, equal to, or greater than those of the currently proposed Keystone Project. The No Action Alternative also could result in more expensive and less reliable crude oil supplies for Midwestern refineries, increasing costs and availability of the refined products for end-users.

ES.5.2 System Alternatives

Several existing and proposed crude oil pipeline systems that currently or would eventually serve the markets targeted by the proposed Keystone Project. The analysis considers whether those systems would meet the proposed Project objectives while offering an environmental advantage over the proposed Project.

One system alternative considered was the expansion of the existing Express and Platte Pipeline systems. This 1,700-mile pipeline system transports crude oil from Alberta's oil sands in Hardisty, Alberta to refineries in the U.S. Rocky Mountain and Midwest regions. In the United States, the pipeline crosses Montana, Wyoming, Nebraska, Kansas, and Missouri and terminates in Wood River, Illinois. The Express system has been in operation from 1997, with a current capacity of 280,000 bpd. The Platte pipeline was built in 1952, and its current capacity is 164,000 bpd. However, as operated today, neither of these existing systems would have the capacity of the proposed Keystone pipeline (435,000 bpd, with a potential increase to 591,000 bpd). As they exist today, neither system could be considered as a system alternative for the proposed action

New construction of other crude oil pipeline systems (Alberta Clipper, Southern Lights, and Spearhead Cushing Expansion) was also considered. Enbridge is proposing these four expansion projects to help address current and future increases in refinery demand as supply from western Canada's vast oil sands increases. The Enbridge projects propose to deliver crude oil directly to Midwestern markets. However, the proposed Enbridge pipelines would provide a less direct route to the Cushing refineries than the Cushing Extension portion of the Keystone Project, involving the need for additional miles of pipe and likely incurring additional impacts to resources. In addition, these projects aim to fulfill other market demands and would not meet the market need and in-service date proposed by the Keystone Project. Therefore, it is possible that market demand and supply of WCSB crude could support construction of the Keystone Project and the Enbridge projects.

ES.5.3 Major Route Alternatives

Three major route alternatives are considered in this Draft EIS: the Iowa Route Alternative, the Proposed Route Alternative, and the Direct Route Alternative. During initial screening, it was determined that the Iowa Route Alternative did not meet the purpose and need for the Project, and the alternative was not considered further in the analysis. Table ES-4 summarizes the potential impacts of the remaining two alternatives, and the following sections discuss these alternatives in more detail. Based on the analysis of the two alternatives, the Proposed Route Alternative has been determined to be the preferred route and a resource-by-resource analysis of potential impacts is conducted in this EIS. Section ES.6 summarizes the results of the analysis.

ES.5.3.1 Iowa Route Alternative

Initial route development identified a ROW that avoided Nebraska and crossed Iowa into northern Missouri (Figure 4.3-1). Desktop data analysis, along with limited aerial and ground reconnaissance, was used to identify this route. The Iowa Route entered the United States in Pembina County, North Dakota, just north of Walhalla, and ran due south to the North Dakota/South Dakota border. In South Dakota, the route ran generally south to the Spink County border before turning southeast toward Plymouth County, Iowa. From there, it crossed the South Dakota/Iowa border north of Sioux City, Iowa and continued in a southeasterly direction through Iowa and Missouri toward a delivery point at Salisbury, Missouri.

TABLE ES-4
Comparison of the Proposed Route and Direct Alternatives for the Keystone Project

Comparative Category	Unit	Proposed Route	Direct Alternative
Facility Requirements			
Pipeline length	Miles	1,373	1,380
Pump station requirements	Number	26	29
Land Requirements [a]			
Construction ROW	Acres	18,214	18,303
Permanent ROW	Acres	8,322	8,362
Environmental Considerations			
Water body crossings [b]	Number	211	261
Wetlands crossed [b]	Miles	36.2	40.0
Federal lands crossed	Miles	4.3	2.2

Here, the Iowa Route was collocated with the existing Platte pipeline to Troy, Missouri. North of Troy, the route was moved to a power line ROW to avoid areas where the city has expanded. East of Troy, the route again collocated with the Platte pipeline, running east to the Missouri/Illinois border—where it deviated from the Platte pipeline and crossed the Mississippi River south of Wood River, Illinois. From Wood River, the route ran eastward through the Carlyle Lake WMA into Patoka, Illinois.

While the Iowa Route would meet the objectives of crude oil delivery to the refineries in Illinois, it would not efficiently deliver crude oil to Cushing, Oklahoma and would not meet the Keystone Project purpose and need, and is not considered further.

ES.5.3.2 Direct Alternative

The Direct Alternative was designed to take the shortest feasible route between the U.S./Canada border crossing and the delivery points at Patoka and Wood River, Illinois, and from there to take the shortest route to the delivery point at Cushing, Oklahoma (Figure 4.3-2). The straight-line path was modified to skirt populated areas and to minimize the number of stream crossings by traveling along drainage divides whenever possible. Between Wood River and Patoka, the Direct Alternative follows the same alignment as Keystone's proposed route. Between Wood River and Cushing, the Direct Alternative roughly parallels Enbridge's Ozark pipeline corridor, but collocation was not assumed.

Based on a reconnaissance-level GIS analysis and comparison of the Direct Alternative with Keystone's Proposed Route, there is no environmental advantage associated with the Direct Alternative. The Direct Alternative would require approximately 7 more miles of pipeline and three more pump stations. Construction of the Direct Alternative would require almost 100 more acres of construction ROW and when completed, it would require 40 more acres of permanent ROW than would the proposed alignment. Furthermore, although the Direct Alternative would cross 2 fewer miles of federal land, it would require crossing approximately 50 additional water bodies and 4 more miles of wetlands, according to available 1:100,000 National Wetlands Inventory data.

ES.5.4 Route Variations for the Proposed Route Alternative

As part of the route development and selection process, 12 route variations to the initially planned Mainline Project route and one variation on the Cushing Extension route have been incorporated. These variations were developed based on discussions with landowners, resource stewards, and project engineers to avoid or minimize impacts to natural or cultural resources, reduce or eliminate engineering and constructability concerns, and avoid or minimize conflicts with existing or proposed residential and agricultural land uses.

In addition to the route variations described above, the scoping process identified public concerns related to route location. Many of these comments addressed specific route variations related to avoiding shelterbelts and aesthetic features, such as bike paths and parks. The Scoping Report is provided as Appendix A for reference. The final design alignment would, where feasible, consider these minor route variations and would attempt to address additional landowner requirements, such as crossing property along quarter section lines. Additional minor alignment shifts would be required prior to and during construction to accommodate unforeseeable site-specific constraints related to other engineering, landowner, and environmental concerns.

ES.5.5 Aboveground Facility Alternatives for the Proposed Route

Pump stations, valve sites, temporary worksites, and pipe and contractor yards are identified in this Draft EIS for the Keystone Project. The proposed project includes 23 pump stations, 42 pipe storage yards, 17 contractor yards, and 45 main line valves (MLVs) along the Mainline Project and 3 pump stations, 13 pipe storage yards, 6 contractor yards, and 12 MLVs along the Cushing Extension. Although the preferred locations for these facilities were chosen based on Project need, the proximity of public access, habitats, dwellings, and other land and ROW issues also were considered in siting the facilities. Over the course of Project development, three pump station locations have been relocated due to environmental or landowner concerns.

ES.6 PROPOSED PROJECT IMPACTS AND MITIGATION MEASURES

Table ES-5 summaries the potential impacts of the proposed route. The table also summaries mitigation measures proposed by Keystone in Appendix B. Additional mitigation measures are recommended in subsequent resource sections within the EIS and are summarized in Section 5.0.

ES.6.1 Geology

The proposed project would not involve substantial topographical alteration and would not disturb any geological features protected by federal or state laws, or tribal practice. Seismic activity is not expected to pose an unacceptable risk to the project.

The proposed pipeline route does not cross any active surface mines or quarries; however, it does cross 40 miles of underlying coal seams between Wood River and Patoka, Illinois, where coal is mined with underground methods (ENSR 2006a). The proposed route does not cross the well pads of any active oil and gas wells. Extraction of oil and gas resources would not be affected by routing operations because any new wells would be located outside of the pipeline ROW. The proposed pipeline would pass through deposits of sand, gravel, clay, and stone in North Dakota, South Dakota, and Nebraska but would restrict access to comparatively small areas of these deposits. In Kansas, Missouri, and Illinois, the proposed route lies adjacent to an existing pipeline, limiting impacts to potentially exploitable geologic resources.

A minimal risk of localized subsidence or collapse exists where the pipeline crosses karst formations or passes above historic coal mines. It is also possible that land clearing will increase the risk of erosion and localized landslides. Most of the proposed Keystone Project route is not located in landslide-prone terrain, but the proposed route does cross areas of high landslide potential, as described by the National Pipeline Mapping System at the Yankton and Mississippi River crossings. Keystone has considered landslide potential in its routing work and has selected crossings of these areas where the landslide potential is reduced.

ES.6.2 Soils

Temporary or short term increases in soil erosion could occur during construction, particularly in areas classified as highly erosive. Receiving water bodies could be affected, and agricultural soils containing agrochemical products could be eroded. During construction, soil compaction is likely, increasing the possibility of runoff.

Approximately 17,000 acres of farmland or rangeland within the ROW would be taken out of production during the 18-month construction period. Some short- or long-term decreases in agricultural productivity are possible. In addition, tile drainage systems would be disturbed during construction. Keystone has proposed to avoid, replace, and/or repair any tile drainage system within the ROW.

There could be compaction-related decreases in productivity from non-agricultural vegetated land, particularly where soils are classified as hydric. It is also possible that boulders and rocks unearthed during construction would be concentrated near the surface at completion. There are also concerns that .

TABLE ES-5 Summary of Potential Impacts and Proposed Mitigation for the Proposed Route Alternative				
Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
Geology	3.1	The proposed project would not involve substantial topographical alteration and would not disturb any geological features protected by federal or state laws, or tribal practice. Seismic activity is not expected to pose an unacceptable risk to the project. The proposed pipeline would pass through deposits of sand, gravel, clay, and stone in North Dakota, South Dakota, and Nebraska but would restrict access to comparatively small areas of these deposits. The proposed route does cross areas of high landslide potential, as described by the National Pipeline Mapping System at the Yankton and Mississippi River crossings. A minimal risk of localized subsidence or collapse exists where the pipeline crosses karst formations or passes above historic coal mines.	In Kansas, Missouri, and Illinois, the proposed route lies adjacent to an existing pipeline, limiting impacts to potentially exploitable geologic resources.	Keystone has considered landslide potential in its routing work and has selected crossings of these areas where the landslide potential is reduced. Prior to surface disturbance activities within karst terrain, a geological investigation will be completed to determine the presence and type of karst features. The investigation will identify the location, distribution, and dimensions of rock cavities within the potential influence zone of construction.
Soils	3.2	Construction. Temporary or short term increases in soil erosion could occur during construction. Short- or long-term decreases in agricultural productivity are possible. In addition, tile drainage systems would be disturbed during construction. Boulders and rocks unearthed during construction would be concentrated near the surface at completion. There are also concerns that spills or leakage from equipment could contaminate soils. In terms of operations impacts, differential settling around the proposed pipeline likely would be minor and would be addressed by mitigation measures. Operations. Soil temperature impacts would be limited to within 3 feet of the pipeline and would not result in serious soil moisture loss.	Potential cumulative erosion effects could occur where construction disturbance areas overlap, or are located near each other, particularly along the sections of Keystone pipeline that are collocated with the Rockies Express Western Phase Project (REX Project). Both the REX Project and the Keystone Project would apply best management practices (BMPs) for soil management and protection to the pipelines and appurtenant facilities. Revegetation mixtures that are appropriate to soil conditions and expected future uses (such as grazing and wildlife habitat) would be applied to the disturbed areas. Consequently, the potential for cumulative erosion effects caused by one or more of these projects is low.	Keystone has proposed to avoid, replace, and/or repair any tile drainage system within the ROW. The objective of topsoil handling is to maintain topsoil capability by conserving topsoil for future replacement and reclamation and to minimize the degradation of topsoil from compaction, rutting, loss of organic matter, or soil mixing so that successful reclamation of the ROW can occur. In cultivated agricultural lands, the actual depth of the topsoil shall be stripped from the area to be excavated above the pipeline to a maximum of 12 inches. When grading is required, the topsoil shall be removed from the entire area to be graded and stored. Stripped topsoil is to be stockpiled in a windrow along the edge

TABLE ES-5
(Continued)

Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
				of the ROW to minimize the potential for subsoil and topsoil to be mixed. Keystone shall monitor the pipeline ROW and all stream crossings for erosion or other potential problems that could affect the integrity of the pipeline. Any erosion identified shall be reclaimed as expediently as practicable by Keystone or by compensation of the landowner to reclaim the area.
Water Resources	3.3	Surface water or groundwater quality would not be significantly affected by normal disposal activities (such as disposal of hydrostatic test water), non-catastrophic spills, or leaks during pipeline construction and operation.	If construction activities of the Keystone Project and the collocated portion of REX pipeline follow a similar schedule, there could be a cumulative contribution to incremental sedimentation in adjacent surface waters. Each project—as well as any other collocated construction projects—would be required to follow BMPs and permit conditions to protect surface waters. Both the Keystone Project and other portions of the REX Project plan to use surface water for hydrostatic testing. However, the timing for REX withdrawals would not overlap with withdrawals planned for Keystone.	Temporary erosion and sediment control measures shall be installed immediately after initial disturbance of the soil and maintained throughout construction (on a daily basis) and reinstalled as necessary until replaced by permanent erosion control structures or restoration of the construction ROW is complete. These measures include sediment barriers, trench plugs, temporary slope breakers, drainage channels or ditches, temporary mulching, and use of a tackifier. All extra work areas (such as staging areas and additional spoil storage areas) at least 10 feet from the water's edge. Flagging shall be installed at all water body crossings, across the construction ROW at least 10 feet from the banks prior to clearing and to ensure that riparian cover is maintained where practicable during construction. Details for water body crossing methods and mitigation are provided in Section 7.4 of Appendix B.

TABLE ES-5
(Continued)

Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
Wetlands	3.4	Wetlands that would be affected within the ROW include emergent wetlands (658 acres), forested wetlands (148 acres), perennial riverine wetlands (54 acres), intermittent riverine wetlands (59 acres), and scrub-shrub wetlands (33 acres).	Cumulative impacts on wetlands would occur in locations where any of the Keystone Project and REX pipelines or other construction projects would be collocated while crossing wetlands. Total wetland impacts within the collocated area could be about 156 acres of wetlands. Both projects would implement mitigation measures to protect wetlands. Other construction projects, such as town expansions, new roads and highways, and other industrial facilities could affect additional wetlands. None of the wetlands crossed by the Keystone Project would be permanently filled or drained, and the contribution of the Keystone Project on cumulative effects to wetlands in the Project area would be minor.	Wetland boundaries shall be clearly marked in the field with signs and/or highly visible flagging during construction. Aboveground facilities shall not be located in a wetland, except where the location of such facilities outside of wetlands would preclude compliance with U.S. Department of Transportation (USDOT) pipeline safety regulations. The width of the construction ROW shall be reduced to 85 feet or less in standard wetlands unless non-cohesive soil conditions require utilization of a greater width. All extra work areas (such as staging areas and additional spoil storage areas) shall be located at least 10 feet away from wetland boundaries. Sediment barriers shall be installed across the entire construction ROW immediately upslope of the wetland to prevent sediment flow into the wetland. Specific wetland crossing procedures are described in Section 6.5 of Appendix B.
Terrestrial Vegetation	3.5	Grassland impacts due to pipeline construction are expected to be minimal, and affected vegetative communities generally are expected to reestablish within 2 years. Construction through previously untilled prairie could produce irreversible impacts. Impacts on upland forest and shrubland would be longer term than those anticipated for grassland.	The total amount of vegetation that may be affected by all of the reasonably foreseeable projects, including the Keystone Project, is relatively small compared to the abundance of similar habitat in the Project area. Impacts would result in the long-term and permanent loss of non-herbaceous vegetation and would cause a small incremental increase	Clearing, grubbing and grading of trees, brush and stumps shall be performed in accordance with the following measures: ROW boundaries including temporary workspaces shall be clearly staked to prevent disturbance to unauthorized areas; timber shall be salvaged as per landowner request; tree stumps shall be grubbed only

TABLE ES-5
(Continued)

Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
			in fragmentation of forested areas. All of the projects would implement mitigation measures designed to minimize the potential for erosion, revegetate disturbed areas, increase the stabilization of site conditions, and control the spread of noxious weeds—thereby minimizing the degree and duration of the cumulative impact on vegetation from these projects.	5 feet either side of the trench line and where necessary for grading a level surface; timber salvage operations shall use cut off-type saw equipment; trees shall be felled in such a way that they fall toward the center line of the ROW; there will be no disposal of woody debris in wooded areas along the pipeline ROW; pruning of branches hanging over the ROW shall be done only when necessary for construction; and stump removal and brush clearing shall be done with bulldozers equipped with brush rakes to preserve organic matter.
Wildlife	3.6	Pipeline construction would result in short-term disturbance and long-term modification to wildlife habitats. However, the total habitat loss is expected to be small in the context of total available habitat.	Construction and operation of the Keystone Project, along with the reasonably foreseeable projects, would result in short-term disturbance to wildlife and long-term wildlife habitat modification. Keystone would incrementally add to the area of habitat disrupted and to the disturbance of resident and migrating species, causing associated impacts on these species as they adjust to the changes brought about by the proposed projects. Increased movement or displacement of species dependent on the disturbed habitats could reduce carrying capacities, reproductive effort, or survival. This potential is greater for species for which suitable habitat is limited in the Project area or that are otherwise sensitive to disturbance.	Spoil and topsoil wind rows shall not be located such that obvious wildlife trails are blocked.

TABLE ES-5 (Continued)				
Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
Fisheries	3.7	Possible impacts to fisheries could occur through siltation and disturbance of streams crossed by the proposed pipeline. Any short-term disturbance caused by instream activities likely would resemble natural high-flow events in the stream. There is a risk that non-native species could be introduced into receiving waters during the disposal of hydrostatic testing water. Keystone has proposed to undertake hydrostatic testing during spring, summer, and autumn, overlapping with key spawning months of April to July. This overlap could affect some sensitive species during breeding.	Because construction schedules for the REX pipeline and the other non-linear projects are different from the Keystone Project, cumulative impacts on fisheries would not occur. If construction of facilities or other projects does become concurrent due to schedule changes, the Keystone Project would contribute to cumulative sedimentation impacts on fisheries. Nevertheless, these impacts would be short term and minor due to implementation of mitigation measures and the requirements of any individual state permits to minimize impacts while crossing water bodies.	Following the proposed mitigation procedures during construction would result in minor short-term impacts to aquatic habitats and organisms. To mitigate impacts, construction would involve dry-ditch techniques at crossings where the timing of construction does not adequately protect environmentally sensitive water bodies, as determined by the appropriate regulatory authority. Horizontal directional drilling (HDD) would be used at designated major and sensitive water bodies. For hydrostatic testing, the intake hose shall be screened to prevent the entrainment of fish or debris. The hose shall be kept off the bottom of the water body. Pumps used for hydrostatic testing within 100 feet of any water body or wetland shall be operated and refueled in accordance with Section 3.0 of Appendix B. Adequate flow rates in the water body shall be maintained to protect aquatic life, provide for all water body uses, and provide for downstream withdrawals of water by existing users. Chemicals shall not be used in the test water. Water containing oil or other substances in sufficient amounts to create a visible color film or sheen on the surface of the receiving water shall not be discharged. Any water obtained or discharged shall comply with permit requirements. Detailed mitigation measures for dewatering the pipeline are provided in Section 8.4 of Appendix B.

TABLE ES-5
(Continued)

Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
Threatened and Endangered Species	3.8	Preliminary data identified 55 federally or state-listed threatened, endangered, or candidate species potentially occurring in or near the Keystone Project ROW. Potential impacts on individual species include habitat loss, alteration, and fragmentation; decreased breeding; direct mortality; and reduced survival or reproduction.	Because the Keystone pipeline would parallel the REX pipeline across Kansas and Missouri, many of the state- and federally listed threatened and endangered species could potentially be affected by construction and operation of these projects. Each project is required to consult with federal, state, and local agencies to determine which species may occur within each individual project area; evaluate potential impacts on those species during construction and operation; and implement measures to avoid, minimize, or mitigate impacts on special-status species and their habitats.	Keystone has been and will continue to contract a qualified biologist to conduct surveys of sensitive species associated with particular habitats along the pipeline corridor. Details regarding mitigation measures for potential encounters with threatened and endangered species are provided in Section 2.9 of Appendix B.
Land Use	3.9	Agricultural, rangeland, forestland, recreational/special use, commercial, and residential land use classes would be affected in areas intersected by the proposed ROW. The largest amount of acreage that would be affected by the Keystone Project would be agricultural land, followed by rangeland. After construction, nearly all agricultural land along the ROW would be allowed to return to production, and productivity is not expected to be reduced significantly over the long term. Approximately 140 acres would be necessary for construction of aboveground facilities; these acres would be permanently removed from farming production. Recreational lands potentially affected include bike trails, sightseeing areas, hiking trails, and wildlife viewing areas; public lands are limited along the ROW. Construction activities are anticipated to cause only temporary impacts.	Land use changes associated with the portion of the REX pipeline that is collocated with Keystone would cumulatively add to the acreage of aboveground oil and gas facilities in the Project area. In addition, the ethanol and coal-fired power plants that would be constructed in Audrain County and Carroll County, Missouri, respectively, would further increase the amount of land in those counties that would be converted to industrial use	Keystone also has developed mitigation plans for limiting impacts on soil drainage mechanisms, compaction, irrigation systems, farm access areas, windbreaks and living fences, and Conservation Reserve Program lands. Keystone has further sought to minimize impacts on rangelands by developing range-specific mitigation measures. Keystone would coordinate with agency and land use managers to reduce conflicts between construction activities and recreational uses. Details on these measures are provided in Appendix B.

TABLE ES-5 (Continued)				
Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
Socio economics	3.10	Construction. Pipeline construction activities would generate substantial direct and indirect economic benefits. Potentially negative impacts include agricultural losses, and increased demands on local highways and emergency services. Some disruption of traffic flows would be expected. Potentially adverse socioeconomic effects including increased demand for public services and inexpensive housing could disproportionately affect lower income areas. Other environmental justice concerns, such as disproportionate air and water quality impacts to communities, would not be expected. Operations. The economic impacts of operating the pipeline are expected to be positive, due to generation of permanent jobs and increased property tax revenue.	Portions of the construction period and locations for the Keystone Project and the collocated portion of the REX Project could overlap due to delays or other issues. These projects, together with any other linear and non-linear projects planned for the Project area, would require workers to temporarily relocate to the Project area during construction, potentially inducing housing shortages at certain locations during certain periods of the construction schedule. The increased tax revenue paid to the state and local governments over the life of the projects also may result in a beneficial long-term cumulative impact. Operation of the proposed facilities would require relatively few permanent employees; thus, there would be no long-term cumulative or additive impacts on population, housing, or municipal services in the Project area.	Agricultural losses would be compensated by Keystone during the easement procurement process, Keystone will maintaining access and traffic flow on local roads during construction activities, particularly for emergency vehicles. Any impacts on local roads would be repaired by Keystone.
Cultural Resources	3.11	To limit impacts on cultural resources, the Keystone Project is avoiding all cultural resources that are listed in or potentially eligible for listing in the National Register of Historic Places (NRHP). Short term construction-related impacts will be minimized through implementation of Keystone's Mitigation Plan (Appendix B). Inadvertent discoveries of buried cultural resources may occur.	No cumulative impacts to cultural resources are anticipated.	Keystone intends to avoid all cultural resources by rerouting the pipeline corridor and/or related appurtenances, avoiding construction activities on properties listed in or eligible for listing in the NRHP, as well as boring and using HDD through culturally sterile soils. Short-term, construction-related impacts will be mitigated through implementation of Keystone's Mitigation Plan (Appendix B). If any adverse effects do occur, they will be resolved through consultation with the Advisory Council on Historic

TABLE ES-5
(Continued)

Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
				Preservation, as well as any applicable Native American tribes, agencies, and the State Historic Preservation Officers. A Programmatic Agreement also will be drafted to address the protocols for inadvertent discoveries, future cultural resources identification and avoidance commitments, and the process for future consultation.
Air	3.12	Construction. Because pipeline construction would move through an area relatively quickly, air emissions typically would be localized, intermittent, and short term. Because Keystone will be required to comply with applicable regulations, emissions from construction-related activities would not significantly affect local or regional air quality. Operations. Project operations would not produce significant air quality impacts, and only minor emissions from the backup gasoline generator and fugitive emissions from valves, tanks, and pumping equipment would occur. Because operating emissions are expected to be minimal, no operational permits would be required.	Should construction periods overlap, the proposed Keystone Project would incrementally add to dust generation and combustion emissions from heavy equipment that also would be produced by the other reasonably foreseeable future projects discussed above. On a local scale, cumulative increases in air emissions could occur where new compressor or pump stations are located at or near existing or proposed compressor stations, or other existing industrial facilities. Pump stations for the Keystone Project also could be located near a proposed ethanol plant in Audrain County, Missouri and the proposed coal-fired power plant in Carroll County, Missouri. Each pump or compressor station and ethanol or power plant would be required to obtain state construction and operation permits, and potential interactions with nearby emission sources would be considered in these permit applications. Emissions from the facilities would be reduced by best available technology.	Keystone's contractor shall at all times control airborne dust levels during construction using water trucks, sprinklers or calcium chloride as necessary to reduce dust to acceptable levels. Dust shall be strictly controlled where the work approaches dwellings, farm buildings, and other areas occupied by people and when the pipeline parallels an existing road or highway. Emissions from fugitive dust, construction equipment combustion, open burning, and temporary fuel transfer systems and associated tanks would be controlled to the extent required by state and local agencies, through the permit process.

TABLE ES-5 (Continued)				
Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
Noise	3.12	Construction. Residential, agricultural, and commercial areas within 500 feet of the project would experience short-term inconvenience from construction equipment noise. Operations. Noise associated with the electric pump stations would be limited to the immediate vicinity of the facilities, and are projected to be minor.	The Keystone Project, along with the other reasonably foreseeable projects, would contribute to ambient noise levels during construction. These noise impacts would be temporary and would occur only during the construction period for each facility or linear project. Because construction proceeds in sections along the pipelines and linear projects, the duration of construction activities—and therefore noise impacts—at any given location at any given time would be limited and short term. Cumulative effects on ambient noise levels would occur only if construction on a congruent section of each project occurred simultaneously. No new major sources of noise are expected during operation of the Keystone facilities that would be near or collocated with facilities associated with the other reasonably foreseeable projects.	Noise impacts from construction would be mitigated in accordance with Keystone's Mitigation Plan (Appendix B) to reduce effects on individuals, sensitive areas, and livestock. To limit disturbance of residential and commercial areas within 500 feet of construction activities by increased noise levels, Keystone would give advanced notice to landowners prior to construction, limit the hours during which construction activities with high-decibel noise levels are conducted, and ensure that construction proceeds quickly through such areas. Keystone would perform a noise assessment survey during operations to confirm the level of noise at each listed noise-sensitive area. Project-related operations therefore are not expected to result in a significant effect on the noise environment.
Reliability and Safety	3.13	The reliability and safety of the Keystone Project can be expected to be well within industry standards. Further, the low probability of large, catastrophic spill events and the routing of the pipeline to avoid most sensitive areas suggest a low probability of impacts to human and natural resources. Nevertheless, some potential for construction- and operation-related spills can be expected.	Keystone and similar crude oil pipeline projects are required to comply with USDOT and state and local regulations regarding pipeline safety, leak detection, and spill response. The Platte pipeline (which is collocated with both the REX and Keystone Projects from the Nebraska/ Kansas border to Troy, Missouri and collocated with Keystone to Wood River, Illinois) could contribute to cumulative effects should an incident occur in relatively the same timeframe from each pipeline or facility.	The Keystone pipeline system would be designed, constructed, and maintained in a manner that meets or exceeds industry standards and regulatory requirements. Details regarding Keystone's Spill Prevention and Containment Plan are provided in Section 3.0 of Appendix B. Keystone's preventative maintenance, inspection, and repair program would monitor the integrity of the pipeline and make repairs if necessary. In compliance with applicable regulations governing the operation of pipelines, periodic inline inspections would be conducted to collect

TABLE ES-5
(Continued)

Resource	Draft EIS Section	Direct and Indirect Impacts	Cumulative Impacts[a]	Proposed Mitigation Measures[b]
				information on the status of pipe for the entire length of the system. In addition, line patrol, leak detection systems, SCADA, fusion-bond epoxy coating, and construction techniques with associated quality control would be implemented. To mitigate the impacts of small spills and leaks, refueling of construction equipment shall be conducted a minimum distance of 100 feet from the stream or a wetland.

[a] Cumulative impacts for each resource category are discussed in Section 3.14 of the Draft EIS.

[b] Mitigation has been proposed by Keystone at the time of Draft EIS publication and is summarized briefly in this table; additional details and a comprehensive list of measures proposed by Keystone are provided in Appendix B. Additional measures recommended by DOS can be found in the appropriate Draft EIS section for the resource.

spills or leakage from equipment could contaminate soils. Keystone has proposed construction methods and mitigation measures to address these concerns, and additional recommended measures are described in the Draft EIS.

In terms of operations impacts, differential settling around the proposed pipeline likely would be minor and would be addressed by mitigation measures. Soil temperature impacts would be limited to within 3 feet of the pipeline and would not result in serious soil moisture loss; mitigation would be adequately addressed through the recommendations discussed in the Draft EIS

ES.6.3 Water Resources

Overall, it is not anticipated that surface water or groundwater quality would be significantly affected by normal disposal activities (such as disposal of hydrostatic test water), non-catastrophic spills, or leaks during pipeline construction and operation. Hydrostatic testing, which would involve the uptake and discharge of water, should not cause any adverse impacts if Keystone's Mitigation Plan (Appendix B) is followed.

Many of the aquifers present beneath, or in the vicinity of, the proposed route are isolated by the presence of glacial till, which characteristically inhibits downward migration of water and contaminants into these aquifers. Although the pipeline has been routed to avoid most near-surface aquifers, in several areas shallow or near-surface aquifers are present beneath the proposed route. For these areas, measures have been proposed (such as containment structures) to reduce the potential impact of leaks and spills during construction. Keystone's Mitigation Plan outlines procedures for contractor preparedness and emergency spill response to reduce the potential for contaminants to migrate into the aquifer during construction activities. Additionally, the risk of dewatering shallow groundwater aquifers or reducing groundwater quality through an increase in total suspended solids during construction likely would be temporary, and these aquifers are expected to recover quickly following construction activities. Construction and normal operations therefore are not expected to result in a long-term significant impact on groundwater.

Keystone has proposed three construction methods for crossing surface water bodies: dry-cut methods, open cut wet crossings, and horizontal directional drilling (HDD). The HDD method would avoid any impacts on water bodies; however, the open cut wet method, involving trenching while water continues to flow, would entail a high risk of temporary siltation to streams and other water bodies. Dry-cut methods are not feasible for wider streams. The risks of open-cut trenching could be temporary (for the duration of construction) or longer term (where compromised stream bank stability or bank erosion occurs). Keystone's Mitigation Plan (Appendix B) includes several measures to reduce siltation and erosion. Additional measures are recommended in the Draft EIS.

ES.6.4 Wetlands

Wetlands that would be affected within the ROW include emergent wetlands (658 acres), forested wetlands (148 acres), perennial riverine wetlands (54 acres), intermittent riverine wetlands (59 acres), and scrub-shrub wetlands (33 acres). While emergent wetlands would regenerate quickly after disturbance (within 3–5 years generally), forested and scrub-shrub wetlands would potentially experience long-term effects. Wetlands in parks or reserves have significant conservation value. Keystone would implement mitigation measures described in its Mitigation Plan, including restoration efforts in some cases. Additional recommended mitigation measures are described in this Draft EIS.

ES.6.5 Terrestrial Vegetation

Terrestrial vegetation classes include all the wetland classes in addition to grasslands, upland forest, and developed land. Grassland impacts due to pipeline construction are expected to be minimal, and affected vegetative communities generally are expected to reestablish within 2 years. Construction through 29 miles of previously untilled prairie could produce irreversible impacts, as prairie sod can take up to 100 years to recover. As described in this Draft EIS, Keystone has identified several measures to limit impacts on vegetation, and additional measures are recommended.

Impacts on upland forest and shrubland would be longer term than those anticipated for grassland, because of the time required for these plant communities to reestablish and reach mature, pre-construction conditions.

ES.6.6 Wildlife

Pipeline construction would result in short-term disturbance and long-term modification to wildlife habitats. Increased habitat fragmentation would be experienced by white-tailed deer and other large mammals. Although disturbance of dens during winter hibernation could be potentially fatal for newborn black bears cubs, the probability of this event is extremely low, as black bear habitat minimally overlaps the ROW. Small game birds and rodents would be affected through destruction of nests and burrows, death of young or loss of eggs, and loss of foraging areas and cover. However, the total habitat loss is expected to be small in the context of total available habitat.

ES.6.7 Fisheries

Possible impacts to fisheries could occur through siltation and disturbance of streams crossed by the proposed pipeline. Following the proposed mitigation procedures during construction would result in minor short-term impacts to aquatic habitats and organisms. Any short-term disturbance caused by instream activities likely would resemble natural high-flow events in the stream. To mitigate impacts, construction would involve dry-ditch techniques at crossings where the timing of construction does not adequately protect environmentally sensitive water bodies, as determined by the appropriate regulatory authority. HDD would be used at designated major and sensitive water bodies (ENSR 2006a). However, along the Cushing Extension through Kansas, Keystone has proposed to use HDD at only two of six locations designated as special use. Measures to address sensitive stream crossing have been proposed in the Draft EIS.

There is a risk that non-native species could be introduced into receiving waters during the disposal of hydrostatic testing water. Keystone has proposed to undertake hydrostatic testing during the spring, summer, and autumn months, overlapping with key spawning months of April to July. This overlap could affect some sensitive species during breeding.

ES.6.8 Threatened and Endangered Species

Preliminary data identified 55 federally or state-listed threatened, endangered, or candidate species potentially occurring in or near the Keystone Project ROW. These include mammals, reptiles, insects, birds, fish, mollusks, and plants. Most affected habitat would include croplands (13,594 acres) and grasslands (4,112 acres), followed by wetlands and open water (845 acres), and upland and riparian forests (1,078 acres). Loss of shrublands and wooded habitats would be long term (5–20 years) in reclaimed areas of the construction ROW.

As discussed in detail in the Draft EIS, potential impacts on individual species include:

- Habitat loss, alteration, and fragmentation;
- Decreased breeding success due to disturbance from construction and operations noise and increased human activity;
- Direct mortality from project construction and operation and/or collision with or electrocution by power lines;
- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 3.13).
- Reduced survival or reproduction due to decreased abundance of forage species;
- Interruption of foraging activities due to exposure to construction and operations noise and increased human activity.

ES.6.9 Land Use

Agricultural, rangeland, forestland, recreational/special use, commercial, and residential land use classes would be affected in areas intersected by the proposed ROW. The largest amount of acreage that would be affected by the Keystone Project would be agricultural land, followed by rangeland.

Keystone is planning to undertake construction over an 18-month period, during which agricultural lands in the ROW would not be farmed. Keystone has agreed to compensate landowners for crop and other losses on a case-by-case basis. Keystone also has developed mitigation plans for limiting impacts on soil drainage mechanisms, compaction, irrigation systems, farm access areas, windbreaks and living fences, and Conservation Reserve Program (CRP) lands. After construction, nearly all agricultural land along the ROW would be allowed to return to production, and productivity is not expected to be reduced significantly over the long term. Approximately 140 acres would be necessary for construction of aboveground facilities; these acres would be permanently removed from farming production. Keystone has further sought to minimize impacts on rangelands by developing range-specific mitigation measures.

Although it is unclear at present exactly how many CRP acres would be affected by pipeline construction and operation, the Farm Service Agency has estimated that, in a worst-case scenario, over 16,000 acres of CRP land would be affected during construction, with over 6,500 acres remaining affected due to pipeline operation. It is likely that total affected CRP acreage would be less than these estimates. Impacts on CRP lands would include tilling of grasslands and clearance and tillage of forested lands; if within the operational ROW, these lands would not be allowed to regenerate during the life of the Project. Thus, impacts on these lands would be localized but long term. Keystone would address these impacts, and any impacts to Farmable Wetland Program Lands and Wetlands Reserve Program lands, with landowners on a case-by-case basis. Overall impacts on residential and commercial land uses are expected to be minor and would be addressed by Keystone through landowner negotiations on a case-by-case basis.

Recreational lands potentially affected include bike trails, sightseeing areas, hiking trails, and wildlife viewing areas; public lands are limited along the ROW. Construction activities are anticipated to cause only temporary impacts. Keystone would coordinate with agency and land use managers to reduce conflicts between construction activities and recreational uses.

ES.6.10 Socioeconomics

The proposed pipeline construction has the potential to generate substantial direct and indirect economic benefits. Keystone is expected to utilize temporary local construction labor where possible, and

Likewise, non-local residents would temporarily move into the area of influence. This would translate into the need for additional housing units, rental units, and or hotel rooms. Keystone estimates that, at the local level, construction income benefits are expected to total from $28 to $48 million. Approximately 40 percent of the cost of construction goods and services, or from $44 to $52 million, would be spent locally.

Potentially negative impacts include agricultural losses, which would be compensated by Keystone during the easement procurement process, and increased demands on local highways and emergency services. Keystone does not anticipate any other increased public expenditures. Some disruption of traffic flows would be expected; Keystone would use public and preexisting private roads to access most of the ROW. Any impacts on local roads would be repaired by Keystone.

The impacts of operating the pipeline are expected to be positive. The cost of operational goods and services is estimated at $1.3 million per year, plus an additional $46.5 million for electricity. About 90 percent of this ($43 million annually) would be spent locally in the Project area. Approximately 26 permanent full-time jobs would be associated with operation of the pipeline, representing an annual payroll of $5.5 million. The project would generate additional property tax revenues of approximately $46.7 million throughout the Project area.

Agricultural losses along the pipeline corridor would likely be relatively low; however, in a very unlikely "worst case" scenario, over 16,000 acres of CRP-enrolled lands could be affected. This scenario assumes that all acreage enrolled in the program along the corridor would be sufficiently affected that the land would need to be removed from the program according to the rules of the CRP. In reality, the actual acreage that would be removed is likely to be a fraction of the overall enrolled acreage. Keystone has agreed to address the actual economic impacts resulting from crossing CRP lands on a case-by-case basis with the individuals potentially affected. In addition, as part of the ROW procurement process, Keystone would negotiate with the affected landowners to obtain an easement, compensating for any losses, including potential decreases in property values.

Expansion of the Wood River Refinery in response to increased crude oil deliveries from the Keystone pipeline is expected to generate both positive and adverse socioeconomic effects. Expansion of the Wood River Refinery is estimated to cost approximately $1 billion, which likely would include expenditures on capital equipment, other goods and materials, services, and labor. To the extent that these expenditures are made in the local region, for example Madison County, and industries are present to meet Project demands, the Project would result in substantial regional economic benefits. Within an input-output model framework, these benefits would include increases in direct, indirect, and induced economic output; value added (i.e., labor income, other property income, and indirect business taxes); and employment in the region.

In the long term, expansion of the Wood River Refinery would result in greater refining capacity and increased production/output in the refined petroleum industry. Based on an estimated 340,000 bpd in increased crude oil shipments and an approximate crude oil contract price of $60 per barrel, the estimated value of refinery inputs is $20.4 million per day, or $744.6 million annually. Other socioeconomic parameters that could be affected by expansion of the Wood River Refinery include increases in fiscal revenues and increased demands for public services and other local resources.

Potentially adverse socioeconomic effects could occur—particularly during construction—as a result of increased demand for a range of public services, including law enforcement, fire protection, and medical aid. This could disproportionately affect lower income areas. Depending on the characteristics of the construction workforce, demands may increase for short-term housing in the region, such as hotels/motels and rental units, driving rents up and affecting lower income or minority populations. Other environmental justice concerns, such as disproportionate air and water quality impacts to communities, would not be expected.

ES.6.11 Cultural Resources

A cultural resource is defined as any historic district, archeological site, building, structure, or object that is either listed, or eligible for listing, in the National Register of Historic Places (NRHP). Cultural resources may also include traditional cultural properties. Resource types that have been currently identified within the Keystone Project APE include pre-contact and historic archaeological sites, historic-era farmsteads, railroads, historic trails, as well as historic cemeteries and pre-contact burial sites. The principal types of adverse effects that could occur for this project include physical destruction of or damage to all or part of the property caused by pipeline trenching or related excavations or boring, introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features by short term pipeline construction or construction of above-ground appurtenant facilities and roads, and change of the character of the property's use or of physical features within the property's setting that contribute to its significance.

To mitigate impacts to cultural resources, using the FERC project approach, the Keystone Project is avoiding all cultural resources that are potentially eligible for listing in the NRHP. Avoidance is achieved by rerouting the pipeline corridor or related roadways, work spaces, and appurtenances; avoiding construction activities on NRHP-eligible properties; and by boring or using HDD beneath resources. Short term, construction-related impacts, such as excessive dust, noise, and visual impacts will be mitigated by implementing the Keystone Mitigation Plan (Appendix B). If adverse effects do occur, they will be resolved through consultation with the Advisory Council on Historic Preservation (ACHP); any applicable agency, tribal groups, and public organization; and the respective State Historic Preservation Officer (SHPO). A Programmatic Agreement will be drafted to address the protocols for unanticipated discoveries, future cultural resources identification efforts, avoidance commitments and measures, and the process for future consultation.

DOS is in the process of consulting under Section 106 of the National Historic Preservation Act (NHPA) with the SHPO, Native American tribes, and the ACHP to make final determinations of NRHP eligibility and findings of effect for the cultural resources identified within the Keystone area of potential effect. Monthly consultation meetings and conference calls have been ongoing with interested agencies and tribes to share information on the Project and develop a Programmatic Agreement.

ES.6.12 Air Quality

Two types of impacts on air quality were considered for this analysis: temporary impacts resulting from emissions associated with construction activities, and long-term or permanent impacts resulting from emissions generated from continued operation of a stationary source.

Construction of the proposed Keystone Project would be similar to other pipeline projects in terms of schedule, equipment used, and types of activities. Because pipeline construction would move through an area relatively quickly, air emissions typically would be localized, intermittent, and short term. Emissions from fugitive dust, construction equipment combustion, open burning, and temporary fuel transfer systems and associated tanks would be controlled to the extent required by state and local agencies, as explained above. Because Keystone will be required to comply with applicable regulations, emissions from construction-related activities would not significantly affect local or regional air quality. Project operations would not produce significant air quality impacts, and only minor emissions from the backup gasoline generator and fugitive emissions from valves, tanks, and pumping equipment would occur. Because operating emissions are expected to be minimal, no operational permits would be required.

ES.6.13 Noise

Construction would increase noise levels in the vicinity of Project activities; noise levels would vary during the construction period, depending on the construction phase. Residential, agricultural, and commercial areas within 500 feet of the Mainline Project and the Cushing Extension ROW would experience short-term inconvenience from construction equipment noise. Noise impacts from construction would be mitigated in accordance with Keystone's Mitigation Plan (Appendix B) to reduce effects on individuals, sensitive areas, and livestock. To limit disturbance of residential and commercial areas within 500 feet of construction activities by increased noise levels, Keystone would give advanced notice to landowners prior to construction, limit the hours during which construction activities with high-decibel noise levels are conducted, and ensure that construction proceeds quickly through such areas. Additional recommendations are summarized in Section 5.12.2.

During operation of the pipeline, the noise associated with the electric pump stations would be limited to the immediate vicinity of the facilities. Although noise impacts from the electric pump stations are projected to be minor, Keystone would perform a noise assessment survey during operations to confirm the level of noise at each listed noise-sensitive area. Project-related operations therefore are not expected to result in a significant effect on the noise environment.

ES.6.14 Reliability and Safety

As discussed in this Draft EIS, the most common spills are the very small (< 5 bbl) and small (5–49.9 bbl) spills of diesel, hydraulic fluid, transmission oil, and antifreeze on work pads, roads, and facility parking or work areas. Some small spills may result from slow and small leaks of crude oil from the pipeline. Most of these small spills would not reach non-facility land or water bodies. Significant (50–499.9 bbl) and large (500–5,000 bbl) spills are much less common. Significant spills are more likely to: (1) be caused by accidents at construction and operation/maintenance sites; (2) be composed of refined products; and (3) occur on or near roads, construction pads, facility sites, or along the ROW.

Very large (>5,000 bbl) spills are a highly unlikely, but nonetheless possible, event. They are likely to result from a major rupture or a complete break in the pipeline and would release crude oil somewhere along the ROW. Causes could include corrosion; major earth movement resulting from slides, earthquakes, or flood flows eroding river banks at non-HDD crossings; mechanical damage from excavation work; or vandalism and terrorist actions. The actual volumes spilled could vary, depending on the location and the activation methods and times for valves, pressure in the line, actual location of the break, the extent to which the pipeline follows the topographic contours and presence of low spots in the pipeline, and other factors.

The Keystone pipeline system would be designed, constructed, and maintained in a manner that meets or exceeds industry standards and regulatory requirements. The proposed Keystone Project would be built within an approved ROW. Signage would be installed at all road, railway, and water crossings—indicating that a pipeline is located in the area—to help prevent third-party damage or impact to the pipeline. Keystone would manage a crossing and encroachment approval system for all other operators. Keystone would ensure safety near its facilities through a combination of programs encompassing engineering design, construction, and operations; public awareness and incident prevention programs; and emergency response programs. Details regarding Keystone's Spill Prevention and Containment Plan are provided in Section 3.0 of Appendix B.

Keystone's preventative maintenance, inspection, and repair program would monitor the integrity of the pipeline and make repairs if necessary. Keystone is required to prepare an Integrity Management Plan that would describe Keystone's Pipeline Maintenance Program in detail. In compliance with applicable regulations governing the operation of pipelines, periodic inline inspections would be conducted to collect information on the status of pipe for the entire length of the system. Additional types of information collected along the pipeline would include cathodic protection readings, geotechnical investigations, aerial patrol reports, and routine investigative digs. In addition, line patrol, leak detection systems, SCADA, fusion-bond epoxy coating, and construction techniques with associated quality control would be implemented

The reliability and safety of the Keystone project can be expected to be well within industry standards. Further, the low probability of large, catastrophic spill events and the routing of the pipeline to avoid most sensitive areas suggest a low probability of impacts to human and natural resources. Nevertheless, some potential for construction- and operation-related spills can be expected. Commitments and procedures described for reliability and safety in this section and in Appendices B and C are intended to mitigate spill effects, particularly when considered in combination with rapid and effective response and clean-up procedures.

ES.6.15 Cumulative Impacts

As defined in 40 CFR 1508.7, cumulative impacts are the incremental impacts on the environment resulting from adding the proposed action to other past, present, and reasonably foreseeable future actions. Cumulative impacts were assessed by combining the potential environmental impacts of the proposed action with the impacts of projects that have occurred in the past, are currently occurring, or are proposed in the future within the pipeline corridor or in the vicinity of the pipeline ROW.

ES.6.15.1 Past and Existing Projects

Several existing pipelines transport natural gas liquids and compressed natural gas across North Dakota, South Dakota, and Nebraska from hubs in Montana to the west or Illinois to the east. The Williston Basin Pipeline carries compressed natural gas and crosses through the southern part of North Dakota, and a natural gas liquid pipeline crosses the southeast corner of Nebraska and continues in a southwest direction through Kansas. Portions of this pipeline may parallel the Keystone Project but are likely to be well outside of the Keystone Project ROW.

The Express pipeline is an existing 24-inch-diameter pipeline that interconnects with the Platte Pipeline, an existing 20-inch-diameter pipe, at Casper, Wyoming. This 1,700-mile pipeline system transports crude oil from Alberta's oil sands in Hardisty, Alberta to refineries in the U.S. Rocky Mountain and Midwest regions. In the United States, the pipeline crosses Montana, Wyoming, Nebraska, Kansas, and Missouri, and terminates in Wood River, Illinois. The section known as the Platte pipeline was built in 1952; the proposed Keystone Project would be collocated with the existing Platte pipeline from the Nebraska/ Kansas border to the Wood River, Illinois terminal.

Along the proposed Keystone Project corridor, multiple existing utility corridors serve local and regional needs. For example, the WEB Water Development Association provides high-quality water service to 7,728 rural hookups, 100 towns and bulk users, and five ethanol plants in a 17-county service area, which includes 14 counties in South Dakota and three counties in North Dakota. The Keystone Project would cross WEB-owned PVC water pipelines at eight locations in Day and Clark Counties South Dakota. In addition, numerous existing transportation projects, such as interstate and state highways and railroads, parallel or intersect the proposed Keystone pipeline ROW.

ES.6.15.2 Reasonably Foreseeable Future Projects

The Rockies Express Western Phase Project (REX Project) would include construction and operation of approximately 795.7 miles of natural gas pipeline that would transport natural gas from the Cheyenne Hub in Colorado to its terminus at the Panhandle Eastern Pipe Line Company interconnect in Audrain County, Missouri. A portion of the proposed REX pipeline would parallel the Keystone pipeline from the Nebraska/ Kansas border to Troy, Missouri (approximately 280 miles).

The REX Project proposes to construct the Turney Compressor Station, a large aboveground facility near Plattsburg in Clinton County, Missouri that is up to several miles east of the proposed location for Keystone's Pump Station 31, and a compressor station near Steele City Gage County, Nebraska that is along the ROW for the Keystone Mainline Project.

Enbridge is proposing three expansion projects to help address current and future increases in refinery demand as supply from the WCSB increases. The Southern Access, is an expansion and extension of Enbridge's existing pipeline system, including new pipeline in Wisconsin and Illinois; the Southern Lights is a petroleum products pipeline from Chicago through Wisconsin, Minnesota, and North Dakota to bring light hydrocarbons or "diluents" to the Canadian oil sands area of Alberta; and the Alberta Clipper is a new crude oil pipeline from Alberta to Superior, Wisconsin. As presently planned, these pipelines would cross Minnesota and Iowa. The sections supplying Cushing, Oklahoma and Wood River, Illinois do not appear to be collocated with the proposed Keystone Project ROW. The applicability of these projects as System Alternatives for the Keystone Project is discussed in Section ES.5.2.

Proposed non linear-projects collocated with the Keystone Project and the REX pipeline in Missouri include an ethanol plant in Audrain County (unknown completion date), and a coal-fired power plant in Carroll County (anticipated completion in 2013).

ES.6.15.3 Cumulative Impacts

Geology, Soils, and Sediments

Construction of the REX pipeline and the Keystone Project would require the commitment of granular borrow resources from areas along the pipeline corridors and areas near appurtenant facilities for the lifetime of the pipelines and related facilities. In addition, these projects and the proposed ethanol plant could result in a cumulative impact on clay pits in Audrain County, Missouri. Given the limited areal extent of the Keystone Project in comparison to the potential mineral extraction areas along the corridor, construction of the Keystone Project is not likely to result in cumulative impacts that would affect future exploitation of mineral resources in that area.

Along with construction of pipelines, roads, and other surface-disturbing activities, construction of the Keystone Project could contribute to the cumulative exposure and potential loss of scientifically valuable fossils in the project area. However, should Keystone prepare and follow a Paleontological Resources Protection Plan, significant fossil resources that may be encountered during Project construction would be identified and protected, thereby ensuring that the Keystone Project would not contribute to cumulative effects on these resources.

Potential cumulative erosion effects could occur where construction disturbance areas overlap, or are located near each other, particularly along the sections of Keystone pipeline that are collocated with REX. However, the existing pipelines, utility, and roadway projects have been installed for a number of years and the construction ROWs have been partially or completely restored to pre-existing conditions. Irrigated hayfields and pasturelands have returned to their prior uses. Both the REX Project and the Keystone Project would apply best management practices (BMPs) for soil management and protection to the pipelines and appurtenant facilities. Revegetation mixtures that are appropriate to soil conditions and expected future uses (such as grazing and wildlife habitat) would be applied to the disturbed areas. Consequently, the potential for cumulative erosion effects caused by one or more of these projects is low because consistent erosion control practices would be applied, and structural erosion control measures would be integrated between and among adjacent projects

Water Resources

Groundwater potentially would be used for Keystone, REX, and other collocated or nearby construction projects to control dust generated and for other uses during construction. Keystone does not propose to use groundwater for hydrostatic testing; however, groundwater could be used for hydrostatic testing for certain portions of the REX Project (FERC 2006). In addition, contaminant spills during construction could occur from any project in the cumulative impact study area during construction or operation. Each project would be required to implement spill containment and control plans as required by federal and state agencies. No additional cumulative impacts on groundwater volume or quality from the Keystone Project are expected.

Impacts due to crossing of surface waters by linear projects, such as highways and pipelines, are generally localized and short term. However, if construction activities of the Keystone Project and the collocated portion of REX pipeline follow a similar schedule, there could be a cumulative contribution to incremental sedimentation in adjacent surface waters. At present, the project schedules show construction of the two projects separated by at least a year. In addition, each project—as well as any other collocated construction projects—would be required to follow BMPs and permit conditions to protect surface waters.

Both the Keystone Project and other portions of the REX Project plan to use surface water for hydrostatic testing. However the timing for REX withdrawals would not overlap with withdrawals planned for Keystone; therefore, cumulative effects on surface water or groundwater due to hydrostatic test water withdrawals would not occur.

Wetlands

Cumulative impacts on wetlands would occur in locations where any of the Keystone Project and REX pipelines or other construction projects would be collocated while crossing wetlands. A portion of the REX Project would be collocated with the Keystone pipeline for about 280 miles. Within the Keystone Project pipeline collocation, the REX pipeline would disturb a total of 77.5 acres of wetlands (55.0 acres of forested wetland, 1.3 acres of scrub-shrub wetlands, and 21.2 acres of wet meadow and marsh) (FERC 2006). Should the Keystone pipeline affect the same or similar wetland habitats within the collocated area, but within its respective construction ROW, total wetland impacts within the collocated area could be 156.0 acres of wetlands. Both projects would follow mitigation measures to protect wetlands. In the case of REX, the FERC Procedures would apply. Other construction projects, such as town expansions, new roads and highways, and other industrial facilities—both within the section of the Keystone Project that is collocated with REX, and in other areas along the Mainline Project and Cushing Extension—could affect additional wetlands. However, applicants for any projects that would place fill in waters of the United States would be subject to conditions in the U.S. Army Corps of Engineers' Section 404 permits and to state and local water quality permits. None of the wetlands crossed by the Keystone Project would be permanently filled or drained. Therefore, the contribution of the Keystone Project on cumulative effects to wetlands in the Project area would be minor.

Terrestrial Vegetation and Wildlife

The total amount of vegetation that may be affected by all of the reasonably foreseeable projects, including the Keystone Project, is relatively small compared to the abundance of similar habitat in the Project area. Impacts resulting from construction of the pipelines and other linear and non-linear projects would result in the long-term and permanent loss of non-herbaceous vegetation and would cause a small incremental increase in fragmentation of forested areas. The effects would be further reduced by collocation of the linear projects with existing and proposed ROWs. All of the projects would implement mitigation measures designed to minimize the potential for erosion, revegetate disturbed areas, increase the stabilization of site conditions, and control the spread of noxious weeds—thereby minimizing the degree and duration of the cumulative impact on vegetation from these projects.

Construction and operation of pumping stations for Keystone and compressor stations for REX also would permanently affect vegetation and wildlife habitat. Keystone would require a total of about 61 acres of land along the Mainline Project (for aboveground facilities, including pump stations, delivery facilities, densitometer sites, and mainline valves) and about 13 acres for similar facilities along the Cushing Extension. The two compressor stations for the portion of REX that is collocated with the Keystone Project each would affect about 13 acres.

Construction and operation of the Keystone Project, along with the reasonably foreseeable projects, would result in short-term disturbance to wildlife and long-term wildlife habitat modification. Keystone would incrementally add to the area of habitat disrupted and to the disturbance of resident and migrating species, causing associated impacts on these species as they adjust to the changes brought about by the proposed projects. Increased movement or displacement of species dependent on the disturbed habitats could reduce carrying capacities, reproductive effort, or survival. This potential is greater for species for which suitable habitat is limited in the Project area or that are otherwise sensitive to disturbance.

Removal of woodlands and shrublands would result in a long-term reduction of wildlife habitat because the regeneration of woody species is typically slow in the Project region. However, construction of the Keystone pipeline is not likely to contribute significantly to cumulative impacts on wildlife, given that most of the Project area consists of relatively open fields or is presently used for agricultural purposes. Habitat types potentially crossed or affected are widely available for wildlife use outside of the immediate area of disturbance. In addition, each proposed project would be required to follow appropriate mitigation measures to minimize impacts on wildlife.

Fisheries

Stream channel disturbance and hydrostatic test water withdrawals from water bodies in Kansas and Missouri would occur during the Keystone Project, including in areas where the REX pipeline would parallel the Keystone pipeline. Because construction schedules for the REX pipeline and the other non-linear projects are different from the Keystone Project, cumulative impacts on fisheries would not occur. If construction of facilities or other projects does become concurrent due to schedule changes, the Keystone Project would contribute to cumulative sedimentation impacts on fisheries. Nevertheless, these impacts would be short term and minor due to implementation of mitigation measures and the requirements of any individual state permits to minimize impacts while crossing water bodies.

Threatened and Endangered Species

Because the Keystone pipeline would parallel the REX pipeline across Kansas and Missouri, many of the state and federally listed threatened and endangered species could potentially be affected by construction and operation of these projects. Each project is required to consult with federal, state, and local agencies to determine which species may occur within each individual project area; evaluate potential impacts on those species during construction and operation; and implement measures to avoid, minimize, or mitigate impacts on special-status species and their habitats. Because all applicants would be required to restore their respective construction ROWs and follow all applicable laws and regulations regarding special-status species and habitats, the contribution of the Keystone Project to cumulative impacts on special-status species and their habitats would not be significant.

Land Use, Recreation and Special Interest Areas, and Visual Resources

New land requirements for construction and operation of the aboveground facilities for the Keystone pipeline would involve acquisition of about 61 acres of land along the Mainline Project and 13 acres for similar facilities along the Cushing Extension. Land use changes associated with the collocated portion of the REX pipeline would cumulatively add to the acreage of aboveground oil and gas facilities in the Project area. In addition, the ethanol and coal-fired power plants that would be constructed in Audrain County and Carroll County, Missouri, respectively, would further increase the amount of land in those counties that would be converted to industrial use.

Recreation and special interest areas to the west of Troy, Missouri that would be crossed by the Keystone pipeline also would be potentially affected by the REX pipeline. This includes a number of conservation and hunting areas that are either privately or publicly owned. Recreational uses of these areas could be temporarily affected during construction activities for the pipelines. Mitigation measures created to protect the conservation area and parks would minimize the contribution of Keystone to recreational impacts.

A significant contribution to cumulative effects on visual resources from the Keystone Project is not expected due to collocation with other linear projects, restoration of the ROW, and the lack of sensitive visual resource areas that would be crossed. The majority of aboveground facilities associated with both the Keystone and REX Projects would be located in agricultural or rangeland areas, or adjacent to existing industrial facilities. In addition, the new aboveground facilities associated with the projects would be limited in number and widely distributed. Mitigation measures such as screening with vegetation and use of non-reflective paints that are similar in color to the surrounding terrain would help to minimize visual impacts.

Overall, the Keystone Project would contribute to cumulative impacts on agricultural land use and farming practices and on recreation and visual resources along the extent of the proposed ROW. While construction of new pipelines parallel to existing corridors would incrementally reduce the area available for future development, use of established utility corridors would concentrate the cumulative land use and other impacts into a less extensive area.

Socioeconomics

Portions of the construction period and locations for the Keystone Project and the collocated portion of the REX Project could overlap due to delays or other issues. These projects, together with any other linear and non-linear projects planned for the Project area, would require workers to temporarily relocate to the Project area during construction, potentially inducing housing shortages at certain locations during certain periods of the construction schedule. Workers would be dispersed over the entire length of the pipeline route and throughout the counties and states crossed by the pipelines. Based on the review of the information regarding availability of local rental housing for both projects, the combined number of non-local workers may exceed the available housing in a given area. However, the preference of most workers likely would be short-term accommodations, primarily in hotels and motels that would be found in the more populated, service-oriented communities located within a reasonable commuting distance from the work site.

During construction of the Keystone Project, the Applicants' expenditures for payroll, local purchases, and related tax revenues would provide a short-term beneficial impact to the affected counties. Similar benefits are likely to be associated with the REX Project and any other non-linear or industrial projects. The increased tax revenue paid to the state and local governments over the life of the projects also may result in a beneficial long-term cumulative impact. Operation of the proposed facilities would require relatively few permanent employees; thus, there would be no long-term cumulative or additive impacts on population, housing, or municipal services in the Project area.

Cultural Resources

To date, the REX Project surveys have identified nine potential historic properties in Nebraska, Kansas, and Missouri that may also be in the vicinity of the Keystone Project. Federally regulated projects such as Keystone and REX are required to conduct cultural resources surveys and identify historic properties that may be affected by those projects. In accordance with 36 CFR 800, the ACHP's regulations for implementing Section 106 of the NHPA, the lead federal agencies for those projects would consult with the appropriate SHPOs, Native American tribes, and other consulting parties, and would mitigate impacts on any historic properties that may be adversely affected. Other potential non-federal actions in the Project area would be required to comply with any identification procedures and mitigation measures required by the state where the action is proposed. Therefore, no cumulative impacts on cultural resources are expected.

Air Quality

Should construction periods overlap, the proposed Keystone Project would incrementally add to dust generation and combustion emissions from heavy equipment that also would be produced by the other reasonably foreseeable future projects discussed above. Cumulative fugitive dust (particulate) increases could occur where the REX, Keystone, and other non-linear construction projects use the same access road systems.

On a local scale, cumulative increases in air emissions could occur where new compressor or pump stations are located at or near existing or proposed compressor stations, or other existing industrial facilities. Depending on the final locations for pump stations for the Keystone Project, facilities also could be located near a proposed ethanol plant in Audrain County, Missouri and the proposed coal-fired power plant in Carroll County, Missouri. Each pump or compressor station and ethanol or power plant would be required to obtain state construction and operation permits, and potential interactions with nearby emission sources would be considered in these permit applications. Emissions from the facilities would be reduced by best available technology.

The majority of the potential cumulative construction and operational effects on air quality due to the Keystone Project would be negligible because of the large geographical area over which the various existing and reasonably foreseeable projects are located, and the fact that these projects likely would be constructed over varying periods.

Noise

The Keystone Project, along with the projects discussed above, would contribute to ambient noise levels during construction. Construction noise impacts would be temporary and would occur only during the construction period for each facility or linear project. Because construction proceeds in sections along the pipelines and linear projects, the duration of construction activities—and therefore noise impacts—at any given location at any given time would be limited and short term. Cumulative effects on ambient noise levels would occur only if construction on a congruent section of each project occurred simultaneously.

No new major sources of noise are expected during operation of the Keystone facilities that would be near or collocated with facilities associated with the other reasonably foreseeable projects. Noise levels resulting from operation of the pump stations for Keystone and the meter and regulator facilities for REX would be minimal or not noticeable, as the proposed facilities would be located in areas of low population density. Consequently, no cumulative impacts are expected. Based on a review of available information, it appears that Keystone's Pump Station 31 could be located up to several miles west of REX's proposed Turney Compressor Station in Clinton County, Missouri. Taking into account the geographical locations of the two stations, the noise data available, and preliminary calculations, Keystone's contribution to cumulative noise impacts during operations would not be significant.

Reliability and Safety

Landowners have expressed concerns about the safety of collocating multiple pipelines in a common corridor across their property. As described in this Draft EIS, Keystone is required to comply with USDOT and state and local regulations regarding pipeline safety, leak detection, and spill response. Because the REX Project will transport natural gas rather than any type of liquid material, cumulative effects caused by spills and leaks of crude oil are not expected from the two collocated pipelines. The Platte pipeline (which is collocated with both the REX and Keystone Projects from the Nebraska/Kansas border to Troy, Missouri and collocated with Keystone to Wood River, Illinois) could contribute to cumulative effects should an incident occur in relatively the same time frame from the Keystone pipeline and from one or several of the other pipelines or facilities.

ES.6.16 Conclusions

The analysis presented in this Draft EIS is based on information provided in eight filings by TransCanada and was further developed from three data requests; public and agency scoping; literature research; alternatives analysis; and contacts with federal, state, and local agencies. Based on the information provided herein, DOS and the cooperating agencies conclude that the proposed Keystone Mainline Project and Cushing Extension would result in limited adverse environmental impacts during both construction and operation, and would be an environmentally acceptable action. The conclusion assumes that the Project would be constructed and operated in accordance with all applicable laws and regulations, Keystone's proposed mitigation measures, and the additional mitigation measures recommended in this EIS.

1.0 INTRODUCTION

TransCanada Keystone Pipeline, L.P. (Keystone) has applied to the U.S. Department of State (DOS) for a Presidential Permit at the border of the United States for the proposed construction, connection, operation, and maintenance of a pipeline and associated facilities for importation of crude oil from Canada. DOS receives and considers applications for Presidential Permits for such oil pipelines pursuant to the authority delegated to it by the President of the United States under Executive Order (EO) 13337 *as amended* (69 Federal Register [FR] 25299). DOS has determined that issuance of a Presidential Permit would constitute a major federal action that may have a significant impact upon the environment within the context of the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] § 4321 et seq.). To comply with NEPA, the principal objectives of this environmental impact statement (EIS) are to:

- Identify and assess potential impacts on the natural and human environment that would result from implementation of the proposed Keystone Pipeline Project (Keystone Project) in the United States.
- Describe and evaluate reasonable alternatives to the Keystone Project in the United States that would avoid or minimize adverse effects to the environment,
- Identify and recommend specific mitigation measures, as necessary, to minimize environmental impacts, and
- Facilitate public, tribal, and agency involvement in identifying significant environmental impacts.

1.1 KEYSTONE PIPELINE PROJECT OVERVIEW

Keystone proposes to construct and operate a crude oil pipeline and related facilities to transport Western Canadian Sedimentary Basin (WCSB) crude oil from an oil supply hub near Hardisty, Alberta, Canada to destinations in the Midwest United States. The Keystone Project initially would have the nominal transport capacity of 435,000 barrels per day (bpd) of crude oil from the oil supply hub near Hardisty to an existing terminal and refinery at Wood River, Illinois, and an existing terminal at Patoka, Illinois. Additional pumping capacity could be added to increase the average throughput to 591,000 bpd if warranted by future shipper demand and market conditions. Two pipeline extensions are proposed and would be built if deemed feasible, based on shipper demand. The extensions would provide for transporting crude oil from terminals in Ft. Saskatchewan, Alberta to existing facilities in Cushing, Oklahoma. With these extensions, the pipeline would interconnect with existing crude oil pipelines that supply U.S. Gulf Coast refinery markets.

In total, the Keystone Project would consist of the Mainline Project (approximately 1,845 miles of pipeline, including about 767 miles in Canada and 1,078 miles in the United States) and the Cushing Extension (293.5 miles of pipeline in the United States). Including the Cushing Extension, the total length of pipeline in the United States would be 1,371.4 miles.

In Canada, the Keystone Project would involve purchase of an existing 537-mile, 34-inch-diameter pipeline currently owned by TransCanada Limited and conversion of that pipeline to crude oil service; construction of a new 230-mile pipeline extension from Hardisty to the existing pipeline, and construction of a pipeline extension from the existing pipeline to the U.S./Canada border (Figure 1.1-1). Conversion of the existing natural gas pipeline as opposed to a new pipeline would reduce construction costs associated with the Keystone Project. Appropriate regulatory authorities in Canada will conduct an independent environmental review process for the proposed Canadian facilities.

In the United States, the Mainline Project would comprise a 1,023-mile segment of 30-inch-diameter pipe from the Canadian border to Wood River, Illinois and an approximately 56-mile segment of 24-inch-diameter pipe between Wood River and Patoka, Illinois

The Cushing Extension would consist of 293.5 miles of 36-inch-diameter pipe extending from Steele City, Nebraska to Cushing, Oklahoma. Construction of the Cushing Extension could occur if warranted by future shipper demand and market conditions. This EIS describes and evaluates the U.S. portion of the proposed Keystone Project, including both the Mainline Project and Cushing Extension, and the additional facilities required to increase throughput capacity to 591,000 bpd.

The length of pipeline proposed within each affected state is listed in Table 1.1-1.

TABLE 1.1-1
Miles of Pipeline by State for the Keystone Project

	ND	SD	NE	KS	MO	IL	OK	Total
Mainline Project	216.9	218.9	213.7	98.8	273.1	56.5	0.0	1,078.0
Cushing Extension	0.0	0.0	2.4	210.1	0.0	0.0	81.0	293.5
Keystone Project total	**216.9**	**218.9**	**216.1**	**308.9**	**273.1**	**56.5**	**81.0**	**1,371.4**

Keystone would construct the 30- and 36-inch-diameter pipelines within a 110-foot-wide corridor, consisting of a temporary 60-foot-wide construction right-of-way (ROW) and a 50-foot-wide permanent ROW. In Illinois, the 24-inch-diameter pipeline segment would be constructed within a 95-foot-wide corridor, consisting of a temporary 45-foot-wide construction ROW and a 50-foot-wide permanent ROW.

Ownership of lands that would be crossed by the proposed Keystone Project is identified in Table 1.1-2.

The Keystone Project would require construction of pump stations, pigging[1] facilities, delivery facilities, and densitometer sites (for detection of crude oil batch interfaces). Mainline valves (MLVs) would be placed along the pipeline at locations necessary to maintain adequate flow through the pipeline. Valves would be installed and located as dictated by the hydraulic characteristics of the pipeline, as required by federal regulations, and with the intent to provide for public safety and environmental protection as part of pipeline integrity management practices. Densitometer sites for detection of crude oil batch interfaces would be located at Steele City (at the junction of the Mainline Project and the Cushing Extension), as well as at Wood River and Patoka, Illinois and Ponca City and Cushing, Oklahoma, where delivery metering and power facilities also would be located.

Electrical transmission lines and associated substation upgrades required for the Keystone Project would be constructed by local providers, who would be responsible for obtaining any necessary federal, state, and local approvals or authorizations. Construction and operation of these facilities are considered connected actions under NEPA and therefore are evaluated within this EIS.

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[1] A pig is a mechanical device that passes through the interior of a pipeline to clean or to inspect it.

TABLE 1.1-2 Ownership of Land Crossed by the Keystone Project (miles)					
	Federal	Tribal	State	Private	Total
Mainline Project					
North Dakota	0.0	0.0	0.8	216.1	216.9
South Dakota	0.0	0.0	0.5	218.4	218.9
Nebraska	0.0	0.0	0.0	213.7	213.7
Kansas	0.0	0.0	0.0	98.8	98.8
Missouri	0.1	0.0	1.9	271.1	273.1
Illinois	3.0	0.0	0.0	53.5	56.5
Mainline Project subtotal	*3.1*	*0.0*	*3.2*	*1,071.6*	*1,077.9*
Cushing Extension					
Nebraska	0.0	0.0	0.0	2.4	2.4
Kansas	3.6	0.0	0.0	206.6	210.2
Oklahoma	0.0	0.0	3.6	77.3	80.9
Cushing Extension subtotal	*3.6*	*0.0*	*3.6*	*286.3*	*2,931.5*
Keystone Project total	**6.7**	**0.0**	**6.8**	**1,357.9**	**1,371.4**

As currently proposed, the majority of the crude oil to be transported from Canada by the Keystone Project would be delivered to an existing refinery at Wood River, Illinois. A major capital project at the Wood River Refinery is planned in anticipation of receiving Canadian crude oil from the Keystone pipeline. This refinery upgrade is described in more detail in Section 1.7.

1.2 PROJECT PURPOSE AND NEED

The primary purpose of the proposed pipeline is to transport incremental crude oil production from the WCSB across the border to meet the growing demand by refineries and markets in the United States. The Keystone Project will initiate at the crude oil supply hub near Hardisty, Alberta, Canada and terminate near the crude oil storage and pipeline hub near Patoka, Illinois. Keystone also may interconnect with other existing crude oil pipelines that supply refinery markets in Cushing, Oklahoma, and the U.S. Gulf Coast.

The need for the project is dictated by a number of factors, among them:

- Increasing WCSB heavy crude oil supply combined with insufficient export pipeline capacity.
- Increasing crude oil demand in the United States and static domestic crude supply, and
- Projected oil production capacity in other traditional U.S. oil suppliers.

1.2.1 Increasing Western Canadian Sedimentary Basin Crude Oil Supply

According to Oil and Gas Journal, Canada has 179 billion barrels of proven oil reserves, with 174 billion of those reserves in oil sands located in the WCSB.[2] The Alberta Energy and Utilities Board also estimates that 174 billion barrels of proven reserves are recoverable from Canada's oil sands. The province of Alberta is now widely accepted as having the second largest reserves in the world, second only to Saudi Arabia.

Total production of crude bitumen and synthetic crude oil from the oil sands has increased from 600,000 to 1.1 million bpd by the beginning of 2007.[3] As of mid-2006, the number of major mining, upgrading, and thermal in situ production projects has grown to include over 46 existing and proposed projects, encompassing 135 individual project expansions phases in various stages of execution. Canadian National Energy Board's (CNEB's) 2006 projections indicate a relatively aggressive ramp-up in oil sands production that extends to 2015.[4] CNEB's projected base scenario, in which most but not all announced projects were assumed to go forward, anticipated that production capacity would increase year-over-year to eventually reach 3 million bpd by 2015.[5]

Crude oil production from the entire WCSB, including oil sands and conventional production, is now at 2.3 million bpd. According to CNEB, conventional crude oil production in the WCSB is expected to decline but as a result of rapidly growing oil sands production total WCSB production will rise to 3.9 million bpd by 2015.

1.2.2 U.S. Crude Oil Market Demand

According to the U.S. Energy Information Administration (EIA), U.S. consumption of liquid fuels (crude oil and refined products) is projected to total 26.9 million bpd in 2030, an increase of 6.2 million bpd over the 2005 total.[6] Most of this increased demand is expected to be met with crude oil imports. In 2005, net imports of liquid fuels (primarily petroleum) accounted for 60 percent of domestic consumption. The United States is expected to continue its dependence on liquid fuel imports. The import share of domestic consumption declines slightly to 55 percent in 2015 before climbing to 61 percent in 2030.[7] Based on this projection, U.S. imports by 2030 will be 16.5 million bpd, up from 12.4 million bpd in 2005—an increase of 4 million bpd in imported oil.

Canada has traditionally been the United State's largest supplier of oil due to its reliability and proximity to U.S. markets. Canada's share of U.S. oil imports has risen from 15 to 16 percent over the last 10 years, while the whole of the Western Hemisphere now accounts for 41 percent of U.S. oil imports. Demand for the proportion of heavy to light crude used by U.S. refiners has increased over the last 20 years as world supplies of light crude have diminished in proportion to supplies of heavy and extra-heavy crude. Many U.S. refiners have completed or are in the process of completing retrofits to handle the heavier types of crude in response to this change in the world supply. In recent years, crude oil imports from Venezuela (most of which are of heavy grade) have declined. The heavy crude oil that Keystone will deliver to U.S.

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[2] Proved reserves are estimated quantities that analysis of geologic and engineering data demonstrates with reasonable certainty are recoverable under existing economic and operating conditions.

[3] Canadian National Energy Board figures, www.neb.gc.ca.

[4] Canadian National Energy Board (CNEB), *Canada's Oil Sands Opportunities and Challenges to 2015*. Energy Market Assessment. Calgary, Alberta. June 2006. p.12.

[5] Ibid. p. 13.

[6] Energy Information Agency (EIA), *Annual Energy Outlook 2007*. Report #DOE/EIA-0383(2007). February 2007. p. 96.

[7] Ibid. p. 97.

refiners is ideally suited to replace the loss of these types of crude and meet the expected increase in demand.

1.2.3 World Oil Supply

Global oil production capacity and consumption remain tightly balanced after 3 years of rapid demand growth in Asia, the United States, and the Middle East. DOS and industry analysts project that it will remain so into the medium term. The ability and willingness of major oil and gas producers to step up investment in order to meet rising global demand are particularly uncertain. Capital spending by the world's leading oil and gas companies increased sharply in nominal terms over the course of the first half of the current decade and, according to company plans, will rise further to 2010. Expressed in cost inflation-adjusted terms, investment in 2005 was only 5 percent above that in 2000. Planned upstream investment to 2010 is expected to boost slightly the global spare crude oil production capacity. Capacity additions could be smaller because of shortages of skilled personnel and equipment, regulatory delays, cost inflation, and higher decline rates at existing fields.[8] Investment issues are of particular concern in Mexico (the United States' third largest supplier of crude oil) where capital expenditures by its national oil company are insufficient to offset natural declines in oil field output (projected at 12 percent per annum by industry analysts.)

Political instability in several of the United States' top 11 suppliers is also expected to increase demand for crude from Canada. Nigeria's high rate of violent crime, large income disparity, tribal/ethnic conflict, and protests repeatedly have suspended oil exports. At times during the last several years, as much as 70 percent of Nigeria's output has been shut down due to militant attacks on oil production infrastructure. Venezuela's production has continually declined since 1998 due to a combination of lack of investment to offset natural declines and loss of technical expertise in the state-run *Petroleos de Venezuela, S. A.* (PDVSA). Additionally, President Chavez has repeatedly threatened to divert Venezuela's large exports to markets other than the United States. In Iraq lack of investment due to security concerns, continual attacks by insurgents on oil infrastructure, and the tenuous political situation keep output at or below pre-war levels. In Algeria armed militants have confronted government forces and political instability and protests in Ecuador threaten oil production.

Canada's expected production increases, coupled with the adverse factors affecting other major U.S. suppliers make it likely that an ever larger share of U.S. oil imports will be sourced from this stable and nearby supplier. Even if the share of total imported oil in overall U.S. demand remains the same or declines slightly in coming years, as expected, DOS expects that heavy oil imports from the WCSB will continue to increase.

1.2.4 Pipeline Capacity from Western Canadian Sedimentary Basin

Nearly all of the 1.9 million bpd of crude oil imported from Canada in 2006 came from the WCSB[9], and all of that was transported through three major pipeline systems: Enbridge, Kinder Morgan Express, and Kinder Morgan Trans Mountain. Total capacity from the WCSB for crude oil to U.S. markets now stands at 2.4 million bpd. However, the majority of WCSB crude continues to be sold into U.S. Petroleum Administration for Defense District I (PADD I – the U.S. Midwest) where a large proportion of U.S. refining capacity is located, and an increasing amount is forwarded on to refiners in PADD II (U.S. Gulf

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[8] International Energy Agency. *World Energy Outlook 2006*. OECD/IEA Paris, France, 2006. p. 4.

[9] CNEB data. www.neb.gc.ca.

Coast) to offset declines in offshore production. These two districts are directly and indirectly served by the Enbridge system and Kinder Morgan Express, which together have a capacity of 2.1 million bpd.

All of the expected increases in WCSB production will come from Alberta's oil sands, which produce a heavy synthetic crude oil when upgraded. The product can also be shipped as a non-upgraded bitumen mixed with diluents. Total capacity for heavy oil on the Enbridge and Kinder Morgan Express systems now stands at 1.2 million bpd.[10] In 2006, approximately 1 million bpd of heavy crude was exported from the WCSB to the United States via these two pipelines.[11]

The CNEB and DOS comparisons of the forecasted growth in heavy crude oil production in the WCSB versus the available pipeline capacity for heavy oil show a potential shortfall as early as 2007. Even with modifications to existing systems and de-bottlenecking efforts that are underway by Enbridge, it is likely that crude oil exports from the WCSB to the United States will exceed available pipeline capacity in 2009, necessitating the construction of a new pipeline to facilitate continued importation of crude oil.[12]

Exactly how much more capacity will be needed in the short term to mid term can be estimated. Given CNEB projections of an additional 1.6 million bpd of WCSB production over the current level by 2015, expected increased U.S. demand, and a similar proportion continued to be consumed by Canada (30 percent), an additional 1.1 million bpd of pipeline capacity would be needed by 2015 to accommodate U.S. crude oil imports from the WCSB. This increase in capacity would justify construction of Keystone's planned 450,000-bpd pipeline, and would necessitate additional pipeline construction to meet the remaining 700,000 bpd of capacity.

1.2.5 Mainline Project and Cushing Extension Demand

In December 2005, Keystone provided shippers an opportunity to participate in the Keystone Project by entering into contractual commitments for pipeline capacity. Shippers committed to binding contracts for 340,000 bpd. These binding commitments demonstrate the need for incremental pipeline capacity and access to Canadian crude supplies, and represent a commitment to utilize the Keystone Project. Keystone expects that the remainder of the excess capacity will be utilized by non-contract shippers at the tariff rate approved by the Federal Energy Regulatory Commission (FERC) (ENSR 2006a). Potential shippers also have expressed strong interest in a proposed pipeline extension to the Cushing market area. TransCanada conducted an Open Season process for the Mainline Project which ran from November 4 to December 1, 2005. As a result of the Open Season, TransCanada has secured firm, long-term contracts totaling 340,000 bpd, with an average duration of 18 years. Keystone anticipates that existing contracts will be renewed and additional contracts will be entered into such that the average contract term will continue beyond 18 years. This reasoning is based on the amount of crude oil reserves in the WCSB and the expected increase in production from the oil sands (TransCanada 2007c). A binding Open Season for the Cushing Extension closed at noon on March 14, 2007 (ENSR 2006a).

1.3 AGENCY PARTICIPATION

DOS, as the lead agency for the EIS, discussed the appropriate level of participation required with other federal agencies that will be required to issue permits associated with the proposed Keystone Project.

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[10] Canadian Association of Petroleum Producers, (CAPP), *Crude Oil Pipeline Expansion Summary*. Calgary, Canada, February 2005. p. 5.

[11] CNEB data. www.neb.gc.ca.

[12] Canadian National Energy Board (CNEB), *Canada's Oil Sands Opportunities and Challenges to 2015*. Energy Market Assessment. Calgary, Alberta, June 2006. p. 33.

Federal agencies elected to participate as cooperating agencies in the process or to provide technical assistance to the environmental review. State agencies also were consulted to ensure that their needs for state permitting analyses would be assessed in the EIS. To facilitate agency participation in the EIS review, state and federal agencies were invited to the scoping meetings (see Section 1.5), and agency advisory meetings were conducted in February 2007 at the following locations:

- St. Louis, Missouri;
- Kansas City, Kansas;
- Oklahoma City, Oklahoma;
- Lincoln, Nebraska;
- Pierre, South Dakota; and
- Bismarck, North Dakota.

1.3.1 Lead Agency – U.S. Department of State

For cross-border oil pipelines, DOS is responsible for issuance of Presidential Permits and is the lead agency for the Keystone Project. As the lead federal agency, DOS is responsible for NEPA compliance and for compliance with Section 106 of the National Historic Preservation Act (NHPA) (16 USC § 470 et seq.). As the lead federal agency, DOS is also responsible for initiating informal consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) [16 USC § 1536] to determine the likelihood of effects on listed species. Additionally, DOS coordinates with the cooperating and assisting agencies to ensure compliance with acts and executive orders addressing:

- Potential effects to prime and unique agricultural lands (Natural Resources Conservation Service [NRCS]),
- Executive Order (EO) 11988 – Floodplain Management,
- EO 11990 – Protection of Wetlands,
- EO 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,
- EO 13007 – Indian Sacred Sites,
- EO 13112 – Invasive Species,
- EO 13175 – Consultation and Coordination with Indian Tribal Governments,
- EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, and
- EO 13212 – Actions to Expedite Energy-Related Projects

EO 11423 (33 FR 11741), as amended by EO 12847 (58 FR 29511) and EO 13337 as amended (69 FR 25299), governs the DOS issuance of Presidential Permits that authorize construction of pipelines carrying petroleum, petroleum products, and other liquids across U.S. international borders. Within DOS, the Bureau of Economic and Business Affairs, Office of International Energy and Commodity Policy, receives and processes Presidential Permit applications. Upon receipt of a Presidential Permit application for a cross-border pipeline, DOS is required to request the views of the Secretary of Defense, the Attorney General, the Secretary of the Interior, the Secretary of Commerce, the Secretary of Transportation, the Secretary of Energy, the Secretary of Homeland Security, the Administrator of the U.S. Environmental Protection Agency (EPA), and such other government department and agency heads as the Secretary of

State deems appropriate. DOS must consider the project to be in the national interest to issue a Presidential Permit.

1.3.2 Cooperating Agencies

The following agencies have agreed to cooperate in the NEPA process.

1.3.2.1 Advisory Council on Historic Preservation

Section 106 of the NHPA, as amended, requires the lead federal agency to take into account effects on historic properties or historic resources that are listed in, or eligible for listing in, the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment if adverse effects on NRHP-eligible properties are anticipated. Historic properties are prehistoric or historic districts, sites, buildings, structures, objects, or properties of traditional religious or cultural importance that are listed or eligible for listing in the NRHP, including artifacts, records, and material remains related to such a property or resource. ACHP's regulations are codified in 36 Code of Federal Regulations (CFR) Section 800.2.

1.3.2.2 U.S. Environmental Protection Agency

Under Section 402 of the Clean Water Act (CWA) (33 USC §1251 et seq.), EPA has jurisdiction over the discharge of pollutants from a point source into waters of the United States. Administration of permit programs for point-source discharges that require a National Pollutant Discharge Elimination System (NPDES) permit has been delegated to the states affected by the Keystone Project. EPA maintains oversight of the delegated authority. Regulated discharges include, but are not limited to, sanitary and domestic wastewater, gravel pit and construction dewatering, and hydrostatic test water storm water (40 CFR 122).

Under Section 404 of the CWA (33 USC § 1251 et seq.), EPA reviews and comments on COE Section 404 permit applications for compliance with the Section 404(b)(1) guidelines and other statutes and authorities within its jurisdiction (40 CFR 230).

Under Section 309 of the Clean Air Act (CAA) (42 USC § 7401 et seq.), EPA has the responsibility to review and comment in writing on the EIS for compliance with Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500–1508).

Under Sections 3001 through 3019 of the Resource Conservation and Recovery Act (RCRA) (42 USC § 3251 et seq.), EPA establishes criteria governing the management of hazardous waste. In accordance with 40 CFR 261.4(b)(5), any hazardous waste generated in conjunction with construction or operation of the Keystone Project is subject to the hazardous waste regulations.

The proposed Keystone Project is located within EPA Regions 5, 7, and 8. Region 8 is the lead for EPA's involvement as a cooperating agency.

1.3.2.3 Natural Resources Conservation Service

NRCS administers the Wetlands Reserve Program (WRP) (16 USC § 3837 et seq.), under which it purchases conservation easements and provides cost share to landowners for the purposes of restoring and protecting wetlands. Under the WPR, the United States may purchase 30-year or permanent easements. Land eligibility for the WRP is based on NRCS's determination that the land is farmed or converted wetland, that enrollment maximizes wildlife benefits and wetland values, and that the likelihood of successful restoration merits inclusion into the program. Lands under WRP easement are subject to development and other use restrictions in order to ensure protection of wetland and wildlife conservation values. The Keystone Project preferred route will cross land restricted by at least one WRP lease. NRCS also administers the Emergency Watershed Protection Program (Floodplain Easements) and the Healthy Forests Reserve Program, and shares management of the Grasslands Reserve Program with the Farm Service Agency (FSA). The Keystone Project may involve lands included in these other NRCS land conservation programs. NRCS is also responsible for the Farmland Protection Policy Act (7 CFR Part 658), including protection of prime and unique agricultural lands. The Keystone Project would traverse prime farmland and potentially prime farmland.

1.3.2.4 U.S. Army Corps of Engineers

Under Section 404 of the CWA, COE has the authority to issue or deny permits for placement of dredge or fill material in the waters of the United States, including adjacent wetlands. Under Section 10 of the Rivers and Harbors Act (33 USC § 403), COE regulates work and placement of structures in, on, over, or under navigable waters of the United States.

1.3.2.5 U.S. Fish and Wildlife Service

USFWS is responsible for ensuring compliance with the ESA. Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by any federal agencies should not "...jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined...to be critical..." (16 USC § 1536[a][2][1988]). USFWS also reviews project plans and provides comments regarding protection of fish and wildlife resources under the provisions of the Fish and Wildlife Coordination Act (FWCA) (16 USC § 661 et seq.).

1.3.2.6 Farm Service Agency

The Farm Service Agency (FSA) is a unit of the U. S. Department of Agriculture (USDA) and administers several land conservation programs, including the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), the Farmable Wetlands Program, and the Grasslands Reserve Program. These programs provide annual rental payments and cost-share assistance to establish long-term resource conservation measures on eligible farmland. The terms of rental agreements are from 10 to 30 years, during which most agricultural uses of the affected lands are prohibited. The Grasslands Reserve Program is managed jointly with NRCS and includes provisions for rental agreements up to 30 years, 30-year-easements, and permanent easements. The Keystone Project involves lands included in FSA land conservation programs.

1.3.2.7 U.S. Department of Energy

The U.S. Department of Energy (DOE) administers multiple federal energy projects and has relevant experience in addressing the environmental review of projects of similar scope to the Keystone Project.

In addition, the Western Area Power Authority (Western) may play a role in determining final NEPA compliance with regard to associated transmission line and substation construction and operation.

As required by 10 CFR 1022, the DOE is obligated to incorporate floodplain management goals and wetland protection considerations into its planning and regulatory decisionmaking processes. The agency accomplishes this goal by preparing a floodplain or wetland assessment consisting of a description of the proposed action, a discussion of potential effects on the floodplain or wetland, and consideration of alternatives. For actions such as this proposed action where an EIS is required, the assessment can be included in the appropriate NEPA document. Information provided in Section 2.0 (for description of proposed action), 3.2 (floodplain issues) 3.3 (additional floodplain issues), 3.4 (wetlands issues), and 4.0 (alternatives) of this DEIS will be used by DOE to prepare a floodplain or wetland assessment and statement of findings consistent with 10 CFR 1022 for inclusion in the Final EIS.

1.3.2.8 Western Area Power Administration

The Western Area Power Administration (Western) markets and delivers power and related services within a 15-state region of the central and western United States, including North Dakota, South Dakota, Nebraska, and Kansas. Local power utilities would purchase power from the Western grid to supply power required for pump station operations. In some cases, the interconnect with the Western grid would require construction of a new substation or upgrades to existing substations, and Western would be responsible for implementing these actions.

The Western Area Power Administration (Western) is a Federal power-marketing agency in the Department of Energy (DOE) that sells and delivers Federal electric power to municipalities, public utilities, Federal and state agencies, and Native American tribes in 15 western and central states. A portion of the proposed Keystone Project is located within Western's Upper Great Plains Region, which operates and maintains nearly 90 substations and more than 8,000 miles of Federal transmission lines in Minnesota, South Dakota, North Dakota, Montana, Nebraska, and Iowa.

Western has received requests from Network customers for unplanned network load delivery points to serve unplanned load growth associated with the Keystone Project. Western, as the Network Provider and a Balancing Authority, is responsible to meet load growth requests for Network customers. Western needs to respond to the requests from the Network customers. Western's power transmission system would require either modification of existing electrical transmission facilities or construction of new Western transmission facilities. According to DOE's NEPA Implementing Procedures (10 CFR Part 1021) these actions require an Environmental Impact Statement.

- In responding to the need for agency action, Western must abide by the following:
- Addressing Interconnection Requests.
- Western's General Guidelines for Interconnection establishes a process for addressing applications for interconnection. The process dictates that Western respond to the applications as presented by the Network customers.
- Protecting Transmission System Reliability and Service to Existing Customers.

Western's purpose and need is to ensure that existing reliability and service is not degraded. Western's General Guidelines for Interconnection provides for transmission and system studies to ensure that system reliability and service to existing customers is not adversely affected. If the existing power system cannot accommodate the applicant's request without modifications or upgrades, the applicant may be responsible for funding the necessary work unless the changes would provide overall system benefits.

1.3.2.9 U.S. Department of Agriculture - Rural Utility Service

The Rural Utilities Service (RUS) is an agency that administers the U.S. Department of Agriculture's Rural Development Utilities Programs. These programs include the provision of loans and loan guarantees to electric utilities and other entities to serve customers in rural areas, through the construction or expansion of generation, transmission and distribution facilities. Applications for financing have been or may be submitted to RUS by several rural electric cooperatives to enable the cooperatives' provision of electricity to pump stations that would serve the Keystone Pipeline. RUS is responsible for NEPA compliance for facilities proposed by the cooperatives to provide these services.

1.3.3 Assisting Agencies

The following agencies have agreed to provide technical assistance to DOS in the environmental review process.

1.3.3.1 U.S. Department of Transportation – Office of Pipeline Safety

The U.S. Department of Transportation's (DOT's) Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety (OPS) has responsibility for monitoring the operation of oil pipeline systems in the United States, in compliance with 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline. OPS is providing technical expertise to DOS in assessment of the Keystone Project and in determination of appropriate mitigating measures.

1.3.3.2 U.S. Department of Transportation – Federal Highway Administration

The Federal Highway Administration (FHWA) is responsible for reviewing and approving the design of proposed Keystone Project federal highway crossings. FHWA is assisting DOS in this capacity during the Keystone Project NEPA review.

1.3.3.3 Federal Energy Regulatory Commission

FERC is responsible for, among other things, interstate natural gas transportation pipelines in the United States. In this capacity, FERC has gained extensive experience in issues surrounding pipeline construction and operation. Based on this experience, FERC is providing technical assistance to DOS in review of the proposed Keystone Project.

1.3.3.4 Department of Homeland Security

The Department of Homeland Security (DHS) is providing technical assistance to DOS in the assessment of security issues surrounding construction and operation of the proposed Keystone Project.

1.3.3.5 Council on Environmental Quality

CEQ provides guidance to all federal agencies on the NEPA implementation process.

1.3.3.6 National Park Service

The National Park Service (NPS) provides technical review of the proposed crossing of NPS-administered lands by the Keystone Project.

1.3.3.7 Bureau of Indian Affairs

The Bureau of Indian Affairs (BIA) provides review and assistance regarding tribal and environmental justice issues.

1.3.4 State Agencies

Various resource agencies from each of the states crossed by the proposed Keystone Project have responsibilities for state and local permit issuance. The permits required by the various state and local jurisdictions crossed by the proposed corridor are discussed in Section 1.6. State agencies participated in project scoping and were invited to the agency advisory meetings described above.

1.4 TRIBAL CONSULTATION

Potentially affected tribes with interests along the proposed pipeline corridor were invited to the public scoping meetings held in October and November 2006, and DOS consultation meetings held in February 2007. In addition, as the lead federal agency, DOS is conducting government-to-government consultation with agencies and federally recognized Indian tribes (70 FR 71194) within the Keystone Project area of potential effect (APE). Potentially affected tribes were invited to participate in these meetings and become "consulting parties" under Section 106 of the NHPA regulations.

- The United Keetoowah Band of Cherokee, the Upper Sioux Community, the Cherokee Nation, the Pawnee Nation, and the Kaw Nation participated in the scoping process.
- Tribal historic preservation officer (THPO) participation is summarized in Table 3.11.3.2.

1.5 SCOPING PROCESS

On October 4, 2006, DOS issued a Notice of Intent (NOI) to prepare an EIS. The NOI informed the public about the proposed action, announced plans for scoping meetings, invited public participation in the scoping process, and solicited public comments for consideration in establishing the scope and content of the EIS. The NOI was published in the Federal Register and distributed to:

- Landowners along the proposed route,
- Federal agencies,
- Native American tribes,
- State agencies,
- Municipalities and counties,

- Elected officials,
- Non-governmental organizations,
- The media, and
- Interested individuals.

The official scoping period ended on November 30, 2006; however, any comments received after this date were considered in the Draft EIS.

1.5.1.1 Public Scoping Meetings

DOS held 13 separate scoping meetings in the vicinity of the proposed route to provide opportunity for public comment on the scope of the EIS. The dates, locations, and numbers of attendees were:

- October 24 – Michigan, North Dakota (55);
- October 25 – Lisbon, North Dakota (34);
- October 26 – Clark, South Dakota (18);
- October 24 – Yankton, South Dakota (36);
- October 25 – Stanton, Nebraska (36);
- October 26 – Seward, Nebraska (35);
- November 1 – St. Charles, Missouri (32);
- November 2 – Collinsville, Illinois (24);
- November 8 – Carrolton Missouri (23);
- November 9 – Seneca, Kansas (20);
- November 14 – Abilene, Kansas (38);
- November 15 – El Dorado, Kansas (34); and
- November 16 – Morrison, Oklahoma (31).

1.5.1.2 Public Scoping Comments

DOS received verbal, written, and electronic comments during the scoping comment period. All verbal comments formally presented at the meetings were recorded and transcribed. Additional written comments were received on comment forms provided to the public at the meetings and in letters. A summary of public comments related to EIS scope follows. Details are provided in the Scoping Summary Report (Appendix A).

Summary of Scoping Issues by Subject

Table 1.5.1-1 summarizes the issues identified and comments received during the public scoping process for the Keystone Project. For each comment, the table references the section in this EIS that addresses the concern.

1.6 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

This EIS is intended to fulfill the needs and obligations set forth by NEPA and other relevant laws, regulations, and policies of DOS (the lead agency) and of COE, EPA, USFWS, NRCS, FSA, and ACHP (cooperating agencies; see Section 1.3.2). Assisting federal, tribal, state, and local agencies with jurisdiction over various aspects of the Keystone Project will participate in the EIS process by providing direct input to DOS or through the EIS review and comment process (see Sections 1.3.3 and 1.3.4).

NEPA directs the federal government to examine major federal actions that may result in significant effects on the environment. Because it is considered a major federal action, authorization of the Keystone Project requires analysis under NEPA (42 USC § 4231 et seq.). Table 1.6-1 lists the permits, licenses, approvals, and consultation requirements for federal agencies that are not cooperating agencies and for state and local agencies.

1.7 CONNECTED ACTIONS

The Keystone Project would require electric power to service the proposed pump stations. Local electric transmission lines that supply power to pump stations would be contracted to local power providers. Therefore, the specific transmission corridors and substation locations would be determined at a later date. For the purposes of this EIS, general environmental concerns associated with typical transmission and substation facilities in the Keystone Project area are considered. When actual power contracts are consummated and specific transmission line and substation locations are identified, additional NEPA compliance analyses may be required prior to the issuance of construction permits. Once site locations for substation locations have been identified, Western would conduct supplement analyses to determine if the impacts at the sites would be within the bounds of impacts considered in this EIS.

Another connected action is the Coker and Refinery Expansion (CORE) Project that is planned for the Wood River Refinery. The project will increase both the refinery's total crude processing capacity and the percentage of heavy crude oil processed. Presently, lighter, low sulfur crude oil from foreign oil sources supply the Wood River Refinery. In May 2006, ConocoPhillips, the operator of the Wood River Refinery, submitted applications to the Illinois Environmental Protection Agency for Prevention of Significant Deterioration (PSD) and National Pollutant Discharge Elimination System (NPDES) permits pursuant to the CAA and CWA. Potential impacts on water and air quality due to construction and operation of the refinery upgrade are discussed in Sections 3.3 and 3.12, respectively.

TABLE 1.5.1-1
Issues Identified and Comments Received during the Public Scoping Process for the Keystone Pipeline Project

Issue	Comment	Section Where Comment/Issue Addressed in EIS:
Purpose and Need	Need for the Mainline Project and the Cushing Extension, expected life of the pipeline, agency involvement, and required approvals.	1.2
Project Description	Distance to adjacent structures, construction methods, abandonment plans, sources of Keystone Project materials, construction schedule, maintenance and inspection plans and procedures, expected service life of the pipeline, right-of-way (ROW) revegetation, pipeline temperature, protection measures, operations, construction impacts to adjacent areas, powering, pipeline security, hydrostatic testing, and pump stations.	2.0
Alternatives	Selection of alternatives, route adjustments, use of abandoned rail ROWs, route selection, routes that avoid sensitive areas, Kinder Morgan and Enbridge Pipelines, shipping refined products instead of a crude oil pipeline, renewable energy sources, seasonal avoidance of construction in agricultural areas, collocation with other ROWs, and adding a new refinery along the Mainline Project rather than constructing the Cushing Extension.	4.0
Geology	Potential rock slope instability and effects of earthquakes and fault lines.	3.1
Soils and Sediments	Soil compaction and settlement, topsoil segregation during construction, replacement of top soils after construction and abandonment, soil erosion, streambank erosion, pipeline effects on soil temperature, and soil instability.	3.2
Water Resources	Impacts on springs, aquifers, and water wells; water supply contingencies in the event of a spill; impacts to septic systems and sewage treatment facilities; stream channel erosion; impacts to dikes, dams, and reservoirs; runoff during construction; effects on drain tiles and drainage systems; and impacts on flood protection.	3.3
Wetlands	Impacts and mitigation measures, stabilization during construction, enforcement of wetland protection requirements.	3.4
Terrestrial Vegetation	Impacts on prairies and woodlands, impacts of pipeline temperature on vegetation and crops, revegetation of affected area, impacts on crop growth, invasive and noxious weeds, use of herbicides near organic farms, and effects on old-growth trees.	3.5
Fish and Wildlife	Impacts on game animals and their habitats; and impacts on deer, turkey, frogs, toads, bald eagles, beaver, pheasants, and quail.	3.6 and 3.7

TABLE 1.5.1-1 (Continued)		
Issue	**Comment**	**Section Where Comment/Issue Addressed in EIS:**
Land Use, Recreation and Special Interest Areas, and Visual Resources	Use of eminent domain; land use restrictions; impacts on bicycle trails, day care centers, special use areas, agriculture, water lines, drainage facilities; impacts on the Conservation Reserve Program; access and agricultural restrictions during construction; compensation for crop production loss; protection of cattle during construction; and inconvenience to landowners and residents.	3.9
Socioeconomics	Potential loss of conservation easement and lease payments to landowners, impacts to property values, impacts of importing Canadian oil on U.S. trade deficit, revenues and taxes to local governments, costs of road damage related to construction traffic and Keystone Project use, impacts of Keystone Project electricity demand on local electric rates, costs of grassland destruction, impacts of Keystone Project traffic on local transportation infrastructure, and ROW access control.	3.10
Cultural Resources	Impacts on cemeteries and burial grounds, archaeological sites and artifacts, and cultural sites; and impacts of blasting and vibrations on historic structures.	3.11
Air Resources	Air pollution abatement from pump stations.	3.12
Noise	Effects of pump station noise on humans and cattle, noise from blasting, and effects of pipeline vibrations on nearby structures.	3.12
Reliability and Safety	Protection from vandalism and terrorist activities, ROW security, safety of pipeline crossings, spill contamination and cleanup, leak detection, pipeline integrity, compensation to landowners affected by spills, likelihood of spills, pipeline safety requirements, record of spills for similar pipelines, TransCanada's safety record, water supply contamination, emergency response plans, and systems for public notification and complaints.	3.13
Cumulative Impacts	Impacts when combined with the Rockies Express pipeline, Platt pipeline, Stillwater (potable water) pipeline, roads, and highways; potential for additional pipelines in the Keystone ROW; and effects on development of renewable energy resources.	3.14

TABLE 1.6-1 Other Permits, Licenses, Approvals, and Consultation Requirements for the Keystone Pipeline Project		
Agency	**Permit or Consultation Authority**	**Agency Action**
Federal		
National Park Service	16 USC § 1271 et seq.	Permit for pipeline crossing of the Missouri River, classified as a National Recreational River under the Wild and Scenic Rivers Act
U.S. Department of Energy U.S Department of Commerce U.S. Department of Homeland Security U.S Department of Justice	Executive Order (EO) 11423 (33 Federal Register [FR] 11741), as amended by EO 12847 (58 FR 29511) and EO 13337 (69 FR 25299)	U.S. Department of State (DOS) is required to request the views of these agencies regarding applications for Presidential Permits
Federal Energy Regulatory Commission (FERC)	42 USC § 4231 et seq.	Advise DOS on proper implementation of the National Environmental Policy Act of 1969 (NEPA) for assessment of pipeline projects. (FERC has jurisdiction over natural gas pipelines and has well established procedures for environmental impact statement evaluations of pipelines.)
U.S. Department of Transportation (DOT) – Federal Highway Administration	Encroachment Permits	Permits for crossing federally funded highways
DOT – Office of Pipeline Safety	49 CFR Part 195	Review and approval of Integrity Management Plan for high-consequence areas
	49 CFR Part 194	Review and approval of Emergency Preparedness Plan
Council on Environmental Quality (CEQ)	NEPA (42 USC § 4321 et seq.), EO 11514	Coordination of federal programs related to environmental quality, including implementation of NEPA
North Dakota		
Public Service Commission	Energy Conversion and Transmission Facility Siting Act Corridor Certificate; Route Permit	Permit for construction of a pipeline within an approved corridor and along an approved route
Department of Health, Division of Water Quality	Section 401 Clean Water Act (CWA), Water Quality Certification	Permit for stream and wetland crossings/consultation for U.S. Army Corps of Engineers (COE) Section 404 process
	National Pollutant Discharge Elimination System (NPDES) Temporary Dewatering/ Hydrostatic Testing Permit (NDG07000)	Permit regulating hydrostatic test water discharge and construction dewatering to waters of the state

TABLE 1.6-1 (Continued)		
Agency	**Permit or Consultation Authority**	**Agency Action**
North Dakota (continued)		
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
County Road Departments	Encroachment Permits	Permits for encroachment on county roads
South Dakota		
Public Utilities Commission	Energy Conversion and Transmission Facilities Act	Permit for a pipeline and associated facilities
Department of Environment and Natural Resources, Surface Water Quality Program	Section 401 CWA Water Quality Certification	Permit for stream and wetland crossings and consultation for Section 404 process
	NPDES Temporary Discharge Permit (General Permit for Temporary Discharges and a Temporary Water Use Permit)	Permit regulating hydrostatic test water discharge and construction dewatering to waters of the state
	NPDES Storm Water Discharge Permit (SWD) General Permit for Storm Water Discharges Associated with Industrial or Construction Activities)	Permit regulating discharge of storm waters from the construction work area; submitted in conjunction with Section 401 application
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
County Road Departments	Encroachment Permits	Permits for encroachment on county roads
Bon Homme-Yankton Water District	Permit	Permit to cross Bon Homme-Yankton water lines
Nebraska		
Department of Environmental Quality (DEQ), Division of Water Resources	Section 401 CWA Water Quality Certification	Permit for stream and wetland crossings/consultation for Section 404 process
	NPDES Excavation Dewatering and Hydrostatic Testing Permit	Permit regulating hydrostatic test water discharge and construction dewatering to waters of the state
	NPDES Storm Water Discharge Permit	Permit regulating discharge of storm waters from the construction work area
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
County Road Departments	Encroachment Permits	Permits for encroachment on county roads
Kansas		
Kansas Corporation Commission	Certificate of Convenience and Authority to Transport the Business of a Liquids Pipeline Carrier	Certificate to construct pipeline and associated facilities across all land

TABLE 1.6-1 (Continued)		
Agency	**Permit or Consultation Authority**	**Agency Action**
Kansas (continued)		
Department of Health and Environment, Division of Water Resources	Section 401 CWA Water Quality Certification	Permit for stream and wetland crossings/consultation for Section 404 process
	NPDES Temporary Discharge Permit	Permit regulating hydrostatic test water discharge
Kansas Department of Wildlife and Parks	Action Permit	Permit for potential effects on federally and state-listed species
Kansas Department of Agriculture	Temporary and Term Water Appropriations Permits	Permits for appropriation of water for hydrostatic testing and watering right-of-way (ROW) for dust suppression
	Stream Channel Modification Permits	General pipeline crossing permit or specific permits for stream channel crossings
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
Kansas Turnpike Authority	Permission to construct	Permits to construct across jurisdictional roads
County Road Departments	Encroachment permits	Permits for encroachment on county roads
Missouri		
Department of Natural Resources, Division of Water Resources	Section 401 CWA Water Quality Certification	Permit for stream and wetland crossings/ consultation for Section 404 process
	NPDES Storm Water Discharge Permit	Permit regulating discharge of storm waters from the construction work area
	NPDES Temporary Discharge Permit	Permit regulating hydrostatic test water discharge, and construction dewatering to waters of the state
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
County Planning Departments	Development Permit/ Application	Permit to construct in floodplains. Reviewed in conjunction with Section 401 application
County Road Departments	Encroachment Permits	Permits for encroachment on county roads
Illinois		
Illinois Commerce Commission	Certificate of Good Standing	Certificate to construct pipeline and associated facilities across all lands
Illinois Environmental Protection Agency (EPA), Division of Water Pollution Control	Joint Application for Section 401 CWA Water Quality Certification	Permit for stream and wetland crossings/consultation for Section 404 process
	NPDES Temporary Discharge Permit (General Forms 1 and 2E and Form ILG67)	Permit regulating hydrostatic test water discharge and construction dewatering to waters of the state
	NPDES Storm Water Discharge Permits (Notice of Intent Form ILR10)	Permit regulating discharge of storm waters from the construction work area

TABLE 1.6-1 (Continued)		
Agency	Permit or Consultation Authority	Agency Action
Illinois (continued)		
Illinois Department of Natural Resources, Office of Water Resources	Joint Application for Section 401 CWA Water Quality Certification (Statewide Permit 8 - Floodplain Development Permit)	Permit for construction of pipeline in a floodway; submitted in conjunction with Section 401 application
Illinois Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
County Road Departments	Encroachment Permits	Permits for encroachment on county roads
Oklahoma		
DEQ, Division of Water Resources	Section 401 CWA Water Quality Certification	Permit for stream and wetland crossings/consultation for Section 404 process
Oklahoma Corporation Commission	Notice of Surface Discharge of Hydrostatic Test Water	Permit regulating hydrostatic test water discharge
Water Resources Board	Water Appropriations Permit, Temporary Water Lease Permit	Permit to withdraw groundwater or surface water from public or private sources for hydrostatic testing and watering ROW for dust suppression
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways
Oklahoma Turnpike Authority	Construction Permits	Permits to construct across jurisdictional roads
County Road Departments	Encroachment Permits	Permits for encroachment on county roads

Note:

Regulatory requirements for federal cooperating agencies are described in Section 1.3.2.

1.8 REFERENCES

ENSR. 2006a. Keystone Pipeline Project Environmental Report. Prepared for the U.S. Department of State. April. Updated November 15, 2006.

2.0 PROJECT DESCRIPTION

2.1 PROPOSED FACILITIES AND LAND REQUIREMENTS

Keystone proposes to construct and operate a crude oil pipeline and related facilities from an oil supply hub near Hardisty, Alberta in Canada to existing terminals in the United States. The Keystone Project as defined for this EIS consists of the Mainline Project (extending from the Canada/U.S. border to terminals and refineries in Illinois) and the Cushing Extension (extending from Steele City, Nebraska to Cushing, Oklahoma). The Project would have the capacity to deliver approximately 435,000 bpd, with the ability to increase the pumping capacity to approximately 600,000 bpd. See Figure 2.1-1 for a Project overview.

2.1.1 Mainline Project

Keystone proposes to begin construction of the Mainline Project in early 2008. Construction would occur over an approximately 18-month period, with a proposed in-service date of no later than November 2009.

2.1.1.1 Pipeline

The proposed Mainline Project comprises 1,023 miles of 30-inch-diameter pipe from the Canada/U.S. border to Wood River, Illinois and 55 miles of 24-inch-diameter pipe between Wood River and Patoka, Illinois—for a total of approximately 1,078 miles of new pipeline. Table 2.1-1 summarizes the pipeline mileage per state for the Mainline Project.

TABLE 2.1-1
Miles of Pipe by State for the Keystone Mainline Project

State	Length (miles)	Mileposts (From – To)
North Dakota	216.9	0–217
South Dakota	218.9	217–436
Nebraska	213.7	436–650
Kansas	98.8	650–748
Missouri	273.1	748–1021
Illinois	56.5	1021–1078
Mainline Project total	**1,077.9**	

Source: ENSR 2006a.

With the exception of urban/suburban areas around Troy and St. Charles, Missouri and Wood River and Edwardsville, Illinois, the pipeline would be constructed primarily in rural areas. Along the Mainline Project, approximately 610 miles would require new ROW. Figures 2.1-2 through 2.1-5 illustrate the typical construction ROW and equipment work locations in these areas. Approximately 467 miles would be would be collocated within an approximately 300-foot-wide corridor of existing ROWs for pipelines, utilities, and roads. Figures 2.1-6 through 2.1-9 illustrate the proposed construction ROW in areas where the pipeline would be located parallel to an existing pipeline.

The 30-inch-diameter pipeline would require a 110-foot-wide corridor, consisting of a temporary 60-foot-wide construction ROW and a 50-foot-wide permanent ROW. The 24-inch-diameter pipeline would require a 95-foot-wide corridor, consisting of a 45-foot-wide construction ROW and a 50-foot-wide permanent ROW. Keystone would reduce the construction ROW width to 85 feet in certain wetlands, shelterbelts, other forested areas, residential areas, and commercial/industrial areas.

2.1.1.2 Aboveground Facilities

Aboveground facilities for the Mainline Project would include pump stations, MLVs, delivery sites, and densitometer sites. Pigging facilities would be located at some pump stations and delivery sites. Transmission lines and substations required for aboveground facilities would be constructed and operated by local utility providers. Table 2.1-2 summarizes the location of each aboveground facility, and Figures 2.1-10 through 2.1-15 provide state-specific maps that show the pipeline route and general location of aboveground facilities.

Pump Stations

Keystone initially would construct 23 pump stations for the Mainline Project. Expansion to approximately 600,000 bpd would require one additional pump station in Bond County, Illinois (PS-38, see Table 2.1-2) and additional pumps at existing pump stations. Pump stations would be placed along the pipeline at locations necessary to maintain adequate flow. The pipe entering and exiting pump stations would be located below grade; the pipe within the pump stations would be aboveground. Two or three electric pumps driven by an electrical motor with a 3,000-kW rating would be located at each pump station. In total for the Keystone Project, the current design includes 58 motors installed for the initial phase and additional 64 motors for the expansion (TransCanada 2007c). An electrical building and substation, two sump tanks, a small maintenance building, and parking area would complete each pump station.

Retail electrical power would be purchased locally. Stations would be fully automated. Backup electrical power would be provided by an uninterruptible power supply (UPS) that uses internal batteries to guarantee continuous power in the event of brief electrical service disruption. A 5-kilowatt (kW) gasoline-powered standby generator would provide backup in the event of an extended outage. Keystone anticipates that the backup generator would operate less than 20 hours per year. A small gasoline storage tank with a capacity of about 200 gallons would be located with the backup generator at each pump station. The storage tank would have the appropriate valves and containment structures.

TABLE 2.1-2 Aboveground Facilities for the Keystone Mainline Project		
Aboveground Facility	**Location (County, State)**	**Milepost**
Pump Stations		
PS-15	Walsh, North Dakota	33.032
PS-16	Nelson, North Dakota	75.916
PS-17	Steele, North Dakota	123.411
PS-18 and pigging facility	Ransom, North Dakota	170.222
PS-19	Dickey, North Dakota	216.820
PS-19 (alternate location)	Sargent, North Dakota	216.820
PS-20	Day, South Dakota	262.161
PS-21	Clark, South Dakota	309.038
PS-22	Miner, South Dakota	356.820
PS-23 and pigging facility	Hutchinson, South Dakota	404.853
PS-24	Cedar, Nebraska	452.691
PS-25	Stanton, Nebraska	499.099
PS-26	Butler, Nebraska	549.536
PS-27	Saline, Nebraska	601.802
PS-28 and pigging facility	Jefferson, Nebraska	637.301
PS-29	Nemaha, Kansas	688.198
PS-30 and pigging facility	Doniphan, Kansas	736.837
PS-31	Clinton, Missouri	784.057
PS-32	Carroll, Missouri	829.799
PS-33	Chariton, Missouri	864.679
PS-34	Audrain, Missouri	898.923
PS-35	Montgomery, Missouri	944.581
PS-36	St. Charles, Missouri	984.865
PS-37, Wood River Terminal and pigging facility	Madison, Illinois	1022.756
PS-38	Bond, Illinois	1049.814
Mainline Valves		
V-01	Cavalier, North Dakota	5.592
V-02	Pembina, North Dakota	8.220
V-03	Pembina, north Dakota	16.756
V-04	Pembina, North Dakota	19.518
V-47	Walsh, North Dakota	49.450
V-05	Barnes, North Dakota	167.219
V-06	Ransom, North Dakota	179.601
V-07	Ransom, North Dakota	184.696
V-51	Sargent, North Dakota	201.879
V-48	Marshall, South Dakota	239.939
V-52	Clark, South Dakota	276.398
V-08	Clark, South Dakota	292.908

TABLE 2.1-2 (Continued)		
Aboveground Facility	**Location (County, State)**	**Milepost**
Mainline Valves (continued)		
V-09	Clark, South Dakota	300.932
V-49	Kingsbury, South Dakota	330.761
V-10	Miner, South Dakota	353.501
V-11	Hanson, South Dakota	365.864
V-12	McCook, South Dakota	387.673
V-13	Yankton, South Dakota	417.485
V-15	Yankton, South Dakota	429.912
V-16	Cedar, Nebraska	438.754
V-17	Stanton, Nebraska	505.375
V-18	Colfax, Nebraska	532.146
V-19	Colfax, Nebraska	537.311
V-21	Butler, Nebraska	546.361
V-22	Seward, Nebraska	572.026
V-23	Seward, Nebraska	576.086
V-24	Seward, Nebraska	587.284
V-25	Saline, Nebraska	591.748
V-53	Saline, Nebraska	611.819
V-26	Marshall, Kansas	654.954
V-27	Marshall, Kansas	667.520
V-28	Nemaha, Kansas	681.925
V-29	Nemaha, Kansas	698.876
V-54	Brown, Kansas	718.343
V-30	Doniphan, Kansas	741.502
V-31	Buchanan, Missouri	749.834
V-32	Buchanan, Missouri	756.000
V-33	Buchanan, Missouri	763.841
V-34	Carroll, Missouri	839.502
V-35	Chariton, Missouri	843.546
V-36	Chariton, Missouri	859.748
V-50	Randolph, Missouri	883.644
V-37	Audrain, Missouri	918.380
V-38	Audrain, Missouri	919.965
V-39	Lincoln, Missouri	968.192
V-40	Lincoln, Missouri	972.803
V-41	Lincoln, Missouri	980.898
V-46	St. Charles, Missouri	999.770
V-42	St. Charles, Missouri	1015.119
V-43	Madison, Illinois	1044.945
V-44	Bond, Illinois	1065.465

TABLE 2.1-2 (Continued)		
Aboveground Facility	**Location (County, State)**	**Milepost**
Mainline Valves (continued)		
V-45	Marion, Illinois	1074.951
Densitometers		
D-1	Jefferson, Nebraska	625.800
D-2	St. Charles, Missouri	1012.076
D-3	Bond, Illinois	1065.470
Terminals (Including Delivery Facilities)		
Wood River (includes PS-37 and a pigging facility)	Madison, Illinois	1022.756
Patoka Terminal	Marion	1077.925

Source: TransCanada 2007c.

Valves

Keystone would construct 52 MLVs along the Mainline Project (Table 2.1-2). Proposed MLV locations were determined by the hydraulic characteristics of the pipeline, DOT regulations, and environmental and safety concerns. In addition to the 52 MLVs, each pump station would have one block valve. When not located at pump stations, MLVs would be constructed within a fenced 50-foot- by 50-foot area centered on the 50-foot-wide permanently maintained ROW. Remotely activated valves would be located at pump stations, upstream of major river crossings and sensitive water bodies. These valves can be quickly activated to shut down the pipeline in the event of an emergency. MLVs would be no more than 50 miles apart, with an average spacing of approximately 15 to 20 miles. Keystone's proposed MLV placement along the ROW complies with 40 CFR Part 195, "Transportation of Hazardous Liquids by Pipeline," Subpart A – General, Section 195.260, Valves: Locations, Items(c), (e), and (f) (TransCanada 2007b). This regulation requires valves at locations that:

- Minimize damage or pollution from accidental oil discharges,
- Are on each side of a water crossing more than 100 feet wide, and
- Are on each side of a reservoir holding water for human consumption.

In addition, valve placement considered streams less than 100 feet wide that are near or flow into streams that are greater than 100 feet wide, pump station locations, presence of high-consequence areas (HCAs) as defined by DOT, proximity to densely populated areas, and other topographic and environmental considerations.

Delivery Sites

Keystone would install two delivery sites along the Mainline Project route, near Wood River (Madison County) and at the Patoka Terminal (Marion County), both in Illinois (see Table 2.1-2). The proposed Wood River delivery site would be constructed outside the existing Wood River Terminal. The proposed Patoka delivery site would be located within the existing Patoka Terminal. The delivery sites would include equipment for regulating pressure, temperature, sampling, chromatography, tube switching, and measuring crude oil.

Densitometer Sites

Keystone would install three densitometer sites along the Mainline Project: one in Jefferson County Nebraska; one in St. Charles County, Missouri; and one in Bond County, Illinois (see Table 2.1-2). Densitometer sites would be 50 feet wide by 66 feet long and centered on the 50-foot-wide permanent ROW. Densitometers measure the batch density of the crude oil so that operators can track individual crude oil shipments.

Pigging Facilities

The Keystone pipeline is designed to permit full pigging capabilities with a minimum interruption of service. All pig launchers and receivers would be constructed and operated within the boundaries of the pump stations or delivery sites.

Power Lines and Substations

Keystone estimates that 21 new transmission lines would be required to provide electrical power to the proposed pump stations along the Mainline Project. According to Keystone (ENSR 2006a), approximately 149 miles of new transmission lines would be constructed in North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Illinois for the Mainline Project. These would comprise eight 69-kilovolt (kV), seven 115-kV, seven 34.5-kV, and one 161-kV transmission lines. Pole heights would vary depending on line voltage between 40 and 80 feet, and pole spacing would vary between 300 and 400 feet. The width of the poles and attached electrical insulators would range between 4 and 15 feet.

Existing substations would need to be modified and new substations would need to be constructed in order to provide power to the proposed pump stations along the Mainline Project. Western anticipates that there would be modifications to four existing substations and construction of one new substation to provide power to the proposed pump stations in North Dakota and South Dakota. Substation modification and construction activities would comply with Western's Construction Standard, Standard 13 - Environmental Quality Protection and Western's Standard Mitigative Measures for Construction, Operation, and Maintenance of Western Facilities (see Appendix B). The area required for the substation modifications or construction would be surveyed, cleared, and graded prior to installation. The surface would be graded in compliance with storm water control plans and other applicable permit requirements. Gravel would be delivered to the site after all subsurface work is complete and leveled to create a surface for the installation of the above ground substation equipment. A secure chain link fence would be installed to control and limit access during construction and maintenance activities. The substation equipment would be delivered on tractor-trailer trucks and installed on top of a concrete foundation in the graveled area. All areas would be graded to ensure proper drainage and runoff control in accordance with applicable regulations.

2.1.1.3 Ancillary Facilities

Ancillary facilities for the Mainline Project would include lateral pipelines, additional temporary workspace areas, pipe storage and contractor yards, and access roads.

Lateral Pipelines

A lateral pipeline would be constructed from the Mainline Project to deliver crude oil to the tank storage terminal in Wood River, Illinois. The Wood River lateral pipeline would be approximately 5,213 feet in length. Construction and operation of the lateral pipeline would be similar to that for the Mainline

Project; the pipeline would be constructed within a 110-foot-wide corridor consisting of a 60-foot-wide temporary construction ROW and a 50-foot-wide permanent ROW.

Additional Temporary Workspace Areas

Over 6,700 temporary work space areas would be required for the Mainline Project (TransCanada 2007c). The general types of workspace areas required, and their typical dimensions and acreages are provided in Table 2.1-3. Temporary workspaces would be needed for areas requiring special construction techniques (e.g., river, wetland, and road crossings; horizontal directional drill [HDD] entry and exit points; steep slopes; and rocky soils) and construction staging areas. Specific locations of these workspaces would be modified as the Keystone Project design progresses.

Pipe Storage and Contractor Yards

Keystone has identified required pipe storage and contractor yards for the construction phase of the Mainline Project (Table 2.1-4). Keystone estimates that 42 pipe storage and 17 contractor yards would be required for the Mainline Project construction. Each 15- to 20-acre contractor yard would reduce construction worker transportation requirements. Each approximately 25-acre pipe staging yard would typically be located at 30-mile intervals along the pipeline route in proximity to railroad siding facilities.

Fuel transfer stations would be located only at contractor yards (TransCanada 2007c) and would be designed to dispense gasoline or diesel fuel directly to project work trucks and heavy equipment, and to other project delivery trucks for dispensing in the field. A typical fuel transfer station would consist of temporary aboveground storage tanks or trailers, rigid steel piping, valves and fittings, and transfer or dispensing pumps and associated containment structures. Two to three 10,000-gallon storage tanks for diesel fuel and one 10,000-gallon storage tank for gasoline would be placed at each yard. The tanks would be located in earthen berm secondary containment structures with impervious membrane liners. Total storage capacity would vary among locations, depending on the anticipated fuel requirements for the spread; a 2- to 3-day supply typically is stored at each location, equaling up to 30,000 gallons in storage at a given time.

TABLE 2.1-3 Additional Temporary Workspace Areas for the Keystone Mainline Project		
Type of Workspace Area	**Typical Dimension (length by width in feet at each side of crossing)**	**Typical Acreage**
Directionally drilled water bodies	350 x 140 plus length of drill x 25	1.1+
Water bodies > 50 feet wide	300 x 100	0.7
Water bodies < 50 feet wide	250 x 50	0.3
Bored highways and railroads	50 x length of crossing plus 50	varies
Open-cut or bored county or private roads	125 x 50	0.1
Foreign pipeline/utility/other buried feature crossings	125 x 50	0.1
Push-pull wetland crossing	50 x length of wetland	varies
Construction spread mobilization and demobilization	300 x 150	1.0
Stringing truck turnaround areas	200 x 80	0.4

Source: ENSR 2006a.

TABLE 2.1-4 Potential Pipe Storage Yards and Contractor Yards for the Keystone Mainline Project		
State/Type of Yard	**Counties**	**Acreage**
North Dakota		
Contractor yards	Walsh, Ramsey, Nelson	60
Pipe storage yards	Walsh, Pembina, Cavalier, Grand Forks, Steele, Ransom, Barnes	266
North Dakota subtotal		*326*
South Dakota		
Contractor yards	Yankton	21
Pipe storage yards	Beadle, McCook	70
Combination pipe/ contractor yard	Kingsbury	50
South Dakota subtotal		*141*
Nebraska		
Contractor yards	Stanton	38
Pipe storage yards	Cedar, Stanton, Platte, Seward	130
Combination pipe/ contractor yard	Butler, Colfax	115
Nebraska subtotal		*283*
Kansas		
Pipe storage yards	Brown	40
Combination Pipe/contractor yard	Marshall, Brown, Doniphan	378
Kansas subtotal		*418*
Missouri		
Contractor yards	Lincoln	33
Pipe storage yards	Montgomery, St. Charles, Clinton	184
Combination Pipe/contractor yard	Chariton, Randolph, Caldwell	324
Missouri subtotal		*541*
Illinois		
Contractor yards	Madison, Bond	110
Pipe storage yards	Madison, Bond	65
Illinois subtotal		*175*

Sources: ENSR 2006a, TransCanada 2007c.

Fuel would be offloaded into the storage tanks by connecting a 3-inch petroleum-rated hose from a delivery tanker to the fuel transfer line at the fill truck connection at the fuel station. The connection between the fill truck and fill line would be accomplished by a cam-loc, followed by a block valve, rigid steel piping, and one or more tank block valves. One or more check valves would be located immediately upstream of the connection to the storage tank. Offloading of the fuel typically would use a transfer pump powered by the delivery vehicle.

The bulk loading of diesel to fuel distribution trucks for delivery in the field (off-road diesel) would be completed by first connecting a 3-inch petroleum-rated hose between the truck tank and the withdraw truck connection. The withdraw connection and line would consist of rigid steel piping from the tank through one or more block valves to an intrinsically safe, explosion-proof, fuel transfer pump with a downstream cam-loc connection. The fuel transfer pump would be equipped with an emergency shut-off switch located at the pump; a secondary emergency switch would be located at least 100 feet distant from the fueling operation.

Gasoline and diesel also would be dispensed directly to project vehicles from the storage tanks (on-road diesel). A dispensing pump with petroleum-rated hoses and automatic shut-off nozzles would be used. These would be similar to those at commercial gasoline stations. Table 2.1-5 summarizes the daily and annual throughput of each proposed temporary fuel transfer system site.

TABLE 2.1-5
Maximum Fuel Throughput – Temporary Fuel Transfer Systems for the Keystone Project

	Daily (gallons/site)	Annual (gallons/site)
Gasoline	400	36,600
Off-road diesel	1,700	175,000
On-road diesel	7,000	723,000

Source: TransCanada 2007c.

All storage tanks or trailers, rigid steel piping valves and fittings, and transfer or dispensing pumps would be enclosed within a containment structure that would provide 110 percent containment of the fuel stored within the structure. The containment structure would be constructed of sandbag or earthen berms that would be lined with a chemically resistant membrane. Figures 2.1-16 and 2.1-17 provide typical layout designs for diesel and gasoline transfer stations, respectively.

To the extent practical, Keystone proposes to use existing commercial/industrial sites or sites that previously have been used for construction. Existing public or private roads would be used to access each yard. Both pipe storage yards and contractor yards would be used on a temporary basis and would be restored to their previous use upon completion of construction.

Access Roads

Keystone does not plan to construct any permanent access roads to the construction ROW. Existing public and private roads would be used on a temporary basis. The Mainline Project would require 104 temporary access roads or expansions of existing roads. The length of these temporary access roads would range from 0.01 to 13.5 miles, with the majority being less than 0.5 mile. Only five of the access roads would be more than 1 mile. The temporary roads and upgrades to existing roads would disturb approximately 90.5 acres along the entire Mainline Project ROW. New temporary access roads or expansion of existing private or public roads would be used and maintained only with permission of the landowner or land management agency.

Keystone also would construct short permanent access roads from public roads to the Mainline Project's proposed pump stations, delivery sites, and MLVs. Pre-construction drainage patterns would be maintained by installing culverts and ditches as necessary, and the roads would be surfaced with crushed rock (TransCanada 2007c). Prior to construction, Keystone would finalize the locations of the permanent access roads and any additional temporary access roads, and would obtain necessary federal, state, and local approvals. Keystone would be responsible for maintenance of newly created access roads.

2.1.1.4 Wood River Refinery and Products Terminal Upgrades

ConocoPhillips operates the Wood River Refinery in Roxana, Illinois. The refinery presently produces a variety of petroleum products for distribution in the St. Louis, Chicago, and Indianapolis areas and for additional markets throughout the Midwest. Currently, shippers have contracted with Keystone to ship 340,000 bpd of crude oil on the proposed pipeline. The majority of that volume will go to the Wood River Refinery (TransCanada 2007c). To process the growing volume of Canadian heavy crude, the refinery is slated to undergo a Coker and Refinery Expansion (CORE) project, which will increase both the total crude processing ability and the ability of the facility to handle a higher percentage of heavier crude. This will increase the supply of petroleum products to the Upper Midwest markets. Permit applications for federal PSD and NPDES permits, and the State of Illinois permit for Major Stationary Sources Construction and Modifications have been filed for the CORE project.

Key elements of the CORE project include:

- Constructing a new delayed coking unit and other associated coker units that will enable processing higher volumes of heavy crude;
- Upgrading and revising an existing distilling unit and constructing a new vacuum flasher to handle the high-acid, high-sulfur, heavy crude;
- Restarting an existing, but idled, distilling unit to provide additional crude oil processing capacity;
- Upgrading and revising two existing fluid catalytic cracking units to handle the higher acid charge and changes in unit yields, and installing new wet gas scrubbers and selective catalytic reduction systems on the flue gas emissions from these units;
- Restarting an existing, but idled distilling catalytic cracking unit to enable processing of the additional gas oil;
- Constructing a new hydrogen plant;
- Restarting the lube vacuum fractionation column as an ultra-low sulfur diesel hydrotreater;
- Providing for additional sulfur processing capacity and additional amine treating and sour water stripping capabilities; and
- Modifying the wastewater treatment plant to handle the increased loads.

Changes at the Wood River Products Terminal also are being proposed by ConocoPhillips to handle the increased product throughput. The proposed upgrades include constructing one new gasoline tank, two new ethanol tanks, and two new distillate oil tanks. The existing truck loading rack also would be expanded.

Any other refinery upgrades due to the Keystone Project would be speculative at this time. The remaining 95,000 bpd of crude oil that the pipeline would be capable of transporting would likely be shipped on a short-term spot-order basis to refineries throughout the country. It is not possible to predict where the oil would be sent and what, if any, refinery upgrades would be required. It is likely that the oil shipped by the Keystone pipeline would be used to a limited degree as replacement for other more expensive crude oil (TransCanada 2007c).

2.1.2 Cushing Extension

Keystone proposes to begin construction of the Cushing Extension no later than late 2009 or early 2010, with an in-service date of 2010. See Figure 2.1-1 for a Project overview.

2.1.2.1 Pipeline

The Cushing Extension would consist of 293.5 miles of 36-inch-diameter pipe between Steele City in Nebraska near the Nebraska/Kansas border and the existing crude oil terminal in Cushing (Payne County) in Oklahoma. Table 2.1-6 summarizes the pipeline mileage by state.

TABLE 2.1-6
Miles of Pipe by State for the Keystone Cushing Extension

State	Length (miles)	Mileposts (From – To)
Nebraska	2.4	0–2
Kansas	210.1	2–212
Oklahoma	81.0	212–293
Cushing Extension total	**293.5**	

Source: TransCanada 2007b.

Along the Cushing Extension route, approximately 16 miles of the 294 miles of pipeline route would be collocated within 300 feet of existing pipeline, utility, or road ROWs. Approximately 276 miles of the route ROW would be new ROW.

Similar to the Mainline Project, Keystone would construct the Cushing Extension within a 110-foot-wide corridor, consisting of a temporary 60-foot-wide construction ROW and a 50-foot-wide permanent ROW, as described in Section 2.1.1.1. In addition, the Cushing Extension pipeline would be constructed of high-strength steel pipe (American Petroleum Institute [API] 5L) with external coating equivalent to that for the Mainline Project.

2.1.2.2 Aboveground Facilities

Aboveground facilities for the Cushing Extension would include pump stations, MLVs, delivery sites, and densitometer sites. Pigging facilities would be located at some pump stations and delivery sites. As described for the Mainline Project, transmission lines and substations would be constructed and operated by local utility providers. Table 2.1-7 summarizes the location of each aboveground facility. Figures 2.1-18 and 2.1-19 provide state-specific maps showing the Cushing Extension pipeline route and general locations of aboveground facilities.

Pump Stations

Keystone would construct three pump stations for the Cushing Extension (see Table 2.1-7). Pump stations would be placed along the pipeline at locations necessary to maintain adequate flow. The pump stations would be built and would operate as described for the Mainline Project in Section 2.1.1.2.

TABLE 2.1-7 Aboveground Facilities for the Keystone Cushing Extension		
Facility	**Location (County, State)**	**Milepost**
Pump Stations		
CE-30	Dickinson, Kansas	49.971
CE-32	Cowley, Kansas	183.470
CE-33	Kay, Oklahoma	228.389
Mainline Valves		
V-02	Clay, Kansas	49.971
V-03	Clay, Kansas	53.866
V-04	Dickinson, Kansas	67.445
V-05	Dickinson, Kansas	77.090
V-06	Marion, Kansas	102.466
V-07	Marion, Kansas	121.507
V-08	Cowley, Kansas	194.537
V-09	Cowley, Kansas	210.580
V-10	Noble, Oklahoma	244.763
V-13	Noble, Oklahoma	256.571
V-11	Payne, Oklahoma	278.242
V-12	Payne, Oklahoma	285.462
Densitometers		
D-1-CE	Kay, Oklahoma	224.554
D-2-CE	Payne, Oklahoma	279.442
Terminals (includes delivery sites and pigging facilities)		
Ponca City Terminal	Kay, Oklahoma	235.934
Cushing Terminal	Payne, Oklahoma	291.770

Source: TransCanada 2007c.

Valves

Keystone would construct 12 MLVs along the Cushing Extension (see Table 2.1-7). In addition, each pump station would have one block valve. Proposed MLV locations were determined by the hydraulic characteristics of the pipeline, DOT regulations, and environmental and safety concerns. The valves would be built and would operate as described for the Mainline Project in Section 2.1.1.2.

Delivery Sites

Keystone would install two delivery sites along the Cushing Extension route, at the Ponca City Terminal (Kay County) and at the Cushing Terminal (Payne County), both in Oklahoma (see Table 2.1-7). The delivery sites would be constructed inside the existing terminals, and would operate as described for the Mainline Project in Section 2.1.1.2.

Densitometer Sites

For the Cushing Extension, Keystone would install two densitometer sites in Oklahoma, one in Kay County and one in Payne County (see Table 2.1-7). The densitometer sites would be built and operated as described for the Mainline Project in Section 2.1.1.2.

Pigging Facilities

The Keystone pipeline is designed to permit full pigging capabilities with a minimum interruption of service. All pig launchers or receivers would be constructed and operated within the boundaries of the pump stations or delivery sites.

Keystone estimates that three new transmission lines would be required to provide electrical power to the proposed pump stations along the Cushing Extension. According to Keystone (ENSR 2006a), approximately 11.5 miles of new transmission lines would be constructed in Kansas and Oklahoma. These would comprise one 230-kV and two 138-kV transmission lines. Pole heights would vary depending on line voltage between 55 and 80 feet, and pole spacing would vary between 370 and 550 feet. The width of the poles and attached electrical insulators would range from 9 to 15 feet.

Keystone does not anticipate that new substations would be required on any of these transmission systems. Western is at this time working with Keystone to validate or modify this assumption.

2.1.2.3 Ancillary Facilities

Ancillary facilities for the Cushing Extension would include lateral pipelines, additional temporary workspace areas, pipe storage and contractor yards, and access roads.

Lateral Pipelines

Two lateral pipelines would be constructed from the Cushing Extension to deliver crude oil to the tank storage terminals in Ponca City and Cushing in Oklahoma. The Ponca City lateral pipeline would be approximately 6,618 feet in length, and the Cushing lateral pipeline would be approximately 3,544 feet. Construction and operation of the lateral pipelines would be similar to the description for the Mainline Project. The pipelines would be constructed within a 110-foot-wide corridor, consisting of a 60-foot-wide temporary construction ROW and a 50-foot-wide permanent ROW.

Additional Temporary Workspace Areas

Over 1,700 temporary workspace areas would be required for the Cushing Extension (TransCanada 2007c). The general types of workspace areas required, and their typical dimensions and acreages are provided in Table 2.1-8. Specific locations of these workspaces would be modified as the Keystone Project design progresses. The temporary workspace areas would be constructed as described in Section 2.1.1.3.

TABLE 2.1-8 Additional Temporary Workspace Areas for the Keystone Cushing Extension		
Type of Workspace Area	**Typical Dimension (length by width in feet at each side of crossing)**	**Typical Acreage**
Directionally drilled water bodies	350 x 140 plus length of drill x 25	1.1+
Water bodies > 50 feet wide	300 x 100	0.7
Water bodies < 50 feet wide	250 x 50	0.3
Bored highways and railroads	50 x length of crossing plus 50	varies
Open-cut or bored county or private roads	125 x 50	0.1
Foreign pipeline/utility/other buried feature crossings	125 x 50	0.1
Push-pull wetland crossing	50 x length of wetland	varies
Construction spread mobilization and demobilization	300 x 150	1.0
Stringing truck turnaround areas	200 x 80	0.4

Sources: ENSR 2006a; TransCanada 2007b, c.

Pipe Storage and Contractor Yards

Keystone has identified required pipe storage and contractor yards for the construction phase of the Cushing Extension (Table 2.1-9). Keystone estimates that 13 pipe storage and six contractor yards would be required for construction of the Cushing Extension. Fuel transfer stations would be located only at contractor yards (TransCanada 2007c), and the pipe storage and contractor yards and temporary fueling stations would be constructed as described in Section 2.1.1.3.

TABLE 2.1-9 Potential Pipe Storage Yards and Contractor Yards for the Keystone Cushing Extension		
State/Type of Yard	**County**	**Combined Acreage**
Nebraska		
Combination pipe/contractor yard	Jefferson	39
Kansas		
Contractor yards	Geary	26
Pipe storage yards	Clay, Washington, Marion, Dickinson	325
Kansas subtotal		*351*
Oklahoma		
Pipe storage yards	Kay, Noble	123

Source: ENSR 2006a.

Access Roads

Keystone does not plan to construct any permanent access roads to the construction ROW. Existing public and private roads would be used on a temporary basis. Twenty-four temporary access roads or expansions of existing roads would be required for the Cushing Extension. The lengths of these temporary access roads would range from 0.06 to 1.10 miles, with the majority less than 0.5 mile. Only one of the access roads would be more than 1 mile. The temporary roads and upgrades to existing roads would disturb approximately 90.5 acres along the entire Mainline Project ROW. New temporary access roads or expansion of existing private or public roads would be used and maintained only with permission of the landowner or land management agency.

Keystone also would construct short permanent access roads from public roads to the Cushing Extension's proposed pump stations, delivery sites, and MLVs. The access roads would be constructed as described in Section 2.1.1.3.

2.1.3 Land and Borrow Material Requirements

Table 2.1-10 summarizes the land requirements for the proposed Keystone Project. For the Mainline Project, approximately 17,205 acres of land would be disturbed during construction. This total includes temporary construction workspaces and the approximately 6,673 acres that would be retained as permanent ROW. All disturbed acreage would be restored and returned to its previous aboveground use after construction, except for approximately 134 acres of permanent ROW that would serve to provide adequate space for aboveground facilities (including pump stations and valving) for the life of the Keystone Project and 6 acres that would be permanent lateral ROW. During construction of pump stations, valves, and densitometer sites along the Mainline Project, Keystone estimates the need for approximately 500,000 cubic yards of granular borrow material that would be obtained from existing local commercial aggregate suppliers (TransCanada 2007b).

TABLE 2.1-10 Summary of Land Requirements and Surface Disturbances for the Keystone Project		
Facility	Land Affected during Construction[a] (acres)	Land Affected during Operation[b] (acres)
MAINLINE PROJECT		
North Dakota		
Pipeline right-of-way (ROW)	2,891	1,314
Lateral ROW	0	0
Additional temporary workspace areas	141	0
Pipe and contractor yards	326	0
Pump station / delivery sites	28	28
North Dakota subtotal	3,386	1,342
South Dakota		
Pipeline ROW	2,919	1,327
Lateral ROW	0	0
Additional temporary workspace areas	171	0
Pipe and contractor yards	141	0
Pump station / delivery sites	22	22
South Dakota subtotal	3,253	1,323
Nebraska		
Pipeline ROW	2,850	1,295
Lateral ROW	0	0
Additional temporary workspace areas	166	0
Pipe and contractor yards	283	0
Pump station / delivery sites	28	28
Nebraska subtotal	3,327	1,323
Kansas		
Pipeline ROW	1,317	599
Lateral ROW	0	0
Additional temporary workspace areas	81	0
Pipe and contractor yards	418	0
Pump station / delivery sites	11	11
Kansas subtotal	1,827	610
Missouri		
Pipeline ROW	3,641	1,655
Lateral ROW	0	0
Additional temporary workspace areas	282	0
Pipe and contractor yards	541	0
Pump station / delivery sites	34	13
Missouri subtotal	4,498	1,689
Illinois		
Pipeline ROW	653	343
Lateral ROW	11	6
Additional temporary workspace areas	64	0

TABLE 2.1-10 (Continued)		
Facility	Land Affected during Construction[a] (acres)	Land Affected during Operation[b] (acres)
MAINLINE PROJECT (CONTINUED)		
Illinois (continued)		
Pipe and contractor yards	175	0
Pump station / delivery sites	11	11
Illinois subtotal	914	360
Mainline Project subtotal	***17,205***	***6,673***
CUSHING EXTENSION		
Nebraska		
Pipeline ROW	32	15
Lateral ROW	0	0
Additional temporary workspace areas	4	0
Pipe and contractor yards	39	0
Pump station / delivery sites	0	0
Nebraska subtotal	75	15
Kansas		
Pipeline ROW	2,802	1,273
Lateral ROW	0	0
Additional temporary workspace areas	158	0
Pipe and contractor yards	351	0
Pump station / delivery sites	11	11
Kansas subtotal	3,322	1,284
Oklahoma		
Pipeline ROW	1,079	496
Lateral ROW	11	6
Additional temporary workspace areas	77	0
Pipe and contractor yards	123	0
Pump station / delivery sites	6	6
Oklahoma subtotal	1,296	508
Cushing Extension subtotal	***4,693***	***1,807***
Keystone Project total	**21,898**	**8,480**

[a] Construction disturbance is based on a total of 110-foot-wide construction ROW for 30- and 36-inch-diameter pipe, and a 95-foot-wide construction ROW for 24-inch-diameter pipe, except in certain wetlands, shelterbelts, and other forested areas; residential areas; and commercial/industrial areas where a 85-foot-wide construction ROW would be used or in areas requiring extra width for workspace necessitated by site conditions.

[b] Operation disturbance is based on a 50-foot-wide permanently maintained ROW in all areas. All pigging facilities would be located within either pump stations or delivery sites. MLVs and densitometers would be constructed within the construction ROW and operated within a 50- by 50-foot or 50- by 66-foot area, respectively, centered on the permanently maintained 50-foot-wide ROW. Other MLVs would be located within the area associated with the pump station. Consequently, the acres for these aboveground facilities are captured within the pipeline ROW and pump station/delivery site categories.

Sources: ENSR 2006a; TransCanada 2007b, c.

For the Cushing Extension, approximately 4,595 acres of land would be disturbed during construction. This total includes temporary construction workspaces and the approximately 1,807 acres that would be retained as permanent ROW. All disturbed acreage would be restored and returned to its previous aboveground use after construction, except for approximately 17 acres of permanent ROW that would serve to provide adequate space for aboveground facilities for the life of the Keystone Project. During construction of pump stations, valves, and densitometer sites along the Cushing Extension, Keystone estimates the need for approximately 130,000 cubic yards of granular borrow material that would be obtained from existing local commercial aggregate suppliers (TransCanada 2007b).

Almost all land affected by construction and operation of the Keystone Project would be privately owned; less than 1 percent would be public land. Keystone would seek to acquire the necessary ROW for the Keystone Project by negotiating easements with landowners along the pipeline route. Keystone would negotiate permanent easements to construct, operate, and maintain the pipeline in the permanent ROW and temporary easements for additional construction workspaces.

Landowners would receive payment for granting pipeline ROW easements. Landowners would be compensated for temporary loss of land use and loss of crops or other resources attributable to pipeline construction or operation. They also would receive payment for restoration of any unavoidable property damage. If an easement cannot be negotiated with the landowner, state eminent domain laws may be invoked. Keystone also would acquire a limited number of sites in fee for siting pump stations. Keystone began land acquisition in Illinois, eastern Missouri, and for all pump stations in late 2006. All other land acquisitions are occurring in early 2007. Refer to Section 3.9 for additional discussion of easement acquisition procedures.

2.2 CONSTRUCTION PROCEDURES

The Keystone Project would be designed, constructed, tested, and operated in accordance with all applicable requirements included in the DOT regulations at 49 CFR Part 195, "Transportation of Hazardous Liquids by Pipeline," and in other applicable federal and state regulations. These regulations are intended to prevent crude oil pipeline accidents and failures. Among other design standards, 40 CFR Part 195 specifies pipeline material and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion.

Throughout the Keystone Project, Keystone would implement:

- **Keystone's Construction Mitigation and Reclamation Plan (Mitigation Plan).** The Mitigation Plan contains construction and mitigation procedures that would be used throughout the Project to avoid and minimize impacts, with subsections to address specific environmental conditions. The Mitigation Plan is included in Appendix B.
- **Keystone's Spill Prevention, Control, and Countermeasure (SPCC) Plan.** The SPCC Plan describes spill prevention practices, emergency response procedures, emergency and personnel protection equipment, release notification procedures, and cleanup procedures to avoid or minimize the potential for harmful spills and leaks. Although Keystone has not yet submitted a specific SPCC Plan, Section 3.0 of Keystone's Mitigation Plan (Appendix B) describes spill prevention and containment measures to be followed during construction activities. Other topics related to spill response can be found in Appendix B and in the Emergency Response Plan (ERP) (Appendix C [see below]).
- **Keystone's Emergency Response Plan.** The ERP identifies emergency personnel and the logical sequence of actions that should be taken in the event of an emergency involving the

Keystone system facilities during construction or operation, including written emergency shutdown procedures, communication coordination, and cleanup responsibilities. A preliminary draft of Keystone's ERP was submitted to DOS on July 1, 2006 (Appendix C).

Mitigation and other measures identified would constitute the basic construction design applicable to all land disturbed by the Keystone Project. This approach would enable construction to proceed with a single set of specifications, irrespective of the ownership status of the land being crossed. On private land, this basic design may be modified to accommodate specific landowner requests and preferences.

2.2.1 Standard Pipeline Construction Procedures

Construction of the pipeline would proceed as shown in Figure 2.2-1. Keystone would construct the pipeline in five to seven construction spreads or completed lengths, with four to five spreads along the Mainline Project and one or two spreads along the Cushing Extension (Section 2.2.4). Separate crews would be used for construction of aboveground facilities. The entire process would be coordinated to minimize the total time a tract of land is disturbed and therefore exposed to erosion and temporarily precluded from normal use.

Standard pipeline construction is composed of specific activities and methods, as described in the following sections. Special pipeline construction methods are described in Section 2.2.2.

2.2.1.1 Survey and Staking

Initial construction involves surveying the limits of the approved work area (the construction ROW boundaries and any additional temporary workspace areas). A survey crew would stake the centerline of the proposed trench. Approved access roads and existing utility lines would be flagged. Wetland boundaries and other environmentally and culturally sensitive areas also would be marked or fenced for protection. Inadvertent discoveries of cultural resources would be managed as described in Section 3.11.4.

2.2.1.2 Clearing and Grading

Clearing and grading crews would protect existing land improvements to the degree practicable, including landowner fences and gates. Livestock would be contained if necessary by temporary gates and fences. Vegetation and crops would be cleared and rocks, brush, trees, and other debris would be removed. Inadvertent discoveries of cultural resources would be managed as described in Section 3.11.4. If burning is conducted, it would comply with state and local regulations. Burning would be confined to the center of the ROW in small pipes or barrels to avoid overheating or damage to trees or structures along the ROW. Open burning would not take place on cultivated lands.

In wetland or riparian zones, temporary erosion control measures such as sediment barriers (silt fences and straw bales) and temporary slope breakers (water bars) would be installed prior to vegetation removal. Grading would occur in uneven grade areas to level the working surface, and disturbed topsoil would be segregated and piled to prevent mixing of the subsoil and topsoil. Steep side slope areas would require more severe grading due to the need to avoid unusual bending of the pipeline during installation.

2.2.1.3 Trenching

Typically, the trench would be excavated to a depth of approximately 7 to 8 feet. Typical trench widths in stable soils are about 4 to 5 feet. The DOT requires a minimum of 36 inches of cover in most areas, and a minimum of 18 inches of cover in rocky areas. Keystone proposes to use a minimum of 36 inches of cover in rocky areas and 48 inches in other locations, as illustrated in Table 2.2-1 and in Figure 2.2-2. In some cases, trenching would occur before contractors weld or bend the pipeline joints. Rock would be excavated by tractor-mounted mechanical rippers or rock trenchers, unless the rock formations are sufficiently resistant to necessitate blasting with explosives (Section 2.2.2.5). Keystone estimates that 37 miles of the Mainline Project and 9.5 miles of the Cushing Extension would require ripping (use of an excavator to remove rock and bedrock formations). Excavated rock would be used to backfill the trench to the top of the existing bedrock profile.

TABLE 2.2-1
Minimum Pipeline Cover for the Keystone Project

Location	Cover, Normal Excavation (inches)	Cover, Rock Excavation (inches)
All water bodies	60	36
Dry creeks, ditches, drains, washes, and gullies	60	36
Drainage ditches at public roads and railroads	60	48
All other land	48	36

Source: ENSR 2006a.

Disturbed topsoil would be separated from underlying soils in all cases. In areas where only the removal of trench topsoil is required, it would be stored in a pile on one side of the trench and the subsoil would be stored on the other side of the trench (see Figures 2.1-2 through 2.1-9). In areas where topsoil covering the trench and the spoil pile area would be removed, separated topsoil would be stored either on the edge of the spoil side of the construction ROW or on the edge of the working side of the construction ROW. This special handling of topsoil would ensure that it is replaced to the original soil sequence prior to disturbance. Gaps would be left between the spoil piles to prevent stormwater runoff from backing up or flooding.

To minimize the impact on livestock and wildlife movements during construction, Keystone would leave hard plugs (short lengths of unexcavated trench) or install soft plugs (areas where the trench is excavated and replaced with minimal compaction) to allow livestock or wildlife to safely cross the open trench. Soft plugs would be constructed with a ramp on each side to provide an avenue of escape for animals that fall into the trench.

2.2.1.4 Pipe Stringing, Bending, and Welding

Prior to and/or following trenching, sections of externally coated pipe joints up to 80 feet long would be transported by truck to the ROW and laid in a line along the trench. Prior to welding, individual pipe sections would be bent as necessary to fit the trench contours. Where extreme bend angles are required, the pipe sections would be factory pre-bent prior to delivery to the working ROW. Along the ROW, a track-mounted hydraulic pipe-bending machine would be used.

The pipe joints then would be welded into long strings and placed on temporary supports. Keystone would non-destructively inspect 100 percent of the welds using radiographic, ultrasonic, or other DOT-approved method. Welds that do not meet established specifications would be repaired or removed. Once the welds are approved, a protective epoxy coating would be applied to the weld joints. The pipeline then would be electronically inspected or "jeeped" and visually inspected for any faults in the epoxy coating. Damage to the coating would be repaired before the pipeline is lowered into the trench.

2.2.1.5 Installing and Backfilling

Before the pipeline is installed, the trench would be inspected to ensure that it is free of debris that could damage the pipe or protective coating; the trench would be dewatered where necessary.

After thorough inspection, the pipeline would be lowered into the trench. Trench breakers consisting of foam inserts or stacked sand bags would be used in steeper terrain to inhibit water movement within the trench. Resistant coatings and rock shields would be used in rocky terrain to protect the pipe coating from scratching and abrasion. In some cases, fine sands and gravels would be used as pipe bedding to protect the pipeline from damage during installation and operation. In no case would topsoil be used as bedding material.

After the pipe is installed, the pipeline would be backfilled with previously excavated material. The material would be pushed back into the trench using bladed equipment, backhoes, or auger-type backfilling machines. Erosion would be limited by minimizing the linear distance of cleared ROW and open trench per spread prior to trench closure and ROW stabilization.

2.2.1.6 Hydrostatic Testing, Pipe Roundness Testing, and Final Tie-In

After installation and before operation, the pipeline would be hydrostatically tested to verify that it can withstand the internal pressures expected during typical operations. Keystone has identified 29 surface water sources that could supply water for hydrostatic testing, depending on the flows at the time of testing and the sensitivity of the individual water bodies for other uses (ENSR 2006a). These potential sources are listed in Section 8.2 of Keystone's Mitigation Plan (see Appendix B). The testing would occur in approximately 30-mile isolated sections (up to a maximum of 50 miles). During testing, the pipeline segment would be filled with water and pressurized to at least 1.25 times the maximum allowable operating pressure for at least 8 hours, in accordance with 49 CFR Part 195. If leaks are found through pressure loss, they would be repaired, and the pipe section would be retested until integrity is verified. Keystone would obtain the test water from rivers and streams along the pipeline route in accordance with federal, state, and local permit stipulations. After an individual test section is complete, test water would be transferred to another isolated pipe for additional testing for contaminants and harmful biota or would be discharged in compliance with NPDES permit requirements, including pre-treatment if necessary. Keystone estimates that a total volume of 78 million gallons of test water would be required for the Mainline Project and an additional 34 million gallons would be required for testing the Cushing Extension, assuming that test water could be reused in three test sections (TransCanada 2007b). After all hydrostatic testing is concluded, a caliper pig that detects any dents or flaws in the pipeline from fabrication or construction events would be launched. Any detected "out-of-round" problems that could affect pipe integrity would be repaired. Following successful hydrostatic testing and pipe geometry inspection, all hydrostatic test manifolds would be removed and the final pipeline tie-ins would be welded and inspected.

2.2.1.7 Commissioning

Prior to commissioning, the pipeline would be cleaned and dried, if necessary, with up to 10 pounds per square inch, gauge (psig) of dry air. Commissioning includes verification of the pipeline equipment operational integrity, including pump stations, valves, and system controls and communications. The pipeline then would be purged of air, and crude oil pumping and line-filling would begin.

2.2.1.8 Cleanup and Restoration

Cleanup operations along the ROW would begin as soon as weather and site conditions permit, and would include construction debris removal, final grading, topsoil replacement, and installation of permanent erosion control structures. Pre-construction contours would be restored as closely as possible. Depending on weather and site logistics, final cleanup would be completed in most locations within approximately 20 days after trench backfilling. In residential areas, cleanup would be completed within approximately 10 days. All debris would be taken to a disposal facility.

To stabilize soils, reduce erosion, and reestablish native vegetation, disturbed work areas in non-cultivated fields would be seeded as soon as practicable, and would be subject to the prescribed dates and seed mixes specified by the landowners and regulatory agencies. Agricultural lands would be reseeded as specified in agreements with the landowners.

ROW access would be restricted through gates and barriers in accordance with landowner agreements. Pipeline markers would identify pipeline ownership and emergency reporting information, and would be installed at road and railroad crossings and other locations as required by 49 CFR Part 195. Special markers visible to aerial patrol pilots also would be installed.

2.2.2 Non-Standard Pipeline Construction Procedures

Keystone would use special construction techniques where warranted by site-specific conditions. These special construction techniques are described in subsequent sections.

2.2.2.1 Road, Highway, and Railroad Crossings

Construction of the pipeline across roads, highways, railroads, and existing water utility lines would be in accordance with required permits and approvals obtained by Keystone. To minimally disrupt traffic, it is Keystone's intent that pipeline crossings of major paved roads, primary gravel roads, highways, and railroads where traffic cannot be interrupted would be accomplished by boring under the road belt, as illustrated in Figure 2.2-3.

Pits would be excavated on each side of the crossing to seat boring equipment. A hole equal to at least the diameter of the pipe then would be bored under the feature, and a pre-fabricated pipe section would be pulled through the bored hole. For longer crossings, pipe sections would be welded prior to the pull beneath the crossing. Construction of these crossings would be expected to take from 1 to 10 days, depending on the length of the crossing.

Keystone intends that most small unpaved roads and driveways would be crossed using an open-cut method that typically would be completed within 1 to 2 days, and would require only temporary road closure and detours. Where detours are not feasible, at least one lane of traffic would be kept open, except during pipeline installation. Signs would be used for traffic safety and to reduce traffic disruption.

Permits will be required to cross water distribution systems. In South Dakota, the Keystone Mainline Project would cross the Bon Homme-Yankton water delivery utility lines at 27 locations. The lines that would be crossed are PVC or iron pipes ranging in diameter from 1.5 to 18 inches. The water district requires a separation distance of 18 inches, and cathodic protection must be provided by Keystone to protect iron lines and miscellaneous vaults. Permits will be required that detail the responsibilities, process, and methodology associated with crossing these and all water lines.

2.2.2.2 Steep Terrain

Steep slope grades would be reduced as needed for construction safety and pipe contour limitations. The slopes would be contoured prior to pipeline installation and recontoured to the extent practicable during site restoration. Cross-slope construction may require cut-and-fill grading. Prior to grading, topsoil would be stripped and stockpiled—in most cases, on the low side of the ROW. After pipeline installation, the site would be recontoured, topsoil would be replaced, erosion control features would be installed, and site reseeding would be accomplished.

Steep terrain construction would include temporary sediment barriers (e.g., silt fences and straw bales) and slope breakers (e.g., water bars of mounded and compacted soil) to reduce soil erosion and transport. Permanent slope breakers would be installed during ROW restoration. ROW stabilization would include re-seeding, mulching, and installation of erosion control fabric.

2.2.2.3 Water Body Crossings

Site Preparation

Temporary workspace areas would be required on both sides of all water bodies to stage construction, fabricate the pipeline, and store materials. These workspace areas would be located at least 50 feet from the water's edge where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. Before construction, temporary bridges (e.g., subsoil fill over culverts, timber mats supported by flumes, railcar flatbeds, and flexi-float apparatus) would be installed across all perennial water bodies. Construction equipment would be required to use the bridges, except the clearing crew, which would be allowed one pass through the water bodies before the bridges are installed. Equipment refueling and lubrication typically would take place in upland areas that are 100 feet or more from the edges of lakes, streams, intermittent streams, and wetlands. Section 3.0 of Keystone's Mitigation Plan (Appendix B) provides procedures for refueling and lubrication of construction vehicles, and identifies spill prevention and contingency planning for these operations.

Perennial Stream and River Crossings

The Mainline Project would cross 272 streams and rivers, and the Cushing Extension would cross 58, using one of four techniques: the open-cut wet method (Keystone's preferred method), the flume method, the dam-and-pump method, or the HDD method. Keystone intends to install the pipeline at an appropriate depth to address the potential hazard represented by scour during high-flow events as determined during final design (TransCanada 2007b). Detailed information on Keystone's proposed methodology for water crossings and general mitigation planning is presented in Appendix D (Site-Specific Water Body Crossing Plans) and in Appendix B (Keystone's Mitigation Plan).

In the open-cut wet method, trench excavation occurs as water flows along the stream channel (Figure 2.2-4). Backhoes typically would excavate the trench and would access the streambed from either side of the crossing, avoiding the channel if possible, depending on the channel width. In wider streams and rivers, equipment likely would operate within the channel. Relatively impermeable trench plugs would be placed to preclude water flowing into the nearby pipeline trench. Material excavated from the trench typically would be stockpiled at least 10 feet from the active channel, although wider channels may require placement within the stream bed. The stockpiles would be constrained as necessary with sediment barriers to prevent excessive stream siltation.

After trench excavation, the pipe would be carried, pushed, or pulled across the water body and installed in the trench. To prevent pipe flotation, the pipe would be covered with reinforced concrete or concrete weights and then backfilled with either stockpiled or imported material, depending on permit stipulations. Stream banks then would be restored and stabilized.

Keystone occasionally would use the flume and dam-and-pump methods where technically feasible and where determined necessary based on permit stipulations. During flume construction, water would be diverted through the trenching area through one or more flume pipes. During dam-and-pump construction, pumps and hoses would be used to divert water around the trench area. In each method, water flow is not returned to the construction area until pipeline installation and backfilling is complete. To minimize any streambank, streambed, or water quality impacts, Keystone intends to use the HDD installation method for the Missouri River (two crossings), the Platte River, the Chariton River, the Cuivre River (two crossings), the Mississippi River, the Kaskaskia River, and at Hurricane Creek along the Mainline Project; and at the Republican River, the Arkansas River, the Salt Fork Arkansas River, and the Cimarron River along the Cushing Extension (TransCanada 2007b). Detailed drawings depicting the HDD crossings for the Mainline Project are provided in Appendix D.

At an HDD crossing (Figure 2.2.5), a drilling unit would first set up on one of the river or stream banks. The setup for HDD would require clearing and disruption of several acres on the entrance side of the crossing and a segment of construction ROW aligned along the drilling trajectory on the exit side of the boring. The ROW between the boring point of entry and the point of exit on the opposite side of the river or stream would not be cleared or graded. The minimum drilled length for a 30-inch-diameter pipeline crossing would be approximately 1,000 feet due to pipe bending constraints (TransCanada 2007b). A pilot hole is drilled under the crossing, using a rotary bit and clay slurry, and enlarged through repeated reamings. Pipe sections long enough to span the entire crossing would be staged and welded along the ROW on the opposite side of the water body and pulled through the drilled and reamed hole. Depth of cover over the pipeline beneath the 13 proposed HDD river crossings would be approximately 45 feet.

Intermittent Water Body Crossings

The Keystone Project would cross approximately 840 intermittent water bodies on the Mainline Project and about 133 intermittent water bodies on the Cushing Extension. If dry during construction, Keystone proposes to cross these features using standard upland construction techniques. If flowing during construction, Keystone proposes to perform open-cut wet crossings, as previously described. When crossing water bodies, Keystone would adhere to the guidelines outlined in its Site-Specific Water Body Crossing Plans (Appendix D), Keystone's Mitigation Plan (Appendix B), and the requirements of its water body crossing permits.

Site Restoration

Temporary equipment bridges would be removed following construction. River and stream banks would be temporarily stabilized within 24 hours of completing instream construction. River and stream banks ultimately would be restored to pre-construction contours or another stable configuration. Erosion control measures (e.g., rock riprap or gabion baskets (rock enclosed in wire bins), log walls, vegetated geogrids, and willow cuttings) would be installed as necessary on steep water body banks, as stipulated in permits. Other stream banks would be seeded with native grasses and mulched or covered with erosion control fabric. Sediment barriers would be maintained across the ROW at all water body approaches until permanent vegetation is established.

2.2.2.4 Wetland Crossings

Keystone has mapped wetland crossing areas using data from wetland delineation field surveys, aerial photography, and National Wetland Inventory (NWI) maps. Acreages of wetlands potentially affected by construction and the specific impacts identified are described in Section 3.4.

Site Preparation

Clearing of vegetation in wetlands would be limited to trees and shrubs cut flush with the ground surface and removed from the wetland. Stump removal, grading, topsoil segregation, and excavation would be limited to the area immediately over the trench. During clearing, sediment barriers (silt fences and stacked straw bales) would be installed and maintained on down slopes adjacent to saturated wetlands, and within additional temporary workspace areas as necessary to minimize the potential for sediment runoff. Temporary workspace areas located at least 10 feet from the wetlands perimeter would be required on both sides of particularly wide saturated wetlands to stage construction, fabricate pipeline, and store materials. Typical ROW width in saturated wetlands would be 85 feet unless a wider ROW is needed to address non-cohesive soils

Construction

Construction equipment would be limited to areas essential for ROW clearing, excavating the trench, fabricating and installing the pipeline, backfilling the trench, and restoring the ROW. In areas where access to the ROW is through wetlands, equipment would be allowed to travel through the wetlands only if the ground is firm enough or has been stabilized to avoid creating ruts.

Construction within wetland areas that can support construction equipment without equipment mats would be accomplished using upland cross-country construction techniques (Figure 2.2-6). Topsoil salvaging and stockpiling would occur to the extent feasible. Where topsoil has been segregated from subsoil, the subsoil would be backfilled first—followed by the topsoil. Topsoil would be replaced to the original ground level, leaving no crown over the trench line. In some areas where wetlands overlie rocky soils, the pipe would be padded with rock-free soil or sand before backfilling with native bedrock and soil.

Where wetland soils are saturated or inundated, the pipeline can be installed using the push-pull technique. The push-pull technique would involve stringing and welding the pipeline outside the wetland, and excavating and backfilling the trench using a backhoe supported by equipment mats or timber riprap. The prefabricated pipeline is installed in the wetland by equipping it with buoys and pushing or pulling it across the water-filled trench. After the pipeline is floated into place, the floats are removed and the pipeline sinks into place. Most pipe installed in saturated wetlands would be coated with concrete or equipped with set-on weights to provide negative buoyancy.

Restoration

Because little or no grading would occur in wetlands, restoration of contours would be accomplished during backfilling. Prior to backfilling, trench breakers would be installed where necessary to prevent subsurface drainage of water from wetlands. Equipment mats, timber riprap, gravel fill, geotextile fabric, and straw mats would be removed from wetlands following backfilling.

Where wetlands are located at the base of slopes, permanent slope breakers would be constructed across the ROW in upland areas adjacent to the wetland boundary. Temporary sediment barriers would be installed where necessary until revegetation of adjacent upland areas is successful. Once revegetation is successful, sediment barriers would be removed from the ROW and disposed of properly.

In wetlands where no standing water is present, the construction ROW would be seeded in accordance with recommendations of the local soil conservation authorities or land management agency.

2.2.2.5 Blasting

Explosive rock fracturing (blasting) may be required in certain consolidated shallow bedrock areas or where large boulders occur. Keystone estimates that 6.5 miles of the Mainline Project and 1.8 miles of the Cushing Extension would require blasting (TransCanada 2007b). Keystone would implement strict safety precautions during blasting and would work to avoid damage to underground structures, cables, conduits, pipelines, and underground watercourses or springs. Blasting would occur during daylight hours, with adequate notice to adjacent landowners and tenants and in compliance with federal, state, and local codes and ordinances—as well as manufacturer's prescribed safety procedures and industry practices.

2.2.2.6 Residential and Commercial/Industrial Areas

Keystone used 2005 aerial photography to identify buildings located within 25 feet of the construction ROW. These areas are summarized in Table 2.2-2. Prior to construction, Keystone would verify the proximity of buildings to the pipeline and determine whether the structures are residences or commercial/industrial businesses. Keystone would develop site-specific construction plans to mitigate construction-related impacts on these areas. Further construction and mitigation measures are identified in Keystone's Mitigation Plan (Appendix B).

2.2.2.7 Fences and Pasture/Rangelands

Before cutting down any fences in the construction ROW for pipeline construction, each fence would be braced and secured to prevent slacking. To prevent the passage of livestock, openings in the fence line would be closed with temporary gates. Gaps in natural barriers used for livestock control that may be created by pipeline construction would be fenced according to the landowner's requirements. Upon completion of construction, temporary fences would be removed and permanent fences, gates, irrigation ditches, cattle guards, and reservoirs that were maintained during construction would be repaired to pre-construction conditions or better. Further construction and mitigation measures are identified in Keystone's Mitigation Plan (Appendix B).

TABLE 2.2-2
Areas with Buildings Located within 25 Feet of the Construction Right-of-Way for the Keystone Project

State	County	Milepost	Structures
Mainline Project			
North Dakota	Barnes	126.8	Single
	Sargent	204.9	Single
South Dakota	Marshall	240.3	Single
	Hanson	377.9	Single
	Hutchinson	403.7	Single
	Yankton	429.3	Single
	Yankton	433.8	Single
Nebraska	Seward	570.9	Single
	Seward	585.3	Single
	Jefferson	627.1	Single
	Gage	647.0	Single
Kansas	Nemaha	684.8	Several
	Nemaha	687.1	Single
	Nemaha	693.8	Single
	Brown	703.6	Single
	Brown	708.7	Single
	Doniphan	728.1	Several
	Doniphan	733.7	Development
	Doniphan	734.4	Several
Missouri	Buchanan	753.4	Several
	Buchanan	754.4	Several
	Buchanan	756.4	Development
	Buchanan	757.2	Single
	Clinton	771.8	Single
	Clinton	773.3	Single
	Clinton	777.1	Several
	Clinton	785.6	Several
	Clinton	789.2	Single
	Caldwell	794.0	Single
	Caldwell	796.4	Single
	Caldwell	802.9	Single
	Caldwell	807.7	Single
	Caldwell	810.5	Single
	Carroll	823.3	Single
	Carroll	823.9	Single
	Carroll	824.6	Several
	Carroll	827.8	Single
	Carroll	830.8	Several
	Carroll	832.9	Single
	Chariton	842.7	Single
	Chariton	848.5	Several
	Chariton	858.4	Single
	Chariton	859.5	Several
	Chariton	859.7	Single
	Chariton	867.4	Several
	Chariton	871.9	Single
	Randolph	877.6	Several
	Randolph	881.2	Single

TABLE 2.2-2 (Continued)			
State	**County**	**Milepost**	**Structures**
Mainline Project (continued)			
Missouri (continued)	Audrain	905.1	Development
	Audrain	908.8	Single
	Audrain	914.4	Several
	Audrain	926.4	Single
	Montgomery	943.7	Single
	Montgomery	945.8	Single
	Montgomery	947.6	Single
	Montgomery	948.6	Several
	Montgomery	950.9	Development
	Montgomery	952.3	Several
	Lincoln	956.1	Single
	Lincoln	956.7	Single
	Lincoln	961.3	Several
	Lincoln	965.9	Several
	Lincoln	968.4	Development
	Lincoln	972.2	Several
	Lincoln	975.8	Single
	Lincoln	978.7	Several
	St. Charles	982.3	Several
	St. Charles	983.3	Single
	St. Charles	1007.9	Single
	St. Charles	1013.6	Single
Illinois	Madison	1024.5	Single
Cushing Extension			
Nebraska	NA	NA	None
Kansas	Marion	124.6	Single
	Butler	156.4	Development
	Butler	162.0	Single
	Cowley	180.3	Single
	Cowley	208.3	Several
Oklahoma	Kay	233.2	Development
	Noble	241.9	Several
	Noble	246.7	Single
	Noble	258.7	Single
	Payne	269.7	Several
	Payne	270.5	Single
	Payne	274.5	Development
	Payne	279.4	Single
	Payne	289.6	Single
	Payne	291.7	Single

NA = Not applicable.

Sources: ENSR 2006a, TransCanada 2007b.

2.2.2.8 Forestlands

Keystone would ensure that pipeline construction activities would cause minimal effects on forestlands by managing and minimizing impacts when clearing, grubbing, and grading trees, brush, and stumps. Keystone would follow specific construction and mitigation measures, as identified in Keystone's Mitigation Plan (Appendix B) and as specified in applicable federal, state, and local permits.

2.2.3 Construction Procedures for Aboveground Facilities

Keystone would construct aboveground facilities as described below.

2.2.3.1 Pump Stations

Site construction activities at pump stations would include clearing and grading, installing foundations for the electrical buildings and support buildings, and erecting the pump station support structures. A block valve would be installed in the main line, with two side block valves—one to the suction piping of the pumps and one from the discharge piping of the pumps. Materials laydown and construction activities would be within the proposed site layout area. Figures 2.2-7 and 2.2-8 illustrate typical plot plans for pump stations without and with pigging facilities, respectively.

Pump station sites would be cleared and graded, and foundations for the pump supports, the electrical building, and the support building would be installed. The electrical building would include electrical systems, communications, and control equipment. The support building would house a small office and washroom. Each pump station would require electricity and telephone facilities, which would be obtained from local utilities. Table 2.2-3 summarizes electric power and distribution line requirements.

Aboveground and below ground crude oil piping would be installed and pressure tested (Section 2.2.1). The pipes then would be tied in to the main pipeline. Piping installed below grade would be coated for corrosion protection prior to backfilling, and all below-grade facilities would be protected by a cathodic protection system. Prior to commissioning the pumps, controls, and safety devices would be checked and tested. The pump station sites then would be regraded, and a permanent security fence would be installed.

2.2.3.2 Mainline Valves

Construction of MLVs would be concurrent with construction of the pipeline. When not located at pump stations, MLVs would be constructed within a fenced 50-foot-wide by 50-foot-long site located in the pipeline construction ROW and centered on the 50-foot-wide permanently maintained ROW. To allow continuous access, MLVs typically would be located near public roads. If necessary, short permanent access roads or approaches would be constructed in the permanent ROW to each MLV site. The MLVs would operate on locally provided power.

Selected MLVs would be remotely monitored. For each remote terminal unit (RTU), a small skid-mounted building with a cabinet attached to a wooden pole would be installed. Conduit and wiring would be installed to connect the RTU to adjacent MLVs.

TABLE 2.2-3 Summary of Pump Station Electrical Power Supply Requirements for the Keystone Project		
Station	**Local Utility**	**Service Description**
MAINLINE PROJECT		
North Dakota		
Pump station ML #15	NODAK Electric Cooperative	Approximately 8 miles of new 69-kilovolt (kV) transmission line from existing 69-kV line to main substation at pump station site. Approximately 25 miles of existing 69-kV line upgrades. Main pump station substation with 15-million volt-amps (MVA) 69/4.16-kV transformer.
Pump station ML #16	NODAK Electric Cooperative	Approximately 1 mile of new 69-kV transmission line from existing 69-kV line to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #17	NODAK Electric Cooperative	Approximately 11.5 miles of new 69-kV transmission line from existing 69-kV line to main substation at pump station site. Approximately 17 miles of existing 69-kV line upgrades. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #18	Ottertail Power Company	Approximately 18 miles of new 115-kV transmission line to main substation at pump station site. Remote end upgrades. Main pump station substation with 12/16-MVA 115/4.16-kV transformer.
Pump station ML #19	Dakota Valley Electric Cooperative	Approximately 29 miles of new 115-kV transmission line from Foreman substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 12/16-MVA 115/4.16-kV transformer.
South Dakota		
Pump station ML #20	Lake Region Electric Association, Inc.	Approximately 13 miles of new 115-kV transmission line from Groten substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Pump station ML #21	Dakota Energy Cooperative, Inc.	Approximately 3.7 miles of new 69-kV transmission line from a new 230/69-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer. Note: Keystone moved PS-21 across a street from Clark County and into Beadle County.
Pump station ML #22	Central Electric Cooperative, Inc.	Approximately 12 miles of new 115-kV transmission line from a new 230/115-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Pump station ML #23	Southeastern Electric Service Cooperative, Inc.	Approximately 19 miles of new 115-kV transmission line from a new 230/115-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Nebraska		
Pump station ML #24	Nebraska Public Power District	Approximately 5 miles of new 69-kV transmission line from a new 115/69-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #25	Nebraska Public Power District	Approximately 3 miles of new 34.5-kV transmission line from a new 115/34.5-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 34.5/4.16-kV transformer.

TABLE 2.2-3 (Continued)		
Station	**Local Utility**	**Service Description**
MAINLINE PROJECT (CONTINUED)		
Nebraska (continued)		
Pump station ML #26	Nebraska Public Power District	Approximately 4 miles of new 34.5-kV transmission line tapping an existing 34.5-kV line to main substation at pump station site. Main pump station substation with 10-MVA 34.5/4.16-kV transformer.
Pump station ML #27	Nebraska Public Power District	Approximately 2.5 miles of new 115-kV transmission line tapping an existing 115-kV line to main substation at pump station site. Remote end upgrades. Main pump station substation with 15-MVA 115/4.16-kV transformer. Note: Keystone moved PS-27 across a street out of native grassland and into pasture land.
Pump station ML #28	Nebraska Public Power District	Approximately 9 miles of new 69-kV transmission line from local substation to main substation at pump station site. New 115/69-kV substation and rebuilding 4 miles of 34.5-kV line to 69-kV. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Kansas		
Pump station ML #29	Westar Energy	Approximately 4.5 miles of new 115-kV transmission line tapping an existing line to main substation at pump station site. Remote end upgrades. Main pump station substation with 10-MVA 115/4.16-kV transformer.
Pump station ML #30	Doniphan Electric Cooperative	Approximately 2.8 miles of new 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15-MVA 34.5/4.16-kV transformer. Note: Keystone moved PS-30 out of the creek bed and across a street.
Missouri		
Pump station ML #31	Platte-Clay Electric Cooperative	No powerlines are required. Note: Keystone moved PS-31 next to the Rockies Express compressor station to eliminate additional power lines.
Pump station ML #32	Kansas City Power & Light	Approximately 6 miles of new 34.5-kV line from an existing substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 7.5-MVA 34.5/4.16-kV transformer.
Pump station ML #33	Kansas City Power & Light	Approximately 0.5 mile of new 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 7.5-MVA 34.5/4.16-kV transformer.
Pump station ML #34	Central Electric Cooperative	Note: Keystone moved PS-34 to a site collocated with an existing substation. Power lines are not required.
Pump station ML #35	Central Electric Power Cooperative	Approximately 0.5 mile of new 69-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer. Note: Keystone moved PS-34 to a site that is nearer electrical lines to reduce power line costs.
Pump station ML #36	Ameren UE	Approximately 0.5 mile of new 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15-MVA 34.5/4.16-kV transformer.

TABLE 2.2-3 (Continued)		
Station	**Local Utility**	**Service Description**
MAINLINE PROJECT (CONTINUED)		
Illinois		
Pump station ML #37	Ameren IP	Less than 0.5 mile of new 34.5-kV transmission line from nearby utility to main substation at pump station site. Main pump station substation with 5-MVA 34.5/4.16-kV transformer.
Pump station ML #38	To be determined	About 1 mile of new 115-kV transmission line to a 115/4.16-kV substation would be required. This pump station would be installed only if the Project meets the 591,000-barrels-per-day capacity (expansion).
CUSHING EXTENSION		
Kansas		
Pump station CE #30	To be determined	Approximately 2.5 miles of new 230-kV transmission line tapped off an existing 230-kV line. Main pump station substation with a 15-MVA transformer. Remote end upgrades as required.
Pump station CE #32	To be determined	Approximately 9 miles of new 138-kV transmission line tapped off an existing 138-kV line. Main pump station substation with a 10-MVA transformer. Remote end upgrades as required.
Oklahoma		
Pump station CE #33	To be determined	Approximately 0.8 mile of new 138-kV transmission line tapped off an existing 138-kV line. Main pump station substation with a 12-MVA transformer. Remote end upgrades as required.

ML = Mainline Project.
CE = Cushing Extension.

Sources: ENSR 2006a, TransCanada 2007c.

2.2.3.3 Delivery Sites, Densitometer Sites, and Pigging Facilities

Where delivery and densitometer sites and pigging facilities are collocated with pump stations, construction would occur as part of the pumping station construction schedule, and would be performed similarly to the pump stations. These sites also would require locally provided power. Certain densitometer sites would be remotely monitored. They would be connected to adjacent facilities as described for MLVs in Section 2.2.3.2.

2.2.3.4 Transmission Lines

Construction of transmission lines would be scheduled and performed by local power providers contracted with Keystone at a future date. Each of the U.S. pump stations would require a new substation that would receive power from nearby transmission lines. Routing of the overhead transmission lines linking the substations and the existing lines are provided in the Keystone Pipeline Project Environmental Report (ENSR 2006a) and summarized in Table 2.2-3. Subsequent changes to the pump station locations and associated power line reroutes have occurred due to reassessment of supply options, electrical loads, and proximity to existing lines (TransCanada 2007c).

Currently, power providers are proposing to build 18 new power lines; the voltage ratings of the lines would range from 34.5 to 115 kV, with the majority being either 69 or 115 kV. In addition to the 24 substations associated with the pump stations, six new source substations would be constructed: one in North Dakota, three in South Dakota, and two in Nebraska. Supplemental filings will provide details on the additional substations (TransCanada 2007c).

It is assumed that, prior to power line construction, easements would be negotiated and that any necessary ROW clearing and grading would proceed after NEPA compliance review and acquisition of required permits. It is Keystone's assumption that the majority of the required transmission lines would parallel existing county road ROWs, and it is further assumed that no substation construction would be necessary to accommodate Keystone Project power requirements. It is assumed that either steel or wood poles would be installed along the transmission corridors, embedded and anchored as required to achieve appropriate stability. Wire conductors would be installed through pulling or reeling, as determined by the selected contractors. Insulators also would be installed as needed. No other information on the alignment, design, or construction of the proposed transmission lines is currently available.

2.2.4 Construction Schedule and Workforce

Keystone proposes to begin construction on the Mainline Project in early 2008. Construction is expected to last 18 months, ending in September 2009, with a proposed in-service date of November 30, 2009. Work on the Cushing Extension would begin in late 2009 or early 2010, with a proposed in-service date of 2010.

Keystone proposes to construct the Mainline Project using four to five construction spreads and the Cushing Extension using one or two spreads (Table 2.2-4). Construction would occur simultaneously on all Mainline Project spreads. Each spread would require 15 months to complete. Keystone anticipates a workforce of approximately 500 to 600 construction personnel per spread and a total peak work force of approximately 2,500 to 3,000 construction personnel. Construction personnel would consist of Keystone employees, contractor employees, construction inspection staff, and environmental inspection staff.

Keystone proposes construction of the Mainline Project's aboveground facilities in spring 2008. Construction of each pump station would require approximately 20 to 30 additional workers. Construction of pump stations would be completed in 18 months.

Through its construction contractors and subcontractors, Keystone would attempt to hire temporary construction staff from the local work force. At peak employment, Keystone anticipates that approximately 10 to 15 percent of the construction workforce would be locally hired.

2.3 OPERATIONS AND MAINTENANCE

Keystone would operate and maintain project facilities in accordance with the DOT regulations in 49 CFR Parts 194 and 195 and other applicable federal and state regulations. Operation and maintenance of the pipeline system typically would be performed by Keystone personnel. Keystone estimates that the operational pipeline workforce would comprise about 20 U.S. employees.

TABLE 2.2-4 Construction Spreads Associated with the Keystone Project		
Spread Number	**Location**	**Approximate Length of Construction Spread**
Mainline Project		
Spread 1	Cavalier, North Dakota to Spink, South Dakota	300 miles
Spread 2	Beadle, South Dakota to Gage, Nebraska	330 miles
Spread 3	Marshall, Nebraska to Chariton, Missouri	215 miles
Spread 4	Chariton, Missouri to Patoka, Illinois	220 miles
Cushing Extension		
Spread 5	Jefferson, Nebraska to Cushing, Oklahoma	300 miles

Source: ENSR 2006a.

2.3.1 Normal Operations and Routine Maintenance

During operations, Keystone would regularly monitor the pipeline both electronically and through aerial and ambulatory pipeline integrity surveys at a frequency consistent with 49 CFR Part 195. These surveys are conducted to identify any encroachments or nearby construction activities, as well as any ROW erosion, exposed pipe, or visual or olfactory evidence of potential crude oil releases. Keystone would encourage local landowners to report any pipeline integrity concerns to Keystone or to OPS. Keystone would monitor evidence of population changes and identify HCAs as necessary. In addition, MLVs would be inspected annually. All operation and maintenance work would be performed in accordance with OPS requirements.

As part of the regular surveys, Keystone would identify areas where permanent erosion control devices require repair or additional erosion control devices are necessary to prevent future degradation. Keystone would further monitor the ROW to identify any areas where soil productivity has been degraded as a result of pipeline construction, and reclamation measures would be implemented to rectify any such concerns.

Woody vegetation along the pipeline permanent ROW would periodically be cleared using mechanical mowing or cutting. Supervisory Control and Data Acquisition (SCADA) facilities would be located at all pump stations and delivery facilities. The pipeline SCADA system would:

- Provide MLV position remote indication,
- Provide MLV remote closing and opening control from a control center,
- Provide remote indication of line pressure and temperature, and
- Provide remote indication of delivery flow and total flow.

The Keystone pipeline control center would be manned 24 hours per day and 365 days per year. A backup control center also would be constructed. Primary and backup communications systems would provide real-time information from the pump stations and connection to field personnel. State-of-the-art pipeline monitoring systems in the control center would include a leak detection system capable of identifying abnormal conditions (see Section 2.3.2) and initiating visual and audible alarms if an operating condition that warrants operator investigation is identified. Serious abnormal situations that are not investigated would initiate automatic pipeline shutdown systems.

2.3.2 Abnormal Operations

Abnormal operating procedures would be implemented in accordance with 49 CFR Section 195.402(d). In the event of any unusual situation, the operations manager on duty would alter the pipeline's operation. If pressure indications change, the pipeline controller would immediately evaluate the situation. If a leak is suspected, Keystone would initiate its ERP. If a pipeline segment is shutdown due to a suspected leak, operation of the affected segment would not be resumed until the cause of the alarm (e.g., false alarm by instrumentation or leak) is identified and repaired. In the event of a reportable leak, DOT approval would be required to resume operation of the affected segment.

As per 49 CFR Part 195, Keystone would perform aerial surveillance of the pipeline ROW at least 26 times a year. Keystone also would use both software associated with the SCADA monitoring system and volumetric balancing to assist in leak detection during pipeline operations.

The smallest leak that Keystone's SCADA system would be capable of detecting is in the range of 1.5 to 2 percent by volume in approximately 140 minutes (TransCanada 2007b). It would constantly monitor pipeline operation to detect potential leaks greater than or equal to this minimum detection level. The SCADA system and leak detection software would fully comply with industry standards (API 1149). Using real-time dynamic-flow modeling software, line-pack compensated volumetric balancing, and a hydraulic gradient model, the SCADA system would check pipeline conditions (flow rates, pressure, temperature, and fluid density) every 3 to 5 seconds while the pipeline is actively transporting crude oil. Pressure transducers and other monitoring equipment would be located at pump stations, and data from these locations would be transmitted via satellite to the centralized SCADA location. If a real-time measurement exceeds a predetermined threshold, the information would be sent to the SCADA system and the operator would take corrective actions. Compared to older leak detection programs, line-pack compensated volume balancing represents an improved method for volume accounting that calculates changes in fluid volume in the pipeline.

When the Keystone pipeline is not actively transporting oil, the pipeline would enter a "static" mode. Because crude oil would not be moving, the pressures between pressure transducers should remain relatively constant after accounting for temperature changes and other minor pressure changes.

2.3.2.1 Emergency Response Procedures

System emergencies could result from natural or human-induced events that lead to damage to critical components of the pipeline system. In the event of a system emergency, pipeline flow would be stopped and would not resume until the cause of the problem (e.g., instrumentation failure or leak) was detected and if necessary, repaired.

Keystone would be required to prepare site-specific ERPs for the system, which would be submitted to and approved by OPS prior to operation. A preliminary draft ERP was submitted to DOS on July 1, 2006 (see Appendix C). The final ERP would establish:

- Guidelines and procedures to be followed in emergencies in order to minimize hazards resulting from pipeline emergencies;
- Procedures for training Keystone's employees on emergency procedures; and
- Guidelines for continuing educational programs designed to inform the public of the procedures to follow in recognizing and reporting an emergency condition, in compliance with the recommended practice of API 1162.

If an oil release occurred, Keystone would be required to immediately notify the National Response Center in the event that the release of crude oil violates water quality standards, creates a sheen on water, or causes a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines (40 CFR Part 112). In addition to the National Response Center, Keystone would make timely notifications to other agencies, including the appropriate Local Emergency Planning Committees, sheriff's departments, applicable state's environmental departments, EPA, and affected landowners.

While a typical potential oil spill response could likely be handled by Keystone, significant releases could require assistance from local, state, or federal agencies. Under the National Contingency Plan, EPA is the lead federal response agency for oil spills occurring on land and in inland waters. EPA would evaluate the size and nature of a spill, its potential hazards, the resources needed to contain and clean it up, and the ability of the responsible party or local authorities to handle the incident. EPA would monitor all activities to ensure that the spill is being contained and cleaned up appropriately.

A fire associated with a crude oil spill is relatively rare. According to historical data (OPS 2005), only about 4 percent of reportable liquid petroleum spills are ignited. In the unlikely event of a fire, firefighters would take actions to prevent the conflagration from spreading to adjacent foliage or structures. Fire departments might choose to extinguish a small- or moderate-sized crude oil fire; in certain cases, however, the best course of action may be to let the fire burn itself out. It is Keystone's intent to work with emergency response agencies to provide pipeline awareness education and other support within the local communities along the proposed pipeline corridor.

2.3.2.2 Remediation

In the event of an oil release, corrective remedial actions would be required by relevant federal, state, and local regulations and could be enforced by EPA, OPS, and other state and local agencies with potential jurisdiction. Required remedial actions may include:

- A detailed remedial investigation of environmental contamination resulting from the release,
- Determination of the appropriate scope of cleanup and restoration for contaminated soils,
- Determination of the appropriate scope of cleanup of contaminated surface water and groundwater,
- Implementation of soil and groundwater remediation,
- Determination of natural resource damages resulting from oil release, and
- Enforcement of penalties related to a natural resources damage assessment.

Several federal and state regulatory programs are involved in spill response, including at the federal level the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), the CWA, and the Oil Pollution Act of 1990.

2.4 FUTURE PLANS AND ABANDONMENT

The Keystone pipeline initially would be capable of transporting 435,000 bpd and could be expanded to a capacity of approximately 591,000 bpd. While there is no certainty that the Project would reach this potential, the expansion would require one additional pump station to be constructed in Bond County, Illinois and additional pumps at existing pump stations. In addition, Keystone is still evaluating whether sufficient shipper support warrants construction of the Cushing Extension.

The proposed Keystone pipeline is expected to operate for 50 years or more. At this time, Keystone has not submitted plans for abandonment of these facilities at the end of their operational life. If eventually necessary, abandonment would proceed according to regulations in place at the time.

2.5 REFERENCES

ENSR. 2006a. Keystone Pipeline Project Environmental Report. Updated November 15, 2006.

Office of Pipeline Safety. 2005. Hazardous Liquid Accident Data – 1986 to January 2002 and Hazardous Liquid Accident Data – Pre 1986. Available online at: <http://ops.dot.gov/stats/IA98.htm>.

OPS. See Office of Pipeline Safety.

TransCanada. See TransCanada Keystone Pipeline, L.P.

TransCanada Keystone Pipeline, L.P. 2007b. Response to Data Request #1. Submitted to U.S. Department of State by TransCanada Keystone Pipeline, L.P. Application for Presidential Permit. January 29.

TransCanada Keystone Pipeline, L.P. 2007c. Response to Data Request #2. Submitted to U.S. Department of State by TransCanada Keystone Pipeline, L.P. Application for Presidential Permit. April 4.

3.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the proposed Keystone Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts generally occur during construction, with the resources returning to pre-construction conditions almost immediately afterward. Short-term impacts could continue for approximately 3 years following construction. Impacts were considered long term if the resources would require more than 3 years to recover. Permanent impacts would occur as a result of activities that modify resources to the extent that they would not return to pre-construction conditions during the life of the proposed Keystone Project, such as with construction of aboveground structures. An impact resulting in a substantial adverse change in the environment would be considered significant.

This section discusses the affected environment, construction and operations impacts, and mitigation for each affected resource. Keystone has indicated that it would implement certain measures to reduce environmental impacts. These measures have been evaluated and additional measures that might be necessary to further reduce impacts are recommended. The recommended measures are shown as bulleted, boldface paragraphs in the text of the EIS.

Conclusions in this EIS are based on the analysis of environmental impacts and the following assumptions:

- Keystone would comply with all applicable laws and regulations;
- The proposed facilities would be constructed as described in Section 2.0 of this EIS; and
- Keystone would implement the mitigation measures identified in the Environmental Report (ENSR 2006a) and supplemental filings to the DOS.

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3.1 GEOLOGY

3.1.1 Physiography and Surface and Bedrock Geology

3.1.1.1 Affected Environment

The proposed Keystone Project ROW crosses the U.S./Canada border at the western edge of the Lake Agassiz Plain, and then ascends the Pembina Escarpment to the Northern Glaciated Plains (Bryce et al. 1998). The Lake Agassiz Plain is named for glacial Lake Agassiz, the most recent in a series of proglacial lakes that, during the Pleistocene, filled what is now the Red River Valley. The resulting plain is composed of lacustrine sediments underlain by glacial till; it is extremely flat except at its margins, where sandy former deltas and beach ridges mark the multiple shorelines of glacial Lake Agassiz. The Pembina Escarpment marks the northeastern boundary of the Northern Glaciated Plains, a flat to gently rolling region of fertile glacial drift dotted with temporary and seasonal wetlands. The proposed Keystone Project ROW traverses most of North Dakota and all of South Dakota within the Northern Glaciated Plains.

South of its Missouri River crossing at the South Dakota/Nebraska border, the proposed ROW crosses the Western Corn Belt Plains for 65 miles before entering the Central Great Plains near Columbus, Nebraska (Chapman et al. 2001). The proposed route continues south through the Central Great Plains to the Smoky Hills, north of the Kansas/Nebraska border, where the proposed Mainline Project ROW turns east-southeast and crosses Kansas within the Western Corn Belt Plains to another crossing of the Missouri River at the Kansas/Missouri border. The Western Corn Belt Plains are characterized by level to gently rolling plains formed in glacial till, locally interrupted by moraine hills and loess deposits. The Central Great Plains crossed by the proposed ROW include the rolling dissected Central Nebraska Loess Plains, the alluvial Platte River valley, and the Rainwater Basin Plains, flat to rolling loess plains with many closed watersheds that formerly supported natural wetlands. The proposed Cushing Extension branches off at the point where the proposed Mainline Project turns eastward. The Cushing Extension continues south into Kansas and Oklahoma; its route is described below, after state-specific descriptions of the proposed Mainline.

Twenty miles into Missouri the proposed Mainline Project ROW crosses into the Central Irregular Plains, where it remains until it descends into the Interior River Valleys and Hills region, approaches the Mississippi River, and crosses into Illinois before reaching its terminus at Patoka, Illinois (Chapman et al. 2002, Woods et al. 2006). The Central Irregular Plains are a region of gentle irregularly-dissected topography built upon clayey glacial drift. Toward the eastern edge of the region, the topography is flatter—with streams that drain east toward the Mississippi, entering the Interior River Valleys and Hills region as they go. The Interior River Valleys and Hills region crossed by the proposed ROW incorporates wide alluvial valleys and terraces, forested river bluffs and hills, and partially-dissected till plains, underlain by Paleozoic sedimentary rocks.

Because the geological surface traversed by the proposed Keystone Project has been formed by a series of continental glacial advances and retreats, most of the proposed ROW is underlain by thick quaternary sediments and depth to bedrock is typically much greater than 5 feet, but there are 330.8 miles of soils that indicate potential shallow bedrock. This bedrock-controlled terrain is located primarily within the Missouri and Mississippi River valleys and locally found along the more deeply incised stream valleys. The locations and characteristics of near-surface bedrock are described more fully in the following sections on physiography by state.

Mainline Project Route

North Dakota

Throughout North Dakota, the proposed Mainline Project ROW lies within the Dakota-Minnesota Drift and Lake-Bed Flats physiographic subdivision (Hammond 1965), an area of low-relief glacial moraines and lakebeds (Radbruch-Hall et al. 1982). The proposed ROW traverses seven EPA Level IV Ecoregions, each with a distinct physiography (Bryce et al. 1998). Regional physiographic characteristics are presented in detail in Table 3.1.1-1.

The proposed Mainline Project ROW crosses the U.S./Canada border in the Red River Valley, part of the Lake Agassiz Plain. After crossing the Pembina River at MP 7, the proposed ROW ascends the Pembina Escarpment, and then runs roughly parallel to the Pembina Hills above the western edge of the Red River Valley for the remainder of its path through North Dakota.

Elevations along the proposed route range between 950 and 1,550 feet above mean sea level (amsl). The greatest local relief is found where the proposed ROW crosses the Pembina and Sheyenne River valleys; elevation changes between river crossing and valley wall are on the order of 200–300 feet (ENSR 2006a).

Surface materials along most of the proposed Mainline Project route consist of unconsolidated alluvium, lake sediments, and glacial drift (Bluemle 1977), but bedrock consisting of Upper Cretaceous marine shale and limestone is exposed at outcrops along gullies and valleys in the Pembina Escarpment (Bluemle and Ashworth 2002). A total of 4.3 miles of potential shallow bedrock lie along the proposed Mainline Project ROW in North Dakota.

There are no known areas of karst along the proposed Mainline Project route in North Dakota.

South Dakota

The proposed Mainline Project ROW continues through South Dakota within the Dakota-Minnesota Drift and Lake-Bed Flats physiographic subdivision (Hammond 1965). It traverses five EPA Level IV Ecoregions (Bryce et al. 1998), physiographic characteristics of which are presented in detail in Table 3.1.1-2.

The proposed ROW enters South Dakota at MP 217 and proceeds southward along the James River Valley, a broad north-south trending valley of low relief situated between the Coteau du Prairies to the east and the Coteau du Missouri to the west (SDSGS 1964).

Elevations along the proposed route range between 1,300 and 1,150 feet amsl. Local relief is slight except where the ROW crosses the James River and also where it descends to the Missouri River Valley; elevation changes at the James River crossing are about 140 feet, those at the edge of the Missouri River valley are about 100 feet (ENSR 2006a).

Surface deposits consist of glacial till, loess, and alluvium (Martin et al. 2004). For the most part the underlying bedrock is similar to that described for North Dakota, consisting of shale, limestone, and sandstone of the Pierre Shale, Niobrara Formation, Carlile Shale, and Greenhorn Formation (Martin et al. 2004). Dakota Formation sandstone and shale may be present in places, and in Hanson County (MP 365–378) some bedrock consists of Precambrian quartzite (ENSR 2006a). Outcrops are occasionally present along road cuts and streams in South Dakota, but the proposed Mainline Project ROW does not cross any areas of known potential shallow bedrock.

TABLE 3.1.1-1
Physiographic Characteristics of Ecoregions Crossed in North Dakota by the Keystone Mainline Project

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Lake Agassiz Plain—Glacial Lake Agassiz Basin [a]					
0–6	Extremely flat glacial lake plain. Streams and rivers sluggish, meandering, and highly turbid with large sediment loads. Ditching and channelization common.	790–1,200	1–50	150–300 feet of glacial drift overlain by up to 95-foot silt/clay lake deposits	Cretaceous shales and sandstones, Ordovician and Precambrian basement
Lake Agassiz Plain—Sand Deltas and Beach Ridges [a]					
6–16	Parallel ridges up to several miles wide composed of medium sand to medium gravel. Deltas comprised of lenses of fine to coarse sands. Thickest sand deposits windblown into dunes. Stream substrates, sand or gravel riffles contrast with clay- and silt-bottom streams elsewhere in Red River Valley.	900–1,200	40–250	Stratified sand and gravel beach deposits interlayered with lacustrine silts and sandy deltaic lenses	Cretaceous shales and sandstones, Ordovician and Precambrian basement
Northern Glaciated Plains—Pembina Escarpment [a]					
16–43	Glaciated. Steep, dissected escarpment. High-gradient perennial streams.	1,225–1,580	100–400	Glacial till	Tertiary sandstone and shale
Northern Glaciated Plains—Drift Plains [a]					
43–111, 134–197, 199–207	Glaciated. Generally flat, with occasional "washboard" undulations. High concentrations of temporary and seasonal wetlands. Simple drainage pattern.	1,080–2,000	0–200	Glacial till	Cretaceous Pierre Shale and Fox Hills Formations
Northern Glaciated Plains—End Moraine Complex [a]					
111–134	Glaciated. A diverse area of hummocky stagnation moraine; parallel end moraine ridges; and other glacial features such as eskers, kames, and thrust ridges.	1,450–1,790	20–179	Glacial till and outwash	–

TABLE 3.1.1-1
(Continued)

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Northern Glaciated Plains—Glacial Outwash [a]					
207–211	Glaciated. Flat to slightly rolling. Ancient channel depressions, relict lakes.	1,300–1,550	0–50	Sand and plane-bedded gravel, sediments of glacial meltwater rivers	--
Northern Glaciated Plains—Glacial Lake Deltas [a]					
211–217	Glaciated. Flat sheets of sand and gravel or rolling sand dunes. Paucity of stream channels.	1,290–1,595	6–85	Sand and gravel deposits over lacustrine sediments	--

-- = Not available.

[a] EPA Level III-IV Ecoregion name.

Source: Bryce et al. 1998.

TABLE 3.1.1-2 Physiographic Characteristics of Ecoregions Crossed in South Dakota by the Keystone Mainline Project					
Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Northern Glaciated Plains – Glacial Lake Deltas [a]					
217–223, 228–232	*See Table 3.1.1-1.*				
Northern Glaciated Plains–Glacial Lake Basins [a]					
223–228, 232–247	Glaciated. Very level glacial lake floors. Low wetland density.	1,300–1,585	0–30	Glacial lacustrine silts and clays	NA
Northern Glaciated Plains–Drift Plains [a]					
247–265	*See Table 3.1.1-1.*				
Northern Glaciated Plains–Prairie Coteau [a]					
265–273	Glaciated. Platform of hummocky, rolling terrain raised above surrounding drift plains. Stream network lacking. High concentration of large lakes and wetlands.	1,500–2,010	50–150	Glacial till	Cretaceous shales
Northern Glaciated Plains–James River Lowland [a]					
307–436	Glaciated. Level to slightly rolling plain composed of glacial drift. Dense concentrations of temporary and seasonal wetlands.	1,200–1,850	10–150	Glacial till	Cretaceous Pierre Shale and Niobrara sandstone

NA = Not applicable.

[a] EPA Level III-IV Ecoregion name.

Source: Bryce et al. 1998.

In the southern half of the state, karst may be present from MP 353 to the border with Nebraska; karst features are found in southern portions of Miner County, northern Hanson County southern Hutchinson County, and all of Yankton County (ENSR 2006a), where carbonate rocks of the Niobrara Formation can form fissures up to 1,000 feet long and 100 feet deep, spaced at intervals of 1,000 feet or more (Tobin and Weary 2005). Where fissures are likely to occur, however, 50 feet or more of quaternary sediments cover the carbonate rocks.

Nebraska

The proposed Mainline Project ROW crosses Nebraska within the Middle Western Upland Plain and West-Central Rolling Hills physiographic subdivisions (Hammond 1965). It traverses six EPA Level IV Ecoregions (Chapman et al. 2001), physiographic characteristics of which are presented in detail in Table 3.1.1-3.

The proposed ROW enters Nebraska at MP 436 and proceeds southward across the Western Corn Belt Plains to the Platte River Valley. It then continues south across the Central Great Plains to the Smoky Hills, a few miles north of the Kansas/Nebraska border, where it turns to the east-southeast and crosses into Kansas.

Elevations along the proposed route range between 1,150 and 1,800 feet amsl. Significant local relief is found near the Missouri and Elkhorn Rivers; elevation changes along the Elkhorn River crossing are about 140 feet, those at the edge of the Missouri River valley are about 100 feet (ENSR 2006a).

Surface deposits consist of glacial till, loess, and alluvium. Underlying bedrock consists of shale, limestone, and sandstone of the Pierre Shale, Niobrara Formation, Carlisle Shale, Greenhorn Formation, and Graneros Shale (Bennison and Chenowith 1984). Dakota Formation sandstone and shale underlie the proposed route from Butler County to the Kansas border. There are 3.3 miles of potential shallow bedrock along the proposed route in Nebraska.

Karst features are found along the proposed route in between MP 436 and 520 in Cedar and Wayne Counties (Tobin and Weary 2005), where the proposed ROW is underlain by carbonate rocks of the Niobrara Formation (Burchett 1986).

Kansas

The proposed Mainline Project ROW crosses Kansas within the West-Central Rolling Hills physiographic (Hammond 1965). It traverses three EPA Level IV Ecoregions (Chapman et al. 2001), physiographic characteristics of which are presented in detail in Table 3.1.1-4.

The proposed ROW enters Kansas at MP 650 and then proceeds east-southeast across the Western Corn Belt Plains to the Missouri River Valley.

Elevations along the proposed route range between 790 and 1,500 feet amsl. The greatest relief is found at the edge of the Missouri River valley, where the proposed route descends about 220 feet from the bluffs to the floodplain. Relatively high local relief—on the order of 100 to 130 feet—is also found where the proposed route crosses the Big Blue and Nemaha Rivers (ENSR 2006a).

TABLE 3.1.1-3
Physiographic Characteristics of Ecoregions Crossed in Nebraska by the Keystone Mainline Project

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Western Corn Belt Plains – Missouri Alluvial Plains [a]					
436–438	Smooth to irregular alluvial plain. Channelized streams.	600–1,100	0–50	Alluvium	Pennsylvanian and Cretaceous shale, sandstone, and limestone
Western Corn Belt Plains–Northeastern Nebraska Loess Hills [a]					
438–501	Glaciated. Rolling low hills. Perennial streams.	1,100–1,900	100–300	Deep calcareous loess	Cretaceous shale, sandstone, and limestone, Oglalla Formation
Western Corn Belt Plains–Transitional Sandy Plains [a]					
501–506	Level to rolling plains.	1,400–2,000	5–150	Alluvial sand and gravel, lacustrine silt	Miocene sandstone of the Oglalla Formation
Central Great Plains–Platte River Valley [a]					
532–547	Flat, wide alluvial valley. Shallow, interlacing streams on a sandy bed.	1,300–2,900	2–75	Alluvial sand, silt, clay and gravel	Quaternary and Tertiary unconsolidated sand and gravel
Central Great Plains–Rainwater Basin Plains [a]					
547–634	Flat to gently rolling loess-covered plains. Historically, extensive rainwater basins, and wetlands.	1,300–2,400	5–100	Quaternary loess and sandy alluvium	Tertiary Oglalla sandstone, Cretaceous Niobrara, Carlisle limestone and shale
Central Great Plains–Smoky Hills [a]					
634–650	Undulating to hilly dissected plain. Broad belt of low hills formed by mature dissection of Cretaceous rock layers.	1,200–1,800	100–250	Local thin loess, loamy colluvium	Chalky limestone, Cretaceous sandstone of the Dakota Formation

[a] EPA Level III-IV Ecoregion name.

Source: Chapman et al. 2001.

TABLE 3.1.1-4
Physiographic Characteristics of Ecoregions Crossed in Kansas by the Keystone Mainline Project

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Central Great Plains – Smoky Hills [a]					
650–658	*See Table 3.1.1-3.*				
Western Corn Belt Plains –Glacial Drift Hills [a]					
658–729	Glaciated. Rolling low hills. Perennial streams.	1,000–1,600	40–250	Loess and clay-loam calcareous till	Pennsylvanian shale, sandstone, limestone, Permian shale, limestone
Western Corn Belt Plains–Nebraska-Kansas Loess Hills [a]					
729–748	Glaciated. Deep, rolling loess-covered hills. Perennial streams.	1,000–1,500	100–300	Loess over calcareous till	Pennsylvanian shale, sandstone, limestone

[a] EPA Level III-IV Ecoregion name.

Source: Chapman et al. 2001.

Surface materials consist of glacial drift—till, lake deposits, and loess—with alluvium in river valleys and smaller drainages (SGSK 1964). Glacial deposits are generally not continuous or thick, and bedrock units are exposed along some valleys; but loess deposits can be more than 100 feet deep. Underlying bedrock consists of Pennsylvanian limestone, shale, and localized sandstones of the Shawnee and Wabaunsee Groups and Permian limestone and shales of the Admire, Council Grove, Chase, and Sumner Groups. Permian rocks are found in Marshall, Nemaha, and western Brown Counties, while the Pennsylvanian rocks are found in eastern Brown and Doniphan Counties (SGSK 1964). There are 4.2 miles of potential shallow bedrock along the proposed route in Kansas.

There are no known areas of karst along the proposed Mainline Project route in Kansas.

Missouri

The proposed Mainline Project ROW crosses Missouri within the West-Central Rolling Hills, Mid-continent Plains and Escarpments, and Middle Western Upland Plain (Hammond 1965). It traverses five EPA Level IV Ecoregions (Chapman et al. 2002), physiographic characteristics of which are presented in detail in Table 3.1.1-5.

The proposed ROW enters Missouri at MP 748 and proceeds across irregular plains and low hills until it drops down into the Upper Mississippi Alluvial Plain and crosses into Illinois at approximately MP 1021.

Elevations along the proposed route range from between 790 and 1,165 feet amsl in northwestern Missouri to 400 feet amsl at the Mississippi River (ENSR 2006a). Relief is generally low to moderate, with rolling hills and dissected drainages (Chapman et al. 2002). Areas of steep relief are found adjacent to the major river valleys. The greatest elevation change is in northwest Missouri, where the elevation change at the edge of the Missouri River floodplain is about 250 feet.

Surface deposits consist of alluvium and glacial drift composed of till and loess. Most of northern Missouri is covered with a mantle of glacial drift. Alluvium is present in the river valleys and is especially thick in the flood plains of the Mississippi and Missouri Rivers. Underlying bedrock consists of Pennsylvanian sandstone, limestone, shale, and coal (Oetking et al. 1966) in the northwest corner of the state and for a small distance west of the Mississippi River north of St. Louis, and Mississippian cherty limestone with minor amounts of shale and sandstone from Montgomery County to the Mississippi River. There are 31.2 miles of potential shallow bedrock along the Mainline Project route in Missouri.

Karst features are found along the Mainline Project route in Lincoln and St. Charles Counties. Bedrock with karst potential is found from MP 735 through 811 and between MP 946 and the Illinois border. The potential karst has been characterized as fissures, tubes, and caves usually less than 1,000 feet long and less than 50 feet deep (Tobin and Weary 2005).

Illinois

The proposed Mainline Project ROW crosses Illinois within the Middle Western Upland Plain physiographic subdivision (Hammond 1965). It traverses three EPA Level IV Ecoregions (Woods et al. 2006), physiographic characteristics of which are presented in detail in Table 3.1.1-6.

The proposed ROW enters Illinois at MP 984 and proceeds across the Mississippi Alluvial Plain for approximately 40 miles before climbing the River Hills up to Patoka.

TABLE 3.1.1-5
Physiographic Characteristics of Ecoregions Crossed in Missouri by the Keystone Mainline Project

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Western Corn Belt Plains – Missouri Alluvial Plain [a]					
748–753, 841–846	*See Table 3.1.1-3.*				
Western Corn Belt Plains–Rolling Loess Prairies [a]					
753–768	Irregular plains to open low hills. Intermittent and perennial streams, many channelized.	700–1,300	100–200	Moderate to thick loess, generally less than 25 feet, over clay loam till	Pennsylvanian and Cretaceous shale, sandstone, and limestone
Central Irregular Plains–Loess Flats and Till Plains [a]					
768–841	Glaciated. Low hills and smooth plains. Perennial streams with many channelized.	600–1,200	100–300	Moderate loess over loamy till and clay loam till	Pennsylvanian sandstone, limestone, and shale
Central Irregular Plains–Claypan Prairie [a]					
846–939, 944–947	Glaciated. Smooth plains. Perennial streams with many channelized.	700–1,000	50–100	Loamy till and clay loam till, well developed claypan	Pennsylvanian sandstone, limestone, and shale
Interior River Valleys and Hills–River Hills [a]					
939–944, 947–984	Bluffs, valleys, and low hills. Areas of karst features. Perennial streams. Missouri River channelized.	400–810	50–300	Thin cherty clay and silty to sandy clay solution residuum; areas of clay loam till along the northern boundary along the Missouri River and eastern boundary of the upper Mississippi River; thin loess, 5 to 13 feet, on uplands along bluffs; alluvium along the Missouri and Mississippi Rivers	Ordovician, Mississippian, and Pennsylvanian limestones, sandstones, and shales with considerable bedrock exposures throughout the region

[a] EPA Level III-IV Ecoregion name.

Source: Chapman et al. 2002.

TABLE 3.1.1-6
Physiographic Characteristics of Ecoregions Crossed in Illinois by the Keystone Mainline Project

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Interior River Valleys and Hills – Upper Mississippi Alluvial Plain [a]					
984–1001	Broad floodplains and low terraces of the Mississippi River (and its major tributaries) upstream of the confluence with the Missouri River. Levees, oxbow lakes, islands, disjunct sand sheets, and scattered dunes occur.	420–600	< 50	Quaternary alluvium, outwash deposits, and slackwater deposits	Paleozoic sedimentary rock; bedrock is deeply covered by Quaternary sediments
Interior River Valleys and Hills–Middle Mississippi Alluvial Plain [a]					
1001–1026	Broad floodplains and low terraces, levees, oxbow lakes, islands, spring-fed swamps, sand sheets and scattered dunes.	350–420	< 50	Deep Quaternary alluvial, outwash, and slackwater sediments	Paleozoic sedimentary rocks
Interior River Valleys and Hills–River Hills [a]					
1026–1027	Formerly glaciated rugged hills, bluffs, cliffs, and ravines. Some karst caves and sinkhole ponds.	425–800	50–375	Quaternary loess > 60 inches deep, glacial till	Paleozoic sedimentary rocks, limestone, and sandstone

[a] EPA Level III-IV Ecoregion name.

Source: Woods et al. 2006.

Elevations along the proposed route range between 500 and 600 feet amsl. Local relief is slight along the entire route until it reaches the till plains east of Edwardsville, where it occasionally crosses larger incised drainages with local relief of up to 100 feet (ENSR 2006a).

Surface materials consist of glacial deposits and alluvium. The Mississippi River valley is composed of alluvial sand, silt, and clay, while the uplands to the east are composed of glacial tills between 50 and 200 feet thick (Lineback 1979). Underlying bedrock consists of Mississippian limestone, sandstone, and shale grading up-section eastward to Pennsylvanian sandstone, shale, and coal (Willman et al. 1967). There is less than 1 mile of potential shallow bedrock along the Mainline Project route in Illinois.

Karst features—including numerous sink holes and collapse structures—are present along the western edge of Illinois along the Mississippi River (ISGS 2003). Although the entire Mainline Project route in Illinois is underlain by karst-prone bedrock, no karst features have been identified under the ROW (Tobin and Weary 2005, ENSR 2006a).

Cushing Extension

Nebraska

The Cushing Extension separates from the Mainline Project ROW in the Smoky Hills, then proceeds 2 miles south to the Nebraska/Kansas border. Physiographic characteristics of the Smoky Hills are presented in detail in Table 3.1.1-7.

Surface deposits consist of thin loess and loamy colluvium. Underlying bedrock consists of Dakota Formation sandstone and shale (ENSR 2006a). There is 0.2 mile of potential shallow bedrock along the Cushing Extension in Nebraska.

No karst features are found along the Cushing Extension route in Nebraska (Tobin and Weary 2005).

Kansas

The Cushing Extension ROW in Kansas traverses three EPA Level IV Ecoregions (Chapman et al. 2001), physiographic characteristics of which are presented in detail in Table 3.1.1-8.

The proposed ROW enters Kansas at MP 2 and then proceeds east-southeast through the Smoky Hills to the Flint Hills and on into the Wellington-McPherson Lowland. At MP 212, it crosses into the Prairie Tableland region of Oklahoma.

Elevations along the proposed route range between 1,070 and over 1,400 feet amsl. Local relief at major drainages along the proposed route is on the order of 100 feet, but slopes are typically not steep (ENSR 2006a).

Surface materials consist of glacial till, loess, alluvium, and colluvium. In upland areas of the Flint Hills region, the colluvium consists of cherty gravels. Underlying bedrock consists of Dakota Formation sandstone and shale in the north, and Permian Council Grove, Chase, and Sumner limestones and shales from southern Washington County to the border with Oklahoma (SGSK 1964). There are 10.5 miles of potential shallow bedrock or consolidated sediments along the Cushing Extension route in Kansas.

There are 84 miles of potential karst features along the Cushing Extension route in Kansas. Where present, karst is likely to consist of fissures, tubes, and caves generally less than 1,000 feet long; 50 feet or less in vertical extent; in gently dipping to flat-lying beds of carbonate rock (Tobin and Weary 2005).

TABLE 3.1.1-7
Physiographic Characteristics of Ecoregions Crossed in Nebraska by the Keystone Cushing Extension

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Central Great Plains – Smoky Hills [a]					
0–2	Undulating to hilly dissected plain. Broad belt of low hills formed by mature dissection of Cretaceous rock layers.	1,200–1,800	100–250	Local thin loess, loamy colluvium	Chalky limestone, Cretaceous sandstone of the Dakota Formation

[a] EPA Level III-IV Ecoregion name.

Source: Chapman et al. 2001.

TABLE 3.1.1-8
Physiographic Characteristics of Ecoregions Crossed in Kansas by the Keystone Cushing Extension

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Central Great Plains–Smoky Hills [a]					
2–52, 54–82	*See Table 3.1.1-7.*				
Flint Hills [a]					
52–54, 82–157	Undulating to rolling hills, cuestas, cherty limestone, and shale outcrops. Perennial streams and springs common.	1,000–1,600	50–400	Cherty and clayey residuum, some limited glacial drift in the northeast corner of region	Interbedded cherty Permian limestone and shale
Central Great Plains–Wellington-McPherson Lowland [a]					
157–212	Flat alluvial lowlands. Perennial streams and numerous springs.	1,000–1,800	2–75	Loess and silty, sandy, and clayey alluvium	Permian sandstone, shale, and salt deposits (Wellington Formation)

[a] EPA Level III-IV Ecoregion name.

Source: Chapman et al. 2001.

Oklahoma

The Cushing Extension ROW crosses Oklahoma in the Mid-continent Plains and Escarpments physiographic subdivision (Hammond 1965). The terrain is characterized by low- to moderate-relief escarpments formed in gently west-dipping bedrock, similar to the Flint Hills. It traverses two EPA Level IV Ecoregions (Woods et al. 2005), physiographic characteristics of which are presented in detail in Table 3.1.1-9.

The proposed ROW enters Oklahoma at MP 212 and proceeds across the level to slightly rolling plains of the Wellington-McPherson Lowland until approximate MP 254, where it crosses into the rough, broken plains of the Cross-Timbers Transition region. The proposed route terminates at Cushing, Oklahoma, at MP 293.

Between the Kansas/Oklahoma border and the Cimarron River, elevations along the proposed route range between 900 and 1,150 feet amsl. Local relief at river crossing is typically 50 feet or less. At the Cimarron crossing relief is on the order of 140 to 180 feet. South of the Cimarron River crossing, elevations range between 860 and 1,070 feet amsl (ENSR 2006a)

Surface deposits consist of relatively fine-grained alluvium and terrace deposits. Underlying bedrock consists of Lower Permian Wellington Formation sandstone and limestone from the Kansas/Oklahoma border to the terminus at Cushing (Miser 1954). Upper Pennsylvanian rocks also outcrop at the edge of the Salt Fork Arkansas River floodplain (ENSR 2006a). There is 0.7 mile of potential shallow bedrock along the proposed Cushing Extension in Oklahoma.

Karst features similar to those described above for Kansas may be found along 4 miles of the proposed Cushing Extension route in Oklahoma (ENSR 2006a).

3.1.1.2 Potential Impacts and Mitigation

Construction Impacts

The proposed Keystone Project does not involve substantial long- or short-term alteration of topography, and no disturbance of geological features that have received state or federal protection. Native American tribes along the proposed route have been consulted, and none have identified any geological features of tribal significance. Most of the proposed route is within areas where bedrock is deeply buried by Pleistocene and Holocene sediments. Consequently, impacts to bedrock are expected to be minimal, and limited to areas where bedrock is within 8 feet of the surface. Potential impacts to surface sediments and topography due to accelerated erosion or soil compaction are described in Section 3.2.

During construction, blasting may be required at locations where shallow bedrock is present. In addition to temporary effects, including generation of dust, noise, and vibration, blasting will permanently alter the bedrock surface. Appendix E lists by milepost locations where shallow bedrock may be found, the type of bedrock likely to be found, and whether ripping or blasting is expected to be used at the identified locations. Tables 3.1.1-10 and 3.1.1-11 summarize the approximate locations of expected blasting and ripping operations respectively, by state, county, and approximate milepost.

TABLE 3.1.1-9
Physiographic Characteristics of Ecoregions Crossed in Oklahoma by the Keystone Cushing Extension

Milepost Range	Physiographic Description	Elevation Range (feet above mean sea level)	Local Relief (feet)	Surface Geology	Bedrock Geology
Central Great Plains–Prairie Tableland [a]					
212–254	Level to slightly rolling plains with broad, flat interfluves and low-gradient broad, shallow, and sand- or silt-choked channels; uncommon short reaches with gravel, cobble, or bedrock substrates occur. Streams usually flow strongly after rains, have high suspended sediment concentrations, and go dry in late summer.	850–1,650	10–125	Quaternary alluvium, terrace deposits, and decomposition residuum of clay loam, fine sandy loam, and sandy clay loam	Permian-age red shale, sandstone, and siltstone with some Pennsylvanian-age limestone in northeastern-most areas
Central Great Plains–Cross Timbers Transition [a]					
254–293	Rough plains that are sometimes broken. Incised streams occur and have rocky or muddy substrates.	750–1,950	30–300	Quaternary alluvium; terrace deposits; and decomposition residuum of fine sandy loam, clayey silt, sandy clay loam, silty clay, and clayey loam	Permian- and Pennsylvanian-age sandstone and shale, as well as some limestone and mudstone conglomerate

[a] EPA Level III-IV Ecoregion name.

Source: Woods et al. 2005.

TABLE 3.1.1-10
Potential Blasting Locations
for the Keystone Project

MP Range	State	County	Length (miles)
Mainline Project			
635.4 – 636.2	Nebraska	Jefferson	0.33
747.0 – 747.8	Kansas	Doniphan	0.26
766.9 – 766.9	Missouri	Buchanan	0.02
799.4 – 813.9		Caldwell	1.24
848.7 – 871.4		Chariton	2.07
918.4 – 919.5		Audrain	0.24
948.6 – 953.7		Montgomery	0.71
957.2 – 979.0		Lincoln	1.63
Mainline Project subtotal			6.5
Cushing Extension			
0.5 – 0.7	Nebraska	Jefferson	0.15
14.9 – 15.9	Kansas	Washington	0.15
39.8 – 42.3		Clay	1.11
116.2 – 116.5		Marion	0.38
Cushing Extension subtotal			1.79
Keystone Project total			**8.3**

Source: TransCanada 2007b.

TABLE 3.1.1-11 Potential Ripping Locations for the Keystone Project			
MP Range	State	County	Length (miles)
Mainline Project			
33.0 – 54.6	North Dakota	Walsh	1.90
63.0 – 84.8		Nelson	0.41
104.2 – 109.6		Steele	2.01
439.3 – 449.0	Nebraska	Cedar	1.44
635.6 – 639.8		Jefferson	1.53
658.2 – 662.2	Kansas	Marshall	0.39
685.4 – 685.4		Nemaha	0.03
704.1 – 728.0		Brown	3.18
728.5 – 740.5		Doniphan	0.36
754.3 – 764.8	Missouri	Buchanan	1.13
798.2 – 814.4		Caldwell	1.63
814.5 – 838.3		Carroll	4.68
843.2 – 857.0		Chariton	0.58
876.1 – 890.8		Randolph	4.74
898.6 – 932.8		Audrain	6.55
932.8 – 953.8		Montgomery	3.73
953.8 – 972.1		Lincoln	2.29
1045.5 – 1046.0	Illinois	Madison	0.11
Mainline Project subtotal			6.5
Cushing Extension			
15.0 - 26.0	Kansas	Washington	0.47
44.1 - 61.0		Clay	1.89
67.7 - 98.1		Dickinson	1.01
101.9 - 120.5		Marion	5.46
261.2 - 264.6	Oklahoma	Noble	0.22
280.5 - 287.8		Payne	0.45
Cushing Extension subtotal			1.79
Keystone Project total			**8.3**

Source: TransCanada 2007b.

In its Mitigation Plan, Keystone has committed to complying with all laws and regulations governing explosives, notifying nearby residents, using blasting mats or subsoil to prevent fly-rock, clearing and cleaning all blasting locations before and after blasting operations, and performing all blasting during regular daylight working hours. Keystone has not, however, developed a Blasting Specification Plan. Therefore, **the following measure is recommended:**

- **Keystone should develop a site-specific Blasting Specification Plan for any locations where blasting would be necessary. This plan should include at a minimum:**
  - **Identification of applicable blasting regulations and method of compliance;**
  - **Provisions for pre-blast geotechnical investigations, where required;**
  - **Determination of charge type, weight, and configuration;**
  - **Depth and spacing of charges;**
  - **Detonation delays;**
  - **Procedures for notifying nearby residents;**
  - **Procedures for pre- and post-blasting structural and well inspections;**
  - **Identification of sensitive biological resources in the blast area (within 0.5 mile);**
  - **Mitigation measures to minimize blasting impacts on nesting birds; and**
  - **Specifications and placement of blasting mats.**

  The Blasting Specification Plan should be filed with state and local jurisdictions for review and written approval prior to the commencement of blasting.

Operations Impacts

Routine pipeline operation and maintenance activities are not expected to affect physiography or surface or bedrock geology. Potential impacts to surface sediments and topography due to accelerated erosion or soil compaction are described in Section 3.2.

3.1.2 Paleontological Resources

3.1.2.1 Affected Environment

Although no areas of known sensitive paleontological resources would be crossed, surficial materials along the proposed ROW may contain Quaternary vertebrate fossils. Glacial deposits in particular may contain fossils of mastodon, mammoth, horses and other Pleistocene large vertebrates (Paleontology Portal). Vertebrate fossils are relatively rare, and locations containing vertebrate fossils are more likely to be scientifically significant than those containing invertebrate or plant fossils. Where exposed, bedrock may contain Cretaceous and earlier marine fossils. Upper Cretaceous bedrock outcrops may contain fossils of marine organisms, including turtles, fish, ammonites, and various invertebrates. Pennsylvanian bedrock outcrops may contain fossils of marine invertebrates, including mussels, echinoids, bryozoans, crinoids, snails, corals, and trilobites. Pennsylvanian rocks in Illinois may contain plant fossils. Permian outcrops may contain fish and shark fossils. Along the Cushing Extension route in Noble County, Oklahoma, the Wellington Formation has yielded non-mammal vertebrate, invertebrate, and plant fossils (Paleontology Portal).

3.1.2.2 Potential Impacts and Mitigation

Construction Impacts

Potential impacts to paleontological resources during construction include damage to or destruction of fossils resulting from excavation activities, erosion of fossil beds resulting from grading, and unauthorized collection of fossils by construction personnel or the public.

Pleistocene-age mammal fossils may be discovered during construction in areas where the proposed route crosses glacial and glacial-derived surface deposits, which includes the entire length of the proposed Mainline Project, except for bedrock outcrop areas. Keystone does not propose to recover or study any such fossils that may be uncovered during excavation. However, because vertebrate fossils are relatively rare, and as such may be of scientific value, **the following measure is recommended:**

- **Keystone should develop a Paleontological Resources Protection Plan to identify and protect significant fossil resources that may be encountered during construction. The Paleontological Resources Protection Plan should include:**
  - **Procedures for documenting and reporting unexpected fossil discoveries during construction,**
  - **Mitigation procedures (e.g., excavation, recording of localities) for fossils encountered during construction,**
  - **Provisions for preparation and curation of fossil collections, and**
  - **Provisions for preparation of a written report based on the recovered specimens.**

  Except for reporting the initial find, all work conducted under the Paleontological Resources Protection Plan should be performed by qualified paleontologists with trained assistants. The plan should be filed with the respective states prior to construction.

Where necessary, blasting and bedrock ripping are likely to destroy any fossils that might be found in shallow bedrock. Because these fossils are unlikely to be of particular scientific importance, Keystone does not propose to log or recover fossils from shallow bedrock locations. If a location that is likely to contain valuable fossils is encountered where blasting is required the recommended Paleontological Resources Protection Plan should be implemented to identify and protect significant fossil resources.

Table 3.1.1-10 summarizes likely blasting areas. Table 3.1.1-11 summarizes areas where consolidated materials are within 7 feet of the surface, but ripping is likely to be sufficient. More precise location information for blasting and ripping areas is presented in Appendix E. The estimates of blasting and ripping locations were obtained from Keystone's review of depth to bedrock, as recorded in NRCS soils data; locations where depth to bedrock was shallower than 80 inches were classified as likely to require blasting if the bedrock was indurated, well-cemented, or lithic, and potentially rippable otherwise (TransCanada 2007b). Approximately 36.7 miles of the proposed Mainline Project route may require ripping, and approximately 6.5 miles may require blasting. Some areas identified as being rippable may require blasting and vice-versa. The final decision concerning methods would be determined at the time of construction, based on site-specific conditions. If blasting and ripping are required, Keystone would follow the procedures described in Section 2.2.

Operations Impacts

Routine pipeline operations and maintenance activities are not expected to affect paleontological resources. Although maintenance activities may result in surface disturbance, this would typically occur in areas previously disturbed by construction. Therefore, operational impacts to paleontological resources would be negligible.

3.1.3 Mineral and Fossil Fuel Resources

3.1.3.1 Affected Environment

The proposed route does not cross any active surface mines or quarries, but potentially valuable sand, gravel, clay, and stone resources may lie within the proposed Mainline Project ROW for the approximately 800 miles that traverse glacial deposits. Sand, gravel, crushed stone, and dimensional limestone are also present along the Kansas portion of the Cushing Extension ROW (ENSR 2006a).

The proposed Mainline Project route does not cross the well-pads of any active or proposed oil or gas wells (ENSR 2006a). The proposed Cushing Extension ROW in Kansas crosses or passes near several oil and gas fields. In addition to four abandoned oil-fields in Clay County, the proposed route passes near the active El Dorado oil field (Brooks et al. 1975, in ENSR 2006a). In Oklahoma, numerous oil and gas fields are in the vicinity of the proposed Cushing Extension route. Cushing, the destination of the extension, has been a major crude oil refining and pipeline transportation hub since the early part of the 20^{th} century. Table 3.1.3-1 identifies oil and gas fields that would be crossed by the Mainline Project and Cushing Extension ROWs.

In Kansas, coal beds are present in Pennsylvanian rocks below the proposed route; they are too deep to mine, although coal bed methane production is a possibility (Charpentier and Rice 1995). The proposed route crosses approximately 40 miles of underlying coal seams between Wood River and Patoka, Illinois, where coal is mined with underground methods (USGS 2004, ENSR 2006a). Table 3.1.3-2 identifies coal fields that would be crossed by the Mainline Project; no coal fields would be crossed by the Cushing Extension.

3.1.3.2 Potential Impacts and Mitigation

Although the proposed route does not cross any active surface mines or quarries, construction and operation of the Keystone Project would limit access to sand, gravel, clay, and stone resources that are within the width of the permanent pipeline ROW for the approximately 800 miles of proposed pipeline that traverses glacial deposits. In Kansas, Missouri, and Illinois, the proposed route lies in or directly adjacent to an existing pipeline ROW; therefore, no additional restriction on mineral resources would result from the Keystone Project. In North Dakota, South Dakota, and Nebraska, the proposed route would cross deposits of sand, gravel, clay, and stone, but the acreage of deposits covered by the proposed ROW is insignificant compared to the total acreage of deposits present in each state.

The proposed route crosses approximately 40 miles of underlying coal seams between Wood River and Patoka, Illinois, where coal is mined with underground methods (ENSR 2006a). If surface mining was proposed for this area in the future, the pipeline might serve as an impediment. The effect of this impediment is likely to be minimal, however, as the proposed route follows existing pipelines in this area.

The proposed route does not cross the well-pads of any active oil and gas wells. Extraction of oil and gas resources would not be affected by routing operations because any new wells would be located outside of the pipeline ROW.

TABLE 3.1.3-1
Identified Oil and Gas Fields Crossed by the Keystone Project

State	Starting Milepost	Ending Milepost	Type of Field
Mainline Project			
Kansas	701.2	701.6	Oil
	1021.3	1024.7	Oil*
	1021.4	1027.7	Oil*
Illinois	1027.7	1038.8	Oil*
	1038.8	1039.9	Oil*
	1039.9	1040.8	Oil*
	1040.8	1041..4	Oil*
	1041.4	1070.1	Oil*
	1070.1	1072.1	Oil*
	1072.1	1072.6	Oil*
	1072.6	1077.9	Oil*
Cushing Extension			
Kansas	118.8	120.8	Inactive
	131.3	133.6	Oil
	133.6	134.4	Oil
	136.4	136.9	Oil
	136.9	137.4	Oil
	137.4	142.6	Oil
	142.6	143.1	Oil
	146.2	146.7	Oil
	148.8	149.3	Oil
	152.3	154.9	Oil
	154.9	156.0	Oil
	156.0	157.0	Oil
	168.6	169.1	Oil
	176.0	178	Oil
	186.6	187.1	Oil
	189.7	190.7	Oil
	199.5	201.5	Oil and gas
	204.2	205.9	Oil and gas
	207.1	208.9	Oil and gas
	209.1	209.5	Oil and gas
	209.5	209.8	Oil and gas
	209.8	210.1	Oil and gas
	210.1	213.3	Oil and gas
Oklahoma	267.3	267.8	Gas
	292.6	292.9	Gas
	296.1	298.5	Gas
	217.8	233.5	Oil and gas
	235.2	236.1	Oil and gas
	289.5	289.8	Oil and gas

TABLE 3.1.3-1 (Continued)			
State	**Starting Milepost**	**Ending Milepost**	**Type of Field**
Mainline Project (continued)			
Oklahoma (continued)			
	290.6	292.2	Oil and gas
	215.8	218.1	Oil
	226.4	227.6	Oil
	228.4	229.4	Oil
	237.0	245.3	Oil
	259.3	259.9	Oil
	270.5	271.1	Oil
	277.8	278.9	Oil
	280.0	280.7	Oil
	281.2	281.5	Oil
	282.5	283.9	Oil
	284.4	286.3	Oil
	286.6	287.0	Oil
	287.8	288.9	Oil
	293.6	295.9	Oil

[a]Information obtained from oilfields database; however, the field might also produce gas.

Source: TransCanada 2007c.

TABLE 3.1.3-2 Identified Coal Fields Crossed by the Keystone Mainline Project			
State	**Starting Milepost**	**Ending Milepost**	**Type of Coal**
Nebraska	669.2	692.0	Medium and high volatile bituminous/other uses
	692.0	719.2	Medium and high volatile bituminous/other uses
Kansas	719.2	948.0	Medium and high volatile bituminous/potentially minable
Illinois	1026.9	1027.7	Medium and high volatile bituminous/potentially minable
	1027.7	1070.1	Medium and high volatile bituminous/potentially minable
	1070.1	1077.9	Medium and high volatile bituminous/potentially minable

Source: TransCanada 2007c.

3.1.4 Geologic Hazards

3.1.4.1 Affected Environment

The proposed Keystone pipeline would be located entirely within the relatively flat and stable continental interior. Consequently, the potential for impacts from geologic hazards is lower than for facilities located in active mountain belts or coastal areas. Nonetheless, at some locations along the proposed route, seismic hazards, landsliding, subsidence, or flooding may occur. Table 3.1.4-1 summarizes by state the miles of proposed pipeline that cross areas of potential geologic hazard.

TABLE 3.1.4-1
Summary of Geological Hazard Areas for the Keystone Project (miles)

State	High Seismic Hazard[a]	Flood	Landslide	Subsidence
North Dakota	0.0	3.0	0.0	0.0
South Dakota	0.0	21.9	7.7	0.0
Nebraska	0.0	21.9	13.1	0.0
Kansas	0.0	10.9	0.0	0.0
Missouri	0.0	99.5	30.1	0.0
Illinois	0.0	12.8	6.9	0.0
Keystone Project total	**0.0**	**170.0**	**57.8**	**0.0**

[a] Peak Ground Acceleration with 2% probability of exceedance in 50 years >0.5 g.

Source: ENSR 2006a.

Seismic Hazards

Based on a comprehensive review of the fault activity east of the Rocky Mountains (Crone and Wheeler 2000), Keystone concluded that the proposed pipeline would not cross active faults (defined as movement along the fault within the last 10,000 years). Earthquake hazards can occur at a distance from actual faults, as a result of ground motion. The earthquake hazard rank map (Figure 3.1.4-1) shows earthquake hazard risk along the proposed Keystone Project route. There is low seismic hazard in Kansas, Oklahoma, Missouri, and Illinois. Hazard increases to an intermediate level in the Mississippi Valley and in southern Illinois. This hazard is due to unconsolidated sediments that have the potential of being affected by New Madrid fault motion. The proposed Keystone Project is approximately 120 miles from the nearest active faulting in the New Madrid Seismic Zone (TransCanada 2007b).

As part of its National Pipeline Mapping System (NPMS) program, the DOT has compiled data from a variety of sources to identify areas of high geologic hazard potential for pipelines (DOT 1996). The Integrity Management Rule of 2002 states that segments of pipeline with a high geologic risk and the potential to affect HCAs must implement protective measures. HCAs are specific locales and areas where a release could result in more significant adverse consequences. No earthquake HCAs have been identified along the Keystone Project route.

Landslides

Landslides typically occur on steep or convergent terrain during conditions of partial or total soil saturation. Most of the proposed Keystone Project route is not located in landslide-prone terrain, but the proposed route does cross areas of high landslide potential as described by the NPMS at the Yankton and Mississippi crossings, as shown in Table 3.1.4-2. The areas listed with high landslide potential are based on high-level assessments for the NPMS and tend to overestimate the surficial extent of the hazard; actual areas of potential instability tend to be much smaller and discontinuous within the indicated zone (ENSR 2006a). Keystone has considered landslide potential in its routing work and has selected crossings of these areas where the landslide potential is considered minimal.

During scoping meetings, issues were raised concerning the potential for rock slope instability in the vicinity of the Whitewater River crossing in Kansas. Therefore, **the following measure is recommended:**

- **Prior to crossing these water bodies, Keystone should submit a site-specific Construction Mitigation and Restoration Plan for the Whitewater River crossing, as well as for the crossings listed in Section 3.3.2.2.**

TABLE 3.1.4-2
Areas with High Landslide Potential Crossed by the Keystone Project

Area	Start (MP)	End (MP)	Length (miles)
Mainline Project			
Yankton Crossing	428.1	442.9	14.8
	454.0	424.3	0.2
	635.9	641.6	5.7
Mississippi Crossing	979.6	987.7	8.1
	999.4	1,021.1	21.7
	1,023.0	1,027.7	4.7
	1,027.7	1,029.9	2.2
Mainline Project subtotal			55.2
Cushing Extension			
Silver Hills	0.0	9.3	9.3
Cushing Extension subtotal	0.0	9.3	9.3
Keystone Project total			**121.9**

Source: ENSR 2006a.

Subsidence

Although a potential result of soil liquefaction during seismic events, subsidence hazard generally is a consequence of the presence of karst features, such as sinkholes and fissures. Keystone reviewed national karst maps (Tobin and Weary 2005) to determine areas of potential karst terrain (i.e., areas where limestone bedrock is near the surface) along the proposed pipeline route. These areas are summarized in Table 3.1.4-3 and represented in the Karst map shown in Figure 3.1.4-2. Because national scale karst maps may not incorporate the most recent field data, or be of sufficient resolution to determine local subsidence risk due to karst features, **the following measure is recommended:**

- **Keystone should consult with the respective state geological survey departments to identify the most up-to-date sources of data on karst-related subsidence hazards along the proposed route.**

TABLE 3.1.4-3
Karst Areas Crossed by the Keystone Project

Location	Start (MP)	End (MP)	Length (miles)
Mainline Project [a]			
South Dakota, Nebraska	353	520	167
Missouri	735	811	76
Missouri, Illinois	946	1,028	82
Cushing Extension [b]			
Kansas	65	83	18
	118	134	16
	150	200	50
Oklahoma	244	248	4
Keystone Project total			**413**

[a] Type: Fissures, tubes and caves generally less than 1,000 feet (300 meters long; 50 feet (15 meters) or less vertical extent; in gently dipping to flat-lying beds of carbonate rock beneath an overburden of noncarbonate material 10 to 200 feet (3 to 60 meters) thick.

[b] Type: Fissures, tubes, and caves generally less than 1,000 feet (300 meters) long, 50 feet (15 meters) or less vertical extent, in gently dipping to flat-lying beds of carbonate rock.

Source: ENSR 2006a.

Deep (generally 50 feet or more) glacial drift deposits overlie karst terrain in South Dakota, Nebraska, and Kansas. This deep and interbedded glacial material matrix limits the potential for sinkholes to cause fractures and soil displacement at the surface. The overall subsidence hazard risk from sinkholes that form in karst terrain along the proposed route is low. This conclusion is based on Keystone's review of the sinkhole data base for the segment of the route in Missouri where limestone bedrock is at, or near to, the surface; the Missouri Environmental Geology Atlas indicates that the Keystone pipeline alignment would avoid all known sinkhole zones within the state (Missouri Division of Geology and Land Survey 2007, in TransCanada 2007b).

Floods

Floods can cause lateral and vertical scour that can expose the pipeline to damage. Keystone has not completed scour analysis for all stream crossings, but proposes to use HDD at major river crossings and to bury the pipeline under at least 5 feet of cover for at least 15 feet on either side of the bankfull width of all rivers, creeks, streams, ditches, and drains. Our assessment of hazards and potential environmental impacts related to Keystone's proposed stream crossing procedures can be found in Section 3.3.

3.1.4.2 Potential Impacts and Mitigation

Seismic

Construction and operation of the proposed Keystone Project would not increase the likelihood of earthquakes; however, there would be a risk of pipeline rupture from earthquake ground motion. This risk is considered to be minimal for the proposed Keystone Project—and Keystone has not proposed special seismic-hazard related construction methods—because the proposed route does not cross any active faults and would be located outside of known zones of high seismic hazard. In addition, no earthquake-induced ruptures in post-1945 electric-arc-welded transmission pipelines in good repair (the type proposed by Keystone) were observed to have resulted from large southern California earthquakes with reported surface wave magnitudes of up to 7.7 (O'Rourke and Palmer 1996). The New Madrid Seismic Zone is unlikely to produce an earthquake with a magnitude greater than 7.7 (NAHB 2003). Furthermore, in accordance with federal regulations (49 CFR 195), Keystone would conduct an internal inspection of the pipeline if an earthquake, landslide, or soil liquefaction event were suspected of causing abnormal pipeline movement. Thus, any damage to the pipeline would quickly be detected, and impacts resulting from crude oil releases would be minimized.

Landslides

During construction, landslide risk may be increased due to vegetation clearing and alteration of surface-drainage. Measures to reduce the risk of erosion during construction (described in Section 2.2) also would reduce the likelihood of construction-triggered landslides. During operations, landslide risk may be higher in forested areas where tree regrowth is suppressed to facilitate pipeline surveillance and maintenance.

The proposed Keystone Project would be designed and constructed in accordance with 49 CFR, Parts 192 and 193. These specifications ensure that pipeline facilities are designed and constructed in a manner to provide adequate protection from washouts, floods, unstable soils, landslides, or other hazards that may cause the pipeline facilities to move or sustain abnormal loads. Proposed pipeline installation techniques, especially padding and use of rock-free backfill, are designed to effectively insulate the pipeline from minor earth movements.

Keystone plans to limit the potential for exacerbating landslide risk by preserving or improving the contour of native slopes; preserving or improving drainage patterns; and, in some circumstances, considering the use of light-weight granular material surrounding the pipe to insulate it from small ground movements. Keystone has proposed erosion and sediment control and reclamation procedures in its Mitigation Plan that are expected to limit the potential for erosion and enable slopes to remain in a stable configuration following construction. The proposed mitigation measures are sufficient to minimize risks to the pipeline and environment due to landslide hazards.

The potential for landslide activity would be monitored during operations through aerial and ground patrols and through landowner awareness programs, which are designed to encourage reporting from local landowners of events that may suggest instability or other threats to the integrity of the pipeline. In addition to the landowner/tenant communication measures contained in Keystone's Plan, **the following measure is recommended:**

- **Keystone should develop and implement a Landowner Awareness Plan that complies with the recommendations in API Recommended Practice 1162 (Public Awareness Programs for Pipeline Operators) and includes at a minimum:**
  - **Distribution of educational materials to inform landowners of potential threats and identifying signs of threats to pipeline, and**
  - **Provision of a dedicated toll-free telephone number for landowners to report potential threats to the integrity of the pipeline.**

Subsidence

There is a risk of subsidence where the proposed route crosses karst formations. Table 3.1.4-3 shows the locations by milepost where karst may be found. Where karst terrain is present or suspected to be near the surface, Keystone has proposed to conduct site-specific studies as necessary to characterize the karst features, and will evaluate and modify construction techniques as necessary. Because the karst formations that may be present along the proposed route tend to be deeply covered, karst formations likely would be encountered only where deep HDD is proposed, as described in Section 3.3.2.2. The overall risk to the Keystone Project and environment from karst-related subsidence is expected to be minimal.

In Missouri, the proposed route runs through a region containing a considerable number of historic underground coal mines characterized by small shafts and adits. There is a risk of encountering mine-related shallow voids during pipeline construction, and those voids may collapse. Any such collapse is likely to be noticed and remediated during construction, and thus is not likely to pose a long-term subsidence hazard.

Potential impacts from minor subsidence associated with soil settling in the ROW and recommended mitigation are discussed in Section 3.2.2.2.

Floods

There is a risk of pipeline exposure due to lateral or vertical scour at water crossings. Keystone's Mitigation Plan (Appendix B) details procedures that would be used at water crossings; additional recommendations are presented in Section 3.3.

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3.2 SOILS AND SEDIMENTS

3.2.1 Affected Environment

There is a wide range of variability in soil properties along the length of the proposed Keystone Project. Most of the soils under the proposed route have developed in glacial and alluvial deposits. Soil textures vary widely depending on location and parent material. Some soils have been heavily modified by agriculture. In determining the environmental impact of the proposed Keystone Project, the main concerns with respect to soils are the extent to which a given soil has any of the following characteristics:

- Highly erodible soils—these soils are prone to high rates of erosion when exposed to wind or water by removal of vegetation.
- Prime farmland soils—these soils have combinations of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if they are treated and managed according to acceptable farming methods. (http://soils.usda.gov/technical/handbook/contents/part622.html.)
- Hydric soils—these soils "formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." (Federal Register, July 13, 1994.)
- Compaction-prone soils—these soils have clay loam or finer textures in somewhat poor, poor, and very poor drainage classes.
- Stony/rocky soils—these soils have (1) a cobbly, stony, bouldery, gravelly, or shaly modifier to the textural class; or (2) >5 percent (weight basis) of stones larger than 3 inches in the surface layer.
- Shallow-bedrock soils—these soils typically are defined as soils that have bedrock within 60 inches of the soil surface. For the purpose of the proposed Keystone Project, however, shallow-bedrock soils are defined as those with bedrock within 80 inches of the surface, because trenching typically would be done to that depth.
- Drought-prone soils—these soils include coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained.

Keystone provided information regarding the soil types occurring in the Keystone Project area that was derived from NRCS STATSGO and SSURGO databases (available online at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx). The soil characteristics of concern are erosion potential (wind and water), designation as prime farmland, compaction potential, percentage of stones/rocks, droughty soil, hydric soil, and potential for shallow bedrock. Because the proposed Keystone Project would not cross any drought-prone soils, this soil constraint is not a concern and is not discussed further.

Table 3.2.1-1 is a summary of proposed pipeline miles by state that would cross soils with the above properties. Table 3.2.1-2 is a summary of the acreage by state of soils with the above properties that lie within the proposed ROW. More detail is provided in Appendix F, a table provided by Keystone that lists soil associations from the STATSGO database by milepost along the proposed route—along with the proportion of each map unit that has specific soil limitations.

TABLE 3.2.1-1
Miles of Sensitive Soils Crossed by the Keystone Project

State	Total Miles	Highly Erodible	Prime Farmland	Hydric	Compaction-Prone	Stony/ Rocky	Shallow Bedrock
Mainline Project							
North Dakota	216.9	18.7	115.1	28.4	14.4	3.1	29.5
South Dakota	218.9	11.6	99.8	26.8	27.7	1.5	NA
Nebraska	213.7	43.8	134.8	8.9	10.9	0.5	4.0
Kansas	98.8	23.6	46.3	2.0	8.6	0.2	29.6
Missouri	273.1	48.9	145.9	51.8	140.3	16.5	80.2
Illinois	56.5	4.5	40.8	16.3	35.2	0.1	0.1
Mainline Project subtotal	1,077.9	151.1	582.7	134.2	237.1	21.9	143.4
Cushing Extension							
Nebraska	2.4	1.1	1.4	0.0	0.0	0.0	0.0
Kansas	209.7	13.0	156.7	1.4	10.9	9.8	140.1
Oklahoma	79.7	4.4	53.1	0.1	0.3	7.8	47.3
Cushing Extension subtotal	291.8	18.5	211.2	1.4	11.2	17.6	187.4
Keystone Project total	**1,369.7**	**169.6**	**793.9**	**135.6**	**248.3**	**39.5**	**330.8**

Source: ENSR 2006a.

TABLE 3.2.1-2
Acres of Sensitive Soils Crossed by the Keystone Project

State	Total Acres	Highly Erodible	Prime Farmland	Hydric	Compaction-Prone	Stony/Rocky	Shallow Bedrock
Mainline Project							
North Dakota	3,343	270	1,607	392	198	39	45
South Dakota	3,099	167	1,476	383	398	21	4
Nebraska	3,027	625	1,906	126	154	7	30
Kansas	1,402	351	642	16	105	3	22
Missouri	3,936	728	2,069	803	2,054	260	271
Illinois	736	57	537	218	454	1	5
Mainline Project subtotal	*15,243*	*2,198*	*8,237*	*1,938*	*3,363*	*533*	*373*
Cushing Extension							
Nebraska	35	15	30	0	0	0	0
Kansas	2,968	182	2,221	20	155	138	536
Oklahoma	1,155	63	770	<1	5	113	150
Cushing Extension subtotal	*4,158*	*260*	*3,012*	*20*	*160*	*251*	*686*
Keystone Project total	**19,401**	**2,458**	**11,248**	**1,959**	**3,522**	**582**	**1,059**

Source: ENSR 2006a.

Along the proposed Mainline Project route are:

- 151.1 miles of highly erodible soils,
- 582.7 miles of prime farmland soils,
- 134.2 miles of hydric soils,
- 237.1 miles of compaction-prone soils,
- 21.9 miles of stony/rocky soils, and
- 143.4 miles of shallow bedrock soils.

Along the proposed Cushing Extension route are:

- 18.5 miles of highly erodible soils,
- 211.2 miles of prime farmland soils,
- 1.4 miles of hydric soils,
- 11.2 miles of compaction-prone soils,
- 17.6 miles of stony/rocky soils, and
- 187.4 miles of shallow-bedrock soils.

3.2.1.1 North Dakota

Along the proposed pipeline route in North Dakota, most soils have thick, dark topsoil and mixed mineralogy. They range from well drained undulating soils on upland plains, to very poorly drained soils in "prairie potholes" and along streams. Sodic soils are present in places on glacial lake plains. Soil fertility is naturally high, and prime farmland soils are extensive—occupying approximately half of the proposed ROW. The average freeze-free period ranges from 100 to120 days at the U.S.-Canada border to 120 to 140 days in the southern portion of the state. Along the proposed Mainline Project route in North Dakota are:

- 18.7 miles of highly erodible soils,
- 115.1 miles of prime farmland soils,
- 28.4 miles of hydric soils,
- 14.4 miles of compaction-prone soils,
- 3.1 miles of stony/rocky soils, and
- 29.5 miles of shallow-bedrock soils.

3.2.1.2 South Dakota

In the northern portions of South Dakota, the soils are similar to those of North Dakota but experience warmer mean annual temperatures. In the southern portion of the state, upland soils are formed from both loess and medium-textured glacial till. Most of the soils are deep, silty or loamy, with thick, organically enriched topsoil layers. Poorly drained upland depressions contain wet, dark soils. In the Missouri River region, stream valley floors and bottomlands contain poorly-drained soils with thick, dark topsoil, interspersed with the well drained to poorly drained highly stratified soils formed in mixed sediments. Approximately 45 percent of the proposed route within South Dakota consists of prime farmland soils. The average freeze-free period is between 135 and 165 days. Along the proposed Mainline Project route in South Dakota are:

- 11.6 miles of highly erodible soils,
- 99.8 miles of prime farmland soils,
- 26.8 miles of hydric soils,

- 27.7 miles of compaction-prone soils,
- 1.5 miles of stony/rocky soils, and
- No shallow bedrock soils.

3.2.1.3 Nebraska

From the border with South Dakota into central Nebraska, soil characteristics along the proposed pipeline are similar to those described for southern South Dakota. From Butler County to northeastern Kansas, most of the soils are deep, silty, and loamy—with relatively thick, dark, fertile topsoil. These soils formed in thick loess deposits that lie over glacial deposits buried tens of feet deep. Highly erodible soils are present on slopes in the dissected topography of southern Nebraska. Prime farmland soils occupy approximately 63 percent of the proposed route in Nebraska. The average freeze-free period is between 160 and 180 days. Along the proposed Mainline Project route in Nebraska are:

- 43.8 miles of highly erodible soils,
- 134.8 miles of prime farmland soils,
- 8.9 miles of hydric soils,
- 10.9 miles of compaction-prone soils,
- 0.5 mile of stony/rocky soils, and
- 4.0 miles of shallow-bedrock soils.

Along the proposed Cushing Extension route in Nebraska are:

- 1.1 miles of highly erodible soils,
- 1.4 miles of prime farmland soils,
- No hydric soils,
- No compaction-prone soils,
- No stony/rocky soils, and
- 0.2 mile of shallow-bedrock soils.

3.2.1.4 Kansas

In southern Nebraska and northeastern Kansas, shallow soils form where sedimentary bedrock outcrops along valley side slopes and ridge crests. Elsewhere along the western part of the proposed route in Kansas, deep soils with fertile topsoil and loamy or clayey subsoil occur on the silty uplands. East of central Marshall County, the soil moisture regime becomes wetter; loess-mantled ridge ops and side slopes have deep, silty soils with fertile, dark topsoil. Soils in flatter landscape positions have more clayey subsoil. All of these soils have thick topsoil layers. Soils with internal drainage limitations occur in bottomlands. About 46 percent of the proposed route in Kansas consists of prime farmland soils. The average freeze-free period is from 160 to 190 days. Along the proposed Mainline Project route in Kansas are:

- 23.6 miles of highly erodible soils,
- 46.3 miles of prime farmland soils,
- 2.0 miles of hydric soils,
- 8.6 miles of compaction-prone soils,
- 0.2 mile of stony/rocky soils, and
- 29.6 miles of shallow-bedrock soils.

Along the proposed Cushing Extension route in Kansas, shallow soils are found in places where sandstones and limestones are exposed along valley side slopes and ridge crests. Deep soils with fertile topsoils and loamy or clayey subsoils are found in upland areas where loess mantles the bedrock. Deep stratified soils with fertile topsoils are found along smaller streams, while deep loamy, silty, or clayey soils with fertile enriched topsoils that may be wet near the surface during parts of the year are found along major streams. In some locations, the topsoil may be as thick as 20 inches or more. The average freeze-free period is from 170 to 190 days. Along the proposed Cushing Extension route in Kansas are:

- 13.0 miles of highly erodible soils,
- 156.7 miles of prime farmland soils,
- 1.4 miles of hydric soils,
- 10.9 miles compaction-prone soils,
- 7.8 miles of stony/rocky soils, and
- 10.5 miles of shallow-bedrock soils.

3.2.1.5 Missouri

Deep, highly erodible soils formed in thick loess and alluvial deposits are found near the Missouri River in both Kansas and Missouri. Loess deposits thin as the route progresses eastward into Missouri; in places, the route crosses soils formed in clay-rich glacial till. Erosion hazard remains high for several miles into the uplands on either side of the Missouri River floodplain. Poorly drained and very poorly drained soils occur in the Missouri River bottomlands and along tributary drainages. Deep, well drained and moderately well drained soils occur on Missouri uplands, but so do soils with claypan layers; and some soils lack the highly fertile, dark topsoil found further north. In addition, poor soil drainage is common along much of the proposed route in central and eastern Missouri, and shrink-swell potential may be severe in upland areas. About 54 percent of the proposed route in Missouri crosses soils classified as prime farmland. The average freeze-free period ranges from 180 to 190 days. Along the proposed Mainline Project route in Missouri are:

- 48.9 miles of highly erodible soils,
- 145.9 miles of prime farmland soils,
- 51.8 miles of hydric soils,
- 140.3 miles of compaction-prone soils,
- 16.5 miles of stony/rocky soils, and
- 80.2 miles of shallow-bedrock soils.

3.2.1.6 Illinois

Soil characteristics vary widely along the proposed route in Illinois. From the Mississippi River eastward to its terminus in Patoka, the proposed route crosses wide river bottomlands with poorly drained, very deep, and fertile alluvial soils and bordering hillslopes—where shallow to moderately deep limestone-derived soils occur along the edge of the river valley. Upland soils are derived from glacial till and other parent materials; depths range from shallow to deep and textures from sandy to clayey. Most of the upland soils near the Mississippi River are medium textured, well drained or moderately well drained, and lack highly fertile dark topsoil layers. Inland toward Patoka, soils are generally deep and soil wetness is a major land use problem. About 93 percent of the proposed route within Illinois consists of prime farmland. The average freeze-free period ranges from about 180 to 200 days.

Along the proposed route in Illinois are:

- 4.5 miles of highly erodible soils,
- 40.8 miles of prime farmland soils,
- 16.3 miles of hydric soils,
- 35.2 miles of compaction-prone soils,
- 0.1 mile of stony/rocky soils, and
- 0.1 mile of shallow-bedrock soils.

3.2.1.7 Oklahoma

Along the Cushing Extension route in Oklahoma, deep soils with dark topsoil layers above subsoil clay accumulations are found in gently sloping upland areas. Shallow to deep well drained soils occur on steeper slopes. Soil erosion potential can be high on these steeper slopes. In small drainages and river valleys, deep, clayey, or loamy soils are found. In these areas, the topsoil can be over 20 inches in depth, and some soils are saturated at depths of 2 feet or more below the surface during part of the year. The average freeze-free period is from 190 to 230 days. Along the proposed Cushing Extension route in Oklahoma are:

- 4.4 miles of highly erodible soils,
- 53.1 miles of prime farmland soils,
- 0.1 mile of hydric soils,
- 0.3 miles compaction-prone soils,
- 7.8 miles of stony/rocky soils, and
- 0.7 mile of shallow-bedrock soils.

3.2.2 Potential Impacts and Mitigation

3.2.2.1 Construction Impacts

Pipeline construction activities, including clearing, grading, trench excavation, backfilling, heavy equipment traffic, and restoration along the construction ROW, may adversely affect soil resources. Potential impacts include temporary and short-term soil erosion, short-term to long-term soil compaction, permanent increases in the proportion of large rocks in the topsoil, and short-term to permanent soil contamination. Pipeline construction also may result in damage to existing tile drainage systems. In its Mitigation Plan (see Appendix B), Keystone has proposed construction procedures that are designed to minimize the likelihood and severity of these impacts, and to mitigate where impacts are unavoidable. Additionally, Keystone will develop a comprehensive conservation and reclamation document for construction, operation, and maintenance of the proposed pipeline. This document will contain information from pertinent NRCS Field Office Technical Guides. The specific practices (listed by state) are presented in Appendix M.

Pre-construction clearing of the temporary ROW would remove protective vegetative cover and could potentially increase soil erosion and the transport to sensitive areas. A total of 2,458 acres—approximately 14 percent of the overall project surface area—would be constructed where the soils are listed as highly erodible. In these areas, some temporary and short-term increases in soil erosion may occur. Where agricultural soils are subject to a construction-related increase in erosion, receiving water bodies may be affected by hazardous substances (such as pesticide or herbicide residues) that might be present in the eroded material. In its Mitigation Plan, Keystone has proposed construction methods that are designed to minimize impacts resulting from soil erosion (Appendix B). These methods include installation of sediment barriers, temporary slope breaks, erosion control mats, and installation of temporary mulch in the event that construction activities are interrupted. Keystone's Mitigation Plan does not, however, include provisions for environmental inspection during construction, which would ensure effective implementation of the Plan. Therefore, **the following measure is recommended:**

- **Keystone should amend its Mitigation Plan to include designation of at least one Environmental Inspector (EI) per construction spread, who would have the authority to stop work and/or order corrective action in the event that construction activities violate the provisions of the Mitigation Plan, landowner requirements, or any applicable permit. The EI should inspect temporary erosion control measures on a daily basis in areas of active construction or equipment operation, on a weekly basis in areas without active construction or equipment operation, and within 24 hours of continuous rainfall greater than 0.5 inch. The EI should have the authority to ensure the repair of any ineffective erosion control measures within 24 hours of their detection, and should keep records of compliance with provisions of the Mitigation Plan and applicable regulations and permits.**

Farmland within the proposed ROW would be removed from production for the duration of construction. Agricultural and rangeland production on approximately 17,094 acres would be lost from the construction ROW for the construction season. During the next growing season, production may be reduced but not completely lost. Long-term productivity is not expected to be impaired.

The structure of farmland soils may be degraded by construction. Grading and equipment traffic may compact soil, reducing porosity and percolation rates, which can result in increase runoff potential. As detailed in Appendix B, Keystone has proposed construction methods that are designed to minimize these impacts. These include removing and storing the top 12 inches of topsoil from the trench line and any areas to be graded, ripping to relieve compaction in all areas from which topsoil has been removed, removing all excess rocks exposed due to construction activity, and adding soil amendments to return topsoil as warranted by conditions and agreed to by landowners. Although Keystone plans to minimize impacts to soil productivity that may result from construction activities, some short- to long-term decreases in agricultural productivity are possible. Therefore, **the following measure is recommended:**

- **Prior to construction, Keystone should submit to DOS an Agricultural Impact Evaluation and Compensation Plan to document and compensate for decreases in productivity that may result from degradation of agricultural soils along the proposed ROW. This plan should include, at a minimum, the following provisions:**
  - **Independent determination of the extent of, and responsibility for, any observed post-construction declines in agricultural production; and**
  - **Compensation or other mitigation of impacts or damage determined to have resulted from pipeline construction.**

Construction and maintenance activities may lead to localized soil compaction in soils listed as hydric or compaction prone, regardless of their suitability for farming, and this compaction may lead to slower or less successful vegetation reestablishment following construction. Approximately 13 percent of the overall proposed route is characterized by hydric soils. Locations where compaction-prone soils are crossed by the proposed ROW are shown in Appendix F. Because hydric and otherwise compaction-prone soils are particularly sensitive to the impact of construction activities during wet weather, **the following measure is recommended:**

- **Prior to construction, Keystone should amend its Mitigation Plan to include a Wet Weather Construction Plan to address construction practices in agricultural areas during conditions**

of active precipitation or saturated ground. This plan should include, at a minimum, the following information:

- **Specification of the allowable depth of rutting and allowable working conditions prior to suspension of construction activities, based on the topsoil thickness or the Atterberg Field Test Procedure;**
- **Designation of "stop-work" authority in the event that wet weather conditions place topsoil at risk; and**
- **Identification of alternate construction procedures to minimize compaction in the event of an unseasonably wet construction season.**

Construction may result in concentration of large clasts near the surface in areas where rocky soil or near-surface bedrock is found. Locations along the proposed ROW where stony/rocky soils are found are listed in Appendix F. As detailed in Section 2.2 and Appendix B, Keystone has proposed construction methods to ensure that soils along the proposed route do not become more rocky as a result of pipeline construction. These methods include topsoil removal, segregation and redistribution after construction, and removal from the ROW and off-site disposition of excess rocks and rock fragments. In short, the Mitigation Plan states that Keystone will restore the ROW soils to approximately the same condition they were in prior to construction. Stones of a size and in quantities greater than were present before construction that are unearthed during construction will be removed from the ROW. Revegetation establishment may be slow where stony or rocky soils are crossed in North Dakota, as well as where near-surface bedrock is present in Missouri. Where shallow bedrock is found, blasting may be required. The potential impacts of blasting, and locations where it may be necessary, are described in Section 3.1.1.2.

During construction, potential equipment spills or leakage of fuels, lubricants, and coolants could affect soils. Keystone has proposed construction methods that will minimize these impacts. These procedures include proper storage and disposal of all hazardous and non-hazardous wastes generated during the construction process, use of controlled staging areas for refueling and hazardous material loading/unloading operations, provision of adequate spill-cleanup materials and equipment, and contingency plans for spills that may pose a danger to human health or the environment (see Section 2.23 and Appendix C). In the event that a spill does occur that causes irreparable damage to soil productivity, the impact should be mitigated in accordance with the recommended Agricultural Impact Evaluation and Compensation Plan. It is also possible that Keystone may discover previously contaminated soils during construction. If this occurs, Keystone plans to immediately contact the appropriate state agency responsible for emergency response and site remediation, and to develop a remediation plan in consultation with that agency (see Keystone's Mitigation Plan, Appendix B).

Construction of the proposed pipeline would, in places, necessitate disruption of existing drain tile systems. In Section 5 of its Mitigation Plan, Keystone has committed to identifying and avoiding, repairing, or replacing drainage tiles that may be damaged by pipeline construction. Although these procedures should eliminate or compensate for any long-term impacts to drain tile function, unavoidable temporary impacts would be experienced during construction. Implementation of the recommended Agricultural Impact Evaluation and Compensation Plan would compensate for potential flooding that could occur because of temporary disruption of drain tile systems.

In modifying or constructing transmission line substations to support the Keystone Project, Western would implement the following mitigation measures for Soils and Sediments:

- Topsoil would be removed, stockpiled, and respread at all heavily disturbed areas not needed for maintenance access.

- Water bars or small terraces would be constructed across all ROW and access roads on hillsides to prevent water erosion and to facilitate natural revegetation.
- Erosion control measures would be implemented on disturbed areas, including areas that must be used for maintenance operations (access ways and areas around structures).
- When no longer required, construction roads would be restored to their original condition. Surfaces of construction roads would be scarified to facilitate natural revegetation, provide for proper drainage, and prevent erosion. If revegetation is required, regionally native plants would be used.

3.2.2.2 Operations Impacts

Operational maintenance of cleared areas may lead to increased erosion by wind or water. Maintenance activities may lead to localized compaction due to vehicular traffic. Incidental soil contamination due to minor leaks from maintenance vehicles also may occur. None of these impacts are expected to be extensive or severe. In the event that agricultural productivity is impaired, the procedures in the recommended Agricultural Impact Evaluation and Compensation Plan should be implemented.

During scoping meetings, a concern was expressed that soils may be prone to settling in the permanent ROW either during the Keystone Project's operational life or after its retirement. Keystone has committed to returning the ROW to its pre-construction topography. Once construction is complete, the permanent ROW would not be fenced; therefore, the same traffic that is experienced by neighboring soils would be experienced by those within the ROW. Consequently, differential settling is not expected. It is possible, however, that procedures to alleviate soil compaction implemented under Keystone's Mitigation Plan may result in relatively excessive soil aeration and subsequent settling of soils within the ROW. Therefore, **the following measure is recommended:**

- **Prior to construction, Keystone should amend its Mitigation Plan to include a Post-Construction Soil Monitoring Plan, to ensure that any erosion or settling that does occur is detected and mitigated. This plan should include, at a minimum, the following provisions:**
  - **Procedures for observing and recording evidence of soil erosion or compaction during routine pipeline surveillance and maintenance operations, and**
  - **Mechanisms to facilitate reporting by landowners of soil erosion or compaction.**

Also expressed during scoping meetings was a concern that increased soil temperatures resulting from the relatively high temperature of the oil in the pipeline might cause decreases in soil moisture content. Keystone conducted a detailed analysis of the effects of pipeline operations on winter and summer soil temperatures along the proposed route, based on operating volumes of 435,000 and 591,000 bpd (TransCanada 2007c). They found that near-surface soil temperatures would continue to be influenced mainly by climate, with minimal effects from pipeline operations. For the lower operating volume, soil temperatures at 6 inches depth within 3 feet of the pipe centerline would be elevated by less than 5 °F in early March, less than 2 °F for the rest of the spring and early summer, and by negligible amounts from mid-June through late February. Increases in soil temperature at distances of 7 feet or more from the centerline would be negligible. For the operating volume of 591,000 bpd, the same general pattern was found; but the temperature elevation within 3 feet of the pipe centerline in early March would be approximately 5 °F, and the period of approximately 2-°F temperature increase would begin in late December and extend to late August. Direct temperature effects on vegetation are expected to be minimal, and may even result in enhanced growth. Although decreases in soil moisture content within

3 feet of the pipe centerline may occur, no drought-prone soils have been identified along the proposed route, and any impacts to agricultural productivity would be addressed by the recommended Agricultural Impact Evaluation and Compensation Plan.

3.2.3 References

ENSR. 2006a. Keystone Pipeline Project Environmental Report. Updated November 15, 2006.

TransCanada. See TransCanada Keystone Pipeline, L.P.

TransCanada Keystone Pipeline, L.P. 2007c. Response to Data Request #2. Submitted to U.S. Department of State by TransCanada Keystone Pipeline, L.P. Application for Presidential Permit. April 4.

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3.3 WATER RESOURCES

This section describes the groundwater and surface water resources in the Keystone Project area that could be affected by the proposed Keystone Project and evaluates the potential impacts that may result from Keystone Project implementation. The analysis focuses on major aquifers and wells in the vicinity of the pipeline route, streams and rivers that would be crossed, and reservoirs and larger lakes that are downstream of these crossings.

3.3.1 Environmental Setting

3.3.1.1 Groundwater

The proposed Mainline Project route is located within the glaciated Central Lowlands physiographic province. The Central Lowlands physiographic province is characterized by glacial terrain. Buried stream channels, sand and gravel deposits, and glacial till were deposited following glacial retreat. Shallow groundwater is often contained in the buried stream channels or in recently deposited stream alluvium. Deeper wells also have been constructed into bedrock aquifers; however, the presence of the pipeline and associated construction activities are not likely to affect deeper groundwater aquifers because of the presence of glacial till above these zones. Glacial till typically inhibits the downward migration of groundwater.

In the region of the proposed Keystone Project route, unconsolidated deposit aquifers in Quaternary-aged sediments are the most productive aquifers and are the source of water for thousands of shallow wells (Whitehead 1996). Shallow groundwater in this region is often used for agricultural, domestic, and industrial purposes. The Mainline Project route does not cross over any sole source aquifers, as designated by EPA Regions 5, 6, 7, and 8 (EPA 2007).

Major aquifers and wells in the vicinity of the proposed Mainline Project route are described below by state.

North Dakota

Aquifers

In North Dakota, aquifers present beneath the proposed ROW are generally in unconsolidated glacial and alluvial deposits. Major aquifers in the vicinity of the proposed route are described below.

The Pembina River Aquifer is a productive aquifer located in eastern Cavalier and western Pembina Counties, occupying approximately 20 square miles in the area of the proposed route. The aquifer is surficial and is hydraulically connected to the nearby Pembina River. The groundwater table lies at ground surface within the floodplain along the proposed route.

The Pembina Delta Aquifer contains well yields up to 50 gallons per minute (gpm) (Hutchinson 1977), depending on the location along the proposed route. Depth to the saturated zone in this aquifer is approximately 50 feet below ground surface (bgs).

In Walsh County, the Edinburg Aquifer encompasses approximately 13 square miles, and depths to the saturated zone range from approximately 20 to 40 feet near the proposed route (Downey 1973). Adjacent to the proposed route, the Fordville Aquifer is one of the largest and most used surficial (glacial drift) aquifers in the area. The topography in this area lacks drainage features; consequently, the aquifer receives abundant recharge from precipitation. The Fordville Aquifer is hydraulically connected to the Forest River and tributaries (Downey 1973).

Adjacent to the proposed route in Steele and Barnes Counties, the McVille Aquifer lies in a buried river valley. Depth to saturation is on average 80 feet and up to 300 feet in southern Steele County (Downey and Armstrong 1977). In northern Barnes County, near Lake Ashtabula, the McVille Aquifer obtains recharge by precipitation.

The McVille Aquifer, Sand Prairie Aquifer, and Englevale Aquifer are present beneath the proposed route in Ransom County. All of these aquifers consist of buried channel deposits. The Englevale Aquifer consists of buried sand and gravel deposits associated with the historical course of the Sheyenne River (Armstrong 1982). The depth to the saturated zone in the Englevale Aquifer ranges from the land surface up to 80 feet bgs. The thickness of sand and gravel is varied and averages 40 feet.

In Sargent County, the proposed route would cross the Spiritwood Aquifer (also hydraulically connected to the Englevale Aquifer), the Brampton Aquifer, and the Oakes Aquifer. All three of these aquifers are characterized by coarse-grained alluvial channels underlying glacial till. The total area occupied by these aquifers is estimated at 450 square miles (Armstrong 1982). Depth to the saturated zone is typically 10 to 30 feet. In the vicinity of the proposed route, aquifer thicknesses range from approximately 100 to 200 feet.

In Sargent and Dickey Counties, excavation activities for the proposed route may penetrate the Oakes Aquifer. The Oakes Aquifer water table lies at the ground surface and extends to the west to the James River (Armstrong 1980, Koch and Bradford 1976). Subsurface materials in the aquifer consist of deltaic and lacustrine deposits of sand and gravel interbedded with silt and clay. In general, over 40 feet of glacial till, silt, and clay isolate the Oakes Aquifer from the underlying Spiritwood Aquifer. Literature indicates that in some areas the two aquifers are hydraulically connected vertically (Armstrong 1980). The average thickness of the saturated zone is approximately 30 feet, ranging from 2 to 100 feet. The aquifer yields from a few to up to a maximum of 1,500 gpm.

Available water quality information for the aquifers described in North Dakota is presented in Table 3.3.1-1. Literature indicates that, in general, water from these aquifers is not contaminated; however, water from two wells screened in the Oakes Aquifer in North Dakota may contain elevated nitrate concentrations resulting from fertilizers (Armstrong 1980).

The majority of the aquifers described are surficial. Principal regional aquifers are not present beneath the proposed route in North Dakota. The closest principal aquifer is the Lower Cretaceous Aquifer that is located adjacent to the Red River of the North, approximately 30 miles to the east (TransCanada 2007b).

Table 3.3.1-2 lists the locations beneath the proposed Mainline Project ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

TABLE 3.3.1-1 Groundwater Quality of Select Subsurface Aquifers					
Aquifer	**Milepost**	**State**	**County**	**TDS (mg/L)**	**Other Water Quality Information**
Pembina River		ND	Cavalier/Pembina	625	Calcium magnesium bicarbonate type
Pembina Delta		ND	Cavalier/Pembina	340	Calcium magnesium bicarbonate type
Edinburg		ND	Walsh	450–900	–
Fordville/Medford		ND	Walsh	300–600	–
McVille		ND	Steele/Barnes/ Ransom	2,200	–
Englevale		ND	Ransom	225–4,670	Calcium bicarbonate type
Spiritwood		ND	Sargent	625–2,260	–
Brampton		ND	Sargent	532–1,290	Calcium bicarbonate type in upper groundwater zone
Oakes		ND	Sargent/Dickey	300–800	Calcium bicarbonate type
Oakes		SD	Brown/Marshall	NA	Saline in many locations
Altamont		SD	Clark	500–1,400	–
Floyd		SD	Clark/Beadle/Miner/ Hanson/McCook	1,500–3,200	Sodium, calcium, sulfate rich
Lower James - Missouri		SD	McCook/Hutchinson/ Yankton	775–3,300	Calcium and sulfate rich
High Plains		NE	Cedar/Wayne	200–600	–
Barneston limestone		KS	Marshall	410–2,500	Sulfate (30–1,540 mg/l)
Alluvial deposits		KS	Marshall	470–650	Sulfate (40–60 mg/l)
Terrace (glacial) deposits		KS	Marshall	190–1,070	Sulfate (20–320 mg/l), nitrate (0.40–97 mg/l)
Permian limestones		KS	–	1,000–3,000	–
Glacial drift aquifers		KS	Brown/Doniphan	250–600	–
Missouri River alluvium		KS	–	500–700	–
Glacial drift		MO	–	350–800	–
Deep sandstone/ limestone aquifers		MO	–	>10,000	–

TABLE 3.3.1-2 Water-Bearing Zones Less Than 50 Feet below Ground Surface beneath the Proposed Right-of-Way for the Keystone Mainline Project	
Milepost	Description of Water-Bearing Zone
North Dakota	
7	Surficial aquifer
8–12	Surficial aquifer
12–16	Surficial aquifer
29–30	Surficial aquifer
119–121	Surficial aquifer
123–124	Surficial aquifer
193–196	Surficial aquifer
203–217	Surficial aquifer
South Dakota	
217–219	Surficial aquifer
225–227	Surficial aquifer
261–264	Surficial aquifer
266–270	Unconsolidated sand and gravel aquifers
278–290	Unconsolidated sand and gravel aquifers
296–309	Unconsolidated sand and gravel aquifers
342–349	Unconsolidated sand and gravel aquifers
358–371	Unconsolidated sand and gravel aquifers
377–380	Unconsolidated sand and gravel aquifers
390–393	Unconsolidated sand and gravel aquifers
413–436	Unconsolidated sand and gravel aquifers
Nebraska	
436-439	Unconsolidated sand and gravel aquifers
439-447	Unconsolidated sand and gravel aquifers
447–449	Unconsolidated sand and gravel aquifers
452–453	Unconsolidated sand and gravel aquifers
456–457	Unconsolidated sand and gravel aquifers
470–471	Unconsolidated sand and gravel aquifers
500–506	Unconsolidated sand and gravel aquifers
531–623	Unconsolidated sand and gravel aquifers, sandstone aquifers
627–629	Unconsolidated sand and gravel aquifers, sandstone aquifers
631–635	Unconsolidated sand and gravel aquifers, sandstone aquifers
649–650	Glacier drift aquifers
Kansas	
650-657	Glacier drift aquifers
656–659	Unconsolidated sand and gravel aquifers, alluvial aquifers, glacial drift aquifers
660–661	Glacial drift aquifers

TABLE 3.3.1-2 (Continued)	
Milepost	**Description of Water-Bearing Zone**
Kansas (continued)	
662–688	Glacial drift aquifers
688–691	Unconsolidated sand and gravel aquifers, alluvial aquifers, glacial drift aquifers
692–709	Glacial drift aquifers
710–720	Glacial drift aquifers
721–722	Glacial drift aquifers
723–723	Glacial drift aquifers, unconsolidated sand and gravel aquifers
724–724	Glacial drift aquifers, unconsolidated sand and gravel aquifers
725–727	Glacial drift aquifers
727–739	Glacial drift aquifers
741–742	Glacial drift aquifers
743–747	Glacial drift aquifers, alluvial aquifers, unconsolidated sand and gravel aquifers
Missouri	
748–748	Alluvial aquifers, unconsolidated sand and gravel aquifers
751	Alluvial aquifers, unconsolidated sand and gravel aquifers
760–763	Unconsolidated sand and gravel aquifers
771–772	Unconsolidated sand and gravel aquifers
839–847	Unconsolidated sand and gravel aquifers
857–859	Unconsolidated sand and gravel aquifers
860–863	Unconsolidated sand and gravel aquifers
867–869	Unconsolidated sand and gravel aquifers
870–875	Unconsolidated sand and gravel aquifers
954–963	Unconsolidated sand and gravel aquifers
969–972	Unconsolidated sand and gravel aquifers
974–978	Unconsolidated sand and gravel aquifers
981–983	Unconsolidated sand and gravel aquifers
Illinois	
1004–1026	Unconsolidated sand and gravel aquifers
1023.3	Sandstone and carbonate-rock aquifers
1045–1051	Unconsolidated sand and gravel aquifers
1053–1056	Unconsolidated sand and gravel aquifers
1058–1061	Unconsolidated sand and gravel aquifers
1069–1072	Unconsolidated sand and gravel aquifers

Wells

As presented in Appendix G, six public water supply (PWS) wells are located within 1 mile of the centerline of the pipeline. Five of these six wells are located in Pembina County, and one is in Walsh County; the wells are located in the general vicinity of each other, between MP 20 and 31 along the proposed route.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. Therefore, **the following measure is recommended:**

- **Keystone should obtain and evaluate information regarding all private wells within 100 feet of the ROW prior to initiation of construction activities to ensure the protection of these water resources.**

South Dakota

Aquifers

In South Dakota, shallow aquifers consist of glacially deposited sands and gravels or are present within glacially associated features such as buried lakes and channels. Shallow aquifers are present in alluvial deposits along stream channels. Deeper aquifers are also present in sandstone bedrock that is isolated from the surface or these shallow unconsolidated aquifers by glacial till.

In northern Brown and Marshall Counties, the James Aquifer underlies the proposed route. The aquifer ranges in thickness from approximately 10 to 100 feet. The aquifer is under artesian conditions. Depth to the saturated zone ranges from 100 to 190 feet bgs in the low-lying areas and as much as 580 feet bgs at higher land elevations (Koch 1975). The aquifer is composed mainly of buried outwash deposits and alluvium from an historical river. Deposits consist of sorted gravels, sand, and silt (Koch 1975). South of Marshall County, in northern South Dakota, underlying major aquifer zones are not present; the proposed route is located between the Tulare Aquifer and the Vermillion Aquifer (Geological Survey Program 2001, in ENSR 2006a). In Day and Clark Counties, near-surface aquifers in the glacial drift are generally not present; however, a number of small stream deposits containing near-surface aquifers are present in northwestern Day County.

In western Clark County and near the Spink County line, the proposed route would cross the underlying Altamont Aquifer along Foster Creek. This aquifer consists of a buried channel system and contains two saturated zones: from 2 to 10 feet bgs and from 35 to 80 feet bgs (Hamilton and Howells 1996). The average thickness of the Altamont Aquifer is approximately 22 feet.

The Floyd Aquifer (a confined aquifer) is present in southwestern Clark, Beadle, Miner, Hanson, and McCook Counties. According to cross-sections, depth to the saturated zone in Miner County is approximately 100 feet bgs near the county line. Near Carthage, the depth to the saturated zone ranges from the land surface to about 100 feet bgs (Koch and McGarvie 1988). Thickness of the Floyd Aquifer ranges between 4 and 100 feet. Also in this region, groundwater is present in the Niobrara Formation, a chalky shale bedrock aquifer. This aquifer is overlain by as much as 600 feet of glacial drift and shale in northern Miner County and as little as 60 feet in southern Miner County (Koch and McGarvie 1988).

The Lower James–Missouri Aquifer is present beneath the proposed route in southern McCook County, in the northern and southern ends of Hutchinson County and Yankton County (Lindgren and Hansen 1990). This aquifer is isolated from the surface by approximately 150 feet of till (Lindgren and Hansen 1990) and is approximately 50 to 75 feet thick in northern Hutchinson County and 130 feet thick in southern Hutchinson County. In Yankton County, depths to the saturated zone in this aquifer are generally 50 to 100 feet bgs; however, the depth to the saturated zone ranges from the land surface to 50 feet bgs at the James River, at Beaver Creek, and along the Missouri River (McCormick 2003).

Deeper aquifers in the region include the Dakota Formation Aquifer (sandstone) in Clark County, present at depths of 900 to 1,100 feet bgs (Jensen 2001c). The aquifer is isolated from the surface by thick deposits of glacial till and/or shale beds (Hamilton 1986). In Beadle County, the Codell Sandstone member of the Carlisle Shale is present at depths ranging from 350 to 500 feet. This aquifer is isolated from the surface by overlying glacial till and Niobrara Formation (Howells and Stephens 1968).

Available water quality information for the aquifers described in South Dakota is presented in Table 3.3.1-1. Literature indicates that, in general, water from these aquifers is not contaminated.

Principal regional aquifers are not present beneath the proposed route in South Dakota (TransCanada 2007b).

Table 3.3.1-2 lists the locations beneath the proposed Mainline Project ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Wells

As presented in Appendix G, no PWS wells are identified within 1 mile of the centerline of the pipeline in South Dakota. However, the pipeline passes within 0.04 mile of the Marshall County Source Water area and crosses a Zone B Aquifer Protection Area in Kingsbury County.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. Keystone should obtain and evaluate information concerning private wells within 100 feet of the ROW prior to initiation of construction activities to ensure the protection of these water resources.

Nebraska

Aquifers

Mainline Project. In Nebraska, the uppermost (shallow) groundwater-bearing zones along the proposed pipeline route include glacial drift and alluvium aquifers.

In Cedar and Wayne Counties, undifferentiated Quaternary-aged sands and gravels form a portion of the High Plains Aquifer (a principal regional aquifer).

In Stanton County, shallow aquifers are present in Quaternary sands and gravels. The saturated zone may be at or near the land surface in stream valleys and near water body crossings; however, in upland settings, depth to the saturated zone ranges from 30 to 60 feet.

In Platte and Colfax Counties, Quaternary-aged aquifers are similar to those to the north in Stanton County. Depth to the saturated zone is generally 50 to 100 feet bgs. Approaching the Platte River and in the Platte River valley, the saturated zone is present at depths of 5 to 15 feet bgs (CSD 1958, in ENSR 2006a). Shallow alluvial aquifers are also present in depressional areas and the headwaters of the Big Blue River near Garrison and Ulysses.

To the south, groundwater is present in Butler, Seward, Saline, Jefferson, and Gage Counties in coarse-grained glacial deposits and stream-valley alluvium (Miller and Appel 1997). These unconsolidated deposits are Quaternary aged and collectively comprise the surficial aquifer in the area (Miller and Appel 1997).

Principal aquifers beneath the proposed route in Nebraska include the High Plains Aquifer and the Lower Cretaceous Aquifer. The High Plains Aquifer is present beneath the majority of the Mainline Project route in Nebraska. South of the Platte River, the Lower Cretaceous Aquifer is located adjacent and to the east, underlying the proposed route (TransCanada 2007b).

Available water quality information for these aquifers is presented in Table 3.3.1-1. Waters from the unconsolidated Quaternary deposits and the deeper Cretaceous bedrock sources generally appear to be of similar quality (Verstraeten et al. 1998). Additionally, the High Plains Aquifer contains a range of pH values of 6.1–8.8, specific conductance of 320–960 microSiemens per centimeter (μS/cm), and dissolved nitrate and nitrite concentrations of 4.2–7.6 milligrams per liter (mg/L). The Dakota Aquifer contains a range of pH values of 7.0–7.4, specific conductance of 550–570 μS/cm, and a dissolved nitrate and nitrite concentration of 0.26 mg/L. A wider variation and higher upper ranges of these values in the shallower water-bearing zones are likely due to irrigation.

Table 3.3.1-2 lists the locations beneath the proposed Mainline Project ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Cushing Extension. The proposed Cushing Extension route traverses southern Jefferson County for approximately 2.5 miles before crossing the state line into Kansas. In this area, shallow aquifers are present in glacial deposits and alluvium.

Principal regional aquifers in southern Jefferson County, Nebraska beneath the proposed Cushing Extension include the Lower Cretaceous Aquifer (TransCanada 2007b).

Table 3.3.1-3 lists the locations beneath the proposed Cushing Extension ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Wells

Mainline Project. As presented in Appendix G, nine well head protection areas of public water supply wells are present within 1 mile of the centerline of the proposed route in Wayne, Colfax, Seward, and Jefferson Counties. Of the nine wells, seven are present within 300 feet of the proposed ROW. These seven wells are located in Colfax, Seward, and Jefferson Counties.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. As recommended earlier, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

TABLE 3.3.1-3 Water-Bearing Zones Less Than 50 Feet below Ground Surface beneath the Proposed Right-of-Way for the Keystone Cushing Extension	
Milepost	Description of Water-Bearing Zone
Kansas	
6–20	Dakota aquifer
8–10	Alluvial aquifer
9–10	Unconsolidated sand and gravel aquifers
10–12	Alluvial aquifer
13–14	Alluvial aquifer
25–30	Dakota aquifer
31–32	Dakota Aquifer and sandstone aquifers
38–43	Dakota Aquifer and sandstone aquifers
49–51	Alluvial aquifer
68–70	Alluvial aquifer
74–77	Alluvial aquifer
112–114	Alluvial aquifer
116–119	Alluvial aquifer
154–160	Alluvial aquifer
160–161	Alluvial aquifer
163–164	Alluvial aquifer
180–181	Alluvial aquifer
185–185	Alluvial aquifer
189–191	Alluvial aquifer
196–206	Alluvial aquifer

Note:

The Cushing Extension route in Nebraska and Oklahoma does not contain water-bearing zones less than 50 feet below ground surface.

Cushing Extension. Crystal Springs, located approximately 12 miles northwest of the beginning of the Cushing Extension route, supplies the Little Blue Public Water Project. This groundwater resource supplies potable water for several hundred domestic, livestock, and business purposes in Jefferson County and nearby Thayer County. Three public water supply wells are located 0.5 mile east of Fairbury, and six public water supply wells are located west of Fairbury; however, these water supply wells are approximately 11 miles west of the proposed Cushing Extension route.

No PWS wells within 1 mile of the centerline are present for the Cushing Extension route in Nebraska. Information regarding private wells within 100 feet of the Cushing Extension ROW is not available at this time. As recommended earlier, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

Kansas

Aquifers

Mainline Project. In northeastern Kansas along the proposed Mainline Project route, shallow aquifers consist of alluvium and terrace deposits. The Barneston Limestone Formation also contains groundwater in northern Marshall County (Walters 1954).

In eastern Nemaha County, unconsolidated Pleistocene-age deposits of glacial drift and buried channel deposits are the best potential sources of groundwater (Ward 1974, in ENSR 2006a). Several well-yielding springs flow from these glacial deposits along the proposed route in Nemaha County (Maxwell Spring) and in Brown County (Sycamore Springs and Sun Springs) (Buchanan et al. 1998).

Unconsolidated sand and gravel deposits along the Big Blue River and the Missouri River drainages are used locally as water supply sources. Depth to groundwater is typically less than 10 feet bgs in these areas. Glacial drift aquifers yielding between 50 and 100 gpm remain the most significant source of water supply eastward through the Missouri River basin in Brown and Doniphan Counties, Kansas.

Deep groundwater aquifers in Kansas include the Barneston, Wreford, Beattie, Foraker, and Grenola Limestones. These formations generally yield on the order of 50 gpm to wells where fracture zones are present.

Principal regional aquifers are not present beneath the proposed route in Kansas. Shallow aquifers consist primarily of glacial drift aquifers (TransCanada 2007b).

Available water quality information for these aquifers is presented in Table 3.3.1-1.

Table 3.3.1-2 lists the locations beneath the proposed Mainline Project ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Cushing Extension. In Washington and Clay Counties in Kansas, the Great Plains Aquifer is exposed at the ground surface or underlies the shallow aquifers present in the area. The Great Plains Aquifer consists of semi-consolidated sedimentary rock and consists of two separate aquifers in Cretaceous-aged sandstone, separated by a confining unit composed of shale (Miller and Appel 1997). Saline water conditions are common in deeper zones; total dissolved solids (TDS) values typically range from 1,000 to 10,000 mg/L. In areas where the aquifer is shallower, or present at the surface, freshwater is present and of better quality.

South of Washington County to the Kansas state border, in Clay, Dickinson, Marion, and Cowley Counties, stream-valley aquifers are present in unconsolidated coarse-grained sand and gravel deposits. Larger river valleys, such as the Republican, Smoky Hill, Cottonwood, and Arkansas Rivers, contain the most productive aquifers. The most notable of these aquifers is the stream-valley aquifer along the Smoky Hill River, ranging laterally in width from 3 to 5 miles. The upper 30 to 50 feet of this aquifer contains freshwater and is highly productive (from 200 to 900 gpm). The stream-valley aquifers along the Cushing Extension in Kansas typically yield from 100 to 1,000 gpm and are hydraulically connected to the surface water in the streams. Water quality in these aquifers is calcium bicarbonate rich. TDS concentrations are typically less than 500 mg/L, although concentrations up to 7,000 mg/L are present in some areas.

From Clay County to Cowley County in Kansas, The Flint Hills Aquifer is oriented north to south and is present beneath the proposed Cushing Extension. The aquifer consists of Permian-aged limestones. This aquifer contains yields up to 1,000 gpm (MacFarlane 2000, in ENSR 2006a), is used for public water supplies, and is a source for numerous small springs. Karst features are common in the aquifer; sinkholes and springs are common along the proposed route. The freshwater aquifer is unconfined; water quality decreases in the deeper zones.

The Wellington Aquifer lies adjacent to the proposed Cushing Extension route several miles to the west, from Saline County to the state border of Oklahoma. In southwest Cowley County, a small portion of the aquifer would be crossed by the proposed route. The Wellington Aquifer lies within Permian-aged fractured shales resulting from dissolution of halite, gypsum, and anhydrite that underlies these shales. Groundwater conditions in the Wellington Aquifer, east of Salina, are saline and contain increased chloride and TDS concentrations. Sinkholes are common at the ground surface in this area.

Principal regional aquifers beneath and adjacent to the proposed route include the Lower Cretaceous Aquifer and the High Plains Aquifer. The Lower Cretaceous Aquifer is located beneath the proposed Cushing Extension in Kansas, in Washington County and northern Clay County. South of Clay County to central Marion County, the Lower Cretaceous Aquifer is located west of the proposed route. South of Marion County, the High Plains Aquifer is located to the west, in the Arkansas River drainage area (TransCanada 2007b).

Table 3.3.1-3 lists the locations beneath the proposed Cushing Extension ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Wells

Mainline Project. As presented in Appendix G, only one public water supply well is located within 1 mile of the centerline of the proposed route. That well is in Doniphan County.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. As recommended earlier, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

Cushing Extension. As presented in Appendix G, 30 PWS wells are located within 1 mile of the centerline of the Cushing Extension. These wells are located in Washington, Dickinson, Butler, and Cowley Counties.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. As recommended earlier, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

Missouri

Aquifers

Water-bearing zones in Missouri are present in glacially deposited sediments, similar to those described for Nebraska and Kansas. Water-bearing zones in the drift deposits consist of sand and gravel lenses that fill pre-glacial valleys cut into the underlying bedrock. Many of these aquifers drain to nearby surface water bodies or adjacent alluvium. The depth to groundwater follows topography, generally being deeper beneath ridges and shallower (approximately 15 to 20 feet) beneath valley floors (Fuller et al. 1957a, 1957b, 1957c, in ENSR 2006a).

Additionally, unconsolidated deposits of sand and gravel along stream channels (such as the Platte River, the Grand River, and the Chariton River drainages) are used locally as water supply sources. Depth to groundwater is typically less than 10 feet bgs in these areas.

Deeper bedrock aquifers along the proposed pipeline route in western and central Missouri consist of sandstones and limestones. Aquifers in this area include the Burlington-Keokuk formation, Ste. Genevieve Formation, Cotter and Kimmswick Formations, and Ardmore Formation (Fuller et al. 1957a, 1957b, 1957c, in ENSR 2006a). The quality of water from the bedrock formations is typically poor (TDS concentrations >10,000 mg/L). As a result, these deeper bedrock aquifers are not used as sources of drinking water or for other uses.

Karst features, including sinkholes, dissolution cavities, caves, and fissures, are present in the subsurface in central Missouri (Veni 2002, in ENSR 2006a). In Caldwell, Lincoln, and St. Charles Counties in Missouri, karst areas are present but are typically less than 1,000 feet long and less than 50 feet deep (Davies et al. 1984).

Regionally, the Mississippian Aquifer (a principal aquifer) is present beneath portions of the proposed Mainline Project route in eastern Missouri (TransCanada 2007b).

Available water quality information for these aquifers is presented in Table 3.3.1-1.

Table 3.3.1-2 lists the locations beneath the proposed Mainline Project ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Wells

As presented in Appendix G, 20 PWS wells are located within 1 mile of the proposed route in Chariton, Audrain, Lincoln, and St. Charles Counties in Missouri. Of the 20 wells, one well (well No. 14629) is located within 300 feet of the proposed ROW in Chariton County.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. As recommended earlier, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

Illinois

Aquifers

In Illinois, shallow aquifers are present in the broad floodplain alluvium in the vicinity of the confluence of the Missouri and Mississippi Rivers. Large quantities of groundwater are withdrawn from terrace deposits of the Cahokia Formation, containing Quaternary-aged river deposits. In Madison County, these deposits extend from the Mississippi River for approximately 12 miles inland (Wehrman et al. 2003). Additional shallow sand and gravel aquifers are present in east-central Madison County, in central Bond County, and all along the Kaskaskia River alluvium in Fayette County (Wehrman et al. 2003).

In areas away from the river, aquifer zones less than 45 feet bgs are scattered along the proposed route in Illinois (Berg undated, in ENSR 2006a). Springs are present along or in the vicinity of the proposed route in eastern Madison County, southwestern Bond County, and Fayette County (Wetzel and Webb 2004). Karst features are not present along the Keystone Project route in westernmost Illinois (Davies et al. 1984).

The Mississippian Aquifer (a principal aquifer) is present beneath the far western portion of the proposed Mainline Project route in eastern Illinois, in the region beneath the confluence of the Illinois River, Mississippi River, and Missouri River (USGS 2003).

Table 3.3.1-2 lists the locations beneath the proposed Mainline Project ROW where water-bearing zones are expected to be present at less than 50 feet bgs.

Information regarding groundwater quality was not presented in the available literature reviewed.

Wells

As presented in Appendix G, 12 PWS wells within 200 feet of the proposed ROW are present. These wells are located in Madison County, between MP 1030 and 1035 of the proposed Mainline Project route.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. As recommended, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

Oklahoma

Aquifers

The proposed Cushing Extension route passes through Kay, Noble, and Payne Counties in Oklahoma. Aquifers crossed by the route consist of stream valley alluvial terraces. Significant alluvial aquifers include those associated with the Salt Fork Arkansas River in Kay County and the Cimarron River in Payne County. These aquifers consist of Quaternary-aged deposits of sand and gravel up to 100 feet in thickness and up to several miles wide. Both of these aquifers are high-yielding and are important water sources in Oklahoma (Ryder 1996, in ENSR 2006a); however, the Salt Fork Arkansas River and associated alluvial aquifers are saline and unsuitable for use (Ryder 1996, in ENSR 2006a).

The Arkansas River is located adjacent to and east of the proposed Cushing Extension in Oklahoma. The alluvium and alluvial terraces associated with the river can yield up to 600 gpm. The aquifer is up to 45 feet thick and 5 miles wide (Ryder 1996, in ENSR 2006a).

At the Cimarron River crossing near Cushing, Oklahoma (at the southern end of the proposed route), alluvial terrace deposits contain calcium-magnesium-bicarbonate rich water that is suitable for domestic and irrigation water supplies (Ryder 1996, in ENSR 2006a). TDS concentrations are 400 mg/L or less, and hardness is less than 200 mg/L.

Principal regional aquifers are not present beneath or adjacent to the Cushing Extension route in Oklahoma (TransCanada 2007b)

Wells

As presented in Appendix G, four PWS wells are located within 1 mile of the centerline of the Cushing Extension in Oklahoma. Three of these wells are located in Kay County, and one is located in Payne County. The well located in Payne County (MP 290) is present within 200 feet of the ROW.

Information regarding private wells within 100 feet of the Keystone Project ROW is not available at this time. As recommended earlier, Keystone should obtain and evaluate this information prior to initiation of construction activities to ensure the protection of these water resources.

3.3.1.2 Surface Water

Surface water resources that would be crossed by the proposed pipeline are located within three water resource regions:

- Souris-Red-Rainy Rivers region (eastern North Dakota),
- Missouri River region (North Dakota, South Dakota, Nebraska, Kansas, and Missouri), and
- Upper Mississippi region (Missouri and Illinois).

Stream and river crossings are described below by state. Additionally, reservoirs and larger lakes that are present within 10 miles downstream of these crossings are listed in Appendix H. Levees, water control structures, and flood protection structures along the proposed route are presented in Appendix I. The majority of levees and water control structures along the proposed Mainline Project route are in the state of Missouri.

Levees, water control structures, and flood protection structures are not present along the proposed Cushing Extension route, as presented in Appendix I.

North Dakota

Water Bodies Crossed

As presented in Appendix J, 171 water body crossings are proposed in North Dakota along the proposed Mainline Project route.

According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width in North Dakota include:

- Pembina River in Pembina County (approximately 125 feet wide, MP 7),
- Tongue River in Pembina County (approximately 50 to 100 feet wide, MP18), and
- Sheyenne River in Ransom County (approximately 50 to 100 feet wide, MP 169).

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings include Weiler Dam/Reservoir, Herzog Dam/Reservoir, Renwick Dam at Icelandic State Park, Charles C. Cook State Game Management Area and wetlands, Homme Lake, Pickart Lake, Lake Ashtabula, Lone Tree Lake, Lake Taayer, and three unnamed reservoirs. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H. Small glacially formed water bodies (ponds and potholes) also are present along the Mainline Project route through North Dakota.

Sensitive or Protected Water Bodies

Water bodies with a designated state water use classification are included in Appendix J. Seven of the water body crossings in North Dakota have water use classifications.

The following streams and rivers along the Mainline Project route in North Dakota contain state water quality designations or use designations:

- Pembina River, Tongue River, and North Branch Park River in Pembina County;
- Middle Branch Forest River in Walsh County;
- North Branch Turtle River and Goose River in Nelson County; and
- Sheyenne River in Ransom County.

Impaired or Contaminated Water Bodies

Keystone identified that contamination has been documented in all seven of these sensitive or protected water bodies in North Dakota. Contamination or impairment in each of these water bodies includes unacceptable levels of at least one of the following parameters: sedimentation/siltation, total fecal coliform, biological indicators, TDS, and cadmium.

Impaired or contaminated water bodies are listed in Appendix K.

Water Supplies

Along the proposed ROW from the United States through North Dakota, municipal water supplies are largely obtained from groundwater sources.

South Dakota

Water Bodies Crossed

As presented in Appendix J, 120 water body crossings are proposed in South Dakota.

According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width include:

- James River in Yankton County (approximately 150 feet wide, MP 422), and
- Missouri River in Yankton County, South Dakota and Cedar County, Nebraska (approximately 1,400 feet wide, MP 436).

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings in South Dakota include Renzienhausen Slough, Amsden Lake, Logan Dam/Reservoir, Fordham Reservoir, an unnamed reservoir, Lake Iroquois, Twin Lakes, and Lake Eli. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H. Small glacially formed water bodies (ponds, potholes, and small lakes) also are present along the Keystone Project route through South Dakota.

Gavins Point Dam, a major control structure on the Missouri River, is located about 3 miles upstream of the proposed crossing of the Missouri River in South Dakota.

Sensitive or Protected Water Bodies

Water bodies with a state water use classification are included in Appendix J. Seven of the water bodies (11 total water body crossings) in South Dakota have been assigned water use classifications.

The following streams and rivers along the Mainline Project route in South Dakota have state water quality designations or use designations:

- Pearl Creek in Beadle County;
- Redstone Creek and Rock Creek in Miner Counties;

- Wolf Creek in Hanson, McCook, and Hutchinson Counties; and
- James River, Beaver Creek, and the Missouri River in Yankton County at the border with Nebraska.

Impaired or Contaminated Water Bodies

Keystone identified 10 impaired water bodies (14 water crossings total) along the pipeline route in South Dakota (see Appendix K – source: TransCanada 2007c); however, specific contamination or impairment was documented in only five of these water bodies. Two of the streams in Day Country (unnamed and mud Creek flowing from Amsden Lake) are impaired due to nutrient levels, Wolf Creek in McCook and in Hutchinson Counties is impaired due to ammonia, and the James River in Yankton County is impaired due to total suspended solids and turbidity.

Water Supplies

Along the proposed Mainline Project ROW in South Dakota, municipal water supplies are largely withdrawn from groundwater sources.

Nebraska

Water Bodies Crossed

Mainline Project. As presented in Appendix J, 191 water body crossings are proposed in Nebraska.

According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width include:

- Missouri River in Yankton County, South Dakota and Cedar County, Nebraska (approximately 1,400 feet wide, MP 436),
- Elkhorn River in Stanton County (approximately 225 feet wide, MP 503),
- Shell Creek in Colfax County (approximately 125 feet wide, MP 533), and
- Platte River in Colfax and Butler Counties (approximately 1,500 feet wide, MP 542).

The Platte River at the proposed pipeline crossing is a highly braided stream that is approximately 1,500 feet wide. The river basin contains sandy floodplain deposits up to 3 miles wide. The Elkhorn River is a meandering river that contains numerous oxbows and sloughs along the floodplain.

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings in Nebraska include Whitetail State Wildlife Management Area, and five unnamed reservoirs. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H.

Cushing Extension. The Cushing Extension runs from the Mainline Project route approximately 2.5 miles in Nebraska to the Kansas border. As presented in Appendix J, five water body crossings are proposed in Nebraska along the Cushing Extension. These water bodies consist of small intermittent streams and tributaries to the Little Blue River.

No water bodies and reservoirs are located within 10 miles downstream of proposed water crossings in Nebraska along the Cushing Extension.

Sensitive or Protected Water Bodies

Mainline Project. Water bodies with a state water use classification are included in Appendix J. Six of the water bodies (six total crossings) in Nebraska have been assigned water use classifications.

The following streams and rivers in Nebraska along the Mainline Project route in Nebraska have state water quality designations or use designations:

- Missouri River in Cedar County,
- Elkhorn River in Stanton County,
- Platte River in Colfax County,
- Big Blue River in Seward County, and
- West Fork Big Blue River and Swan Creek in Saline County.

Cushing Extension. None of the water body crossings in Nebraska along the Cushing Extension have been assigned a state water use classification.

Impaired or Contaminated Water Bodies

Mainline Project. Keystone identified 19 water crossings on its list of impaired water bodies in Nebraska; however, specific contamination or impairment was documented in only six of these water bodies. Contamination or impairment in each of these water bodies includes unacceptable levels of at least one of the following parameters: fecal coliform, dieldrin, polychlorinated biphenyls (PCBs), dissolved oxygen (DO), and selenium.

Cushing Extension. Contamination was not documented in any of the water body crossings in Nebraska along the Cushing Extension, as presented in Appendix K.

Water Supplies

Mainline Project. Along the proposed Mainline Project ROW in Nebraska, municipal water supplies are largely obtained from groundwater sources.

Cushing Extension. Information regarding the locations of surface water supplies along the Cushing Extension has been requested from appropriate federal, state, and local agencies; however, the information is not yet available. Therefore, **the following measure is recommended:**

- **Keystone should obtain and evaluate the locations of surface water supplies along the Cushing Extension prior to initiation of construction activities to ensure the protection of these water resources.**

Kansas

Water Bodies Crossed

Mainline Project. As presented in Appendix J, 161 water body crossings are proposed in Kansas. According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width include:

- Big Blue River in Marshall County (approximately 175 feet wide, MP 659); and

- Missouri River in Doniphan County, Kansas and Buchannan County, Missouri (approximately 800 feet wide, MP 748).

At the second proposed crossing of the Missouri River, at the state line, the channel is approximately 800 feet wide. A system of channel controls (levees and jetties) is located along the west bank, and levees and ditches are located along the east bank.

No major water bodies or reservoirs are located within 10 miles downstream of proposed water crossings in Kansas, as presented in Appendix H.

Cushing Extension. As presented in Appendix J, 169 water body crossings are proposed in Kansas along the Cushing Extension.

According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width include:

- Smoky Hill River in Dickinson County (approximately 125 feet wide, MP 77), and
- Arkansas River in Cowley County (approximately 400 feet wide, MP 206).

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings in Kansas include Milford Lake, Herrington Reservoir, Marion Lake Reservoir, and Kaw Lake. Additionally, Turtle Creek Lake, a very large reservoir, is located approximately 15 to 20 miles downstream of the proposed route. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H.

Sensitive or Protected Water Bodies

Mainline Project. Water bodies with a state water use classification are included in Appendix J. Thirteen of the water bodies and tributaries (18 total water body crossings) in Kansas have been assigned water use classifications.

The following streams and rivers in Kansas along the Mainline Project route have state water quality designations or use designations:

- Deer Creek, North Elm Creek and its tributaries, and Robidoux Creek in Marshall County;
- Wildcat Creek, Nemaha River, and Harris Creek in Nemaha County;
- Walnut Creek, Wolf River Middle and South Forks, Buttermilk Creek, and Squaw Creek in Brown County; and
- Halling Creek, Rock Creek, and Brush Creek in Doniphan County.

Cushing Extension. Water bodies with a state water use classification are included in Appendix J. Thirty of the water bodies and their associated tributaries (38 total water body crossings) in Kansas along the Cushing Extension have been assigned water use classifications.

The following streams and rivers in Kansas along the Cushing Extension have state water quality designations or use designations:

- Little Blue River, Mill Creek, and Coon Creek in Washington County;
- Carter Creek, West Fancy Creek, Lincoln Creek, and Republican River in Clay County;

- Chapman Creek, Smoky Hill River, Carry Creek, and West Branch Lyon Creek in Dickinson County;
- Mud Creek, Cottonwood River, Spring Branch, Catlin Creek, and Doyle Creek in Marion County;
- East Branch Whitewater River, Fourmile Creek, Rock Creek, Spring Branch, Whitewater River, Badger Creek, Dry Creek, Fourmile Creek, and Eightmile Creek in Butler County; and
- Polecat Creek, Stewart Creek, Crooked Creek, Spring Creek, and Arkansas River in Cowley County.

Impaired or Contaminated Water Bodies

Mainline Project. Keystone identified 23 water crossings along the Mainline Project on its list of impaired water bodies in Kansas; however, specific contamination or impairment was documented in only 15 of these water bodies. Contamination or impairment in each of these water bodies includes unacceptable levels of at least one of the following parameters: biological impairment, atrazine, beryllium, copper, and pH.

Impaired or contaminated water bodies that would be crossed are presented in Appendix K.

Cushing Extension. Keystone identified 32 water crossings along the Cushing Extension on its list of impaired water bodies in Kansas; however, specific contamination or impairment was documented in only 19 of these water bodies. Contamination in each of these water bodies includes unacceptable levels of at least one of the following parameters: atrazine, fecal coliform, sulfate, chloride, zinc, pH, and biological impairment.

Impaired or contaminated water bodies that would be crossed are presented in Appendix K.

Water Supplies

Mainline Project. Along the proposed route from Jefferson County, Nebraska eastward through Kansas, surface water reservoirs and groundwater wells supply municipal requirements.

In general, Marshall County depends on both surface water and groundwater resources for water supply. Marysville, which historically had depended on Blue River surface water, now obtains its water supply from a wellfield southeast of town along a tributary. This wellfield is located approximately10 miles south of the proposed Blue River crossing. Oketo obtains municipal water from a well on the Big Blue River floodplain. Summerfield and Axtell also are supplied by wells (Walters 1954).

Cushing Extension. Table 3.3.1-4 provides information on surface water intakes within 5 miles of the Cushing Extension ROW in Kansas. There are no surface water intakes within 1 mile of the centerline (TransCanada 2007c).

Missouri

Water Bodies Crossed

As presented in Appendix J, 459 water body crossings are proposed in Missouri.

According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width include:

- Missouri River in Doniphan County, Kansas and Buchannan County, Missouri (approximately 800 feet wide, MP 749);
- Grand River in Carroll County (approximately 250 feet wide, MP 841);
- Chariton River in Chariton County (approximately 280 feet wide, MP 862);
- Cuivre River in Lincoln County (approximately 225 feet wide, MP 971);
- Cuivre River in St. Charles County (approximately 225 feet wide, MP 982); and
- Mississippi River in St. Charles County, Missouri and Madison County, Illinois (approximately 2,200 feet wide, MP 1021).

TABLE 3.3.1-4
Surface Water Intakes within 5 Miles of the Keystone Cushing Extension in Kansas

Milepost	County	Approximate Distance from Centerline (miles)
91–100	Marion	2.0
112–122	Marion	1.5
158–166	Butler	2.0
163–173	Butler	1.5
204–210	Cowley	4.8

In this section of the Mainline Project, many levees or embankments are associated with the Missouri River and Mississippi River drainage areas and along the Grand River, Chariton River tributaries, and the Cuivre River (Appendix I). Abandoned stream meanders and ponds are present in the area at the confluence of the Mississippi and Missouri Rivers. At the state border, the proposed route would cross the Mississippi River.

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings in Missouri include New Mud Lake/Old Mud Lake, Smithville River, five fishing areas, Cut-Off Lake, Middletown Lake, Horseshoe Lake, Mud Lake, and Graus Lake. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H.

Sensitive or Protected Water Bodies

Water bodies with a state water use classification are included in Appendix J. Twenty-eight of the water bodies and tributaries (31 total water body crossings) in Missouri have been assigned water use classifications.

The following streams and rivers in Missouri along the Mainline Project have state water quality designations or use designations:

- Missouri River, Contrary Creek, Pigeon Creek, and Platte River in Buchanan County;
- Castile Creek, Little Platte River, and Shoal Creek in Clinton County;
- Brush Creek, Crabapple Creek, and Mud Creek in Caldwell County;
- Big Creek and Grand River in Carroll County;
- Salt Creek, Lake Creek, Mussel Fork, and Chariton River and forks, and Puzzle Creek in Chariton County;
- Long Branch, Youngs Creek, Bean Branch, Littleby Creek, and West Fork Cuivre River in Audrain County;
- Brush Creek in Montgomery County;
- Bear Creek and Cuivre River in Lincoln County; and
- Peruque Creek, Dardenne Creek, and Mississippi River in St. Charles County, Missouri.

Impaired or Contaminated Water Bodies

Keystone identified 53 water crossings on its list of impaired water bodies in Missouri; however, specific contamination or impairment was documented in only 13 of these water bodies. Contamination or impairment in each of these water bodies includes unacceptable levels of at least one of the following parameters: chlordane, PCBs, fecal coliform, biological oxygen demand (BOD), volatile suspended solids (VSS), metals, and sediment.

Impaired or contaminated water bodies that would be crossed are presented in Appendix K.

Water Supplies

Along the proposed route eastward through Missouri, surface water reservoirs and groundwater wells are used for municipal requirements.

St. Joseph, Andrews County, is supplied by a groundwater wellfield several miles north of the city (Water-Technology-net 2006). This wellfield would not be crossed by the proposed pipeline, which would be routed south of the city.

Illinois

Water Bodies Crossed

As presented in Appendix J, 74 water body crossings are proposed along the Mainline Project in Illinois. No water body crossings are associated with the 1-mile-long lateral pipeline to the Wood River Terminal.

According to evaluation of aerial photographs (flown in 2006), water bodies greater than 100 feet in width include:

- Mississippi River in St. Charles County, Missouri and Madison County, Illinois (approximately 2,200 feet wide, MP 1021);
- East Fork Silver Creek/Silver Lake in Madison County (approximately 300 feet wide, MP 1046);

- Hurricane Creek in Fayette County (approximately 100 feet wide, MP 1070); and
- Kaskaskia River in Fayette County (approximately 100 feet wide, MP 1072).

At the state border, the Mississippi River is approximately 2,100 feet wide at the proposed crossing location. The proposed route lies in the floodplain for the next 5 miles. Approximately 3 miles of floodplain associated with the Kaskaskia River would be crossed, upstream from Carlyle Lake (a 26,000-acre multi-purpose lake) and 5 miles east of the proposed eastern end of the pipeline route.

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings in Illinois include Highland Silver Lake, an unnamed reservoir, and Carlyle Lake. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H.

In addition to stream crossings, a number of lakes and ponds are located along the proposed pipeline route.

Sensitive or Protected Water Bodies

Water bodies with a state water use classification are included in Appendix J. Eleven of the water bodies (11 total water body crossings) that would be crossed in Illinois have been assigned water use classifications.

The following streams and rivers that would be crossed in Illinois have state water quality designations or use designations:

- Mississippi River, Indian Creek, Cahokia Canal, Mooney Creek, Silver Creek, Sugar Fork, Sand Creek, and Silver Lake in Madison County;
- Shoal Creek and Little Beaver Creek in Bond County; and
- Kaskaskia River in Fayette County.

Impaired or Contaminated Water Bodies

Keystone identified 14 water crossings in Illinois along the Mainline Project route that are on its list of impaired water bodies; however, specific contamination or impairment was documented in only seven of these water bodies. Contamination or impairment in each of these water bodies includes unacceptable levels of at least one of the following parameters: fecal coliform, DO, sediments and siltation, total suspended solids, pH, total nitrogen, total petroleum hydrocarbons (TPH), aldrin, chlordane, manganese, aquatic algae, and silver. Additionally, chlordane and PCBs were reported at the proposed Illinois/Missouri border crossing of the Mississippi River.

Impaired or contaminated water bodies that would be crossed in Illinois are presented in Appendix K.

Water Supplies

Along the proposed route eastward through Illinois, surface water reservoirs and groundwater wells are used for municipal requirements. Municipalities also are served by Highland Silver Lake and Carlyle Lake in Illinois.

Oklahoma

Water Bodies Crossed

As presented in Appendix J, 45 water body crossings are proposed in Oklahoma.

According to evaluation of aerial photographs (flow in 2006), water bodies greater than 100 feet in width include:

- Salt Fork Arkansas River in Kay County (approximately 300 feet wide, MP 239), and
- Cimarron River in Payne County (approximately 400 feet wide, MP 285).

Major water bodies and reservoirs located within 10 miles downstream of proposed water crossings in Oklahoma include Kaw Lake and Sooner Lake. The approximate mileposts of these water bodies and their associated pipeline stream crossings are presented in Appendix H.

Sensitive or Protected Water Bodies

Water bodies with a state water use classification are included in Appendix J. Two of the water bodies (10 total crossings) that would be crossed in Oklahoma have been assigned water use classifications.

The following streams and rivers that would be crossed in Oklahoma have state water quality designations or use designations:

- Bois d'Arc Creek and Salt Fork Arkansas River in Kay County.

Impaired or Contaminated Water Bodies

Keystone identified 13 water crossings on its list of impaired water bodies in Oklahoma; however, specific contamination or impairment was documented in only six of these water bodies. Contamination or impairment in each of these water bodies includes unacceptable levels of at least one of the following parameters: sulfates, pathogens, turbidity, lead, nitrates, and unknown toxicity.

Impaired or contaminated water bodies that would be crossed are presented in Appendix K.

Water Supplies

Table 3.3.1-5 provides information on surface water intakes within 5 miles of the Cushing Extension ROW in Oklahoma. There are no surface water intakes within 1 mile of the centerline (TransCanada 2007c).

TABLE 3.3.1-5 Surface Water Intakes within 5 Miles of the Keystone Cushing Extension in Oklahoma		
Milepost	County	Approximate Distance from Centerline (miles)
246–255	Noble/Pawnee	2.5
280–289	Payne/Lincoln	1.5

3.3.2 Potential Impacts and Mitigation

3.3.2.1 Groundwater

Construction Impacts

Potential impacts to groundwater during construction activities include:

- Groundwater quality degradation during or after construction resulting from disposal of materials and equipment, or vehicle spills and leaks;
- Temporary increases in total suspended solids (TSS) concentrations where the water table is disturbed during trenching and excavation activities (drawdown of the aquifer is possible where dewatering is necessary);
- Increased surface water runoff and erosion from clearing vegetation in the ROW; and
- Degradation of groundwater quality because of blasting.

Spills and Leaks

Overall, it is not anticipated that groundwater quality would be affected by disposal activities, spills, or leaks. Many of the aquifers present in the subsurface beneath the proposed route are isolated by the presence of glacial till, which characteristically inhibits downward migration of water and contaminants into these aquifers; however, shallow or near-surface aquifers are also present beneath the proposed route.

Temporary fueling stations would be used to refuel construction equipment. To prevent releases, fuel tanks or fuel trailers would be placed within secondary containment structures equipped with impervious membrane liners.

Implementation of procedures outlined in Sections 2 and 3 of Keystone's Mitigation Plan (Appendix B) would ensure that (1) contractors would be prepared to respond to any spill incident; and (2) all contaminants would be contained and not allowed to migrate into the aquifer during construction activities, regardless of the depth of the underlying aquifer.

TSS Concentrations

Although there is potential for dewatering of shallow groundwater aquifers and potential changes in groundwater quality (such as increases in TSS concentrations) during trenching and excavation activities, these changes are expected to be temporary. Shallow groundwater aquifers generally recharge quickly because they have high hydraulic conductivities and thus are receptive to recharge from precipitation and surface water flow.

Runoff and Erosion

Implementation of measures described in Section 4.5 of Keystone's Mitigation Plan (Appendix B) would reduce erosion and control surface water runoff during vegetation clearing in the ROW.

Blasting

Where required for pipeline construction, blasting has the potential to affect groundwater resources. In Section 3.1.1.2, it is recommended that Keystone prepare a site-specific Blasting Specification Plan for any location where blasting is required. In addition, **the following measure is recommended:**

- **Keystone should include measures in each site-specific Blasting Specification Plan (c.f. Section 3.1.1.2) to avoid impacts on groundwater and incorporate post-blasting test procedures to ensure that groundwater resources are not negatively affected due to necessary blasting activities.**

Operations Impacts

During the life of the Keystone Project, potential minor short- to long-term groundwater quality degradation is possible from equipment and vehicle spills or leaks.

Routine operation and maintenance is not expected to affect groundwater resources; however, if a crude oil release occurred, crude oil could migrate into subsurface aquifers and into areas where these aquifers are used for water supplies.

Keystone's ERP describes actions to be taken in the event of a crude oil release or other accident (Appendix C). As noted earlier, the ERP would be finalized prior to initiation of construction. Keystone also has submitted a risk assessment that assesses the likelihood of crude oil releases from the proposed pipeline and the potential for environmental impacts (See Section 3.13 and Appendix L).

3.3.2.2 Surface Water

Construction Impacts

Potential impacts on surface water resources during construction activities include:

- Temporary to long-term surface water quality degradation during or after construction from disposal of materials and equipment or vehicle spills and leaks,
- Temporary increases in TSS concentrations and increased sedimentation during stream crossings,
- Temporary to short-term degradation of aquatic habitat from in-stream construction activities,
- Changes in channel morphology and stability caused by channel and bank modifications,
- Temporary reduced flow in streams and potential other adverse effects during hydrostatic testing activities, and
- Temporary degradation of surface water quality and alteration of aquatic habitat from blasting activities within or adjacent to stream channels.

Spills and Leaks

Implementation of the procedures in Section 3 in Keystone's Mitigation Plan (Appendix B) would minimize the potential for spills and leaks to affect surface water resources. During all construction activities, all refueling would be conducted at least 100 feet away from all surface water bodies.

Stream Crossings and In-Stream Construction Activities

Depending on the type of stream crossing, one of four construction methods would be used: the open-cut wet method, the flume method, the dam-and-pump method, or the HDD method. Open-cut wet crossings are planned for most water bodies along the proposed pipeline route, except for locations where dam-and-pump or flume methods are technically feasible and warranted by resource-specific sensitivities, and for the following nine river crossings and one levee, where HDD would be used:

- Missouri River, South Dakota/Nebraska (MP 436);
- Platte River, Nebraska (MP 542);
- Missouri River, Kansas/Missouri (MP 748);
- Chariton River, Missouri (MP 862);
- Cuivre River, Missouri (MP 971);
- Cuivre River, Missouri (MP 982);
- Mississippi River, Missouri/Illinois (MP 1021);
- Hurricane Creek, Illinois (MP 1070); and
- Kaskaskia River, Illinois (MP 1072).

As an example of guidelines that could be followed, FERC requires site-specific construction mitigation and restoration plans for each proposed crossing of a water body greater than 100 feet wide. For water body crossings greater than 100 feet in width where HDD would be used, no mitigation would be necessary because HDD does not involve direct contact with the surface water body, stream channel bed, or stream channel banks. HDD is not proposed to cross the following streams with widths greater than 100 feet along the Keystone Mainline Project route:

- Pembina River, North Dakota (MP 7);
- Tongue River, North Dakota (MP 18);
- Sheyenne River, North Dakota (MP 169);
- James River, South Dakota (MP 422);
- Elkhorn River, Nebraska (MP 503);
- Shell Creek, Nebraska (MP 533);
- Big Blue River, Kansas (MP 659);
- Grand River, Missouri (MP 841); and
- East Fork Silver Creek/Silver Lake, Illinois (MP 1046).

The following water bodies (greater than 100 feet in width) along the Cushing Extension route would be crossed using HDD:

- Republican River, Kansas (MP 51);
- Arkansas River, Kansas (MP 206);
- Salt Fork Arkansas River, Oklahoma (MP 239); and
- Cimarron River, Oklahoma (MP 285).

The Smoky Hill River in Kansas (MP 76) is greater than 100 feet wide but would be crossed by open-cut methods.

To minimize impacts at crossings of larger water bodies where the HDD method is not proposed, **the following measure is recommended:**

- **Prior to construction, Keystone should submit a site-specific Construction Mitigation and Restoration Plan for the following water body crossings: Pembina River-North Dakota (MP 7), Tongue River-North Dakota (MP 18), Sheyenne River-North Dakota (MP 167), James River-South Dakota (MP 418), Elkhorn River-Nebraska (MP 498), Shell Creek-Nebraska (MP 527), Big Blue River-Kansas (MP 653), Grand River-Missouri (MP 853), East Fork Silver Creek-Illinois (MP 1041), Smoky Hill River-Kansas (MP 76), Arkansas River-Kansas (MP 206), Salt Fork Arkansas River-Oklahoma (MP 239), and Cimarron River-Oklahoma (MP 285).**

Additionally, prior to commencement of stream-crossing construction activities, Keystone will be required to obtain a permit under Section 404 of the Clean Water Act through the Corps (State of Missouri). Keystone also will be required to obtain a Section 401 water quality certification as per state regulations.

Construction activities for open-cut wet crossings involve excavation of the channel and banks. Construction equipment and soils excavated thus would be in direct contact with surface water flow. The degree of impact from construction activities depends on flow conditions, stream channel conditions, and sediment characteristics. Because the open-cut wet crossing method necessarily involves substantial disturbance and transport of sediments, **the following measures are recommended:**

- **Keystone should in no case use the open-cut wet crossing method to cross impaired or contaminated water bodies, water bodies upstream of HCAs, or sensitive or protected water bodies; and**
- **For these water body types, Keystone should implement either the dry flume or dry dam-and-pump crossing methods described in Keystone's Mitigation Plan (Appendix B), or other method as approved by the pertinent regulatory authorities.**

Implementation of measures in Section 7.4 of Keystone's Mitigation Plan (Appendix B) would reduce adverse impacts resulting from open-cut wet crossings. All contractors would be required to follow the identified procedures to limit erosion and other land disturbances. Keystone's Mitigation Plan describes the use of buffer strips, drainage diversion structures, sediment barrier installations, and clearing limits—as well as procedures for water body restoration at crossings. See Section 2.2.3 for a discussion of Keystone's proposed water body crossing methods.

Following completion of water body crossings, water body banks would be restored to preconstruction contours, or at least to a stable slope. Banks would be seeded with native vegetation, mulch, or erosion control fabric, where possible. Additional erosion control measures would be installed, if necessary, in accordance with permit requirements. Erosion control measures can themselves cause adverse environmental impacts, however. Geomorphic assessment of water body crossings could provide significant cost savings and environmental benefits. The implementation of appropriate measures to protect pipeline crossings from channel incision and channel migration can reduce the likelihood of washout-related emergencies, reduce maintenance frequency, limit adverse environmental impacts, and—in some cases—improve stream conditions. Therefore, **the following measure is recommended:**

- **Stream and river crossings should be evaluated by a qualified fluvial geomorphologist, who will:**
  - **Determine the minimum depth of cover for the channel crossing and channel migration zone;**
  - **Determine the width of the channel migration zone;**
  - **Where necessary, prescribe grade-control structures that maximize benefits and/or minimize adverse impacts to the stream; and**
  - **Where necessary, prescribe bank-protection measures that maximize benefits and/or minimize adverse impacts to the stream.**

In accordance with the CWA, all construction activities would comply with the NPDES permit and other applicable permitting; this includes following procedures in Keystone's Storm Water Pollution Prevention Plan, which would be required at the permitting stage.

Hydrostatic Testing

Water used for hydrostatic testing would be obtained from nearby surface water resources. These sources include streams, rivers, and privately owned reservoirs. Keystone has identified 29 surface water sources that could supply water for hydrostatic testing, depending on the flows at the time of testing and the sensitivity of the individual water bodies for other uses (ENSR 2006a) These potential sources are listed in Section 8.2 of Keystone's Mitigation Plan (see Appendix B). Whenever possible, hydrostatic test manifolds would be located more than 100 feet away from wetlands and riparian areas.

All surface water resources utilized for hydrostatic testing would be approved by state or federal agencies prior to initiation of any testing activities. Planned withdrawal rates for each water resource would be evaluated and approved by these agencies prior to testing. No resource would be utilized for hydrostatic testing without receipt of applicable permits. As stated in Keystone's Mitigation Plan, Keystone will be responsible for obtaining required water analyses prior to any filling and discharging operations associated with hydrostatic testing.

Water withdrawal methods described in Section 8.0 of Keystone's Mitigation Plan (Appendix B) should be implemented and followed. These procedures include screening of intake hoses to prevent the entrainment of fish or debris, keeping the hose at least 1 foot off the bottom of the water resource, prohibiting the addition of chemicals into the test water, and avoiding discharging any water that contains visible oil or sheen following testing activities.

Hydrostatic test water would be discharged such that applicable federal, state, and local environmental standards are met. Discharged water would meet the water quality standards imposed by the discharge permits for the permitted discharge locations. Keystone's Mitigation Plan incorporates additional measures designed to minimize the impact of hydrostatic test water discharge, including regulation of discharge rate, the use of energy dissipation devices, channel lining, and installation of sediment barriers as necessary (see Appendix B, Section 8.4). Section 3.7 discusses additional mitigation measures necessary to protect fisheries.

Blasting

Where required for pipeline construction, blasting has the potential to affect surface water resources. In Section 3.1.1.2, it was recommended that Keystone prepare a site-specific Blasting Specification Plan for any location where blasting is required. In addition, **the following measure is recommended:**

- **Keystone should include measures to avoid impacts on surface water and incorporate post-blasting testing procedures in each site-specific Blasting Specification Plan (c.f. Section 3.1.1.2), to ensure that surface water resources are not negatively affected by blasting activities.**

Connected Action

In modifying or constructing transmission line substations to support the Keystone Project, Western would implement the following mitigation measures for Water Resources:

- Construction activities would be performed by methods that prevent entrance, or accidental spillage, of solid matter contaminants, debris, any other objectionable pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and waste include, but are not restricted to refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailing, mineral salts, and thermal pollution.
- Excavated material or other construction materials would not be stockpiled or deposited near or on stream banks, lake shorelines, or other watercourse perimeters where they can be wasted away by high water or storm runoff or can in any way encroach upon the actual watercourse itself. Best Management Practices would be utilized to ensure sediments and other pollutants do not enter any water body

Operations Impacts

Minor temporary to short-term surface water quality degradation is possible from maintenance equipment and vehicle spills or leaks. Although washout-related spills are not considered a part of routine operations, in the event that channel migration or streambed degradation threatens to expose the pipeline, protective activities such as reburial or bank armoring are likely be implemented. These activities could result in temporary, short-term, or long-term adverse impacts to water resources. In its Mitigation Plan (Appendix B), Keystone has committed to a minimum depth of cover of 5 feet below the bottom of all water bodies, maintained for a distance of at least 15 feet to either side of the edge of the water body. However, in Keystone's Frequency and Volume Analysis Report (DNV 2007) the likelihood of washout-related spills for cover depths less than or equal to 10 feet is estimated to be twice that for cover greater than 10 feet. Channel incision of several meters is typical of many Midwestern streams and rivers; such incision would expose and threaten pipelines buried 5 feet (1.5 meters) below the channel bed. Furthermore, channel incision can sufficiently increase bank heights to destabilize the slope, ultimately widening the stream. Sedimentation within a channel also can trigger lateral bank erosion, such as the expansion of a channel meander opposite a point bar. Bank erosion rates can exceed several meters per year. Maintaining an adequate burial depth for pipelines only 15 feet (5 meters) beyond either side of the active stream channel may necessitate bank protection measures that would increase both maintenance costs and environmental impacts. Therefore, **the following measure is recommended:**

- **Crossing-related cover depths should be maintained for at least 15 feet beyond the channel migration zone, as determined by a qualified fluvial geomorphologist.**

Although spills are not considered a part of routine operations, there is the possibility of a crude oil release occurring with the potential to affect surface water bodies. Keystone has submitted a draft ERP (Appendix C) that describes actions to reduce the potential for crude oil releases to affect surface water and groundwater resources. Potential impacts on water resources from accidental crude oil spills are described in Section 3.13.

As described in Section 3.13, control valves would be installed on both sides of larger perennial streams for the Mainline Project and the Cushing Extension pipelines. In the event of a crude oil release, the presence of valves and enactment of Keystone's ERP and spill containment measures would minimize the potential for any crude oil releases to affect surface water resources.

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3.4 WETLANDS

3.4.1 Environmental Setting

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of wetland vegetation typically adapted for life in saturated soil conditions (Cowardin et al. 1979). Many wetlands in eastern North Dakota and South Dakota are isolated depressional wetlands of the Prairie Potholes region. This formerly glaciated landscape is pockmarked with an immense number of potholes that fill with melted snow and rain in spring. The hydrology of prairie pothole marshes varies from temporary to permanent; concentric circle patterns of submerged and floating aquatic plants generally form in the middle of the pothole, with bulrushes and cattails growing closer to shore, and wet sedge marshes next to the upland areas.

Wetlands throughout Nebraska, Kansas, Oklahoma, Missouri, and Illinois include isolated depressional wetlands associated with the Rainwater Basin wetlands, glaciated kettle-hole wetlands, and sinkhole wetlands, as well as isolated floodplain wetlands such as oxbows (naturally caused by changes in river channel configuration or artificially caused by levee construction or other diversions). States also contain wetlands with direct connections to minor and major drainages of the Red River basin in North Dakota and the Mississippi River basin in all seven states.

Wetland functions provided by both isolated and connected wetlands include surface water storage (flood control), shoreline stabilization (wave damage protection/shoreline erosion control), stream flow maintenance (maintaining aquatic habitat and aesthetic appreciation opportunities), groundwater recharge (some types replenish water supplies), sediment removal and nutrient cycling (water quality protection), supporting aquatic productivity (fishing, shell fishing, and waterfowl hunting), production of trees (timber harvest), production of herbaceous growth (livestock grazing and haying), production of peaty soils (peat harvest), and provision of plant and wildlife habitat (hunting, trapping, plant/wildlife/nature photography, nature observation, and aesthetics) (USFWS 2007).

Wetland types in the Keystone Project area (Table 3.4.1-1) were identified based on photo interpretation of 1:6,000-scale aerial photography dated 2006. Some wetlands have been verified by ground surveys, in accordance with direction provided by COE staff in the Omaha, Kansas City, St. Louis, and Tulsa districts, during 2005 to 2007 for the Keystone Mainline Project and Cushing Extension routes and for contractor yards, pipe storage yards, and access roads. Small linear features such as windbreaks were included with the surrounding land use when less than 50 feet wide; and perennial, intermittent, and ephemeral streams were identified at a resolution of about 10 feet wide. Descriptions of plant communities typical of emergent, forested, and scrub-shrub wetland types within the pipeline ROW are presented in Section 3.5 (Table 3.5.1-1).

As part of federal regulatory requirements under the CWA, inventories of wetlands and other waters of the United States involving field surveys are required to evaluate the potential for adverse effects to waters of the United States along the proposed pipeline ROW and other associated areas of disturbance related to Project construction. Information gathered during the inventories will be used to complete notification and permitting requirements under Section 410 and 404 of the CWA, as managed by COE and applicable state agencies.

TABLE 3.4.1-1 Description of Wetlands Communities in the Keystone Project Area		
Wetland Type	**National Wetland Inventory Code**	**Description**
Palustrine emergent wetland	PEM	Emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes are included except subtidal and irregularly exposed. In areas with relatively stable climatic conditions, emergent wetlands maintain the same appearance year after year. In other areas, such as the prairies of the central United States, violent climatic fluctuations cause them to revert to an open water phase in some years. Emergent wetlands are known by many names, including marsh, meadow, fen, prairie pothole, and slough. (See Table 3.5.1-1 for habitat types within this group for the Keystone Project area.)
Palustrine forested wetland	PFO	Forested wetlands are characterized by woody vegetation that is 6 meters tall or taller. All water regimes are included except subtidal. Forested wetlands are most common in the eastern United States and in those sections of the West where moisture is relatively abundant, particularly along rivers and in the mountains. Forested wetlands normally possess an overstory of trees, an understory of young trees or shrubs, and a herbaceous layer.
Palustrine scrub-shrub wetland	PSS	Scrub-shrub wetlands include areas dominated by woody vegetation less than 6 meters tall. Vegetation forms found in this wetland include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. All water regimes are included except subtidal. Scrub-shrub wetlands may represent a successional stage leading to a forested wetland or they may be relatively stable communities.
Riverine-perennial water	R2	The lower perennial subsystem includes low-gradient rivers and streams (riverine system) where some water flows throughout the year and water velocity is slow. The upper perennial subsystem includes high-gradient rivers and streams where some water flows throughout the year, water velocity is high, and there is little floodplain development. Perennial streams have flowing water year-round during a typical year, the water table is located above the stream bed for most of the year, groundwater is the primary source of water, and runoff is a supplemental source of water.
Riverine-intermittent water	R4	The intermittent subsystem includes channels where the water flows for only part of the year, when groundwater provides water for stream flow. When water is not flowing, it may remain in isolated pools or surface water may be absent. Runoff is a supplemental source of water.
Open water	OW	Open water habitats are rivers, streams, lakes, and ponds (riverine, lacustrine, and palustrine systems) where, during a year with normal precipitation, standing or flowing water occurs for a sufficient duration to establish an ordinary high-water mark. Aquatic vegetation within the area of standing or flowing water is either non-emergent, sparse, or absent. Vegetated shallows are considered as open waters.

Sources: Cowardin et al. 1979, COE 2002.

The Keystone Project crosses four COE districts:

- Mainline Project: Omaha District (North Dakota, South Dakota, and Nebraska), Kansas City District (Kansas and Missouri), St. Louis District (eastern Missouri and Illinois), and Tulsa District (Oklahoma).
- Cushing Extension: Omaha District (Nebraska), Kansas City District (Kansas), and Tulsa District (Oklahoma).

Each of these districts has slightly different surveying and permitting requirements. Keystone will continue consultations with the COE district offices and state resource agencies to develop the specific wetland and waters of the United States information required for permit applications.

3.4.2 Wetlands of Special Concern or Value

Depressional wetlands of the Prairie Potholes region in North Dakota and South Dakota support large numbers of migrating and nesting waterfowl, as do depressional wetlands associated with the Rainwater Basin in Nebraska (EPA 2007). Karst or sinkhole wetlands and forested floodplains associated with the Missouri, Mississippi, and Arkansas Rivers also are wetland habitats of conservation concern due primarily to their rarity (sinkhole wetland) and previous destruction (floodplain forest) (EPA 2007). No fen wetlands have been identified within the Keystone Project ROW.

The COE Riverlands Management Area at the Mississippi River and Missouri River confluence in St. Charles County, Missouri, contains a 2,500-acre prairie marsh restoration site that has been designated as an Important Bird Area by the Audubon Society. This restoration area is designed as a flow-through wetland, with controlled water levels, and supports an abundant array of waterfowl, shorebirds, and raptors. The COE will require additional specific mitigation and management practices should construction through the Riverlands Management Area be unavoidable. Habitat losses within the COE Riverlands Management Area and the COE Carlyle Lake WMA will require additional compensatory mitigation. The Missouri Confluence State Park also is located within this region where the Missouri River joins the Mississippi River; wetlands restoration projects, including tree plantings to restore floodplain forests, also have been established within this park.

3.4.3 Potential Impacts and Mitigation

Wetland and riverine communities that would be affected by the proposed Keystone Project, including valve, meter, densitometer sites, ancillary facilities, contractor yards, pipe storage yards, and access roads, are summarized in Tables 3.4.3-1, 3.4.3-2, and 3.4.3-3. The delineation of jurisdictional and non-jurisdictional wetlands will occur prior to the issuance of required permits. Wetland impacts that affect non-jurisdictional wetlands under the CWA Section 404 would not require mitigation.

TABLE 3.4.3-1 Wetlands Estimated Impact Summary for the Keystone Mainline Project			
Wetland Classification [a]	Length of Wetlands Crossed (miles)	Wetland Area Affected during Construction (acres) [a]	Wetland Area Affected by Operations (acres) [a]
North Dakota			
Palustrine emergent wetland	16.7	238	53
Palustrine forested wetland	0.4	6	1
Palustrine scrub-shrub wetland	1.0	14	6
Riverine-perennial water	0.1	2	0
Riverine-intermittent water	0.4	6	2
Open water	0.1	1	0
North Dakota subtotal	*18.7*	*267*	*62*
South Dakota			
Palustrine emergent wetland	18.6	262	65
Palustrine forested wetland	0.0	0	0
Palustrine scrub-shrub wetland	0.3	6	1
Riverine-perennial water	0.2	3	0
Riverine-intermittent water	0.4	6	2
Open water	0.1	1	0
South Dakota subtotal	*19.6*	*278*	*68*
Nebraska			
Palustrine emergent wetland	2.0	27	6
Palustrine forested wetland	0.4	11	3
Palustrine scrub-shrub wetland	0.1	1	0
Riverine-perennial water	0.3	4	1
Riverine-intermittent water	0.4	5	1
Open water	0.6	9	2
Nebraska subtotal	*3.8*	*57*	*13*
Kansas			
Palustrine emergent wetland	0.5	7	1
Palustrine forested wetland	0.4	6	1
Palustrine scrub-shrub wetland	0.0	0	0
Riverine-perennial water	0.2	3	0
Riverine-intermittent water	0.6	9	2
Open water	0.5	8	2
Kansas subtotal	*2.2*	*33*	*6*

TABLE 3.4.3-1 (Continued)			
Wetland Classification [a]	Length of Wetlands Crossed (miles)	Wetland Area Affected during Construction (acres) [a]	Wetland Area Affected by Operations (acres) [a]
Missouri			
Palustrine emergent wetland	1.9	28	6
Palustrine forested wetland	3.3	47	10
Palustrine scrub-shrub wetland	0.3	4	1
Riverine-perennial water	1.7	26	6
Riverine-intermittent water	1.8	27	6
Open water	0.6	9	2
Missouri subtotal	*9.6*	*141*	*31*
Illinois			
Palustrine emergent wetland	0.9	12	3
Palustrine forested wetland	0.8	11	2
Palustrine scrub-shrub wetland	0.6	8	2
Riverine-perennial water	0.5	6	2
Riverine-intermittent water	0.1	2	0
Open water	0.5	6	1
Illinois subtotal	*3.4*	*45*	*10*
Mainline Project			
Palustrine emergent wetland	40.6	574	134
Palustrine forested wetland	5.3	81	17
Palustrine scrub-shrub wetland	2.3	33	10
Riverine-perennial water	3.0	44	8
Riverine-intermittent water	3.7	55	14
Open water	2.4	34	7
Mainline Project total	**57.3**	**821**	**190**

[a] Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project.

Sources: TransCanada 2007b, c.

TABLE 3.4.3-2 Wetlands Estimated Impact Summary for the Keystone Cushing Extension			
Wetland Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)** [a]	**Wetland Area Affected by Operations (acres)** [a]
Nebraska			
Palustrine emergent wetland	0.0	0	0
Palustrine forested wetland	0.0	0	0
Palustrine scrub-shrub wetland	0.0	0	0
Riverine-perennial water	<0.1	<1	0
Riverine-intermittent water	<0.1	0	0
Open water	<0.1	0	0
Nebraska subtotal	*<0.1*	*<1*	*0*
Kansas			
Palustrine emergent wetland	2.6	38	9
Palustrine forested wetland	3.5	52	12
Palustrine scrub-shrub wetland	0.0	0	0
Riverine-perennial water	0.3	4	1
Riverine-intermittent water	0.3	5	1
Open water	<0.1	0	0
Kansas subtotal	*6.7*	*99*	*23*
Oklahoma			
Palustrine emergent wetland	3.6	46	10
Palustrine forested wetland	1.3	17	4
Palustrine scrub-shrub wetland	0.0	0	0
Riverine-perennial water	0.4	5	1
Riverine-intermittent water	0.1	0	0
Open water	<0.1	0	0
Oklahoma subtotal	*5.3*	*68*	*15*
Cushing Extension			
Palustrine emergent wetland	6.2	84	19
Palustrine forested wetland	4.8	67	16
Palustrine scrub-shrub wetland	0.0	0	0
Riverine-perennial water	0.7	10	2
Riverine-intermittent water	0.3	4	1
Open water	0.0	0	0
Cushing Extension total	**12.0**	**165**	**38**

[a] Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project.

Sources: TransCanada 2007b, c.

TABLE 3.4.3-3 Wetlands Estimated Impact Summary for the Keystone Project			
Wetland Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)** [a]	**Wetland Area Affected by Operations (acres)** [a]
Mainline Project			
Palustrine emergent wetland	40.6	574	134
Palustrine forested wetland	5.3	81	17
Palustrine scrub-shrub wetland	2.3	33	10
Riverine-perennial water	3.0	44	8
Riverine-intermittent water	3.7	55	14
Open water	2.4	34	7
Mainline Project subtotal	*57.3*	*821*	*190*
Cushing Extension			
Palustrine emergent wetland	6.2	84	19
Palustrine forested wetland	4.8	67	16
Palustrine scrub-shrub wetland	0.0	0	0
Riverine-perennial water	0.7	10	2
Riverine-intermittent water	0.3	4	1
Open water	<0.1	0	0
Cushing Extension subtotal	*12.0*	*165*	*38*
Keystone Project			
Palustrine emergent wetland	46.8	658	153
Palustrine forested wetland	10.1	148	33
Palustrine scrub-shrub wetland	2.3	33	10
Riverine-perennial water	3.7	54	10
Riverine-intermittent water	4.0	59	15
Open water	2.4	34	7
Keystone Project total	**69.3**	**986**	**228**

[a] Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project.

Sources: TransCanada 2007b, c.

Emergent wetlands are the most common type of wetland community that would be crossed by the pipeline routes, followed by forested wetlands, intermittent and perennial streams, open water, and scrub-shrub wetlands (Table 3.4.3-3). Most (76 percent, 500 of 658 acres) of the emergent wetland habitats are located in the Prairie Pothole region of North Dakota and South Dakota. Most of the forested wetlands (71 percent, 105 of 148 acres) are riparian woodlands of the Missouri and Arkansas drainages in Chariton, St. Charles, and Lincoln counties in Missouri; and Clay, Dickinson, and Butler counties in Kansas. Other wetland communities that would be disturbed by the Keystone Project include perennial riverine wetlands (54 acres), intermittent riverine wetlands (59 acres), and scrub-shrub wetlands (33 acres).

TABLE 3.4.3-4
Wetlands of Special Interest or Conservation Concern for the Keystone Project

Mileposts	Miles Crossed	Name	Ownership	Wetland Types	Wetlands Crossed
MAINLINE PROJECT					
North Dakota					
6.9–7.7	0.8	Tetrault Woods State Forest	North Dakota Forest Service	PFO	0.14
25.0–28.5	3.5	Forest	State Forest Service	PEM	0.73
76.0–77.0	1.0	U.S. Fish and Wildlife Service (USFWS) Wetland Easement	Private	PEM	0.75
77.0–84.3	4.6	Conservation reserve	Privately owned North Dakota Game and Fish easement	PEM	1.65
79.1–79.6	0.5	USFWS wetland easement	Private	PEM	0.53
80.1–82.3	2.2	USFWS wetland easement	Private	PEM	0.65
85.8–86.5	0.7	USFWS wetland easement	Private	None	
87.0–88.1	1.1	USFWS wetland easement	Private	None	
89.6–89.9	0.3	USFWS wetland easement	Private	None	
91.7–92.7	1.0	USFWS wetland easement	Private	PEM	0.30
97.7–98.3	0.6	USFWS wetland easement	Private	PEM	0.05
100.9–101.2	0.3	USFWS wetland easement	Private	None	
109.6–110.1	0.5	USFWS wetland easement	Private	None	
110.1–111.1	1.0	Conservation reserve	Privately owned North Dakota Game and Fish easement	PEM	0.50
110.6–111.1	0.5	USFWS wetland easement	Private	PEM	0.05
117.3–117.7	0.4	USFWS wetland easement	Private	None	
118.9–119.2	0.3	USFWS wetland easement	Private	None	
121.8–122.3	0.5	USFWS wetland easement	Private	PEM	0.02
127.6–127.9	0.3	USFWS wetland easement	Private	None	
128.3–128.6	0.3	USFWS wetland easement	Private	None	
137.3–138.2	0.9	USFWS wetland easement	Private	PEM	0.03
138.9–140.0	1.1	USFWS wetland easement	Private	PEM	0.10
169.3–170.3	1.0	USFWS wetland easement	Private	None	
170.5–170.8	0.3	USFWS wetland easement	Private	None	
172.5–173.0	0.5	USFWS wetland easement	Private	PEM	0.01

TABLE 3.4.3-4 (Continued)					
Mileposts	Miles Crossed	Name	Ownership	Wetland Types	Wetlands Crossed
MAINLINE PROJECT(CONTINUED)					
North Dakota (Continued)					
174.0–174.5	0.5	USFWS wetland easement	Private	None	
175.5–176.0	0.5	USFWS wetland easement	Private	PEM	0.05
176.5–177.0	0.5	USFWS wetland easement	Private	None	
177.6–179.1	1.5	USFWS wetland easement	Private	PEM	0.06
180.6–183.2	2.5	USFWS wetland easement	Private	None	
183.2–183.4	0.3	USFWS Conservation or Federal Highway Administration (FHWA) Easement	Private	None	
186.7–187.2	0.5	USFWS wetland easement	Private	None	
187.7–189.2	1.5	USFWS wetland easement	Private	PEM	0.47
198.8–199.1	0.3	USFWS wetland easement	Private	PEM	0.18
214.9–216.9	2.0	USFWS wetland easement	Private	PEM	0.30
South Dakota					
216.9–218.8	1.9	USFWS wetland easement	Private	PEM	0.20
219.3–219.8	0.5	USFWS grassland easement	Private	PEM	0.03
222.3–222.8	0.5	USFWS grassland easement	Private	PEM	0.37
228.4–228.9	0.5	Game production area	South Dakota Game, Fish and Parks Department	PEM	0.50
261.3–261.6	0.3	USFWS wetland easement	Private	PEM	0.02
310.5–311.0	0.5	USFWS conservation or FHWA easement	Private	None	
316.4–316.9	0.5	USFWS wetland easement	Private	None	
318.8–319.3	0.5	USFWS wetland easement	Private	None	
321.9–322.4	0.5	USFWS wetland easement	Private	None	
324.4–324.6	0.2	USFWS wetland easement	Private	None	
325.5–326.5	1.0	USFWS wetland easement	Private	PEM	0.17
329.2–329.6	0.4	USFWS wetland easement	Private	PEM	0.01
332.2–332.7	0.5	USFWS wetland easement	Private	None	
333.7–334.7	1.0	USFWS wetland easement	Private	PEM	0.41
334.9–335.2	0.3	USFWS wetland easement	Private	PEM	0.04

TABLE 3.4.3-4
(Continued)

Mileposts	Miles Crossed	Name	Ownership	Wetland Types	Wetlands Crossed
MAINLINE PROJECT (CONTINUED)					
South Dakota (Continued)					
338.9–340.0	1.1	USFWS wetland easement	Private	PEM	0.04
349.2–349.8	0.6	USFWS wetland easement	Private	None	
355.5–356.0	0.5	USFWS wetland easement	Private	PEM	0.28
360.5–361.7	1.2	USFWS wetland easement	Private	PEM	0.24
363.4–364.7	1.3	USFWS wetland easement	Private	PEM	0.07
Missouri					
748.5–748.6	0.1	Pigeon Hill Conservation Area	Missouri Department of Conservation	PFO	0.07
748.35–752.8	4.5	Western Missouri River Alluvial Plain Conservation Opportunity Area (COA)	Private and Missouri Conservation Department	PFO	0.01
823–823.8	0.8	Shoal Creek Prairie	Private	PEM	0.01
838.8–841.6	2.8	Lower Grand River Lowland Plains/Missouri-Grand River Lowland Plains COA	Private	PEM	0.01
838.8–841.6		COA	Private	PSS	
871.4–872.2	0.8	Lower Chariton Woodland/Forest Hills COA	Private	PEM	0.05
970.5–972.8	2.3	Cuivre River Woodland/Forest Hills COA	Private	PFO	0.39
984.9–1019.9	35.0	St. Charles County Prairie/Woodland Low Hills, St Charles/ Lincoln Alluvial Plain, Mairas Temp Clair Alluvial Plain, Alluvial Plain, St Louis West Allan County Prairie/Savannah Dissected Karst Plain COA	Private	PEM	0.52
984.9–1019.9		COA	Private	PFO	1.24
984.9–1019.9		COA	Private	PSS	0.26
1015–1017.8	1.1	Riverlands Environmental Demonstration Area	U.S. Army Corps of Engineers	PEM	0.05
1019.9–1021.1	1.2	Edward "Ted" & Pat Jones-Confluence Point State Park	Missouri Department of Natural Resources	PEM	0.15

TABLE 3.4.3-4
(Continued)

Mileposts	Miles Crossed	Name	Ownership	Wetland Types	Wetlands Crossed
MAINLINE PROJECT (CONTINUED)					
Illinois					
1069.6–1072.7	3.1	Carlyle Lake	COE	PEM	0.61
1069.6–1072.7		Carlyle Lake	COE	PFO	0.86
1069.6–1072.7		Carlyle Lake	COE	PSS	0.78
CUSHING EXTENSION					
Kansas					
4.1		Little Blue River		None	
12.1–13.5		Mill Creek		PFO	0.05
50.0–54.3	3.4	Milford Wildlife Area (Republican River)	COE	PEM	0.05
50.0–54.3		Milford Wildlife Area	COE	PFO	0.89
68.8		Chapman Creek		PFO	0.05
76.2		Oxbow		PFO	0.17
76.6		Smokey Hill River		PFO	0.04
87.1		Carry Creek		PFO	0.01
92.1		West Br. Lyon		PFO	0.02
117.1		Cottonwood River		PFO	0.02
128.2		Doyle Creek		None	
158.3		Whitewater River		PFO	0.02
206.4		Arkansas River		None	
Keystone Project total	**102.1**				**15.23**

Notes:

PEM = Palustrine emergent wetland.
PFO = Palustrine forested wetland.
PSS = Palustrine scrub-shrub wetland.

Sources: ENSR 2006a, TransCanada 2007b.

Table 3.4.3-4 summarizes wetlands that would be crossed by the Mainline Project and Cushing Extension that are considered important for conservation—as indicated by inclusion within state forestlands, state park lands, conservation areas and reserves, wetland easements, and wildlife areas. A total of 102.1 miles of conservations lands with 14.8 miles of wetlands would be crossed by the pipelines. Of these conservation wetlands, 10.2 miles are emergent wetlands (representing 21 percent of all emergent wetlands affected by the Keystone Project), 3.6 miles are forested wetlands (representing 34 percent of all forested wetlands affected by the Keystone Project), and 1.0 miles are scrub-shrub wetlands (representing 35 percent of all scrub-shrub wetlands affected by the Keystone Project).

Construction of the pipeline primarily would affect wetlands and their functions during and immediately following construction activities, but permanent changes also are possible. Wetlands function as natural sponges that trap and slowly release surface water, rain, snow melt, groundwater, and flood waters. Trees, root mats, and other wetland vegetation slow flood waters and distribute them over the floodplain. Wetlands at the margins of lakes, rivers, and streams protect shorelines and stream banks against erosion. Wetland plants hold the soil in place with their roots, absorb the energy of waves, and break up the flow of stream or river currents. This combined water storage and braking can lower flood heights and reduce erosion. The water-holding capacity of wetlands reduces flooding and prevents water logging of crops. Preserving and restoring wetlands, together with other water retention, can help or supplant flood control otherwise provided by expensive dredge operations and levees (EPA 1995 cited in USFWS 2007).

Potential construction- and operations-related effects include:

- Modification in wetland productivity due to modification of surface and subsurface flow patterns;
- Temporary and permanent modification of wetland vegetation community composition and structure from clearing and operational maintenance (clearing temporarily affects the wetland's capacity to buffer flood flows and/or control erosion);
- Loss of wetlands due to backfilling or draining;
- Wetland soil disturbance (mixing of topsoil with subsoil with altered biological activities and chemical conditions that could affect reestablishment and natural recruitment of native wetland vegetation after restoration);
- Compaction and rutting of soils from movement of heavy machinery and transport of pipe sections, altering natural hydrologic patterns, inhibiting seed germination, or increasing siltation;
- Temporary increase in turbidity and changes in wetland hydrology and water quality;
- Permanent alteration in water-holding capacity due to alteration or breaching of water-retaining substrates in the Prairie Pothole region; and
- Alteration in vegetation productivity and phenology due to increased soil temperatures associated with heat loss from the pipeline.

Generally, the wetland vegetation community eventually would transition back into a community functionally similar to that of the wetland prior to construction, if pre-construction conditions such as elevation, grade, and soil structure are successfully restored. In emergent wetlands, the herbaceous vegetation would regenerate quickly (typically within 3 to 5 years). In forested and scrub-shrub wetlands, the effects of construction would be extended due to the longer period needed to regenerate a mature forest or shrub community. Following revegetation, there would be little permanent effects on emergent wetland vegetation because these areas naturally consist of, and would remain as, an herbaceous community. Herbaceous wetland vegetation in the pipeline ROW generally would not be mowed or otherwise maintained, although Keystone's Mitigation Plan (Appendix B) allows for annual maintenance of a 20- to 30-foot-wide strip centered over the pipeline. Tree species that typically dominate forested wetlands in the Keystone Project area (maple, hickory, and oak) have regeneration periods of up to 50 years. Trees and shrubs would not be allowed to regenerate within the maintained ROW; therefore, removal of forested and scrub-shrub wetland habitats due to pipeline construction would be long term, and the maintained ROW would represent a permanent conversion of forested and scrub-shrub wetlands to herbaceous wetlands. The total acreage of affected forested wetland during construction is small (148 acres), as is the total acreage of scrub-shrub wetland affected during construction (33 acres). Restoration of some of these forested and scrub-shrub wetlands may be possible; however, long-term effects would remain.

Operation of the Keystone Project would cause slight increases in soil temperatures at the soil surface (1 to 2 °F) primarily during winter months; and at depths of 6 inches (1 to 5 °F) ,with most notable increases during spring (March). While many species would not produce root systems that would penetrate much below 6 inches, some species, notably native prairie grasses, trees, and shrubs, have root systems penetrating well below 6 inches. Soil temperatures closer to the pipeline burial depth of 6 feet may be as much as 30 °F warmer than the ambient surrounding soil temperatures. In general, increased soil temperatures during early spring would cause early germination and emergence and increased productivity in wetland plant species (TransCanada 2007c). Increased soil temperatures also may stimulate root development (TransCanada 2007c).

To minimize potential construction- and operations-related effects, Keystone would implement procedures outlined in the Mitigation Plan for wetland crossings. Keystone would minimize impacts and restore wetlands affected by construction activities, to the extent practicable. Pipeline construction through wetlands must comply with COE Section 404 permit conditions and NRCS Standards and Practices for Construction in Wetlands (NRCS 2007). Additional specific mitigation measures would be required for crossings in the COE Riverlands Management Area (Patsy Crooke, St. Louis COE, May 1, 2007).

Keystone has committed to the following measures in its Mitigation Plan:

- Avoid placement of aboveground facilities in a wetland, except where the location of such facilities outside of wetlands would preclude compliance with DOT pipeline safety regulations;
- Directionally drill large river crossings to minimize effects on streamside wetlands or floodplain forests;
- Use open-cut crossing methods for smaller streams and ephemeral or intermittent drainages; trench wetlands;
- Limit the width of the construction zone to 85 feet through non-cultivated wetlands, unless a wider zone is requested on a site-specific basis;
- Limit the operation of construction equipment within wetlands to that equipment essential for clearing, excavation, pipe installation, backfilling, and restoration;
- Limit grading in wetlands to directly over the trenchline, except where necessary to ensure safety;
- Segregate and replace wetland soils (except in areas of standing water, saturated wetlands, or where no topsoil is evident) to aid in restoration;
- Minimize the length of time that topsoil is segregated and the trench is open;
- Install trench breakers at the boundaries of wetlands as needed to prevent draining of a wetland and to maintain original wetland hydrology;

- Prohibit storage of hazardous materials, chemicals, fuels, and lubricating oils within a wetland or within 100 feet of a wetland boundary;
- Limit post-construction maintenance of vegetation within herbaceous wetlands to a 10-foot wide strip of vegetation centered over the pipeline; and
- Limit post-construction maintenance within forested areas to removal of trees greater than 15 feet in height and within 15 feet of the pipeline centerline.

Additional procedures for dry wetlands (those with groundwater levels below the surface and with stable trench excavations and normal trench widths), standard wetlands (those with saturated and non-cohesive soils, and difficult trenching conditions), and flooded wetlands (those with standing water over much of the wetland area) are discussed below.

The following additional measures for dry wetlands are specified in Keystone's Mitigation Plan:

- A standard construction ROW width would be used,
- Extra work areas may be placed no closer than 10 feet from the wetland edge,
- Sediment barriers would not be required across or along the edges of the construction ROW,
- If cultivated, topsoil would be stripped using trench and spoil side method at the same depth as adjacent upland areas, and
- Seeding requirements for agricultural lands would be applied to farmed wetlands.

The following additional measures for standard wetlands are specified in Keystone's Mitigation Plan:

- The width of the construction zone would be limited to 85 feet, unless a wider zone is requested on a site-specific basis;
- Low-ground-pressure construction equipment or support equipment on timber rip-rap or timber mats would be used; and
- Sediment barriers would be installed across the entire ROW where it enters and exits the wetland.

The following additional measures for flooded wetlands are specified in Keystone's Mitigation Plan:

- Topsoil stripping would not be possible (the trench would be up to 35 feet wide),
- Pipe stringing and fabrication would be conducted in a designated extra workspace adjacent to the wetland,
- Pipe would be pushed or pulled across the wetland, and
- Pipe flotation using metal barrels (or styrofoam floats) may be used.

Restoration and reclamation procedures for wetland crossings that are outlined in Keystone's Mitigation Plan include:

- Replace topsoil, spread to its original contours with no crown over the trench;
- Remove any excess spoil, stabilize wetland edges and adjacent upland areas using permanent erosion control measures and revegetation;
- For standard wetlands, install a permanent slope breaker and trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas;

- Apply temporary cover crop at a rate adequate for germination and ground cover using annual ryegrass or oats unless standing water is present (in the absence of detailed revegetation plans or until appropriate seeding season);
- Apply seeding requirements for agricultural lands or as required by the landowner for farmed wetlands;
- No application of fertilizer, lime, or mulch unless required by the appropriate land management or state agency;
- No herbicides or pesticides may be used within 100 feet of a wetland (unless allowed by the appropriate land management or state agency);
- Monitor the success of wetland revegetation after construction until revegetation is successful (success is defined as less than 80 percent cover by herbaceous or woody vegetation of the type, density, and distribution in undisturbed adjacent wetland areas within 3 years); and
- If revegetation is not successful within 3 years, develop a remedial revegetation plan and continue efforts until successful.

In addition to the mitigation measures committed to by Keystone in the Mitigation Plan, wetland areas within conservation lands or easements should be restored to a level consistent with any additional criteria established by the relevant managing agency.

Implementation of the measures identified in Keystone's Mitigation Plan would reduce impacts on wetlands. **In addition, the following measures are recommended:**

- **Keystone should replace topsoil, spread to its original contours with no crown over the trench (John Cochnar, USFWS May 27, 2007).**
- **Keystone should remove any excess spoil and stabilize wetland edges and adjacent upland areas, using permanent erosion control measures and revegetation (John Cochnar, USFWS May 27, 2007).**
- **Keystone should restore wetland areas within conservation lands or easements to the criteria established by the managing agency (John Cochnar, USFWS May 27, 2007; Matthew Judy, NRCS, April 30, 2007).**
  - **In shallow farmed easement wetlands, USFWS recommends that a gap be left in the spoil so that no fill material is left in the wetlands.**
  - **USFWS requests that Keystone restore all easement wetland contours where spoil must be piled, including dry and or formed wetlands, to plus or minus 1 inch to reduce the possibility of filling shallow wetlands.**
- **Keystone should establish buffer zones of a minimum width of 100 feet around wetland mitigation areas (John Cochnar, USFWS April 28, 2006).**
- **Keystone should monitor wetland restoration areas for noxious and invasive species (Larry Svoboda, USEPA, November 30, 2006).**
- **Keystone should develop a plan to compensate for permanent wetland losses to include:**
  - **The type of mitigation to be used: creation of new wetlands, restoration of degraded wetlands, and/or preserving existing wetlands.**

- **Restoration or preservation of existing wetlands should apply a ratio of more than 2:1 (3:1 to 6:1), depending on the vegetation type and if mitigation would occur within the same watershed as the wetland loss.**
- **Timing of compensatory mitigation should be specified, preferably prior to or concurrent with project construction.**
- **Monitoring should be specified that documents mitigation success, noxious and invasive species, and provisions for corrective actions.**

- **Keystone should mitigate permanent wetland impacts, including loss of forested wetlands, at ratios of 6:1 to 2:1 for each affected acre (Larry Svoboda, USEPA May 3, 2007; John Cochnar, USFWS April 28, 2006; Michael G. McKenna, NDGFD May 4, 2006; Doyle Brown, Missouri Department of Conservation [MDC], April 27, 2007).**

Implementation of measures in Keystone's Mitigation Plan and the recommended measures would avoid or mitigate significant impacts on wetlands associated with construction and operation activities, and would ensure that potential effects would be minor and short term. Impacts to forested wetlands in Missouri would not be considered minor, as this community is rapidly disappearing and is considered at risk by MDC, Missouri Department of Natural Resources, and others. Impacts to forested wetlands would be long-term and in Missouri typically would require a 6:1 compensatory mitigation for conversion and temporal loss (Doyle Brown, MDC, April 27, 2007).

In modifying or constructing transmission line substations to support the Keystone Project, Western would implement the following mitigation measures for Wetlands:

- ROW would be located to avoid sensitive vegetation conditions including wetlands where practical, or, if they are linear to cross them at the least sensitive feasible point.

3.4.4 References

COE. See U.S. Army Corps of Engineers.

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NRCS. See Natural Resources Conservation Service.

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USFWS. See U.S. Fish and Wildlife Service.

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3.5 TERRESTRIAL VEGETATION

Ecoregions are described through analysis of patterns and composition of geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. Vegetative cover is an important component in the classification of ecoregions that reflects differences in ecosystem quality and integrity (EPA 2006). The Mainline and Cushing Extension would cross seven Level III Ecoregions of the United States—Lake Agassiz Plain, Northern Glaciated Plains, Western Corn Belt Plains, Central Great Plains, Central Irregular Plains, Interior River Valleys and Hills, and Flint Hills (Figure 3.5-1, Table 3.5-1).

3.5.1 General Vegetation Resources

Vegetation types crossed by the Keystone Project were delineated based on review of aerial photographs, general observations made during reconnaissance, and information collected during wetland delineation and grassland assessment surveys. Plant communities and their occurrence by state within the eight general vegetation types or general land use categories are described in Table 3.5.1-1.

Grassland/rangeland, upland forest, palustrine emergent wetland, palustrine shrub/scrub wetlands, palustrine forested wetland, streams, and open water areas support naturally occurring terrestrial and aquatic vegetation. Residential, commercial, industrial, and special designation areas (e.g., schools, parks, and recreational facilities) primarily include artificially created landscapes with minimal naturally occurring vegetation. Cropland and pivot-irrigated cropland areas primarily include introduced crop species, which provide forage and grain for livestock and human consumption. Right-of-way areas consist of previously disturbed areas associated with pipelines and other utilities that have been restored primarily with native herbaceous species and may include some introduced species.

No vegetation resources have been identified along the Keystone project ROW that are important plant-gathering areas for tribal entities.

TABLE 3.5-1 EPA Level III Ecoregions Crossed by the Keystone Project		
Ecoregion	**Location of Occurrence in Keystone Project Area**	**Description**
Lake Agassiz Plain	North Dakota	Glacial Lake Agassiz was the last in a series of proglacial lakes to fill the Red River Valley in the 3 million years since the beginning of the Pleistocene. Thick beds of lake sediments on top of glacial till create the extremely flat floor of the Lake Agassiz Plain. The historic tall-grass prairie has been replaced by intensive row crop agriculture. The preferred crops in the northern half of the region are potatoes, beans, sugar beets and wheat; soybeans, sugar beets, and corn predominate in the south.
Northern Glaciated Plains	North Dakota and South Dakota	The Northern Glaciated Plains Ecoregion is characterized by a flat to gently rolling landscape composed of glacial till. The sub-humid conditions foster a transitional grassland containing tall-grass and short-grass prairie. High concentrations of temporary and seasonal wetlands create favorable conditions for waterfowl nesting and migration. Although the till soils are very fertile, agricultural success is subject to annual climatic fluctuations.
Western Corn Belt Plains	Nebraska, Kansas, and Missouri	Once covered with tall-grass prairie, over 75 percent of the Western Corn Belt Plains now is used for cropland agriculture, and much of the remainder is in forage for livestock. A combination of nearly -level to gently -rolling glaciated till plains and hilly loess plains; an average annual precipitation of 63 to 89 centimeters that occurs mainly in the growing season, and fertile, warm, moist soils make this one of the most productive areas of corn and soybeans in the world. Major environmental concerns in the region include surface water and groundwater contamination from fertilizer and pesticide applications, as well as impacts from concentrated livestock production.
Central Great Plains	Nebraska and Kansas	The Central Great Plains are slightly lower, receive more precipitation, and are somewhat more irregular than the Western High Plains to the west. Once a grassland, with scattered low trees and shrubs in the south, much of this ecological region is now cropland. The eastern boundary of the region marks the eastern limits of the major winter wheat--growing area of the United States.
Central Irregular Plains	Missouri	The Central Irregular Plains have a mix of land use and are topographically more irregular than the Western Corn Belt Plains to the north, where most of the land is in crops. The region is less irregular and less forest covered than the ecoregions to the south and east. The potential natural vegetation of this ecological region is a grassland/forest mosaic, with wider forested strips along the streams compared to the Northern Glaciated Plains to the north. The mix of land use activities in the Central Irregular Plains also includes mining operations of high-sulfur bituminous coal. The disturbance of these coal strata in southern Iowa and northern Missouri has degraded water quality and affected aquatic biota.

TABLE 3.5-1 (Continued)		
Ecoregion	**Location of Occurrence in Keystone Project Area**	**Description**
Interior River Valleys and Hills	Missouri and Illinois	The Interior River Lowland is made up of many wide, flat-bottomed terraced valleys; forested valley slopes; and dissected glacial till plains. In contrast to the generally rolling to slightly irregular plains in adjacent ecological regions to the north, east, and west—where most of the land is cultivated for corn and soybeans, a little less than one-half of this area is in cropland, about 30 percent is in pasture, and the remainder is in forest. Bottomland deciduous forests and swamp forests were common on wet lowland sites, with mixed oak and oak-hickory forests on uplands. Paleozoic sedimentary rock is typical, and coal mining occurs in several areas.
Flint Hills	Kansas and Oklahoma	The Flint Hills is a region of rolling hills, with relatively narrow steep valleys, and is composed of shale and cherty limestone with rocky soils. In contrast to surrounding ecological regions that are mostly in cropland, most of the Flint Hills region is grazed by beef cattle. The Flint Hills mark the western edge of the tall-grass prairie and contain the largest remaining intact tall-grass prairie in the Great Plains.

Sources: Classification of Level III Ecoregions is based on EPA (2006); descriptions of the regions are based on EPA (2002).

TABLE 3.5.1-1
Vegetation Communities Occurring along the Keystone Project Route

General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State: Mainline Project ND	SD	NE	KS	MO	IL	Cushing Extension NE	KS	OK
Cropland											
Not applicable	Agricultural fields	Wheat, barley, oats, sorghum, corn, beans, and hay	X	X	X	X	X	X			X
	Horticultural cultivated species										
	Planted perennials										
	Hay meadows										
Urban/Built-Up Areas											
Commercial/residential	Suburban residential areas	Ornamental trees and shrubs	X	X	X	X	X	X			X
Urban	Commercial development areas										
Impervious/no vegetation	Paved areas (roadways and parking lots										
Barren/sand/outcrop	Gravel quarries, rock outcrops	None	X	X	X	X	X	X			X
Herbaceous Rangeland											
Tall grass prairie	Grassland community dominated by tall grasses 3 to 6 feet tall	Big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*)	X	X	X	X	X		X	X	X
Mid-grass prairie	Grassland community dominated by grasses approximately 1 to 2 feet tall	Blue grama (*Bouteloua gracilis*), needle and thread (*Hesperostipa comata*), green needlegrass (*Nassella viridula*), western wheatgrass (*Pascopyrum smithii*)	X								
Short grass prairie	Grassland community generally dominated by grasses less than 1 foot tall	Blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*)			X						
Sand prairie	Grassland community on sand or gravel soils, dominated by mid to tall grasses	Sand bluestem (*Andropogon hallii*), blue grama (*Bouteloua gracilis*), prairie sandreed (*Calamovilfa longifolia*), needle and thread (*Hesperostipa comata*)	X	X	X						

TABLE 3.5.1-1
(Continued)

General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State: Mainline Project ND	SD	NE	KS	MO	IL	Cushing Extension NE	KS	OK
Herbaceous Rangeland (continued)											
Non-native grassland	Pasturelands planted with non-native cool-season grasses	Fescue (*Festuca* spp.), smooth brome (*Bromus inermis*), and other seed pasture grasses				X	X				
Deciduous shrubland	Upland or lowland communities dominated by shrubs	Chokecherry (*Prunus virginia*), sandbar willow (*Salix interior*), silver buffaloberry (*Shepherdia argentea*), western snowberry (*Symphoricarpos occidentalis*)	X	X							
Conservation reserve program	Mixed native and non-native grasses and forbs; may include shrubs; land is fallow	A variety of native and introduced grass species	X	X	X	X					
Mixed prairie	Prairie grasses of mixed heights	Grama (*Bouteloua* spp.), little bluestem (*Schizachyrium scoparium*)	X	X	X	X					
Upland Forest											
Deciduous woodland	Woodlands dominated by a wide variety of mixed native and non-native deciduous species	Green ash (*Fraxinus pennsylvanica*), quaking aspen (*Populus tremuloides*), bur oak (*Quercus macrocarpa*), American elm (*Ulmus americana*)	X		X		X				
Maple-basswood forest	Community dominated by sugar maple and basswood; found in valley slopes and bottoms	Sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), american basswood (*Tilia americana*)				X					
Oak-hickory forest	Upland community dominated by multiple oak and hickory species	Bitternut hichory (*Carya cordiformis*), shagbark hickory (*C. ovata*), white oak (*Quercus alba*), black oak (*Q. velutina*)				X	X	X		X	
Green ash woodland	Community dominated by green ash; occurs in floodplains and mesic slopes	Boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*)	X								

TABLE 3.5.1-1 (Continued)											
			Occurrence along Right-of-Way by State								
			Mainline Project						Cushing Extension		
General and Subclass Designation	General Description	Common Species	ND	SD	NE	KS	MO	IL	NE	KS	OK
Upland Forest (continued)											
Aspen woodland	Woodlands dominated by aspen species	Green ash (*Fraxinus pennsylvanica*), quaking aspen (*Populus tremuloides*), bur oak (*Quercus macrocarpa*)	X								
Bur oak woodland	Woodlands dominated by bur oak, generally in ravines and well-drained uplands	Green ash (*Fraxinus pennsylvanica*), quaking aspen (*Populus tremuloides*), bur oak (*Quercus macrocarpa*)	X								
Evergreen forest	Forest with greater than 60% evergreen trees	Shortleaf pine (*Pinus echinata*)					X				
Mixed oak ravine	Oak forest with multiple species on moderate to steep slopes of ravines and river valleys	Big bluestem (*Andropogon gerardii*), bur oak (*Quercus macrocarpa*), chinquapin oak (*Q. muhlenbergii*)			X	X	X		X	X	
Deciduous	Native deciduous forest communities	Bur oak (*Quercus macrocarpa*), post oak (*Q. stellata*)					X				
Riverine/Open Water											
Open water	Open water, sometimes associated with wetland habitat	None			X			X			
Riverine wetlands	Wetlands contained within a channel		X					X			
Palustrine Forested Wetlands											
Floodplain woodland	Wooded communities in floodplains	Green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), bur oak (*Quercus macrocarpa*), American elm (*Ulmus americana*)	X								
Riparian or floodplain woodland	Temporarily flooded woodlands				X			X			

TABLE 3.5.1-1
(Continued)

General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State: Mainline Project ND	SD	NE	KS	MO	IL	Cushing Extension NE	KS	OK
Palustrine Forested Wetlands (continued)											
Mixed oak floodplain forest	Oak-dominated forests with temporary flooding in floodplains	Bitternut hichory (*Carya cordiformis*), Indian woodoats (*Chasmanthium latifolium*), bur oak (*Quercus macrocarpa*), shumard oak (*Q. shumardii*)				X					
Ash-elm-hackberry floodplain forest	Forest in floodplains and upland ravine bottoms; dominated by ash, elm, and hackberry	Common hackberry (*Celtis occidentalis*), green ash (*Fraxinus pennsylvanica*), elm (*Ulmus* spp.)				X					
Woody-dominated wetland	Semi-permanently or permanently flooded forest community	Maple (*Acer* spp.), hickory (*Carya* spp.), oak (*Quercus* spp.)					X	X			
Cottonwood floodplain woodland	Floodplain forest dominated by cottonwood species	Green ash (*Fraxinus pennsylvanicus*), eastern cottonwood (*Populus deltoides*), willow (*Salis* spp.)				X					
Palustrine Emergent/Scrub-Shrub Wetlands											
Palustrine emergent wetlands	Temporary, seasonal, or semi-permanent wetlands dominated by persistent emergent vegetation	Common spikerush (*Eleocharis palustrisi*), rush (*Juncus* spp.), rice cutgrass (*Leersia oryzoides*), bulrush (*Schoenoplectus* spp.), burreed (*Sparganium* spp.), cattail (*Typha* spp.)	X	X	X	X	X	X	X	X	X
Riparian shrubland	Temporarily flooded shrub community	Sedge (*Arex* spp.), willow (*Salix* spp.), bulrush (*Schoenoplectus* spp.), western snowberry (*Symphoricarpos occidentalis*)	X	X	X						
Aquatic bed wetland	Intermittently, temporarily, or permanently flooded wetlands	Inland saltgrass (*Distichlis spicata*), western wheatgrass (*Pascopyrum smithii*), smartweed and knotweed (*Polygonum* spp.), pondweed (*Potamogeton* spp.)			X						

TABLE 3.5.1-1
(Continued)

General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State								
			Mainline Project						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
Palustrine Emergent/Scrub-Shrub Wetlands (continued)											
Cattail or freshwater marsh	Shallow to deep emergent marshes	Rush (*Juncus* spp.), bulrush (*Schoenoplectus* spp.), burreed (*Sparganium* spp.), cattail (*Typha* spp.)	X	X	X	X					
Herbaceous-dominated wetland	Semi-permanently or permanently flooded wetland	Rush (*Juncus* spp.), bulrush (*Schoenoplectus* spp.), cattail (*Typha* spp.), sedge (*Carex* spp.)					X				
Right-of-Way											
None	Pipeline and other utilities	Mixture of grasses and forbs				X	X				

Source: ENSR 2006a.

3.5.2 Vegetation Communities of Conservation Concern

Native grasslands or prairies are considered the most threatened vegetation communities in the United States. In the past, grasslands such as the tall-grass prairies, mixed-grass prairies, and short-grass prairies dominated central North America. Prairies have been lost to agriculture, urbanization, and mineral exploration and have been altered by invasions of non-native plants after fire suppression, establishment of woodlots and shelterbelts, water developments, and tree-lined river and stream corridors. Tall-grass prairie is the wettest of the grasslands composed of sod-forming bunch grasses. Mixed-grass prairies are intergrades between tall-grass and short-grass prairies and are characterized by the warm-season grasses of the short-grass prairie and the cool and warm-season grasses of the tall-grass prairie. Short-grass prairies are dominated by blue grama and buffalo grass—two warm-season grasses that flourish under intensive grazing. The status of native grasslands in states through which the pipeline ROW would pass is listed in Table 3.5.2-1. The 49 plant species of conservation concern that have been identified along the pipeline ROW are listed in Table 3.5.2-2; many of these species occupy prairie and wetland habitats.

TABLE 3.5.2-1
Status of Native Prairies—Tall Grass, Mixed Grass and Short Grass—In States Crossed by the Keystone Project

Type	State	Past Area (hectares)	Current Area (hectares)	Current Area (acres)	Decline (%)
Tall grass	North Dakota	130,000	120	297	99.9
	South Dakota	2,600,000	20,000	49,421	99.2
	Nebraska	6,100,000	123,000	303,940	98.0
	Kansas	6,900,000	1,200,000	2,965,265	82.6
	Missouri	6,000,000	32,000	79,074	99.5
	Illinois	8,500,000	2,930	2,298	99.9
	Oklahoma	5,200,000	NA	NA	NA
Mixed grass	North Dakota	14,200,000	4,500,000	11,119,742	68.3
	South Dakota	1,600,000	480,000	1,186,106	70.0
	Nebraska	7,700,000	1,900,00	4,695,002	75.3
	Oklahoma	2,500,000	NA	NA	NA
Short grass	South Dakota	179,000	116,350	287,507	35.0
	Oklahoma	1,300,000	NA	NA	NA

NA = Not available.

Source: Samson et al. 2007.

TABLE 3.5.2-2
Plants of Conservation Concern along the Keystone Project Route

Species	Status [a]	State Conservation Status [b]							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Indian ricegrass (*Achnatherum hymenoides*)	KS-SC	SNR	SNR	SNR	S2	SNR		S1	Sandy, stony, gravelly, shallow soils in upland and semi-desert climatic zones. Adapted to soils high in lime, moderately salt and alkali tolerant. Flowering: May–August.
Woolly milkweed (*Asclepias lanuginosa*)	SD-SC	S1	S4	S3	S1		S1		Dry woods, prairies, hillside prairies, rocky soils. Flowering: June–July.
Subarctic ladyfern (*Athyrium filix-femina*)	ND-SC	S3	SNR	SH	SNR	SNR	SNR	SNR	Swamp margins, wooded banks, and alluvial woods. Aquatic or wetland species.
Texas bergia (*Bergia texana*)	MO-SC		SNR	S1	S2	S2	SNR	SNR	Muddy or sandy shores and flats, rare. Flowering: June–October.
Broad-glumed (earlyleaf) brome (*Bromus latiglumis*)	MO-SC	SNR	SNR	SNR	S1	S3	S3		Wooded slopes and bluffs, alluvial banks of streams, usually in limestone areas. Flowering: July–August.
Nottoway (Valley) brome grass (*Bromus nottowayanus*)	MO-SC				S1	S3	S1	SNR	Rich, loamy soils in bottomland forests along rivers and streams, mesic woods not far (<50 meters) from a river or stream.
Bellow's-beak sedge (*Carex albicans var. australis*)	MO-SC				S1	S1	SNR	SNR	Acid, dry soils of sandstone and granite, calcareous regions, wooded slopes, sandstone ridges, woodland clearings in partial shade of deciduous forests. Fruiting: April–June.
Buxbaum's sedge (*Carex buxbaumii*)	ND-SC	S1		S2	S1	S2	SNR	SNR	Bogs, wet meadows, springs, and fens. Flowering: Late May–June.
Crested sedge (*Carex cristatella*)	KS-SC	SNR	SNR	SNR	S2	SNR	S3		Openings in wet meadows, moist woodlands, swamps, soggy thickets, wet prairies, sedge meadows, sloughs, low-lying areas along rivers, power line clearances in woodlands, and ditches. Occurs in both degraded and higher quality habitats. Flowering: late spring–early summer.
Ravenfoot sedge (*Carex crus-corvi*)	KS-SC			S1	S2	SNR	S3	SNR	Wet meadows, wet prairies, swamps, floodplain woods, and roadside ditches. Flowering: May–July.
Bristly-stalk sedge (*Carex leptalea*)	ND-SC	S2	S2			SNR	S2	S1	Bogs and wet woodlands. Flowering: June–July.

TABLE 3.5.2-2
(Continued)

Species	Status [a]	State Conservation Status [b]							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Blue cohosh (*Caulophyllum thalictroides*)	ND-SC	S1	S3	S1	S1	SNR	SNR	SNR	Rich valley woodlands, ravines, north-facing wooded slopes, and moist base of bluffs. Flowering: April–May.
Sand (lanceleaf) coreopsis (*Coreopsis lanceolata*)	KS-SC				S2	SNR	SNR	SNR	Dunes, dry woods, and meadows; in full sun to partial sun; and very dry to somewhat moist sites. Occurs in open sandy banks, roadsides, grasslands, banks, and bluffs in oak-pine woodland and in other sandy areas. Flowering: April–June.
American yellow lady's-slipper (*Cypripedium parviflorum*)	ND-SC	SNR	S3	SNR	SNR	SNR	SNR	SNR	Soft soils in moist tall-grass prairie, especially near trees or shrubs along lakeshores. Flowering: 25 May–20 June.
Showy lady's-slipper (*Cypripedium reginae*)	ND-SC	S2				S2	S1		Calcareous wetlands, wet woodlands. Flowering: 20 June–5 July.
Spinulose shieldfern (woodfern) (*Dryopteris carthusiana*)	ND-SC	S3	SNR	S2		S2	S3		Wet alluvial woods or swamps.
Crested shieldfern (woodfern) (*Dryopteris cristata*)	ND-SC	S3		S1		S1	S2		Wet alluvial woods or swamps.
Walter's barnyard grass (*Echinochloa walteri*)	MO-SC					S1	S3	SNR	Low ground, rarely standing water, basic to alkaline marshes.
Small spikerush (*Eleocharis parvula*)	ND-SC	S1	SNR		S2	SNR	EX	SNR	Wet saline or alkaline flats and shores. Flowering: July–early September.
Green keeled cottongrass (*Eriophorum viridi-carinatum*)	ND-SC	S1					SX		Cold, calcareous sphagnum bogs, and swamps, permafrost tussocks and calcicoles.
Spotted Joe-pyeweed (*Eupatorium maculatum* var. *bruneri*)	KS-SC	SNR	SNR	SNR	S1	SNR			Moist black soil prairies, sand prairies, sedge meadows, marshes, fens, and swampy thickets with small trees or shrubs. Flowering: July–September.
Fringed gentian (*Gentianopsis crinita*)	ND-SC	S1	SNR				SNR		Low, moist native grassland. Flowering: September–October.
Plains frostweed (*Helianthemum bicknellii*)	ND-SC	S1	SNR	S1	SNR	SNR	SNR		Prairies, rocky open areas, dry sandy soil. Also woodlands and glades. Flowering: early June–late July.

TABLE 3.5.2-2
(Continued)

Species	Status [a]	State Conservation Status [b] ND	SD	NE	KS	MO	IL	OK	Habitat
Greater Canadian St. John's wort (*Hypericum majus*)	KS-SC	SNR	SNR	SNR	S2	SH	SNR	S1	Along ponds, lakesides, or other low, wet places; facultative wetland species. Flowering: July–September.
Narrowleaf morning-glory (*Ipomoea shumardiana*)	KS-SC				S1			SNR	Prairie species, eastern Kansas through central Oklahoma to north Texas. Flowering: June–August.
Butternut (*Juglans cinerea*)	MO-SC	SNR			SNR	S2	S2		Mixed hardwood forests, often on stream benches and terraces, on slopes, in the talus of rock ledges, on other sites with good drainage. Flowering: April–May.
Star duckweed (*Lemna trisulca*)	MO-SC	SNR	SNR	SNR	S1	S2	S3		Cool, freshwater creeks and in shallow lakes, ponds, and marshes. Flowering: (rare) late spring to summer.
Loesel's twayblade (*Liparis loeselii*)	ND-SC	S2	S1	S1	SX	S2	S1		Bogs, wet ditches, old sand pits, and moist meadows. Often in acidic soils, also in strongly basic soils; requires lack of competing vegetation. Flowering: 10 July–20 July.
Fourflower (prairie) loosestrife (*Lysimachia quadriflora*)	SD-SC	SNR	S1	SNR		SNR	SNR	S1	Wet meadows and around pond margins, usually where sandy, often on calcareous soils. Flowering: July–August.
Hispid (yellow) falsemallow (*Malvastrum hispidum*)	MO-SC				SNR	S3	S1	SNR	Rocky prairies; limestone, sandstone, or cherty limestone glades; bluffs; open alluvial valleys; along gravel bars. Flowering: July–September.
Tender creeping-cucumber (*Melothria pendula*)	KS-SC				S2	SNR	S1	SNR	Rich or rocky low woods, at base of limestone bluffs, and in alluvial woods—often along streams. Flowering: July–September.
Naked bishop's-cap (*Mitella nuda*)	ND-SC	S3							Moist forests, thickets, bogs, and swamps; often growing among mosses.
Southern adder's tongue (*Ophioglossum vulgatum*)	MO-SC				SX	S3	SNR	SNR	Shaded secondary woods, wooded slopes, forested bottomlands, and floodplain woods. Leaves: spring to early summer. Spores: April–June.

TABLE 3.5.2-2
(Continued)

Species	Status [a]	State Conservation Status [b]							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Lanceolateleaf rock moss (*Orthotrichum speciosum* var. *elegans*)	MO-SC					S1			Epiphytic moss generally on tree trunks and branches.
Pendant-pod point-vetch (*Oxytropis deflexa*)	ND-SC	S1							Drier prairies and plains, open wooded areas. Flowering: June–July.
Oklahoma phlox (*Phlox oklahomensis*)	KS-SC			SNR	S2			S1	Tall–grass and mixed–grass prairies, thrives in low to moderately gazed areas; gently rolling uplands and steeper slopes of canyons; most abundant on north-facing slopes and well–drained grassland soils, weathered from calcareous shales. Flowering: March–May.
Heartleaf plantain (*Plantago cordata*)	MO-SC					S3	S1		Semi–aquatic, areas of dolomitic limestone; often in rock crevices or gravel bars in shallow, clear streams running through heavily wooded areas; requires a specific stream habitat, with regular and predictable erosion and deposition. Flowering: April–June.
Greek valerian (Jacob's ladder) (*Polemonium reptans*)	KS-SC		SNR	S1	S2	SNR	SNR	SNR	Rich low woods, thickets at the base of bluffs, and moist ground near streams. Flowering: April–June.
Prickly gooseberry (*Ribes cynosbati*)	ND-SC	S3	SNR			SNR	SNR	S1	Thin rocky woodlands, wooded slopes, woodland borders, and limestone bluffs; some disturbance beneficial, if it reduces overhead tree canopy.
Prairie willow (*Salix humilis*)	SD-SC	SNR	S1	SNR	SNR	SNR	S3	SNR	Moist to slightly dry black soil prairies, sand prairies, sandy savannas, barrens, and gravelly seeps; lowland or upland areas, depending on variety or local ecotype.
Rocky Mountain bulrush (*Schoenoplectus saximontanus*)	MO-SC		SNR	S1	S1	S1		SNR	Damp sandy soils near freshwater ponds, ditches, or watercourses. Fruiting: summer to fall.
Lesser (oval) ladies'-tresses (*Spiranthes ovalis* var. *erostellata*)	MO-SC				S1	S3	SNR	SNR	Moist, rich woodlands; thickets; old fields; second–growth woodlands; and wooded hillsides. Flowering: September–October.

TABLE 3.5.2-2 (Continued)									
		State Conservation Status [b]							
Species	Status [a]	ND	SD	NE	KS	MO	IL	OK	Habitat
Goat's-rue (*Tephrosia virginiana*)	NE-SC			S1	SNR	SNR	SNR	SNR	Sandy soils in open woods, glades, and prairies, and along roadsides. Often indicts shallow soils. Flowering: May–July.
Nodding pogonia (*Triphora trianthophora*)	KS-SC			S1	S1	SNR	S3	S2	Moist lowland woods, ravines, stream valleys, and bottoms in the lower half of Missouri. Flowering: August–September.
Rock elm (*Ulmus thomasii*)	MO-SC	SNR	SNR	S3	S1	S2	S1		Mesic hardwood forests; moist, well-drained uplands; rocky ridges; floodplains; stream banks; and on limestone outcrops.
Flatleaf bladderwort (*Utricularia intermedia*)	ND-SC	S2					S1		Aquatic species in bogs, ponds, swamps, slow-moving streams, and wet sedge or rush meadows. Flowering: July–August.
Lesser bladderwort (*Utricularia minor*)	ND-SC	S2	SNR	S1			S1		Open bogs, sedge meadows, and marshlands; prefers calcium-rich shallow water.
Bird's-foot violet (*Viola pedata*)	NE-SC			S1	SNR	SNR	SNR	SNR	Rocky or dry open woodlands, on slopes, ridges, prairies, glades, and roadsides; almost always in acid soils. Flowering: April–June, September–December.

EX = Exotic species.
SX = Presumed extirpated.
SH = Possibly extirpated.
S1 = Critically imperiled.
S2 = Imperiled.
S3 = Vulnerable.
S4 = Apparently secure.
S5 = Secure.
SNR = Species not ranked.

[a] State listing as species of conservation concern (SC) according to ENSR 2006a.

[b] State conservation status (Natureserve 2006).

Native forests, especially forested floodplains, are also of conservation concern. Forest communities are generally rare within the native prairie grasslands but provide refuge habitats for many wildlife species. Native wooded communities were once an integral component of the landscape throughout the Great Plains. Many of these communities have been lost due to land conversion to agricultural, levee construction, and urban development. The current distribution of forested lands, grasslands and prairies, and croplands and pasture in the states crossed by the Keystone Project are illustrated in Figure 3.5.2-1.

3.5.3 Conservation Reserve Program

The Mainline Project and Cushing Extension would potentially cross three easements enrolled in the CRP. The CRP is described in Section 3.9.3.2.

3.5.4 Noxious Weeds

Noxious weeds and other invasive plants are non-native, undesirable native, or introduced species that are able to exclude and out-compete desirable native species, thereby decreasing overall species diversity. The term "noxious weed" is legally defined under both federal and state laws. Under the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974 [7 USC SS 2801–2814]), a noxious weed is defined as "any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment." The Federal Plant Protection Act contains a list of 137 federally restricted and regulated federal noxious weeds, as per CFR Title 7, Chapter III, Part 360, including 19 aquatic and wetland weeds, 62 parasitic weeds, and 56 terrestrial weeds. Each state is federally mandated to uphold the rules and regulations set forth by the Federal Plant Protection Act and to manage its lands accordingly. Five federally listed noxious weeds have been reported to occur in states that would be crossed by the construction ROWs (NRCS 2007); one aquatic species (ducklettuce) occurs in Missouri; parasitic species of dodder, including the native bigfruit dodder, occur in North Dakota, South Dakota, Nebraska, and Kansas; the introduced upland species professor-weed occurs in Nebraska, and giant hogweed and serrated tussock occur in Illinois (Table 3.5.4-1).

In addition to federal noxious weed lists, each state that would be crossed by the proposed Mainline Project and Cushing Extension pipelines maintains a list of regulated and prohibited noxious and invasive weed species. County weed control boards or districts are present in most counties that would be crossed by the pipeline route. These county weed control boards monitor local weed infestations and provide guidance on weed control. An additional 68 state-listed noxious, invasive, and regulated weed species occur across the construction ROWs—including nine aquatic and wetland species and 59 upland species (Table 3.5.4-1).

Many of these noxious weeds are widespread across the Keystone Project area but are listed as noxious in only one or a few of the states. Noxious weeds listed as occurring by all states that would be crossed by the construction ROWs include Canada thistle and nodding plumeless (musk) thistle (Table 3.5.4-1). Species listed as noxious by four of the seven affected states include leafy spurge, purple loosestrife, field bindweed, and Johnsongrass (Table 3.5.4-1). The differences in listing terminologies and status for weed species across states may lead to difficulties in obtaining seed sources consistently identified as "weed free" across the Keystone Project area.

TABLE 3.5.4-1
Noxious and Invasive Weeds along the Keystone Project Route

Species [a]	Status / Habitat	Occurrence and State Designations						
		ND	SD	NE	KS	MO	IL	OK
Hardheads (Russian knapweed) (*Acroptilon repens*)	Introduced species / Upland	√ NW	√ CP	√	√ NW	√	√	√
Creasted wheatgrass (*Agropyron cristatum*)	Introduced species / Upland	√ INV	√	√	√		√	√
Garlic mustard (*Alliaria petiolata*)	Introduced species / Upland	√ INV		√	√	√	√	√
Annual ragweed (*Ambrosia artemisiifolia*)	Native species / Upland	√	√	√	√	√	√ NW	√
Wollyleaf burr ragweed (*Ambrosia grayi*)	Native species / Upland			√	√ NW			√
Great ragweed (*Ambrosia trifida*)	Native species / Upland	√	√	√	√	√	√ NW	√
Corn chamomile (*Anthemis arvensis*)	Introduced species / Upland	√ INV		√		√	√	
Lesser burdock (*Arctium minus*)	Introduced species / Upland	√	√ LW	√	√	√	√	√
Absinthium (*Artemisia absinthium*)	Introduced species / Upland	√ NW	√ LW	√	√	√	√	
Smooth brome (*Bromus inermis*)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Japanese brome (*Bromus japonicus*)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Cheatgrass downy brome (*Bromus tectorum*)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Marijuana (*Cannabis sativa*)	Introduced species / Upland	√	√	√	√	√ NW	√ NW	√
Siberian peashrub (*Caragana arborescens*)	Introduced species / Upland	√ INV	√	√			√	
Whitetop (*Cardaria draba*)	Introduced species / Upland	√ INV	√ NW	√	√ NW	√	√	√

TABLE 3.5.4-1
(Continued)

Species [a]	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Spiny plumeless thistle (*Carduus acanthoides*)	Introduced species / Upland	√ INV	√ LW	√ NW	√		√	√
Nodding plumeless (musk) thistle (*Carduus nutans*)	Introduced species / Upland	√ NW	√ CP	√ NW	√ NW	√ NW	√ NW	√ NW
Meadow knapweed (*Centaurea debeauxii*)	Introduced species / Upland	INV						
Diffuse (white) knapweed (*Centaurea diffusa*)	Introduced species / Upland	NW	CP	√ NW		√	√	
Bighead knapweed (*Centaurea macrocephala*)	Introduced species / Upland	INV						
Spotted knapweed (*Centaurea stoebe* [*maculosa*])	Introduced species / Upland	√ NW	√ CP	√ NW	√	√	√	
Yellow star-thistle (*Centaurea solstitialis*)	Introduced species / Upland	√ NW	√ CP	√	√	√	√	√
Rush skeletonweed (*Chondrilla juncea*)	Introduced species / Upland		CP					
Chickory (*Cichorium intybus*)	Introduced species / Upland	√	√ CP	√	√	√	√	√
Canada thistle (*Cirsium arvense*)	Introduced species / Upland and wetland	√ NW	√ NW	√ NW	√ NW	√ NW	√ NW	√ NW
Bull thistle (*Cirsium vulgare*)	Introduced species / Upland	√ INV	√ NW	√	√ LW	√	√	√
Poison hemlock (*Conium maculatum*)	Introduced species / Upland	√	√ NW	√	√	√	√	√
Field bindweed (*Convolvulus arvensis*)	Introduced species / Upland	√ NW	√ CP	√	√ NW	√ NW	√	√
Common crupina (*Crupina vulgaris*)	Introduced species / Upland		CP					
Dodder (*Cuscuta* spp. - not inclusive)	Native and introduced species / Upland	√	√ CP	√	√	√	√	√

TABLE 3.5.4-1
(Continued)

Species [a]	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Bigfruit dodder (*Suscuta megalocarpa*)	Native species / Upland	√	√	√	√			
Gypsyflower (*Cynoglossum officinale*)	Introduced species / Upland and woodland	√ INV	√ LW	√	√	√	√	
Fuller's teasel (*Dipsacus fullonum*)	Introduced species / Upland		√	√	√	√ NW	√	√
Cutleaf teasel (*Dipsacus laciniatus*)	Introduced species / Upland			√	√	√ NW	√	
Brazilian waterweed (*Egeria densa*)	Introduced species / Aquatic	INV		√	√	√	√	√
Russian olive (*Elaeagnus angustifolia*)	Introduced species / Upland, wetland, and woodland	√ INV	√	√	√	√	√	√
Quackgrass (*Elymus repens*)	Introduced species / Upland	√ INV	√	√	√ NW	√	√	√
Leafy spurge (*Euphorbia esula*)	Introduced species / Upland	√ NW	√ NW	√ NW	√ NW	√	√	
Professor-weed (Goatsrue) (*Galega officinalis*)	Introduced species / Upland			√				
Giant hogweed (*Heracleum mantegazzianum*)	Introduced species / Upland						√	
Orange hawkweed (*Hieracium aurantiacum*)	Introduced species / Upland	INV					√	
Meadow hawkweed (*Hieracium pratense*)	Introduced species / Upland	INV					√	
Indian rushpea (*Hoffmannseggia densiflora*)	Native species / Upland				√ NW			√
Black henbane (*Hyoscyamus niger*)	Introduced species / Upland	√ INV	√	√			√	
Common St. Johnswort (*Hypericum perforatum*)	Introduced species / Upland	√	√ CP	√	√	√	√	√

TABLE 3.5.4-1
(Continued)

Species [a]	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Broadleafed pepperweed (*Lepidium latifolium*)	Introduced species / Upland		CP	√	√	√	√	
Sericea (Chinese) lespedeza (*Lespedeza cuneata*)	Introduced species / Wetland			√	√ NW	√	√	√
Dalmatian toadflax (*Linaria dalmatica*)	Introduced species / Upland	√ NW	√ CP	√	√		√	√
Butter-and-eggs (*Linaria vulgaris*)	Introduced species / Upland	√ INV	√ CP	√	√	√	√	√
Purple loosestrife (*Lythrum salicaria*)	Introduced species / Wetland	√ NW	√ NW	√ NW	√	√ NW	√	√
Black medick (*Medicago lupulina*)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Yellow sweetclover (*Melilotus officinalis*)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Twoleaf watermilfoil (*Myriophyllum heterophyllum*)	Native species / Aquatic	√ INV	√		√	√	√	√
Eurasian (Spike) watermilfoil (*Myriophyllum spicatum*)	Introduced species / Aquatic	√ INV	√ CP	√		√	√	√
Serrated tussock (*Nassella trichotoma*)	Introduced species / Upland						√	
Scotch cottonthistle (*Onopordum acanthium*)	Introduced species / Upland	INV	LW	√	√	√ NW		√ NW
Ducklettuce (*Ottelia alismoides*)	Introduced species / Aquatic					√		
Reed canarygrass (*Phalaris arundinacea*)	Native species / Wetland	√ INV	√	√	√	√	√	√
Kentucky bluegrass (*Poa pratensis*)	Native and introduced species / Upland	√ INV	√	√	√	√	√	√
Japanese knotweed (*Polygonum cuspidatum*)	Introduced species / Upland	INV	√	√	√	√	√	√

TABLE 3.5.4-1
(Continued)

Species [a]	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Giant knotweed (*Polygonum sachalinense*)	Introduced species / Upland	INV	LW				√	
Curly pondweed (*Potamogeton crispus*)	Introduced species / Aquatic	√ INV	√	√	√	√	√	√
Kudzu (*Pueraria lobata*)	Introduced species / Upland			√	√ NW	√ NW	√ NW	√
Common buckthorn (*Rhamnus cathartica*)	Introduced species / Upland and woodland	√ INV	√	√	√	√	√	
Multiflora rose (*Rosa multiflora*)	Introduced species / Upland		CP	√	√ NW	√ NW	√	√
Field sowthistle (*Sonchus arvensis*)	Introduced species / Upland and wetland	√ INV	√ NW	√	√	√	√ NW	
Columbus grass (*Sorghum almum*)	Introduced species / Upland						√ NW	
Johnsongrass (*Sorghum halepense*)	Introduced species / Upland	√	√ CP	√	√ NW	√ NW	√ NW	√
Tamarisk (Salt cedar) (*Tamarix aphylla, T. chinensis, T. gallica, T. parviflora, T. ramosissima*)	Introduced species / Upland, wetland, and woodland	√ NW	√ NW	√	√	√	√	√
Common tansy (*Tanacetum vulgare*)	Introduced species / Upland	√	√ LW	√	√	√	√	√
Puncturevine (*Tribulus terrestris*)	Introduced species / Upland	√ INV	√ LW	√	√	√	√	√
Narrowleaf cattail (*Typha angustifolia*)	Introduced species / Wetland	√ INV	√	√	√	√	√	√
Hybrid cattail (*Typha x. glauca*)	Native species / Wetland	INV	√			√	√	
Siberian elm (*Ulmus pumila*)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Common mullein (*Verbascum thapsus*)	Introduced species / Upland	√	√ LW	√	√	√	√	√

TABLE 3.5.4-1 (Continued)

√ = Occurs within state (Natureserve 2006).
CP = Classified as a state regulated plant.
INV = Classified as a state invasive species.
LW = Classified as a local noxious weed.
NW = Classified as a state noxious weed.

[a] Species in bold are federal noxious weeds. Source: NRCS 2007.

Source: Adapted from ENSR 2006a.

Noxious weeds are addressed by Executive Order 13112, which directs federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts that invasive species can cause. The executive order further specifies that federal agencies shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions.

3.5.5 Potential Impacts and Mitigation

Total miles crossed and acres of terrestrial vegetation affected during construction and operation of the Mainline Project and Cushing Extension are presented in Tables 3.5.5-1, 3.5.5-2, and 3.5.5-3. Individual grasslands that would be crossed by the pipeline ROWs are presented in Table 3.5.5-4.

Potential construction- and operations-related effects include:

- Temporary and permanent modification of vegetation community composition and structure from clearing and operational maintenance;
- Increased risk of soil erosion due to lack of vegetative cover;
- Expansion of invasive and noxious weed populations along the pipeline ROW as a result of construction and operational vegetation maintenance;
- Loss of sensitive plan species and habitats as a result of construction clearing and grading;
- Soil and sod disturbance (mixing of topsoil with subsoil with altered biological activities and chemical conditions that could affect reestablishment and natural recruitment of native vegetation after restoration);
- Compaction and rutting of soils from movement of heavy machinery and transport of pipe sections, altering natural hydrologic patterns, inhibiting seed germination, or increasing siltation; and
- Alteration in vegetation productivity and phenology due to increased soil temperatures associated with heat loss from the pipeline.

3.5.5.1 General Vegetation Resources

The primary impacts on vegetation from construction and operation of the Mainline Project and Cushing Extension pipelines would be cutting, clearing, or removing the existing vegetation within the construction work area and potential invasion by noxious weeds. The degree of impact would depend on the type and amount of vegetation affected, the rate at which vegetation would regenerate after construction, and the frequency of vegetation maintenance conducted on the ROW during pipeline operation.

Impacts on pastureland generally would be shorter term, with vegetation typically becoming reestablished within 2 years. Impacts on these communities during operation of the pipeline would be minimal because these areas would be allowed to recover following construction and typically would not require maintenance mowing. Impacts on annually tilled croplands also generally would be short term and limited to the current growing season, provided that topsoil segregation was maintained and that soils were not compacted during construction.

TABLE 3.5.5-1
Estimated Impacts on Vegetation Communities for the Keystone Mainline Project

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres) [a]	Community Area Affected by Operations (acres) [a]
North Dakota			
Cropland	167.6	2,322	565
Grassland/rangeland	26.3	379	94
Upland forest	3.0	45	10
Riverine/open water	0.6	9	2
Forested wetlands	0.4	6	1
Emergent/shrub-scrub wetlands	17.7	252	59
Right-of-way	1.1	294	68
Developed land	0.2	79	17
North Dakota subtotal	*216.9*	*3,386*	*816*
South Dakota			
Cropland	158.6	1,974	495
Grassland/rangeland	37.7	550	145
Upland forest	0.2	4	1
Riverine/open water	0.7	10	2
Forested wetlands	0.0	0	0
Emergent/shrub-scrub wetlands	18.9	268	66
Right-of-way	1.6	255	62
Developed land	1.2	192	47
South Dakota subtotal	*218.9*	*3,253*	*818*
Nebraska			
Cropland	181.0	2,601	635
Grassland/rangeland	24.8	355	84
Upland forest	2.1	34	8
Riverine/open water	1.3	18	4
Forested wetlands	0.4	11	3
Emergent/shrub-scrub wetlands	2.1	28	6
Right-of-way	1.7	238	56
Developed land	0.3	42	9
Nebraska subtotal	*213.7*	*3,327*	*805*
Kansas			
Cropland	70.5	1,314	265
Grassland/rangeland	18.5	270	58
Upland forest	7.5	113	22
Riverine/open water	1.3	20	4
Forested wetlands	0.4	6	1
Emergent/shrub-scrub wetlands	0.5	7	1
Right-of-way	0.0	0	0
Developed land	0.1	97	19
Kansas subtotal	*98.8*	*1,827*	*370*

TABLE 3.5.5-1 (Continued)			
Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres) [a]	Community Area Affected by Operations (acres) [a]
Missouri			
Cropland	148.3	2,386	555
Grassland/rangeland	72.5	1,035	234
Upland forest	35.9	538	119
Riverine/open water	4.1	62	14
Forested wetlands	3.3	47	10
Emergent/shrub-scrub wetlands	2.2	32	7
Right-of-way	3.9	228	50
Developed land	2.9	170	38
Missouri subtotal	*273.1*	*4,498*	*1,027*
Illinois			
Cropland	44.4	613	151
Grassland/rangeland	1.7	20	5
Upland forest	4.7	63	14
Riverine/open water	1.1	14	3
Forested wetlands	0.8	11	2
Emergent/shrub-scrub wetlands	1.5	20	5
Right-of-way	1.6	91	21
Developed land	0.7	82	19
Illinois subtotal	*56.5*	*826*	*220*
Mainline Project			
Cropland	770.4	11,210	2,666
Grassland/rangeland	181.5	2,609	620
Upland forest	53.4	797	174
Riverine/open water	9.1	133	29
Forested wetlands	5.3	76	17
Emergent/shrub-scrub wetlands	42.9	612	144
Right-of-way	9.9	1,101	257
Developed land	5.4	667	149
Mainline Project total	**1,077.9**	**17,205**	**4,056**

[a] Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project.

Sources: TransCanada 2007a, c.

TABLE 3.5.5-2 Estimated Impacts on Vegetation Communities for the Keystone Cushing Extension			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)** [a]	**Community Area Affected by Operations (acres)** [a]
Nebraska			
Cropland	0.8	36	4
Grassland/rangeland	1.2	18	2
Upland forest	0.4	6	1
Riverine/open water	0.0	<1	0
Forested wetlands	0.0	0	0
Emergent/shrub-scrub wetlands	0.0	0	0
Right-of-way	0.0	0	0
Developed land	0.0	15	2
Nebraska subtotal	*2.4*	*75*	*9*
Kansas			
Cropland	130.8	1,893	445
Grassland/rangeland	63.8	887	205
Upland forest	6.5	104	24
Riverine/open water	0.6	9	2
Forested wetlands	3.5	52	12
Emergent/shrub-scrub wetlands	2.6	38	9
Right-of-way	2.1	309	71
Developed land	0.2	30	7
Kansas subtotal	*210.1*	*3,322*	*775*
Oklahoma			
Cropland	30.7	455	110
Grassland/rangeland	40.4	598	140
Upland forest	1.7	28	8
Riverine/open water	0.4	5	1
Forested wetlands	1.3	17	4
Emergent/shrub-scrub wetlands	3.6	46	10
Right-of-way	1.8	91	21
Developed land	1.1	56	13
Oklahoma subtotal	*80.9*	*1,296*	*307*
Cushing Extension			
Cropland	162.3	2,384	559
Grassland/rangeland	105.4	1,503	347
Upland forest	8.5	138	33
Riverine/open water	1.0	14	3
Forested wetlands	4.8	67	16
Emergent/shrub-scrub wetlands	6.2	86	19
Right-of-way	3.9	376	92
Developed land	1.3	125	22
Cushing Extension total	**293.4**	**4,693**	**1,091**

Sources: TransCanada 2007a, c.

TABLE 3.5.5-3
Estimated Impacts on Vegetation Communities for the Keystone Project

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres) [a]	Community Area Affected by Operations (acres) [a]
Mainline Project			
Cropland	770.4	11,210	2,666
Grassland/rangeland	181.5	2,609	620
Upland forest	53.4	797	174
Riverine/open water	9.1	133	29
Forested wetlands	5.3	76	17
Emergent/shrub-scrub wetlands	42.9	612	144
Right-of-way	9.9	1,101	257
Developed land	5.4	667	149
Mainline Project subtotal	*1,077.9*	*17,205*	*4,056*
Cushing Extension			
Cropland	162.3	2,384	559
Grassland/rangeland	105.4	1,503	347
Upland forest	8.5	138	33
Riverine/open water	1.0	14	3
Forested wetlands	4.8	67	16
Emergent/shrub-scrub wetlands	6.2	86	19
Right-of-way	3.9	376	92
Developed land	1.3	125	22
Cushing Extension subtotal	*293.4*	*4,693*	*1,091*
Keystone Project			
Cropland	932.7	13,594	3,225
Grassland/rangeland	286.9	4,112	967
Upland forest	61.9	935	207
Riverine/open water	10.1	147	32
Forested wetlands	10.1	143	33
Emergent/shrub-scrub wetlands	49.1	698	163
Right-of-way	13.8	1,477	349
Developed land	6.7	792	171
Keystone Project total	**1,371.3**	**21,898**	**5,147**

[a] Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project.

Sources: TransCanada 2007a, c.

TABLE 3.5.5-4 Estimated Impacts on Grasslands Occurring along the Keystone Project Route				
State and County	**Type**	**Quality**	**Number**	**Mile Post** [a]
MAINLINE PROJECT				
North Dakota				
Pembina	Native prairie	High	7	6–32
Walsh	Prairie	Medium to high	13	32–46
Nelson	Prairie	High	3	58–59
Barnes	Prairie	Medium to high	1	124–125
Ransom	Prairie	High	2	167–169
Sargent	Wet lowland, native prairie, pasture and wetland mosaic	Low to high	4	200–205
Dickey	Wet meadow	Medium to high	2	207–213
South Dakota				
Day	Native prairie, grazed pasture, and riparian area	Low to high	7	258–272
Clark	Pasture/wetland mosaic, grassland/wetland, riparian meadow, wetland	Low to medium	8	272–298
Kingsbury	Grassland	Medium to high	1	325–326
Miner	Pasture with isolated wetlands	Low	2	342–360
McCook	Native grassland with wetlands	Medium to high	1	384–385
Hutchinson	Native prairie and pasture	Low and high	2	390–392
Yankton	Native grassland and pasture	Low to high	6	419–429
Nebraska				
Cedar	Grassland	High	1	436–437
Stanton	Grassland	High	1	503–504
Colfax	Grassland	High	1	540–541
Butler	Grassland	High	2	548–565
Saline	Grassland	High	1	606–607
Jefferson	Grassland	High	3	622–638
Kansas				
Nemaha	Mixed grass prairie	Unknown	2	693–695
Brown	Mixed grass prairie	Unknown	2	714–715
Doniphan	Mixed grass prairie	Unknown	2	740–742
Missouri				
Clinton	Mixed grass prairie	Unknown	6	770–790
Chariton	Mixed grass prairie	Unknown	3	849–866
Randolph	Mixed grass prairie	Unknown	22	881–894
Audrain	Mixed grass prairie	Unknown	14	904–920
Illinois				
None				

TABLE 3.5.5-4
(Continued)

State and County	Type	Quality	Number	Mile Post [a]
CUSHING EXTENSION				
Nebraska				
Jefferson	Grassland	Unknown	7	0–2.5
Kansas				
Washington	Grassland	Unknown	22	3–31
Clay	Grassland	Unknown	26	33–59
Dickinson	Grassland	Unknown	49	63–98
Marion	Grassland	Unknown	50	100–132
Butler	Grassland	Unknown	59	136–177
Cowley	Grassland	Unknown	23	181–209
Oklahoma				
Kay	Grassland	Unknown	49	212–238
Noble	Grassland	Unknown	53	240–264
Payne	Grassland	Unknown	76	266–291

[a] Approximate.

Sources: ENSR 2006a, b.

Clearing trees within upland forest communities, including riparian forest, would result in long-term impacts on these vegetation communities, given the length of time needed for the community to mature to pre-construction conditions. Permanent impacts would occur within the 30-foot-wide permanent easement, where trees would be removed and prevented from reestablishing through the periodic mowing and brush clearing required for pipeline operation and inspections.

Impacts on shrubland also would be long term because of the time required to reestablish the woody vegetation characteristic of this community type. Permanent impacts on shrubland would result from vegetation clearing over a 10-foot-wide corridor centered over the pipeline and vegetation clearing at 3-year intervals within the 30-foot-wide permanent ROW in non-riparian areas. These clearing activities would prevent larger woody species from reverting to preconstruction form and size.

Operation of the Keystone project would cause slight increases in soil temperatures at the soil surface (from 1 to 2 °F) primarily during winter, and at depths of 6 inches (from 1 to 5 °F), with most notable increases during spring (March). While many species would not produce root systems that would penetrate much below 6 inches, the root systems of some species—notably native prairie grasses, trees and shrubs—often penetrate well below 6 inches. Soil temperatures closer to the pipeline burial depth of 6 feet may be as much as 30 °F warmer than the ambient surrounding soil temperatures. In general, increased soil temperatures during early spring would cause early germination and emergence in annual crops such as corn and soybeans and in tall-grass prairie species (TransCanada 2007c). Increased soil temperatures also may stimulate root growth in oak species (TransCanada 2007c).

To reduce impacts on vegetation within the construction and permanent ROWs and to improve the probability of successful revegetation of disturbed areas, Keystone would implement the following measures in its Mitigation Plan:

- Provide temporary and permanent erosion control measures.
- Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas.
- Restore pre-construction contours and natural drainage patterns.
- Fertilize and add soil pH modifiers in accordance with written recommendations from the local soil conservation authority.
- Monitor the ROW for the first year following construction and again during the second growing season; consider revegetation successful if density and cover are similar to adjacent undisturbed lands.
- Complete additional revegetation efforts until revegetation is deemed successful.
- Construction traffic will be restricted to the construction ROW, existing roads, and approved private roads.
- Construction ROW boundaries, including pre-approved temporary workspaces, shall be clearly staked to prevent disturbance to unauthorized areas.
- If crops are present, they shall be mowed or disced to ground level unless an agreement is made for the landowner to remove for personal use.
- Burning is prohibited on cultivated land.
- The construction ROW at timber shelterbelts in agricultural areas shall be reduced to the minimum necessary to construct the pipeline.
- In agricultural lands, topsoil will be stripped from the area to a maximum of 12 inches.

- In non-cultivated agricultural lands, the actual depth of topsoil shall be stripped from the areas to be excavated.
- When grading is required, the topsoil shall be removed from the entire area to be graded and shall be stored.
- Stripped topsoil is to be stockpiled, and mixing of topsoil and subsoil is to be minimized.
- Topsoil will not be used to fill low areas.
- To prevent wind erosion, topsoil piles will be tackified using either water or a suitable tackifier.
- The surface drainage network shall be maintained to prevent any accumulation of water.
- Topsoil shall not be used to construct ramps at road or water body crossings.
- Compaction shall be alleviated on all agricultural land crossed by construction equipment. Cropland that has been compacted will be ripped a minimum of three passes at least 18 inches deep, and all pasture and woodland shall be ripped or chiseled a minimum of three passes at least 12 inches deep.
- Areas stripped for topsoil salvage will be ripped at 18 inches or less a minimum of three passes, graded, and smoothed prior to topsoil replacement.
- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete.
- Plowing under of organic matter, including wood chips, manure, or planting a new crop such as alfalfa, to decrease soil bulk density and improve soil structure or any other measures in consultation with the NRCS shall be considered if mechanical relief of compaction is deemed unsatisfactory.
- Seeding will follow cleanup and topsoil replacement as closely as possible. Seed shall be applied to all disturbed surfaces (except cultivated fields, unless requested by the landowner).
- The final seed mix shall be based on input from the local NRCS and availability of seed at the time of reclamation. The landowner may request specific seeding requirements during easement negotiations.
- Certificates of seed analysis are required for all seed mixes, to limit the introduction of noxious weeds.
- Seeds not used within 12 months of seed testing shall be approved by Keystone prior to use.
- Remove and dispose of excess mulch prior to seedbed preparation.
- Evenly re-apply and anchor temporary mulch following seeding.
- Seed at a rate appropriate for the region and stability of the reclaimed surface based on Pure Live Seed.
- Weather conditions, construction ROW constraints, site access, and soil type shall influence the seeding method used. Drill seed unless too steep, temporary cover crop seed shall be broadcast.
- Delay seeding until soil is in an appropriate condition for drill seeding.
- Use Truax or an equivalent-type drill seeder equipped with a cultipacker that is designed and equipped to apply grass and grass-legume seed mixtures, with mechanisms such as seed box agitators to allow even distribution of all species in each seed mix and with an adjustable metering mechanism to accurately deliver the specified seeding rate and depth.

- Calibrate drill seeders so that the specified seeding rate is planted; row spacing is not to exceed 8 inches.
- Seep depths should be consistent with local or regional agricultural practices.
- Broadcast or hydro-seeding will be used in lieu of drilling. For these uses, double the recommended seeding rates and use a harrow, cultipacker, or other equipment immediately following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.
- Hand rake all areas that are too steep or otherwise cannot be safely harrowed or cultipacked.
- Use hydro-seeding on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods.

3.5.5.2 Vegetation Communities of Conservation Concern

Construction affects on previously untilled native prairies may be irreversible, as destruction of the prairie sod during trenching may require more than 100 years for recovery. Short-grass prairie and mixed-grass prairie areas may take 5 or more years to become reestablished due to poor soil conditions and low moisture levels. Invasion of non-native plants also may prevent recovery of prairie grasslands, especially as these are related to altered land management that would require suppression of wildfires that maintain prairie sod. An estimated minimum of 29 miles of native prairie and/or grasslands would be affected during construction of the Keystone Project (Table 3.5.5-4). These impacts would contribute to the decline in native grasslands described in Table 3.5.2-1 and represent an additional loss to current grassland areas across the Keystone Project area.

Keystone would implement the following measures in its Mitigation Plan for native prairie:

- Keystone will contract a qualified biologist to conduct a survey of sensitive species associated with native tall-grass prairie.
- If sensitive species are identified in the construction ROW, Keystone will work with the relevant regulatory authorities to determine whether any additional protection measures would be required.
- Once construction is complete, disturbance in native prairie will be reclaimed to native prairie species, using native seed mixes specified by applicable state and federal agencies such that no net loss of native prairie habitat will occur.
- To minimize impacts on native prairie, no permanent developments (such as access roads or pump stations) will be constructed in native prairie tracts, if possible.

To minimize impacts on native prairie communities, **the following measures are recommended:**

- **Keystone should minimize impacts to native prairie communities (Larry Svoboda, EPA, May 3, 2007) by:**
  - **Siting extra workspaces outside of native prairie habitats,**
  - **Minimizing the width of the construction area within native prairie areas, and**
  - **Continuing consultation with federal and state management agencies on avoidance of native prairie impacts.**

- **Keystone should mitigate unavoidable impacts to native prairie communities at a minimum replacement/restoration of 1 acre of native prairie for each acre of native prairie impact; mitigation compensation should occur offsite and onsite, which may involve a restoration or preservation program (Larry Svoboda, EPA, May 3, 2007).**
- **Keystone should monitor restoration in native prairies to ensure that native species become established and to ensure no net loss of native prairie habitats (John Cochnar, USFWS, May 27, 2007).**

Native forests, especially forested floodplains, are also of conservation concern. Native wooded communities were once an integral component of the landscaped throughout the Great Plains. Many of these communities have been lost due to land conversion to agricultural, levee construction, and urban development. An estimated 797 acres of upland forests and 76 acres of forested wetlands would be cut down during construction of the Mainline Project. An estimated 138 acres of upland forests and 67 acres of forested wetlands would be cut down during construction of the Cushing Extension. An estimated 174 acres of upland forests and 17 acres of forested wetland would not be allowed to reestablish within the permanently maintained 30-foot Mainline Project ROW. An estimated 33 acres of upland forest and 16 acres of forested wetlands would not be allowed to reestablish within the permanently maintained 30-foot Cushing Extension ROW. While these areas represent a small proportion of the total area affected by construction of the Keystone Project, these forested communities are already reduced in most areas.

Keystone would implement the following measures in its Mitigation Plan (Appendix B) for forested uplands and wetlands:

- Prior to the start of clearing, clearly stake ROW boundaries, including pre-approved temporary workspaces, to prevent disturbance to unauthorized areas.
- Consult with the landowner to determine whether any trees are of commercial or other value to the landowner. Salvage timber as requested by the landowner.
- Grub tree stumps only 5 feet on either side of the trench line and only where necessary for grading a level surface for pipeline construction equipment to operate safely.
- Follow the landowner's desires in the easement agreement regarding the disposal of trees, brush, and stumps of no value to the landowner by burning, burial, or complete removal from any affected property.
- Use cut-off-type saw equipment for timber salvage operations. Undertake felling in a manner that minimizes butt shatter, breakage, and off-ROW disturbance. Use skidders or alternate equipment to transport salvaged logs to stacking sites.
- Fell trees in such a way that they fall toward the centre line of the ROW, to avoid breaking trees and branches off the ROW. Salvage leaners or felled trees that inadvertently fall into adjacent undisturbed vegetation.
- Recover and dispose of trees and slash falling outside the ROW.
- Limb and top salvaged logs before removal from the construction ROW. Orient log decks (if required) to best facilitate loading by picker trucks and locate them adjacent to the working side of the ROW where possible.
- The Contractor will not be allowed to dispose of woody debris in wooded areas along the pipeline ROW.

- Prune branches hanging over the ROW only when necessary for construction. Any branch that is broken or seriously damaged should be cut off near its fork, and the collar of the branch should be preserved.
- All tree wastes, stumps, tree crown, brushes, branches, and other forest debris will be either burned, chipped (using a mobile chipper), or removed from the ROW. Chips must not be spread over cultivated land; however, they may be spread and incorporated with mineral soil over the forest floor at a density that will not prevent revegetation of grass.
- Stump removal and brush clearing will be performed with bulldozers equipped with brush rakes to preserve organic matter.
- Establish decking sites, approximately 2,000 feet apart in timbered areas, on sites located on approved temporary workspaces in existing cleared areas, and size them appropriately to accommodate the loading equipment.
- The Contractor will remove decked timber from the construction ROW and transport it to a designated all-weather access point or mill if the landowner does not want the timber.

To minimize impacts on native forest communities, **the following measures are recommended:**

- **Keystone should minimize impacts to native wooded communities (John Cochnar, USFWS, May 27, 2007) by:**
  - **Siting extra workspaces outside of forested areas,**
  - **Minimizing the width of the construction area within forested areas, and**
  - **Continuing consultation with federal and state management agencies on avoidance of forested community impacts.**
- **Keystone should mitigate unavoidable impacts to native wooded communities at a minimum replacement of 2 acres of native forest for each acre of native forest impact; higher ratios may be applicable if mitigation ratios already have been determined for specific habitat at the state level by federal and/or state resource agencies (John Cochnar, USFWS, May 27, 2007).**
- **Keystone should evaluate terrestrial vegetation impacts and habitat fragmentation impacts to COE lands in the Riverlands Management Area in St. Charles County, Missouri, and in the Carlyle Lake WMA in Fayette County, Illinois to determine compensatory mitigation for impacts to these habitats (St. Louis District COE, May 2007).**

3.5.5.3 Conservation Reserve Program

Temporary and permanent impacts on CRP land generally would be the same as those described above for vegetation. Keystone has committed to avoiding impacts to the three CRP lands potentially crossed by the Project ROW.

3.5.5.4 Noxious Weeds

After disturbances to the soil, vegetation communities can be susceptible to infestations of invasive or noxious weed species. Vegetation removal and soil disturbance during construction could create optimal conditions for the establishment of undesirable species. Construction equipment traveling from weedinfested areas into weed-free areas could disperse invasive or noxious weed seeds and propagates, resulting in the establishment of noxious weeds in previously weed-free areas.

A number of federal and state agencies submitted comments requesting that disturbed areas be revegetated with native plant species that currently are found in the Keystone Project area. Keystone proposes to control the introduction and spread of noxious weeds by implementing the construction and restoration procedures detailed in its Mitigation Plan.

Keystone's Mitigation Plan includes coordination with appropriate local, state, and federal agencies to:

- Obtain written recommendations from local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specification; and
- Develop specific procedures in coordination with the appropriate agency to prevent the introduction or spread of noxious weeds resulting from construction and restoration activities, including:
  - Ensuring that all soil imported for agricultural or residential use has been certified as weed-free,
  - Ensuring that only weed-free straw or hay for sediment control devices or mulch application,
  - Cleaning all equipment and vehicles prior to beginning of construction, and
  - Monitoring restoration for 3 years following construction in wetlands and during the first and second growing seasons in uplands.

Weed control addressed in Section 2.13 of Keystone's Mitigation Plan includes the following measures:

- Thoroughly clean all construction equipment, including timber mats, prior to moving the equipment to the job site, using high-pressure washing equipment.
- Mark all areas of the ROW that contain infestations of noxious, invasive species or soil-borne pests. Clean the tracks, tires, and blades of equipment by hand or compressed air to remove excess soil prior to movement of equipment out of weed- or soil-borne pest-infested areas.
- Use mulch and straw or hay bales that are free of noxious weeds for temporary erosion and sediment control.
- Apply pre-construction treatments such as mowing prior to seed development or herbicide application to areas of noxious weed infestation prior to other clearing, grading, and trenching or other soil-disturbing work at the identified locations.
- Where required, apply herbicides by state-licensed or -certified personnel, within 1 week or as deemed necessary for optimum mortality success prior to disturbing the area by clearing, grading, trenching, or other soil-disturbing work.
- Prohibit application of herbicides in or within 100 feet of a wetland or water body.
- Provide weed control on the construction ROW with Keystone surface jurisdiction (i.e., valve sites, metering station, and pump stations).
- Reimburse landowners adjacent to aboveground facilities when landowners must control weeds determined to have spread from land with Keystone aboveground facilities.

Although these measures would minimize the spread of noxious weeds during construction, additional measures should be taken to ensure that all federal, state, and local agency concerns regarding noxious weeds have been addressed. Therefore, **the following measures are recommended:**

- **Keystone should develop a Project-wide noxious weed control plan, which should identify noxious weeds and exotic plants within the Project area and should describe prevention, early detection of invasion, and control procedures for each species (Larry Svoboda, EPA, November 30, 2006).**
- **Keystone should ensure that all construction equipment will be completely washed down before crossing the state line from Kansas into Oklahoma to avoid transfer of noxious or other invasive species across state lines (John Cochnar, USFWS, April 28, 2006).**

3.5.5.5 Connected Action

In modifying or constructing transmission line substations to support the Keystone Project, Western would implement the following mitigation measures for Terrestrial Vegetation:

- ROW would be located to avoid sensitive vegetation conditions including wetlands where practical, or, if they are linear to cross them at the least sensitive feasible point.
- Clearing for the access roads would be limited to only those trees necessary to permit the passage of equipment.
- Water bars or small terraces would be constructed across all ROW and access roads on hillsides to prevent water erosion and to facilitate natural revegetation.
- Western or its contractor would exercise care to preserve the natural landscape and would conduct construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, approved construction roads, or excavation operations, all trees, native shrubbery, and vegetation would be preserved and would be protected from damage by construction operations and equipment.
- Construction staging areas would be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all storage and construction buildings, including concrete footings and slabs, and all construction materials and debris would be removed from the site. The area would be regraded as required so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that would facilitate natural revegetation, provide for proper drainage, and prevent erosion.
- Topsoil would be removed, stockpiled, and respread at all heavily disturbed areas not needed for maintenance access.
- All construction equipment and vehicles would be pressure-washed (especially the undercarriage) to remove foreign soil and debris that may introduce weeds into the project area.
- On completion of the work, all work areas except access roads needed for maintenance would be scarified or left in a condition which would facilitate natural revegetation, provide for proper drainage, and prevent erosion. All destruction, scarring, damage, or defacing of the landscape resulting from Western or its contractor's operations would be repaired.
- If revegetation is required, regionally native plants would be used.

3.5.6 References

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3.6 WILDLIFE

The seven-state Keystone Project area encompasses a diversity of wildlife; including large and small mammals, raptors, waterfowl, songbirds, snakes, lizards, turtles, and various amphibians. Wildlife habitats along the Keystone Project ROW include agricultural land, grasslands (short-grass prairie, mixed-grass prairie, and tall-grass prairie), forests and woodlands, wetlands and riparian areas, and shrublands. These vegetation communities provide foraging, cover, and breeding habitats for wildlife. This section addresses general wildlife resources, big game animals, small game animals, and raptors and other migratory birds in the Keystone Project area.

3.6.1 General Wildlife Resources

Typical habitats for representative big game animals, small game animals, furbearers, waterfowl, and game birds are described in Table 3.6.1-1, which also lists estimated harvest levels by state during 2005. Most hunting for big and small game animals, upland game birds, and waterfowl occurs during fall. Turkeys are hunted both spring and fall, with most harvest occurring during the spring hunts.

3.6.2 Big Game Animals

White-tailed deer is the principal big game species that occurs along the entire pipeline route. White-tailed deer are highly adaptable and inhabit a variety of habitats, including cropland, grasslands, shrublands, orchards, and woodlands. White-tailed deer may be found in close association with humans. In the northern portions of their range, they will aggregate or "yard" during winter in stream bottoms, on south-facing slopes, or other areas where snow accumulations are reduced. Mule deer, pronghorn, and elk are generally found west of the Keystone Project area. Isolated populations of pronghorns extend into eastern South Dakota. Elk have been reintroduced into isolated wildlife areas. The northeast corner of North Dakota is the only area along the proposed route where elk may be present. Moose occur along the proposed route in the northeastern portion of North Dakota. Black bear are common only in southeastern Missouri, where they are hunted.

TABLE 3.6.1-1
Game Animals That Occur along the Keystone Project Route

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
BIG GAME								
White-tailed deer (*Odocoileus virginianus*)	√	√ 60,000	√	√	√ 313,000	√ 114,000	√ 101,000	Found in various habitats—from forest to fields—with adjacent cover. In northern regions, usually require stands of conifers for winter shelter. In the north and in mountain regions, limited ecologically by the depth, duration, and quality of snow cover; summer ranges are traditional, but winter range may vary with snow conditions.
Mule deer (*Odocoileus hemionus*)	√	√ 14,000	√	√			√	Found in coniferous forests, desert shrub, chaparral, grasslands with shrubs, and badlands. Often associated with successional vegetation, especially near agricultural lands. Generally found west of Keystone Project area.
Pronghorn (*Antilocapra americana*)	√	√	√	√			√	Generally found in grasslands, sagebrush plains, deserts, and foothills. Need for free water varies with succulence of vegetation in the diet. Generally found west of Keystone Project area.
Elk (*Cervus canadensis*)	√	√	√	√				Found over a range of habitats. Uses open areas, such as alpine pastures, marshy meadows, river flats, and aspen parkland, as well as coniferous forests, brushy clear cuts or forest edges, and semi-desert areas.
Moose (*Alces alces*)	√							Prefers mosaic of second-growth forest, openings, swamps, lakes, and wetlands. Requires water bodies for foraging and hardwood-conifer forests for winter cover. Avoids hot summer conditions by using dense shade or bodies of water.
Black bear (*Ursus americanus*)					√			Prefers mixed deciduous-coniferous forests with thick understory but may occur in various situations. In Keystone Project area, restricted to southern and southeast Missouri.

TABLE 3.6.1-1
(Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
SMALL GAME								
Eastern gray squirrel (*Sciurus carolinensis*)	√	√	√	√	√	√	√	Prefers mature deciduous and mixed forests with abundant supplies of acorns and hickory nuts. Diversity of nut trees needed to support high densities. Uses city parks and floodplain forests. Seldom far from permanent open water. Nests in tree cavities or in leaf nests. usually 25 feet or more above ground.
Eastern fox squirrel (*Sciurus niger*)	√	√	√	√	√	√	√	Found in open mixed hardwood forests or mixed pine-hardwood associations; species also has adapted well to disturbed areas, hedgerows, and city parks. Prefers savannas or open woodlands to dense forests. Western range extensions are associated with riparian corridors of cottonwoods and fencerows of osage-orange. Dens are in tree hollows or leaf nests.
Eastern cottontail (*Sylvilagus floridanus*)	√	√ 138,000	√	√	√	√ 331,000	√	Inhabits cropland/hedgerow, grassland/ herbaceous, old field, shrubland/chaparral, suburban/orchard, woodland-hardwood, and woodland-mixed forests. Mix of row crops, small grain, and legume fields with shrubby fencerows, old pasture, and forest edge. Burrows in or using soil and fallen log/debris. Early mid-successional habitats over much of continental United States. May be found in brushy areas, open woodlands, swampy areas, stream valleys, grasslands, and suburbs. Very adaptable species. Nests usually are in shallow depressions, in thick vegetation or in underground burrows.
FURBEARERS								
Coyote (*Canis latrans*)	√	√	√ 34,000	√ 21,800	√ Common	√	√	Wide ranging and found in virtually all habitats. Often considered pest species, especially by the livestock industry. Control programs have been largely ineffective.

Class and Species	ND	SD	NE	KS	MO	IL	OK	Habitat
	Occurrence and 2005 Harvest Estimate by State [a]							
FURBEARERS (CONTINUED)								
Red fox (*Vulpes vulpes*)	√	√	√ 3,800	√ 459	√ Common	√	√	Found in various open and semi-open habitats. Usually avoids dense forest, although open woodlands are frequently used. Sometimes occurs in suburban areas or cities. Maternity dens are in burrows dug by fox or abandoned by other mammals, often in open fields or wooded areas; sometimes under rural buildings, in hollow logs, or under stumps.
Gray fox (*Urocyon cinereoargenteus*)	√	√	√	√ 89	√ Common	√	√	Found in a variety of habitats, including chaparral, rimrock, riparian, old fields, and early-successional-stage woodlands. Usually prefers diversity of open and wooded areas rather than large tracts of homogeneous habitat.
Swift fox (*Vulpes velox*)	√ Rare	√ Rare	√ Rare	√ 206				Prefers short-grass and mixed-grass prairies over most of the Great Plains. Also will use agricultural lands and irrigated meadows, generally west of Keystone Project area. Protected.
Raccoon (*Procyon lotor*)	√	√	√ 171,800	√ 66,400	√	√	√	Found in variety of habitats but prefers riparian and edges of wetlands, ponds, streams, and lakes.
Ermine (*Mustela erminea*)	√							Found in agricultural lowlands, woodlands, and meadows.
Long-tailed weasel (*Mustela frenata*)	√	√	√	√	√	√	√	Most widespread of the weasels and found in all habitats in Keystone Project area but prefers shrublands, open woodlands, and habitats near water.
Least weasel (*Mustela nivalis*)	√	√	√					Inhabits cultivated fields, brushy areas, open woods, wetland edges, and meadows.
Mink (*Mustela vision*)	√	√	√ 3,990	√ 206	√ Common	√	√	Occurs in wetlands, riparian woodlands, lake and river edges, and near ponds.

TABLE 3.6.1-1 (Continued)

TABLE 3.6.1-1
(Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
FURBEARERS (CONTINUED)								
Striped skunk (*Mephitis mephitis*)	√	√	√ 20,520	√ 12,730	√ Common	√	√	Prefers semi-open country with woodland and meadows interspersed with brushy areas, and bottomland woods. Frequently found in suburban areas. Dens often under rocks, logs, or buildings. May excavate burrow or use burrow abandoned by other mammals.
Eastern spotted skunk (*Spilogale putorius*)	√	√	√	√	√		√	Found in forested areas or habitats with significant cover. Also uses open and brushy areas, rocky canyons, and outcrops in woodlands and prairies. When inactive or bearing young, occurs in dens—in burrows abandoned by other mammals, under brush piles, in hollow logs or trees, in rock crevices, under buildings, or in similar protected sites.
Opossum (*Didelphis marsupialis*)		√	√ 32,400	√ 38,900	√ Abundant	√	√	Uses cropland/hedgerow, grassland/ herbaceous, old field, shrubland/chaparral, suburban/orchard, forested wetlands, herbaceous wetland, and riparian habitats in Keystone Project area. Also uses forest and woodland hardwood, and mixed forest. Constructs burrows in or using soil, fallen logs/debris, and standing snags or hollow trees. Very adaptable; may be found in most habitats. Prefers wooded riparian habitats. Also in suburban areas. Generally uses abandoned burrows, buildings, hollow logs, and tree cavities for den sites.
American badger (*Taxidea taxus*)	√	√	√ 3,942	√ 1,312	√	√	√	Prefers open grasslands and field, and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.
Bobcat (*Felis rufus*)	√		√ 1,308	√ 7,458			√	Found in woodlands, brushlands, and wooded swampy areas.

TABLE 3.6.1-1
(Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
FURBEARERS (CONTINUED)								
American beaver (*Castor canadensis*)	√	√	√ 16,074	√ 7,200	√ Common	√	√	Inhabits permanent sources of water of almost any type in its range, which extends from arctic North America to Gulf of Mexico and arid Southwest, and from sea level to over 6,800 feet in mountains. Prefers low-gradient streams, which it modifies), ponds, and small mud-bottomed lakes with outlets that can be dammed. Associated with deciduous tree and shrub communities.
WATERFOWL								
Dark Geese								
Canada goose (*Branta canadensis*) White-fronted goose (*Anser albifrons*)	√ 133,200	√ 79,800	√ 102,100	√ 100,150	√ 40,430	√ 104,600	√ 31,000	Found in various habitats near water, from temperate regions to tundra. Usually breeds and feeds in areas near lakes, ponds, large streams, and inland and coastal marshes. Forages in pastures, cultivated lands, grasslands, and flooded fields. Canada geese present in Keystone Project area year-round, white-fronted geese occur in Keystone Project area during spring and fall migrations. Widely hunted, with an estimated Mississippi Flyway harvest of 1.0 million and Central Flyway harvest of 735,000 (USFWS 2006).
Light Geese								
Snow goose (*Chen caerulescens*) Ross's goose (*Chen rossii*)	√ 20,100	√ 23,300	√ 11,600	√ 8,150	√ 39,300	√ 6,200	√ 11,500	Found in various habitats near water, from temperate regions to tundra. Winters in both freshwater and coastal wetlands, wet prairies, and extensive sandbars; forages in pastures, cultivated lands, and flooded fields. In Keystone Project area during spring and fall migrations. Widely hunted, with an estimated Mississippi Flyway harvest of 250,000 and Central Flyway harvest of 360,000 (USFWS 2006).

TABLE 3.6.1-1
(Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
WATERFOWL (CONTINUED)								
Light Geese (continued)								
Tundra swan (*Cygnus columbianus*)	√	√ 120	√	√	√	√	√	Generally found in lakes, sloughs, rivers, and sometimes fields during migration. Open marshy lakes and ponds, and sluggish streams in summer. Present in Keystone Project area during spring and fall migration; hunted in North Dakota and South Dakota, with estimated harvest of several hundred birds.
Dabbling Ducks								
Mallard (*Anas platyrhynchos*)	√ 450,200	√ 165,100	√ 156,100	√ 150,000	√ 438,000	√ 339,400	√ 262,650	Primarily found in shallow waters, such as ponds, lakes, marshes, and flooded fields; in migration and in winter, mostly found in fresh water and cultivated fields, less commonly in brackish situations. Both migratory and resident populations may occur in Keystone Project area. Widely hunted, with estimated Mississippi Flyway harvest of 4.7 million and Central Flyway harvest of 2.5 million during 2005 (USFWS 2006).
Gadwall (*Anas strepera*)								
Green-winged teal (*Anas crecca*)								
Blue-winged teal (*Anas discors*)								
Cinnamon teal (*Anas cyanoptera*)								
American wigeon (*Anas americana*)								
Northern shoveler (*Anas clypeata*)								
Northern pintail (*Anas acuta*)								

TABLE 3.6.1-1
(Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
WATERFOWL (CONTINUED)								
Diving Ducks								
Ring-necked duck (*Aythya collaris*) Lesser scaup (*Aythya affinis*) Redhead (*Aythya americana*) Bufflehead (*Buchephala albeola*) Canvasback (*Aythya valisineria*) Greater scaup (*Aythya marila*) Hooded merganser (*Lophodytes cucullatus*)	√ 69,170	√ 13,900	√ 8,600	√ 7,950	√ 27,200	√ 41,000	√ 22,460	Commonly found on marshes, ponds, lakes, rivers, and bays. Widely hunted, with estimated Mississippi Flyway harvest of 580,000 and Central Flyway harvest of 260,000 during 2005 (USFWS 2006).
American coot (*Fulica americanan*)	√ 800	√ 5,300	√ 1,500	√ 400	√ 400	√ 4,300	√ 200	Commonly found on marshes, ponds, lakes, rivers, and bays. Widely hunted, with estimated Mississippi Flyway harvest of 110,000 and Central Flyway harvest of 15,000 during 2005 (USFWS 2006).
GAME BIRDS								
Sandhill crane (*Grus canadensis*)	√ 3,792	√ 190	√	√ 475			√ 513	During migration, roosts at night along river channels, on alluvial islands of braided rivers, or natural basin wetlands. Communal roost site consisting of an open expanse of shallow water is key feature of wintering habitat. Occurs throughout Keystone Project area during spring and fall migrations. Hunted during fall in North Dakota and South Dakota, and during fall and winter in Oklahoma. Estimated Central Flyway harvest of 18,575 during 2005 (Sharp et al. 2006).

TABLE 3.6.1-1
(Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
GAME BIRDS (CONTINUED)								
Wild turkey (*Meleagris gallopavo*)	√	√	√	√	√ 63,000	√ 16,000	√ 45,000	Resident game birds found in forest, open woodland, scrub oak, and deciduous or mixed deciduous-coniferous forests. Also uses agricultural areas, which may provide important food resources. Roosts in trees at night and nests on ground, usually in open areas at the edge of woods. Widely hunted.
Greater prairie chicken (*Tympanus cupido*)	√	√		√	√		√	Inhabits tall grassland prairies and occasionally croplands. Nests in grasslands, prairies, pastures, and hayfields.
Sharp-tailed grouse (*Tympanuchus phasianellus*)	√	√	√					Inhabits short to tall grasslands intermixed with cropland and shrublands.
Ruffed grouse (*Bonasa umbellus*)	√	√ 39,188						Inhabits mixed and deciduous woodlands. Not common in Keystone Project area.
Northern bobwhite (*Colinus virginianus*)		√ 1,717	√	√	√	√	√	Inhabits a wide variety of vegetation types, particularly early-successional stages. Occurs in croplands, grasslands, pastures, fallow fields, grass-brush rangelands, open pinelands, open mixed pine-hardwood forests, and habitat mosaics. In Midwest and Northeast, associated principally with heterogeneous, patchy landscapes comprised of moderate amounts of row crops and grasslands, and abundant woody edge. Nests on the ground, in a scrape lined with grasses or dead vegetation.
Woodcock (*Scolopax mir*) Snipe (*Gallinago gallinago*)	√ 600	√ 100	√ 2,300	√ 900	√ 1,600	√ 7,800	√ 600	Wetlands, marshes, moist woodlands, and thickets. Woodcock harvested in Illinois, Missouri, Nebraska, and Kansas—5,200 during 2005. Snipe harvested in Central and Mississippi Flyways—48,300 during 2005 (USFWS 2006).

TABLE 3.6.1-1 (Continued)

Class and Species	Occurrence and 2005 Harvest Estimate by State [a]							Habitat
	ND	SD	NE	KS	MO	IL	OK	
GAME BIRDS (CONTINUED)								
Ring-necked pheasant (*Phasianus colchincus*)	√	√ 1,653,26 5	√	√	√ 31,204	√ 155,000	√	Non-native game bird; inhabits open country (especially cultivated areas, scrubby wastes, open woodland, and edges of woods), grassy steppe, desert oases, riverside thickets, swamps, and open mountain forest. Winter shelter includes bushes and trees along streams, shelterbelts, and fencerows. Usually nests in fields, brushy edges, or pastures; also along road rights-of-way. Nest is shallow depression scratched out by female.
Gray partridge (Hun) (*Perdix perdix*)	√	√ 9,280	√					Non-native game bird; inhabits cultivated lands, hedgerows, brushy pastures, and meadows.
Mourning dove (*Zenaida macrora*)	√ 55,500	√ 127,700	√ 371,100	√ 680,400	√ 641,800	√ 798,800	√ 828,500	Inhabits open woodlands, forest edge, cultivated lands with scattered trees and bushes, and arid and desert country. Widely hunted—9.0 million estimated harvest during 2005 (USFWS 2006).

[a] State abbreviations: ND =North Dakota, SD = South Dakota, NE = Nebraska, KS = Kansas, MO = Missouri, IL = Illinois, OK = Oklahoma.

√ = Indicates that the species occurs in the state. Numbers that may follow are the 2005 harvest estimate.

Sources: Adapted from ENSR 2006a; occurrence information (Natureserve 2006); harvest information (state wildlife management agency web sites, USFWS 2006, Shart et al. 2006).

3.6.3 Small Game Animals

The small game animals most often hunted in the Project area include ducks, geese, turkeys, squirrels, cottontails, and mourning doves. Waterfowl are harvested primarily in fall; however, spring light goose seasons (snow and Ross's geese) are open in some areas in response to expanding populations of these birds that nest in arctic Canada. Many waterfowl breed in habitats that would be crossed by the pipeline, and additional migrants pass through the Keystone Project area to northern breeding grounds during both spring and fall. The Keystone Project area crosses both the Central and Mississippi Flyways. Waterfowl that occur only as migrants in the Keystone Project area include snow geese, Ross's geese, white-fronted geese, and sandhill cranes. Sandhill cranes are hunted in North Dakota, eastern portions of South Dakota, Kansas, and Oklahoma. Nebraska is closed to hunting for sandhill cranes (Sharp et al. 2006). Turkeys are hunted primarily during spring (bearded birds—males only), when most harvest occurs; but they also may be taken during fall hunts, which are usually open for any turkey.

3.6.4 Raptors and Other Migratory Birds

Numerous migratory and resident bird species occupy habitats that would be crossed by the pipeline ROWs. All migratory birds are protected by the Migratory Bird Treaty Act (MBTA) (16 USC 703–712; 40 Stat. 755 as amended) which prohibits the take of any migratory bird without authorization from USFWS. The MBTA states that "unless and except as permitted by regulations. . . it shall be unlawful at any time, by any means or in any manner, to . . . take, capture, kill, possess. . . any migratory bird, any part, nest, or eggs of any such bird. . .". Non-migratory birds such as upland game birds and non-native birds such as European starling, pigeon (rock dove), and English house sparrow are not protected by the MBTA. Eagles and their nests are further protected by the Bald and Golden Eagle Protection Act (16 USC 688–688d [a and b]), and bald eagles are further protected by the ESA of 1973 (87 Stat. 884, as amended; 16 USC 1531 et seq.). Eagles are discussed in Section 3.8. Destruction or disturbance of a migratory bird nest that results in the loss of eggs or young is a violation of the MBTA.

Aerial surveys were conducted along the entire Mainline Project and Cushing Extension ROWs from January 30 to February 4, 2007, to identify raptor nest sites in deciduous trees within or next to the Keystone Project ROW (ENSR 2007a). A total of 103 nests were documented within 300 feet of the Keystone Project ROW; 86 along the Mainline Project and 17 along the Cushing Extension. Of those nests identified by species, there were 35 red-tailed hawk nests, 14 crow nests, 3 great horned owl nests, 4 Swainson's hawk nests, 2 Cooper's hawk nests, 1 sharp-shinned hawk nest, and 2 osprey nests at artificial nest stands. Of those nests that could not be definitively identified by species, 35 were Cooper's hawk or sharp-shinned hawk nests, 3 were these hawks or great-horned owl nests, and 2 were unknown. Woodlots (40 percent) were the most common habitats recorded for raptor nests, followed by riparian habitats (35 percent), and shelterbelts (19 percent).

3.6.5 Potential Impacts and Mitigation

The pipeline ROW would cross habitats set aside for wildlife, as described in Table 3.6.5-1. The Mainline Project and Cushing Extension pipeline primarily would affect wildlife resources by:

- Habitat loss, alteration, and fragmentation;
- Loss of breeding success from exposure to construction and operations noise, and from increased human activity;

TABLE 3.6.5-1 Important Wildlife Habits along the Keystone Project Route			
Milepost	**Name**	**Ownership and Description**	**Miles**
North Dakota			
Various	U.S. Fish and Wildlife Service (USFWS) wetland easements	Private	24.0
Various	USFWS conservation easements	Private	0.3
Various	Conservation easement	Private – North Dakota Game and Fish	6.1
6.9	Tetrault Woods State Forest	North Dakota State Forest	0.8
8.0	Pembina River	State of North Dakota	0.1
25.0	Forest	North Dakota State Forest	3.5
18.4	Tongue River	State of North Dakota	<0.1
54.5	Middle Branch Forest River	State of North Dakota	<0.1
168.5	Sheyenne River	State of North Dakota	<0.1
187.2	Wildlife Preserve	Private	0.5
South Dakota			
228.4	Game production area	South Dakota Game Fish and Parks Department	0.5
Various	USFWS wetland easements	Private	11.8
Various	USFWS conservation easements	Private	0.5
Various	USFWS grassland easement	Private	1.0
433.5	Missouri National Recreational River	Private, and National Park Service	2.3
Nebraska			
435.8	Missouri National Recreational River	National Park Service	0.1
542	Platte River	State of Nebraska	<0.1
Kansas			
50.0	Milford State Wildlife Management Area	U.S. Army Corps of Engineers	3.4
Missouri			
748.5	Pigeon Hill Conservation Area	U.S. Army Corps of Engineers	0.1
748.3	Western Missouri River Alluvial Plain Conservation Opportunity Area (COA)	Private and Missouri Conservation Department	4.4
758.4	Pigeon Hill Conservation Area	Missouri Department of Conservation	0.6
767.4	Platte River Loess Prairie/ Woodland Hills COA	Private	1.4
771.0	Little Platte River Woodland COA	Private	1.2
779.3	Cameron Upland Prairie Plain COA	Private	2.2
823.0	Shoal Creek Prairie	Private	0.8
825.9	Shoal Creed Prairie/Woodland Scarped Plain COA	Private	0.6
838.8	Lower Grand River Lowland Plains COA	Private	2.8
867.7	Lower Chariton Woodland/ Forest Hills COA	Private	1.3
871.4	Lower Chariton Woodland/ Forest Hills COA	Private	0.8
923.4	West Fork Cuivre River	State of Missouri	0.1

TABLE 3.6.5-1 (Continued)			
Milepost	**Name**	**Ownership and Description**	**Miles**
Missouri (continued)			
961.1	Cuivre River Woodland/ Forest Hills COA	Private	1.9
970.5	Cuivre River Woodland/ Forest Hills COA	Private	2.3
983.0	Cuivre River Woodland/ Forest Hills COA	Private	0.2
983.7	Cuivre River Woodland/ Forest Hills COA	Private	0.6
984.9 – 1,019.9	St. Charles County Prairie / Woodland Low Hills, other COAs	Private	35.0
1,019.9	Edward "Ted" and Pat Jones Confluence Point State Park	Missouri Department of Natural Resources	1.2
Illinois			
1,069.60	Carlyle Lake Wildlife Management Area	Illinois Department of Natural Resources and U.S. Army Corps of Engineers	3.1

Note:

In Oklahoma, no important wildlife habitats occur in the Keystone Project vicinity.

Sources: Adapted from TransCanada 2007b and ENSR 2006a.

- Direct morality from Keystone Project construction and operation;
- Direct mortality due to collision with or electrocution by power lines; and
- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 3.13, Safety and Reliability).

Pipeline construction would result in short-term disturbance and long-term habitat modification to 11 acres in the Pigeon Hill State Wildlife Area in Buchanan County, Missouri, and 33 acres in the Carlyle Lake WMA in Fayette County, Illinois. The Keystone Project also would intersect or potentially affect four terrestrial Conservation Opportunity Areas (COAs) in Missouri, which are included in Table 3.6.5-1. Long-term conversion of wooded habitats to herbaceous communities would result in increased habitat fragmentation in these state WMAs and COAs.

Three proposed blasting locations would potentially affect important wildlife habitats along the Keystone Project. These locations are within the Platte River Loess Prairie/ Woodland Hills COA (MP 767), the Lower Chariton Woodland/ Forest Hills COA (MP 867–871), and the Cuivre River Woodland/ Forest Hills COA (MP 961–970). Blasting can cause both short-term disturbance, in the form of increased noise, dust, and vibration, and permanent habitat modification. Recommendations for blasting operations and mitigation measures to decrease the effects are found in Section 3.1.1.2.

Loss of shrublands and wooded habitats would be long term (5–20 years) within reclaimed areas of the construction ROW. Additional shelterbelt habitats along fields that were too small to be quantified (habitats less than 50 feet wide were not mapped) across the 1,300-mile ROW would be lost. Due to the linear nature of the ROW, these long-term habitat losses represent a small total area of available habitat and therefore are expected to have little impact on wildlife species (Table 3.6.5-2).

TABLE 3.6.5-2 Summary of Wildlife Habitat Impacts for the Keystone Project		
Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)
Cropland	932.7	13,594
Grassland/rangeland	286.9	4,112
Upland and riparian forests	72.0	1,078
Riverine/open water	10.1	147
Emergent/scrub-shrub wetlands	49.1	698
Keystone Project total	**1,350.8**	**19,629**

Source: TransCanada 2007a, Table 3.5.5-3.

Permanent habitat loss would occur along shelterbelts, windbreaks, and living snow fences that are intersected by the Keystone Project. Most of these habitats would be identified as cropland due to the resolution of habitat mapping. Those areas crossed as part of the construction ROW would be removed of trees and brush to provide access to construction equipment. At the intersection points that are part of the permanent ROW, trees and brush would not be allowed to revegetate. Keystone has identified mitigation procedures in the Mitigation Plan to minimize adverse effects in these areas. Additional recommendations for procedures can be found in Section 3.9.3.2.

Keystone Project construction would affect white-tailed deer by loss of potential foraging and cover habitats, and would result in increased habitat fragmentation. Noise and increased human activity during construction would lead to short-term displacement of some individuals from the construction area. Winter construction at woodlands or in riparian corridors with denning black bears in Missouri could lead to destruction of bears and dens during hibernation. Disturbance of female bears with newborn cubs likely would lead to the death of the newborn cub(s).

Potential impacts on small game animals include nest or burrow destruction or abandonment and loss of eggs or young, foraging, and cover habitat. Losses of active waterfowl nests, incubating adults, eggs, or young also could occur. Habitat loss and fragmentation would occur until vegetation is reestablished; then the habitat may be degraded due to the spread of noxious and invasive species. For species that use tree and shrub habitats for cover, forage, and nesting, these losses would be long term because the permanent ROW would be maintained free of trees and large shrubs. Displacement or attraction of small game animals from disturbance areas would be short term, as animals would be expected to return following completion of construction and reclamation activities.

To minimize potential construction- and operations-related effects, Keystone would implement procedures outlined in its Mitigation Plan. Pipeline construction would be conducted in accordance with any required permits.

Keystone has committed to implementing the following measures in its Mitigation Plan to protect wildlife:

- Bevel shavings produced during pipe bevel operation will be removed immediately to ensure that livestock and wildlife do not ingest this material.

- Litter and garbage that could attract wildlife will be collected and removed from the construction site at the end of the day's activities.
- Feeding or harassment of livestock or wildlife is prohibited.
- Construction personnel will not be permitted to have firearms or pets on the construction ROW.
- All food and wastes will be stored and secured in vehicles and/or appropriate facilities.
- Areas of disturbance in native range will be seeded with a native seed mix after topsoil replacement.

Total habitat loss due to pipeline construction would be small in the context of total available habitat, because of the linear nature of the Keystone Project and because restoration would follow pipeline construction. However, if disturbance involved important remnant habitats, such as prairie chicken leks or cricket frog marshes, habitat loss would significantly affect local populations. Normal operation of the pipelines would result in negligible effects on terrestrial wildlife. Direct impacts from maintenance activities, such as physical pipe inspections or ROW repair, would be the same as those for construction. Keystone would consult with appropriate state wildlife agencies prior to initiation of maintenance activities beyond standard inspection procedures.

Keystone has committed to the implementing the following measures in its Mitigation Plan to protect sensitive wildlife species:

- Keystone will contract a qualified biologist to conduct a survey of sensitive species associated with native tall-grass prairie. Locations of sensitive species found will be documented; if sensitive species are identified in the ROW, Keystone will work with the relevant regulatory authorities to determine whether any additional protection measures would be required.
- Disturbance in native prairie will be reclaimed to native prairie species using native seed mixes specified by applicable state and federal agencies, to ensure no net loss of native prairie habitat.
- Where avoidance of native tall-grass prairie by the pipeline ROW is infeasible, appropriate surveys will be implemented to ensure that populations of sensitive wildlife species are not affected.
- Keystone will contract a qualified biologist to conduct a survey of breeding bird habitat within 330 feet of proposed surface disturbance activities that would occur during the breeding season. The biologist will document active nests, bird species, and other evidence of nesting (e.g., mated pairs, territorial defense, and birds carrying nesting material or transporting food). If the biologist documents an active nest for a species that is designated as a migratory bird during the survey, Keystone will work with USFWS to identify measures to comply with the MBTA.
- Immediately prior to construction activities during the raptor breeding season (February 1–July 31), breeding raptor surveys will be conducted by a qualified biologist through areas of suitable nesting habitat to identify any potentially active nest sites in the Keystone Project area. If raptors are identified within 0.5 mile of the construction ROW, Keystone will work with USFWS and state agency wildlife biologists to determine whether additional mitigation is needed to protect raptors.. These measures will be implemented on a site-specific and species-specific basis, in coordination with USFWS and state agency wildlife biologists.

Approximately 161 miles of new electrical power lines would be necessary to power pump stations along the pipeline ROW (see Sections 2.1.1.2 and 2.1.2.2). Approximately 61 percent of these lines (98 miles) would be located in proximity to prairie potholes in North Dakota and South Dakota, which are notable waterfowl production areas. Other routes would cross rivers and riparian areas that are likely to attract raptors and migratory birds. These new electrical power line segments would increase the collision potential for migrating and foraging birds. Factors influencing collision risk are related to the avian species, the environment, and the configuration and location of lines. Species-related factors include habitat use, body size, flight behavior, age, sex, and flocking behavior. Heavy-bodied, less agile birds—or birds within large flocks, as is typical of migrating sandhill cranes—may lack the ability to quickly negotiate obstacles, making them more likely to collide with overhead lines. Environmental factors influencing collision risk include weather, time of day, lighting and line visibility, land use practices that may attract birds (such as grain fields), and human activities that may flush birds (such as nearby roadways). Power line-related factors influencing collision risk include the configuration and location of the line and line placement with respect to other structures or topography (APLIC and USFWS 2005).

Birds are electrocuted by power lines because of two factors: (1) environmental factors such as topography, vegetation, available prey, and other behavioral or biological factors that influence avian use of power poles; and (2) inadequate separation between energized conductors or energized conductors and grounded hardware that provide two points of contact (APLIC and USFWS 2005). Raptors are opportunistic and may use power poles for nesting sites, vantages for territorial defense, or vantages for hunting. Power poles and lines may provide perches for hunting that offer a wide field of view above the surrounding terrain (APLIC and USFWS 2005).

Collision and electrocution impacts on birds resulting from the Keystone Project would be reduced if electrical service providers agree to implement mitigation measures such as incorporation of:

- Standard, safe designs, as outlined in Suggested Practice for Avian Protection on Power Lines (APLIC 2006), into the design of electrical distribution lines in areas of identified avian concern.
- Marking techniques to increase transmission line visibility using balls or flappers.
- A minimum 60-inch separation between conductors and/or grounded hardware and recommended use of insulation materials and other applicable measures, depending on line configuration.
- Standard raptor-proof designs, as outlined in Avian Protection Plan Guidelines (APLIC and USFWS 2005), into the design of the electrical distribution lines to prevent collision by foraging and migrating raptors in the Keystone Project area.

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3.7 FISHERIES

3.7.1 Fisheries Resources

Two categories of fisheries resources are examined in this report: species of concern and special-status species. The species of concern are those that have been identified by a state as occurring at or immediately downstream of proposed crossings and have recreational or commercial value. Special-status species include the species that are state listed or listed under the federal ESA as threatened, endangered, or sensitive. Section 3.7.2 describes the species of concern by state for those states that would be crossed by the Keystone pipeline. Special-status species are discussed in Section 3.8.

The water bodies in consideration include those that would be directly crossed by the proposed pipeline route and those that are located within approximately 0.5 mile of the proposed crossing and support recreationally or commercially important game fish. The types of water bodies that are included in the study area include lakes, ponds, rivers, and perennial and intermittent streams. Perennial streams are those that contain water at all times except in the case of an extreme drought. An intermittent stream contains water most of the time, but ceases to flow occasionally or seasonally. The Mainline Project route would cross 272 perennial streams and rivers and 840 intermittent water bodies. The perennial crossings include 4 in North Dakota, 5 in South Dakota, 22 in Nebraska, 33 in Kansas, 117 in Missouri, and 37 in Illinois.

The Cushing Extension would cross an additional 48 perennial streams in Kansas and 10 perennial streams in Oklahoma. An additional 133 intermittent water bodies would be crossed through Kansas, Oklahoma, and Nebraska. Table 3.7.1-1 lists the crossings that contain important fisheries resources or habitat.

The type of fisheries present in a water body can be defined as coldwater or warmwater fisheries. Coldwater fisheries include the family Salmonidae, for example, trout and salmon. Warmwater fisheries include resident, nonanadromous families such as Ictaluridae (catfish), Centrarchidae (sunfish), and Cyprinidae (minnows). No water bodies supporting coldwater fisheries would be crossed by the Keystone Project.

Table 3.7.1-2 provides the major game and commercial fish species located in the perennial streams and rivers along the Keystone Project route, as identified by the state agencies. Information on these fisheries is covered by state in Section 3.7.2.

Keystone proposes five crossing techniques for water bodies, depending on stream size, water flow, and species present (see Section 2.2.2.3 for construction method details). If an intermittent water body is dry at the time of crossing, Keystone would use conventional upland cross-country construction techniques.

Perennial water bodies would be crossed using one of four techniques:

- Flowing open cut,
- Flowing open-cut dry flume,
- Flowing open-cut dry dam-and-pump, and
- HDD.

TABLE 3.7.1-1
Important Water Bodies Crossed by the Keystone Project

Water Body	County	Number of Crossings
MAINLINE PROJECT		
North Dakota		
Pembina River	Pembina	1
Tongue River	Pembina	1
Middle Branch Forest River	Walsh	1
Sheyenne River	Ransom	1
South Dakota		
Amsden Lake	Day	1
Wolf Creek	Hutchinson/Hanson	1
James River	Yankton	1
Beaver Creek	Yankton	1
Missouri River	Yankton	1
Nebraska		
Missouri River	Cedar	1
Elkhorn River	Stanton	1
Shell Creek	Colfax	1
Platte River	Colfax	1
West Fork Big Blue River	Saline	1
Turkey Creek	Saline	1
Kansas		
Big Blue River	Marshall	1
Robidoux Creek	Marshall	1
South Fork Nemaha River	Nemaha	1
Delaware River	Brown	1
Missouri River	Buchanan	1
Missouri		
Missouri River	Buchanan	1
Platte River	Buchanan	1
Malden Creek	Buchanan	1
Mud Creek	Caldwell	1
Grand River	Carroll/Chariton	1
Lake Creek	Chariton	1
Palmer Creek	Chariton	1
Chariton River	Chariton	1
Duck Lake	Chariton	2
Salt Creek	Audrain	1
Cuivre River	Lincoln	2
Turkey Creek	Lincoln	1
Sugar Creek	Lincoln	1
Mississippi River	St. Charles	1

TABLE 3.7.1-1
(Continued)

Water Body	County	Number of Crossings
MAINLINE PROJECT (CONTINUED)		
Illinois		
Mississippi River	Madison	2
Cahokia Canal	Madison	3
Silver Creek	Madison	1
East Fork Silver Creek	Madison	1
Shoal Creek	Fayette	1
Kaskaskia River	Bond	1
CUSHING EXTENSION		
Kansas		
Little Blue River	Washington	1
Republican River	Clay	1
Smokey Hill River	Dickinson	1
Carry Creek	Dickinson	1
West Branch Lyon Creek	Dickinson	1
Mud Creek	Marion	1
East Branch Whitewater River	Butler	1
Whitewater River	Butler	1
Arkansas River	Cowley	1
Oklahoma		
Salt Fork Arkansas River Creek	Kay	1
Cimarron River	Payne	1

TABLE 3.7.1-2 Major Recreational and Commercial Fisheries in Water Bodies Crossed by the Keystone Project	
Common Name	**Scientific Name**
Bigmouth buffalo	*Ictiobus cyprinellus*
Black buffalo	*Ictiobus niger*
Blue catfish	*Ictalurus furcatus*
Bluegill	*Lepomis macrochirus*
Brook trout	*Salvelinus fontinalis*
Bullhead	*Ameiurus natalis*
Carpsuckers	*Carpiodes carpio*
Channel catfish	*Ictalurus punctatus*
Common carp	*Cyprinus carpio carpio*
Crappie	*Pomoxis* spp.
Flathead catfish	*Pylodictis olivaris*
Freshwater drum	*Aplodinotus grunniens*
Largemouth bass	*Micropterus salmoides*
Muskellunge	*Esox masquinongy*
Northern pike	*Esox lucius*
Paddlefish	*Polyodon spathula*
Rainbow trout	*Oncorhynchus mykiss*
Sauger	*Sander canadensis*
Shovelnose sturgeon	*Scaphirhynchus platorynchus*
Smallmouth bass	*Micropterus dolomieu*
Walleye	*Sander vitreus*
White bass	*Morone chrysops*
Yellow perch	*Perca flavescens*

If a water body is flowing when crossed, the pipeline would be installed using one of the open-cut wet crossing methods. Flume or dam-and pump-methods would be used where technically feasible on environmentally sensitive water bodies. The specific crossing locations for open-cut dry-ditch methods have not yet been determined. Keystone has committed to using HDD at nine crossings along the Mainline Project route (two crossings of the Missouri River, one of the Mississippi River, one of the Platte River, one of the Chariton River, two of the Cuivre River, one of Hurricane Creek, and one of the Kaskaskia River). Four locations along the Cushing Extension also are proposed for HDD crossings (the Republican, Arkansas, Salt Fork Arkansas, and Cimarron Rivers). Potential construction related impacts and mitigation measures are discussed in more detail in Section 3.7.3.

3.7.2 Fisheries of Special Concern

Fisheries of special concern along the Keystone route are defined as those that individual states have designated as having recreational or commercial value. Special-status aquatic species (threatened, endangered, or sensitive species) are discussed in Section 3.8. The study area for fisheries resources includes the perennial streams, rivers, and ponds or lakes that would be directly crossed by the pipeline route along with water bodies that are located within approximately 0.5 mile of the proposed crossing. A summary of the water bodies crossed by the Mainline Project and the recreationally or commercially important fisheries they contain is provided below for each state.

3.7.2.1 Mainline Project

North Dakota

North Dakota contains four perennial streams and numerous unnamed ponds within the proposed Mainline Project route. In North Dakota, the Department of Health has established the classification levels for surface water (NDDH 2001).

- Class I – Suitable for propagation and/or protection of resident fish species and other aquatic biota.
- Class IA – The same as Class I, except for treatment for municipal use.
- Class II – The same as Class I, except for additional treatment for drinking water requirements.
- Class III – These streams have low average flows and prolonged periods of no flow. They are of limited seasonal value for fish life and aquatic biota. The quality of these waters must be maintained to protect recreation, fish, and aquatic biota.

The Sheyenne River has been classified as a Class IA water body and supports the greatest number of game fish species, with nine (ENSR 2006a). In contrast, the other perennial rivers (Pembina, Tongue, and Middle Branch Forest Rivers) each contain two to four game fish species. Northern pike, yellow perch, and bass species represent the most important species in the state in terms of management or game fish harvests. The only known stocking effort is for the northern pike in the Sheyenne River in 2005 and 2006 (NDGFD 2006). Information on fish populations in the numerous small ponds crossed by the proposed route is not available, but they likely support recreational fisheries with species such as bass, bluegill, perch, or bullheads.

South Dakota

The proposed Mainline Project route would cross four perennial streams and one lake (Amsden Lake) in South Dakota. The Missouri River, a warmwater permanent habitat, is the largest water body and contains 19 species of game fish (ENSR 2006a). The other streams are classified as either warmwater semi-permanent (James River) or warmwater marginal (Wolf and Beaver Creeks). The stream classifications are defined by the State of South Dakota as follows (SDDENR 2004):

- Warmwater permanent – Supports aquatic life and is suitable for permanent propagation and/or maintenance of warmwater fish.
- Warmwater semi-permanent – Supports aquatic life and is suitable for propagation and/or maintenance of warmwater fish but may suffer occasional fish kills because of critical natural conditions.
- Warmwater marginal – Supports aquatic life and more tolerant species of warmwater fish naturally or by frequent stocking and intensive management but suffers frequent fish kills because of critical natural conditions.

The most popular game fish species include catfish, northern pike, and bass species. There is no record of recent stocking efforts for these species, indicating that they are sustained by natural reproduction.

Amsden Lake is a valuable fishing habitat for many species, including pike, bluegill, walleye, bass, and crappie.

Nebraska

Nebraska contains 22 perennial streams that would be crossed by the proposed Mainline Project route, including 8 with Class A and 13 with Class B warmwater fisheries. Class A fisheries support one or more key species on a year-round basis, while Class B fisheries support key species only on a seasonal or intermittent basis. The Missouri River has the highest number of game fish species, with 19 (ENSR 2006a). The primary species include catfish, yellow perch, sauger, walleye, northern pike, and basses. The other streams contain from one to five fish groups, including catfish, bass, and sunfish.

Kansas

Kansas contains 33 perennial streams that could be crossed by the proposed Mainline Project route. The Kansas Department of Health and Environment has classified the water bodies based on the relative abundance of each habitat type within the state (KDHE 2004).

- Special use – Contains unique habitats or biota not commonly found in the state or contains populations of threatened or endangered species.
- Expected use – Contains habitats or biota commonly found in the state.
- Restricted use – Contains biota in a limited abundance or diversity due to the physical quality or availability of habitat compared to more productive habitats in adjacent waters.

Most of the streams are classified as warmwater fisheries, with "expected use" for common species in the state. The South Fork Nemaha River and Missouri River are classified as "special use" due to the presence of special-status species (see Section 3.8). Of the 33 streams, the Missouri River contains the highest number of game and commercial fish species, including catfish, buffalofish, carp, freshwater drum, and shovelnose sturgeon. The other streams also include catfishes and walleye.

Missouri

The Missouri portion of the proposed Mainline Project route includes approximately 113 perennial stream and four unnamed perennial lake or pond crossings. Six larger streams would be crossed (Missouri, Platte, Grand, Chariton, Cuivre, and Mississippi Rivers), while the others are tributaries in these drainages. All of the streams and rivers contain at least one game fish species; the Mississippi and Missouri Rivers have the most—at 17 and 18 species, respectively, followed by the Grand River with 12 species (ENSR 2006a). While these rivers are home to many species of fish (100+), this analysis discusses only those that have been recognized by the state as important for recreation and commercial fisheries.

The most popular game fish species in these rivers include catfish, walleye, sauger, largemouth bass, and white bass. It is important to note that the proposed pipeline route also crosses the Jentell Brees Access in Buchanan County, which was developed with Sport Fish Restoration federal monies. The Mississippi, Missouri, and Grand Rivers also contain important commercial fish species (ENSR 2006a). These include channel catfish, blue catfish, flathead catfish, paddlefish, and shovelnose sturgeon. Freshwater drum, black buffalo, smallmouth bass, bigmouth buffalo, common carp, and carpsuckers also are harvested in the Mississippi River.

The Keystone Project also would intersect or potentially affect eight aquatic COAs or State Outstanding Streams through the state of Missouri. These are areas that have been designated as containing high integrity or minimal alterations and/or a high number of aquatic species. Potential crossings that contain important recreational or commercial species include Duck Lake, Turkey Creek, and Sugar Creek.

Illinois

There are 36 perennial streams and one lake (Highland Silver Lake) that would be crossed in the Illinois portion of the proposed Mainline Project route. The surface water classifications in this state are based on an assessment of the water body's degree of support for a designated use, such as supporting aquatic life (ILEPA 2006). This is determined by an analysis of various types of information, including biological, physico-chemical, physical habitat, and toxicity data.

A fully supporting water body attains the designated aquatic life use and is considered to have good resource quality. A partially supporting water body attains the designated use at a reduced level and is considered to have fair resource quality. For Illinois streams, the major potential causes of impairment are high concentrations of metals, low DO, high PCBs, high nutrients, excessive siltation, high pathogens, physical-habitat alterations, and high suspended solids.

The Mississippi River is considered to be fully supporting aquatic life. Two water bodies, Shoal Creek and Kaskaskia River, are considered to be fully and partially supporting segments at or downstream of the proposed pipeline crossings (ENSR 2006a). Results of the assessments of the other streams indicate that they are considered partially supporting aquatic life. The Mississippi River contains 19 game fish species, in addition to commercial species that include three species of buffalofish, common carp, carpsuckers, and catfish. Catfishes also support a primary recreational fishery in Cahokia Canal and Shoal and Silver Creeks, although the fishing use is lower than for the Mississippi River.

Highland Silver Lake would be crossed on the East Fork of Silver Creek, located north of Highland, Illinois. The lake is within 10 miles downstream of the proposed Project route and is a very large reservoir popular for recreational fishing. Common species found in the lake include catfish, crappie, bluegill, rockbass, stripped bass, largemouth bass, and walleye. The lake is also stocked with trout in the winter season.

3.7.2.2 Cushing Extension

Kansas

The Kansas portion of the Cushing Extension would cross a total of 48 perennial streams. The majority of these streams are minor to intermediate in size, with the exception of five larger streams (Little Blue, Republican, Smokey Hill, Whitewater, and Arkansas Rivers) (ENSR 2006a). Keystone has proposed using the HDD crossing method at two locations, the Republican River and Arkansas River.

As described in the previous section, Kansas classifies the water bodies based on the relative abundance of each habitat type within the state. The classification levels are special use, expected use, and restricted use. Of the 48 crossings, three have not been classified, six have special use classification, and the remaining are expected use. Popular recreational fisheries in these streams include bluegill, channel catfish, crappie, largemouth bass, and saugeye.

Oklahoma

The Cushing Extension would cross 10 perennial streams in Oklahoma. These streams are home to numerous warmwater recreational fisheries. Popular species include walleye, basses, sunfish, catfish, and rainbow trout. The water bodies that support these fisheries have been designated by the state as warmwater aquatic community, indicating that the water quality and habitat are adequate to support climax fish populations (OWRB 2006). Keystone has proposed crossing the Salt Fork Arkansas River and Cimarron River with the HDD method.

3.7.3 Potential Impacts and Mitigation

The degree of construction-related impacts would depend on the crossing method, existing conditions at each crossing, duration of instream activity, and mitigation measures implemented. Possible effects include the loss of instream habitat, loss of streambank habitat, disruption of fish movement, spawning disturbance, and water quality and sedimentation effects. Keystone's Mitigation Plan (Appendix B) describes the best management practices that would be used for each type of water body crossing, to reduce potential effects on fish and aquatic/streambank habitat.

The non-flowing upland cross-country crossing method would be used at all water body crossings with no perceptible flow at the time of construction. For flowing water bodies, Keystone may utilize either an open-cut wet method or a variety of flowing open cut "dry-ditch" techniques. The open-cut wet method involves trenching through the water body while the water continues to flow. The dry flume method diverts the water across the trenching area through one or more flume pipes placed in the water body. The dam-and-pump method is similar to the flume, except that pumps and hoses would be used instead of the flumes to divert the flow of water. The final crossing method is HDD, which would be utilized for designated major and sensitive water bodies. This method involves drilling a pilot hole under and across the water body and banks through which the pipe sections would be pulled through.

The open-cut wet method is Keystone's preferred crossing method and is also the most invasive. However, effects would be short term and generally limited to periods of instream construction. Flumed or dam-and-pump crossings generally produce less downstream sedimentation impacts than traditional open-cut methods. HDD crossings would not alter or remove habitat and would not affect fisheries. The use of this procedure is limited due to the increase in cost and materials. HDD crossings for major and sensitive water bodies would be constructed in accordance with a site-specific construction and mitigation plan produced by Keystone.

Sedimentation in the water body can increase due to trenching, backfilling, and streambank erosion, resulting in alteration of instream habitat. The extent of sedimentation would depend on the nature of the soil materials from the lower depths of the trench with respect to those near the surface. Increased sediment loads can alter a stream's substrate composition and fill inter-gravel spaces and pool habitats. They also can degrade the existing aquatic habitat by reducing spawning habitat, available rearing habitat, and benthic invertebrate production. Fish populations can be directly affected by suffocation of eggs and newly hatched larvae living in gravels, and by abrading the sensitive gill membranes of both young and adult fish.

Effects to fish populations would be minimized by avoiding instream activities during the sensitive breeding periods when the eggs and young larvae are present. Spawning periods for most fish species in the Keystone Project area extend from April through June (ENSR 2006a). For example, in the FERC Wetland and Water Body Construction and Mitigation Procedures (FERC 2003), instream work for warmwater fisheries is limited to the time window of June 1 through November 30, which avoids most of the sensitive spawning season. Keystone should follow a similar construction timeline to avoid the sensitive breeding periods of the species located in the water bodies.

To minimize streambank erosion, Keystone would use equipment bridges, mats, and pads to support construction equipment that must cross the water body. Equipment bridges are not required at minor or dry crossings unless the water body supports a recreationally or commercially valuable fishery. Immediately after the initial disturbance of the soil at all flowing water body crossings, the contractor would install temporary sediment barriers across the entire construction ROW. The sediment barriers would act to stop the flow of sediments into the water body, prevent deposition of sediments into sensitive resources, and contain any spill within the construction ROW. All spoil from minor and intermediate water body crossings and upland soil from major water body crossing would be placed within sediment barriers in the construction ROW, at least 10 feet from that water's edge or in an additional extra work area.

To reduce the risk of additional sedimentation in the dry flume method, the Keystone Mitigation Plan states that sand bags or plastic sheeting would be used to develop an effective seal and to divert stream flow through the flume pipe. The flume pipe would be aligned to prevent bank erosion and streambed scour and would not be removed until the final clean up of the streambed and bank is complete. When using the dam-and-pump method, sufficient pumps would be used to maintain 1.5 times the flow present in the stream at the time of construction. To minimize impacts to aquatic species, screening devices would be installed at the intakes.

If the proposed mitigation procedures are followed in the crossings, there would be minimal impact to the habitat and aquatic organisms. The short-term disturbance that would be caused by instream activities would resemble natural high-flow events in the stream. To decrease the direct effects of sedimentation, **the following measure is recommended**:

- **Keystone should increase the distance at which it establishes the sediment barriers. The suggested location of 10 feet from the water's edge is not a sufficient distance to protect against possible contamination. This distance should be increased to a minimum of 50 feet, and 100 feet when practicable.**

The loss of bank cover would directly affect the quality of habitat in the water body. One of the biggest impacts related to removal of riparian cover is the direct loss of the bank features that are utilized by fish for cover, nesting, and feeding. An indirect effect would be the loss of larger structures (trees, boulders, and woody debris) that fall into the water body and create cover, as well as enhance the habitat complexity by creating pools and gravel bars. The removal of vegetation also destabilizes the banks at discrete locations and increases the potential for additional erosion, resulting in sedimentation and turbidity in the water body. These impacts are believed to be temporary and relatively minor due to the limited amount of total stream bank area that would be affected at each water body.

To conserve as much vegetation as possible, all staging areas for materials and equipment would be located at least 10 feet from the water body edge. As with the placement of sediment barriers, **the following measure is recommended:**

- **Keystone should increase the distance at which it locates staging areas for material and equipment. The suggested location of 10 feet from the water's edge is not a sufficient distance to protect against possible contamination. This distance should be increased to a minimum of 50 feet, and 100 feet when practicable.**

The vegetation would be cut off at ground level, leaving the existing root systems in place to provide stability. Pulling of tree stumps and rooting for grading activities would be limited to directly over the trench line. After construction is complete, the banks of the water bodies would be stabilized with temporary sediment barriers within 24 hours of completing the activities. Where conditions allow, riparian vegetation would be restored with native plant species or conservation grasses and legumes (Appendix B).

To minimize the impacts of construction activities on fishes and their habitats, Keystone would complete all instream activity for minor water body crossings (less than 10 feet wide) within 24 hours and within 48 hours for intermediate water bodies (10 to 100 feet wide). Major water body crossings (greater than 100 feet wide) would be completed according to the Site-Specific Plan as shown in the Construction Drawings produced by Keystone (ENSR 2006a). These crossings are the 13 locations designated for the HDD technique (two Missouri River, one Mississippi River, one Platte River, one Chariton River, two Cuivre River, one Hurricane Creek, one Kaskaskia River, one Republican River, two Arkansas River, and one Cimarron River).

Although crossing perennial water bodies using the HDD method would avoid most impacts to the aquatic habitat and organisms, this method is not necessarily effective and may not result in the least impact for all crossings. This method usually involves longer crossing times, specialized equipment, and increased construction effort, which would be more destructive to non-sensitive water bodies. An open-cut wet or dry method at these locations would be adequate if Keystone adheres to the fishery timing window restrictions and the other measures set out in the Mitigation Plan (Appendix B).

For those water bodies that have been deemed as sensitive or significant (e.g., habitat for sensitive species, or important commercial or recreational fisheries), Keystone should use more dry-ditch or HDD crossings. Keystone proposes using dry-ditch techniques at "crossings where technically feasible on environmentally sensitive water bodies as warranted by resource-specific sensitivities", and HDD at "designated major and sensitive water bodies" (ENSR 2006a). Because Keystone has not identified which water bodies would be crossed using a dry-ditch technique, **the following measure is recommended:**

- **Keystone should reevaluate those water bodies that contain recreationally or commercially important fisheries and consider using a dry crossing method.**

This is especially pertinent to the Cushing Extension. In the Kansas section, the State has classified six water bodies as special use; however, Keystone proposes to use HDD at only two of these locations (the Republican and Arkansas Rivers). Keystone has identified an additional three larger crossings and has proposed an open-cut crossing method (Little Blue, Smokey Hill, and Whitewater Rivers). Therefore, **the following measure is recommended**:

- **For the Cushing Extension, Keystone should consider using a dry crossing method, potentially HDD, at the crossings of larger water bodies and water bodies classified as special use.**

During construction activities, there is also the potential for spills of fuel or other hazardous liquids. Sources of spills can include refueling and lubricating construction equipment and leaks or spills from storage containers or equipment working in or near streams. As a general rule, any actions involving the use of hazardous materials would be restricted to areas not within 100 feet of any water body. For a detailed examination of the effects and mitigation measures for spills, refer to the SPCC Plan.

Blasting operations would occur on or near potential water body crossings containing important fisheries. These are all located in the state of Missouri and include Malden Creek, Mud Creek, Lake Creek, Palmer Creek, East Fork Little Chariton River, Salt Creek, and Turkey Creek. Effects from the blasting could include increased sedimentation, noise, and vibrations. Recommendations for blasting operations and mitigation measures to decrease the effects are discussed in Section 3.1.1.2.

Withdrawal and discharge of water for hydrostatic testing also can affect fisheries. Keystone lists 29 water bodies on the Mainline Project and nine water bodies on the Cushing Extension as sources for hydrostatic testing. Among the list of proposed water sources are eight locations that are known to contain sensitive species (Rock Creek, the James River, the Platte River, the Elkhorn River, the West Fork of the Big Blue River, two sections of the Missouri River, and the Mississippi River). As stated in the Mitigation Plan, discharge locations would not include state-designated exceptional value waters, water bodies that provide habitat for federally listed threatened or endangered species, or water bodies designated as public water supplies. However, this same policy is not extended to the intake sources for hydrostatic testing. Recommendations concerning location and screening of intake manifolds are provided in Section 3.3.2.2. In addition, **the following measure is recommended:**

- **Keystone should avoid using water bodies as intake sources that contain commercially and/or recreationally important species for hydrostatic testing. If this is not possible, Keystone should obtain written permission from the appropriate federal, state, and local permitting agencies, as is specified in its Mitigation Plan for hydrostatic test discharge locations.**

Keystone anticipates performing the testing during spring, summer, and fall months. Almost all of the fish species located along the Keystone Project route spawn from April to July, with some continuing into August. If Keystone performs the testing as planned, there would be a high coincidence with sensitive breeding periods for multiple fish species. To minimize the potential adverse effects on fisheries, **the following measure is recommended**:

- **Keystone should reschedule all hydrostatic testing events to the late fall and winter months, periods that are less sensitive to most fish species.**

A large effect of the withdrawal is the potential entrainment of small fish and drifting macroinvertebrates. To minimize this effect, the Keystone Mitigation Plan states that it would install intakes with filtering and screening devices and suspend the intakes above the stream bottom. Withdrawals would be made at controlled rates to protect aquatic life, provide for all water body uses, and avoid effects on downstream withdrawals of water by existing users.

The discharge of large volumes of hydrostatic test waters into surface waters could temporarily cause a change in the water temperature and DO levels, an increase in downstream flows, and increase streambank and substrate scour. Discharge controls to reduce water quality affects listed in the Mitigation Plan include restrictions on pipeline dewatering rates, energy dissipaters to prevent erosion, and/or temporary synthetic channel linings. If interbasin transfers of water occur, there is also the potential to introduce and spread aquatic nuisance species. To minimize the risk associated with introduced species, **the following measure is recommended:**

- **Keystone should discharge the hydrostatic test water into the same water body that was used as the intake source.**

3.7.4 References

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Oklahoma Water Resources Board. 2006. Water Quality Standards (Chapter 25). Available online at: <http://www.owrb.state.ok.us/util/rules/rules.php#ch45>.

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3.8 THREATENED AND ENDANGERED SPECIES

This section addresses species that are federally listed as endangered or threatened, or are considered as candidates for listing by USFWS, those species that are state listed as threatened or endangered, and those species designated as species of conservation concern.

Species listed as threatened, endangered, or candidates for listing as threatened or endangered are afforded an additional level of protection. In accordance with Section 7 of the ESA, DOS (as the lead agency), in coordination with USFWS, must ensure that any action authorized, funded, or carried out does not jeopardize the continued existence of a federally listed threatened or endangered species, or result in the adverse modification of the designated critical habitat of a federally listed species.

Candidate species receive no substantive or procedural protection under the ESA; however, USFWS encourages federal agencies and project proponents to consider candidate species in the project-planning process. Actions taken to avoid effects on candidate species may reduce the need to consider listing the species under the ESA in the future.

Keystone initiated Section 7 consultation with USFWS in January 2006 by sending a project overview and information request letter. The Grand Island Nebraska Field Office was named as the USFWS point of contact for the Keystone Project. Keystone also contacted the following state wildlife agencies and provided them with a project overview and information request:

- North Dakota Game and Fish Department (NDGFD);
- South Dakota Game, Fish and Parks (SDGFP);
- Nebraska Game and Parks Commission (NGPC);
- Kansas Department of Wildlife and Parks (KDWP);
- Missouri Department of Conservation (MDC);
- Illinois Department of Natural Resources (IDNR); and
- Oklahoma Department of Wildlife Conservation (OKDWC).

Based on input from these state and federal agencies, state natural heritage programs, agency web sites and other applicable web sites (e.g., NaturServe.org); biological packages summarizing potential habitat for special-status species were sent to applicable federal and state agencies for review and input in June 2006. These applicant-prepared summaries and responding correspondence from federal and state agencies provide the basis for the species listings, life history description, impact assessments, and mitigation measure recommendations in the following EIS sections (ENSR 2006c [Agency correspondence binders]). Meetings between Keystone and federal and state resource agencies were held in July and October 2006 and in February 2007. Work plans were developed for surveys of protected species in each state. The plans included the species to be surveyed; survey locations (mileposts and maps); survey periods; and requirements for proposed surveys in 2006, 2007, and pre-construction surveys in 2008.

3.8.1 Federally Listed Threatened and Endangered Species

In the 59 counties that would be traversed by the proposed Keystone Project, federally listed species are known to occur in all but two. Federally protected species with the potential to occur in the Keystone Project area include four birds, three mammals, four fish, three mollusks, and five plants. Candidate species include one reptile, one insect, one fish, and one mollusk. The distribution, life histories, and habitat requirements for these species are discussed below. Many of these species also are protected by individual states.

3.8.1.1 Federally Protected Birds

Table 3.8.1-1 lists federally and state-protected birds. Federally protected bird species include the bald eagle, piping plover, interior least tern, and whooping crane.

Bald Eagle

The bald eagle is federally listed as threatened; it is stated listed as threatened in South Dakota, Nebraska, Kansas, Illinois, and Oklahoma; and is state listed as endangered in Missouri. Historically, populations of bald eagles were drastically reduced by low productivity from the bioaccumulation of pesticides. Since organochlorine pesticides such as DDT have been banned, bald eagle numbers have been increasing—leading to the species being proposed for federal de-listing on July 4, 1999, as "recovered."

A Final Rule has not been issued on removal of the bald eagle from the federally threatened species list; therefore, this species remains listed as threatened in the lower 48 states. Bald eagles also are protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Bald eagles use mature, forested, riparian areas near rivers, streams, lakes, wetlands, and reservoirs. They nest, migrate, and winter in all seven states and within most of the counties along the proposed Mainline Project and Cushing Extension routes. They generally nest from early February through mid-August, and often return to use the same nest and winter roost year after year. The bald eagle's diet consists mostly of fish. Eagles also forage opportunistically on waterfowl, dead fish, jackrabbits, and big game carrion—especially in winter. Southward migration begins as early as October, and the wintering period extends from December to March. Bald eagles roost in a forested area known as a communal roost. A communal roost is generally defined as an area where six or more eagles spend the night within 100 meters of each other.

Least Tern and Piping Plover

The least tern is federally listed as endangered and is listed as a state-endangered species in South Dakota, Nebraska, Kansas, Missouri, and Oklahoma. The piping plover is federally listed as threatened and is listed as a state-threatened species in South Dakota, Nebraska, and Kansas.

Least terns feed on small fish in the river, and piping plovers forage for invertebrates on exposed beach substrates. These species nest on unvegetated or sparsely vegetated sandbars in river channels and wetlands. Least terns also will nest on bare alluvial or dredge spoil island and sand or gravel bars in or adjacent to rivers, lakes, gravel pits, and cooling ponds. Nesting season for the least tern and piping plover is from April 15 through September 15.

TABLE 3.8.1-1
Protected Birds Potentially Occurring along the Keystone Project Route

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
Pied-billed grebe (*Podilymbus podiceps*)							T – Fayette		Potential nesting habitat, seasonal or permanent ponds with dense stands of emergent vegetation
King rail (*Rallus elegans*)				SC – Seward		E – Buchanan, Carroll, Chariton, Lincoln, St. Charles			Suitable nesting habitat in wetlands with abundant grasses, sedges, rushes, and cattails
Least bittern (*Ixobrychus exilis*)						SC – Buchanan, Chariton, Lincoln, St. Charles	T – Madison, Fayette		Nesting habitat in freshwater wetlands with dense, tall growths of emergent vegetation with woody vegetation and open water
Yellow-crowned night heron (*Nyctanassa violacea*)							E – Fayette		Nesting habitat includes trees; winter foraging habitats include wetlands, lakes, and rivers
Bald eagle (***Haliaeetus leucocephalus***)	T	SC – All	T – All	T – All	T – All	E – Buchanan, Carroll, Chariton, Clinton, Lincoln, Montgomery	T – Bond, Fayette, Madison	T	Potential nesting and roosting habitats along river corridors crossed by the Keystone Project; state-designated critical habitat at the Big Blue and Missouri River crossings in Kansas
Northern harrier (*Circus cyaneus*)						E – Buchanan, Clinton, Carroll, Chariton, Montgomery, Lincoln, St Charles	E –		Potential nesting habitats in marshes, meadows, grasslands, and cultivated fields
Barn owl (*Tyto alba*)						E – Buchanan, Chariton, St Charles	E – Fayette, Marion		Nesting habitats include tree cavities, caves, cliff crevices, cut bank burrows, and buildings
Snowy plover (*Charadrius alexandrinus*)					T				Suitable habitats, including alkaline flats, mudflats, sandy shorelines, sandbars along rivers, lakes, ponds, and marshlands, occur along the Keystone Project route

TABLE 3.8.1-1
(Continued)

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
Piping plover (*Charadrius melodus*)	T	SC	T – Day, Yankton	T – Butler, Cedar, Colfax, Platte	T – Cowley			Kay, Noble, Payne	Suitable habitats in open sandy areas, saline flats, sandbars, and sand and gravel beaches along rivers and gravel pits
Interior least tern (*Sterna antillarum athalassos*)	E		E – Yankton	E – Butler, Cedar, Colfax, Platte	E – Cowley	E – St. Charles	E – Madison	E – Kay, Noble, Payne	Nesting habitats in sparsely vegetated sandy, gravelly or silty beaches, and sandbars in wide unobstructed river channels
Whooping crane (*Grus americanan*)	E	SC – Barnes, Cavalier, Dickey, Griggs, Lamoure	E – Beadle, Clark	E – Seward	E – Cowley			E – Noble, Payne	The primary migration route is generally east of the Project area; foraging habitat in croplands, freshwater marshes, and lake margins; roosting habitat on submerged bars in large rivers
Loggerhead shrike (*Lanius ludovicianus*)						SC – Buchanan	T – bond, Fayette, Marion		Potential nesting habitats in open areas with mixed shrub/brush hedgerows and scattered thorny trees
Henslow's sparrow (*Ammodramus henslowii*)					SC – Butler, Dickinson, Nemaha	SC – Randolph, Clinton	E – Marion		Potential nesting habitat in tall grasslands, meadows, and abandoned fields with wet areas
Greater prairie-chicken (*Tympanuchus cupido*)		SC – Sargent				E – Audrain			Potential nesting habitat in mid- and tall-grass prairies bordered by oak forests and croplands

Notes:

Boldface text indicates a federally protected species.

E = Endangered.
SC = Species of conservation concern.
T = Threatened.

[a] Species designated as E, T, or SC by states and reported to occur in counties crossed by the Keystone pipeline ROW.

Sources: ENSR 2006a, c; TransCanada 2007c.

Whooping Crane

Whooping cranes are federally listed as endangered; state listed as endangered by South Dakota, Kansas, Nebraska, and Oklahoma; and listed as species of conservation concern in North Dakota. Whooping cranes use numerous habitats such as cropland and pastures; wet meadows; shallow marshes; shallow portions of rivers, lakes, reservoirs, and stock ponds; and both freshwater and alkaline basins for feeding and loafing during their spring and fall migration. Overnight roosting sites frequently require shallow water in which they stand and rest. Shallow, sparsely vegetated streams and wetlands are required to feed and roost during migration.

The north-south migration corridor through Oklahoma, Kansas, Nebraska, South Dakota, and North Dakota would be crossed by the Mainline Project and Cushing Extension. Migrating whooping cranes could be roosting or feeding in the Keystone Project area. The migration periods are approximately from March 23 through May 10 and from September 16 through November 16. Migration periods throughout the states involved may vary, depending on the northern or southern location during the migration period.

3.8.1.2 Federally Protected Mammals

Table 3.8.1-2 lists federally and state-protected mammals. Federally-protected mammals include the gray bat, Indiana bat, and gray wolf.

Gray Bat

The gray bat is federally endangered and is state listed as endangered in Missouri, Illinois, Kansas, and Oklahoma. This species has been recorded in Madison County, Illinois, and Lincoln County, Missouri and could occur along the Keystone Project ROW in these counties. Gray bats are not known to occur along the Mainline Project in Kansas or along the Cushing Extension in Kansas and Oklahoma.

The gray bat inhabits caves throughout the year and forages over rivers and reservoirs adjacent to forests. In some areas, the same caves are used in winter and summer; in other areas (e.g., Missouri and Arkansas), many caves used in summer are vacant in winter. This species requires undisturbed caves with a corridor of mature trees, such as oak-hickory floodplain forests, between caves and foraging sites over lakes, reservoirs, streams, and riparian forests. Gray bats feed on aquatic insects and are generally opportunistic feeders. Virtually all prey are associated with water, swamp, or riparian vegetation.

Summer colonies occupy traditional home ranges that often contain several roosting caves scattered along as much as 43 miles of river or reservoir borders. Individuals forage along rivers or shoreline up to 12 miles from their roost caves. Roost sites are restricted nearly exclusively to caves throughout the year, although only a few percent of available caves are suitable. Large summer colonies use caves that trap warm air and provide restricted rooms or domed ceilings; maternity caves often have a stream flowing through them. Forested areas along the banks of streams and lakes provide important protection for adults and young. Rivers or reservoirs where the forest has been cleared are unsuitable as foraging habitat.

TABLE 3.8.1-2
Protected Mammals Potentially Occurring along the Keystone Project Route

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
Gray bat (***Myotis grisescens***)	E					E – Lincoln	E – Madison		Forages along streams and lakes and uses caves for winter, summer, and maternity roosts
Indiana bat (***Myotis sodalis***)	E					E – all counties	E – all counties		Maternity roost beneath loose bark in oak and hickory trees; winter hibernation in caves in Shannon, Washington, and Iron Counties, MO
Eastern spotted skunk (*Spilogale putorius*)			SC		T – Marshall, Nemaha, Brown, Doniphan	E			Suitable forest edge, prairie, shrub-scrub, and cultivated fields occur along the Keystone Project route
River otter (*Lontra canadensis*)				T – Stanton, Colfax					Suitable habitats include rivers, streams, lakes, ponds, and marshes
Gray wolf (***Canis lupus***)	E	SC – Cavalier, Dickey, Grand Forks, Nelson, Pembina, Sargent, Walsh							Suitable habitats in the project area include hardwood forest, mixed forest, and grasslands; has been extirpated from most of the Keystone Project route, although individuals could occur in the project area

Notes:

Boldface text indicates a federally protected species.

E = Endangered.
SC = Species of conservation concern.
T = Threatened.

[a] Species designated as T, E, or SC by states and reported to occur in counties crossed by the Keystone pipeline ROW.

Sources: ENSR 2006a, c; TransCanada 2007c.

Indiana Bat

The Indiana bat is federally listed as endangered and state listed as endangered in Missouri and Illinois. This species is found east of the Missouri River in all counties in Missouri and Illinois along the proposed Keystone Project route. Potential habitat for this species occurs statewide in Illinois; therefore, Indiana bats are considered as potentially occurring in any area with forested habitat, including Marion County.

Indiana bats have recently been identified at the Swan Lake National Wildlife Refuge in Chariton County, Missouri; approximately 6 miles north of the Keystone Project alignment. Two confirmed winter hibernacula are more than 5 miles south of the Mainline Project in Boone County, Missouri. USFWS also indicated a hibernaculum in St. Louis County, Missouri; approximately 15 miles south of the Mainline Project. Indiana bats are assumed present during summer in all Illinois counties. Known occurrences include non-reproductive Indiana bats in Madison County and capture of lactating females and juveniles in Bond County, Illinois, indicating the presence of a maternity colony. Adult female Indiana bats also have been collected in mid-August in Clinton County on both the east and west side of Carlyle Lake. The distribution of these collections suggests the possible presence of one or more maternity colonies in the vicinity of Carlyle Lake, including the WMA. Indiana bats are not known to occur in North Dakota, South Dakota, Nebraska, or Kansas.

Indiana bats migrate seasonally between winter hibernacula and summer roosting habitats. Winter hibernacula include caves and abandoned mines. These bats hibernate in large, tight clusters that may contain thousands of individuals. Very few caves exist that provide the conditions necessary for hibernation. Stable, low temperatures are required to allow the bats to reduce their metabolic rate and conserve fat reserves.

Females emerge from hibernation in late March or early April to migrate to summer roosts. Females form nursery colonies (1 to 100 individuals) under the loose bark of trees (dead or alive) or cavities, where each female gives birth to a single young in June or early July. A single colony may use a number of roost trees during the summer—typically a primary roost tree and several alternates. The species or size of trees does not appear to influence whether Indiana bats use a tree for roosting, provided the appropriate bark structure is present.

Indiana bats feed entirely on nocturnal flying insects, and a colony of bats can consume thousands of insects each night. During summer, Indiana bats frequent the corridors of small streams with well-developed riparian woods, as well as mature upland and bottomland forests. They forage for insects along stream corridors, within the canopy of floodplain and upland forests, over clearings with early succession vegetation (old fields), along the borders of crop lands, along wooded fence rows, and over farm ponds and in pastures. The foraging range for the bats varies by season, age, and sex, and ranges up to 81 acres.

Indiana bats are subject to natural hazards during hibernation, such as cave flooding; however, humans have been the major cause of declining bat populations. Clusters of hibernating bats are very susceptible to disturbance and vandalism. Clearing of forests has caused a decline in the summer habitat of the Indiana bat.

Gray Wolf

The gray wolf is federally listed as endangered and state listed as a species of conservation concern by North Dakota. The gray wolf is an occasional visitor to the Keystone Project area in North Dakota. The gray wolves in North Dakota and South Dakota are part of the Great Lakes Region Population and the Western Great Lakes Distinct Population Segment. On March 16, 2006, USFWS published in the Federal

Register a proposal to remove the gray wolves of the Western Great Lakes Distinct Population Segment from the endangered species list.

3.8.1.3 Federally Protected Reptiles and Insects

Table 3.8.1-3 lists federal candidate and state-protected reptiles and insects. Federal candidates include the eastern massasauga; a pygmy rattlesnake; and the Dakota skipper, a butterfly.

Massasauga

The eastern massasauga rattlesnake (one of three subspecies of massasauga) is a federal candidate species and is state listed as endangered by Missouri and Illinois. The three subspecies of massasauga are the eastern massasauga (*Sistrurus catenatus catenatus*), western massasauga (*Sistrurus catenatus tergeminus*), and desert massasauga (*Sistrurus catenatus edwardsii*). Two of these three subspecies, the eastern and western massasauga, may occur within the Keystone Project area. Taxonomic review of the species has indicated that the three designated subspecies appeared to be arbitrary (Crother et al. 2000). To further complicate the conservation status of this species, Nebraska lists the massasauga at a species level, using the common name for the western subspecies. The federal candidate listing includes only the eastern subspecies within Illinois and Missouri; however, both the eastern and western subspecies may occur in Missouri. Massasauga (c.f. eastern or western) accounts have been recorded in the Keystone Project area within Jefferson and Gage Counties in Nebraska; Chariton, Randolph, and St. Charles Counties in Missouri; and Bond, Fayette, and Madison Counties in Illinois.

Massasaugas live in wet areas, including wet prairies, marshes, and low areas along rivers and lakes. In many areas, massasaugas also use adjacent uplands—including forest—during part of the year. They often hibernate in crayfish burrows, but they also may be found under logs and tree roots or in small mammal burrows. Unlike other rattlesnakes, massasaugas hibernate alone. Small mammal and crayfish burrows are used for winter hibernation.

Females sexually mature in 3 years and breed every few years, giving birth in late July through early September. Movement within the home range occurs between suitable winter and summer habitats, sometimes spanning almost 2 miles; however, most movement occurs within 650 feet from their burrows. Peak activity occurs from about April or May through October.

Dakota Skipper

The Dakota skipper (butterfly) is federally listed as a candidate species and is state listed as a species of concern by North Dakota and South Dakota. The Dakota skipper is found in North Dakota and South Dakota native prairies containing a high diversity of wildflowers and grasses. In the vicinity of the Keystone Project, the Dakota skipper occurs in Ransom and Sargent Counties in North Dakota; and in Brookings, Brown, Codington, Day, Duel, Edmunds, Grant, Hamlin, Marshall, McPherson, and Roberts Counties in South Dakota.

One of the best indicators for Dakota skipper habitat is the presence of food plants for larva and nectar plants for adults. Habitats include low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; and upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple and upright coneflowers, and blanketflower. Nectar provides the nutrients and carbohydrates for Dakota skippers to meet the energetic demands of flight. Grassland sites with a diverse mix of native forbs, one or two of the known larvae or pollen plants, and proximity to other native grassland areas are considered suitable habitats.

TABLE 3.8.1-3
Protected Amphibians, Reptiles, and Insects Potentially Occurring along the Keystone Project Route

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
AMPHIBIANS									
Illinois chorus frog (*Pseudacris strecheri illino*)							T		Sand prairies
REPTILES									
Kirtland's snake (*Clonophis kirtlandi*)							T		Prairie wetlands, herbaceous wetlands, and riparian wetlands; usually associated with crayfish burrows
Western fox snake (*Elaphe vulpine vulpina*)						E			Riparian habitat, woodlands, prairie wetlands, and croplands
Eastern massasauga (*Sistrurus catenatus catenatus*)	C					E – Chariton, Randolph, St. Charles	E – Bond, Fayette, Madison		Wet prairies, marshes, and swamps dominated by emergent vegetation and lowland areas along rivers and lakes
Massasauga (c.f. Western) (*Sistrurus catenatus*)				T - Gage, Jefferson					Wet prairies, marshes, and swamps dominated by emergent vegetation and lowland areas along rivers and lakes
False map turtle (*Graptemys pseudogeo-graphica*)			T						Rivers, streams, sloughs, oxbow lakes, ponds impoundments, and backwaters
INSECTS									
Dakota skipper (*Hesperia dacotae*)	C	SC – Ransom, Sargent	SC						Lowland and upland prairies

Notes:

Boldface text indicates a federally protected species.

E = Endangered.
SC = Species of conservation concern.
T = Threatened.

[a] Species designated as E, T, or SC by states and reported to occur in counties crossed by the Keystone pipeline ROW.

Sources: ENSR 2006a, c; TransCanada 2007c.

3.8.1.4 Federally Protected Fish and Mollusks

Table 3.8.1-4 lists federally and state-protected fish and mollusks. Federally protected fish include the pallid sturgeon, Arkansas River shiner, Topeka shiner, and Neosho madtom. Federally protected mollusks include the Higgins' eye pearlymussel, scaleshell mussel, and winged mapleleaf. Federal candidate species include the Arkansas darter (fish) and spectaclecase mussel.

Pallid Sturgeon

The pallid sturgeon is a federally listed endangered species and is state listed as endangered in South Dakota, Nebraska, Kansas, Missouri, and Illinois. Within the Keystone Project area, the pallid sturgeon has been identified in the Missouri River in South Dakota, the Missouri and lower Platte Rivers in Nebraska, the Missouri River in Kansas and Missouri, and the Mississippi River in Illinois.

This species inhabits diverse aquatic habitats. It requires large, turbid, free-flowing riverine habitats; however, it also has been found in reservoirs and deep water with low current velocities. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large river ecosystems that provide macrohabitat requirements. Adults are opportunistic feeders with prey including aquatic insects, crustaceans, mollusks, annelids, eggs of other fish, and other fish.

Pallid sturgeons are extremely long-lived fish; their lifespan in the wild is estimated to average 60 years. They usually take a decade to mature and become able to reproduce. The fish spawns between June and August, and can produce thousands of eggs. The eggs produced in the wild are heavily subject to predation and other forces of nature.

Arkansas Darter

The Arkansas darter is federally listed as a candidate species and state listed as threatened in Kansas. Along the Keystone Project route, the Arkansas darter has been identified in one tributary of the Arkansas River in Kansas. Arkansas darters live in shallow, clear, usually spring-fed streams with sandy bottoms. They prefer slow currents of cool water, partially overgrown with rooted aquatic vegetation, such as watercress. The vegetation provides a cover that offers the Arkansas darter hiding places from predators. Arkansas darters feed on a variety of aquatic insects and some plant material, including small seeds.

Spawning occurs from mid-February to mid-July. Although this darter will live 3 years, most of the spawning population is in its first year. Spawning takes place in open areas of shallow water over a bottom of coarse gravel.

Historically, the biggest threat to the Arkansas darter has been loss of habitat as more water is taken from streams and underlying aquifers for agricultural uses. Livestock grazing near streambanks often destroys the vegetation that darters use as protection and increases the organic matter that enters the streams. Removal of sand and gravel from stream bottoms destroys the Arkansas darter's breeding habitat. Impoundments and reduced stream flows decrease the Arkansas darter's ability to move to new locations.

TABLE 3.8.1-4
Protected Fish and Mollusks Potentially Occurring along the Keystone Project Route

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
FISH									
Chestnut lamprey (*Ichtyomyzon castaneus*)					T				Rivers and creeks; Missouri River
Pallid sturgeon (*Scaphirhynchus albus*)	E		E – Yankton	E – Cedar	E – Doniphan	E – Buchanon, Carrol, Montgomery, St. Charles	E – Madison		Large turbid rivers and sand substrate; Missouri, Platte, and Mississippi Rivers
Lake sturgeon (*Acipenser fulvescens*)				T		E	E		Large rivers and lakes, and gravel substrate; Missouri and Mississippi Rivers
Arkansas darter (*Etheostoma cragini*)	C				T – Cowley	E –			Tributaries to the Arkansas River; shallow, clear, spring-fed tributaries with sand and sand-gravel substrates
Flathead chub (*Platygobio gracilis*)					T – Clay, Cowley				Turbid rivers and streams, and sand substrate; Nemaha and Missouri Rivers
Silver chub (*Macrhybopsis storeriana*)					E – Clay, Cowley	SC			Large sandy rivers; Missouri, Republican, and Arkansas Rivers
Sturgeon chub (*Macrhybopsis gelida*)			T	E	T	SC			Large, turbid rivers and sand-gravel substrates; Missouri and Platte Rivers
Sicklefin chub (*Machrybopsis meeki*)			E	SC	E	SC			Large, turbid rivers and sand-gravel substrates; Rock Creek; Missouri and Platte Rivers
Arkansas River speckled chub (*Machrybopsis tetranema*)					E – Cowley				Shallow channels of perennial streams with clean fine sand; Arkansas River
Western silvery minnow (*Hybognathus argyritis*)					T	SC			Backwaters of large, turbid rivers and prairie streams; South Fork Nemaha and Missouri Rivers
Arkansas River shiner (*Notropis girardi*)	T				E – Cowley			T	Depends on flood flows in June-August for spawning; Arkansas River and main tributaries

TABLE 3.8.1-4
(Continued)

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
FISH (CONTINUED)									
Silverband shiner (*Notropis shumardi*)				T					Large, turbid rivers
Topeka shiner (*Notropis topeka*)	E	SC – all but Day, Marshall		T – Butler, Dickinson, Marion, Marshall		E			Small, cool (often intermittent) prairie streams; Wolf, North Elm, Castile, Shoal, Log, Crush, and Crabapple Creeks; James, Missouri, West Fork Big Blue, and Little Platte Rivers;
Neosho madtom (*Noturus placidus*)	T				T – Marion	E		T	riffles and sloping gravel bars in relatively clear, moderately large rivers; Cottonwood River
Mollusks									
Spectaclecase mussel (*Cumberlandia monodonta*)	C	SC							Large rivers, mud to cobble substrates; Missouri drainage
Higgins' eye pearlymussel (*Lampsilis higginsi*)	E	SC – Yankton	E – Cedar			E	E		Fast-flowing creeks and rivers, and silt substrate; Missouri drainage
Scaleshell mussel (*Leptodea leptodon*)	E	SC – Yankton	E – Cedar						Creeks and rivers; Missouri drainage
Winged mapleleaf (*Quadrula fragosa*)	E	SC							Rivers and streams; sand, gravel, rubble substrates; Missouri drainage

Notes:

Boldface text indicates a federally protected species.

E = Endangered.
SC = Species of conservation concern.
T = Threatened.

[a] Species designated as E, T, or SC by states and reported occurring within counties crossed by the Keystone pipeline ROW.

Sources: ENSR 2006a, c; TransCanada 2007c.

Arkansas River Shiner

The Arkansas River shiner is federally listed as threatened and state listed as endangered in Kansas and threatened in Oklahoma. In the Keystone Project area, this species has been identified in the Republican and Arkansas Rivers in Kansas, and in the Cimarron River in Oklahoma. Its preferred habitat usually consists of turbid waters of broad, shallow, unshaded channels of creeks and small to large rivers, over mostly silt and shifting sand bottoms. They tend to congregate on the downstream side of large transverse sand ridges. Their diet consists mainly of plankton and organisms that are exposed by moving sand or by drifting downstream. Spawning occurs from June to July in the main stream channel.

Current threats to this species include habitat destruction, water quality degradation, and reduced stream flow, caused by diversion of surface water, groundwater pumping, and construction of impoundments. The decline in populations also may be attributed to competition, accidental capture, drought, and other natural causes.

Topeka Shiner

The Topeka shiner is federally listed as endangered. It is state listed as a species of concern in South Dakota, threatened in Kansas, and endangered in Missouri. The Topeka shiner is a small minnow that historically was distributed throughout much of the Midwestern states. The fish inhabits spring-fed, sandy-bottomed streams with good water quality. This species lives in pools and slack water areas between riffle sequences along a stream course.

Within the Keystone Project area, the Topeka shiner occurs in several drainage basins in South Dakota, Kansas, Missouri, and Nebraska. Topeka shiners are known to occupy numerous small streams in eastern South Dakota, and most are concentrated in the Big Sioux, Vermillion, and James Rivers watersheds. Survey efforts continue to reveal additional inhabited streams. In Missouri, the proposed Keystone pipeline ROW would pass through Caldwell and Clinton Counties. The Topeka shiner's historical range occurred in these two counties; however, it is believed that the fish no longer occurs in this part of its former range.

Topeka shiners are opportunistic omnivore predators; their prey includes insects, algae, fish larvae, and worms. The maximum life span of the Topeka shiner is three summers. Most reach maturity in the spring or summer of their second year. They spawn from late-May to mid-July and deposit their eggs in the nests of green and orange-spotted sunfish.

The Topeka shiner is susceptible to water quality changes in its habitat and has disappeared from several sites because of increased sedimentation resulting from accelerated soil runoff. Stream modifications, sediment deposition, pollution, overgrazing, and predation by introduced fish are thought to have led to the decline of the Topeka shiner across its Midwestern range.

Neosho Madtom

The Neosho madtom is federally listed as a threatened species and state listed as endangered in Missouri, and state listed as threatened in Kansas, and Oklahoma. The preferred habitat of the adult Neosho madtom is shallow riffles with loose, uncompacted gravel bottoms. In the Keystone Project area, the species has been found in the Cottonwood River in Kansas.

Larval, aquatic insects are the major food source of Neosho madtoms. These fish have a short life cycle, with a maximum life expectancy of 3 years. The reproductive cycle begins in March with egg development, and continues through at least the end of July.

The Neosho madtom has declined because of habitat destruction. Construction of dams, dredging of gravel, and an increase in water demands have contributed to habitat loss. Pollution from cattle feedlot runoff also has adversely affected the fish.

Spectaclecase Mussel

The spectaclecase mussel is federally listed as a candidate species and is state listed as a species of conservation concern in Missouri. It is found throughout the tributaries of the Mississippi and Missouri Rivers.

This species usually occurs in medium to large rivers in microhabitats that are sheltered from the main force of the current.

Habitat types preferred by this species include typically shallow riffles and shoals with a slow to swift current. Substrate varies from boulders to sand and gravel. Except for occasional passive downstream movement when adults are disrupted from the substrate during floods, dispersal occurs while the larvae are encysted on their host. This poses the threat of stranding during drought events.

The species appears to spawn twice a year during relatively short periods in autumn and spring, with the entire reproductive period lasting only a few weeks. Autumnal reproduction is restricted to portions of October and November, while vernal spawning occurs in April and May. The start of the reproductive cycle may be triggered by a narrow range of water temperatures. As with most species of freshwater mussels, the larvae are parasitic on fish, although no specific host species have been identified for the spectaclecase.

Higgins' Eye Pearlymussel

The Higgins' eye pearlymussel is federally listed as endangered and is state listed as a species of conservation concern in South Dakota. This species is native to the Mississippi River and some of its northern tributaries. Along the proposed Keystone Project route, the Higgins' eye pearlymussel is expected to occur in the Missouri River in South Dakota. Shells of the endangered Higgins' eye pearlymussel recently have been found below the Gavins Point Dam; however, populations of these mussels are not known to occur in this reach of the Missouri River.

The Higgins' eye pearlymussel prefers areas with deep water and moderate currents; stable but not firmly packed substrates that vary from silt to boulders; low current velocities; and mussel beds that are dense with other associated species.

The exact breeding season for this species is unknown; however, closely related species are gravid from September to June. Sexual maturity is reached in 6–12 years, with a total life expectancy of up to 50 years. This species has been found to use a large variety of fish hosts for their larvae, including the sauger, walleye, yellow perch, largemouth and smallmouth bass, and freshwater drum.

Scaleshell Mussel

The scaleshell mussel is federally listed as endangered; it is state listed as endangered in Kansas and as a species of conservation concern in South Dakota. In the Keystone Project area, the scaleshell mussel is currently found in South Dakota and in a portion of the Missouri River in Nebraska. Shells of the endangered scaleshell mussel recently have been found below the Gavins Point Dam; however, populations of these mussels are not known to occur in this reach of the Missouri River. No scaleshell mussels were found during sampling of the James River crossing for the Keystone pipeline ROW (ENSR 2006h).

Scaleshells live in medium and large rivers with stable channels and good water quality. They are usually found in riffle habitats of the rivers with substrates including gravel, rock, and boulder, and occasionally sand and mud. They bury themselves into the substrate with only the edge of their partially-opened shells exposed. As river currents flow over them, they siphon particles for food out of the water, such as plant debris, plankton, and other microorganisms.

Little is known about the specific reproductive requirements for this species. It is believed to be a long-term brooder that spawns in fall months, with females brooding the larvae in their gills until the following spring or summer. The scaleshell mussel uses the freshwater drum as a fish host for its larvae.

Winged Mapleleaf

The winged mapleleaf is federally listed as an endangered species and is state listed as a species of concern in South Dakota. The range of the winged mapleleaf once included 13 states, where it was found in large rivers and streams that flow into the Mississippi River and in one river that flows into the Missouri River. Along the Keystone Project proposed route, this species is known to occur in the James River, South Dakota, but no winged mapleleaf were found during sampling of the James River crossing for the Keystone pipeline ROW (ENSR 2006h).

Winged mapleleaf are found in riffles with clean gravel, sand, or rubble bottoms and in clear, high-quality water. In the past, it also may have been found in large rivers and streams on mud, mud-covered gravel, and gravel bottoms.

Little is known regarding the exact reproductive schedule of this species, although its lifecycle follows that of other freshwater mussels. The larvae brood in September and October, indicating a late spring to fall breeding season. It has been confirmed that the larvae use channel catfish and blue catfish as hosts.

3.8.1.5 Federally Protected Plants

Table 3.8.1-5 lists the federally and state-protected plants potentially occurring in the Keystone Project area. Under common law, plants generally are treated differently than animals; they typically are considered the private property of the landowner. Federal regulations prohibit any commercial activity involving federally listed plant species or the destruction, malicious damage, or removal of these species on federal property. Federally-protected plants include the decurrent false aster, eastern prairie fringed orchid, western prairie fringed orchid, and running buffalo clover.

Decurrent False Aster

The decurrent false aster is federally listed as threatened and is state listed as threatened by Illinois and endangered by Missouri. It occurs in seasonally flooded emergent wetlands. In the Keystone Project area, the plant is known to occur in Madison County in Illinois, in the floodplain of the Mississippi River. A number of populations occur in the Mississippi River and Missouri River floodplains in St. Charles County, Missouri.

TABLE 3.8.1-5
Protected Plants Potentially Occurring along the Keystone Project Route

Species	Federal Status	State Status and Occurrence by County [a]							Comments
		ND	SD	NE	KS	MO	IL	OK	
Decurrent false aster (***Boltonia decurrens***)	T					E – St. Charles	T – Madison		Riparian floodplains and bottomlands subject to periodic flooding
Small white lady's slipper (*Cypripedium candidum*)				T					Herbaceous wetlands, prairie wetlands, and fens
Eastern prairie fringed orchid (***Plantanthera leucophaea***)	T						E		Herbaceous wetlands, wet prairie, and mesic-wet prairie
Western prairie fringed orchid (***Platanthera praeclara***)	T	SC – Ransom	SC – Day, Yankton	T – Seward, Stanton					Mesic-wet tall-grass prairie, herbaceous wetlands, and dune complexes
Running buffalo clover (***Trifolium stoloniferum***)	E					E – Buchanan, Chariton, Lincoln, St. Charles			Riparian areas, woodland/prairie edge, and disturbed areas
Royal catchfly (*Silene regia*)							E		Prairies, upland forest clearings, savannas, and disturbed areas
Prairie spiderwort (*Tradescantia bracteata*)							T		Dry, sandy prairies and grazed prairies
Spring ladies' tresses (*Spiranthes vernalis*)							E		Dry to mesic forests, prairies, and croplands

Notes:

Boldface text indicates a federally protected species.

E = Endangered.
SC = Species of conservation concern.
T = Threatened.

[a] Species designated as E, T, or SC by states and reported to occur in counties crossed by the Keystone pipeline ROW.

Sources: ENSR 2006a, c; TransCanada 2007.

Decurrent false asters maintain self-sustaining populations in habitats with moist, sandy soil; regular disturbance (preferably from periodic flooding); and open areas with high light levels. The plant blooms from August through October, and historically has occurred along the Illinois and Mississippi River floodplains. Habitat destruction and modification have contributed to the species decline. The asters are dependent on periodic disturbance from major floods, which are currently controlled by dams and levees, and much of their former habitat has been converted to agricultural use (NatureServe 2006).

Eastern Prairie Fringed Orchid

The eastern prairie fringed orchid is federally listed as threatened and state listed as endangered in Illinois. Potential habitats for the eastern prairie fringed orchid that would be crossed by the Keystone pipeline ROW would be similar to those native prairie habitats for the western prairie fringed orchid. This species was not identified during consultation with USFWS, Region 6 as a concern for the Keystone Project. Coordination with USFWS and IDNR has identified the eastern prairie fringed orchid as a species potentially occurring along the Mainline Project ROW in Madison, Bond and Fayette Counties in Illinois.

These orchids are found in mesic-wet calcareous tall-grass sand or silt loam prairies. The plants may be found in open graminoid (grass-like herbaceous cover composed of grasses, sedges, and/or rushes) portions of lake margins, sedge meadows, and marshes; wet prairies or open swamps; bogs; and shorelines. They flower in late-June to early-July but do not flower annually.

Much of the historical habitats for eastern prairie fringed orchids has been altered by drainage and conversion to agriculture. Because of the destruction of most of the natural grasslands east of the Mississippi River, large populations of eastern prairie fringed orchids no longer occur in the United States. The small, isolated populations that remain are only infrequently visited by appropriate pollinators (hawk moths), further contributing to their decline (NatureServe 2006).

Western Prairie Fringed Orchid

The western prairie fringed orchid is federally listed as threatened; it is state listed as endangered in Missouri, threatened in Nebraska, and a species of conservation concern in North Dakota and South Dakota. Along the proposed Keystone pipeline route in Nebraska, populations of western prairie fringed orchid are known to occur in Seward and Stanton Counties, and may occur at other sites in Nebraska. The western prairie fringed orchid has not been documented recently in South Dakota. However, the life cycle of the plant can impede its detection, and populations currently exist in the neighboring states of Nebraska, Minnesota, and North Dakota. Potential habitat still may be found in South Dakota; therefore, the potential exists for the orchid to be found there. In North Dakota, the orchid is found in Ransom County and on the Sheyenne National Grasslands, where the largest population in the United States is known to occur.

The western prairie fringed orchid is similar in appearance to the closely related eastern prairie fringed orchid; but grows west of the Mississippi River and has generally fewer, but larger flowers than the eastern prairie fringed orchid. The western prairie fringed orchid inhabits tall-grass calcareous silt loam or sub-irrigated sand prairies, where it flowers from May to August.

Declines in western prairie fringed orchid populations have been caused by drainage and conversion of its habitats to agricultural production, channelization, siltation, road and bridge construction, grazing, haying, and herbicide application.

Running Buffalo Clover

Running buffalo clover is federally listed as endangered and is state listed as endangered by Missouri. In the Keystone Project area, the plant occurs on the floodplain of the Cuivre River in Cuivre River State Park in Lincoln County, Missouri.

Running buffalo clover occurs most commonly in mesic woodlands in partial to filtered sunlight, where there is moderate periodic disturbance, such as mowing, trampling, or grazing. Running buffalo clover has been reported in disturbed woodland habitats, including floodplains, streambanks, grazed woodlots, mowed paths, old roads and trails; mowed wildlife openings within mature forests; and steep, weedy ravines. The clover may prefer soils underlain with limestone or other calcareous bedrock. It blooms from mid-May through early June.

Declines of running buffalo clover have been attributed to: (1) habitat destruction, (2) poor dispersal following the elimination of bison and other large herbivores, (3) loss of the natural grazers, (4) increased grazing from cattle and rabbits, and (5) competition from exotic plants (NatureServe 2006).

3.8.1.6 Potential Impacts and Mitigation for Federally Protected Species

Preliminary data identified 55 federally or state-listed threatened, endangered, or candidate species potentially occurring within or near the Keystone Project ROW that could be affected by construction. USFWS Region 6 determined that 14 federally listed species and two candidate species are known to occur along the Keystone Project route and may be affected by its location or construction activities. An additional five federally listed species and two candidate species were identified as occurring along the Keystone Project ROW during consultations with KDWP and SDGFP. Designated critical habitats for federally listed species also were identified along the Keystone Project ROW.

Federally Protected Birds

Types of impacts on protected birds would be generally similar to those described for wildlife in Section 3.6.5Table 3.8.1-1 lists federally and state-protected birds. The Mainline Project and Cushing Extension pipeline could affect these species by:

- Habitat loss, alteration, and fragmentation;
- Loss of breeding success from exposure to construction and operations noise, and from increased human activity;
- Direct mortality from project construction and operation;
- Direct mortality due to collision with or electrocution by power lines; and
- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 3.13).

Keystone has committed to implementing the following measures in its Mitigation Plan (Appendix B):

- Keystone will contract a qualified biologist to conduct a survey of breeding bird habitat within 330 feet from proposed surface disturbance activities that would occur during the breeding season. The biologist will document active nests, birds, and other evidence of nesting (e.g., mated pairs, territorial defense, and birds carrying nesting material or transporting food). If an active nest of a federally or state-protected bird species (Table 3.8.1-1) is documented during the survey, Keystone will work with the relevant regulatory authorities to determine whether any additional protection measures would be required.

- Immediately prior to construction activities during the raptor breeding season (February 1–July 31), breeding raptor surveys will be conducted by a qualified biologist through areas of suitable nesting habitat to identify any potentially active nest sites in the Keystone Project area. If raptors are identified within 0.5 mile of the construction ROW, Keystone will work with the relevant regulatory authorities to develop mitigation measures. These measures will be implemented on a site-specific and species-specific basis, in coordination with federal and state agency wildlife biologists.

Wildlife habitat loss or alteration from construction of the Keystone Project pipeline is described in Section 3.5.5. Most affected habitat would include croplands (13,594 acres) and grasslands (4,112 acres), followed by wetlands and open water (845 acres) and upland and riparian forests (1,078 acres) (Table 3.6.5-1). Loss of shrublands and wooded habitats would be long term (5–20 years) in reclaimed areas of the construction ROW. Additional hedgerow or windrow habitats along fields that were too small to be quantified (habitats less than 50 feet wide were not mapped) across the 1,370-mile ROW also would be lost. The incidence of electrocution and collision mortality would be increased by construction and operation of approximately 161 miles of new electrical power lines from generation sources to the pump stations. Because of the linear nature of the ROW, these long-term habitat losses represent a small area of the total available habitat and therefore are expected to have little effect on wildlife species (Table 3.6.5-1).

In addition to these general impacts, specific impacts and mitigation measures have been identified for the species described below.

Bald Eagle

Potential impacts to bald eagles include long-term loss or alteration of potential breeding, foraging, or winter habitats due to the removal of large trees and snags in the vicinity of large reservoirs, lakes, rivers, or streams—especially in the vicinity of the Missouri and Mississippi Rivers. Habitat fragmentation from ROW crossings through forested floodplains of large rivers and habitat degradation from invasion of noxious species are also potential impacts from construction. Habitat degradation and forage species declines may occur because of water withdrawal for hydrostatic testing. Direct mortality of adults and juveniles may occur due to collisions with construction vehicles or power lines, and mortality of eggs or young may occur due to nest disturbances.

Because bald eagles are particularly sensitive to human disturbance at nests and communal roosts, protective buffers should be implemented around these areas. Disturbances near an active nest or within line-of-sight of the nest could cause adult eagles to discontinue nest building or abandon eggs. Recent survey work and agency consultations have identified 11 bald eagle nests within 1 mile of the Project ROW (Table 3.8.1-6). Generally, bald eagle nest buffer recommendations include restricting activities within 1 mile of bald eagle nests in open country. In more heavily forested or mountainous areas, where the line-of-sight distance from the nest is shorter, this buffer distance potentially could be reduced. During the nesting season, bald eagle nest buffers should receive maximum protection. Seven of nine bald eagle nest sites along the Mainline Project were within 1 mile of the pipeline ROW, and both of the two nest sites along the Cushing Extension were within 1 mile of the pipeline ROW (Table 3.8.1-6).

For some activities (construction, seismic exploration, blasting, and timber harvest) a limited-disturbance home-range buffer may be required to extend outward into potential foraging habitat for 2.5 miles from the nest. No identified bald eagle nest sites appeared to occur within 2.5 miles of the proposed blasting locations (Table 3.8.1-6).

TABLE 3.8.1-6 Bald Eagle Nest Sites and Territories along the Keystone Project Route				
Milepost	**State**	**County**	**Distance from Right-of-Way (Observation Date)**	**Comments**
Mainline Project				
7.4	North Dakota	Cavalier	2,859 feet (February 2007)	Historical nest on south bank of Pembina River
435.6	South Dakota	Yankton	220 feet to the east (April–May 2006)	Actively incubating, two adults present, on north bank of Missouri River; immature bald eagle present 0.5 mile west of nest site
658.5	Kansas	Marshall	2,026 feet (January 2007)	Two adults flushed from tree near nest
985.7	Missouri	St. Charles	958 feet (January 2007)	Adult on nest, Cuivre River
985.7	Missouri	St. Charles	1,557 feet (January 2007)	Partially collapsed nest, Cuivre River
989.2	Missouri	St. Charles	7,708 feet (January 2007)	Nest – west side of drainage, Cuivre and Missouri River floodplains
989.4	Missouri	St. Charles	Unknown distance (October 2006)	Active nest
1021.0	Missouri	St. Charles	2,900 feet (January 2007)	Historical nest on west bank in Confluence State Park
1021.0	Missouri	St. Charles	6,744 feet (January 2007)	Alternate nest on island on west side, south of Confluence State Park
Cushing Extension				
76.2	Kansas	Dickinson	2,081 feet (February 2007)	Nest – within 0.5 mile of ROW
285.3	Oklahoma	Payne	4,056 feet (February 2007)	Collapsed nest within 1 mile of ROW

Sources: ENSR 2006c, 2006d, 2007a.

Human disturbances to communal winter roosts and loss of eagle wintering habitat can cause undue stress, leading to cessation of feeding and failure to meet winter thermoregulatory requirements. These effects can reduce the carrying capacity of preferred wintering habitat and subsequent reproductive success for the species. Twenty-four major river crossings were selected in consultation with USFWS (John Cochnar, USFWS, February 5, 2007) for surveys of potential bald eagle winter roost areas on the Mainline Project ROW (Table 3.8.1-7). Of these, 14 were found to be frozen solid or supported no suitably sized perch trees near the ROW (ENSR 2007a). Seven major river crossings were selected for surveys of potential bald eagle winter roost areas on the Cushing Extension ROW (Table 3.8.1-7); of these, all were found to contain suitable habitat (ENSR 2007a).