COVER SHEET
FINAL ENVIRONMENTAL IMPACT STATEMENT
for the
KEYSTONE XL PROJECT

August 26, 2011
Subject: Final EIS for the Keystone XL Project

The U.S. Department of State (DOS) has issued a final environmental impact statement (final EIS) for the Keystone XL Project (the Project) for public review and comment. DOS is the lead federal agency for the National Environmental Policy Act (NEPA) process. Cooperating agencies include the U.S. Army Corps of Engineers; the U.S. Department of Agriculture –Natural Resources Conservation Service, Farm Service Agency, and Rural Utilities Service; the U.S. Department of Energy – Office of Policy and International Affairs and Western Area Power Administration; the U.S. Department of the Interior – Bureau of Land Management, National Park Service, and U.S. Fish and Wildlife Service; the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety; the U.S. Environmental Protection Agency; and the Montana Department of Environmental Quality.

The proposed action is to construct and operate a crude oil pipeline and related facilities at the international border of the United States and Canada and continuing into the United States to transport Western Canadian Sedimentary Basin (WCSB) crude oil and other crude oils to a proposed tank farm in Cushing, Oklahoma, and to delivery points in the Port Arthur and east Houston areas of Texas. The proposed pipeline would traverse Montana, South Dakota, Nebraska, Oklahoma, and Texas, with localized facilities constructed on an existing segment of pipeline in Kansas.

DOS issued a draft EIS for public review on April 16, 2010 and a supplemental draft EIS on April 15, 2011. The final EIS was prepared and circulated consistent with the Council on Environmental Quality and DOS regulations for implementing NEPA. The final EIS includes responses to substantive comments on the draft and supplemental draft EISs and revisions to the EIS based on comments and additional information received. It describes the proposed Project and alternatives to the proposed Project, the potential impacts of construction and normal operation of the proposed Project and alternatives, cumulative impacts, the agency-preferred alternative, and issues related to potential spills from the proposed Project.

The final EIS is available for download from the DOS Keystone XL Project-related website (www.keystonepipeline-xl.state.gov). Paper copies of final EIS are available at public libraries along the proposed route and include maps and figures.

For further information on the Keystone XL Project EIS, contact Alexander Yuan using the contact information provided below.

Alexander Yuan
NEPA Coordinator, Keystone XL EIS Project Manager
U.S. Department of State, OES/ENV Room 2657
Washington, DC 20520
Telephone: 202-647-4284
Website: www.keystonepipeline-xl@state.gov

Final
Environmental Impact Statement
Keystone XL Project

Applicant for Presidential Permit:
TransCanada Keystone Pipeline, LP

August 26, 2011

United States Department of State
Bureau of Oceans and International
Environmental and Scientific Affairs

VOLUME 1
Sections 1.0 – 3.8

United States Department of State
Final Environmental Impact Statement

For the

KEYSTONE XL PROJECT

Applicant for Presidential Permit:
TransCanada Keystone Pipeline, LP

Alexander Yuan, NEPA Contact & Project Manager
United States Department of State
Bureau of Oceans and International Environmental
and Scientific Affairs, Room 2657
Washington, DC 20520

Cooperating Agencies

U.S. Army Corps of Engineers (USACE)
U.S. Department of Agriculture – Farm Service Agency (FSA)
U.S. Department of Agriculture – Natural Resource Conservation Service (NRCS)
U.S. Department of Agriculture – Rural Utilities Service (RUS)
U.S. Department of Energy – Office of Policy and International Affairs (PI)
U.S. Department of Energy – Western Area Power Administration (Western)
U.S. Department of Interior – Bureau of Land Management (BLM)
U.S. Department of Interior – National Park Service (NPS)
U.S. Department of Interior – U.S. Fish and Wildlife Service (USFWS)
U.S. Department of Transportation – Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety (PHMSA)
U.S. Environmental Protection Agency (EPA)
Montana Department of Environmental Quality (MDEQ)

Assisting Agencies

U.S. Department of Interior – Bureau of Reclamation (Reclamation)
Filmore, Greeley, Holt, Merrick, Nance, Saline, and Wheeler counties, Nebraska
Lower Big Blue Natural Resources and Upper Elkhorn Natural Resources districts, Nebraska

August 26, 2011

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ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/m^3	micrograms per cubic meter
µS/cm	microSiemens per centimeter; a measure of conductivity
ACHP	Advisory Council on Historic Preservation
AEUB	Alberta Energy and Utilities Board
AGS	Armor grip suspension
AIRFA	American Indian Religious Freedom Act of 1978
amsl	above mean sea level
ANSI	American National Standards Institute
AOPL	Association of Oil Pipelines
APC	area of probable concern
APE	area of potential effects
APHIS	Animal and Plant Health Inspection Service
API	American Petroleum Institute
APLIC	Avian Power Line Interaction Committee
AQCR	Air Quality Control Regions
ARG	American Resources Group, Ltd.
ARM	Administrative Rules Montana
ARPA	Archeological Resources Protection Act
ASME	American Society of Mechanical Engineers
ASRD	Alberta Sustainable Resource Development
BACT	best available control technology
bbl	barrel
BEPC	Basin Electric Power Cooperative
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
bpd	barrels per day
C&SD	Conservation and Survey Division
CAA	Clean Air Act
CAPP	Canadian Association of Petroleum Producers
CEAA	Canadian Environmental Assessment Act

ABBREVIATIONS AND ACRONYMS (CONTINUED)

CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMR Plan	Construction, Mitigation, and Reclamation Plan
CNRL	Canadian Natural Resources Limited
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CREP	Conservation Reserve Enhancement Program
CRA	corrosion-resistant alloy
CRP	Conservation Reserve Program
CSA	Canadian Standards Association
CWA	Clean Water Act
CWS	Canadian Wildlife Service
CZMA	Coastal Zone Management Act of 1972
dBA	decibels on the A-weighted scale
DEQ	Department of Environmental Quality
DNRC	Department of Natural Resources and Conservation
DOS	Department of State
DPHHS	Department of Public Health and Human Services
EA	Environmental Analysis
EFH	essential fish habitat
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EMF	Electro magnetic field
EO	Executive Order
ERCB	Energy Resources Conservation Board
ERP	Emergency Response Plan
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
FBE	fusion-bonded epoxy
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHA	Federal Highway Administration

ABBREVIATIONS AND ACRONYMS (CONTINUED)

FLPMA	Federal Land Policy and Management Act
FR	Federal Register
FWCA	Fish and Wildlife Coordination Act
GAP	National Gap Analysis Program
GEP	good engineering practice
GHG	greenhouse gas(es)
GIS	Geographic Information System
GLO	General Land Office
GPA	Game Production Area
gpm	gallons per minute
H_2	hydrogen gas
HAP	hazardous air pollutant
HCA	high consequence area
HDD	horizontal directional drill
HHS	Health and Human Services
HSI	Habitat Suitability Index
HPRCC	High Plains Regional Climate Center
HPSA	Health Professional Shortage Areas
HRSA	Health Resource Services Administration
IFR	internal floating roof
IMP	integrity management plan
IPL	Institute of Public Law
KDHE	Kansas Department of Health and Environment
Keystone	TransCanada Keystone Pipeline, LP
KGS	Kansas Geological Survey
kPa	kilopascal
KSDA	Kansas Department of Agriculture
Ksi	pounds per square inch
kV	kilovolt
LCA	lifecycle analysis
Ldn	day-night sound level
LEPC	Local Emergency Planning Committee
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LULC	land use and land cover

ABBREVIATIONS AND ACRONYMS (CONTINUED)

MACT	Maximum Achievable Control Technology
MAOP	maximum allowable operating pressure
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
MEPA	Montana Environmental Policy Act
MFSA	Major Facilities Siting Act
MFWP	Montana Fish, Wildlife, and Parks
mg/l	milligrams per liter
MGWPCS	Montana Ground Water Pollution Control System
MLA	Mineral Leasing Act
MLV	mainline valve
MNHP	Montana Natural Heritage Program
MPDES	Montana Pollutant Discharge Elimination System
MSGWG	Montana Sage Grouse Work Group
MUA/P	Medically Underserved Areas/Populations
MUID	Map Unit Identification
MVA	million volt amperes
mya	million years ago
NAAQS	National Ambient Air Quality Standards
NAC	Nebraska Administrative Code
NACE	National Association of Corrosion Engineers
NAGPRA	Native America Graves Protection and Repatriation Act
NASS	National Agricultural Statistical Service
NAUS	National Atlas of the United States
NDA	Nebraska Department of Agriculture
NHD	National Hydrography Dataset
NDT	non-destructive testing
NEAAQS	Nebraska Ambient Air Quality Standards
NEB	National Energy Board (Canada)
NEBA	National Energy Board Act (Canada)
NEDEQ or NDEQ	Nebraska Department of Environmental Quality
NEDNR	Nebraska Department of Natural Resources
NEPA	National Environmental Policy Act

ABBREVIATIONS AND ACRONYMS (CONTINUED)

NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NGPC	Nebraska Game and Parks Commission
NGPD	Nebraska Game and Parks Department
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act of 1986
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NNSR	Nonattainment New Source Review
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Association
NOGCC	Nebraska Gas and Oil Conservation Commission
NOI	Notice of Intent
NO_X	nitrogen oxide
nominal capacity	The long-term sustainable capacity of the pipeline
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRD	Natural Resources District
NRHP	National Register of Historic Places
NRI	National Rivers Inventory
NSA	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review
NVCS	National Vegetation Classification System
NWI	National Wetland Inventory
NWP	nationwide permits
NWR	National Wildlife Refuge
NWSRS	Nebraska Wild and Scenic River System
O_2	oxygen gas
O_3	ozone
OAFF	Oklahoma Agriculture Food and Forestry

ABBREVIATIONS AND ACRONYMS (CONTINUED)

OCC	Operations Control Center
ODWC	Oklahoma Department of Wildlife Conservation
ONHI	Oklahoma Natural Heritage Inventory
OPS	Office of Pipeline Safety
OSHA	Occupational Safety and Health Administration
PADD	Petroleum Administration for Defense District. Regions defined by the Energy Information Administration, U.S. Department of Energy that describes a market area for crude oil in the U.S.
PEM	palustrine emergent wetland
PFO	palustrine forested wetland
PFYC	Potential Fossil Yield Classification
PHMSA	Pipeline Hazardous Material Safety Administration
PIP	Preliminary Information Package
PMP	Pipeline Maintenance Program
POD	Plan of Development
ppb	parts per billion
ppm	parts per million
ppmw	parts per million by weight
Project	Keystone XL Project
PSD	prevention of significant deterioration
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PSRP	Pipeline Spill Response Plan
PSS	palustrine scrub shrub wetland
PWMB	Piney Woods Mitigation Bank
PWS	Public Water and Sewer
Reclamation	Bureau of Reclamation
RFI	radio frequency interference
RMPs	Resource Management Plans
ROW	right-of-way
RSA	regional study area
RWBC	Rainwater Basin Complex
SAL	State Archaeological Landmark
SARC	State Archaeological Research Center

ABBREVIATIONS AND ACRONYMS (CONTINUED)

SCADA	Supervisory Control and Data Acquisition
SDCL	South Dakota Common Law
SDCWCS	South Dakota Comprehensive Wildlife Conservation Service
SDDENR	South Dakota Department of Environment and Natural Resources
SDGFP	South Dakota Game, Fish, and Parks
SDNHD	South Dakota Natural Heritage Database
SDPUC	South Dakota Public Utilities Commission
SDGS	South Dakota Geological Survey
SGSK	State Geological Survey of Kansas
SHPO	State Historic Preservation Office(er)
SIP	State Implementation Plan
SMYS	specified minimum yield strength
SO_2	sulfur dioxide
SPAF	Special Permit Analysis and Findings
SPCC	Spill Prevention, Control, and Countermeasure
SSURGO	Soil Survey Geographic database
SWCA	SWCA Environmental Consultants
SWPA	Source Water Protection Area
SWPPP	Stormwater Pollution Prevention Plan
THC	Texas Historical Commission
TARL	Texas Archaeological Research Laboratory
TBD	To Be Determined
TCEQ	Texas Commission on Environmental Quality
TCP	traditional cultural properties
TCZB	Texas Coastal Zone Boundary
TDS	total dissolved solids
TERP	Texas Emissions Reduction Plan
THC	Texas Historical Commission
THPO	Tribal Historic Preservation Officer
TMDL	total maximum daily load
TNC	transient non-community
TOPS	Texas Offshore Port System
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TRB	Transportation Research Board

ABBREVIATIONS AND ACRONYMS (CONTINUED)

TSS	total suspended solids
TWAs	temporary workspace areas
TxLED	Texas Low Emission Diesel
TXNDD	Texas Natural Diversity Database
UPS	uninterrupted power supply
U.S.	United States
USA	unusually sensitive area
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDA SCS	U.S. Department of Agriculture-Soil Conservation Service
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VEC	valued ecosystem component
VOC	volatile organic compounds
VOL	volatile organic liquid
VRM	visual resource management
WCS	Western Canadian Select
WCSB	Western Canadian Sedimentary Basin
Western	Western Area Power Administration
WHPA	wellhead protection areas
WHMA	wildlife habitat management area
Williston Basin	A large sedimentary basin in eastern Montana, western North and South Dakota, and southern Saskatchewan known for its rich deposits of crude oil
WMA	wildlife management area
WRCC	Western Regional Climate Center
WRP	Wetland Reserve Program
WRPA	water resource protection areas
WSA	wilderness study area
WTT	well to tank
WTW	well to wheel

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INTRODUCTION

In September 2008, TransCanada Keystone Pipeline, LP (Keystone) filed an application for a Presidential Permit with the U.S. Department of State (DOS) to build and operate the Keystone XL Project. The proposed Project would have the capacity to transport 700,000 barrels per day (bpd) of crude oil to delivery points in Oklahoma and southeastern Texas.

This Executive Summary of the final environmental impact statement (final EIS) summarizes the proposed Project, including the purpose of and need for the Project, and the major conclusions and areas of concern raised by agencies and the public. More detailed information on the proposed Project, alternatives to the proposed Project, and the associated potential environmental impacts is presented in the final EIS that is provided in the CD in the sleeve on the back page.

PRESIDENTIAL PERMITTING PROCESS

All facilities which cross the international borders of the United States require a Presidential Permit. For liquid hydrocarbon pipelines, the President, through Executive Order 13337, directs the Secretary of State to decide whether a project is in the national interest before granting a Presidential Permit.

As part of the Presidential Permit review process, DOS determined that it should prepare an EIS consistent with the National Environmental Policy Act (NEPA). DOS is the lead federal agency for the NEPA environmental review of the Proposed Project because the need for a Presidential Permit is the most substantial federal decision related to the Proposed Project. To assist in preparing the EIS, DOS retained an environmental consulting firm, Cardno ENTRIX, following DOS guidelines on third-party contracts. The DOS environmental and safety review of the proposed Project that lead to the final EIS was conducted for nearly 3 years and included consultations with the third-party contractor, cooperating agencies, and scientists and engineers with expertise in key areas of concern related to the proposed Project.

The determination of national interest involves consideration of many factors, including energy security; environmental, cultural, and economic impacts; foreign policy; and compliance with relevant federal regulations. Before making a decision, DOS will consult with the eight federal agencies identified in Executive Order 13337: the Departments of Energy, Defense, Transportation, Homeland Security, Justice, Interior, and Commerce, and the Environmental Protection Agency (EPA). DOS will also solicit public input on the national interest determination by accepting written comments and holding comment meetings in the six states traversed by the proposed route and in Washington, D.C.

Figure ES-1 lists the major events, public outreach activities, and other details of the environmental review and national interest determination processes.

Aboveground Facilities

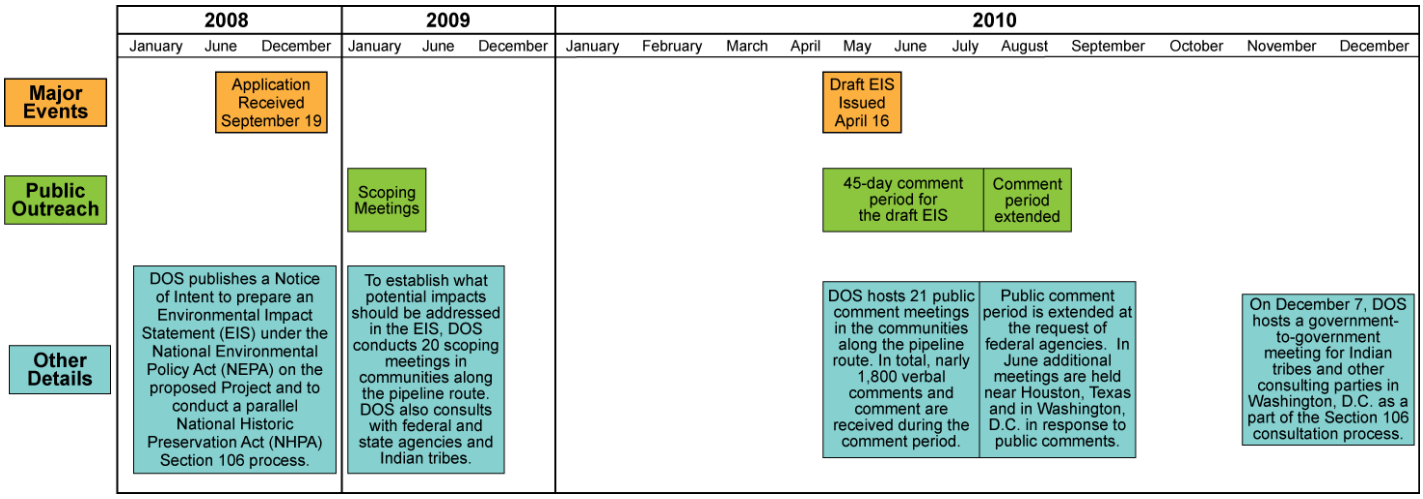
- 30 pump stations on 5- to15-acre sites
- Delivery facilities at Cushing, Oklahoma and Nederland and Moore Junction, Texas
- Densitometer sites located at all injection points and at all delivery points
- 112 mainline valves along pipeline and 2 mainline valves at each pump station
- Tank farm at Cushing, Oklahoma on a 74-acre site

See Section 2.2 for further information on aboveground facilities.

SUMMARY OF THE KEYSTONE XL PROJECT

The proposed Keystone XL Project consists of a crude oil pipeline and related facilities that would primarily be used to transport Western Canadian Sedimentary Basin crude oil from an oil supply hub near Hardisty, Alberta, Canada to delivery points in Oklahoma and Texas. The proposed Project would also be capable of transporting U.S. crude oil to those delivery points. The U.S. portion of the pipeline would begin near Morgan, Montana at the international border of the United States and extend to delivery points in Nederland and Moore Junction, Texas. There would also be a delivery point at Cushing, Oklahoma. These three delivery points would provide access to many other U.S. pipeline systems and terminals, including pipelines to refineries in the U.S. Gulf Coast region. Market conditions, not the operator of the pipeline, would determine the refining locations of the crude oil.

Figure ES-1
U.S. Department of State Environmental and National Interest Determination Review Processes



The proposed Keystone XL pipeline would consist of approximately 1,711 miles of new 36-inch-diameter pipeline, with approximately 327 miles of pipeline in Canada and 1,384 miles in the U.S. Figure ES-3 depicts the three segments of the proposed Project in the U.S. As noted in that illustration, the proposed Project would connect to the northern and southern ends of the existing Cushing Extension of the Keystone Oil Pipeline System.

Figure ES-4 illustrates the construction sequence that would be followed for the proposed Project. The proposed Project would also include 30 electrically operated pump stations, 112 mainline valves, 50 permanent access roads, and a new oil storage facility in Cushing, Oklahoma. If market conditions change, the capacity of the proposed Project could be increased to 830,000 bpd by increasing pumping capacity at the proposed pump stations.

The overall proposed Keystone XL Project is estimated to cost $7 billion. If permitted, it would begin operation in 2013, with the actual date dependant on the necessary permits, approvals, and authorizations.

Transport of Canadian Oil Sands Crude Oil

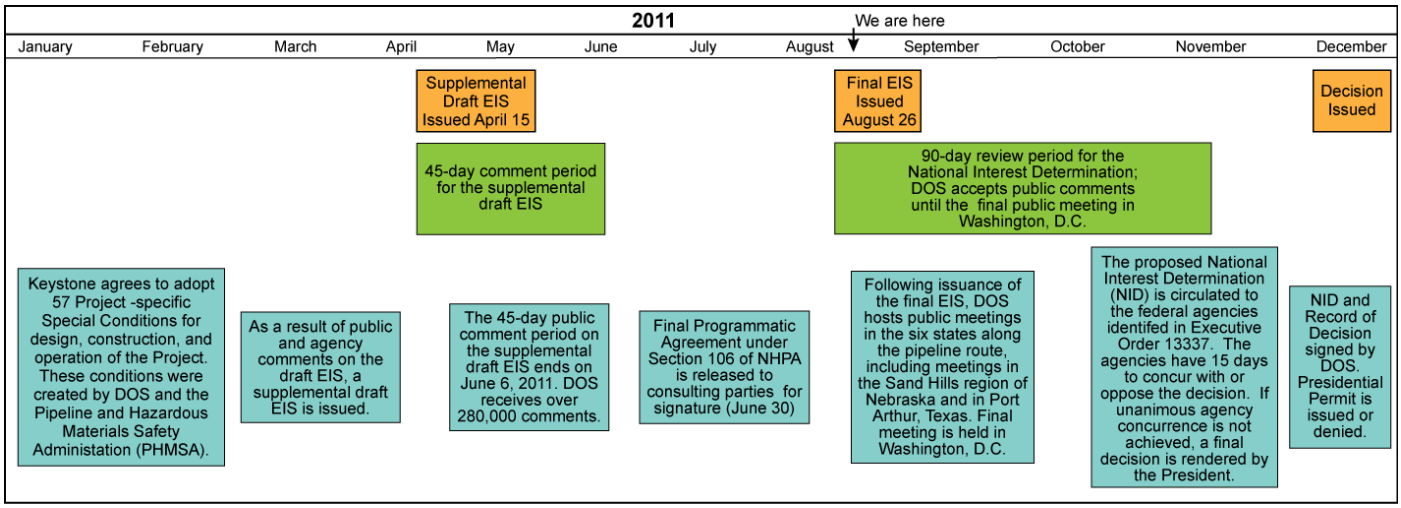
The proposed Keystone XL Project would primarily transport crude oil extracted from the oil sands areas in Alberta, Canada. Oil sands (which are also referred to as tar sands) are a combination of clay, sand, water, and bitumen, which is a material similar to soft asphalt. Bitumen is extracted from the ground by mining or by injecting steam underground to heat the bitumen to a point where it liquefies and can be pumped to the surface.

Bitumen is treated in several ways to create crude oil suitable for transport by pipeline and refining. The types of Canadian crude oil that would be transported by the proposed Project would primarily consist of synthetic crude oil and diluted bitumen.

Synthetic crude oil is produced from bitumen using refining methods – a process termed upgrading – that in general converts bitumen into lighter liquid hydrocarbons. In other words, the bitumen is converted into a crude oil similar to conventional crude oil.

Figure ES-2
36-Inch-Diameter Crude Oil Pipe

Figure ES-1 (Cont.)
U.S. Department of State Environmental and National Interest Determination Review Processes



Diluted bitumen – often termed dilbit – consists of bitumen mixed with a diluent, which is a light hydrocarbon liquid such as natural gas condensate or refinery naphtha. The bitumen is diluted to reduce its viscosity so that it is in a more liquid form that can be transported via pipeline. Dilbit is also processed to remove sand, water, and other impurities. The diluents in dilbit are integrally combined with the bitumen to form a crude oil that is a homogenous mixture that does not physically separate when released.

Both synthetic crude oil and dilbit are similar in composition and quality to the crude oils currently transported in pipelines in the U.S. and being refined in Gulf Coast refineries. Neither type of crude oil requires heating for transport in pipelines.

Pipe Specifications

- Material: High-strength X70 steel pipe, API 5L
- Outside diameter: 36 inches
- Operating Pressure: 1,308 psig
- External Coating: fusion-bonded epoxy

See Section 2.3.1 for further information on pipe specifications.

Transport of U.S. Crude Oil

In late 2010, Keystone Marketlink, LLC announced plans for two separate projects that would enable crude oil from domestic sources to be transported in the proposed Keystone XL Project. Those two projects, the Bakken Marketlink Project and the Cushing Marketlink Project, are considered "connected actions" under NEPA. The Bakken Marketlink Project would allow transport of up to 100,000 bpd of crude oil from the Bakken formation in the Williston Basin in Montana and North Dakota. These fields have experienced high growth in the last few years as new technology has allowed the oil to be profitably extracted. Keystone currently has long-term commitments for transporting 65,000 bpd of crude oil in the proposed Keystone XL Project from the Bakken Marketlink Project.

The Cushing Marketlink Project would allow transport of up to 150,000 bpd on the proposed Project from the Cushing, Oklahoma area to the proposed Keystone XL Project delivery points in Texas.

Other Connected Actions

In addition to the Marketlink projects, there are two other types of connected actions associated with the proposed Project: electrical distribution lines and substations that would provide power for the pump stations, and an electrical transmission line that would be required to ensure transmission system reliability when the proposed Project is operating at maximum capacity. Those projects would not be built or operated by Keystone, and the permit applications for those projects would be reviewed and acted on by other agencies. Although only limited information was available on the design, construction, and operation of the projects, DOS assessed the potential impacts of the projects based on currently available information.

Figure ES-3
Proposed Pipeline Route

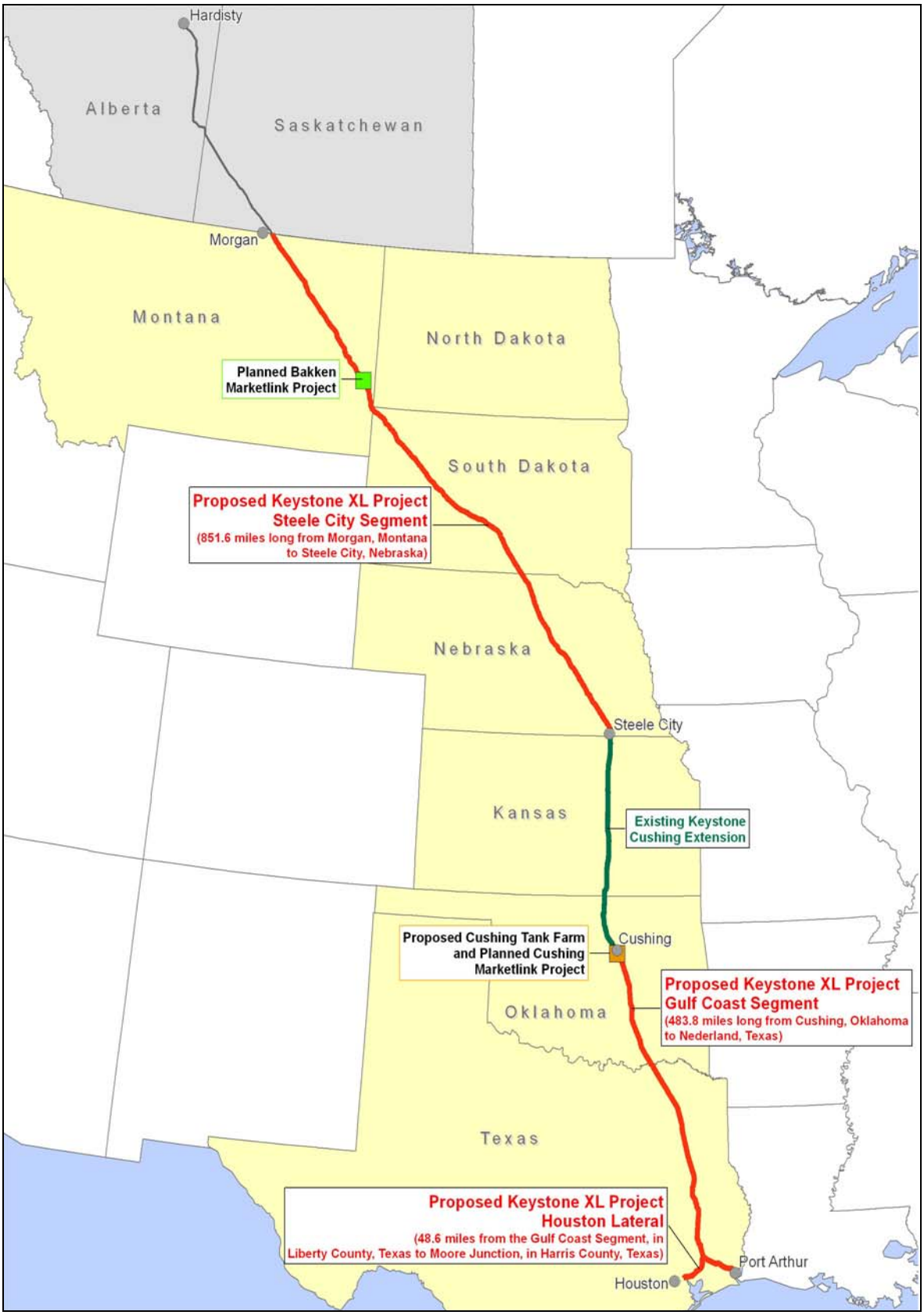
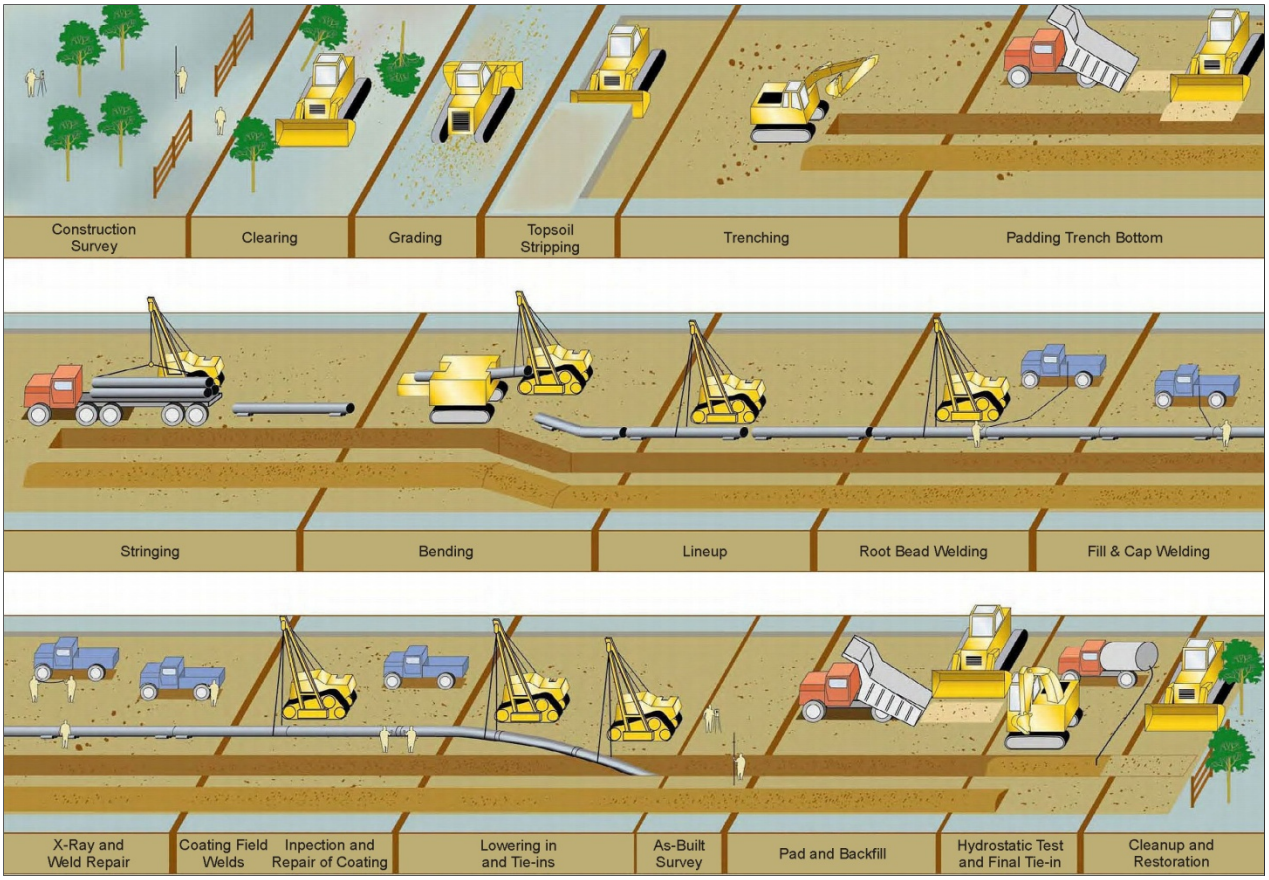


Figure ES-4
Typical Pipeline Construction Sequence



PURPOSE OF AND NEED FOR THE KEYSTONE XL PROJECT

The primary purpose of the proposed Project is to provide the infrastructure necessary to transport Western Canadian Sedimentary Basin heavy crude oil from the U.S. border with Canada to delivery points in Texas in response to the market demand of Gulf Coast refineries for heavy crude oil. This market demand is driven by the need of the refiners to replace declining feed stocks of heavy crude oil obtained from other foreign sources with crude oil from a more stable and reliable source. Keystone currently has firm, long-term contracts to transport 380,000 bpd of Canadian crude oil to the Texas delivery points.

An additional purpose of the proposed Project is to transport Canadian heavy crude oil to the proposed Cushing tank farm in response to the market demand of refineries in the central and Midwest U.S. for heavy crude oil. Keystone also has firm contracts to transport 155,000 bpd of Canadian crude oil to Cushing, Oklahoma in the existing Keystone Oil Pipeline Project. If the proposed Project is approved and implemented, Keystone would transfer shipment of crude oil under those contracts to the proposed Project. Although there is sufficient pipeline capacity from Canada to the U.S. in general to accommodate projected additional imports of Canadian crude in the short to medium term, there is extremely limited pipeline transport capacity to move such crude oils to Gulf Coast refineries.

The 58 refineries in the Gulf Coast District provide a total refining capacity of approximately 8.4 million bpd, or nearly half of U.S. refining capacity. These refineries provide substantial volumes of refined petroleum product, such as gasoline and jet fuel, via pipeline to the Gulf Coast region as well as the East Coast and the Midwest.

In 2009, Gulf Coast refineries imported approximately 5.1 million bpd of crude oil from more than 40 countries. The top four suppliers were Mexico, Venezuela, Saudi Arabia, and Nigeria. Of the total

volume imported, approximately 2.9 million bpd was heavy crude oil similar to the crude oil that would be transported by the proposed Project; Mexico and Venezuela were the major suppliers. However, imports of heavy crude oil from these two countries have been in steady decline while Gulf Coast refining capacity is projected to grow by at least 500,000 bpd by 2020, with or without the proposed Project.

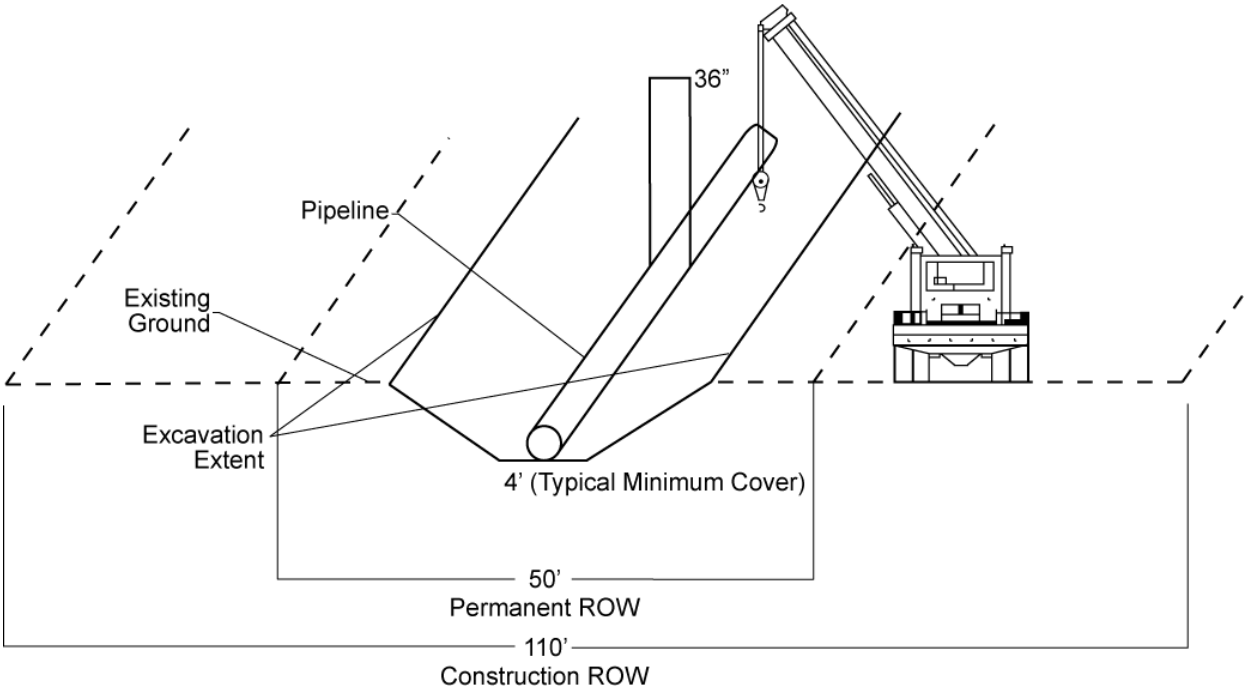
PROJECT DESIGN AND SAFETY

The Pipeline and Hazardous Materials Safety Administration (PHMSA), a federal agency within the U.S. Department of Transportation, is the primary federal regulatory agency responsible for ensuring the safety of America's energy pipelines, including crude oil pipeline systems. As a part of that responsibility, PHMSA established regulatory requirements for the construction, operation, maintenance, monitoring, inspection, and repair of hazardous liquid pipeline systems.

In 2009, Keystone applied to PHMSA for a Special Permit to operate the proposed Project at a slightly higher pressure than allowed under the existing regulations. DOS worked with PHMSA to develop Project-specific Special Conditions that would have been incorporated into the Special Permit. However, in August 2010, Keystone withdrew its application to PHMSA for a Special Permit. However, to enhance the overall safety of the proposed Project, DOS and PHMSA continued working on Special Conditions specific to the proposed Project and ultimately established 57 Project-specific Special Conditions. As a result, Keystone agreed to design, construct, operate, maintain, and monitor the proposed Project in accordance with the more stringent 57 Project-specific Special Conditions in addition to complying with the existing PHMSA regulatory requirements.

In consultation with PHMSA, DOS determined that incorporation of the Special Conditions would result in a Project that would have a degree of safety greater than any typically constructed domestic oil pipeline system under current regulations and a degree of safety along the entire length of the pipeline system that would be similar to that required in high consequence areas as defined in the regulations. Key aspects of the Special Conditions are summarized below. Appendix U of the EIS presents the Special Conditions and a comparison of the conditions with the existing regulatory requirements.

Figure ES-5
Pipeline Cross-section



Pipe Design and Manufacturing

The first nine Special Conditions present design standards to be used in manufacturing the pipe and requirements for pipe materials, pipe inspections at the mill and in the field, performance tests, and quality control procedures.

System Design, Construction and Testing

Conditions 10 through 23 address design and construction of the proposed Project, including testing of Project components. Those Conditions present requirements for aspects of the proposed Project such as field coatings, depth of cover over the pipeline, temperature and overpressure control, welding procedures, and testing prior to operations. Testing requirements include hydrostatic testing, a process which involves filling the line with water and increasing the pressure within the pipeline to test the pipeline's ability to withstand pressure. If the test water pressure drops, further testing must be conducted and reported to PHMSA, and faulty pipeline sections must be repaired or replaced. Operations could not begin until the entire system has passed the required hydrostatic testing.

Operations, Maintenance, and Monitoring

Conditions 24 through 49 present the requirements for the Supervisory Control and Data Acquisition (SCADA) system that would be used to remotely monitor and control the pipeline, as well as requirements for internal corrosion inspection, cathodic protection, identification of the location of the pipeline with aboveground markers, internal pipeline inspections using electronic sensing devices termed "smart pigs," visual monitoring of the pipeline corridor, and repair procedures. The SCADA system would alert the Operations Control Center of an abnormal operating condition, indicating a possible release of oil. The system would include automatic features that would ensure operation within prescribed pressure limits. There would also be a complete backup system.

Figure ES-6
Smart Pig

Pipeline pressure is the primary indicator used by the SCADA system to detect an oil spill. If the monitoring system identifies a pressure change in the pipeline, the controller would evaluate the data to determine if it is a false alarm or an actual spill. Using pipeline pressure allows the operator to detect leaks down to approximately 1.5 to 2 percent of pipeline flow rate.

The proposed Project would also include a computer-based system that does not rely on pipeline pressure to assist in identifying leaks below the 1.5 to 2 percent detection thresholds.

In addition to computer monitoring, there would be scheduled patrols of the pipeline right-of-way as well as public and landowner awareness programs. Communities along the pipeline would be given information to facilitate the reporting of suspected leaks and events that could suggest a threat to pipeline safety.

Reporting, Record Keeping, and Certification

The final eight conditions present requirements for maintaining detailed records, development a right-of-way management plan, reporting to PHMSA, and providing PHMSA with certification from a senior officer of Keystone that it has complied with the Special Conditions.

SPILL POTENTIAL AND RESPONSE

Spills could result from many causes, including corrosion (external or internal), excavation equipment, defects in materials or in construction, over-pressuring the pipeline, and geologic hazards, such as ground movement, washouts, and flooding. Although the leak detection system would be in place, some leaks might not be detected by the system. For example, a pinhole leak could be undetected for days or a few weeks if the release volume rate were small and in a remote area.

In most cases the oil from a small leak would likely remain within or near the pipeline trench where it could be contained and cleaned up after discovery. As a result, for most small leaks it is likely that the oil would be detected before a substantial volume of oil reaches the surface and affects the environment. Spills may be identified during regular pipeline aerial inspections, by ground patrols and maintenance staff, or by landowners or passersby in the vicinity of the spill.

For larger spills, the released oil would likely migrate from the release site. However, DOS analysis of previous large pipeline oil spills suggests that the depth and distance that the oil would migrate would likely be limited unless it reaches an active river, stream, a steeply sloped area, or another migration pathway such as a drainage ditch.

Estimated Frequency of Spills

In spite of the safety measures included in the design, construction, and operation of the proposed Project, spills are likely to occur during operation over the lifetime of the proposed Project. Crude oil could be released from the pipeline, pump stations, or valve stations.

Although a large spill could occur at the proposed Cushing tank farm, each of the three 350,000-barrel tanks would be surrounded by a secondary containment berm that would hold 110 percent of the contents of the tank plus freeboard for precipitation. Therefore, there would have to be a concurrent failure of the secondary containment berm for a tank-farm spill to reach the area outside of the tank. Such an event is considered unlikely.

DOS calculated estimates of spill frequency and spill volumes. Those estimates included potential spills from the pipeline, pump stations, and valve stations. The calculations used data from the PHMSA spill incident database for hazardous liquid pipelines and crude oil pipelines, and from the National Response Center (NRC) database for releases and spills of hazardous substances and oil.

Based on those data, DOS calculated that there could be from 1.18 to 1.83 spills greater than 2,100 gallons per year for the entire Project. The estimated frequency of spills of any size ranged from 1.78 to 2.51 spills per year.

Keystone submitted a risk analysis that also included an estimate of the frequency of spills over the life of the proposed Project. Keystone's analysis was for the pipeline only and did not include releases from pump stations, valve stations, or the tank farm.

Keystone initially calculated a spill frequency of 1.38 spills per year based only on the historical PHMSA spill incident database available in 2008 when the application was submitted. Keystone also calculated a Project-specific spill frequency for the pipeline that considered the specific terrain and environmental conditions along the proposed Project corridor, required regulatory controls, depth of cover, strength of materials, and technological advances in the design of the proposed Project. Using those factors, Keystone estimated that there could be 0.22 spills per year from the pipeline.

Spills from the Existing Keystone Oil Pipeline System

The existing Keystone Oil Pipeline System has experienced 14 spills since it began operation in June 2010. The spills occurred at fittings and seals at pump or valve stations and did not involve the actual pipeline. Twelve of the spills remained entirely within the confines of the pump and valve stations. Of those spills, 7 were 10 gallons or less, 4 were 100 gallons or less, 2 were between 400 and 500 gallons, and 1 was 21,000 gallons.

The spill of 21,000 gallons occurred when a fitting failed at the Ludden, North Dakota pump station. As a result, PHMSA issued a Corrective Action Order, halting pipeline operation. Keystone was required to consult with PHMSA before returning the pipeline to operation. In that incident, most of the oil was contained within the pump station, but 210 gallons discharged from the pump station to adjacent land. The land affected was treated in place in compliance with North Dakota Department of Health land treatment guidelines.

Maximum Spill Volume

Keystone conducted an assessment of the maximum potential pipeline spill volume from a complete pipeline structural failure. Keystone estimated that the maximum spill volume would be approximately 2.8 million gallons, which would be possible along less than 1.7 miles of the proposed pipeline route due to topographic conditions. For approximately 50 percent of the proposed pipeline route (approximately 842 miles), the maximum spill volume would be approximately 672,000 gallons.

Figure ES-7
Pump Station on the Existing Keystone Oil Pipeline System

Emergency Planning

As required by PHMSA regulations, Keystone must submit an Emergency Response Plan and a Pipeline Spill Response Plan to PHMSA for review prior to initiation of operation of the proposed Project. These plans would not be completed until the final details of the proposed Project are established in all applicable permits.

If a leak is suspected, the Emergency Response Plan and Pipeline Spill Response Plan would be initiated. After confirmation that a spill occurred, the operator would shut down pumps and close the isolation valves, actions that would require approximately 12 minutes.

Local Emergency Planning Committees (LEPCs)

LEPCs were established as a part of the Emergency Planning and Community Right-to-Know Act. Keystone has committed to a communication program to reach out to LEPCs along the proposed pipeline corridor during development of the Emergency Response Plan and the Pipeline Spill Response Plan, with particular consideration given to emergency planning for low income and minority populations. The LEPCs would participate in emergency response consistent with their authority under the Right-to-Know Act and as required by their local emergency response plans.

POTENTIAL ENVIRONMENTAL IMPACTS OF OIL SPILLS

Impacts from an oil spill would be affected by variables such as the weather, time of year, water level, soil, local wildlife, and human activity. The extent of impact would also depend on the response time and capabilities of the emergency response team.

The greatest concern would be a spill in environmentally sensitive areas, such as wetlands, flowing streams and rivers, shallow groundwater areas, areas near water intakes for drinking water or for commercial/industrial uses, and areas with populations of sensitive wildlife or plant species.

General Types of Potential Impacts

There are two primary types of impacts that occur with a spill of crude oil – physical impacts and toxicological impacts. Physical impacts typically consist of the coating of soils, sediments, plants, and animals. The coating of organisms can result in effects such as preventing them from feeding or obtaining oxygen, reducing the insulating ability of fur or feathers, and adding weight to the organism so that it cannot move naturally or maintain balance. In addition, oil may coat beaches along rivers or lakes and foul other human-use resources.

Toxicological impacts of an oil spill are a function of the chemical composition of the oil, the solubility of each class of compounds in the oil, and the sensitivity of the area or organism exposed. Crude oil may be toxic when ingested. Ingestion typically occurs when an oiled animal attempts to clean its fur or feathers. Some of the possible toxic effects include direct mortality, interference with feeding or reproductive capacity, disorientation, reduced resistance to disease, tumors, reduction or loss of various sensory perceptions, and interference with metabolic, biochemical, and genetic processes.

Birds typically are the most affected wildlife due to an oil spill. Oil on feathers causes hypothermia or drowning due to the loss of flotation, and birds may suffer both acute and chronic toxicological effects. In addition, dead oiled birds may be scavenged by other animals.

Fish and aquatic invertebrates could also experience toxic impacts of spilled oil. The potential impacts would generally be greater in standing water habitats − such as wetlands, lakes and ponds − than in flowing rivers and creeks.

Crude oil spills are not likely to have toxic effects on the general public because of the many restrictions that local, state and federal agencies impose to avoid environmental exposure after a spill.

Potential Impacts to the Ogallala Aquifer and other Groundwater Areas

DOS recognizes the public's concern for the Northern High Plains Aquifer System, which includes the Ogallala aquifer formation and the Sand Hills aquifer unit.

The Northern High Plains Aquifer system supplies 78 percent of the public water supply and 83 percent of irrigation water in Nebraska and approximately 30 percent of water used in the U.S. for irrigation and agriculture. Of particular concern is the part of the aquifer which lies below the Sand Hills region. In that region, the aquifer is at or near the surface.

DOS assessed the potential impacts of the proposed Project on many aquifer systems. The aquifer analysis included the identification of potable groundwater in water wells within 1 mile of the proposed centerline of the pipeline. More than 200 Public Water Supply wells, most of which are in Texas, are within 1 mile of the proposed centerline, and 40 private water wells are within 100 feet of the centerline. No sole-source aquifers, or aquifers serving as the principal source of drinking water for an area, are crossed by the proposed pipeline route.

The potential for a crude oil spill to reach groundwater is related to the spill volume, the viscosity and density of the crude oil, the characteristics of the environment into which the crude oil is released (particularly the characteristics of the underlying soils), and the depth to groundwater. The depth to groundwater is less than 10 feet for about 65 miles of the proposed route in Nebraska and there are other areas of shallow groundwater in each state along the proposed route. Diluted bitumen and synthetic crude oil, the two types of crude oil that would be transported by the proposed Project, would both initially float on water if spilled. Over time, the lighter aromatic fractions of the crude oil would evaporate, and water-soluble components could enter the groundwater.

Studies of oil spills from underground storage tanks indicate that potential surface and groundwater impacts are typically limited to several hundred feet or less from a spill site. An example of a crude oil release from a pipeline system into an environment similar to the Northern High Plains Aquifer system occurred in 1979 near Bemidji, Minnesota.

While the conditions at Bemidji are not fully analogous to the Sand Hills region, extensive studies of the Bemidji spill suggest that impacts to shallow groundwater from a spill of a similar volume in the Sand Hills region would affect a limited area of the aquifer around the spill site. In no spill incident scenario would the entire Northern High Plains Aquifer system be adversely affected.

In addition to the Northern High Plains Aquifer system, there are other groundwater areas along the proposed route, including shallow or near-surface aquifers. DOS in consultation with PHMSA and EPA determined that Keystone should commission an independent consultant to review the Keystone risk assessment. The independent review will be conducted by a firm approved by DOS in concurrence with PHMSA and EPA, and would focus on a review of valve placement and the possibility of deploying external leak detection systems in areas of particularly sensitive environmental resources, but would not be limited to those issues. The specific scope of the analysis will be approved by DOS, PHMSA, and EPA. DOS, with concurrence from PHMSA and EPA, will determine the need for any additional mitigation measures resulting from the analysis.

Potential Environmental Justice Concerns

Low income and minority communities could be more vulnerable to health impacts than other communities in the event of a spill, particularly if access to health care is less available in the release area. Exposure pathways could include direct contact with the crude oil, inhalation of airborne contaminants, or consumption of food or water contaminated by either the crude oil or components of the crude oil. Keystone agreed to remediate spills, restore the affected areas, and provide alternative water supplies if a spill contaminates groundwater or surface water. Keystone also agreed to develop communications directed at bilingual communities, such as signage in both English and Spanish languages, and emergency communications in both languages.

ALTERNATIVES CONSIDERED

DOS considered the following three major alternative scenarios:

- No Action Alternative – potential scenarios that could occur if the proposed Project is not built and operated;
- System Alternatives − the use of other pipeline systems or other methods of providing Canadian crude oil to the Cushing tank farm and the Gulf Coast market;
- Major Route Alternatives − other potential pipeline routes for transporting heavy crude oil from the U.S./Canada border to Cushing, Oklahoma and the Gulf Coast market.

No Action Alternative

Under the No Action Alternative, the potential adverse and positive impacts associated with building and operating the proposed Project would not occur. However, there is an existing market demand for heavy crude oil in the Gulf Coast area. The demand for crude oil in the Gulf Coast area is projected to increase and refinery runs are projected to grow over the next 10 years, even under a low demand outlook.

A report commissioned by the Department of Energy (DOE) indicated that whether the proposed Project is built or not is unlikely to impact the demand for heavy crude oil by the Gulf Coast refineries. Even if improved fuel efficiency and broader adoption of alternative fuels reduced overall demand for oil, demand for Canadian heavy crude oil at Gulf Coast refineries would not be substantially affected.

At the same time, three of the four countries that are major crude oil suppliers to Gulf Coast refineries currently face declining or uncertain production horizons. As a result, those refineries are expected to obtain increased volumes of heavy crude oil from alternative sources in both the near term and further into the future. Implementation of the No Action Alternative would not meet this need.

If the proposed Project is not built and operated, Gulf Coast refineries could obtain Canadian crude oil transported through other new pipelines or by rail or truck transport. Other pipeline projects have been proposed to transport Canadian crude oil to the Gulf Coast area, and both rail transport and barge transport could be used to meet a portion of the need. In addition, the Gulf Coast refineries could obtain crude oil transported by marine tanker from areas outside of North America. Many of the sources outside of North America are in regions that are experiencing declining production or are not secure and reliable sources of crude oil, including the Middle East, Africa, Mexico, and South America.

As a result of these considerations, DOS does not regard the No Action Alternative to be preferable to the proposed Project.

If the proposed Project is not implemented, Canadian producers would seek alternative transportation systems to move oil to markets other than the U.S. Several projects have been proposed to transport crude oil out of using pipelines to Canadian ports.

Whether or not the proposed Project is implemented, Canadian producers would seek alternative transportation systems to move oil to markets other than the U.S. Several projects have been proposed to transport crude oil out of the oil sands area of Alberta using pipelines to Canadian ports.

System Alternatives

System alternatives would use combinations of existing or expanded pipeline systems, pipeline systems that have been proposed or announced, and non-pipeline systems such as tank trucks, railroad tank cars, and barges and marine tankers to transport Canadian heavy crude oil to Gulf Coast refineries.

None of the pipeline systems considered would be capable of transporting Canadian crude oil to Gulf Coast delivery points in the volumes required to meet Keystone's commitments for transporting 380,000 bpd to delivery points in Texas. Therefore they would not meet the purpose of the proposed Project. A combination of the pipeline systems considered could, over time, deliver volumes of Canadian oil sands crude oil in volumes similar to the volumes that would be transported by the proposed Project. However, that would not meet the near-term need for heavy crude oil at the Gulf Coast refineries. Expanding the pipeline systems that were considered to meet the purpose of the proposed Project or construction of new components or a combination of those systems would result in impacts similar to those of the proposed Project.

The trucking alternative would add substantial congestion to highways in all states along the route selected, particularly at and near the border crossing and in the vicinity of the delivery points. At those locations it is likely that there would be significant impacts to the existing transportation systems. Trucking would also result in substantially higher greenhouse gas emissions and a higher risk of accidents than transport by pipeline.

Development of a rail system to transport the volume of crude oil that would be transported by the proposed Project would likely produce less impact from construction than would the proposed Project because it could be done using existing tracks. However, there would be greater safety concerns and greater impacts during operation, including higher energy use and greenhouse emissions, greater noise impacts, and greater direct and indirect effects on many more communities than the proposed Project.

As a result of these considerations as described in Section 4.2 of the EIS, system alternatives were considered either not reasonable or not environmentally preferable.

Major Route Alternatives

The analysis of route alternatives considered 14 major route alternatives. Figure ES-8 depicts the alternative routes considered. The analysis of alternatives routes was conducted following the approach to assessments of alternative pipeline routes used by the Federal Energy Regulatory Commission. As a result, the analysis began with a screening process that first established criteria for screening alternatives, then identified potential alternatives that met the criteria, and determined whether or not they would (1) meet the purpose of and need for the proposed Project, and (2) be technically and economically practicable or feasible. For those alternatives meeting the criteria, DOS assessed whether or not the alternative offered an overall environmental advantage over the proposed route.

Due to public concern regarding the Ogallala Aquifer (Northern High Plains Aquifer system) and the Sand Hills region, 5 of the alternative routes were developed to either minimize the pipeline length over those areas or avoid the areas entirely. These alternative routes consisted of I-90 Corridor Alternatives A and B, Keystone Corridor Alternatives 1 and 2 (which are parallel to all or part of the route of the existing Keystone Oil Pipeline System), and the Western Alternative.

The assessment considered the environmental characteristics of the areas that these alternatives would cross, including the presence of aquifers, the depth of wells, developed land, forested areas, wetlands, and streams and rivers.

The Western Alternative was eliminated since it was financially impracticable. Although the other four route alternatives could have been eliminated based on consideration of economical and technical practicability and feasibility without further evaluation, they were nonetheless examined further with an emphasis on groundwater resources. The I-90 Corridor and Keystone Corridor alternatives would all avoid the Sand Hills; however, they would not avoid the Northern High Plains Aquifer system, and they would not avoid areas of shallow groundwater. Instead, these routes would shift risks to other areas of the Northern High Plains Aquifer system and to other aquifers.

In addition, these alternatives would be longer than the proposed route and would disturb more land and cross more water bodies than the proposed route. In addition, I-90 Corridor Alternatives A and B require crossing Lake Francis Case on the Missouri River which would pose technical challenges due to the width of the reservoir and the slope of the western side of the crossing area.

Keystone Corridor Alternatives 1 and 2 would cost about 25 percent more than the proposed Project (about $1.7 billion more) and implementation of either of those alternatives would compromise the Bakken Marketlink Project and the opportunity to transport crude oil from the producers in the Bakken formation to markets in Cushing and the Gulf Coast.

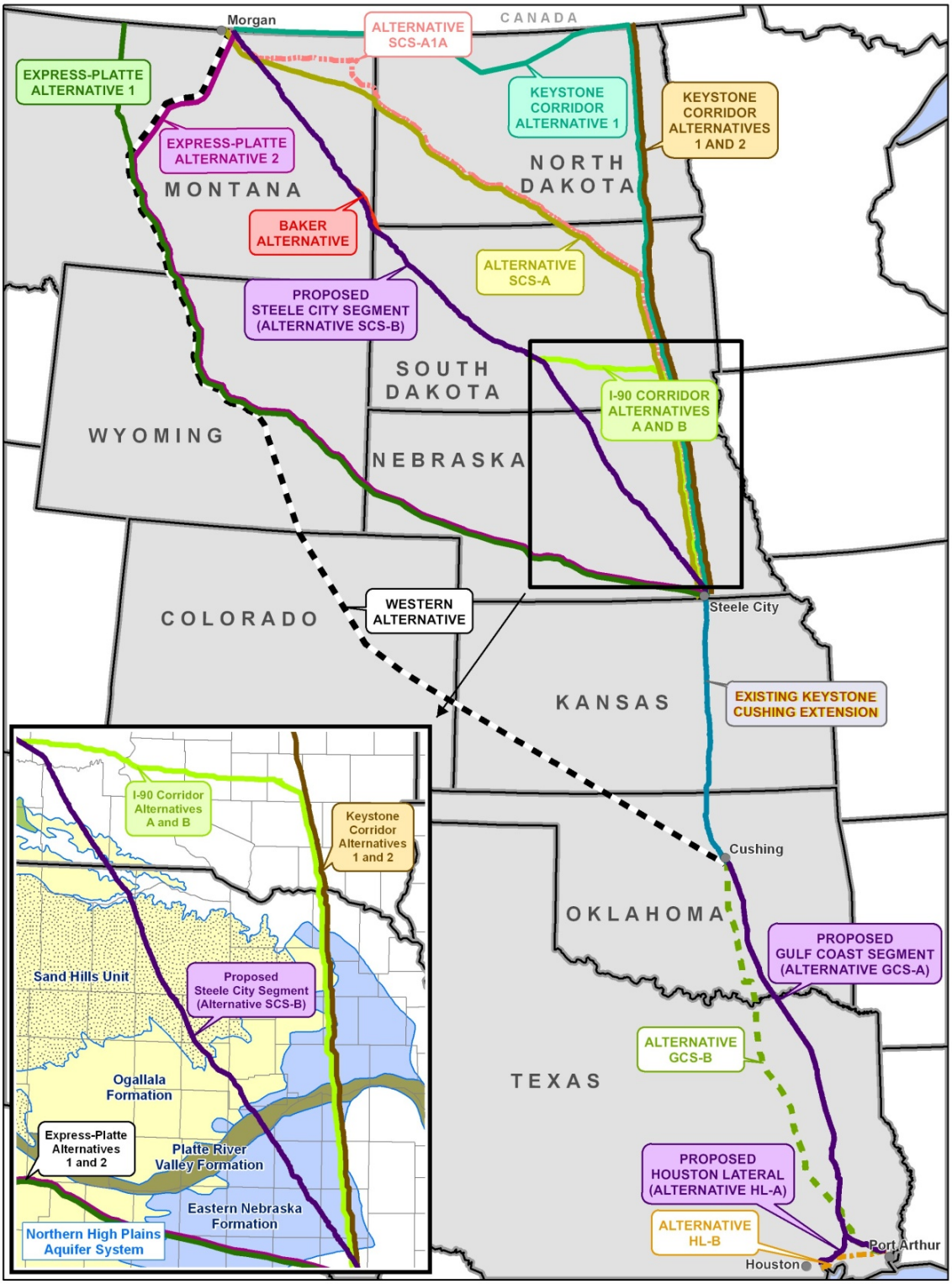
Based on the above considerations and as described in Section 4.3 of the EIS, DOS eliminated the major potential route alternatives from further consideration.

Route Variations and Minor Realignments

A route variation is a relatively short deviation from a proposed route that replaces a segment of the proposed route. Variations are developed to resolve landowner concerns and impacts to cultural resource sites, wetlands, recreational lands, and terrain.

DOS consulted with the Bureau of Land Management and state agencies to negotiate route variations and minor realignments, including nearly 100 in Montana and about 240 minor realignments in other states along the proposed route. Additional route variations and minor realignments may be added in response to specific conditions that may arise throughout the construction process.

Figure ES-8
Major Route Alternatives



The variations and minor realignments would replace short segments of the proposed Project, are relatively close to the proposed route, and would be implemented in accordance with applicable regulatory requirements of federal, state, or local permitting agencies. DOS considers the variations and minor realignments selected to have been evaluated sufficiently to meet the environmental review requirements of the National Environmental Protection Act.

Other Alternatives Considered

DOS also considered several other scenarios in response to comments on the draft EIS. The alternative pipeline designs considered consisted of an aboveground pipeline and a smaller diameter pipe to decrease the volume of oil released from a spill. DOS also considered alternative sites for the major aboveground facilities of the proposed Project, including pump stations, mainline valves, and the Cushing tank farm. None of the alternative designs or facility locations were considered safer or environmentally preferable to the proposed Project design.

Agency Preferred Alternative

DOS did not find any of the major alternatives to be preferable to the proposed Project for the reasons presented in the final EIS and summarized above. As a result, the agency-preferred alternative is the proposed Project route with the variations and minor route realignments described in the EIS, and the proposed location of the Cushing tank farm.

ENVIRONMENTAL ANALYSES

Four levels of impact duration were considered in the analysis of potential environmental impacts due to construction and normal operation of the proposed Project: 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 after construction, and impacts were considered long term if the resources would require more than 3 years to recover. Permanent impacts would occur if the resources would not return to pre-construction conditions during the life of the proposed Project, such as impacts to land use due to installation of pump stations.

Conclusions in the EIS are based on the analysis of environmental impacts and the understanding that:

- Keystone would comply with all applicable laws and regulations;
- The proposed Project would be constructed, operated, and maintained as described in the EIS;
- Keystone has agreed to incorporate the 57 Project-specific Special Conditions developed by PHMSA into the proposed Project;
- Keystone has agreed to implement the measures designed to avoid or reduce impacts described in its application for a Presidential Permit and supplemental filings with DOS, the measures in its Construction, Mitigation, and Reclamation (CMR) Plan presented in Appendix B of the EIS, and the construction methods for the Sand Hills region described in Appendix H to the EIS; and
- Keystone would incorporate the mitigation measures required in permits issued by environmental permitting agencies into the construction, operation, and maintenance of the proposed Project.

Environmental Justice

Executive Order 12898 requires federal agencies to address and mitigate potential adverse impacts to minority and low income populations. In consultation with EPA, DOS identified these communities within a 4-mile-wide corridor centered on the pipeline using census and county level data.

Potential Construction Impacts: The assessment suggested that potential impacts to minority and low income populations could occur primarily in Harris, Jefferson, and Angelina Counties in Texas and in Lincoln County, Oklahoma. During construction, potential impacts include exposure to increased dust and noise, disruption of traffic patterns, and increased competition for social services in underserved populations. At any given location along the proposed pipeline route, the duration of the construction period would typically range from 20 to 30 working days. As a result, the impacts to minority and low-income populations due to construction would be temporary and minor.

Medical Services: Areas along the pipeline route that are medically underserved may be more vulnerable during construction periods. These communities have been identified as Health Professional Shortage Areas or Medically Underserved Areas/Populations. However, construction-related disruptions in those areas would be temporary and minor. In areas in

Montana and South Dakota, minor medical needs of workers would be handled in construction camps to avoid or minimize the need for medical services from the surrounding communities.

Air Emissions Related to Environmental Justice Issues: The refineries that are likely to receive oil transported by the pipeline are already configured to process heavy crude oil, and in the future would seek to continue processing heavy crude oil whether or not the proposed pipeline is constructed. The analysis in the EIS, including a DOE-commissioned study, indicates that the proposed Project would not likely affect the overall quality or quantity of crude oil refined in the Gulf Coast region, and, as a result, would not likely effect refinery emissions.

Greenhouse Gas Emissions

DOS commissioned a detailed study of greenhouse gas life-cycle emissions that compared Canadian oil sands crude with other selected reference crudes. This study was a thorough review of recent scientific literature on greenhouse gas life-cycle emissions for Canadian oil sands crude including extraction, upgrading, transportation, refining, and combustion.

The study's major conclusion was that, throughout its life cycle, oil sands crude is, on average, more greenhouse gas intensive than the crude oil it would replace in the U.S. However, the relative greenhouse gas intensity varies depending on (1) study design factors, such as the reference crudes selected for comparison with Canadian oil sands crudes (e.g., 2005 U.S. average crude oil, Venezuelan Bachaquero, Middle East Sour, and Mexican Heavy) and the timeframe selected, and (2) study assumptions, such as the extraction method and the mix of crudes that would be transported by the pipeline.

For example, the Department of Energy's National Environmental Technology Lab (NETL) study indicated that the life-cycle greenhouse gas emissions of gasoline produced from Canadian oil sands crude are approximately 17 percent higher than gasoline from the 2005 average mix of crude oil consumed in the U.S. The NETL study serves as a key input for analyses conducted by EPA and DOE. In comparison, a study conducted by TIAX, LLC, found that the greenhouse gas emissions from gasoline produced from Canadian oil sands crude are only 2 percent higher when compared to gasoline from Venezuelan heavy crude, a type of crude oil that is similar to the crude oil that would be transported by the proposed Project and is currently refined in large quantities by Gulf Coast refineries.

The proposed Project is not likely to impact the amount of crude oil produced from the oil sands. However, for illustrative purposes, the DOS-commissioned study estimated that incremental life-cycle U.S. greenhouse gas emissions from displacing reference crude oils with Canadian oil sands crude oils imported through the proposed Project would be between 3 and 21 million metric tons of carbon dioxide emissions annually. This range is equivalent to annual greenhouse gas emissions from the combustion of fuels in 588,000 to 4,061,000 passenger vehicles.

In addition, current projections suggest that the amount of energy required to extract all crude oils is projected to increase over time due to the need to extract oil from ever deeper reservoirs using more energy intensive techniques. However, while the greenhouse gas intensity of reference crude oils may trend upward, the projections for the greenhouse gas intensity of Canadian oil sands crude oils suggests that they may stay relatively constant. Although there is some uncertainty in the trends for both reference crude oils and oil sands derived crude oils, on balance it appears that the gap in greenhouse gas intensity may decrease over time.

Geology and Soils

Geologic Hazards: Potential geologic hazards assessed in the EIS include seismic hazards (earthquakes), landslides, or subsidence (sink holes). The proposed route extends through relatively flat and stable areas and the potential for these events is low. The pipeline would not cross any known active faults with confirmed surface offsets. During construction, land clearing could increase the risk of landslides and erosion. Keystone agreed to construct temporary erosion control systems and revegetate the right-of-way after construction.

There is a risk of subsidence (sink holes) where the proposed route potentially crosses karst formations in Nebraska, Oklahoma, and Texas. Site-specific studies would be conducted as necessary to characterize the karst features, if they are encountered, and evaluate and modify construction techniques as necessary in these areas. The overall risk to the pipeline from karst-related subsidence is expected to be minimal.

Soils and Sediments: Potential impacts to soils include soil erosion, loss of topsoil, soil compaction, soil contamination, damage to existing tile drainage

systems, and permanent increases in the proportion of large rocks in the topsoil. However, Keystone agreed to construction procedures that are designed to reduce the likelihood and severity of Project impacts to soils and sediments, including topsoil segregation methods, and to mitigate impacts to the extent practicable.

Sand Hills Region: Of particular concern is the soil of the Sand Hills region of Nebraska, which is particularly vulnerable to wind erosion. To address this concern, Keystone developed and agreed to construction, reclamation, and post-construction procedures specifically for this area in consultation with local experts and state agencies. The goal of the Sand Hills region reclamation plan is to protect this sensitive area by maintaining soil structure and stability, stabilizing slopes to prevent erosion, restoring native grass species, and maintaining wildlife habitat and livestock grazing areas. Keystone agreed to monitor the right-of-way through the Sand Hills region for several years to ensure that reclamation and revegetation efforts are successful.

Water Resources

Groundwater: Many of the aquifers along the proposed route are isolated from the surface due to soil types above the aquifers that prevent or slow downward migration of water. However, shallow or near-surface aquifers are also present along the proposed route, as discussed above. Construction of the proposed Project may result in temporary to short-term increases in suspended solids in the shallow aquifers. The risk of dewatering shallow groundwater aquifers during construction or reducing groundwater quality due to increased sediments in the water would be temporary to short term.

At some locations, groundwater may be used as a source of water for pressure testing the pipeline during construction. Keystone must obtain all applicable water withdrawal and discharge permits prior to testing, and the test water would be tested and discharged in accordance with permit requirements.

River and Stream Crossings: Surface water bodies would be crossed using one of three methods: the open-cut wet method, the dry-cut method, or the horizontal directional drilling method. The method selected would be based on the characteristics of the crossing location and the requirements of the permitting agencies.

The open-cut wet method, which involves trenching while the stream is flowing, would result in temporary increases in turbidity and bank erosion where vegetation is removed. The dry-cut method, which involves diverting stream flow around the construction site, results in lower increases in turbidity than the open-cut wet method.

Horizontal directional drilling would minimize impacts to the stream or river because it involves drilling well below the streambed. This method would be selected at large body crossings to avoid disturbing the streambeds and streamflow and to reduce the potential that deep scour during flooding would endanger pipeline integrity. Figure ES-9 presents a cross section of a river crossing using the horizontal directional drilling method.

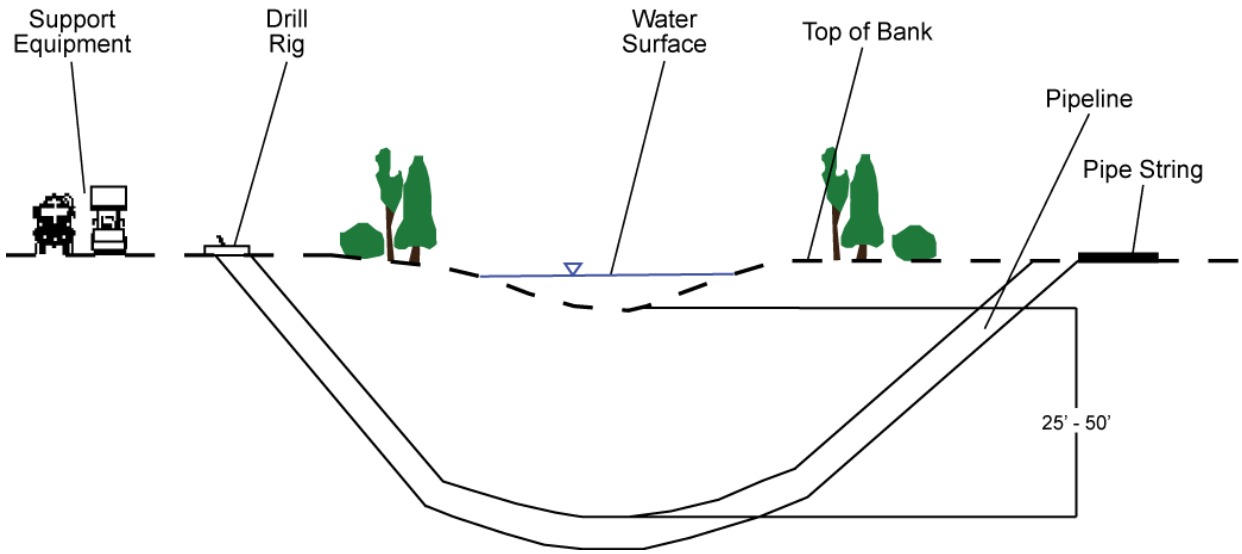
At all water crossings, Keystone agreed to use vegetative buffer strips, drainage diversion structures, and sediment barriers, and limit vegetation clearing to reduce siltation and erosion. After construction, the right-of-way would be restored and revegetated to reduce the potential for erosion of the stream bank.

Hydrostatic Test Water: Water used to pressure test the pipeline during construction would be discharged to its source waters or to an approved upland area within the same drainage and tested to ensure it meets applicable water quality standards and discharge rates.

Wetlands

The proposed Project route crosses emergent, scrub/shrub, and forested wetlands that are protected by the U.S. Army Corps of Engineers (USACE) and applicable state agencies under the review of EPA through Section 401 and 404 of the Clean Water Act. Specific plans regarding wetland avoidance and minimization of impacts, and the development of mitigation to compensate for the permanent loss or conversion of forested to emergent wetlands would be further developed during the permitting process. Wetland impacts presented in the EIS represent preliminary estimates based on the best available wetland information. DOS reviewed potential impacts to wetlands and the avoidance, minimization, and mitigation process that would be followed with USACE and EPA.

Figure ES-9
Cross Section of Horizontal Directional Drilling Method



Most wetlands crossed by the proposed Project in Montana, South Dakota, and Nebraska are emergent wetlands, and most wetlands crossed by the proposed Project in Oklahoma and Texas are forested wetlands. Construction of the pipeline would affect wetlands and their functions primarily during and immediately after construction activities, but permanent changes also are possible. Keystone agreed to use construction methods that avoid or minimize impacts to wetlands. These measures include installing trench breakers and/or sealing the trench to maintain the original wetland hydrology to avoid draining wetlands, using timber mats to protect wetlands during construction, and restoring wetland areas to a level consistent with the requirements of the applicable permits.

Most wetland vegetation communities would transition back into a community that would function similarly to the previously undisturbed wetland. Because most wetlands would be restored, the overall impact of the proposed Project to wetlands would be minor to moderate and would range in duration from short term to the life of the proposed Project. However, some forested and scrub-shrub wetlands over the pipeline would be converted to herbaceous wetlands since trees and shrubs would not be allowed to grow over the pipeline for inspection and integrity purposes. Keystone is working with each USACE district along the proposed route to identify wetlands and to develop wetland mitigation and compensation plans for the permanent conversion of forested wetland to herbaceous wetland.

Texas Bottomland Hardwood Wetlands: These are forested wetlands with trees, such as Bald Cypress, Water Oak, Water Hickory, and Swamp Tupelo that can exist in lowland floodplains in the Gulf Coast states. Clearing bottomland hardwood trees during construction would result in long-term to permanent impacts because forests require decades to re-establish and would mature over the span of centuries. DOS reviewed potential Project impacts on bottomland hardwood wetlands with EPA and USACE. Preliminary mitigation measures to protect bottomland hardwood wetlands are discussed in the EIS and would be developed further by the USACE during the wetland permitting process.

Figure ES-10
Texas Bottomland Hardwood Wetland

Terrestrial Vegetation

The proposed Project crosses primarily grasslands and rangelands, followed by croplands, upland forests, developed lands, and wetlands. After construction, Keystone agreed to restore topsoil, slopes, contours, and drainage patterns to preconstruction conditions as practicable and to reseed disturbed areas to restore vegetation cover, prevent erosion, and control noxious weeds. Keystone committed to controlling the introduction and spread of noxious weeds and pests by adhering to construction and restoration procedures recommended by local, state, and federal agencies. Soils and vegetation over the pipeline would be warmed slightly compared to surrounding soils by heat loss from the pipeline during operation.

Native Grasslands and Rangelands: Native mixed shrub rangelands would be crossed by the proposed Project in Montana and South Dakota and native grasslands would be crossed by the proposed Project in the Sand Hills region in Nebraska. Both of these native prairie habitats would be challenging to reclaim. In recognition of these challenges, Keystone developed specific construction and reclamation methods for the proposed Project in consultation with local, state, and federal agencies and local experts to ensure that sagebrush and native grasses are restored to rangelands in Montana and South Dakota and that fragile soils and diverse native vegetation cover are re-established in the Sand Hills region of Nebraska.

Figure ES-11
Sand Hills Grassland

Upland and Riparian Forests: Native forests, especially forested floodplains, were once an integral component of the landscape throughout the Great Plains and they provide important habitats for wildlife. Clearing trees in upland and riparian forest communities would result in long-term impacts because trees would be required to remain outside of the 50-foot-wide permanent right-of-way. These impacts would last throughout the life of the proposed Project because trees would not be allowed to reestablish within the permanent right-of-way and because forests require decades to re-establish and would mature over the span of centuries.

Wildlife

Big game animals, small game animals and furbearers, waterfowl and game birds, and other nongame animals use habitats in and around the six states crossed by the proposed Project. Construction would result in the temporary and permanent loss and alteration of habitats which provide foraging, cover, and breeding habitats for wildlife. Most habitat loss would be temporary as vegetation cover would be re-established after construction and would be small in context to habitats available throughout the region crossed by the proposed Project. Loss of shrublands and wooded habitats would be long-term (from 5 to 20 years or more), however; and trees and tall shrubs would not be allowed to re-establish over the pipeline for inspection and integrity purposes. Aboveground facilities would result in some permanent habitat loss. Power lines to pump stations can provide vantage perches for raptors that lead to increased predation on ground nesting birds and small mammals. Construction can produce short-term barriers to wildlife movement, direct and indirect mortality, and reduced survival and reproduction. Disturbance from construction activities may have moderate local affects on wildlife if important remnant habitats are crossed or when sensitive breeding or overwintering periods are not avoided. Habitat alteration and fragmentation caused by the pipeline right-of-way may reduce habitat suitability and use by wildlife.

Construction could also produce short-term barriers to wildlife movement, direct and indirect mortality, and reduced survival and reproduction. Disturbance from construction activities would have moderate local affects on wildlife if important remnant habitats are crossed or when sensitive breeding or overwintering periods are not avoided. Habitat alteration and fragmentation caused by construction of the pipeline could reduce habitat suitability and use by wildlife.

During the environmental review of the proposed Project, state and federal wildlife management agencies were contacted and they provided information on sensitive seasons and wildlife habitats such as big game overwintering habitats, important riparian corridors, and raptor and other migratory bird

nesting habitats. In addition state and federal wildlife management agencies provided recommendations for surveys to more specifically locate areas such as raptor nests and prairie dog colonies that could potentially be avoided. Keystone is working with state and federal wildlife management agencies to minimize impacts to wildlife during sensitive breeding periods. Measures developed to minimize impacts to wildlife include development of a Migratory Bird Conservation Plan in consultation with the USFWS, removal of litter and garbage that could attract wildlife, control of unauthorized off-road vehicle access to the construction right-of-way, and reclamation of native range with native seed mixes. Overall, the impact of construction to wildlife is expected to be minor and would be primarily temporary to short term. Normal Project operation would result in negligible effects to wildlife.

Figure ES-12
Mule Deer

Keystone must work with state and federal wildlife management agencies to minimize impacts to wildlife during sensitive breeding periods. Overall, the impact of construction to wildlife is expected to be minor and would be primarily temporary to short term. Normal Project operation would result in negligible effects to wildlife.

Fisheries Resources

The proposed route would cross rivers and streams, including perennial streams that support recreational or commercial fisheries. Most potential impacts to fisheries resources would occur during construction and would be temporary to short term. Potential impacts from construction of stream crossings include siltation, sedimentation, bank erosion, sediment deposition, short-term delays in movements of fish, and transport and spread of aquatic invasive animals and plants. Keystone has agreed to minimize vehicle contact with surface waters and to clean equipment to prevent transportation of aquatic invasive animals and plants on equipment.

Most streams would be crossed using one of several trenching methods. Trenching stream crossings when water is still flowing through the stream bed can result in destruction of fish that do not avoid the construction area. Trenching methods may also use dams, pumps, and flumes to divert the stream flow around the trench location to allow a “dry” trenching method. However, direct disturbance to the stream bed can release fine sediments during construction through flowing waters or after the flow is returned to the stream bed. Sediment would be transported downstream and could affect fish, other aquatic life, and aquatic habitats through either direct exposure or smothering. Most stream crossings would be completed in less than 2 days, grading and disturbance to waterbody banks would be minimized, and crossings would be timed to avoid sensitive spawning periods, such that resulting steam bed disturbance and sediment impacts would be temporary and minor.

Most large rivers would be crossed using the horizontal directional drilling method which would install the pipeline well below the active river bed. As a result, direct disturbance to the river bed, fish, aquatic animals and plants, and river banks would be avoided. Keystone has developed site specific plans for horizontal directional drill crossings and has agreed to develop site-specific contingency plans to address unintended releases of drilling fluids that include preventative measures and a spill response plan.

Figure ES-13
Recreational Fishing

Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) is responsible for protecting threatened and endangered species under the Endangered Species Act (ESA). Federally-protected threatened or endangered species that are known or thought to be in the vicinity of the proposed Project include three mammals, five birds, one amphibian, five reptiles, three fish, two invertebrates, and four plants. DOS prepared a Biological Assessment and consulted with USFWS to evaluate the proposed Project's potential impact on federally-protected threatened or endangered species.

USFWS has determined that the proposed Project would have no affect on 12 of the listed species, and may affect, but is not likely to adversely affect 10 of those species. These evaluations are based on species occurrence and conservation measures developed in consultation with USFWS that Keystone has agreed to implement. DOS and USFWS determined that the proposed Project would likely adversely affect the American burying beetle and a formal consultation was initiated to determine whether impacts could jeopardize the continued existence of the species and to further develop conservation measures and an incidental take statement. Based on the formal consultation, USFWS is formulating a Biological Opinion that would be required prior to the issuance of a Record of Decision by DOS or any other federal cooperating agency.

Direct impacts to beetles could occur due to habitat loss, construction, and pre-construction conservation measures (where beetles would be trapped and relocated away from the project area). During operation, the flow of oil through the pipeline would generate heat that would warm the surrounding soils and could affect beetles during the winter when they bury themselves in the soil to hibernate. During formal consultation with the USFWS, conservation measures were developed that include Keystone providing funding for conservation efforts and monitoring of American burying beetle habitat restoration, and the establishment of a performance bond for supplemental habitat reclamation if initial reclamation efforts are unsuccessful.

Several candidate species for federal protection under the ESA are known or thought to be in the vicinity of the proposed Project including three birds, one reptile, one fish, and two plants. Measures that have been developed to avoid and minimize potential impacts to these species include reclamation of native range with native seed mixes, development of a Migratory Bird Conservation Plan in consultation with USFWS, and development of greater sage-grouse mitigation implementation plans for Montana and South Dakota in consultation with state and federal agencies.

Figure ES-14
American Burying Beetle

A total of 35 state-protected species may also be present along the proposed right-of-way. These species have been designated by state wildlife management agencies as being of concern to assist with conservation planning and maintenance of the state's natural heritage. Conservation measures developed in consultation with state agencies include conducting additional species-specific surveys to determine whether nests, dens, or suitable habitats are present along the proposed right-of-way; adhering to construction timing restrictions to avoid the breeding, denning, and spawning seasons; and reducing the width of the construction right-of-way in areas where state-protected plant populations have been identified.

Cultural Resources

DOS, in coordination with consulting parties, has minimized the potential for adverse effects to historic properties along the Area of Potential Effect (APE) of the proposed Project by the development of avoidance and mitigation measures. Since 2008, DOS has consulted with Indian tribes, State Historic Preservation Officers, federal agencies and local agencies under Section 106 of the National Historic Preservation Act. As part of this effort, DOS initially contacted over 95 Indian tribes to find out their level of interest in becoming a consulting party. DOS also conducted Section 106 government-to-government consultation with the consulting parties for the proposed Project. DOS also invited the consulting tribes to prepare Traditional Cultural Property studies as part of the lead agency responsibilities for the

identification, evaluation and mitigation of historic properties.

A Programmatic Agreement was developed by DOS and the parties. The Programmatic Agreement establishes a procedure for the further identification, evaluation, mitigation, and treatment of historic properties and will be completed prior to construction of the proposed Project. The Advisory Council on Historic Preservation participated in the development of this agreement with DOS and the other consulting parties. As part of this agreement, a Tribal Monitoring Plan and a Historic Trails and Archaeological Monitoring Plan were also developed. If previously unidentified archaeological sites are encountered during construction of the proposed Project, Keystone, DOS, and the consulting parties would follow the procedures described in the Unanticipated Discovery Plans.

Air Quality and Noise

Air Quality: Air quality impacts from construction would include emissions from construction equipment, temporary fuel transfer systems, fuel storage tanks, and dust and smoke from open burning. Most of these emissions would occur only intermittently, would be limited to active construction areas, and would be controlled to the extent required by state and local agencies.

All pump stations will be electrically powered by local utility providers. As a result, during normal operation there would be minor emissions from valves and pumping equipment at the pump stations. There would also be low levels of emissions from mobile sources, and low levels of emissions from the proposed Cushing tank farm and the surge relief systems at the delivery points. The proposed Project would not cause or contribute to a violation of any federal, state, or local air quality standards and it would not require a Clean Air Act Title V operating permit.

The proposed Project would cross five counties where the background concentration of ozone is greater than the national ambient air quality standards. Those areas are designated as nonattainment for the federal 8-hour ozone standard. However, the emissions from the proposed Project would be consistent with state implementation plans for air quality issues.

Noise: During construction there would be intermittent, temporary, and localized increases in sound levels as construction activities move through an area. To reduce construction noise impacts, Keystone agreed to limit the hours during which activities with high-decibel noise levels are conducted in residential areas, require noise mitigation procedures, monitor sound levels, and develop site-specific mitigation plans to comply with regulations. As a result, the potential noise impacts associated with construction would be minor and temporary.

During operation, sound levels within 2,300 feet of pump stations would increase. Outside of this distance, noise levels would remain at existing sound levels. Keystone committed to performing a noise assessment survey and to mitigating identified impacts by installing noise reducing measures at the pump stations.

Land Use, Recreation, and Visual Resources

The majority of land that would be affected by the project is privately owned (21,333 acres) with nearly equal amounts of state (582 acres) and federal (579 acres) lands being impacted.

Agriculture: After construction, nearly all agricultural land and rangeland along the right-of-way would be allowed to return to production with little impact on production levels in the long term. However, there would be restrictions on growing woody vegetation and installing structures within the 50-foot-wide permanent right-of-way. Keystone has agreed to compensate landowners for crop losses on a case-by-case basis.

There are 102 tracts of land that would be impacted which are part of the Conservation Reserve Program. The proposed Project is not expected to affect landowner ability to participate in that program.

Keystone agreed to use construction measures designed to reduce impacts to existing land uses, such as topsoil protection, avoiding interference with irrigation systems except when necessary, reducing construction time in irrigated areas, repairing or restoring drain tiles, restoring disturbed areas with custom seed mixes to match the native plants, providing access to rangeland during construction, installing temporary fences with gates around construction areas to prevent injury to livestock or workers, providing trench crossing areas to allow livestock and wildlife to cross the trench safely, and controlling noise and dust control.

Recreation: Operation of the proposed Project would not affect recreational resources, national or state parks, or users of those resources. Keystone has committed to cooperating with private landowners, and with federal, state, and local agencies to reduce

the conflict between recreational users and Project construction.

Visual Resources: During construction, there would be visual impacts associated activities along the proposed right-of-way such as clearing, trenching, pipe storage, and installing above-ground structures. Most of the visual impacts of the pipeline corridor in agricultural and rangeland areas would be substantially reduced with restoration and revegetation. Keystone agreed to install vegetative buffers around the pump stations to reduce the visual impacts of those facilities. Overall, the visual impacts of the proposed Project would generally be minor to moderate.

Socioeconomics

During construction, there would be temporary, positive socioeconomic impacts as a result of local employment, taxes on worker income, spending by construction workers, and spending on construction goods and services. The construction work force would consist of approximately 5,000 to 6,000 workers, including Keystone employees, contractor employees, and construction and environmental inspection staff. That would generate from $349 million to $419 in total wages. An estimated $6.58 to $6.65 billion would be spent on materials and supplies, easements, engineering, permitting, and other costs.

Adverse impacts during construction could include temporary and minor increases in the need for public services, disruption of local transportation corridors, and reduced availability of transient housing. Keystone would establish four temporary work camps in southeastern Montana and northwestern South Dakota to minimize impacts to transient housing and public services in those areas. Operation of the proposed Project would also result in long-term to permanent beneficial socioeconomic impacts, including employment and income benefits resulting from long-term hires and local operating expenditures, and increased property tax revenues. An estimated $140.5 million in annual property tax revenues would be generated by the proposed Project.

Cumulative Impacts

The analysis of cumulative impacts combined the potential impacts of the proposed Project with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the proposed route. This assessment included consideration of the many existing pipelines, electrical transmission lines, and roadways, as well as other linear projects that are under construction, planned, proposed, or reasonably foreseeable in the vicinity of the proposed route. The analysis also included existing and likely energy development projects.

During construction, the proposed Project would contribute to cumulative dust and noise generation, loss of vegetation or crop cover, and minor localized traffic disruptions where other linear projects are under construction at the same time and are in the vicinity of the proposed route.

One of the primary contributions to cumulative effects during operation would be emissions from storage tanks. However, the proposed Project and all other petroleum storage projects would have to comply with the emissions limitations of air quality permits. In addition, where Project-related aboveground facilities and visible corridors are present along with those of other projects, there would be cumulative effects to visual resources. Other cumulative impacts associated with operation include changes in land use, terrestrial vegetation, wetland function, and wildlife habitat, as well as increases in tax revenues, and employment. Where the pump stations or compressor stations of other pipeline systems are in the vicinity of the pump stations for the proposed Project, there would also be cumulative noise impacts.

An increase in the development of wind power projects in the central plains region as well as increased need for electrical power is likely to increase the number of electrical transmission lines in the vicinity of the proposed route. If the construction of power distribution or transmission lines in the vicinity of the proposed route overlaps with construction of the proposed Project, short-term cumulative impacts associated with noise, dust, and general construction activity could occur. Likely cumulative impacts of the proposed Project and operation of new transmission lines include viewshed degradation, changes to land uses and vegetation, and impacts to birds.

Environmental Impacts in Canada

An evaluation of the impacts resulting from extraction of crude oil from the oil sands in Canada is outside of the scope of analysis required under the National Environmental Policy Act. However, in response to comments and as a DOS policy decision, the general regulatory oversight and the environmental impacts in

Canada related to oil sands production were summarized in the EIS.

The potential environmental effects of the proposed Project have been assessed on both sides of the international border. In March 2010, the National Energy Board of Canada determined that the proposed Keystone XL Project is needed to meet the present and future public convenience and necessity, provided that the Board's terms and conditions presented in the project certificate are met. The Board's assessment included evaluations of need, economic feasibility, potential commercial impacts, potential environmental and socioeconomic effects, appropriateness of the general route of the pipeline, potential impacts on Aboriginal interests, and other issues.

Oil sands development projects undergo an environmental review in Canada under Alberta's Environmental Protection and Enhancement Act and other environmental regulations. Other federal and provincial agencies may participate in the review as Responsible Authorities or as Federal Authorities with specialist advice. Government regulators of oil sands activities in Canada are working to manage and provide regional standards for air quality, land impact, and water quality and consumption based on a cumulative effects approach.

Oil sands mining projects have reduced greenhouse gas emissions intensity by an average of 39 percent between 1990 and 2008 and are working toward further reductions. In addition, the Alberta Land Stewardship Act supports the Land-use Framework, which includes province-wide strategies for establishing monitoring systems, promoting efficient use of lands, reducing impact of human activities, and including aboriginal people in land-use planning.

EIS Contents

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1.0 INTRODUCTION

On September 19, 2008, TransCanada Keystone Pipeline, LP (Keystone) applied to the U.S. Department of State (DOS) for a Presidential Permit for the proposed construction, connection, operation, and maintenance of a pipeline and associated facilities at the United States border for importation of crude oil from Canada. The Keystone application is for its proposed Keystone XL Project (the proposed Project). DOS served as the lead federal agency for the environmental review of the proposed Project under the National Environmental Policy Act (NEPA). DOS receives and considers applications for Presidential Permits for such oil pipeline border crossings and associated facilities pursuant to the President's constitutional authority over foreign relations, and as Commander-in-Chief, which authority the President delegated to DOS in Executive Order (EO) 13337, as amended (69 Federal Register [FR] 25299). DOS jurisdiction to issue a Presidential Permit includes only the border crossing and the associated facilities at the border.

DOS authority over the border crossing does not include the legal authority to regulate petroleum pipelines within the U.S. The Department of Transportation's Pipelines and Hazardous Materials Safety Administration (PHMSA) is responsible for promulgating regulations regarding issues of petroleum pipeline construction, operation, and maintenance. Individual states have the legal authority to approve petroleum pipeline construction in their states, including selecting the routes for such pipelines. Different states have made different choices in how or whether to exercise that authority. Some states, such as Montana, have chosen to grant the authority to a state agency to approve pipeline routes through that state. Other states, such as Nebraska, have chosen not to grant any state agency such authority. In preparation of this EIS, DOS has consulted extensively with those federal and state agencies that possess regulatory authority over petroleum pipelines, as well as local, state, tribal and federal agencies that have jurisdiction with particular expertise regarding evaluating potential impacts of the proposed Project.

In addition to its application to DOS, Keystone also filed a right-of-way (ROW) application under Section 28 of the Mineral Leasing Act of 1920 (MLA), as amended, with the Bureau of Land Management (BLM) for the proposed Project across federal lands.

DOS issued a draft environmental impact statement (EIS) for public review on April 16, 2010. The public comment period for the draft EIS closed on July 2, 2010 (see Section 1.9.1). After the draft EIS was issued, new information and additional information became available on the proposed Project and on issues and resources related to the potential impacts of the proposed Project. To provide the public with the opportunity to review this information and to ensure openness and transparency in the NEPA environmental review process of the proposed Project, DOS issued a supplemental draft EIS (supplemental draft EIS) for public review on April 22, 2011. The public comment period for the supplemental draft EIS ended on June 6, 2011 (see Section 1.9.2).

This final EIS includes information generated in response to comments on both the draft and supplemental draft EIS, as well as information related to surveys and studies along the proposed Project corridor completed after the relevant sections of the draft and supplemental draft EIS were published (e.g., studies and surveys within properties where access was not previously available). The EIS also includes the latest available information on the proposed Project plan resulting from ongoing negotiations with federal, state, and local regulatory agencies. The remainder of this section addresses the following topics:

- Overview of the Proposed project (Section 1.1);
- Purpose and Need (Section 1.2);
- Presidential Permit Process (Section 1.3);
- Overview of the Crude Oil Market (Section 1.4);
- Agency Participation (Section 1.5);
- Indian Tribe Consultation (Section 1.6);
- SHPO Consultation (Section 1.7);
- Environmental Review of the Canadian Portion of the Proposed keystone XL Project (Section 1.8);
- Preparation and Review of the EIS (Section 1.9);
- Permits, Approvals, and Regulatory Requirements (Section 1.10); and
- References (Section 1.11).

1.1 OVERVIEW OF THE PROPOSED PROJECT

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 south central United States, including a new tank farm in Cushing, Oklahoma and delivery points in Nederland (near Port Arthur) and Moore Junction (in Harris County), Texas (see Figure 1.1-1). In total, the proposed Keystone XL Project would consist of approximately 1,711 miles of new, 36-inch-diameter pipeline, with approximately 327 miles of pipeline in Canada and approximately 1,384 miles in the United States. The proposed Project would cross the international border between Saskatchewan, Canada, and the United States near Morgan, Montana. The proposed Project initially would have a nominal transport capacity of 700,000 barrels per day (bpd) of crude oil. Up to 200,000 bpd of crude oil would be delivered to the proposed Cushing, Oklahoma tank farm, which is in Petroleum Administration for Defense District (PADD) II, with the remainder of the crude oil transported to the delivery points in Texas, which are in the Gulf Coast portion of PADD III. By increasing the pumping capacity in the future, the proposed Project could ultimately transport up to 830,000 bpd of crude oil.

At the time of publication of the draft EIS, Keystone had applied to the U.S. Department of Transportation (USDOT), Pipeline and Hazardous Materials Safety Administration (PHMSA) for consideration of a Special Permit request to operate the proposed Project at a slightly higher pressure than would be allowed using the standard design factor in the regulations. As reported in the draft EIS, the maximum crude oil throughput for that proposed system would have been 900,000 bpd. On August 5, 2010, Keystone withdrew its application to PHMSA for a Special Permit. As a result, the maximum throughput of the proposed Project decreased and is currently proposed to be approximately 830,000 bpd. However, to enhance the overall safety of the proposed Project, DOS and PHMSA continued working on Special Conditions specific to the proposed Project and ultimately established 57 Project-specific Special Conditions. As a result, the proposed Project would be designed, constructed, operated, maintained, and monitored in accordance with the existing PHMSA regulatory requirements and in compliance with the more stringent 57 Project-specific Special Conditions that Keystone agreed to incorporate into the proposed Project. In consultation with PHMSA, DOS determined that incorporation of those Special Conditions would result in a Project that would have a degree of safety greater than any typically constructed domestic oil pipeline system under current regulations and a degree of safety along the entire length of the pipeline system that would be similar to that required in high consequence areas as defined

in the regulations. Appendix U presents the Special Conditions and a comparison of the conditions with the existing regulatory requirements.

The proposed Project would primarily deliver WCSB crude oil, which would likely be heavy crude oil based on current market forecasts, to three delivery points in the U.S. that in turn provide access to many other U.S. pipeline systems and terminals. The ultimate destinations of the crude oil beyond these delivery points would not be contracted with Keystone and are not a part of the proposed Project. While the exact destinations of the crude oil that would be transported by the proposed Project are uncertain, there are 15 refineries within the proposed delivery area in Texas that would have direct access to crude oil delivered by the proposed Project (Purvin & Gertz 2009). Those refineries currently process heavy crude oil that is similar in composition to the oil that would be delivered by the proposed Project (Purvin & Gertz 2009).

1.2 PURPOSE AND NEED

The primary purpose and need of the proposed Project is to provide the infrastructure necessary to transport WCSB heavy crude oil from the border with Canada to delivery points in PADD III in response to the market demand of refineries in PADD III for heavy crude oil. This market demand is driven by the need of refiners in PADD III to replace declining feed stocks of heavy crude oil obtained from other foreign sources with crude oil from a more stable and reliable source. Keystone currently has firm, long-term contracts to transport 380,000 bpd of WCSB crude oil to existing PADD III delivery points. Keystone also has firm contracts to transport 155,000 bpd of WCSB crude oil to Cushing, Oklahoma in the existing Keystone Oil Pipeline Project, which includes the Keystone Mainline and the Keystone Cushing Extension. An additional purpose of the proposed Project is to transport WCSB heavy crude oil to the proposed Cushing tank farm in response to the market demand of refineries in PADD II for heavy crude oil. If the proposed Project is approved and implemented, Keystone would transfer shipment of crude oil under those contracts to the proposed Project. While there is existing transboundary pipeline capacity to accommodate projected additional imports of WCSB crude in the short to medium term, there is extremely limited pipeline transport capacity to move such crude oils to PADD III refineries.

Further, since the time of the Presidential Permit application, Keystone has provided the opportunity to shippers to access the proposed Project to transport crude oil from the Williston Basin and from portions of PADD II to delivery points in PADDs II and III. Shippers in those areas have committed to transport 65,000 bpd of crude oil on the proposed Project (see Sections 2.5.3 and 2.5.4). As noted in the previous section, the proposed Project would provide an initial capacity of 700,000 bpd, with the ability to increase capacity to 830,000 bpd by increasing pumping capability.

DOS evaluated the proposed Project to determine whether approving it and granting a Presidential Permit for "construction, connection, operation, or maintenance at the borders of the United States of facilities for the exportation or importation of petroleum, petroleum products, coal, or other fuels to or from a foreign country" is in the national interest. The Secretary of State has the authority to approve or deny such applications, and to issue such permits on terms and conditions that the Secretary determines are appropriate under EO 13337, as amended. Although the primary focus of DOS is related to the conduct of foreign affairs, in considering the national interest for purposes of applications for Presidential Permits, DOS takes into account many factors, including domestic impacts associated with issuance of a permit, such as environmental, cultural, and economic considerations, consistent with the relevant federal statutes and Executive Orders identified in Sections 1.5, 1.6, and 1.10 of this EIS.

In response to comments on the draft EIS, the market analysis relevant to purpose and need has been reorganized in the EIS, and the following section on the Presidential Permit review process (Section 1.3) has been added. The extensive information on crude oil markets is included in this EIS because the

United States has a largely unregulated market for obtaining crude oil (the primary use of which is the production of transportation fuel). Thus, understanding the basic dynamics of the crude oil market is key to understanding the potential alternatives to the proposed Project (including the No Action Alternative). In addition, the analysis of the crude oil market has been expanded in response to comments to include scenarios that base projections on alternate policy scenarios, including adoption of more aggressive policies that address climate change by reducing crude oil consumption.

The BLM's purpose and need for the proposed Project is to respond to the Keystone application under Section 28 of the Mineral Leasing Act of 1920, as amended (MLA; 30 USC 185) for a right-of-way (ROW) grant to construct, operate, maintain, and decommission a crude oil pipeline and related facilities on federal lands in compliance with the MLA, BLM ROW regulations, and other applicable federal laws. The BLM will decide whether to approve, approve with modification, or deny issuance of a ROW grant to Keystone for the proposed Project, and if so, under what terms and conditions. The proposed ROW action appears consistent with approved BLM land use planning.

1.3 PRESIDENTIAL PERMIT REVIEW PROCESS

Consistent with the President's broad discretion in the conduct of foreign affairs, DOS has significant discretion in the factors it examines in making a National Interest Determination (NID). The factors examined and the approaches to their examination are not necessarily the same from project to project. However, previous NID processes can provide insights into the factors DOS is likely to consider in evaluating the present application. Some of the key factors considered in past decisions include the following:

- Environmental impacts of the proposed projects;
- Impacts of the proposed projects on the diversity of supply to meet U.S. crude oil demand and energy needs;
- The security of transport pathways for crude oil supplies to the U.S. through import facilities constructed at the border relative to other modes of transport;
- Stability of trading partners from whom the U.S. obtains crude oil;
- Impact of a cross-border facility on the relations with the country to which it connects;
- Relationship between the U.S. and various foreign suppliers of crude oil and the ability of the U.S. to work with those countries to meet overall environmental and energy security goals;
- Impact of proposed projects on broader foreign policy objectives, including a comprehensive strategy to address climate change;
- Economic benefits to the U.S. of constructing and operating proposed projects; and
- Relationships between proposed projects and goals to reduce reliance on fossil fuels and to increase use of alternative and renewable energy sources.

This list is not exhaustive, and DOS may consider additional factors in the NID process. After publication of the final EIS, the federal agencies identified in EO 13337 (see Section 1.5.1) will have 90 days to provide their input on whether or not approving the proposed Project would be in the national interest. Additionally, DOS will solicit public comments on determination of national interest during a public comment period after publication of this EIS.

1.4 OVERVIEW OF THE CRUDE OIL MARKET

DOS conducted its own thorough assessment of market dynamics of the crude oil market for purposes of fully understanding how those dynamics relate to the purpose and need of the proposed Project as a part of the environmental review under NEPA. This assessment relied upon expertise within DOS from staff with extensive knowledge of international energy markets, on consultations with other federal agencies, in particular the Department of Energy, and on consideration of relevant information from the many independent sources as described below. The sources relied upon included in particular information presented in reports published by government agencies such as the Energy Information Administration (EIA), the International Energy Agency (IEA), and the Alberta Energy Resource Conservation Board (ERCB). The mandates of these three agencies are described below:

- The EIA is a statistical agency of the U.S. Department of Energy (DOE). Its mission is to provide policy-independent data, forecasts, and analyses to promote sound policy making, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. By law, EIA's products are developed independently and are not subject to clearance by DOE or other government agencies. EIA neither formulates nor advocates any policy positions, and its views may not reflect those of DOE or the Administration. EIA issues a wide range of weekly, monthly, and annual reports on energy production, stocks, demand, imports, exports, and prices. It also prepares analyses and special reports on topics of current interest in response to requests from the Congress, DOE, and other government agencies.
- The IEA is an intergovernmental organization which acts as energy policy advisor to 28 member countries in their effort to ensure reliable, affordable, and clean energy for their citizens. Its current mandate incorporates the "Three E's" of balanced energy policy making: energy security, economic development, and environmental protection. IEA currently focuses its work on climate change policies, market reform, energy technology collaboration, and outreach to the rest of the world, especially major consumers and producers of energy such as China, India, Russia, and the OPEC countries.
- The ERCB is an independent, quasi-judicial agency of the Government of Alberta, Canada. It regulates development of Alberta's energy resources, including oil, natural gas, oil sands, coal, and pipelines. The ERCB's mission is to ensure that the discovery, development, and delivery of Alberta's energy resources take place in a manner that is fair, responsible, and in the public interest. The information and knowledge responsibility of the Board includes the collection, storage, analysis, appraisal, dissemination, and stakeholder awareness of information about energy and utility matters.

In its assessment of proposed Project Purpose and Need, DOS also reviewed information from industry associations, such as the Canadian Association of Petroleum Producers, and private companies such as Purvin and Gertz and IHS Cambridge Energy Research Associates (IHS CERA).

The assessment was also informed by two recent reports contracted by the Department of Energy Office of Policy & International Affairs (PI) and conducted by EnSys Energy and Systems, Inc (EnSys 2010 and 2011) that evaluated different North American crude oil transport scenarios through 2030 the potential impacts of those different transport scenarios (in particular the presence or absence of the proposed Project) on U.S. refining and petroleum imports, on production and disposition of WCSB oil sands crude, and on international crude oil markets. Because the EnSys reports informs many aspects of the EIS, they are described more fully here.

The EnSys (2010) analysis examined key metrics under seven different scenarios, each representing a different combination of existing and potential pipeline transportation systems in Canada and the U.S.

that could deliver WCSB crude oil to U.S. PADDs II and III and to world oil markets. Market dynamics for each pipeline combination were explored for two different projections of U.S. oil demand,[1] resulting in 14 separate scenarios.

DOE requested that EnSys address the following issues:

- What is the outlook for the U.S. refining industry's competitive position as measured by U.S. refinery throughputs, utilizations, investments, CO_2 emissions, product import dependency and oil import costs?
- How does the level and composition of crude oil imports into the U.S. change with and without the incremental WCSB crude oil transport capacity of the proposed Project?
- What are the changes in crude oils that would supply PADD III refineries with and without the transportation of incremental WCSB crude oils into PADD III?
- What are the changes in world regional demands for incremental WCSB crude oils with and without the incremental pipeline capacity to U.S. refineries?
- What are the U.S. petroleum product supply and price impacts, and also U.S. oil import cost impacts, with and without the incremental imports of WCSB crude oil to the U.S.?
- What impacts, if any, would disallowing the proposed Project have on WCSB crude oil flows into the U.S.?
- What would be the impacts of much lower U.S. product demand (consistent with the EPA low demand outlook) on U.S. refining, Canadian, and other oil imports and the implications for WCSB crude oil export capacity?

The study employed the EnSys World Oil Refining Logistics & Demand (WORLD) model to provide an integrated analysis and projection of the global petroleum industry that encompasses total liquids, captures the effects of developments, changes and interactions between regions, and projects the economics and activities of refining crude oils and products. WORLD has been used for DOE's Office of Strategic Petroleum Reserve since 1987, and has been applied in analyses for many organizations, including EIA, EPA, the American Petroleum Institute, the World Bank, the OPEC Secretariat, the International Maritime Organization, Bloomberg, and major and specialty oil and chemical companies. The EnSys (2011) study revisited the No Expansion scenarios presented in the EnSys (2010) report and reassessed in more depth the factors that could render the No Expansion scenarios probable or improbable.

Although the EnSys (2010 and 2011) studies are contractor reports and do not necessarily represent the views of any U.S. government agency, they were conducted in close collaboration with, and had significant input from DOE. The EnSys (2010 and 2011) reports are presented in Appendix V. Section 1.11 presents a list of the references used in developing the need assessment for the proposed Project. Owing largely to its availability, energy density, and ease of transport, crude oil is currently the world's most important energy resource. It is traded in a global market that includes crude oils that vary in their points of delivery, densities, sulfur contents, and prices. For example, in December of 2010 the price of crude oil ranged from $73 per barrel for heavy, sour WCSB crude oil to over $88 per barrel for light, sweet crude oil such as West Texas Intermediate or Arab Light. These prices represent a balance between supply and demand in the global crude oil market. In that market, each oil field can be thought of as a potential supply source. In the past, most crude oil came from fields that produced relatively light crude

[1] EnSys (2010) included a low-demand outlook based on a February/March 2010 study by EPA which examined "more aggressive fuel economy standards and policies to address vehicle miles traveled".

oil, and while those fields are distributed throughout the world, the leading producers were in Saudi Arabia, the United States, Russia (the former USSR), and Iran. More recently, the world oil market has experienced an increase in the supply of crude oil from unconventional sources. These unconventional oil fields, primarily in Canada and Venezuela, produce a very heavy crude oil that is often referred to as bitumen.[2]

On the demand side of the market, each refinery can be thought of as a crude oil consumer. Each refinery makes decisions as to which crude oil to buy based on the characteristics of the crude (e.g., the point of delivery, density, sweetness, and price) and the refinery's unique ability to transform the crude oil into a refined petroleum product that can be profitably sold.[3]

Much effort has gone into predicting future conditions in the crude oil market. Individuals, organizations, and countries attempt to forecast supply, demand, and price based on economic trends, governmental regulations, the cost and availability of substitute forms of energy, and many other factors. While these predictions are uncertain, there is a general consensus that the volume of crude oil consumed worldwide is unlikely to decrease substantially over the next 30 years, even under policy scenarios that more aggressively address global climate change (EIA 2009c, EIA 2010a, and IEA 2010), and that the mix of crude oil consumed in the future will include an increased proportion of oil from high-cost unconventional sources and/or heavy crude oil.

For example, IEA (2010) included three policy scenarios, a Current Policies Scenario, which assumed no change in policies in place in mid-2010; a New Policies Scenario, which assumed that countries act on their announced policy commitments and plans to address climate change; and a scenario designed to stabilize greenhouse gas emissions at 450 parts per million of CO_2-equivalent, which would be consistent with an increase in global temperature of approximately 2 degrees Celsius (the 450 Scenario). There are significant differences for estimates of total global crude oil demand among the three scenarios, but in all three scenarios, the estimated total demand is greater in 2020 than in 2010. Only in the 450 Scenario is the total estimated global demand in 2035 less than in 2010. There was a significant difference in the projections of total unconventional oil production among the three scenarios, but in all three scenarios, the total estimated production from unconventional sources was projected to increase by at least 5 million bpd by 2035.

1.4.1 Supply of Heavy Crude Oil from the WCSB

The WCSB is now widely accepted as having one of the largest crude oil reserves in the world. The ERCB (2009) and CAPP (2009) estimated that Canada's oil sands contain 170 to 173 billion barrels of proven oil reserves while the Central Intelligence Agency (CIA) estimated WCSB reserves to be 175.2 billion (CIA 2010).[4] However, the mere presence of oil in a field does not mean that oil will be produced. For oil to be produced, field operators must be convinced that they can extract and deliver the oil to the marketplace in a profitable manner (i.e., the price per barrel that consumers are willing to pay is high enough for producers to make a profit). Therefore, decisions regarding unconventional crude oil production in the WCSB are affected by the price of conventional crude oil.

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[2] For the purposes of this EIS, oil from the WCSB is referred to as heavy crude. Section 3.13.5.1 provides information on the composition of the WCSB crude oil.

[3] EIA (2009a) reported that crude oil is generally fungible, i.e., one crude oil can be substituted for another. However, many refineries are optimized to refine crude oil with specific qualities, and switching from one crude oil to another can be costly.

[4] Proven oil reserves are those that can be economically extracted given current and projected market conditions.

Given this market dynamic, CAPP (2009) reported that:

> "Over the past 12 months (June 2008 to June 2009) the industry has witnessed a dramatic change in oil prices. The benchmark West Texas Intermediate (WTI) crude oil price dropped from a peak in July 2008 of over $140 per barrel to less than $40 per barrel by year's end. CAPP's estimate of industry capital spending for oil sands development was reduced to $10 billion dollars for 2009 compared to $20 billion in 2008. The forecast for market demand growth is also lower than in the previous report, which is in line with the slower forecasted growth in supply."[5]

Most industry analysts predict that there will be growth in market demand as the global economy recovers from the recent world financial crisis. Consequently, many oil sands projects that were put on hold in 2009 were revived in 2010.

In earlier reports, CAPP (2009) projected that heavy crude production in the WCSB will increase from its 2008 level of 0.9 million bpd to between 1.4 and 1.6 million bpd by 2015 and then remain at relatively elevated levels until the end of the projection periods. These projections were largely consistent with: (1) the 2009 EIA forecast, which also projected that the unconventional oil supply from Canada will become an increasingly important source of global crude oil supply over time (EIA 2009a); and (2) projections made by ERCB (2009), the National Energy Board of Canada (NEB 2009), and Strategy West (2009). At the current and projected production levels, production from the estimated proven reserves in the WCSB could continue into the later part of the 21st century.

Three of the studies and projections referenced above were updated for 2010. CAPP (2010) projected that the WCSB will produce more than 2.1 million bpd by 2015; this is up from the 1.4 to 1.6 million bpd projected in 2009. CAPP (2011) shows further increases in WCSB crude oil production projections. These increased projections are largely consistent with the reference price case reported in EIA (2010a, 2010b, and 2011[6]) and Strategy West (2010) which project significant increases in WCSB crude oil production over the next 10 to 25 years. EnSys (2010) suggested that total WCSB crude oil production would reach approximately 4.4 million bpd by 2030 in almost all pipeline construction scenarios it considered. EnSys (2010) also projected oil sands production to grow to 4.2 million bpd by 2030 in the low-demand outlook for all pipeline construction scenarios except the No Expansion scenario. IEA (2010) projected that by 2035, oil sands production would increase to 4.6 million bpd under the Current Policies scenario, 4.2 million bpd in the New Policies scenario, and 3.3 million bpd under the 450 Scenario.

Historically, the majority of the WCSB crude oil has been exported to the U.S. CAPP (2010) and EIA (2010) continue to project that the vast majority of WCSB production will be exported to the U.S. Much of this will be transported to PADD II through the existing Enbridge pipeline system, including the recently constructed Alberta Clipper Pipeline and the Keystone Oil Pipeline. As described in Section 4.1.3, the proposed Enbridge Northern Gateway and the Kinder Morgan Trans Mountain pipelines, if implemented, would ship WCSB crude oil to the west coast of Canada for potential marine-based export to refineries in Asia and along the west coast of the U.S. If implemented, the proposed Project or a similar project would provide access to refineries in PADD III.

EnSys (2010) suggested that cross-border WCSB deliveries will more than double from the current 1.2 million bpd to between 2.6 and 3.6 million bpd by 2030. The volume of future U.S. imports of WCSB

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[5] Crude oil benchmarks are reference points for the various types of oil that are available in the market. The WTI is the most commonly used benchmark in the U.S.

[6] The EIA (2011) early release previewed several revisions to its reference case projections for the 2011 release, and projected that oil sands growth would reach 5.1 million bpd by 2035.

crude oil will be dependent on the available transport capacity for WCSB crude oil into the U.S., the level of demand for WCSB crude oil from Asian refiners, and the overall level of crude oil demand in the U.S.

1.4.2 Demand for Heavy Crude Oil in PADD III

The U.S. petroleum industry is divided into five PADDs. Refineries within a PADD tend to have more in common with each other (e.g., pipeline infrastructure and supply streams) than they do with refineries in other PADDs.

The majority of the crude oil that would be transported by the proposed Project would be shipped to delivery points in PADD III, which has 58 refineries. These refineries represent a total refining capacity of approximately 8.4 million bpd, and for the past 20 years have run at between 80 and 100 percent of maximum throughput (EIA 2010b). PADD III refineries provide significant volumes of refined petroleum product to both the U.S. East Coast and Midwest via pipeline. For example in 2008, approximately 50 percent of the gasoline consumed on the East Coast and 18 percent of the gasoline consumed in the Midwest was supplied by PADD III refineries.

The PADD III Gulf Coast refineries have the capacity to refine over 5 million bpd of heavy crude oil (EnSys 2010). In 2009, PADD III imported approximately 2.9 million bpd of heavy crude oil (EnSys 2010). Typically, heavy crude oils sell at a discount as compared to light, sweet crude oils, and refiners that can process heavy crude oils can take advantage of that price differential. Once refiners have made the capital investments in equipment and processes to refine heavy crude oil or to increase the capacity of heavy crude oil refining, they cannot easily move back to refining a lighter crude oil slate. PADD III has a particularly high heavy crude oil processing capacity in part because of the large supplies of heavy crude oil in Mexico and Venezuela. Mexico and Venezuela, through their state-controlled oil companies, encouraged expansion of the heavy oil refining capacity through joint-venture investments in Gulf Coast refineries to create a more profitable market for their heavy crude oil resources.

There are ongoing or completed major refinery upgrades at several PADD III refineries that would have direct pipeline access to oil transported through the proposed Project (i.e., Motiva, Port Arthur; Valero, Texas City; and Total, Port Arthur) and at several PADD III refineries without direct pipeline access (Borger, Texas; Artesia, New Mexico; and Garyville, Louisiana). There are also continuing plans for upgrades in Port Arthur and revived plans in St. Charles and Tuscaloosa, Alabama, and smaller-scale upgrades designed to increase heavy crude oil refining capacity in PADD III. In PADD II, expansions and upgrades have been proposed or implemented in Oklahoma (Sinclair), Illinois (WRB Refining and ConocoPhillips Refinery), Michigan (Marathon), and Indiana (Whiting). There is no indication that the availability of oil transported via the proposed Project would directly result in specific expansions of existing refineries and development of new refineries (none have been built in the U.S. in 30 years). Recently implemented refinery expansions and upgrades in PADDs II and III were primarily focused on increasing the capacity to refine heavy crude oil. This diversification strategy could put downward pressure on PADD III crude oil prices, provided that sufficient transportation capacity is available for heavy crude oil.

In 2009, PADD III refineries imported approximately 5.1 million bpd of crude oil from more than 40 countries, and the top four suppliers were Mexico (21 percent), Venezuela (17 percent), Saudi Arabia (12 percent), and Nigeria (11 percent) (EIA 2010b). Of this amount, approximately 2.9 million bpd was heavy crude oil (EnSys 2010). In addition, PADD III refinery runs are projected to grow by at least 500,000 bpd by 2020 (Purvin & Gertz 2009, EnSys 2010). However, as noted by EnSys (2010), crude oil imports from Mexico and Venezuela, which flow predominantly into Gulf Coast refineries, have been in steady decline and are projected to continue to drop over the next several years, from 2.9 million bpd in 2004 to about 0.8 million bpd by 2020. Although the supply of crude oil from Saudi Arabia to the U.S.

appears to be fairly stable, the remaining major PADD III suppliers face declining or uncertain production horizons as summarized below.

- Capital expenditures by Mexico's national oil company have been insufficient to offset natural declines in oil field output. As a result, the production of heavy crude from Mexico has been falling and there has been a 250,000-bpd decrease in production of Mexican heavy crude since 2006. In particular, production from the offshore Cantarell field (which produces most of the Maya heavy crude supplied to the U.S.) is falling rapidly (Hook et al 2009, IEA 2008, and EnSys 2010). In addition, expansion of the Minatitlan refinery was completed in January 2011 and the expanded refinery processes at least 110,000 bpd of Mexican crude oil, which further reduced the volume exported to the U.S.
- Most of Venezuela's oil production is heavy crude, and over half of the production has been exported to the U.S. (Purvin & Gertz 2009). However, Venezuela is increasingly diversifying its oil customers to lessen its dependence on the U.S. Exports to the U.S. as a portion of Venezuela's total output have therefore decreased (Alvarez and Hanson 2009), and EnSys (2010) predicts that this trend will continue.
- Nigeria is Africa's largest oil producer. However, "since December 2005, Nigeria has experienced increased pipeline vandalism, kidnappings and militant takeovers of oil facilities in the Niger Delta…The instability in the Niger Delta has caused significant amounts of shut-in production and several companies declaring *force majeure* on oil shipments. EIA estimates Nigeria's effective oil production capacity to be around 2.7 million barrels per day (bbl/d) but as a result of attacks on oil infrastructure, 2008 monthly oil production ranged between 1.8 million bbl/d and 2.1 million bbl/d. Additional supply disruptions for the year were the result of worker strikes carried out by the Petroleum and Natural Gas Senior Staff Association of Nigeria (PENGASSAN) that shut-in 800,000 bbl/d of ExxonMobil's production for about 10 days in late April/early May" (EIA 2009e).
- Angola, Algeria, and Iraq, which were among the top 15 suppliers of crude oil to the U.S. in 2009 (EIA 2010b), have each experienced armed conflict or significant political unrest within the last decade.

In all domestic pipeline scenarios considered by EnSys (2010), increased U.S. imports of Canadian crude oil would reduce U.S. imports of foreign oil from sources outside of North America. Reductions in U.S. oil demand would result in reductions of oil imports from non-Canadian foreign sources, with no material reduction in imports of WCSB crude oil (EnSys 2010). Additionally, the firm, long-term commitment of shippers to transport 380,000 bpd of WCSB crude oil to PADD III destinations through the proposed Project indicates a market preference for WCSB heavy crude oil. In addition to those commitments, on August 15, 2011 Keystone launched a binding Open Season to obtain additional firm commitments from interested parties for shipments of crude oil on the Houston Lateral portion of the proposed Project.

1.4.3 Transport of Crude Oil from the WCSB to PADDs II and III

Prior to 2010, two major crude oil pipelines transported crude oil from the WCSB directly to U.S. markets: the Enbridge Pipeline System and the Kinder Morgan Express Pipeline. Combined, those pipeline systems have a total capacity of about 2.1 million bpd. Of that total capacity, approximately 63 percent is heavy crude, and in 2008 both pipelines operated at or around 100 percent capacities (CAPP 2009). Two new pipeline systems were recently constructed and began transporting crude oil from the WCSB to areas in the U.S. outside of PADD III: the Keystone Oil Pipeline Project (including the Cushing Extension) and the Enbridge Alberta Clipper Pipeline. CAPP (2009) and Smith (2009) reported that, with those pipelines, the transport capacity of crude oil from Canada to the U.S. is sufficient to provide the

needs of all areas outside of PADD III through 2019. EnSys (2010) projected that excess cross border capacity for areas of the U.S. outside of PADD III would exist until about 2019 to 2030. However, the capacity to transport WCSB crude oil to PADD III is currently limited. There is only one pipeline that provides PADD III refineries access to WCSB crude, the ExxonMobil Pegasus Pipeline. This pipeline has a maximum capacity of only 96,000 bpd (CAPP 2009). Thus, limited pipeline capacity continues to constrain the supply of WCSB crude oil to PADD III (CAPP 2009 and 2010, Purvin & Gertz 2009), and PADD III represents the largest refining capacity, both overall and for heavy crude, in the U.S. Limited transport capacity to PADD III was also identified by EnSys (2010):

> "a market opportunity exists short term (2010 – 2015) as well as longer term for pipeline capacity to deliver heavy WCSB crudes to U.S. Gulf Coast refiners; this to fill a gap being created by declining supply from traditional heavy crude suppliers, notably Mexico and Venezuela, a gap it is projected would otherwise be filled by increases in other foreign supplies, notably from the Middle East."

The conclusions of CAPP (2009 and 2010), Purvin & Gertz (2009), and EnSys (2010) are consistent with observed marketplace behavior. In September 2008, when shippers were given an opportunity to enter into contractual commitments for capacity on the proposed Project, several firms executed binding contracts with Keystone for a total of 380,000 bpd of WCSB crude to be transported to PADD III for an average of 18 years. In addition, Valero, a major refinery operator in the Houston area, stated that it expects to be one of the largest recipients of heavy crude oil from the proposed Project pending regulatory approval (Valero 2008), and Canadian Natural Resources Limited (CNRL) has agreed to supply 100,000 bpd of heavy crude oil to an unnamed U.S. Gulf Coast refiner (CNRL 2008).

1.5 AGENCY PARTICIPATION

1.5.1 Federal Lead Agency – U.S. Department of State

For cross-border oil pipelines, DOS is responsible for issuance of Presidential Permits. Therefore, DOS is the lead agency for both the NEPA environmental review and the Section 106 of the National Historic Preservation Act (NHPA) process for the proposed Project. As the lead agency, DOS directed the preparation of the EIS for the proposed Project consistent with NEPA and also directed the Section 106 process consistent with the NHPA (16 U.S.C § 470 et seq.). As the lead federal agency, DOS initiated both informal and formal consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA; 16 U.S.C § 1536) to determine the likelihood of effects on listed species.

DOS also coordinated the evaluation of the proposed Project's compliance with the Coastal Zone Management Act (CZMA) of 1972. Components of the proposed Project are within the coastal zone of Texas. The Texas General Land Office administers the federally approved Texas Coastal Management Program and will determine if the proposed Project is consistent with the program. This determination will only apply to portions of the Gulf Coast Segment and the Houston Lateral.

DOS coordinated with the cooperating and assisting agencies to ensure compliance with laws and regulations within their authority as well as to ensure compliance with the following executive orders:

- EO 11988 – Floodplain Management;
- EO 11990 – Protection of Wetlands;
- EO 12114 – Environmental Effects Abroad of Major Federal Actions;

- 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;
- EO 13212 – Actions to Expedite Energy-Related Projects; 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 other government department and agency heads as the Secretary of State deems appropriate. DOS must conclude that the proposed Project is in the national interest in order to issue a Presidential Permit.

1.5.2 Cooperating Agencies

The following agencies have agreed to be cooperating agencies in the NEPA process. A cooperating agency is any federal or state agency other than a lead agency which has jurisdiction by law or special expertise relevant to a proposed action.

1.5.2.1 U.S. Environmental Protection Agency (EPA)

Under Section 402 of the Clean Water Act (CWA; 33 U.S.C §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 proposed 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, hydrostatic test water, and storm water (40 CFR 122).

Under Section 404 of the CWA (33 U.S.C § 1251 et seq.), EPA reviews and comments on U.S. Army Corps of Engineers (USACE) 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 CAA (42 U.S.C § 7401 et seq.), EPA has the responsibility to review and comment in writing on the EIS for compliance with CEQ's Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500 to 1508).

Under Sections 3001 through 3019 of the Resource Conservation and Recovery Act (RCRA; 42 U.S.C § 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 proposed Project would be subject to the hazardous waste regulations.

The proposed Project would extend through EPA Regions 6, 7, and 8. Region 8 is the lead for EPA's involvement as a cooperating agency.

1.5.2.2 U.S. Department of the Interior, Bureau of Land Management (BLM)

BLM has authority to issue right-of-way (ROW) grants for all affected federal lands under the Mineral Leasing Act (MLA) of 1920, as amended (30 U.S.C 181 et seq.), excluding National Park Service (NPS) lands, and the public lands BLM administers under the Federal Land Policy and Management Act (FLPMA) of 1976. BLM will consider the issuance of a new ROW grant and issuance of associated temporary use permits that would apply to BLM-managed lands crossed by the proposed Project, as well as all other federal lands affected. Conformance with land use plans and impacts on resources and programs will be considered in determining whether to issue a ROW grant. BLM staff participated in interagency meetings with DOS and other federal agencies and reviewed and approved proposed routing across BLM managed lands, including canals and water pipelines operated by the Bureau of Reclamation.

BLM is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.3 U.S. Department of the Interior, National Park Service (NPS)

NPS provided technical review of the proposal in the vicinity of NPS-administered lands affected by the proposed Project. NPS retained this role despite the BLM authority on U.S. public federal lands since the MLA authorization administered by BLM is not applicable to NPS lands. Keystone's proposed route crosses several National Historic Trails that are managed with the assistance of the NPS. As a result, NPS was a cooperating agency for the NEPA environmental review of the proposed Project and a consulting party under Section 106 of the NHPA. NPS is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.4 U.S. Department of the Interior, U.S. Fish and Wildlife Service (USFWS)

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 U.S.C § 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 U.S.C § 661 et seq.). USFWS is responsible for the implementation of the provisions of the Migratory Bird Treaty Act (16 U.S.C § 703) and the Bald and Golden Eagle Protection Act (16 U.S.C § 688). Easements are protected under the National Wildlife Refuge Systems Administration Act (16 U.S.C § 668dd[c]).

1.5.2.5 U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

NRCS administers the Wetlands Reserve Program (WRP; 16 U.S.C § 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 WRP, 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 to ensure protection of wetland and wildlife conservation values. 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). NRCS is also responsible for the Farmland Protection Policy Act (7 CFR Part 658), including protection of prime and unique agricultural lands. As proposed, the Project would cross easements within one or more of the NRCS conservation reserve programs.

NRCS is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.6 U.S. Department of Agriculture, Farm Service Agency (FSA)

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 proposed Project would cross lands included in FSA land conservation programs.

FSA is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.7 U.S. Department of Agriculture, Rural Utilities Service (RUS)

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 submitted to RUS by several rural electric cooperatives to provide electricity to the proposed Project's pump stations. RUS is responsible for NEPA compliance for facilities proposed by the cooperatives to provide these services.

RUS is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.8 U.S. Army Corps of Engineers (USACE)

The USACE has jurisdictional authority pursuant to Section 404 of the Clean Water Act (CWA) (33 U.S. Code [USC] 1344), which governs the discharge of dredged or fill material into waters of the United States, and Section 10 of the Rivers and Harbors Act (33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody. Because the USACE must comply with the requirements of NEPA before issuing permits under these statutes, it has elected to participate as a cooperating agency in the preparation of this EIS. The USACE would adopt this EIS pursuant to 40 CFR 1506.3 if, after an independent review of the document, it concludes that its comments and suggestions have been satisfied.

As an element of its review, the USACE must consider whether a proposed project avoids, minimizes, and compensates for impacts on existing aquatic resources, including wetlands, to achieve a goal of no net loss of values and functions. Although this EIS addresses environmental impacts associated with the proposed Project as it relates to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act, it does not serve as a public notice for any USACE permits. Such notice will be issued separately. The

USACE's Record of Decision (ROD) resulting from consideration of this EIS and materials submitted by Keystone will formally document the agency's decision on the proposed Project, including the Section 404 (b)(1) analysis and the required environmental mitigation commitments.

USACE is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.9 U.S. Department of Energy (DOE), Office of Policy and International Affairs (PI)

The role of the Office of Policy and International Affairs (PI) is to deliver unbiased advice to the Department of Energy's leadership on existing and prospective energy-related policies, based on integrated and well-founded data and analysis. PI has primary responsibility for the DOE international energy activities including international emergency management, national security, and international cooperation in science and technology. At the request of DOS, PI has provided expert assistance in the analysis of the proposed Project in light of world crude oil market demand, and domestic and global energy challenges ranging from energy price and market volatility to the long-term technology transitions related to greenhouse gas emission reduction, energy efficiency, and the use of renewable resources. As part of this assistance, PI commissioned EnSys Energy and Systems, Inc. (EnSys) to conduct two studies specific to the proposed Project (EnSys 2010 and 2011).

1.5.2.10 U.S. Department of Energy, Western Area Power Administration (Western)

Western is a federal power-marketing agency within the U.S. 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 Project is 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 customers on its network for unplanned network load delivery points to serve unplanned load growth associated with the proposed Project in Montana and South Dakota.

Western is the network balancing authority and as such is required to perform joint system engineering studies to determine the effects that additional facilities or services might have on system reliability and stability. To accommodate these requests, the transmission system grid would require modification of existing electrical grid facilities, including installation of a new electric substation and construction of new transmission lines. According to DOE's NEPA Implementing Procedures (10 CFR Part 1021), these actions require environmental review.

The joint system engineering studies conducted in response to the requests for electrical power associated with the proposed Project determined that power demands for pump stations in South Dakota with the proposed Project operating at maximum throughput (830,000 bpd) would require that the existing area power grid be expanded to include a new 230-kilovolt (kV) electrical transmission line (the Big Bend to Witten 230- kV transmission line [formerly termed the Lower Brule to Witten 230-kV transmission line]), modification of an existing substation (Witten), construction of a new switchyard/substation (Lower Brule), and construction of a new double-circuit transmission line (from Big Bend to Lower Brule). According to DOE's NEPA Implementing Procedures (10 CFR Part 1021), these actions require environmental review. These actions are considered connected actions to the proposed Project as defined by 40 CFR 1508.25(a)(1) since they would be needed as a direct result of implementation of the proposed Project (see Section 2.5.2).

In responding to the need for agency action, Western must abide by the following:

- Address 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.
- Protect 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 an 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.

Western consulted with DOS to ensure cultural resources potentially affected by any Western transmission lines are taken into account. Western is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.2.11 U.S. Department of Transportation (USDOT), Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS)

PHMSA is responsible for protecting the American public and the environment by ensuring the safe and secure movement of hazardous materials to industry and consumers by all transportation modes, including the nation's pipelines. Through PHMSA, the USDOT develops and enforces regulations for the safe, reliable, and environmentally sound operation of the nation's 2.3-million-mile pipeline transportation system and the nearly 1 million daily shipments of hazardous materials by land, sea, and air. Within PHMSA, OPS has the safety authority for the nation's natural gas and hazardous liquid pipelines.[7] For those pipelines, PHMSA identifies and evaluates risks; develops and enforces standards for design, construction, operations and maintenance of pipelines; responds to accidents/incidents; educates operators and the public; conducts research on promising technologies; provides grants to states in support of their pipeline safety programs; and reviews oil spill response plans, with a special focus on protecting unusually sensitive areas. The regulations for Transportation of Hazardous Liquids by Pipeline are presented in 49 CFR Part 195; the regulations for Response Plans for Onshore Oil Pipelines are presented in 49 CFR Part 194. PHMSA, as a cooperating agency, provided technical expertise to DOS in the assessment of the proposed Project and in identifying appropriate mitigation measures.

1.5.2.12 Montana Department of Environmental Quality (MDEQ)

MDEQ is the lead agency for compliance with the State of Montana Environmental Policy Act (MEPA). Additionally, Keystone is required to obtain a Certificate of Compliance (Certificate) from MDEQ under the Montana Major Facility Siting Act (MFSA) before the proposed Project may begin construction or acquire easements in Montana through the eminent domain process. MDEQ must also consider issuance of permits under the Montana Water Quality Act, including turbidity authorizations for in-stream construction activities and Section 401 certification under the CWA. MDEQ's issuance of a Certificate must be based on substantive findings pursuant to Section 75-20-301(1), Montana Code Annotated (MCA) and Administrative Rules of Montana (ARM), Sections 17.20.1604 and 17.20.1607. Issuance of the Certificate would be a state action for which MDEQ is required to prepare an EIS under MEPA. Appendix I provides the environmental analyses required by MEPA to supplement the environmental

[7] For simplicity within this EIS, "PHMSA" is used for this agency and incorporates OPS.

assessments presented in the main body of the EIS, which was prepared in accordance with the requirements of NEPA.

MDEQ is also a signatory consulting party for the Programmatic Agreement developed under Section 106 of the NHPA.

1.5.3 Assisting Agencies and Other State Agencies

The U.S. Department of Interior, Bureau of Reclamation (Reclamation) is a water management agency with a Strategic Plan that includes many programs, initiatives, and activities designed to help the western states, Native American tribes, and others meet new water needs and balance the multitude of competing uses of water in the West. The mission of Reclamation is to assist in meeting the increasing water demands of the West while protecting the environment and public investments in these structures. The agency emphasizes fulfilling its water delivery obligations, water conservation, water recycling and reuse, and developing partnerships with its customers, states, and Native American tribes, and in finding ways to bring together the variety of interests to address the competing needs for limited water resources.

The federal lands that would be included within the MLA application for the proposed Project include eight canals, water lines, and ditches managed by Reclamation in Montana, South Dakota, and Nebraska. Reclamation must determine whether or not to issue "use authorization" for the proposed Project in accordance with requirements of 43 CFR 429.3 and whether or not the ROW grant issued under MLA by BLM is in compliance with Reclamation standards. Those standards for each facility are presented in Appendix E. Reclamation consulted with DOS and BLM regarding the ROW grant and the use authorization.

The following county governments in Nebraska assisted DOS in addressing their concerns regarding local planning processes and laws: Fillmore, Greeley, Holt, Merrick, Nance, Saline, and Wheeler. The Lower Big Blue Natural Resources and Upper Elkhorn Natural Resources districts in Nebraska have also served as assisting agencies.

In addition to these assisting agencies, many other state and local resource agencies from each of the states crossed by the proposed Project have responsibilities for state and local permit issuance. The permits required by the various state and local jurisdictions crossed by the proposed Project are listed in Section 1.10.

1.6 INDIAN TRIBE CONSULTATION

In its Notice of Intent (NOI) to prepare an EIS for the proposed Project (see Section 1.9.1), DOS also presented its intent to conduct a parallel Section 106 consultation under the NHPA. DOS and BLM initially contacted potentially affected Indian tribes to determine whether the tribes were interested in reviewing the proposed Project under NEPA and whether they were interested in participating in consultation under Section 106. As the lead federal agency for the proposed Project, DOS is continuing to engage in consultation with identified consulting parties, including federal agencies, state agencies, State Historic Preservation Officers (SHPOs), the Advisory Council on Historic Preservation (ACHP), and interested federally recognized Indian tribes (70 FR 71194) in the vicinity of the proposed Project. Tribes potentially affected by the undertaking were invited to become consulting parties under Section 106 of the NHPA regulations. Consultation was initiated on May 12, 2009 and included the development of a Programmatic Agreement (PA) between the consulting parties that would guide the continuing compliance with Section 106 if Keystone receives all necessary permits and implements the proposed Project. Consultation to date has included many Section 106 consultation meetings in both the northern and southern regions of the proposed Project and a meeting at the DOS offices in Washington, D.C. in

December, 2010. A list of these meeting dates and locations is included in Section 3.11. DOS recognizes its responsibility for government-to-government consultation with federally recognized tribes, and is engaging in such consultation as requested by appropriate tribal officials. The final PA is included as Appendix S.

1.7 SHPO CONSULTATION

Consultation with the SHPOs was initiated on April 21, 2009. Consultation to date has included consultation meetings in Lincoln, Nebraska, Helena, Montana, Pierre, South Dakota, and Austin, Texas. The SHPOs were invited to all Section 106 consultation meetings held in the vicinity of the proposed route. The SHPOs, other agencies, and Indian tribes have been active participants in providing feedback to DOS on the PA, the Tribal Monitoring Plan, and the Historical Trails and Archaeological Monitoring Plan (attachments to the PA). Additional meetings were held with the Texas and Montana SHPOs to address the development of mitigation measures for adverse effects to historic properties in Texas and Montana that would occur if the proposed Project is implemented.

1.8 ENVIRONMENTAL REVIEW OF THE CANADIAN PORTION OF THE PROPOSED KEYSTONE XL PROJECT

As a matter of policy, in addition to its environmental analysis of the proposed Project in the United States, DOS monitored and obtained information from the ongoing environmental analysis of the Canadian portion of the proposed Keystone XL Project. In so doing, DOS was guided by EO 12114 (Environmental Effects Abroad of Major Federal Actions) which stipulates the procedures and other actions to be taken by federal agencies with respect to environmental impacts outside of the United States. The Canadian government conducted an environmental review of the portion of the proposed Keystone XL Project in Canada. As a result, and consistent with EO 12114, DOS did not conduct an assessment of the potential impacts of the Canadian portion of the proposed Keystone XL Project. However, as a matter of policy, DOS has included information in this EIS on the Canadian government's assessment of potential direct and indirect impacts of the proposed Keystone XL Project in Canada (see Section 3.14.4).

The Canadian environmental analysis process began on July 18, 2008 when Keystone submitted a Preliminary Information Package (PIP) regarding the proposed Keystone XL Pipeline to Canada's National Energy Board (NEB). Upon receipt of the PIP, the NEB issued a Federal Coordination Notice that formally initiated an environmental assessment process pursuant to the Canadian Environmental Assessment Act (CEAA). In early 2009, Keystone submitted an application to NEB for a Certificate of Public Convenience and Necessity for the Canadian portion of the proposed Keystone XL Project pursuant to Section 52 of the NEB Act. The NEB solicited comments from provincial governments and agencies and other potential intervening parties in the process and held hearings on Keystone's application from September 15 through October 2, 2009. Information presented in those hearings is included in portions of this EIS.

On March 11, 2010, the NEB issued its Reasons for Decision granting Keystone's application. The NEB's Reasons for Decision included an Environmental Screening Report (ESR) that was prepared to meet the requirements of CEAA for the Canadian portion of the proposed Keystone XL Project. The ESR concluded that implementation of the proposed Keystone XL Project in Canada would not likely result in significant adverse environmental effects with incorporation of Keystone's proposed measures to avoid or minimize impacts and with Keystone's acceptance of the NEB's regulatory requirements and recommended conditions attached to the ESR. The CEAA and the NEB's Reasons for Decision are presented in Appendix R.

1.9 PREPARATION AND PUBLICATION OF THE DRAFT, SUPPLEMENTAL DRAFT, AND FINAL EISs

The principal objectives of the EIS are as follows:

- Identify and assess potential impacts on the natural and human environment that would result from implementation of the proposed Project in the United States;
- Describe and evaluate reasonable alternatives, including no action, to the proposed Project that would avoid or minimize adverse effects to the environment;
- Identify the DOS-preferred alternative;
- Identify and recommend specific mitigation measures, as necessary, to avoid or minimize environmental impacts; and
- Facilitate public, tribal, and agency involvement in identifying significant environmental impacts.

This section provides a description of the preparation, publication, and public review of the draft EIS (Section 1.9.1) and the supplemental draft EIS (Section 1.9.2), and the preparation and publication of the final EIS (Section 1.9.3).

1.9.1 Draft EIS

1.9.1.1 Scoping and Draft EIS Preparation

The sources of information DOS used to obtain details regarding the proposed Project are listed in Section 1.0. Based on that information, on January 28, 2009, DOS issued an NOI to prepare an EIS to address reasonably foreseeable impacts from the proposed action and alternatives, and to conduct a parallel consultation process under Section 106 of NHPA.

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 the following stakeholders:

- Landowners along the proposed route;
- Federal, state, and local agencies;
- Municipalities and counties;
- Native American Tribes;
- Elected officials;
- Non-governmental organizations;
- Media; and
- Interested individuals.

The scoping period was originally planned to extend from January 28 to March 16, 2009. Weather conditions in South Dakota precluded holding the scoping meetings on this schedule, and an amended NOI published on March 23, 2009 extended the scoping period until April 15, 2009 to provide time to allow rescheduling of two South Dakota scoping meetings.

DOS held 20 separate scoping meetings in the vicinity of the proposed route to give the public the opportunity to provide comments regarding the scope of the EIS. The dates and locations of the meetings are listed below, along with the attendance at each meeting (in parentheses).

February 9 – Beaumont, Texas (10)

February 10 – Liberty, Texas (15)

February 11 – Livingston, Texas (15)

February 12 – Tyler, Texas (60)

February 17 – Durant, Oklahoma (34)

February 18 – Ponca City, Oklahoma (12)

February 19 – El Dorado, Kansas (10)

February 19 – Clay Center, Kansas (20)

February 23 – York, Nebraska (62)

February 23 – Baker, Montana (39)

February 24 – Atkinson, Nebraska (65)

February 24 – Terry, Montana (30)

February 25 – Murdo, South Dakota (46)

February 25 – Circle, Montana (100)

February 25 – Plentywood, Montana (7)

February 25 – Glendive, Montana (45)

February 26 – Glasgow, Montana (53)

February 26 – Malta, Montana (32)

April 8 – Faith, South Dakota (12)

April 8 – Buffalo, South Dakota (31)

DOS received verbal, written, and electronic comments during the scoping 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 submitted to DOS. A summary of public comments related to the scope of the EIS is presented in Table 1.9.1-1 along with the EIS section that addresses the concern. Additional details on the scoping comments are provided in Appendix A.

TABLE 1.9.1-1 Comments Received on Environmental Issues during the Public Scoping Process for the Proposed Project		
Issue	**Comment**	**Section Where Comment/Issue Addressed in EIS:**
Purpose and Need	Purpose and economics of this proposed Project needs to be explained, including forecasts for Canadian sand oil production and U.S. crude oil demand and evaluate the proposed Project in the context of overall U.S. oil production, transportation, storage and refining. How much supply comes from which nations and what is the stability of those sources? Describe commercial terms for commitments to the proposed Project. Indicate how long the oil supply for the pipeline is projected to last at the throughput volumes planned for the proposed Project.	1.2
Project Description	Pipeline installation methods should minimize impacts to the surrounding environment. Effects of installation, maintenance, operation, life expectancy, and removal of the pipeline.	2.0
Alternatives	Process to select alternatives, evaluation of a no-action alternative, route adjustments, route selection, routes that avoid sensitive areas and risks to homes and farming operations, use of other methods of transportation, shipping refined products instead of a crude oil pipeline, renewable energy sources, collocation with other ROWs.	4.0
Geology	Seismicity in the Brockton-Froid fault zone. Lower portion of the Niobrara River is underlain by Pierre shale, which is a very week rock prone to fracturing and slumping.	3.1
Soils and Sediments	Methods to reduce erosion, repair of erosion channels, sediment control, topsoil segregation during construction and replacement of topsoil after construction and abandonment, restoring right-of-way land to previous state, pipeline effects on soil temperature, effects of frost/moisture on bring rocks to the soil surface, construction related erosion impacts on sand dunes.	3.2
Water Resources	Impacts on public and private water sources, water supply contingencies in the event of a spill, stream channel erosion, impacts to reservoirs, availability of hydrostatic testing water. The EIS should provide a clear description of aquatic resources that may be impacted.	3.3
Wetlands	Identification of potentially impacted wetlands, impact and mitigation measures, replacement or restoration of loss wetlands, and avoidance of wetland drainage as a result of trenching.	3.4
Vegetation	Impacts and mitigation to native vegetation along pipeline ROW, revegetation measures, impact to tree shelter belts, spread of invasive weeds, effects to rare plant communities.	3.5
Fish, wildlife, and threatened and endangered species	Impacts to fisheries, potential impacts and mitigation to threatened and endangered species, fragmentation of habitat, off-site mitigation to compensate for impacts, and effects of power lines on avian collision.	3.6, 3.7 and 3.8
Land Use	Restrictions of land use over pipeline and cost of reclamation to agriculture land. Protection measure to protect landowner's ability to graze cattle, run equipment, and to be free of noxious weeds.	3.9

TABLE 1.9.1-1 Comments Received on Environmental Issues during the Public Scoping Process for the Proposed Project		
Issue	**Comment**	**Section Where Comment/Issue Addressed in EIS:**
Recreation and Special Interest Areas	Impacts to state parks, National Historic Trails, and National Scenic Rivers; impacts to boating, tubing and other activities; and degradation of recreational opportunities.	3.9
Visual Resources	Visual impacts of above-ground facilities, use of "Standard Environmental colors", impacts of fuel spills and visible sediment plumes in rivers and lakes, impacts on historic landscapes and National wild and scenic rivers.	3.9
Socioeconomics	Impacts to property values, impacts on property taxes, and Project-related tax revenues to municipalities and counties associated with the pipeline.	3.10
Transportation and Traffic	Impacts to county and private roads, methods used to cross roadways, and restoration of damaged roads.	3.10
Cultural Resources	Impacts to archaeological sites, paleontological resources, prehistoric and historic sites, and historic landscapes; route should visually inspect for historic properties; route should avoid any significant cultural resource on public land as well as hunting and subsistence areas. Potential major adverse impacts to cultural resources associated with El Camino Real de los Tejas in Nacogdoches County, Texas.	3.11
Air Resources	Air emissions and air pollution abatement from pump stations, and air quality impacts of refining tar sands.	3.12
Noise	Effects of pump station operational noise on humans and cattle, impacts due to construction noise, and effects of pipeline vibrations on nearby structures and cattle.	3.12
Reliability and Safety	Local county input to Emergency Response Plan; training for local responders; protection from vandalism, terrorist activities and fire risk; ROW security; safety of pipeline crossings; spill contamination and cleanup procedures; maximum potential spill volumes; state-of-the art leak detection, and detection of small leaks in particular; monitoring of pressure; automatic shut-down procedures; corrosive nature of Canadian tar sands; pipeline integrity; compensation to landowners affected by spills; spill clean up and restoration plans; TransCanada's operational experience and safety record; water supply contamination due to oil spills; and impacts of spills on animals and humans.	3.13
Cumulative Impacts	Impacts from building another pipeline on properties that may already have up to four other pipelines running through them; impact of mining, making, refining and using tar sands oil; impacts from activities such as new roads, gas or oil wells, power lines, wind farms, coal mines, etc.; and the impacts of adding additional volumes of crude oil to Wood River and Cushing terminals.	3.14

The draft EIS was developed consistent with the scoping process required under NEPA, the Council on Environmental Quality (CEQ) NEPA regulations under 40 CFR 1500, and the DOS regulations for implementing NEPA under 22 CFR 161. It included relevant issues raised by the public and the agencies during the scoping period.

1.9.1.2 Public Review

The draft EIS for the proposed Project was issued for public review on April 16, 2010. The notice of availability (NOA) for the draft EIS was published in the Federal Register on April 20, 2010 (75 FR 20653). The NOA included notice of 19 public comment meetings to be held during a 3-week period in May, 2010 in the vicinity of the proposed pipeline route in Texas, Oklahoma, Kansas, Nebraska, South Dakota, and Montana. The NOA also provided additional information regarding the draft EIS and requested the submission of all comments by May 31, 2010. The NOA was also sent to agencies, elected officials, media organizations, Indian tribes, private landowners, and other interested parties. Approximately 2,000 copies of printed and/or electronic copies of the draft EIS were sent to libraries, elected officials, agencies, landowners, Indian tribes, and other interested parties. Electronic versions of the draft EIS were also available for download on the DOS website. The distribution list for the draft EIS is presented in Appendix Z.

In response to requests from several organizations, on April 30, 2010 DOS extended the public comment period on the draft EIS until June 16, 2010 (75 FR 22890). During that period, DOS received additional requests to extend the review period and, in response, DOS again extended the public comment period, this time until July 2, 2010 (75 FR 33883).

The public comment meetings were held from May 3 through May 20, 2010 to solicit both verbal and written comments on the draft EIS. The meetings were held in the vicinity of the proposed route and corresponded with the locations of the scoping meetings held between February and April of 2009. The dates and locations of the 19 meetings are listed below:

May 3 – Durant, Oklahoma

May 4 – Stroud, Oklahoma

May 5 – El Dorado, Kansas

May 6 – Fairbury, Nebraska

May 10 – York, Nebraska

May 11 – Atkinson, Nebraska

May 12 – Murdo, South Dakota

May 13 – Faith, South Dakota

May 13 – Buffalo, South Dakota

May 17 – Beaumont, Texas

May 17 – Malta, Montana

May 18 – Glasgow, Montana

May 18 – Terry, Montana

May 18 – Liberty, Texas

May 19 – Livingston, Texas

May 19 – Circle, Montana

May 19 – Glendive, Montana

May 20 – Baker, Montana

May 20 – Tyler, Texas

In response to requests to hold additional public comment meetings in the Houston area and in Washington, D.C., DOS conducted additional comment meetings in Channelview, Texas (near the eastern border of Houston) on June 18, 2010 and in Washington, D.C. on June 29, 2010. In addition to receiving written and verbal comments at the draft EIS comment meetings, DOS received comments by email, website link (e-comments), telephone, and U.S. mail.

DOS received comment letters, postcards, emails, and faxes from 1,753 individuals or organizations. Verbal comments were received from 233 people at the 21 public comment meetings. The verbal comments were recorded and transcribed by a court reporter. DOS also received 1,520 letters, cards, emails, e-comments, and telephone conversation records. From these submissions DOS distilled approximately 5,600 separate substantive comments. These comments and the DOS response to these comments are provided in Appendix A.

In addition to the public review process described above, DOS conducted agency consultations to identify issues to be addressed in the EIS. From June 2010 through April 2011 DOS participated in interagency teleconferences and meetings and corresponded with concerned agencies.

1.9.2 Supplemental Draft EIS

1.9.2.1 Preparation of the Supplemental Draft EIS

Some commenters on the draft EIS expressed concern that the document did not provide a sufficient analysis of the impacts of the proposed Project and requested that DOS issue a supplemental draft EIS for public review. As part of its continuing evaluation of the adequacy of the draft EIS, DOS analyzed the new and additional information that became available after the draft EIS was issued and made a determination that the new information does not show that the proposed Project would affect the quality of the environment in a significant manner or to a significant extent not already considered in the draft EIS. The analysis further noted that there are no new alternatives that are outside of the spectrum of alternatives already analyzed in the draft EIS.

Although the determination of adequacy indicated that it would not be mandatory to issue a supplemental document to comply with NEPA, DOS decided that decision-makers and the public would benefit from additional public review of and comment on both the information that was not available at the time the draft EIS was issued and the portions of the EIS that were revised to address the new information and comments on the draft EIS. As a result the supplemental draft EIS was prepared.

To focus public attention on the topics that DOS determined would be of value for additional review, the supplemental draft EIS provided only information directly or indirectly related to those topics and did not include all sections that were presented in the draft EIS. However, the supplemental draft EIS incorporated the draft EIS by reference in compliance with CEQ NEPA regulations. The supplemental draft EIS included revised information on proposed Project facilities; design, construction and maintenance, regulatory requirements; and potential connected actions. It also included additional information on groundwater, potential spill impacts, alternatives to the proposed Project, Environmental Justice considerations, crude oil composition, potential refinery emissions, and greenhouse gas (GHG) and climate change considerations.

1.9.2.2 Public Review

The supplemental draft EIS was circulated consistent with CEQ NEPA regulations and DOS guidelines (*Using Existing Environmental Analyses*). It included copies of new reports and other documents relevant to the proposed Project and revisions to portions of the EIS.

The supplemental draft EIS was issued for public review on April 15, 2011 and the NOA was published in the Federal Register on April 22, 2010 (75 FR 20653). The NOA was also sent to agencies, elected officials, media organizations, Indian tribes, private landowners, and other interested parties. Approximately 2,000 copies of printed and/or electronic copies of the draft EIS were sent to libraries, elected officials, agencies, landowners, Indian tribes, and other interested parties. Electronic versions were also available for download on the DOS website. The distribution list for the supplemental draft EIS is presented in Appendix Z.

DOS received a total of approximately 280,000 "form letters," including letters submitted by U.S. mail, postcards, and electronic submissions (emails and CDs). In addition, DOS received approximately 3,000 unique submissions, including letters, faxes, emails, and submissions on the DOS website. DOS distilled from all form and unique submissions approximately 5,360 separate substantive comments. These comments and the DOS response to these comments are provided in Appendix A.

In addition to the public review process described above, DOS continued to conduct agency consultations after the supplemental draft EIS was published to identify issues to be addressed in the final EIS. From April 2011 through July 2011, DOS participated in interagency teleconferences and meetings and corresponded with concerned agencies.

1.9.3 Final EIS

1.9.3.1 Preparation of the Final EIS

Portions of the EIS were revised in response to comments received on the draft and supplemental draft EISs and as a result of updated information that became available after the issuance of the supplemental draft EIS. Appendix A contains comment response matrices that include:

- Comments distilled from the various submissions received on the draft EIS and supplemental draft EIS; and
- Individual responses to the distilled comments received on the draft EIS and supplemental draft EIS.

Appendix A also includes the "Consolidated Responses" referenced in the individual responses that address issues raised by multiple commenters.

As required by CEQ, a subject index for the EIS is provided at the end of the EIS.

The extraction of oil sands in Canada and construction and operation of the Canadian portion of the Keystone XL Project are under the jurisdiction of the Canadian government. Canadian governmental agencies reviewed those activities, found them to be in compliance with the relevant environmental laws and regulations, and approved them. As set forth by NEPA, CEQ, and the Executive Orders and CFR regulations authorizing NEPA, review by DOS of the activities in Canada are beyond the NEPA authority of DOS and therefore were not evaluated in this EIS. However, a summary of the environmental reviews conducted by the Canadian government is presented in the EIS (see Section 3.14.4).

Refining of the oil that would be transported by the proposed Project is not part of the proposed Project. Keystone would not own the oil and would not determine its destination or what refined products ultimately would be processed from the oil (such as fuel, plastics, and lubricants). Further, Keystone would have no control over the end use of the oil. In addition, as described in Section 1.4, construction and operation of the proposed Project would be independent of the level of oil refining in PADD III and would not directly result in increased or significantly changed refinery emissions in Gulf Coast refineries.

Therefore, neither refining nor end use could reasonably be considered part of the NEPA review of the proposed Project, although they are discussed in the Cumulative Impacts analysis of this EIS (Section 4.14).

DOS received comments stating that the EIS must incorporate future changes in national and international policy, campaign promises, and pending legislation. In accordance with CEQ guidance, the NEPA analysis in this EIS was based on existing federal and state laws, regulations, and policy. The purpose of NEPA in preparing a project-specific EIS is to provide a public disclosure document that takes a hard look at the specific impacts of a proposed project (including alternatives and cumulative impacts) to inform decision makers on the potential environmental impacts in accordance with existing laws and regulations. In accordance with NEPA, this EIS is not intended to dictate national or international policy or to speculate on potential changes to laws or policies that may occur at some undetermined time in the future. Therefore, the EIS for the proposed Project does not address such issues. DOS recognizes that the proposed Project, if approved, would need to adhere to all applicable laws that exist at the time of construction and operation.

1.9.3.2 Publication of the Final EIS

The final EIS was issued on August 26, 2011 to allow EPA to publish the NOA in the Federal Register on September 2, 2011. The NOA was also sent to agencies, elected officials, media organizations, Indian tribes, private landowners, and other interested parties. Approximately 2,000 copies of printed and/or electronic copies of the draft EIS were sent to libraries, elected officials, agencies, landowners, Indian tribes, and other interested parties. Electronic versions were also available for download on the DOS website. The distribution list for the final EIS is presented in Appendix Z. In accordance with the CEQ regulations implementing NEPA, no agency decision on the proposed action may be made until 30 days after the NOA for this final EIS is published.

1.9.3.3 Public Input on the National Interest Determination

After publication of the EIS, DOS will hold meetings in: Glendive, Montana; Pierre, South Dakota; Lincoln, Nebraska; Atkinson, Nebraska; Topeka, Kansas; Oklahoma City, Oklahoma; Austin Texas; Port Arthur, Texas; and Washington, DC. These meetings will give individuals an opportunity to voice their views on whether granting or denying a Presidential Permit for the pipeline would be in the national interest and to comment on economic, energy security, environmental and safety issues relevant to that determination.

1.10 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

The cooperating agencies and the assisting federal, tribal, state, and local agencies with jurisdiction over various aspects of the proposed Project participated in the EIS process by providing direct input to DOS or through the EIS review and comment process (see Sections 1.5.2, 1.5.3, and 1.6).

DOS received many comments on the draft EIS expressing concerns regarding Keystone's application to PHMSA for a Special Permit. The Special Permit would have required additional safety conditions to allow Keystone to use stronger steel pipe and operate the pipeline at a higher pressure than would be allowed using the standard design factor specified in 49 CFR 195.106. As noted in Section 1.1, on August 5, 2010, Keystone withdrew its application to PHMSA for a Special Permit.

If approved, the proposed Project would be constructed in accordance with the regulatory requirements in 49 CFR 195 and also in accordance with the 57 Project-specific Special Conditions developed by

PHMSA and agreed to by Keystone. These special conditions are described in Sections 2.3 and 3.13.1.1 and are presented in Appendix U.

Table 1.10-1 lists the major permits, licenses, approvals, authorizations, and consultation requirements for the proposed Project that would be required by federal, state, and local agencies prior to implementation of the proposed Project.

TABLE 1.10-1
Permits, Licenses, Approvals, and Consultation Requirements for the Proposed Project[a]

Agency	Permit or Consultation/Authority	Agency Action
Federal		
U.S. Department of State (DOS)	Presidential Permit, Executive Order 13337 of April 30, 2004 (69 Federal Register [FR]. 25299, et seq.)	Considers approval of cross-border facilities.
	National Environmental Policy Act (NEPA)	Lead federal agency for the environmental review of major projects considered for Presidential Permits require environmental impact statements
	Section 106 of the National Historic Preservation Act (NHPA)	Supervises and coordinates compliance with Section 106 of NHPA and consultation with interested Tribal agencies
Bureau of Land Management (BLM)	Right-of-way (ROW) grant(s) and short-term ROWs under the Federal Land Policy and Management Act of 1976 as amended (FLPMA) and Temporary Use Permit under Section 28 of the Mineral Leasing Act (MLA)	Considers approval of ROW grant and temporary use permits for the portions of the proposed Project that would encroach on public lands
	Archeological Resources Protection Act (ARPA) Permit	Considers issuance of cultural resource use permit to survey, excavate or remove cultural resources on federal lands
	Notice to Proceed	Following issuance of a ROW grant and approval of the proposed Project's Plan of Development (POD), considers the issuance of a Notice to Proceed with Project development and mitigation activities for federal lands
	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies
U.S. Corps of Engineers (USACE) – Omaha, Tulsa, Fort Worth, and Galveston Districts	Section 404, Clean Water Act (CWA)	Considers issuance of Section 404 permits for the placement of dredge or fill material in Waters of the U.S., including wetlands
	Section 10 Permit (Rivers and Harbors Act of 1899)	Considers issuance of Section 10 permits for pipeline crossings of navigable waters
	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies
U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act (ESA) Section 7 Consultation, Biological Opinion	Considers lead agency findings of an impact of federally-listed or proposed species; provide Biological Opinion if the proposed Project is likely to adversely affect federally-listed or proposed species or their habitats
U.S. Bureau of Reclamation (Reclamation)	ROW Grant and Temporary Use Permit under Section 28 of the MLA	Determines if ROW grant issued under MLA by BLM is in compliance with Reclamation standards
	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies

TABLE 1.10-1 Permits, Licenses, Approvals, and Consultation Requirements for the Proposed Project[a]		
Agency	**Permit or Consultation/Authority**	**Agency Action**
Federal Highway Administration (FHA)	Crossing Permit	Considers issuance of permits for the crossing of federally funded highways
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety	49 CFR Part 195 – Transportation of Hazardous Liquids by Pipeline	Reviews design, construction, operations, maintenance, and emergency operations plan (termed Emergency Response Plan [ERP] in this EIS), inspection of pipeline projects, including Integrity Management Programs and identifying high consequence areas prior to installation
	49 CFR Part 194 – Response Plans for Onshore Pipelines	Reviews Response Plans (termed Pipeline Spill Response Plan [PSRP] in this EIS) prior to initiation of operation and within 2 years of startup approves the PSRP.
U.S. Environmental Protection Agency, Regions 6, 7, and 8	Section 401, CWA, Water Quality Certification	Considers approval of water use and crossing permits for non-jurisdictional waters (implemented through each state's Water Quality Certification Program)
	Section 402, CWA, National Pollutant Discharge Elimination System (NPDES)	Reviews and issues NPDES permit for the discharge of hydrostatic test water (implemented through each state's Water Quality Certification Program, where required)
U.S. Department of Agriculture – Natural Resources Conservation Service	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies
U.S. Department of Agriculture – Farm Service Agency	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies
U.S. Department of Agriculture – Rural Utilities Services (RUS)	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies
Western Area Power Administration (Western)	Section 106 (NHPA)	Responsible for compliance with Section 106 of NHPA and consultation with interested Tribal agencies
Advisory Council on Historic Preservation	Consultation	Advises federal agencies during the Section 106 consultation process; signator to the Programmatic Agreement
U.S. Department of Treasury – Bureau of Alcohol, Tobacco, and Firearms	Treasury Department Order No. 120-1 (former No. 221), effective 1 July 1972	Considers issuance of permit to purchase, store, and use explosives should blasting be required
Montana		
Montana State Historic Preservation Office (SHPO)– Montana Historical Society[c]	Section 106 consultation regarding National Register of Historic Places (NRHP) eligibility of cultural resources and potential Project effects on historic properties, Compliance with Montana State Antiquities Act	Reviews and comments on activities potentially affecting cultural resources
Montana Department of Environmental Quality (MDEQ)	Certificate of Compliance under the state Major Facility Siting Act (MFSA)	Considers issuance of a certificate of compliance under MFSA for construction and operation

TABLE 1.10-1 Permits, Licenses, Approvals, and Consultation Requirements for the Proposed Project[a]		
Agency	**Permit or Consultation/Authority**	**Agency Action**
MDEQ – Permitting and Compliance Division – Water Protection Bureau	Montana Ground Water Pollution Control System and Nondegredation Review (three levels of water protection based on water classification, i.e., outstanding resource waters etc.), Standard 318 (Permitting conditions for Pipeline Crossings at Watercourses – short term turbidity)	Considers issuance of permit for stream and wetland crossings; provides Section 401 certification consults for Section 404 process
	Montana Pollutant Discharge Elimination System (MPDES)	Considers issuance of permit for hydrostatic test water discharge into surface water, trench dewatering, and stormwater discharge
MDEQ – Permitting and Compliance Division – Waste and Underground Tank Management Bureau	Septic Tank, Cesspool, and Privy Cleaner New License Application Form (for work camps)	Reviews and licenses Cesspool, Septic Tank and Privy Cleaners, inspects disposal sites for septic tank, grease trap and sump wastes
MDEQ – Permitting and Compliance Division – Air Resources Bureau	Air Quality Permit Application for Portable Sources; Air Quality Permit Application for Stationary Sources	Considers issuance of air quality permit(s) for work camps dependant on source of power such as portable diesel generator or use of non-electrical equipment is used during construction or operation of the pipeline (i.e., diesel powered pumps during hydrostatic testing)
MDEQ – Permitting and Compliance Division – Public Water Supply Bureau	Water and Wastewater Operator Certification (for work camps)	Reviews and licenses operators of certain public drinking water and wastewater treatment facilities; issues approval to construct, alter or extend public water or sewer systems (including hauling, storage and distribution of water)
Montana Department of Natural Resources and Conservation (DNRC) – Water Resources Division (General)	Water Appropriation Permit (Beneficial Water use Permit) and/or Water Wells Drilling/ Alteration	Considers issuance of permit for water use for hydrostatic testing or waters for dust control
Montana DNRC State Board of Land	Management of timber, surface, and mineral resources for the benefit of the common schools and the other endowed institutions in Montana	Considers approval of permanent easements across state land
Montana DNRC State Board of Land and, Real Estate Management Division	Administers all activities on lands classified as "Other" and all secondary activities on lands classified as grazing, agriculture, or timber	Considers issuance of license to use state land
Montana DNRC Trust Land Management Division	Navigable Rivers/Land use License/Easement	Consults on and considers issuance of permit for projects in, on, over, and under navigable waters
Montana DNRC, Conservation Districts	Natural Streambed and Land Preservation Act (also known as the 310 Law)	Consider issuance of permits for construction in perennial streams, rivers, or designated reservoirs on private land
Montana Fish, Wildlife and Parks	Natural Streambed and Land Preservation Act (also known as the 310 Law)	Provide technical oversight to DNRC Conservation Districts in review of applications for 310 permits
Department of Transportation – Glendive District	State and Highway Crossing Permit for pipeline and access roads that encroach state highway ROW, with traffic control based on the Manual on Uniform Traffic Control Devices	Considers issuance of permits for crossings of state highways
Department of Transportation – Helena Motor Carrier Services (MCS) Division Office	Oversize/Overweight Load Permits, where required	Considers issuance of permit for oversize/overweight loads on state maintained roadways

TABLE 1.10-1 Permits, Licenses, Approvals, and Consultation Requirements for the Proposed Project[a]		
Agency	**Permit or Consultation/Authority**	**Agency Action**
Montana Public Service Commission	Grant Common Carrier Status	Considers whether or not an applicant qualifies as a common carrier under Montana Annotated Code (MAC) 69-13-101; if a common carrier, the commission would supervise and regulate operations under MCA Title 69 allowing Keystone to cross state highways and state streams.
County Road Departments	Crossing Permits	Considers issuance of permits for crossing of state highways
County Floodplain Departments	County Floodplain permitting	Considers issuance of permits and review of work in floodplains
County and Local Authorities	Pump Station Zoning Approvals, where required	Reviews under county approval process
	Special or Conditional Use Permits, where required	Reviews under county approval process (Note: These permits are not required after a Certificate of Compliance under MFSA is issued)
County Weed Control Boards	Approval of reclamation plan	Considers approval of a reclamation/weed control plan (Note: These approvals still required after Certificate of Compliance under MFSA is issued)
South Dakota[b]		
South Dakota Historical Society[c]	Consultation under Section 106, NHPA	Reviews and comments on activities potentially affecting cultural resources
South Dakota Public Utilities Commission	Energy Conversion and Transmission Facilities Act	Considers issuance of permit for a pipeline and appurtenant facilities
Department of Environment and Natural Resources, Surface Water Quality Program	Section 401, CWA, Water Quality Certification	Considers issuance of permit for stream and wetland crossings; consult for Section 404 process
	Hydrostatic Testing/Dewatering & Temporary Water Use Permit (SDG070000)	Considers issuance of General Permit regulating hydrostatic test water discharge, construction dewatering to waters of the state, and Temporary Water use Permit
	SDCL 34A-18 (oil spill response plans).	Review and consider approving crude oil pipeline spill response plans.
Department of Game, Fish, and Parks	Consultation	Consults regarding natural resources
Department of Transportation	Crossing Permits	Considers issuance of permits for crossing of state highways
County Road Departments	Crossing Permits	Considers issuance of permits for crossing of county roads
County and Local Authorities	Pump Station Zoning Approvals, where required	Reviews under county approval process
	Special or Conditional Use Permits, where required	Reviews under county approval process
Nebraska		
Nebraska State Historic Preservation Office (SHPO)[c]	Consultation under Section 106, NHPA	Reviews and comments on activities potentially affecting cultural resources

TABLE 1.10-1 Permits, Licenses, Approvals, and Consultation Requirements for the Proposed Project[a]		
Agency	**Permit or Consultation/Authority**	**Agency Action**
Department of Environmental Quality, Division of Water Resources	Section 401, CWA, Water Quality Certification	Considers issuance of permit for stream and wetland crossings; consult for Section 404 process
	Excavation Dewatering and Hydrostatic Testing Permit Form NEG6720000 Dewatering Form NEG6721000 Relocation	Considers issuance of permit regulating hydrostatic test water discharge and construction dewatering to waters of the state
Department of Natural Resources	Water Appropriations – Groundwater and Surface Water	Considers issuance of permit to use Public Waters (for hydrostatic test water or dust control)
Game and Parks Commission	Consultation	Consults regarding natural resources
Department of Transportation	Crossing Permits	Considers issuance of permits for crossing of state highways
County Road Departments	Crossing Permits	Considers issuance of permits for crossing of county roads
County and Local Authorities	Pump Station Zoning Approvals, where required	Reviews under county approval process
	Special or Conditional Use Permits, where required	Reviews under county approval process
Kansas		
Department of Health and Environment, Bureau of Water	Hydrostatic Testing Permit (if applicable)	For pump station piping, may be below permitting thresholds
	Water Withdrawal Permit (if applicable)	For pump station piping, may be below permitting thresholds
Department of Wildlife and Parks	Non-game and Endangered Species Action Permit (if applicable)	Reviews of new pump station locations
SHPO[c]	Historical Resources Review (if applicable)	Reviews of new pump station locations
County and Local Authorities	Pump Station Zoning Approvals, where required	Reviews under county approval process
Oklahoma		
Oklahoma State Historical Society[b]	Consultation under Section 106, NHPA	Reviews and comments on activities potentially affecting cultural resources
Oklahoma Archaeological Survey (OAS)	Consultation	Reviews and comments on activities potentially affecting archaeological sites
Department of Environmental Quality (DEQ), Division of Water Resources	Section 401, CWA, Water Quality Certification.	Considers issuance of permit for stream and wetland crossings; consults for Section 404 process; Critical Water Resources.
	Excavation Dewatering and Hydrostatic Testing Permit (OKG270000)	Considers issuance of permit regulating hydrostatic test water discharge and construction dewatering to waters of the state
DEQ, Air Division	Minor Source Air Permit	For tank farm near Cushing
Department of Wildlife Conservation	Consultation	Consults regarding natural resources
Department of Transportation	Crossing Permits	Considers issuance of permits for crossing of state highways
County Road Departments	Crossing Permits	Considers issuance of permits for crossing of county roads

TABLE 1.10-1 Permits, Licenses, Approvals, and Consultation Requirements for the Proposed Project[a]		
Agency	**Permit or Consultation/Authority**	**Agency Action**
County and Local Authorities	Pump Station Zoning Approvals, where required	Reviews under county approval process
	Special or Conditional Use Permits, where required	Reviews under county approval process
Texas		
SHPO[c]	Consultation under Section 106, NHPA	Reviews and comments on activities potentially affecting cultural resources
Texas Commission on Environmental Quality (TCEQ)	Section 401, CWA, Water Quality Certification.	Consults for Section 404 process; permit regulating hydrostatic test water discharge, and construction dewatering to waters of the state
	General Conformity Determination	Determines conformity of the federal action to the State Implementation Plan (SIP)
Parks and Wildlife Department	Consultation 31 TAC 69 - Marl, Sand, and Gravel Permits	Consults regarding natural resources, considers issuance of stream crossing permits
Texas General Land Office	Coastal Zone Management Program	Considers issuance of Coastal Zone Consistency Determination
	State owned lands	Considers approval of easement grants for ROW cover state-owned lands
Railroad Commission of Texas	State lead on oil and gas projects; Excavation Dewatering and Hydrostatic Testing Permit	Considers issuance of permit to operate the pipeline; considers issuance of permit regulating hydrostatic test water discharge and construction dewatering to waters of the state
Department of Transportation	Crossing Permits	Considers issuance of permits for crossing of state highways
County Road Departments	Crossing Permits	Considers issuance of permits for crossing of county roads
County and Local Authorities	Pump Station Zoning Approvals, where required	Reviews under county approval process
	Special or Conditional Use Permits, where required	Reviews under county approval process
Jefferson County Drainage District	Crossing Permits	Considers issuance of permits for crossing of drainage canals
Lower Neches Valley Authority	Crossing Permits	Considers issuance of permits for crossing of drainage canals

[a] All permits are considered attainable and consistent with existing land use plans based on consultation with the relevant agencies listed in the table.

[b] Permits associated with construction camps are described in Section 2.2.7.4.

[c] The SHPO has the opportunity to review federal agency decisions under Section 106 of the National Historic Preservation Act, but it is not a legal obligation.

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2.0 PROJECT DESCRIPTION

Keystone proposes to construct, operate, maintain, inspect, and monitor a pipeline system that would transport crude oil from its existing facilities in Hardisty, Alberta, Canada to delivery points at Cushing, Oklahoma and in Texas. This section describes Keystone's proposed action and includes the following information:

- Overview of the Proposed Project (Section 2.1);
- Aboveground Facilities (Section 2.2);
- Project Design and Construction Procedures (Section 2.3);
- Operations and Maintenance (Section 2.4);
- Connected Actions (Section 2.5); and
- Future Plans and Decommissioning (Section 2.6).

Information presented in this EIS on the proposed Project was obtained from documents submitted to DOS by Keystone, including the following primary sources:

- Keystone's application for a Presidential Permit;
- Keystone's Environmental Report (ER), attachments to the ER, and related supplemental filings;
- Keystone's General Conformity Determination; and
- Keystone's responses to DOS data requests.

The EIS includes basic graphics depicting key aspects of the proposed Project; more detailed alignment sheets are available at the DOS website for the proposed Project at: http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open. To access the documents, click on "Project Documents" then "Supplemental Filing."

In addition to the proposed Project, this EIS describes and addresses the impacts of four actions that are separate from the proposed Project and are not part of the Presidential Permit application submitted by Keystone. Those actions have been determined to be connected actions for the purposes of this NEPA review as defined by 40 CFR 1508.25(a)(1) and are described in Section 2.5.

2.1 OVERVIEW OF THE PROPOSED PROJECT

The proposed Project would have the initial capacity to deliver up to 700,000 bpd of WCSB crude oil from the proposed Canada-U.S. border crossing to delivery points in Cushing, Oklahoma, in Nederland, Texas (near Port Arthur), and in Moore Junction, Texas (east of Houston). Keystone currently has binding commitments to ship 380,000 bpd of Canadian crude oil. The proposed Project could transport up to 830,000 bpd of crude oil by adding pumping capacity if warranted by future market demand.

At the time of publication of the draft EIS, Keystone had applied to the PHMSA for consideration of a Special Permit request to operate the proposed Project at a slightly higher pressure than would be allowed using the standard design factor in the regulations. That would have resulted in a maximum crude oil throughput of approximately 900,000 bpd. DOS worked with PHMSA to develop Project-specific

Special Conditions that would have been incorporated into the Special Permit. On August 5, 2010, Keystone withdrew its application to PHMSA for a Special Permit. To enhance the overall safety of the proposed Project, DOS and PHMSA continued working on Special Conditions specific to the proposed Project and ultimately established 57 Project-specific Special Conditions. As a result, Keystone agreed to design, construct, operate, maintain, and monitor the proposed Project in accordance with the regulatory requirements in 49 CFR Parts 194 and 195 as well as the more stringent set of 57 Project-specific Special Conditions developed by PHMSA presented in Appendix U. As a result, the maximum throughput of the proposed Project decreased and is currently proposed to be approximately 830,000 bpd. In addition, the maximum operating pressure would be reduced from the requested 1,400 psig to 1,308 psig.

The proposed Project would deliver primarily WCSB crude oil (which would likely be heavy crude oil) based on current market forecasts, to three delivery points in the U.S. that in turn provide access to many other U.S. pipeline systems, terminals, and refineries. The ultimate destinations of the crude oil beyond these delivery points would not be contracted with Keystone and therefore are not considered part of the proposed Project.

The proposed Project includes three new pipeline segments in five states plus additional pumping capacity on the existing Cushing Extension of the Keystone Oil Pipeline Project (See Figures 2.1-1 through 2.1-6). The proposed new pipeline segments are:

- The Steele City Segment (from near Morgan, Montana to Steele City, Nebraska) − the southern end of this segment would connect to the northern end of the existing Cushing Extension near Steele City;
- The Gulf Coast Segment (from Cushing, Oklahoma to Nederland, Texas) − the northern end of this segment would connect to the southern end of the Cushing Extension at the Cushing tank farm; and
- The Houston Lateral (from the Gulf Coast Segment, in Liberty County, Texas to Moore Junction, in Harris County, Texas).

The actual alignment continues to undergo small revisions based on ongoing landowner negotiations and regulatory/resource agency input. The analysis in the EIS is based on the alignment as of March 26, 2010, which used an approximate total pipeline length of 1,384 miles. As of June 10, 2011, these small alignment revisions have increased the total pipeline miles by approximately 3 along the entire alignment. For completeness, Table 2.1-1 has been revised to show the small alignment revisions in mileage by state as of June 10, 2011 as well as the mileage by state as of March 26, 2010. The alignment and resulting mileage will continue to be adjusted as landowner and agency input is addressed prior to proposed Project implementation. Approximately 1,387 linear miles of proposed new pipeline would be located in five states as listed in Table 2.1-1.

TABLE 2.1-1
Miles of New Pipe by State

Segment	State	June 10, 2011 New Pipeline Miles[a]	June 10, 2011 Mileposts (From – To)[b]	March 26, 2010 New Pipeline Miles[a]	March 26, 2010 Mileposts (From – To)[b]
Steele City Segment	Montana	284.2	0-284.2	282.7	0-282.7
	South Dakota	314.8	284.2-599.0	314.2	282.7-596.8
	Nebraska	254.8	599.0-853.8	254.7	596.8-851.6
Steele City Total		**853.8**	-	**851.6**	-

TABLE 2.1-1 Miles of New Pipe by State					
Segment	**State**	**June 10, 2011 New Pipeline Miles[a]**	**June 10, 2011 Mileposts (From – To)[b]**	**March 26, 2010 New Pipeline Miles[a]**	**March 26, 2010 Mileposts (From – To)[b]**
Keystone Cushing Extension	Nebraska	0	N/A	0	N/A
	Kansas	0	N/A	0	N/A
	Oklahoma	0	N/A	0	N/A
Gulf Coast Segment	Oklahoma	155.9	0-155.9	155.7	0-155.7
	Texas	328.4	155.9-484.3	328.1	155.7-483.8
Gulf Coast Total		**484.3**	-	**483.8**	-
Houston Lateral	Texas	48.6	0-48.6	48.6	0-48.6
Project Total		**1,386.7**	-	**1,383.9**	-

[a] Mileages are approximate and subject to change based on final approved design and routing.
[b] Mileposting for each segment of the proposed Project starts at 0.0 at the northernmost point of each segment and increases in the direction of oil flow.

The proposed Project would include 30 new pump stations, mainline valves (MLVs) at the pump stations, 112 MLVs along the proposed pipeline (termed "intermediate" MLVs) based on current information, a tank farm at Cushing, Oklahoma that would be a delivery point, one delivery point with a surge relief system that includes two surge relief tanks at Nederland, and an oil delivery point and a surge relief system without tanks at Moore Junction. These facilities are listed in Table 2.1-2 and are described in more detail in Section 2.2.

Access roads, pipe stockpile sites, railroad sidings, and construction camps would also be required during construction of the proposed Project. Electric power lines and associated facility upgrades would be constructed, as required, by local providers to supply electrical power for the proposed new pump stations and remotely operated valves and densitometers[1] located along the pipeline route. Local power providers would be responsible for obtaining the necessary approvals or authorizations from federal, state, and local governments for such facilities. Although the permitting process for the electrical facilities is an independent process, the construction and operation of these facilities are considered connected actions under NEPA. Therefore, the potential impacts of the facilities were preliminarily evaluated as a part of the NEPA environmental review described in this EIS based on currently available information.

TABLE 2.1-2 Ancillary Facilities by State		
Segment	**State**	**Ancillary Facilities**
Steele City Segment	Montana	6 New Pump Stations
		21 Intermediate Mainline Valves (MLVs)
		50 Access Roads

[1] A densitometer is an on-line and continuous use device used to measure the density of a flowing stream. In the oil and gas industry, a densitometer is normally used to measure the density of liquid hydrocarbon. The measurement of density is used to determine the quantity of crude oil passing through a meter.

TABLE 2.1-2 Ancillary Facilities by State		
Segment	**State**	**Ancillary Facilities**
	South Dakota	7 New Pump Stations 17 Intermediate MLVs 18 Access Roads
	Nebraska	5 New Pump Stations 19 Intermediate MLVs 12 Access Roads
Keystone Cushing Extension	Kansas	2 New Pump Stations 1 Access Road
Gulf Coast Segment	Oklahoma	Cushing Tank Farm 4 New Pump Stations 15 Intermediate MLVs 76 Access Roads
	Texas	6 New Pump Stations 32 Intermediate MLVs 157 Access Roads 1 Delivery Site
Houston Lateral	Texas	8 Intermediate MLVs 1 Delivery Site 31 Access Roads

Additionally, the Western Area Power Administration (Western) has determined that due to load demands at proposed pump stations in South Dakota when the proposed Project is at or near maximum throughput, a new 230-kilovolt (kV) transmission line approximately 70 miles long (the proposed Big Bend to Witten electrical transmission line)[2] would need to be added to the existing electrical grid system to ensure system reliability.

Construction would require a 110-foot wide construction right-of-way (ROW) in most areas, pipe stockpile sites, construction yards, railroad sidings, and construction camps. A 50-foot-wide ROW would be maintained along the proposed route during operation.

Keystone has Project commitments to transport approximately 600,000 bpd of crude oil, including firm contracts to transport 380,000 bpd of WCSB crude oil to existing PADD III delivery points. Keystone also has firm contracts to transport 155,000 bpd of WCSB crude oil to Cushing in its existing Keystone Oil Pipeline Project, which includes the Keystone Mainline and the Keystone Cushing Extension. If the proposed Project is approved and implemented, Keystone would transfer shipment of crude oil under those contracts to the proposed Project. In addition, the proposed Project has firm commitments to transport approximately 65,000 bpd of crude oil, and could ship up to 100,000 bpd of crude oil, delivered to the proposed Project through the planned Keystone Market Link, LLC. Bakken Marketlink Project. The proposed Project may also transport up to 150,000 bpd of crude oil delivered to the proposed Project

[2] In the draft EIS the facility now known as the Big Bend to Witten 230-kV transmission line was named the Lower Brule to Witten 230-kV transmission line.

through the planned Keystone Marketlink, LLC. Cushing Marketlink Project (both projects are considered connected actions as defined by CEQ and are described in Section 2.5).

The proposed Project is planned to be in service in 2013, with the actual date dependant on receipt of all necessary permits, approvals, and authorizations.

As noted in Section 1.1, the proposed Project would primarily deliver WCSB crude oil, which would likely be heavy crude oil based on current market forecasts, to three delivery points in the U.S. that in turn provide access to many other U.S. pipeline systems and terminals. The ultimate destinations of the crude oil beyond these delivery points would not be contracted with Keystone and are not a part of the proposed Project.

2.1.1 Proposed Route Segments

2.1.1.1 Steele City Segment

A total of approximately 852 miles of new pipeline would be constructed for the Steele City Segment. Approximately 30 miles (4 percent) of the alignment would be within approximately 300 feet of currently existing pipelines, utilities, or ROWs. The remaining 822 miles (96 percent) of the route would be new ROW. Eighteen new pump stations would be constructed and operated on land parcels ranging in area from 5 to 15 acres. New electrical distribution lines would be constructed and operated by local power providers to service the pump stations. Those facilities are considered connected actions for the purposes of this EIS and are described in Section 2.5.

A total of approximately 14,875 acres of lands would be affected during construction of the Steele City Segment. Of this acreage, approximately 5,344 acres would be permanent ROW during operation.

2.1.1.2 Cushing Extension (New Pump Stations)

Two new pump stations would be constructed in Kansas along the existing Keystone Cushing Extension. These pump stations would enable the proposed Project to maintain the pressure required to make crude oil deliveries at the desired throughput volumes. The two new pump stations would disturb a total of approximately 15 acres of land during both construction and operation of the proposed Project.

2.1.1.3 Gulf Coast Segment and Houston Lateral

A total of approximately 484 miles of new pipeline would be constructed along the Gulf Coast Segment. Approximately 393 miles (82 percent) would be within approximately 300 feet of existing pipelines, utilities, or road ROWs. The remaining 87 miles (18 percent) of the route would be in new ROWs. The Houston Lateral would be approximately 49 miles long, 20 miles (41 percent) of which would be within approximately 300 feet of existing pipelines, utilities, or road ROWs. The remaining 29 miles (59 percent) would be in a new ROW. Approximately 8,542 acres of land would be affected during construction of the Gulf Coast and Houston Lateral segments combined. Of this, 3,121 acres would be permanent ROW during Project operation.

Keystone would also construct a tank farm on an approximately 74-acre site at Cushing (see Section 2.2.6). Ten new pump stations would be constructed and operated on the Gulf Coast Segment. Nine of the pump stations would be on land parcels ranging in area from 5 to 15 acres. Pump station 32 would be constructed within the boundaries of the tank farm. Keystone would also install two delivery facilities, one at Nederland and one at Moore Junction, Texas. At Nederland, the proposed Project would include construction and operation of two surge relief tanks (a primary tank and a backup tank). Each tank would

have a capacity of approximately 10,417 barrels (435,514 gallons) with two carbon adsorption beds each, in series. One tank would be on line at all times and the second would be on standby to be able to direct crude oil in the proposed pipeline into one of the tanks to relieve pressure on the system during surge events. Although the actual number of surge relief events that could occur during proposed Project operations is not known, it was assumed that there would be an average of one surge relief event per month for a total of 12 surge relief events per year (see Section 2.12 for additional information on the surge relief system).

2.1.2 Land and Borrow Material Requirements

2.1.2.1 Land Requirements

Construction of the proposed Project would require a 110-foot-wide construction ROW. In certain sensitive areas, which may include wetlands, cultural sites, shelterbelts, residential areas, or commercial/industrial areas, the construction ROW would be reduced to 85 feet except in South Dakota where it would be reduced to a 75-foot width unless the USACE requires an 85-foot width.

Figure 2.1.2-1 illustrates typical construction areas along the ROW where the route would not parallel an existing pipeline corridor or another linear facility. Figures 2.1.2-2 and 2.1.2-3 illustrate typical construction areas where the pipeline would parallel an existing linear feature.

Approximately 24,134 acres of land would be disturbed during construction. The areas of surface disturbance due to construction and operation of the proposed Project are listed in Table 2.1.2-1.

After construction, the temporary ROW (15,341 acres) would be restored consistent with applicable federal and state regulations and permits, the easement agreements negotiated between Keystone and individual landowners or land managers, and the construction methods and environmental protection procedures described in the Keystone Construction, Mitigation, and Reclamation (CMR) plan (presented in Appendix B and described in Section 2.3). Those measures would be incorporated into the proposed Project to reduce the potential impacts of construction.

The permanent ROW would have an area of approximately 8,793 acres; of that total, 292 acres would be the area of pump stations, valves, and other aboveground facilities. The permanent ROW would also be restored as described above and to allow access to the ROW for the life of the proposed Project to support surface and aerial inspections and any repairs or maintenance as necessary.

TABLE 2.1.2-1
Summary of Lands Affected

		Area Affected (Acres)[a]	
Segment/State	**Facility**	**Construction[b]**	**Operation[c]**
Steele City Segment			
Montana	Pipeline ROW	3,758.6	1,713.2
	Additional Temporary Workspace Areas	327.8	0.0
	Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	460.7	0.0
	Construction Camps	182.5	0.0
	Pump Stations and Delivery Facilities	50.1	50.1
	Access Roads[d]	266.5	21.7
Montana Subtotal		**5,046.3**	**1,785.0**

TABLE 2.1.2-1 Summary of Lands Affected			
		Area Affected (Acres)[a]	
Segment/State	**Facility**	**Construction[b]**	**Operation[c]**
South Dakota	Pipeline ROW	4,178.9	1,904.0
	Additional Temporary Workspace Areas	309.3	0.0
	Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	581.2	0.0
	Construction Camps	160.2	0.0
	Pump Stations/Delivery Facilities	59.4	59.4
	Access Roads[d]	144.8	9.1
South Dakota Subtotal		**5,433.7**	**1,972.5**
Nebraska	Pipeline ROW	3,384.8	1,543.8
	Additional Temporary Workspace Areas	349.5	0.0
	Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	515.6	0.0
	Pump Stations and Delivery Facilities	42.2	42.2
	Access Roads[d]	53.3	0.0
Nebraska Subtotal		**4,345.3**	**1,586.1**
Steele City Subtotal		**14,875.3**	**5,343.5**
Keystone Cushing Extension			
Kansas	Pipeline ROW	0.0	0.0
	Additional Temporary Workspace Areas	0.0	0.0
	Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	0.0	0.0
	Pump Stations and Delivery Facilities	15.2	15.2
	Access Roads[d]	0.0	0.0
Kansas Subtotal		**15.2**	**15.2**
Keystone Cushing Extension Subtotal		**15.2**	**15.2**
Gulf Coast Segment			
Oklahoma	Pipeline ROW	2,033.5	943.8
	Additional Temporary Workspace Areas	179.1	0.0
	Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	701.3	0.0
	Tank Farm, Pump Stations, and Delivery Facilities	74.1	74.1
	Access Roads[d]	118.6	15.1
Oklahoma Subtotal		**3,106.6**	**1,033.1**
Texas	Pipeline ROW	4,198.8.	1,988.9
	Additional Temporary Workspace Areas	332.6	0.0
	Pipe Stockpile Sites, Rail Sidings, and Contractor Yards	519.6	0.0
	Pump Stations and /Delivery Facilities[e]	51.1	51.1
	Access Roads	333.6	48.1
Texas Subtotal		**5,435.8**	**2,088.1**
Gulf Coast Subtotal		**8,542.4**	**3,121.1**

TABLE 2.1.2-1 Summary of Lands Affected			
		Area Affected (Acres)[a]	
Segment/State	**Facility**	**Construction[b]**	**Operation[c]**
Houston Lateral	Pipeline ROW	652	294
	Additional Temporary Workspace Areas	32	0
	Pipe Storage Sites, Rail Sidings, and Contractor Yards	5	0
	Access Roads[d]	62	19
Houston Lateral Subtotal		751	313
Project Total		**24,133.9**	**8,792.8**

[a] Areas listed do not include the electrical distribution lines required for the pump stations. Information on the electrical distribution lines is presented in Section 2.5.

[b] Area calculated based on a 110-foot-wide construction ROW except in certain wetlands, cultural sites, shelterbelts, residential areas, and commercial/industrial areas where an 85-foot-wide construction ROW would be used, or in areas requiring extra width for workspace necessitated by site conditions.

[c] Area calculated based on a 50-foot-wide permanent ROW. All pigging facilities would be located within either pump stations or delivery facility sites. Intermediate MLVs and densitometers would be within the permanent ROW.

[d] Access road area calculated based on 30-foot width.

[e] Keystone would install two 10,417-barrel surge tanks at the terminus of the Gulf Coast Segment on previously disturbed land.

2.1.2.2 Borrow Material Requirements

Borrow material would be required for temporary sites (such as storage sites, contractor yards, temporary access roads, and access pads at ROW road crossings), to stabilize the land for permanent facilities (including pump stations, valve sites, and permanent access roads), and for padding the bottom of the pipeline trench in some areas. All gravel and other borrow material would be obtained from existing, previously permitted commercial sources located as close to the pipe or contractor yards as possible.

Generally, about 7,000 cubic yards of gravel would be required for each pipe storage site and about 4,600 cubic yards of gravel would be required for each contractor yard. The approximately 400 temporary access roads would be graveled, as would access pads at ROW crossings of public and private roads. Approximately 1,590 such road crossings are proposed. The 50 permanent access roads would also be graveled. About 6 inches of gravel would typically be used at pump stations and MLV sites. Along portions of the route, the trench bottom would be filled with padding material such as sand or gravel, to protect the pipeline coating.

Table 2.1.2-2 lists the approximate amount of borrow material that would be required in each state, and Table 2.1.2-3 lists the borrow material required for each facility type. Keystone would conduct detailed surveys of pipe storage sites, railroad sidings, and contractor yards prior to construction to determine the exact amounts of borrow material that would be required for each site.

TABLE 2.1.2-2 Borrow Material Requirements by State	
State	**Cubic Yards of Material**
Montana	152,531
South Dakota	142,122
Nebraska	108,935
Kansas[a]	12,000
Oklahoma	144,402
Texas[b]	298,412
Total	**858,402**

[a] Borrow material required for the two proposed pump stations on the Keystone Cushing Extension.
[b] Includes a portion of the Gulf Coast Segment and the Houston Lateral.

TABLE 2.1.2-3 Borrow Material Requirements by Facility Type	
Facility Type	**Cubic Yards of Material**
Pipe Storage Site	108,000
Contractor Yard	134,400
Temporary Access Roads	28,579
Access Pads for Road Crossings	37,860
Pump Stations	180,000
Valve Sites	2,812
Permanent Access Roads	242,970
Trench Bottom Padding[a]	85,000
Cushing Tank Farm	38,781
Total	**858,402**

[a] Gravel may be replaced with sand or soil.

2.2 ABOVEGROUND FACILITIES

The proposed Project would require approximately 292 acres of land for aboveground facilities, including pump stations, delivery facilities, densitometer sites, intermediate MLVs, and the tank farm. During operations, Keystone would use standard agricultural herbicides to control the growth of vegetative species on all aboveground sites.

2.2.1 Pump Stations

A total of 30 new pump stations, each situated on an approximately 5- to15-acre site, would be constructed; 18 would be in the Steele City Segment, 10 in the Gulf Coast Segment, and 2 along the existing Keystone Cushing Extension in Kansas. Keystone has proposed the pump station locations based on hydraulics analyses of the flow in the pipeline and other relevant variables. Figures 1.1-1 and 2.1-1 through 2.1-6 show the proposed locations of the pump stations. Table 2.2.1-1 lists the locations of the pump stations by milepost.

Each new pump station would consist of up to six pumps driven by electric motors, an electrical equipment shelter, a variable frequency drive equipment shelter, an electrical substation, 1 sump tank, 2 MLVs, a communication tower, a small maintenance and office building, and a parking area for station maintenance personnel. The electrical shelter would house the electrical systems and the communication and control equipment.

TABLE 2.2.1-1
Proposed Project Pump Station Locations

Segment/State	Approximate Milepost	Segment/State	Approximate Milepost
Steele City Segment		**Cushing Extension**	
Montana		**Kansas**	
Pump Station 09	1.2	Pump Station 27	49.0
Pump Station 10	49.5	Pump Station 29	144.5
Pump Station 11	98.4	**Gulf Coast Segment**	
Pump Station 12	149.1	**Oklahoma**	
Pump Station 13	199.6	Pump Station 32	0.0
Pump Station 14	237.1	Pump Station 33	49.0
South Dakota		Pump Station 34	95.4
Pump Station 15	285.7	Pump Station 35	147.4
Pump Station 16	333.7	**Texas**	
Pump Station 17	387.4	Pump Station 40	380.5
Pump Station 18	440.2	Pump Station 41	435.2
Pump Station 19	496.1		
Pump Station 20	546.7		
Pump Station 21	591.9		
Nebraska			
Pump Station 22	642.4		
Pump Station 23	694.5		
Pump Station 24	751.7		
Pump Station 25	800.5		
Pump Station 26	851.3		

The pipe entering and exiting the pump station sites would be below grade. There would be an MLV installed on the entry pipe and on the exit pipe as required by 49 CFR 195.260 to allow isolation of the pump station equipment in the event of an emergency. The manifold connecting the pipeline to the equipment at each pump station would be aboveground and entirely within the pump station boundaries.

Down-lighting would be used at the pump stations wherever possible to minimize impacts to wildlife and would install a security fence around the entire pump station site. Inspection and maintenance personnel would access the pump stations through a gate that would be locked when no one is at the pump station.

The pump stations would operate on locally purchased electric power and would be fully automated for unmanned operation. If there is an electrical power outage, batteries would be used to maintain power to all communication and specific control equipment. Backup generators would not be installed at the pump

stations and therefore there would not be fuel storage tanks at the pump stations. Communication towers at pump stations generally would be approximately 33 feet high, but the antenna height at some pump stations may be greater based on final detailed engineering studies. In no event would antennae exceed a maximum height of 190 feet.

2.2.2 Mainline Valves

Keystone would install 112 intermediate MLVs along the proposed route and one MLV at each pump station. The intermediate MLVs would be installed within the permanent ROW. The intermediate MLVs would comprise:

- 17 manual mainline block valves;
- 24 check valves; and
- 71 remotely operated mainline block valves.

Block valves can block oil flow in both direction and divide up the pipeline into smaller segments that can be isolated to minimize and contain the effects of a line rupture. The block valves can be either manually or remotely operated. Check valves are designed to be held open by flowing oil and to close automatically when oil flow stops or is reversed. Each MLV would be within a fenced site that would be approximately 40 feet by 50 feet. Inspection and maintenance personnel would access the MLVs through a gate that would be locked when no one is at the MLV site.

EPA suggested considering the placement of additional intermediate mainline valves, particularly in areas of shallow groundwater and at river crossings of less than 100 feet where sensitive aquatic resources may exist. Remotely operated intermediate MLVs would be located at major river crossings, upstream of sensitive waterbodies, and at other locations required by 49 CFR 195.260 and as required by Special Condition 32 imposed by PHMSA and agreed to by Keystone (see Section 2.3.1 and Appendix U). Project-specific Special Condition 32 developed in consultation with PHMSA that Keystone agreed to incorporate into the proposed Project plan states:

> "Keystone must design and install mainline block valves and check valves on the Keystone XL system based on the worst case discharge as calculated by 49 CFR § 194.105. Keystone shall locate valves in accordance with 49 CFR § 195.260 and by taking into consideration elevation, population, and environmentally sensitive locations, to minimize the consequences of a release from the pipeline. Mainline valves must be placed based on the analysis above or no more than twenty (20) miles apart, whichever is smaller."

The requirement to take into consideration elevation, population, and environmentally sensitive locations to minimize consequences of a release, and the maximum valve spacing of 20 miles exceed what is currently required in 49 CFR § 195.260. Based on Special Condition 32, the proposed Project was redesigned to increase the number of intermediate mainline valves from 76 to 104 and some previously planned valve locations were moved. As per standard code requirements, there would also be two valves at each of the 30 pump stations.

Keystone would be able to operate the valves remotely to shut isolate a section of pipeline in the event of an emergency to minimize environmental impacts if an accidental release occurs. Mainline valves must be capable of closure at all times. Special Condition 32 also requires that the remotely operated valves must have remote power back-up to ensure communications are maintained during inclement weather. Each motor-operated valve station would include a diesel-fired emergency generator and a diesel fuel tank with secondary containment. Table 2.2.2-1 lists the locations of intermediate MLVs.

TABLE 2.2.2-1 Intermediate Mainline Valve Locations			
Valve Tag	**Type**	**Milepost**	**Segment[a]**
260-PHLPS-01A-B0-MLV-01	Motor Operated Valve	20.3	Steele City Segment
260-PHLPS-02A-B0-CKV-01	Check Valve	28.1	Steele City Segment
260-PHLPS-02A-B0-MLV-01	Manual Operated Valve	28.1	Steele City Segment
260-PHLPS-03A-B0-MLV-01	Motor Operated Valve	40.3	Steele City Segment
260-VLLEY-01A-B0-MLV-01	Motor Operated Valve	63.6	Steele City Segment
260-VLLEY-02A-B0-CKV-01	Check Valve	71.8	Steele City Segment
260-VLLEY-02A-B0-MLV-01	Manual Operated Valve	71.8	Steele City Segment
260-VLLEY-03A-B0-MLV-01	Motor Operated Valve	81.3	Steele City Segment
260-VLLEY-04A-B0-CKV-01	Check Valve	83.9	Steele City Segment
260-VLLEY-04A-B0-MLV-01	Manual Operated Valve	83.9	Steele City Segment
260-VLLEY-05A-B0-CKV-01	Check Valve	91.1	Steele City Segment
260-VLLEY-05A-B0-MLV-01	Manual Operated Valve	91.1	Steele City Segment
260-FTPCK-01A-B0-MLV-01	Motor Operated Valve	117.7	Steele City Segment
260-FTPCK-02A-B0-MLV-01	Motor Operated Valve	134.3	Steele City Segment
260-CRCLE-01B-B0-MLV-01	Motor Operated Valve	170.9	Steele City Segment
260-CRCLE-01A-B0-MLV-01	Motor Operated Valve	178.9	Steele City Segment
260-CRCLE-02A-B0-MLV-01	Motor Operated Valve	195.5	Steele City Segment
154-PRAIR-B0-CKV-0102	Check Valve	202.1	Steele City Segment
260-PRAIR-01A-B0-MLV-01	Motor Operated Valve	220.5	Steele City Segment
260-FALLN-01A-B0-MLV-01	Motor Operated Valve	245.9	Steele City Segment
260-FALLN-02A-B0-MLV-01	Motor Operated Valve	266.4	Steele City Segment
206-LKTLR-B0-CKV-0102	Check Valve	284.5	Steele City Segment
260-HRDNG-02A-B0-CKV-01	Check Valve	300.2	Steele City Segment
260-HRDNG-02A-B0-MLV-01	Motor Operated Valve	300.2	Steele City Segment
260-HRDNG-03A-B0-MLV-01	Motor Operated Valve	318.2	Steele City Segment
260-BFLPS-01B-B0-MLV-01	Motor Operated Valve	352.3	Steele City Segment
260-BFLPS-01A-B0-MLV-01	Motor Operated Valve	372.2	Steele City Segment
260-FAITH-01B-B0-MLV-01	Motor Operated Valve	407.3	Steele City Segment
260-FAITH-01A-B0-MLV-01	Motor Operated Valve	422.8	Steele City Segment
260-FAITH-02A-B0-CKV-01	Check Valve	434.1	Steele City Segment
260-FAITH-02A-B0-MLV-01	Manual Operated Valve	434.1	Steele City Segment
260-FAITH-03A-B0-MLV-01	Motor Operated Valve	460.1	Steele City Segment
260-HAKON-01A-B0-MLV-01	Motor Operated Valve	478.3	Steele City Segment
260-MURDO-01A-B0-MLV-01	Motor Operated Valve	515.7	Steele City Segment
260-MURDO-02A-B0-MLV-01	Motor Operated Valve	532.1	Steele City Segment
260-WINNR-01A-B0-MLV-01	Motor Operated Valve	566.5	Steele City Segment
260-WINNR-02A-B0-MLV-01	Motor Operated Valve	585.1	Steele City Segment
260-COLOM-01A-B0-MLV-01	Motor Operated Valve	599.0	Steele City Segment
260-COLOM-02A-B0-CKV-01	Check Valve	602.9	Steele City Segment
260-COLOM-02A-B0-MLV-01	Manual Operated Valve	602.9	Steele City Segment
260-COLOM-03A-B0-MLV-01	Motor Operated Valve	617.3	Steele City Segment

TABLE 2.2.2-1 Intermediate Mainline Valve Locations			
Valve Tag	**Type**	**Milepost**	**Segment[a]**
260-COLOM-04A-B0-CKV-01	Check Valve	619.7	Steele City Segment
260-COLOM-04A-B0-MLV-01	Manual Operated Valve	619.7	Steele City Segment
260-COLOM-05A-B0-MLV-01	Motor Operated Valve	637.1	Steele City Segment
260-ATKNS-01A-B0-MLV-01	Motor Operated Valve	663.5	Steele City Segment
260-ATKNS-01B-B0-MLV-01	Motor Operated Valve	681.6	Steele City Segment
260-ATKNS-02A-B0-MLV-01	Motor Operated Valve	714.5	Steele City Segment
260-ERCSN-01A-B0-MLV-01	Motor Operated Valve	735.1	Steele City Segment
260-ERCSN-02A-B0-CKV-01	Check Valve	749.5	Steele City Segment
260-ERCSN-02A-B0-MLV-01	Manual Operated Valve	749.5	Steele City Segment
260-CLCTY-01A-B0-CKV-01	Check Valve	767.1	Steele City Segment
260-CLCTY-01A-B0-MLV-01	Motor Operated Valve	767.1	Steele City Segment
260-CLCTY-02A-B0-MLV-01	Motor Operated Valve	774.3	Steele City Segment
260-CLCTY-03A-B0-CKV-01	Check Valve	792.6	Steele City Segment
260-CLCTY-03A-B0-MLV-01	Motor Operated Valve	792.6	Steele City Segment
260-EXETR-01A-B0-MLV-01	Motor Operated Valve	823.1	Steele City Segment
260-EXETR-02A-B0-MLV-01	Motor Operated Valve	839.9	Steele City Segment
290-CSHSP-01A-B0-MLV-01	Motor Operated Valve	17.8	Gulf Coast Segment
290-CSHSP-02A-B0-CKV-01	Check Valve	24.2	Gulf Coast Segment
290-CSHSP-02A-B0-MLV-01	Manual Operated Valve	24.2	Gulf Coast Segment
290-CSHSP-03A-B0-MLV-01	Motor Operated Valve	37.8	Gulf Coast Segment
290-CSHSP-04A-B0-CKV-01	Check Valve	40.6	Gulf Coast Segment
290-CSHSP-04A-B0-MLV-01	Manual Operated Valve	40.6	Gulf Coast Segment
290-CRMWL-01A-B0-MLV-01	Motor Operated Valve	66.7	Gulf Coast Segment
290-CRMWL-02A-B0-MLV-01	Motor Operated Valve	73.5	Gulf Coast Segment
290-CRMWL-03A-B0-MLV-01	Motor Operated Valve	77.5	Gulf Coast Segment
290-CRMWL-03A-B0-CKV-01	Check Valve	77.5	Gulf Coast Segment
290-TPELO-01A-B0-MLV-01	Motor Operated Valve	106.4	Gulf Coast Segment
290-TPELO-02A-B0-MLV-01	Motor Operated Valve	125.5	Gulf Coast Segment
290-TPELO-03A-B0-CKV-01	Check Valve	128.9	Gulf Coast Segment
290-TPELO-03A-B0-MLV-01	Motor Operated Valve	128.9	Gulf Coast Segment
290-BRYAN-01A-B0-MLV-01	Motor Operated Valve	151.0	Gulf Coast Segment
290-BRYAN-02A-B0-MLV-01	Manual Operated Valve	162.6	Gulf Coast Segment
290-BRYAN-02A-B0-CKV-01	Check Valve	162.6	Gulf Coast Segment
290-BRYAN-02B-B0-MLV-01	Motor Operated Valve	170.0	Gulf Coast Segment
290-BRYAN-03A-B0-MLV-01	Motor Operated Valve	188.9	Gulf Coast Segment
290-BRYAN-04A-B0-MLV-01	Manual Operated Valve	192.4	Gulf Coast Segment
290-BRYAN-04A-B0-CKV-01	Check Valve	192.4	Gulf Coast Segment
290-DELTA-01A-B0-MLV-01	Motor Operated Valve	200.6	Gulf Coast Segment
290-DELTA-02A-B0-MLV-01	Manual Operated Valve	203.1	Gulf Coast Segment
290-DELTA-02A-B0-CKV-01	Check Valve	203.1	Gulf Coast Segment
290-DELTA-03A-B0-MLV-01	Motor Operated Valve	220.3	Gulf Coast Segment

TABLE 2.2.2-1 Intermediate Mainline Valve Locations			
Valve Tag	**Type**	**Milepost**	**Segment[a]**
290-DELTA-04A-B0-MLV-01	Motor Operated Valve	233.6	Gulf Coast Segment
290-WNSBR-01B-B0-MLV-01	Motor Operated Valve	252.5	Gulf Coast Segment
290-WNSBR-01A-B0-MLV-01	Motor Operated Valve	262.4	Gulf Coast Segment
290-WNSBR-02A-B0-MLV-01	Manual Operated Valve	267.7	Gulf Coast Segment
290-WNSBR-02A-B0-CKV-01	Check Valve	267.7	Gulf Coast Segment
290-WNSBR-03A-B0-MLV-01	Motor Operated Valve	277.7	Gulf Coast Segment
290-LKTLR-01A-B0-MLV-01	Motor Operated Valve	299.8	Gulf Coast Segment
290-LKTLR-02A-B0-MLV-01	Motor Operated Valve	315.2	Gulf Coast Segment
290-LKTLR-03A-B0-MLV-01	Motor Operated Valve	330.5	Gulf Coast Segment
290-LUFKN-01B-B0-MLV-01	Motor Operated Valve	349.8	Gulf Coast Segment
290-LUFKN-01A-B0-MLV-01	Motor Operated Valve	365.9	Gulf Coast Segment
290-LUFKN-02A-B0-MLV-01	Manual Operated Valve	371.6	Gulf Coast Segment
290-LUFKN-02A-B0-CKV-01	Check Valve	371.6	Gulf Coast Segment
290-CORGN-01B-B0-MLV-01	Motor Operated Valve	400.7	Gulf Coast Segment
290-CORGN-01A-B0-MLV-01	Motor Operated Valve	408.7	Gulf Coast Segment
290-CORGN-02A-B0-MLV-01	Motor Operated Valve	420.4	Gulf Coast Segment
290-CORGN-03A-B0-MLV-01	Motor Operated Valve	430.2	Gulf Coast Segment
290-LIBRT-01A-BO-MLV-01	Motor Operated Valve	448.8	Gulf Coast Segment
290-LIBRT-02A-B0-MLV-01	Motor Operated Valve	454.8	Gulf Coast Segment
290-LIBRT-03A-B0-MLV-01	Motor Operated Valve	462.5	Gulf Coast Segment
290-LIBRT-04A-B0-MLV-01	Motor Operated Valve	470.4	Gulf Coast Segment
290-LIBRT-05A-B0-MLV-01	Motor Operated Valve	478.1	Gulf Coast Segment

[a] The Houston Lateral will have 8 valves that meet the 20-mile spacing requirement stipulated in Special Condition 32 and all the other design criteria (4 motor-operated valves upstream of Trinity and Sabine Rivers; 2 manually operated valves and 2 check valves downstream of Trinity and Sabine Rivers). As of this writing, exact milepost locations are being updated.

These proposed valve locations have been reviewed during the environmental analysis. Given public and agency concerns over sensitive environmental resources, DOS in consultation with PHMSA and EPA determined that Keystone should commission an engineering analysis by an independent consultant that would review the proposed Project risk assessment and proposed valve placement. The engineering analysis would, at a minimum, assess the advisability of additional valves and/or the deployment of external leak detection systems in areas of particularly sensitive environmental resources. The scope of the analysis and the selection of the independent consultant would be approved by DOS with concurrence from PHMSA and EPA. After completion and review of the engineering analysis, DOS with concurrence from PHMSA and EPA would determine the need for any additional mitigation measures.

2.2.3 Pigging Facilities

Keystone would use high-resolution internal line inspection, maintenance, and cleaning tools known as "pigs" during operation of the proposed Project. The proposed Project would be designed to allow full pigging of the entire pipeline, with minimal interruption of service. Pig launchers and receivers would be constructed and operated completely within the boundaries of the pump stations (see Figures 2.2.3-1 and 2.2.3-2) or delivery facilities.

2.2.4 Densitometer Facilities

Densitometer facilities on the pipeline would be equipped with densitometer/viscometer analyzers which measure the density of the product prior to delivery. Densitometer information would be incorporated into quality and custody metering located at all injection points and at all delivery points.

Keystone proposes to install and operate four densitometers within the permanent ROW. One of the densitometers would be on the Steele City Segment, two would be on the Gulf Coast Segment, and one would be on the Houston Lateral. The locations of the densitometers are listed below:

- Upstream side of Pump Station 26 (Saline County, Nebraska; MP SCS-820.8);
- Upstream side of Pump Station 41 (Liberty County, Texas; MP GCS-429.9);
- Upstream side of the Nederland delivery station (Jefferson County Texas; MP GCS-477.8); and
- Upstream side of the delivery station near Moore Junction (Harris County Texas; MP HL-42.6).

2.2.5 Delivery Sites

Keystone would install two crude oil delivery facilities in Texas. One would be at the end of the Gulf Coast Segment in Nederland within a terminal owned and operated by Sunoco Logistics. The second would be installed at the end of the Houston Lateral at Moore Junction on a previously disturbed site. Each delivery facility would have a pig receiver on the incoming pipeline and would connect to a surge relief system and a metering system installed upstream of a manifold owned by the third party receiving crude oil transported by the proposed Project. The surge relief system at the Nederland delivery site would include two surge relief tanks, each with a capacity of approximately 10,417 barrels (435,514 gallons) (see Section 2.1.1.3). The delivery facilities would also include pressure regulating equipment, flow control valves, isolation valves, and a quality measurement building that would include a densitometer and a sampling system. Each delivery facility would also include a sump tank with injection pumps to receive oil from the drains of safety valves and traps. The drain system piping would connect to the main line to return captured oil to the pipeline.

The delivery facilities would operate on locally provided power.

2.2.6 Cushing Tank Farm

Keystone originally proposed to construct a tank farm in Steele City, Nebraska to manage the movement of oil through the system. However, after completing a detailed operational review of the proposed Project, Keystone determined that there would be greater operational efficiency if the tank farm were installed near Cushing, adjacent to the existing Cushing Oil Terminal, which is the largest crude oil storage facility in the U.S. and has a substantial network of connecting crude oil pipelines.

Keystone proposes to construct a tank farm on an approximately 74-acre site that is approximately 2,000 feet from the southern end of the existing Cushing Oil Terminal. The site would also include Pump Station 32. The plot plan for the Cushing tank farm is presented on Figure 2.2.6-1. As indicated on that figure, there is sufficient room on the site to house the facilities proposed for the Bakken and Cushing Marketlink projects, which are two connected actions described in Sections 2.5.3 and 2.5.4.

The Cushing tank farm would include three, 350,000-barrel aboveground storage tanks. Each tank would have a single-deck pontoon external floating roof with provisions for installation of geodesic fixed roofs. The tanks would be installed inside an impervious bermed area that would act as secondary containment. The piping in the tank farm site would be both above and below ground. The tank farm would also

include four booster pumps, two sump tanks, two positive displacement meters, pig launchers and receivers, two electrical buildings, a field service building, and parking for maintenance personnel. The tanks and associated piping would be isolated electrically from the pipeline and protected by a separate cathodic protection system. The tank farm would operate on locally purchased electricity and would be fully automated for unmanned operation.

Down-lighting would be used to light the tank farm wherever possible to minimize impacts to wildlife. A security fence would be installed around the entire tank farm. Inspection and maintenance personnel would access the tank farm through a gate that would be locked when no one is at the tank farm.

In addition to the design requirements for the pipe for the proposed Project, procedures, specifications, applicable codes and standards promulgated by the organizations listed below would be used for the design of the Cushing tank farm facility:

- Oklahoma Corporation commission – adopts DOT part 195 as outlined in Oklahoma Administrative Code 165 Chapter 20, Gas and Hazardous Liquid Pipeline
- American Petroleum Institute – API
- American Society of Testing and Materials – ASTM
- American Welding Society – AWS
- Institute of Electrical and Electronics Engineers – IEEE
- Instrument Society of America – ISA
- International Organization for Standardization – ISO
- Manufacturers Standardization Society of the Valve and fittings industry – MSS
- National Electrical Safety Code – NEC
- National Electrical Manufacturers Association – NEMA
- National Fire Protection Association – NFPA
- Occupational Safety and Health Administration – OSHA
- Pipeline and Hazardous Material Safety Administration – PHMSA
- Steel Structure Painting Council – SSPC
- Underwriters Laboratories – UL

2.2.7 Ancillary Facilities

2.2.7.1 Additional Temporary Workspace Areas

Additional temporary workspace areas would be needed for some construction staging areas and where special construction techniques are to be used. These areas would include river, wetland, and road/rail crossings; horizontal directional drilling (HDD) entry and exit points; steep slopes (20 to 60 percent); and rocky soils. The setback distances of temporary workspace areas adjacent to wetland and waterbody features would be established on a site-specific basis, consistent with applicable permit requirements and the appropriate procedures listed in the CMR Plan (Appendix B). The location of additional temporary workspace areas would be adjusted as design of the proposed Project is refined.

The dimensions and acreages of typical additional temporary workspace areas are listed in Table 2.2.7-1.

TABLE 2.2.7-1 Dimensions and Acreage of Typical Additional Temporary Workspace Areas		
Crossing Type	**Dimensions (length by width in feet at each side of feature crossed)**	**Acreage**
Waterbodies crossed using HDD	250 x 150, as well as the length of the drill plus 150 x 150 on exit side	1.4
Waterbodies ≥ 50 feet wide	300 x 100	0.7
Waterbodies < 50 feet wide	150 x 25 on working and spoil sides or 150 x 50 on working side only	0.2
Bored highways and railroads	175 x 25 on working and spoil sides or 175 x 50 on working side only	0.2
Open-cut or bored county or private roads	125 x 25 on working and spoil sides or 125 x 50 on working side only	0.1
Foreign pipeline/utility/other buried feature crossings	125 x 50	0.1
Push-pull wetland crossings	50 feet x length of wetland	Varies
Construction spread mobilization and demobilization	470 x 470	5.1
Stringing truck turnaround areas	200 x 80	0.4

2.2.7.2 Pipe Storage Sites, Railroad Sidings, and Contractor Yards

Construction would require establishment and use of pipe storage sites, railroad sidings, and contractor yards. Pipe storage sites would be required at 30- to 80-mile intervals and contractor yards would be required at approximately 60-mile intervals. Keystone estimated that 40 pipe storage yards and 19 contractor yards would be required for the proposed Project. Table 2.2.7-2 provides the locations and acreages of potential pipe storage yards and contractor yards.

TABLE 2.2.7-2 Locations and Acreages of Proposed Pipe Storage Sites, Railroad Sidings, and Contractor Yards			
State	**Types and Numbers of Yards**	**Counties**	**Combined Acreage**
Montana	Contractor Yards (3)	Valley, McCone, Dawson	90.6
	Railroad Siding (5)	Valley, Fallon, Roosevelt, Dawson (2)	100.0
	Pipe Stockpile Sites (9)	Phillips, Valley (2), McCone (2), Dawson (2), Fallon (2)	270.1
South Dakota	Contractor Yards (5)	Harding, Meade, Haakon, Jones, Tripp	150.2
	Railroad Siding (5)	Butte, Pennington (2), Stanley, Hutchinson	100.0
	Pipe Stockpile Sites (11)	Harding (3), Meade (2), Haakon (2), Jones (2), Tripp (2)	331.0
Nebraska	Contractor Yards (7)	Holt (2), Greeley, Merrick, York, Gage, Jefferson	213.3
	Railroad Siding (3)	Merrick, York, Jefferson	60.0
	Pipe Stockpile Sites (8)	Keya Paha, Holt (2), Greeley, Nance, Hamilton, Fillmore, Jefferson	242.3
Kansas	Contractor Yards	None	0
	Pipe Stockpile Sites	None	0

TABLE 2.2.7-2 Locations and Acreages of Proposed Pipe Storage Sites, Railroad Sidings, and Contractor Yards			
State	**Types and Numbers of Yards**	**Counties**	**Combined Acreage**
Oklahoma	Contractor Yards (3)	Hughes, Lincoln, Bryan	65.2
	Railroad Siding (1)	Pittsburg	9.2
	Pipe Stockpile Sites (3)	Bryan, Lincoln, Hughes	258.1
	Pipe Stockpile Sites/Railroad Siding (4)	Pottawatomie, Grady (2), Hughes	378.0
Texas	Contractor Yards (8)	Angelina, Nacogdoches, Cherokee, Liberty, Houston, Lamar, Titus, Rusk	141.4
	Railroad Siding (5)	Titus, Angelina, Franklin, Hardin, Lamar	27.6
	Pipe Stockpile Sites (5)	Orange, Jefferson, Polk (2), Lamar	237.5
	Pipe Stockpile Sites/Railroad Siding (2)	Grayson/Fannin, Franklin/Titus	91.1
	Pipe Stockpile Sites/Contractor Yards (2)	Angelina, Lamar	21.9

Each pipe storage site would occupy approximately 30 to 40 acres and would typically be located close to railroad sidings. Contractor yards would occupy approximately 30 acres. Keystone would select existing commercial/industrial sites or sites that were used for construction of other projects as preferred sites for the storage sites.

Existing public or private roads would be used to access the yards. Pipe storage sites and contractor yards would be used on a temporary basis and would be reclaimed, as appropriate, upon completion of construction.

2.2.7.3 Fuel Transfer Stations

Fuel storage sites would be established at approved contractor yards and pipe storage sites. No other fuel stations would be constructed. Fuel would be transported daily by fuel trucks from the yards to the construction area for equipment fueling.

Each fuel storage system would consist of the following:

- Temporary, aboveground 10,000- to 20,000-gallon skid-mounted tanks and/or 9,500-gallon fuel trailers;
- Rigid steel piping;
- Valves and fittings;
- Dispensing pumps; and
- Secondary containment structures.

The fuel storage system would have a secondary containment structure capable of holding 110 percent of the volume of the fuel storage tanks or fuel trailers. Containment structures would consist of sandbags or earthen berms with a chemically resistant membrane liner. Typical diesel and gasoline fuel storage systems are depicted on Figures 2.2.7-1 and 2.2.7-2.

The total fuel storage capacity would vary from yard to yard, depending on daily fuel requirements. Typically, a 2- to 3-day supply of fuel would be maintained in storage, resulting in a maximum volume of approximately 30,000 gallons of fuel at each storage location.

Prior to the receiving or off-loading of fuel, the trucks and equipment would be grounded to eliminate static electricity potential. The distributor would connect a petroleum-rated hose from the delivery tanker to the fill line at the storage facility. The fill truck connection and fill line would consist of a cam-loc connection followed by a block valve, rigid steel piping, tank block valve(s), and check valve(s) just upstream of the connection to the tank. Off-loading of fuel would be accomplished by a transfer pump powered by the delivery vehicles. For dispensing gasoline and on-road diesel fuel, the transfer pump would be a dispensing pump with petroleum-rated hoses with automatic shut-off nozzles. The fuel transfer pump would have an emergency shut-off at the pump and a secondary emergency shut-off at least 100 feet away.

Vehicle maintenance would be performed at the contractor yards or at existing vehicle maintenance and repair shops.

2.2.7.4 Construction Camps

Some areas within Montana and South Dakota do not have sufficient temporary housing in the vicinity of the proposed route to house all construction personnel working on spreads in those areas. In those remote areas, temporary work camps would be constructed to meet the housing needs of the construction workforce. A total of four temporary construction camps would be established: two would be in Montana, near Nashua and Baker, and two would be in South Dakota, near Union Center and Winner (see Figure 2.2.7-3). Depending on the final construction spread configuration and construction schedule, additional or larger camps may be required. The number and size of camps would be determined based on the time available to complete construction and to meet Keystone's commercial commitments. All construction camps would be permitted, constructed, and operated consistent with applicable county, state, and federal regulations. The relevant regulations that would have to be complied with and the permits required for the construction camps are presented in Table 2.2.7-3.

TABLE 2.2.7-3
Construction Camp Permits and Regulations

Agency / State	Permit / Discussion
Montana	
Montana Department of Environmental Quality (MDEQ)	Public water and sewer (PWS) laws, Title 75, chapter 6, part 1, Montana Code Annotated (MCA). Rules at Administrative Rules of Montana (ARM) 17.38 101, and Department Circulars incorporated by reference. Require plan and specification review before construction of a public water or sewer system. Circulars contain design requirements. Requires water quality monitoring of water supply. Sanitation in subdivisions laws, Title 76, Chapter 4, MCA. Rules at ARM Title 17, Chapter 36. If applicable (e.g., if the site is less than 20 acres), requirements the same as PWS laws and Circulars for water supply and wastewater. Would require additional review of stormwater systems and solid waste management. (Likely not applicable unless "permanent" multiple spaces created for mobile homes or RVs. 76-4-102(16), MCA.) Water Quality Act Discharge Permits, Title 75, Chapter 5, MCA. Rules at ARM Title 17, Chapter 30. Groundwater discharge permit would be required if a wastewater drain field had a design capacity over 5,000 gallons per day (gpd). ARM 17.30.1022. Air Quality Permits, Title 17, Chapter 8, Subchapter 7. Permits would be

TABLE 2.2.7-3 Construction Camp Permits and Regulations	
Agency / State	**Permit / Discussion**
	required for sources with potential emissions exceeding 25 tons per year (tpy) unless exemptions exist and are met for temporary non-road engines.
Department of Public Health and Human Services (DPHHS)	Work Camp licensing laws, Title 50, Chapter 52, MCA. Rules at ARM Title 37, Chapter 111, Subchapter 6. Regulations regarding water, sewer, solid waste, and food service. Incorporates MDEQ PWS requirements but has additional water and sewer provisions. Administered by DPHHS, Public Health and Safety Division, Communicable Disease Control and Prevention Bureau, Food and Consumer Safety Section.
Counties	Permit required for wastewater systems, regulations adopted under Section 50-2-116(1)(k), MCA. Adopting state minimum standards promulgated by Board of Environmental Review at ARM Title 17, Chapter 36, Subchapter 9. Generally follow state laws for subdivisions, PWS, DEQ-4.
	Work camp permit required in some counties.
South Dakota	
South Dakota Department of Environment and Natural Resources Drinking Water Program and Surface Water Quality Program	Permit required for a Transient Non-community (TNC) PWS. There also are sampling requirements for a TNC PWS.
	A National Pollution Discharge Elimination System Permit would be required for waste water discharge.
South Dakota Administrative Rules	Air Quality Permit, Chapters 74:36:04-05. The diesel-fired generator engines and emergency back-up generators at each camp in South Dakota would require a minor operating permit, unless exemptions exist and are met for temporary nonroad engines.
Counties	An approach permit and a building permit may be necessary in some counties.
	A wide load permit is necessary for transport of modulars units to camps.

Design of Camps

Each construction camp site would be established on an approximately 80-acre site. Of that area, 30 acres would be used as a contractor yard, and 50 acres would be used for housing and administration facilities. The camps would be constructed using modular units and would provide the required infrastructure and systems necessary for complete food service, housing, and personal needs, including a convenience store, recreational and fitness facilities, entertainment rooms and facilities, telecommunications/media rooms, kitchen/dining facilities, laundry facilities, and security units. Each camp would also have a medical infirmary for first aid needs and to provide routine minor medical services for the workers and staff.

There would also be dedicated medical transport vehicles for both the camp sites and for the construction ROW.

Housing facilities of the camps would consist of modular, dormitory-like units that house roughly 28 occupants per unit. The units would have heating and air conditioning systems. The camps would be set up with the housing areas clustered together, with both shared and private wash rooms. Each camp site would provide parking for about 100 recreational vehicles. Each camp would accommodate approximately 600 people.

Potable water would be provided by drilling a well where feasible. If an adequate supply cannot be obtained from a well, water would be obtained from municipal sources or trucked to each camp. A self-contained wastewater treatment facility would be included in each camp except where it is practicable to use a licensed and permitted publically owned treatment works (POTW). Wastewater treated on site would undergo primary, secondary, and tertiary treatment consisting of solids removal, bioreactor treatment, membrane filtration, and ultraviolet exposure. Final effluent discharge would be consistent with all applicable regulatory requirements. If a POTW is used, Keystone would either pipe or truck wastewater to the treatment facility.

Electricity for the camps would either be generated on site through diesel-fired generators, or would be provided by local utilities from an interconnection to their distribution system. Keystone would contract with a camp supplier that would provide security 24 hours per day, 7 days per week at each camp. Keystone would work with the supplier to ensure that as many local employees are hired as possible to staff the camps.

Use of Camps

The camps are planned to service the needs of the proposed Project work force. As a result, the dormitories do not include facilities for families. However, workers using the recreational vehicle areas may include family members.

Most of the workers would be transported to and from the ROW each day by buses. In addition, there would be individual crews and workers that, due to the nature of their work, would be transported to and from job sites by utility trucks or by welding rigs. There would also be support workers such as mechanics, parts and supply staff, and supervisory personnel that would drive to the ROW in separate vehicles.

Based on the current construction schedule, the camps would operate in standby mode during the winter (from December through March or April). Each camp would have sufficient staff to operate and secure the camp plant and systems during that time period.

Decommissioning of Camps

Decommissioning would be accomplished in two stages. First, all infrastructure systems would be removed and either hauled away for re-use, recycled, or disposed of in accordance with regulatory requirements. Each site would then be restored and reclaimed in accordance with permit requirements and the applicable procedures described in Keystone's CMR Plan (Appendix B).

2.2.7.5 Access Roads

Development of Access Roads

Existing public and private roads would be used to provide access to most of the construction ROW. Paved roads would not likely require improvement or maintenance prior to or during construction. However, the road infrastructure would be inspected prior to construction to ensure that the roads, bridges and cattle guards would be able to withstand oversized vehicle use during construction. Gravel roads and dirt roads may require maintenance during the construction period due to high use. Road improvements such as blading and filling would generally be restricted to the existing road footprint; however, some roads may require widening in some areas.

To the extent Keystone is required to conduct maintenance of any county roads, it would be done pursuant to an agreement with the applicable county. In the event that oversized or overweight loads would be needed to transport construction materials to the proposed Project work sites, Keystone would submit required permit applications to the appropriate state regulatory agencies.

Approximately 400 temporary access roads would be needed to provide adequate access to the construction sites. Private roads and any new temporary access roads would be used and maintained only with permission of the landowner or the appropriate land management agency. Keystone would also construct short permanent access roads from public roads to the tank farm, pump stations, delivery facilities, and intermediate MLVs. Approximately 50 permanent access roads would be needed.

The final locations of new permanent access roads would be determined prior to construction. At a minimum, construction of new permanent access roads would require completion of cultural resources and biological surveys and consultations and approvals of the appropriate SHPO and USFWS office. Other state and local permits also could also be required prior to construction. Maintenance of newly created access roads would be the responsibility of Keystone as described below.

The acreages of access roads are included in the listing of lands affected in Table 2.1.4-1. Access road temporary and permanent disturbance estimates are based on the 30-foot roadway width required to accommodate oversized vehicles. In developing the acreages of disturbance, all non-public roads were conservatively estimated to require upgrades and maintenance during construction.

Roadway Maintenance, Repair, and Safety

There were many comments on the draft EIS concerning the maintenance and repair of road surfaces used during construction and operation of the proposed Project, as well as comments expressing concern about roadway safety. If the proposed Project receives all permits and approvals, Keystone would work with state and local road officials, the pipeline construction contractor, and a third-party road consultant to identify routes that would be used for moving materials and equipment between storage and work yards to the pipeline, valve, and pump station construction sites. When these routes are mutually agreed upon, the road consultant would document the existing conditions of roads, including a video record. When construction is completed, the same parties would review the road conditions, and Keystone would restore the roads to their preconstruction condition or better. This restoration would be paid for by Keystone.

Keystone would also perform a preliminary evaluation to determine the design-rated capacity of bridges anticipated to be used during construction and would inspect all bridges it intends to use prior to construction and confirm that the capacity of the bridges is adequate for the anticipated weights. In cases where the bridges are not adequate to handle the maximum weight, an alternate route would be used. Keystone would also inspect cattle guard crossings prior to their use. If they are determined to be inadequate to handle anticipated construction traffic, Keystone may place mats on crossings, establish an alternate crossing, enhance existing structures, or install new infrastructure with the landowner's approval. All such actions would be paid for by Keystone.

During construction, Keystone and the pipeline contractor would maintain roads used for construction in a condition that is safe for both the public and work force. Local road officials would be actively engaged in the routine assessment of road conditions.

Keystone would follow all federal, state, and local safety plans and signage as set forth in current Manuals of Uniform Traffic Control for streets and highways, or in similar documents issued by regulatory agencies along the proposed route. This would include compliance with all state and local permits pertaining to road and crossing infrastructure usage.

Keystone would require that each construction contractor submit a road use plan prior to mobilization, coordinate with the appropriate state and county representatives to develop a mutually acceptable plan, and obtain all necessary road use permits. The road use plans would identify potential scenarios that may occur during construction based on surrounding land use, known recreational activities, and seasonal influences (such as farming), and would establish measures to reduce or avoid effects to local communities. Keystone would also have inspection personnel monitor road use activities to ensure that the construction contractors comply with the road use plans and stipulations of the road.

Commenters also expressed concern that some counties in Montana stipulate that a private individual conducting maintenance of a county road becomes liable for the safety of traffic on the road. Keystone has stated that to the extent it is required to conduct maintenance of any county road in Montana, it would be done pursuant to an agreement with the applicable county, and such agreement would address potential liability, including appropriate indemnity and insurance provisions. Further, Keystone has the necessary insurance coverage to address such potential liability.

2.3 PIPELINE SYSTEM DESIGN AND CONSTRUCTION PROCEDURES

Many commenters expressed concerns about the safety of the proposed Project, the use of industry standards in the design of the proposed Project, and the inspection and monitoring procedures that would be conducted. The USDOT's Pipeline and Hazardous Materials Administration (PHMSA) is responsible for protecting the American public and the environment by ensuring the safe and secure movement of hazardous materials to industry and consumers by all transportation modes, including the nation's pipelines. Through PHMSA, the USDOT develops and enforces regulations for the safe, reliable, and environmentally sound operation of the nation's 2.3-million-mile pipeline transportation system and the nearly 1 million daily shipments of hazardous materials by land, sea, and air. Within PHMSA, the Office of Pipeline Safety (OPS) has the safety authority for the nation's natural gas and hazardous liquid pipelines. The proposed Project is included in the latter category.

As described below, to protect the public and environmental resources, Keystone would be required to construct, operate, maintain, inspect, and monitor the Project consistent with the PHMSA requirements presented in 49 CFR 195 (Transportation of Hazardous Liquids by Pipeline), as well as relevant industry standards, and applicable state standards. These regulations specify pipeline material and qualification standards, minimum design requirements, and required measures to protect the pipeline from internal, external, and atmospheric corrosion. The regulations are designed to prevent crude oil pipeline accidents and to ensure adequate protection for the public.

In addition, Keystone would comply with a set of 57 Special Conditions developed by PHMSA for the proposed Project (see Appendix U). Originally, PHMSA began development of these conditions in consideration of a special permit request from Keystone that, if granted, would have allowed Keystone to operate the Project at a maximum operating pressure higher than would be allowed using the specified design factor in 49 CFR 195.106. On August 5, 2010, Keystone withdrew its application to PHMSA for a special permit. However, DOS continued to work with PHMSA to develop Special Conditions in response to comments received about pipeline construction, operation, and maintenance. Keystone agreed to incorporate the Special Conditions into the proposed Project and would include those conditions in its manual for operations, maintenance, and emergencies that is required by 49 CFR 195.402. PHMSA has the legal authority to inspect and enforce any items contained in a pipeline operator's operations, maintenance, and emergencies manual, and would therefore have the legal authority to inspect and enforce the 57 Special Conditions if the proposed Project is approved. DOS, in consultation with PHMSA, has determined that incorporation of those conditions would result in a Project that would have a degree of safety over any other typically constructed domestic oil pipeline system under current

code and a degree of safety along the entire length of the pipeline system similar to that which is required in High Consequence Areas (HCAs) as defined in 49 CFR 195.450.

Several commenters have recommended that the pipeline be constructed above ground. While it would be technically feasible to construct the pipeline aboveground in most areas along the proposed route, there are many disadvantages to an aboveground pipeline. In comparison to an aboveground pipeline, burying a pipeline reduces the potential for pipeline damage due to vandalism, sabotage, and the effects of other outside forces, such as vehicle collisions. Further, there has been increased concern about homeland security since the September 11, 2001 attacks, and burying the pipeline provides a higher level of security. Further, an above ground pipeline would be more susceptible to the effects of ambient temperature, wind, and other storm events. Construction of an aboveground pipeline would also require exposing the pipeline above rivers (e.g., hung from a bridge or constructed as a special pipeline span) and roadways where it would be more accessible to those intent on damaging the pipeline.

Nearly all petroleum pipelines in the U.S. are buried, and Keystone has also proposed to bury the proposed Project pipeline. As described above, the facilities would be designed, constructed, tested, and operated in accordance with the regulations in 49 CFR 195, the 57 Special Conditions provided to Keystone by PHMSA, and all other applicable federal and state regulations.

If the proposed Project is approved and implemented, PHMSA would maintain continual regulatory oversight over the Project, throughout construction, testing, start-up, operation, and maintenance. The PHMSA regulations presented in 49 CFR 195 Transportation of Hazardous Liquids by Pipeline specify pipeline material and qualification standards, minimum design requirements, and required measures to protect the pipeline from internal, external, and atmospheric corrosion. The regulations are designed to prevent crude oil pipeline accidents and to ensure adequate protection for the public. Section 2.3.1 presents the major pipeline design considerations of the proposed Project. In addition, the Special Conditions provide more stringent requirements for many of these design factors.

Keystone prepared a draft CMR Plan that was included in Appendix B of the draft EIS. That plan described the construction methods and environmental protection measures that Keystone committed to in order to reduce the potential construction impacts of the proposed Project. The CMR Plan was revised after the publication of the draft EIS to update the procedures based on agency reviews and input. The current version of the plan is presented in Appendix B. If the proposed Project is issued a Presidential Permit, the CMR Plan would be updated after the ROD is issued to reflect any additional conditions included in the ROD and in other permits issued to Keystone, and to reflect regional construction considerations.

Prior to pipeline construction, Keystone would prepare a Spill Prevention, Control, and Countermeasure (SPCC) Plan to avoid or minimize the potential for harmful spills and leaks during construction. A draft version of the SPCC submitted by Keystone is included in Appendix C.

EPA submitted a comment expressing concern that the non-transportation related equipment and activities at pump stations, breakout tanks, and the tank farm may require the submission and some cases, approval, of a Facility Response Plan (FRP) as required under 40 CFR 112.20. However, it appears unlikely that the proposed Project would be required to submit an FRP under 40 CFR 112.20 for equipment and activities at the pump stations, the Cushing tank farm, or the surge relief tanks at the Nederland delivery point. Those facilities would not house any non-transportation-related equipment or activities subject to the requirement to prepare and submit an FRP. Further, 40 CFR 112.20 requires an FRP if a facility could reasonably be expected to cause substantive harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines. However, if EPA makes the determination that any or all of

those facilities meet the criteria for an FRP within 40 CFR 112.20, Keystone would be required to prepare and submit an FRP to EPA for review.

In addition, Keystone would submit a Pipeline Spill Response Plan (PSRP) to PHMSA prior to the initiation of proposed Project operations in accordance with the requirements of 49 CFR 194. The PSRP would describe how spills would be responded to in the event of a release from the proposed Project resulting from any cause as well as the maximum spill scenario and the procedures that would be in place to deal with the maximum spill. As required by 49 CFR 195.40, Keystone would also prepare and follow a manual of written procedures for conducting normal operations and maintenance activities and handling abnormal operations and emergencies that would include Keystone's Emergency Response Plan (ERP). The PSRP and the ERP are addressed in Sections 2.4.2.2 and 3.13.5.5.

The remainder of this section provides information on the following topics:

- Pipeline Design (Section 2.3.1);
- Pipeline Construction Procedures (Section 2.3.2);
- Special Pipeline Construction Procedures (Section 2.3.3);
- Construction Procedures for Aboveground and Ancillary Facilities (Section 2.3.4);
- Construction Schedule and Workforce (Section 2.3.5); and
- Construction Conditions Imposed by PHMSA (Section 2.3.6).

2.3.1 Pipeline Design

2.3.1.1 Pipe Specifications

All pipe used for the proposed Project would be required to be in compliance with the pipe design requirements of 49 CFR 195, Subpart C (Design Requirements) and PHMSA Special Conditions 1, 2, 3, 4, 7, and 8. The pipeline would be constructed of high-strength X70 steel pipe that would be mill-inspected by an authorized owner's inspector and mill-tested to API 5L (American Petroleum Institute [API] 5L[3]) specification requirements. Key design parameters applicable to the proposed Project pipeline are listed in Table 2.3.1-1.

TABLE 2.3.1-1
Pipe Design Parameters and Specification

Pipe Design Parameters	Specification
Material code	API 5L-PSL2-44th Edition
Material grade thousand pounds of pressure per square inch (ksi) (yield strength)[a]	Grade X70
Maximum pump station discharge	1,308 pounds per square inch gauge (psig)
Maximum Operating Pressure (MOP)	1,308psig; 1,600 psig[a]

[3] The American Petroleum Institute (API) 5L test standard is used to determine the fracture ductility of metal line pipe. Specimens are cut from sections of pipe, soaked at a prescribed temperature, and tested within 10 seconds.

TABLE 2.3.1-1 Pipe Design Parameters and Specification	
Pipe Design Parameters	**Specification**
Minimum hydrostatic test pressure	In conformance with Special Conditions 8 and 22, the pipe must be subjected to a mill hydrostatic test pressure of 95% SMYS or greater for 10 seconds and the pre-in service hydrostatic test must be to a pressure producing a hoop stress of a minimum 100% SMYS for mainline pipe and 1.39 times MOP for pump stations for eight (8) continuous hours. The hydrostatic test results from each test must be submitted in electronic format to the applicable PHMSA Director(s) in PHMSA Central, Western and Southwest Regions after completion of each pipeline.
Joint length (feet)	Nominal 80-foot (double-joint)
Field production welding processes	Mechanized – gas metal; arc welding (GMAW); Manual-shielded metal arc welding (SMAW)
Pipeline design code	49 CFR Part 195
Outside diameter	36 inches
Line pipe wall thickness (0.72 design factor as per 49 CFR 195.106)	0.465 inch
Heavy wall thickness – High Consequence Areas (HCAs) including, high population areas, other populated areas, unusually sensitive areas, including drinking water and ecologically sensitive areas, mainline valve and pump station sites.	0.515 inch
Heavy wall thickness – directly downstream of pump stations at lower elevations as determined by steady state and transient hydraulic analysis. [a]	0.572 inch
Heavy wall thickness – uncased road and cased railway crossings	0.618 inch
Heavy wall thickness – uncased railway crossings, horizontal directional drillings (HDDs)[a]	0.748 inch

[a] The design of the proposed Project pipeline system is based on a maximum 1,308 pounds per square inch gauge (psig) discharge pressure at each pump station. The pump station discharge pressure would be a maximum of 1,308 psig. There would be situations where, due to elevation changes, the hydraulic head created would result in a Maximum Operating Pressure of up to and including 1,600 psig. Suction pressure at the pump stations is generally on the order of 200 psig.

Commenters have expressed concern about the quality of pipe used for the proposed Project and the countries of origin of the pipe. Keystone has stated that approximately 75 percent of the pipe for the U.S. portion of the proposed Project would be purchased from North American pipe manufacturing facilities and that regardless of the country of origin, it would purchase pipe only from qualified pipe suppliers and trading houses. Qualification includes comprehensive evaluations of manufacturing facilities, extensive technical discussions with the lead quality control and metallurgy personnel, and a clear demonstration that the mills can meet the requirements to produce and test pipe in accordance with Keystone's standards and specifications.[4] In addition, as noted above, all pipe used for the proposed Project would have to be manufactured and tested in accordance with the requirements of 49 CFR 195 and the 57 Project-specific Special Conditions developed in consultation with PHMSA and accepted by Keystone.

[4] Keystone would use TransCanada Pipelines pipe specifications for the proposed Project where those specifications exceed federal regulations and the PHMSA Special Conditions.

Keystone would review, and if appropriate, approve the pipe manufacturer's procedure specifications prior to the pipe mill initiating purchase or production of steel to ensure the material meets the API 5L Line Pipe Specification and Keystone's Corporate Specifications and Project-specific requirements. Surveillance personnel would be stationed in the pipe mill through the duration of production to inspect the finished pipe and monitor compliance to the specifications throughout the manufacturing process. These personnel would monitor things such as mill test reports and other appropriate documentation, including production logs, steel quality, fabrication, welding rejection summaries, lab results, and non-conformance reports.

TransCanada's pipe manufacturing specifications also specify that any deviation in the rolling process requires testing to be recommenced from the point of deviation to ensure uniformity. Finally, additional mechanical and chemical property tests based on steel grade, plate, and/or coil would be completed based on the steel manufacturing process as well as rolling and cooling temperatures. Those tests ensure that steel properties are not variable.

2.3.1.2 External Corrosion Protection

To protect against corrosion, an external coating (fusion-bonded epoxy, or FBE) would be applied to the pipeline and all buried facilities, and cathodic protection (CP) would be applied to the pipeline by impressed current. These measures would be provided in compliance with 49 CFR Part 195, Subpart H (Corrosion Control) and the requirements of 14 of the PHMSA 57 Special Conditions (see Appendix U). The primary impressed current CP systems would be rectifiers coupled to semi-deep vertical anode beds at each pump station, as well as rectifiers coupled to deep-well anode beds at selected intermediate mainline valve sites. The rectifiers would be variable output transformers which would convert incoming AC power to DC voltage and current to provide the necessary current density to the CP design structures. The rectifiers would have a negative cable connection to the design structure and a positive cable connection to the anode beds. The anode beds would consist of high silicon cast iron anodes backfilled with a highly conductive coke powder to allow for an expected anode minimum life of 20 years. During operation, the CP system would be monitored and remediation performed to prolong the anode bed and systems. The semi-deep anode beds would be 12-inch-diameter vertical holes spaced 15 feet apart with a bottom hole depth of approximately 45 feet. The deep-well anode bed would be a single 12-inch-diameter vertical hole with a bottom hole depth of approximately 300 feet.

2.3.2 Pipeline Construction Procedures

Once engineering surveys of the ROW centerline and additional temporary workspace areas have been finalized, and the acquisition of ROW easements and any necessary acquisitions of property in fee have been completed, construction would begin. Several commenters have expressed concern about the negotiation process for easement agreements along the proposed route and the use of eminent domain for the procurement of some easements. Commenters have also suggested that the applicant is a Canadian company and should not be allowed to use the eminent domain process to obtain easements. In addition, some commenters have expressed concern about their options if Keystone does not comply with easement agreements.

Keystone is a U.S. corporation that was incorporated in accordance with the laws of the State of Delaware. Keystone is the corporate entity that will construct the pipeline if it is approved. Keystone is therefore eligible to use eminent domain laws. To construct, operate, and maintain the proposed Project, Keystone would need the rights to easements along the entire proposed route. Keystone is responsible for negotiating easement agreements with landowners along the route in each state. The easement agreements would list the conditions that both the landowner and Keystone agree to, including financial compensation to the landowners in return for granting easements. Compensation would also be made for

loss of use during construction, crop loss, loss of non-renewable or other resources, and restoration of any unavoidable damage to personal property during construction. DOS expects Keystone to negotiate fairly, honestly, and respectfully with landowners when they negotiate an easement. However, those negotiations and final agreements are private business concerns between the landowners and Keystone, and DOS has no legal authority or ability to intervene in the proceedings.

If Keystone obtains all necessary permits and approvals and an easement negotiation cannot be completed in a manner suitable to both parties, Keystone would use state eminent domain laws to obtain easements needed for pipeline construction, maintenance, and operation. State laws dictate under what circumstances eminent domain may be used and define the eminent domain process within the state. The level of compensation would be determined by a court according to applicable state law. Again, DOS has no legal authority or ability to intervene in eminent domain proceedings. In addition, eminent domain does not apply to land under federal ownership or management.

State or local trespass and access laws are applicable along the entire route and therefore along each easement negotiated by Keystone and the landowner or obtained by Keystone through the eminent domain process. As noted above, DOS has no legal authority over negotiating easement agreements and has no legal status to enforce the conditions of an easement agreement. A landowner who considers Keystone to be out of compliance with an easement agreement would have take up the matter with Keystone or local law enforcement officials, or initiate legal consultation.

As proposed, the pipeline would be constructed in 17 spreads. Final spread configurations and the final construction schedule may result in the use of additional spreads or fewer shorter or longer spreads. Figure 2.3.2-1 depicts the approximate location of each spread. The 851.6-mile-long Steele City Segment would be constructed using 10 mainline spreads from approximately 63 to 109 miles long. Construction of the 483.8-mile-long Gulf Coast Segment pipeline would be accomplished using 6 spreads from about 49 to 100 miles in length. The 48.6-mile-long Houston Lateral would be constructed using one spread.

Pipeline construction would generally proceed as a moving assembly line composed of specific activities including surveying and staking of the ROW, clearing and grading, pipe stringing, bending, trenching, welding, installing, backfilling, hydrostatic testing, and cleanup, as described in the subsections below and illustrated in Figure 2.3.2-2. In addition, special construction techniques would be used for specific site conditions such as rugged terrain, waterbodies, wetlands, paved roads, highways, and railroads. These non-standard pipeline construction procedures are described in Section 2.3.3.

On the Steele City Segment, construction is planned to continue into the early winter months for as long as the weather permits construction without the use of special winter construction techniques. However, as stated in the CMR Plan (Appendix B), if the proposed Project is authorized and winter construction is necessary to meet construction deadlines, Keystone would consult with the relevant federal, state, and local regulatory agencies to determine what changes may be necessary in permits issued, what additional permits may be required, and to identify the procedures that would have to be incorporated into construction to avoid or minimize environmental impacts. Winter construction plans would be finalized based on those consultations and permit requirements. On the Gulf Coast Segment and the Houston Lateral, although construction is planned for winter months, the prevailing climate would not require the use of special winter construction techniques.

A list of typical equipment to be used during construction is presented in Table 2.3.2-1. Actual equipment used would depend on the construction activity and specific equipment owned or leased by the construction contractors selected.

TABLE 2.3.2-1 Minimum Equipment Required for Selected Construction Activities	
Activity	**Minimum Equipment**
Clearing and grading	6 D8 dozers
	1 – 330 trackhoe (thumb and hoe pack)
	6 – 345 trackhoes
	2 D8 with ripper attachment
	1 – 140 motor grader
Trenching	6 – 345 trackhoes
	1 – 345 trackhoe with hammer
	4 ditching machines
Stringing, bending, and welding	2 – 345 trackhoes vacuum fitted (1 at pipe yard, 1 at ROW)
	1 – D7 tow cat
	15 string trucks
	2 bending machines
	10 – 572 side booms
	10 – 583 side booms
	6 – automatic welding machines with end-facing machine
	8 ultrasonic testing units
	1 NDE unit
	2 heat rings
	4 coating rings
	3 sled with generators
Lowering in and backfilling	3 – 345 trackhoes (1 equipped with long neck)
	5 – 583 side booms
	2 padding machines
	3 D8 dozers
Tie-ins to the mainline (Six tie-in crews per spread; equipment listed if for each crew)	4 welding rigs
	7 – 572 side booms
	2 ultrasonic testing units
	2 heat rings
	2 coating rings
	1 sled with generators
	2 – 345 trackhoes (1 equipped with shaker bucket)
	2 – 583 side booms
	1 D8 dozer

TABLE 2.3.2-1 Minimum Equipment Required for Selected Construction Activities	
Activity	**Minimum Equipment**
Cleanup and restoration	6 D8 dozers 3 – 345 backhoes 2 tractors with mulcher spreaders (seed and reclamation)
Equipment deployed for each spread	100 pickup trucks 2 water trucks 2 fuel trucks 7 equipment low-boys 7 flat bed trucks 5 – 2-ton boom truck

In addition to the equipment listed in Table 2.3.2-1, each spread would have 450 to 500 construction personnel and 30 inspection personnel. Normal construction activities would be conducted during daylight hours, with the following exceptions:

- Completion of critical tie-ins on the ROW would likely occur after daylight hours. Completion requires tie-in welds, non-destructive testing, and sufficient backfill to stabilize the ditch.
- HDD operations (see Section 2.3.3.5 for additional information on the HDD method) may be conducted after daylight hours, if determined by the contractor to be necessary to complete a certain location. In some cases, that work may be required continuously until the work is completed; this may last one or more 24-hour days. Such operations may include drilling and pull-back operations, depending upon the site and weather conditions, permit requirements, schedule, crew availability, and other factors.
- Hydrostatic testing operations may be conducted after daylight hours if determined by the contractor to be necessary to complete a certain location. In some cases, that work may be required continuously until the work is completed; this activity may take place for 24 continuous hours or longer. While not anticipated in typical operations, certain work may be required after the end of daylight hours due to weather conditions, for safety, or for other Project requirements.

2.3.2.1 Surveying and Staking

Before construction begins, the construction ROW boundaries and any additional temporary workspace areas would be marked to identify the limits of the approved work area. The locations of approved access roads and existing utility lines would be flagged. Wetland boundaries and other environmentally sensitive areas would be marked or fenced for protection. A survey crew would stake the centerline of the trench and any buried utilities along the ROW.

Some landowner fences would be crossed or paralleled by the construction ROW, requiring fence cutting and modifications. Each fence would be braced and secured before cutting to prevent the fence from weakening or slacking. Openings created in the fences would be temporarily closed when construction crews leave the area to contain livestock. In addition, gaps through natural livestock barriers would be fenced according to landowners' or land managers' requirements. If livestock is present, temporary gates and fences would be installed.

2.3.2.2 Clearing and Grading

Prior to vegetation removal along slopes leading to wetlands and riparian areas, temporary erosion control measures such as silt fences or straw bales would be installed. The work area would be cleared of vegetation, including crops and obstacles such as trees, logs, brush, or rocks.

Grading would be performed where necessary to provide a reasonably level work surface or where required by landowners or land managers. Where the ground is relatively flat and does not require grading, rootstock would be left in the ground. More extensive grading would be required in steep slope areas to safely construct the pipeline along ROW. Where grading occurs and topsoil is present, topsoil would be removed from the entire area to be graded and stored separately from the subsoil.

2.3.2.3 Trenching

Trenching may be carried out before or after stringing, bending and welding (see Section 2.3.2.4) depending upon several factors such as soil characteristics, water table, presence of drain tiles, and weather conditions at the time of construction.

In areas of rocky soils or bedrock, tractor-mounted mechanical rippers or rock trenchers would fracture the rock prior to excavation. In areas where topsoil segregation would be required, the actual depth of topsoil would be removed up to a maximum depth of 12 inches and segregated. In most areas where soil would be removed from only the trench, topsoil would be piled on the near-side of the trench and subsoil on the far side of the trench. A "triple lift" method would be used in areas where deep soils would be excavated, primarily over the pipeline trench in cultivated fields to minimize impacts to agricultural production. This method would involve stockpiling three different soil horizons, including the topsoil horizon, as described in Section 3.2.2.1. This separation of topsoil from subsoil would allow for proper restoration of the soil during the backfilling process. Where soil is removed from both the trench and the spoil side, topsoil would be stored on the near-side of the construction ROW edge, and the subsoil on the spoil-side of the trench.

These procedures separating topsoil would reduce the potential for mixing of subsoil and topsoil. In addition, the spoil piles would be spaced to accommodate storm water runoff. Typical soil separation methods are illustrated in Figures 2.1.2-1 through 2.1.2-3.

On agricultural land, rocks that are exposed on the surface due to construction activity would be removed from the ROW prior to and after topsoil replacement. Rock removal would also occur in rangeland to ensure that the productive capability of the land is maintained. In some landscapes, thin soils overlay bedrock, or exposed bedrock exists at the surface. In these cases, rock would be replaced to the extent practicable. Clearing of rocks could be carried out either manually or with a mechanical rock picker and topsoil would be preserved. Rocks that are similar in size to those occurring in the undisturbed landscape would be left in place to the extent practicable. Rock removed from the ROW would be either hauled away for disposal in appropriate facilities or placed in a location acceptable to the landowner.

Trench excavation would typically be to depths of between 7 and 8 feet, with a trench width of approximately 4 to 5 feet. In most areas, there would be a minimum of 4 feet of cover over the pipeline after backfilling. The depth of burial would be consistent with PHMSA Special Condition 19 which states the following:

> "19) Depth of Cover: Keystone shall construct the pipeline with soil cover at a minimum depth of forty-eight (48) inches in all areas, except in consolidated rock. The minimum depth in consolidated rock areas is thirty-six (36) inches."

In addition, the depth of burial at waterbodies, ditches, drainages, and other similar features would be 60 inches, except in rocky areas where the minimum burial depth would be 36 to 48 inches. Where major waterbodies are crossed using the HDD method, the depth from the streambed to the top of the pipe would be substantively greater than 60 inches. Depths of cover over the pipe along the proposed route in areas of normal excavation and in rocky excavation areas are listed in Table 2.3.2-2.

TABLE 2.3.2-2
Minimum Pipeline Cover

Location	Depth Below Ground Surface in Inches	
	Normal Excavation	Rock Excavation
Most areas	48	36
All waterbodies	60	36
Dry creeks, ditches, drains, washes, gullies, etc.	60	36
Drainage ditches at public roads and railroads	60	48

Special Condition 19 also requires that Keystone maintain the depth of cover after construction is completed. Specifically, the condition states the following:

> "Keystone shall maintain a depth of cover of 48 inches in cultivated areas and a depth of 42 inches in all other areas."

Some commenters recommended that Keystone install "warning tape" over the pipeline to alert excavators to the presence of the pipeline. Keystone would comply with the following stipulations of PHMSA Special Condition 19 that relates to the use of warning tape.

> "In cultivated areas where conditions prevent the maintenance of forty-eight (48) inches of cover, Keystone must employ additional protective measures to alert the public and excavators to the presence of the pipeline. The additional measures shall include:
>
> > a) Placing warning tape and additional line-of-sight pipeline markers along the affected pipeline segment,
> >
> > b) In areas where threats from chisel plowing or other activities are threats to the pipeline, the top of the pipeline must be installed and maintained at least one foot below the deepest penetration above the pipeline, not to be less than 42-inches of cover."

2.3.2.4 Pipe Stringing, Bending, and Welding

After the pipe sections are bent, the pipeline joints would be lined up and held in position until welding. The joints would be welded together to create long "strings" that would be placed on temporary supports. All welds would be inspected using non-destructive radiographic, ultrasonic, or other methods that provide an equivalent or better level of safety as those required in 49 CFR Part 195. All aspects of welding, including reporting, would be conducted consistent with the requirements of 49 CFR 195.228 and PHMSA Special Conditions 4, 5, 6, 12, 18, and 20 (Appendix U). Welds that do not meet established specifications would be repaired or removed and replaced. Once the welds are approved, a protective epoxy coating would be applied to the welded joints to inhibit corrosion.

2.3.2.5 Installing and Backfilling

Prior to installing the pipe into the trench, the trench would be cleared of rocks and debris that might damage the pipe or the pipe coating. If water has entered the trench, dewatering may be required prior to installation. Discharge of water from dewatering would be accomplished in accordance with applicable discharge permits. On sloped terrain, trench breakers (e.g., stacked sand bags or foam) would be installed in the trench at specified intervals to prevent subsurface water movement along the pipeline.

In some cases sand or gravel padding material may be placed in the bottom of the trench to protect the pipeline from damage during installation. In no case would topsoil be used as a padding material. In areas of rocky soils or bedrock, the bottom of the trench would be padded with borrow material such as sand or gravel. Where rock occurs within the trench perimeter, abrasion resistant coatings or rock shields would be used to protect the pipe prior to installation.

The pipeline would be lowered into the trench and the trench would first be backfilled using the excavated subsoil material. In rocky areas, excavated rock would be used to backfill the trench to the top of the existing bedrock profile. After the initial backfilling, topsoil would be returned to its original position over the trench.

2.3.2.6 Hydrostatic Testing

In addition to hydrostatic testing at the pipe mills, the pipeline would be cleaned and hydrostatically tested prior to putting the pipe into service and after backfilling and all construction work that could directly affect the pipe is complete. The testing would be conducted in pipeline sections approximately 30 to 50 miles long. Hydrostatic testing would provide assurance that the system is capable of withstanding the maximum operating pressure and would be conducted in accordance with the regulatory requirements of 49 CFR Part 195, Subpart E (Pressure Testing) and the stipulations in PHMSA Special Conditions 5, 20, 22, and 23 (Appendix U). The process would be conducted as follows:

- Isolate the pipe section being tested with test manifolds;
- Fill the section with water;
- Pressurize the section to a pressure that would produce a hoop stress of a minimum of 100 percent of the specified minimum yield strength for the mainline pipe and 1.39 times the maximum operating pressure for pump stations; and
- Maintain that pressure for a period of 8 hours.

2.3.2.7 Pipe Geometry Inspection, Final Tie-ins, and Commissioning

After hydrostatic testing is complete, the pipeline would be dewatered and inspected using an electronic caliper (geometry) pig to check for dents or other deformations and where appropriate, pipe sections would be replaced in accordance with the requirements of 49 CFR 195 and the Special Conditions in Appendix U. The final pipeline tie-ins would then be welded and inspected.

After the final tie-ins are complete and inspected, the pipeline would be commissioned through the verification of proper installation and function of the pipeline and appurtenant systems, including control and communication equipment, based on the requirements of 49 CFR 195 and the relevant PHMSA Special Conditions.

2.3.2.8 Cleanup and Restoration

Cleanup would include the removal of construction debris, final contouring, and installation of erosion control features. The cleanup process would begin as soon as possible after backfilling but the timing would be dependent on weather conditions. Preliminary cleanup would be completed within approximately 20 days after the completion of backfilling assuming appropriate weather conditions prevail. Removed construction debris would be disposed in existing, permitted disposal facilities in accordance with relevant federal, state, and local regulations.

Reseeding of the ROW would occur as soon as possible after completion of cleanup to stabilize soil. Procedures would depend on weather and soil conditions and would follow recommended rates and seed mixes provided by the landowner, the land management agency, or the NRCS. Access to the permanent easement would be restricted using gates, boulders, or other barriers to minimize unauthorized access by all-terrain vehicles, if requested by the landowner.

All existing fencing and grazing structures, such as fences, gates, irrigation ditches, cattle guards, and reservoirs would be repaired to pre-construction conditions or better upon completion of construction activities.

Pipeline markers would be provided for identification of the pipeline location for safety purposes in accordance with the requirements of 49 CFR 195.410 (Line Markers) and PHMSA Project-specific Special Condition 40 (see Appendix U), including the following:

- Pipeline markers would be installed on both sides of all highways, roads, road ROWs, railroads, and waterbody crossings and in areas where the pipeline is buried less than 48 inches;
- Pipeline markers would be made from industrial strength materials to withstand abrasion from wind and damage from cattle;
- Pipeline markers would be installed at all fences;
- Pipeline markers would be installed along the ROW to provide line-of-sight marking of the pipeline, providing it is practical to do so and consistent with the type of land use, such that it does not hinder the use of the property by the landowner. Pipeline markers would be installed at all angle points, and at intermediate points, where practical, so that from any marker, the adjacent marker in either direction would be visible;
- Consideration would be given to installing additional markers, except where they would interfere with land use (e.g., farming);
- Aerial markers showing identifying numbers would be installed at approximately 5-mile intervals; and
- At each MLV site and pump station, signs would be installed and maintained on the perimeter fence where the pipeline enters and exits the fenced area.

Markers would identify the owner of the pipeline and convey emergency contact information. Special markers providing information and guidance to aerial patrol pilots also would be installed. The markers would be maintained during operating life of the proposed Project.

2.3.2.9 Post-Construction Reclamation Monitoring and Response

The ROW would be inspected after the first growing season to determine the success of revegetation and noxious weed control. Eroded areas would be repaired and areas that were unsuccessfully re-established would be revegetated by Keystone or Keystone would compensate the landowner for reseeding. The

CMR Plan (Appendix B) provides information on revegetation and weed control procedures that Keystone would incorporate into the proposed Project.

2.3.3 Special Pipeline Construction Procedures

Special construction techniques would be used when crossing roads, highways and railroads; pipeline, utility, and other buried feature crossings; steep terrain; unstable soils; perennial waterbodies; wetlands; areas that require ripping; and residential and commercial areas. These special techniques are described below.

2.3.3.1 Road, Highway, and Railroad Crossings

Construction across paved roads, highways, and railroads would be in accordance with the requirements of the appropriate road and railroad crossing permits and approvals. In general, all major paved roads, all primary gravel roads, all highways, and all railroads would be crossed by boring beneath the road or railroad, as shown in Figure 2.3.3-1. Boring would result in minimal or no disruption to traffic at road or railroad crossings. Each boring would take 1 to 2 days for most roads and railroads, and 10 days for long crossings such as interstate or 4-lane highways.

Initially, a pit would be excavated on each side of the feature; boring equipment would be placed in the pit and a hole would be bored under the road at least equal to the diameter of the pipe and a prefabricated pipe section would be pulled through the borehole. For long crossings, sections would be welded onto the pipe string before being pulled through the borehole.

If permitted by local regulators and landowners, smaller gravel roads and driveways would likely be crossed using an open-cut method that would typically take between 1 and 2 days to complete. This would require temporary road closures and the establishment of detours for traffic. If no reasonable detour is feasible, at least one lane of traffic would be kept open in most cases. Keystone would post signs at these open-cut crossings and would implement traffic control plans to reduce traffic disturbance and protect public safety. Section 2.2.7.5 provides additional information on roadway safety, maintenance, and repair.

2.3.3.2 Pipeline, Utility, and Other Buried Feature Crossings

Keystone and its pipeline contractors would comply with USDOT regulations, utility agreements, and industry BMPs with respect to utility crossing and separation specifications. One-call notification would be made for all utility crossings to identify utilities. Similarly, private landowners would be notified of planned construction activities so that buried features, such as irrigation systems and other water lines, could be avoided or replaced. Prior to construction, each rancher with a stock watering or irrigation system or other water lines would be asked to provide the location of any waterlines in the construction area. The location of these waterlines would be documented and Keystone would lower some waterlines prior to construction. In the case of existing buried oil or gas pipelines, the owner of the facility would be asked to provide information on the locations of pipes in the construction area. Metallic pipelines would be physically located by a line locating crew prior to construction.

Unless otherwise specified in a crossing agreement, the contractor would excavate to allow installation of the proposed Project pipeline across the existing pipeline or utility with a minimum clearance of 12 inches. The clearance distance would be filled with sandbags or suitable fill material to maintain the clearance. Backfill of the crossing would be compacted in lifts to ensure continuous support of the existing utility.

For some crossings, the owner of the utility or buried feature may require the facility to be excavated and exposed by their own employees prior to the Keystone contractor getting to the location. In those cases, Keystone would work with owners to complete work to the satisfaction of the owner. Where the owner of the utility does not require pre-excavation, generally, the pipeline contractor would locate and expose the utility before excavating the trench.

2.3.3.3 Steep Terrain

Steep slopes traversed by the proposed route would be graded to reduce slope angles, thus allowing safer operation of construction equipment and reducing the degree of pipe bending required. In areas where the pipeline route crosses side slopes, cut-and-fill grading may be employed to obtain a safe working terrace. Prior to cut-and-fill grading on steep terrain, topsoil would be stripped from the ROW and stockpiled. If soil and slope conditions permit, soil from the high side of the ROW would be excavated and moved to the low side to create a safer and more level working surface. After pipeline installation, soil from the low side of the ROW would be returned to the high side and the contour of the slope would be restored to its pre-construction condition to the degree practicable.

Temporary sediment barriers, such as silt fences and straw bales, would be installed where appropriate to prevent erosion and siltation of wetlands, waterbodies, or other environmentally sensitive areas. During grading, temporary slope breakers consisting of mounded and compacted soil would be installed across the ROW. In the cleanup phase, permanent slope breakers would be installed where appropriate. Section 4.5 of the CMR Plan (Appendix B) presents additional information on the use of sediment barriers and slope breakers.

After regrading and installation of erosion control devices, seed would be applied to steep slopes and mulch consisting of hay or non-brittle straw would be placed on the ROW, or the ROW would be protected with erosion control geofabrics. Where appropriate to avoid animal entanglement, geofabric mesh size would be 2 inches or greater. Sediment barriers would be maintained across the ROW until permanent vegetation is established. Additional temporary workspaces may be required for storage of graded material and/or topsoil during construction.

2.3.3.4 Unstable Soils

Special construction techniques and environmental protection measures would be applied to areas with unstable soils, such as those within the Sand Hills region of South Dakota and Nebraska, and to areas with high potential for landslides, erosion, and mass wasting. Construction in these areas could require additional temporary workspace areas.

Topsoil piles would be protected from erosion through matting, mulching, watering, or tackifying to the extent practicable. Photodegradable matting would be placed on steep slopes or areas prone to extreme wind exposure, such as north- or west-facing slopes and ridge tops. Biodegradable pins would be used in place of metal staples to hold the matting in place.

Reseeding would be carried out using native seed mixes that are certified noxious weed-free, if possible. Land imprinting may be employed to create impressions in the soil to reduce erosion, improve moisture retention, and create micro-sites for seed germination. Keystone would work with landowners to evaluate fencing the ROW from livestock, or alternatively, to provide compensation if a pasture needs to be rested until vegetation can become established.

2.3.3.5 Waterbody Crossings

In the final design phase of the proposed Project, perennial waterbody crossings for the proposed pipeline would be assessed by qualified personnel with respect to the potential for channel aggradation or degradation and lateral channel migration. The level of assessment for each crossing would vary based on the professional judgment of the qualified design personnel. The pipeline would be installed as necessary to address any hazards identified by the assessment. The pipeline would be installed at the design crossing depth for at least 15 feet beyond the design lateral migration zone, as determined by qualified personnel. The design of the crossings also would include the specification of appropriate stabilization and restoration measures. The actual crossing method employed at a perennial stream would depend on permit conditions from USACE and other relevant regulatory agencies, as well as additional conditions that may be imposed by landowners or land managers at the crossing location. Appendices D and E provide Site Specific Waterbody Crossing Plans and Waterbody Crossing Tables, respectively. Additional information on the types of crossing methods proposed for use on the proposed Project is presented in the subsections below.

In addition to the proposed pipeline crossings of waterbodies, there would be temporary equipment bridges installed across many waterways. Prior to the start of clearing for the proposed Project pipeline along each pipeline construction spread, temporary bridges (e.g., subsoil fill over culverts, timber mats supported by flumes, railcar flatbeds, or flexi-float apparatus) would be installed across all perennial waterbodies to allow construction equipment to cross with reduced disturbance. Clearing crews would be allowed only one pass through the waterbodies prior to temporary bridge construction. All other construction equipment would be required to use the bridges.

Proposed Waterbody Crossing Methods

Waterbodies would be crossed using one of four different open-cut methods or the HDD method. These waterbody crossing methods are described below.

Open-Cut Crossing Methods

For most waterbodies to be crossed by the proposed Project, one of the open-cut methods listed below would be used:

- Non-flowing dry open-cut crossing method (for waterbodies that do not have a perceptible flow at the time of construction);
- Flowing open-cut crossing method;
- Dry-flume open-cut method; or
- Dry dam-and-pump open-cut method.

The trenching, pipeline installation, and backfilling methods used for these types of crossings would be similar to the cross-country construction methods described above.

Non-Flowing and Flowing Open-Cut Crossing Methods

The non-flowing open-cut method would be used for all waterbodies with no visible flow at the time of construction. Prior to construction, timber matting and riprap would be installed in the entire area of the crossing to minimize compaction from equipment. The pipe section would be fabricated adjacent to the stream or in a staging area, the stream would be trenched, the pipe would be lowered into the trench, and the trench would be backfilled. Detail 11 of the CMR Plan (Appendix B) is an illustration of a typical

open-cut crossing method for non-flowing waterbodies. After installation, the timber mats would be removed, the grade would be restored to pre-construction condition, topsoil would be replaced (unless saturated conditions exist), and permanent erosion control devices would be installed.

If there is flow at the time of construction, the flowing open-cut method would be used and the trench would be excavated through flowing water. Backhoes operating from one or both banks would excavate the trench within the streambed while water continues to flow through the construction work area (see Detail 12 of the CMR Plan [Appendix B]). In wider rivers, in-stream operation of equipment may be necessary. Keystone would trench through the stream, lower in a pipe that is weighted for negative buoyancy, then backfill. The need for negative buoyancy would be determined by detailed design and site-specific considerations at the time of construction. Material excavated from the trench generally would be placed at least 10 feet away from the water's edge unless stream width exceeds the reach of the excavation equipment. Sediment barriers would be installed where necessary to prevent excavated spoil from entering the water. Hard or soft trench plugs would be placed to prevent the flow of water into the upland portions of the trench. After installation, the grade would be restored to pre-construction condition, topsoil would be replaced (unless saturated conditions exist), and permanent erosion control devices would be installed.

For both crossing types, pipe segments for each crossing would be welded and positioned adjacent to the waterbody. After the trench is excavated, the pipeline segment would be carried, pushed, or pulled across the waterbody and positioned in the trench. The trench would be backfilled with native material or with imported material if required by permits.

Keystone would minimize the time of in-stream construction to reduce impacts to waterbody channel and banks. For minor waterbodies (less than 10 feet wide at the water's edge), the trenching and backfill of the crossing would typically require no more than 24 hours; intermediate waterbodies (10 to 100 feet wide) would typically require no more than 48 hours. Major waterbodies (more than 100 feet wide) would be crossed as quickly as possible. It is possible that the time required to accomplish the crossings of major waterbodies could exceed 48 hours. To the extent practicable, non-flowing open-cut crossings would be the preferred crossing method.

Dry-Flume Open-Cut Method

Keystone would use the dry-flume method on selected environmentally sensitive waterbodies where technically feasible. The dry-flume method is used for sensitive, relatively narrow waterbodies free of large rocks and bedrock at the trenchline and with a relatively straight channel across the construction ROW. The dry-flume method generally is not appropriate for wide, deep, or heavily flowing waterbodies. Use of this method involves installing dams upstream and downstream of the construction area and installing one or more pipes (flumes) that would extend along the course of the waterbody and through both dams. Streamflow would be carried through the construction area by the flume pipe(s).

Keystone would install flumes with sufficient capacity to transport the maximum flows that could be generated seasonally within the waterbody. The flumes, typically 40 to 60 feet long, would be installed before trenching and aligned to prevent impounding of water upstream of the construction area or to cause back-erosion downstream.

The upstream and downstream ends of the flumes would be incorporated into dams made of sandbags and plastic sheeting (or equivalent material). Upstream dams would be installed first and would funnel streamflow into the flumes. Downstream dams then would be constructed to prevent water from flowing back into the area to be trenched. The flumes would remain in place during pipeline installation, backfilling, and streambank restoration.

Prior to trenching, the area between the dams typically would be dewatered. Backhoes working from one or both banks, or from within the isolated waterbody bed, would excavate the trench across the waterbody and under the flume pipes. Excavated material would be stockpiled on the upland construction ROW at least 10 feet from the water's edge or in the extra workspaces. Sediment containment devices, such as silt fences and straw bales, would be installed to contain the excavated material and to minimize the potential for sediment to migrate into the waterbody.

After the trench is excavated to the proper depth, a prefabricated section of pipe would be positioned and lowered into the trench. The trench then would be backfilled with the excavated material from the stream unless otherwise specified in stream crossing permits. Prior to removing the dams and flume pipes and restoring streamflow, water that accumulated in the construction area would be pumped into a straw bale structure or similar dewatering device, and the bottom contours of the streambed and the streambanks would be restored as close as practical to pre-construction contours.

Dry Dam-and-Pump Open-Cut Method

As an alternative to the dry-flume crossing method, Keystone could use the dry dam-and-pump method on selected environmentally sensitive waterbodies where practical. The dry dam-and-pump method is similar to the dry-flume method except that pumps and hoses would be used instead of flumes to move water around the construction work area. When using this method, Keystone would initiate pumping while the dams are being installed to prevent interruption of streamflows. Where necessary to prevent scouring of the waterbody bed or adjacent banks, the downstream discharge would be directed into an energy-dissipation device or concrete weight. The pump capacity would be greater than the anticipated flow of the waterbody being crossed. As with the dry-flume method, trenching, pipe installation, and backfilling would be done while water flow is maintained for all but a short reach of the waterbody at the actual crossing location. Once backfilling is completed, the stream banks would be restored and stabilized and the pump hoses would be removed.

Horizontal Directional Drilling Method

As currently proposed, the HDD crossing method would be used at the waterbody crossings listed in Table 2.3.3-1. The HDD method could also be used to bore beneath terrestrial areas that contain special resources that require avoidance.

TABLE 2.3.3-1
Waterbodies Crossed Using the Horizontal Directional Drilling Method

Segment	Waterbody	Number of Crossings	Approximate Milepost
Steele City	Milk River	1	82.9
	Missouri River	1	89.2
	Yellowstone River	1	196.4
	Little Missouri River	1	292.1
	Cheyenne River	1	426.1
	White River	1	537.2
	Niobrara River	1	615.5
	Cedar River	1	697.3
	Loup River	1	740.7
	Platte River	1	756.3
Gulf Coast	Deep Fork	1	22.2
	North Canadian River	1	38.6
	Little River	1	70.4

TABLE 2.3.3-1 Waterbodies Crossed Using the Horizontal Directional Drilling Method			
Segment	**Waterbody**	**Number of Crossings**	**Approximate Milepost**
	Canadian River	1	74.1
	Fronterhouse Creek	1	122.6
	Clear Boggy Creek	1	127.1
	Red River	1	155.7
	Bois D'Arc Creek	1	162.0
	North Sulphur River	1	190.8
	South Sulphur River	1	201.8
	White Oak Creek	1	212.8
	Big Cypress Creek	1	228.4
	Private Lake	1	254.8
	Big Sandy Creek	1	256.9
	Sabine River	1	263.5
	East Fork of Angelina River	1	313.3
	Angelina River	1	334.2
	Neches River and Fiberboard Lake	1	368.6
	Menard Creek	1	416.3
	Pine Island Bayou	1	448.9
	Lower Neches Valley Canal Authority	1	461.8
	Lower Neches Valley Canal Authority	1	462.5
	Willow Marsh Bayou	1	469.9
	Canal	1	471.0
	Hillebrandt Bayou	1	473.8
Houston Lateral	Turkey Creek Marsh	1	17.7
	Trinity River	1	22.8
	Cedar Bayou	1	35.6
	San Jacinto River	1	43.3

Waterbodies Keystone has considered for HDD include commercially navigable waterbodies, waterbodies wider than 100 feet, waterbodies with terrain features that prohibit open crossing methods, waterbodies adjacent to features such as roads and railroads, and sensitive environmental resource areas. Additional HDD crossings could be incorporated into the proposed Project as a result of resource agency, landowner, or land manager concerns, as well as due to construction related issues.

The HDD method involves drilling a pilot hole under the waterbody and banks, then enlarging the hole through successive ream borings with progressively larger bits until the hole is large enough to accommodate a pre-welded segment of pipe. Throughout the process of drilling and enlarging the hole, a water-bentonite slurry would be circulated to lubricate the drilling tools, remove drill cuttings, and provide stability to the drilled holes. Pipe sections long enough to span the entire crossing would be staged and welded along the construction work area on the opposite side of the waterbody and then pulled through the drilled hole. The welded drill string would be hydrostatically tested for 4 hours prior to being pulled into place. Depending on the angle of approach of the pipeline alignment to the water crossing, a "false ROW" may need to be cleared on the pull back side to allow pipe placement at the appropriate angle to the waterbody. Keystone has created Site Specific Waterbody Crossing Plans (Appendix D) that describe the procedures to be used at each perennial waterbody crossed using the HDD method.

Several commenters on the draft EIS were concerned that the HDD method might damage the pipe or the protective coating of the pipe. Keystone would use industry standard procedures to ensure pipe and coating integrity are maintained during HDD installations. This includes application of an abrasion resistant overcoat to the FBE coating on the pipe joints designated for HDDs. This overcoat prevents damage to the corrosion resistant FBE coating as the pipe is pulled through the bored hole. During HDD operations, the hole that is reamed to allow the pipeline to be pulled through is much larger than the pipe diameter (approximately a 42-inch-diameter hole or larger for the 36-inch-diameter pipe). As noted above, bentonite drilling mud would be used to reduce friction and provide lubrication and buoyancy for the pipe during the pull back, assuring minimal contact with the walls of the drill hole. After installation, Keystone would conduct cathodic protection and in-line inspection surveys to determine if any damage may have resulted to the pipe coating during the construction process.

Procedures to Avoid or Minimize Impacts of Waterbody Crossings

Equipment refueling and lubricating would take place in upland areas 100 feet or more from the water. If equipment refueling and lubricating becomes necessary within 100 feet of a perennial waterbody, the SPCC Plan would be adhered to relative to the handling of fuel and other hazardous materials.

To minimize the potential for sediment runoff during clearing, sediment barriers such as silt fences and staked straw bales would be installed and maintained on drainages in the ROW and adjacent to waterbodies and within additional temporary workspace areas. Silt fences and straw bales located across the working side of the ROW would be removed during the day when vehicle traffic is present and would be replaced each night. Drivable berms may be installed across the ROW instead of silt fences or straw bales.

After pipeline installation, stream banks would be restored to preconstruction contours or to a stable configuration. Stream banks would be seeded for stabilization, and covered with mulch or covered with erosion control fabric in accordance with the CMR Plan (Appendix B) and applicable state and federal permit conditions. Stream banks would be temporarily stabilized within 24 hours of completing in-stream construction. Sediment barriers, such as silt fences, straw bales, or drivable berms, would be maintained across the ROW at all stream or other waterbody approaches until permanent vegetation becomes established. Temporary equipment bridges would be removed after construction.

2.3.3.6 Wetland Crossings

Construction across wetlands would be similar to typical conventional upland cross-country construction, with modifications to reduce the potential for effects to wetland hydrology and soil structure. The wetland crossing methods used would depend largely on the stability of the soils at the crossing location at time of construction.

Over most of the ROW, clearing of vegetation in wetlands would be limited to flush-cutting of trees and shrubs and their subsequent removal from wetland areas. Stump removal, grading, topsoil segregation, and excavation would be limited to the area immediately over the trench line. During clearing, sediment barriers, such as silt fences and staked straw bales, would be installed and maintained on slopes adjacent to saturated wetlands and within additional temporary workspace areas as necessary to reduce sediment runoff. Tall-growing vegetation would be allowed to regrow in riparian areas in the temporary ROW, but not in the permanent ROW.

In areas with unsaturated soils that are able to support construction equipment without equipment mats, construction would occur in a manner similar to conventional upland cross-country construction. Topsoil removed from the trench line would be segregated and replaced after backfilling the trench with subsoil.

In areas where wetlands overlie rocky soil, 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 could be installed using the push-pull technique. The push-pull installation process would involve stringing and welding the pipeline outside of the wetland, and excavating and backfilling the trench using a backhoe supported by equipment mats or timber riprap. Trench breakers would be installed where necessary to prevent the subsurface drainage of water from wetlands. The pipeline segment would be installed in the wetland by equipping it with floats and pushing or pulling it across the water-filled trench. After the pipeline is floated into place, the floats would be removed and the pipeline would sink into place. Most pipes installed in saturated wetlands would be coated with concrete or installed with set-on weights to provide negative buoyancy. Where topsoil has been segregated from subsoil, the subsoil would be backfilled first followed by the topsoil. Restoration of contours would be accomplished during backfilling because little or no grading would occur in wetlands.

Construction equipment working in saturated wetlands would be limited to that area essential for clearing the ROW, excavating the trench, welding and installing the pipeline, backfilling the trench, and restoring the ROW. In areas where there is no reasonable access to the ROW except through wetlands, non-essential equipment would be allowed to travel through wetlands only if the ground is firm enough or has been stabilized to avoid rutting. Additional temporary workspace areas would be required on both sides of wide saturated wetlands to stage construction, weld the pipeline, and store materials. These additional temporary workspace areas would be located in upland areas a minimum of 10 feet from the wetland edge. This distance is that a standard backhoe can reach and would avoid the need for additional equipment to transfer soil farther from the wetland.

Equipment mats, timber riprap, gravel fill, geotextile fabric, and straw mats would be removed from wetlands after backfilling except in the travel lane to allow continued, controlled access through the wetland until the completion of construction. Upon the completion of construction, these materials would be removed. Topsoil would be replaced to the original ground level leaving no crown over the trench line. Excess excavated material would be removed from the wetland and spread along the upland ROW, placed in a location as requested by a landowner, or disposed of at an existing authorized landfill.

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 at an existing authorized landfill.

If equipment refueling and lubricating becomes necessary within 100 feet of a wetland, the SPCC Plan would be adhered to relative to the handling of fuel and other hazardous materials.

2.3.3.7 Ripping

In areas where bedrock is within 84 inches (7 feet) of the surface and is expected to be dense or highly stratified, ripping could be required. Ripping would involve tearing up the rock with mechanical excavators. During ripping, Keystone would take extreme care to avoid damage to underground structures, cables, conduits, pipelines, and underground watercourses.

Keystone anticipates that blasting would not be required. If blasting is necessary, Keystone would prepare and file a blasting plan with the appropriate agencies.

2.3.3.8 Construction in Residential and Commercial Areas

Keystone would prepare site-specific construction plans to address the potential impacts of construction on residential and commercial structures near the construction ROW. Areas containing buildings within 25 feet and 500 feet of the construction ROW are listed in Table 2.3.3-2. Information on the types of structures present is provided in Section 3.9 (Land Use). Additional construction and environmental protection measures for structures near the construction ROW are described in the CMR Plan (see Appendix B).

TABLE 2.3.3-2
Structures Located Within 25 Feet and 500 Feet of the Construction ROW

Segment and State	County	Structures Within 25 Feet of Construction ROW (Number)	Structures Within 500 Feet of Construction ROW (Number)
Steele City Segment			
Montana	Phillips	0	9
	Valley	2	38
	McCone	2	21
	Dawson	3	21
	Prairie	0	3
	Fallon	2	25
South Dakota	Harding	3	19
	Butte	0	0
	Perkins	1	3
	Meade	2	22
	Pennington	0	0
	Haakon	4	26
	Jones	0	3
	Lyman	1	9
	Tripp	4	14
Nebraska	Keya Paha	2	3
	Rock	0	2
	Holt	3	11
	Garfield	0	0
	Wheeler	1	4
	Greeley	0	8
	Boone	0	0
	Nance	0	11
	Merrick	7	25
	Hamilton	1	5
	York	1	28
	Fillmore	1	22
	Saline	1	13
	Jefferson	0	18

TABLE 2.3.3-2 Structures Located Within 25 Feet and 500 Feet of the Construction ROW			
Segment and State	**County**	**Structures Within 25 Feet of Construction ROW (Number)**	**Structures Within 500 Feet of Construction ROW (Number)**
Cushing Extension			
Kansas	0	0	0
Gulf Coast Segment			
Oklahoma	Lincoln	4	91
	Creek	0	0
	Okfuskee	7	61
	Seminole	6	51
	Hughes	7	88
	Coal	1	56
	Atoka	1	50
	Bryan	2	51
Texas	Fannin	0	1
	Lamar	7	89
	Delta	6	41
	Hopkins	7	78
	Franklin	4	68
	Wood	2	140
	Upshur	7	31
	Smith	16	258
	Cherokee	1	33
	Rusk	10	44
	Nacogdoches	5	123
	Angelina	2	80
	Polk	9	112
	Liberty	4	76
	Hardin	5	15
	Jefferson	6	221
Houston Lateral (Texas)			
	Liberty	6	60
	Chambers	0	3
	Harris	4	41

2.3.4 Aboveground and Ancillary Facilities Construction Procedures

2.3.4.1 Pump Station Construction

Construction at each new pump station would begin with clearing of vegetation and removal of topsoil. After that the site would be graded as necessary to create a level working surface for the movement of construction vehicles and to prepare the area for building foundations. Foundations would be installed for the electrical equipment shelter (EES) and the pump equipment shelter. The EES would include electrical systems, communication, and control equipment. The structures to support the pumps, manifolds, pig

receiving and pig launching equipment, densitometers (where present), and associated facilities would then be erected. This would include installation of a block valve into the mainline as well as two MLV block valves: one would be installed on the suction piping of the pumps and one would be installed on the discharge piping of the pumps as required by 49 CFR 195.260.

The piping, both aboveground and below ground, would be installed and pressure tested using the methods employed for the main pipeline. After successful testing, the piping would be tied into the main pipeline. Piping installed below grade would be coated for corrosion protection as required by 49 CFR 195 Subpart H (Corrosion Control) and the applicable Project-specific PHMSA special conditions. In addition, all below-grade facilities would be protected by a cathodic protection system as required by Subpart H and the applicable Project-specific PHMSA special conditions. Pumps, controls, and safety devices would be checked and tested to ensure proper system operation and activation of safety mechanisms before being put into service. After hydrostatic testing of the below-grade equipment, the site would be graded and surfaced with gravel and a security fence would be installed around the entire perimeter of each site.

Construction activities and the storage of construction materials would be confined to each pump station site. Figures 2.2.3-1 and 2.2.3-2 are plot plans for typical pump stations.

2.3.4.2 Tank Farm Construction

The tank farm would be installed on a 74-acre site that would also include pump station 32. Wildhorse Creek extends through the site, but there would not be any construction activities in the creeks or on its banks. Portions of the site to be developed would be cleared and graded to create a level work surface for the tanks. The 350,000-barrel tanks would be welded steel tanks with external floating roofs that would be installed inside an impervious bermed area that would act as secondary containment. The piping in the tank farm area would be both above and below ground. The tanks and associated piping would be isolated electrically from the pipeline and protected by a separate cathodic protection system. The tank farm would use the electrical supply and control system of the adjacent pump station (see Figure 2.2.6-1). The tank farm would be final graded and a permanent security fence would be installed around the entire perimeter of the 74-acre site.

After successful hydrostatic testing of the tanks and associated piping and manifolds, the control system would be put into service and the tanks would be connected to the pipeline via the manifold. Each tank would have a separate water screen and fire suppression system supplied by an on-site fire water supply pond. A separate larger pond would be installed to manage storm water and mitigate any potential contamination from the site.

2.3.4.3 Mainline Valves and Delivery Sites

MLV construction would occur during mainline pipeline construction. All MLVs would be within the permanent ROW. To facilitate year-round access, the MLVs would be located as near as practicable to existing public roads. The construction sequence would consist of clearing and grading followed by trenching, valve installation, fencing, cleanup, and site restoration. If necessary, new access roads would be constructed into the fenced MLV sites. Two 10,417-barrel surge relief tanks would be installed at the end of the Gulf Coast Segment in Nederland on at a previously disturbed site with an industrial property. The area would be graded as necessary for installation of the tank foundations, and the tanks would be installed inside a bermed, impervious area that would act as secondary containment.

2.3.5 Construction Schedule, Workforce and Environmental Inspection

2.3.5.1 Schedule and Workforce

Construction of the proposed Project would begin as soon as Keystone obtains all necessary permits, approvals, and authorizations. Based on the current permitting schedule, the proposed Project is planned to be placed into service in 2013, with the actual date dependant on dates of receipt of all necessary permits, approvals, and authorizations.

As currently planned, the proposed Project would be constructed using 17 spreads (see Table 2.3.5-1), with 10 spreads used for the Steele City Segment, 6 spreads for the Gulf Coast Segment, and 1 spread for the Houston Lateral. The construction schedule may affect the final spread configuration which may result in the need for additional but shorter spreads. In any construction year, all spreads within the same segment would be constructed simultaneously.

TABLE 2.3.5-1
Pipeline Construction Spreads Associated with the Proposed Project

Spread Number	Location by Milepost (MP)[a]	Approximate Length of Construction Spread (miles)	Bases for Construction[b]
Steele City Segment			
Spread 1	MP 0 to 64	64	Hinsdale, Montana, and Glasgow, Montana
Spread 2	MP 64 to 164	100	Glasgow, Montana, and Circle, Montana
Spread 3	MP 164 to 273	109	Glendive, Montana, and Baker, Montana
Spread 4	MP 273 to 345	72	Buffalo, South Dakota
Spread 5	MP 345 to 448	104	Faith, South Dakota, and Union Center, South Dakota
Spread 6	MP 448 to 513	65	Phillip, South Dakota
Spread 7	MP 513 to 616	103	Murdo, South Dakota, and Winner, South Dakota
Spread 8	MP 616 to 679	63	Fairfax, Nebraska, Stuart, Nebraska, and O'Neill, Nebraska
Spread 9	MP 679 to 789	109	Greeley, Nebraska, and Central City, Nebraska
Spread 10	MP 789 to 852	63	York, Nebraska, Beatrice, Nebraska, and Fairbury, Nebraska
Gulf Coast Segment			
Spread 1	MP 0 to 95	95	Holdenville, Oklahoma
Spread 2	MP 95 to 185	90	Paris, Texas
Spread 3	MP 185 to 285	100	Mt. Pleasant, Texas
Spread 4	MP 285 to 371	86	Henderson, Texas, Nacogdoches, Texas, Crockett, Texas, Jacksonville, Texas
Spread 5	MP 371 to 435	64	Lufkin, Texas

TABLE 2.3.5-1 Pipeline Construction Spreads Associated with the Proposed Project			
Spread Number	**Location by Milepost (MP)[a]**	**Approximate Length of Construction Spread (miles)**	**Bases for Construction[b]**
Spread 6	MP 435 to 484	49	Sour Lake, Texas
Houston Lateral			
Spread 7	MP 0 to 49	49	Sour Lake, Texas, Liberty, Texas, Dayton, Texas

[a] Mileposting for each segment of the proposed Project starts at 0.0 at the northernmost point of the segment and increases in the direction of oil flow.
[b] Spreads 1 to 8 may use construction camps for construction bases.

Cross-country pipeline construction would typically proceed at a pace of approximately 20 constructed miles per calendar month per spread. Construction would occur in the following approximate sequence:

- 2 to 3 weeks (14 to 21 calendar days) of work on the ROW prior to the start of production welding. Activities would include clearing, grading, stringing, and ditching.
- Production welding at an average rate of 1.25 miles of pipe welded per working day over a 6-day work week (over 7 calendar days), resulting in completion of an average of about 7.5 miles of pipeline per week.
- 7 weeks (49 calendar days) of additional work after completion of production welding. Activities would include nondestructive testing, field joint coating, pipe installation, tie-ins, backfill, ROW clean-up, hydrostatic testing, reseeding, and other ROW reclamation work.

Those time periods and rates of progress were used as the basis for determining the duration of construction activities on the ROW presented in Table 2.3.5-2 for various spread lengths. Construction in areas with greater congestion or higher population, in industrial areas, or in areas requiring other special construction procedures could result in a slower rate of progress.

TABLE 2.3.5-2 Cross-Country Construction Times Based on Estimates of Schedule				
Spread Length	**Pre-welding**	**Welding Time**	**Post-welding and Clean-up**	**Total Duration**
80 miles	21 days	75 days	49 days	145 days (21 weeks)
90 miles	21 days	84 days	49 days	154 days (22 weeks)
100 miles	21 days	94 days	49 days	164 days (24 weeks)
120 miles	21 days	112 days	49 days	182 days (26 weeks)

In addition, approximately 1 month would be required for contractor mobilization before the work is started and 1 month would be required for contractor demobilization after the work is finished. In general 500 to 600 construction and inspection personnel would be required for each spread, except for the Houston Lateral, which would require approximately 250 workers. Each spread would require about 6 to 9 months to complete, including mobilization and demobilization.

Tank farm construction would involve approximately 30 to 40 construction personnel over a period of 15 to 18 months concurrent with mainline construction. Construction of new pump stations would require 20 to 30 additional workers at each site. Construction of all pump stations would be completed in 18 to 24 months.

A peak workforce of approximately 5,000 to 6,000 personnel would be required to construct the entire Project and would be spread along the nearly 1,384-mile-long route. All workers would be trained and certified for their specific field of work (e.g., welders would be qualified as required by 49 CFR 195.222 and the Project-specific PHMSA special condition 18). Construction personnel would consist of Keystone employees, contractor employees, construction inspection staff and environmental inspection staff. Keystone would attempt to hire construction staff from the local population through its construction contractors and subcontractors. Assuming that qualified personnel are available, approximately 10 to 15 percent (50 to 100 people per spread) could be hired from the local work force for each spread, although this may not be possible in rural areas.

2.3.5.2 Environmental Inspection

Keystone would use Environmental Inspectors on each construction spread. The Environmental Inspectors would review the Project activities daily for compliance with state, federal, and local regulatory requirements and would have the authority to stop specific tasks as approved by the Chief Inspector. The inspectors would also be able to order corrective action in the event that construction activities violate the provisions of the CMR Plan, landowner requirements, or any applicable permit requirements.

2.4 OPERATIONS AND MAINTENANCE

The proposed Project would be operated, maintained, monitored, and inspected in accordance with 49 CFR 194 and 195 and other applicable federal and state regulations. In addition to the requirements of 49 CFR 195, Keystone has agreed to incorporate 57 PHMSA Project-specific special conditions that address proposed Project operation, inspection, and monitoring (see Appendix U). The operational requirements of 49 CFR 195 and the PHMSA Project-specific Special Conditions related to operation of the proposed Project (Appendix U) would be included in the proposed Project operations, maintenance, and emergencies manual that would be required by 49 CFR 195.402, and they would also be incorporated into Keystone's existing Operations Control Center (OCC) in Calgary, Canada.

The remainder of this section addresses normal operation and routine maintenance (Section 2.4.1) and abnormal operations (Section 2.4.2).

2.4.1 Normal Operations and Routine Maintenance

Keystone would prepare the manuals and written procedures for conducting normal operations, maintenance, inspection, and monitoring activities as required by the PHMSA regulations, particularly as required by 49 CFR 195.402 and in the applicable PHMSA Project-specific special conditions (see Appendix U). This would include development and implementation of an annual Pipeline Maintenance Program (PMP) to ensure the integrity of the pipeline. The PMP would include valve maintenance, periodic inline inspections, and cathodic protection readings to ensure facilities are reliable and in service. Data collected in each year of the program would be fed back into the decision-making process for the development of the following year's program.

The Project OCC would be manned by experienced and highly trained personnel 24 hours per day, every day of the year in Calgary. In addition, a fully redundant backup OCC would be constructed, operated,

and maintained, also in Canada. Primary and backup communications systems would provide real-time information from the pump stations to field personnel. The control center would have highly sophisticated pipeline monitoring systems including a leak detection system capable of identifying abnormal conditions and initiating visual and audible alarms. Automatic shut down systems would be initiated if a valve starts to shut and all pumps upstream would turn off automatically. All other pipeline situations would require human response.

The proposed Project would include a supervisory control and data acquisition (SCADA) system to constantly monitor the pipeline system. The SCADA system would be installed and operated in accordance with the requirements of 49 CFR 195 and PHMSA Project-specific special conditions 24 through 31 (see Appendix U). SCADA facilities would be located in the OCC and along the pipeline system, and all pump stations and delivery facilities would have communication software that sends data back to the OCC. The pipeline SCADA system would allow the OCC to remotely read intermediate MLV positions, tank levels, and delivery flow and total volume. The OCC personnel would also be able to start and stop pump stations and open and close MLVs. SCADA systems are further discussed in Sections 2.4.2.1 and 3.13.4.5.

The pipeline ROW would be inspected via aerial and ground surveillance to provide prompt identification of possible encroachments or nearby construction activities, ROW erosion, exposed pipe, or any other conditions that could result in damage to the pipeline. The aerial surveillance of the pipeline ROW would be carried out at least 26 times per year at intervals not to exceed 3 weeks as required by 49 CFR 195.412. Landowners would be encouraged to report any pipeline integrity concerns to Keystone or to PHMSA. Intermediate MLVs and MLVs at pump stations would also be inspected. As required by 49 CFR 195.420(b), they would be inspected at intervals not to exceed 7.5 months but at least twice each calendar year.

In comments on the supplemental draft EIS, EPA expressed concern that relying solely on pressure drops and aerial surveys to detect leaks may result in smaller leaks going undetected for some time, resulting in potentially large spill volumes. In light of those concerns, EPA requested consideration of additional measures to reduce the risks of undetected leaks. A PHMSA report (2007) addressed the state of leak detection technology and its applicability to pipeline leak detection. External leak detection technology addressed included liquid sensing cables, fiber optic cables, vapor sensing, and acoustic emissions. In that report PHMSA concludes that while external leak detection systems have proven results for underground storage tank systems there are limitations to their applicability to pipeline systems and they are better suited to shorter pipeline segments. Their performance even in limited application is affected by soil conditions, depth to water table, sensor spacing, and leak rate. While it is acknowledged that some external detection methods are more sensitive to small leaks than the SCADA computational approach, the stability and robustness of the systems are highly variable and the costs are extremely high. Therefore, long-term reliability is not assured and the efficacy of these systems for a 1,384-mile long pipeline is questionable. It may be possible, however, to incorporate external leak detection methods along discrete segments of pipeline where particularly sensitive resources may exist. For example, in the development of the original Keystone pipeline, specific analysis was commissioned at the request of the North Dakota Public Utilities Commission to examine the possibility of using external leak detection in the area of the Fordville aquifer. That analysis was performed by Accufacts, Inc., a widely recognized expert on pipeline safety that has authored a report for the Pipeline Safety Trust on leak detection technology. The Accufacts, Inc. report (2007) on the Fordville aquifer noted:

> "Such real-time external systems should be considered as complementing CPM [computational pipeline monitoring] leak detection in those few ultra-sensitive areas where the environment can quickly spread low rate releases. These systems may be justified in a few areas that can have

high consequences because of the number of sensitive receptors (i.e., people) or the potential to critically impact the environment."

The author of the report defined "ultra-sensitive" areas as those areas where low rate or seepage pipeline release could "reach a sensitive area, have serious consequences, and could not be actively remediated." (Accufacts, Inc. 2007).

DOS in consultation with PHMSA and EPA determined that Keystone should commission an engineering analysis by an independent consultant that would review the proposed Project risk assessment and proposed valve placement. The engineering analysis would, at a minimum, assess the advisability of additional valves and/or the deployment of external leak detection systems in areas of particularly sensitive environmental resources. The scope of the analysis and the selection of the independent consultant would be approved by DOS in consultation with PHMSA and EPA. After completion and review of the engineering analysis, DOS with concurrence from PHMSA and EPA would determine the need for any additional mitigation measures.

Relative to additional ground patrols, Keystone responded to a data request from DOS concerning the feasibility of more ground-level inspections. Keystone responded that based on land owner concerns, additional ground-level inspections are not feasible due to potential disruption of normal land use activities (e.g., farming, animal grazing). PHMSA technical staff indicated that such concerns about landowner acceptance of more frequent ground-level inspections were consistent with their experience with managing pipelines in the region. Although widespread use of ground-level inspections may not be warranted, in the start-up year it is not uncommon for pipelines to experience a higher frequency of spills from valves, fittings, and seals. Such incidences are often related to improper installation, or defects in materials. In light of this fact, DOS in consultation with PHMSA and EPA determined that if the proposed Project were permitted, it would be advisable for the applicant to conduct inspections of all intermediate valves, and unmanned pump stations during the first year of operation to facilitate identification of small leaks or potential failures in fittings and seals. In the normal course of maintenance beyond the first year of operation, Keystone would have crews at various places along the proposed Project corridor (e.g., maintenance inspections of cathodic protection system rectifiers, MLVs, and pump stations). These crews would be trained and experienced in the identification of crude oil releases. It should be noted that the 14 leaks from fittings and seals that have occurred to date on the existing Keystone Oil Pipeline were identified from the SCADA leak detection system and landowner reports.

PHMSA regulations at 49 CFR 195.450 and Special Condition 14 require that pipeline operators identify areas along the proposed pipeline corridor that would be considered High Consequence Areas (HCAs). While some of these areas need to be defined through sophisticated risk modeling, in general they are specific locales where an accidental release from a hazardous liquid pipeline could produce significant adverse consequences as described in 49 CFR 195.450. HCAs include navigable waterways, high population areas, and unusually sensitive areas. Keystone would need to identify the HCAs along the proposed route. Population changes along the route would be monitored throughout pipeline operation and any additional HCAs identified as necessary. Keystone would conduct a pipeline integrity management program in HCAs as required by 49 CFR 195.452 (Pipeline Integrity Management in High Consequence Areas).

All maintenance work would be performed in accordance with PHMSA requirements, the applicable PHMSA Special Conditions, and the stipulations in environmental permits issued for the proposed Project. Woody vegetation along the permanent easement would be cleared periodically in order to maintain accessibility for pipeline integrity surveys. Mechanical mowing or cutting would be carried out from time to time as needed along the permanent easement for normal vegetation maintenance.

Cultivated crops would be allowed to grow in the permanent easement, but trees would be removed from the permanent ROW in all areas. In areas constructed using the HDD method, trees would be cleared as required on a site specific basis.

Permanent erosion control devices would be monitored to identify any areas requiring repair. The remainder of the ROW would be monitored to identify areas where additional erosion control devices would be necessary to prevent future degradation. The ROW would be monitored to identify any areas where soil productivity has been degraded as a result of pipeline construction. In these areas, reclamation measures would be implemented to rectify the problems.

Operation and maintenance of the pipeline system would typically be accomplished by Keystone personnel. The permanent operational pipeline workforce would comprise about 20 U.S. employees strategically located along the length of the pipeline in the U.S.

2.4.2 Abnormal Operations

Keystone would implement Abnormal Operating Procedures in accordance with 49 CFR Section 195.402(d). Those procedures would be developed and documented in a manual as required by 49 CFR 195.402. The manual would include procedures to provide safety when operating design limits have been exceeded. That would include investigating and correcting the cause of unintended closure of valves or shutdowns, increases or decreases in pressure or flow rate outside normal operating limits, loss of communications, operation of any safety device, and any other malfunction of a component, deviation from normal operation, or personnel error which could cause a hazard to persons or property. Procedures would also include checking variations from normal operation after abnormal operation has ended at sufficient critical locations in the system to accomplish the following:

- Assure continued integrity and safe operation;
- Identify variations from normal operation of pressure and flow equipment and controls;
- Notify responsible operator personnel when notice of an abnormal operation is received;
- Review periodically the response of operator personnel to determine the effectiveness of the procedures controlling abnormal operation; and
- Take corrective action where deficiencies are found.

The operations manager on duty would be responsible for executing abnormal operating procedures in the event of any unusual situation.

2.4.2.1 Pipeline Integrity, SCADA, and Leak Detection

The following overlapping and redundant integrity systems and measures would be incorporated into the proposed Project:

- Quality Assurance (QA) program for pipe manufacture and pipe coating;
- FBE coating;
- Cathodic protection;
- Non-destructive testing of 100 percent of the girth welds;
- Hydrostatic testing;
- Periodic internal cleaning and high-resolution in-line inspection;

- Depth of cover exceeding federal standards;
- Periodic aerial surveillance;
- Public awareness program;
- SCADA system; and
- An OCC with complete redundant backup, providing monitoring of the pipeline every 5 seconds, 24 hours per day, every day of the year.

SCADA facilities would be used to remotely monitor and control the pipeline system. This would include a redundant fully functional backup system available for service at all times. Automatic features would be installed as integral components within the SCADA system to ensure operation within prescribed pressure limits. Additional automatic features would be installed at the local pump station level and would provide pipeline pressure protection in the event communications with the SCADA host are interrupted.

Software associated with the SCADA monitoring system and volumetric balancing would be used to assist in leak detection during pipeline operations. If pressure indications change, the pipeline controller would immediately evaluate the situation. If a leak is suspected, the ERP would be initiated, as described in Section 2.4.2.2. If there is a pipeline segment 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 a leak) is identified and repaired. In the case of a reportable leak, OHMSA approval would be required to resume operation of the affected segment.

A number of complementary leak detection methods and systems would be available within the OCC and would be linked to the SCADA system. Remote monitoring would consist primarily of monitoring pressure and flow data received from pump stations and valve sites that would be fed back to the OCC by the SCADA system. Software based volume balance systems would monitor receipt and delivery volumes and would detect leaks down to approximately 5 percent of pipeline flow rate. Computational Pipeline Monitoring or model-based leak detection systems would separate the pipeline system into smaller segments and would monitor each segment on a mass balance basis. These systems would detect leaks down to a level of approximately 1.5 to 2 percent of the pipeline flow rate. Computer-based, non-real time, accumulated gain/loss volume trending would assist in identifying low rate or seepage releases below the 1.5 to 2 percent by volume detection thresholds. If any of the software-based leak detection methods indicates that a predetermined loss threshold has been exceeded, an alarm would be sent through SCADA and the Controller would take corrective action. The SCADA system would continuously poll all data on the pipeline at an interval of approximately 5 seconds

If an accidental release were to occur, the operator would shut down operating pumping units and close the isolation valves. Once shutdown activities are initiated, it would take approximately 9 minutes to complete the emergency shut-down procedure (shut down operating pumping units) and an additional 3 minutes to close the isolation valves.

In addition to the SCADA and complimentary leak detection systems, direct observation methods, including aerial patrols, ground patrols and public and landowner awareness programs, would be implemented to encourage and facilitate the reporting of suspected leaks and events that could suggest a threat to the integrity of the pipeline.

Several commenters suggested that external mechanical leak detection systems should be considered. In response, DOS requested information from Keystone regarding the feasibility of installing mechanical external leak detection systems along the proposed Project corridor. Keystone considers that the presently

available technology for external leak detection is not practicable for use along a 1,384 mile pipeline. Additionally, a PHMSA report (2007) addressed the state of leak detection technology and its applicability to pipeline leak detection. External leak detection technology addressed included liquid sensing cables, fiber optic cables, vapor sensing, and acoustic emissions. In that report PHMSA concludes that while external leak detection systems have proven results for underground storage tank systems there are limitations to their applicability to pipeline systems and they are better suited to shorter pipeline segments. Their performance even in limited application is affected by soil conditions, depth to water table, sensor spacing, and leak rate. While it is acknowledged that some external detection methods are more sensitive to small leaks than the SCADA computational approach, the costs are extremely high and the stability and robustness of the systems are highly variable. Therefore, long-term reliability is not assured and the efficacy of these systems for a 1,384-mile long pipeline is questionable.

2.4.2.2 Emergency Response Procedures

There were many comments on the draft EIS concerning the ERP, including suggestions that a supplemental draft EIS be issued to include a more complete ERP and allow for public review of that plan. Those issues are addressed below along with additional information on the proposed Project ERP. Section 3.13.1.1 provides additional information on the regulations associated with an ERP.

PHMSA requires that pipeline operators prepare and abide by more than one written emergency plan for responding to emergencies on their systems.

First, 49 CFR 194, which resulted from the CWA as amended by the Oil Pollution Act of 1990 (OPA 90) and as implemented by Executive Order 12777, requires that pipeline operators have response plans that ensure resources are available to remove, mitigate, or prevent a discharge from an oil pipeline that could cause substantial or significant harm to the environment, including a worst case discharge. As stated in 49 CFR 194.7(a), a pipeline operator "may not handle, store, or transport oil unless the operator has submitted a response plan meeting requirements of this part," and as stated in 49 CFR 194.7(b), operators must also operate onshore pipeline facilities in accordance with the approved response plan. In addition, 49 CFR 194.107 requires that the response plan include "procedures and a list of resources for responding, to the maximum extent practicable, to a worst case discharge, and to a substantial threat of such a discharge." Keystone would submit a Pipeline Spill Response Plan (PSRP) to PHMSA prior to the initiation of proposed Project operations in accordance with the requirements of 49 CFR 194. The PSRP would describe how spills would be responded to in the event of a release from the proposed Project resulting from any cause (e.g., corrosion, third-party damage, natural hazards, materials defects, hydraulic surge). The plan would address the maximum spill scenario and the procedures that would be in place to deal with the maximum spill. The PSRP requires PHMSA review and approval; however, there is a 2-year grace period under which operations can proceed, thus allowing PHMSA time to review the document in light of as-built Project conditions and to require incorporation of any needed changes to ensure system safety prior to PHMSA approval.

As required by 49 CFR 195.40, Keystone would also prepare and follow a manual of written procedures for conducting normal operations and maintenance activities and handling abnormal operations and emergencies. This manual would be reviewed by PHMSA at intervals not exceeding 15 months, but at least once each calendar year, and appropriate changes would be made as necessary to ensure that the manual is effective. This manual would be prepared before initial operations of the proposed Project and appropriate sections would be kept at locations where operations and maintenance activities are conducted. The emergency section of this operations and maintenance plan would be prepared by Keystone in a separate document that Keystone refers to as the Emergency Response Plan (ERP).

While EPA has authority under the CWA and OPA 90 with respect to regulation of onshore non-transportation related facilities and EPA requires the development and submittal of a Facility Response Plan (FRP) for any such facility, it appears that none of the facilities or activities associated with the proposed Project would be non-transportation-related equipment or activities subject to the EPA regulatory authority, as previously noted in Section 2.3.

Keystone would therefore be required to develop a PSRP for review and approval by PHMSA and an ERP for review by PHMSA for the proposed Project. PHMSA may request EPA and U.S. Coast Guard consultation on the response elements of the PSRP. Keystone would share on its own volition portions of the PSRP with community emergency responders along the proposed pipeline corridor to ensure an appropriate level of collaborative emergency response planning. However, based on a PHMSA advisory bulletin issued on November 3, 2010, Keystone would be required to share the ERP with local emergency responders in relevant jurisdictions along the proposed Project corridor.

While the draft PSRP and the draft ERP for the proposed Project are not yet available, Keystone prepared similar plans for the existing Keystone Oil Pipeline Project. These plans for the proposed Project would have the same general approach as those plans but would have many specific differences, such as the names and contact information for responders along the proposed Project route. The publically available portion of the Keystone Oil Pipeline System ERP is included as Appendix C to the EIS (some of the ERP and the PSRP are considered confidential by PHMSA and the U.S. Department of Homeland Security). As described in Section 3.13.1.1, the existing Keystone Oil Pipeline Project documents would be used as templates for the plans for the proposed Project. Project-specific information would be inserted into the plans as it becomes available. In addition, response equipment would be procured and strategically positioned along the route, staff would be trained in spill response and the Incident Command System, and emergency services and public officials would be educated on all aspects of the proposed Project and what their roles would be if an accidental release were to occur. If a release were to occur, Keystone and its contractors would be responsible for recovery and cleanup. PHMSA would require a certification from Keystone that necessary emergency response equipment is available in the event of an unplanned spill prior to providing Keystone with an authorization to begin operating the proposed Project.

The specific locations of Keystone's emergency responders and equipment would be determined upon conclusion of the pipeline detailed design and described in the PSRP and ERP. Company emergency responders would be placed consistent with industry practice and with applicable regulations, including 49 CFR Parts 194 and 195. The response time to transfer additional resources to a potential leak site would follow an escalating tier system, with initial emergency responders capable of reaching all locations within 6 hours in the event of a spill. Typically, emergency responders would be based in closer proximity to the following areas:

- Commercially navigable waterways and other water crossings;
- Populated and urbanized areas; and
- Unusually sensitive areas, including drinking water locations, ecological, historical, and archaeological resources.

Types of emergency response equipment situated along the pipeline route would include pick-up trucks, one-ton trucks and vans; vacuum trucks; work and safety boats; containment boom; skimmers; pumps, hoses, fittings and valves; generators and extension cords; air compressors; floodlights; communications equipment including cell phones, two way radios and satellite phones; containment tanks and rubber bladders; expendable supplies including absorbent booms and pads; assorted hand and power tools including shovels, manure forks, sledge hammers, rakes, hand saws, wire cutters, cable cutters, bolt cutters, pliers and chain saws; ropes, chains, screw anchors, clevis pins and other boom connection

devices; personnel protective equipment (PPE) including rubber gloves, chest and hip waders and airborne contaminant detection equipment; and wind socks, signage, air horns, flashlights, megaphones and fluorescent safety vests. Emergency response equipment would be maintained and tested in accordance with manufacturers recommendations.

Additional equipment including helicopters, fixed wing aircraft, all-terrain vehicles, snowmobiles, backhoes, dump trucks, watercraft, bull dozers, and front-end loaders could also be accessed depending upon site-specific circumstances. Other types, numbers and locations of equipment would be determined upon conclusion of the pipeline detailed design and the completion of the PSRP and the ERP for the proposed Project.

Several federal regulations define the notification requirements and response actions in the case of an accidental release, including the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), the CWA, and OPA 90.

If an accidental release occurs, Keystone would implement several procedures to mitigate damage, including a line shut down. Other procedures would include immediate dispatch of a first responder to verify the release and secure the site. Simultaneously, an Incident Command System would be implemented and internal and external notifications would take place. The National Response Center (NRC) would be notified if the release meets one of the prescribed criteria. Keystone and the NRC would also notify other regional and local emergency response agencies as quickly as possible. All of this information would be included in the ERP for the proposed Project.

Many commenters expressed concern that an accidental release of heavy crude oil from the proposed Project would require unique methods to clean up the oil. As described in Section 3.13.5.3, heavy WCSB crude oil is similar to heavy crude oil currently being processed in refineries in the Houston area and elsewhere in the U.S. Therefore, the methods used to cleanup crude oil accidentally released from the proposed Project would be similar to methods used elsewhere in the U.S. to address a heavy crude oil release.

Some commenters also suggested that the EIS should provide alternatives to the ERP and evaluate those alternatives as a part of the NEPA environmental review process. Keystone's ERP would be prepared to meet the PHMSA requirements in 49 CFR 195.40 and would reflect actual field conditions. Additionally, Keystone's PSRP would be prepared to meet the requirements of 49 CFR 194. Due to the range of possible accidental release scenarios (including timing, size, location, season, weather conditions, and many other variables), it is not possible to assess the impact of each and every response and cleanup scenario. As a result, NEPA environmental reviews do not assess the relative effectiveness of specific procedures and PSRP and ERP alternatives.

In the event of a suspected release or if a release is reported to the OCC, after verification there would be an emergency pipeline shutdown. This would involve stopping all operating pumping units at all pump stations. The on-call response designate would respond to and verify an incident. Once the OCC notifies the individual and an assessment of the probability and risk is established, field personnel could elect to dispatch other resources as soon as practical. Response efforts would first be directed to preventing or limiting any further contamination of the waterway, once any concerns with respect to health and safety of the responders have been addressed.

Many commenters expressed concern about abnormal pipeline operations that could result in an explosion. A review of PHMSA data related to pipeline accidents indicates that most "petroleum or hydrocarbon pipeline explosions" occur in pipelines that are transporting highly flammable, highly volatile hydrocarbons such as natural gas, liquid propane gas (LPG), propane, gasoline, naphtha, or

similar products. Typically, any of those materials accidentally released from the pipeline form a flammable vapor cloud that can explode when it reaches a certain concentration level in air, particularly in a confined space. In rare cases diesel, gas condensate, kerosene, or similarly-refined liquid hydrocarbon ignite and burn explosively if the vapors are exposed to a fire or similar high temperature heat source, usually a fire caused by some other accident.

As noted in Section 3.13, PHMSA data for onshore oil and hazardous material pipelines indicate that only 6 of 2,706 (0.2 percent) of incidents that occurred from 1990 through 2009 were attributed to "fire/explosion as a primary cause." A search of the internet for reports of crude oil pipeline explosions suggests that (1) there are very few if any explosions in crude oil pipeline operation that were the result of a failure of the pipeline as a primary cause, and (2) the very few that have occurred are attributable to explosions in ancillary facilities or errors in operations unassociated with crude oil transportation. For example, the recent explosion and fire in the crude oil pipeline/storage tank area in Dalian, China occurred as a result of an improper desulfurization operation; the primary cause was not the transport of crude oil in the pipeline.

The proposed Project would use pump stations that are powered by electricity; as a result, there would not be natural gas or other petroleum products at the facility that could ignite explosively. An accidental crude oil spill from the pipeline or at a pump station would likely result in some hydrocarbon vapors, but they would not be in confined spaces and therefore would be unlikely to explode.

A fire associated with a release from a crude oil pipeline is relatively rare. In the event of a fire, local emergency responders would execute the roles listed above and more specifically in the PSRP and the ERP, and firefighters would take actions to prevent the crude oil fire from spreading to residential areas.

2.4.2.3 Remediation

Corrective remedial actions would be dictated by federal, state, and local regulations and enforced by the USEPA, OPS, and appropriate state and/or local agencies. Required remedial actions may be large or small, dependent upon a number or factors including state-mandated remedial cleanup levels, potential effects to sensitive receptors, the volume and extent of the contamination, whether or not there is a violation of water quality standards, and the magnitude of adverse impacts caused by remedial activities. A large remediation action may include the excavation and removal of contaminated soil, for example, or could involve allowing the contaminated soil to recover through natural attenuation or environmental fate processes such as evaporation and biodegradation. Additional information on remediation is presented in Section 3.13 (Reliability and Safety).

If there is an accidental release from the proposed Project, Keystone would implement the remedial measures necessary to meet the federal, state, and local standards that are designed to ensure protection of human health and environmental quality.

2.5 CONNECTED ACTIONS

DOS identified four actions that are separate from the proposed Project that are not part of the Presidential Permit application submitted by Keystone and has determined that they are connected actions for the purposes of this NEPA review as defined by 40 CFR 1508.25(a)1. The four connected actions are described in the following subsections:

- Electrical distribution lines and substations associated with the proposed pump stations (Section 2.5.1);
- The Big Bend to Witten 230-kilovolt (kV) electrical transmission line (Section 2.5.2);

- The Bakken Marketlink Project (Section 2.5.3); and
- The Cushing Marketlink Project (Section 2.5.4).

Preliminary information on the design, construction, and operation of these projects is presented below. Although the permit applications for these projects would be reviewed and acted on by other agencies, the potential impacts of these projects have been analyzed in the EIS based on currently available information and are addressed within each resource assessed in Section 3.0. However, in some cases only limited information was available on the design, construction, and operation of the projects. The reviews of permit applications by other agencies would include more detailed environmental reviews of the connected actions.

DOS is not aware of any planned refinery upgrades or new refinery construction that would directly result from implementation of the proposed Project.

2.5.1 Electrical Distribution Lines and Substations

2.5.1.1 Overview

Electrical power for the proposed Project would be obtained from local power providers. These power providers would construct the necessary substations and transformers and would either use existing service lines or construct new service lines to deliver electrical power to the specified point of use. The electrical power providers would be responsible for obtaining the necessary permits, approvals, or authorizations from federal, state, and local governments, except in those instances in Montana where new service lines less than 10 miles in length would be constructed. Under Montana regulations, these distribution lines would be considered "associated facilities" connected with the overall pipeline system. Where this occurs, the review and approval of the new lines would occur as part of the review and approval of Keystone's MFSA application for a Certificate of Compliance.

New electrical transmission power lines with voltages of 69 kV or greater would be constructed to service the pump stations and the Cushing tank farm. Table 2.5.1-1 lists the electrical power supply requirements for the pump stations and Figures 2.1-1 through 2.1-6 depict the locations of the distribution lines.

TABLE 2.5.1-1
Electrical Power Supply Requirements for Pump Stations

Pump Station No.	Milepost[a]	Transformer Size (Megavolt Amperes)	Kilovolts of Electricity	Estimated Electrical Line Length (miles)	Power Provider
Steele City Segment					
Montana					
PS-09	1.2	20/27/33	115	61.8[b]	Big Flat Electric Cooperative
PS-10	49.5	20/27/33	115	49.1[c]	NorVal Electric Cooperative
PS-11	98.4	20/27/33	230	0.2	Norval Electric Cooperative
PS-12	149.1	20/27/33	115	3.2	McCone Electric Cooperative
PS-13	199.6	20/27/33	115	15.2	Tongue River Electric Cooperative
PS-14	237.1	20/27/33	115	6.3	Montana-Dakota Utilities Company
South Dakota					
PS-15	285.7	20/27/33	115	24.5	Grand Electric Cooperative

TABLE 2.5.1-1 Electrical Power Supply Requirements for Pump Stations					
Pump Station No.	**Milepost[a]**	**Transformer Size (Megavolt Amperes)**	**Kilovolts of Electricity**	**Estimated Electrical Line Length (miles)**	**Power Provider**
PS-16	333.7	20/27/33	115	40.1	Grand Electric Cooperative
PS-17	387.4	20/27/33	115	10.9	Grand Electric Cooperative
PS-18	440.2	20/27/33	115	25.9	West Central Electric Cooperative
PS-19	496.1	20/27/33	115	20.4	West Central Electric Cooperative
PS-20	546.7	20/27/33	115	17.2	Rosebud Electric Cooperative
PS-21	591.9	20/27/33	115	20.1	Rosebud Electric Cooperative
Nebraska					
PS-22	642.4	20/27/33	115	24.0	Niobrara Valley Electric
PS-23	694.5	20/27/33	115	36.0	Loup Valleys Rural PPD
PS-24	751.7	20/27/33	115	9.0	Southern Power District
PS-25	800.5	20/27/33	69	0.1	Perennial PPD
PS-26	851.3	20/27/33	115	0.5	Norris PPD
Keystone Cushing Extension					
Kansas					
PS-27	49.0*	20/27/33	115	4.6	Clay Center Public Utility
PS-29	144.5*	20/27/33	115	8.9	Westar Energy
Gulf Coast Segment					
Oklahoma					
PS-32	0.0	17/22/28	138	6.9	Oklahoma Gas and Electric Company
PS-33	49.0	20/27/33	138	0.3	Canadian Valley Electric Cooperative/PSO
PS-34	95.4	20/27/33	138	5.5	People's Electric Cooperative/PSO
PS-35	147.4	20/27/33	138	0.0	Southeastern Electric Cooperative
Texas					
PS-36	194.5	20/27/33	138	7.4	Lamar Electric Cooperative
PS-37	238.6	20/27/33	138	0.1	Wood County Electric Cooperative
PS-38	284.0	20/27/33	138	0.6	Cherokee County Electric Cooperative
PS-39	338.1	20/27/33	138	9.1	Cherokee County Electric Cooperative
PS-40	380.5	20/27/33	138	0.3	Sam Houston Electric Cooperative
PS-41	435.2	20/27/33	240	0.4	Sam Houston Electric Cooperative

[a] Mileposting for each segment of the proposed Project start starts at 0.0 at the northernmost point of each segment and increases in the direction of oil flow.
[b] Extends across approximately 32 miles of BLM land.
[c] Extends across approximately 4.8 miles of BLM land.

Most of the proposed new electrical distribution lines to service pump stations would be 115-kV lines strung a single-pole and/or H-frame wood poles. The poles would typically be about 60 to 80 feet high with wire span distances of from about 250 to 400 feet.

Each pump station would have a substation integrated into the general pump station layout. In some cases (pump stations 36 and 41), Keystone would share pump station land with the local utility for the installation of their substation. Sharing of substation land at the pump station would allow the utility to provide a second transformer to provide service to the rural customers in the area.

The exact location of each substation cannot be identified at this time because the electrical supply lines would access pump stations from different alignments. Each substation footprint would be approximately 1 to 1.5 acres and is included in the total land size of each pump station. The actual size of a substation would be dictated by the specific design and size requirements of the local power supply company, the capacity of the power supply lines connected to each specific pump station, and the associated equipment. Figures 2.2.3-1 and 2.2.3-2 provide typical layouts for substations and pump stations.

Other electrical power requirements, such as power for MLVs, would be supplied from distribution service drops from adjacent distribution power lines with voltage below 69 kV. Each distribution service drop would typically be less than 200 feet long, and would require the installation of one or two poles and a transformer. The electric utility would typically install a pole-mounted transformer within 200 feet of the valve site location. However, in some cases the electric utility would install the transformer on an existing pole which would be more than 200 feet from the valve site. The decision on where the transformer pole would be located would generally be based on the most economical installation. For example, MLVs north of the Milk River in Montana would be supplied from transformers on poles along small lines that currently supply power to irrigation systems. Upon completion of the new service drops, the electrical power providers would restore the work area as required, in accordance with local permits.

Preliminary routing for new electrical distribution lines was established in consultation with each utility company. Where practicable, these preliminary routes were along existing county roads, section lines, or field edges, to minimize interference with adjacent agricultural lands. The routes are subject to change as pumping station supply requirements are further reviewed with power providers and in some cases, as a result of environmental review of the routes by the agencies with jurisdiction.

Electromagnetic induction can occur from power lines, which can cause noise, radio, and television interference. This potential interference would be mitigated by siting the power line away from residences (500 feet minimum, if possible) and by routing the power line to reduce parallel metallic interferences.

Power line Radio Frequency Interference (RFI) is usually caused by sparking (arcs) which is typically caused by loose hardware. The power provider design uses spring washers to keep hardware tight to minimize arcing and conductor supports use specialized clamps to keep the conductor and support clamps firmly connected to further reduce the potential for arcing. Defective lightning arrestors could also contribute to RFI. The power providers would use a static conductor at the top of the pole to mitigate lightning-caused flashovers. Lightning arrestors would be limited to the stations where major equipment is located.

The radio communication systems at the proposed Project facilities would operate on specific frequencies licensed by the Federal Communications Commission (FCC). This would reduce the risk of any interference with radio, television, or any other communication system in the area.

Several Montana residents expressed concern about the source of energy for the electricity provided by utility companies to power the pump stations and mainline valves in Montana. Some Montana residents also asked about the potential for residential rates to increase.

Electric cooperatives (coops) in Montana obtain electricity from a variety of sources, including coal-fired power plants, hydroelectric plants, and at wind farms in the area. Many coops have service agreements

with Western Area Power Administration (Western), Bonneville Power Administration (BPA), PPL Montana, and Basin Electric Power Cooperative, some of which likely results in electrical energy being transported to Montana from many distant and varied sources. This energy flows primarily across transmission owned by Western and NorthWestern Energy to delivery points within the cooperative systems. The energy is delivered to the members/consumers through distribution lines, substations, and other related infrastructure.

As a result, it is not possible to identify the specific facilities or the specific sources of energy that would be used to generate the electricity that would be used at the pump stations and mainline valves in Montana. Each of the coops involved has agreed to provide the necessary power and would likely request the additional power from their current providers. Any increase in power generation at the plants providing that power would have to be conducted in compliance with environmental regulations. If additional nonrenewable resources are needed to generate the additional, the provision of those resources would also have to be accomplished consistent with regulatory requirements.

2.5.1.2 Construction Procedures

All distribution lines and substations would be installed and operated by local power providers. This work would include ROW acquisition, ROW clearing, construction, site restoration, cleanup, and obtaining any necessary permits, approvals, or authorizations from federal, state, and local governments. The proposed distribution lines would require a 100-foot-wide construction ROW and an 80-foot-wide permanent ROW. Each power provider would develop detailed power line construction procedures to address site specific conditions. In general, construction of the electrical distribution lines would involve the following:

- ROW Acquisition/Easements: The electric power provider would obtain any necessary easements.
- ROW Clearing: Limited clearing would be required along existing roads in native and improved grasslands and croplands. Either tree trimming or tree removal would be conducted to provide adequate clearance between the conductors and underlying vegetation.
- Power Line Construction: Power line poles and associated structures would be delivered on flatbed trucks. Radial arm diggers would typically be used to excavate the required holes. Poles would be either wood or steel and would be directly embedded into the excavated holes using a mobile crane or picker truck where appropriate. Anchors may be required at angles and dead ends.
- Stringing: After the power line poles are in place, conductors (wires) would be strung between them. Pulling or reeling areas would be needed for installation of the conductor wires which would be attached to the poles using porcelain or fiberglass insulators.
- Restoration: After completion of distribution line construction, the disturbed areas would be restored. All litter and other remaining materials would be removed from the construction areas and disposed of in accordance with regulatory requirements. Preconstruction contours would be restored as closely as possible and reseeding would follow landowner requirements.

2.5.2 Big Bend to Witten 230-kV Transmission Line

2.5.2.1 Overview

After receipt of information on the power requirements for the proposed pump stations in South Dakota, the Western Area Power Administration (Western) conducted a joint system engineering study to determine system reliability under the proposed loads at full Project electrical energy consumption. The joint system engineering studies determined that a 230-kV transmission line originating at the Fort Thompson/Big Bend area and extending south to the existing Witten Substation would be required to

support voltage requirements for pump stations 20 and 21 in the Witten area when the proposed Project is operating at maximum capacity.

To address this requirement, Western proposes to convert the existing Big Bend-Fort Thompson No. 2, 230-kV transmission line turning structure, located on the south side of the dam, to a double-circuit structure. Western would then construct approximately 2.1 miles of new double-circuit transmission line south to a new substation, tentatively named Big Bend Substation, which would also be constructed by Western. The new switchyard/substation would be a 3-breaker ring bus configuration, expandable to a breaker and a half configuration. The new 2.1-mile-long double-circuit 230-kV transmission line would be owned, constructed, and operated by Western. After construction, the ownership of the Big Bend Substation would be transferred to the Basin Electric Power Cooperative (BEPC) which would then own and operate it. Western would complete design of the new substation and double-circuit transmission line in 2012 and would begin construction in the spring of 2013.

BEPC proposes to construct and operate a new 230-kV transmission line from the proposed new Big Bend Substation to the existing Witten Substation owned by Rosebud Electric Cooperative. The new Big Bend Substation and approximately 70-mile-long Big Bend to Witten 230-kV transmission line would assure future electric power requirements at pump stations 20 and 21 would be met without degrading system reliability when the proposed Project is operating at maximum capacity. The new Big Bend to Witten 230-kV transmission line would be built, owned, and operated by BEPC. The Witten Substation would also need to be expanded to accommodate the new switching equipment associated with the Big Bend to Witten 230-kV transmission line.

A SCADA system would interconnect the substations. Hardwire system communications would utilize fiber optics within the Optical Overhead Ground Wire between the substations. Microwave communications equipment would be installed for SCADA redundancy and to facilitate voice and data communications by field personnel. Additional communications facilities may also be needed. The proposed substation and transmission line projects would be in Lyman and Tripp counties in south-central South Dakota. The Big Bend Dam is in Lyman County, close to the city of Fort Thompson. The Witten Substation is in Tripp County near the city of Witten.

Western and BEPC identified two alternative corridors for the proposed Big Bend to Witten transmission line project, and there are nine route options within each corridor between the Big Bend and Witten substations. Initially, a 6-mile-wide corridor, Alternative Corridor A, was identified between an existing substation on the transmission grid and a proposed new substation at Big Bend. BEPC and Western then identified five preliminary alternative routes for the transmission line within Corridor A (see Figure 2.5.2-1); the five alternatives are the Western Alternative and Alternatives BEPC-A through BEPC-D. BEPC, Western, and the Lower Brule Reservation also identified Alternative Corridor B, which is also a 6-mile-wide corridor. This corridor follows a similar path from the existing Witten Substation to the proposed Big Bend Substation but with deviations in the southeast near Winner and the northeast near Reliance. Corridor B was further developed into four preliminary alternative routings for the transmission line (see Figure 2.5.2-1); the four alternatives are Alternatives BEPC-E through BEPC-H. The alternatives within both Corridor A and Corridor B cross the Lower Brule Reservation and connect with an existing transmission line near the Big Bend Dam.

BEPC is pursuing financing for the transmission line project from the Rural Utilities Service (RUS). Under the RUS regulations for implementation of NEPA, an Environmental Assessment (EA) must be prepared to assess potential environmental impacts of the proposed action. BEPC has indicated that RUS would serve as the lead agency for NEPA, and Western would serve as a cooperating agency. In early 2011, BEPC informed DOS that it would contract with an environmental consultant to prepare a Macro Corridor Study and an Alternative Evaluation Study prior to initiating scoping for the EA. Based on the

current schedule, BEPC anticipates that all project permits and approvals would be in place by the end of 2012, and construction could begin in early 2013, assuming that there would be a need for the transmission line at the end of the construction period.

2.5.2.2 Construction Procedures

The proposed transmission line would be constructed within a 125-foot-wide ROW. The specific structure type has not been determined, but would be either single- or two-pole structures.

All substation and switchyard work, including the placement of concrete foundations, erecting support structures, construction of control buildings, and the installation of electrical equipment would take place within secured areas. The proposed substation site at Big Bend and the expansion area at Witten would be cleared and leveled. Aggregate would be spread throughout undeveloped areas within the substation sites. Topsoil would be segregated from underlying soils and redistributed on disturbed areas outside the substation security fences. Soil erosion would be minimized during construction using BMPs. Substation components would be hauled to the site on local highways and roads and off-loaded using cranes and similar equipment. Concrete and aggregate from local sources would be hauled to the site by truck.

The impacts of construction and operation of the transmission line alternatives are generally addressed in Section 3.0 the EIS. However, DOS, Western, and the other cooperating agencies do not have sufficient design and construction information to establish an agency-preferred alternative for the proposed transmission line project. An additional and separate NEPA environmental review of the alternatives to the proposed transmission line will be conducted after the alternative routes are further defined. The design and environmental review of the proposed 230-kV transmission line are on a different schedule than the pipeline system itself. Regional transmission system reliability concerns are not associated with the initial operation of the proposed pipeline pump stations, but only for future operation at the maximum throughput volume of 830,000 bpd.

2.5.3 Bakken Marketlink Project

Keystone Marketlink, LLC (Keystone Marketlink), a wholly owned subsidiary of TransCanada Pipelines Limited, is proposing to construct and operate the Bakken Marketlink Project. That project would include construction of facilities to provide crude oil transportation service from near Baker, Montana to Cushing, Oklahoma via the proposed Project and from Cushing to delivery points at Nederland and Moore Junction (east of Houston), Texas, via the proposed Project. After a successful Open Season, Keystone Marketlink obtained commitments for transport of approximately 65,000 bpd of crude oil through the Bakken Marketlink Project. The project could deliver up to 100,000 bpd to the proposed Project depending on ultimate shipper commitments. Baker is near many existing and proposed crude oil gathering systems, pipelines, and crude oil storage tanks, and the Bakken Marketlink Project would provide direct access to PADD II and PADD III markets. The announced target in-service date for the Bakken Marketlink Project is the first quarter of 2013.

The project would consist of piping, booster pumps, meter manifolds and two tank terminals; one terminal would be near Plevna and Baker, Montana, and the second would be at the proposed Cushing tank farm. The Bakken Marketlink facilities would include two, 250,000-barrel tanks that would be used to accumulate crude from connecting third-party pipelines and terminals and a 100,000-barrel tank that would be use for operational purposes (see Figure 2.5.3-1). The facilities would also include a proposed 5 mile long pipeline that would initiate at an existing Montana tank farm facility in Township 7N Range 58E Section 4. The project is still in the preliminary stages of evaluating the options regarding the routing of this proposed pipeline.

The Bakken Marketlink Project facilities at the Cushing tank farm would include two, 250,000-barrel tanks that would be used for batch deliveries from the Baker facilities (see Figure 2.5.3-2). Figure 2.5.3-3 is a plot plan for the tank farm near Cushing that includes the Bakken Marketlink tanks, the Cushing Marketlink tanks, and two portions of the proposed Keystone XL Project (the Cushing tank farm and pump station 32).

Crude oil in the Bakken Marketlink storage tanks at the Cushing tank farm would either be pumped to the Keystone XL pipeline for delivery to PADD III or delivered to other pipelines and tank farms near Cushing. The Cushing tank farm would be near many pipelines, storage facilities, and refineries since Cushing is a major crude oil marketing, refining, and pipeline hub that provides shippers with many delivery options and market access. Delivery of the crude oil to Nederland would be as described in this EIS for the proposed Project.

The Bakken Marketlink Project would provide the first direct link between the prolific Bakken crude oil producing region and key U.S. markets near Cushing and the in the Gulf Coast area, which is the largest refining market in North America.

2.5.4 Cushing Marketlink Project

Keystone Marketlink also plans to construct and operate the Cushing Marketlink Project. The Cushing Marketlink Project would include construction and operation of facilities within the boundaries of the proposed Keystone XL Cushing tank farm. From there, crude oil would be transported by the proposed Keystone XL Project to delivery points at Nederland and Moore Junction (east of Houston), Texas. After a successful Open Season in late 2010, Keystone Marketlink obtained sufficient commitments to proceed with the project, which will have the ability to deliver approximately 150,000 barrels of crude oil per day to the proposed Keystone Xl pipeline. On August 15, 2011, Keystone Marketlink initiated a second binding Open Season to obtain additional firm commitments from interested parties for the planned project.

The Cushing Marketlink facilities at the proposed Cushing tank farm site would be adjacent to the Cushing Oil Terminal, a key pipeline transportation and crude oil storage hub with over 50 million barrels of storage capacity. As a result, the Cushing Marketlink Project would be near many pipelines and storage facilities that could ship crude oil to the Cushing Marketlink facilities. The Cushing Marketlink Project is expected to alleviate current pipeline constraints from the Cushing area and provide shippers with a new transportation option from the Cushing market to the U.S. Gulf Coast. The announced target in-service date for the Cushing Marketlink Project is the first quarter of 2013.

The Cushing Marketlink Project would include construction and operation of receipt custody transfer metering systems and batch accumulation tankage consisting of two, 350,000 barrel tanks, with one tank dedicated for light sweet crude. The tanks would be located within the proposed Project's Cushing tank farm property, which also would house pump station 32 of the proposed Project (see Figure 2.5.3-3) and the storage tanks for the planned Bakken Marketlink storage tanks (described in Section 2.5.3). The tanks would accumulate batches from existing third-party pipelines and terminals for transportation to the U.S. Gulf Coast on the proposed Project. Delivery of the crude oil to delivery points in Texas would be as described in this EIS for the proposed Project.

2.6 FUTURE PLANS AND PROJECT DECOMMISSIONING

2.6.1 Future Plans

2.6.1.1 Proposed Project

As proposed, the Project would initially have a nominal transport capacity of approximately 700,000 bpd of crude oil. By increasing the capacity of the pump stations in the future, Keystone could transport up to 830,000 bpd of crude oil through the pipeline. Should Keystone decide to increase pumping capacity to 8300,000 bpd at a later date, the necessary pump station upgrades would be implemented in accordance with then-applicable permits, approvals, codes, and regulations.

2.6.1.2 Other Related Facilities

After the draft EIS was issued, plans were announced for future development of two projects that could transport crude oil to the proposed Project from producers in North Dakota and Montana and from producers in the Cushing, Oklahoma area. Those planned projects are the Bakken Marketlink Project and the Cushing Marketlink Project. Those projects are considered connected actions for the purpose of the EIS and are described using all available information in Sections 2.5.3 and 2.5.4.

2.6.2 Decommissioning of the Proposed Project

Many commenters requested that the EIS provide additional information about the anticipated life of the proposed Project and a description of how the proposed Project would be decommissioned at the end of its useful life. This section has been revised in response to those requests.

2.6.2.1 Project Life

Keystone used a design life of 50 years to develop the engineering standards for the proposed Project. However, with implementation of the pipeline integrity management plan, the 57 Project-specific Special Conditions developed by PHMSA (see Appendix U), and an operations and maintenance program as described above, Keystone anticipates that the life of the proposed Project would be much longer. Many other pipeline companies have safely extended the duration of pipeline systems by replacing sections of pipe after finding anomalies and by replacing or upgrading equipment and facilities at pump stations. As a result, it is not possible to identify a specific number of years that the proposed Project may be in service.

2.6.2.2 Decommissioning

PHMSA has requirements that apply to the decommissioning of crude oil pipelines in 49 CFR Section 195.402(c)(10) and in 49 CFR 195.59 and 195.402. These regulations require that for hazardous liquid pipelines, the procedural manuals for operations, maintenance, and emergencies must include procedures for abandonment, including safe disconnection from an operating pipeline system, purging of combustibles, and sealing abandoned facilities left in place to minimize safety and environmental hazards (49 CFR 195.402). Further, these regulations require that for each abandoned onshore pipeline facility that crosses over, under, or through a commercially navigable waterway, the last operator of that facility must file a report upon abandonment of that facility. It further states that ". . . operators must submit the date of abandonment, diameter, method of abandonment, and certification that, to the best of the operator's knowledge, all of the reasonably available information requested was provided and, to the best of the operator's knowledge, the abandonment was completed in accordance with applicable laws . . . The information in the report must contain all reasonably available information related to the facility,

including information in the possession of a third party. The report must contain the location, size, date, method of abandonment, and a certification that the facility has been abandoned in accordance with all applicable laws."

TransCanada (the parent company of Keystone) would adopt operating procedures to address these requirements for the proposed Project as they have for previous pipeline projects including the existing Keystone Pipeline. TransCanada typically does not abandon large diameter pipelines but generally idles or deactivates pipe as market conditions dictate. This allows a dormant pipeline to be reactivated or converted to another purpose in the future. When a pipeline or a segment of a pipeline is idled or deactivated, the pipe generally is purged of its contents, filed with an inert gas, and left in place with warning signage intact. Cathodic protection would likely be left functional as would other integrity measures such as periodic inspections under the integrity management plan.

The proposed Project pipeline would traverse approximately 44.6 miles of federal land under the management and jurisdiction of the BLM. The majority of the federal land is in the state of Montana. The portion of the proposed Project that would cross BLM-administered land would be subject to the pipeline decommissioning and abandonment requirements stipulated in the BLM right-of-way grants and permanent easement permits. These requirements are:

> "1. Boundary adjustments in Oil and Gas [user entry (lease or unit number)] shall automatically amend this right-of-way to include that portion of the facility no longer contained within the above described [user entry]. In the event an automatic amendment to this right-of way grant, the prior on-lease/unit conditions of approval of this facility will not be affected even though they would now apply to facilities outside of the lease/unit as a result of a boundary adjustment. Rental fees, if appropriate shall be recalculated based on the conditions of this grant and the regulations in effect at the time of an automatic amendment.
>
> 2. Prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a predetermination conference. This conference will be held to review the termination provisions of the grant.
>
> 3. [user entry, period of time] prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a joint inspection of the right-of-way. This inspection will be held to agree to an acceptable termination (and rehabilitation) plan. This plan shall include, but is not limited to, removal of facilities, drainage structures, or surface material, recontouring, topsoiling, or seeding. The authorized officer must approve the plan in writing prior to the holder's commencement of any termination activities."

The right-of-way (ROW) grant on federal lands under the management of BLM for the proposed Project would have a maximum term not to exceed of 30 years. For the proposed Project to extend beyond 30 years, the approved ROW grant would require a renewal authorization-certification decision by BLM. This decision would be considered a federal action subject to the requirements of NEPA. As a result, a decision to renew-certify the ROW grant to allow the proposed Project lifetime to remain in place beyond 30 years would be accompanied by an environmental analysis similar to the analysis required for the initial ROW grant. This process occurred on the Alyeska Oil Pipeline in Alaska. The initial ROW grant for federal lands crossed by that project extended from 1974 to 2004, and BLM and the State of Alaska through the Joint Pipeline Office required an EIS addressing continued operation of that project prior to certifying a new ROW grant with a maximum term of 30 years. It is likely that the future environmental assessment that would be required by BLM to renew-certify the approved ROW agreement grant for the proposed Project would include a review of the environmental effects of the continued operation of the entire proposed Project, since operations on non-federal lands would be connected actions to the renewal-

certification action on federal lands. Therefore, any operations or decommissioning that would occur beyond the initial 30-year ROW grant would be subject to extensive federal environmental review.

In Texas, Section 111.025 of the Texas Natural Resources Code would apply to decommissioning of the proposed Project. The provisions of the code are:

> "(a) No common carrier may abandon any of its connections or lines except under authority of a permit granted by the commission or with written consent of the owner or duly authorized agent of the wells to which connections are made.
>
> (b) Before granting a permit to abandon any connection, the commission shall issue proper notice and hold a hearing as provided by law."

While there are no state regulations applicable to pipeline decommissioning in Montana, South Dakota, Nebraska, or Oklahoma, environmental specifications developed by Montana DEQ that would address reclamation of areas disturbed during abandonment would be a condition of the grant of a certificate under MFSA.

Decommissioning activities would have to be conducted consistent with all applicable regulatory requirements that are in place at the time of decommissioning. Since regulations at the federal, state, and local level change over time, it would be highly speculative to project what regulatory framework would apply to Project decommissioning at the end of the useful life of the proposed Project more than 50 years in the future.

Prior to decommissioning the Project, Keystone would identify the decommissioning procedures it would use along each portion of the route, identify the regulations it would be required to comply with, and submit applications for the appropriate environmental permits. At that point, Keystone and the issuing agencies would address the environmental impacts of implementation of the decommissioning procedures and identify the mitigation measures required to avoid or minimize impacts.

It is likely that after decommissioning there would be fewer land use restrictions than during operation of the proposed Project since either the ROW would no longer have strict encroachment limitations for protection of the purged pipeline, or the pipeline may have been removed and there would no longer be limitations of use of the former ROW.

As noted above, PHMSA regulations require that hazardous liquids pipelines be purged of combustibles prior to decommissioning. Therefore the potential for the release of contaminants from the decommissioned pipeline would be negligible.

2.7 REFERENCES

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3.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the proposed Keystone XL Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts would generally occur during construction, with the resources returning to pre-construction conditions almost immediately afterward. Short-term impacts would 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 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. The proposed Project would incorporate measures to reduce environmental impacts as described in Sections 3.1 through 3.14, and Keystone would implement mitigation measures that may be necessary to further reduce impacts as required or recommended by resource agencies.

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;
- Keystone would, if the Presidential Permit is granted, incorporate into the proposed Project and into its manual for operations, maintenance, and emergencies that is required by 49 CFR 195.402, the set of 57 Project-specific Special Conditions developed by PHMSA;
- Keystone would incorporate the mitigation measures required in permits issued by environmental permitting agencies into the construction, operation and maintenance of the proposed Project;
- Keystone would construct, operate, and maintain the proposed Project as described in this EIS; and
- Keystone would implement the measures designed to avoid or reduce impacts described in its application for a Presidential Permit and supplemental filings with DOS, the Construction, Mitigation, and Reclamation (CMR) Plan presented in Appendix B, and the construction methods described in Appendix H.

Sections 3.1 through 3.12 address the impacts of the proposed Project during construction and normal operation. Section 3.13 provides information on potential impacts due to spills of petroleum products or other hazardous materials from the proposed Project during construction and spills of crude oil during operation of the proposed Project.

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3.1 GEOLOGY

3.1.1 Physiography and Surface and Bedrock Geology

3.1.1.1 Environmental Setting

Proposed Project Route

Montana

The proposed route enters Morgan, Montana along Montana's northern border with Saskatchewan and traverses the state along a south-southeasterly corridor that extends to the southeast corner of the state. The route traverses the Great Plains physiographic province (Fenneman 1928) and is characterized by badlands, buttes, mesas, and includes the Black Hills mountain range. The route crosses the Glaciated Missouri Plateau and the Unglaciated Missouri Plateau. The glaciated section to the north is covered in glacial deposits and represents the furthest southern extent of the last ice age. In the vicinity of Circle, Montana, the proposed pipeline enters the Unglaciated Missouri Plateau. Surface elevations average around 3,000 feet above mean sea level (amsl). The route would cross six EPA Level IV Ecoregions, each with a distinct physiography (Omernik 2009). Regional physiographic characteristics are presented in detail within Montana in Table 3.1.1-1.

Surficial geological materials are composed of Quaternary alluvium, colluvium, and glacial till that consist of sand, gravel, and clay. Bedrock consists of Tertiary (Fort Union Formation) and Late Cretaceous-aged rocks (Hell Creek/Fox Hills Formation, Bearpaw Formation/Pierre Shale, Judith River Formation, and Claggett Shale). The Fort Union Formation (approximately 138 miles crossed between MP 105 and MP 286) consists primarily of sandstone, siltstone, mudstone, carbonaceous shale, and lignite. The proposed route crosses the Ludlow, Tongue River, Lebo, and Tullock members of this Formation. The Tongue River and Tullock members also contain thin coal beds. The Hell Creek/Fox Hills Formation (approximately 56 miles crossed between MP 91 and MP 116; and between MP 245 and MP 273) forms badland topography and consists of shale, mudstone, and lenticular coal beds. The Bearpaw/Pierre Shale (approximately 43 miles crossed between MP 31 and MP 90) consists of bentonitic mudstone and shale, the Judith River Formation (approximately 16 miles crossed between MP 1 and MP 45) consists of sandstone, siltstone, mudstone, shale, and coal, while the Claggett Shale (MP 39 to MP 41) consists of shale and siltstone with beds of bentonite. Geology beneath the Steele City Segment is presented in Figure 3.1.1-1.

South Dakota

The proposed route enters South Dakota in the northwestern corner of the state. The route continues in a generally straight fashion in a southeastern direction south of Pierre in the southwest quarter of the state, exiting South Dakota in southeast Tripp County. The proposed route is located in the Unglaciated Missouri Plateau in the Great Plains physiographic province. Surface elevations range from 3,000 feet amsl in northwest South Dakota to 1,800 feet amsl in the White River Valley. The route would cross eight EPA Level IV Ecoregions, each with a distinct physiography (Bryce et al. 1996). Regional physiographic characteristics are presented in detail within South Dakota in Table 3.1.1-2.

Surficial geological materials are composed of Quaternary alluvium, colluvium, alluvial terraces, and aeolian deposits. The majority of bedrock in South Dakota consist of Upper Cretaceous rocks (Hell Creek/Fox Hills Formation, Pierre Shale), while Tertiary-aged (Ogallala Group and Ludlow Member of the Fort Union Formation) are present beneath the southern portion of the proposed route in South

Dakota. The Hell Creek/Fox Hills Formation (MP 285 to MP 418) forms badland topography and consists of shale, mudstone, and lenticular coal beds. The Pierre Shale occurs sporadically through the route in South Dakota and consists of bentonitic mudstone and shale. The Ogallala Group (MP 521 to 593) consists of well to poorly consolidated sandstone and conglomerate with occasional bentonite layers. The Ludlow Member of the Fort Union Formation (approximately 3 miles crossed between MP 283 and 376) consists primarily of sandstone, siltstone, mudstone, carbonaceous shale and lignite. Geology beneath the Steele City Segment is presented in Figure 3.1.1-1.

Several major structural features would be crossed by the proposed pipeline route in South Dakota. The Williston Basin covers northeast Montana, the majority of North Dakota, northwest South Dakota, and extends into Canada (Peterson and MacCary 1987). Regionally, the Williston Basin is a structural basin that contains approximately 15,000 feet of sedimentary bedrock. South of the Williston Basin, the Sioux Arch is a buried ridge that extends east to west from Minnesota through southeast South Dakota (Gries 1996). South of the White River, the proposed route would cross into the Salina Basin, a sedimentary basin that underlies southern South Dakota and the majority of eastern Nebraska.

Nebraska

The proposed route enters Nebraska in northern Keya Paha County and continues in a southeastern direction across the state. The pipeline route in Nebraska joins the Cushing Extension pipeline route in Steele City in southeastern Jefferson County. The majority of the proposed route in Nebraska lies in the High Plains portion of the Great Plains Physiographic Province. In northern Nebraska, the Unglaciated Missouri Plateau underlies the pipeline route, while the southern portion of the route lies in the Plains Border Region. Surface elevations range from 2,200 feet amsl in Northern Nebraska to 1,400 at the Kansas state line. The route would cross nine EPA Level IV Ecoregions, each with a distinct physiographic (Chapman et al. 2001). Regional physiographic characteristics are presented in detail within Nebraska in Table 3.1.1-3.

The majority of the state is covered by Quaternary deposits along with glacial till, loess, and the Sand Hills. Glacial till is present in southeast Nebraska, south of the Loup River to the Kansas state line. Loess is present from the town of Greeley to the Loup River. Between Stuart and Greeley, the proposed route would cross the eastern extent of the Sand Hills. The Sand Hills are composed mainly of well-sorted sands that are present in dunes and sand sheets and are stabilized by existing vegetation.

The underlying bedrock consists of Tertiary-aged Ogallala Group (approximately 135 miles crossed between MP 597 and MP 745) and Cretaceous sedimentary rocks (Pierre Shale, Niobrara Formation, Carlisle Shale, Greenhorn Limestone and Graneros Shale, and Dakota Group). The Niobrara Formation (approximately 28 miles crossed between MP 738 and MP 777), Carlisle Shale (approximately 34 miles crossed between MP 759 and MP 819), and Greenhorn Limestone and Graneros Shale (approximately 14 miles crossed between MP 797 to MP 823) contain varying amounts of limestone which potentially contain karst formations, causing surface subsidence. The Pierre Shale (MP 599 to MP 605 and MP 614 to MP 617) is exposed in Northern Nebraska and is composed of fissile clay shale, claystone, shaly sandstone, and sandy shale. This formation is prone to slumping and is especially weak where layers of volcanic ash are present. The Dakota Group (approximately 33 miles crossed between MP 798 to MP 851) consists of sandstone and shale. Geology beneath the Steele City Segment is presented in Figure 3.1.1-1.

Kansas

In Kansas, two new pump stations would be constructed along the Cushing Extension of the previously permitted Keystone pipeline (ENTRIX 2008). These pump stations (Pump Station 27 and Pump Station

29) are located in Clay and Butler counties at Cushing Extension MP 49.7 and MP 144.6, respectively. These pump stations are located in the Flint Hills Ecoregion and contain outcrops of Permian sedimentary rocks. Elevations in this area range from 1,150 to 1,400 feet amsl. Surficial materials in the vicinity of the Clay County pump station include thick deposits of loess (greater than 30 feet) (Frye and Leonard 1952). In the vicinity of the Butler County pump station, surficial deposits consist of alluvium, colluvium, and cherty gravels in upland areas (KGS 1999). Karst is not present in either of these locations (Davies et al. 1984).

Oklahoma

In Oklahoma, the proposed Gulf Coast Segment pipeline route connects to the southern terminus of the Cushing Extension of the previously permitted Keystone pipeline (ENTRIX 2008). The segment begins at the border between Payne and Lincoln counties and continues in a south-southeastern direction, where the proposed route enters Texas in southeast Bryan County. The proposed pipeline segment in Oklahoma is present in the Central Lowland physiographic province beginning in Cushing to northern Atoka County, where the Gulf Coastal Plains physiographic province begins and continues into Texas. Surface elevations range from 900 feet amsl in central Oklahoma to 450 at the Texas state line. The route would cross six EPA Level IV Ecoregions, each with a distinct physiography (Woods et al. 2005). Regional physiographic characteristics are presented in detail within Oklahoma in Table 3.1.1-4.

Upper Paleozoic (Permian) rock lies beneath the proposed route beginning at Cushing to MP 121. These rocks consist of alternating beds of sandstone, shale, and occasional limestone formed under both marine and non-marine conditions. In southeast Oklahoma, non-marine river and flood plain sands, silts, and clays are present (Johnson 1996). Beneath these surface sediments lie Cretaceous sedimentary rocks. Geology beneath the Gulf Coast Segment is presented in Figure 3.1.1-2.

Texas

The proposed Gulf Coast Segment pipeline route enters Texas in northeast Fannin County and continues in a south to southeast direction. In Liberty County, at the junction with the Houston Lateral, the Gulf Coast Segment continues in an east to southeast direction and terminates in Port Arthur. The Houston Lateral begins in Liberty County and continues in a west to southwest direction, ending in central Harris County. The proposed pipeline route is present in the Gulf Coastal Plains physiographical province, which includes the Coastal Prairies, Interior Coastal Plains, and the Blackland Prairies subprovinces. Surface elevations range from 450 feet amsl in northern Texas to near seal level at the conclusion of the proposed pipeline route. The route would cross 11 EPA Level IV Ecoregions, each with a distinct physiography (Griffith et al. 2004). Regional physiographic characteristics are presented in detail within Texas in Table 3.1.1-5 (Gulf Coast Segment) and Table 3.1.1-6 (Houston Lateral).

In northern Texas along the proposed route, the Blackland Prairie is characterized by black, sandy, calcareous soil originating from the underlying glauconitic sands and clays. The topography is undulating with few bedrock outcroppings (Wermund 2008). The Interior Coastal Plains subprovince is characterized by low-relief bands of eroded shale and sandy ridges. Eocene sandstone bedrock is present where exposed by rivers (Spearing 1991). The Coastal Prairies subprovince in southern Texas is underlain by young deltaic sands, silts, and clays that have eroded to a relatively flat landscape and are present as a grassland (Wermund 2008). Geology beneath the Gulf Coast Segment and Houston Lateral is presented in Figure 3.1.1-2.

TABLE 3.1.1-1
Physiographic Characteristics of Ecoregions Crossed in Montana by the Proposed Project – Steele City Segment

MP Range	Physiographic Description	Elevation Range (ft AMSL)	Local Relief (ft)	Surface Geology	Bedrock Geology
Northwestern Glaciated Plains – Cherry Patch Moraines[a]					
0 - 8	Glaciated, undulating to strongly sloping topography containing bouldery knolls, gravelly ridges, kettle lakes, and wetlands. Prominent end moraine.	2,300 - 3,600	50 - 375	Quaternary drift.	Cretaceous Claggett Formation, Judith River Formation.
Northwestern Glaciated Plains – Glaciated Northern Grasslands[a]					
8 - 90, 109 - 116	Glaciated, dissected, rolling to strongly rolling drift plains.	1,990 - 4,000	50 - 600	Quaternary glacial drift deposits.	Cretaceous Bearpaw Shale, Judith River Formation, Claggett Formation, Hell Creek Formation, Fox Hills Formation, Tongue River Member of Fort Union Formation, and Flaxville Gravels.
Northwestern Great Plains – River Breaks[a]					
90 - 104, 192 - 198	Unglaciated, rugged, very highly dissected terrain adjacent to rivers.	1,900 - 3,450	200 - 500	Erodible, clayey soils; gravelly soils on slopes.	Tongue River, Lebo, Slope, and Tullock members of the Tertiary Fort Union Formation, Hell Creek Formation, Fox Hills Sandstone, and Pierre Shale.
Northwestern Great Plains – Central Grassland[a]					
104 - 109, 116 - 133, 198 - 282	Unglaciated, dissected rolling plains containing buttes. Areas of gravel, clinker, and salt flats. Streams are intermittent.	2,200 - 5,000	125 - 600	Quaternary terrace deposits and alluvium along channels.	Tertiary Fort Union, Hell Creek Formation, Pierre Shale.
Northwestern Great Plains – Missouri Plateau[a]					
133 - 192	Unglaciated rolling hills and gravel covered benches. Some areas are subject to wind erosion.	2,000 - 3,550	50 - 500	Quaternary terrace deposits.	Tongue River and Slope members of the Tertiary Fort Union Formation, Tertiary Flaxville Gravels.
Northwestern Great Plains – Sagebrush Steppe[a]					
282 - 282.4	Unglaciated, level to rolling plains. Landscape contains buttes, badlands, scoria mounds and salt pans.	2,300 - 4,200	50 - 600	Quaternary alluvium along channels. Upper Cretaceous sandstone and shale.	Colorado Group, Pierre Shale, Hell Creek Formation, Fox Hills Sandstone, and Fort Union Formation.

[a] EPA Level III-IV Ecoregion name.
Source: Omernik 2009.

TABLE 3.1.1-2
Physiographic Characteristics of Ecoregions Crossed in South Dakota by the Proposed Project – Steele City Segment

MP Range	Physiographic Description	Elevation Range (ft AMSL)	Local Relief (ft)	Surface Geology	Bedrock Geology
Northwestern Great Plains – Sagebrush Steppe[a]					
282 - 337	Unglaciated, level to rolling plains. Landscape contains buttes, badlands, scoria mounds and salt pans.	3,000 - 3,475	50 - 350	Quaternary alluvium along channels. Upper Cretaceous sandstone and shale.	Hell Creek Formation and Pierre Shale.
Northwestern Great Plains – Moreau Prairie[a]					
337 - 387	Unglaciated, level to rolling plains. Landscape contains buttes, badlands, and salt pans.	2,100 - 3,200	120 - 250	Upper Cretaceous sandstone and shale.	Hell Creek Formation.
Northwestern Great Plains – Missouri Plateau[a]					
387 - 417	Unglaciated, moderately dissected level to rolling plains. Contains sandstone buttes.	1,750 - 3,300	50 - 500	Tertiary sandstone, shale, and coal.	Ludlow member of Fort Union Formation, Fox Hills Formation.
Northwestern Great Plains – Subhumid Pierre Shale Plains[a]					
430 - 478, 487 - 493, 494 - 535, 546 - 570	Unglaciated, undulating plain. Terrain contains incised, steep-sided stream channels.	1,700 - 2,800	50 - 500	Cretaceous shale.	Pierre Shale.
Northwestern Great Plains – River Breaks[a]					
417 - 426, 426 - 431, 478 - 487, 493 - 494, 535 - 546	Unglaciated, highly dissected hills and uplands. Ecoregion borders major rivers and alluvial plains.	1,300 - 2,700	200 - 500	Cretaceous shale.	Pierre Shale.
Northwestern Great Plains – Keya Paha Tablelands[a]					
570 - 575	Unglaciated, level to rolling sandy plains. Topography is dissected near streams.	2,250 - 3,600	20 - 800	Aeolian and alluvial sand and silt.	Ogallala Formation.
Northwestern Glaciated Plains – Ponca Plains[a]					
575 - 589	Unglaciated , level to gently rolling plains. Topography formed by stream drainage (preglacial).	1,900 - 2,350	80 - 140	Miocene soft sandstone and cretaceous shale.	Pierre Shale.
Northwestern Glaciated Plains – Southern River Breaks[a]					
589 - 597	Lightly glaciated dissected hills and canyons. Topography contains slopes of high relief bordering major rivers and alluvial plains.	1,250 - 2,000	250 - 700	Cretaceous shale.	Pierre Shale.

[a] EPA Level III-IV Ecoregion name.
Source: Bryce et al. 1996.

TABLE 3.1.1-3
Physiographic Characteristics of Ecoregions Crossed in Nebraska by the Proposed Project – Steele City Segment

MP Range	Physiographic Description	Elevation Range (ft AMSL)	Local Relief (ft)	Surface Geology	Bedrock Geology
Northwestern Glaciated Plains – Southern River Breaks[a]					
597 - 600	Dissected hills and canyons. Topography contains slopes of high relief bordering major rivers and alluvial plains.	1,400 - 2,000	250 - 500	Cretaceous shale.	Pierre Shale.
Northwestern Great Plains – Keya Paha Tablelands[a]					
600 - 613	Unglaciated, level to rolling sandy plains. Topography is dissected near streams; contains isolated gravelly buttes.	1,900 - 2,400	20 - 400	Aeolian and alluvial sand and silt.	Ogallala Sandstone.
Northwestern Great Plains – Niobrara River Breaks[a]					
613 - 617	Unglaciated, dissected canyons. Contains slopes of high relief adjacent to river.	1,700 - 2,700	200 - 600	Sandy residuum.	Miocene soft sandstone over Pierre Shale.
Nebraska Sand Hills – Wet Meadow and Marsh Plain[a]					
617 - 664	Flat, sandy plain with numerous marshes and wetlands.	1,900 - 2,400	10 - 50	Aeolian sand dunes and sand sheets, alluvial silt, sand and gravel.	Ogallala Sandstone.
Nebraska Sand Hills – Sand Hills[a]					
664 - 709	Sand sheets and extensive fields of sand dunes.	2,200 - 3,900	50 - 400	Aeolian sand dunes and alluvial silt, sand and gravel.	Ogallala Sandstone.
Central Great Plains – Central Nebraska Loess Plains[a]					
709 - 739	Rolling dissected plains with deep layer of loess. Contains perennial and intermittent streams.	1,600 - 3,100	50 - 275	Calcareous loess, alluvial sand, gravel, and lacustrine sand and silt.	Ogallala Sandstone.
Central Great Plains – Platte River Valley[a]					
739 - 759	Flat, wide alluvial valley. Contains shallow, interlacing streams on a sandy bed.	1,300 - 2,900	2 - 75	Alluvial, sand, silt, clay, and gravel deposits.	Quaternary and Tertiary unconsolidated sand and gravel.
Central Great Plains – Rainwater Basin Plains[a]					
759 - 848	Flat to gently rolling loess covered plains. Historical rainwater basins and wetlands.	1,300 - 2,400	5 - 100	Loess and mixed loess and sandy alluvium.	Ogallala Sandstone, Niobrara Formation, and Carlisle Shale.
Central Great Plains – Smoky Hills[a]					
848 - 852	Undulating to hilly dissected plain with broad belt of low hills formed by dissection of Cretaceous rock layers.	1,200 - 1,800	100 - 250	Sandstone and shale, loamy colluvium, chalky limestone, and thin loess.	Cretaceous sandstone of Dakota Group.

[a] EPA Level III-IV Ecoregion name.
Source: Chapman et al. 2001.

TABLE 3.1.1-4
Physiographic Characteristics of Ecoregions Crossed in Oklahoma by the Proposed Project – Gulf Coast Segment

MP Range	Physiographic Description	Elevation Range (ft AMSL)	Local Relief (ft)	Surface Geology	Bedrock Geology
Central Great Plains – Cross Timbers Transition[a]					
0 - 16	Rough Plains that is sometimes broken. Topography contains incised streams.	750 -1,950	30 - 300	Quaternary alluvium, terrace deposits, and residuum.	Permian and Pennsylvanian sandstone and shale, limestone and mudstone conglomerate.
Cross Timbers – Northern Cross Timbers[a]					
16 - 78	Rolling hills, cuestas, ridges, and ledges. Contains shallow streams with sandy substrates and sometimes deep pools, riffles, and bedrock, cobble, or gravel substrates.	600 - 1,300	100 - 350	Uplands contain Quaternary clayey silt to silty clay residuum. Valleys contain Quaternary alluvium. Rock outcrops are common.	Pennsylvanian and Permian sandstone, shale, and limestone.
Arkansas Valley – Lower Canadian Hills[a]					
78 - 119	Hill and valley topography in structural Arkoma Basin with scattered ridges and ponds. Streams contain pools and have substrated composed of cobbles, gravel, and sand.	500 - 1,000	50 - 300	Quaternary terrace deposits, alluvium, and sandy to silty clay loam residuum.	Pennsylvanian shale and sandstone.
South Central Plains – Cretaceous Dissected Uplands[a]					
119 - 138, 140 - 155	Level to hilly, dissected uplands and low cuestas. Large streams are deep and slow moving and have muddy or sandy bottoms. Smaller streams contain gravel, cobble and boulder substrates.	310 – 700	Less than 50 - 200	Quaternary alluvium in valleys. Uplands contain poorly consolidated, calcareous sands, clays, gravels, and limestone.	Calcareous sands, clays, gravels, and limestone.
Cross Timbers – Eastern Cross Timbers[a]					
138 - 140	Rolling hills, cuestas, long narrow ridges with few strongly dissected areas. Stream substrates consist of quartz sand.	640 - 1,100	100 - 200	Uplands are composed of Quaternary sand, gravel, silt, and clay residuum. Valleys consist of Quaternary alluvium.	Cretaceous sand, shale, clay, sandstone, calcareous shale, and limestone.
South Central Plains – Red River Bottomlands[a]					
155.3 - 155.7	Broad, level floodplains and low terraces. Topography contains oxbow lakes, meander scars, back swamps, and natural levees.	300 – 530	10 - 50	Holocene alluvium.	Holocene alluvium.

[a] EPA Level III-IV Ecoregion name.
Source: Woods et al. 2005.

TABLE 3.1.1-5
Physiographic Characteristics of Ecoregions Crossed in Texas by the Proposed Project – Gulf Coast Segment

MP Range	Physiographic Description	Elevation Range (ft AMSL)	Local Relief (ft)	Surface Geology	Bedrock Geology
South Central Plains – Red River Bottomlands[a]					
155.7 - 161	Broad, level floodplains and low terraces. Topography contains oxbow lakes, meander scars, back swamps, and natural levees.	300 - 530	10 - 50	Holocene alluvium.	Holocene alluvium.
South Central Plains – Pleistocene Fluvial Terraces[a]					
161 - 163	Broad flats and gently sloping stream terraces.	310 - 400	10 - 50	Terrace deposits.	Terrace deposits.
East Central Texas Plains – Northern Post Oak Savanna[a]					
163 - 172, 198 - 202, 203 - 205, 206 - 212, 217 - 227	Level and gently rolling topography.	300 - 800	10 - 50	Fine textured loam soils.	Eocene and Paleocene Formations and Cretaceous Formations in northern extent.
Texas Blackland Prairies – Northern Blackland Prairie[a]					
172 - 198	Rolling to nearly level plains.	300 - 800	10 - 50	Fine-textured, dark, calcareous soils.	Interbedded chalks, marls, limestones, and Cretaceous shales.
East Central Texas Plains – Floodplains and Low Terraces[a]					
202 - 204, 212 – 214	Wider floodplains of major streams.	300 - 800	10 - 50	Floodplain and low terrace deposits.	Halocene deposits.
East Central Texas Plains – Northern Prairie Outliers[a]					
205 - 206, 214 - 217	Land cover is mostly pasture, with some cropland.	300 - 800	10 - 50	Paleocene and Eocene formations south of the Sulfur River.	Cretaceous sediments north of the Sulfur River; Paleocene and Eocene formations south of the Sulfur River.
South Central Plains – Tertiary Uplands[a]					
227 - 261, 264 - 333	Rolling topography, gently to moderately sloping.	290 - 390	10 - 50	Tertiary deposits, mainly Eocene sediments.	Tertiary deposits, mainly Eocene sediments.
South Central Plains – Floodplains and Low Terraces[a]					
261 - 264, 334 - 337, 348 - 349, 353 - 354, 361 - 362, 365 - 367, 366 - 370	Alluvial floodplains and low terraces.	290 - 390	10 - 50	Clayey and loamy soils.	Halocene deposits.

TABLE 3.1.1-5 Physiographic Characteristics of Ecoregions Crossed in Texas by the Proposed Project – Gulf Coast Segment					
MP Range	**Physiographic Description**	**Elevation Range (ft AMSL)**	**Local Relief (ft)**	**Surface Geology**	**Bedrock Geology**
South Central Plains – Southern Tertiary Uplands[a]					
333 - 334, 337 - 348, 349 - 353, 354 - 361, 362 - 365, 367, 370 - 411	Consists of longleaf pine range north of Flatwoods EcoRegion. Forested topography is hilly and dissected.	290 - 390	10 - 50	Tertiary sediments.	Tertiary sediments.
South Central Plains – Flatwoods[a]					
411 - 455, 459 - 460	Topography is flat to gently sloping. Streams are low gradient and sluggish.	290 - 390	10 - 50	Pleistocene sediments.	Pleistocene sediments.
Western Gulf Coastal Plain – Northern Humid Gulf Coastal Prairies[a]					
455 - 459, 460 – 483.8	Gently sloping coastal plain.	0 – 400	10 - 50	Fine-textured clay to sandy clay loam soils.	Quaternary deltaic sands, silts, and clays.

[a] EPA Level III-IV Ecoregion name.
Source: Griffith et al. 2004.

TABLE 3.1.1-6 Physiographic Characteristics of Ecoregions Crossed in Texas by the Proposed Project – Houston Lateral					
Milepost Range	**Physiographic Description**	**Elevation Range (ft AMSL)**	**Local Relief (ft)**	**Surface Geology**	**Bedrock Geology**
South Central Plains – Flatwoods[a]					
0 -3, 15.9 - 16.4	Topography is flat to gently sloping. Streams are low gradient and sluggish.	290 - 390	10 - 50	Pleistocene sediments.	Pleistocene sediments.
Western Gulf Coastal Plain – Northern Humid Gulf Coastal Prairies[a]					
3 - 16, 23 - 49	Gently sloping coastal plain.	0 - 400	10 - 50	Fine-textured clay to sandy clay loam soils.	Quaternary deltaic sands, silts, and clays.
South Central Plains – Floodplains and Low Terraces[a]					
16 - 23	Alluvial floodplains and low terraces.	290 - 390	10 - 50	Clayey and loamy soils.	Halocene deposits.

[a] EPA Level III-IV Ecoregion name.
Source: Griffith et al. 2004.

3.1.1.2 Potential Impacts and Mitigation

Construction

The proposed Project would not involve substantial long- or short-term, large scale alteration of topography. Most of the proposed route would be within areas where bedrock is buried by unconsolidated sediments consisting of glacial till, alluvium, colluvium, loess and/or aeolian deposits. In these areas, impacts to bedrock would be expected to be minimal, and limited to areas where bedrock is within 8 feet of the surface. Trench excavation would typically be to depths of between seven to eight feet. Potential impacts to surface sediments and topography due to accelerated erosion or soil compaction are described in Section 3.2.

Rock ripping could be necessary where dense material, paralithic bedrock, abrupt textural change, or strongly contrasting textural stratification is present within 8 feet of the ground surface. Over the entire proposed Project route, approximately 166 miles would cross areas identified as potential ripping locations. Table 3.1.1-7 summarizes the approximate locations of expected ripping operations respectively, by state, county, and approximate milepost.

TABLE 3.1.1-7
Potential Ripping Locations for the Proposed Project

MP Range	State	County	Length (miles)
Steele City Segment			
10.96 - 18.73	Montana	Phillips	1.23 miles
25.82 - 57.59	Montana	Valley	3.31 miles
90.26 - 156.74	Montana	McCone	19.30 miles
156.74 - 197.13	Montana	Dawson	9.45 miles
197.85 - 218.06	Montana	Prairie	6.40 miles
218.54 - 282.67	Montana	Fallon	19.67 miles
282.83 - 354.31	South Dakota	Harding	35.94 miles
355.07 - 358.10	South Dakota	Butte	1.03 miles
358.1 - 373.36	South Dakota	Perkins	13.94 miles
373.36 - 424.61	South Dakota	Meade	30.86 miles
426.26 - 426.28	South Dakota	Pennington	0.02 mile
426.28 - 484.45	South Dakota	Haakon	17.76 miles
485.29 - 523.42	South Dakota	Jones	25.50 mile
530.94 - 536.83	South Dakota	Lyman	2.05 miles
537.56 - 596.84	South Dakota	Tripp	15.26 miles
596.84 - 615.18	Nebraska	Keya Paha	3.36 miles
615.65 - 618.12	Nebraska	Rock	0.35 mile
849.67 - 850.76	Nebraska	Jefferson	0.91 mile
Steele City Segment Subtotal			**206.33 miles**

TABLE 3.1.1-7 Potential Ripping Locations for the Proposed Project			
MP Range	**State**	**County**	**Length (miles)**
Gulf Coast Segment	91.4	91.4	<0.1
0.09 - 17.19	Oklahoma	Lincoln	9.83 miles
17.87 - 21.26	Oklahoma	Creek	2.35 miles
23.09 - 38.24	Oklahoma	Okfuskee	10.81 miles
38.79 - 58.99	Oklahoma	Seminole	9.17 miles
58.99 - 86.48	Oklahoma	Hughes	12.05 miles
87.55 - 112.85	Oklahoma	Coal	15.93 miles
113.3 - 133.12	Oklahoma	Atoka	1.81 miles
133.12 - 151.04	Oklahoma	Bryan	1.35 miles
166.28 - 185.78	Texas	Lamar	6.43 miles
192.13 - 201.46	Texas	Delta	0.51 miles
203.42 - 222.58	Texas	Hopkins	11.49 miles
222.67 - 233.15	Texas	Franklin	5.08 miles
233.44 - 252.99	Texas	Wood	3.35 miles
259.9 - 261.53	Texas	Upshur	0.85 mile
263.64 - 293.32	Texas	Smith	8.79 mile
297.33 - 298.7	Texas	Cherokee	0.28 mile
300.93 - 314.56	Texas	Rusk	6.23 miles
314.56 - 334.07	Texas	Nacogdoches	8.77 miles
337.27 - 340.76	Texas	Cherokee	1.19 miles
340.85 - 365.75	Texas	Angelina	13.28 miles
370.51 - 403.97	Texas	Polk	13.21 miles
Gulf Coast Segment Subtotal			**142.74 miles**
Houston Lateral			
15.2 – 49.21	Texas	Liberty	3.17 miles
51.2 – 52.1	Texas	Chambers	0.29 miles
Houston Lateral Subtotal	-	-	3.46 miles
Proposed Project Total			**355.99 miles**

Operation

Routine pipeline operation and maintenance activities would not be 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

Paleontological resources (fossils) are physical remains of floral and faunal species that have mineralized into or left impressions in solid rock. The study of fossils across geological time and the evolutionary relationships between taxonomies are important elements of paleontological science.

3.1.2.1 Environmental Setting

The potential for the disturbance of paleontological resources during proposed pipeline construction was evaluated (Murphey et al. 2010). In Montana, South Dakota, Nebraska, Kansas, Oklahoma, and Texas paleontological research was performed using museum records and current USGS information. In Montana and South Dakota, field surveys were also conducted along the proposed route on federal, state, and privately owned lands where site access was available.

Potential Fossil-Bearing Geologic Formations

The Potential Fossil Yield Classification (PFYC) system is a survey tool for use on BLM managed lands that designates the fossil-bearing potential of geological formations from very low (Class 1) to very high (Class 5) (BLM 1998, 2007, 2008). The PFYC system provides a baseline for predicting, assessing, and mitigating paleontological resources. The PFYC system and other BLM field survey and monitoring procedures were used to help identify important paleontological resources that could be vulnerable to disturbance from construction activities (BLM 1998, 2007, 2008).

Montana geological formations that are designated as PFYC Class 4 or PFYC Class 5 include:

- Ludlow Member of the Fort Union Formation (occurs sporadically between MP 200.9 to MP 282.5) for mammals;
- Tongue River Member of the Fort Union Formation (MP 129.0 to MP 200.9; MP 203.6 to MP 240.7) for plants; mammals, and mollusks;
- Lebo Member of the Fort Union Formation (sporadically between MP 119.7 to MP 129.0) for mammals;
- Tullock Member of the Fort Union Formation (sporadically between MP 105.4 to MP 128.0) for invertebrates and vertebrates;
- Hell Creek Formation (sporadically between MP 91.5 to MP 114.9) for plants, vertebrates, and invertebrates; and
- Judith River Formation (sporadically between MP 1.1 to MP 45.1) for vertebrates.

South Dakota geological formations that are designated as PFYC Class 4 or PFYC Class 5 include:

- Ludlow Member of the Fort Union Formation (MP 282.5 to MP 284.7) for mammals, plants, and invertebrates, and
- Hell Creek Formation (MP 284.7 to MP 387.1) for reptiles (including dinosaurs) and mammals.

Formations in Nebraska that contain fossil potential include:

- Tertiary Ogallala Group (occurs sporadically from MP 595 to MP 744) for horses, rhinoceroses, proboscideans, mammoths, and other ruminants;
- Upper Cretaceous Pierre Shale, Niobrara, Carlisle, Greenhorn Limestone and Graneros Shale Formations (sporadically between MP 595 to MP 823) for ammonites, gastropods, bivalves, mosasaurs, fish, bivalves, sea turtles, and sharks; and
- Lower Cretaceous Dakota Group (occurs sporadically from MP 798 to MP 850) for flowering plants.

In Kansas, where two new pump stations are proposed, Permian sedimentary rocks may contain fossils of shark and invertebrates including corals, brachiopods, ammonoids, and gastropods (KGS 2005). Surficial unconsolidated deposits have the potential to contain large vertebrate fossils such as mammoths, mastodons, camels, and saber-toothed tigers; and invertebrates such as mollusks (Paleontology Portal 2003).

In Oklahoma, Permian rocks in Payne and Lincoln counties may contain invertebrates. Carboniferous rocks in Creek, Okfuskee, Seminole, Hughes, and Coal counties may contain invertebrates, plants, and fish. Cretaceous rocks in Atoka and Bryan counties may contain fish, reptiles (including dinosaur), and invertebrates.

In Texas, Cretaceous rocks in Fannin, Lamar, and Delta counties may contain invertebrate and fish fossils. Tertiary rocks in Hopkins, Franklin, Smith, Rusk, Upshur, Nacogdoches, Cherokee, Wood, Angelina, and Polk counties may contain invertebrates, reptiles, fish, mammals, and plant fossils. Quaternary rocks in Liberty, Jefferson, Chambers, and Harris counties may contain land mammals, birds, and reptiles.

Field Surveys

In Montana and South Dakota, field surveys were conducted along the proposed Project route, potential reroutes, access roads, and at proposed ancillary facility locations to identify the presence of exposed and visible surface fossils and potentially fossiliferous outcrops of bedrock. All exposures of PFYC Class 4 and 5 geologic formations identified on USGS geologic maps were subjected to pedestrian survey. Exposures of PFYC Class 3 geologic formations were spot-checked and PFYC Class 1 and 2 geologic formations were not surveyed. Paleontological resources identified during surveys along the proposed Project corridor were classified as follows:

- Significant Fossil Localities (SFL) are those localities containing specimens that are field identifiable, of outstanding preservation, or otherwise scientifically significant.
- Non-significant Fossil Occurrences (NFO) are those localities that typically consist of highly weathered or unidentifiable bone or tooth fragments, unidentifiable plant fossils, fossils of common occurrence (such as turtle shell), and fragments of silicified wood.

Montana surveys were conducted consistent with existing BLM and State of Montana regulations and MDEQ requirements using BLM guidelines (BLM 2007, 2008). Prior to field surveys background research was completed at the Montana State Historic Preservation Office (SHPO) in order to assist in identifying potential surface exposures of fossiliferous formations. The field methodology consisted of pedestrian surveys of PFYC 4/5 geologic units along the proposed Project ROW on BLM and state land and on private lands where access was granted. PFYC 3 geologic units were spot-checked. In PFYC 1 and 2 areas geologic maps and aerials were used to identify potential fossil bearing rock outcrops.

South Dakota surveys were conducted consistent with South Dakota Public Utilities Commission (SD-PUC) and South Dakota State Land Commission requirements using BLM guidelines (BLM 2007, 2008). Prior to field surveys, background research was completed at the South Dakota Museum of Geology and at the South Dakota School of Mines and Technology in order to determine any surface exposure of potentially fossiliferous formations. The field methodology consisted of pedestrian surveys of PFYC 4/5 geologic units along the proposed Project ROW on BLM and state land and on private lands where access was granted. PFYC 3 geologic units were spot-checked. In PFYC 1 and 2 areas geologic maps and aerials were used to identify potential fossil bearing rock outcrops.

Table 3.1.2-1 identifies field surveys conducted in Montana and South Dakota.

TABLE 3.1.2-1 Paleontological Surveys and Reports			
Date of Report	**Date(s) of Survey**	**State**	**Title**
October 28, 2008	July 14-22, 2008; August 15-26, 2008	Montana	Paleontological Assessment of BLM Lands along the Steele City Segment of the Keystone XL Project, Montana
May 26, 2009	July 14-22, 2008; August 15-26, 2008	Montana	Paleontological Assessment of BLM Lands along the Steele City Segment of the Keystone XL Project, Montana: Addendum 1
April 23, 2010	July 14-22, 2008; August 15-26, 2008	Montana	Paleontological Assessment of BLM Lands along the Steele City Segment of the Keystone XL Project, Montana: Addendum 2
September 20, 2010	May 17, 2010 – August 27, 2010	Montana	Paleontological Survey Report: BLM Lands along Steele City Segment of the Keystone XL Project, Montana: Addendum 3
September 20, 2010	May 17, 2010 – August 27, 2010	Montana	Paleontological Survey Report: State Lands along Steele City Segment of the Keystone XL Project, Montana
September 20, 2010	May 17, 2010 – August 27, 2010	Montana	Paleontological Survey Report: Private Lands along Steele City Segment of the Keystone XL Project, Montana
April 23, 2010	None given	South Dakota	Paleontological Assessment of BLM Lands along the Steele City Segment of the Keystone XL Project, South Dakota
April 23, 2010	September 9-22, 2009, September 28, 2009 – October 3, 2009	South Dakota	Paleontological Assessment of State Lands along the Steele City Segment of the Keystone XL Project, South Dakota
September 3, 2010	Through June 25, 2010	South Dakota	Paleontological Survey Report: State Lands along Steele City Segment of the Keystone XL Project, South Dakota
September 3, 2010	Through July 10, 2010	South Dakota	Paleontological Survey Report: Private Lands along Steele City Segment of the Keystone XL Project, South Dakota-Volume 1
September 3, 2010	Through July 10, 2010	South Dakota	Paleontological Survey Report: Private Lands along Steele City Segment of the Keystone XL Project, South Dakota-Volume 2

No field surveys were performed in Nebraska, Kansas, Oklahoma, and Texas due to the low potential for paleontological resources.

Field Survey Results

The results of paleontological surveys in Montana identified 27 SFL and 40 NFO sites. The results of paleontological surveys in South Dakota identified four SFL and 21 NFO sites (Table 3.1.2-2).

TABLE 3.1.2-2
Paleontological Resources Identified Along Proposed Project Corridor in Montana and South Dakota

State	Ownership	Parcel	Fossil Type	SFL/NFO	Geology	Recommendation
MT	State	ML-MT-VA-00190	Vertebrate, Invertebrate	SFL	Claggett	Monitor
MT	State	ML-MT-MC-00158	Plant	SFL	Fort Union	Monitor
MT	BLM	ML-MT-MC-00010	Invertebrate	SFL	Bear Paw	Monitor
MT	BLM	PS09-MT-PH10160	Vertebrate	SFL	Judith River	Avoidance
MT	BLM	ML-MT-MC-00010	Invertebrate	SFL	Bearpaw	Spot Check
MT	BLM	ML-MT-MC-00010	Invertebrate	SFL	Bearpaw	Spot Check
MT	BLM	ML-VT-VA-00155	Vertebrate	SFL	Judith River	Monitor
MT	BLM	ML-MT-MC-00010	Invertebrate	SFL	Bearpaw	Spot Check
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00233	Vertebrate	SFL	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00260	Vertebrate	SFL	Fort Union	Monitor
MT	BLM	Ml-MT-PR-00140	Vertebrate	SFL	Fort Union	Monitor
MT	Private	ML-MT-MC00100	Vertebrate	SFL	Hell Creek	Avoidance
MT	Private	ML-MT-MC-00100	Vertebrate	SFL	Hell Creek	Surface collect & monitor
MT	Private	ML-MT-MC-00100	Vertebrate	SFL	Hell Creek	Surface collect & monitor
MT	Private	ML-MT-MC-00195	Vertebrate	SFL	Hell Creek	Surface collect & monitor
MT	Private	ML-MT-MC-00400	Plant	SFL	Fort Union	Monitor
MT	Private	ML-MT-FA-00560	Vertebrate	SFL	Fort Union	Surface collect & monitor
MT	Private	MTV16-MT-FA-00040	Vertebrate	SFL	Hell Creek	Avoidance
MT	BLM	ML-MT-PH_00120	Invertebrate	NFO	Bear Paw	Monitor
MT	BLM	ML-MT-PH-00145	Invertebrate	NFO	Bear Paw	Monitor
MT	BLM	ML-MT-VA-00265	Invertebrate	NFO	Bear Paw	Monitor
MT	BLM	ML-MT-MC-00142	Vertebrate	NFO	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00010	Invertebrate	NFO	Bear Paw	Monitor
MT	BLM	ML-MT-MC-00010	Invertebrate	NFO	Bear Paw	Spot-check
MT	BLM	PS09-MT-PH-10100	Invertebrate	NFO	Claggett	Spot-check

TABLE 3.1.2-2
Paleontological Resources Identified Along Proposed Project Corridor in Montana and South Dakota

State	Ownership	Parcel	Fossil Type	SFL/NFO	Geology	Recommendation
MT	BLM	ML-MT-MC-00010	Vertebrate	NFO	Fort Union	Monitor
MT	BLM	ML-MT-PR-165	Plant	NFO	Bearpaw	Monitor
MT	BLM	ML-MT-PH-00105	Invertebrate	NFO	Bearpaw	Spot -check
MT	BLM	ML-MT-PH-00105	Invertebrate	NFO	Bearpaw	Spot -check
MT	BLM	ML-MT-PH-00105	Invertebrate	NFO	Bearpaw	Spot -check
MT	BLM	ML-MT-VA-00135	Invertebrate	NFO	Bearpaw	Spot -check
MT	BLM	ML-MT-VA-00135	Invertebrate	NFO	Bearpaw	Spot -check
MT	BLM	ML-MT-VA-00155	Invertebrate	NFO	Judith River	Monitor
MT	BLM	ML-MT-VA-00185	Plant	NFO	Judith River	Monitor
MT	BLM	ML-MT-VA-00355	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MT-VA-00355	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MT-VA-00355	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MT-MC00010	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MT-MC00010	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MT-MC00010	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MT-MC00010	Invertebrate	NFO	Bearpaw	Spot-check
MT	BLM	ML-MC-MC-00233	Vertebrate	NFO	Hell Creek	Monitor
MT	BLM	ML-MC-MC-00233	Vertebrate	NFO	Hell Creek	Monitor
MT	BLM	ML-MC-MC-00233	Vertebrate	NFO	Hell Creek	Monitor
MT	BLM	ML-MC-MC-00233	Vertebrate	NFO	Hell Creek	Monitor
MT	BLM	ML-MT-MC-00260	Vertebrate	NFO	Fort Union	Monitor
MT	BLM	ML-MT-MC-00260	Vertebrate, Plant	NFO	Hell Creek	Monitor
MT	Private	MTV1-MT-MC-00320	Vertebrate	NFO	Judith River	Monitor
MT	Private	MTV1-MT-PH-00310	Invertebrate	NFO	Claggett	Monitor
MT	Private	ML-MT-VA-00015	Invertebrate	NFO	Judith River	Monitor
MT	Private	ML-MT-MC-00100	Plant	NFO	Hell Creek	Monitor
MT	Private	ML-MT-MC-00109	Vertebrate	NFO	Hell Creek	Monitor
MT	Private	ML-MT-MC-00106	Plant	NFO	Hell Creek	Monitor
MT	Private	ML-MT-MC-00100	Vertebrate	NFO	Hell Creek	Monitor
MT	Private	ML-MT-FA-00040	Plant	NFO	Fort Union	Monitor
MT	Private	ML-MT-FA-00720	Vertebrate	NFO	Hell Creek	Monitor
MT	Private	Ml-MT-FA-00730	Vertebrate	NFO	Hell Creek	Monitor
MT	Private	ML-MT-PR-00070	Plant	NFO	Fort Union	Monitor
SD	Private	ML-SD-ME-00150	Vertebrate	SFL	Hell Creek	Surface collect & monitor

TABLE 3.1.2-2
Paleontological Resources Identified Along Proposed Project Corridor in Montana and South Dakota

State	Ownership	Parcel	Fossil Type	SFL/NFO	Geology	Recommendation
SD	Private	CAR-041	Vertebrate	SFL	Hell Creek	Surface Collect & monitor
SD	Private	CAR-041	Vertebrate	SFL	Hell Creek	Surface collect & monitor
SD	Private	ML-SD-PE-00360	Vertebrate	SFL	Hell Creek	Surface collect & monitor
SD	Private	CAR-048A	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	CAR-048A	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	ML-SD-ME-00230	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	CAR-041	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	CAR-041	Plant	NFO	Hell Creek	Monitor
SD	Private	CAR-041	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	ML-SD-HA-01780	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	ML-SD-HA-01780	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	ML-SD-PE-00430	Vertebrate	NFO	Hell Creek	Monitor
SD	Private	ML-SD-PE-00360	Vertebrate, Plant	NFO	Hell Creek	Monitor
SD	Private	ML-SD-HK-11767	Invertebrate	NFO	Pierre Shale	Monitor
SD	Private	ML-SD-JO-10060	Invertebrate	NFO	Pierre Shale	Monitor
SD	Private	ML-SD-TR-11630	Vertebrate, Trace	NFO	Ogallala	Monitor
SD	State	PS-15	Plant	NFO	Fort Union	Monitor
SD	State	ML-SD-HA-13020	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-HA-13020	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-PE-00410	Vertebrate, Plant	NFO	Hell Creek	Monitor
SD	State	ML-SD-PE-00410	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-PE-00330	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-PE-00330	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-PE-00330	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-HA-02400	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-HA-02870	Vertebrate	NFO	Hell Creek	Monitor
SD	State	ML-SD-HA-03310	Vertebrate	NFO	Hell Creek	Monitor
SD	State	PS15-SD-HA-00335	Vertebrate	NFO	Hell Creek	Monitor
SD	State	PS16-SD-HA-10012	Plant	NFO	Hell Creek	Monitor
SD	State	PS16-SD-HA-10012	Vertebrate	NFO	Hell Creek	Monitor
SD	State	PS16-SD-HA-10014	Vertebrate	NFO	Hell Creek	Monitor

3.1.2.2 Potential Impacts

Construction

Potential impacts to paleontological resources during construction include damage to or destruction of fossils due to excavation activities, erosion of fossil beds due to grading, and unauthorized collection of fossils.

Because there is potential for discovery of fossils during trench excavation and pipeline installation activities, a Paleontological Monitoring and Mitigation Plan (PMMP) would be prepared prior to beginning construction on federal and certain state and local government lands. Fossils or other paleontological resources found on private land would only be recovered with approval of the landowner, and therefore, may be unavailable for scientific study. Additionally, prior to initiation of excavation and pipeline installation, appropriate regulatory agencies in each state would be consulted on the requirements for the PMMP for federal, certain state and local government lands. There is currently an effort led by MDEQ and other agencies to develop a Memorandum of Understanding (MOU) in Montana for the identification, evaluation and protection of paleontological resources. This MOU will be completed prior to the FEIS.

Paleontological resources identified on Federal lands are managed and protected under the Paleontological Resources Preservation Act (PRSA) as part of the Omnibus Public Land Management Act of 2009. This law requires the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on lands under their jurisdiction using scientific principles and expertise. The Act affirms the authority for many of the policies the Federal land managing agencies already have in place such as issuing permits for collecting paleontological resources, curation of paleontological resources, and confidentiality of locality data. The statute also establishes criminal and civil penalties for fossil theft and vandalism on Federal lands.

Operation and Maintenance

Routine pipeline operations and maintenance activities are not expected to affect paleontological resources. However, collection of paleontological resources for scientific or other purposes would not be possible within the permanent ROW during proposed Project operations.

3.1.2.3 Potential Additional Mitigation Measures

The states of Montana and South Dakota have enacted legislation to manage and protect paleontological resources on state-managed lands.

In Montana, a certificate of compliance under MFSA would be obtained from MDEQ prior to construction of the proposed pipeline. A conditional requirement for the issuance of the certificate of compliance relates to the required implementation of mitigation actions when significant paleontological resources are inadvertently discovered during the construction of the proposed pipeline on lands under the jurisdiction of the State of Montana or a federal agency and also on private land. The requirements are set forth in the document entitled *Conditional Requirements for the Treatment of Inadvertently Discovered Significant Paleontological Resources for the Keystone XL Pipeline* (and the proposed PMMP). The requirements are designed to minimize and mitigate the adverse effects of pipeline construction activities on significant paleontological materials. The Montana Antiquities Act, as amended (1995), requires the Department of Natural Resources and Conservation (DNRC) and other state agencies to avoid or mitigate damage to important paleontological resources (when feasible) on state trust lands. The Montana Department of Fish, Wildlife and Parks have written rules for implementing the State Antiquities Act.

The Montana SHPO also issues antiquities permits for the collection of paleontological resources on state owned lands.

South Dakota requires a permit from the South Dakota Public Utilities Commission (SDPUC) as defined in SDCL Chapter 49-41 B to construct the South Dakota portion of the proposed Project. A permit is also required from the South Dakota Commissioner of School and Public Lands to survey, excavate or remove paleontological resources from state land and to determine the repository or curation facility for paleontological collections from state lands. Condition 44 of the proposed Project's permit from SDPUC specifies the need for surveys in accordance with the procedures described for the South Dakota paleontological field surveys and also mandates the following mitigation measures:

- "Following the completion of field surveys, Keystone shall prepare and file with the Commission a paleontological resource mitigation plan. The mitigation plan shall specify monitoring locations, and include BLM permitted monitors and proper employee and contractor training to identify any paleontological resources discovered during construction and the procedures to be followed following such discovery. Paleontological monitoring will take place in areas within the construction ROW that are underlain by rock formations with high sensitivity (PFYC Class 4) and very high sensitivity (PFYC Class 5), and in areas underlain by rock formations with moderate sensitivity (PFYC Class 3) where significant fossils were identified during field surveys.
- If during construction, Keystone or its agents discover what may be a paleontological resource of economic significance, or of scientific significance….Keystone or its contractors or agents shall immediately cease work at that portion of the site and, if on private land, notify the affected landowner(s). Upon such a discovery, Keystone's paleontological monitor will evaluate whether the discovery is of economic significance, or of scientific significance. If an economically or scientifically significant paleontological resource is discovered on state land, Keystone will notify SDSMT and if on federal land, Keystone will notify the BLM or other federal agency. In no case shall Keystone return any excavated fossils to the trench. If a qualified and BLM-permitted paleontologist, in consultation with the landowner, BLM, or SDSMT determines that an economically or scientifically significant paleontological resource is present, Keystone shall develop a plan that is reasonably acceptable to the landowner(s), BLM, or SDSMT, as applicable, to accommodate the salvage or avoidance of the paleontological resource to protect or mitigate damage to the resource. The responsibility for conducting such measures and paying the costs associated with such measures, whether on private, state or federal land, shall be borne by Keystone to the same extent that such responsibility and costs would be required to borne by Keystone on BLM managed lands pursuant to BLM regulations and guidelines, including the BLM Guidelines for Assessment and Mitigation of Potential Impacts to Paleontological Resources, except to the extent factually inappropriate to the situation in the case of private land (e.g. museum curation costs would not be paid by Keystone in situations where possession of the recovered fossil(s) was turned over to the landowner as opposed to curation for the public). If such a plan will require a materially different route than that approved by the Commission, Keystone shall obtain Commission approval for the new route before proceeding with any further construction. Keystone shall, upon discovery and salvage of paleontological resources either during pre-construction surveys or construction and monitoring on private land, return any fossils in its possession to the landowner of record of the land on which the fossil is found. If on state land, the fossils and all associated data and documentation will be transferred to the SDSM; if on federal land, to the BLM. To the extent that Keystone or its contractors or agents have control over access to such information, Keystone shall, and shall require its contractors and agents to, treat the locations of sensitive and valuable resources as confidential and limit public access to this information."

To comply with MFSA conditions in Montana and SDPUC conditions in South Dakota, a paleontological monitor would be provided for each construction spread in Montana and South Dakota that includes an area assigned moderate to high fossil-bearing potential (PFYC 3, 4 & 5) and in areas where scientifically significant fossils were identified during surface surveys. The paleontological monitor would satisfy the qualifications established by the BLM for paleontological monitoring on federal lands.

In Nebraska, the State Department of Roads has contracted with the University of Nebraska Museum for a highway salvage paleontologist to identify and collect important paleontological resources that may be impacted by the maintenance and construction of federal highways and roads. While directed to investigate paleontological resources on federally funded road projects, the salvage operations are also conducted on state and county road projects. There are no specific regulations concerning paleontological resources that would apply to the proposed Project.

Kansas and Oklahoma have no state regulations concerning the management and protection of paleontological resources on state lands. In Texas, there are no state regulations concerning the management and protection of paleontological resources on state lands except on lands administered by state forests and state parks.

3.1.3 Mineral and Fossil Fuel Resources

3.1.3.1 Environmental Setting

Montana

In the proposed Project area, oil, natural gas, and coal comprise the major energy resources (Montana Bureau of Mines and Geology 1963). Sand, gravel and bentonite are also mined (Montana Bureau of Mines and Geology/USGS 2004). The proposed route would cross few oil and gas producing areas. There are 9 oil and gas producing wells within one-quarter mile (1,320 feet) of the proposed ROW (Appendix F).

The proposed pipeline route does not cross any coal (lignite) mines. Historically, bentonite has been mined and processed in the area southeast of Glasgow and south of the proposed pipeline route; however, bentonite is not currently being mined and processed in the proposed Project area (Montana Bureau of Mines and Geology/USGS 2004).

Aggregate mining of sand and gravel deposits is also conducted in the region; although the proposed pipeline route would not cross any aggregate mines.

South Dakota

In the proposed Project area, sand, gravel, oil, gas, and coal comprise the major energy resources (South Dakota Geological Survey/USGS 2005). A gravel pit is present approximately 0.5 mile from the proposed route, northeast of MP 552. The proposed pipeline route would traverse the Buffalo Field, an oil and gas producing area in Hardin County. Fifteen oil and gas producing wells are located within one-quarter mile of the proposed ROW (Appendix F).

The proposed pipeline route would not cross any known coal mines. The proposed route would cross approximately 2 miles of coal-bearing formations (Fort Union Formation and Hell Creek Formation), but potential for mining of these formations is low.

Nebraska

There is no known active oil, natural gas, coal, or mineral mining operations along the proposed pipeline route in Nebraska. The main mineral resource in the proposed Project area is aggregate (sand and gravel) used for road and building construction, and concrete. Along the northern portion of the route, sandstone has been quarried for road construction. In southern Nebraska, near the proposed route, shales and clays have been mined for producing bricks. Near Tobias in Salina County, limestone has been mined for agricultural lime.

Kansas

Mineral resources in the area of the proposed two new pump stations include sand, gravel, and crushed stone (USGS 2004); however, construction of the two new pump stations would not affect current mining operations.

Oklahoma

Oil and natural gas represent important natural resources in the area of the proposed pipeline route in Oklahoma. Along the Gulf Coast Segment in Oklahoma there are 700 oil and gas wells within one-quarter mile of the proposed pipeline route (Appendix F). Sand, gravel, and crushed stone are also mined along the proposed route in Okfuskee, Seminole, Hughes, Clay, Coal, Atoka, and Bryan counties (Johnson 1998a, USGS 2004). Coal resources are present in eastern Oklahoma. The proposed ROW would cross areas of documented coal resources in Coal County in southeastern Oklahoma (Johnson 1998b).

Texas

Along the Gulf Coast Segment in Texas, there are 252 oil and gas wells within one-quarter mile of the proposed pipeline route (Appendix F). However, field surveys have not identified any existing or capped wells in the construction ROW. Crushed stone, coal (lignite), clay, iron, peat, and sand are other mineral resources present in the proposed Project area (Garner 2008).

Along the proposed Houston Lateral in Texas, there are 48 oil and gas wells within one-quarter mile of the proposed pipeline route (Appendix F). Clay, sand, and gravel are also present in the proposed Project area (Garner 2008).

3.1.3.2 Potential Impacts

Although the proposed route would not cross any active surface mines or quarries, construction and operation of the proposed Project would limit access to sand, gravel, clay, and stone resources that are within the width of the permanent pipeline ROW. As summarized above, the proposed route would cross deposits of sand, gravel, clay, and stone; however, the acreage of deposits covered by the proposed ROW is minimal when compared to the amounts available for extraction throughout the proposed Project area. As summarized in Section 2.1.2.2, approximately 811,722 cubic yards of gravel and other borrow materials would be utilized for temporary sites such as storage sites, contractor yards, temporary access roads, and to stabilize the land for permanent facilities including pump stations, mainline valves, permanent access roads, and the pipeline trench bottom. Borrow materials would be obtained from an existing, previously permitted commercial source located as close to the pipeline or contractor yard as possible.

The proposed route would cross underlying coal bearing formations in South Dakota and in Coal County, Oklahoma. Although not currently planned, if surface mining was proposed for this area in the future, the pipeline could limit access to these resources.

While there are numerous oil and gas wells within one-quarter mile of the proposed ROW in Oklahoma and Texas, the proposed route would not cross the well-pads of any active oil and gas wells. Accordingly, extraction of oil and gas resources would not be affected by operation of the proposed pipeline.

3.1.4 Geologic Hazards

3.1.4.1 Environmental Setting

At certain locations along the proposed route, seismic hazards, landsliding, subsidence, or flooding would be possible. Since the proposed pipeline ROW would be located in the relatively flat and stable continental interior, the potential for impacts from geologic hazards is lower than for facilities located in active mountain belts or coastal areas.

Seismic Hazards

Seismic hazards include faults, seismicity, and ground motion hazards. Collectively, these three phenomena are associated with seismic hazard risk. Faults are defined as a fracture along which blocks of earth materials on either side of the fault have moved relative to each other. An active fault is one in which movement has demonstrated to have taken place within the last 10,000 years (USGS 2008b). Seismicity refers to the intensity and the geographic and historical distribution of earthquakes. Ground motion hazards are defined as movement of the earth's surface as a result of earthquakes (USGS 2008a). Figure 3.1.4-1 presents the earthquake hazard rank map which shows earthquake hazard risk along the proposed Project route. The map indicates that there is low seismic hazard risk along the entire proposed route.

Minor faults are present in the vicinity of the proposed pipeline route. In Montana, the Brockton-Froid Fault is mapped in the Weldon-Brockton fault zone approximately 50 miles east of the proposed route in Roosevelt County, just north of Culbertson, Montana (Wheeler 1999). Based on exploration and field data, there is no indication that this is an active fault (Wheeler 1999). No other information regarding historic earthquakes in the Weldon-Brockton fault zone was identified.

Historic earthquake activity in the vicinity of the proposed pipeline was reviewed using USGS's National Earthquake Information Center on-line database search. Records were available from 1973 to the present time.

Eastern Montana historically contains little earthquake activity. From 1973 to 2007, 14 earthquakes have been recorded with magnitudes 4.1 or less in the eastern half of Montana (USGS 2008b).

In South Dakota, 30 earthquakes have been recorded since 1973, with magnitudes 4.2 or less (USGS 2008b); however, none of these earthquakes occurred along or adjacent to the proposed route.

In eastern Nebraska, 11 earthquakes have been recorded since 1973, with magnitudes ranging from 2.8 to 4.3 (USGS 2008b). These earthquakes are believed to be associated with either the Humboldt fault zone or deep seated faults in the Salinas Basin. There are no active surficial faults along the proposed route (Crone and Wheeler 2000, USGS 2006).

In Oklahoma, approximately 50 minor earthquakes occur each year. The majority of these earthquakes range in magnitude from 1.8 to 2.5, and would not be expected to damage the buried pipeline. In general, earthquake activity in Oklahoma occurs in south central Oklahoma, south of Oklahoma City, approximately 100 to 200 miles to the west of the pipeline.

In Texas, surface faults have been mapped in the proposed Project area. There is little evidence of ground movement along these faults and as such, they pose very minimal risk to the pipeline (Crone and Wheeler 2000). Epicenter maps show only sparse, low magnitude seismicity (USGS 2008a). Commenters on the draft EIS expressed concern over the potential for seismic or earthquake fault hazards to the proposed Project resulting from the Mount Enterprise Fault Zone. The proposed ROW does cross a portion of the Mount Enterprise Fault Zone. This fault zone is located within the East Texas Salt Basin that is characterized by Mesozoic and Cenozoic sedimentary rocks overlying Jurassic aged Louann Salt deposits. Within the zone, listric normal faults typically dip northward at about 75 degrees from horizontal at the surface and extend into the Louann Salt formation. Fault displacements within this geologic environment are generally thought to be associated with salt deforming plastically at depth and are therefore not likely to be tectonic in origin, and the magnitudes of earthquakes that may be associated with the fault zone would be minor.

A search of the USGS earthquake database found two earthquake events in the vicinity of the Mount Enterprise Fault Zone from 1973 to present. These two events occurred 18 and 35 miles from the proposed Project fault zone crossing and had magnitudes of 3.2 and 3.0 respectively. Earthquakes exhibiting Richter magnitudes less than 4 are considered minor earthquakes and would not threaten the integrity of a buried pipeline. Additionally, the proposed Project corridor does not cross any mapped geologic fault within the Enterprise Fault Zone with documented surface offset.

In addition, approximately 300 surface faults were mapped using Lidar (light distancing and ranging) technology in the Houston area. Movement along these surface faults is not characterized by ground shaking typically associated with earthquakes, but rather, is associated with slow movements of up to 1 inch per year (Khan and Engelkeimer 2008), and these faults are likely associated with salt domes present in this region, where subsidence has been noted to occur. Some of these surface fault movements may also be associated with subsidence due to groundwater and petroleum withdrawal (Kahn and Engelkeimer 2008). The proposed pipeline ROW does not cross any of these Lidar mapped surface faults.

Landslides

Some commenters on the draft EIS have expressed concern related to landslide potential in steep slope areas, particularly “breakaway” landslides. According to the classification of landslide slope movements, the widely accepted terms describing landslides include fall, topple, slide, spread, and flow. These slide classifications can be further modified with the descriptive terms extremely rapid, very rapid, rapid, moderate, slow, very slow, and extremely slow (Turner and Schuster 1996). While the meaning of the term breakaway landslide is not clear, it is assumed that the concern relates to extremely rapid to rapid slides. The potential for these types of landslides is increased in areas that contain steep slopes (>20 percent grade) and may be further influenced by unstable soils or bedrock. Only 4.04 miles of the terrain crossed by the Steele City Segment and 0.70 mile crossed by the Gulf Coast Segment contain steep slopes (>20 percent grade). Most of these steep sections are less than 0.1 mile in length and correspond to stream crossing locations. Landslides may cause increased soil erosion where underlying soils are exposed and may also cause increased input of sediment and/or in-stream turbidity in adjacent water bodies, if present. Landslides typically occur on steep terrain during conditions of partial or total soil saturation, or during seismic-induced ground shaking. Given the low likelihood of significant seismically-induced ground shaking along the proposed pipeline corridor, earthquake induced landslide potential is very minor. Stream erosion, undercutting or undermining topography during the construction

of roads or other structures also can cause instability leading to increased landslide potential. FEMA developed a landscape hazard ranking system (LSHR) that relied on existing data for swelling clays, landslide incidence, landslide susceptibility, and land subsidence. Using these criteria, the LSHR places landscapes into three general risk categories: low hazard, medium hazard, and high hazard. Areas along the proposed Project corridor that are within the FEMA LSHR high general risk category are summarized by state in Table 3.1.4-1 and shown in Figure 3.1.4-2.

In addition to steep terrain, certain formations are susceptible to increased landslide potential due to the makeup of the soil and/or geological materials. Along the Steele City Segment, the Claggett, Bearpaw, Pierre Shale, Fort Union shales, and Hell Creek Formation may contain appreciable amounts of bentonite. Bentonite is soft, plastic, light colored clay that expands when exposed to water and may cause soil and/or geologic formations to become unstable. Cretaceous and Tertiary rocks in the Missouri River Plateau have the potential for slumping due to high clay content. Along the proposed route, potentially unstable soils or geologic formations are present at the Missouri River, Willow Creek, Keya Paha River, and Niobrara River crossings.

In the Gulf Coast Segment, landslide potential is highest where shale formations weather to clayey colluviums and is highest in areas where slopes exceed a 2:1 gradient (Luza & Johnson 2005). The Houston Lateral does not contain any areas of high risk for landslides.

TABLE 3.1.4-1
Mileage within PHMSA High Landslide Hazard Category Along the Proposed Project

State	Start (MP)	End (MP)	Length (miles)
Steele City Segment			
Montana	0.2	25.5	25.3
Montana	25.5	89.2	63.7
Montana	89.2	102.0	12.8
South Dakota	308.3	313.5	5.2
South Dakota	355.6	358.1	2.5
South Dakota	358.1	370.9	12.8
South Dakota	389.5	425.9	36.4
South Dakota	425.9	426.3	0.4
South Dakota	426.3	426.3	0.0
South Dakota	426.3	485.1	58.8
South Dakota	485.1	525.2	40.1
South Dakota	525.2	537.1	11.9
South Dakota	537.1	571.5	34.4
Nebraska	597.4	608.8	11.4
Nebraska	616.1	622.6	6.5
Nebraska	850.2	851.6	1.4
Steele City Segment Subtotal			**323.6**
Gulf Coast Segment	91.4	91.4	<0.1
Oklahoma	135.5	142.7	7.2
Texas	163.0	168.3	5.3

TABLE 3.1.4-1 Mileage within PHMSA High Landslide Hazard Category Along the Proposed Project			
State	**Start (MP)**	**End (MP)**	**Length (miles)**
Texas	183.1	190.5	7.4
Texas	190.5	190.7	0.2
Texas	190.7	190.8	0.1
Texas	190.8	201.7	10.9
Texas	201.7	204.6	2.9
Texas	261.8	262.0	0.2
Texas	262.1	263.3	1.2
Texas	480.4	482.7	2.3
Texas	482.7	483.8	1.1
Gulf Coast Segment Subtotal			**38.8**
Houston Lateral			
None	-	-	0
Houston Lateral Subtotal			0
Proposed Project Total			**362.4**

Source: PHMSA-NPMS http://www.npms.phmsa.dot.gov/

Additionally, the Montana Department of Environmental Quality (MDEQ) is concerned about areas where slopes greater than 15 percent occur overlying Cretaceous shales. Table 3.1.4-2 provides a listing of these slopes along the original proposed route in Montana.

TABLE 3.1.4-2 Areas in Montana with >15% Slopes Underlain by Cretaceous Shale Geology			
County	**Start (MP)**	**End (MP)**	**Length (miles)**
Phillips	13.8	13.8	< 0.1
Phillips	16.3	16.6	0.3
Phillips	21.2	21.2	< 0.1
Phillips	25.2	25.4	0.2
Valley	26.1	26.1	< 0.1
Valley	33.9	34.0	0.1
Valley	36.2	36.2	< 0.1
Valley	38.7	38.8	0.1
Valley	38.9	39.0	0.1
Valley	39.5	39.6	0.1
Valley	40.1	40.2	0.1
Valley	41.0	41.1	0.1
Valley	41.5	41.6	0.1
Valley	43.1	43.1	<0.1
Valley	46.8	46.8	<0.1

TABLE 3.1.4-2 Areas in Montana with >15% Slopes Underlain by Cretaceous Shale Geology			
County	**Start (MP)**	**End (MP)**	**Length (miles)**
Valley	48.2	48.3	0.1
Valley	48.4	48.5	0.1
Valley	51.3	51.3	<0.1
Valley	53.1	53.2	0.1
Valley	53.7	53.7	<0.1
Valley	55.0	55.1	0.1
Valley	55.1	55.2	0.1
Valley	66.8	66.8	<0.1
Valley	77.8	77.8	<0.1
Valley	78.1	78.1	<0.1
Valley	82.2	82.2	<0.1
McCone	91.4	91.4	<0.1
McCone	91.4	91.6	0.2
McCone	91.6	91.6	<0.1
McCone	91.8	91.9	0.1
McCone	92.0	92.0	<0.1
McCone	93.4	93.4	<0.1
McCone	93.5	93.5	<0.1
McCone	93.7	93.7	<0.1
McCone	93.8	93.8	<0.1
McCone	94.4	94.7	0.3
McCone	94.8	94.8	<0.1
McCone	94.9	94.9	<0.1
McCone	95.0	95.1	0.1
McCone	95.2	95.2	<0.1
McCone	95.3	95.5	0.2
McCone	95.9	95.9	<0.1
McCone	96.6	96.7	0.1
McCone	96.8	96.9	0.1
McCone	97.0	97.1	0.1
McCone	98.6	98.7	0.1
McCone	99.0	99.0	<0.1
McCone	99.5	99.5	<0.1
McCone	100.9	100.9	<0.1
McCone	101.0	101.0	<0.1
McCone	101.6	101.6	<0.1
McCone	102.1	102.2	0.1

TABLE 3.1.4-2 Areas in Montana with >15% Slopes Underlain by Cretaceous Shale Geology			
County	**Start (MP)**	**End (MP)**	**Length (miles)**
Fallon	254.3	254.3	<0.1
Fallon	262.5	262.5	<0.1
Fallon	269.2	269.2	<0.1
Fallon	269.2	269.3	0.1
Fallon	269.3	269.3	<0.1
Fallon	270.5	270.5	<0.1
Fallon	270.9	270.9	<0.1
Fallon	271.9	272.0	0.1

Subsidence

Subsidence hazards along the proposed pipeline route would most likely be associated with the presence of karst features, such as sinkholes and fissures. National karst maps were reviewed to determine areas of potential karst terrain (i.e., areas where limestone bedrock is near the surface) along the proposed pipeline route (US National Atlas 2009). These areas are summarized in Table 3.1.4-3.

TABLE 3.1.4-3 Karst Areas Crossed by the Proposed Project			
Location	**Start (MP)**	**End (MP)**	**Length (miles)**
Steele City Segment[a]			
Nance County, NE	741.8	742.8	1.0
Merrick County, NE	742.8	752.4	9.6
Hamilton County, NE	759.3	764.9	5.7
York County, NE	764.9	778.0	13.0
Steele City Segment Subtotal			*29.4*
Gulf Coast Segment[b]			
Atoka County, OK	125.7	133.1	7.4
Bryan County, OK	133.1	134.8	1.7
Lamar County, TX	178.5	185.7	7.2
Delta County, TX	191.7	196.0	4.4
Gulf Coast Segment Subtotal			*20.7*
Proposed Project Total			**50.1**

[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: US National Atlas.

In Nebraska, potential karst features are present in the Niobrara Formation; however, these potential hazards are considered minimal since approximately 50 feet of sediment typically covers this formation. In southeastern Oklahoma and Texas, the proposed route crosses potential karst features present in flat-lying carbonate rock.

Floods

In general, seasonal flooding hazards occur in areas where the proposed pipeline would cross active stream and river channels, or in areas where the proposed pipeline could be subject to flash flooding in these channels or intermittent drainages. As with landslide risks FEMA has categorized the general flood hazard of landscapes across the U.S. The mileage along the proposed pipeline by state that falls within the FEMA high flooding risk category is as follows: Montana 20 miles; South Dakota 25 miles; Nebraska 14 miles; Oklahoma 51 miles; and Texas 88 miles (see Figure 3.1.4-3). Flooding could cause lateral and vertical scour that could expose and potentially damage the proposed pipeline. Proposed Project design criteria indicate that the proposed pipeline would be buried below the calculated scour depth at active stream crossings. Additionally, at 34 major river crossings, the HDD method would be employed to install the proposed pipeline. At other river and stream crossings, the proposed pipeline would be buried under at least 5 feet of cover for at least 15 feet on either side of the bank-full width. For additional information on stream crossings, see Section 3.3.

3.1.4.2 Potential Impacts

Seismic

Based on the evaluation of potential seismic hazards along the proposed ROW, the risk of pipeline rupture from earthquake ground motion would be considered to be minimal. The proposed route would not cross any known active faults and is located outside of known zones of high seismic hazard.

The pipeline would be constructed to be able to withstand probable seismic events within the seismic risk zones crossed by the proposed pipeline. The pipeline would be constructed in accordance with USDOT regulations 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline, and all other applicable federal and state regulations. These regulations are designed to prevent crude oil pipeline accidents and to ensure adequate protection for the public.

In accordance with federal regulations (49 CFR 195), internal inspection of the proposed pipeline would occur if an earthquake, landslide, or soil liquefaction event were suspected of causing abnormal pipeline movement or rupture. If damage to the pipeline was evident, the pipeline would be inspected and repaired as necessary.

Landslides

Pipeline routing was conducted to avoid to the degree practicable areas with high landslide potential, particularly areas with slopes greater than 15 to 20 percent with potentially unstable soil or rock conditions (see Tables 3.1.4-2 and 3.1.4-3). However, not all potentially unstable slopes could be practicably avoided. As a result, during construction activities, vegetation clearing and alteration of surface-drainage patterns could increase landslide risk. Implementation of temporary erosion control structures would reduce the likelihood of construction-triggered landslides. Potential erosion control measures would include trench breakers, slope breakers or water bars, erosion control matting and mulching. In addition, areas disturbed by construction along the pipeline ROW would be revegetated consistent with the CMR Plan (Appendix B) and special landowner or land manager requirements.

Revegetation would also help reduce the risk of landslides during the operational phase of the proposed Project. The proposed pipeline would be designed and constructed in accordance with 49 CFR, Parts 192 and 193. These specifications require 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.

To reduce landslide risk, erosion and sediment control and reclamation procedures would be employed as described in Section 4.11 of its CMR Plan (Appendix B). These procedures are expected to limit the potential for erosion, and maintain slope stability after the construction phase. Additionally, the potential for landslide activity would be monitored during pipeline operation through aerial and ground patrols and through landowner awareness programs designed to encourage reporting from local landowners. TransCanada's Integrated Public Awareness (IPA) plan would be implemented. This plan is consistent with the recommendations of API RP-1162 (Public Awareness Programs for Pipeline Operators). The plan includes the distribution of educational materials to inform landowners of potential threats and information on how to identify threats to the pipeline including the potential for landslides. Landowners would be provided a toll-free telephone number to report potential threats to the integrity of the pipeline and other emergencies.

Subsidence

There is a risk of subsidence where the proposed route crosses karst formations in Nebraska, Oklahoma, and Texas. Table 3.1.4-3 shows the locations by milepost where karst may be present. Site-specific studies would be conducted as necessary to characterize the karst features, if encountered, and would evaluate and modify construction techniques as necessary in these areas. The overall risk to the pipeline from karst-related subsidence is expected to be minimal.

Floods

There is a risk of pipeline exposure due to lateral or vertical scour at water crossings and during floods. An assessment of potential environmental impacts and protection measures related to proposed pipeline stream crossing procedures can be found in Section 3.3 and for Montana in Appendix I.

3.1.5 Connected Actions

3.1.5.1 Big Bend to Witten 230-kV Transmission Line

The construction and operation of electrical distribution lines and substations associated with the proposed pump stations, and the Big Bend to Witten 230-kV electrical transmission line would have negligible effects on geological resources.

3.1.5.2 Cushing Marketlink and Bakken Marketlink Projects

Construction and operation of the Bakken Marketlink Project would include metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. Keystone reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there were no waterbodies or wetlands on the property. DOS reviewed aerial photographs of the area and confirmed the current use of the land and that there are no waterbodies associated with the site. A site inspection by the DOS third-party contractor confirmed these findings. As a result, the

potential impacts associated with expansion of the pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

The Cushing Marketlink project would be located within the boundaries of the proposed Cushing tank farm of the Keystone XL Project and would include metering systems and two storage tanks (see Figure 3.1.1-2). As a result, the geologic impacts of construction and operation of the Cushing Marketlink Project would be the same as potential impacts associated with construction and operation of the proposed Cushing tank farm described in this section.

Currently there is insufficient information to complete an environmental review of the Marketlink projects. The permit applications for these projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental review of the Marketlink projects. Potential geologic impacts would be evaluated during the environmental reviews for these projects and potential geologic impacts would be evaluated and avoided, minimized, or mitigated in accordance with applicable regulations.

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3.2 SOILS AND SEDIMENTS

3.2.1 Environmental Setting

Soil characteristics present in the proposed Project area are identified and evaluated using information from the NRCS Soil Survey Geographic (SSURGO) database (available online at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx). The evaluation focused on soil characteristics of particular interest to the proposed pipeline construction. The following soil characteristics were evaluated:

- Highly erodible soils—prone to high rates of erosion when exposed to wind or water by removal of vegetation.
- Prime farmland 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. Undeveloped land with high crop production potential may be classified as prime farmland.
- Hydric 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). These soils, under normal conditions are saturated for a sufficient period of time during the growing season to support the growth of hydrophytic vegetation (USDA 2006).
- Compaction-prone soils— surface clay loam or finer textures in somewhat poor to very poor drainage classes.
- Stony/rocky soils—have a cobbly, stony, bouldery, gravelly, or shaly modifier to the textural class; or are comprised of more than 5 percent stones larger than 3 inches in the surface layer.
- Shallow-bedrock soils—typically defined as soils that have bedrock within 60 inches of the soil surface. However, for the purpose of this proposed Project, shallow-bedrock soils are defined as those containing bedrock within 80 inches of the surface, because trenching typically would be done to that depth.
- Drought-prone soils—include coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained.

Table 3.2.1-1 and Table 3.2.1-2 provide summaries of approximate miles of pipeline ROW by state that would cross soils exhibiting these characteristics. The tables include the approximate acreage (including proposed pump station locations) of soils containing these characteristics that would be disturbed by the proposed Project. More detail is provided in Appendix G, including a table listing soil associations from the SSURGO database by milepost along the proposed Project route.

TABLE 3.2.1-1
Approximate Miles of Soil Characteristics Crossed by the Proposed Project

State	Total Miles Affected[a]	Highly Erodible (Wind)	Highly Erodible (Water)	Prime Farmland	Hydric	Compaction-Prone	Stony/ Rocky	Shallow Bedrock	Drought-prone
Montana	282.7	5.6	109.7	67.8	1.6	233.5	29.6	4.1	20.9
South Dakota	314.2	16.6	107.6	106.3	5.2	251.8	9.0	1.1	65.6
Nebraska	254.7	93.7	81.5	99.6	21.7	118.6	13.2	0.3	73.8
Kansas	0	0	0	0	0	0	0	0	0
Oklahoma	156.0	14.4	27.4	69.7	5.9	130.5	30.7	14.5	22.4
Texas	376.4	44.8	33.7	170.3	75.2	313.0	6.5	53.1	43.1
Proposed Project Total	**1,383.9**	**175.1**	**359.8**	**513.7**	**109.5**	**1,047.4**	**89.0**	**73.2**	**225.8**

[a] Total miles affected include non-sensitive soils and other substrate.
Note: Rounded to nearest whole mile.

TABLE 3.2.1-2
Approximate Acreage of Soil Characteristics Crossed by the Proposed Project[a]

State	Approximate Acres Affected[a]	Highly Erodible (Wind)	Highly Erodible (Water)	Prime Farmland	Hydric	Compaction-Prone	Stony/ Rocky	Shallow Bedrock	Drought-prone
Montana	4,086	83	1,608	961	25	3,367	424	58	302
South Dakota	4,488	233	1,553	1,490	76	3,603	128	16	929
Nebraska	3,734	1,465	1,291	1,389	305	1,668	187	5	1,181
Kansas	15	0	1	14	0	15	2	6	0
Oklahoma	2,215	201	390	985	80	1,856	435	200	315
Texas	5,171	640	478	2,311	989	4,299	92	753	614
Proposed Project Total	**19,710**	**2,621**	**5,321**	**7,150**	**1,474**	**14,807**	**1,268**	**1,037**	**3,341**

[a] This table includes land impacted by the centerline ROW and Additional Temporary Workspace Areas (TWAs) (and the 2 pump stations in Kansas). For land acreage affected by pipe stockpile sites, rail sidings, contractor yards, pump stations/delivery facilities, and access roads, see Table 2.1.4-1.
Note: Rounded to nearest whole acre.

3.2.1.1 Montana

The proposed Project route in northern Montana is located within the Northern Great Plains Spring Wheat Land Resource Region (USDA 2006). This region is characterized by glacially deposited till and lacustrine deposits. Soil profiles typically contain thick, dark topsoils that may contain bentonite (smectitic mineralogy). Soils are generally very deep, well-drained, and loamy or clayey. Small areas of alluvial deposits are present along rivers and drainageways and shale is exposed in some uplands. In northern Montana, soils generally are formed in glacial till. From McCone County to Fallon County along the proposed pipeline route (east central Montana), soils are formed on eroded plateaus and terraces. These soils are shallow to very deep, well-drained, and clayey or loamy. Some soils in this area have high bentonite contents and have saline or sodic chemical properties. In east central Montana, the proposed pipeline route lies within the Western Great Plains Range and Irrigated Land Resource Region (USDA 2006). This region consists of an elevated piedmont plain that is dissected by rivers and that contains steep sided buttes and badlands. Soil types vary from deep organic soils to shallow soils with thin topsoil thickness. In Montana, prime farmland soils occupy approximately 24 percent of the pipeline route. The average freeze free period is between 120 and 165 days.

3.2.1.2 South Dakota

The proposed Project route in South Dakota is located within the Western Great Plains Range and Irrigated Land Resource Region (USDA 2006). In northwestern South Dakota, soils are shallow to very deep, well-drained, and loamy or clayey. To the southeast through Meade County, soils are shallow to very deep, somewhat excessively drained to moderately well-drained and loamy or clayey. In southern South Dakota from Hakkon to Tripp County, areas of smectitic clays are present that have shrink-swell potential and may cause significant problems for roads and structural foundations. From central Tripp County to the state line, these clayey soils contain thick, dark, organically enriched layers of topsoil. Beginning at MP 572, transitional aeolian sandy soils are present that generally consist of aeolian sands, sandy alluvium, and lesser amounts of loess and glacial outwash. In southern Tripp County to the state line, soils grade into deep sandy deposits that are similar to the Sand Hills region soils in Nebraska. In South Dakota, prime farmland soils occupy approximately 34 percent of the pipeline route. The average freeze free period is between 135 and 165 days.

3.2.1.3 Nebraska

The proposed Project route in northern Nebraska is located within the Western Great Plains Range and Irrigated Land Resource Region, and the remainder of Nebraska is located in the Central Great Plains Winter Wheat and Range Land Resource Region (USDA 2006). This region is characterized by a nearly level to gently rolling fluvial plain. Soils are similar to those in the Western Great Plains Range and Irrigated Region with warmer temperatures. Soils in Keya Paha County (northern Nebraska) are similar to those found in southern South Dakota. From Rock County to Greeley County, soils are generally sandy, very deep, excessively drained to somewhat poorly drained. From central to southern Nebraska, soils consist of deep loess deposits that are more susceptible to erosion. Soils in Hamilton County and extending to the state line contain thick, dark, organically-enriched layers of topsoil.

In northern and central Nebraska the pipeline route enters portions of the Sand Hills region from MP 595 to MP 707 (Figure 3.2.1-1) in Keya Paha, Rock, Holt, Garfield, Wheeler, Greeley, and Merrick counties. This region consists of a prairie landscape that supports livestock grazing, wildlife habitat, and recreation. Soils in the Sand Hills region consist of aeolian well sorted sands, sandy alluvium, and lesser amounts of loess and glacial outwash. The topsoil is typically sand mixed with organic matter, with the top 6 inches including vegetative root systems and the native vegetation seed bank. The soils are generally very deep, excessively drained to somewhat poorly drained with intermittent wetland depressions. The rolling to

hilly sand dunes that are common in this area have been stabilized by the existing vegetative cover. Where the vegetative cover has been disturbed or removed without restoration, severe wind erosion associated with the prevailing northwesterly winds typically creates steep-sided irregular or conical depressions referred to as 'blowouts'. Blowouts are most commonly associated with fence lines, windmills, and other features where cattle create trackways that allow the initiation of wind funneling (Wedin, Pers. Comm. 2011). In the Sand Hills region 55 percent of soils designated as highly erodible soils are so designated as a result of their susceptibility to wind erosion. The most erosive months of the year are March, April, and May and the least erosive months are the summer months June, July, and August (Wedin, Pers. Comm. 2011). In the spring months, sustained winds of approximately 162 feet per second with gusts with nearly double that velocity can occur (Stubbendieck et al. 1989). In the eastern portion of the Sand Hills region, non dune derived soils originate from glacial loess and drift deposits (Sullivan 1994). In the southern portion of the Sand Hills region (Garfield, Wheeler, and Greeley counties), approximately 24 miles of Valentine soils are present that are highly susceptible to wind erosion and consist of very deep, dry, highly permeable dune deposits. The sandy soils typical of the Sand Hills region have a high infiltration rate and high permeability; however, the fine-grained loess deposits further to the east can be as thick as 200 feet and can locally restrict water flow where fractures are absent (Stanton and Qi 2007, Johnson 1960). In Nebraska, prime farmland soils occupy approximately 39 percent of the pipeline route. The average freeze free period is between 160 and 180 days.

3.2.1.4 Kansas

Construction planned in Kansas as part of the proposed Project comprises two new pump stations and appurtenant facilities, including transmission lines and access roads located in Clay and Butler counties at MP 49.7 and MP 144.6, respectively. Shallow soils of the Hedville series are present in these areas. These soils are loamy and were developed from the erosion of weathered non-calcareous sandstone. In Kansas, the average freeze free period is between 170 and 190 days.

3.2.1.5 Oklahoma

The proposed Project route in northern Oklahoma is located within the Central Great Plains Winter Wheat and Range Land Resource Region and the Southwestern Prairies Cotton and Forage Region (USDA 2006). The Southwestern Prairies Cotton and Forage Region consists of gently rolling to hilly uplands dissected by numerous streams. From Lincoln County to Seminole County, soils contain siliceous mineralogy and may contain bentonite. Soils range from shallow to very deep, somewhat excessively drained to somewhat poorly drained, and are typically loamy or clayey. Soils formed in alluvium on stream terraces, residuum on hills, and colluvium on footslopes. From southern Hughes County through Atoka County, soils have smectitic, carbonatic, or mixed mineralogy and were formed from limestone residuum. Soils in the southern portion of Oklahoma are generally deep to very deep, well-drained to moderately well-drained, and loamy or clayey.

In Oklahoma, prime farmland soils occupy approximately 45 percent of the pipeline route. The average freeze free period is between 245 and 290 days.

3.2.1.6 Texas

The proposed Gulf Coast segment in Texas is located within the Southwestern Prairies Cotton and Forage Region, the South Atlantic and Gulf Coast Slope Cash Crops, Forest, and Livestock Region and the Atlantic and Gulf Coast Lowland Forest and Crop Region (USDA 2006). The Houston Lateral is located in the Atlantic and Gulf Coast Lowland Forest and Crop Region.

Soils in the Southwestern Prairies Cotton and Forage Region from Fannin County to Franklin County generally consist of deep, black, fertile clay weathered from chalks and marls.

The South Atlantic and Gulf Coast Slope Cash Crops, Forest, and Livestock Region is comprised of smooth marine terraces and hilly piedmont areas. Soils are generally very deep, well-drained to poorly drained, and loamy or clayey. Soils have a siliceous, smectitic, or mixed mineralogy.

The Atlantic and Gulf Coast Lowland Forest and Crop Region is characterized by coastal lowlands, coastal plains, and the Mississippi River Delta. Soils in this region are formed in alluvium on flood plains, in depressions, and on terraces and are sandy and sometimes indurated. Soils have a siliceous, smectitic, or mixed mineralogy and consist of young deltaic sands, silts, and clays.

In Texas, prime farmland soils occupy approximately 45 percent of the pipeline route. The average freeze free period is 270 days.

3.2.2 Potential Impacts

3.2.2.1 Construction Impacts

Pipeline construction activities, including clearing, grading, trench excavation, backfilling, equipment traffic, and restoration along the construction ROW, could adversely affect soil resources. In addition, the construction of pump stations, access roads, construction camps and the tank farm could also affect soil resources. Potential impacts could include temporary and short-term soil erosion, loss of topsoil, short-term to long-term soil compaction, permanent increases in the proportion of large rocks in the topsoil, soil mixing, and short-term to permanent soil contamination. Pipeline construction also could result in damage to existing tile drainage systems. Special considerations and measures would also be undertaken in the Sand Hills region, described in detail, below.

The proposed Project CMR Plan (Appendix B) includes construction procedures that are designed to reduce the likelihood and severity of proposed Project impacts. Proposed Project impacts on soils are assessed assuming these construction procedures and applicant proposed environmental protection measures would be implemented.

Soil Erosion

Prior to construction, clearing of the temporary and permanent ROW would remove protective vegetative cover and could potentially increase soil erosion. Soil erosion could also occur during open cut trenching and during spoil storage, particularly where the soil is placed within a streambed. Where soils are exposed close to waterbodies, soil erosion and mobilization to receiving water bodies could impact water quality through increased turbidity or if potentially hazardous substances (such as pesticides or herbicides) are present in the eroded material. To accommodate potential discoveries of contaminated soils, contaminated soil discovery procedures would be developed in consultation with relevant agencies and these procedures would be added to the CMR Plan (Appendix B). If hydrocarbon contaminated soils are encountered during trench excavation, the state agency responsible for emergency response and site remediation would be contacted immediately and a remediation plan of action would be developed in consultation with that agency. Depending upon the level of contamination found, affected soil may be replaced in the trench, land farmed, or removed to an approved landfill for disposal.

Erosion may result in loss of valuable topsoil from its original location through wind and/or water erosion. A small portion of the proposed Project would encounter droughty soils. Droughty soils would be prone to wind erosion during construction and would be more difficult to successfully stabilize and

revegetate following construction. Approximately 39 percent of the overall proposed Project acreage would be constructed where the soils are characterized as highly erodible by either wind or water. Overall, the majority (67 percent) of 'highly erodible' soils are designated as erodible by water.

Proposed construction methods to reduce soil erosion include installation of sediment barriers (silt fencing, straw or hay bales, and sand bags), trench plugs, temporary slope breakers, drainage channels or ditches, and mulching (see CMR Plan, Appendix B). These erosion control measures would be implemented wherever soil is exposed, steep slopes are present, or wherever erosion potential is high. To enforce these methods, an Environmental Inspector (EI) would be assigned to each construction spread. The EI would have the authority to stop work and/or order corrective action in the event that construction activities violate the measures outlined in the CMR Plan (Appendix B), landowner requirements, or any applicable permit. Specifically, the EI would 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 repair of any ineffective erosion control measures would be completed within 24 hours of detection, where possible. If substantial precipitation or snowmelt events create erosion channels in areas where soil is exposed, additional sediment control measures would be implemented. Potential erosion control measures are described in the CMR Plan (Appendix B).

Compaction

On land with soils that are compaction prone, soil compaction may result from the movement of construction vehicles along the construction ROW and additional temporary workspace areas, and on temporary access roads. The degree of compaction is dependent on the moisture content and texture of the soil at the time of construction and compaction would be most severe where equipment operates on moist to wet soils with high clay contents. Detrimental compaction also can occur on soils if multiple passes are made by construction equipment. If soils are moist or wet during trenching, topsoil would likely adhere to tires and/or tracked vehicles and be carried away. Compaction control measures are described in the CMR Plan (Appendix B) and include ripping to relieve compaction in particular areas from which topsoil has been removed.

Prime Farmland Soil

Approximately 7,150 acres of prime farmland soil would be directly impacted by construction of the proposed pipeline (see Table 3.2.1-2 for a breakdown by state). Within the ROW, the existing structure of prime farmland soil may be degraded by construction. Grading and equipment traffic could compact soil, reducing porosity and percolation rates, which can result in increased runoff potential. Construction methods that would reduce impacts to prime farmland soils are summarized in the following sections.

Topsoil and Subsoil Handling

In non-forested agricultural areas, the top 12 inches of topsoil would be removed and segregated during excavation activities. Stripped topsoil would be stockpiled in a windrow along the edge of the ROW. The work would be conducted to minimize the potential for mixing topsoil and subsoil. Topsoil would not be used to fill low lying areas and would not be used to construct ramps at road or waterbody crossings. Additional methodology detailed in the CMR Plan (Appendix B) include 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 topsoil as warranted by conditions and agreed to by landowners and/or federal or tribal entities.

Areas along the proposed pipeline route were evaluated to identify areas where special handling and additional soil salvage techniques could be necessary to conserve agricultural capability. Physical (i.e. texture, organic matter content) and chemical (i.e. salinity, sodicity, pH) characteristics of individual soil horizons, as well as more general factors such as geographic setting, climate, and associated ecology, have been evaluated in South Dakota consistent with South Dakota Public Utilities Commission conditions. These same characteristics will be evaluated in other areas where soils with similar chemical and physical characteristics occur in low-precipitation portions of the proposed Project. In general, soils considered for special handling contain suitable growing conditions in the topsoil horizon and upper sub-soil horizon (horizons immediately underlying the topsoil), but contain undesirable soil conditions at greater depths which could potentially result in degradation of agricultural capability if not managed appropriately. Soil characteristics criteria were developed in consultation with the NRCS to determine areas where special handling may be effective. Characteristics that trigger consideration for special handling include soil with contrasting levels of salinity/sodicity, interbedded coarse soil layers, or shallow to moderate depths to bedrock that occur within cultivated fields or high-quality native prairie or rangeland. Candidate soils for special handling are identified using publicly available NRCS soil survey data (SSURGO) for all upper sub-soil horizons located within 24 inches of the surface. These data are overlain on landuse mapping that has been compiled from pedestrian and vehicle surveys and aerial photo-interpretation. The criteria and thresholds for each soil property are presented in Table 3.2.2-1.

TABLE 3.2.2-1
Soil Criteria and Thresholds for Determining Special Handling Techniques in Cultivated Land and High-Quality Prairie or Rangeland

Characteristics	Upper Sub-soil Horizon	Lower Horizons
Salinity (EC)	<8 mmhos/cm[a]	≥4 mmhos/cm higher than EC of upper sub-soil horizon
Sodicity (SAR)	<13	≥13
Coarse Fragments – percent by volume	<15 %	≥15 %
Lithic / Paralithic Contact	Soil series with lithic or paralithic contact between 15 inches and 40 inches of depth from surface	

[a] mmhos/cm = millimhos per centimeter.

The properties of topsoil and upper sub-soil horizons are compared to data from all deeper sub-soil horizons to identify contrasting horizons and the NRCS soil series that contain contrasting soil horizons. These soils contain upper sub-soil horizons with suitable reclamation characteristics that are at least 6 inches thick, but are underlain by horizons that contain undesirable soil characteristics identified in Table 3.2.2-1. Each soil series meeting special handling criteria is evaluated to determine the magnitude of the inter-horizon differences in relation to factors such as the physical or chemical characteristics of the other horizons within the soil profile. This case-by-case evaluation of the soil series is used to evaluate the agricultural capability and reclamation potential of soils and anticipated results as a result of proposed Project construction. The exact locations of soils that require special soil handling are mapped and then field-verified along the proposed Project route.

The standard topsoil salvage plan for the proposed Project is to salvage topsoil from the pipeline ROW and other construction sites where excavation or grading would occur. Topsoil stripping depths have been determined through a combination of field surveys along the proposed route and verified using topsoil depths reported by the NRCS soil surveys. Salvage depths would vary from 4 inches in shallow soils to 12 inches in highly productive soils. In general, recommended topsoil salvage depths would be designed to conserve the high organic content soils that do not contain physical or chemical conditions

that could inhibit soil capability. Two primary means of salvaging soil in areas that meet the criteria outlined in Table 3.2.2-1 include “over-stripping” and “triple lift”.

In areas recommended for over-stripping topsoil, the soil salvage would extend below the surface horizon into the underlying sub-surface soils (usually a B-horizon). This type of salvage would be used as a precautionary approach to conserve native seed and organics in the topsoil and provide a buffer over less desirable sub-soil materials. In general, soils recommended for over-stripping topsoil commonly are of low quality and support perennial grasses.

The triple lift soil salvage technique would be implemented in areas where deep soils would be excavated, primarily over the pipeline trench in cultivated fields. In these areas the topsoil would be salvaged across the entire proposed Project area according to the depth determined during pre-construction surveys. The second-lift material would be salvaged and windrowed next to the salvaged topsoil. The trench spoil material would then be placed adjacent to the second-lift material. Following construction, the soils would be replaced in the opposite order of extraction and would be feathered across the proposed Project area. An example of this procedure is shown in Figure 3.2.2-1.

Range and Pasture Land

On range, pastures and other areas not suitable for farming, construction and maintenance activities may lead to localized soil compaction in soils listed as hydric or compaction prone. This compaction could lead to slower or less successful vegetation reestablishment following construction. Productivity of range and pasture land along the proposed Project corridor would be restored consistent with easement agreements with landowners and agencies and compensation would be provided for demonstrated losses from decreased productivity resulting from pipeline operations. Additional environmental protection measures to be employed on pasture and range lands are summarized in the proposed Project CMR Plan (Appendix B).

Wet Weather Conditions

All soil types could be impacted by erosion during major or continuous precipitation events. Soils identified as compaction-prone are subject to rutting and displacement as a result of movement of construction vehicles. When saturated, these soils may be particularly sensitive to rutting. Rutting may cause reduced aeration and infiltration of the soil and may cause surface water pooling or water diversion, which increases localized soil erosion.

Stockpiled topsoil and trench spoils could cause water to pond during precipitation events. Despite the protection measures described below, it is possible that precipitation events may cause unavoidable soil erosion by water. The potential for these impacts would be reduced by scheduling construction during drier months of the year whenever possible. The average precipitation per month for selected locations (one in each state) along the proposed Project route are presented in Table 3.2.2-2.

TABLE 3.2.2-2
Monthly Average Total Precipitation in the Vicinity of the Proposed Project (inches)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Circle, Montana [a]	0.4	0.3	0.6	1.3	2.0	2.6	1.9	1.3	1.3	0.8	0.4	0.4	13.4
Midland, South Dakota [b]	0.3	0.4	1.1	1.6	2.8	3.1	2.2	1.7	1.4	1.1	0.5	0.3	16.4
Lincoln, Nebraska [c]	0.7	0.9	2.1	2.9	4.3	3.6	3.4	3.4	3.0	1.9	1.5	0.8	28.4
Marion Lake, Kansas [d]	0.7	0.9	2.4	3.0	4.6	4.9	3.8	3.8	3.2	2.8	1.7	1.0	33.0
Cushing, Oklahoma [e]	1.2	1.9	3.2	3.7	5.8	4.4	2.9	2.7	40.7	3.4	2.9	1.9	38.2
Beaumont/Port Arthur Texas [f]	5.7	3.4	3.8	3.8	5.8	6.6	5.2	4.8	6.1	4.7	4.7	5.2	59.9
Houston, Texas [g]	6.7	1.3	8.8	4.8	9.6	5.6	10.0	7.2	6.3	1.8	4.4	1.6	68.1

[a] Source: Western Regional Climate Center (WRCC), Circle, Montana, Station 241758, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?mt1758
[b] Source: High Plains Regional Climate Center (HPRCC), Midland, South Dakota, Station 395506, http://hprcc1.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?sd5506
[c] Source: High Plains Regional Climate Center (HPRCC), Lincoln WSO Airport, Nebraska, Station 254795, http://hprcc1.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?ne4795
[d] Source: High Plains Regional Climate Center (HPRCC), Marion Lake, Kansas, Station 145039, http://hprcc1.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?ks5039
[e] Source: National Oceanic and Atmospheric Association (NOAA), Cushing, Oklahoma, Station CUS02, http://www.srh.noaa.gov/oun/climate/getnorm.php?id=cuso2
[f] Source: National Oceanic and Atmospheric Association (NOAA), Beaumont, Texas, http://www.srh.noaa.gov/lch/climate/coop/KBPT.htm
[g] Source: National Oceanic and Atmospheric Association (NOAA), Houston, Texas, http://www.srh.noaa.gov/hgx/climate/reviews/010308pns.txt
Note: T = Trace amounts

The proposed Project CMR Plan (Appendix B) includes methods to determine when to restrict or stop work for wet weather and summarizes methods to reduce impacts when construction activities are conducted in wet conditions. Work would be restricted or suspended during wet conditions when potential rutting could cause mixing of topsoil and subsoil, excessive buildup of mud or soil on tires, increased ponding of surface water in the work area, and the potential for severe compaction. During excessive wet conditions, protection measures that could be implemented include limiting work to areas that have adequately drained soils or have sufficient vegetation cover to prevent mixture of topsoil with subsoil, installing geotextile material or construction mats in saturated areas, or using low-impact construction techniques such as using low-ground weight or wide-track equipment. Additionally, a "stop work" directive would be implemented when recommended by the EI.

Construction in Rocky Soils

In areas where rocky soil or shallow bedrock is present, pipeline backfill activities could result in concentration of large clasts near the surface. As detailed in the CMR Plan (Appendix B), specific construction methods would be utilized to ensure that disturbed areas are returned to conditions consistent with pre-construction use and capability. These methods include topsoil removal, segregation and redistribution during backfilling, and off-site removal of excess rocks and rock fragments. The size threshold for rock removal would be consistent to that which is found in adjacent undisturbed areas off the ROW. As stated in the CMR Plan (Appendix B), this effort would result in an equivalent quantity, size and distribution of rocks to that found on adjacent lands.

Soils Drained by Drain Tile Systems

Construction of the proposed pipeline would occasionally necessitate disruption of existing drain tile systems. Drainage tiles would be identified and avoided or if necessary repaired or replaced if damaged by pipeline construction. Adherence to these procedures should eliminate or compensate for any long-term impacts to drain tile function, however, temporary impacts to the drain tile system would be experienced during construction and existing soils could become saturated during wet weather conditions or during periods of continuous precipitation. Wet weather measures are described above. Any demonstrated losses resulting from that occur due to temporary disruption of drain tile systems would be compensated in accordance with landowner and land manager easement agreements.

Sand Hills Topographic Region

In northern and central Nebraska the proposed pipeline route enters portions of the Sand Hills topographic region from MP 595 to MP 707 (Figure 3.2.1-1) in Keya Paha, Rock, Holt, Garfield, Wheeler, Greeley, and Merrick counties (see Section 3.2.1). Many comments on the draft and supplemental draft EIS expressed concerns related to construction in the Sand Hills topographic region. The Sand Hills topographic region contains soils that are especially sensitive to wind erosion. To address concerns related to potential erosion in the Sand Hills, specific construction, reclamation, and post-construction procedures have been developed, as described in the proposed Project CMR Plan (Appendix B), and in two specific Sand Hills construction documents. These documents (*Pipeline Construction in Sand Hills Native Rangelands* and *Sand Hills Construction/Reclamation Unit*, a site-specific reclamation plan that itemizes construction, erosion control, and revegetation procedures in the Sand Hills region) are presented in Appendix H. DOS recognizes that these native rangelands create unique challenges for restoration and reclamation. DOS has confirmed that Keystone consulted with regional experts from the University of Nebraska, University of South Dakota, the Natural Resources Conservation Service (NRCS), and the Nebraska state road department in the development of construction and reclamation plans for the Sand Hills region. The goal of the Sand Hills region reclamation plan that resulted from these consultations is to protect the integrity of this sensitive area through: maintaining soil structure and stability to the greatest

extent practicable; stabilizing slopes to prevent erosion; restoring native grass species; maintaining wildlife habitat and livestock grazing production; and meeting the specifications for Sand Hills construction, operation and maintenance contained in the proposed Project CMR Plan (Appendix B) contract documents and details, and all applicable permits and easement descriptions.

To reduce potential impacts related to severe wind or water erosion, the following Best Management Practices (BMPs) have either been incorporated during proposed Project design or would be incorporated during construction in the Sand Hills topographic region if the proposed Project is implemented:

- The location of the proposed ROW has been sited to avoid ridgetops and existing wind blowout areas to the extent practicable;
- Specific training would be provided for construction crews prior to working in the Sand Hills region;
- Minor re-routes would be incorporated if necessary to relocate the ROW to areas with decreased wind or water erosion potential, while avoiding wetlands wherever possible;
- Grading and side-slope cuts would be minimized to the extent practicable;
- Tracked equipment and/or low ground pressure equipment would be utilized to the extent practicable during construction;
- Access to construction areas would be limited through an Access Control Plan while work is being conducted in the Sand Hills region. The plan would detail specific timing to conduct construction activities, methods to reduce traffic volume, restrictions on equipment and vehicles allowed to enter the work area, and procedures to identify and reduce any site specific issues that develop during construction;
- Disturbance of soils and native vegetation would be avoided to the extent practicable;
- Topsoil, if present, would be segregated from subsoil, consistent with proposed Project BMPs;
- Root crowns and root structures would be left in place to the maximum extent practicable;
- Following pipeline installation, revegetation of the ROW would be completed using native seed mixes adapted to the Sand Hills region;
- Straw or native prairie hay would be crimped into the exposed soil to prevent wind erosion. Annual cover crops could also be used for vegetative cover;
- Straw wattles would be used where appropriate to provide erosion control in place of earthen slope breakers;
- Photodegradable matting would be used to protect steep slopes or other areas that are prone to high wind exposure such as ridgetops or north and west facing slopes. Biodegradable pins would be used to hold the matting in place;
- If necessary, fencing would be incorporated to keep livestock from grazing on vegetation within the ROW to hasten vegetation re-establishment;
- During pipeline installation into the pipeline ditch, the maximum length of open-ditch would be limited to ten miles. Trench backfilling, final cleanup, erosion control, and revegetation must occur on a schedule that prevents the length of open-ditch from exceeding this limit; and
- Since revegetation with native species typically requires several growing seasons, the ROW through the Sand Hills topographic region would be monitored for several years to ensure that reclamation and revegetation efforts are successful. Any areas where reclamation and

revegetation efforts are initially unsuccessful would be reevaluated and restored (see Appendix H).

In response to concerns expressed relative to wind erosion in the Sand Hills topographic region, DOS also contacted an expert in Sand Hills reclamation who provided input to the Keystone plans included in Appendix H. Based on input received through this contact, the following additional considerations relative to Sand Hills erosion are provided (Wedin, Pers. Comm. 2011):

- Use of erosion control mats or blankets may be advisable anywhere in the Sand Hills that is not in a wet meadow environment;
- A fire management plan should be developed and implemented during proposed Project construction;
- Revegetation seed beds should not be over-prepared but rather left more heterogeneous and irregular; and
- Landowners should be reminded that revegetated areas would be attractive as cattle forage and fencing of the revegetated ROW may be advisable, since animal trackways can serve as incipient blowout areas, and due to potentially warmer soils in the immediate vicinity of the proposed pipeline early forage may be concentrated along the ROW over time.

Potential Spills and Leaks

Construction impacts resulting from fuel or lubricating oil leaks or spills during construction are addressed in Section 3.13.

3.2.2.2 Potential Additional Mitigation Measures

The following potential mitigation measures have been suggested by regulatory agencies:

- The creation of a site specific erosion control and revegetation plan in Montana for agency approval prior to the start of construction (MDEQ).
- Ripping of subsoils on Montana range and pasture lands if requested by the landowner or land management agency (MDEQ).

3.2.2.3 Operations Impacts

During the operational phase of the proposed Project, small scale, isolated surface disturbance impacts could occur from pipeline maintenance traffic and incidental repairs. This could result in accelerated erosion, soil compaction and related reductions in the productivity of desirable vegetation or crops. Impacts related to excavation and topsoil handling would be limited to small areas where certain pipeline maintenance activities take place. During operation, these types of impacts would be addressed with the affected landowner or land management agency and a mutually agreeable resolution reached.

Soil Erosion

Operational maintenance of cleared areas could lead to minor increases in soil erosion by wind or water, however these impacts would be very localized in nature. These impacts are expected to be minor. If necessary, localized soil erosion would be reduced using measures outlined the proposed Project CMR Plan (Appendix B). BMPs may include installation of sediment barriers (silt fencing, straw or hay bales,

sand bags, etc.), trench plugs, temporary slope breakers, drainage channels or ditches, and mulching. These erosion control measures would be implemented wherever soil is exposed, steep slopes are present, or wherever erosion potential is high (CMR Plan, Appendix B).

Compaction

Maintenance activities could lead to localized compaction due to vehicular traffic during maintenance operations. These impacts are expected to be minor. In the event that agricultural productivity is impaired by vehicular compaction associated with the proposed Project, landowners and land managers would be compensated for demonstrated losses associated with decreased productivity (CMR Plan, Appendix B).

Soil Productivity

The ROW would be monitored to identify any areas where soil productivity has been degraded as a result of pipeline construction. Necessary reclamation measures would be implemented to rectify any such concerns. Several commenters on the draft EIS questioned whether landowners would be compensated for loss of soil productivity resulting from operation of the proposed Project. DOS understands that Keystone is negotiating easement agreements with landowners and land management agencies that would require Keystone to restore the productivity of the ROW and provide compensation for demonstrated losses from decreased productivity resulting from pipeline operations to the extent required by the easement or ROW agreement.

Differential Settling

Once construction is complete, the ROW would be inspected to identify areas of erosion or settling in the first year after construction. Erosion and settling would be monitored through aerial patrols consistent with the Integrity Management Plan (IMP), and through landowner reporting. Landowner reporting would be facilitated through use of a toll-free telephone number that would be provided to all landowners and land managers along the proposed Project ROW (Appendix B).

Sand Hills Topographic Region

To address concerns related to potential erosion in the Sand Hills, specific construction, reclamation, and post-construction procedures have been developed, as described in the proposed Project CMR Plan (Appendix B) and in two specific Sand Hills construction documents presented in Appendix H; *Pipeline Construction in Sand Hills Native Rangelands*, and *Sand Hills Construction/Reclamation Unit* (a site specific reclamation plan that itemizes construction, erosion control, and revegetation procedures in the Sand Hills region). The proposed Project ROW through the Sand Hills would be monitored for several years to ensure that reclamation and revegetation efforts are successful. Any areas where reclamation and revegetation efforts are initially unsuccessful would be reevaluated and restored.

Soil Temperature Impacts

Due to the relatively high temperature of the oil in the pipeline, increased pipeline operation temperatures may cause a localized increase in soil temperatures and a decrease in soil moisture content. A detailed analysis of the effects of pipeline operations on winter and summer soil temperatures in six locations along the proposed route (one in each state) was conducted based on operating volumes of 900,000 bpd (see Appendix L). The modeled temperature effects are likely to be conservative since the maximum operating volume of the proposed Project is now 830,000 bpd.

Based on these analytical results, operation of the proposed Project would cause slight increases in soil temperatures at the soil surface of 4 to 8 ˚F primarily during January to May and November to December along the pipeline route in Montana, South Dakota, and Nebraska (see Appendix L), and negligible increases from May to November. Increases in temperatures at the soil surface would be most pronounced directly over the pipeline in the South Dakota portion of the pipeline (up to nearly 10 degrees in March and April). Soil surface temperatures over the pipeline route, and year-round soil surface temperatures would remain unchanged in Oklahoma and Texas. Operation of the proposed Project would cause increases in soil temperature 6 inches below the surface of 10 to 15 ˚F with the largest increases during March and April in the Steele City Segment of the proposed Project (see Appendix L). Soil temperatures close to the pipeline could be as much as 40˚ F warmer than the ambient surrounding soil temperatures (see Appendix L).

See Section 3.4 and Section 3.5 for corresponding effects to wetlands and vegetation due to soil temperature increases.

Potential Spills and Leaks

Impacts due to leaks or spills during operation of the proposed Project are addressed in Section 3.13.

3.2.2.4 Potential Additional Mitigation Measures

The following potential mitigation measures have been suggested by regulatory agencies and university professors:

- Conduct ground patrols to detect and repair any differential settling or subsidence holes that develop over the life of the proposed Project in Montana (MDEQ). As discussed in Section 3.13, regular aerial patrols would occur and these patrols would look for evidence of differential settling or subsidence along the proposed Project corridor. Relative to additional ground patrols, Keystone responded to a data request from DOS concerning the feasibility of more ground-level inspections. Keystone responded that based on land owner concerns, additional ground-level inspections are not feasible due to potential disruption of normal land use activities (e.g., farming, animal grazing). PHMSA technical staff indicated that such concerns about landowner acceptance of more frequent ground-level inspections were consistent with their experience with managing pipelines in the region. Although widespread use of ground-level inspections may not be warranted, in the start-up year it is not uncommon for pipelines to experience a higher frequency of spills from valves, fittings, and seals. Such incidences are often related to improper installation, or defects in materials. In light of this fact, DOS in consultation with PHMSA and EPA determined that if the proposed Project were permitted, it would be advisable for the applicant to conduct inspections of all intermediate valves, and unmanned pump stations during the first year of operation to facilitate identification of small leaks or potential failures in fittings and seals. In the normal course of maintenance beyond the first year of operation, Keystone would have crews at various places along the proposed Project corridor (e.g., maintenance inspections of cathodic protection system rectifiers, MLVs, and pump stations). These crews would be trained and experienced in the identification of crude oil releases. It should be noted that the 14 leaks from fittings and seals that have occurred to date on the existing Keystone Oil Pipeline were identified from the SCADA leak detection system and landowner reports.

- Use erosion control mats or blankets in the Sand Hills of Nebraska anywhere that is not in a wet meadow to reduce erosion potential (Professor Wedin, UNL). The construction reclamation plan in the Sand Hills would be determined by a committee of experts from the USFWS Nebraska

Game and Parks Commission and erosion experts including Professor Wedin. The committee would decide when the use of erosion control mats or blankets would be appropriate.

- Revegetation seed beds should not be over-prepared but rather left more heterogeneous and irregular (Professor Wedin, UNL). The construction reclamation plan in the Sand Hills would be determined by a committee of experts from the USFWS Nebraska Game and Parks Commission and erosion experts including Professor Wedin. The committee would decide the level of preparation of seed beds.
- Landowners should be informed that revegetated areas would be attractive as cattle forage and fencing of the revegetated ROW may be advisable, since animal trackways can serve as incipient blowout areas, and due to potentially warmer soils in the immediate vicinity of the proposed pipeline early forage may be concentrated along the ROW over time (Professor Wedin, UNL). Keystone has agreed to inform landowners.
- A fire management plan should be developed and implemented during proposed Project construction (Professor Wedin, UNL). Keystone has agreed to follow the BLM fire management protocol in the Sand Hills that was developed for the proposed Project for federal lands in Montana and South Dakota.

3.2.3 Connected Actions

3.2.3.1 Big Bend to Witten 230-kV Transmission Line

The construction and operation of electrical distribution lines and substations associated with the proposed pump stations, and the Big Bend to Witten 230-kV electrical transmission line would have negligible effects on soil resources.

3.2.3.2 Bakken Marketlink and Cushing Marketlink Projects

Construction and operation of the Bakken Marketlink Project would include metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. Keystone reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there were no waterbodies or wetlands on the property. DOS reviewed aerial photographs of the area and confirmed the current use of the land and that there are no waterbodies associated with the site. A site inspection by the DOS third-party contractor confirmed these findings. As a result, the potential impacts to soils associated with expansion of the pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

The Cushing Marketlink project would be located within the boundaries of the proposed Cushing tank farm of the Keystone XL Project and would include metering systems and two storage tanks. As a result, the impacts of construction and operation of the Cushing Marketlink Project on soils would be the same as potential impacts associated with construction and operation of the proposed Cushing tank farm described in this section.

Currently there is insufficient information to complete an environmental review of the Marketlink projects. The permit applications for these projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental reviews of the Marketlink projects. Potential soil and sediment impacts would be evaluated during the environmental reviews for these projects.

3.2.4 References

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3.3 WATER RESOURCES

Groundwater and surface water resources that could be potentially impacted by the proposed Project are described in this section. Potentially impacted water resources adjacent to the proposed pipeline route include major aquifers, wells, streams and rivers that would be crossed, and reservoirs and large lakes downstream of these crossings. In addition to their description, an evaluation of potential impacts to water resources from the construction and operation of the pipeline and measures to minimize impacts is provided.

3.3.1 Environmental Setting

3.3.1.1 Groundwater

Water Quality

Major aquifers and wells in the vicinity of the proposed Project route are described in the following sections by state. Available water quality information for the aquifers described in each state is presented in Table 3.3.1-1. Available studies and reports indicate that, in general, water within these aquifers exhibits high total dissolved solids (TDS) but in general is not contaminated with other toxic ions. Most often, high levels of TDS are caused by the presence of potassium, chlorides and sodium.

TABLE 3.3.1-1
Groundwater Quality of Select Subsurface Aquifers

Aquifer	State	County	Total Dissolved Solids (mg/liter)	Other Water Quality Information
Judith River Formation[a]	MT	Phillips, Valley	500-10,000	Sodium chloride rich in Valley County
Missouri River Alluvium[b]	MT	Valley	800-2,700	NA
Hells Creek/Fox Hills[c]	MT	McCone	500-1,800	Sodium bicarbonate rich
Fox Hills[c]	MT	Dawson, Prairie, Fallon	500-2,500	Sodium bicarbonate rich
Fort Union[c]	MT	McCone, Dawson, Prairie, Fallon	500-5,000	Sodium bicarbonate rich
Yellowstone R. Alluvium[d]	MT	Dawson, Prairie, Fallon	1,000-1,500	Calcium bicarbonate rich
Hells Creek/Fox Hills[e]	SD	Harding, Perkins, Meade	1,000-3,000	Sodium bicarbonate rich
Northern High Plains Aquifer (NHPAQ)/Ogallala Formation[f]	SD	Tripp	<500	Sodium bicarbonate rich
Pleistocene River Terrace[g]	SD	Tripp	30-4,000	NA
White River Alluvium[h]	SD	Tripp	287-688	Sodium bicarbonate rich
NHPAQ/Ogallala Formation[i]	NE	Keya Paha	100-250	NA
NHPAQ/Sand Hills Unit[j]	NE	Rock-Greeley	<500	NA
NHPAQ/Ogallala Formation[j]	NE	Greeley-Nance	<500	NA
NHPAQ/Platte River Unit[j]	NE	Merrick	<500	NA

TABLE 3.3.1-1 Groundwater Quality of Select Subsurface Aquifers				
Aquifer	**State**	**County**	**Total Dissolved Solids (mg/liter)**	**Other Water Quality Information**
NHPAQ/Eastern Nebraska Unit[j]	NE	Merrick-Jefferson	<500	NA
North Canadian River Alluvium and Terrace[k]	OK	Seminole	<500	Calcium bicarbonate rich
Red River Alluvium[k]	OK	Bryan	1,000-2,000	
Central Oklahoma[l]	OK	Lincoln	<500 (in upper 200 ft)	Calcium magnesium bicarbonate
Ada-Vamoosa[k]	OK	Osage-Pontotoc	<500	Sodium chloride; Sulfate
Arbuckle-Simpson[k]	OK	Coal-Pontotac	<500	Calcium bicarbonate rich
Trinity-Antlers[k]	OK/TX	Bryan, Atoka, Fannin	300-1,500	NA
Texas Coastal Uplands[m]	TX	Hopkins-Angelina	500-1,000	NA

Data obtained from the following sources: [a] Lobmeyer 1985, [b] Swenson and Drum 1955, [c] Smith et al. 2000, [d] La Rocque 1966, [e] Whitehead 1996, [f] Rich 2005, [g] Hammond 1994, [h] Cripe and Barari 1978, [i] Newport and Krieger 1959, [j] Stanton and Qi 2007, [k] Ryder 1996, [l] Carr and Marcher 1977, [m] Ryder and Ardis 2002.

NA = not applicable.

Aquifers and Depth to Groundwater

Initial information on depth to groundwater along the proposed Project corridor was provided by Keystone. Where readily accessible data on depth to groundwater was available (Montana, South Dakota, and Nebraska), water bearing zones less than 50 feet below ground surface (bgs) were identified by examining available well data. These data included static water level, screened interval, and driller well logs within 100 feet of the centerline. In Oklahoma, it was assumed that groundwater in alluvial floodplains was present at the surface. In Texas, it was assumed that groundwater across the alluvial floodplains was present throughout the floodplain at depths less than 50 feet bgs. Based on these data limitations, locations (by milepost) along the proposed Project corridor where estimated depth to groundwater is less than 50 feet are presented in Table 3.3.1-2.

TABLE 3.3.1-2 Water-Bearing Zones Less Than 50 Feet Below Ground Surface Beneath the Proposed ROW for the Project			
State/County	**Approximate Milepost or Range**	**Approximate Depth to Groundwater (feet bgs)[a]**	**Formation/Aquifer**
Steele City Segment			
Montana			
Phillips	2	8	Cretaceous Bearpaw Shale
Phillips	6	0	Cretaceous Bearpaw Shale
Phillips /Valley	25-26	<50	Frenchman Creek alluvium
Valley	27	0-45	Late-Cretaceous Judith River Formation
Valley	38-41	0-9	Rock Creek glacial/allluvial sediments
Valley	47	6	Late-Cretaceous Judith River Formation

TABLE 3.3.1-2 Water-Bearing Zones Less Than 50 Feet Below Ground Surface Beneath the Proposed ROW for the Project			
State/County	**Approximate Milepost or Range**	**Approximate Depth to Groundwater (feet bgs)[a]**	**Formation/Aquifer**
Valley	55-57	40-43	Late-Cretaceous Bearpaw Shale and Buggy Creek alluvium
Valley	66-72	7-63	Cherry Creek glacial/alluvial sediments
Valley	77-85	10-40	Porcupine Creek and Milk River alluvium
Valley	88	7-22	Milk River/Missouri River alluvial sediments
McCone	94	15	Late-Cretaceous Fox Hills Formation
McCone	99	26	Late-Cretaceous Hell Creek Formation
McCone	109	0	Late-Cretaceous Hell Creek Formation
McCone	119	20-30	Fort Union sands and Flying V Creek alluvium
McCone	122-123	<50	Figure Eight Creek alluvium
McCone	133-153	10-45	Fort Union sands; Redwater River alluvium; Buffalo Springs Creek alluvium; glacial drift
Dawson	159-160	10-50	Fort Union sands
Dawson	166-180	10-45	Clear Creek alluvium
Dawson	186-195	4-38	Clear Creek alluvium; Yellowstone River alluvium
Prairie	201-205	0-15	Cabin Creek alluvium
Prairie	209-214	18-40	Alluvium of merging creeks
Fallon	227	<50	Dry Fork Creek alluvium
Fallon	231-234	0	Glacial drift/alluvium
Fallon	235-238	18-45	River alluvium of Dry Creek and its tributaries
Fallon	242-250	5-26	Sandstone Creek and Butte Creek alluvium
Fallon	257-262	0-37	Hidden Water Creek; Little Beaver Creek alluvium
Fallon	264-272	0	Mud Creek and Soda Creek alluvium
Fallon	275-279	0	North and South Coal Bank Creek alluvium
Fallon	281-282	<50	Box Elder Creek alluvium
South Dakota			
Harding	289-290	<50	Shaw Creek alluvium
Harding	291-292	<50	Little Missouri River alluvium
Harding	298-301	<50	Various creeks -alluvium
Harding	304-306	<50	Jones Creek alluvium
Harding	317-319	15-40	South Fork Grand River alluvium
Harding	322-324	<50	Buffalo Creek/Clarks Fork Creek alluvium
Harding	329	<50	West Squaw Creek alluvium
Harding	339	20	Red Butte Creek alluvium
Harding/Butte	351-355	<50	North Fork Moreau River alluvium
Meade	380-387	15-45	Tertiary or alluvial

TABLE 3.3.1-2 Water-Bearing Zones Less Than 50 Feet Below Ground Surface Beneath the Proposed ROW for the Project			
State/County	**Approximate Milepost or Range**	**Approximate Depth to Groundwater (feet bgs)[a]**	**Formation/Aquifer**
Meade	390-394	25	Tertiary or alluvial
Meade	399	18	Sulphur Creek alluvium
Meade	403-404	14-44	Spring Creek alluvium
Meade	407-408	14	Red Owl Creek alluvium
Meade	411	3	Narcelle Creek alluvium
Meade	425	5	Cheyenne River alluvium
Pennington/Haakon	432-437	<50	Alluvial
Haakon	442	12	Alluvial
Haakon	475	37	Alluvial
Haakon	478-481	14-25	Bad River alluvium
Jones	518-519	6	Alluvial
Lyman	535-536	6	White River alluvium
Tripp	539	23	NHPAQ/ Ogallala Formation
Tripp	561-564	3-9	NHPAQ/ Ogallala Formation
Tripp	570 -595	6-25	NHPAQ/ Ogallala Formation
Nebraska			
Keya Paha	597-600	<50	Keya Paha River alluvium
Keya Paha/Rock	603-616	<50	NHPAQ/ Ogallala Formation and Sandhills Unit.
Keya Paha	613-614	<50	Niobrara River alluvium
Rock /Holt/Garfield	624-675	<50	NHPAQ/ Ogallala Formation and Sandhills Unit. with flowing wells, groundwater seeps, and shallow lakes
Wheeler	692-697	<50	Cedar River alluvium
Nance	726-729	<50	South Branch Timber Creek alluvium
Nance/Merrick	737-757	<10[b]-55	Platte River floodplain alluvium
York	778-779	<50	Beaver Creek alluvium
York	788-789	<10[b]-90	West Fork Big Blue River alluvium
Fillmore/Saline	807-822	<50	South Fork Turkey Creek alluvium
Jefferson	834-836	<10[b]-50	South Fork Swan Creek alluvium
Jefferson	847	<50	Tributary to Big Indian Creek alluvium
Gulf Coast Segment			
Oklahoma			
Lincoln	1-4	0	Wildhorse Creek alluvium
Lincoln/Creek	19-20	0	Euchee Creek alluvium
Creek/Okfuskee	22-25	0	Deep Fork River alluvium
Okfuskee	28-29	0	Little Hilliby Creek alluvium

TABLE 3.3.1-2 Water-Bearing Zones Less Than 50 Feet Below Ground Surface Beneath the Proposed ROW for the Project			
State/County	**Approximate Milepost or Range**	**Approximate Depth to Groundwater (feet bgs)[a]**	**Formation/Aquifer**
Okfuskee	30-31	0	Hilliby Creek alluvium
Okfuskee	33	40	Very High Groundwater sensitivity area
Okfuskee/Seminole	38-39	47	North Canadian River - Very High Groundwater Sensitivity Area
Seminole	43-45	0	Sand Creek alluvium
Seminole	47-48	0	Little Wewoka Creek alluvium
Seminole	50-51	0	Wewoka Creek alluvium
Seminole/Hughes	58-61	0	Wewoka Creek alluvium
Hughes	66-68	0	Bird Creek -Very High Groundwater sensitivity area
Hughes	70-71	0	Little River alluvium
Hughes	74-76	0	Canadian River alluvium
Coal	87-88	0	Muddy Boggy Creek alluvium
Atoka	127-130	0	Clear Boggy Creek alluvium
Bryan	133-134	0	Long Branch alluvium
Bryan	145	0	Whitegrass Creek alluvium
Bryan	155-156	0	Red River alluvium
Texas			
Fannin	156-161	<50	Red River alluvium
Lamar	170	<50	Sanders Creek alluvium
Lamar	172	<50	Cottonwood Creek alluvium
Lamar/-Delta	187-191	<50	North Sulfur River alluvium
Delta/Hopkins	201-202	<50	South Sulfur River alluvium
Hopkins	212-213	<50	White Oak Creek alluvium
Hopkins	216-217	<50	Stouts Creek alluvium
Franklin	227-228	<50	Big Cypress Creek alluvium
Wood/Upshur	256-257	<50	Big Sandy Creek alluvium
Upshur	260-263	<50	Sabine River alluvium
Cherokee	297-301	<50	Striker Creek alluvium
Rusk	308-313	<50	East Fork Angelina River alluvium
Nacogdoches/ Cherokee	330-336	<50	Angelina River floodplain alluvium
Angelina	345-346	<50	Neches River alluvium
Angelina	350-353	<50	Neches River alluvium
Angelina/Polk	360-369	<50	Neches River alluvium
Polk	374-375	<50	Bear Creek alluvium
Polk	380	<50	Jones Creek alluvium

TABLE 3.3.1-2 Water-Bearing Zones Less Than 50 Feet Below Ground Surface Beneath the Proposed ROW for the Project			
State/County	**Approximate Milepost or Range**	**Approximate Depth to Groundwater (feet bgs)[a]**	**Formation/Aquifer**
Polk	400-406	<50	Menard Creek alluvium
Polk/Liberty	412-431	<50	Middle Pleistocene sand/silt along Trinity River
Liberty	432-446	<50	Willow Creek/Pine Island Bayou floodplain alluvium
Jefferson	448-480	<50	Late Pleistocene mud/silt in floodplains of various rivers that coalesce.

[a] bgs = below ground surface; based on available well data from Keystone 2009, except where noted for footnote b.

[b] Data from NEDNR 2010.

Note: Mileposting for each segment of the Project starts at 0.0 at the northernmost point of each segment, and increases in the direction of oil flow.

Supplemental information on groundwater occurrence and depth to groundwater by state has been evaluated (see Figures 3.3.1-1 through 3.3.1-5) to address concerns expressed in comments on the draft EIS relative to the Northern High Plains Aquifer (NHPAQ) system (including the Ogallala aquifer) and concerns relative to other aquifers along the proposed Project corridor. The supplemental analysis provides more information on the likely occurrence of potable groundwater in water wells within 1 mile of the proposed pipeline centerline using publicly available and searchable databases maintained by water resource agencies within each state that would be crossed by the proposed Project. The databases were searched for domestic, irrigation, and public water supply well data. The analysis of impacts on water supplies for human consumption also applies to water intakes for industrial and municipal use. Data accessed included well locations, well total depth, and depth to first water (if available) or static water level (see Appendix E of this SDEIS). The screened intervals for individual water wells were not readily available in these databases. Since the screened intervals are not available, it is not possible in all cases to correlate static water level to likely depth to first water. Given limitations and variations in data quality from state to state, five general categories that relate well depth and reported water levels (first water or static water level) to likely water depth were created. These categories are:

- Category A: very shallow water depth likely with reported water level less than or equal to 10 feet bgs and total well depth less than or equal to 50 feet bgs;
- Category B: shallow water depth likely with reported water level between 10 and 50 feet bgs and total well depth less than or equal to 50 feet bgs;
- Category C: water depth unclear but potentially very shallow since reported water level is less than or equal to 10 feet bgs and total well depth is greater than 50 feet bgs (reported water level could indicate very shallow water depth if well screened in upper 50 feet or deep water depth if well screened at deeper interval under artesian conditions);
- Category D: water depth unclear but potentially shallow since reported water level is between 10 and 50 feet bgs and total well depth is greater than 50 feet bgs (reported water level could indicate shallow water depth if well screened in upper 50 feet or deep water depth if well screened at deeper interval under artesian conditions); and
- Category E: deep water depth likely with reported water level greater than 50 feet bgs and total well depth greater than 50 feet bgs.

Information on key aquifers that would be crossed by the proposed Project and additional information on likely depth to groundwater based on the above categories is presented by state in the following subsections.

Montana

Key Aquifers

The proposed pipeline route is present in the Great Plains physiographic province in Montana (Thornbury 1965). Regionally, aquifers beneath the proposed route are part of the Northern Great Plains aquifer system (Whitehead 1996). In Montana, aquifers consist of unconsolidated alluvial and/or glacial aquifers, lower Tertiary-aged aquifers, and upper Cretaceous-aged aquifers (see Figure 3.3.1-1). Groundwater resources along alternate pipeline routes considered in Montana are described in Appendix I.

In northern Montana, in Phillips and Valley counties, glacial till is present up to 100 feet thick. The till is relatively impermeable and acts as a confining layer above the Cretaceous-aged Judith River Formation and Clagett Formation (Whitehead 1996). The Judith River Formation water table is present at approximately 150 to 500 feet bgs. Wells typically yield 5 to 20 gallons per minute (gpm). Additionally, the glacial till contains local permeable zones of coarse glacial outwash less than 50 feet bgs that provide irrigation water. Most groundwater use in Valley County comes from shallow alluvial aquifers along major river drainages such as the Milk River and Missouri River (Whitehead 1996).

In McCone County, the proposed route crosses the upper-Cretaceous Hells Creek/Fox Hills aquifer and the lower Tertiary Fort Union aquifer. Permeable sandstones of the Hells Creek/Fox Hills aquifer yield 5 to 20 gpm; most wells are drilled to depths of 150 to 500 feet bgs (Whitehead 1996). The lower Tertiary Fort Union aquifer consists of interbedded sandstones, mudstones, shale, and coal seams. Water-bearing zones are found in the sandstone layers. The aquifer is confined in most areas. Well yields are typically 15 to 25 gpm; most wells are drilled to depths of 50 to 300 feet bgs (Lobmeyer 1985); water depths typically range from 100 to 150 feet bgs (Swenson and Drum 1955).

Beneath the proposed route in Dawson, Prairie, and Fallon counties lies the Lower Yellowstone aquifer system which contains groundwater in the lower Tertiary Fort Union Formation. In this area, the Fort Union Formation is a shallow bedrock aquifer that is used as a groundwater resource in these three counties. The Yellowstone River contains abundant alluvial material along its banks which contain shallow aquifers that are often used for water supply. Well yields in the shallow aquifers along the Yellowstone River range from 50 to 500 gpm (LaRocque 1966). Additionally, shallow alluvial aquifers are also present at stream crossings including Clear Creek, Cracker Box/Timber Creek, Cabin Creek, Sandstone Creek, and Butte Creek.

The proposed Project pipeline route does not cross any sole-source aquifers in Montana, as designated by EPA Region 8 (EPA 2009).

Nearby Public Water Supply Wells and Private Water Wells

No public water supply (PWS) wells or source water protection areas (SWPA) are located within 1 mile of the centerline of the pipeline in Montana. A total of eight private water wells are located within approximately 100 feet of the proposed pipeline route within McCone, Dawson, Prairie, and Fallon counties.

Likely Depth to Groundwater

Estimates of the likely depth to groundwater at existing well locations within 1 mile of the proposed pipeline in Montana are provided in Figure 3.3.1-1. As depicted in Figure 3.3.1-1, the numbers of wells within 1 mile of the proposed pipeline that fall within each groundwater depth category are as follows:

- Category A (very shallow): 51
- Category B (shallow): 22
- Category C (unclear but potentially very shallow): 46
- Category D (unclear but potentially shallow): 38
- Category E (deep): 59

South Dakota

Key Aquifers

In South Dakota the proposed pipeline route is present in the Great Plains physiographic province (Thornbury 1965). In northern and north-central South Dakota, aquifers beneath the proposed route are part of the Northern Great Plains Aquifer system (Whitehead 1996). Key aquifers in South Dakota are depicted in Figure 3.3.1-2. These aquifers include the upper-Cretaceous Fox Hills and Hells Creek aquifers in Harding, Perkins, and Meade counties. The town of Bison uses groundwater from the Fox Hills aquifer for its water supply. These municipal wells are 565 to 867 feet deep and yield up to 50 gpm (Steece 1981). Shallow alluvial aquifers are also present at stream crossings including Little Missouri River, South Fork Grand River, Clarks Fork Creek, Moreau River, Sulphur Creek, Red Owl Creek, and Cheyenne River.

In Haakon, Jones, and Lyman counties major water-producing aquifers are not present. The proposed route is underlain by the upper-Cretaceous Pierre Shale which is not an aquifer. The floodplains of the Bad River and the White River contain shallow alluvial aquifers that are used for water supply.

In southern South Dakota, the proposed route is underlain by the northern portion of the NHPAQ system and contains Tertiary-aged aquifers and Pleistocene-aged river terrace aquifers (Whitehead 1996). This aquifer system is located primarily in Nebraska, but underlies portions of five states, including South Dakota. Tertiary-aged aquifers include the Ogallala Formation and the Brule and Arikaree Formation. Depth to groundwater of the Ogallala Formation is typically 10 to 70 feet bgs (Hammond 1994) with wells yielding 250 to 750 gpm.

The proposed pipeline route does not cross any sole-source aquifers in South Dakota, as designated by EPA Region 8 (EPA 2009).

Nearby Public Water Supply Wells and Private Water Wells

One PWS well (associated with the Colome SWPA) is identified within 1 mile of the centerline of the pipeline in Tripp County. This PWS wells is screened at relatively shallow depth (reportedly less than 54 feet bgs) within the Tertiary Ogallala aquifer. The proposed Project would pass through the Colome SWPA in Tripp County. No private water wells are located within approximately 100 feet of the proposed pipeline route in South Dakota.

Likely Depth to Groundwater

Estimates of the likely depth to groundwater at existing well locations within 1 mile of the proposed pipeline in South Dakota are provided in Figure 3.3.1-2. As depicted in Figure 3.3.1-2, the numbers of wells within 1 mile of the proposed pipeline that fall within each groundwater depth category are as follows:

- Category A (very shallow): 11
- Category B (shallow): 13
- Category C (unclear but potentially very shallow): 5
- Category D (unclear but potentially shallow): 40
- Category E (deep): 58

Nebraska

Key Aquifers

The proposed route in Nebraska also overlies the NHPAQ system. The NHPAQ system supplies 78 percent of the public water supply and 83 percent of irrigation water in Nebraska (Emmons and Bowman 1999). Many commenters on the draft EIS requested additional information on portions of the NHPAQ system that could be impacted by the proposed Project.

In Nebraska, the NHPAQ system includes five main hydrogeologic units, including the Brule and Arikaree Formation, the Eastern Nebraska Unit, the Ogallala Formation, the Platte River Valley Unit, and the Sand Hills Unit (see Figure 3.3.1-6). These units occur over approximately 64,400 square miles in Nebraska. The proposed Project ROW would extend 247 linear miles through areas underlain by the NHPAQ system. The pipeline would immediately overlie 81 miles of the Eastern Nebraska Unit, 62 miles of the Ogallala Formation, 12 miles of the Platte River Valley Unit, and 92 miles of the Sand Hills Unit.

The type of soil that overlies the NHPAQ system generally consists of silt loam and sand, although clay loam, loam, and sandy loam are also present (Stanton and Qi 2007). In the High Plains Aquifer, which includes the NHPAQ system, hydraulic conductivity (a measurement of the rate of movement of water through a porous medium such as an aquifer or a soil) ranges from 25 to 100 feet per day (ft/d) in 68 percent of the aquifer and averages 60 ft/d (Weeks et al. 1988). In general, ground water velocity (which also takes into account the porosity and the hydraulic gradient [slope of the water table]) in the High Plains Aquifer is 1 ft/d and flows from west to east (Luckey et al. 1986).

The soils of the Sand Hills Unit of the NHPAQ system are derived primarily from aeolian dune sands and are characterized by very low organic and clay/silt fractions. According to the USGS, the hydraulic conductivity of the Northern High Plains aquifer is relatively small, particularly in the Sand Hills north of the Platte River (Gutentag et al. 1984; Luckey et al. 1986). The aquifer material in this region is composed mainly of fine sands and silts with little hydraulic conductivity (Luckey et al. 1986). Estimates of the hydraulic conductivity of the Sand Hills Unit of the NHPAQ system are variable, with a high end estimate of 50 ft/d (Gutentag et al. 1984) and a lower range estimate of 40 ft/d to 13 ft/d (Lappala 1978). Hydraulic conductivity values for the dune sands at the surface in the Sand Hills Unit range from 16.4 ft/d to 23.0 ft/d near the ground surface (8 inches in depth) (Wang, et al, 2006). At intermediate depths within the root zone, hydraulic conductivity values range from 26.3 ft/d to 32.8 ft/d in lowland areas and 32.8 ft/d to 49.2 ft/d in higher areas. In the lower boundary of the root zone, at approximately 6.5 ft bgs,

hydraulic conductivities ranged from 42.7 ft/d to 49.2 ft/d (Wang et al. 2006). These values were based on direct in-situ measurements by constant head permeameter.

In the eastern portion of the Sand Hills Unit, non dune derived soils originate from glacial loess and drift deposits (Sullivan, 1994). These fine-grained loess deposits further to the east can be as thick as 200 feet and can locally restrict water flow where fractures are absent (USGS SIR 2006-5138, Johnson 1960).

Certain areas within the Ogallala Formation of the NHPAQ system contain soils or lithologic zones that inhibit downward contaminant migration (Gurdak et al. 2009). In these areas transport of dissolved chemicals from the land surface to the water table is slower, taking decades to centuries (Gurdak et al. 2009). However even in these areas, localized preferential flow paths do exist that could enable dissolved chemicals to move at an increased rate through the unsaturated zone to the water table. These preferential flow paths are more likely to be present beneath topographic depressions, where precipitation or surface water collects. Preferential pathways with lower infiltration rates are more likely to be present in areas of fine-grained sediments or beneath flat terrain where free-standing water does not pool or collect (Gurdak et al. 2009). These areas within the Ogallala Formation of the NHPAQ system consist of geologic units that comprise unconsolidated sand, gravel, clay, and silt along with layers of calcium carbonate and siliceous cementation (Stanton and Qi 2007). According to the USGS water quality report, a zone of post-deposition cementation is present in many of these areas near the top of the Ogallala Formation, creating an erosion resistant ledge. The Ogallala Formation also contains localized ash beds. These cementation zones and ash layers would serve as localized aquitards within the Ogallala Formation and would tend to inhibit vertical migration of dissolved contaminants.

In Keya Paha County (northern Nebraska), wells yield 100 to 250 gpm (Newport and Krieger 1959). Alluvial aquifers are also present at the Keya Paha River and the Niobrara River. The Niobrara River is used as a source of irrigation and municipal water supply.

From Rock through Greeley counties, the project route is underlain by the NHPAQ system (Sand Hills Unit and Ogallala Formation). The Sand Hills Unit typically has a shallow water table less than 30 feet bgs and is therefore a potential concern (Stanton and Qi 2006). Alluvial aquifers are also present along the Elkhorn River and its tributaries and the Cedar River.

Beneath Nance, Merrick, and Hamilton counties, the project route is again underlain by the Ogallala Formation of the NHPAQ system to the Loup River. From the Loup River to the Platte River, the project route is underlain by the Platte River Valley Unit of the NHPAQ system. Additional shallow aquifers crossed by the proposed Project include the alluvial aquifer of the South Branch Timber Creek and the alluvial aquifer of the Loup River (used for irrigation and domestic water supply).

South of the Platte River, the proposed route crosses the Eastern Nebraska Unit of the NHPAQ system, used for irrigation, domestic, and municipal water supply. Hordville's public water supply comes from wells screened within this aquifer from 160 to 262 feet bgs (Keech 1962).

From York to Jefferson counties, the depth to groundwater is on average 80 feet bgs within the Eastern Nebraska Unit of the NHPAQ system (Stanton and Qi 2006). Additionally, the project route crosses alluvial aquifers along Beaver Creek, the West Fork of the Big Blue River, and the alluvial floodplain of the South Fork Turkey Creek.

While the water quality in the NHPAQ system is suitable for drinking and as irrigation water, impacts from farming operations are present in areas of shallow groundwater. In areas where crop irrigation occurs and shallow groundwater is present, elevated levels of fertilizers, pesticides, and herbicides occur,

including nitrate and atrazine, indicative of impact caused by farming operations. Concentrations of these constituents are generally higher in the near-surface groundwater (Stanton and Qi 2007).

The proposed pipeline route does not cross any EPA designated sole-source aquifers in Nebraska (EPA 2009).

Nearby Public Water Supply Wells and Private Water Wells

Eight PWS wells are present within 1 mile of the centerline of the proposed route in Hamilton, York, Fillmore, Saline, and Jefferson counties. The proposed route would not however pass through any identified PWS wellhead protection areas. SWPAs within 1 mile of the proposed Project include those for the towns of Ericson, Hordville, McCool Junction, Exeter, Steele City and the Rock Creek State Park. Additional SWPAs within 1 mile of the proposed Project include those mapped in Hamilton County near Milepost (MP) 772 and York County near MP 781 and 783. A total of 29 private water wells are located within approximately 100 feet of the proposed pipeline route within Greeley, Merrick, Hamilton, York, Fillmore, and Jefferson counties.

Likely Depth to Groundwater

Estimates of the likely depth to groundwater at existing well locations within 1 mile of the proposed pipeline in Nebraska are provided in Figure 3.3.1-3. As depicted in Figure 3.3.1-3, the numbers of wells within 1 mile of the proposed pipeline that fall within each groundwater depth category are as follows:

- Category A (very shallow): 183
- Category B (shallow): 62
- Category C (unclear but potentially very shallow): 115
- Category D (unclear but potentially shallow): 205
- Category E (deep): 629

Additionally, a USGS analysis suggests that depth to groundwater in the NHPAQ system is variable and ranges from 0 to 272 feet bgs (Stanton and Qi 2007). The median depths to groundwater in the NHPAQ units that would be crossed by the proposed Project in Nebraska are:

- Ogallala Formation: 110 feet bgs
- Eastern Nebraska Unit: 79 feet bgs
- Sand Hills Unit: 20 feet bgs
- Platte River Valley Unit: 5 feet bgs

The well locations where estimated groundwater depth falls within Categories A and C can be used to estimate the distance along the proposed pipeline corridor in Nebraska where water depths less than or equal to 10 feet bgs could be encountered. These data suggest that approximately 65 miles of the proposed pipeline corridor in Nebraska could encounter groundwater at a depth below ground surface less than or equal to 10 feet (see Figure 3.3.1-3). The majority of these areas are present in the Sand Hills Unit and the Platte River Valley Unit and overlie the deeper Ogallala Formation.

Kansas

Construction planned in Kansas as part of the proposed Project comprises two new pump stations located in Clay and Butler counties along the existing Cushing Extension of the Keystone pipeline. These

counties are underlain by the near surface Permian-aged Flint Hills aquifer. The Flint Hills aquifer, a source for numerous small springs, exhibits yields up to 1,000 gallons per minute and is a source for potable water supplies.

Oklahoma

Key Aquifers

The majority of water supply in eastern Oklahoma comes from shallow alluvial and terrace aquifers (Ryder 1996). Key aquifers in Oklahoma are depicted in Figure 3.3.1-4. Alluvial aquifers are located within the floodplains of major rivers and terrace aquifers are present in historical floodplain terraces. Alluvial aquifers contain a shallow unconfined water table while terrace aquifers typically contain a water table depth of 30 to 50 bgs (Ryder 1996). Major rivers and floodplains that contain these aquifers include the North Canadian River, the Canadian River, and the Red River at the state's southern border. Well yields for these aquifers are up to 1,000 gpm for the North Canadian River aquifer, up to 500 gpm for the Canadian River aquifer, and 200 to 500 gpm for the Red River aquifer (Ryder 1996). Alluvial and terrace aquifers consist of Quaternary and late tertiary deposits of sand and gravel interbedded with clay and silt. These aquifers are used for water supply in eastern Oklahoma (Ryder 1996).

Deeper bedrock aquifers include the Garber-Wellington aquifer, the Vamoosa-Ada aquifer, and the Antlers aquifer. The Garber-Wellington aquifer consists of confined and unconfined formations. Well yields range from 70 to 475 gpm (Carr and Marchur 1977) and well depths can be as shallow as 20 feet bgs but are also screened at depths up to 1,000 feet bgs. This aquifer lies adjacent to the west of the proposed route in central Oklahoma. The Vamoosa-Ada aquifer is present beneath the proposed route from Osage to Pontotoc counties and is composed of sandstone and interbedded shale. Wells typically yield 25 to 150 gpm and are used for domestic supply (Ryder 1996). The Antlers aquifer is located beneath the Red River at the state line between Oklahoma and Texas. In Atoka County, the aquifer is present in Cretaceous-aged sandstone and is unconfined; the aquifer is confined beneath Bryan County to the state border. Water is used for domestic, irrigation, commercial and public water supply (Ryder 1996).

Although the proposed pipeline route does not cross any sole-source aquifers in Oklahoma, the route would pass to the east of the Arbuckle-Simpson aquifer, a designated sole-source aquifer by EPA Region 6 (EPA 2009). From the center line of the pipeline, the eastern extent of the Arbuckle-Simpson aquifer is approximately 12 miles to the west. The Arbuckle-Simpson aquifer underlies the Arbuckle Mountains and Arbuckle Plains in south central Oklahoma and is composed of sandstone and interbedded shale (Ryder 1996). Water is present to depths up to 3,000 feet bgs and wells typically yield 100 to 500 gpm.

Nearby Public Water Supply Wells and Private Water Wells

Within 1 mile of the proposed pipeline route in Hughes, Coal, and Bryan counties, 28 PWS wells are present. The number of private water wells located within 100 feet of the proposed pipeline route in Oklahoma is unknown.

Likely Depth to Groundwater

Estimates of the likely depth to groundwater at existing well locations within 1 mile of the proposed pipeline in Oklahoma are provided in Figure 3.3.1-4. As depicted in Figure 3.3.1-4, the numbers of wells within 1 mile of the proposed pipeline that fall within each groundwater depth category are as follows:

- Category A (very shallow): 1
- Category B (shallow): 2

- Category C (unclear but potentially very shallow): 41
- Category D (unclear but potentially shallow): 60
- Category E (deep): 64

Texas

Key Aquifers

Three principal aquifers are present beneath the proposed Project route, including the Trinity aquifer located south of the Red River at the state line, the Texas Coastal Uplands aquifer system from Hopkins County to the Neches River in Angelina County, and the Texas Coastal Lowlands aquifer system from Polk to Jefferson counties (Ryder 1996). Key aquifers in Texas are depicted in Figure 3.3.1-5. These aquifer systems are composed of multiple aquifers that are described below.

The Trinity aquifer consists of Cretaceous-aged sandstone, siltsone, clay, conglomerate, shale, and limestone. Wells yield 50 to 500 gpm and wells are typically 50 to 800 feet deep (Ryder 1996). Water is used for domestic and agricultural use.

The Texas Coastal Uplands aquifer system consists of two main aquifers: the Paleocene/Eocene Carrizo-Wilcox aquifer and the Eocene Claiborne aquifer, which is situated above the Carrizo-Wilcox aquifer. Both aquifers consist of sand, silt, gravel, and clay and are used extensively for agricultural irrigation, domestic, municipal, and industrial water supply. Groundwater in the Carrizo-Wilcox aquifer is present under unconfined and artesian conditions. Water-table conditions usually occur in areas where the aquifer outcrops, and artesian conditions occur where the aquifer is overlain by confining beds. Well yields are usually 500 gal/min (Thorkildsen and Price 1991).

From Polk County to the southern extent of the proposed route, the ROW is present above the Texas Coastal Lowlands aquifer system. The three main aquifers in this system are the Miocene Jasper aquifer, overlain by the late Tertiary Evangeline, which is overlain by the Quaternary Chicot aquifer (Ryder 1996). These three aquifers are composed of sand with interbedded silt and clay. The Evangeline and Chicot aquifers are used extensively for water supply in this area; water levels range from 100 to 300 feet bgs.

The proposed pipeline route does not cross any sole-source aquifers in Texas, as designated by EPA Region 6 (EPA 2009).

Nearby Public Water Supply Wells and Private Water Wells

Within 1 mile of the proposed Gulf Coast Segment pipeline route in Lamar, Wood, Smith, Rusk, Nacogdoches, Angelina, Polk, and Liberty counties, 53 PWS wells are present. Within 1 mile of the proposed Houston Lateral pipeline route, 145 PWS wells are present in Liberty and Harris counties. The proposed Project would pass within 1 mile of 36 SWPAs in Texas. A total of three private water wells are located within approximately 100 feet of the proposed pipeline route within Smith and Chambers counties.

Likely Depth to Groundwater

Estimates of the likely depth to groundwater at existing well locations within 1 mile of the proposed pipeline in Texas are provided in Figure 3.3.1-5. As depicted in Figure 3.3.1-5, the numbers of wells within 1 mile of the proposed pipeline that fall within each groundwater depth category are as follows:

- Category A (very shallow): 11
- Category B (shallow): 11
- Category C (unclear but potentially very shallow): 52
- Category D (unclear but potentially shallow): 25
- Category E (deep): 55

3.3.1.2 Surface Water

Surface water resources that would be crossed by the proposed Project are located within three water resource regions (Seaber et al. 1994):

- Missouri River Region (Montana, South Dakota, Nebraska, and northern Kansas);
- Arkansas-White-Red Rivers Region (southern Kansas, Oklahoma, and northern Texas); and
- Texas-Gulf Rivers Region (Texas).

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 E. Levees, water control structures, and flood protection structures along the proposed route are also presented in Appendix E.

Montana

Waterbodies Crossed

As presented in Appendix E, 350 waterbody crossings would occur in Montana along the proposed Project route. Of the 350 crossings 19 are perennial streams, 114 are intermittent streams, 201 are ephemeral streams, 15 are canals, and 1 is a man-made pond. Based on stream width, adjacent topography, adjacent infrastructure, and sensitive environmental areas, three rivers in Montana would be crossed using the horizontal directional drill (HDD) method. These rivers include:

- Milk River in Valley County (approximately 100 feet wide, MP 83);
- Missouri River in Valley and McCone counties (approximately 1,000 feet wide, MP 89); and
- Yellowstone River in Dawson County (approximately 780 feet wide, MP 196).

The remaining 347 waterbodies would be crossed using one of several non-HDD methods described in the CMR Plan (Appendix B). The crossing method for each waterbody would be depicted on construction drawings but would ultimately be determined based on site-specific conditions at the time of crossing. Surface water resources along alternate pipeline routes considered in Montana are described in Appendix I. Several route variations have been suggested to either reduce impacts at a crossing or to address landowner concerns. These are also summarized in Appendix I. Bureau of Reclamation (Reclamation) canal crossings would include one in Valley County near MP 85 and three in Dawson County from MP 194 to MP 196 (see Figure 2.1-1). For these crossings, Keystone would apply general design requirements consistent with Reclamation facility crossing criteria (see Appendix E).

Sensitive or Protected Waterbodies

The following streams and rivers that would be crossed by the proposed Project route in Montana contain state water quality designations or use designations (Appendix E). These waterbodies include:

- Dunham Coulee and Corral Coulee, in Phillips County
- Missouri River, Frenchman Creek, East Fork Cache Creek, Hay Coulee, Rock Creek, Willow Creek, Lime Creek, Brush Fork, Bear Creek, Unger Coulee, Buggy Creek, Alkali Coulee, Wire Grass Coulee, Spring Creek, Mooney Coulee, Cherry Creek, Spring Coulee, East Fork Cherry Creek, Lindeke Coulee, Espeil Coulee, and Milk River in Valley County
- West Fork Lost Creek, Lost Creek, Shade Creek, Jorgensen Coulee, Cheer Creek, Bear Creek, South Fork Shade Creek, Flying V Creek, Figure Eight Creek, Middle Fork Prairie Elk Creek, East Fork Prairie Elk Creek, Lone Tree Creek, Tributary to West Fork Lost Creek, Redwater Creek, and Buffalo Springs Creek in McCone County
- Cottonwood Creek, Berry Creek, Hay Creek, Upper Seven Mile Creek, Clear Creek, Cracker Box Creek, Side Channel Yellowstone River, and Yellowstone River in Dawson County
- Cabin Creek, West Fork Hay Creek, and Hay Creek in Prairie County
- Dry Fork Creek, Pennel Creek, Sandstone Creek, Red Butte Creek, Hidden Water Creek, Little Beaver Creek, Soda Creek, North Fork Coal Bank Creek, South Fork Coal Bank Creek, and Boxelder Creek in Fallon County

Several of these waterbodies would be crossed more than once. The waterbodies crossed by the proposed Project that have state water quality classification are presented in Table 3.3.1.2-1.

TABLE 3.3.1.2-1
Sensitive or Protected Waterbodies in Montana Crossed More than Once

Waterbody Name	Type	Number of Crossings
Corral Coulee	Intermittent	2
Cherry Creek	Intermittent	3
Foss Creek	Intermittent	3
Lone Tree Creek	Intermittent/Ephemeral[a]	2
Middle Fork Prairie Elk Creek	Ephemeral	2
Bear Creek	Intermittent/Ephemeral[a]	3
Shade Creek	Intermittent	3
Flying V Creek	Intermittent/Ephemeral[a]	2
Buffalo Springs Creek	Perennial/Intermittent[a]	2
Soda Creek	Intermittent	2

[a] In some cases, the stream type may change between crossings.

Impaired or Contaminated Waterbodies

Contamination has been documented in 11 sensitive or protected waterbodies in Montana (Appendix J). Contamination in these waterbodies includes unacceptable levels of at least one of the following parameters: iron, fecal coliform, lead, mercury, phosphorous, total kjeldahl nitrogen (TKN), dissolved oxygen, total dissolved solids, nitrate/nitrite. Impairments in these waterbodies include fish-passage barriers, sedimentation/siltation, alteration in stream-side or littoral vegetative cover, Chlorophyll-a, dissolved oxygen, low flow alteration, and physical substrate habitat alteration (see Table 3.3.1.2-2).

TABLE 3.3.1.2-2 Impaired or Contaminated Waterbodies in Montana	
Waterbody Name	**Impairment or Contamination**
Frenchman Creek	Alteration in stream-side or littoral vegetative cover; Chlorophyll-a; Low flow alterations
Buggy Creek	Iron
Cherry Creek	Iron
Milk River	Fecal Coliform; Lead; Mercury
Missouri River	Alteration in stream-side or littoral vegetative cover; Other flow regime alterations; Temperature, water
Middle Fork Prairie Elk Creek	Alteration in stream-side or littoral vegetative cover; Phosphorus (Total); Physical substrate habitat alterations; Total Kjehidahl Nitrogen (TKN)
East Fork Prairie Elk Creek	Alteration in stream-side or littoral vegetative cover; Phosphorus (Total); Physical substrate habitat alterations; TKN
Yellowstone River	Fish-passage barrier
Cabin Creek	Oxygen, Dissolved; Sedimentation/Siltation; TKN
Pennel Creek	Total Dissolved Solids
Sandstone Creek	Nitrate/Nitrite (Nitrite + Nitrate as N); TKN

Water Supplies

Along the proposed ROW in Montana, municipal water supplies are largely obtained from groundwater sources and are described in Section 3.3.1.1. The proposed ROW would pass within 1 mile downstream of the Cornwell Reservoir (currently breached) at MP 59 and within 1 mile of the Haynie Reservoir at MP 134. These reservoirs, when functional, are used for irrigation and stock watering.

Major waterbodies and reservoirs located within 10 miles downstream of proposed water crossings include Lester Reservoir, Frenchman Reservoir, Reservoir Number Four, Fort Peck Lake, North Dam, Christenson Reservoir, Lindsay Reservoir, Red Butte Dam, and three unnamed reservoirs. The approximate mileposts of these waterbodies and their associated pipeline stream crossings are presented in Appendix E. Wetlands areas are addressed in Section 3.4.

South Dakota

Waterbodies Crossed

As presented in Appendix E, 293 waterbody crossings would occur in South Dakota along the proposed Project route. Of the 293 crossings 20 are perennial streams, 95 are intermittent streams, 171 are ephemeral streams, 2 are natural ponds, and 5 are man-made ponds. Based on stream width, adjacent topography, adjacent infrastructure, and sensitive environmental areas, three rivers in South Dakota would be crossed using HDD method. These rivers include:

- Little Missouri River in Harding County (approximately 125 feet wide, MP 292);
- Cheyenne River in Meade and Haakon County (approximately 1,125 feet wide, MP 426); and
- White River in Lyman County (approximately 500 feet wide, MP 537).

The remaining 290 waterbodies would be crossed using one of several non-HDD methods described in the CMR Plan (Appendix B). The crossing method for each waterbody would be depicted on

construction drawings but would ultimately be determined based on site-specific conditions at the time of crossing. Reclamation water pipeline crossings would include one in Haakon County near MP 467 and one in Jones County near MP 510 (see Figure 2.1-2). For these two crossings, Keystone would apply general design requirements consistent with Reclamation facility crossing criteria (see Appendix E).

Sensitive or Protected Waterbodies

The following streams and rivers that would be crossed by the proposed Project route in South Dakota contain state water quality designations or use designations (Appendix E). These waterbodies include:

- Little Missouri River, South Fork Grand River, and Clark's Fork Creek in Harding County;
- North Fork Moreau River in Butte County;
- South Fork Moreau River in Perkins County;
- Sulfur Creek, and Red Owl Creek in Meade County;
- Cheyenne River in Pennington County;
- Bad River in Haakon County;
- Williams Creek in Jones County; and
- White River in Lyman County.

In addition, all streams in South Dakota are assigned the beneficial uses of irrigation and fish and wildlife propagation, recreation, and stock watering (SDDENR 2008).

Impaired or Contaminated Waterbodies

Contamination has been documented in five of these sensitive or protected waterbodies in South Dakota (Keystone 2008) (Appendix J). Contamination or impairment in these waterbodies includes unacceptable levels of at least one of the following parameters: total suspended solids (TSS), salinity, specific conductance, and fecal coliform.

TABLE 3.3.1.2-3
Impaired or Contaminated Waterbodies in South Dakota

Waterbody Name	Impairment or Contamination
South Fork Grand River	Total Suspended Solids, Salinity
South Fork Moreau River	Specific Conductance
Cheyenne River	Total Suspended Solids, Fecal Coliform
White River	Total Suspended Solids, Fecal Coliform
Ponca Creek	Total Suspended Solids, Fecal Coliform

Water Supplies

Along the proposed ROW in South Dakota, municipal water supplies are largely obtained from groundwater sources and are described in Section 3.3.1.1. The proposed ROW would pass within 1 mile of the Wilson Lake Reservoir at MP 415.

Major waterbodies and reservoirs located within 10 miles downstream of proposed water crossings include Lake Gardner and five unnamed reservoirs. The approximate mileposts of these waterbodies and their associated pipeline stream crossings are presented in Appendix E.

Nebraska

Waterbodies Crossed

As presented in Appendix E, 157 waterbody crossings would occur in Nebraska along the proposed Project route. Of the 157 crossings 28 are perennial streams, 53 are intermittent streams, 66 are ephemeral streams, 8 are canals, 1 is a natural pond, and 1 is a man-made pond. Based on stream width, adjacent topography, adjacent infrastructure, and sensitive environmental areas, four rivers in Nebraska would be crossed using the HDD method. These rivers include:

- Niobrara River in Keya Paha and Rock County (approximately 1,300 feet wide, MP 615.5);
- Cedar River in Wheeler County (approximately 100 feet wide, MP 697);
- Loup River in Nance County (approximately 900 feet wide, MP 741); and
- Platte River in Merrick County (approximately 1,000 feet wide, MP 756).

The remaining 153 waterbodies would be crossed using one of several non-HDD methods described in the CMR Plan (Appendix B). The crossing method for each waterbody would be depicted on construction drawings but would ultimately be determined based on site-specific conditions at the time of crossing. One Reclamation canal crossing would occur in Nance County near MP 738 (see Figure 2.1-3). For this crossing, Keystone would apply general design requirements consistent with Reclamation facility crossing criteria (see Appendix E).

Sensitive or Protected Waterbodies

The following streams and rivers that would be crossed by the proposed Project route in Nebraska contain state water quality designations or use designations (Appendix E). Several of these waterbodies would be crossed more than once. These waterbodies include:

- Keya Paha River, Niobrara River, and Spring Creek in Keya Paha County;
- Ash Creek in Rock County;
- North Branch Elkhorn River, South Fork Elkhorn River, Elkhorn River, Holt Creek, and Dry Creek in Holt County;
- Cedar River in Wheeler County;
- South Branch Timber Creek and Loup River in Nance County;
- Prairie Creek, Side Channel Platte River, and Platte River in Merrick County;
- Big Blue River, Lincoln Creek, Beaver Creek, and West Fork Big Blue River in York County;
- Turkey Creek in Fillmore County; and
- South Fork Swan Creek and Cub Creek in Jefferson County.

Impaired or Contaminated Waterbodies

Contamination has been documented in five of these sensitive or protected waterbodies in Nebraska (Appendix J). Contamination or impairment in these waterbodies includes unacceptable levels of at least one of the following parameters: *E. coli*, low dissolved oxygen, and atrazine.

TABLE 3.3.1.2-4
Impaired or Contaminated Waterbodies in Nebraska

Waterbody Name	Impairment or Contamination
Keya Paha River	E. coli
Niobrara River	E. coli
Loup River	E. coli
Prairie Creek	Low Dissolved Oxygen
Big Blue River	Low Dissolved Oxygen, May-June atrazine

Water Supplies

Along the proposed ROW in Nebraska, municipal water supplies are largely obtained from groundwater sources and are described in Section 3.3.1.1.

Major waterbodies and reservoirs located within 10 miles downstream of proposed water crossings include Atkinson Reservoir, Chain Lake, Rush Lake, Sininger Lagoon, County Line Marsh, Cub Creek Reservoir 13-C, Cub Lake Reservoir 14-C, Big Indian Creek Reservoir 10-A, Big Indian Creek Reservoir 8-E, an unnamed lake, and four unnamed reservoirs. The approximate mileposts of these waterbodies and their associated pipeline stream crossings are presented in Appendix E.

Kansas

Construction planned in Kansas as part of the proposed Project comprises two new pump stations and appurtenant facilities, including transmission lines and access roads located in Clay and Butler counties at MP 49.7 and MP, 144.6, respectively. There are no expected impacts to surface water resources associated with these activities in Kansas.

Oklahoma

Waterbodies Crossed

As presented in Appendix E, 315 waterbody crossings would occur in Oklahoma along the proposed Project route. Of the 315 crossings, 69 are perennial streams, 111 are intermittent streams, 112 are ephemeral streams, 8 are seasonal, and 15 are unclassified. Based on stream width, adjacent topography, adjacent infrastructure, and sensitive environmental areas, seven rivers in Oklahoma would be crossed using the HDD method. These rivers include:

- Deep Fork in Creek County (approximately 125 feet wide, MP 22);
- North Canadian River in Okfuskee and Seminole County (approximately 250 feet wide, MP 39);
- Little River in Hughes County (approximately 110 feet wide, MP 70);

- Canadian River in Hughes County (approximately 700 feet wide, MP 74);
- Fronterhouse Creek (with a RR and road crossing, MP 122.6);
- Clear Boggy Creek in Atoka County (approximately 80 feet wide, MP 127); and
- Red River in Bryan County, OK and Fannin County TX (approximately 750 feet wide, MP 156).

The remaining 308 waterbodies would be crossed using one of several non-HDD methods described in the CMR Plan (Appendix B). The crossing method for each waterbody would be depicted on construction drawings but would ultimately be determined based on site-specific conditions at the time of crossing.

Sensitive or Protected Waterbodies

The following streams and rivers that would be crossed by the proposed Project route in Oklahoma contain state water quality designations or use designations (Appendix E). These waterbodies include:

- Red River in Bryan County;
- Bird Creek and Little River in Hughes County;
- Euchee Creek in Lincoln County;
- Little Hilliby Creek in Okfuskee County; and
- Sand Creek, Wewoka Creek, Little Wewoka Creek, and North Canadian River in Seminole County.

Impaired or Contaminated Waterbodies

Contamination has been documented in six of these sensitive or protected waterbodies in Oklahoma (Appendix J). Contamination in these waterbodies includes unacceptable levels of at least one of the following parameters: chloride, Fish bioassessments, TDS, *Enterococcus* spp, *E. coli*, and lead. Impairments in these waterbodies include turbidity and dissolved oxygen.

TABLE 3.3.1.2-5
Impaired or Contaminated Waterbodies in Oklahoma

Waterbody Name	Impairment or Contamination
Canadian River	Enterococcus Bacteria, Lead, Total Dissolved Solids, Turbidity
Euchee Creek	Eschericihia coli, Enterococcus bacteria, Turbidity
Hilliby Creek	Fish bioassessments
Little River	Enterococcus bacteria, Lead, Turbidity
Little Wewoka Creek	Dissolved Oxygen
Sand Creek	Chloride, Total Dissolved Solids

Water Supplies

Along the proposed ROW in Oklahoma, municipal water supplies are largely obtained from groundwater sources and are described in Section 3.3.1.1.

Major waterbodies and reservoirs located within 10 miles downstream of proposed water crossings include Stroud Lake. The approximate milepost of this waterbody and its associated pipeline stream crossings is presented in Appendix E.

Texas

Waterbodies Crossed

As presented in Appendix E, 631 waterbody crossings would occur in Texas along the proposed Gulf Coast Segment route, and 20 waterbody crossings would occur along the proposed Houston Lateral route. Of the 631 crossings on the Gulf Coast Segment, 176 are perennial streams, 189 are intermittent streams, 223 are ephemeral streams, 5 are seasonal, and 38 are unclassified. Of the 20 crossings on the Houston Lateral, 5 are perennial streams, 2 are intermittent streams, 8 are ephemeral streams, 2 are artificial path (an artificial path is any man-made or modified flow path), and 3 are canal/ditch. Based on stream width, adjacent topography, adjacent infrastructure, and sensitive environmental areas, 19 waterbodies on the proposed Gulf Coast Segment and 4 waterbodies on the proposed Houston Lateral route would be crossed using the HDD method. These waterbodies include:

Gulf Coast Segment

- Red River in Bryan County, OK and Fannin County TX (approximately 750 feet wide, MP 156);
- Bois d'Arc Creek in Fannin and Lamar counties (approximately 125 feet wide, MP 162);
- North Sulphur River in Lamar and Delta counties (approximately 350 feet wide, MP 191);
- South Sulphur River in Delta and Hopkins counties (approximately 100 feet wide, MP 202);
- White Oak Creek in Hopkins County (approximately 300 feet wide, MP 213);
- Big Cyprus Creek in Franklin County (approximately 75 feet wide, MP 228);
- Private lake in Wood County (approximately 250 feet wide, MP 255);
- Big Sandy Creek in Upshur County (approximately 180 feet wide, MP 257);
- Sabine River in Upshur and Smith counties (approximately 175 feet wide, MP 264);
- East Fork Angelina River in Rusk County (approximately 50 feet wide, MP 313);
- Angelina River in Nacogdoches and Cherokee counties (approximately 80 feet wide, MP 334);
- Neches River in Angelina and Polk counties (approximately 150 feet wide, MP 369);
- Menard Creek in Liberty County (approximately 50 feet wide, MP 416);
- Pine Island Bayou in Hardin County (MP 449);
- Neches Valley Canal Authority (approximately 150 feet wide, MP 462);
- Lower Neches Valley Canal Authority in Jefferson County (approximately 150 feet wide, MP 463);
- Willow Marsh Bayou in Jefferson County (approximately 280 feet wide , MP 470);
- Canal crossing in Jefferson County (MP 471); and
- Hillebrandt Bayou in Jefferson County (approximately 490 feet wide, MP 474).

Houston Lateral Segment

- Trinity Creek Marsh in Liberty County (MP 18);
- Trinity River in Liberty County (MP 23);
- Cedar Bayou in Harris County (MP 36); and
- San Jacinto River in Harris County (MP 43).

The remaining 612 waterbodies on the Gulf Coast Segment and 16 waterbodies on the Houston Lateral would be crossed using one of several non-HDD methods described in the CMR Plan (Appendix B). The crossing method for each waterbody would be depicted on construction drawings but would ultimately be determined based on site-specific conditions at the time of crossing.

Sensitive or Protected Waterbodies

The following streams and rivers that would be crossed by the proposed Project route in Texas contain state water quality designations or use designations (Appendix E). Several of these waterbodies would be crossed more than once. These waterbodies include:

Gulf Coast Segment

- Big Sandy Creek in Wood County;
- Big Sandy Creek in Upshur County;
- Angelina River in Cherokee County;
- Angelina River and East Fork Angelina River in Rusk County;
- Angelina River in Nacogdoches County;
- Pine Island Bayou in Hardin County;
- Neches River, Piney Creek, and Big Sandy Creek in Polk County; and
- Hillebrandt Bayou in Jefferson County.

Impaired or Contaminated Waterbodies

Contamination has been documented in 3 of these sensitive or protected waterbodies in Texas (Appendix J). Contamination in these waterbodies includes unacceptable levels of at least one of the following parameters: bacteria, low dissolved oxygen, and lead.

TABLE 3.3.1.2-6 Impaired or Contaminated Waterbodies in Texas	
Waterbody Name	**Impairment or Contamination**
Angelina River above Sam Rayburn Reservoir	Bacteria
Big Sandy Creek	Bacteria
East Fork Angelina River	Bacteria, Lead
Hillebrandt Bayou	Dissolved Oxygen
Hurricane Creek	Bacteria
Jack Creek	Bacteria
Neches River below Lake Palestine	Bacteria, lead
Pine Island bayou	Dissolved Oxygen
Piney Creek	Bacteria, Dissolved Oxygen
Willow Creek	Dissolved Oxygen
Cedar Bayou above Tidal	Bacteria, Benthic Macroinvertebrates
San Jacinto River above Tidal	Dioxin, PCB's

Water Supplies

Along the proposed ROW in Texas, municipal water supplies are largely obtained from groundwater sources and are described in Section 3.3.1.1.

Major waterbodies and reservoirs located within 10 miles downstream of proposed water crossings for the Gulf Coast Segment and the Houston Lateral include Pat Mayse Lake/WMA, proposed George Parkhouse Reservoir, Lake Cypress Springs, Lake Bob Sandlin, proposed Little Cypress Reservoir, Lake Greenbriar, Prairie Creek Reservoir, Lake Tyler, proposed Lake Columbia, Lake Striker, Drainage in David Crockett National Forest, Fiberboard Lake, Drainage in Big Thicket National Preserve, Drainage in Trinity River National Wildlife Refuge, Daisetta Swamp, drainage in Big Thicket National Preserve, Drainage in J.D. Murphree WMA, Highlands Reservoir, George White Lake, and McCracken Lake. The approximate mileposts of these waterbodies and drainage areas and their associated pipeline stream crossings are presented in Appendix E.

3.3.1.3 Floodplains

Floodplains are relatively low, flat areas of land that surround some rivers and streams and convey overflows during flood events. Floodwater energy is dissipated as flows spread out over a floodplain, and significant storage of floodwaters can occur through infiltration and surficial storage in localized depressions on a floodplain. Floodplains form where overbank floodwaters spread out laterally and deposit fine-grained sediments. The combination of rich soils, proximity to water, riparian forests, and the dynamic reworking of sediments during floods creates a diverse landscape with high habitat quality. Floodplains typically support a complex mosaic of wetland, riparian, and woodland habitats that are spatially and temporally dynamic.

Changing climatic and land use patterns in much of the west-central United States has resulted in region-wide incision of many stream systems. Stream systems cutting channels deeper into the surrounding floodplain cause high floodplain terraces to form along valley margins. These floodplain terraces are common along the proposed Project route and receive floodwaters less frequently than the low floodplains adjacent to the streams.

From a policy perspective, the Federal Emergency Management Agency (FEMA) defines a floodplain as being any land area susceptible to being inundated by waters from any source (FEMA 2005). FEMA prepares Flood Insurance Rate Maps that delineate flood hazard areas, such as floodplains, for communities. These maps are used to administer floodplain regulations and to reduce flood damage. Typically, these maps indicate the locations of 100-year floodplains, which are areas with a 1-percent chance of flooding occurring in any single year.

Executive Order 11988, Floodplain Management, states that actions by federal agencies are to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplain development wherever there is a practicable alternative. Each agency is to provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for:

- Acquiring, managing, and disposing of federal lands, and facilities;
- Providing federally undertaken, financed, or assisted construction and improvements; and
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Designated floodplains crossed by the proposed route are listed in Table 3.3.1.3-1.

TABLE 3.3.1.3-1
Designated Floodplain Areas Crossed by the Proposed Pipeline Route

Location	Approximate Mileposts	Watercourse Associated with Floodplain
Steele City Segment		
Montana		
Valley	81.2 - 84.2	Milk River
Valley/McCone	87.2 - 89.2	Missouri River
Valley/McCone	89.2 - 89.2	Missouri River
Valley/McCone	89.2 - 89.3	Missouri River
Valley/McCone	89.3 - 89.5	Missouri River
McCone	146.4 - 147.4	Redwater River
Dawson	193.4 - 196.4	Yellowstone River
South Dakota		
Harding	291 - 292	Little Missouri River
Meade/Pennington	424.1 - 425.9	Cheyenne River
Meade/Pennington	425.9 - 426.2	Cheyenne River
Haakon	480.2 - 482.4	Bad River
Lyman/ Tripp	536.8 - 537.1	White River
Lyman/ Tripp	537.1 - 538.5	White River
Nebraska		
Keya Paha	599.8 - 600.1	Keya Paha River
Keya Paha/ Rock	615.3 - 615.6	Niobrara River

TABLE 3.3.1.3-1 Designated Floodplain Areas Crossed by the Proposed Pipeline Route		
Location	**Approximate Mileposts**	**Watercourse Associated with Floodplain**
Keya Paha/ Rock	615.6 - 615.8	Niobrara River
Wheeler	697.2 - 697.2	Cedar River
Wheeler	697.2 - 697.3	Cedar River
Wheeler	697.6 - 697.7	Cedar River
Nance	739 - 742.8	Loup River
Merrick	742.8 - 746.2	Loup River
Merrick	747.1 - 747.6	Prairie Creek
Merrick	750.6 - 752.5	Silver Creek
Merrick	753.8 - 754.2	Silver Creek
Merrick	755.6 - 756.7	Platte River
Merrick	757.4 - 757.6	Platte River
Merrick/ Hamilton	758 - 758.3	Platte River
Merrick/ Hamilton	758.3 - 758.5	Platte River
York	765.5 - 765.5	Big Blue River
York	767 - 767.1	Big Blue River
York	774.7 - 775	Lincoln Creek
York	778 - 778	Beaver Creek
York	778 - 780.1	Beaver Creek
York	780.1 - 780.3	Beaver Creek
York	786.1 - 786.1	West Fork Big Blue River
York	786.2 - 786.2	West Fork Big Blue River
York	787.3 - 787.3	West Fork Big Blue River
York	789.4 - 790	West Fork Big Blue River
Fillmore	795 - 795.1	Indian Creek
Fillmore	804.4 - 804.5	Turkey Creek
Fillmore	807.5 - 807.6	Turkey Creek
Fillmore	808.1 - 808.6	Turkey Creek
Saline	810 - 810.1	Turkey Creek
Jefferson	826.2 - 826.3	South Fork Swan Creek
Jefferson	828.3 - 828.4	Swan Creek
Jefferson	829.4 - 829.5	Swan Creek
Jefferson	835.1 - 835.3	Cub Creek
Jefferson	836.3 - 836.4	Cub Creek
Jefferson	836.5 - 836.5	Cub Creek
Jefferson	836.8 - 836.9	Cub Creek
Jefferson	844.9 - 845.1	Big Indian Creek
Jefferson	847.3 - 847.4	Big Indian Creek

TABLE 3.3.1.3-1 Designated Floodplain Areas Crossed by the Proposed Pipeline Route		
Location	**Approximate Mileposts**	**Watercourse Associated with Floodplain**
Gulf Coast Segment		
Oklahoma		
Lincoln	1 - 1.3	Wildhorse Creek
Lincoln	2.4 - 2.5	Turkey Creek
Lincoln	3.2 - 3.5	Euchee Creek
Lincoln	13.9 - 14.1	Lilly Creek
Creek	19.4 - 19.6	Deep Fork River
Creek	21.3 - 21.5	Deep Fork River
Creek	21.6 - 21.8	Deep Fork River
Creek	21.9 - 23	Deep Fork River
Seminole	38.6 - 38.8	North Canadian River
Seminole	43 - 43.1	Sand Creek
Seminole	43.3 - 43.6	Sand Creek
Seminole	47.9 - 48	Little Wewoka Creek
Seminole	50.1 - 50.2	Little Wewoka Creek
Seminole	57.9 - 59	Wewoka Creek
Hughes	59.6 - 59.7	Jacobs Creek
Hughes	59.8 - 59.9	Jacobs Creek
Hughes	60.2 - 60.6	Jacobs Creek
Hughes	60.7 - 60.8	Jacobs Creek
Hughes	64.7 - 64.9	Bird Creek
Hughes	65.2 - 65.3	Bird Creek
Hughes	65.5 - 65.7	Bird Creek
Hughes	65.9 - 66.1	Bird Creek
Hughes	66.3 - 67.4	Bird Creek
Hughes	68.9 - 69	Little River
Hughes	69.2 - 69.4	Little River
Hughes	69.7 - 70.4	Little River
Hughes	74 - 75	Canadian River
Hughes	86.4 - 86.5	Muddy Boggy Creek
Hughes/Coal	86.7 - 86.7	Muddy Boggy Creek
Coal	86.7 - 87.6	Muddy Boggy Creek
Coal	87.8 - 87.8	Muddy Boggy Creek
Atoka	114.7 - 115.2	French Henry Creek
Atoka	122.6 - 122.7	Fronterhouse Creek
Atoka	122.9 - 123	Fronterhouse Creek
Atoka	125.5 - 125.9	Fronterhouse Creek

TABLE 3.3.1.3-1 Designated Floodplain Areas Crossed by the Proposed Pipeline Route		
Location	**Approximate Mileposts**	**Watercourse Associated with Floodplain**
Atoka	126.1 - 127.6	Clear Boggy Creek
Atoka	128.2 - 128.5	Clear Boggy Creek
Atoka	131.3 - 131.7	Cowpen Creek
Atoka	132.9 - 133	Long Branch
Bryan	135.4 - 135.5	Pine Creek
Bryan	155.6 - 155.8	Red River
Texas		
Fannin	155.8 - 160.9	Red River
Fannin	161.5 - 162	Bois d'Arc Creek
Lamar	162 - 162.1	Bois d'Arc Creek
Lamar	162.9 - 163.6	Bois d'Arc Creek
Lamar	166.1 - 166.2	Slough Creek
Lamar	169.2 - 169.5	Sanders Creek
Lamar	170.9 - 171.3	Sanders Creek
Lamar	172.6 - 172.8	Cottonwood Creek
Lamar	174.1 - 174.2	Doss Creek
Lamar	186.3 - 186.6	Mallory Creek
Lamar	187.3 - 187.8	Mallory Creek
Lamar	188.5 - 188.6	Mallory Creek
Lamar	189.2 - 189.4	Justiss Creek
Lamar/Delta	189.4 - 190.5	North Sulphur River
Lamar/Delta	190.7 - 190.8	North Sulphur River
Delta/Hopkins	201.7 - 202.6	Evans Branch
Hopkins	202.7 - 203.4	South Sulphur River
Hopkins	206.7 - 206.8	Wolfpen Creek
Hopkins	212.1 - 212.2	Crosstimber Creek
Hopkins	212.4 - 212.4	Crosstimber Creek
Hopkins	212.7 - 214	White Oak Creek
Hopkins	216.7 - 216.8	Stouts Creek
Hopkins	217 - 217.8	Stouts Creek
Hopkins	218.1 - 218.2	Stouts Creek
Hopkins	220.9 - 221	Greenwood Creek
Wood	234 - 234.2	Briary Creek
Wood	234.6 - 234.6	Briary Creek
Wood	235.5 - 235.6	Briary Creek
Wood	242 - 242.2	Little Cypress Creek
Wood	242.2 - 242.3	Little Cypress Creek

TABLE 3.3.1.3-1 Designated Floodplain Areas Crossed by the Proposed Pipeline Route		
Location	**Approximate Mileposts**	**Watercourse Associated with Floodplain**
Wood	242.7 - 242.7	Little Cypress Creek
Wood	253 - 253.1	Blue Branch
Wood/Upshur	257.2 - 257.4	Big Sandy Creek
Wood/Upshur	257.4 - 257.5	Big Sandy Creek
Wood/Upshur	257.8 - 257.9	Big Sandy Creek
Upshur/Smith	263.5 - 263.7	Sabine River
Smith	268.8 - 269.1	Sabine River
Smith	277 - 277.1	Prairie Creek
Smith	277.3 - 277.4	Prairie Creek
Smith	277.7 - 277.7	Prairie Creek
Smith	278.4 - 278.6	Prairie Creek
Smith	278.7 - 279	Prairie Creek
Smith	280.7 - 280.8	Prairie Creek
Smith	282 - 282.1	Prairie Creek
Smith	283.4 - 283.6	Prairie Creek
Smith	287.5 - 287.6	Kickapoo Creek
Smith	290 - 290.2	Denton Creek
Smith	292.3 - 292.5	Denton Creek
Cherokee	297.6 - 297.7	Mill Creek
Cherokee	298.6 - 298.7	Bowles Creek
Cherokee	298.8 - 298.9	Bowles Creek
Cherokee	299.1 - 299.2	Bowles Creek
Cherokee	300.5 - 300.6	Bowles Creek
Cherokee/Rusk	300.7 - 300.9	Bowles Creek
Cherokee/Rusk	300.9 - 302.3	Bowles Creek
Rusk	303 - 303.1	Boggy Branch
Rusk	303.8 - 303.9	Boggy Branch
Rusk	308.1 - 308.7	Autry Branch
Rusk	309.2 - 309.3	Autry Branch
Rusk	310.8 - 310.8	Striker Creek
Rusk	311.4 - 314	East Fork Angelina River
Nacogdoches	316.6 - 316.9	Indian Creek
Nacogdoches	320.2 - 320.3	Beech Creek
Nacogdoches	320.7 - 320.8	Beech Creek
Nacogdoches	325.9 - 326.4	Yellow Bank Creek
Nacogdoches/Cherokee	334 - 334.1	Legg Creek
Nacogdoches/Cherokee	334.1 - 337.3	Legg Creek

TABLE 3.3.1.3-1 Designated Floodplain Areas Crossed by the Proposed Pipeline Route		
Location	**Approximate Mileposts**	**Watercourse Associated with Floodplain**
Cherokee	338.4 - 338.6	Stokes Creek
Angelina	342.2 - 342.2	Red Bayou
Angelina	342.5 - 342.6	Red Bayou
Angelina	344.9 - 344.9	Watson Branch
Angelina	347.6 - 349	Red Bayou
Angelina	349 - 349.3	Neches River
Angelina	349.3 - 349.3	Neches River
Angelina	350.9 - 351.2	Buncombe Creek
Angelina	352 - 353.1	Crawford Creek
Angelina	353.1 - 353.2	Crawford Creek
Angelina	353.2 - 353.5	Crawford Creek
Angelina	358.8 - 358.9	Neches River
Angelina	359.2 - 359.2	Neches River
Angelina	360.4 - 361.6	Hurricane Creek
Angelina	362.8 - 362.9	Neches River
Angelina	363.1 - 363.2	Neches River
Angelina	363.5 - 364.7	Neches River
Angelina	366 - 367	White Oak Creek
Angelina/Polk	367.9 - 368.5	White Oak Creek
Angelina/Polk	368.5 - 369.1	Neches River
Polk	369.1 - 369.8	Neches River
Polk	375.7 - 375.7	Piney Creek
Polk	375.8 - 375.9	Piney Creek
Polk	376.2 - 376.7	Piney Creek
Polk	377.2 - 377.2	Piney Creek
Polk	377.2 - 377.4	Piney Creek
Polk	377.4 - 377.9	Bear Creek
Polk	378 - 378	Bear Creek
Polk	382.6 - 382.7	Kennedy Creek
Polk	382.8 - 383	Kennedy Creek
Polk	384.5 - 384.6	Johnson Creek
Polk	389.8 - 389.9	Big Sandy Creek
Polk	391.7 - 391.9	Big Sandy Creek
Polk	393 - 393.1	Big Sandy Creek
Polk	397.2 - 397.4	Menard Creek
Polk	404.2 - 404.7	Menard Creek
Polk	407 - 407.2	Dry Branch

TABLE 3.3.1.3-1 Designated Floodplain Areas Crossed by the Proposed Pipeline Route		
Location	**Approximate Mileposts**	**Watercourse Associated with Floodplain**
Liberty	416.2 - 416.3	Menard Creek
Liberty	416.3 - 416.3	Menard Creek
Liberty	416.3 - 416.4	Menard Creek
Liberty	434.7 - 436.1	Batiste Creek
Liberty	439.2 - 439.6	Mayhaw Creek
Liberty	439.6 - 439.6	Mayhaw Creek
Liberty/Hardin	439.6 - 440	Mayhaw Creek
Hardin	440.6 - 441	Mayhaw Creek
Hardin	441.3 - 441.5	Mayhaw Creek
Hardin	448.9 - 449.2	Pine Island Bayou
Hardin	449.2 - 449.5	Pine Island Bayou
Hardin	449.5 - 449.9	Pine Island Bayou
Hardin	449.9 - 450.4	Pine Island Bayou
Hardin/Liberty	451.1 - 451.3	Pine Island Bayou
Hardin/Liberty	451.3 - 451.4	Pine Island Bayou
Hardin/Liberty	451.4 - 451.5	Pine Island Bayou
Hardin/Liberty	451.5 - 451.9	Pine Island Bayou
Liberty/Jefferson	451.9 - 451.9	Pine Island Bayou
Liberty/Jefferson	451.9 - 452	Pine Island Bayou
Liberty/Jefferson	452 - 452.1	Pine Island Bayou
Jefferson	453.3 - 454.4	Pine Island Bayou
Jefferson	457.8 - 458.3	Cotton Creek
Jefferson	465.1 - 465.3	Willow Marsh Bayou
Jefferson	465.7 - 465.9	Willow Marsh Bayou
Jefferson	468.1 - 468.2	Willow Marsh Bayou
Jefferson	468.3 - 468.7	Willow Marsh Bayou
Jefferson	469.5 - 470	Willow Marsh Bayou
Jefferson	470 - 471.4	Willow Marsh Bayou
Jefferson	471.4 - 473.1	Willow Marsh Bayou
Jefferson	473.5 - 474	Willow Marsh Bayou
Jefferson	474.5 - 475.3	Willow Marsh Bayou
Jefferson	482.4 - 482.6	Neches River

Sources: Interpretation of USGS 1:24,000 Topographic Maps and PHMSA (http://www.npms.phmsa.dot.gov); FEMA 100-year floodplain maps.

In the Gulf Coast Segment, pump station 32 at MP 0.0 in Lincoln County, Oklahoma and pump station 41 at MP 435.15 in Liberty County, Texas are situated within 100-year floodplains as designated by FEMA.

As proposed, the Project has 10 MLVs in the 100-year floodplain (Table 3.3.1.3-2). However, MLV locations may change during final design or in response to PHMSA conditions.

TABLE 3.3.1.3-2
Proposed Mainline Valve Locations within Designated 100-Year Floodplains

County	MLV	Approximate Milepost	Watercourse Associated with Floodplain
Steele City Segment			
Montana			
Valley	260-VLLEY-03A-B0-MLV-01	81.4	Milk River
Valley	260-VLLEY-04A-B0-MLV-01	84.4	Milk River
Dawson	260-CRCLE-02A-B0-MLV-01	194.4	Yellowstone River
Nebraska			
Merrick	260-ERSCN-03A-B0-MLV-01	747.5	Prairie Creek
Gulf Coast Segment			
Oklahoma			
Hughes	290-CRMWL-01A-B0-MLV-01	66.6	Bird Creek
Texas			
Jefferson	290-LIBRT-04A-B0-MLV-01	472.5	Willow Marsh Bayou
Houston Lateral			
Texas			
Liberty	MLV-305	21.75	Trinity River
Harris	MLV-320	42.92	San Jacinto River
Harris	CK-MLV-325	44.38	San Jacinto River
Harris	MLV-330	48.57	San Jacinto River

The southeast portion of the proposed Cushing tank farm in Lincoln County, Oklahoma, would also lie within the 100-year floodplain of Wildhorse Creek.

3.3.2 Potential Impacts

3.3.2.1 Groundwater

Construction Impacts

Potential impacts to groundwater during construction activities would include:

- Temporary to long-term surface water quality degradation during or after construction from disposal of materials and equipment;
- Temporary increases in 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 due to potential blasting.

Shallow or near-surface aquifers are present beneath the proposed route (see Table 3.3.1-2 and Figures 3.3.1-1 through 3.3.1-5). Shallow aquifers could be impacted by construction activities. Many of these shallow or near-surface aquifers occur along alluvial stream valleys. In Montana, many shallow aquifers present in the subsurface beneath the proposed route are isolated by the presence of overlying glacial till or other confining units.

Construction impacts to groundwater resources associated with hazardous liquids spills and leaks are discussed in Section 3.13.

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 are receptive to recharge from precipitation and surface water flow.

Runoff, Erosion, and Dust Control

Implementation of measures described in the proposed Project CMR Plan (Appendix B) would reduce erosion (Section 3.2.2.1) and control surface water runoff during vegetation clearing in the ROW. However infiltration to groundwater will ultimately be reduced due to vegetation clearing in the ROW. Groundwater or surface water resources may be needed to control dust during construction activities.

Hydrostatic Testing

Groundwater withdrawal for hydrostatic testing may be necessary at certain locations where surface water sources cannot be used. Infiltration of hydrostatic testing waters would temporarily increase local groundwater levels; however, the duration of increase would be minimal. Hydrostatic test water will be tested and discharged in accordance with state or federal permits. All applicable water withdrawal and discharge permits would be acquired prior to hydrostatic testing.

Operations Impacts

Routine operation and maintenance is not expected to affect groundwater resources.

Operational impacts to groundwater resources associated with hazardous liquids spills and leaks are discussed in Section 3.13.

3.3.2.2 Surface Water

Construction Impacts

Potential impacts on surface water resources during construction activities would include:

- 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 to long-term decrease in bank stability and resultant increase in TSS concentrations from bank erosion as vegetation removed from banks during construction is re-establishing; and
- Temporary reduced flow in streams and potential other adverse effects during hydrostatic testing activities.

Construction impacts to surface water resources associated with hazardous liquids spills and leaks are discussed in Section 3.13.

Stream Crossings and In-Stream Construction Activities

Depending on the type of stream crossing, one of six construction methods would be used: the non-flowing open-cut method, the flowing open-cut method, the dry flume method, the dry dam-and-pump method, the HDD method, or the horizontal bore crossing method. More detailed descriptions of each crossing method and measures to reduce impacts associated with each method are provided in the CMR Plan (Appendix B) and in the Project Description (Section 2.0). Each stream crossing and chosen method would be shown on construction drawings but may be amended or changed based on site-specific conditions during construction. Open-cut methods would be used at most crossings, unless deemed not feasible due to site conditions during construction or to protect sensitive waterbodies, as determined by the appropriate regulatory authority. At 39 major and sensitive waterbody crossings the HDD method would be used. The river crossing procedures and measures to reduce impacts included in the CMR Plan (Appendix B) would be implemented. For waterbody crossings where HDD would be used, disturbance to the channel bed and banks would be avoided, however measures identified in a frac-out plan would be implemented as needed in the instance of a frac-out.

Where the HDD method is not used for major waterbody crossings or for waterbody crossings where important fisheries resources could be impacted, a site-specific plan addressing proposed additional construction and impact reduction procedures would be developed (CMR Plan, Appendix B). Prior to commencing any stream crossing construction activities, permits would be required under Section 404 of the Clean Water Act (CWA) through the USACE and Section 401 water quality certification as per state regulations and these agencies could require measures to limit unnecessary impacts such as requiring all the non-HDD crossings to be done during dry conditions.

Construction activities for open-cut wet crossings involve excavation of the channel and banks. Construction equipment and excavated soils would be in direct contact with surface water flow. The degree of impact from construction activities would depend on flow conditions, stream channel conditions, and sediment characteristics. For the types of crossings listed below, the following measures would be implemented on a site-specific basis:

- **Contaminated or Impaired Waters.** If required, specific crossing and sediment handling procedures would be developed with the appropriate regulatory agencies and agency consultation and recommendations would be documented.
- **Sensitive/Protected Waterbodies.** If required, specific construction and crossing methods would be developed in conjunction with USACE and U.S. Fish and Wildlife Service (USFWS) consultation. The appropriate method of crossing these waterbodies would be determined by USACE or USFWS, as applicable.
- **Frac-out Plan.** A plan would be developed in consultation with the regulatory agencies to address appropriate response and crossing implementation in the event of a frac out during HDD crossings.

Implementation of measures as described in the proposed Project CMR Plan (Appendix B) and additional conditions from permitting agencies 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. The CMR Plan describes the use of buffer strips, drainage diversion structures, sediment barrier installations, and clearing limits, as well as procedures for waterbody restoration at crossings. (See Section 2.0 and the CMR Plan for a discussion of the proposed waterbody crossing methods.)

For construction access, temporary bridges, including subsoil fill over culverts, timber mats supported by flumes, railcar flatbeds, and flexi-float apparatus would be installed across waterbodies. These temporary crossings would be designed and located to minimize damage to stream banks and adjacent lands. The use of temporary crossings would reduce the impacts to the waterbodies by providing access for equipment to specific locations.

Following completion of waterbody crossings, waterbody banks would be restored to preconstruction contours, or at least to a stable slope. Stream banks would be seeded for stabilization, and mulched or covered with erosion control fabric in accordance with the CMR Plan and applicable state and federal permit conditions. Additional erosion control measures would be installed as specified in any permit requirements. However, erosion control measures can themselves cause adverse environmental impacts. For example, placement of rock along the bank at a crossing could induce bank failure further downstream. Geomorphic assessment of waterbody 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, waterbody crossings would be assessed by qualified personnel in the design phase of the proposed Project with respect to the potential for channel aggradation/degradation and lateral channel migration. The level of assessment for each crossing could vary based on the professional judgment of the qualified design personnel. The pipeline would be installed as necessary to address any hazards identified by the assessment. The pipeline would be installed at the design crossing depth for at least 15 feet beyond the design lateral migration zone, as determined by qualified personnel. The design of the crossings also would include the specification of appropriate stabilization and restoration measures. Permits required under Sections 401 and 404 of the CWA would include additional site specific conditions as determined by USACE and appropriate state regulatory authorities.

Hydrostatic Testing

Water used for hydrostatic testing would be obtained from nearby surface water resources or municipal sources. These sources include streams, rivers, and privately owned reservoirs. There have been 50 potential surface water sources identified that could supply water for hydrostatic testing along the proposed project route depending on the flows at the time of testing and the sensitivity of the individual waterbodies for other uses (see CMR Plan, Appendix B). FERC has developed criteria for the minimum separation distance for hydrostatic test manifolds from wetlands and riparian areas appropriate for natural gas pipeline construction. Although the proposed Project is not subject to FERC authority, hydrostatic test manifolds would be located more than 100 feet away from wetlands and riparian areas to the maximum extent possible, consistent with FERC requirements.

During proposed Project construction, hydrostatic test water would not be withdrawn from any waterbody where such withdrawal would create adverse affects. All surface water resources utilized for hydrostatic testing would be approved by the appropriate permitting 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 the proposed Project CMR Plan (Appendix B), required water analyses would be obtained prior to any water filling and discharging operations associated with hydrostatic testing.

The water withdrawal methods described in the proposed Project CMR Plan (Appendix B) would 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 to the source water at an approved location along the waterway/wetland or to an upland area within the same drainage as the source water where it may evaporate or infiltrate. Discharged water would be tested to ensure it meets applicable water quality standards imposed by the discharge permits for the permitted discharge locations. The proposed Project CMR 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).

Operations Impacts

Channel migration or streambed degradation could potentially expose the pipeline, resulting in temporary short-term or long-term adverse impacts to water resources, however protective activities such as reburial or bank armoring would be implemented to reduce these impacts. As described in the proposed Project CMR Plan (Appendix B), a minimum depth of cover of 5 feet below the bottom of all waterbodies would be maintained for a distance of at least 15 feet to either side of the edge of the waterbody. General channel incision or localized headcutting could threaten to expose the pipeline during operations. In addition, channel incision could sufficiently increase bank heights to destabilize the slope, ultimately widening the stream. Sedimentation within a channel could also trigger lateral bank erosion, such as the expansion of a channel meander opposite a point bar. Bank erosion rates could exceed several meters per year. Not maintaining an adequate burial depth for pipelines in a zone that extends at least 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. Potential bank protection measures could include installing rock, wood, or other materials keyed into the bank to provide protection from further erosion, or regarding the banks to reduce the bank slope. Disturbance associated with these maintenance activities may potentially create additional water quality impacts.

All waterbody crossings would be assessed by qualified personnel in the design phase of the proposed Project with respect to the potential for channel aggradation/degradation and lateral channel migration. The level of assessment for each crossing could vary based on the professional judgment of the qualified design personnel. The pipeline would be installed as determined to be necessary to address any hazards identified by the assessment. The pipeline would be installed at the design crossing depth for at least 15 feet beyond the design lateral migration zone as determined by qualified personnel. The design of the crossings would also include the specification of appropriate stabilization and restoration measures

Operational impacts to surface water resources associated with hazardous liquids spills and leaks are discussed in Section 3.13.

In addition to the measures to protect water resources during operation specified in the CMR Plan (Appendix B), the water resource protection measures included in Appendices F, L, and P to the Environmental Specifications developed for the proposed Project by MDEQ would be implemented in

Montana. In South Dakota, the water protection conditions that were developed by the South Dakota Public Utility Commission (SDPUC) and attached to its Amended Final Decision and Order; Notice of Entry HP09-001 would be implemented.

3.3.2.3 Floodplains

The pipeline would be constructed under river channels with potential for lateral scour. In floodplain areas adjacent to waterbodies, the contours would be restored to as close to previously existing contours as practical and would revegetate the construction ROW in accordance with its CMR Plan (Appendix B). Therefore, after construction the pipeline would not obstruct flows over designated floodplains.

Although two pump stations and 6 MLVs would be in the 100-year floodplain as currently proposed, the effect of those facilities on floodplain function would be minor. These facilities would be constructed after consultation with the appropriate county agencies to design and to meet county requirements and to obtain the necessary permits associated with construction in the 100-year floodplain.

3.3.2.4 Potential Additional Mitigation Measures

Potential additional mitigation measures include the following:

- Taking into account the concerns expressed by EPA and other commenters on the draft and supplemental draft EIS, DOS in consultation with PHMSA and EPA, determined that it may be appropriate for the applicant to commission an additional engineering risk analysis of the efficacy of installing external leak detection in areas of particular environmental sensitivity. DOS in consultation with PHMSA and EPA determined that Keystone should commission an engineering analysis by an independent consultant that would review the proposed Project risk assessment and proposed valve placement. The engineering analysis would, at a minimum, assess the advisability of additional valves and/or the deployment of external leak detection systems in areas of particularly sensitive environmental resources. The scope of the analysis and the selection of the independent consultant would be approved by DOS with concurrence from PHMSA and EPA. After completion and review of the engineering analysis, DOS with concurrence from PHMSA and EPA would determine the need for any additional mitigation measures.
- EPA and other commenters on the draft and supplemental draft EIS recommended consideration of ground-level inspections as an additional method to detect leaks. The PHMSA report (2007) on leak detection presented to Congress noted that there are limitations to visual leak detection, whether the visual inspection is done aerially or at ground-level. A limitation of ground-level visual inspections as a method of leak detection is that pipeline leaks may not come to the surface on the right of way and patrolling at ground level may not provide an adequate view of the surrounding terrain. A leak detection study prepared for the Pipeline Safety Trust noted: "A prudent monitor of a pipeline ROW will look for secondary signs of releases such as vegetation discoloration or oil sheens on nearby land and waterways on and off the ROW" (Accufacts 2007). PHMSA technical staff concurred with this general statement, and noted that aerial inspections can provide a more complete view of the surrounding area that may actually enhance detection capabilities. Also, Keystone responded to a data request from DOS concerning additional ground-level inspections and expressed concerns that frequent ground-level inspection may not be acceptable to landowners because of the potential disruption of normal land use activities (e.g., farming, animal grazing). PHMSA technical staff indicated that such concerns about landowner acceptance of more frequent ground-level inspections were consistent with their experience with managing pipelines in the region. Although widespread use of ground-level inspections may not be warranted, in the start-up year it is not uncommon for pipelines to experience a higher

frequency of spills from valves, fittings, and seals. Such incidences are often related to improper installation, or defects in materials. In light of this fact, DOS in consultation with PHMSA and EPA determined that if the proposed Project were permitted, it would be advisable for the applicant to conduct inspections of all intermediate valves, and unmanned pump stations during the first year of operation to facilitate identification of small leaks or potential failures in fittings and seals. It should be noted however, that the 14 leaks from fittings and seals that have occurred to date on the existing Keystone Oil Pipeline were identified from the SCADA leak detection system and landowner reports. Keystone has agreed to incorporate into its operations and maintenance plan a requirement to conduct inspections of all intermediate valves, and unmanned pump stations during the first year of operation to facilitate identification of small leaks or potential failures in fittings and seals.

- Dust suppression chemicals should not be used within this sensitive region. Many of these chemicals are salts of various formulations. Any advanced dust suppression techniques (beyond the use of watering) should be protective of the high water quality present in this area. Part 2.14 of the Revised Construction, Mitigation, and Reclamation Plan mentions the use of calcium chloride. The use of misting dust suppression systems should be used within sensitive areas to eliminate the need for salt compounds (Nebraska DEQ).
- This project could require authorization under the Nebraska Department of Environmental Quality, National Pollutant Discharge Elimination System, Construction Storm Water General Permit (CSW-GP). Conditions of this permit may require modifications to the stabilization of disturbed ground as discussed within the Revised Construction, Mitigation, and Reclamation Plan. Namely, the CSW-GP requires that inactive ground be stabilized (either permanent or temporary stabilization) if the ground will be inactive for a period of 14 days. This conflicts with the 30 day timeframe present within the U.S. Department of State Keystone XL Project Supplemental Draft EIS (part 4.5.6) (Nebraska DEQ).

3.3.3 Connected Actions

3.3.3.1 Big Bend to Witten 230-kV Transmission Line

The construction and operation of electrical distribution lines and substations associated with the proposed pump stations, and the Big Bend to Witten 230-kV electrical transmission line would have negligible effects on water resources.

3.3.3.2 Bakken Marketlink and Cushing Marketlink Projects

Construction and operation of the Bakken Marketlink Project would include metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. Keystone reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there were no waterbodies or wetlands on the property. DOS reviewed aerial photographs of the area and confirmed the current use of the land and that there are no waterbodies associated with the site. A site inspection by the DOS third-party contractor confirmed these findings. As a result, the potential impacts associated with expansion of the pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

The Cushing Marketlink project would be located within the boundaries of the proposed Cushing tank farm of the Keystone XL Project would include metering systems and two storage tanks. As a result, the impacts of construction and operation of the Cushing Marketlink Project on soils would be the same as

potential impacts associated with construction and operation of the proposed Cushing tank farm described in this section. Cushing Marketlink facilities at the Cushing tank farm appear to be located within uplands; although a stream and floodplain appear to be crossed by the pipelines and encroached upon by the metering systems.

Currently there is insufficient information to complete an environmental review of these projects. The permit applications for these projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental review of the Marketlink projects. Potential water resource impacts would be evaluated during the environmental reviews for these projects and potential water resource impacts would be evaluated and avoided, minimized, or mitigated in accordance with applicable regulations.

3.3.4 References

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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). As part of federal regulatory requirements under the Clean Water Act (CWA), inventories of wetlands and other waters of the United States involving field surveys are required along the proposed pipeline ROW and other associated areas of disturbance related to the proposed Project to evaluate the potential for adverse effects to waters of the United States. Information gathered during the inventories will be used to complete notification and permitting requirements under Sections 401 and 404 of the CWA, as managed by U.S. Army Corps of Engineers (USACE) and applicable state agencies under the review of the U.S. Environmental Protection Agency (EPA) with potential veto for projects with unacceptable impacts to wetlands.

Wetland types within the proposed Project area include emergent wetlands, scrub/shrub wetlands, and forested wetlands; and waters include ephemeral, intermittent, and perennial streams and open water (Table 3.4.1-1; Cowardin et al. 1979). Vegetation communities associated with emergent, scrub/shrub and forested wetland types are described in Table 3.5.1-1 for the proposed Project area. Many wetlands in northern Montana and South Dakota are isolated depressional wetlands of the Prairie Potholes region. This formerly glaciated landscape is pockmarked with a large 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. Isolated depressional wetlands of the Rainwater Basin Complex occur in Nebraska. The Rainwater Basin is a flat or gently rolling topography with a poorly developed surface water drainage system that allows many watersheds to drain into low-lying wetlands. These wetlands are shallow, ephemeral depressions that flood during heavy rainstorms and snowmelt. Much of the Rainwater Basin has been drained and converted to croplands with only about 10 percent of the original area remaining undrained.

Wetlands throughout Montana, South Dakota, Nebraska, Kansas, Oklahoma, and Texas include isolated depressional 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). Montana, South Dakota, Nebraska, Kansas, Oklahoma and northern Texas also contain many wetlands and riparian areas with direct connections to minor and major drainages of the Mississippi River basin; and eastern Texas contains wetlands with connections to Gulf of Mexico drainages. 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) (EPA 2001).

The proposed Project crosses five USACE districts:

- Steele City Segment: Omaha District (Montana, South Dakota, and Nebraska);
- Cushing Pump Stations: Kansas City District (Kansas);
- Gulf Coast Segment: Tulsa District (Oklahoma), Fort Worth and Galveston districts (Texas); and
- Houston Lateral: Galveston district (Texas).

Each of these districts has slightly different survey and permit requirements. Consultations would continue with the USACE district offices and state resource agencies to develop the specific wetland and waters of the United States information required for permit applications and to develop avoidance, minimization, and mitigation for impacts to wetlands.

Wetland types in the proposed Project area (Table 3.4.1-1) were identified by completing field surveys and reviewing aerial photography. Wetlands and waters of the U.S. were delineated using either field surveys or desktop analysis in accordance with direction provided by the appropriate USACE districts. Wetland data were collected for routine on-site delineations (USACE 1987) where required, following Great Plains regional guidance (USACE 2008b) for the Steele City Segment, and Atlantic and Gulf Coast Plain regional guidance (USACE 2008a) for the Gulf Coast Segment, and Houston Lateral. In addition, channel characteristics for drainage crossings, defined bed and bank, and connectivity to navigable waters were evaluated to determine jurisdictional status for all wetland and drainage crossings.

TABLE 3.4.1-1
Description of Wetland Types in the Proposed 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.
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.

TABLE 3.4.1-1 Description of Wetland Types in the Proposed Project Area		
Wetland Type	**National Wetland Inventory Code**	**Description**
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, ephemeral 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. Ephemeral streams have flowing water only during, and for a short duration after, precipitation events in a typical year. Groundwater is not a source of water for the stream.
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, USACE 2009.

3.4.2 Wetlands of Special Concern or Value

Depressional wetlands of the Prairie Potholes region in Montana and South Dakota support large numbers of migrating and nesting waterfowl, as do depressional wetlands associated with the Rainwater Basin in Nebraska (EPA 2008). USFWS has negotiated wetland easements with private landowners in Montana, and South Dakota for some lands crossed by the Steele City Segment to protect depressional wetlands of the Prairie Potholes region. Based on preliminary delineations, all prairie pothole wetlands would be avoided by the proposed Steele City Segment of the pipeline. Wetlands are protected by the USFWS easement under 16 USC 668dd(c). USFWS has also negotiated wetland easements with private landowners in Oklahoma and Texas for some lands crossed by the Gulf Coast Segment. The USFWS procedure with any cooperating entity is to restore the ponding capability of the wetlands. If fill material remains in any easement wetland(s) after the pipeline is installed, USFWS will work with Project personnel to remove the fill material from the basin. If a wetlands no longer ponds water after the pipeline is installed, USFWS will work with proposed Project personnel to improve soil compaction and water retention capability in that wetlands. If measures taken to restore the ponding capability of a wetlands are unsuccessful, USFWS may require a similar wetland to be located and an exchange for a replacement wetlands according to USFWS guidance to be executed.

Table 3.4.2-1 summarizes wetlands that would be crossed by the proposed Project that are considered of special concern or value—as indicated by inclusion within conservation areas and reserves, wetland easements, wildlife areas, sensitive landscapes, and sensitive wetland vegetation communities. All wetlands in Montana are generally considered of concern because of their rarity and productivity in this semi-arid environment. A total of 264 miles of conservation lands and sensitive landscapes with an unknown quantity of associated wetlands would be crossed by the proposed Project.

TABLE 3.4.2-1
Number and Type of Wetlands Crossed by the Proposed Project within Wetland Areas of Special Concern or Value

Wetland Areas of Special Concern			Wetlands Crossed		
Approximate Milepost[a]	**Name**	**Ownership**	**Approximate Miles**	**Number of Wetlands**	**Wetland Types**
Montana					
Multiple (at 49.4 and 70.9)	Cornwell Ranch Conservation Easement	Montana Department of Fish, Wildlife, and Parks	3.1	None	None
4.3 – 5.1	Phillips County USFWS Wetland Easement	Private	0.8	None	None
Multiple	Conservation Reserve Program (CRP) Contract Land	Private	9.2	None	None
South Dakota					
Multiple	CRP Contract Land	Private	7.6	None	None
Nebraska					
758.0 – 847.4	Rainwater Basin Wetlands	Unknown	89.4	10	PEM, PFO
Multiple (from 600 to 746)	NE Sand Hills Wetlands	Unknown	67.9	49	PEM
Multiple	CRP Contract Land	Private	5.2	1	PEM
Oklahoma					
Multiple (from 22.1 to 23.3)	Deep Fork Wildlife Management Area	Oklahoma Department of Wildlife Conservation	0.9	1	PSS
Texas					
162	WRP Contract Land	Private	0.7	0	None
Multiple (from 258 to 261)	Water Oak – Willow Oak Community	Unknown	1.7	1	PFO
Multiple (from 313 to 315)	Water Oak – Willow Oak Community	Unknown	1.8	1	PFO
Multiple (from 337 to 340)	Water Oak – Willow Oak Community	Unknown	2.5	1	PFO
Multiple (from 350 to 368)	Water Oak – Willow Oak Community	Unknown	6.1	4	PFO
Multiple (from 457 to 462)	Water Oak – Willow Oak Community	Unknown	4.0	3	PFO
HL Multiple (from 18 to 28)	Water Oak – Willow Oak Community	Unknown	10.3	2	PFO

[a] Approximate Milepost for intersection of proposed pipeline ROW with wetland areas of special concern or value. "Multiple" indicates numerous crossings of the wetland area of special concern along the proposed ROW.
Notes: PEM = Palustrine emergent wetland, PFO = Palustrine forested wetland.
Sources: Grell 2009, TPWD 2009 and see Appendix E and Appendix K.

3.4.3 Potential Impacts

Wetlands and waters that would be affected by the proposed Project, are summarized in Tables 3.4.3-1 through 3.4.3-4. Acres of disturbance provided in the tables were calculated using the data for miles of wetlands crossed by the proposed Project, and the proposed widths for construction and permanent ROWs. Preliminary estimates of impacts to wetlands (some of which are based on desktop analysis) from access roads, pump stations, pipe yards, contractor yards, and construction camps outside of the 110-foot construction right-of-way are summarized in Tables 3.4.3-3 and 3.4.3-4.

The delineation of jurisdictional and non-jurisdictional wetlands would occur in accordance with directions provided by the appropriate USACE districts prior to the issuance of required permits. Wetland impacts that affect non-jurisdictional wetlands under the CWA Section 404 would not require mitigation. Executive Order 11990 directs Federal agencies, in certain circumstances, to avoid and minimize impacts to wetlands. A table of all wetland and water crossings is located in Appendix E.

Emergent wetlands are the most common wetland type crossed by the Steele City Segment in Montana, South Dakota, and Nebraska (Table 3.4.3-1). Most of the emergent wetlands (76 percent, 84 of 111 acres) are located in Nebraska (Table 3.4.3-1). Other wetland areas that would be disturbed by the Steele City Segment include forested wetlands in Nebraska (1 acre), and scrub-shrub wetlands in Montana and South Dakota (1 acre). Forested wetlands are the most common wetland type crossed by the Gulf Coast Segment and the Houston Lateral in Oklahoma and Texas (Table 3.4.3-1). Most of the forested wetlands (95 percent, 249 of 262 acres) are located in Texas (Table 3.4.3-1). Other wetland areas that would be disturbed by the Gulf Coast Segment and Houston Lateral in Oklahoma and Texas include emergent wetlands (52acres) and scrub-shrub wetlands (34 acres, Table 3.4.3-1). Most of the wetlands crossed by the Gulf Coast Segment and Houston Lateral (90 percent, 368 of 407 acres) are located in Texas. The proposed Project would disturb a total of 615 acres of wetlands, primarily forested wetlands (263 acres) and emergent wetlands (262 acres) (Table 3.4.3-2).

A portion of the wetlands crossed by the proposed Project ROW has been identified as farmed wetlands, and some wetlands are located within grazed rangelands. One of the proposed pump stations would be located within an agricultural emergent wetland (PS 22 in Nebraska), however, the USACE has determined that it is not a USACE-jurisdictional wetland and Keystone would develop compensation for impacts to this emergent wetland with the Nebraska Department of Environmental Quality staff under the State Water Quality Certification Program.

TABLE 3.4.3-1 Construction and Operation Right-of-Way Wetlands Estimated Impact Summary by State for the Proposed Project				
Wetland Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)[a]**	**Wetland Area Affected by Operations (acres)[a]**	**Number of Wetland Crossings**
Steele City Segment				
Montana				
Palustrine emergent wetland	1.1	16	7	39
Palustrine forested wetland	0.0	0	0	0
Palustrine scrub-shrub wetland	<0.1	1	1	2
Riverine/Open water	2.7	38	17	NA
Montana total	*3.8*	*55*	*25*	*41*
South Dakota				
Palustrine emergent wetland	1.1	11	7	47
Palustrine forested wetland	0.0	0	0	0
Palustrine scrub-shrub wetland	<0.1	1	1	2
Riverine/Open water	2.9	37	18	NA
South Dakota total	*4.0*	*49*	*26*	*49*
Nebraska				
Palustrine emergent wetland	5.2	84	42	108
Palustrine forested wetland	0.1	1	1	5
Palustrine scrub-shrub wetland	0.0	0	0	0
Riverine/Open water	1.7	19	11	NA
Nebraska total	*7.0*	*104*	*54*	*113*
Gulf Coast Segment and Houston Lateral				
Oklahoma				
Palustrine emergent wetland	0.3	5	2	35
Palustrine forested wetland	1.3	13	8	14
Palustrine scrub-shrub wetland	0.1	1	1	5
Riverine/Open water	1.4	20	9	NA
Oklahoma total	*3.1*	*39*	*20*	*54*
Texas				
Palustrine emergent wetland	7.1	95	46	70
Palustrine forested wetland	26.0	281	156	144
Palustrine scrub-shrub wetland	2.5	33	15	16
Riverine/Open water	3.5	42	22	NA
Texas total	*39.1*	*451*	*239*	*230*

[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 Project. Wetland areas for emergent and scrub-shrub wetlands disturbed during construction are generally considered temporary with no impact remaining during operations.

Note: NA = Not Applicable.

Source: See Appendix E.

TABLE 3.4.3-2 Construction and Operation Right-of-Way Wetlands Estimated Impact Summary by Segment for the Proposed Project				
Wetland Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)[a]**	**Wetland Area Affected by Operations (acres)[a]**	**Number of Crossings**
Steele City Segment				
Palustrine emergent wetland	7.4	111	56	194
Palustrine forested wetland	0.1	1	1	5
Palustrine scrub-shrub wetland	<0.1	2	2	4
Riverine/Open water	7.3	94	46	NA
Steele City Segment subtotal	*14.8*	*208*	*105*	*203*
Gulf Coast Segment				
Palustrine emergent wetland	3.4	52	24	96
Palustrine forested wetland	24.7	262	148	149
Palustrine scrub-shrub wetland	2.6	34	16	20
Riverine/Open water	4.6	59	29	NA
Gulf Coast Segment subtotal	*35.3*	*407*	*217*	*265*
Houston Lateral				
Palustrine emergent wetland	4.0	48	24	9
Palustrine forested wetland	2.6	32	16	9
Palustrine scrub-shrub wetland	0.0	0	0	1
Riverine/Open water	0.3	3	2	NA
Houston Lateral subtotal	*6.9*	*83*	*42*	*19*
Project				
Palustrine emergent wetland	14.8	211	104	299
Palustrine forested wetland	27.4	294	165	163
Palustrine scrub-shrub wetland	2.6	36	18	25
Riverine/Open water	12.2	156	77	NA
Project total	**57.0**	**697**	**364**	**487**

[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 Project. Wetland areas for emergent and scrub-shrub wetlands disturbed during construction are generally considered temporary with no impact remaining during operations. Areas presented are those within the permanent right-of-way.

Note: NA = Not Applicable.

Source: See Appendix E.

TABLE 3.4.3-3 Ancillary Facility Wetlands Estimated Impact Summary by State for the Proposed Project			
Wetland Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)[a]**	**Wetland Area Affected by Operations (acres)[a]**
Steele City Segment			
Montana			
Palustrine emergent wetland	NA	0.03	0.00
Palustrine forested wetland	<0.01	0.01	0.00
Palustrine scrub-shrub wetland	None	0.00	0.00
Riverine/Open water			
Montana total	*< 0.01*	*0.04*	*0.00*
South Dakota			
Palustrine emergent wetland	< 0.01	0.13	0.00
Palustrine forested wetland	None	0.00	0.00
Palustrine scrub-shrub wetland	None	0.00	0.00
Riverine/Open water			
South Dakota total	<0.01	0.13	0.00
Nebraska			
Palustrine emergent wetland	0.06	11.68	9.85
Palustrine forested wetland	None	0.00	0.00
Palustrine scrub-shrub wetland	None	0.00	0.00
Riverine/Open water			
Nebraska total	*0.06*	*11.68*	*9.85*
Gulf Coast Segment and Houston Lateral			
Oklahoma			
Palustrine emergent wetland	0.01	0.19	0.16
Palustrine forested wetland	0.01	0.10	0.00
Palustrine scrub-shrub wetland	None	0.00	0.00
Riverine/Open water			
Oklahoma total	*0.02*	*0.29*	*0.16*
Texas			
Palustrine emergent wetland	0.84	5.05	0.03
Palustrine forested wetland	1.90	7.77	0.95
Palustrine scrub-shrub wetland	0.06	3.18	0.00
Riverine/Open water			
Texas total	*2.80*	*16.00*	*0.98*

[a] Some data are based on desktop analyses and have not been verified. Access road acreage is based on a 30-foot-wide corridor centered on the existing road bed. Does not include rail sidings for the Steele City Segment. No wetlands would be impacted by ancillary facilities in Kansas.

Notes: Ancillary facilities located outside of the ROW include: access roads, pump stations, pipe yards, contractor yards, rail sidings, and construction camps. NA = Not Applicable

Source: See Appendix E.

TABLE 3.4.3-4 Ancillary Facility Wetlands Estimated Impact Summary by Segment for the Proposed Project			
Wetland Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)[a]**	**Wetland Area Affected by Operations (acres)[a]**
Steele City Segment			
Palustrine emergent wetland	0.06	11.84	9.85
Palustrine forested wetland	<0.01	0.01	0.00
Palustrine scrub-shrub wetland	None	0.00	0.00
Riverine/Open water			
Steele City Segment subtotal	*0.06*	*11.85*	*9.85*
Gulf Coast Segment			
Palustrine emergent wetland	0.67	4.60	0.19
Palustrine forested wetland	1.83	7.55	0.80
Palustrine scrub-shrub wetland	0.06	3.18	0.00
Riverine/Open water			
Gulf Coast Segment subtotal	*2.56*	*15.33*	*0.99*
Houston Lateral			
Palustrine emergent wetland	0.18	0.64	0.00
Palustrine forested wetland	0.08	0.32	0.15
Palustrine scrub-shrub wetland	None	0.00	0.00
Riverine/Open water			
Houston Lateral subtotal	*0.26*	*0.96*	*0.15*
Project			
Palustrine emergent wetland	0.91	17.08	10.04
Palustrine forested wetland	1.91	7.88	0.95
Palustrine scrub-shrub wetland	0.06	3.18	0.00
Riverine/Open water			
Project total	**2.88**	**28.14**	**10.99**

[a] Some data are based on desktop analyses and have not been verified. Access road acreage is based on a 30-foot-wide corridor centered on the existing road bed. Does not include rail sidings for the Steele City Segment. No wetlands would be impacted by ancillary facilities in Kansas.

Note: Ancillary facilities located outside of the ROW include: access roads, pump stations, pipe yards, contractor yards, rail sidings, and construction camps. NA = Not Applicable

Source: See Appendix E.

Construction of the pipeline would affect wetlands and their functions primarily during and immediately following construction activities, but permanent changes also are possible (FERC 2004). 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 2001).

Potential construction- and operations-related effects include:

- Loss of wetlands due to backfilling or draining;
- 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);
- 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 wetland 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 and Rainwater Basin regions;
- Alteration in vegetation productivity and life stage timing due to increased soil temperatures associated with heat input from the pipeline; and
- Alteration in freeze-thaw timing due to increased water temperatures associated with heat input 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 (FERC 2004). In emergent wetlands, the herbaceous vegetation would regenerate quickly (typically within 3 to 5 years) (FERC 2004). Following restoration and revegetation, there would be little permanent effects on emergent wetland vegetation because these areas naturally consist of, and would be restored as an herbaceous community (FERC 2004). Herbaceous wetland vegetation in the pipeline right-of-way generally would not be mowed or otherwise maintained, although the CMR Plan (Appendix B) allows for annual maintenance of a 30-foot-wide strip centered over the pipeline. 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. Tree species that typically dominate forested wetlands in the proposed Project area [plains cottonwood (*Populus deltoides*), maple (*Acer* spp.), hickory (*Carya* spp.), oak (*Quercus* spp.), loblolly pine (*Pinus taeda*), and bald cypress (*Taxodium distichum*)] have regeneration periods of 20 to 50 years. Some forested wetlands in Texas are planted pine plantations that are regularly harvested. Trees and shrubs would not be allowed to regenerate within the maintained right-of-way except within areas with HDD crossings; therefore, removal of forested and scrub-shrub wetland habitats due to pipeline construction would be long term, and the maintained right-of-way would represent a permanent conversion of forested and scrub-shrub wetlands to herbaceous wetlands. The total acreage of affected forested wetland during construction would be 294 acres, and the total acreage of scrub-shrub wetland affected during construction would be 36 acres. Restoration of some forested and scrub-shrub wetlands may be possible; however, long-term effects would remain.

Operation of the proposed Project would cause slight increases in soil temperatures at the soil surface of 4 to 8˚ F primarily during January to May and November to December along the pipeline route in Montana, South Dakota, and Nebraska (see Appendix L). Increases in temperatures at the soil surface would be most pronounced directly over the pipeline in the South Dakota portion of the pipeline. Soil surface temperatures over the pipeline route, and year-round soil surface temperatures would remain unchanged in Oklahoma and Texas. Operation of the proposed Project would cause increases in soil temperature 6 inches below the surface of 10 to 15 ˚F with the largest increases occurring during March and April in the Steele City Segment of the proposed Project (see Appendix L).

While many plants, especially herbaceous annuals, would not produce root systems that would penetrate much below 6 inches, some plants, notably native prairie grasses, trees, and shrubs, have root systems penetrating well below 6 inches. Soil temperatures closer to the pipeline burial depth may be as much as 40˚ F warmer than the ambient surrounding soil temperatures (see Appendix L). In general, increased soil temperatures during early spring would cause early germination and emergence and increased productivity in wetland plant species (see Appendix L). Increased soil temperatures also may stimulate root development (see Appendix L). Operation of the proposed Project also would cause slight increases in water temperatures where the pipeline crosses through wetlands. Effects would be most pronounced in small ponds and wetlands, as any excess heat would be quickly dissipated in large waterbodies and flowing waters. Small ponded wetlands may remain unfrozen later than surrounding wetlands and may thaw sooner than surrounding wetlands. Early and late migrant waterfowl may be attracted to and concentrated within these areas during spring and fall migrations.

Impacts to wetlands from spills during construction and operation of the proposed Project are addressed in Section 3.13.

3.4.4 Impact Reduction Procedures

Procedures outlined in the proposed Project CMR Plan (Appendix B) for wetland crossings would be implemented to minimize potential construction- and operations-related effects and wetlands affected by construction activities would be restored to the extent practicable. Implementation of measures in the CMR Plan (Appendix B) would avoid or minimize most impacts on wetlands associated with construction and operation activities, and would ensure that potential effects would be primarily minor and short term. Involvement of the USACE and FWS, as well as other federal and state agencies, during the early phases of project routing and siting identified high quality wetlands or areas requiring additional protection to be avoided. Data reviewed to avoid and minimize impacts to wetlands to the extent possible included: National Wetland Inventory maps, aerial imagery, soil surveys, and field wetland surveys. Wetland impacts were further avoided or minimized by horizontal directional drilling to avoid impacts, locating the route next to existing utilities to minimize impacts, perpendicular crossing of riparian wetland features to minimize impacts where possible, and route variation to reduce the total length of the wetland crossing to minimize impacts.

Commitments described in the proposed Project CMR Plan (Appendix B) to protect wetlands include the following general measures:

- 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 or the 57 Project-specific Special Conditions developed by PHMSA (see Appendix U);
- Clearly mark wetland boundaries with signs and/or highly visible flagging during construction and maintain markers until permanent seeding is completed;

- Reduce the width of the construction right-of-way to 85 feet or less in standard wetlands unless non-cohesive soil conditions require a greater width and unless the USACE or other regulatory authority authorizes a greater width;
- Locate extra work spaces at least 10 feet away from wetland boundaries, where topographic conditions permit;
- Limit clearing of vegetation between extra work areas and the edge of the wetland to the construction right-of-way and limit the size of extra work areas to the minimum needed to construct the wetland crossing;
- Clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way using wide-track or low-ground pressure construction equipment and/or conventional equipment operating from timber and slash (riprap) cleared from the right-of-way, timber mats, or prefabricated equipment mats;
- Install and maintain sediment barriers at all saturated wetlands or wetlands with standing water across the entire construction right-of-way upslope of the wetland boundary and where saturated wetlands or wetlands with standing water are adjacent to the construction right-of-way as necessary to prevent sediment flow into the wetland;
- Limit the duration of construction-related disturbance within wetlands to the extent practicable;
- Use no more than two layers of timber riprap to stabilize the construction right-of-way;
- Cut vegetation off at ground level leaving existing root systems in place and remove it from the wetland for disposal;
- Limit pulling of tree stumps and grading activities to directly over the trench line unless safety concerns require the removal of stumps from the working side of the construction right-of-way;
- Segregate and salvage all topsoil up to a maximum of 12 inches of topsoil from the area disturbed by trenching in dry wetlands, where practicable, and restore topsoil to its approximate original stratum after backfilling is complete;
- Dewater the trench in a manner to prevent erosion and to prevent heavily silt-laden water from flowing directly into any wetland or waterbody;
- Remove all timber riprap and prefabricated equipment mats upon completion of construction;
- Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable;
- Prohibit storage of hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities within a wetland or within 100 feet of any wetland boundary, if possible;
- Perform all equipment maintenance and repairs in upland locations at least 100 feet from waterbodies and wetlands, if possible;
- Avoid parking equipment overnight within 100 feet of a watercourse or wetland, if possible;
- Prohibit washing equipment in streams or wetlands;
- Install trench breakers and/or seal the trench to maintain the original wetland hydrology, where the pipeline trench may drain a wetland;
- Refuel all construction equipment in an upland area at least 100 feet from a wetland boundary, if possible; and

- Avoid sand blasting in wetlands to the extent practicable, if unavoidable place a tarp or suitable material to collect as much waste shot as possible, clean up all visible wastes, and dispose of collected waste at an approved disposal facility.

Restoration and reclamation procedures for wetland crossings outlined in the proposed Project CMR Plan (Appendix B) include:

- Remove all timber riprap, timber mats, and prefabricated equipment mats and other construction debris upon completion of construction;
- 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 where necessary to prevent the wetland from draining;
- 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 resource agency and with land owner permission;
- Restore wetland areas within conservation lands or easements to a level consistent with any additional criteria established by the relevant managing agency; and
- Prohibit use of herbicides or pesticides within 100 feet of any wetland (unless allowed by the appropriate land management or state agency).

3.4.5 Potential Additional Mitigation Measures

Various state and federal agencies have expressed concerns about and provided recommendations for compensatory mitigation of jurisdictional wetland losses. Pipeline construction through wetlands must comply with USACE Section 404 permit conditions. The requirements for compensatory mitigation would depend on final USACE decisions on jurisdictional delineations. Under the authority of Section 404 of the Clean Water Act, Department of the Army (DA) permits are required for the discharge of fill material into waters of the U.S. Waters of the U.S. include the area below the ordinary high water mark of stream channels and lakes or ponds connected to the tributary system, and wetlands adjacent to these waters. Isolated waters and wetlands, as well as man-made channels and ditches, may be waters of the U.S. in certain circumstances, which must be determined on a case-by-case basis. Under the authority of Section 10 of the Rivers and Harbors Act, DA permits are required for structures or work in, over, under or affecting navigable waters of the U.S.

All wetland and waterway crossed by the Project would be evaluated under the preliminary jurisdictional determination (PJD) process, with exception to isolated wetlands which will require approved jurisdictional determinations. Waters evaluated by the PJD process are treated as jurisdictional waters of the U.S. for the purposes of determining project impacts and compensatory mitigation requirements. Compensatory mitigation, where required by USACE, would be provided for losses of aquatic resources. Compensatory Mitigation Plans would be developed and carried out in accordance with 33 CFR Part 332

(Compensatory Mitigation for Losses of Aquatic Resources). All temporary wetland impacts due to construction activities would be restored in accordance with the Project Construction Mitigation and Reclamation (CMR) Plan (Appendix B).

Additional recommendations for compensatory mitigation provided to DOS by state agencies include:

- Where appropriate and applicable, a plan to compensate for permanent wetland losses should be developed to include:
  - Permanent impacts to forested wetlands in Texas should be calculated to include the total width of area where trees would be removed during long-term maintenance including any removal areas beyond the 30-foot wide maintained area. All forested wetland clearing is considered a permanent impact that would require compensatory mitigation (Texas Parks and Wildlife, TPW).
  - In Texas, the wetland mitigation plan should be developed in consultation with TPW, and that impacts to all wetland types are addressed in the wetland mitigation plan and mitigate for these impacts (TPW).
- Should routing or facilities change such that Prairie Pothole wetlands would be affected; pre- and post construction monitoring plans should be developed for depressional wetlands of the Prairie Potholes region in Montana and wetlands that no longer pond water after the pipeline is installed should receive additional compaction, replacement, or at the landowner's or managing agency's discretion compensatory payments should be made for drainage of the wetland (MDEQ).

DOS received comments on the draft EIS from EPA concerning completion and submittal of a compensatory mitigation plan approved by the USACE. EPA recommended that each EPA region and USACE district be consulted with to determine appropriate compensation and to develop a wetland mitigation plan for inclusion in the EIS. As of the publication of the EIS, the final level of required compensation and mitigation would ultimately be determined by:

- USACE regulatory offices, USFWS Ecological Services field offices, and state fish and wildlife agencies; or
- States in their 401 certifications or certificates of compliance.

Impacts to forested wetlands are long-term and would be considered permanent. Portions of water oak/willow oak forest communities may or may not be determined to be wetlands (as defined by USACE and EPA) and may or may not be eligible for compensatory mitigation through the Section 404 CWA process. It is not possible to entirely avoid impacts to bottomland hardwood wetlands in Texas. However, aerial mapping of field delineated wetlands were reviewed by Keystone working with USACE personnel in the Fort Worth and Galveston district offices to determine the best crossing locations to minimize impacts to wetlands, including bottomland hardwood wetlands. Methods used to avoid and/or minimize permanent impacts to bottomland hardwood wetlands include the use of horizontal directional drilling, the routing of the proposed Project next to previously impacted areas along existing linear utilities, the perpendicular crossings of riparian wetland features wherever possible, and the selection of route variations to reduce the total length of the wetland crossings.

Each USACE district would be consulted to determine the kind of compensatory mitigation that would be required for losses of aquatic resources, including the permanent conversion of forested wetland to herbaceous wetland. Pre-construction notification packages would include the mitigation plans agreed upon with the USACE. Preliminary mitigation discussions with the USACE districts have identified the following mitigation options for the proposed Project:

- USACE Omaha District (Montana, South Dakota, and Nebraska)
  - Compensatory mitigation for permanent wetland impacts would follow state-specific protocols established by field offices in Montana, South Dakota, and Nebraska.
- USACE Tulsa District (Oklahoma)
  - Compensatory mitigation for permanent wetland impacts to forested and other wetlands could include combinations of any of several different mitigation strategies. Mitigation banking is not available in the Tulsa District in the vicinity of the proposed Project. Refer to Tulsa District Mitigation and Monitoring Guidelines at: http://www.swt.usace.army.mil/permits/Documents%20-%20Mitigation/M&MG.pdf.
- USACE Fort Worth and Galveston Districts (Texas)
  - Compensatory mitigation for permanent wetland impacts would be based on the results of functional wetland assessments completed for all anticipated impacts to forested wetlands which would be used to determine an appropriate number of wetland credits to be purchased from USACE-approved wetland mitigation banks in proximity to the proposed Project.

DOS received a letter from EPA questioning whether all wetlands along the proposed Project corridor would be covered by a Nationwide Permit. DOS understands that USACE will determine eligibility for each wetland crossing under the Nationwide Permit program and also understands that EPA will review that eligibility determination. EPA also recommended that USACE review the proposed wetland impacts as a single project requiring an individual CWA Section 404 permit.

DOS in consultation with PHMSA and EPA determined that Keystone should commission an engineering analysis by an independent consultant that would review the proposed Project risk assessment and proposed valve placement. The engineering analysis would, at a minimum, assess the advisability of additional valves and/or the deployment of external leak detection systems in areas of particularly sensitive environmental resources. The scope of the analysis and the selection of the independent consultant would be approved by DOS with concurrence from PHMSA and EPA. After completion and review of the engineering analysis, DOS with concurrence from PHMSA and EPA would determine the need for any additional mitigation measures.

3.4.6 Connected Actions

3.4.6.1 Power Distribution Lines and Substations

Power distribution line construction and operation requires clearing of trees and shrubs, and maintaining vegetation under the power lines in a herbaceous state. Power distribution lines and substations constructed to provide power for the Project pump stations could affect wetland resources through:

- 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);
- Compaction and rutting of wetland soils from movement of heavy machinery and transport and installation of transmission structures, altering natural hydrologic patterns, inhibiting seed germination, or increasing siltation; and
- Temporary increase in turbidity and changes in wetland hydrology and water quality.

The primary impacts on wetlands from construction or modification of distribution lines to provide electrical power to pump stations would be cutting, clearing, or removing the existing vegetation within

the construction work area and potential invasion by noxious weeds. In general, distribution line construction impacts to wetlands would be minor as most lines would run alongside existing roadways and smaller wetlands could be spanned. Trees in forested wetlands crossed by the distribution line ROW would be removed, and the ROW would be maintained free of woody vegetation. Approximately 6.3 miles of riverine or open water and 3.2 miles of wetlands including: forested wetlands in South Dakota, Nebraska, Kansas, and Oklahoma; emergent wetlands in Montana, South Dakota, Nebraska, and Oklahoma; and scrub-shrub wetlands in Montana, South Dakota, and Oklahoma could be affected during construction and operation of new distribution lines for the proposed Project (Tables 3.4.5-1 and 3.4.5-2).

Electric service providers would avoid and minimize impacts by spanning wetlands and selecting pole locations away from sensitive habitats.

TABLE 3.4.5-1
Wetlands Estimated Impact Summary by State for Proposed Electric Distribution Lines for the Proposed Project

Vegetation Community Classification	Length of Wetlands Crossed (miles)	Wetland Area Affected during Construction (acres)[a]	Wetland Area Affected by Operations (acres)[a]
Steele City Segment			
Montana			
Palustrine Emergent wetlands	0.6	2.0	1.5
Palustrine Forested wetlands	<0.1	1.0	1.0
Palustrine Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	1.7	5.5	4.1
Montana subtotal	*2.3*	*8.5*	*6.6*
South Dakota			
Palustrine Emergent wetlands	1.3	4.1	3.1
Palustrine Forested wetlands	0.1	0.2	0.7
Palustrine Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	2.9	9.4	7.0
South Dakota subtotal	*4.2*	*13.7*	*10.7*
Nebraska			
Palustrine Emergent wetlands	0.3	0.8	0.6
Palustrine Forested wetlands	0.5	1.6	6.0
Palustrine Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	1.1	3.7	2.7
Nebraska subtotal	*1.9*	*6.1*	*9.3*
Cushing Extension Pump Stations			
Kansas			
Emergent wetlands	0.0	0.0	0.0
Forested wetlands	0.0	0.0	0.0
Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	0.2	0.6	0.4

TABLE 3.4.5-1 Wetlands Estimated Impact Summary by State for Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Wetlands Crossed (miles)**	**Wetland Area Affected during Construction (acres)[a]**	**Wetland Area Affected by Operations (acres)[a]**
Kansas subtotal	*0.2*	*0.6*	*0.4*
Gulf Coast Segment			
Oklahoma			
Palustrine Emergent wetlands	<0.1	0.1	0.1
Palustrine Forested wetlands	0.0	0.0	0.0
Palustrine Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	0.1	0.4	0.3
Oklahoma subtotal	*0.2*	*0.5*	*0.4*
Texas			
Palustrine Emergent wetlands	0.0	0.0	0.0
Palustrine Forested wetlands	0.0	0.1	0.4
Palustrine Shrub-scrub wetlands	0.2	0.5	0.4
Riverine/open water	0.2	0.6	0.4
Texas subtotal	*0.4*	*1.2*	*1.2*

[a] Temporary disturbance areas include structure pads, access roads, pulling and tension area, turn around areas, and staging areas. Permanent disturbance areas include forested areas within 80-or 150-foot-wide right-of-way, around pole structures, and crossed by operational access roads. Some power lines have not been surveyed and data presented is from aerial photointerpretation.

TABLE 3.4.5-2 Wetlands Estimated Impact Summary for Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Steele City Segment			
Palustrine Emergent wetlands	2.1	7.0	5.2
Palustrine Forested wetlands	0.6	2.8	7.7
Palustrine Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	5.7	18.6	13.8
Steele City Segment subtotal	*8.4*	*28.4*	*26.6*
Cushing Extension Pump Stations			
Palustrine Emergent wetlands	0.0	0.0	0.0
Palustrine Forested wetlands	0.0	0.0	0.0
Palustrine Shrub-scrub wetlands	0.0	0.0	0.0
Riverine/open water	0.2	0.6	0.4
Pump Station subtotal	*0.2*	*0.6*	*0.4*

TABLE 3.4.5-2 Wetlands Estimated Impact Summary for Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Gulf Coast Segment			
Palustrine Emergent wetlands	0.0	0.1	0.1
Palustrine Forested wetlands	0.0	0.1	0.4
Palustrine Shrub-scrub wetlands	0.2	0.5	0.4
Riverine/open water	0.3	1.0	0.7
Gulf Coast Segment subtotal	*0.5*	*1.7*	*1.6*
Project			
Emergent wetlands	2.2	7.1	5.2
Forested wetlands	0.6	2.9	8.1
Shrub-scrub wetlands	0.2	0.5	0.4
Riverine/open water	6.2	20.2	14.9
Project total	**9.1**	**30.6**	**28.6**

[a] Temporary disturbance areas include structure pads, access roads, pulling and tension area, turn around areas, and staging areas. Permanent disturbance areas include forested areas within 80- or 150-foot-wide right-of-way, around pole structures, and crossed by operational access roads. Some power lines have not been surveyed and data presented is from aerial photointerpretation.

3.4.6.2 Big Bend to Witten 230-kV Transmission Line

Upgrades to the power grid in South Dakota to support power requirements for pump stations in South Dakota would include construction of a new 230-kV transmission line and a new substation. As described in Section 2.5.2, Western and BEPC have identified two alternative corridors (Alternative Corridors A and B) for the proposed Big Bend to Witten 230-kV transmission line project, and there are several route options within each corridor.

Under Alternative Corridor A, lengths of wetland communities crossed by five route options for the power grid upgrade presented in Table 3.4.5-3 range from 0.3 to 1.4 miles based on National Wetlands Inventory data (USFWS 2009). The proposed routes also cross between 0.3 and 0.6 miles of riverine and open water habitats.

TABLE 3.4.5-3 Wetlands Estimated Impact Summary for Proposed Big Bend to Witten 230-kV Transmission Line Corridor A Alternatives for the Proposed Project					
Vegetation Community Classification	**Western (miles)**	**BEPC-A (miles)**	**BEPC-B (miles)**	**BEPC-C (miles)**	**BEPC-D (miles)**
Palustrine Emergent Wetlands	1.4	0.3	0.3	0.5	0.7
Palustrine Forested Wetlands	0	0	0	0	0
Palustrine Shrub-scrub Wetlands	0	0	0	0	0
Riverine/Open Water	0.6	0.5	0.4	0.3	0.3
Total	*2.0*	*0.8*	*0.7*	*0.8*	*1.0*

Under Alternative Corridor B, lengths of wetland communities crossed by four route options for the power grid upgrade presented in Table 3.4.5-4 range from 0.4 to 0.9 miles based on National Wetlands Inventory data (USFWS 2009). The proposed routes also cross between 0.2 and 0.5 miles of riverine and open water habitats.

TABLE 3.4.5-4
Wetlands Estimated Impact Summary for Proposed Big Bend to Witten 230-kV Transmission Line Corridor B Alternatives for the Proposed Project

Vegetation Community Classification	BEPC-E (miles)	BEPC-F (miles)	BEPC-G (miles)	BEPC-H (miles)
Palustrine Emergent Wetlands	0.6	0.9	0.4	0.4
Palustrine Forested Wetlands	0	0	0.1	0.1
Palustrine Shrub-scrub Wetlands	0	0	0	0
Riverine/Open Water	0.5	0.3	0.2	0.2
Total	*1.1*	*1.2*	*0.7*	*0.7*

Construction and operation impacts on wetlands would be the same as for the distribution lines discussed above, however, it is likely that the poles would be larger and that the area disturbed around the installation site would likely be larger. Electric service providers would avoid and minimize impacts by spanning wetlands and selecting pole locations away from sensitive habitats.

3.4.6.3 Bakken Marketlink and Cushing Marketlink Projects

Construction and operation of the Bakken Marketlink Project would include metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. Keystone reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there were no waterbodies or wetlands on the property. DOS reviewed aerial photographs of the area and confirmed the current use of the land and that there are no waterbodies associated with the site. A site inspection by the DOS third-party contractor confirmed these findings. As a result, the potential impacts associated with expansion of the pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

The Cushing Marketlink project would be located within the boundaries of the proposed Cushing tank farm of the Keystone XL Project would include metering systems and two storage tanks. As a result, the impacts of construction and operation of the Cushing Marketlink Project on wetlands would be essentially the same as potential impacts associated with construction and operation of the proposed Cushing tank farm described in this section. Cushing Marketlink facilities at the Cushing tank farm appear to be located within uplands; although a stream and floodplain appear to be crossed by the pipelines and encroached upon by the metering systems.

Currently there is insufficient information to complete an environmental review of these projects. The permit applications for these projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental review of the Marketlink projects. Potential wetland impacts would be evaluated during the environmental reviews for these projects and potential wetland impacts would be evaluated and avoided, minimized, or mitigated in accordance with direction from the appropriate USACE district offices.

3.4.7 References

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3.5 TERRESTRIAL VEGETATION

Vegetative cover is an important component in the classification of ecoregions that reflects differences in ecosystem quality and integrity (EPA 2007). Ecoregions are described through analysis of patterns and composition of geology, physiography, native vegetation, climate, soils, land use, wildlife, and hydrology. Variation in temperatures and precipitation, and differences in soils and parent materials along the northwest to southeast gradient crossed by the proposed Project, result in wide variation in vegetation communities. At the northern end of the proposed Project in Montana and South Dakota mixed-grass prairies and sagebrush[1] (*Artemisia* spp.) predominate; which transition to tall grass prairies through Nebraska, Kansas, and Oklahoma to southern piney woods, bald cypress (*Taxodium distichum*) and tupelo (*Nyssa* spp.) swamps at the southern end of the proposed Project in Texas. The proposed Project would cross 11 Level III Ecoregions of the United States from northwest to southeast:

- Northwestern Glaciated Plains (9 percent);
- Northwestern Great Plains (36 percent);
- Nebraska Sand Hills (7 percent);
- Central Great Plains (11 percent);
- Flint Hills;
- Cross Timbers (4 percent);
- Arkansas Valley (3 percent);
- South Central Plains (20 percent);
- East Central Texas Plains (4 percent);
- Texas Blackland Prairies (2 percent); and
- Western Gulf Coastal Plain (5 percent, Figure 3.5-1, Table 3.5-1).

Level IV Ecoregions (EPA 2002, 2007) supported by descriptions of dominant native vegetation communities within each state are presented to describe potential native vegetation cover and generalized landuse (Table 3.5-2, Woods et al. 2002, Bryce et al. 1996, Chapman et al. 2001, Woods et al. 2005, Griffith et al. 2004).

The occurrence of vegetation communities identified as conservation priorities are summarized from the states' Comprehensive Wildlife Conservation Strategies and agency correspondence (MFWP 2005, SDGFP 2006, Schneider et al. 2005, Wasson et al. 2005, ODWC 2005, Bender et al. 2005). Landcover types crossed by the proposed Project were identified and delineated based on review of literature, internet database resources, interpretation of aerial photographs, general observations made during field reconnaissance, and information collected during wetland delineation surveys. Generalized landcover types, and areas with native vegetation cover within wildlife areas, preserves, parklands, wetlands and forests crossed by the proposed pipeline ROW, access roads, workspaces, and transmission lines provide the basis for assessing potential impacts to vegetation cover.

[1] Common names of plants are used in this section. Scientific names for plants are used after their initial mention in text or tables following nomenclature in the U.S. Department of Agriculture, Natural Resources conservation Service's PLANTS database (USDA NRCS 2009). Scientific names for noxious weeds are listed in Table 3.5.4-1.

TABLE 3.5-1 EPA Level III Ecoregions Crossed by the Proposed Project		
Ecoregion (Identifier)	**Location of Occurrence in the Project Area**	**Description**
Northwestern Glaciated Plains (42)	Montana, South Dakota, and Nebraska	This is a transitional region between the generally more level, moister, more agricultural Northern Glaciated Plains to the east and the generally more irregular, dryer, Northwestern Great Plains to the west and southwest. The western and southwestern boundary roughly coincides with the limits of continental glaciations. This region is pocked by a moderately high concentration of semi-permanent and seasonal wetlands, locally referred to a Prairie Potholes.
Northwestern Great Plains (43)	Montana, South Dakota, and Nebraska	This region includes the Missouri Plateau section of the Great Plains. It is a semiarid rolling plain of shale and sandstone punctuated by occasional buttes. Native grasslands, largely replaced on level ground by winter and spring wheat and alfalfa, persist in rangeland areas on broken topography. Agriculture is restricted by the erratic precipitation and limited opportunities for irrigation.
Nebraska Sand Hills (44)	Nebraska, South Dakota	This is one of the most distinct and homogenous regions in North America and one of the largest areas of grass stabilized sand dunes in the world. The Sand Hills are generally devoid of cropland agriculture, and except for some riparian areas in the north and east, the region is treeless. Much of the region contains numerous lakes and wetlands that lack connecting streams.
Central Great Plains (27)	Nebraska, Kansas, and Oklahoma	This region is slightly lower, receives more precipitation, and is somewhat more irregular than the Western High Plains to the west. Once grasslands, with scattered low trees and shrubs in the south, much of this region has been converted to croplands. The eastern boundary marks the eastern limits of the major winter wheat--growing area of the United States.
Flint Hills (28)	Kansas	This is a region of rolling hills, with relatively narrow steep valleys, composed of shale and cherty limestone with rocky soils. In contrast to surrounding regions that are mostly in cropland, most of the Flint Hills region is grazed. 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.
Cross Timbers / Central Oklahoma/Texas Plains (29)	Oklahoma	This is a transition area between the once prairie, now winter wheat growing regions to the west, and the forested low mountains of eastern Oklahoma. The region is not suitable for grain crops such as corn and soybeans that are common to the northeast. Cross-Timbers [little bluestem (*Schizachyrium scoparium*) grassland with scattered blackjack oak (*Quercus marilandica*) and post oak (*Q. stellata*) trees] is the native vegetation, and presently rangeland and pastureland are the predominant land covers. Oil extraction has been a major activity in this region for over eighty years.

TABLE 3.5-1 EPA Level III Ecoregions Crossed by the Proposed Project		
Ecoregion (Identifier)	**Location of Occurrence in the Project Area**	**Description**
Arkansas Valley (37)	Oklahoma	This is a region of mostly forested valleys and ridges that is much less irregular than that of the Boston Mountains to the north and the Ouachita Mountains to the south, but is more irregular than the regions to the west and east. About one fourth of the region is grazed and roughly one tenth is cropland.
South Central Plains (35)	Texas	Locally called the "piney woods", this region of mostly irregular plains was once covered by oak-hickory-pine forests, but is now predominantly loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*). Only about one sixth of the region is cropland, and about two thirds are forests and woodlands. Lumber and pulpwood production are major economic activities.
East Central Texas Plains (33)	Texas	Also called the Clay Pan Area, this region of irregular plains was originally covered by post oak savanna vegetation, in contrast to the more open prairie-type regions to the north, south and west and the piney woods to the east. The bulk of this region is now used for pasture and range.
Texas Blackland Prairies (32)	Texas	This discontinuous region is distinguished from surrounding regions by its fine textured clayey soils and predominantly prairie vegetation. This region contains a higher percent of croplands than adjacent regions, although much of the land has been converted to urban and industrial uses.
Western Gulf Coastal Plain (34)	Texas	The distinguishing characteristics of this region are its relatively flat coastal plain topography and grassland vegetation. Inland from this region the plains are more irregular and have mostly forest or savanna-type vegetation. Largely because of these characteristics, a higher percentage of the land is in cropland compared to bordering regions, although much land has been converted to urban and industrial uses.

Sources: See Appendix M; Classification of Level III Ecoregions is based on EPA (2007); descriptions of the regions are based on EPA (2002).

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
Steele City Segment and Cushing Pump Stations					
MT **7.8**	0.0	7.8	Cherry Patch Moraines (42m) (Northwestern Glaciated Plains)	Grama (*Bouteloua* spp.)-needlegrass (*Hesperostipa* spp.)-wheatgrass (*Pascopyrum* spp.); Shrubs limited to moister depressional areas	Undulating to strongly sloping with many seasonal lakes and wetlands. Shortgrass prairie vegetation is native with shrubs restricted to moist depressions. Extensive cereal farming, steep slopes, moraines, gullies and ridges are often grazed.
MT 82.4 7.7 **90.1**	7.8 109.0	90.2 116.7	Glaciated Northern Grasslands (42j) (Northwestern Glaciated Plains)	Grama-needlegrass-wheatgrass	Glaciated, dissected, rolling to strongly rolling drift plain with many seasonal impoundments. Mostly rangeland with some farming on scattered, un-dissected benches and on alluvial, irrigated soils.
MT 14.5 6.0 **20.5**	90.2 192.3	104.7 198.3	River Breaks (43c) (Northwestern Great Plains)	Bottomlands with heavy soils– western wheatgrass (*Pascopyrum smithii*), buffalograss (*Bouteloua dactyloides*); with gravelly soils – threadleaf sedge (*Carex filifolia*) needle and thread (*Hesperostipa comata*). On north facing slopes – junipers (*Juniperus* spp.) and deciduous trees	Unglaciated, very dissected terraces and uplands that descent to the Missouri River system (89.9 to 104.3) and to the Yellowstone River system (191.8 to 197.4). Primarily used for grazing on native grasses with remnant woodlands in draws and on north facing slopes and alluvial flats.
MT 4.3 16.6 83.7 **104.6**	104.7 116.7 198.3	109.0 133.3 282.0	Central Grassland (43n) (Northwestern Great Plains)	Grama-needlegrass-wheatgrass	Unglaciated, rolling plains studded with buttes and badlands dissected by many small, ephemeral or intermittent streams, underlain by fine-grained sedimentary rock. Primarily rangeland, with some irrigated and dry-land farming, and coal mining.
MT **59.0**	133.3	192.3	Missouri Plateau (43a) (Northwestern Great Plains)	Wheatgrass-needlegrass	Primarily unglaciated, treeless, rolling hills and gravel covered benches, less arid soils result in mosaic of rangeland and farmland with spring wheat, hay, barley and oats; in contrast to neighboring regions which are mainly rangelands. Subject to wind erosion.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
MT 0.4 SD 55.3 **55.7**	282.0 282.4	282.4 337.7	Sagebrush Steppe (43e) (Northwestern Great Plains)	Little sagebrush (*Artemisia arbuscula*), big sagebrush (*A. tridentata*), with western wheatgrass, green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), Sandberg bluegrass (*Poa secunda*), and buffalograss.	Unglaciated, level to rolling plains with occasional buttes, badlands, scoria mounds, and salt pans with thick mats of short-grass prairie and dusky gray sagebrush. Primarily grazing with minimal cultivation.
SD **49.2**	337.7	386.9	Moreau Prairie (43j) (Northwestern Great Plains)	Western wheatgrass, green needlegrass, blue grama and buffalograss	Unglaciated, level to rolling plains with occasional buttes, badlands, and numerous salt pans on alkaline soils. Mostly cattle and sheep ranching, with occasional dry-land wheat and alfalfa.
SD **30.5**	386.9	417.4	Missouri Plateau (43a) (Northwestern Great Plains	Blue grama, wheatgrass/needlegrass, little bluestem, prairie sandreed (*Calamovilfa longifolia*)	Unglaciated, moderately dissected rolling plains with isolated sandstone buttes. Mosaic of dry-land farming with spring wheat, barley, oats, sunflowers, and alfalfa.
SD 47.9 5.8 41.1 24.4 **119.2**	430.5 487.2 494.2 546.0	478.4 493.0 535.4 570.4	Subhumid Pierre Shale Plains (43f) (Northwestern Great Plains)	Short grass prairie: western wheatgrass, green needlegrass, blue grama and buffalograss	Unglaciated, undulating to rolling plains with steep-sided, incised streams on shale. Rangeland cattle grazing, dry-land farming winter wheat and alfalfa.
SD 8.9 4.2 8.8 1.2 10.6 **33.7**	417.4 426.3 478.4 493.0 535.4	426.3 430.5 487.2 494.2 546.0	River Breaks (43c) (Northwestern Great Plains)	Blue grama, western wheatgrass, buffalograss, some bluestem, prairie sandreed. Rocky Mountain juniper (*Juniperus scopulorum*) in draws and on north slopes, scattered cottonwoods (*Populus* spp.) in riparian areas	Unglaciated, highly dissected hills and uplands bordering Cheyenne River, Bad River, and White River and alluvial plains. Mostly rangeland and native grasses, cattle grazing, remnant woodlands in draws and on alluvial flats.
SD **5.1**	570.4	575.5	Keya Paha Tablelands (43i) (Northwestern Great Plains)	Blue grama, sideoats grama, western wheatgrass, little bluestem, and needle and thread.	Unglaciated, level to rolling sandy plains with isolated gravelly buttes, dissected near streams. Rangeland with areas of cropland, alfalfa, winter wheat, millet, and corn.
SD **13.3**	575.5	588.9	Ponca Plains (42g) (Northwestern Glaciated Plains)	Mixed grass prairie - little bluestem, prairie sandreed, green needlegrass and needle and thread	Unglaciated, level to rolling plains. Intensive row crops, soybeans, corn, sunflowers, alfalfa and some grazing.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
SD 8.4 NE 3.0 **11.4**	588.9 597.3	597.3 600.3	Southern River Breaks (42h) (Northwestern Glaciated Plains)	Mixed grass prairie: western wheatgrass, little bluestem, sideoats grama (*Bouteloua curtipendula*), green needlegrass on uplands. Deciduous woodland: bur oak (*Quercus macrocarpa*), American basswood (*Tilia americana*), and eastern redcedar (*Juniperus virginiana*) in canyons and northfacing slopes. Plains cottonwood (*Populus deltoides monilifera*), green ash (*Fraxinus pennsylvanica*), peachleaf willow (*Salix amygdaloides*), boxelder (*Acer negundo*), buffaloberry (*Shepherdia* spp.), sumac (*Rhus* spp.).	Lightly glaciated, dissected hills and canyons with high relief bordering Keya Paha River. Mixed grass and woodlands - grazing.
NE **13.3**	600.3	613.5	Keya Paha Tablelands (43i) (Northwestern Great Plains)	Mosaic of Sand Hills transition prairie and gravelly mixed grass prairie: little bluestem, prairie sandreed, threadleaf sedge, and needle and thread.	Unglaciated, level to rolling sandy plains with isolated gravelly buttes, dissected near streams. Rangeland with areas of cropland, alfalfa, winter wheat, millet, and corn.
NE **3.6**	613.5	617.1	Niobrara River Breaks (43r) (Northwestern Great Plains)	Ponderosa pine (*Pinus ponderosa*) woodlands with eastern redcedar south-facing bluffs and canyon slopes. Deciduous woodlands: bur oak, American basswood, green ash, and some paper birch (*Betula papyrifera*) on north-facing bluffs and lower canyon slopes. Plains cottonwoods and eastern redcedar on floodplains and mixed grass and Sand Hills prairies in valley	Unglaciated, dissected canyons with high relief bordering the Niobrara River. Rangeland with scattered cropland in valley bottom. Pine woodlands, deciduous woodlands, floodplain forest and mixed grass and Sand Hills prairies.
NE **46.8**	617.1	663.9	Wet Meadow and Marsh Plain (44c) (Nebraska Sand Hills)	Sand Hills transition mixed grass prairie: prairie sandreed, little bluestem, sand bluestem (*Andropogon hallii*), sun sedge (*Carex inops*), porcupinegrass (*Hesperostipa spartea*), needle and thread, blue grama and hairy grama (*Bouteloua hirsuta*). Wetlands: big bluestem (*Andropogon gerardii*), bluejoint (*Calamagrostis canadensis*), prairie cordgrass (*Spartina pectinata*), and sedges (*Carex* spp.)	Flat, sandy plain with numerous marshes and wetlands. Grassland with a small acreage used for cultivated crops, some irrigation.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
NE **44.8**	663.9	708.7	Sand Hills (44a) (Nebraska Sand Hills)	Sand Hills mixed grass prairie: prairie sandreed, little bluestem, sand bluestem, switchgrass (*Panicum virgatum*), sand lovegrass (*Eragrostis trichodes*), needle and thread, blue grama, and hairy grama.	Sand sheets and dune fields, high water table. Rangeland.
NE **30.4**	708.7	739.1	Central Nebraska Loess Plains (27e) (Central Great Plains)	Mixed grass prairie: big bluestem, little bluestem, sideoats grama, blue grama, and western wheatgrass with eastern redcedar intrusion. Redcedar concentrated in northwest and next to Sand Hills.	Rolling dissected plains with deep loess layer, perennial and intermittent streams. Predominantly rangeland with large areas of cropland in winter wheat, corn, forage crops, and some irrigated agriculture
NE **19.8**	739.1	758.9	Platt River Valley (27g) (Central Great Plains)	Lowland tall grass prairie with areas of wet meadow and marsh. With flood management and reduced river flow, floodplain forests have increased along the Platte River.	Flat, wide, alluvial valley with shallow, interlacing streams on a sandy bed. Extensive cropland, much of which is irrigated, corn, grain sorghum, soybeans, and alfalfa. Some native rangeland and hay lands, many channelized streams and flood control structures.
NE **89.5**	758.9	848.4	Rainwater Basin Plains (27f) (Central Great Plains)	Transitional tall grass prairie to the east and mixed grass prairie in the west dominated by big bluestem, little bluestem, and sideoats grama. Wetlands dominated by western wheatgrass, sedge, spikerush (*Eleocharis* spp.) and slender bulrush (*Schoenoplectus heterochaetus*).	Flat to gently rolling loess-covered plains, historically covered with extensive rainwater basins and wetlands. Extensive cropland, dry land sorghum and winter wheat, irrigated corn, and alfalfa. Most of the basins have been drained for cultivation.
NE **3.2**	848.4	851.6	Smokey Hills (27a) (Central Great Plains)	Transition from tall grass prairie in the east to mixed grass prairie in the west. Some floodplain forests along riparian areas.	Undulating to hilly dissected plain, broad belt of low hills formed by dissection of sandstone formations. Cropland with winter wheat, corn in irrigated areas and areas of grassland.
KS 0.0	PS 27				
KS 0.0	PS 29		Flint Hills (28) (Flint Hills)	Tall grass prairie: big bluestem, little bluestem, switchgrass, Indiangrass (*Sorghastrum nutans*).	Undulating to rolling hills, cuestas, cherty limestone, and shale outcrops, perennial streams and springs common. Rangeland cattle grazing, limited areas of croplands along river valleys.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
Gulf Coast Segment					
OK **15.5**	0.0	15.5	Cross Timbers Transition (27o) (Central Great Plains)	Mixed grass prairie: little bluestem, sideoats grama, blue grama, Indiangrass. Cross timbers: blackjack oak, post oak, hickory (*Carya* spp.), little bluestem. Tall grass prairie: big bluestem, little bluestem, switchgrass, Indiangrass. Uplands: oak (*Quercus* spp.), hickory, eastern redcedar. Riparian: cottonwood, willow, elm (*Ulmus* spp.), ash, walnut (*Juglans* spp.), pecan (*Carya illinoinensis*).	Rough plains that are sometimes broken, incised stream with rocky or muddy substrates. Mixture of rangeland and cropland, small grains, sorghum, alfalfa, soybeans. Stream banks previously supported hardwood forests. Upland trees increased due to fire suppression, riparian forests and wetlands degraded or lost due to channelization or landuse changes.
OK **62.2**	15.5	77.7	Northern Cross Timbers (29a) (Cross Timbers)	Cross timbers: post oak, blackjack oak, little bluestem. Tall grass prairie: big bluestem, little bluestem, switchgrass, Indiangrass. Mosaic of tall grass prairie and oak-hickory forest. Riparian forest: common hackberry (*Celtis occidentalis*), American elm (*Ulmus americana*), post oak, black walnut (*Juglans nigra*), green ash, willow, American sycamore (*Platanus occidentalis*), cottonwood.	Rolling hills, cuestas, ridges, and ledges. Stream flow annually variable. Scrubby oak forests, oak savannas, riparian forests and prairie openings. Woodland, grassland, rangeland, pastureland and limited croplands. Main crops are small grains, sorghum, hay and soybeans. Fire suppression has allowed the woodlands to expand.
OK **41.1**	77.7	118.8	Lower Canadian Hills (37e) (Arkansas Valley)	Cross timbers, tall grass prairie, mosaic of tall grass prairie and oak-hickory forest, and oak-hickory-pine forest. High terraces mixed deciduous forests: post oak, black oak (*Quercus velutina*), southern red oak (*Q. falcata*), and black hickory (*Carya texana*). Wooded hills and ridges: post oak, blackjack oak, white oak (*Q. alba*), hickory, eastern redcedar, shortleaf pine. Floodplains: eastern cottonwood (*Populus deltoides*), sycamore, oaks, black willow (*Salix nigra*), green ash, pecan, sweetgum (*Liquidambar styraciflua*), black walnut.	Mosaic of hills and valleys in Arkoma Basin, scattered ridges and numerous ponds. Woodland, pastureland, cropland with soybeans, wheat, sorghum, alfalfa, peanuts, and corn, coal strip mines.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
OK 19.5 15.6 **35.1**	118.8 139.7	138.3 155.3	Cretaceous Dissected Uplands (35d) (South Central Plains)	Oak-hickory-pine forest. Shortleaf pine more abundant than loblolly pine in natural woodlands. Floodplains: deciduous forest. Moist upland forests: sweetgum, hickory, blackgum (*Nyssa sylvatica*), oak. Drier upland forests: oaks and pines. Floodplain forests American elm, common hackberry, water oak (*Quercus nigra*), southern red oak and green ash.	Level to hilly, dissected uplands and low cuestas underlain by poorly consolidated often calcareous sands, clays, gravels, and limestone. Mostly forests and pastureland, logging, livestock farming, poultry production, some croplands in gently sloping areas, corn, soybeans, hay, small grains, peanuts.
OK **1.4**	138.3	139.7	Eastern Cross Timbers (29b) (Cross Timbers)	Cross timbers (dominants: post oak, blackjack oak, black hickory, little bluestem) and tall grass prairie (dominants: big bluestem, little bluestem, switchgrass, and Indiangrass). Native bottomlands: pecan, black walnut, American elm and cottonwood.	Rolling hills, cuestas, long narrow ridges and a few strongly dissected areas underlain by sand, shale, clay, sandstone, calcareous shale and limestone. Vegetation diversity, density and growing season typically greater than Northern Cross Timbers. Primarily livestock grazing – grassland, pasture, rangeland and woodland, with some small grains, sorghum, and peanuts. Fire suppression and passive land use have allowed woodlands to expand, small impoundments are common.
OK 0.4 TX 4.9 **5.3**	155.3 155.7	155.7 160.6	Red River Bottomlands (35g) (South Central Plains)	Southern floodplain forest: eastern cottonwood, sycamore, hackberry, sweetgum, green ash, pecan, water oak, willow, American elm, southern red oak, and river birch (*Betula nigra*).	Broad, level to nearly level floodplains and low terraces with oxbow lakes, meander scars, backwaters. Mostly cleared and drained for cropland and pastures. Crops soybeans, sorghum, alfalfa, corn, wheat, pecans, cotton. Artificial levees and drainage ditches are common.
TX **2.5**	160.6	163.1	Pleistocene Fluvial Terraces (35c) (South Central Plains	Pine-hardwood forests with post oak, Shumard oak (*Quercus shumardii*) and eastern redcedar woods	Terrace deposits along the Red River, broad flats and gently sloping stream terraces mostly forest covered.
TX 9.0 3.2 1.4 5.8 10.0 **29.4**	163.1 198.9 203.7 206.5 217.6	172.1 202.1 205.1 212.3 227.6	Northern Post Oak Savanna (33a) (East Central Texas Plains)	Deciduous forest: post oak, blackjack oak, eastern redcedar, black hickory. Prairie openings: little bluestem and other grasses.	Level to gently rolling plains. Improved pasture, some coniferous trees planted loblolly pine

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
TX **26.8**	172.1	198.9	Northern Blackland Prairie (32a) (Texas Blackland Prairies)	Mixed grass prairie: little bluestem, big bluestem, Indiangrass, dropseed (*Sporobolus* spp.). Northeast grass communities dominated by Silveus' dropseed (*S. silveanus*), Mead's sedge (*Carex meadii*), bluestems (*Andropogon* spp., *Bothriochloa* spp., *Schizachyrium* spp.), and longspike tridens (*Tridens strictus*) with asters (*Aster* spp.), diamondflowers (*Stenaria nigricans*), prairie clover (*Dalea* spp.), and blackeyed Susan (*Rudbeckia hirta*). Riparian woodlands: bur oak, Shumard oak, sugarberry (*Celtis laevigata*), elm, ash, eastern cottonwood, pecan.	Rolling to nearly level plains underlain by interbedded chalks, marls, limestone, and shales. Most of the prairie has been converted to cropland, non-native pasture, and expanding urban areas.
TX 1.6 1.8 **3.4**	202.1 212.3	203.7 214.1	Floodplains and Low Terraces (33f) (East Central Texas Plains)	Bottomland forests: water oak, post oak, elms, green ash, pecan, willow oak (*Quercus phellos*), hackberry, eastern cottonwoods.	Floodplain and low terrace deposits, wider floodplains of Sulfur River on Holocene deposits. Northern floodplains have more forested cover than cropland and pasture.
TX 1.4 3.5 **4.9**	205.1 214.1	206.5 217.6	Northern Prairie Outliers (33d) (East Central Texas Plains)	Tall grass prairie: little bluestem, big bluestem, Indiangrass, dropseed.	Small disjunct areas historically containing a mosaic of forest and prairie. Fire suppression has allowed invasion of woody vegetation. Mostly pasture with some croplands
TX 33.7 69.1 **102.8**	227.6 263.8	261.3 332.9	Tertiary Uplands (35a) (South Central Plains)	Mixed forest: loblolly pine, shortleaf pine, southern red oak, post oak, white oak, hickory, sweetgum and mixed and tall grasses, Indiangrass, little bluestem, longleaf woodoats (*Chasmanthium sessiliflorum*), panicgrass (*Panicum* spp.); with American beautyberry (*Callicarpa americana*), sumac, greenbrier (*Smilax* spp.) and hawthorn (*Crataegus* spp.) understory. Sandier areas have more bluejack oak (*Quercus incana*), post oak, and stunted pines.	Irregular plains at the western edge of the coniferous forest belt. Rolling uplands, gently to moderately sloping plains. Once covered with a mix of pine and hardwood, much of the region is now in loblolly and shortleaf pine plantations. Pastures, loblolly pine timber forest, lumber and pulpwood production, grazing and poultry production.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
TX 2.5 3.1 1.4 0.9 1.3 2.2 2.8 **14.1**	 261.3 334.0 347.9 352.7 360.5 364.8 367.0	 263.8 337.1 349.2 353.6 361.8 367.0 369.8	Floodplains and Low Terraces (35b) (South Central Plains)	Wetland communities: water oak, willow oak, sweetgum, blackgum, elm, red maple (*Acer rubrum*), southern red oak, swamp chestnut oak (*Quercus michauxii*), loblolly pine. Bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*) in semipermanently flooded areas.	Alluvial floodplains and low terraces of the Sabine River, Angelina River, Neches River where there is a distinct vegetation change into bottomland oaks and gum forest. Lumber and pulpwood production.
TX 1.1 10.8 3.5 6.9 3.0 40.9 **66.2**	 332.9 337.1 349.2 353.6 361.8 369.8	 334.0 347.9 352.7 360.5 364.8 410.7	Southern Tertiary Uplands (35e) (South Central Plains)	Longleaf pine (*Pinus palustris*) forests on sand ridges and uplands. Mesic forests: American beech (*Fagus grandifolia*), magnolia-beech loblolly pine (*Magnolia* spp., *Fagus* spp., *Pinus* spp.) forests. Acid bogs: sweetbay (*Magnolia virginiana*), holly (*Ilex* spp.), bayberry (*Morella* spp.), insectivorous plants, orchids (Orchidaceae), rhododendron (*Rhododendron* spp.).	Hilly and dissected longleaf pine range, sand ridges and uplands, open forests, some sandstone outcrops. Seeps in sand hills with acid bog species. More pine than oak-pine forests and pasture, large areas are National Forests.
TX 44.3 0.2 **44.5**	 410.7 459.3	 455.0 459.5	Flatwoods (35f) (South Central Plains)	Upland pine forest: longleaf pine, sweetgum, white oak, southern red oak, willow oak, blackgum and holliy. Wetter, flat areas: pine savannas, small prairies: beech-magnolia communities, swamp chestnut oak, loblolly pine, laurel oak (*Quercus laurifolia*).	Mostly flat to gently sloping, irregular plains at the western edge of the southern coniferous forest belt. Once supported diversity of mixed pine-hardwood forests with mosaic of well-drained and poorly drained communities. Much of the region in loblolly and shortleaf pine plantations about one sixth of the region is cropland, two thirds is forests and woodland. Lumber, pulpwood production.
TX 4.3 23.2 1.1 **27.2**	 455.0 459.5 482.7	 459.3 482.7 483.8	Northern Humid Gulf Coastal Prairies (34a) (Western Gulf Coastal Plain)	Grasslands with clusters of oaks: little bluestem, Indiangrass, brownseed paspalum (*Paspalum plicatulum*), hairawn muhly (*Muhlenbergia capillaris*), switchgrass. Some loblolly pine in northern portion.	Deltaic sands, silts, and clays on gently sloping coastal plain. Flat grasslands, more irregular and with forest or savanna vegetation further inland. Almost all coastal prairies converted to cropland, rangeland, pasture, urban use. Primarily croplands, rice sorghum, cotton and soybeans. Urban and industrial developments.

TABLE 3.5-2
Level IV Ecoregions Crossed by the Proposed Project

State Length (miles)	Milepost In	Milepost Out	Level IV (Identifier) (Level III)	Potential Natural Vegetation	Description
Houston Lateral Segment					
TX 3.2 0.5 **3.7**	0.0 15.9	3.2 16.4	Flatwoods (35f) (South Central Plains)	Upland pine forest: longleaf pine, sweetgum, white oak, southern red oak, willow oak, blackgum and holly. Wetter, flat areas: pine savannas, small prairies: beech-magnolia communities, swamp chestnut oak, loblolly pine, laurel oak.	Mostly flat to gently sloping, irregular plains at the western edge of the southern coniferous forest belt. Once supported diversity of mixed pine-hardwood forests with mosaic of well-drained and poorly drained communities. Much of the region in loblolly and shortleaf pine plantations about one sixth of the region is cropland, two thirds is forests and woodland. Lumber, pulpwood production.
TX 12.7 26.0 **38.7**	3.2 22.6	15.9 48.6	Northern Humid Gulf Coastal Prairies (34a) (Western Gulf Coastal Plain)	Grasslands with clusters of oaks: little bluestem, Indiangrass, brownseed paspalum, hairawn muhly, switchgrass. Some loblolly pine in northern portion.	Deltaic sands, silts, and clays on gently sloping coastal plain. Flat grasslands, more irregular and with forest or savanna vegetation further inland. Almost all coastal prairies converted to cropland, rangeland, pasture, urban use. Primarily croplands, rice sorghum, cotton and soybeans. Urban and industrial developments.
TX **6.2**	16.4	22.6	Floodplains and Low Terraces (35b) (South Central Plain)	Wetland communities: water oak, willow oak, sweetgum, blackgum, elm, red maple, southern red oak, swamp chestnut oak, loblolly pine. Bald cypress and water tupelo in semipermanently flooded areas.	Floodplains and low terraces of the lower Trinity River.

Sources: See Appendix M; Level III Ecoregions is based on EPA (2002, 2007); Level IV Ecoregions are based on Woods et al. 2002, Bryce et al. 1996, Chapman et al. 2001, Woods et al. 2005, Griffith et al. 2004. Plant names follow USDA NRCS (2009) PLANTS Database.

3.5.1 General Vegetation Resources

Generalized vegetation cover including prairie, forest, wetland communities and croplands that may occur within landcover classes crossed by the proposed Project is summarized 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. Shrublands are included in the grassland/rangeland landcover class. 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 irrigated cropland primarily include introduced crop species, which provide forage and grain for livestock and human consumption. ROW areas consist of previously disturbed areas associated with pipelines and other utilities that have been restored primarily with native herbaceous and introduced plants.

TABLE 3.5.1-1
Landcover Types with Generalized Plant Communities Crossed by the Proposed Project

General and Subclass Designation	General Description	Common Plants	Occurrence along ROW by Route Segment and State						
			Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
			MT	SD	NE	KS	OK	TX	TX
Agriculture									
Cropland	• Cultivated land • Row crops • Hayfields	Wheat, barley, oats, sorghum, corn, beans, hay	X	X	X		X	X	X
Irrigated Cropland	Cultivated, center pivot irrigated	Wheat, barley oats, corn, beans, alfalfa	X	X	X	X			
Hay Meadows		Non-native grasslands	X	X	X		X	X	
Urban / Built-Up Areas									
Residential	Suburban and rural residential areas	Ornamental trees, shrubs, windbreaks	X	X	X	X	X	X	X
Commercial	Commercial development areas	Planted vegetation	X	X	X	X	X	X	X
Industrial	• Electric power and gas utility stations • Roads • Landfills • Mines • Wind farms, etc.	Planted and potential native vegetation	X	X	X	X	X	X	X
Right of Way	Roads, Railroads and utility corridors	Mixture of native and non-native grasses and forbs	X	X	X	X	X	X	X
Grasslands / Rangeland									
Tall-Grass Prairie	Grassland community dominated by 3 to 6 foot tall grasses	Big Bluestem, Little Bluestem, Indiangrass			X	X	X		X
Mixed-Grass Prairie	Grassland community dominated by 1 to 2 foot tall grasses	Blue Grama, Needle and Thread, Green Needlegrass, Western Wheatgrass, Little Bluestem, Buffalograss	X	X	X		X		X
Short-Grass Prairie	Grassland community dominated by grasses less than 1 foot tall	Blue Grama, Buffalograss	X	X					

TABLE 3.5.1-1
Landcover Types with Generalized Plant Communities Crossed by the Proposed Project

General and Subclass Designation	General Description	Common Plants	Occurrence along ROW by Route Segment and State						
			Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
			MT	SD	NE	KS	OK	TX	TX
Sand Hills Dune Prairie	Grassland community on sand or gravel soils, dominated by sand-adapted grasses	Sand Bluestem, Hairy Grama, Prairie Sandreed, Little Bluestem		X	X				
Non-native Grassland	Pasturelands planted with nonnative cool-season grasses	Smooth Brome (*Bromus inermis*), Crested Wheatgrass (*Agropyron cristatum*) and other seeded pasture grasses	X	X	X		X	X	X
Deciduous Shrubland	Upland or lowland communities dominated by shrubs	Chokecherry (*Prunus virginiana*), Sandbar Willow (*Salix interior*), Silver Buffaloberry (*Shepherdia argentea*), Western Snowberry (*Symphoricarpos occidentalis*)	X				X	X	X
	Sagebrush communities dominated by shrubs	Silver Sagebrush (*Artemisia cana*), Big Sagebrush	X	X					
Conservation Reserve Program	Fallow, mixed native and non-native grasses, forbs and shrubs.	A variety of native and introduced grass species	X	X	X				
Upland Forest									
Deciduous Forest	Forests dominated by a wide variety of mixed native and non-native deciduous trees	Green Ash, Quaking Aspen (*Populus tremuloides*), Bur Oak, Post Oak, Blackjack Oak, American Hickory, Boxelder, Common Hackberry	X	X	X		X	X	X
Mixed Forest	Forest composed by a wide variety of mixed deciduous and evergreen species, with neither type more than 75 percent of total tree cover.	Juniper, Pine, Green Ash, Quaking Aspen, Bur Oak, Shortleaf Pine, Water, Blackgum, Winged Elm (*Ulmus alata*)	X	X	X		X	X	

TABLE 3.5.1-1
Landcover Types with Generalized Plant Communities Crossed by the Proposed Project

General and Subclass Designation	General Description	Common Plants	Occurrence along ROW by Route Segment and State						
			Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
			MT	SD	NE	KS	OK	TX	TX
Riverine / Open Water									
Open Water	Open water, sometimes associated with wetland habitat	Not applicable	X	X	X		X	X	X
Riverine Wetlands	Wetlands contained within a channel	Not applicable						X	X
Palustrine Forested									
Riparian or Floodplain Woodland	Temporarily flooded woodland	Green Ash, Eastern Cottonwood, Boxelder, Bur Oak, American Elm , Willow	X	X	X		X		
	Bald Cypress-Water Tupelo Swamp	Bald Cypress, Water Oak, Water Hickory (*Carya aquatica*), Swamp Tupelo (*Nyssa biflora*), Swampprivet (*Forestiera* spp.)					X	X	X
Palustrine Emergent / Scrub-Shrub Wetlands									
Emergent Wetlands	Wetlands dominated by persistent emergent vegetation	Common Spikerush (*Eleocharis palustris*), Rush (*Juncus* spp.), Rice Cutgrass (*Leersia oryzoides*), Bulrush, Bur-reed (*Sparganium* spp.), Cattail (*Typha* spp.), Sedges, Fowl Bluegrass (*Poa palustris*), Foxtail Barley (*Hordeum jubatum*)	X	X	X		X	X	X
Riparian Shrubland	Temporarily flood scrub-shrub community	Sedge, Willow, Bulrush, Western Snowberry, Greasewood (*Sarcobatus vermiculatus*), Winterfat (*Krascheninnikovia lanata*), Fourwing Saltbush (*Atriplex canescens*)	X	X	X				
Aquatic Bed Wetland	Intermittently, temporarily, or permanently flooded wetlands	Saltgrass (*Distichlis spicata*), Knotweed (*Polygonum* spp.), Pondweed (*Potamogeton* spp.)			X				

3.5.2 Vegetation Communities of Conservation Concern

Native vegetation communities throughout the proposed Project area are altered by agricultural, urban and industrial development and by changes in ecosystem processes that maintain or reset succession including fire, bison grazing and prairie dogs. Vegetation communities crossed by the proposed Project that have become conservation concerns because of declining abundance, sensitivity to disturbance, and/or reliance of listed or sensitive species on the habitats that they create include: native grasslands, sagebrush grasslands, riparian habitats and bottomland hardwoods, and native forests. Vegetation cover within wetlands, conservation and reserve areas, wildlife production areas, and unique landscapes are areas of concern. The following sections provide brief descriptions of these unique and often rare vegetation communities. Figure 3.5.2-1 illustrates the current distribution of grasslands and prairies, forestlands, and croplands and pasture in the states crossed by the proposed Project.

3.5.2.1 Native Grasslands

Native grasslands or prairies are among the most threatened native 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. Across the proposed Project area the influence of fire and grazing, especially by large herds of bison, maintained native grasslands in a relatively treeless condition. With suppression of fires, woody vegetation has encroached upon the prairie landscape in some parts of Great Plains. Prairies have been lost to agriculture, urbanization, and mineral exploration and altered by invasions of non-native plants, fire suppression, establishment of woodlots and shelterbelts, and water developments.

Tall-grass prairie is the wettest of the grasslands composed of sod-forming grasses. Mixed-grass prairies are intergrades between tall-grass and short-grass prairies 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 buffalograss – two warm-season grasses that flourish under intensive grazing. Estimated declines in native tall-grass prairie range from 83 to 99 percent, mixed-grass prairie range from 30 to 75 percent, and short-grass prairie ranges from 35 to 79 percent in some of the Great Plains states crossed by the proposed Project (Samson et al. 1998). Because of this decline and the importance of these areas as wildlife habitat, conservation of native prairie remnants is a high priority throughout the proposed Project area. Many of the sensitive plant species discussed in Section 3.8 that occur along the pipeline ROW occur within native grasslands.

Sand Hills

The Sand Hills is one of the largest grass-stabilized dune regions in the world (Schneider et al. 2005). Dunes are oriented northwest to southeast in alignment with the prevailing winds. Rainwater and snowmelt percolate rapidly through the poorly developed soils and most lakes and wetlands in the area are small, shallow and clustered near stream headwaters where surface drainage is poor (Schneider et al. 2005). Typical grassland communities include: dune prairie with a mixture of sand-adapted grasses; dry valley prairie with taller prairie grasses in wetter areas between dunes; blowout communities with unique plant communities in wind-excavated depressions; and wet meadows (Schneider et al. 2005). Most (95 percent) of the Sand Hills region remains in a relatively natural state maintained as native grasslands for livestock grazing and contains a variety of native plant communities, with nearly 700 native plants and associated high biological diversity (Schneider et al. 2005). The rich flora and fauna supported by the Sand Hills is one of the few remaining examples of a functioning prairie ecosystem. The proposed Project crosses through the Elkhorn Headwaters Unique Landscape in Nebraska (Schneider et al. 2005).

Rainwater Basin

The Rainwater Basin is a complex of wetlands and grasslands on the flat to rolling loess-covered plains of the Rainwater Basin Plains. This complex of playa wetlands formed by wind scour retain water because of impervious clay layers accumulated in the bottoms of the depressions over thousands of years slows water from seeping into the ground (LaGrange, 2005). Surface water drainage is poorly developed, and wetlands fill with precipitation and snowmelt (Schneider et al. 2005). This region supports millions of migratory ducks, geese, and shorebirds. Vegetation communities include mixed grass, tall grass, and saline prairie communities. The proposed Project crosses through the Rainwater Basin-East Unique Landscape in Nebraska (Schneider et al. 2005).

Prairie Dog Towns

Prairie dogs change grassland habitats by digging and maintaining extensive burrow complexes, by selective grazing which changes the associated grasses, and by urination and defecation that change soil nutrients. Vegetation typically associated with active and inactive prairie dog towns may include: threeawn (*Aristida* spp.), sixweeks fescue (*Vulpia octoflora*), fetid marigold (*Dyssodia papposa*), curlycup gumweed (*Grindelia squarrosa*), saltgrass (*Distichlis spicata*), prairie junegrass (*Koeleria macrantha*), threadleaf sedge, blue grama, and western wheatgrass (SDGFP 2006).

Sagebrush Grasslands

Mixed shrub and grass habitats characterize large expanses of grasslands throughout Montana and South Dakota. Depending on site moisture communities may include, silver sagebrush in more moist areas, big sagebrush and rabbitbrush (*Chrysothamnus* spp. and *Ericameria* spp.) in drier areas, or greasewood in alkali flats. Large areas of intact native sagebrush grasslands are a conservation priority in Montana and South Dakota. Sagebrush is susceptible to fire and low-lying, xeric big sagebrush communities may have a natural fire return interval of 100 to 200 years depending on topography and exposure, while sagebrush communities on more moist sites may have a natural fire interval of decades (USFWS 2008). Post-fire reestablishment of sagebrush communities may require 20 to 50 years.

3.5.2.2 Riparian Habitats and Bottomland Hardwoods

Riparian vegetation changes substantially in character from woody draws in the northwest portion of the proposed Project area to bald cypress-tupelo swamps in the southeast. Riparian areas are important as wildlife habitat within the western United States (USFWS, 1997). Riparian areas represent a transition between wetland and upland habitats, generally lack the amount or duration of water present in wetlands, and riparian vegetation may include wetland or upland plants. Riparian habitats identified as conservation priorities in Montana include: woody draws (dry streambed areas dominated by broadleaf riparian communities such as cottonwood-alder-chokecherry-willow communities); shrub riparian communities (alder-chokecherry-dogwood community); graminoid and forb riparian communities (bluejoint reedgrass-cinquefoil-cattails); and mixed riparian communities (mixed grasses and shrubs). Extensive riparian habitats occur near the confluence of the Milk and Missouri rivers, and near the Yellowstone River in Montana. High-priority conservation riparian communities in South Dakota include areas with emergent, scrub-shrub, or forest vegetation in semi-permanent or permanent depressional wetlands and low gradient perennial streams and rivers (SDGFP 2006). The proposed Project crosses through the Keya Paha Watershed, Lower Niobrara River, and Lower Loup River Unique Landscapes in Nebraska with priority cottonwood-willow riparian woodlands. In Oklahoma, priority riparian communities include: oak and hickory bottomland hardwood forests, and small streams and associated riparian forests (ODWC 2005). In Texas, priority riparian communities include bottomland hardwoods

and riparian conservation areas (Bender et al. 2005). Specific communities of conservation concern in Texas include the Water Oak – Willow Oak Series community (Brewer 2009).

3.5.2.3 Forest Communities

Native wooded communities were once an integral component of the prairie landscape throughout the Great Plains where they provide foraging, breeding, and refuge habitats for many wildlife species. Prairie woodlands were generally limited in size and distribution by fire to river breaks and protected areas. Many of these communities have been lost due to land conversion to agricultural uses, levee construction, and urban development. At the southern end of the proposed Project in Oklahoma and Texas, native trees develop within the prairies creating savannas and continue increasing in density creating woodlands and forests within the Cross Timbers and South Central Plains or Piney Woods. In the Cross Timbers region, fire suppression has led to expansion of forests. Much of the South Central Plains is used for silviculture. Some forest communities in uplands or outside of riparian areas are priorities for conservation across the proposed Project. In Montana, green ash and cottonwood woodlands are declining in abundance (MFWP 2005). No forested habitats are considered high conservation priorities within the Great Plains Steppe region of South Dakota (SDGFP 2006). Within the biologically unique landscapes identified in Nebraska several forest communities are identified as conservation priorities including: Keya Paha Watershed (oak woodland); Middle Niobrara River (bur oak-basswood-ironwood forest, oak woodland, and ponderosa pine woodland); and Lower Loup River (oak woodland) (Schneider et al. 2005). Forest community conservation priorities within the Cross Timbers Region of Oklahoma include: oak and hickory bottomland hardwood forest, post oak/blackjack oak/hickory woodlands and forest, and post oak/blackjack oak shrubland. Forest community conservation priorities by ecoregion in Texas include: Post Oak Savanna (mesic hardwood woodlands and bottomland hardwoods); Piney Woods (longleaf pine forests and savanna and East Texas hardwood upland and slope forests) (Bender et al. 2005). Potential occurrences of remnant ancient Cross Timbers forest that would be crossed by the proposed Project in Oklahoma and Texas were evaluated using the predictive model developed by the Ancient Cross Timbers Consortium (Therrell and Stahl 1998).

3.5.2.4 Traditionally Used Native Plants

Native Americans have traditionally used many native plants for food, construction materials, forage for livestock, fuel, medicine, and spiritual purposes (Johnston 1987, Hart and Moore 1976, and Gilmore 1977). Although the dependence on plants for many aspects of survival in the natural environment have become less pronounced in recent times, plants continue to be of substantial importance to the culture of most Native Americans. The plants themselves are important and in some cases, indigenous peoples consider them sacred. Places where traditionally used plants grow and have been collected for millennia may be considered to have spiritual and cultural significance.

Plants of ethnobotanical importance known or likely to occur in the proposed Project area include plants from all native vegetation communities, although many grow in wetlands and riparian areas. Important wetland and riparian plants include: cottonwood (*Populus* spp.), hawthorn (*Crataegus* spp), sweet grass (*Hierochloe odorata*), cattail (*Typha* spp.), snowberry (*Symphoricarpos* spp.), silver buffaloberry (*Sheperdia argentea*), and saskatoon (*Amelanchier alnifolia*). Wetlands and riparian habitats are a small percentage of the land area in the Great Plains, however, they are disproportionately important as sources of traditionally used plants. Native grasslands also provided numerous traditionally used plants including: Indian bread-root (*Psoralea esculenta*), wild flax (*Linum lewisii*), prickly pear cactus (*Opuntia* spp.), fringed sage (*Artemisia frigida*), and white sage (*Artemisia ludoviciana*). Reductions in native grasslands have also reduced populations of plants valued by Native Americans. In addition to plants traditionally used by Native Americans, many people also use and collect for sale the purple (or prairie) coneflower (*Echinacea* spp.) as an herbal supplement.

3.5.3 Wetland and Conservation Easements

The Steele City Segment Gulf Coast Segment, and Houston Lateral would potentially cross multiple conservation easements including USFWS wetland easements, Montana Fish, Wildlife, and Parks Conservation Easements, and multiple conservation easements enrolled in the NRCS Conservation Reserve Program (CRP) and the Wetland Reserve Program (WRP). The WRP and CRP are described in Section 3.9.4.6.

3.5.4 Noxious Weeds

Noxious weeds and 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 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. Four federally listed exotic noxious weed species and one noxious weed genus have been reported to occur in Texas, a state that would be crossed by the construction ROWs (USDA NRCS 2009) (Table 3.5.4-1). The parasitic genus (dodder) occurs as both native and introduced species within all states crossed by the ROW (Table 3.5.4-1).

In addition to federal noxious weed lists, each state maintains a list of state and local noxious weeds. County weed control boards or districts are present in most counties along the proposed pipeline corridor. These county weed control boards monitor local weed infestations and provide guidance on weed control. Weed distributions (USDA NRCS 2009) in the counties along the proposed pipeline corridor suggest that 93 noxious weeds and invasive plants could potentially occur within the construction ROW including:

- 29 aquatic or wetland weeds;
- 51 upland weeds; and
- 13 weeds that may occur in either wetland or upland habitats.

Of these, 66 are federally or state designated noxious weeds, including:

- 15 aquatic or wetland weeds;
- 42 upland weeds; and
- 8 weeds that may occur in either wetland or upland habitats.

TABLE 3.5.4-1
Federal, State, or Local Noxious Weeds Potentially Occurring along the Proposed Project Route[a]

Species[b]	Status / Habitat	Occurrence and State Designations[c]						
		Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
		MT	SD	NE	KS	OK	TX	TX
Hardheads [Russian knapweed] (*Acroptilon [Centaurea] repens*)	Introduced / Upland	√ C1	√ NW		√ NW	√		
Alligatorweed (*Alternanthera philoxeroides*)	Introduced / Wetland					√ NAP	√ NW	√ NW
Wollyleaf bur ragweed [Wollyleaf burdock] (*Ambrosia grayi*)	Native / Upland				√ NW			
Lesser [Common] burdock (*Arctium minus*)	Introduced / Upland	√ LW	√ LW	√	√	√	√	√
Absinthium (*Artemisia absinthium*)	Introduced / Upland	√	LW					
Giant reed (*Arundo donax*)	Introduced / Upland				√	√	√ NW	√ NW
Flowering rush (*Butomus umbellatus*)	Introduced / Wetland	√ C3		√				
Hedge false bindweed (*Calystegia sepium*)	Native / Upland	√	√	√	√	√	√ NW	√ NW
Whitetop [Hoary cress] (*Cardaria draba*)	Introduced / Upland	√ C1	√ NW	√	√ NW	√		
Balloon vine (*Cardiospermum halicacabum*)	Introduced / Upland					√	√ NW	√ NW
Spiny plumeless thistle (*Carduus acanthoides*)	Introduced / Upland		LW	√ NW		√		
Nodding plumeless [Musk] thistle (*Carduus nutans*)	Introduced / Upland	√	LW	√ NW	√ NW	√ NW		
Diffuse [White] knapweed (*Centaurea diffusa*)	Introduced / Upland	√ C1	LW	√ NW	IW			
Yellow star-thistle (*Centaurea solstitialis*)	Introduced / Upland	C3	√	√		√		
Spotted knapweed (*Centaurea stoebe* [*maculosa*])	Introduced / Upland	√ C1	√ LW	√ NW	IW			

TABLE 3.5.4-1
Federal, State, or Local Noxious Weeds Potentially Occurring along the Proposed Project Route[a]

		Occurrence and State Designations[c]						
		Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
Species[b]	**Status / Habitat**	**MT**	**SD**	**NE**	**KS**	**OK**	**TX**	**TX**
Chicory (*Cichorium intybus*)	Introduced / Upland	√	√ LW	√	√	√	√	√
Canada thistle (*Cirsium arvense*)	Introduced / Wetland and Upland	√ C1	√ NW	√ NW	√ NW	NW		
Bull thistle (*Cirsium vulgare*)	Introduced / Upland	√	√ LW		√ LW			
Poison hemlock (*Conium maculatum*)	Introduced / Wetland and Upland	LW	√ LW	√	√			
Field bindweed (*Convolvulus arvensis*)	Introduced / Upland	√ C1	√ LW	√	√ NW	√	√ NW	√ NW
Common crupina (*Crupina vulgaris*)	Introduced / Upland	√ C3						
Japanese dodder (*Cuscuta japonica*)	Introduced / Upland						√ NW	√ NW
Dodder (*Cuscuta* spp.)	Introduced and Native / Upland	√	√	√	√	√	√	√
Gypsyflower [Houndstongue] (*Cynoglossum officinale*)	Introduced / Upland	√ C1	√ LW	√	√			
Woodrush flatsedge [Deep-rooted sedge] (*Cyperus entrerianus*)	Introduced / Wetland					√	√ NW	√ NW
Common viper's bugloss [Blueweed] (*Echium vulgare*)	Introduced / Upland	C2					√	√
Common water hyacinth (*Eichhornia crassipes*)	Introduced / Aquatic					WL	√ NW	√ NW
Quackgrass (*Elymus repens*)	Introduced / Upland	√	√	√	NW		√	√
Leafy spurge (*Euphorbia esula*)	Introduced / Upland	√ C1	√ NW	√ NW	√ NW			
Baby's breath (*Gypsophila paniculata*)	Introduced / Upland	LW	√		√			

TABLE 3.5.4-1
Federal, State, or Local Noxious Weeds Potentially Occurring along the Proposed Project Route[a]

Species[b]	Status / Habitat	Occurrence and State Designations[c]						
		Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
		MT	SD	NE	KS	OK	TX	TX
Orange hawkweed (*Hieracium aurantiacum*)	Introduced / Upland	√ C2	√					
Meadow hawkweed complex (*Hieracium caespitosum, H. x. floribundum, H. piloselloides*)	Introduced / Upland	√ C2						
Waterthyme (*Hydrilla verticillata*)	Introduced / Aquatic				IW	WL	√ NW	√ NW
Indian swampweed (*Hygrophilla polysperma*)	Introduced / Aquatic					NAP	√	√
Common St. Johnswort (*Hypericum perforatum*)	Introduced / Upland	√ C1	LW	√	√			
Paleyellow iris [Yellow flag iris] (*Iris pseudacorus*)	Introduced / Upland and wetland	√ C2				WL	√	
Dyer's woad (*Isatis tinctoria*)	Introduced / Upland	√ C3						
Dotted duckmeat [Giant duckweed] (*Landoltia punctata [Spirodela oligorrhiza]*)	Native / Aquatic					√ WL	√ NW	√ NW
Broadleaved [Perennial] pepperweed (*Lepidium latifolium*)	Introduced / Upland	√ C2			√			
Sericea [Chinese] lespedeza (*Lespedeza cuneata*)[d]	Introduced / Wetland				√ NW	√ IW		
Oxeye daisy (*Leucanthemum vulgare [Chrysanthemum leucanthemum]*)	Introduced / Upland	√ C1	√		√		√	√
Dalmatian toadflax (*Linaria dalmatica*)	Introduced / Upland	√ C1	√ LW		IW			
Butterandeggs [Yellow toadflax] (*Linaria vulgaris*)	Introduced / Upland	√ C1	√ LW	√	√ IW	√	√	√
Purple loosestrife (*Lythrum salicaria*)	Introduced / Wetland	√ C2	NW	√ NW	IW	√ NAP	NW	NW

TABLE 3.5.4-1
Federal, State, or Local Noxious Weeds Potentially Occurring along the Proposed Project Route[a]

		Occurrence and State Designations[c]						
		Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
Species[b]	**Status / Habitat**	**MT**	**SD**	**NE**	**KS**	**OK**	**TX**	**TX**
European wand loosestrife (*Lythrum virgatum*)	Introduced / Wetland	√ C2		NW				
Eurasian (Spike) watermilfoil (*Myriophyllum spicatum*)	Introduced / Aquatic	C3		√		WL	NW	NW
Scotch cottonthistle (*Onopordum acanthium*)	Introduced / Upland		LW			√ NW		
Hemp broomrape (*Orobanche ramosa*)	Introduced / Upland						√ NW	√ NW
Ducklettuce (*Ottelia alismoides*)	Introduced / Aquatic					NAP	√	√
Torpedograss [Couch panicum] (*Panicum repens*)	Introduced / Upland					WL	√ NW	√ NW
Common reed (*Phragmites australis*)	Native / Wetland	√	√ LW	√ NW			√	√
Waterlettuce (*Pistia stratiotes*)	Native / Aquatic				√	WL	NW	NW
Japanese knotweed complex [Crimson beauty] (*Polygonum cuspidatum, P. polystachyum, P. sachalinense*)	Introduced / Upland and wetlands	√ C3	√ LW	√	√	√		
Sulphur cinquefoil (*Potentilla recta*)	Introduced / Upland	√ C1		√		√		
Kudzu (*Pueraria montana* [*lobata*])	Introduced / Upland			√	√ NW	√ IW	√ NW	√ NW
Multiflora rose (*Rosa multiflora*)	Introduced / Upland				√ LW			
Itchgrass (*Rottboellia cochinchinensis*)	Introduced / Upland						√ NW	√ NW
Water spangles (*Salvinia minima*)	Introduced / Aquatic					√	√ NW	√ NW

TABLE 3.5.4-1
Federal, State, or Local Noxious Weeds Potentially Occurring along the Proposed Project Route[a]

		Occurrence and State Designations[c]						
		Steele City Segment			Cushing Pump Stations	Gulf Coast Segment		Houston Lateral
Species[b]	**Status / Habitat**	**MT**	**SD**	**NE**	**KS**	**OK**	**TX**	**TX**
Field [Perennial] sowthistle (*Sonchus arvensis*)	Introduced / Wetland and Upland	√ LW	√ NW		√		√ NW	√ NW
Johnsongrass (*Sorghum halepense*)[d]	Introduced / Wetland and Upland				√ NW	√ IW	√	√
Tamarisk [Saltcedar] (*Tamarix* spp.)	Introduced / Wetland and Upland	√ C2	√ NW	NW		√ IW	√ NW	√ NW
Common tansy (*Tanacetum vulgare*)	Introduced / Upland	√ C1	LW	√				
Chinese tallow [tree] (*Triadica sebifera*)	Introduced / Wetland and Upland						√ NW	√ NW
Puncturevine (*Tribulus terrestris*)	Introduced / Upland	√	√ LW	√	√	√	√	
Common mullein (*Verbascum thapsus*)	Introduced species / Upland	√	√ LW	√	√	√	√	√

Notes:

√ = Occurs within counties crossed by proposed Project or within state if county data not available (USDA NRCS 2009).
CP = Classified as a state regulated plant.
C1 = Classified as a category 1 noxious weed for the state of Montana.
C2 = Classified as a category 2 noxious weed for the state of Montana.
C3 = Classified as a category 3 noxious weed for the state of Montana.
IW = Classified as a state invasive plant.
LW = Classified as a local noxious weed.
NAP = Classified as a state noxious aquatic plant.
NW = Classified as a state noxious weed or state noxious plant.
WL = Classified as a "Watch List" invasive plant.

[a] This information was compiled from weed surveys completed by Keystone across the proposed Project ROW. It is not intended to represent a comprehensive list of weeds in all states.

[b] Species in bold are federal noxious weeds (USDA NRCS 2009). Common and species synonyms in square brackets [] are as listed on state noxious weed or plant lists.

[c] Sources: USDA NRCS 2009, MDA 2008, MDA 2009, SDA 2009, NDA 2009, KDA 2007, KDA 2009, ODA 2000, ODWC 2002, OBS undated, TDA 2008.

[d] Neither Sericea [Chinese] lespedeza (Lespedeza cuneata) or Johnsongrass (Sorghum halepense) are considered noxious weeds in Nebraska http://www.agr.state.ne.us/division/bpi/nwp/nwp1.htm.

Executive Order 13112 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. It 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 outweigh the potential harm and that all feasible and prudent measures to minimize risk have been taken.

3.5.5 Potential Impacts and Mitigation

Total miles crossed and acres of terrestrial vegetation affected during construction and operation of the proposed Project are presented in Tables 3.5.5-1 and 3.5.5-2.

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;
- 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 water infiltration and seed germination, or increasing siltation;
- Alteration in vegetation productivity and phenology due to increased soil temperatures associated with heat input from the pipeline; and
- Loss of vegetation due to exposure to toxic materials or crude oil releases (addressed in Section 3.13).

3.5.5.1 General Vegetation Resources

The primary impacts on vegetation from construction and operation of the proposed Project 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 annually tilled croplands also generally would be short-term and limited to the current growing season if topsoil is segregated and soils are not compacted during construction. Impacts on pastures, rotated croplands, and open grassland range generally would be short to long-term, with vegetation typically reestablishing within 1 to 5 years after construction. Perennial herbaceous cover may require as long as 5 to 8 years to establish cover similar to adjacent undisturbed lands in northern arid portions of the proposed Project especially when drought conditions or livestock grazing interfere with reestablishment. Impacts on these communities during operation of the pipeline would be minimal because these areas would recover following construction and typically would not require maintenance mowing.

TABLE 3.5.5-1 Summary of Estimated Impacts on Vegetation Communities by State for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Steele City Segment			
Montana			
Cropland	70.2	1,005	448
Grassland/rangeland	204.4	3,010	1,261
Upland forest	0.6	8	4
Riverine/open water	3.5	48	21
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	<0.0	1	0
Emergent wetlands	1.2	16	7
Developed land	2.8	41	19
Montana total	*282.7*	*4,128*	*1,760*
South Dakota			
Cropland	80.9	1,152	510
Grassland/rangeland	223.7	3,255	1,389
Upland forest	0.9	15	6
Riverine/open water	3.6	45	22
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	1.9	23	12
Developed land	3.0	48	20
South Dakota total	*314.0*	*4,538*	*1,959*
Nebraska			
Cropland	112.8	1,578	693
Grassland/rangeland	126.1	1,955	780
Upland forest	4.5	67	29
Riverine/open water	1.9	22	11
Forested wetlands	0.1	1	1
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	5.5	88	43
Developed land	3.9	60	26
Nebraska total	*254.8*	*3,771*	*1,583*
Cushing Extension Pump Stations			
Kansas			
Cropland	0.0	0	0
Grassland/rangeland	0.0	14	14
Upland forest	0.0	1	1

TABLE 3.5.5-1 Summary of Estimated Impacts on Vegetation Communities by State for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Riverine/open water	0.0	0	0
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	0.0	0	0
Developed land	0.0	0	0
Kansas total	*0.0*	*15*	*15*
Gulf Coast Segment and Houston Lateral			
Oklahoma			
Cropland	11.7	166	71
Grassland/rangeland	83.4	1,224	539
Upland forest	40.3	607	245
Riverine/open water	1.4	20	9
Forested wetlands	1.3	13	8
Shrub-scrub wetlands	0.1	1	1
Emergent wetlands	0.3	4	2
Developed land	17.3	220	113
Oklahoma total	*155.9*	*2,255*	*987*
Texas			
Cropland	53.6	755	323
Grassland/rangeland	116.8	1,664	719
Upland forest	129.2	1,840	782
Riverine/open water	3.6	42	22
Forested wetlands	26.0	281	155
Shrub-scrub wetlands	2.5	33	15
Emergent wetlands	7.1	94	46
Developed land	37.6	506	259
Texas total	*376.4*	*5,215*	*2,321*

[a] Includes acres disturbed on a temporary basis (permanent ROW width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Project. Acreage does not include disturbance associated with tank farm, access roads, pipe stockpile sites, rail sidings, contractor yards, and construction camps.

TABLE 3.5.5-2 Summary of Estimated Impacts on Vegetation Communities by Pipeline Segment for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Steele City Segment			
Cropland	263.9	3,735	1,651
Grassland/rangeland	554.2	8,220	3,430
Upland forest	6.0	90	39
Riverine/open water	9.0	115	54
Forested wetlands	0.1	1	1
Shrub-scrub wetlands	<0.1	1	0
Emergent wetlands	8.6	127	62
Developed land	9.7	149	65
Steele City Segment total	*851.5*	*12,438*	*5,302*
Cushing Extension Pump Stations			
Cropland	0.0	0	0
Grassland/rangeland	0.0	14	14
Upland forest	0.0	1	1
Riverine/open water	0.0	0	0
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	0.0	0	0
Developed land	0.0	0	0
Pump Station total	*0.0*	*15*	*15*
Gulf Coast Segment			
Cropland	62.1	879	374
Grassland/rangeland	181.1	2,621	1,142
Upland forest	151.8	2,211	922
Riverine/open water	4.8	59	29
Forested wetlands	24.7	262	147
Shrub-scrub wetlands	2.6	34	16
Emergent wetlands	3.4	50	23
Developed land	53.2	703	360
Gulf Coast Segment total	*483.7*	*6,819*	*3,013*
Houston Lateral			
Cropland	3.2	43	19
Grassland/rangeland	19.1	267	116
Upland forest	17.7	236	105
Riverine/open water	0.3	3	2

TABLE 3.5.5-2 Summary of Estimated Impacts on Vegetation Communities by Pipeline Segment for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Forested wetlands	2.6	32	16
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	4.0	48	24
Developed land	1.7	23	12
Houston Lateral total	*48.6*	*652*	*294*
Proposed Project			
Cropland	329.2	4,657	2,045
Grassland/rangeland	754.4	11,122	4,702
Upland forest	175.5	2,538	1,067
Riverine/open water	14.1	177	85
Forested wetlands	27.4	295	164
Shrub-scrub wetlands	2.6	35	16
Emergent wetlands	16.0	225	109
Developed land	64.6	875	437
Proposed Project Total	**1,383.8**	**19,924**	**8,625**

[a] Includes acres disturbed on a temporary basis (permanent ROW width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Project. Acreage does not include disturbance associated with tank farm, access roads, pipe stockpile sites, rail sidings, contractor yards, and construction camps.

Clearing trees within upland and riparian forest communities 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 50-foot-wide permanent easements centered on the pipeline. In this area, trees would be removed and would not be allowed to reestablish due to periodic mowing and brush clearing during pipeline operation. Routine maintenance vegetation clearing would occur no more frequently than every one to three years.

Impacts on shrubland also would be long-term because of the time required to reestablish the woody vegetation characteristic of this community type. Most shrubs would be expected to reestablish within the non-maintained portion of the ROW within 5 to 15 years. The permanent easement in shrubland would not be regularly mowed or cleared and would be allowed to revegetate.

Operation of the proposed Project would cause increases in soil temperatures at the soil surface (from 4 to 8 ˚F) primarily during winter, and at depths of 6 inches (from 10 to 15 ˚F), with the most notable increases during spring in the northern portion of the pipeline (see Appendix L). While many plants would not produce root systems that would penetrate much below 6 inches, the root systems of some plants, notably native prairie grasses, trees, and shrubs; often penetrate well below 6 inches. Soil temperatures closer to the buried pipeline may be as much as 40 ˚F warmer than the ambient surrounding soil temperatures (Appendix L). In general, increased soil temperatures during early spring would cause early germination and emergence and increased productivity in annual crops such as corn and soybeans

and in tall-grass prairie species (Appendix L). Increased soil temperatures may lead to localized soil drying and localized decreases in soil moisture available for evapotranspiration.

To reduce impacts on vegetation within the construction and permanent ROW and to improve the probability of successful revegetation of disturbed areas, the following measures as described in the proposed Project CMR Plan (Appendix B) would be implemented in accordance with applicable permits:

- Limit construction traffic to the construction ROW, existing roads, newly constructed roads, and approved private roads;
- Clearly stake construction ROW boundaries including pre-approved temporary workspaces to prevent disturbance to unauthorized areas;
- Mow or disc crops if present to ground level unless an agreement is made for the landowner to remove for personal use;
- Prohibit burning on cultivated lands, as well as on rangelands and pastures when recommended by regulatory agencies;
- In South Dakota, limit the width of the construction ROW at timber shelterbelts in agricultural areas to the minimum necessary to construct the pipeline;
- Strip topsoil in cultivated and agricultural lands to the actual depth of the topsoil to a maximum depth of 12 inches;
- Stockpile stripped topsoil in a windrow along the edge of the ROW, such that the potential for subsoil and topsoil mixing is minimized;
- Prohibit the use of topsoil as construction fill;
- Increase adhesion in topsoil piles by using water or an alternative adhesive agent if required to prevent wind erosion;
- Leave gaps in rows of topsoil and subsoil and prevent obstructions in furrows, furrow drains, and ditches to allow drainage and prevent ponding of water next to or on the ROW;
- Install flumes and ramps in furrows, furrow drains, ditches, and for any watercourse where flow is continuous during construction to facilitate water flow across the trench;
- Ramp bar ditches with grade or ditch spoil to prevent damage to the road shoulder and ditch;
- Restore original contours and drainage patterns to the extent practicable after construction;
- Survey agricultural areas with terraces such that pre-construction contours may be restored after construction;
- Use timber mats, timber riprap, or other methods to stabilize surface conditions when the construction surface is inadequate to support equipment and remove these mats or riprap when construction is complete;
- Provide and maintain temporary and permanent erosion control measures on steep slopes or wherever erosion potential is high;
- Install sediment barriers below disturbed areas where there is a hazard of offsite sedimentation such as at the base of slopes next to road crossings, at the edge of the construction ROW next to a roadway, stream, spring, wetland or impoundment, at trench or test water discharge locations, or where waterbodies or wetlands are next to the construction ROW, across the ROW at flowing

waterbody crossings, upslope of saturated wetlands or wetlands with standing water boundaries, along the edge of the ROW to contain spoil and sediment;

- Install slope breakers (water bars) on slopes greater than 5 percent on all disturbed lands to prevent erosion, or on slopes greater than 8 percent in some areas not prone to erosion on the Steele City Segment;
- Use appropriate erosion control measures (water bars, silt fencing, temporary mulch, etc.)-on disturbed construction work areas that have been inactive for one month or are expected to be inactive for a month or more;
- Ensure all temporary mulch materials are weed free; and
- Limit soil compaction by prohibiting access by certain vehicles, using only machinery with low ground pressure (tracks or extra-wide tires), limiting access and minimize frequency of all vehicle traffic, digging ditches to improve surface drainage, using timber riprap, matting or geotextile fabric overlain with soil, and stopping construction when necessary.

To restore disturbed areas to pre-construction use and vegetation cover, the following reclamation and revegetation measures as described in the proposed Project CMR Plan (Appendix B) would be implemented in accordance with applicable permits:

- Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas;
- Relieve soil compaction on all croplands by ripping a minimum of three passes at least 18 inches deep, and on all pastures by ripping or chiseling a minimum of three passes at least 12 inches deep;
- Relieve subsoil compaction on areas stripped for topsoil salvage by ripping a minimum of three passes at 18 inches or less followed by grading and smoothing if necessary (disc or harrow) to avoid topsoil mixing;
- Replace topsoil to pre-existing depths once ripping and discing of subsoil is complete up to a maximum of 12 inches, alleviate compaction on cultivated fields by cultivation;
- Consult with NRCS if there are any disputes between landowner and Keystone as to areas where compaction should be alleviated;
- Plow under 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 if mechanical relief of compaction is deemed unsatisfactory;
- Inspect the ROW in the first year following construction to identify areas of erosion or settling;
- If soil quality has been deteriorated the application of soil amendments such as fertilize and soil pH modifiers may be required in accordance with written recommendations from local soil conservation authorities and land management agencies and authorized by the landowners;
- Reseed the reclaimed construction ROW following cleanup and topsoil replacement as closely as possible using seed mixes based on input from the local NRCS and specific seeding requirements as requested by the landowner or the land management agency;
- Use certified seed mixes to limit the introduction of noxious weeds within 12 months of seed germination testing, and adjust seeding rates based on test results;
- Remove and dispose of excess mulch prior to seedbed preparation to prevent seed drills from becoming plugged and to ensure that seed incorporation can operate effectively;

- Re-apply and anchor temporary mulch, such as erosion control blankets, on the construction ROW following seeding;
- Seed at a rate appropriate for the region and for the stability of the reclaimed surface based on pure live seed;
- Use seeding methods appropriate for weather conditions, construction ROW constraints, site access, and soil types using drill seeding unless the ROW is 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;
- Operate and calibrate drill seeders so that the specified seeding rate is planted using seed depths consistent with local or regional agricultural practices and row spacing that does not exceed 8 inches;
- Use broadcast or hydro-seeding in lieu of drilling at 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;
- Delay broadcast seeding during high wind conditions and when the ground is frozen;
- Hand rake all areas that are too steep or otherwise cannot be safely harrowed or cultipacked to incorporate broadcast seed to the specified depth;
- Use hydro-seeding on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods; and
- Work with landowners to the extent practicable to discourage intense livestock grazing of the construction ROW during the first growing season by using temporary fencing, deferred grazing, or increased grazing rotation frequency.

3.5.5.2 Vegetation Communities of Conservation Concern

The proposed pipeline corridor would cross an estimated 339 miles that lie within 66 high-quality native grasslands, and would also cross an estimated 2 miles that lie within 16 prairie dog grasslands (Table 3.5.5-3). High quality grasslands are sites dominated by native grass (>75 percent) and corridor areas adjacent to large tracts of native grasslands with a relatively high diversity of native grasses (three or more) and native forbs (four or more that are relatively common), and very few exotic weeds. As delineated in Table 3.5.5-3, this category may also include some sagebrush grasslands. 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 proposed Project area. Although native grasslands would be restored, construction affects on previously untilled native prairies could be long-term, as destruction of the prairie sod during trenching may require more than a 100 years for recovery. Short-grass prairie and mixed-grass prairie areas may take 5 to 8 or more years to reestablish due to poor soil conditions and low moisture levels. Construction through the native grasslands in the Sand Hills region would expose the fragile soils to erosion by wind and water and re-establishment of vegetative cover in this region will be difficult requiring an estimated 4 or more years. Re-establishment of diverse native Sand Hills vegetation communities would likely require a longer term. Construction through prairie dog towns would destroy the burrow systems and surrounding soil characteristics at active and inactive burrow sites. If the burrow

sites are active, prairie dogs may reconstruct some of the burrows, if the site is inactive, the loss would be permanent. Soil compaction within extra work-spaces and changes in vegetation structure within the construction ROW would likely lead to reduced use or abandonment of previously used areas by ground squirrels or prairie dogs as habitat suitability would likely be reduced (Lauzon et al. 2002). Heat dissipated from the pipeline as discussed above would potentially lead to early germination and increased productivity of native prairie grasses but may lead to decreased soil water that could be detrimental to native prairie plants (Appendix L). Invasion of non-native plants also may prevent recovery of prairie grasslands, as would altered land management that may require suppression of wildfires that maintain prairie sod.

The proposed pipeline corridor would cross an estimated 34.4 miles that lie within 86 sagebrush grasslands (Table 3.5.5-3). Construction through shrublands would remove shrubs most of which would typically become reestablished within 5 to 15 years. The permanent easement in shrublands would not be regularly mowed or cleared and would be allowed to revegetate with sagebrush. Sagebrush would require 20 to 50 years to reestablish within the non-maintained ROW. The proposed pipeline corridor would cross an estimated 47 miles that lie within 223 riparian areas and bottomland forests (Table 3.5.5-3). Bottomland forests would require 20 to 50 years or more to reestablish late succession floodplain forests. The proposed pipeline corridor would cross an estimated 32 miles that lie within 614 upland forests potentially containing tree communities of conservation concern (Table 3.5.5-3). Based on modeled occurrence the proposed pipeline corridor would potentially cross predicted old-growth Cross Timbers forest remnants in 29 locations (41 acres) in Oklahoma and 4 locations (3 acres) in Texas (Table 3.5.5-3).

TABLE 3.5.5-3
Estimated Impacts on Vegetation Communities of Conservation Concern Occurring along the Proposed Project Route

Community Type	Length (miles)[a]	Number of Communities Crossed	Milepost[a]
Steele City Segment			
Montana			
Broadleaf mixed forests	4.3	36	84.3 – 261.1
High-quality native grasslands	164.4	35	0.0 – 280.9
Prairie dog towns	0.2	2	46.8 – 115.6
Riparian habitats	16.3	164	1.0 – 281.8
Sagebrush grasslands	21.9	51	40.4 – 280.0
South Dakota			
High-quality native grasslands	103.6	17	282.5 – 576.3
Prairie dog towns	2.1	13	285.9 – 584.3
Sagebrush grasslands	12.6	35	285.7 – 366.9
Nebraska			
Deciduous forests and woods	4.0	174	597.6 – 849.5
High-quality native grasslands	70.6	14	601.4 – 724.1
Prairie dog towns	0.1	1	600.3
Riparian woodlands	0.4	5	740.0 – 755.9

TABLE 3.5.5-3 Estimated Impacts on Vegetation Communities of Conservation Concern Occurring along the Proposed Project Route			
Community Type	**Length (miles)[a]**	**Number of Communities Crossed**	**Milepost[a]**
Gulf Coast Segment			
Oklahoma			
Bottomland forests	3.9	42	2.6 – 151.8
Oak forests and savannas	20.8	371	0.0 – 156.0
Predicted old-growth Cross Timbers forest	2.9	29	20.0 – 155.5
Texas			
Swamp chestnut oak-willow oak	4.0	3	453.5 – 458.5
Water oak-willow oak	12.2	7	257.5 – 371.3
Predicted old-growth Cross Timbers forest	0.2	4	163.5 – 164.7
Houston Lateral			
Texas			
Water oak-willow oak	10.3	2	18.0 – 29.0

[a] Approximate mileage and milepost ranges, categories may overlap. Summaries generated using a variety of data sources including GAP databases (USGS 2009), old-growth Cross Timbers model (Therrell and Stahle 1998), and Texas Natural Diversity Database (TPWD 2009).

Sources: Redmond et al. 1998, Smith et al. 2001, Henebry et al. 2005, Fisher and Gregory 2001, Brewer 2009, USGS 2009, TPWD 2009.

The following measures as identified in the proposed Project CMR Plan (Appendix B) would be implemented to minimize impacts to native grasslands:

- Seed disturbance areas in native range with a native seed mix after topsoil replacement; and
- Monitor the ROW to determine the success of revegetation after the first growing season, and for areas in which vegetation has not been successfully reestablished, reseed the area[2].

In addition, to minimize impacts to native grasslands in the Sand Hills region, the following measures as described in the CMR Plan (Appendix B) would be implemented:

- Educate construction personnel about the fragility of Sand Hills soils and the necessity to adhere to BMPs designed to minimize impacts;
- Incorporate minor route alterations to avoid particularly erosion-prone locations where practicable;
- Avoid highly saturated areas to the maximum extent possible;
- Strive to reduce width of disturbance to the native prairie landscape by adopting trench-line or blade-width stripping procedures where practicable;
- Conserve topsoil to a maximum of 12 inches in depth in all areas where excavation occurs;

[2] Any areas with unsuccessful revegetation would be monitored until adequate vegetation cover is achieved. In addition, the pipeline corridor would be monitored continually during operations to identify areas of erosion.

- Protect topsoil piles from erosion to the degree practicable; and
- Manage vehicle traffic in areas with high erosion potential or sensitive habitat.

Reclamation and revegetation measures applicable to the Sand Hills region were developed in consultation with regional experts in Sand Hills restoration and ecology (see Appendix H). These measures were then incorporated into the CMR Plan (Appendix B) for native grasslands in the Sand Hills region in accordance with applicable permits:

- Develop noxious-weed-free native seed mixes with input from the local NRCS offices and through collaboration with regional experts;
- Mulch and crimp into the soil noxious-weed-free straw or native prairie hay to prevent wind erosion;
- Imprint the land surface to create impressions in the soil to reduce erosion, improve moisture retention and create micro-sites for seed germination;
- Reduce soil disturbance by using sediment logs or straw wattles in place of slope breakers that are constructed of soil;
- Apply photodegradable matting anchored with biodegradable pins on steep slopes or areas prone to extreme wind exposure such as north- or west-facing slopes and ridge tops;
- Work with landowners to prevent overgrazing of the newly established vegetation;
- Monitor reclamation, repair erosion, and reseed poorly revegetated areas as necessary for several years; and
- Develop a noxious-weed management plan specific to the Sand Hills region pending consultation with state and county experts.

In response to concerns expressed relative to wind erosion and re-vegetation in the Sand Hills topographic region, DOS coordinated exchange between experts in Sand Hills reclamation and vegetation communities who provided input to the Keystone plans included in Appendix H of the EIS and for restoration of Sand Hills grassland habitats used by the endangered American burying beetle in Section 3.8. Based on input received through these contacts, the following additional considerations relative to Sand Hills erosion are provided (Wedin, Pers. Comm. 2011):

- Use of erosion control mats or blankets may be advisable anywhere in the Sand Hills that is not in a wet meadow environment;
- A fire management plan should be developed and implemented during proposed Project construction;
- Revegetation seed beds should not be over-prepared but rather left more heterogeneous and irregular; and
- Landowners should be reminded that revegetated areas would be attractive as cattle forage and fencing of the revegetated ROW may be advisable, since animal trackways can serve as incipient blowout areas, and due to potentially warmer soils in the immediate vicinity of the proposed pipeline early forage may be concentrated along the ROW over time.

Native forests, especially forested floodplains, 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 uses, levee construction, and urban development although in some areas trees have invaded native prairie habitats due to reduced incidence of fire.

DOS received comments expressing concern over the potential that the proposed Project corridor would cross areas containing old growth Cross Timber forest remnants. At the request of DOS, Keystone evaluated predicted occurrence of old-growth Cross Timber forest remnants. While the Cross Timber old growth forest remnant model suggests that the proposed Project ROW could cross old growth forest remnants, potential impacts to this resource would be reduced through the following measures:

- The proposed Project ROW would parallel other pipeline ROWs for 26 of the 33 predicted old-growth forest remnants;
- The proposed Project ROW would be located in pastures with few trees at 2 of the 33 predicted old-growth forest remnants; and
- HDD river crossings would avoid 3 of the 33 predicted old-growth forest remnants.

Two potential old growth forest remnants occur along the proposed Project ROW in areas not previously disturbed by older pipeline construction. The routing of the proposed Project ROW in these two areas was selected to avoid a cultural resource site and an existing primitive road.

These measures for forested uplands and wetlands as identified in the CMR Plan (Appendix B) would be implemented:

- Salvage timber or allow landowner to salvage timber as requested by landowners;
- Grub tree stumps to a maximum of 5 feet on either side of the trench line and where necessary for grading a level surface for construction equipment using bulldozers equipped with brush rakes to preserve organic matter;
- Dispose of trees, brush, and stumps as per landowners' requirements as stated in the easement agreement;
- Fell trees toward the center line of the ROW to avoid damage to nearby trees and branches and recover trees and slash falling outside of the ROW;
- Prune any broken or damaged branches and branches hanging over the ROW as necessary;
- Burn, chip, or remove tree wastes incorporating chips into soil such that revegetation is not prevented;
- 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; and
- Remove unwanted timber from the construction ROW and transport it to a designated all-weather access point or mill.

In addition to the measures to protect terrestrial vegetation, the following potential mitigation measures have been suggested by regulatory agencies:

- In Montana, re-inspect the ROW after 5 years to identify areas of erosion or settling and to evaluate the reestablishment of vegetation cover (MDEQ);

- In Montana, test topsoils and subsoils for compaction at regular intervals on rangelands and pastures where requested by landowners, land management agencies or permitting agencies (MDEQ);
- In Montana, relieve compaction on rangelands by ripping or chiseling a minimum of three passes at least 12 inches deep where requested by landowners, land management agencies or permitting agencies (MDEQ);
- In Montana, reseed disturbed areas with seed sources from local populations of Native American traditional use plants in areas used to harvest these resources (MDEQ); and
- In Texas, avoid impacts to water oak – willow oak forest communities; survey route to determine extent and quality of water oak – willow oak community (tree species, tree heights, tree diameter at breast height, and percent canopy); avoid by re-route or by boring underneath; where unavoidable provide mitigation for permanent impacts that do not fall under the jurisdiction of the USACE through habitat restoration, purchase of mitigation bank credits (TPWD).

3.5.5.3 Conservation Reserve Program

There would be temporary and permanent impacts similar to those described in Sections 3.5.5.1 and 3.5.5.2 on about 51 miles of CRP land and less than 2 miles of WRP lands along the proposed pipeline corridor. Successful restoration of native vegetation and CRP fields (defined as 90 percent cover of desirable perennial plants, stable soils, and comparable vegetation community composition) would be expected within 4 to 8 years (see Appendix K).

3.5.5.4 Noxious Weeds

After removal of vegetation cover and disturbance to the soil, reestablishment of vegetation communities could be delayed or prevented by infestations of noxious weeds and invasive plants. Vegetation removal and soil disturbance during construction could create optimal conditions for the establishment of many weeds. Construction equipment traveling from weed-infested areas into weed-free areas could disperse noxious weed seeds or propagules, resulting in the establishment of noxious weeds in previously weed-free areas. A total of 9.9 miles containing 99 individual noxious weed sources occur along the Steele City Segment of the proposed pipeline corridor. These noxious weed sources could lead to additional noxious weed distribution during construction (Table 3.5.5-4).

TABLE 3.5.5-4
Noxious Weed Sources Occurring along the Steele City Segment of the Proposed Project

State and Number of Counties	Weed Type	Length (mi)	Number of Weed Sources
Steele City Segment			
Montana (six counties)			
Three	Bindweeds	0.98	5
One	Common Burdock	0.01	1
Two	Field Sowthistle	0.04	2
One	Gypsyflower	0.88	3
One	Hawkweeds	<0.01	1
Two	Knapweeds	0.62	15
Two	Leafy Spurge	1.31	13

TABLE 3.5.5-4 Noxious Weed Sources Occurring along the Steele City Segment of the Proposed Project			
Two	Plumeless Thistles	0.13	3
One	Thistles – Canada and Bull (*Cirsium* spp.)	0.79	8
Montana total		***4.76***	**51**
South Dakota (ten counties)			
Two	Bindweeds	0.10	2
One	Common Burdock	0.03	1
Four	Thistles – Canada and Bull	1.25	11
South Dakota total		***1.38***	**14**
Nebraska (fourteen counties)			
One	Leafy Spurge	0.56	11
Three	Plumeless Thistles	3.09	21
One	Tamarisk – Saltcedar	0.05	1
One	Thistles – Canada and Bull	0.05	1
Nebraska total		***3.75***	**34**
Steele City Segment total		***9.89***	**99**

Specific noxious weed sources along the proposed pipeline corridor in Kansas, Oklahoma and Texas have not yet been identified through field surveys. A list of potential noxious weeds that occur in these states is shown in Table 3.5.4-1.

In a commitment to control the introduction and spread of noxious weeds, the construction and restoration procedures detailed in the CMR Plan (Appendix B) would be implemented. The plan would be coordinated with appropriate local, state, and federal agencies to prevent the spread of noxious weeds, and would include the following procedures:

- Clean all construction equipment, including timber mats, with high-pressure washing equipment prior to moving equipment to the job site;
- Mark all areas of the ROW which contain infestation of noxious weeds;
- 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 infested areas, or use cleaning stations to remove vegetative materials with high pressure washing equipment;
- Strip and store topsoil contaminated with weed populations separately from clean topsoil and subsoil;
- Use mulch and straw or hay bales that are free of noxious weeds for temporary erosion and sediment control;
- Use pre-construction treatment such as mowing prior to seed development or herbicide application (in consultation with county or state regulatory agencies, and landowners) for areas of noxious weed infestations prior to clearing grading, trenching or other soil disturbing work to weed infestation locations identified on construction drawings;
- Limit the potential for spread of weeds by providing weed control by a state-licensed pesticide applicator at valve sites, metering stations and pump stations;

- Reimburse adjacent landowners when they must control weeds that are determined to have spread from the proposed Project's aboveground facilities; and
- Implement weed control measures as required by any applicable plan and in conjunction with the landowner.

3.5.5.5 Potential Additional Mitigation Measures

- Use erosion control mats or blankets in the Sand Hills of Nebraska anywhere that is not in a wet meadow to reduce erosion potential (Professor Wedin, UNL). The construction reclamation plan in the Sand Hills would be determined by a committee of experts from the USFWS Nebraska Game and Parks Commission and erosion experts including Professor Wedin. The committee would decide when the use of erosion control mats or blankets would be appropriate;
- Revegetation seed beds should not be over-prepared but rather left more heterogeneous and irregular (Professor Wedin, UNL). The construction reclamation plan in the Sand Hills would be determined by a committee of experts from the USFWS Nebraska Game and Parks Commission and erosion experts including Professor Wedin. The committee would decide the level of preparation of seed beds;
- Landowners should be informed that revegetated areas would be attractive as cattle forage and fencing of the revegetated ROW may be advisable, since animal trackways can serve as incipient blowout areas, and due to potentially warmer soils in the immediate vicinity of the proposed pipeline early forage may be concentrated along the ROW over time (Professor Wedin, UNL). Keystone has agreed to inform landowners; and
- A fire management plan should be developed and implemented during proposed Project construction (Professor Wedin, UNL). Keystone has agreed to follow the BLM fire management protocol in the Sand Hills that was developed for the proposed Project for federal lands in Montana and South Dakota.

3.5.6 Connected Actions

3.5.6.1 Power Distribution Lines and Substations

The primary impacts on vegetation from construction of power distribution lines to pump stations would be cutting, clearing, or removing the existing woody vegetation within the construction work area and potential invasion by noxious weeds. In general, distribution line construction impacts to vegetation would be minor, as many distribution lines would run alongside existing roadways. Where necessary, trees generally would be removed from the distribution line ROW, and the ROW would be maintained free of vegetation that poses an outage risk to the lines or interferes with access for maintenance. Total miles and area by vegetation community affected by construction and operation of the 430 miles of new distribution lines for the proposed Project is presented in Table 3.5.6-1 and Table 3.5.6-2. After construction, power providers would reclaim affected lands in accordance with state and local standards and associated permits.

TABLE 3.5.6-1 Estimated Impacts on Vegetation Communities Crossed by Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Steele City Segment			
Montana			
Cropland	25.0	82	61
Grassland/rangeland	105.5	345	255
Upland forest	0.3	1	4
Riverine/open water	1.7	6	4
Forested wetlands	<0.1	1	1
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	0.6	2	1
Developed land	2.7	9	7
Montana subtotal	*135.8*	*446*	*333*
South Dakota			
Cropland	42.0	137	102
Grassland/rangeland	96.3	315	233
Upland forest	0.3	1	4
Riverine/open water	2.9	9	7
Forested wetlands	0.1	0	1
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	1.3	4	3
Developed land	16.5	54	40
South Dakota subtotal	*159.4*	*520*	*390*
Nebraska			
Cropland	32.5	106	79
Grassland/rangeland	27.7	91	67
Upland forest	1.7	6	21
Riverine/open water	1.1	4	3
Forested wetlands	0.5	2	6
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	0.3	1	1
Developed land	4.4	14	11
Nebraska subtotal	*68.2*	*224*	*188*
Cushing Extension Pump Stations			
Kansas			
Cropland	5.8	19	14
Grassland/rangeland	6.6	22	16

TABLE 3.5.6-1 Estimated Impacts on Vegetation Communities Crossed by Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Upland forest	0.5	2	7
Riverine/open water	0.2	1	0
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	0.0	0	0
Developed land	0.4	1	1
Kansas subtotal	*13.5*	*45*	*38*
Gulf Coast Segment and Houston Lateral			
Oklahoma			
Cropland	0.5	1	1
Grassland/rangeland	8.0	26	19
Upland forest	2.7	9	33
Riverine/open water	0.1	0	0
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	<0.1	0	0
Developed land	1.4	5	3
Oklahoma subtotal	*12.7*	*41*	*56*
Texas			
Cropland	8.1	27	20
Grassland/rangeland	3.4	11	8
Upland forest	4.6	15	55
Riverine/open water	0.2	1	0
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.2	1	0
Emergent wetlands	0.0	0	0
Developed land	1.4	5	3
Texas subtotal	*17.9*	*60*	*86*

[a] Temporary disturbance areas include structure pads, access roads, pulling and tension area, turn around areas, and staging areas. Permanent disturbance areas include forested areas within 80- or 150-foot-wide right-of-way, around pole structures, and crossed by operational access roads. Some power lines have not been surveyed and data presented is from aerial photointerpretation.

TABLE 3.5.6-2 Summary of Impacts on Vegetation Communities Crossed by Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Steele City Segment			
Cropland	99.5	325	241
Grassland/rangeland	229.5	750	556
Upland forest	2.3	8	28
Riverine/open water	5.7	19	14
Forested wetlands	0.6	3	8
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	2.2	7	5
Developed land	23.6	77	57
Steele City Segment subtotal	*363.4*	*1189*	*909*
Cushing Extension Pump Stations			
Cropland	5.8	19	14
Grassland/rangeland	6.6	22	16
Upland forest	0.5	2	7
Riverine/open water	0.2	1	0
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.0	0	0
Emergent wetlands	0.0	0	0
Developed land	0.4	1	1
Pump Station subtotal	*13.5*	*45*	*38*
Gulf Coast Segment			
Cropland	8.6	28	21
Grassland/rangeland	11.4	37	27
Upland forest	7.3	24	88
Riverine/open water	0.3	1	1
Forested wetlands	0.0	0	0
Shrub-scrub wetlands	0.2	1	0
Emergent wetlands	<0.1	0	0
Developed land	2.8	10	6
Gulf Coast Segment subtotal	*30.7*	*101*	*142*
Proposed Project			
Cropland	113.9	372	276
Grassland/rangeland	247.5	809	599
Upland forest	10.1	34	123
Riverine/open water	6.2	21	14

TABLE 3.5.6-2 Summary of Impacts on Vegetation Communities Crossed by Proposed Electric Distribution Lines for the Proposed Project			
Vegetation Community Classification	**Length of Community Crossed (miles)**	**Community Area Affected during Construction (acres)[a]**	**Community Area Affected by Operations (acres)[a]**
Forested wetlands	0.6	3	8
Shrub-scrub wetlands	0.2	1	0
Emergent wetlands	2.2	7	5
Developed land	26.8	88	64
Proposed Project Total	**407.5**	**1,335**	**1,089**

[a] Temporary disturbance areas include structure pads, access roads, pulling and tension area, turn around areas, and staging areas. Permanent disturbance areas include forested areas within 80- or 150-foot-wide right-of-way, around pole structures, and crossed by operational access roads. Some power lines have not been surveyed and data presented is from aerial photointerpretation.

3.5.6.2 Big Bend to Witten 230-kV Transmission Line

Upgrades to the power grid in South Dakota to support power requirements for pump stations in South Dakota would include construction of a new 230-kV transmission line and a new substation.

As described in Section 2.5.2 of the EIS, Western and BEPC have identified two Alternative Corridors (Alternative Corridors A and B) for the proposed Big Bend to Witten 230-kV transmission line project, and there are several route options within each corridor.

Lengths of vegetation communities crossed by the route options within the two alternative corridors are based on National Land Cover Data presented in Tables 3.5.6-3 and 3.5.6-4. For corridor A, these vegetation communities range from 67.2 to 72.0 miles of primarily agricultural and range lands and for corridor B, these range from 73.9 to 75.2 miles of primarily agricultural and range lands. Construction and operation impacts on vegetation cover would be the same as for the distribution lines discussed above, however, it is likely that the poles would be larger and that the area disturbed around the installation site would likely be larger.

TABLE 3.5.6-3 Summary of Impacts on Vegetation Communities Crossed by Proposed Big Bend to Witten 230-kV Transmission Line Corridor A Route Options for the Project					
Vegetation Community Classification	**Western (miles)**	**BEPC-A (miles)**	**BEPC-B (miles)**	**BEPC-C (miles)**	**BEPC-D (miles)**
Cropland	33.1	25.7	26.7	28.2	26.3
Grassland/rangeland	30.3	41.3	40.9	38.0	40.1
Upland forest	0.1	0.1	0.1	0.1	0.1
Riverine/open water	0.3	0.3	0.3	0.3	0.2
Forested wetlands	0.5	0.4	0.2	0.3	0.2
Shrub-scrub wetlands	0.0	0.0	0.0	0.0	0.0
Emergent wetlands	0.3	0.1	0.1	0.2	0.1
Developed land	2.6	1.8	1.8	4.6	5.0
Total	*67.2*	*69.7*	*70.1*	*71.7*	*72.0*

Source: *Homer et al. 2004.*

TABLE 3.5.6-4 Summary of Impacts on Vegetation Communities Crossed by Proposed Big Bend to Witten 230-kV Transmission Line Corridor B Route Options for the Project				
Vegetation Community Classification	**BEPC-E (miles)**	**BEPC-F (miles)**	**BEPC-G (miles)**	**BEPC-H (miles)**
Cropland	22.9	23.0	28.6	24.7
Grassland/rangeland	45.7	47.0	40.4	42.5
Upland forest	0.2	0.1	0.1	0.2
Riverine/open water	0.4	0.2	0.2	0.2
Forested wetlands	0.2	0.1	0.5	0.4
Shrub-scrub wetlands	0.0	0.0	0.0	0.0
Emergent wetlands	0.1	0.2	0.3	0.1
Developed land	4.4	4.0	4.4	7.1
Total	*73.9*	*74.6*	*74.5*	*75.2*

Source: Homer et al. 2004.

3.5.6.3 Bakken Marketlink and Cushing Marketlink Projects

Construction and operation of the Bakken Marketlink Project would include metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. Keystone reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there were no waterbodies or wetlands on the property. DOS reviewed aerial photographs of the area and confirmed the current use of the land and that there are no waterbodies associated with the site. A site inspection by the DOS third-party contractor confirmed these findings. As a result, the potential impacts associated with expansion of the pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

The Cushing Marketlink project would be located within the boundaries of the proposed Cushing tank farm of the Keystone XL Project would include metering systems and two storage tanks. As a result, the impacts of construction and operation of the Cushing Marketlink Project on terrestrial vegetation would be the same as potential impacts associated with construction and operation of the proposed Cushing tank farm described in this section.

Currently there is insufficient information to complete an environmental review of these projects. The permit applications for these projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental review of the Marketlink projects. Potential impacts to terrestrial vegetation would be evaluated during the environmental reviews for these projects and potential vegetation impacts would be evaluated and minimized or mitigated to the extent practicable in accordance with direction from federal and state land management agencies.

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3.6 WILDLIFE

The proposed Project crosses six states with a diversity of wildlife, including big game animals, small game animals and furbearers, waterfowl and game birds, and many other nongame animals[1]. Wildlife habitats along the proposed Project ROW include croplands, grasslands/rangelands (short-grass prairie, mixed-grass prairie, tall-grass prairie, and shrublands), upland forests and wetlands. These vegetation communities provide foraging, cover, and breeding habitats for wildlife. This section addresses common big game animals, small game animals and furbearers, waterfowl and game birds, and other nongame animals in the proposed Project area. Threatened and endangered species as well as species that are candidates for listing as threatened and endangered and species that have been identified as conservation concerns are discussed in Section 3.8. These species include black-tailed prairie dogs (*Cynomys ludovicianus*), swift fox (*Vulpes velox*), bald eagle (*Haliaeetus leucocephalus*), greater prairie-chicken (*Tympanuchus cupido*), and greater sage-grouse (*Centrocercus urophasianus*). Aquatic species are discussed in Section 3.7.

3.6.1 Wildlife Resources

Wildlife and the habitats they use that are common in the vicinity of the proposed Project are described in Table 3.6.1-1. Some animals such as white-tailed deer and eastern cottontail are present across the entire proposed Project area whereas other animals, such as nutria (coypu) and armadillo, are present only within the southern portion of the proposed Project area. Many common waterbirds and landbirds nest in the northern or central portions of the proposed Project area and winter in the southern portion of the proposed Project area. Many common animals are valued game resources and most hunting for big and small game animals, furbearers, upland game birds, and waterfowl occurs during the fall. Turkeys are hunted both spring and fall, with most harvest occurring during the spring hunts.

3.6.1.1 Big Game Animals

White-tailed deer, mule deer, and pronghorn are the principal big game animals that occur along the proposed Project route. White-tailed deer and mule deer are highly adaptable and inhabit a variety of habitats, including cropland, grasslands, shrublands, and woodlands. White-tailed deer may also be found in close association with humans. In the northern portions of their range, deer may aggregate or "yard" during winter in stream bottoms, on south-facing slopes, or other areas where snow accumulations are reduced. Pronghorns are generally more abundant west of the proposed Project area. Translocation has been used to reestablish elk in Montana and South Dakota and elk have been reestablished in some areas crossed by the proposed Project in Nebraska. American bison (*Bos bison*) are a species of conservation concern in Montana, and once occurred throughout the Great Plains in multitudes. Free-ranging bison no longer occur within the area crossed by the proposed Project.

3.6.1.2 Small Game Animals and Furbearers

The small game animals and furbearers most often hunted or trapped in the proposed Project area include cottontails, coyotes, opossums, raccoons, red fox, and tree squirrels. Tree squirrels depend on forested habitats, usually deciduous or mixed hardwood forests with abundant supplies of acorns and hickory nuts. Cottontails, coyotes, opossums, and raccoons use a wide variety of habitats, including croplands, forests, shelterbelts, living snowfences and rangelands. Many furbearers, such as American beavers, American mink, raccoon, and weasels, are associated with riparian and wetland areas.

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[1] Common names of animals are used in this section. Scientific names following nomenclature in the NatureServe Explorer database (NatureServe 2009) for most animals discussed in this section are listed in Table 3.6.1-1. Where animals discussed in this section are not included in Table 3.6.1-1, common names are followed by the scientific name.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Big Game Animals							
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. Not common, generally present west of the proposed Project area, present in the Niobrara River area in Nebraska.
Mule deer *(Odocoileus hemionus)*	√	√	√	√	√	√	Found in coniferous forests, desert shrub, chaparral, grasslands with shrubs, and badlands. Often associated with successional vegetation, especially near agricultural lands. Generally more common west of the proposed Project area.
Pronghorn [antelope] *(Antilocapra americana)*	√	√	√				Found in grasslands, sagebrush plains, deserts, and foothills. Need for free water varies with succulence of vegetation in the diet. More common west of the proposed Project area.
White-tailed deer *(Odocoileus virginianus)*	√	√	√	√	√	√	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.
Small and Medium Game Animals							
Eastern cottontail [rabbit] *(Sylvilagus floridanus)*	√	√	√	√	√	√	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.
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 savanna or open woodlands to dense forests. Western range extensions are associated with riparian corridors of cottonwoods (*Populus* spp.) and fencerows of osage-orange (*Maclura pomifera*). Dens are in tree hollows or leaf nests.
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.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
North American porcupine *(Erethizon dorsatum)*	√	√					Prefers coniferous and mixed forests, also uses riparian zones, grasslands, shrublands, and deserts in some parts of range. Winter dens in rock outcrops, hollow trees, hollow logs or outbuildings, may shelter in dense conifers in winter. Range is generally west of proposed Project area in Nebraska, Kansas, Oklahoma and Texas.
Furbearers							
American badger *(Taxidea taxus)*	√	√	√	√	√	√	Prefers open grasslands and fields, and may also frequent shrublands with little groundcover. When inactive, occupies underground burrows.
American beaver *(Castor canadensis)*	√	√	√	√	√	√	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.
Bobcat *(Lynx rufus)*	√	√	√	√	√	√	Found in various habitats, including mixed woodlands and forest edge, hardwood forests, swamps, forested river bottomlands, shrublands, and other areas with thick undergrowth. Dens in hollow logs, under fallen trees, in rock shelter; rests in similar habitats changing locations daily.
Coyote *(Canis latrans)*	√	√	√	√	√	√	Wide ranging and found in virtually all habitats from open prairies in west to heavily forested regions in northeast. Den in burrow or at base of tree under branches, in hollow log or rock crevice, reuses den site. Often considered a pest, especially by the livestock industry. Control programs have been largely ineffective.
Red fox *(Vulpes vulpes)*	√	√	√	√	√	√	Found in 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)*			√	√	√	√	Found in woodland and shrubland in rough, broken country, usually avoids open areas. Dens in cleft, small cave, hollow in tree or log or debris pile, or less frequently in abandoned burrows.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
White-tailed jackrabbit *(Lepus townsendii)*	√	√	√				Found in sage-grasslands, open areas, woodlots and riparian areas. Nests in depression in ground or burrows abandoned by other animals. During day usually in shallow depressions at base of bush or in or near cavity in snow.
American mink *(Neovison vision)*	√	√	√	√	√	√	Prefers forested, permanent or semipermanent wetlands with abundant cover, marshes, and riparian zones. Dens in muskrat burrow, abandoned beaver den, hollow log, hole under tree roots or in stream bank burrows.
Common muskrat *(Ondatra zibethicus)*	√	√	√	√	√	√	Prefers fresh or brackish marshes, lakes, ponds, swamps, and other bodies of slow-moving water, most abundant in areas with cattail. Dens in bank burrow or in vegetation mound in shallow water, sometimes in uplands.
Nutria [Coypu] *(Myocastor coypus)*			√		√	√	Introduced from South America for weed control, prefers freshwater marshes, brackish marshes. Nests in burrows, abandoned muskrat houses or in dense vegetation. May displace native muskrat populations.
Virginia opossum *(Didelphis virginiana)*		√	√	√	√	√	Found in a variety of habitats, prefers wooded riparian habitats, also found in suburban areas. Very adaptable; may be found in most habitats. Generally uses abandoned burrows, buildings, hollow logs, and tree cavities for den sites.
Raccoon *(Procyon lotor)*	√	√	√	√	√	√	Found in variety of habitats usually with moisture, often along streams and shorelines; prefers riparian and edges of wetlands, ponds, streams, and lakes. Dens under logs or rocks, in tree hole, ground burrow, or in bank den.
Striped skunk *(Mephitis mephitis)*	√	√	√	√	√	√	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.
Least weasel *(Mustela nivalis)*	√	√	√	√			Uses variety of habitats as available including open forests, farmlands, grassy fields and meadows, riparian woodlands, hedgerows, prairies and sometimes residential areas. Young born in abandoned burrows, rests in nests in abandoned vole burrows, or holes in walls, or under out buildings.
Long-tailed weasel *(Mustela frenata)*	√	√	√	√	√	√	Found in a variety of habitats, usually near water. Preferred habitats are shrubland and open woodlands, field edges, riparian grasslands, swamps and marshes. Dens in abandoned burrows, rock crevice, brush pile, stump hollow or among tree roots.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Waterfowl							
Dark Geese							
Canada goose *(Branta canadensis)* White-fronted goose *(Anser albifrons)*	√	√	√	√	√	√	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 may be year-round residents in proposed Project area, seasonal migrants or overwintering populations. White-fronted geese are seasonal migrants or overwintering populations. Widely hunted, with estimated Central Flyway mid-winter population of 1.67 million during 2008.
Light Geese							
Snow goose *(Chen caerulescens)* Ross's goose *(Chen rossii)*	√	√	√	√	√		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. Migrate and winter in the proposed Project area. Widely hunted, with estimated Central Flyway mid-winter population of 816,000 during 2008.
Swans							
Tundra swan *(Cygnus columbianus)*	√	√	√	√	√	√	Generally found in lakes, sloughs, rivers, and sometimes fields during migration. Open marshy lakes and ponds, and sluggish streams in summer. Generally west of proposed Project area during spring and fall migration; hunted in Montana and South Dakota.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Dabbling Ducks							
Mallard *(Anas platyrhynchos)* Gadwall *(Anas strepera)* Green-winged teal *(Anas crecca)* Blue-winged teal *(Anas discors)* American wigeon *(Anas americana)* Northern shoveler *(Anas clypeata)* Northern pintail *(Anas acuta)* Cinnamon teal *(Anas cyanoptera)*	√	√	√	√	√	√	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. Widely hunted, with estimated Central Flyway mid-winter population of 5.66 million during 2008.
Diving Ducks							
Redhead *(Aythya americana)* Ring-necked duck *(Aythya collaris)* Lesser scaup *(Aythya affinis)* Greater scaup *(Aythya marila)* Canvasback *(Aythya valisineria)*	√	√	√	√	√	√	Commonly found on marshes, ponds, lakes, rivers, and bays. Widely hunted, with estimated Central Flyway mid-winter population of 600,000 during 2008.
Waterbirds							
American coot *(Fulica americanan)*	√	√	√	√	√	√	Commonly found on marshes, ponds, lakes, rivers, and bays. Widely hunted, with estimated Central Flyway mid-winter population of 730,000 during 2008.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Sandhill crane *(Grus canadensis)*	√	√	√	√	√	√	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 proposed Project area during spring and fall migrations. Winters along Texas coastline in proposed Project area. Hunted in all states except Nebraska. Estimated mid-continent spring abundance of 470,000 during 2008.
Game Birds							
Northern bobwhite *(Colinus virginianus)*		√	√	√	√	√	Inhabits a wide variety of vegetation types, particularly early-succession stages. Occurs in croplands, grasslands, pastures, fallow fields, grass-shrub rangelands, open pinelands, open mixed pine-hardwood forests, and habitat mosaics. Nests on the ground, in a scrape lined with grasses or dead vegetation.
Mourning dove *(Zenaida macroura)*	√	√	√	√	√	√	Found in open woodlands, forest edge, cultivated lands with scattered trees and bushes, parks and suburban areas, and arid and desert country. Usually nests in tree or shrub, may also use stumps, rocks, buildings, or ground. Breeding resident at in Montana and South Dakota, year-round resident within remainder of proposed Project area. Widely hunted—7.0 million harvested in states crossed by the proposed Project during 2007, primarily in Texas.
Sharp-tailed grouse *(Tympanuchus phasianellus)*	√	√	√				Requires a mosaic of dense grass and shrubs with rich forb and insect foods during nesting, relies on riparian areas during winter, also uses cultivated grains and hedgerows.
Gray partridge [hun] *(Perdix perdix)*	√	√	√				Non-native game bird; found in cultivated lands with marginal cover of bushes, undergrowth or hedgerows. Nests in grasslands, hayfields, or grain fields in scratched-out hollow lined with grasses and leaves.
Ring-necked pheasant *(Phasianus colchicus)*	√	√	√	√			Non-native game bird; found in 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.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Wilson's snipe *(Gallinago delicata)*	√	√	√	√	√	√	Nests in wet grassy or marshy areas, non-breeding in wet meadows, flooded fields, bogs, swamps, marshy banks of rivers and lakes. Breeds Montana, South Dakota; migrant and nonbreeding resident Nebraska, Kansas, Oklahoma, and Texas. Widely hunted with Central Flyway harvest estimate of 12,000 in 2008.
Wild turkey *(Meleagris gallopavo)*	√	√	√	√	√	√	Found in forests and open woodland, scrub oak, deciduous or mixed deciduous-coniferous forests, also agricultural areas. Roosts in trees at night and nests on ground, usually in open areas at the edge of woods. Not native to Montana. Widely hunted.
American Woodcock *(Scolopax minor)*			√	√	√	√	Found associated with young, second-growth hardwoods and early succession habitats resulting from forest disturbance, prefers young forests and abandoned farmland mixed with forests, prefers edge habitats. Woodcock are harvested in Nebraska, Kansas, Oklahoma and Texas—6,700 during 2008.
Representative Non-Game Animals							
Mammals							
Little brown myotis [bat] *(Myotis lucifugus)*	√	√	√	√	√		Found using human-made structures for resting and maternity roosts, also uses caves and hollow trees. Forages in woodlands near water, requires caves, tunnels, abandoned mines in winter.
Nine-banded armadillo *(Dasypus novemcinctus)*			√	√	√	√	Prefers brushy areas with loose soil, also common in pinelands and hardwood uplands. Individuals make several burrows, often at side of creek.
Cinereus [Masked] shrew *(Sorex cinereus)*	√	√	√				Found in most terrestrial habitats, except areas with little or no vegetation, thick leaf litter in damp forests may be favored habitat. Nests in shallow burrows or in logs and stumps.
White-footed mouse *(Peromyscus leucopus)*	√	√	√	√	√	√	Prefers woodland edges, brushy fields, riparian zones. Nests underground, under debris, in buildings, in logs or stumps, tree cavities, old squirrel or bird nests.
Birds							
American Crow *(Corvus brachyrhynchos)*	√	√	√	√	√	√	Found in open and partly open country, agricultural lands, suburban areas. Nests in open forests and woodlands
Great blue heron *(Ardea herodias)*	√	√	√	√	√	√	Found in freshwater and brackish marshes, along lakes, rivers, fields, meadows. Nests in high trees in swamps and forested areas, often with other herons close to foraging habitat.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Prairie falcon *(Falco mexicanus)*	√	√					Found primarily in open habitats, mountainous areas, steppe, plains or prairies. Nests in hole or sheltered ledge on rocky cliff or steep earth embankments. During winter use large areas with low vegetation structure for foraging. Resident or migratory within proposed Project area.
Red-tailed hawk *(Buteo jamaicensis)*	√	√	√	√	√	√	Found in wide variety of open woodland and open country with scattered trees, nests in forests, elevated perches are important habitat component. Often reuses nest trees.
Red-shouldered hawk *(Buteo lineatus)*				√	√	√	Found in bottomland hardwoods to upland deciduous or mixed forests. Nests usually forested area near water. Year-round resident eastern Kansas, Oklahoma and Texas.
Roseate spoonbill *(Platalea ajaja)*						√	Brackish waters and coastal bays in Texas, shallow,open, still or slow-flowing water. Nests in mangroves (*Avicennia germinans*), low bushes along coastal islands.
Turkey vulture *(Cathartes aura)*	√	√	√	√	√	√	Found in forested and open areas, may roost in large flocks. Nests on cliffs, hollow logs, trees, tree-cavities, or on ground in dense shrubs. Feeds primarily on carrion.
Eastern screech-owl *(Megascops asio)*	√	√	√	√	√	√	Open woodland, deciduous forest, woodland/forest edge, swamps, parklands, residential areas, scrub and riparian woodland in drier regions. Nests in natural tree cavity, old woodpecker hole, nest boxes.
Great horned owl *(Bubo virginianus)*	√	√	√	√	√	√	Found in various forested habitats, moist or arid, deciduous or evergreen lowland forests to open woodlands, swamps, riverine forests. Nests in trees, tree cavities, stumps, rocky ledges, barns. Year-round resident throughout proposed Project area.
Long-eared owl *(Asio otus)*	√	√	√	√	√	√	Found in forests, riparian woodlands, woodlots next to open areas for hunting. Nests in trees, usually in old nest of other large birds or squirrels, sometimes in tree cavities. Year-round resident in Montana and South Dakota, non-breeding resident in Nebraska, Kansas, Oklahoma and Texas.
Western meadowlark *(Sturnella neglecta)*	√	√	√	√	√	√	Grasslands, open fields, pastures, cultivated lands, sometimes marshes. Nests on ground in vegetation. Primarily feed on insects, grains seeds. Migratory in northern portions of range, breeding resident in Montana and South Dakota, year-round resident in Nebraska and Kansas, overwinters in Oklahoma and Texas in the proposed Project area.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Amphibians							
Bufonid toads (*Bufo* spp.)	√	√	√	√	√	√	Found in variety of lowland habitats, deserts, prairie grasslands, pastures, woodlands. Reproduction dependent on rain pools, flooded areas, ponds in shallow water. Adults feed primarily on invertebrates. Hibernates during winter months and during summer dry spells, burrows underground when inactive.
Ranid Frogs (*Rana* spp.)	√	√	√	√	√	√	Found in variety of aquatic and wetland habitats. Adults feed primarily on invertebrates. Hibernates during winter months, burrows in benthic sediments, generally underwater.
Reptiles							
Gartersnakes (*Thamnophis* spp.)	√	√	√	√	√	√	Found in a wide range of aquatic, wetland, and upland habitats, preference appears regional. When inactive occurs underground or in other secluded site, hibernates in northern portions of range, remains active year-sound in southern locations.
Rattlesnakes (*Crotalus* spp.)	√	√	√	√	√	√	Found in a wide variety of habitats; forests, prairies, riparian habitats often associated with rocky outcroppings. Feeds on small mammals, lizards, birds, bird eggs. Seasonally migrate between hibernacula typically located in rocky areas with underground crevices, and summer habitat, communal hibernation.
Six-lined racerunner [lizard] (*Aspidoscelis sexlineata*)		√	√	√	√	√	Found in sunny areas with open ground; grassland, sandhills, sandy or gravelly banks and floodplains of streams, sparsely vegetated rocky areas, woodland edges and open woods. Shelters underground or under rocks on ground. Eggs laid in nest in soft soil or under logs. Insectivore, hibernates.
Western box turtle (*Terrapene ornata*)		√	√	√	√	√	Found in prairie grasslands, pastures, fields, sandhills, open woodland, sometime in slow, shallow streams and creek pools. Burrows into soil or enters burrows made by other animals. Eggs laid in nests in soft well-drained soil in open area. Insectivore, hibernates.

TABLE 3.6.1-1
Terrestrial Wildlife Resources That May Occur along the Proposed Project Route[a]

Sporting Status and Species	Occurrence by State						Habitat Association
	MT	SD	NE	KS	OK	TX	
Insects							
Cicada [locust] (Family *Cicadidae*)	√	√	√	√	√	√	Large flying insect, juveniles feed on plant roots. Varying life cycles with periods of 2 to 8 and up to 17 year periods for emergence from nymphs from the ground.
Monarch [butterfly] *(Danaus plexippus)*	√	√	√	√	√	√	Breeds and larvae feed on milkweed (*Asclepias* spp.) in North America, migrate to overwintering areas in Mexico and coastal California. Adults feed on nectar.

Notes:

√ = Indicates that the species occurs in the state. Square brackets present alternative common names.

[a] Protected animals including federal and state listed endangered, threatened or candidate species and species identified as conservation concerns or priority are discussed in Section 3.8. Aquatic animals are discussed in Section 3.7.

Sources: NatureServe 2009, Kruse 2008, Raftovich et al. 2009.

3.6.1.3 Waterfowl and Game Birds

The proposed Project is within the Central Flyway; all ducks, geese, swans, waterbirds, shorebirds and sandhill cranes present within the proposed Project area are considered migratory. Most of the region's waterfowl and waterbirds either nest within the proposed Project area or to the north, migrate through the proposed Project area during spring and fall, and winter in areas near the southern end of the proposed Project in Oklahoma and Texas. All migratory birds (identified in 50 CFR § 10.13) 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 (*Sturnus vulgaris*), rock pigeon (*Columba livia*), and house sparrow (*Passer domesticus*) are not protected by the MBTA; although harvest of upland game birds is regulated under state wildlife laws and regulations. Hunting seasons for migratory birds are set and regulated by USFWS and state wildlife management agencies. 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 proposed Project area to and from northern breeding grounds during spring and fall. Sandhill cranes are hunted in Montana, South Dakota, Kansas, Oklahoma, and Texas. Nebraska is closed to hunting for sandhill cranes (Sharp et al. 2006).

Wild turkeys, grouse, and northern bobwhite are resident game birds and as such are not protected by the MBTA. Some native game birds are considered conservation concerns and are discussed in Section 3.8. Seasons and bag limits for native and introduced game birds, such as ring-necked pheasants and gray partridge, are set by state wildlife management agencies. 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. Most other resident game birds are hunted during fall. Mourning doves, Wilson's snipe, and American woodcock are migratory game birds that are protected by the MBTA. Hunting seasons and limits are set and regulated by USFWS and state wildlife management agencies.

3.6.1.4 Non-game Animals

The proposed Project crosses many different habitats that are home to a wide variety of animals. A small sample of wide-ranging representative common non-game animals is described in Table 3.6.1-1. Small mammals such as northern pocket gophers (*Thomomys talpoides*), woodchucks (*Marmota monax*), mice (Muridae), shrews (generally *Sorex* spp.), ground squirrels (*Spermophilus* spp.), and voles (*Microtus* spp.) provide important prey for badgers, coyotes, foxes, weasels, raptors and snakes. Common amphibians and reptiles include many types of frogs, toads, turtles, lizards, and snakes. Many different types of invertebrates occur across the proposed Project area including bees, beetles, butterflies, cicadas, earthworms, grasshoppers, hornets, moths, and spiders which provide food for birds, amphibians, reptiles, and small mammals.

The proposed Project is primarily within the Prairie Avifaunal Biome (Rich et al. 2004). Breeding landbirds in grassland habitats in the Prairie Avifaunal Biome are primarily short-distance migrants, with several species wintering in the southern portions of the proposed Project area, and others overwintering in the southeast and southwest (Rich et al. 2004). Many migratory birds use habitats crossed by the proposed Project for nesting, migration, and overwintering, with the largest number of species nesting in the northern portion of the proposed Project in Montana, South Dakota and Nebraska and the largest

number of wintering species in the southern portion of the proposed Project in Texas. Bald and golden eagles (*Aquila chrysaetos*) and their nests are further protected by the Bald and Golden Eagle Protection Act (16 USC 688–688d [a and b]). Bald and golden eagles are discussed in Section 3.8, as are other migratory birds that have been identified as conservation concerns. Destruction or disturbance of a migratory bird nest that results in the loss of eggs or young is a violation of the MBTA.

The proposed Project would cross through the North Valley Grasslands Important Bird Area (IBA); which is considered a globally important site because it supports 15 species of grassland birds, 5 of which are considered globally threatened (Montana Audubon 2008). The site contains one of the largest blocks of intact grasslands in Montana including rare mixed-grass prairie with porcupinegrass (*Hesperostipa spartea*) – and thickspike wheatgrass (*Elymus lanceolatus*). This site supports 73 species of birds including 7 endemic breeding birds: ferruginous hawk (*Buteo regalis*), long-billed curlew (*Numenius americanus*), Sprague's pipit (*Anthus spragueii*), lark bunting (*Calamospiza melanocorys*), Baird's sparrow (*Ammodramus bairdii*), McCown's longspur (*Rhynchophanes mccownii*), and chestnut-collared longspur (*Calcarius ornatus*). Long-billed curlews, Sprague's pipits, and chestnut-collared longspurs occur in numbers that exceed the threshold for global significance and McCown's longspurs and Baird's sparrow numbers exceed the threshold for continental significance (Montana Audubon 2008). Horned larks (*Eremophila alpestris*) and western meadowlarks are especially abundant (Montana Audubon 2008).

Aerial stick nest surveys were conducted along the entire proposed Project ROW during spring 2008, 2009, and 2010 to identify large stick nest sites of raptors and herons in deciduous trees within from 0.25 to 1 mile from the proposed Project centerline. A total of 320 nests, 12 great blue heron rookeries, and 1 roseate spoonbill rookery were documented; 209 nests and 3 great blue heron rookeries along the Steele City Segment, and 111 nests and 10 rookeries along the Gulf Coast Segment and Houston Lateral. Of the active nests where the birds could be identified for species, there were 105 red-tailed hawk nests, 2 red-shouldered hawk nests, 50 great horned owl nests, 18 ferruginous hawk nests, 12 great blue heron rookeries, 3 long-eared owl nests, 1 roseate spoonbill rookery, and 3 raptor nests occupied by Canada geese. An additional unoccupied rookery on the Gulf Coast Segment was determined to be a great blue heron rookery. Locations of all nests including both occupied and unoccupied nests that could potentially be removed prior to construction (and the nesting season) to avoid direct impacts to nesting birds were documented. Raptor nest substrates used along the Steele City Segment included trees, rock outcrops, and clay banks. All raptor nests along the Gulf Coast and Houston Lateral segments were in trees.

3.6.2 Potential Impacts

The proposed Project would affect wildlife resources through:

- Habitat loss, alteration, and fragmentation;
- Direct mortality during construction and operation;
- Indirect mortality because of stress or avoidance of feeding due to exposure to construction and operations noise, low-level helicopter or airplane monitoring overflights, and from increased human activity;
- Reduced breeding success from exposure to construction and operations noise, and from increased human activity; and
- Reduced survival or reproduction due to decreased abundance of forage species or reduced cover.

The proposed Project would cross habitats used by wildlife described in Table 3.6.1-1. Construction of the proposed Project would result in loss and alteration of about 19,272 acres, including 10,855 acres of grasslands and rangelands, 2,565 acres of forested habitat, and 476 acres of wetland habitats (including

263 acres of forested wetlands) (Table 3.5.5-2). The proposed Project would parallel other pipelines or utility ROWs along about 34 percent of its 1,384-mile route, primarily in Oklahoma and Texas. The Steele City Segment would cross primarily rangeland and croplands. The Gulf Coast Segment would cross primarily rangeland and forestland and would parallel other ROWs along much of the route. The Houston Lateral would cross primarily forestlands and rangelands. Some, but not all, important wildlife habitats identified along the proposed Project route are listed in Table 3.6.2-1. In addition, about 400 temporary access roads (about 252 miles) and about 50 permanent access roads (about 34 miles) would be used; most (over 90 percent) would be modifications of existing roads. Four construction camps (80 acres each) would be established within remote areas crossed by the proposed Project in Montana and South Dakota. Areas altered by construction of temporary access roads and construction camps would be restored and revegetated. Communication towers, generally 33 feet in height, would be erected at each of the 30 pump stations.

Fragmentation is the splitting of a large continuous expanse of habitat into numerous smaller patches of habitat with a smaller total habitat area, and isolation within a matrix of habitats that are unlike the original (Wilcove et al. 1986). Habitat fragmentation has two components; (1) reduction in total habitat area and (2) reorganization of areas into isolated patches (Fahrig 2003). Habitat loss generally has large negative effects on biodiversity, while fragmentation generally has a much weaker effect that may be either positive or negative (Fahrig 2003). The effects of habitat fragmentation are dependent on many variables including original habitat structure, landscape context, predator communities, and susceptibility to nest parasitism (Tewksbury et al. 1998). Habitat fragmentation effects may be most pronounced in forested and shrubland habitats and would generally be reduced for pipeline corridors compared to road corridors because their widths are usually narrower, some vegetation cover is reestablished, and there is usually less associated human disturbance during operation (Hinkle et al. 2002). During construction, however, pipelines can be significant barriers to wildlife movements (Hinkle et al. 2002). After construction, pipeline corridors may be used as travel corridors by coyotes, deer, raccoons, and many other animals. Wildlife habitat fragmentation issues relevant for pipeline construction and operation include:

- Reduction in patch size of remaining available habitats;
- Creation of edge effects;
- Barriers to movement;
- Intrusion of invasive plants, animals, and nest parasites;
- Facilitation of predator movements;
- Habitat disturbance; and
- Intrusion of humans (Hinkle et al. 2002).

Pipeline construction removes vegetation including native grasses, sagebrush, and trees, creating an unvegetated strip over the pipeline trench and the adjacent construction areas. Subsequent revegetation may not provide habitat features comparable to pre-project habitats, and restoration of wetlands in arid regions is not always successful (FERC 2004). Typically, seed mixes used for post construction reclamation include many non-native plants that quickly establish vegetative cover to prevent soil erosion, but these plants often outcompete and do not allow subsequent reestablishment of native flora and vegetation structure. Sagebrush is particularly difficult to establish on disturbed sites; especially when these sites are seeded with non-native grasses and other plants that germinate and establish more rapidly. Removal of vegetation increases the potential for the establishment and spread of noxious weeds and other invasive plants that have little use or value for wildlife and that displace native plants resulting in degraded wildlife habitat values. Freshly seeded grasses can attract domestic livestock and wildlife and

are often preferentially grazed. Grazing of the ROW prior to the development of a self-sustaining vegetative cover can inhibit revegetation and extend the time to reestablish habitat linkages across the ROW. The pipeline ROW would be maintained free of trees and shrubs, with the exception of sagebrush unless over 4 or 5 feet high, resulting in long-term alteration of wildlife habitat structure and value.

During construction, pipelines can present a significant temporary physical barrier to wildlife movement. The open trench and welded pipeline sections stored along the construction ROW prior to burial can block movements of both large and small animals across the construction ROW. Small animals may also become trapped in open trench sections. Operation of heavy equipment can also create behavioral barriers to wildlife movements by displacing animals by disturbance.

After construction, the pipeline ROW, unblocked temporary access roads, and permanent access roads may alter human activity especially within remote sections of the proposed Project which could lead to increased wildlife disturbance and potentially to increased direct wildlife mortality from vehicle-animal collisions, and legal and illegal killing of wildlife; and indirect mortality and reduced reproduction due to displacement, increased stress, and increased predation (Madson 2006, MBOGC 1989, WYGF 2004). All-terrain vehicle users could travel on portions of the ROW, either legally or illegally. The construction of new roads, upgrades to existing roads, and the subsequent use of those roads generally would result in negative impacts to a wide range of wildlife including: elk and deer (Canfield et al. 1999); carnivores (Claar et al. 1999), small mammals (Hickman et al. 1999), birds (Hamann et al. 1999); and amphibians and reptiles (Maxell and Hokit, 1999).

Impacts associated with the release of petroleum products, hazardous materials, or crude oil during construction and operation of the proposed Project are addressed in Section 3.13.

TABLE 3.6.2-1
Important Wildlife Habitats within or near the Proposed Project ROW

Milepost	Name	Ownership and Description	Miles
Steele City Segment			
Montana			
4.3 to 5.1	USFWS Wetland Easement	Private	0.8
25.5 to 69.7	North Valley Grasslands Important Bird Area (IBA)	Private 45%, Bureau of Land Management 43%, State 11%, Tribal 1%	44.2
49.4 to 70.9	Cornwell Ranch Conservation Easement (proposed – overlaps IBA)	Montana Fish, Wildlife and Parks	21.5
82.9	Milk River Valley	Montana Department of Natural Resources	~0.2
89.2	Missouri River Valley	Montana Department of Natural Resources	~1.0
196.4	Yellowstone River Valley	Montana Department of Natural Resources & Private	~0.5
Various	Conservation Reserve Program	Private	9.2
South Dakota			
426	Cheyenne River Valley		~0.7
537.1	White River Valley		~0.2
Various	State Wildlife Areas	South Dakota Game, Fish and Parks	20.7
Various	Conservation Reserve Program	Private	7.6

TABLE 3.6.2-1 Important Wildlife Habitats within or near the Proposed Project ROW			
Milepost	**Name**	**Ownership and Description**	**Miles**
Nebraska			
599.9	Keya Paha River Valley		~0.4
615.5	Niobrara River Valley		~0.5
617.1 – 663.9	Sand Hills	Various	46.8
697.3	Cedar River Valley		~0.1
740.7	Loup River Valley		~0.4
756.3	Platte River Valley		~0.5
758.0 – 847.4	Rainwater Basin	Various	50
Various	Conservation Reserve Program	Private	5.2
Gulf Coast Segment			
Oklahoma			
22.1 – 23.3	Deep Fork Wildlife Management Area	Oklahoma Department of Wildlife Conservation	0.9
38.6	North Canadian River Valley		~0.2
74.2	South Canadian River Valley		~1.0
155.7	Red River Valley		~0.2
Texas			
155.7	Red River Valley		~0.3
~162	Wetland Reserve Program	Private	0.7
190.2	North Sulphur River Valley		~0.5
367.3	Neches River Valley		~2.0
417.8 – 418.3	Big Thicket National Preserve (Menard Creek Unit)	Private, Crosses Menard Creek next to road and utility ROW	~0.5
Houston Lateral			
Texas			
18.9 – 22.4	Trinity River National Wildlife Refuge (Champion Lake Unit)	U.S. Fish and Wildlife Service	~3.5
43.3	San Jacinto River Valley		~1.0

Note: No important wildlife habitats were reported for the pump station locations in Kansas.

Some rangeland habitats crossed by the Steele City Segment have not been extensively fragmented by road and transmission line networks, and exist as expanses of open mosaics of grasslands, shrublands and croplands interrupted by forested draws. Fragmentation may be of more consequence in shrublands than grasslands, as species dependent on sagebrush cover would become more exposed when crossing the pipeline corridor. Fragmentation of native grasslands would generally be considered short-term, until sufficient herbaceous cover has reestablished to allow small mammals, amphibians and reptiles to cross without exposure. Many forestlands crossed by the Gulf Coast Segment have been previously fragmented by road and transmission line networks and some areas are actively managed for timber production.

Fragmentation related issues applicable to wildlife habitat types crossed by the proposed Project are summarized in Table 3.6.2-2.

TABLE 3.6.2-2
Habitat Types and Related Fragmentation-Issues

Habitat Type	Breaking Large Habitat Into Smaller Areas	Hindered Movements	Nest Parasitism	Facilitated Predator Movements	Habitat Disturbance - Construction Maintenance	Human Intrusion
Upland Forests	√	√	√	√	√	√
Wetland Forests	√	√	√	√	√	√
Scrub-Shrub Wetlands	√	√	√	√		√
Wetlands/Swamps	√	√				√
Aquatic/Riverine	√	√	√		√	√
Grassland/Prairie	√	√	√		√	√
Sagebrush Steppe	√	√	√	√		√
Wildlife Type Affected	Birds, small mammals	Mammals, amphibians, reptiles	Birds	Birds, small mammals	Birds, mammals, amphibians, reptiles, invertebrates	Birds, mammals, amphibians, reptiles

Sources: Hinkle et al. 2002, Inglefinger, 2001, Miller et al. 1998, Vander Haegen, 2007.

Review of state land cover mapping produced for Gap analyses (USGS 2009) indicates that the pipeline could potentially contribute to increased fragmentation of several apparently contiguous areas (≥ 0.2 miles) of native grassland, shrubland or forestland that would be crossed by the pipeline ROW within the wildlife habitats identified in Table 3.6.2-1. A summary of locations within wildlife habitats that may be susceptible to fragmentation based on this Gap data (USGS 2009) is presented in Table 3.6.2-3.

TABLE 3.6.2-3
Wildlife Habitats and Potential Fragmentation Locations along the Proposed Project Route

Milepost	Name	Habitat Type[a]	Total Miles	Number of Locations	Proposed Impact Reduction Procedures[b]
Steele City Segment					
Montana					
4.3 to 5.1	USFWS Wetland Easement	Grasslands – moderate to high cover	0.2	1	Parallel, CMR Plan
25.5 to 69.7	North Valley Grasslands Important Bird Area (IBA)	Grasslands – low to high cover	15.2	18	Parallel, CMR Plan
		Riparian – graminoid/shrub mixed	0.6	1	CMR Plan
		Sagebrush	0.4	1	See greater sage-grouse (Section 3.8.1.2)
		Shrubs mesic/xeric mixed	0.3	1	CMR Plan
49.4 to 70.9	Cornwell Ranch Conservation Easement (proposed – overlaps IBA)	Grasslands – very low to high cover	10.8	14	CMR Plan
		Sagebrush	0.2	1	See greater sage-grouse (Section 3.8.1.2)
		Salt Desert Shrub/Salt Flats	2.5	5	CMR Plan
82.9	Milk River Valley	Riparian – graminoid	0.2	1	HDD, CMR Plan
89.2	Missouri River Valley	Riparian – shrub	0.2	1	CMR Plan
196.4	Yellowstone River Valley	Grasslands – low to moderate cover	1.5	1	CMR Plan
Nebraska					
615.5	Niobrara River Valley	Little Bluestem/Gramma Prairie	0.2	1	HDD, CMR Plan
617.1 – 663.9	Sand Hills	Little Bluestem/Gramma Prairie	0.4	2	Sand Hills Unit Plan
		Lowland Tallgrass Prairie	10.8	29	Sand Hills Unit Plan
		Sandhills Upland Prairie	5.0	12	Sand Hills Unit Plan
758.0 – 847.4	Rainwater Basin	Little Bluestem/Gramma Prairie	2.9	10	CMR Plan
Gulf Coast Segment					
Oklahoma					
22.1 – 23.3	Deep Fork Wildlife Management Area	Central Bottomland Forest	0.8	1	HDD, Parallel, CMR Plan
		Tallgrass Oak Savanna	0.2	1	Parallel, CMR Plan
38.6	North Canadian River Valley	Oak-Cedar Forest	0.5	1	HDD, Parallel, CMR Plan
74.2	South Canadian River Valley	Oak-Cedar Forest	0.7	2	HDD, CMR Plan

TABLE 3.6.2-3
Wildlife Habitats and Potential Fragmentation Locations along the Proposed Project Route

Milepost	Name	Habitat Type[a]	Total Miles	Number of Locations	Proposed Impact Reduction Procedures[b]
Texas					
155.7	Red River Valley	Mixed Forest	2.6	1	HDD, Parallel, CMR Plan
~162	Wetland Reserve Program	Mixed Forest	2.4	1	HDD, CMR Plan
190.2	North Sulphur River Valley	Cold Deciduous Forest	1.1	1	Parallel, CMR Plan
367.3	Neches River Valley	Mixed Forest	1.7	1	Parallel, CMR Plan
		Needleleaf Forest	1.1	1	Parallel, CMR Plan
417.8 – 418.3	Big Thicket National Preserve (Menard Creek Unit)	Needleleaf Forest	2.5	1	Avoided, Parallel, CMR Plan
Houston Lateral					
Texas					
18.9 – 22.4	Trinity River National Wildlife Refuge (Champion Lake Unit)	Needleleaf Forest	2.8	1	Parallel, CMR Plan

[a] Habitat types as listed in state Gap data (USGS 2009).
[b] HDD = horizontal directional drilling; Parallel = route parallels (runs next to) an existing ROW; CMR Plan (Appendix B); Sand Hills Unit Plan (Appendix H).

Fragmentation may result in altered wildlife communities as animals adapted to exploiting edge habitats increase, and animals requiring large contiguous habitats are displaced. The severity of fragmentation-induced effects on wildlife communities depends on factors such as sensitivity of the animal, seasonal habitat use, type and timing of construction activities, and physical habitat parameters such as topography, cover, forage, and climate. Generalist animals have been found to be more abundant near trails, while specialist animals are generally less common within grassland and forest ecosystems (Miller et al. 1998).

Loss of shrublands and wooded habitats would be long-term (from 5 to 20 years or more) within reclaimed areas of the construction ROW. Due to the linear nature of the ROW, these long-term habitat losses represent a small total area of locally available habitat and therefore are expected to have few long-term impacts on wildlife populations (see Tables 3.6.2-1, 3.6.2-2).

Total habitat loss due to pipeline construction would likely be small in the context of available habitat both because of the linear nature of the proposed Project and because restoration would follow pipeline construction. During restoration, area would be reseeded as directed by the landowner, such that areas of native vegetation could be converted to non-native species. Such conversion could reduce the value of the habitat for wildlife. If disturbance involved important remnant habitat types, habitat loss could be locally significant. Normal operation of the pipeline would result in negligible effects on wildlife. Direct impacts from maintenance activities, such as physical pipeline inspections or pipeline repair that would require digging up the pipeline, would be the same as those for construction. Appropriate federal and state wildlife management agencies would be consulted with prior to initiation of maintenance activities beyond standard inspection procedures.

3.6.2.1 Big Game Animals

Proposed Project construction would affect large game animals, primarily white-tailed and mule deer, by loss of potential foraging and cover habitats; and would result in increased habitat fragmentation, especially in areas with continuous forest cover within the Gulf Coast Segment. Noise and increased human activity during construction would lead to short-term displacement and may act as a temporary barrier to movements for some animals. Construction during spring fawning would potentially lead to loss of reproduction. Construction during winter within critical winter habitat, or blocking access to critical winter range during fall movements could reduce overwinter survival and reproduction of big game animals such as white-tailed deer, mule deer, and pronghorn. Mule deer are more vulnerable to habitat changes and disturbance than white-tailed deer. After construction, the maintained ROW may be used as movement corridors by some big game animals, predators, and humans. Increased predator movement could adversely affect big game survival and productivity. Human access may be facilitated by vegetation clearing and the perception that the ROW is no longer private property. Increased human use could lead to increased disturbances and hunting pressure (Hinkle et al. 2002).

3.6.2.2 Small Game Animals and Furbearers

Potential impacts on small game animals and furbearers include nest or burrow destruction, or abandonment and loss of young, foraging habitat, and cover habitat. Displacement or attraction of small game animals and furbearers from disturbance areas would be short-term, as animals would be expected to return following completion of construction and reclamation activities. Small mammals can fall into and become trapped in the open trench during pipeline construction and die as a result. Burrowing animals would be expected to return and re-colonize the ROW after construction, although compacted areas such as temporary workspaces may become less suitable habitat (Lauzon et al. 2002). Disturbed areas through native prairie habitats also were found to be used less often by ground squirrels following construction of a gas pipeline, suggesting that these habitats may not be equivalent at least for several

years after construction (Lauzon et al. 2002). Some badger, ground squirrel, and rodent burrows would likely be destroyed during construction if they occur within the construction ROW. Badgers, ground squirrels, and burrowing rodents may be attracted by the warmth generated by the pipeline, especially during fall, winter, or spring months. The heat generated by the pipeline would warm the soils within the proximity of the pipeline out to as much as 11 feet from the pipeline center (see Appendix L). Differences from surrounding soil temperature at the surface would be largest during spring. The pipeline would increase soil temperatures at the burial depth near the pipeline by as much as 40 °F and at a depth of 6 inches by as much as 10 to 15 °F, with soil temperatures at the surface increased by 4 to 8 °F during the spring (see Appendix L).

For animals that use tree and shrub habitats for cover, forage, and nesting, losses of these habitat types would be long-term because the permanent ROW would be maintained free of trees and large shrubs. An estimated 2,538 acres of forested habitats (see Table 3.5.5-2) would be affected by construction of the proposed Project, of which an estimated 1,067 acres would be maintained as herbaceous vegetation. Those areas crossed as part of the construction ROW would be cleared of trees and brush to provide access for construction equipment. Trees and shrubs would not be allowed to reestablish on the permanent ROW. Differences in vegetation cover between the ROW and the surrounding landscape can act as a barrier for some animals, such as snakes, lizards, mice and tree squirrels, while acting as a movement corridor for others, such as coyotes and raccoons.

3.6.2.3 Waterfowl and Game Birds

Most waterfowl and game birds nest on the ground, although a few notable species such as wood ducks (*Aix sponsa*), mergansers (*Mergus* spp.), and mourning doves nest in trees. Habitat loss, alteration, 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, losses of these habitats would be long-term because trees and shrubs would require from 5 to 20 years or more to reestablish and the permanent ROW would be maintained free of trees and large shrubs. Migratory waterfowl may be attracted to the pipeline corridor during early spring if it becomes snow free earlier than surrounding habitats. This would be most likely to occur in Montana, South Dakota, and Nebraska. Communication towers at pump stations (~33 feet tall) could be a collision hazard to waterfowl and game birds especially if supported by guy wires or if located near foraging and nesting habitats. Towers may provide vantage perches and artificial nesting habitat depending on their configurations for raptors and common ravens (*Corvus corax*) or crows which may prey on ground nesting upland game birds.

Sharp-tailed grouse inhabit native prairies and nest in grasslands. These species have disappeared from large portions of their historical ranges, due primarily to habitat loss or degradation resulting from agricultural practices, livestock overgrazing, and habitat succession. Breeding habitats are vulnerable to disturbance as these birds gather to breed where males display in leks, and nesting may be concentrated within several miles of active leks. Sharp-tailed grouse are also vulnerable to displacement by the creation of roads and power lines and reductions in habitat suitability due to fragmentation.

3.6.2.4 Non-game Animals

Removal of trees from the construction ROW and extra workspaces in woodlots, riparian areas, and shelterbelts could lead to the destruction of bat roosting habitats, raptor and owl nests, migrant bird nests, and great blue heron habitat. About 323 large stick nests, 12 great blue heron rookeries and 1 roseate spoonbill rookery were found inside the survey area, which covered the area within about 0.25 to 1 mile of the proposed Project centerline. Migratory birds and their active nests are protected under the MBTA. Direct impacts to nesting migratory birds can be avoided by limiting construction to non-nesting periods

during late summer through winter. If any of these nests or rookeries are actually located within the construction ROW, and if any nests were occupied when trees were cut, the nests, eggs, or young would be lost. Because most raptors reuse nest structures, loss of nest structures would require pairs to find new nest trees. If suitable new nest trees are not available within their established territory, new territories would need to be established within unoccupied territories. These processes would lead to increased energy demands during nesting and could lead to reduced or lost reproduction in subsequent years. Losses of tree and shrub habitats used by migratory birds for cover, forage, and nesting would be long-term because it would require from 5 to 20 years or more to reestablish trees and shrubs, and the permanent ROW would be maintained free of trees and large shrubs.

Habitat fragmentation caused by changes in vegetation cover within the pipeline ROW through large blocks of forest, shrub steppe, and grassland habitats would generally have the greatest effect on raptors and migrant songbirds (Hinkle et al. 2002, Vander Haegen 2007, Miller et al. 1998). The severity of fragmentation-induced effects on migratory birds depends on factors such as sensitivity of the animal, seasonal habitat use, type and timing of construction activities, and physical habitat parameters such as topography, cover, forage, and climate. Forest-nesting songbird abundance, diversity, and reproduction rates all become depressed as a result of fragmentation associated with linear developments (Jalkotzy et al. 1997). Habitat fragmentation leads to the creation of more edge habitats that in turn increase the susceptibility of nesting birds and other animals to predation, because many predators concentrate their search efforts within habitat edges (MDNRC 1979). Predators such as coyotes, badgers, foxes, crows, jays, ravens and others may use the cleared ROW for foraging leading to reduced reproduction and survival for many small mammals and birds in proximity to the ROW. Nest parasitism by brown-headed cowbirds resulting in fewer young birds fledging successfully has been documented to increase when shrub-steppe habitat is fragmented (Vander Haegen 2007).

Habitats crossed by access roads and above-ground facilities could contribute to both temporary and long-term fragmentation. Bird community composition and productivity can change next to recreational trails in grassland and forest ecosystems. Birds are less likely to nest near trails in grasslands, and nest predation is greater near trails in both grassland and forests (Miller et al. 1998). Densities of sagebrush-obligate songbirds have been shown to decline within 100 meters of natural gas pipeline access roads, even under light traffic volumes (less than 12 vehicles per day), while horned lark (*Eremophila alpestris*) abundance has been shown to increase within 100 meters of roads (Inglefinger 2001).

Small mammals, reptiles, amphibians, and non-flying insects would be blocked from moving across the open pipeline trench during construction. If timing of the open trench coincides with migration of snakes to hibernacula, large numbers of snakes could become trapped within the open trench. Trapped animals, especially small animals that would not normally be noticed by construction crews would likely perish if they became trapped. Erosion control blankets, especially those supported by fine non-biodegradable monofilament meshes, can entangle and entrap snakes, small mammals and birds. Changes in vegetation cover and structure over the maintained ROW could inhibit movements of amphibians, reptiles, small mammals and some birds. Reduction in riparian shrubs and trees could reduce riparian habitat function as a movement corridor for small mammals, furbearers, amphibians and reptiles. Communication towers at pump stations could be a collision hazard to migrant birds and may provide vantage perches and artificial nesting habitat for raptors, ravens or crows which may prey on grassland and shrubland nesting birds and small mammals.

Ripping for construction through rock outcrops which may provide hibernacula for snakes or nesting, perching or foraging habitats for birds could destroy all or portions of these habitats. Areas potentially requiring ripping that coincide with observed raptor nests on rock outcrops or clay ridges occur at:

- MP 255.4 to 255.6 – 1 active ferruginous hawk nest, Fallon County, Montana;
- MP 264.7 to 264.8 – 1 inactive ferruginous hawk nest, Fallon County, Montana;
- MP 270.5 to 270.6 – 1 inactive ferruginous hawk nest, Fallon County, Montana; and
- MP 311.4 to 312.0 – 1 inactive ferruginous hawk nest, Harding County, South Dakota.

If ripping occurs when hibernating animals are present, these animals would likely perish. If ripping occurs during nesting, raptors nesting nearby may be disturbed.

3.6.3 Impact Reduction Procedures

To reduce potential construction- and operations-related effects, procedures outlined in the proposed Project CMR plan (Appendix B) would be implemented. Measures to minimize adverse effects to wildlife habitats including shelterbelts, windbreaks, and living snow fences are identified in the CMR plan (Appendix B). Pipeline construction would be conducted in accordance with required permits.

The following measures to minimize impacts to wildlife, as identified in the proposed Project CMR plan, would be implemented:

- Remove shavings produced during pipe bevel operation immediately to ensure that livestock and wildlife do not ingest this material;
- Collect and remove litter and garbage that could attract wildlife from the construction site at the end of the day's activities;
- Prohibit feeding or harassment of livestock or wildlife;
- Prohibit construction personnel from having firearms or pets on the construction ROW;
- Ensure all food and wastes are stored and secured in vehicles or appropriate facilities;
- Reseed disturbed native range with native seed mixes after topsoil replacement; and
- Control unauthorized off road vehicle access to the construction ROW through the use of signs; fences with locking gates; slash and timber barriers, pipe barriers, or boulders lined across the construction ROW; or plant conifers or other appropriate trees or shrubs in accordance with landowner or manager request.

The following measures would also be employed to minimize impacts to wildlife resources:

- Develop a Migratory Bird Conservation Plan in consultation with USFWS to comply with the Migratory Bird Treaty Act and implement provisions of Executive Order 13186 by providing benefits to migratory birds and their habitats within the states where the TransCanada Keystone XL Pipeline Project will be constructed, operated, and maintained;
- Develop construction timing restrictions and buffer zones, such as those described in Table 3.6.3-1, through consultation with regulatory agencies for the Steele City Segment;
- Prohibit cutting of active raptor nest trees during the nesting season;

- If construction would occur during the April 15 to July 15 grassland ground-nesting bird season, nest-drag surveys would be completed to determine the presence or absence of nests on BLM Lands in Phillips County, Montana (USFWS); and
- If construction would occur during the raptor nesting season during January to August, pre-construction surveys would be completed to locate active nest sites to allow for appropriate construction scheduling.

TABLE 3.6.3-1
Seasonal Timing Restrictions[a] and Buffer Distances for Big Game Animals, Game Birds, and Raptors

Animal and Habitat Type	State	Buffer Distance	Seasonal Timing Restrictions
White-tailed deer – Winter range	Montana	NA	December 1 to March 31 (MFWP) & December 1 to May 15 (BLM)
Mule deer – Winter range	Montana	NA	December 1 to March 31 (MFWP) & December 1 to May 15 (BLM)
Antelope – Winter range	Montana	NA	December 1 to March 31 (MFWP) & December 1 to May 15 (BLM)
Snakes – Hibernacula	Montana	Rocky outcroppings with hibernacula	October 1 to May 1 (MFWP)
Sharp-tailed Grouse – Active lek and nesting habitat	Montana South Dakota	0.25 miles (MFWP & BLM)	March 1 to June 15
Rookeries – Great Blue Herons or Double Crested Cormorants	Montana	0.31 miles (MFWP)	May 1 to July 31 (MFWP)
Raptors and Herons – active nests and rookeries	Entire ROW	0.5 miles (MFWP) 0.25 miles no surface occupancy (MWFP & BLM) 0.5 miles timing limitations (BLM)	March 1 to August 1 (MFWP) March 1 to July 31 (BLM) February 1 through August 15 (USFWS)
Rookeries	Gulf Coast	1,000 feet (FWS)	February 15 through September 1 (USFWS)

[a] Timing restrictions and avoidance distances for protected animals including federal and state listed endangered, threatened or candidate species and species identified as conservation concerns or priority are discussed in Section 3.8. Timing restrictions for aquatic animals are discussed in Section 3.7. Required and recommended restrictions and buffers that apply to Montana are presented in Appendix I.

3.6.4 Potential Additional Mitigation Measures

In Montana, consistency with wildlife mitigation measures included in Appendix A to the Environmental Specifications developed for the proposed Project by MDEQ (see Appendix I), would be required. On federal lands in Montana and South Dakota, consistency with wildlife mitigation measures attached to the federal grant of ROW would be required. In South Dakota, consistency with conditions that were developed by the South Dakota Public Utility Commission (SDPUC) and attached to its Amended Final Decision and Order; Notice of Entry HP09-001, would also be required. Wildlife mitigation measures may include:

- Conduct surveys of sharp-tailed grouse leks prior to construction using approved methods to detect lek locations that can be seen from the construction ROW in Montana (MDEQ and MFWP);

- Construction and routine maintenance activities within 0.25 miles of an active sharp-tailed grouse lek that can be seen from the construction ROW would be prohibited from March 1 to June 15 (MDEQ, MFWP, and BLM);
- Avoid construction and reclamation activities within 0.62 miles of active raptor nests between March 15 and July 15 (MDEQ and MFWP);
- Avoid great blue heron rookeries by 500 feet (MDEQ and MFWP);
- Minimize tree clearing through a narrowing of the construction ROW and final centerline location near certain stream crossings to minimize impacts to bats and other wildlife associated with riparian habitats (MDEQ and MFWP);
- Within winter ranges for pronghorn and mule deer in Montana, develop construction timing restrictions after November 15 in consultation with MFWP biologists based on the severity of winter conditions (MDEQ and MFWP; and
- To protect small animals from entanglement, do not use erosion materials that incorporate plastic netting with openings less than 2 inches across (MDEQ and MFWP).

3.6.5 Connected Actions

3.6.5.1 Power Distribution Lines and Substations

Power distribution line construction and operation requires clearing of trees and shrubs, and maintaining vegetation under the power lines in an herbaceous state. Power distribution lines and substations constructed to provide power for the proposed Project pump stations could affect wildlife resources through:

- Habitat loss, alteration, and fragmentation;
- Direct morality during construction;
- Direct mortality due to collision with or electrocution by power distribution lines;
- Stress or avoidance of feeding due to exposure to construction and operations noise, and from increased human activity;
- Loss of breeding success from exposure to construction and operations noise, and from increased human activity; and
- Reduced survival and reproduction for ground nesting birds due to the creation of perches for raptors in grassland and shrubland habitats.

Preliminary siting information indicates that approximately 430 miles of new electric distribution lines would be necessary to power pump stations along the pipeline ROW for the proposed Project (see Section 2.1.4.1). Wildlife habitats potentially affected by construction and operation of distribution lines include 264 miles of grassland/rangeland, 112 miles of cropland, 9 miles of upland forest, 10 miles of wetland and water, and 35 miles of developed land (see Table 3.5.5-6).

The power distribution lines to Pump Stations 9 and 10 would cross the Milk River and associated oxbows and wetlands in Phillips County, Montana and are expected to present a collision hazard for waterfowl. The power distribution line to Pump Station 9 would cross 14.3 miles of the Glaciated Prairie Sage-steppe IBA. This IBA encompasses an expanse of largely unbroken sage brush shrub-steppe and prairie grassland supporting the greater sage-grouse, a species of global concern (Montana Audubon 2008). The power distribution line to Pump Station 10 would cross 18.6 miles of the North Valley

Grasslands IBA and may impact survival and reproduction for ground nesting grassland birds; and 2.1 miles of the Charles M. Russell National Wildlife Refuge, an IBA that supports 15 birds of global conservation concern (Montana Audubon 2008). The power distribution line to Pump Station 24 would cross the Platte River and associated riparian habitats in Nebraska. Other power distribution line routes would also cross smaller rivers and streams that are likely to attract raptors and migratory birds. Power distribution lines across riparian and wetland habitats provide perches that facilitate eagle, hawk and falcon predation on waterfowl and shorebirds. Newly constructed power distribution lines across grasslands, shrublands, croplands and pastures that are used by grassland nesting songbirds, and grouse would be used as vantage perches by raptors, facilitating predation on these ground-nesting birds. Location of poles across grassland and shrubland habitats reduces habitat suitability for ground-nesting birds potentially resulting in functional habitat loss and population declines through site avoidance. New electric power distribution 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 distribution line-related factors that influence collision risk include the configuration and location of the line, conductor, ground wire, and guy wire diameter, and line placement with respect to other structures or topography (APLIC and USFWS 2005).

Birds are electrocuted by power distribution 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).

Raptor nest surveys of power line routes for Pump Stations 9 to 26 identified 41 active raptor nests within 1 mile of proposed power line routes. Fourteen of these nests occurred within 0.5 mile of the proposed power line routes. Most nests (66 percent) belonged to red-tailed hawks and great horned owls.

Collision and electrocution impacts on birds resulting from construction of distribution lines would be reduced by mitigation requirements imposed by state and federal regulatory agencies, including:

- Incorporate Avian Protection Plan Guidelines (APLIC and USFWS 2005), into the routing, design, and operation of the electrical distribution lines to prevent collision and electrocution mortality of migratory birds which may include:
    - routing to avoid construction of new lines in high-use bird areas to avoid areas with grouse leks, brood-rearing habitat, and habitats that support wintering raptors;
    - reduce risk of collisions by burying new power lines over short segments where they cross known flight paths of birds, especially next to wetland areas and near grouse leks; and
    - reduce risk of collisions by using marking techniques to increase visibility of overhead wires to birds.

- Incorporate standard, avian-safe designs, as outlined in Suggested Practice for Avian Protection on Power Lines (APLIC 2006, APLIC and USFWS 2005), into the design of electrical distribution lines in areas of identified avian concern to prevent electrocution, including:
    - use a minimum 60-inch separation between energized conductors / hardware and grounded conductors / hardware to protect eagles;
    - increase separation where necessary to achieve adequate separation for types of birds involved;
    - cover energized parts and/or cover grounded parts to provide incidental contact protection for birds; and
    - apply perch management techniques where appropriate.

3.6.5.2 Big Bend to Witten 230-kV Transmission Line

Upgrades to the power grid in South Dakota to support power requirements for pump stations in South Dakota would include construction of a new 230-kV transmission line and a new substation. Construction and operation impacts on wildlife would be the same as for the distribution lines discussed above, however, it is likely that the poles would be larger and that the area disturbed around the installation site would likely be larger.

Under alternative corridor A, wildlife habitats potentially affected by construction and operation of the five transmission line route options include 30.3 to 41.3 miles of grassland/rangeland 25.7 to 33.1 miles of cropland, 0.1 miles of upland forest, 0.2 to 0.3 miles of wetland and water, and 1.8 to 5.0 miles of developed land (see Table 3.5.5-7). The transmission line route options would cross between one and four perennial streams/rivers and between 26 and 36 intermittent streams.

Under alternative corridor B, wildlife habitats potentially affected by construction and operation of the four transmission line route options include 40.4 to 47.0 miles of grassland/rangeland, 22.9 to 28.6 miles of cropland, less than 0.2 miles of upland forest, 0.2 to 0.4 miles of wetland and water, and 4.0 to 7.1 miles of developed land (see Table 3.5.5-8). The transmission line route options would cross the Missouri River, the White River, and between 20 and 31 intermittent streams. Transmission line crossings of the large river crossings would likely increase collision hazard for migrant and breeding waterfowl at these locations as discussed above. Collision and electrocution impacts on birds resulting from construction of the 230-kV transmission line would be reduced by the agencies with regulatory authority requiring that the electric power line providers implement the mitigation measures discussed above for power distribution lines to pump stations.

3.6.5.3 Bakken Marketlink and Cushing Marketlink Projects

Construction and operation of the Bakken Marketlink Project would include metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. Keystone reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there were no listed species or listed species habitat, raptors, waterbodies, or wetlands on the property. DOS reviewed aerial photographs of the area and confirmed the current use of the land and that there are no waterbodies associated with the site. A site inspection by the DOS third-party contractor confirmed these findings. As a result, the potential impacts associated with expansion of the pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

The Cushing Marketlink project would be located within the boundaries of the proposed Cushing tank farm of the Keystone XL Project and would include metering systems and two storage tanks. As a result, the impacts of construction and operation of the Cushing Marketlink Project on wildlife would be the same as potential impacts associated with construction and operation of the proposed Cushing tank farm described in this section.

Currently there is insufficient information to complete an environmental review of the Marketlink projects. The permit applications for these projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental reviews of the Marketlink projects. Potential impacts to wildlife would be evaluated during the environmental reviews for these projects and potential wildlife impacts would be evaluated and minimized or mitigated to the extent practicable in accordance with direction from federal and state resource management agencies.

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