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

Draft Supplemental Environmental Impact Statement

for the

Keystone XL Project

Volume II

March 2013

Applicant for Presidential Permit: TransCanada Keystone Pipeline, LP

United States Department of State
Draft Supplemental Environmental Impact Statement

For the

KEYSTONE XL PROJECT

Applicant for Presidential Permit:
TransCanada Keystone Pipeline, LP

Volume II

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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 (DOE)
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 (USEPA)

Assisting Agencies

U.S. Department of the Interior, Bureau of Reclamation (BOR)
Nebraska Department of Environmental Quality (NDEQ)
Various State and Local Agencies in Montana, South Dakota, Nebraska, and Kansas

March 1, 2013

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3.0 Affected Environment

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/m^3	micrograms per cubic meter
/m	per meter
AA	alluvial aquifer
AAQS	Ambient Air Quality Standards
AAR	American Association of Railroads
ABMI	Alberta Biodiversity Monitoring Institute
AC	alternating current
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACVG	alternating current voltage gradient
AEO	Annual Energy Outlook
AEUB	Alberta Energy and Utilities Board
AG	agriculture
Al-Pac FMA	Alberta-Pacific Forest Industries Forest Management Area
amsl	above mean sea level
ANSI	American National Standards Institute
AOC	abnormal operating conditions
AOPL	Association of Oil Pipelines
APE	area of potential effects
API	American Petroleum Institute
APLIC	Avian Power Line Interaction Committee
AQCR	Air Quality Control Regions
AqL	aquatic life
ARM	Administrative Rules Montana
ARPA	Archeological Resources Protection Act
ASME	American Society of Mechanical Engineers
ATWS	additional temporary work space
AUB	Alberta Utilities Commission
AWBP	Aransas-Wood Buffalo National Park
BA	Biological Assessment
bbl	barrel
bcf	billion cubic feet
bcf/d	billion cubic feet/day
BEA	U.S. Bureau of Economic Analysis
BEPC	Basin Electric Power Cooperative
BG	block group
BGEPA	Bald and Golden Eagle Protection Act
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
BNSF	BNSF Railway Company
BOR	U.S. Bureau of Reclamation
bpd	barrels per day
BS&W	basic sediment and water
BTEX	benzene, toluene, ethylbenzene, and xylene
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAFE	Corporate Average Fuel Economy
CAFO	concentrated animal feeding operation
CAPP	Canadian Association of Petroleum Producers
CCPS	Center for Chemical Process Safety
CCS	Carbon capture and storage
CE	carbon equivalents
CEA	cumulative effects analysis
CEAA	Canadian Environmental Assessment Act
CEC	Commission for Environmental Cooperation
CEQ	Council on Environmental Quality

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CH_4	methane
CHAAP	Cornhusker Army Ammunition Plant
CIS	close-interval survey
CL	centerline
CL ROW	centerline of the right-of-way
cm	centimeter
CMIP	Coupled Model Intercomparison Project
CMRP	Construction, Mitigation, and Reclamation Plan
CMZ	channel mitigation zone
CN	Canadian national
CNW	commercially navigable waterway
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
co-ops	cooperatives
cP	centipoises
CP	cathodic protection
CPRS	Canadian Pacific Railway System
CRM	Control Room Management Rule
CRP	Conservation Reserve Program
CSA	Canadian Standards Association
CSS	cyclic steam stimulation
CT	census tract
CVA	Central Valley Agriculture
CWA	Clean Water Act
CY	contractor yard
dBA	decibels on the A-weighted scale
DC	direct current
DCVG	direct current voltage gradient
Department	U.S. Department of State
dilbit	diluted bitumen
DME	Dakota, Minnesota, & Eastern Railroad
DNRC	Department of Natural Resources and Conservation
DO	dissolved oxygen
DOH	Department of Health
DPHHS	Department of Public Health and Human Services
Dth/day	decatherms per day
DW	drinking water
DWT	deadweight tonnage
e-GRID	Emissions & Generation Resource Integrated Database
EC	Economic Corridor
EES	electrical equipment shelter
EI	environmental inspector
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EO	Executive Order
ERCB	Energy Resources Conservation Board
ERP	Emergency Response Plan
ESA	Endangered Species Act
ESR	Environmental Screening Report
ESRI	Environmental Systems Research Institute
EUB	Alberta Energy and Utilities Board
FBE	fusion-bonded epoxy
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Final EIS	Final Environmental Impact Statement
FIRM	*Flood insurance rate map*
FOIA	Freedom of Information Act
FPR	failure pressure ration
FR	Federal Register
FSA	Farm Service Agency
ft	feet
ft/d	feet per day
FWCA	Fish and Wildlife Coordination Act
FWP	Farmable Wetlands Program
g	gram

g/cm^3	grams per cubic centimeter
g/hp-hr	grams per horsepower-hour
g/m^2	grams per square meter
g/ml	grams per milliliter
GAP	National Gap Analysis Program
GDP	gross domestic product
GHG	greenhouse gas
GIS	Geographic Information System
GOR	Gas-oil ratio
GPA	Great Plains Aquifer
gpm	gallons per minute
GSP	gross state product
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HC	hydrocarbons
HCA	high consequence area
HDD	horizontal directional drill
HFC	hydrofluorocarbon
HFE	hydrofluorinated ether
HHV	high heating value
hp	horsepower
HPA	high population area
HPRCC	High Plains Regional Climate Center
HPSA	Health Professional Shortage Areas
hr	hour
hr/yr	hours per year
HRSA	Health Resource Services Administration
HSSM	Hydrocarbon Spill Screening Model
HVDC	high voltage direct current
IBA	important bird area
IC	Incident Commander
ICF	ICF International LLC
ICS	Incident Command System
IEA	International Energy Agency
IEO	International Energy Outlook
IHS CERA	IHS Cambridge Energy Research Associates, Inc.
IMLV	Intermediate mainline valve
in	inch
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ITOPF	International Tanker Owners Pollution Federation Limited
KDWPT	Kansas Department of Wildlife, Parks, and Tourism
Keystone	TransCanada Keystone Pipeline, LP
kg	kilogram
kg/m^3	kilograms per cubic meter
km	kilometer
km^2	square kilometers
KMIGT	Kinder-Morgan Interstate Gas Transmission
kPa	kilopascal
KSDA	Kansas Department of Agriculture
kV	kilovolt
kW	kilowatt
LB	Legislative Bill
lb/MMBtu	pounds per million British Thermal Units
LCA	lifecycle analysis
LCFS	low carbon fuel standard
LCNHT	Lewis and Clark National Historic Trail
Ldn	day-night sound level
LDS	leak detection system
Leq	equivalent continuous sound level
Leq(24)	24-hour equivalent sound level
LHV	Lower heating value
LLC	limited liability company
LLS	Light Louisiana Sweet
LNAPL	light non-aqueous phase liquid
LOOP	Louisiana Offshore Oil Port
LSHR	landscape hazard ranking system
LVH	lower heating value
LW	local/county noxious week
m	meter
m/d	meter per day

m^3	cubic meter
MACT	Maximum Achievable Control Technology
MALAA	may affect, likely to adversely affect
MBCA	Migratory Bird Convention Act
MBCB	Montana Building Code Bureau
MBOGC	Montana Board of Oil and Gas Conservation
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MCL	maximum contaminant level
MCR	micro carbon residue
MDA	Montana Department of Agriculture
MDEQ	Montana Department of Environmental Quality
MDNRC	Montana Department of Natural Resources and Conservation
MDT	Montana Department of Transportation
MDU	Montana-Dakota Utilities
MFSA	Major Facilities Siting Act
MFWP	Montana Fish, Wildlife, and Parks
mg	milligrams
mg/L	milligrams per liter
mgKOH/g	milligrams potassium hydroxide per gram
MGWPCS	Montana Ground Water Pollution Control System
mi^2	square miles
MJ	megajoule
MLA	Mineral Leasing Act
MLV	mainline valve
mmbpd	million barrels per day
MMBtu	million British thermal units
MMcf/d	million cubic feet per day
MMDK	million decatherms
mmhos/cm	millimhos per centimeter
$MMTCO_2e$	million metric tons of CO_2 equivalent
MNHP	Montana Natural Heritage Program
MOP	maximum operating pressure
MP	milepost
MPDES	Montana Pollutant Discharge Elimination System
mpg	miles per gallon
MROW	Midwest Reliability Organization West
MSA	metropolitan statistical area
MSDS	Material Data Safety Sheets
MT	Montana
MUA/P	Medically Underserved Areas/Populations
MW	megawatt
MWh/yr	megawatt-hour per year
N_2O	nitrous oxide
NA	not applicable
na	not available
NAAQS	National Ambient Air Quality Standards
NAC	Nebraska Administrative Code
NACE	National Association of Corrosion Engineers
NAGPRA	Native America Graves Protection and Repatriation Act
NAIP	National Aerial Imagery Program
NAS	National Academy of Sciences
NCRC	Nebraska Central Railroad Company
ND	no data
NDA	Nebraska Department of Agriculture
NDE	nondestructive examination
NDEQ	Nebraska Department of Environmental Quality
NDGFD	North Dakota Game and Fish Department
NDHHS	Nebraska Department of Health and Human Services
NDOR	Nebraska Department of Roads
NDPA	North Dakota Pipeline Authority
NE SFM	Nebraska State Fire Marshal

NEAAQS	Nebraska Ambient Air Quality Standards
NEB	National Energy Board (Canada)
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NETL	National Energy Technology Laboratory
NF_3	nitrogen trifluoride
NFO	Non-significant Fossil Occurrence
NGFC	Nebraska Game and Fish Commission
NGL	natural gas liquids
NGPAS	Northern Great Plains Aquifer System
NGPC	Nebraska Game and Parks Commission
NGPD	Nebraska Game and Parks Department
NHD	National Hydrography Dataset
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act of 1986
NHPAQ	Northern High Plains Aquifer
NHTSA	National Highway Traffic Safety Administration
NID	National Interest Determination
NLAA	may affect, not likely to adversely affect
NLCD	National Land Cover Database
NMHC	non-methane hydrocarbon
NNLP	Nebraska Natural Legacy Project
NNRC	Nebraska Northeastern Railway Company
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_X	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPPD	Nebraska Public Power District
NPR	National Public Radio
NPS	National Park Service
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRD	Natural Resources District
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NSA	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review
NTSB	National Transportation Safety Board
NW	noxious weed
NWI	National Wetland Inventory
NWP	Nationwide Permit
O_2	oxygen gas
O_3	ozone
OCC	Operations Control Center
OGJ	Oil & Gas Journal
OGP	International Association of Oil and Gas Producers
OPA	other populated area
OPA 90	Oil Pollution Act of 1990
OPS	Office of Pipeline Safety
OW	open water
PA	Programmatic Agreement
PADD	Petroleum Administration for Defense District
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PCIC	project cumulative impact corridor
PEM	palustrine emergent wetland
PFC	perfluorocarbon
PFO	palustrine forested wetland
PFYC	Potential Fossil Yield Classification
PHMSA	Pipeline Hazardous Material Safety Administration
PI	point of inflection (angle)

PM	particulate matter
PM_{10}	particulate matter with aerodynamic diameter of 10 microns and less
$PM_{2.5}$	particulate matter with aerodynamic diameter of 10 microns and less
PMMP	Paleontological Monitoring and Mitigation Plan
PMP	Pipeline Maintenance Program
POTW	publically owned treatment works
PPA	Protection Priority Areas
PPD	Public Power District
PPE	personal protective equipment
ppm	parts per million
ppmw	parts per million by weight
PPR	Prairie Pothole Region
Project	Keystone XL Project
PS	pump station
PSD	prevention of significant deterioration
psi	pounds per square inch
psig	pounds per square inch gauge
PSRP	Pipeline Spill Response Plan
PSS	palustrine scrub shrub wetland
ptb	pounds per thousand barrels
PWS	public water supply
py	pipeyard
QC	quality control
R	riverine wetlands
R-STRENG	remaining strength
RBOB	reformulated blendstock for oxygenate blending
Rec	recreation
Reclamation	Bureau of Reclamation
REX-W	Rockies Express-West
RFI	radio frequency interference
RFS2	USEPA Renewable Fuel Standard
riv-OW	riverine-open water
ROD	Record of Decision
ROS	rest of state
ROW	right-of-way
RP	Recommended Practice
RPMA	Recovery-Priority Management Area
RPS	Renewable Portfolio Standard
RUS	Rural Utilities Service
RV	recreational vehicle
SAGD	Steam-assisted gravity drainage
SARA	Species at Risk Act
SC	species of concern
SCADA	Supervisory Control and Data Acquisition
SCC	stress corrosion cracking
SCO	synthetic crude oil
SD	South Dakota
SD DOT	South Dakota Department of Transportation
SDA	South Dakota Department of Agriculture
SDCL	South Dakota Common Law
SDDENR	South Dakota Department of Environment and Natural Resources
SDGFP	South Dakota Game, Fish, and Parks
SDIWWG	South Dakota Interagency Wetlands Working Group
SDPUC	South Dakota Public Utilities Commission
SDSMT	South Dakota School of Mines and Technology
SDWA	Safe Drinking Water Act
SER	Supplemental Environmental Report
SF_6	sulfur hexafluoride
SFL	Significant Fossil Localities
SFM	Office of the State Fire Marshall
SHPO	State Historic Preservation Office(er)
SIP	State Implementation Plan
SMS	Scenery Management System
SO_2	sulfur dioxide
SOR	Steam-oil ratio

SPCC	Spill Prevention, Control, and Countermeasure
SPSO	Southwest Power Pool South
Supplemental EIS	Supplemental Environmental Impact Statement
SWPA	Source Water Protection Area
TAN	total acid number
TBD	to be determined
TCE	trichloroethylene
TCEQ	Texas Commission on Environmental Quality
TCP	traditional cultural properties
TDS	total dissolved solids
TEFC	The Ecological Framework of Canada
THPO	Tribal Historic Preservation Officer
TKN	total Kjehldahl nitrogen
TPG	The Perryman Group
tpy	tons per year
TSB	Transportation Safety Board
TTW	Tank-to-wheels
TWA	temporary workspace area
UP	Union Pacific Railroad Company
U.S.	United States
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	United States Code
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	United States Global Change Research Program
USGS	U.S. Geological Survey
USNABCI	U.S. North American Bird Conservation Initiative
UST	underground storage tank
VES	variable frequency drive equipment shelter
VOC	volatile organic compound
vol%	percent volume
VRM	visual resource management
WCD	worst-case discharge
WCI	Western Climate Initiative
WCSB	Western Canadian Sedimentary Basin
WEG	Wind Erodibility Group
Western	Western Area Power Administration
WHIP	Wildlife Habitat Incentive Program
WHPA	wellhead protection areas
WHSRN	Western Hemisphere Shorebird Reserve Network
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
WIPA	Western Interior Plains Aquifer
WMA	wildlife management area
WMD	Wetland Management District
WRCC	Western Regional Climate Center
WRP	Wetland Reserve Program
wt%	weight percent
WTI	West Texas Intermediate
WTR	Well-to-refinery gate
WTT	well to tank
WTW	well to wheels
WW	warmwater
WYGF	Wyoming Game and Fish Department
yr	year

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the direct and indirect environmental impacts that would be caused by the construction, operation, maintenance, and decommissioning of the proposed Project. The Department has issued this Supplemental Environmental Impact Statement that builds on the analysis completed in August 2011. That analysis has been revised, expanded, and updated to include significant new circumstances or information that is now available. Particular attention has been placed on impacts within those portions of the proposed Project and its connected actions that differ from the previously proposed Keystone XL pipeline route. Cumulative environmental impacts of the proposed Project and other past, present, and reasonably foreseeable projects are described separately in Section 4.15, Cumulative Effects Assessment. Impacts associated with alternatives to the proposed Project are described in Chapter 5.0, Alternatives. As noted in Chapter 3.0, Affected Environment, this Supplemental Environmental Impact Statement does not include an analysis of environmental impacts from the proposed Project in Canada, as these have been assessed separately by the Canadian government consistent with Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions).

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4.1 GEOLOGY

4.1.1 Introduction

This section describes potential impacts to geological resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS, and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to geological resources:

- A new section, Section 4.1.2, Impact Assessment Methodology, was added to explain the assessment methodology used to evaluate potential geologic impacts associated with the proposed Project;
- Impacts to paleontological resources have changed due to the availability of results from additional field surveys that were conducted in 2011 and 2012 in Montana and South Dakota;
- The discussion of procedures to minimize and mitigate adverse effects of pipeline construction activities on significant paleontological materials has been expanded;
- The number of miles identified with the potential for rock ripping has been changed due to the proposed Nebraska reroute; and
- Additional discussion about the Bakken Marketlink connected action has been incorporated in the context of mineral and fossil fuel resources.

4.1.2 Impact Assessment Methodology

The impacts of the proposed Project on the geological resources are evaluated using a combination of quantitative and qualitative methods, including the following:

- Qualitative evaluation of the effects of the proposed Project on the surficial and bedrock geology;
- Calculation of areas along the proposed pipeline route that may require rock ripping for the construction of the proposed pipeline;
- Calculation of the distance of the proposed pipeline route to nearby fossil fuel and mineral resources and its direct effect to the resource or indirect effect to the accessibility to the resource;
- Evaluation of the effects of the proposed Project to fossil-bearing geologic formations and paleontological resources; and
- Evaluation of the risks that a geology hazards found along the proposed pipeline route may have to the proposed pipeline.

4.1.3 Potential Impacts

4.1.3.1 Geological Resources

Construction

Most of the proposed Project route passes through areas where bedrock is buried under 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, which reflects the typical maximum depth of trench excavation.

Rock ripping (the break up and removal of rock material with an excavator) 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. Approximately 202 miles of the proposed Project route would cross areas identified as potential ripping locations. Table 4.1-1 summarizes the approximate locations of expected ripping operations by state, county, and approximate milepost.

Table 4.1-1 Potential Ripping Locations for the Proposed Project[a]

Milepost Range	State	County	Length (miles)
10.96–18.73	Montana	Phillips	1.23
25.82–57.59	Montana	Valley	3.31
90.26–156.74	Montana	McCone	19.30
156.74–197.13	Montana	Dawson	9.45
197.85–218.06	Montana	Prairie	6.40
218.54–282.67	Montana	Fallon	19.67
282.83–354.31	South Dakota	Harding	35.94
355.07–358.10	South Dakota	Butte	1.03
358.1–373.36	South Dakota	Perkins	13.94
373.36–424.61	South Dakota	Meade	30.86
426.26–426.28	South Dakota	Pennington	0.02
426.28–484.45	South Dakota	Haakon	17.76
485.29–523.42	South Dakota	Jones	25.50
530.94–536.83	South Dakota	Lyman	2.05
537.56–596.84	South Dakota	Tripp	15.26
871.49–871.53	Nebraska[a]	Jefferson	0.04
871.62–871.69	Nebraska[a]	Jefferson	0.07
872.11–872.22	Nebraska[a]	Jefferson	0.11
872.27–872.32	Nebraska[a]	Jefferson	0.05
Proposed Project Total			**201.99**

[a] Shallow bedrock areas (<60 inches) taken from the SSURGO Soils Database (USDA 1932).

Additionally, at 14 major river crossings, horizontal directional drilling would be employed to install the proposed pipeline, requiring depths greater than 8 feet and thereby impacting additional bedrock. These major river crossings include four planned in Montana, five in South Dakota, and five in Nebraska. 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. Rock ripping and the installation of the pipeline at some river crossings would involve some disturbance and modification of the surficial geology, but would not have substantive impacts to geology. For additional information on stream crossings, see Section 4.3, Water Resources.

Some areas within Montana, South Dakota, and Nebraska do not have sufficient temporary housing in the vicinity of the proposed pipeline route to house all construction personnel working in those areas. As such, temporary work camps would be constructed to meet the housing needs of the construction workforce in these remote locations. Potential impacts to geological resources during the construction of these camps would be negligible.

Operation and Maintenance

Routine pipeline operation and maintenance activities would not be expected to affect physiography or bedrock geology. The depth to the bottom of the pipeline is, on average, between 7 and 8 feet below ground surface, which is below the frost line along the proposed route. The frost line is not expected to impact the operation of the pipeline.

4.1.3.2 Paleontological Resources

Construction

Excavation activities, erosion of fossil beds exposed due to grading, and unauthorized collection can damage or destroy paleontological resources during construction. Because fossils might be discovered during trench excavation, a Paleontological Monitoring and Mitigation Plan would be prepared by TransCanada Keystone Pipeline, LP (Keystone) prior to 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. In addition, appropriate regulatory agencies in each state would be consulted on the requirements for the Paleontological Monitoring and Mitigation Plan prior to excavation.

According to the guidelines provided in the Potential Fossil Yield Classification (PFYC) system, there are various mitigation measures that may be applied to geological units where the concern for paleontological resources is moderate to very high. These measures could include such actions as monitoring of excavations during construction to identify the presence of completely buried subsurface fossils, periodic spot-checking of impacts to significant fossils during construction activities, or avoidance of disturbance to the fossil-bearing unit of potential impact. Collaboration between land managers and knowledgeable researchers would be necessary to determine the appropriate action during construction of the proposed route.

Paleontological resources identified on federal lands are managed and protected under the Paleontological Resources Preservation Act 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 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.

Both Montana and South Dakota have enacted legislation to manage and protect paleontological resources on state-managed lands. In Montana, a certificate of compliance under the Major Facilities Siting Act would be required from Montana Department of Environmental Quality (MDEQ) prior to construction of the proposed pipeline. MDEQ has the authority to require mitigation actions when significant paleontological resources are inadvertently discovered on any lands (i.e., public and privately owned 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. 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 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 has written rules for implementing the State Antiquities Act. The Montana State Historic Preservation Office also issues antiquities permits for the collection of paleontological resources on state-owned lands. The MDEQ has drafted a Memorandum of Understanding with Keystone in Montana for the identification, evaluation, and protection of paleontological resources. This Memorandum of Understanding has not yet been fully signed and executed.

South Dakota requires a permit 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 the South Dakota Public Utilities Commission specifies the need for surveys in accordance with the procedures described for the South Dakota paleontological field surveys. Condition 44 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 Bureau of Land Management (BLM) permitted monitors[1] 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 right-of-way (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 or 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 or scientific significance. If an economically or

[1] The onsite monitor would be required to hold a valid Paleontological Resource Use Permit from the BLM, authorizing the monitor to survey and collect paleontological resources in anticipation or in conjunction with a land-use action.

scientifically significant paleontological resource is discovered on state land, Keystone will notify South Dakota Schools of Mines and Technology (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 be 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 SDSMT; 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 Major Facilities Siting Act conditions in Montana and South Dakota Public Utilities Commission conditions in South Dakota, a paleontological monitor would be provided for each construction spread that includes an area assigned moderate-to-high fossil-bearing potential (PFYC 3, 4, and 5) and in areas where scientifically significant fossils were identified during surface surveys. The paleontological monitor would need to meet the qualifications established by the BLM for paleontological monitoring on federal lands.

No specific regulations have been identified concerning paleontological resources that would apply to the proposed Project in Nebraska.

Operation and Maintenance

Routine pipeline operations and maintenance activities are not expected to affect paleontological resources. Collection of paleontological resources for scientific or other purposes, however, would not be allowed by Keystone within the permanent ROW during proposed Project operations.

4.1.3.3 Mineral and Fossil Fuel Resources

Although the proposed Project 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 located within the permanent ROW. As summarized in Section 3.1.2.4,

Fossil Fuel and Mineral and Resources, the proposed Project 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 route.

As summarized in Section 2.1.3, Borrow Material Requirements, approximately 415,588 cubic yards of gravel and other fill materials would be used for temporary sites such as storage sites, contractor yards, and temporary access roads. These materials would also be used to stabilize the land for permanent facilities including pump stations, mainline valves, permanent access roads, and the proposed pipeline trench bottom. Fill materials would be obtained from an existing, previously permitted commercial source located as close to the proposed pipeline or contractor yard as possible.

The proposed Project route would cross underlying coal-bearing formations in South Dakota. Although not currently planned, if surface mining was proposed for this area in the future, the proposed pipeline could limit access to these resources.

As mentioned in Section 3.1.2.4, Fossil Fuel and Mineral and Resources, the proposed Project route would span across the crude-oil-rich Williston Basin through a portion of Montana. The proposed pipeline would not have a significant impact on the currently existing oil and gas producing wells within the vicinity of the proposed ROW. The Bakken crude oil wells would be connected to the Cushing Oil Terminal at Cushing, Oklahoma through a connection with the Bakken Marketlink Project at Baker, Montana.

4.1.3.4 Geologic Hazards

Seismic

Based on the evaluation of potential seismic hazards along the proposed ROW, the risk of the proposed pipeline rupture from earthquake ground motion is considered to be minimal. The proposed Project route would not cross any known active faults and is located outside of known zones of high seismic hazard.

The proposed pipeline would be constructed to withstand probable seismic events within the seismic risk zones crossed by the proposed pipeline. The proposed pipeline would be constructed in accordance with U.S. Department of Transportation regulations 49 Code of Federal Regulation (CFR) Part 195, Transportation of Hazardous Liquids by Pipeline (49 CFR 195), 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 proposed pipeline was evident, the proposed pipeline would be inspected and repaired as necessary.

Landslides

Construction activities, such as 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 Construction, Mitigation, and Reclamation Plan (CMRP) (see Appendix G) and specific 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 could cause the proposed 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 proposed pipeline from minor earth movements.

To reduce landslide risk during operations, erosion and sediment control and reclamation procedures would be employed as described in Section 4.11 of the CMRP (Appendix G). These procedures are expected to limit erosion and maintain slope stability after the construction phase. Additionally, landslide activity would be monitored during the proposed pipeline's operation through aerial and ground patrols and through landowner awareness programs designed to encourage reporting. Keystone's company-wide Integrated Public Awareness plan would be implemented. This plan is consistent with the recommendations of American Petroleum Institute RP-1162 (Public Awareness Programs for Pipeline Operators). The plan includes educational materials designed to inform landowners of potential threats associated with the proposed pipeline and teach landowners to identify threats to the proposed pipeline including the potential for landslides. Landowners would be provided a toll-free telephone number to report potential threats to the proposed pipeline and other emergencies.

Subsidence

Because there no appreciable limestone areas in Nebraska (or in other states along the proposed route), the risk of subsidence from karst features along the proposed pipeline route are negligible.

Floods

There is a risk of pipeline exposure due to lateral or vertical scour at water crossings due to floods. To mitigate the potential risk of pipeline exposure to lateral and vertical scours, the pipeline has been designed to be buried below the calculated scour depth at active stream crossings. In addition, at some stream crossings the pipeline would be installed using the horizontal directional drilling method deep below the stream bed where it would not be affected by scouring events. Additional protection measures related to proposed pipeline stream crossing procedures can be found in Section 4.3, Water Resources.

4.1.4 Recommended Additional Mitigation

No additional potential mitigation measures are recommended.

4.1.5 Connected Actions

4.1.5.1 Bakken Marketlink Project

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. 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. As a result, the potential impacts associated with expansion of the proposed pump station site to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed pipeline ROW in that area.

4.1.5.2 Big Bend to Witten 230-kV Transmission Line

The proposed Big Bend to Witten electrical lines would be a 230-kilovolt (kV) single circuit transmission line strung to a single-pole structure. The poles would typically about 110 feet high steel poles with wire span distances averaging 800 feet. The poles would be directly embedded into excavated holes to a depth of about 20 feet. All substation and switchyard work installation activities, including the placement of concrete foundations, erecting support structures, construction of control buildings, and the installation of electrical equipment would involve surficial land clearance and landscape leveling. Excess fill material would be spread throughout undeveloped areas within the substation sites. Since the construction and operation of electrical distribution lines and substations would require minor disturbances to the landscape of the area, the impacts to the geological resources are expected to be negligible.

4.1.5.3 Electrical Distribution Lines and Substations

The proposed Project would require electrical service from local power providers for pump stations and other aboveground facilities in Montana, South Dakota, and Nebraska. Most of the proposed new electrical lines to service pump stations would be 115-kV lines stung a single-pole and/or H-frame wood poles. The poles would be typically about 60 to 80 feet high with wire span distance of about 250 to 400 feet. The 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. Since the construction and operation of electrical lines and associated structures would require minor disturbances to the landscape of the area, the impacts to the geological resources are expected to be negligible.

4.1.6 References

Burns and McDonnell, 2011, Clay Center 115 kV Transmission Project in Clay County, Kansas, Westar Energy, Project No. 62783.

USDA. See United States Department of Agriculture.

United States Department of Agriculture (USDA). 1932. Natural Resources Conservation Service Web Soil Survey. Retrieved August 5, 2008: http://websoilsurvey.nrcs.usda.gov/app.

4.2 SOILS

4.2.1 Introduction

This section describes potential impacts to soils resources associated with construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS, and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to soils resources:

- A new section, Section 4.2.2 "Impact Assessment Methodology," was added to explain the assessment methodology used to evaluate potential soils impacts associated with the proposed Project;
- The acreages of impacted soils with particular characteristics or constraints have been revised;
- Impacts to fragile soils (i.e., landscapes where the soil exhibits conditions similar to the NDEQ-identified Sand Hills Region and soils that are very susceptible to wind erosion) have changed due to the proposed Nebraska reroute;
- Section 4.2.4 "Recommended Additional Mitigation" provides a list of additional mitigation measures to further reduce impacts to soils;
- Revised procedures for topsoil and subsoil handling are described; and
- A discussion of the impacts to shelterbelts and proposed associated mitigation measures has been added.

4.2.2 Impact Assessment Methodology

The impacts of the proposed Project on the soil resources of the Project area are evaluated using a combination of quantitative and qualitative methods, including the following:

- Calculation of the miles and acreage of sensitive soils disrupted (summarized in Section 3.2, Soils); and
- Qualitative evaluation of the potential direct and indirect impacts to these soils resulting from the proposed project's construction and operation activities (discussed in this section).

4.2.3 Potential Impacts

4.2.3.1 Construction Impacts

Pipeline construction activities, including clearing, grading, trench excavation, backfilling, equipment traffic, and restoration along the construction right-of-way (ROW), could adversely affect soil resources. In addition, the construction of pump stations, pipe yards, valve sites, access roads, temporary work areas, and construction camps could also affect soil resources. Potential impacts could include temporary and short-term soil erosion, loss of topsoil, short- 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. In addition, pipeline construction also could result in damage to existing tile drainage systems, irrigation systems, and shelterbelts. Special considerations and measures also would be undertaken in proposed Project areas in southern South Dakota and northern Nebraska where the soils are fragile (i.e., sandy soils that exhibit conditions similar to the Nebraska Department of Environmental Quality-identified Sand Hills Region that are highly susceptible to erosion by wind), (see Soils Environmental Setting sections 3.2.2.2, South Dakota, and 3.2.2.3, Nebraska), as described in detail below.

The proposed Project Construction, Mitigation, and Reclamation Plan (Appendix G, CMRP) 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.

Soil 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 route would cross drought-prone soils. Drought-prone soils would be relatively more prone to wind erosion during construction and would be more difficult to successfully stabilize and revegetate following construction.

Approximately 50 percent of the overall proposed Project route would cross soils characterized as highly erodible by either wind or water (see Table 3.2-2). Overall, the majority (85 percent) of these highly erodible soils are designated as highly erodible by water.

TransCanada Keystone Pipeline, LP's (Keystone's) 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 Appendix G, CMRP). These erosion control measures would be implemented wherever soil is exposed, steep slopes are present, or erosion potential is high. To enforce use of 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 deviate from the measures outlined in the CMRP, agreed landowner requirements, or any conditions of any applicable permits. Specifically, the EI would inspect temporary erosion-

control measures daily in areas of active construction or equipment operation, weekly in proposed Project areas without active construction or equipment operation, and within 24 hours of continuous rainfall greater than 0.5 inch along the ROW undergoing construction and in other construction ancillary areas where the rainfall occurred. The repair of any erosion control measures determined to be not functioning acceptably would be completed within 24 hours of detection, where reasonably practicable. If substantial precipitation or snowmelt events create erosion channels in proposed Project areas where soil is exposed, additional sediment control measures would be implemented as soon as practical after the rain or snowmelt event. Potential erosion control measures are described in greater detail in the CMRP.

Soil Contamination

If soils impacted by potentially hazardous substances (such as hydrocarbons, pesticides, or herbicides) would be disturbed by pipeline construction, adverse impacts could result. These may include the potential spread of impacted soils, hazardous material exposure to workers or the public, or mobilization of contaminants through soil erosion or contaminant leaching from soils to groundwater, which could affect groundwater or surface water quality. 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 CMRP. In the event that the proposed Project encounters contaminated or potentially contaminated soils, based on obvious odor or discoloration, work in the area of the discovery would halt and equipment would be moved from the immediate area. Containment berms would be installed, as necessary, to prevent migration of runoff from the excavated material. The state agency responsible for site assessment and remediation would be contacted and a plan of action would be developed in consultation with that agency and the landowner. Testing of the potentially contaminated soil may be necessary. Depending upon the level of contamination found and based on approvals from the appropriate agency(ies), affected soil may be replaced in the trench, remediate *in situ*, or removed for off-site disposal.

Soil Compaction

On land with soils that are compaction prone (approximately 72 percent of the overall proposed Project route acreage; see Table 3.2-2), soil compaction may result from the movement of construction vehicles along the construction ROW, within additional temporary workspace areas, and on temporary access roads. The degree of compaction would be dependent on the moisture content and texture of the soil at the time of construction; although compaction can occur on nearly any soil type, compaction would be most severe where equipment operates on moist to wet soils with high clay contents. The likelihood for compaction would increase with increasing numbers of passes by construction equipment. Additionally, if soils are moist or wet during trenching and vehicle movement, topsoil would likely adhere to tires and/or tracked vehicles and be carried away (i.e., resulting in rutting of soil). Compaction control measures are described in the CMRP and include ripping (i.e., the loosening of the compacted soils with a dozer equipped with a ripper blade or a deep plow) to relieve compaction, particularly in proposed Project areas from which topsoil has been removed.

Prime Farmland Soil

Approximately 4,715 acres of prime farmland soil would be directly impacted by construction of the proposed pipeline (see Table 3.2-2 for a breakdown by state). 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 and to soils in non-forested agricultural areas are discussed in the Topsoil and Subsoil Handling section below.

Topsoil and Subsoil Handling

In non-forested agricultural proposed Project 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 proposed Project areas and would not be used to construct ramps at road or waterbody crossings. Additional methodology detailed in the CMRP (Appendix G) includes ripping to relieve compaction in proposed Project 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.

The proposed Project route was 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 as required for South Dakota soils consistent with South Dakota Public Utilities Commission conditions. These same characteristics also would be evaluated prior to construction in other proposed Project areas where soils with similar chemical and physical characteristics occur in low-precipitation portions of the Project route. Soils considered for special handling are those that contain suitable growing conditions in the topsoil horizon and upper subsoil horizon (horizons immediately underlying the topsoil), but contain undesirable soil conditions at greater depths; excavation and replacement of these soils could potentially result in degradation of agricultural capability if not managed appropriately. The criteria for special handling of soils to conserve agricultural capability were developed in consultation with the Natural Resources Conservation Service (NRCS) to determine proposed Project areas where special handling may be warranted. Meetings covering these criteria were held in 2011 in Montana and in 2010 in South Dakota and Nebraska. 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 would be identified using publicly available NRCS soil survey data (Soil Survey Geographic Database) for all upper subsoil horizons within 24 inches of the surface. These data would be overlain on land-use mapping compiled from pedestrian and vehicle surveys and aerial photo-interpretation. The criteria for each soil property are presented in Table 4.2-1.

Table 4.2-1 Soil Criteria for Determining Special Handling Techniques in Cultivated Land and High-Quality Prairie or Rangeland

Characteristics	Upper Subsoil Horizon	Lower Subsoil Horizons
Salinity (EC)	<8 mmhos/cm[a]	≥4 mmhos/cm higher than EC of upper subsoil 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.

Using NRCS soil series data, the properties of the upper subsoil horizons would be compared to data from the lower subsoil horizons to identify soil series with characteristics meeting the special handling criteria. A soil series would be selected for special handling if it meets the criteria for both the upper and lower subsoil horizons. Additionally, the upper subsoil horizons must be at least 6 inches thick or thicker to be selected for special handling. Each soil series meeting special handling criteria would be 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 would be conducted by Keystone prior to construction. The exact locations of soils that require special soil handling would be mapped prior to construction and then field-verified along the proposed Project route.

The standard plan for the proposed Project route 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 review of topsoil depths reported by 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 proposed Project areas that meet the criteria outlined in Table 4.2-1 include “over-stripping” and “triple lift.”

In proposed Project areas recommended for over-stripping of topsoil, the soil salvage would extend below the surface horizon into the underlying subsurface 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. In general, soils recommended for over-stripping of topsoil commonly are of low quality and support perennial grasses.

The triple lift soil salvage technique would be implemented in proposed Project areas where the topsoil to be excavated is deep/thick, primarily over the pipeline trench in cultivated fields. In these proposed Project areas, the topsoil (i.e., the “first lift”) would be salvaged across the entire proposed Project route ROW according to the depth determined during pre-construction surveys. The “second-lift” material would then be salvaged and windrowed next to the salvaged topsoil. The trench spoil material (the “third lift”) 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 route area. An example of this procedure is shown in Details 67 and 67A of the CMRP (Appendix G).

Range and Pasture Land

On range, pastures, and other proposed Project 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 re-establishment following construction. Productivity of range and pasture land along the proposed Project route 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 CMRP.

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, in particular when their moisture levels are high. 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 (i.e., because they could represent artificial barriers to natural surface water flow). Despite the protection measures described below, it is possible that precipitation events may cause unavoidable soil erosion by water.

The CMRP includes methods to determine when to restrict or stop work due to wet weather and describes 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 soil compaction. During excessive wet conditions, protection measures that could be implemented include limiting work to proposed Project 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 proposed Project 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 proposed Project 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 CMRP, specific construction methods would be utilized to ensure that disturbed proposed Project 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 with that found in adjacent surface soils that are undisturbed off the ROW. The intent of this effort would be to ensure an equivalent quantity, size, and distribution of rocks in the backfilled surface horizon to that found in the surface horizon on adjacent lands.

Soils Drained by Drain Tile Systems and Irrigation Systems

Construction of the proposed pipeline would occasionally necessitate disruption of existing drain tile and irrigation systems. Drainage tiles and irrigation systems 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 or irrigation systems; however, temporary impacts to drain tile and irrigation systems during construction could result in soils becoming saturated during wet weather conditions or during periods of continuous precipitation or in temporary disabling of irrigation systems. Any demonstrated agricultural losses resulting from temporary disruption of drain tile systems and/or irrigation systems would be compensated in accordance with landowner and land manager easement agreements.

Shelterbelts

Shelterbelts include planted tree and shrub stands and windbreaks typically located at field margins, near roadsides, or around residences. Construction of the proposed pipeline would occasionally necessitate the disruption of existing shelterbelts. Shelterbelts potentially impacted by the pipeline construction would be avoided by the pipeline construction where practicable, or measures would be implemented to mitigate or compensate for impacts, as specified in Appendix R, Construction/Reclamation Plans and Documentation. Where shelterbelts would be disrupted, the ROW would be revegetated and seeded, and wind fences would be installed across the ROW in areas where trees and/or shrubs have been removed. Adherence to these procedures should minimize or mitigate long-term impacts to shelterbelts. Demonstrated agricultural losses resulting from the disruption of shelterbelts would be compensated in accordance with landowner and land manager easement agreements.

Fragile Soils in Southern South Dakota and Northern Nebraska

In southern South Dakota and northern Nebraska, the proposed Project route would enter an area with fragile soils (i.e., landscapes where the soil exhibits conditions similar to the Nebraska Department of Environmental Quality-identified Sand Hills Region and the soils are very susceptible to wind erosion; see Soils Environmental Setting sections 3.2.2.2, South Dakota, and 3.2.2.3, Nebraska, and Figure 3.2.2-1, Highly Wind Erodible Soil). To address concerns related to potential erosion in the region, specific construction, reclamation, and post-construction procedures have been developed, as described in the CMRP (Appendix F, Fragile Soils).This document provides site-specific reclamation plans that itemize construction, erosion control, and revegetation procedures for these fragile areas. Additionally, Keystone would implement micro-routing adjustments where practicable and appropriate to minimize steep topography with fragile soils.

To reduce potential impacts related to severe wind and water erosion, the following provides a summary of proposed Project Best Management Practices (BMPs) that would be implemented during construction, reclamation, and post-construction. These BMPs are included in the CMRP for fragile soil areas. Additional procedures are also described in Sandy Prairie Construction/Reclamation Unit Plan (Appendix R, Construction/Reclamation Plans and Documentation):

- Keystone would educate construction personnel regarding the necessity to strictly adhere to the proposed Project BMPs designed to minimize impacts to fragile soil landscape areas.
- Minor route re-alignments would be incorporated through these fragile areas to avoid particularly erosion-prone locations, such as ridgetops and existing blowouts as much as practicable.
- Keystone would avoid highly saturated areas, such as wetlands, to the maximum extent possible.
- Construction soil handling procedures would strive to reduce the width of disturbance to the native prairie landscape by adopting Trench-line or Blade-width stripping procedures where practicable.
- Topsoil conservation would be conducted on all areas where excavation occurs.
- Topsoil piles would be protected from erosion through matting, mulching, watering, or tackifying as deemed practicable.
- Traffic management limitations would be employed on specific areas possessing high erosion potential or sensitive habitat.
- Native seed mixes would be developed with input from the local NRCS offices and through collaboration with regional experts. All seed would be certified noxious weed-free and would be calculated on a pure live seed basis.
- Straw or native prairie hay may be used as mulch, applied to the ROW, and crimped into the soil to prevent wind erosion. All mulch would be documented as noxious weed-free.
- Land imprinting may be employed to create impressions in the soil, thereby reducing erosion, improving moisture retention, and creating micro-sites for seed germination.
- Sediment logs or straw wattles would be used in place of slope breakers (short terraces) that are constructed of soil. Using sediment logs would result in less soil disturbance to the ROW.
- Photodegradable matting would be applied 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.
- Keystone would work with landowners to evaluate fencing the ROW from livestock, or alternatively, provide compensation to rest a pasture until vegetation can become established.
- Management concerns such as livestock access to water or movement within a pasture would be addressed as necessary.
- As part of post-construction monitoring and repair, Keystone would monitor reclamation on the ROW for several years and repair erosion and reseed poorly revegetated areas as necessary. During monitoring, landowners would be informed of these efforts and intended actions going forward.
- A noxious weed management plan would be established based on consultation with state and county experts.

Potential Spills and Leaks

Construction impacts resulting from fuel or lubricating oil leaks or spills during construction are addressed in Section 4.13, Potential Releases.

4.2.3.2 Operation 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 proposed Project areas where 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 proposed Project 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 in the CMRP. 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.

Soil 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.

Soil Productivity

The ROW would be monitored to identify any proposed Project areas where soil productivity has been degraded as a result of pipeline operation. Necessary reclamation measures would be implemented to rectify any such concerns. The U.S. Department of State (Department) 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 easements or ROW agreements.

Differential Settling

In the first year after construction, the ROW would be inspected to identify areas of erosion or settling. Consequently, erosion and settling would be monitored through aerial patrols consistent with an Integrity Management Plan, 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 (see Appendix G, CMRP).

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 three locations along the proposed route (one in each state) was conducted based on operating volumes of 900,000 barrels per day (see Appendix S, Pipeline Temperature Effects Study). The modeled temperature effects are likely to be conservative since the maximum operating volume of the proposed Project is now 830,000 barrels per day. Based on these analytical results, operation of the proposed Project would be expected to cause slight increases in soil temperature 6 inches below the surface of 10 to 15 degrees Fahrenheit. However, this increase in temperature is not expected to have any significant effects to the surficial temperature of the soils, particularly during the growing season. Soil temperatures close to the pipeline (the depth to the bottom of the pipeline is, on average, between 7 and 8 feet below ground surface) could be as much as 40 degrees Fahrenheit warmer than the ambient surrounding soil temperature. See Sections 4.4, Wetlands, and 4.5, Terrestrial Vegetation, for corresponding effects on wetlands and vegetation due to soil temperature increases.

Fragile Soils in Southern South Dakota and in Northern Nebraska

To address concerns related to potential erosion in the fragile soil areas in southern South Dakota and northern Nebraska, specific construction, reclamation, and post-construction procedures have been developed, as described in the CMRP (see Appendix R, Construction/Reclamation Plans and Documentation, Sandy Prairie Construction/Reclamation Unit). This document provides a site-specific reclamation plan that itemizes construction, erosion control, and revegetation procedures in sandy prairie soil areas. The proposed Project ROW through this region would be monitored for several years to ensure that reclamation and revegetation efforts are successful. Any proposed Project areas where reclamation and revegetation efforts are initially unsuccessful would be re-evaluated and restored.

Potential Spills and Leaks

Impacts due to leaks or spills during operation of the proposed Project are addressed in Section 4.13, Potential Releases.

4.2.4 Recommended Additional Mitigation

The following sections list potential additional mitigation measures that are recommended and/or would be required based on input received from regulatory agencies and local experts.

4.2.4.1 Construction

A site-specific erosion control and revegetation plan for Montana should be prepared for agency approval prior to the start of construction (Montana Department of Environmental Quality [MDEQ]). Ripping of subsoils on Montana range and pasture lands should be performed if requested by the landowner or land management agency (MDEQ).

4.2.4.2 Operation

Ground patrols should be performed 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 4.13, Potential Releases, regular aerial patrols would occur and these patrols would look for evidence of differential settling or subsidence along the proposed Project route. Keystone has indicated that based on landowner concerns, additional ground-level inspections are not feasible due to potential disruption of normal land use activities (e.g., farming, animal grazing).

Proposed Project areas that have been revegetated would be attractive as cattle forage, and fencing of the ROW may be advisable. 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 (Wedin 2011). Keystone has agreed to inform landowners of this concern. As described previously, Keystone would work with landowners to evaluate fencing the ROW from livestock, or alternatively, provide compensation to rest a pasture until vegetation can become established.

Also as previously indicated, Keystone would monitor reclamation on the ROW for several years and repair erosion and reseed poorly revegetated areas as necessary. Additionally, based on comments received from NRCS, it is recommended that Keystone employ a method of assessment of soil productivity such as yield comparison between ROW and non-ROW areas.

4.2.5 Connected Actions

4.2.5.1 Bakken Marketlink Project

Construction and operation of the Bakken Marketlink Project would include an approximately 5-mile-long pipeline, 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. The Department reviewed aerial photographs of the Project area and confirmed the current use of the land. A site inspection by a Department 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 likely would be similar to those described above for the proposed Project in that area.

4.2.5.2 Big Bend to Witten 230-kV Transmission Line

The proposed Big Bend to Witten electrical lines would be a 230-kilovolt (kV) single circuit transmission line strung to a single-pole structure. The poles typically would be about 110-feet-high steel poles with wire span distances averaging 800 feet. The poles would be directly embedded into excavated holes to a depth of about 20 feet. All substation and switchyard work installation activities, including the placement of concrete foundations, erecting support structures, construction of control buildings, and the installation of electrical equipment would involve surficial land clearance and landscape leveling. Excess fill material would be spread throughout undeveloped areas within the substation sites.

Since the construction and operation of electrical distribution lines and substations would require minor disturbances to the landscape of the area, the impacts to the soils resources are expected to be negligible.

4.2.5.3 Electrical Distribution Lines and Substations

The proposed Project would require electrical service from local power providers for pump stations and other aboveground facilities in Montana, South Dakota, Nebraska, and Kansas. Most of the proposed new electrical lines to service pump stations would be 115-kV lines stung a single-pole and/or H-frame wood poles. The poles would be typically about 60 to 80 feet high with wire span distance of about 250 to 400 feet. 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.

Since the construction and operation of electrical lines and associated structures would require minor disturbances to the landscape of the area, the impacts to the soils resources are expected to be negligible.

4.2.6 References

Wedin, D. Pers. Comm. 2011. Teleconference with Professor Dave Wedin, University of Nebraska. June 29, 2011.

4.3 WATER RESOURCES

4.3.1 Introduction

This section describes potential impacts to water resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed major reroute in Nebraska and numerous minor (less than one mile) reroutes in Montana and South Dakota. The information that is provided here builds on the information provided in the Final EIS and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to water resources:

- A new section, Section 4.3.2 "Impact Assessment Methodology" was added to explain the assessment methodology used to evaluate potential water resources impacts associated with the proposed Project.
- Additional water resource datasets for both ground and surface water were used in South Dakota and Montana to supplement previous information to allow for a more detailed and accurate assessment of impacts to this resource;
- Ground and surface water data were collected and analyzed for the major new proposed routing in Nebraska in order to address water quality, flow, usage, and availability;
- The impacts of releases to ground water were assessed and included anticipated release assessment, response, and mitigation measures;
- Recommended proposed pipeline inspections and testing steps were developed that would supplement Keystone's process and procedures;
- Potential winter deicing impacts and criteria for mitigation were assessed;
- The activities and impacts associated with acquiring water from surface or ground water sources were assessed;
- The number and type of stream crossings and stream crossing methods have changed due to changes in the proposed Project route as well as updated field survey information provided by Keystone. The stream crossing assessment was comprised of a desktop analysis based on National Hydrologic Dataset (NHD) information and supplemented by Keystone field survey descriptions;
- Based on the limitations of the data used in the desktop analysis, the intermittent and ephemeral stream categories were combined and assessed as intermittent streams. Mitigation measures and construction best management practices (BMPs) were applied consistently to both stream types throughout this section;

- Surface water bodies which may be considered for potential hydrostatic test water sources along the proposed Project route were listed as provided by Keystone. Probable limitations on water withdrawal in over allocated basins were discussed; and
- Ancillary facilities with known locations that intersect state and federally designated or mapped floodplain areas or in some instances effective floodplain areas in Montana, South Dakota, and Nebraska were identified;
- Section 4.3.4 "Recommended Additional Mitigation" provides a list of additional mitigation measures to further reduce impacts to water resources.

Further discussion of impacts and potential mitigation measures related to potential petroleum releases from pipeline operation is provided in Section 4.13, Potential Releases.

4.3.2 Impact Assessment Methodology

4.3.2.1 Groundwater

The impacts of the proposed Project on groundwater quality may potentially occur as a result of two main categories of petroleum product releases: those from construction-related activities and those from operation-related activities. Note that the responses to releases to groundwater will be similar for the two categories, and will be scaled as appropriate based on the magnitude of the specific release. The volume of different petroleum release scenarios is based on the same volumetric divisions included in the spill impact assessment discussion in Section 4.13, Potential Releases. Potential releases from construction-related activities would be expected to be small (less than 2,100 gallons) to medium (2,100 gallons to 42,000 gallons) releases of refined petroleum products, such as motor fuel or lubricating oils, from vehicles or from bulk storage areas related to vehicle refueling and maintenance activities. Potential releases related to proposed Project operation also include these types of impacts, in addition to including releases of crude oil ranging from small (less than 2,100 gallons) to large (42,000 gallons to 840,000 gallons), which are the established release ranges evaluated in Section 4.13, Potential Releases. Note that the maximum planned storage capacity of refined petroleum products (motor fuels) on the Project during construction activities is 12,000 gallons.

Although refined petroleum products (e.g., gasoline, diesel, heating oil), as compared to crude oil, typically travel more readily in soils and groundwater due to their typically lower viscosity and higher soluble fractions, the general impacts from releases of both types of materials retain enough similarity that the effects of each will be discussed in a single narrative below. The relatively small scale of potential refined petroleum product releases related to the proposed Project also limits the utility of evaluating releases of refined products and crude oil separately within the scope of this document. Information from releases of both crude oil and refined petroleum products are included in the discussion of groundwater impact assessment.

As discussed in Section 4.13.3.4; Potential Releases, Spill Impact Assessment, Types of Spill Impact; most crude oils are more than 95 percent carbon and hydrogen, with small amounts of sulfur, nitrogen, oxygen, and traces of other elements. Crude oils contain lightweight straight-chained alkanes (e.g., hexane, heptane); cycloalkanes (e.g., cyclohexane); aromatics (e.g., benzene, toluene); cycloalkanes; and heavy aromatic hydrocarbons (e.g., polycyclic aromatic hydrocarbons, asphaltines). Straight-chained alkanes are more easily degraded in the environment than branched alkanes. Cycloalkanes are extremely resistant to biodegradation.

Aromatics (i.e., benzene, toluene, ethylbenzene, and xylene [BTEX] compounds) pose the most potential for toxic impacts because of their lower molecular weight, making them more soluble in water than alkanes and cycloalkanes. Refined petroleum products typically have variable concentrations of these more soluble compounds, with lighter fuel products such as gasoline containing as much as 35percent or greater BTEX, and heavier distillates used as lubricating oils having no significant BTEX fraction. In general, the higher the concentration of BTEX in the petroleum material, the greater the risk to groundwater quality related to a release of the material.

To evaluate the potential impacts to groundwater resources, regional aquifer information and well locations within 1 mile of the proposed Project were superimposed on the proposed pipeline route using Geographic Information System (GIS) software. Results of the evaluation of water resources and water use in the proposed Project area are included in Section 3.3.2; Water Resources, Groundwater. The potential impacts to groundwater resources from both construction and operation impacts from the proposed Project are discussed in Section 4.3.3.1, Groundwater. Medium to large spills would typically require greater than 3 years to attenuate or remediate, and, therefore, would be considered a long-term impact.

Additional groundwater-related impacts may also be related to increased local extraction of groundwater during construction and pipeline testing activities. Additional Project-related groundwater use, although temporary, would remove water from aquifers and could potentially decrease groundwater levels in extraction wells, depending on aquifer recharge characteristics.

4.3.2.2 Surface Water

The impacts of the proposed Project on surface water resources are separated into two categories: construction impacts and operations impacts. In many cases, potential impacts overlap between construction and operations. The impact assessment takes into account potential impacts to surface water resources by categorizing them into duration (temporary, short-term, long-term, and permanent) and describing mitigation measures to reduce or minimize impacts. Durations are described as follows:

- Temporary impacts would generally occur during construction, with the resources returning to preconstruction conditions almost immediately afterward;
- Short-term impacts would continue for approximately 3 years following construction;
- Long-term impacts would require more than 3 years to recover; and
- Permanent impacts would occur as a result of activities that modify resources to the extent that they would not return to preconstruction conditions during the life of the proposed Project.

In addition, the impact assessment calculated several different metrics and performed additional evaluations for surface waterbodies, including the following:

- Calculated the number of waterbodies and waterbody types crossed by the proposed pipeline route;
- Evaluated water quality classifications and impairments for the waterbodies crossed by the proposed pipeline route;
- Evaluated surface water supply sources within 1 mile of the proposed pipeline centerline;

- Calculated the number of mapped floodplains and the total width of mapped floodplains crossed by the proposed pipeline route; and
- Evaluated the same types of surface water resources and waterbody attributes (such as water quality classifications and impairments) impacted by proposed ancillary features such as access roads, pads, and work areas.

4.3.3 Potential Impacts

4.3.3.1 Groundwater

The impacts of the proposed Project on groundwater may potentially occur as a result of construction-related activities and operation-related activities. The volume of different petroleum release scenarios is based on the same volumetric divisions included in the spill impact assessment discussion in Section 4.13, Potential Releases. Potential small (less than 2,100 gallons) releases of petroleum products that could impact groundwater quality would be related to spills or leaks of refined petroleum products from equipment and vehicles. Small (less than 2,100 gallons) to medium (2,100 gallons to 42,000 gallons) refined petroleum product spills may also occur from tanks in material staging areas supporting equipment operation during the construction and operation phases. Medium to large (42,000 gallons to 840,000 gallons) spills of crude oil may occur during the proposed Project operation. Any petroleum releases from construction or operation could potentially impact groundwater where the overlying soils are permeable and the depth to groundwater is shallow. The factors influencing subsurface migration of a crude oil release that reaches groundwater are discussed in the following subsection.

There is potential for spills and releases from equipment maintenance areas, camps, horizontal directional drilling (HDD) locations, and pipeline placement areas. The size of those spills and releases would generally be small (< 5,000 gallons), as most equipment would be fueled by a tanker that would be staffed during operations. The Construction, Mitigation, and Reclamation Plan (CMRP) addresses actions to prevent spills and releases, and emergency response plans will be developed and training conducted, thereby reducing the potential impact to ground or surface water quality.

Keystone would conduct baseline water quality testing for domestic and livestock water wells within 300 feet of the centerline of the approved route, upon the request of individual landowners who provide access to perform the testing. These baseline samples would be collected prior to placing the pipeline in service. In the event of a significant spill, Keystone would conduct water well testing as required by the relevant regulation governing the location where the spill occurs. Keystone would also provide an alternate water supply for any well where water quality was found to be compromised by a spill.

Subsequent subsections present potential impacts to the aquifers beneath the proposed pipeline area resulting from the proposed Project construction and/or operation. Mitigation measures that would be put in place to avoid, minimize, and mitigate releases from pipeline operation are discussed in Section 4.13, Potential Releases.

Factors Affecting Subsurface Petroleum Migration and Groundwater Flow

The potential for, and dynamics of, crude oil or refined oil products migrating into groundwater, and subsequent fate and transport[1] in the groundwater as light non-aqueous phase liquid (LNAPL)[2] or as a dissolved-phase plume,[3] is determined by the several factors, including:

- The volume and areal extent of the petroleum release;
- The viscosity and density of the petroleum release;
- The permeability of unsaturated soils and aquifer characteristics within the area of the petroleum release;
- The depth to first groundwater; and
- Horizontal and vertical groundwater gradient and aquifer hydraulic conductivity including surface water and groundwater interconnections.

Release Volume and Extent

The volume and extent of a petroleum release typically affects whether or not the release will affect groundwater quality, and to what degree groundwater quality will be affected. Petroleum released to soils at the ground surface or in the subsurface will be absorbed to soil particles, which will limit the migration of the petroleum material downward to groundwater. In order for LNAPL to reach groundwater, the release must be large enough to overcome the natural absorption capacity of the soil through which it migrates. The measure of the maximum amount of petroleum material that a soil can absorb and immobilize is known as residual saturation. Typical petroleum residual saturation rates in clean sands range from approximately 5,833 milligrams of petroleum per kilogram of soil for light petroleum products, such as gasoline, to 20,382 to 42,618 milligrams per kilogram of soil for more viscous petroleum products, such as mineral oil (Brost and DeVaull 2000). Residual saturation rates for petroleum products typically increase as soil grain size decreases and viscosity of the petroleum product increases; higher residual saturation rates result in more contaminant mass immobilized within the soil.

Studies related to petroleum product releases from over 600 underground storage tank (UST) leaks indicate that potential surface and groundwater impacts from these releases are typically limited to the area within several hundred feet of the release site (American Petroleum Institute [API] 1998). The median length of groundwater plumes composed of soluble petroleum components (benzene, toluene, ethylbenzene, and xylenes) from these UST sites was 132 feet, and approximately 75 percent of these plumes were under 200 feet (API 1998). Although the petroleum products and release conditions at a crude oil pipeline are somewhat dissimilar from those at a typical UST, the contaminant distribution conditions in groundwater observed at UST sites would correlate to conditions expected from small to medium releases related to the proposed Project, especially for the potential releases of refined petroleum products associated

[1] Fate and transport: A term alluding to the manner in which a contaminant moves through an aquifer in groundwater, and how concentrations in groundwater are ultimately reduced over time and/or distance.
[2] Light non –aqueous phase liquid: A liquid that does not contain water (e.g., gasoline) that has a lower density than water, and will therefore float on a water surface.
[3] Dissolved-phase plume: The portion of a released material that becomes dissolved in groundwater and moves along the direction of groundwater flow.

with construction and maintenance activities and for smaller potential releases from pipeline operations.

As detailed in Section 4.13 Potential Releases, releases of different volumetric scales (small, medium, and large) of crude oil from the proposed Project were modeled to evaluate the expected extent of the dissolved-phase petroleum hydrocarbon plume in groundwater that would be expected to be associated with those releases. The release modeling assumed a sandy aquifer similar to many of the alluvial aquifers and of the Tertiary Northern Great Plains Aquifer System (NGPAS) and Northern High Plains Aquifer (NHPAQ) groups present along the proposed Project route. The model outputs indicate that releases of crude oil from the proposed Project ranging from small (2,100-gallon) to large (840,000 gallon) would result in axial lengths of the dissolved-phase petroleum hydrocarbon plumes ranging from 640 to 1,443 feet, respectively.

To further assess groundwater impacts related to a large-scale crude oil release into a coarse-grained, shallow, unconfined aquifer, studies of a 1979 pipeline release near Bemidji, Minnesota, were reviewed. Approximately 449,400 gallons (10,700 barrels) of crude oil were released onto a glacial outwash (alluvial) deposit consisting primarily of sand and gravel. The water table in the spill area ranged from near ground surface to approximately 35 feet below ground surface (bgs). As of 1996, the leading edge of the subsurface LNAPL plume had migrated approximately 131 feet downgradient from the spill site, and the leading edge of the dissolved contaminant plume had migrated approximately 650 feet downgradient from the spill site.

These studies of the UST sites and the Bemidji release, and the results of the petroleum release modeling completed as part of this study (Section 4.13, Potential Releases), indicate that the size of the oil release is a primary factor influencing the ultimate oil plume dimensions (including the dissolved-phase plume). While there are differences in the rate of oil movement through different soil types, hydrogeologic factors such as hydraulic conductivity and gradient—although important to understanding contaminant migration within an aquifer—are not as significant in determining ultimate plume length (API 1998). Based on a comparison of the UST site releases, the Bemidji release described above, and the release modeling effort completed as part of this study, the petroleum contaminant plume extent in groundwater is not directly proportional to the volume of petroleum product released, and that incremental increases in release volume typically result in incrementally smaller increases in the areal extent of impacted groundwater. For example, under the release model developed as part of this study (Section 4.13, Potential Releases), a release of 2,100 gallons (or 50 barrels) of crude oil resulted in a groundwater contaminant plume a maximum of 820 feet long, while a release of 840,000 gallons (or 20,000 barrels) that is 400 times as large resulted in a maximum plume length of 1,443 feet, or roughly twice as long as the plume related to the smaller release.

Viscosity and Density of Released Material

The dilbit crude oil that would typically be transported by the proposed pipeline would have a viscosity within the range of 52 to 96 centistokes at a temperature of 38 degrees Celsius (viscosity range of diluted bitumen, Imperial Oil 2002), a viscosity similar to that of corn syrup at room temperature. If the oil was released to the surrounding soils and groundwater, it would cool and the viscosity would increase significantly, with a resultant increase in resistance to flow. Viscosity would also increase somewhat under conditions where diluent material used to decrease the crude viscosity can volatilize to the atmosphere. The relatively high viscosity of the crude oil would not only retard the petroleum flow velocity within soil, but would also result in a

residual saturation condition in which small crude oil releases would essentially be immobilized as the petroleum cools and viscosity increases.

The high fluid viscosity and resultant resistance to flow in a compacted granular medium (soil) also suggests a higher likelihood that pipeline releases would preferentially migrate under pressure upward through the disturbed soils excavated during pipeline installation and discharge onto the ground surface, with relatively less crude oil infiltrating under gravity deeper into soil toward groundwater.

The crude oil transported within the proposed pipeline is anticipated to have a specific gravity of less than 1 and would be considered an LNAPL. Therefore, potential product releases from the proposed pipeline that migrate to groundwater would preferentially float on the groundwater surface as LNAPL.

Soil and Bedrock Permeability

Permeability of soils and aquifer materials also affects transport of LNAPL and dissolved-phase contaminants from petroleum releases to and within groundwater. Shallow unconfined aquifers are commonly overlain by permeable materials and therefore are at risk if the overlying soils are contaminated.

Many petroleum fractions, including BTEX, are present in bituminous crude oil and associated diluents. These fractions can be transported to groundwater by dissolved-phase[4] transport, either by direct contact of groundwater with LNAPL or by infiltration of precipitation and surface water through petroleum-contaminated soil and into groundwater. Once the dissolved-phase petroleum is in groundwater, the material typically flows within the aquifer at a velocity somewhat less than the groundwater flow, as the dissolved-phase petroleum is subject to absorption to soil particles (in a similar manner as described above regarding migrations through soils above the water table) and degradation by naturally occurring bacteria in the aquifer. The LNAPL typically migrates in the direction of groundwater flow at a rate that varies with product viscosity; more viscous materials (such as heavy crude oil) migrate significantly slower than the groundwater flow.

Downward and, less commonly, horizontal migration of contaminants in unsaturated sediments and within aquifers is commonly attenuated by confining layers or zones of finer-grained, lower permeability sediment. Flow through these units is typically very slow or absent. Confining layers are commonly present between aquifer units, and can also be present within aquifers. For example, the Ogallala Formation of the NHPAQ contains many layers of volcanic ash that are much finer than the aquifer materials above and below them; the ash layers typically function as intra-aquifer confining layers. Additionally, glacial till and silty and clayey layers in alluvial aquifers typically form confining layers in those otherwise coarse-grained units.

Depth to Groundwater

Depth to groundwater would also factor into the travel time of petroleum from the point of release to groundwater. Where groundwater is relatively shallow, contaminants can reach groundwater more quickly than in areas where groundwater is deeper, given similar soil types.

[4] Dissolved-phase plume: The portion of a released material that becomes dissolved in groundwater and moves along the direction of groundwater flow.

Where groundwater is in contact with the proposed pipeline, releases from the pipeline would immediately impact groundwater quality nearest to the release.

Aquifer Gradients and Hydraulic Conductivity

Groundwater flow gradient and hydraulic conductivity of the aquifer materials affect the migration rates of LNAPL and dissolved-phase petroleum products in groundwater. Gradient is a function of potentiometric differential, or, in other words, the tendency of water to flow from areas of higher pressure or elevation to areas of lower pressure or elevation. Hydraulic conductivity is a measure of the ability of the fractured or porous aquifer media to transmit fluid; typically, the smaller the grain size of the aquifer material, the lower the hydraulic conductivity. The groundwater flow velocity in an aquifer is the product of the gradient and the hydraulic conductivity, so the higher the gradient and hydraulic conductivity of an aquifer, the higher the velocity of fluid flow through the aquifer.

As an example, the shallow water-bearing zones in the NHPAQ in eastern Nebraska have an average horizontal flow velocity of about 0.1 foot per day (ft/d) based on an observed gradient of 0.002 (Bleed and Flowerday 1998) and a maximum hydraulic conductivity of 50 ft/d (Gutentag et al. 1984). For the Bemidji release mentioned above, estimates of the aquifer soil hydraulic conductivity ranged from 1.25 to 152 ft/d (Strobel et al. 1998). The hydraulic conductivity reported for the shallow water-bearing zones of the NHPAQ system are within this range.

Vertical flow within and between aquifers is also important to consider when evaluating contaminant migration, and is driven by pressure differentials within and between water-bearing units. For example, vertical groundwater flow between the water-bearing units in the NGPAS within the proposed pipeline area is typically upward, while groundwater flow from the Ogallala Formation is downward in areas where the underlying aquitards (e.g., the Pierre Shale) are absent. Vertical flow velocities are typically at least an order of magnitude less than horizontal flow velocities in aquifer systems.

Aquifer-Specific Contamination Risk Evaluation

Based on the release and migration dynamics of refined petroleum products and crude oil in the subsurface as discussed above, the potential risk and likely magnitude of potential impacts to groundwater quality in each of the aquifers and aquifer groups along the proposed pipeline area in Montana, South Dakota, and Nebraska are evaluated in the following subsections. The final subsection provides an overview of the presence of shallow groundwater in the proposed Project vicinity, as well as water wells reported within one mile of the proposed Project.

Potential groundwater impacts related to the two proposed pump stations in Kansas include releases of refined petroleum products during construction and operation of the pump stations and/or releases of crude oil from the proposed pipeline during Project operation. The extent of groundwater impacts would be dependent on the volume and extent of releases, depth to groundwater, soil characteristics, location of operating water supply wells that would influence hydraulic gradients, aquifer characteristics (e.g., hydraulic conductivity, transmissivity, storativity), and whether the releases reach surface water since groundwater is typically interconnected with surface waterbodies.

Potential groundwater impacts related to construction and operation of the proposed pipe yard in Bowman County, North Dakota would be related to releases of refined petroleum products used

as vehicle fuels and lubricants. These releases would typically be relatively small in volume and downward migration of the petroleum compounds through the soil to groundwater would be minimal based on the depth to groundwater and the fine-grained shale and coal intervals of the Fort Union Formation which would tend to slow and/or prevent downward migration. There is a low potential for groundwater impacts depending on the volume and extent of the release. The extent of groundwater impacts for releases that reach groundwater at each of the South Dakota and Kansas locales would be influenced by the same characteristics and parameters discussed in this section.

Alluvial Aquifers and Northern High Plains Aquifer

Alluvial aquifers and the NHPAQ represent the most commonly used sources of groundwater in the proposed pipeline area. Many private and public wells extract groundwater from these aquifers, including those in several Source Water Protection Areas (SWPAs) in the proposed pipeline area. Compared to the other aquifers in the region (Great Plains Aquifer [GPA], Western Interior Plains Aquifer [WIPA], and NGPAS), these aquifers also are typically at highest risk of contamination from the proposed Project construction and operation because of the relatively shallow depth of water tables in the alluvial and NHPAQ aquifers (commonly less than 50 feet) and the relatively high permeability of the aquifers and overlying material. The combination of an extensive groundwater-use profile and high sensitivity to releases from the proposed pipeline area make these aquifers particularly sensitive to potential releases.

No information regarding conditions related to large-scale petroleum releases was readily accessible for the alluvial aquifers or NHPAQ along the proposed pipeline area; however, the crude oil release in Bemidji, Minnesota, previously discussed, occurred in an environment similar to the NHPAQ and alluvial aquifers. At that location, approximately 20 years after the release, the leading edge of the LNAPL oil remaining in the subsurface at the water table had moved approximately 131 feet downgradient from the spill site, and the leading edge of the dissolved contaminant plume had moved about 650 feet downgradient.

Although the subsurface conditions in the NHPAQ or alluvial aquifers as compared to the Bemidji spill site are not identical, the aquifers exhibit similar characteristics that affect groundwater flow and contaminant transport. The Bemidji site provides a reasonable physical model to establish expectations for the behavior of crude oil released in the NHPAQ system and alluvial aquifers. The Bemidji site studies and information from many other petroleum releases in similar conditions suggest that a spill of similar magnitude in the NHPAQ and alluvial aquifer systems would remain localized to a similar extent as the Bemidji plume.

The results of an evaluation of the Bemidji release and other petroleum releases indicate that the dissolved-phase petroleum contaminant plume from a large-scale release that reaches groundwater in the NHPAQ and alluvial aquifers could be expected to affect groundwater quality up to several hundred feet downgradient of the release source. The LNAPL plume, if any, could be expected to affect a significantly smaller distance downgradient of the release. Downward vertical migration may occur, but the lower specific gravity of petroleum material limits the downward migration of contaminants under all but the most robust vertical gradient conditions in aquifers. Even under such conditions in which groundwater flow to deeper aquifers occurs, similar attenuation to contaminant flow would be expected as with the shallower aquifer, and lateral extent of the petroleum contaminants within the deeper aquifer would typically be similar in magnitude to those described for shallow aquifer distribution.

The presence of the high nitrate concentrations common in the shallow groundwater of the NHPAQ and alluvial aquifers in Nebraska may promote degradation of some portion of petroleum mass released into groundwater. Nitrate in groundwater typically encourages biologic degradation of dissolved-phase petroleum hydrocarbons in groundwater.

Aquifer conditions in the NHPAQ in the proposed Project area indicate that recharge to shallow groundwater is typically from local precipitation and surface water, and shallow groundwater generally discharges to local surface water bodies. Recharge of shallow groundwater in this area typically does not come from deeper aquifer units or from horizontal flow across long distances. Therefore, petroleum releases from the proposed Project would not be expected to affect groundwater quality within recharge areas that provide a source of groundwater to large portions of the NHPAQ or associated alluvial aquifers.

Great Plains Aquifer

Across most of the proposed pipeline area where the GPA is present, it is very unlikely that any releases from the proposed pipeline would affect groundwater quality in the aquifer because the aquifer is typically deeply buried beneath younger, water-bearing sediments and/or aquitard units.

Near the proposed pipeline area in southern Nebraska, where the aquifer is closer to the surface and contains groundwater with low salinity, the GPA is typically overlain by water-bearing sediments of the NHPAQ and alluvial aquifers. Water quality in the GPA could be affected by releases in this area, but only under conditions of a strong downward gradient in the overlying aquifer units. Although a significant downward, vertical gradient is observed between the GPA and overlying aquifers across much of Nebraska, downward gradients in the proposed pipeline area in southern Nebraska are minimal or absent. Given the expected scale, characteristics, and behavior of potential petroleum releases related to the proposed pipeline, it is very unlikely that the proposed pipeline area could affect water quality in the GPA.

Western Interior Plains Aquifer

There is extremely low probability that a release from the proposed pipeline area would affect water quality in the WIPA, given the relative typical depth of the WIPA of several hundreds of feet across the proposed Project area.

Northern Great Plains Aquifer System

After the NHPAQ and alluvial aquifers, the NGPAS represents the third most commonly used groundwater resource in the proposed pipeline area. Hydrogeologic conditions within the NGPAS are relatively complex, with several different aquifer and confining units present; however, within the proposed pipeline area, usable groundwater is typically limited to the Tertiary and Late Cretaceous formations within the aquifer group. The upward groundwater gradient across the NGPAS indicates that only those aquifer portions near the ground surface would be susceptible to water quality impacts from potential releases from the proposed pipeline area.

If a release impacts NGPAS aquifer system water quality, similar fate and transport of the petroleum products as those described for the NHPAQ and alluvial aquifers would be expected. Based on available information, the downgradient extent of groundwater impacts related to a

large-scale release would typically be limited to several hundred feet of the release source, similar in scale to that expected from a large-scale release to the NHPAQ or alluvial aquifers.

Shallow aquifer conditions in the NGPAS in the proposed pipeline area indicate that recharge to shallow groundwater is typically a mixture of local precipitation and surface water and water moving upward from lower aquifers under an upward gradient; therefore, it is not expected that petroleum releases would affect groundwater within areas that provide groundwater recharge to large portions of the NGPAS.

Shallow Groundwater and Water Wells

Table 3.3-1 provides a summary of those areas where water-bearing zones are within 50 feet of the ground surface in the proposed pipeline area. These areas are typically found within alluvial aquifers along streams and rivers, within the Ogallala Formation in southern South Dakota and Nebraska, and within the overlying Nebraska Department of Environmental Quality- [NDEQ-] identified Sand Hills Unit alluvium in Nebraska. A summary of known and potential groundwater use along the proposed Project for each state is as follows:

- In Montana, a total of 326 wells are present within one mile of the proposed Project. No public water supply (PWS) wells or SWPA are located within this area. A total of six private water wells are located within approximately 100 feet of the proposed pipeline area within McCone, Dawson, Prairie, and Fallon counties.
- In South Dakota, a total of 87 wells are present within 1 mile of the proposed Project in South Dakota. One PWS well (associated with the Colome SWPA) is identified within 1 mile of the proposed pipeline in Tripp County. This PWS well is screened at a relatively shallow depth (reportedly less than 54 feet bgs) within the Tertiary Ogallala Formation. The proposed pipeline area would pass through the Colome SWPA in Tripp County. No private water wells are located within approximately 100 feet of the proposed pipeline area in South Dakota.
- In Nebraska, a total of 2,124 wells are present within 1 mile of the proposed pipeline in Nebraska. A total of 38 known PWS wells are present within 1 mile of the proposed pipeline in Boone, York, Fillmore, Saline, and Jefferson counties. The nine SWPAs within 1 mile of the proposed pipeline area include those for the towns of St. Edward, Bradshaw, York, McCool Junction, Exeter, Western, Jansen, and Steele City, and the Rock Creek State Park. The only SWPA traversed by the proposed pipeline area in Nebraska is in Steele City, Jefferson County. A total of 14 private water wells are located within approximately 100 feet of the proposed pipeline area within Antelope, Polk, York, Fillmore, and Jefferson counties.

If a potential release from the proposed pipeline would impact groundwater wells, Keystone would be required to contact the appropriate regulatory authorities and determine agency requirements for the most appropriate course of action necessary including response actions such as well abandonment, provision of alternate water supplies, and site remediation. Further, if during construction or operation activities an unregistered well is found, Keystone would provide the landowner with technical assistance to register the well.

Groundwater Extraction Effects

Construction of the Project would require use of water for activities such as dust control, directional drilling, and hydrostatic testing of the pipeline. It is likely that at least some of the

water used for construction would be generated from existing groundwater resources local to the Project. Since the Project construction effort would be of relatively short duration, it is unlikely that groundwater extraction related to the Project would affect long-term water levels in any significant aquifer units along the route.

4.3.3.2 Surface Water

The proposed Project would affect waterbodies across the states of Montana, South Dakota, and Nebraska. Potential impacts to water features classified as either open water or riverine are addressed in Section 4.4, Wetlands. Pipeline construction and operational infrastructure in KS and ND would be utilized and upgraded to support the proposed Project. These locations present no unique impacts to the proposed project.

Generally speaking, the proposed Project route has been selected and modified to minimize the potential for impacts to surface water resources, as well as other sensitive environments, by avoiding them whenever possible and shifting the route to limit the area affected. There are a number of waterbodies that would be crossed by the proposed pipeline where mitigation measures would be used to reduce or minimize impacts as described in later sections. Table 4.3-1 presents a summary of potential impacts to surface water resources by state.

Table 4.3-1 Summary of Impacts to Surface Water Resources by State[a]

	Montana	South Dakota	Nebraska
Total Waterbodies Crossed	459	333	281
Perennial Waterbodies Crossed	9	16	31
Intermittent Waterbodies Crossed	424	313	237
Other Waterbodies Crossed	26	4	13
Waterbodies with State Use Classifications	15	10	40
Waterbodies with Impairments	9	5	10
Mapped Floodplains	12	4	74
Total Width of Mapped Floodplains (miles)	6.2	1.7	16.2

Source: Please refer to data tables in Section 3.3, Water Resources.

[a] The summary numbers in this table are for waterbodies and surface water resources that the proposed pipeline would cross.

Construction-Related Impacts

Construction activities could result in the following potential impacts on surface water and groundwater resources:

- Temporary increases in total suspended solids concentrations and increased sedimentation during stream crossings or at upland locations with soil erosion and transport to streams.
- Temporary to long-term changes in channel morphology and stability caused by channel and bank modifications.
- Temporary to long-term decrease in bank stability and resultant increase in total suspended solids concentrations from bank erosion as vegetation removed from banks during construction is re-establishing.

- Temporary reductions in stream flow and potential other adverse effects during hydrostatic testing activities and stream crossing construction.
- Impacts to surface water resources associated with hazardous liquids spills and leaks. See Section 4.13, Potential Releases.
- Removal of some wells within or near the right-of-way. The removal would need to be coordinated with, and approved by the owners.
- Dewatering where groundwater is less than the burial depth of the pipe (typically 4 to 7 feet) during pipe-laying activities. Dewatering through a wee system or in the excavation could generate substantial localized amounts of water to be discharged. The withdrawal and discharge would need to be permitted, monitored, and performed in a manner that has the least impact on the environment.
- Pipeline trench potentially acting as a conduit for groundwater migration and/or as a barrier to near-surface flow in areas of shallow groundwater (<7 feet bgs). While the near-surface geology is generally rather transmissive, excavating and backfilling for the pipeline may increase groundwater flow along the pipeline. Construction techniques can be employed to impede changed groundwater flow patterns. In addition, the pipe can also act as a barrier for near-surface flow down to the bottom of the pipe. Groundwater would accumulate against the pipe or more likely flow under the pipe assuming that similar geology exists all around the pipe. Impacts from these processes are believed to be minor.
- The proposed pipe in direct continuous or intermittent contact with groundwater in shallow water settings. The proposed pipeline would be designed, built, and installed using steel with protective coatings, cathodic protection, and other features to inhibit pipe degradation. Oils, grease, and other foreign materials used during manufacturing or installation would need to be removed prior to operation.
- Construction water uses, construction camp potable water, and pipeline testing related withdrawals from groundwater or surface waterbodies.

Stream Crossings and In-Stream Construction Activities

Depending on the type of stream crossing, one of six construction methods would be used: non-flowing open-cut, flowing open-cut, dry flume, dry dam-and-pump, HDD, or horizontal bore crossing. As required by the Montana Department of Environmental Quality (MDEQ) for Nationwide Permits, water must be diverted, pumped or flumed around the trench at pipeline crossings where water is present. Therefore, the non-flowing open-cut and flowing open-cut crossing methods may not meet the Section 401 requirements of the MDEQ for Nationwide Permits. For Standard Permits, separate Section 401 verification from the MDEQ would be required. Trenches through water bodies that are dry or contain non-moving water at the time of crossing would not be left open for more than 24 hours, except in extenuating circumstances, to reduce sediment discharge from a sudden storm event resulting in runoff. This commitment would not apply where excavation of rock by blasting or mechanical means may be required in the water body. More detailed descriptions of each crossing method and measures to reduce impacts associated with each method are provided in the CMRP (Appendix G) and in the Project Description (Chapter 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. Permitting requirement will vary based on crossing method, designated waterbody use and regulatory jurisdiction. For crossings of Section 10 navigable waters in Montana (Yellowstone and Missouri Rivers); scour depth calculations will be required to show the maximum expected depth of scour at those locations. This evaluation must include the expected depth of scour of the riverbed for a range of flows, including very high flows such as the 100-year and 500-year flows. 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. The HDD method would be used to cross 15 major and sensitive waterbodies (see Section 3.3, Water Resources for a listing of specific crossings). The river crossing procedures and measures to reduce impacts included in the CMRP would be implemented. For waterbody crossings where HDD would be used, disturbance to the channel bed and banks would be avoided. In some instances, the pressurized fluids and drilling lubricants used in the HDD process may escape the active bore, migrate through the soils, and come to the surface at or near the construction site, an event commonly known as a frac-out. Make-up water for the drilling fluids can be extracted from local surface waterbodies, imported from more distant sources, or extracted from groundwater wells near the HDD crossing. This would be a temporary and limited use of these water resources.

There is potential for groundwater mixing between two aquifers. However, this would be minimized by the drilling fluids and muds that would seal the pipe in place. Measures identified in a contingency plan would be implemented including monitoring of the directional drill, monitoring downstream for evidence of drilling fluids, and mitigation measures to address a frac-out should one occur.

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 (see Appendix G, CMRP). Prior to commencing any stream-crossing construction activities, at a minimum, permits would be required under Section 404 of the Clean Water Act through the U.S. Army Corps of Engineers (USACE), and Section 401 Water Quality Certification, per state regulations. These agencies could require measures to limit unnecessary impacts such as requiring all the non-HDD crossings to be constructed during dry conditions.

In order to minimize HDD impacts, the U.S. Department of the Interior (DOI) has specific requirements, recommendations, and comments related HDD activities used to cross above National Wild and Scenic River segments or tributary rivers and streams of a designated river and the associated floodplain areas (DOI 2012).

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 and implemented.
- Sensitive/Protected Waterbodies—If required, specific construction and crossing methods would be developed in conjunction with USACE and U.S. Fish and Wildlife Service

consultation. The appropriate method of crossing these waterbodies would be determined by the USACE or U.S. Fish and Wildlife Service, as applicable.

- HDD Crossings—A frac-out contingency 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 CMRP (Appendix G) 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 CMRP 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 Chapter 2.0 and the CMRP 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. These crossings would be designed and constructed to provide unimpeded fish and aquatic organism passage during the timeframe the crossing is in place.

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 CMRP 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.

The pipeline would be installed at the design crossing depth for at least 15 feet beyond the design lateral migration zone, with design width and depths determined by qualified personnel. 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. 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 Clean Water Act would include additional site-specific conditions as determined by USACE and appropriate state regulatory authorities.

The National Hydrography Dataset (U.S. Geological Survey [USGS] 2012) indicates that three proposed pump stations (Pump Station 9 in Phillips County, Montana, Pump Station 10 in Valley County, Montana, and Pump Station 20 in Tripp County, South Dakota) would be constructed over unnamed intermittent streams. However, field surveys indicated Pump Station 9 is located in tilled crop land and was not in an intermittent stream. Further, as the location and design for Pump Station 24 in Nebraska is finalized, Keystone will develop an access plan for this pump station given its location near the Loup River that takes into account access issues during flood conditions.

Hydrostatic Testing and Water Withdrawals

Water hydrostatic testing is performed to expose defective materials or welds that have missed prior detection, expose possible leaks, and serve as a final validation of the integrity of the constructed system. A hydrostatic test is conducted on individual segments of pipeline prior to completion. Buried high-pressure oil pipelines are tested for strength by pressurizing them to at least 125 percent of their maximum operating pressure at any point along their length with water drawn from local water sources. Water used for hydrostatic testing would be obtained from nearby surface water resources, groundwater, or municipal sources. These sources include streams, rivers, privately owned reservoirs, and private or public wells.

Table 4.3-2 lists the surface water bodies which may be considered for potential hydrostatic test water sources along the project route as provided by Keystone. The proposed Project CMRP Section 8 (Appendix G) specifies the applicant's committed actions for securing pipeline hydrostatic test water. The Federal Energy Regulatory Commission (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.

Table 4.3-2 Potential Hydrostatic Test Water Sources along the Project Route[a, b, c, d]

County	Approximate Milepost	Waterbody Name	Maximum Water Withdrawal (million gallons)
Montana			
Phillips	25.4	Frenchman Creek	32
Valley	83.4	Milk River	32
Valley/McCone	89.2 to 89.3	Missouri River	55
Dawson	196.4	Yellowstone River	55
South Dakota			
Harding	295.1	Little Missouri River	27
Harding	315	Gardner Lake	67
Perkins	360.97	North Fork Moreau River	36
Meade	429.9	Cheyenne River	35
Haakon	486	Bad River	22
Tripp	541.3	White River	39
Nebraska[e]			
Boyd	618.1	Keya Paha River	37
Holt	626.1	Niobrara River	37
Antelope	713.3	Elk Horn River	37

County	Approximate Milepost	Waterbody Name	Maximum Water Withdrawal (million gallons)
Nance	761.7	Loup River	37
Polk	775.2	Platte river	47

[a] These volumes are estimated at this time. Final volumes will be included in appropriate water use permits for each state. At that time, the state permitting agency will determine which rivers can be used, if they approve the volume, and any permitting conditions associated with the withdrawals. Water will be used for hydrostatic test water, drilling mud for HDD operations, and dust control.
[b] Additional water sources will be needed for dust control. These additional sources will require lower volumes (up to 6 million gallons on average). Dust control sources would be permitted in accordance with state permit requirements and could include existing irrigation wells.
[c] Ground water sources (irrigation wells) may be used for water sources instead of the rivers listed below. These water sources and the volumes to be used would be purchased from landowners and would be permitted in accordance with state requirements.
[d] These water volumes would be required for both years of construction.
[e] Additional water would be withdrawn from irrigation wells in several counties crossed by the project for approximately 55,000,000 gallons of water for dust control, hydrostatic testing, and HDD operations.

In an effort to avoid or minimize impacts to sensitive waterbodies, detailed consultation with the USFWS and Natural Resource Conservation Service (NRCS) would be done during the permitting phases when planning stream crossings in already depleted and drought prone watersheds.

During droughts, surface water withdrawal permits from larger rivers with existing water rights would be regulated by state regulatory agencies to preserve existing water rights and environmental requirements. If inadequate water is available from rivers, Keystone would use alternative water sources nearby such as local private wells or municipal sources for HDD operations, hydrostatic testing the mainline, and dust control during these dry conditions. Keystone has indicated that in the event surface water is unavailable, groundwater would be used for HDD operations, hydrostatic testing, and dust control. Water would be purchased from nearby willing sellers with available water rights and would not increase overall groundwater use.

The U.S. Fish and Wildlife Service (USFWS) has expressed concerns about any water withdrawals from the Platte River. They were requested to provide informal Section 7 consultation and technical assistance for the Project. In their response letter dated September 4, 2012 (FWS NE: 2013-013) from Michael D. George to K. Nicole Gibson, Ph.D., they state: “Since 1978, the USFWS has concluded in all of its Section 7 consultations on water projects in the Platte River basin that the Platte River ecosystem is in a state of jeopardy, and any federal action resulting in a water depletion to the Platte River System will further or continue the deterioration of the stressed habitat conditions.” They go on the say that any depletion of flows, either direct or indirect, from the Platte River System would be considered significant and they consider the river and associated wetland habitats to be “resources of national and international importance.” To mitigate any impacts to the Platte River ecosystem, Keystone would coordinate with the USFWS before any water withdrawals.

Withdrawals from impaired or contaminated waterbodies would be avoided and only used if approved as a water source. All surface water resources used 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 used for hydrostatic testing without receipt of applicable permits. As stated in the proposed Project CMRP Section 8.2 (Appendix G), required

water analyses would be obtained prior to obtaining any water for filling or any discharging operations associated with hydrostatic testing.

The water withdrawal methods described in the proposed Project CMRP 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 hydrostatic test water, and avoiding discharging any hydrostatic test water that contains visible oil or sheen (from pipe or equipment) following testing activities. As a standard procedure and as part of its water withdrawal and discharge permits, Keystone would identify water rights that could be affected by temporary interruptions of water flow. Keystone would also abide by mitigation measures outlined in applicable water withdrawal and discharge permits to protect sensitive receptors, such as fisheries.

Hydrostatic test water would be discharged 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 for water quality prior to release in the environment to ensure it meets applicable water quality standards imposed by the discharge permits for the permitted discharge locations. Where hydrostatic test water does not meet standards for discharge proper, treatment or disposal is required. The proposed Project CMRP 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.

4.3.3.3 Operational-Related Impacts

Surface water impacts associated with potential crude oil releases from pipeline operation are addressed in Section 4.13, Potential Releases.

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 CMRP (Appendix G), 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 regrading 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 proposed 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 and 4.13, Potential Releases.

The measures to protect water resources during operations are specified in the CMRP, (Appendix G). In South Dakota, the water protection conditions that were developed by the South Dakota Public Utility Commission as part of its Amended Final Decision and Order (Notice of Entry HP09-001) would be implemented.

4.3.3.4 Floodplains

The proposed pipeline would cross mapped and unmapped floodplains in Montana, South Dakota, and Nebraska. The proposed pipeline would be constructed under many river channels with potential for vertical and lateral scour. In floodplain areas adjacent to waterbodies, the contours would be restored to as close to previously existing contours as practical and the disturbed area would be revegetated during construction in accordance with the CMRP (Appendix G). Therefore, after construction, the proposed pipeline would not obstruct flows over designated floodplains, resulting in only minor changes to topography, and thus would not affect local flood dynamics or flood elevations.

Ancillary features, such as pump stations, mainline valves, and access roads in mapped and unmapped floodplain areas would be assessed prior to permitting and designed to minimize impacts to floodplains. These facilities would be constructed after consultation with the appropriate county agencies to ensure the design meets county requirements and to obtain the necessary permits associated with construction in the 100-year floodplain zones. Table 4.3-3 shows the infrastructure in mapped floodplains.

Table 4.3-3 Ancillary Facilities Crossing Designated Floodplain Areas for the Proposed Pipeline Route

State	County	Approximate Project ROW Milepost[a]	Waterbody Associated with Floodplain[b,]	Facility Type[c]	ID (or HDD #)	ID	ID
MT	Valley	59.89 - 59.91	Spring Creek	Access Roads	CAR-084	CAR-225	
MT	Valley	61.74 - 61.75	Morgan Creek	Transmission Line	PS 10		
MT	Valley	65.90 - 66.20	Cherry Creek	Transmission Line	PS 10		
MT	Valley	71.70 - 71.90	East Fork Cherry Creek	Transmission Line	PS 10		
MT	Valley	83.20 - 85.50	Milk River	Access Roads	CAR-120	CAR-122	CAR-123
				Transmission Line	PS 10		
MT	Valley & McCone	89.10 - 90.70	Missouri River	Access Roads	CAR-124	CAR-125	
				HDD portals	2		
MT	McCone	148.23 - 148.78	Redwater River	Transmission Line	PS-12		

State	County	Approximate Project ROW Milepost[a]	Waterbody Associated with Floodplain[b,]	Facility Type[c]	ID (or HDD #)	ID	ID
MT	Dawson	197.24 - 198.17	Yellowstone River	Access Roads	CAR-127	CAR-292	
				HDD portal	1		
				Valve	MLV-10		
				Other	PY-07 SITE 4		
SD	Harding	294.8 - 295.0	Little Missouri River	HDD portal	1		
				Transmission Line	PS 15		
SD	Haakon	485.9 - 486.0	Bad River	Transmission Line	PS 19		
SD	Lyman & Tripp	541.0 - 541.7	White River	Access Roads	CAR-080	CAR-237	
				HDD portal	1		
NE	Boyd	617.85 - 618.18	Meglin Cr	Access Road	CAR-306		
NE	Boyd	617.85 - 618.18	Unnamed Tributary to Keya Paha River	Access Road	CAR-306		
NE	Boyd	617.85 - 618.18	Keya Paha River	Access Road	CAR-307		
				HDD portal	1		
NE	Boyd	625.81 - 626.09	Niobrara	HDD portal	1		
NE	Antelope	712.77 - 713.52	Elkhorn River	Access Roads	CAR-253	CAR-286	
				HDD portal	1		
NE	Nance	761.13 - 762.36	Loup River	Access Roads	CAR-264	CAR-268	
				HDD portals	2		
NE	Polk	775.09 - 775.68	Platte River	HDD portal	1		
NE	York	801.12 - 801.8	Unnamed Tributary to Beaver Creek	Access Road	CAR-274	CAR-218	
NE	Saline	838.35 - 838.40	Unnamed Tributary to North Fork Swan Creek	Access Road	CAR-280		

[a] Ancillary facilities floodplain crossings are listed by the Project Milepost numbers and are not necessarily adjacent to the project ROW at that milepost.
[b] Ancillary facilities may cross unmapped floodplain areas.
[c] Additional ancillary facility floodplain crossings may be incurred when final route adjustments are made.

4.3.4 Recommended Additional Mitigation

The following mitigation measures are recommended in addition to those proposed or planned by the applicant:

- Taking into account the concerns expressed by U.S. Environmental Protection Agency (USEPA) and other commenters on the prior National Environmental Policy Act documents for this project, the Department in consultation with the Pipeline Hazardous Materials Safety

Administration (PHMSA) and USEPA, 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. The Department in consultation with PHMSA and USEPA 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. This analysis was begun but not completed because the previous application was denied in January 2012. If Nebraska approves a route through the state the report would be completed taking into account that approved route. After completion and review of the engineering analysis, the Department with concurrence from PHMSA and USEPA would determine the need for any additional mitigation measures.

- USEPA and other previous commenters have 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 (ROW) 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 the Department 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, the Department, in consultation with PHMSA and USEPA, determined that if the proposed Project were permitted, it would be advisable for the applicant to conduct ground 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 Supervisory Control and Data Acquisition leak detection system and landowner reports. Keystone has agreed to incorporate into its operations and maintenance plan a requirement to conduct ground 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 or adjacent to sensitive regions. 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. Overuse can cause potential localized degradation of groundwater quality where groundwater is near the surface. Usage should be proactively managed and monitored. Part 2.14 of the Revised CMRP 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 NDEQ. This approach will be revised for the Final SEIS based on updated NDEQ requirements for sensitive areas as necessary.
- This project could require authorization under the NDEQ National Pollutant Discharge Elimination System Construction Storm Water General Permit. Conditions of this permit may require modifications to the stabilization of disturbed ground as discussed within the CMRP. Namely, the Construction Storm Water General Permit requires that ground which will be inactive for 14 days be stabilized (either permanent or temporary stabilization), assuming NPDES permit conditions would supersede any state-level regulation that is less stringent.
- An assessment of the streambed and bank forms at waterbody crossings would be done during the permitting and design phase; adding this analysis should 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 proposed pipeline would be installed as necessary to address any hazards identified by the assessment.
- For any waterbody crossings that utilize HDD or any other bore method, it is recommended that the bore entrance and exit points be located entirely outside of the channel migration zone (CMZ), and that the pipeline be constructed sufficiently below the maximum design scour depth for the entire CMZ width to prevent unexpected pipeline exposure during channel migration events. In addition, other permanent features such as access roads or construction pads should also be placed outside the areal extent of the 100-year CMZ. Many of the rivers in the proposed Project ROW are unstable with high sediment supply systems with dynamic active channel(s), depositional bars and active bank margins. Some of the larger rivers crossed by the proposed Project, such as the Yellowstone and Missouri Rivers in Montana; or the Platte River, Loup River, and Prairie Creek in Nebraska, are all drainage systems capable of substantial lateral channel migration, bank retreat, and subsequent re-activation of historic floodplains and channels during the life of the proposed Project. All states affected by the proposed Project are prone to ice jams on their major rivers, which often cause substantial backwatering and lateral scour. CMZs are defined by the corridor that each river is expected to occupy over a given timeframe and are based on physical geomorphic parameters and local geologic control. As an example, CMZs for the Yellowstone River in Montana have been mapped (Yellowstone River Conservation District Council 2009) as part of an effort by state and federal agencies to provide additional

information for minimizing impacts to major surface water and natural resources, including avoidance of poor development decisions and subsequent damage or loss of infrastructure and property.

- Culvert design and construction should be done to ensure unimpeded fish and aquatic organism passage during the lifetime of the proposed Project for all road-stream crossings over fish-bearing streams. There are many recent and reliable engineering manuals that provide methods for designing and constructing fish friendly road-stream crossings. These methods should be followed when road-stream crossings on fish bearing streams are required and should be incorporated into the CMRP (Appendix G).
- Construction camps built along the proposed pipeline route, construction activities and pipeline testing would use water from surface waterbodies, imported water, or groundwater from a local well. Water would be used for drinking, dust suppression, vehicle washing, and other uses. Water withdrawal from surface waterbodies or wells would need to be permitted and approved by various agencies and water rights owners. There are currently four construction camps planned for Montana, three construction camps planned for South Dakota, and one camp slated for Nebraska. Waterbodies with habitats and species sensitive to or potentially impacted by flow reductions should be thoroughly analyzed to prevent adverse effects.

4.3.5 Connected Actions

4.3.5.1 Bakken Marketlink Project

Groundwater

No significant large-scale potable water aquifers underlie the Bakken Marketlink Project area, although alluvium is likely present that contains potable groundwater. The Upper Cretaceous Hells Creek/Fox Hills Aquifer of the NGPAS underlies the area, but water quality in this area of the aquifer is relatively saline. Larger potable water aquifers within recent alluvium are present within several miles to the east and west of the Bakken Marketlink Project area, and Lower Tertiary rocks of the NGPAS containing potable water are present within a few miles west of the western terminus of the Bakken Marketlink Project area (Whitehead 1996, LaRocque 1966). Well depths are also typically greater than 50 feet. Because of the limited amount of potable water directly beneath the Bakken Marketlink Project area and the significant depth to groundwater in this area, it is not likely that releases would significantly impact groundwater resources in the area.

Surface Water

Construction and operation of the Bakken Marketlink Project would include metering systems and three new storage tanks near Baker, Montana and two storage tanks in Cushing, Oklahoma. Based on a GIS analysis of the planned route and intersections with waterbodies identified in the 2012 NHD, there would be a total of 8 waterbodies crossed in Montana. Of the total, Sandstone Creek is the only waterbody classified as perennial; 7 waterbodies are intermittent.

The property proposed for the Bakken Marketlink Project facilities near Pump Station 14 is currently used as pastureland and hayfields and a site inspection of the property indicated that there were no waterbodies or wetlands on the property. As a result, the potential impacts

associated with expansion of the pump station site to include the Bakken Marketlink Project facilities would likely be similar to those described above for the proposed Project pump station and pipeline ROW in that area. The construction and operation of the Bakken Marketlink Project would have negligible effects on water resources. Any impacts associated with the Bakken Marketlink Project would be similar in scope and duration to the proposed Project.

4.3.5.2 Big Bend to Witten 230-kV Transmission Line

Groundwater

Groundwater along the alignment of the Big Bend to Witten 230-kilovolt (kV) Transmission Line is present primarily in recent alluvium of the White and Missouri Rivers and in Quaternary glacial deposits near the Missouri River. Groundwater is typically present at depths of less than 50 feet bgs in these unconsolidated deposits. The deposits overlie the Cretaceous Pierre Shale, which is a regional aquitard. Water-bearing units of the GPA and WIPA beneath the Pierre Shale are typically saline and not used for drinking water or irrigation purposes.

Potential impacts to groundwater resources related to the installation and operation of the Big Bend to Witten 230-kV Transmission Line are expected to be limited to small-scale petroleum product releases related to vehicle operations and fueling. Hydrogeologic conditions and fate and transport of releases would be similar to conditions described for alluvial aquifers in the proposed pipeline area.

Surface Water

The Big Bend to Witten 230-kV electrical transmission line would cross three perennial streams along the preferred route (Appendix J, Basin Electric Big Bend to Witten 230-kV Transmission Project Routing Report). Potential impacts to crossings of surface water resources would be minimized by spanning them entirely. Project construction would use an typical span length between 650 and 950 feet. The largest perennial stream crossed is the White River which has a maximum waterbody width of 570 feet.

In addition, the transmission line would run parallel to and within 100 feet of perennial and intermittent streams for a cumulative distance of 28,000 feet. An adequate buffer between the transmission line corridor and adjacent surface waters would be needed to minimize continued impacts to surface water features during initial construction and long-term operation and maintenance activities.

4.3.5.3 Electrical Distribution Lines and Substations

Groundwater

Potential impacts to groundwater resources related to the installation and operation of electrical transmission lines associated with the proposed pipeline area are expected to be limited to small-scale petroleum product releases related to vehicle operations and fueling. Hydrogeologic conditions and fate and transport of releases would be similar to conditions described for the proposed pipeline area adjacent to the planned transmission lines.

Surface Water

The proposed Project would require electrical service from local power providers for pump stations and other aboveground facilities in Montana, South Dakota, Nebraska, and Kansas.

Based on a GIS analysis of the planned locations for electrical lines and substations and intersections with waterbodies identified in the 2012 NHD, there would be a total of 217 waterbodies crossed in Montana. Of the total, Duck Creek is the only waterbody classified as perennial; 192 waterbodies are intermittent, 13 are canals/ditches, and 12 are unidentified waterbodies. Using the same GIS comparison, there would be a total of 250 waterbodies crossed in South Dakota. Of the total, 16 are perennial, 218 are intermittent, and 16 are unidentified waterbodies. In Nebraska, there would be an approximate total of 281 waterbodies crossed. These include 31 perennial, 237 intermittent, and 13 unidentified waterbodies. Additional relevant information regarding the distribution lines in Kansas is pending and will be included in this review as part of the Final Supplemental EIS.

There is no information provided regarding the locations of poles or other on-the-ground features associated with this connected action that could impact the waterbodies identified above; however, effects on surface waters are expected to be limited based on permitting requirements and generally accepted practices used during the construction of distribution lines. These lines typically span surface water bodies, equipment crossings are likely to use existing access or temporary crossings, and standard construction erosion controls are employed to limit sedimentation, similar to methods that would be used for the proposed pipeline. Poles placed in effective and designated floodplain areas have the potential to snag and collect debris being conveyed by flood water. This debris should be cleared from poles following flood subsidence. Obstructions in the floodplain have the potential to induce scour and sedimentation, however based on typical sizing and spacing of poles the affects to the environment are considered negligible.

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4.4 WETLANDS

4.4.1 Introduction

This section describes potential impacts to wetland resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS, and in many instances, replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to wetland resources:

- A new section (Section 4.4.2, Impact Assessment Methodology) was added to explain the wetland assessment methodology used to evaluate potential wetland impacts associated with the proposed Project. This section describes how the assessment methodology used for the Supplemental Environmental Impact Statement (Supplemental EIS) evaluation differs in some respects from the methodology used for the Final EIS evaluation;
- Wetland acreage impacts differ from those presented in the Final EIS due to route alterations and the modified wetland evaluation method;
- Impact reduction procedures identified in the Final EIS were carried over to the Supplemental EIS and expanded upon to include recommendations from natural resource agencies;
- Section 4.4.4, Recommended Additional Mitigation, provides a list of additional mitigation measures to further reduce impacts to wetland resources; and
- Updates were made to the connected actions based on additional data and information provided since the publication of the Final EIS.

4.4.2 Impact Assessment Methodology

The potential wetland impacts for the proposed Project presented below are based on an evaluation of the wetland resources along the Project corridor, review of available Project reports and data, and public comments received during the Supplemental EIS scoping period.

Wetlands within the proposed Project area were mapped using a combination of wetland data from various TransCanada Keystone Pipeline, LP (Keystone) sources, including the 2011 Final EIS, the TransCanada Keystone XL Pipeline Project: Supplemental Environmental Report for the Nebraska Reroute (exp Energy Services Inc. 2012a), the TransCanada Keystone Pipeline Project: Environmental Report (exp Energy Services Inc. 2012b), and additional 2012 field data gathered by Keystone during the development of this Supplemental EIS document. Wetland impacts described in previous Project reports relied primarily on field data, aerial photo interpretation, and National Wetland Inventory (NWI) data (USFWS 2012a). For the purpose of the SEIS, wetland data presented in the above sources were supplemented by two additional

national wetland datasets: National Land Cover Dataset (NLCD [Fry 2011]), and U.S. Geological Survey (USGS) Gap Analysis Program (GAP) (USGS 2011). In addition, a desktop analysis of 2010 National Aerial Imagery Program (NAIP) orthoimagery (NAIP 2010 and 2011), National Hydrography Data (USGS 2012), and U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil data (UGSG 2012) was used to check the quality of the wetland data from the above sources.

Potential wetland impacts for the SEIS were analyzed by assessing the area of wetland overlapped by the proposed Project area. Field and desktop analysis data provided by Keystone were given priority, followed by wetland coverage in the NWI, NLCD, and GAP datasets, respectively. Data from these four sources were analyzed using ArcInfo GIS software whereby wetland data were mapped in the following order of priority: Keystone wetland data (field data and desktop data), NWI wetlands, NLCD wetland communities, and GAP wetland communities. When more than one dataset provided wetland coverage for a given location, overlapping acreages were clipped (removed) to avoid double-counting. No further edits to the wetland boundaries and acreages resulting from the combined datasets were made.

While the additional wetland coverage from the combined datasets provides a more representative picture of potential wetland distribution throughout the proposed Project area, there are limitations to the data presented in the potential wetland impact analysis section. Field-based data have been incorporated into the estimated affected wetland acreage. However, most of these wetland acreage estimates are based on desktop analysis using the data sources noted. As a result, wetland boundaries and wetland acreages may be under- or over-estimated in some locations. In addition, certain wetland types may be under-represented in this analysis because they require field-based surveys to accurately evaluate wetland characteristics and wetland boundary locations. Wetland types that may be under-represented include narrow wetland fringe along small streams and rivers; seasonal wetlands in topographic depressions; small depressional wetlands, particularly in the Prairie Pothole Region; wetland mosaics in forested areas, particularly in floodplains; wetlands in areas that are managed for agricultural purposes, and small riverine/open water features. As noted in Sections 3.4.4 and 4.4.3, while the impacts presented in the Supplemental EIS may not be fully quantified at this time, all existing wetlands would be accounted for during the Section 401 certification and Section 404 permitting process.

It is also important to recognize that in some cases, the wetland acreages presented in Section 4.4.3 will be different than the acreages presented in other sections of this Supplemental EIS document, such as Section 4.5, Terrestrial Vegetation, and Section 4.9, Land Use, Recreation, and Visual Resources. This is the result of incorporating additional wetland data sources into the Section 4.3 Wetlands analysis to more accurately describe impacts to U.S. Army Corps of Engineers (USACE)-defined wetlands. Other sections such as Land Use are interested in broader land use classifications that have unique land use classifications. These were drawn from different data sources. For example, a *farmed wetland* area would be considered a wetland in Section 4.4.3 below, while in Section 4.9, Land Use it may be classified as an ‘agricultural’ land use.

4.4.3 Potential Wetland Impacts

An estimate of wetland acreage that would be affected by the proposed Project is summarized in Table 4.4-1 and Table 4.4-2. Refer to Appendix D, Waterbody Crossing Tables and Required Crossing Criteria for Reclamation Facilities, for additional wetland data. Estimated impacts are based on the impact analysis methods described above and the best available information. Impacts are categorized by proposed Project phase (construction versus operations) and by location (Project corridor right-of-way [ROW] versus ancillary facilities). The potential wetland impact discussion that follows applies to all identified wetland types, including 'sensitive wetlands' previously described in Section 3.4.3, Wetlands of Special Concern or Value.

Construction-related wetland impacts are associated with construction activities occurring within the proposed Project right-of-way (ROW) and in support of Project-related ancillary facilities. Operations-related wetland impacts are associated with both ROW and ancillary facilities that would persist for the life of the proposed Project. Construction-related impacts would occur within the 110-foot construction ROW as a result of proposed pipeline installation activities. The 110-foot construction corridor width would be reduced to 85 feet for wetlands in Montana and Nebraska, and 75 feet for wetlands in South Dakota, unless conditions require a wider construction corridor, per state requirements. For the purpose of this analysis, estimated construction-related ROW wetland impact calculations are based on a general 110-foot construction corridor to provide a high-end estimate.

Operations-related wetland impacts are those that are expected to occur within the 50-foot permanent operations ROW. Estimated operations-related wetland impact calculations are based on a general 50-foot permanent ROW, again as a high-end estimate.

Impacts associated with ancillary facilities include impacts for access roads, construction camps, staging areas, pipe yards, contractor yards, rail sidings, and pump stations. Construction-related ancillary facilities would only be used during construction and would be removed when the construction phase is complete. Operations-related ancillary facility impacts are considered permanent and would persist for the life of the proposed Project. Operations-related ancillary facilities include permanent access roads (30-foot ROW width for access roads), emergency response staging areas, and pump stations. The construction and operations wetland impacts summarized in Table 4.4-1 are not additive. Construction related wetland impacts include all impacts that will occur within the 110-foot construction corridor, including construction impacts that will occur within the 50-foot permanent ROW. Operations impacts are those impacts that will persist within the 50-foot permanent ROW following the construction phase.

South Dakota has approximately half of the estimated wetland acreage that would be affected during pipeline construction (47 percent; 124.3 acres of 262.2 acres; Table 4.4-1). Emergent wetlands are the most common wetland type affected by the proposed Project. Total estimated palustrine emergent (PEM), palustrine scrub-shrub (PSS), palustrine forested (PFO), and riverine/open water wetlands affected during construction are 78.4 acres in Montana, 124.3 acres in South Dakota, and 59.5 acres in Nebraska. This does not imply a permanent loss of wetland acreage due to construction, but identifies the total number of wetlands acres that would be affected to some degree by construction related activities and may need minor to more involved post-construction reclamation.

Table 4.4-1 Estimated Wetlands Affected by Proposed Project ROW and Ancillary Facilities

State	Impact Area	Length of Wetlands Crossed (miles)[b]				Wetland Area Affected During Construction (acres)[c]				Wetland Area Affected During Operations (acres)[d]			
Montana		**PEM**	**PSS**	**PFO**	**Riv-OW**	**PEM**	**PSS**	**PFO**	**Riv-OW**	**PEM**	**PSS**	**PFO**	**Riv-OW**
	ROW	1.7	1.2	0.003	2.3	23.5	16.9	0.1	28.8	10.2	7.1	0.0	14.1
	Ancillary[e]	0.3	1.3	0.0	0.2	3.0	4.8	0.0	1.3	0.4	0.4	0.0	0.02
Subtotal		*2.0*	*2.5*	*0.003*	*2.5*	*26.5*	*21.7*	*0.1*	*30.1*	*10.6*	*7.5*	*0.0*	*14.2*
South Dakota													
	ROW	5.6	1.4	0.04	2.1	73.5	19.8	0.6	26.1	33.4	8.3	0.2	13.0
	Ancillary[e]	0.2	0.1	0.0	0.1	2.7	1.2	0.0	0.4	0.4	0.6	0.0	0.2
Subtotal		*5.8*	*1.4*	*0.04*	*2.2*	*76.2*	*21.0*	*0.6*	*26.5*	*33.8*	*8.9*	*0.2*	*13.2*
Nebraska													
	ROW	1.8	1.0	0.8	1.7	24.3	10.6	6.3	17.4	10.8	6.1	4.7	10.4
	Ancillary[f]	0.1	0.0	0.02	0.0	0.6	0.0	0.1	0.2	0.0	0.0	0.0	0.0
Subtotal		*1.9*	*1.0*	*0.8*	*1.7*	*24.9*	*10.6*	*6.4*	*17.6*	*10.8*	*6.1*	*4.7*	*10.4*
North Dakota													
	Ancillary[g]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kansas													
	Ancillary[g]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Total		9.7	4.9	0.9	6.4	127.6	53.3	7.1	74.2	55.2	22.5	4.9	37.8

Sources: exp Energy Services Inc. 2012a, b; USFWS 2012a; Fry 2011; USGS 2011.

[a] Cowardin et al., 1979; PEM-palustrine emergent; PSS-palustrine scrub-shrub; PFO-palustrine forested; Riv-OW-riverine-open water; NA-Not Available.
[b] Length of wetlands crossed for ROW is the length of wetlands bisected by pipeline centerline; length of wetlands crossed for ancillary facilities length of wetlands bisected by access roads centerlines only.
[c] Construction ROW impacts calculated using a 110-foot general construction corridor width.
[d] Operational ROW impacts were calculated based on a 50-foot permanent ROW corridor width.
[e] Ancillary facilities located outside of the ROW include: access roads (30-foot easement), pump stations, pipe yards, contractor yards, rail sidings, and construction camps.
[f] Ancillary facilities impacts for Nebraska do not include construction camps, temporary staging areas, pipe yards, contractor yards, and rail sidings, but does include access roads, all of which are temporary. The location of some Nebraska ancillary facilities is pending and will be evaluated for the Final Supplemental EIS when it becomes available.
[g] There are no NWI data in these areas.

Approximately 1,073 waterbodies may be crossed by the proposed Project, see Sections 3.3, Affected Environment, Water Resources, and 4.3, Environmental Consequences, Water Resources, for further details.

Similar to construction, half of the estimated wetland acreage that would be affected by proposed pipeline operations is located in South Dakota (47 percent; 56.1 acres of 120.4 acres). Total wetland acres affected during operation are estimated at 32.3, 56.1, and 32.0 acres in Montana, South Dakota, and Nebraska, respectively. Again, this does not imply a permanent loss of wetland acreage due to the continued operation of the proposed Project. Many of the wetlands affected by operations would remain as functioning wetlands provided impact minimization and restoration efforts described in the Construction, Mitigation, and Reclamation Plan (CMRP) (Appendix G, CMRP) are successful. Permanent conversion from one wetland type to another are estimated to be 7.1 acres in Montana, 8.3 acres in South Dakota, and 10.8 acres in Nebraska (see Wetland to Wetland Conversions in Table 4.4-2).

Table 4.4-2 Estimated Permanent Wetland Impacts[a]

Permanent Wetland to Wetland Conversions (acres)				Permanent Wetland to Upland Conversions (acres)			
	MT	**SD**	**NE**		**MT**	**SD**	**NE[d]**
PSS to PEM[b]	7.1	8.3	6.1	PEM to UPL	0.4	0.4	0.0
PFO to PEM	0.0	0.1	4.7	PSS to UPL	0.4	0.6	0.0
Riv/OW to PEM[c]	0.0	0.0	0.0	PFO to UPL	0.0	0.0	0.0
				Riv/OW to UPL	0.02	0.2	0.0
Total	7.1	8.3	10.8	Total	0.8	1.2	0.0

Sources: exp Energy Services Inc. 2012 a, b; USFWS 2012a; Fry 2011; USGS 2011.

[a] Permanent wetland impacts include PSS/PFO conversions to PEM wetlands within the 50-foot-wide permanent ROW; and wetland to upland conversion resulting from fills associated with the construction of permanent ancillary facilities.
[b] Cowardin et al., 1979; PEM-palustrine emergent; PSS-palustrine scrub-shrub; PFO-palustrine forested; Riv-OW-riverine-open water; UPL-upland
[c] Refer to Section 4.3 for details related to surface water feature impacts.
[d] Some ancillary facilities in Nebraska have not been sighted yet.

Wetland losses (wetland conversion to uplands) would only be associated with the construction of permanent ancillary facilities such as permanent access roads, pump stations, and emergency response staging areas. Permanent wetland losses due to operational ancillary facilities are estimated to be 0.82 acres in Montana and 1.2 acres in South Dakota (see Wetland to Upland Conversion in Table 4.4-2). At the time of this report the location of some Nebraska ancillary facilities were still unknown. For the purpose of this SEIS, the total number of wetlands that would be converted to uplands in Nebraska would likely be similar to the Montana and South Dakota totals. Where required, all permanent wetland impacts would be mitigated by following standard USACE-required mitigation protocols and ratios, negotiated during the Project permitting.

In the methodology section above, data presented in Table 4.4-1 have limitations and may underestimate the actual acreage of PEM, PSS, PFO, and riverine/open water wetlands that would be affected by the proposed Project. In addition, a large proportion of the proposed Project corridor passes through sub-irrigated agricultural lands that may include wetlands on grazed, cultivated, or other agricultural lands. Wetlands occurring on lands that are actively managed for agricultural purposes are difficult to map from aerial photo interpretation, are not well represented in national wetland databases, and are difficult to accurately delineate in the field

due to agricultural-related changes to the soil, vegetation, and hydrology. As a result, wetlands occurring on lands managed for agricultural use may be under-represented by the acreages presented in Table 4.4-1 and Table 4.4-2. This under-representation may be balanced, at least in part, by the wider construction and operation corridor used in estimates of wetland impacts, as described above.

While acreages presented in the tables may not be fully quantified at this time, they would be accounted for during the subsequent federal and state permitting process. These data do capture the wetland types (PEM, PSS, PFO, and riverine / open water) that are encountered within the proposed Project area, thus enabling reasonable discussions regarding impact analysis. For the purpose of this analysis, impacts to riverine and open water features are addressed in Section 4.3, Water Resources, while the remainder of this section focuses on impacts to vegetated wetland communities (PEM, PSS, and PFO).

The term *affected* wetland implies a temporary, short-term, long-term, or permanent impact. A temporary impact would generally occur during construction with recovery following almost immediately afterwards, a short-term impact would have duration of up to 3 years, a long-term impact would have duration greater than 3 years but with recovery achievable over time, and a permanent impact would be an impact that persists over the life of the proposed Project or longer. Temporary, short-term, and long-term impacts noted below are based on the assumption that post-construction restoration efforts would be successful and no unforeseen conditions resulting from proposed pipeline operations (e.g., pipeline soil temperature effects, potential spills) delay anticipated recovery rates. Note that a long-term or permanent *affect* or *impact* does not necessarily mean a permanent loss of wetland habitat. For example conversion of scrub-shrub or forested wetlands to herbaceous wetlands is considered a permanent impact to those woody wetland classes, but does not represent a complete loss of wetland habitat; whereas a permanent wetland loss would be a conversion of a wetland to an upland as a result of the construction of a pump station or access road.

Impacts to emergent wetlands affected within the proposed construction corridor width, which would encompass the permanently maintained operations ROW, would likely be short-term to long-term, with successful re-establishment within 3 to 5 years. All impacted emergent wetlands would be restored to near pre-construction conditions following proposed pipeline installation. Emergent wetlands would be allowed to persist outside of and within the permanent operations ROW for the life of the proposed Project. The only permanent loss of emergent wetlands would be associated with the construction of permanent ancillary facilities such as permanent access roads, emergency response staging areas, and pump stations. Permanent emergent wetland losses are estimated to be 0.4 acres in Montana and 0.4 acres in South Dakota. At the time of this report the location of some Nebraska ancillary facilities were still unknown.

In forested and scrub-shrub wetlands, the effects of proposed construction would be longer term due to the longer period needed to regenerate a mature forest or shrub community. Prior to proposed pipeline installation, scrub-shrub and forested wetland vegetation within the construction corridor (area between the approximate 50-foot permanently-maintained operations ROW and 110-foot construction corridor limit) would be cut to ground level and root systems would be left in place. Once construction activities were completed, woody vegetation outside of the 50-ft permanently maintained corridor and outside of permanent ancillary footprint facilities would be restored to near pre-construction conditions and woody vegetation would be allowed to regrow. Shrubs and trees would also be allowed to regrow at horizontal directional drilling

(HDD) locations within the permanent ROW after construction activities are complete. Scrub-shrub and forested wetlands that would be initially cleared (cut to ground surface) for construction, but would be allowed to regrow over time are estimated at 14.3 acres in Montana, 12.5 acres in South Dakota, and 6.2 acres of scrub-shrub/forested wetlands in Nebraska. This would be considered a long-term impact based on the slower growth rate of trees and shrubs, which may require decades for complete regeneration.

The 50-foot-wide permanently-maintained ROW would be kept free of woody vegetation for the life of the project. Woody vegetation within the 50-foot ROW would be completely removed during construction and would be prevented from re-establishing due to periodic mowing and brush cutting during pipeline operation. Scrub-shrub and forest wetlands within the 50-foot ROW would be converted to emergent wetlands, which represents a permanent impact to the woody wetland class, but does not represent a permanent loss of wetland habitat. Scrub-shrub and forested conversion to emergent wetlands is estimated to be 7.1 acres, 8.3 acres, and 10.8 acres in Montana, South Dakota, and Nebraska, respectively (Table 4.4-2). The only permanent conversion of scrub-shrub and forested wetlands to uplands would be associated with the construction of permanent ancillary facilities such as permanent access roads, emergency response staging areas, and pump stations. Permanent scrub-shrub and forested wetland losses are estimated to be 0.4 acres in Montana and 0.6 acres in South Dakota. At the time of this report the location of some Nebraska ancillary facilities were still unknown (Table 4.4-2).

Construction and operation of ancillary facilities would result in short-term, long-term and permanent impacts. Impacts associated with non-permanent ancillary facilities (i.e. temporary access roads) would be similar to those described above for emergent wetlands (short-term to long-term with recovery in 3 to 5 years), and long-term to permanent for scrub-shrub and forested wetlands. The continued operation of permanent ancillary facilities (i.e. permanent access roads, emergency response staging areas, and pump stations) would require permanent wetland fills and represent a permanent wetland loss (wetland to upland conversion) of approximately 0.82 acres in Montana and 1.2 acres in South Dakota. At the time of this report the location of some Nebraska ancillary facilities were still unknown. (see Wetland to Upland Conversion in Table 4.4-2).

Construction of the proposed pipeline would affect wetlands and their functions primarily during and immediately following construction activities; however, permanent changes also are possible (Federal Energy Regulatory Commission [FERC] 2004). Wetland functions that may be affected 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; sediment removal and nutrient cycling (water quality protection); aquatic productivity support (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 (federally listed and candidate species, photography, nature observation, and aesthetics) (U.S. Environmental Protection Agency [USEPA] 2001). The degree to which a given wetland and its functions are impaired depends on a number of factors including wetland type (e.g., wet meadow versus forested), landscape position (riverine versus wet meadow), level of impairment or impact, and success of restoration efforts. Potential construction- and operations-related effects include the following:

- Permanent loss of wetlands as a result of permanent fill (e.g., backfilling at permanent ancillary facility locations or improper removal of temporarily staged soils in wetlands adjacent to the pipeline trench).
- Disturbances that result in permanent wetland loss as a result of improperly maintained wetland integrity (hydrology, hydric soil strata, or hydrophytic vegetation).
- Temporary to permanent modification of surface and subsurface flow patterns that could result in modification in wetland productivity (rate of seed maturity, wildlife usage, etc.), wetland plant community diversity, and wetland to upland plant community conversion.
- Temporary to permanent modification of wetland vegetation community composition and structure from clearing and operational maintenance (e.g., wetland scrub-shrub and forested communities would not be allowed to regenerate within the permanent ROW and would permanently be maintained as emergent wetlands; in some HDD crossing areas, regeneration of shrub and forested communities would be allowed, but would require several decades to reach maturity).
- Loss or alteration of wetland soil integrity as a result of improperly restored hydric soil strata (topsoil and root stock, clays, and gravels/cobbles), rutting, and compaction that could result in altered biological activities and chemical conditions that could affect re-establishment and natural recruitment of native wetland vegetation after restoration.
- Temporary increase in turbidity and water quality.
- Permanent alteration in water-holding capacity in the Prairie Pothole, Rainwater Basin and Playa regions due to alteration or breaching of water-retaining substrates.
- Permanent alteration in vegetation productivity and life-stage timing to wetlands located directly over the pipeline due to increased soil temperatures associated with heat generation of the pipeline (during the cooler months of January to May and November to December, operation of the proposed Project would cause increases of 4 degrees Fahrenheit [˚F] to 8˚F in soil temperatures at the soil surface directly over the proposed pipeline, and 10 to 15˚F at 6 inches below the surface directly over the pipeline [Appendix S, Pipeline Temperature Effects Study]).
- Permanent alteration of freeze-thaw timing in wetlands directly over the proposed pipeline as a result of the increased soil temperatures associated with heat generation from the pipeline. In the event of a spill incident along the proposed pipeline during the winter months, open-water areas that refreeze could hamper recovery efforts and lead to emergent wetland vegetation die-off or cause harmful effects to wildlife (amphibians, fish) as a result of further drops in dissolved oxygen.
- Permanent alteration of soil water availability, soil biological activity, and soil chemical conditions to wetlands located directly over the proposed pipeline due to the increased soil temperature associated with the heat generated by the pipeline.

- General wetland impacts associated with hazardous liquid spills and leaks during the construction and operation phase are addressed in Section 4.13.3, Spill Impact Assessment. In the event of a spill during construction and reclamation activities, Keystone has identified and prepared written procedures to address a response action. These activities are provided in Keystone's Draft Spill Prevention, Control and Countermeasure (SPCC) Plan (Appendix I, Spill Prevention Control and Countermeasure Plan and Emergency Response Plan Sections). An Emergency Response Plan (ERP) would be prepared 6 months prior to project initiation.

Procedures outlined in the proposed Project CMRP (Appendix G) 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 CMRP (Appendix G) would avoid or minimize most impacts on wetlands associated with construction and operation activities and would ensure that potential effects would be primarily short-term.

Keystone has made route modifications to avoid known wetland areas and to generally minimize wetland impacts, based on aerial mapping, field surveys, and consultation with agencies. Involvement of the USACE and U.S. Fish and Wildlife Service (USFWS), 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 HDD 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.

The U.S. Fish and Wildlife Service (USFWS) has expressed concerns about any water withdrawals from the Platte River. They were requested to provide informal section 7 consultation and technical assistance for the Project. In their response letter dated September 4, 2012 (FWS NE: 2013-013) from Michael D. George to K. Nicole Gibson, Ph.D., they state: "Since 1978, the USFWS has concluded in all of its section 7 consultations on water projects in the Platte River basin that the Platte River ecosystem is in a state of jeopardy, and any federal action resulting in a water depletion to the Platte River System will further or continue the deterioration of the stressed habitat conditions." They go on the say that any depletion of flows, either direct or indirect, from the Platte River System would be considered significant and they consider the river and associated wetland habitats to be "resources of national and international importance." To mitigate any impacts to the Platte River ecosystem, Keystone would coordinate with the USFWS before any water withdrawals.

Commitments described in the proposed Project CMRP (Appendix G) and additional Keystone correspondence to protect and restore wetlands include the following general measures (refer to the CMRP for additional details and figures):

- 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 the Pipeline Hazardous Material Safety Administration (PHMSA) (see Appendix G, CMRP);

- 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 proposed construction ROW to 85 feet or less in Montana and Nebraska, and 75 feet or less in South Dakota 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 wetlands to the proposed construction ROW and limit the size of extra work areas to the minimum needed to construct the wetland crossing;
- Clear the construction ROW, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction ROW using wide-track or low-ground pressure construction equipment and/or conventional equipment operating from timber and slash (riprap) cleared from the ROW, timber mats, or prefabricated equipment mats;
- Install and maintain sediment barriers at all saturated wetlands or wetlands with standing water across the entire construction ROW upslope of the wetland boundary and where saturated wetlands or wetlands with standing water are adjacent to the construction ROW 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 proposed construction ROW;
- 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 ROW;
- 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, repairs, and refueling 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;
- Develop compensation for impacts to forested wetlands impacted by the construction ROW through the USACE Clean Water Act Section 404 and 401 permitting program. Keystone would mitigate for impacts to non-jurisdictional, as well as jurisdictional forested wetlands;
- 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.
- Apply seeding requirements for agricultural lands or as required by the landowner for farmed wetlands;
- Use 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;
- Prohibit use of herbicides or pesticides within 100 feet of any wetland (unless allowed by the appropriate land management or state agency); and
- Develop compensation for both jurisdictional and non-jurisdictional forested wetlands impacted by the construction of the proposed right-of-way through the USACE's Section 404 and 401 permitting program.

In the Final EIS document, various state and federal agencies have expressed concerns about and provided recommendations for compensatory mitigation of jurisdictional wetland losses. Proposed 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 CWA, USACE permits are required for the discharge of fill material into waters of the U.S. As noted in Section 3.4.4, waters of the United States 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, including wetlands that have a 'significant nexus' 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 by the USACE. Under the authority of Section 10 of the Rivers and Harbors Act, USACE permits are required for structures or work in, over, under or affecting navigable Waters of the United States.

All wetlands and waterways crossed by the proposed Project would be evaluated under the preliminary jurisdictional determination process. Under this process, all wetlands are tentatively

considered jurisdictional until an approved determination is made by USACE (Regulatory Guidance Letter No. 08-02). A more detailed explanation of wetland regulatory framework can be found in Section 3.4.4, Federal and State Regulatory Setting. Compensatory mitigation, where required by USACE or state agencies, would be provided for permanent losses of jurisdictional wetlands and water resources. Compensatory Mitigation Plans would be developed and carried out in accordance with Title 33 of the Code of Federal Regulations Part 332 (Compensatory Mitigation for Losses of Aquatic Resources) or applicable state standards. All non-permanent wetland impacts due to construction activities would be restored in accordance with the proposed Project CMRP (Appendix G).

The USACE Omaha District would be consulted to determine the kind of compensatory mitigation that would be required for losses of wetlands and water resources, including the permanent conversion of forested wetland to herbaceous wetland. USACE would determine eligibility for each wetland crossing under the nationwide and individual permit program. Pre-construction notification packages would include the mitigation plans agreed upon with the USACE.

In an effort to avoid and minimize impacts to sensitive wetlands that may provide important habitat resources for federally listed species, the USFWS recommends that HDD be considered during the permitting process when crossing streams and wetland habitats containing high diversity and unique aquatic species assemblages (USFWS 2012b).

Additionally, Keystone would follow state-specific impact reduction, mitigation, and reclamation plans as outlined in the following Project-related publicly available documents:

- Montana—Keystone XL Project: Supplemental Information for Compliance With the Montana Environmental Policy Act and Support for Decisions Under the Major Facility Siting Acting (signed March 30, 2012) (Appendix N, Supplemental Information for Compliance with MEPA). For example, where Prairie Pothole wetlands would be affected, develop pre- and post-construction monitoring plans for depressional wetlands of the Prairie Potholes region in Montana and wetlands that no longer pond water after the proposed pipeline is installed. These affected wetlands 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 (Appendix G, CMRP).
- South Dakota—South Dakota Public Utilities Commission Final Decision and Order (SDPUC 2010)
- Nebraska—2012 Nebraska Supplement Environmental Report (Nebraska Department of Environmental Quality, pending report available in December 2012).

In addition to these additional mitigation measures offered by the Department and other participating federal, state, and local agencies, supplementary list of recommendations has been generated through the Supplemental Environmental Impact Statement development process. Where appropriate and applicable, a plan to compensate for permanent wetland losses and to prevent temporary to permanent wetland degradation would be developed to include the following:

- Jurisdictional and non-jurisdictional wetlands within the Prairie Pothole Region (Montana, South Dakota, northern Nebraska), sand hill-type wetlands (if any are affected in Nebraska), and Rainwater Basin Region wetlands (Nebraska), according to state and USACE regulations;
- Final restoration for all jurisdictional wetlands, and other wetlands of state or federal concern, according to the USACE and other agencies as required;
- Monitoring of wetland mitigation sites for success according to applicable federal and state permit conditions;
- For temporarily disturbed wetland hydrology that does not recover (i.e., disturbance resulted in permanent hydrologic change or loss) from construction, compaction testing to determine if compaction is excessive or insufficient, soil strata replacement, or at the landowner's or managing agency's discretion, compensatory payments or wetland replacement;
- Compensation for conversion of scrub-shrub or forested wetlands to emergent wetlands if required by local, state, or federal agencies;
- Removal of soil and vegetation in areas of noxious weed infestation to areas outside of a wetland and avoidance of use to restore wetland contours or soil strata above the pipeline;
- Consultation of local and/or state agencies to address weed management within wetland areas;
- During freezing temperatures, special accommodations to adequately wash noxious weed plant seeds and parts from machinery and other vehicles prior to entering a wetland area; and,
- Approval by appropriate agencies for all seed mixes and revegetation materials used to restore wetlands or agricultural farmed wetlands.

4.4.4 Recommended Additional Mitigation

This section describes additional mitigation measures that are recommended to reduce construction impacts and to improve restoration activities.

- "Dry" and "standard" (e.g., saturated) wetlands are approached in a similar manner. This construction and mitigation approach would provide the greatest amount of protection for all wetland types, and potentially eliminate confusion of contract workers when dealing with wetland construction, restoration, and spill response methods, for example.
- Clearly mark wetland boundaries with signs and/or highly visible flagging during construction and maintain markers until USACE-, and/or state-approved restoration methods and monitoring requirements are completed.
- To prevent compaction of wetland soils, low ground pressure equipment construction equipment or conventional equipment on supportive mats would be used in all wetland areas. It is recommended that timber riprap, timber mats or other pre-fabricated equipment mats that can be easily removed following construction would be used to support conventional construction equipment.
- Install and maintain sediment barriers at all wetlands across the entire construction ROW upslope of the wetland boundary and where any wetlands are adjacent to the construction

ROW as necessary to prevent sediment flow into the wetland. It is recommended that "dry" and "standard" wetlands are treated equally where restoration or mitigation measures are concerned.

- Segregate and salvage topsoil, sod mats, and root stock (maximum of 12 inches), as well as clays, and gravel/cobbles in all wetlands where practicable. Segregating soil strata in wetlands with surface or standing water may not be practicable. Restore wetland soil to its approximate original stratum after pipe installation is complete.
- After installation of pipe is complete; replace salvaged wetland vegetation and spread soil to its original contours with no crown over the trench; surface soils would be left slightly rough (not be smoothed or overly compacted) in order to maximize wetland revegetation re-growth and seed germination potential.
- Remove any excess spoil, stabilize wetland edges and adjacent upland areas using permanent erosion control measures and USACE-, state-, or locally mandated revegetation methods.
- For all 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.
- In the absence of detailed revegetation plans or until appropriate seeding season, apply temporary vegetation cover at a rate adequate for germination and ground cover using an appropriate wetland seed mix approved by local, state, and/or federal agencies unless standing water is present.

4.4.5 Connected Actions

4.4.5.1 Bakken Marketlink Project

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. No wetland impacts are expected for this 5-mile pipeline. The permit applications for these proposed projects would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental review of the Bakken Marketlink Project. 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.

4.4.5.2 Big Bend to Witten 230-Kilovolt (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 through Lyman and Tripp counties in south-central South Dakota. The Western Area Power Administration (Western) and Basin Electric Power Cooperative (BEPC) have identified a preferred corridor for the proposed Big Bend to Witten 230-kV Transmission Line project (Figure 2.1.12-3). This proposed connected action is more fully explained in Section 2.1.12.2, Big Bend to Witten 230-kV Transmission Line, and the in the Basin Electric Big Bend to Witten 230-kV Transmission Project Routing Report (Appendix J).

As described in BEPC's Routing Report, the Big Bend to Witten project would be constructed using 230-kV transmission structures that allow for an average span length of 650 to 950 feet. Surface water bodies and wetlands that are less than 950 feet wide could be spanned by the proposed transmission line. Most surface water features and wetlands would be spanned; however, those that fall within the ROW would need to be delineated in localized areas prior to construction and measures to avoid impacts would be implemented. The applicant preferred route would cross approximately 1,600 surface water bodies and approximately 6,000 feet of wetlands, most of which could be spanned by the transmission line. Refer to Appendix J for a complete discussion of the selected alternatives as well as the surface water and wetland analysis that was performed to estimate potential impacts.

The permit applications for the Big Bend to Witten project would be reviewed and acted on separately by agencies and those agencies would conduct more detailed environmental review of the project. 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.

4.4.5.3 Electrical Distribution Lines and Substations

Electrical distribution line construction and operation requires clearing of trees and shrubs, and maintaining vegetation under the power lines in an herbaceous state. Electrical distribution lines and substations constructed to provide power for the Project pump stations could affect wetland resources through the following:

- Temporary, short-term, long-term, and permanent modification of wetland vegetation community composition, community structure, potential increase in noxious weeds, and the wetland's capacity to perform existing wetland functions;
- Alteration of drainage patterns and wetland hydrology;
- Compaction and rutting of wetland soils from movement of heavy machinery and transport and installation of transmission structures, inhibiting seed germination, or increasing siltation; and
- Temporary increase in turbidity and water quality and changes in wetland hydrology.

In general, electrical distribution line construction impacts to wetlands would be temporary and short-term, as most lines would run alongside existing roadways and smaller wetlands might be spanned. Trees in forested wetlands crossed by the electrical distribution line ROW would be removed, and the ROW would be maintained free of woody vegetation. Table 4.4-3 provides preliminary estimates of wetland impacts in Montana and South Dakota. Impacts were calculated based on a 150-foot wide ROW corridor width, which provides a high-end estimate of potential wetland impacts. Specific location data for ancillary and ROW proposed Project components for this connected action are to be determined, the impacts notes in Table 4.4-3 are considered interim. Electricity service providers would avoid and minimize impacts by spanning wetlands and selecting pole locations away from sensitive habitats. The exact locations of operational structures, such as poles, are still to be determined, however, permanent impacts are expected to be substantially lower than the estimated construction related impacts noted in Table 4.4-3.

Table 4.4-3 Estimated Impacts to Wetlands Associated with the Electrical Distribution Lines and Substations

State	Impact Area	Length of Wetlands Crossed (miles)[a]				Wetland Area Affected During Construction (acres)[b]			
		PEM	PSS	PFO	Riv-OW	PEM	PSS	PFO	Riv-OW
Montana									
	ROW[d]	2.8	1.3	0.04	1.6	49.7	24.1	0.6	28.1
South Dakota									
	ROW[d]	1.8	0.6	0.1	1.9	31.9	11.0	0.7	35.8
Nebraska									
	ROW[e]	NA	NA	NA	NA	NA	NA	NA	NA
Grand Total		4.6	1.9	0.1	3.5	81.6	35.1	1.3	63.9

Sources: exp Energy Services Inc. 2012 a, b; USFWS 2012a; Fry 2011; USGS 2011.

[a] Length of wetlands crossed for ROW is the length of wetlands bisected by transmission centerline.
[b] Construction electrical distribution line impacts were calculated based on a 150-foot general construction corridor width. These impacts do not include ancillary impacts. Actual construction corridor width will be 80 feet, and expanded to 150-feet wide around pole structures. Pole structure location was unknown at the time of this report. This estimate represents the maximum extent of wetland impacts associated with this connected action. Actual wetland impacts will likely be significantly lower. Location of operational structures is to be determined, therefore wetland acreage affected by operations is undetermined at this time, but would likely be substantially lower than construction related impacts.
[c] Cowardin et al., 1979; PEM-palustrine emergent; PSS-palustrine scrub-shrub; PFO-palustrine forested; Riv-OW-riverine-open water; NA-Not Available.
[d] Complete data for the electric distribution lines and substations were not available for Nebraska or Kansas at the time of this report.

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4.5 TERRESTRIAL VEGETATION

4.5.1 Introduction

This section describes potential impacts to terrestrial vegetation resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS, and in many instances, replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to terrestrial vegetation resources:

- A new section, Section 4.5.2, Impact Assessment Methodology, was added to explain the assessment methodology used to evaluate potential terrestrial vegetation impacts associated with the proposed Project;
- Potential impacts to general vegetation, biologically unique landscapes, and vegetation communities of conservation concern have changed due to the proposed reroute and the exclusive use of Geographical Information Systems (GIS) databases;
- Impacts to terrestrial vegetation associated with ancillary activities and connected actions have changed due to the proposed Nebraska reroute and new information that has become available since preparation of the Final EIS; and
- Section 4.5.5, Recommended Additional Mitigation, provides a list of additional mitigation measures to further reduce impacts to terrestrial vegetation.

The impacts to state or federally threatened, endangered, and candidate species or otherwise protected species and habitat are addressed Section 4.8, Threatened and Endangered Species and Species of Conservation Concern.

4.5.2 Impact Assessment Methodology

The impacts of the proposed Project on biologically unique landscapes and vegetation communities of conservation concern have been evaluated using a qualitative assessment of the potential direct and indirect impacts to species and their habitat through literature review and consultation with regional scientists. The potential impacts would result from the construction and operation of the proposed Project. 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, potential invasion by noxious weeds, and maintenance activities associated with the proposed Pipeline and ancillary facilities. The magnitude of impact would depend on the type and amount of vegetation affected, the rate at which vegetation would establish after construction, and the frequency of vegetation maintenance conducted on the permanent route during pipeline operation. Potential construction- and operations-related impacts would 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 proposed pipeline route 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 re-establishment 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, and inhibiting water infiltration, which could affect seed germination;
- Alteration in vegetation productivity and the timing of life cycle stages due to increased soil temperatures associated with heat emanating from the pipeline; and
- Loss of vegetation due to exposure to accidental crude oil releases (see Section 3.13, Potential Releases).

4.5.3 General Vegetation Impacts

Clearing trees within upland, wetland, 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 to 47.3 acres of forested areas would occur within the 50-foot-wide permanent easements centered on the proposed pipeline. In these areas, trees would be removed and would not be allowed to re-establish due to periodic mowing and brush clearing during pipeline operation. Routine maintenance vegetation clearing would occur no more than every 1 to 3 years. Impacts to the 538.3 acres of shrubland would be long term due to the time required to re-establish the woody vegetation characteristics of this community type. Most shrubs would be expected to re-establish within the non-maintained portion of the proposed route 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 degrees Fahrenheit [˚F]) primarily during winter and greater increases would occur with increasing depth toward the pipeline (from 10 to 15˚F at 6 inches below ground surface), with the most notable increases during spring in the northern portion of the pipeline (see Appendix S, Pipeline Temperature Effects Study). 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, often penetrate well below 6 inches. Soil temperatures immediately around the buried pipeline may reach temperatures as much as 40˚F warmer than the ambient surrounding soil temperatures (Appendix S, Pipeline Temperature Effects Study). In general, increased soil temperatures during early spring could cause early germination and emergence and increased productivity in annual crops such as corn and soybeans and in tallgrass prairie species (Appendix S). Increased soil temperatures may lead to localized soil drying and localized decreases in soil moisture available for evapotranspiration.

Impacts on annually tilled croplands generally would be short term and limited to the current growing season because topsoil would be segregated and soils would not be compacted during construction. Impacts on pastures, rotated croplands, and open grassland range generally would be short to long term, with vegetation typically re-establishing within 1 to 5 years after construction. In northern arid portions of the proposed Project, perennial herbaceous cover may require as long as 5 to 8 years to establish cover similar to adjacent undisturbed lands, especially when drought conditions or livestock grazing interfere with re-establishment. Native grasslands with fragile soils could take considerably longer to recover (see Section 4.5.4, Potential Impacts to Biologically Unique Landscapes and Vegetation Communities of Conservation Concern). Impacts on these communities during operation of the proposed pipeline would be minimal, because these areas would recover following construction and typically would not require maintenance mowing.

After removal of vegetation cover and disturbance to the soil, re-establishment of native 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 (such as buds or spores), resulting in the establishment of noxious weeds in previously weed-free areas. A total of 50 individual noxious weed species may occur along the proposed pipeline corridor. These noxious weeds are identified in Table 3.5-5. Figures 4.5.3-1 through 4.5.3-3 illustrate the land cover types (per the 2006 National Land Cover Database) crossed by the proposed route and Table 4.5-1 below summarizes the potential impacts to vegetation during the construction and operation period for the proposed Project.

Table 4.5-1 Summary of Estimated Impacts on Vegetation Communities

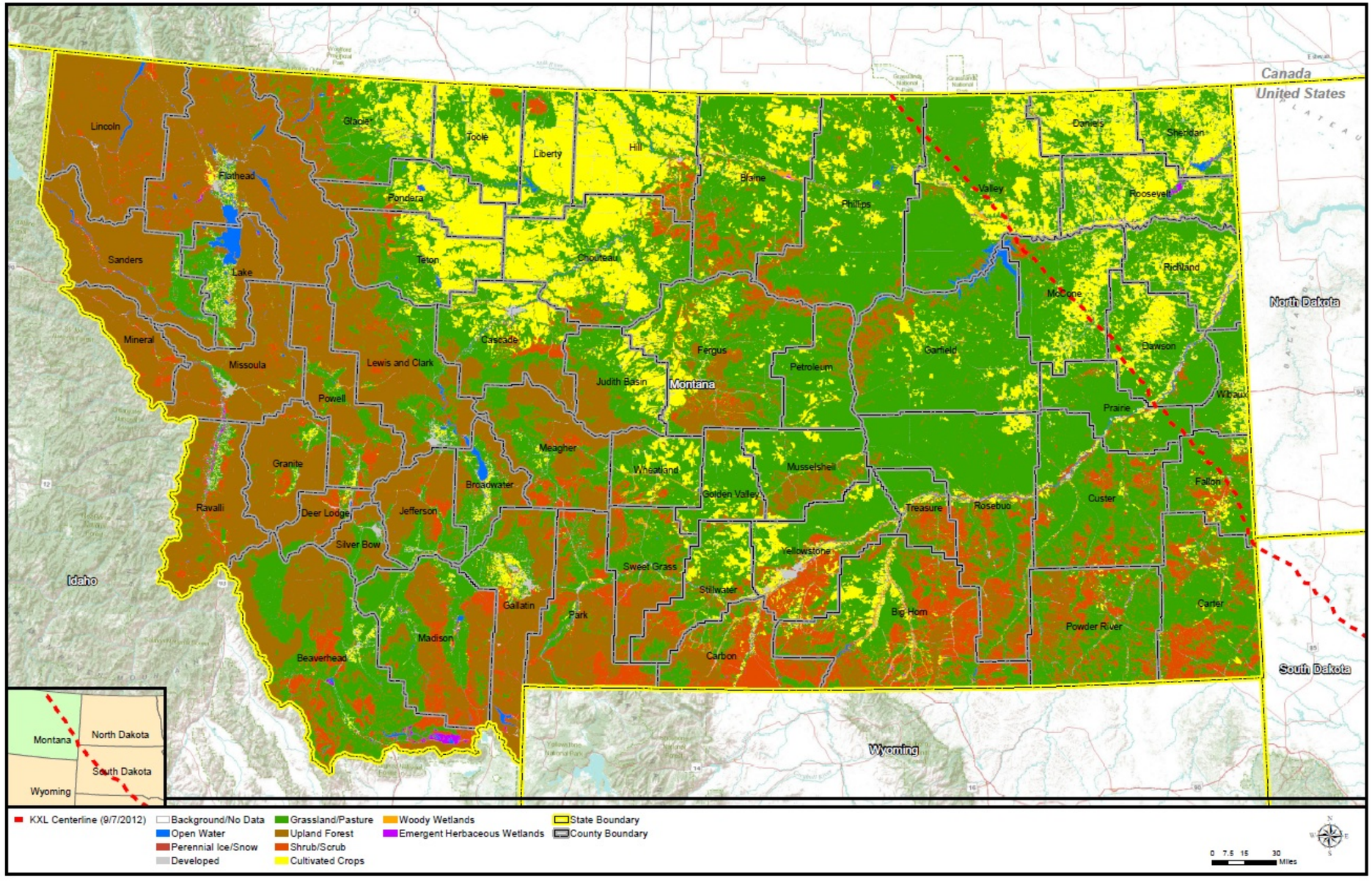
Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)[a]	Community Area Affected by Operations (acres)[a]
	Montana		
Cultivated Crops	61.2	904.8	372.6
Grassland/Pasture	187.4	2,833.7	1,138.7
Upland Forest	0.6	8.0	3.4
Open Water	0.3	1.8	1.8
Forested Wetlands	1.5	19.3	8.9
Emergent Herbaceous Wetlands	0.4	7.1	2.6
Shrub-Scrub	31.1	495.1	189.8
Developed Land	3.6	63.5	22.4
Montana Total	**286.2**	**4,333.5**	**1,740.2**
	South Dakota		
Cultivated Crops	49.3	707.7	298.3
Grassland/Pasture	256.5	3,786.8	1,557.6
Upland Forest	0.5	3.3	3.0
Open Water	0.3	1.7	1.5
Forested Wetlands	1.5	21.3	9.0
Emergent Herbaceous Wetlands	1.3	16.2	7.6
Shrub-Scrub	3.0	43.2	18.3
Developed Land	3.7	60.9	22.4

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)[a]	Community Area Affected by Operations (acres)[a]
South Dakota Total	**315.9**	**4,641.1**	**1,917.8**
	Nebraska		
Cultivated Crops	180.5	2,402.4	1,093.0
Grassland/Pasture	79.8	1,123.9	483.8
Upland Forest	2.0	28.5	12.1
Open Water	0.7	4.5	4.5
Forested Wetlands	1.9	17.2	11.3
Emergent Herbaceous Wetlands	0.6	8.8	3.7
Shrub-Scrub	0.0	0.0	0.0
Developed Land	8.5	136.4	52.3
Nebraska Total	**274.0**	**3,721.8**	**1,660.8**
	North Dakota Pipe Yard		
Grassland/Pasture	NA[b]	NA	4.1
Developed Land	NA	NA	2.2
North Dakota Pipe Yard Total			**6.3**
	Kansas Pump Stations		
Grassland/Pasture	NA	NA	13.5
Developed Land	NA	NA	1.7
Kansas Pump Stations Total	NA	NA	**15.2**
	Project Total		
Cultivated Crops	**291.0**	**4,014.9**	**1,763.9**
Grassland/Pasture	**523.8**	**7,744.4**	**3,197.7**
Upland Forest	**3.1**	**39.8**	**18.1**
Open Water	**1.3**	**8.0**	**7.8**
Forested Wetlands	**4.9**	**57.8**	**29.2**
Emergent Herbaceous Wetlands	**2.3**	**32.1**	**13.9**
Shrub-Scrub	**34.1**	**538.3**	**208.1**
Developed Land	**15.8**	**260.8**	**101.0**
Project Total	**876.1**	**12,696.4**	**5,340.3**

Source: National Land Cover Database (Fry et al. 2011).

[a] Includes acres disturbed on a temporary basis (permanent route 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.
[b] Not applicable (NA).
Note: the anticipated impacts to waters and wetlands as indicated in the table are based entirely on geographical information system (GIS) information. These acreages are estimates and do not reflect those acreages indicated in Wetlands, Sections 3.4 or 4.4, which include additional field verified data.

In Montana, 86 percent of the construction and operations impacts would be to areas that are Grassland/Pasture (65 percent) and Cultivated Crops (21 percent). In South Dakota, 96 percent of the construction and operations impacts would be to areas that are Grassland/Pasture (81 percent) and Cultivated Crops (15 percent). The Nebraska, 94 percent of the construction and operation impacts would be to areas that are Cultivated Crops (64 percent) and Grassland/Pasture (30 percent). Approximately 65 percent and 88 percent of the operations impacts to the North Dakota pipe yard and the Kansas pump stations, respectively, would be to Grassland/Pasture communities. In total, 93 percent of the construction and operations impacts of the proposed Project would be to areas that are Grassland/Pasture (61 Percent) and Cultivated Crops (32 percent).



Source: Fry et al. 2011.

Figure 4.5.3-1 Montana Land Cover

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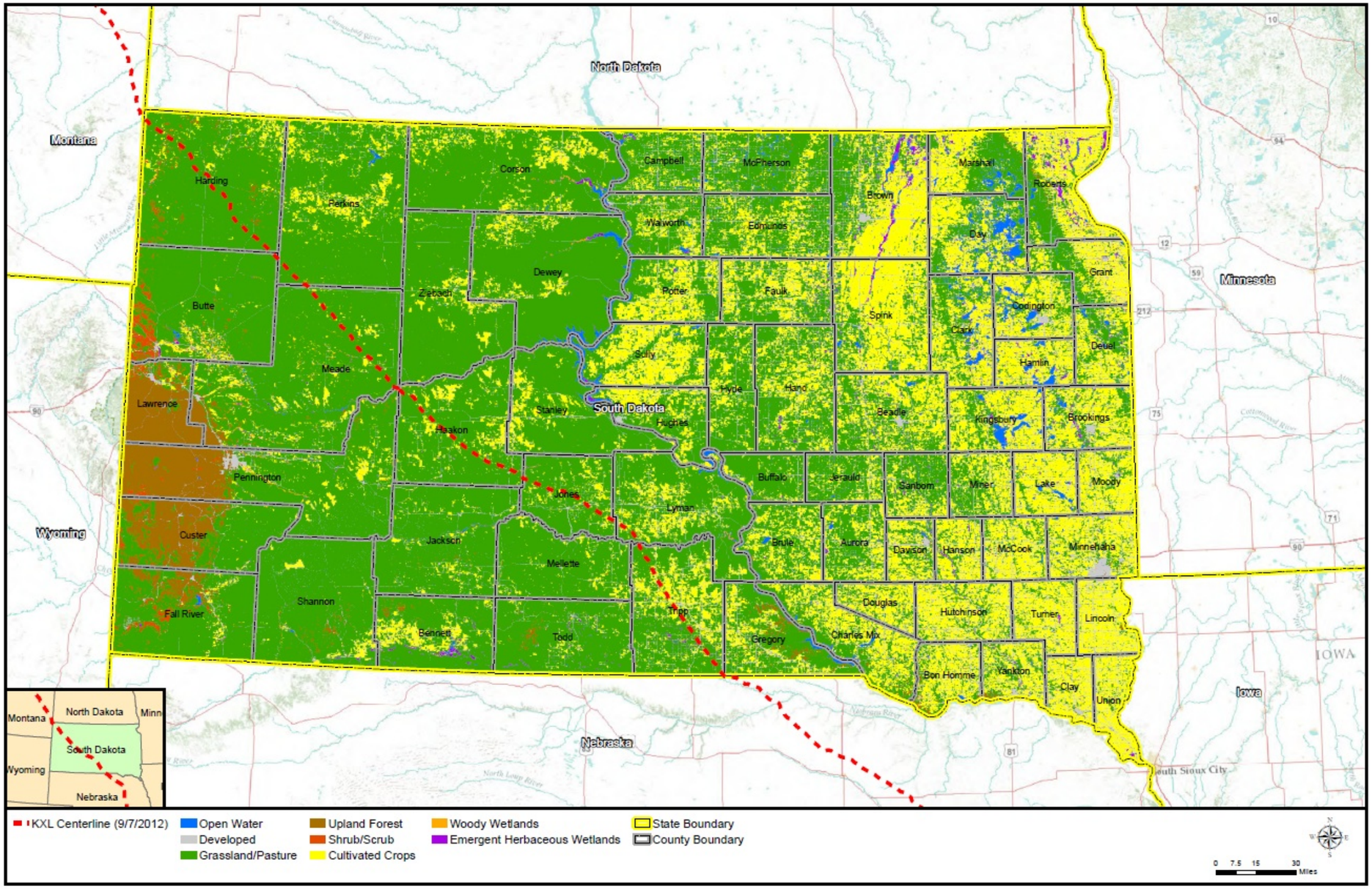

Source: Fry et al. 2011.

Figure 4.5.3-2 South Dakota Land Cover

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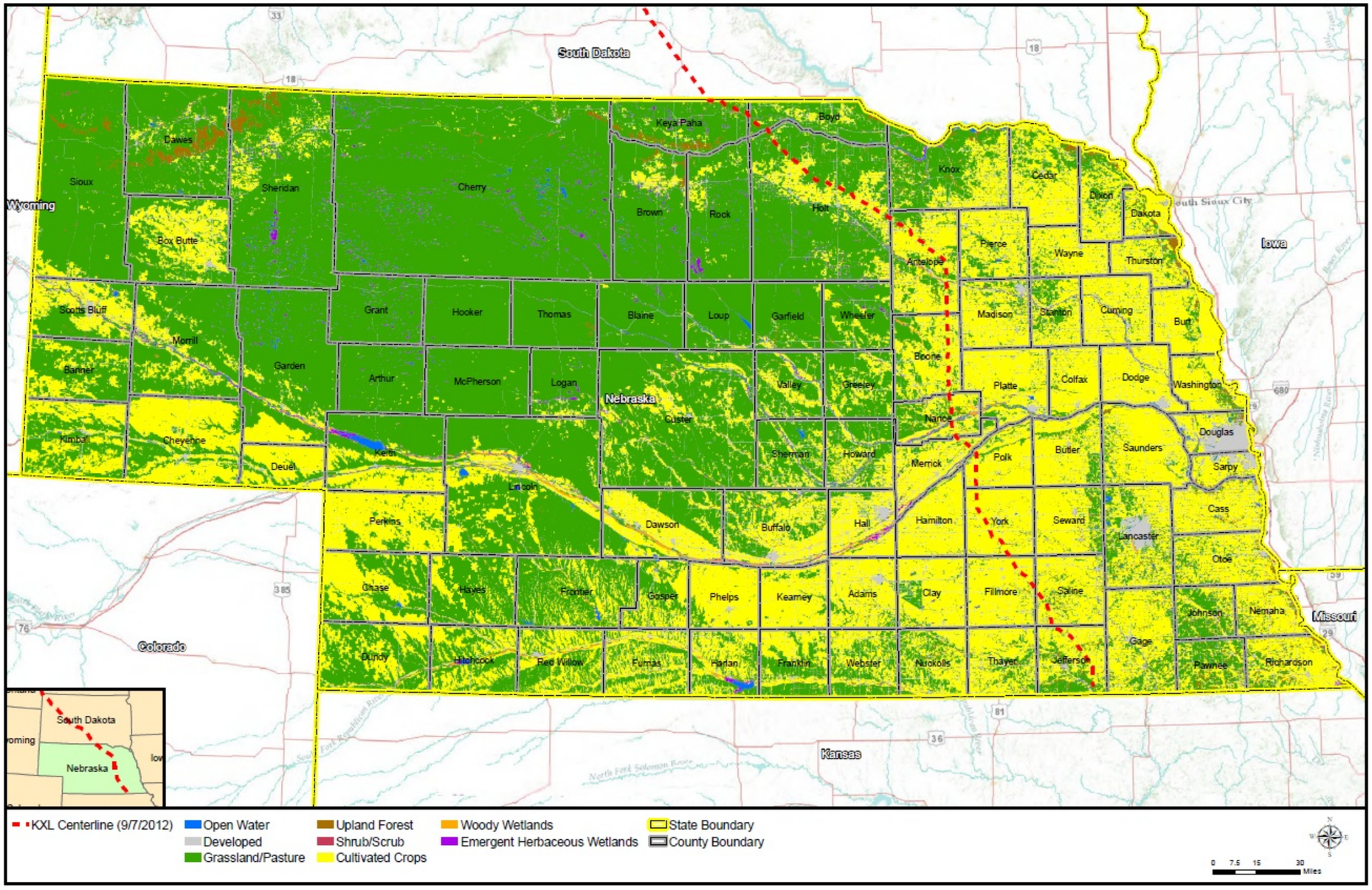

Source: Fry et al. 2011.

Figure 4.5.3-3 Nebraska Land Cover

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4.5.4 Potential Impacts to Biologically Unique Landscapes and Vegetation Communities of Conservation Concern

The potential impacts detailed in Section 3.5.4, Biologically Unique Landscapes and Vegetation Communities of Conservation Concern (including native grasslands, Rainwater Basin, sagebrush steppe, riparian habitats, and forest communities) are presented in Table 4.5-2. The proposed pipeline route would cross an estimated 355 miles of native grassland, distributed across 1,054 individual native grassland communities through Montana, South Dakota, and Nebraska. Although native grasslands would be reseeded with native seed, construction effects on previously untilled native prairies could be long term, as destruction of the prairie sod during trenching may require more than 100 years for recovery. Shortgrass prairie and mixed-grass prairie areas may take 5 to 8 or more years to re-establish due to poor soil conditions and low moisture levels. Construction through native grasslands would expose the fragile soils to erosion by wind and water and re-establishment of vegetative cover in this region would be difficult, requiring an estimated 4 or more years.

Table 4.5-2 Estimated Impacts on Vegetation Communities of Conservation Concern Occurring along the Proposed Project Route[a]

Community Type	Length (miles)	Communities Crossed
Montana		
Native Grasslands[b]	132.3	574
Sagebrush Steppe[c]	0.6	1
Riparian Habitats	6.2	131
Forest Communities	2.5	101
South Dakota		
Native Grasslands[b]	204.9	393
Sagebrush Steppe[c]	54.9	1
Riparian Habitats	0.2	8
Forest Communities	4.0	87
Nebraska		
Native Grasslands[b]	18.5	87
Rainwater Basin Plains	69.5	1
Forest Communities[d]	3.9	93
Total		
Native Grasslands[b]	355.7	1,054
Sagebrush Steppe[c]	55.5	2
Riparian Habitats	6.4	139
Forest Communities	11.4	281
Rainwater Basin Plains	69.5	1

Sources: U.S. Geological Survey (USGS) GAP Analysis (USGS 2011).

[a] Approximate mileage ranges presented. Communities are documented within the ranges presented and categories may overlap. Impacts based on a 110-foot-wide construction corridor.
[b] Native Grasslands include mixed-grass and tallgrass prairie ecosystems as identified in the GAP Analysis (USGS 2011).
[c] Sagebrush Steppe length and communities crossed based on Inter Mountain Basins Big Sagebrush Steppe Ecosystem layer (USGS 2011).
[d] Forest communities occur intermittently throughout the route in the state of Nebraska (mileposts 602-875).

Heat dissipated from the pipeline as discussed above could potentially lead to early germination and increased productivity of native prairie grasses, but may also lead to decreased soil water content, which could be detrimental to native prairie plants (Appendix S, Pipeline Temperature

Effects Study). Invasion of non-native plants also may prevent recovery of prairie grasslands, as would altered land management, which could include suppression of wildfires that help to maintain prairie sod.

The proposed pipeline route would cross an estimated 55.5 miles of Inter Mountain Basins Big Sagebrush Steppe ecosystem habitat. Construction through this ecosystem habitat would remove sagebrush shrubs. The sagebrush shrubland disturbed in the construction phase would typically become re-established within 5 to 15 years. The Sagebrush shrubland in the permanent easement would not be regularly mowed and would also be allowed to revegetate with sagebrush. Minimal maintenance would be necessary in this portion of the right-of-way (ROW) and sagebrush may require 20 to 50 years to re-establish.

The proposed pipeline route would cross an estimated 6.4 miles that lie within 139 riparian areas in the states of Montana and South Dakota. Bottomland forests would require 20 to 50 years or more to re-establish. The proposed pipeline route would cross an estimated 10.4 miles that lie within 281 upland and wetland forest communities. These communities would require 20 to 50 years to re-establish within temporary construction areas. Forests will not be allowed to regenerate within the maintained portion of the proposed Project ROW due to ongoing ROW maintenance activities.

There would be temporary and permanent impacts to Conservation Reserve Program land and Wetlands Reserve Program lands along the proposed pipeline route. The exact location and extent of these easements relative to the proposed Project route is pending additional relevant information and will be included in this review as part of the Final Supplemental Environmental Impact Statement. Successful restoration of native vegetation and Conservation Reserve Program 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.

TransCanada Keystone Pipeline, LP (Keystone) proposes to reduce impacts on vegetation within the construction and permanent ROW and to improve the probability of successful revegetation of disturbed areas by implementing the following measures as described in the proposed Project Construction, Mitigation, and Reclamation Plan (CMRP) (see Appendix G) 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 reduced;
- 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 CMRP (Appendix G) 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 in order to alleviate compaction on cultivated fields by cultivation.
- Consult with the Natural Resources Conservation Service (NRCS) if there are any disputes between landowners and Keystone as to areas where compaction should be alleviated.
- Plow under organic matter, including wood chips or manure, or plant a new crop such as alfalfa to decrease soil bulk density and improve soil structure, or conduct 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. Where appropriate, Keystone would retain a local rangeland expert to coordinate area-specific seed mixes.
- 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. Broadcast temporary cover crop seed.
- 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.
- 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.

The following measures, as identified in the proposed CMRP (Appendix G), would be implemented to minimize impacts specifically to native grasslands:

- Develop noxious-weed-free native seed mixes with input from the local NRCS offices and through collaboration with regional experts.
- Seed disturbance areas in native range with a native seed mix after topsoil replacement.
- 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.
- Monitor the ROW to determine the success of revegetation after the first growing season, and for areas in which vegetation has not been successfully re-established, reseed the area.
- 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.
- Protect topsoil piles from erosion to the degree practicable.
- Manage vehicle traffic in areas with high erosion potential or sensitive habitat.
- Any areas with unsuccessful revegetation would be monitored until adequate vegetation cover is achieved. In addition, the pipeline route would be monitored continually during operations to identify areas of erosion.

These measures for forested uplands and wetlands, as identified in the CMRP (Appendix G), 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 staging areas, 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.
- Remove unwanted timber from the construction ROW and transport it to a designated all-weather access point or mill.

As listed in the CMRP (Appendix G), the Montana Department of Environmental Quality has suggested the following potential mitigation measures:

- Test topsoils and subsoils for compaction at regular intervals on rangelands and pastures where requested by landowners, land management agencies or permitting agencies; and
- 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.

In order to control the introduction and spread of noxious weeds, Keystone in coordination with appropriate local, state, and federal agencies would implement the following construction and restoration procedures as detailed in the CMRP (Appendix G):

- Mark all areas of the ROW which contain infestation of noxious weeds.
- 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. Keystone would implement Best Management Practices for conducting vegetation control where necessary before and after construction. Agricultural herbicides used would be developed in consultation with county of state regulatory agencies and would not be used within 100 feet of a wetland or waterbody. In Nebraska, herbicides applied prior to or during construction would be non-residual.
- 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.
- Clean all construction equipment, including timber mats, with high-pressure washing equipment prior to moving equipment to the next job site; 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.
- 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.
- Implement weed control measures as required by any applicable plan and in conjunction with the landowner.

4.5.5 Recommended Additional Mitigation

In addition to the mitigation measures that Keystone would implement as discussed above, the following additional mitigation measures are recommended to minimize adverse impacts to natural vegetation during the construction phase and the operational phase:

- Do not over-prepare revegetation seed beds; instead, leave them intentionally heterogeneous and irregular.
- Re-inspect the ROW after 5 years to identify areas of erosion or settling and to evaluate the re-establishment of vegetation cover;
- Reseed disturbed areas with seed sources from local populations of Native American traditional use plants in areas used to harvest these resources; and
- Use hydro-seeding during extended drought conditions.

4.5.6 Connected Actions

4.5.6.1 Bakken Marketlink Project

The proposed route for the Bakken Marketlink Project is currently cultivated crops and grassland/pasture and there are no waterbodies or wetlands on the property (see Table 4.5-3 below). The two new storage tanks at Cushing would be located within the boundaries of the Cushing tank farm.

Table 4.5-3 Summary of Impacts on Vegetation Communities Crossed by Proposed Bakken Market Link Project

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected by Construction (acres)[a]
Cultivated Crops	1.9	26.7
Grassland/Pasture	2.7	34.7
Upland Forest	0.0	0.0
Open Water	0.0	0.0
Forested Wetlands	0.0	0.0
Shrub-Scrub	1.5	20.5
Emergent Herbaceous Wetlands	0.0	0.0
Developed Land	0.1	1.9
Total	**6.3**	**83.8**

Source: National Land Cover Data (Fry et al. 2011).

[a] Includes acres disturbed on a temporary basis (permanent route 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.
Note: the anticipated impacts to waters and wetlands as indicated in the table are based entirely on geographical information system (GIS) information. These acreages are estimates and do not reflect those acreages indicated in Wetlands, Sections 3.4 or 4.4, which include additional field verified data.

4.5.6.2 Big Bend to Witten 230-kV Transmission Line

The Western Area Power Administration and Basin Electric Power Cooperative have identified a preferred route for the proposed Big Bend to Witten 230-kilovolt (kV) transmission line project. Lengths of vegetation communities crossed by the preferred route are presented in Table 4.5-4. The preferred route would cross approximately 76 miles of primarily grassland/pasture and agricultural lands.

Table 4.5-4 Summary of Impacts on Vegetation Communities Crossed by Proposed Big Bend to Witten 230-kV Transmission Line Preferred Route

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected by Construction (acres)[a]
Cultivated Crops	24.4	323.9
Grassland/Pasture	43.7	580.1
Upland Forest	0.2	1.9
Open Water	0.1	1.3
Forested Wetlands	0.2	2.0
Shrub-Scrub	0.0	0.0
Emergent Herbaceous Wetlands	0.1	1.7
Developed Land	7.1	96.6
Total	**75.7**	**1,007.4**

Source: National Land Cover Data (Fry et al. 2011).

[a] Includes acres disturbed on a temporary basis (permanent route 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.
Note: The anticipated impacts to waters and wetlands as indicated in the table are based entirely on GIS information and do not include field verified information. These acreages are estimates and do not reflect those acreages indicated in Wetlands, Sections 3.4 or 4.4.

4.5.6.3 Electrical Distribution Lines and Substations

The primary impacts on vegetation from construction and operation of approximately 300 miles of new power distribution lines and substations in Montana and South Dakota[1] to provide power to the 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 new distribution lines for the proposed Project are presented in Table 4.5-5. After construction, power providers would restore affected lands in accordance with state and local standards and associated permits.

[1] Complete data for the electric distribution lines and substations were not available for Nebraska and Kansas at the time of this report.

Table 4.5-5 Estimated Impacts on Vegetation Communities Crossed by Proposed Electrical Distribution Lines for the Proposed Project

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected by Construction (acres)[a]
Montana		
Cultivated Crops	24.5	325.3
Grassland/Pasture	96.9	1,288.5
Upland Forest	0.3	4.3
Open Water	0.0	0.0
Forested Wetlands	1.6	20.9
Shrub-Scrub	7.0	94.7
Emergent Herbaceous Wetlands	0.0	0.0
Developed Land	8.5	117.8
Montana Total	**138.8**	**1,851.5**
South Dakota		
Cultivated Crops	23.1	307.2
Grassland/Pasture	103.0	1,377.2
Upland Forest	0.2	2.8
Open Water	0.3	3.5
Forested Wetlands	0.9	12.5
Shrub-Scrub	5.1	67.8
Emergent Herbaceous Wetlands	0.8	9.9
Developed Land	27.7	368.3
South Dakota Total	**161.0**	**2,149.3**
Project Totals		
Cultivated Crops	47.6	632.5
Grassland/Pasture	199.9	2,665.7
Upland Forest	0.5	7.1
Open Water	0.3	3.5
Forested Wetlands	2.5	33.4
Shrub-Scrub	12.1	162.5
Emergent Herbaceous Wetlands	0.8	9.9
Developed Land	36.2	486.1
Grand Project Totals	**299.8**	**4,000.8**

Source: National Land Cover Data (Fry et al. 2011)

[a] Includes acres disturbed on a temporary basis (permanent route 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.

Note: The anticipated impacts to waters and wetlands as indicated in the table are based entirely on GIS information and do not include field verified information. These acreages are estimates and do not reflect those acreages indicated in Wetlands Sections 3.4 or 4.4.

4.5.7 References

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U.S. Geological Survey (USGS). 2011. Gap Analysis Program (GAP). May 2011. National Land Cover, Version 2 Website: http://gapanalysis.usgs.gov/gaplandcover/data/ Accessed September 2012.

4.6 WILDLIFE

4.6.1 Introduction

This section describes potential impacts to wildlife resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to wildlife resources:

- A new section (Section 4.6.2, Impact Assessment Methodology) was added to explain the assessment methodology used to evaluate potential wildlife resources impacts associated with the proposed Project;
- Revised important wildlife areas are listed to reflect the route modifications with specific emphasis on changes to the route through Nebraska; and
- The discussion has been expanded on potential impacts to big game mammals, small game mammals, and non-game wildlife.

4.6.2 Impact Assessment Methodology

The impacts of the proposed Project on wildlife resources have been evaluated using a combination of quantitative and qualitative assessments of the potential direct and indirect impacts to species and their habitat through literature review and consultation with regional biologists:

- Calculation of the distance to nearby raptor nests and the effects that active construction may have to this resource;
- Evaluation of the effects of the proposed Project to hunting;
- Calculation of the miles and acreage of habitats and important wildlife habitat potentially impacted; and
- Qualitative evaluation of the potential direct and indirect impacts to wildlife and their habitats resulting from the proposed Project's construction and operation activities.

4.6.3 Potential Impacts

Construction of the proposed Project would have direct and indirect, and temporary (short-term and long-term) and permanent impacts on wildlife resources. Direct impacts could occur due to vegetation removal or conversion, obstructions to movement patterns, or the removal of native habitats that may be used for foraging, nesting, roosting, or other wildlife uses (Barber et al. 2010). Indirect impacts to wildlife are difficult to quantify and are dependent on the sensitivity of

the species, individual, type and timing of activity, physical parameters (e.g., cover, climate, and topography), and seasonal use patterns of the species (Berger 2004). Short-term impacts on wildlife would occur during construction and may extend beyond construction activities. Disturbed habitat may not be returned to former levels of functionality for up to 3 years following restoration efforts (Braun 1998), but long-term impacts on wildlife could extend through the life of a project and possibly longer for those habitats that require many years to be restored (Harju et al. 2010). Permanent impacts would result from construction of aboveground facilities that convert natural habitat to land used for pipeline operations, and where operational maintenance of the right-of way (ROW) permanently alters vegetation characteristics (Braun 1998).

The proposed Project could affect wildlife resources through the following:

- 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 less edible plants or reduced cover.

Construction of the proposed Project would result in disturbance of about 12,696 acres of various habitat types, including approximately 7,744 acres of grasslands and rangelands, 40 acres of upland forested habitat, and 636 acres of wetland habitats, including 58 acres of forested wetlands (see Table 3.6-1). In addition, about 150 temporary access roads (about 156 miles) and about 41 permanent access roads (about 20 miles) would be used; most (over 90 percent) would be modifications of existing roads. Four construction camps (approximately 80 acres each) would be established within remote areas crossed by the proposed Project route in Montana while three would be established in South Dakota and one camp would be established in Nebraska. Also, 6.3 acres of grassland and developed land would be impacted to construct a pump station in North Dakota and 15.2 acres of grass land and developed land would be impacted in Kansas to construct pump stations.

The proposed Project route would cross areas considered important habitats used by wildlife (see Table 4.6-1). Encompassing both public and private lands, these areas include wetland and conservation easements, Important Bird Areas (IBAs), river valleys, and state wildlife areas. Additional relevant information is pending and will be included in this review as part of the Final Supplemental Environmental Impact Statement (Supplemental EIS).

Table 4.6-1 Important Wildlife Habitats within or near the Proposed Project Area

Milepost	Name	Ownership and Description	Pipeline Miles Affected
	Montana		
4-5	U.S. Fish and Wildlife Service Wetland Easement	Private	0.8
26-68	North Valley Grasslands IBA	Private 45%, Bureau of Land Management 43%, State 11%, Tribal 1%	43.1
49-71	Cornwell Ranch Conservation Easement (proposed—overlaps IBA)	Montana Fish, Wildlife, and Parks	21.5
83	Milk River Valley	Montana Department of Natural Resources	~0.2
90	Missouri River Valley	Montana Department of Natural Resources	~1.0
196	Yellowstone River Valley	Montana Department of Natural Resources and Private	~0.5
Various	Conservation Reserve Programs	Private	na[a]
	South Dakota		
426	Cheyenne River Valley	na[a]	~0.7
537	White River Valley	na[a]	~0.2
Various	State Wildlife Areas	South Dakota Game, Fish, and Parks	20.7
Various	Conservation Reserve Program	Private	na[a]
	Nebraska		
602-623	Keya Paha River Valley	Various	22.4
623-628	Niobrara River Valley	Various	5.7
677-688	Verdigris/Bazile	Various	11.4
760-764	Loup River Valley	Various	5.2
778-847	Rainwater Basin	Various	69.5
Various	Conservation Reserve Program	Private	na[a]
TBD	Hosford Conservation Easement	Private	TBD

Source: Schneider et al. 2011, National Audubon Society 2012, Keystone 2012a.

[a] na = not available. Additional relevant information is pending and will be included in this review as part of the Final Supplemental EIS.

Fragmentation of wildlife habitat would result from the proposed Project. 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 adverse effects on biodiversity; fragmentation typically has a lower magnitude effect (relative to habitat loss) that may be either beneficial or adverse (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 are typically most pronounced in forested and shrubland habitats and are generally reduced for pipeline corridors because their widths can be narrowed in sensitive habitats, vegetative cover is re-established in temporary working areas, and there is minimal 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 coyote, deer, raccoon, and

many other species. The following are wildlife habitat fragmentation issues relevant for pipeline construction and operation:

- Reduction in patch size of remaining available habitats;
- Creation of edge effects;
- Creation of 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 would remove vegetation including native grasses, shrubs, 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 (Federal Energy Regulatory Commission [FERC] 2004). 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 could inhibit revegetation and extend the time to re-establish habitat linkages across the ROW. The pipeline ROW would be maintained free of trees and shrubs, resulting in long-term alteration of wildlife habitat structure and value. Approximately 18 acres of upland forest and 29 acres of forested wetland would be converted to non-forest habitat due to ongoing ROW maintenance.

Constructing the proposed pipeline could present a significant temporary physical barrier to wildlife movement. The open trench and welded pipeline sections stored along the construction ROW prior to burial could block movements of both large and small animals across the construction ROW. Small animals could also become trapped in open trench sections. Operation of heavy equipment could also create behavioral barriers to wildlife movements by displacing animals by disturbance.

After construction, the proposed pipeline ROW, unblocked temporary access roads, and permanent access roads could increase human activity especially within remote sections of the proposed Project route. This 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, Montana Board of Oil and Gas Conservation [MBOGC] 1989, Wyoming Game and Fish Department [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 adverse 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).

Some rangeland habitats crossed by the proposed Project route 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 more consequential in shrublands than grasslands, as species dependent on sagebrush cover would become more exposed when crossing the proposed pipeline corridor. Additionally, sagebrush is slow growing and regeneration along the proposed pipeline route may be inhibited by increased foraging during the establishment of this species. Fragmentation of native grasslands would generally be considered short term, until sufficient herbaceous cover is re-established to allow small mammals, amphibians, and reptiles to cross without exposure. Fragmentation-related issues applicable to wildlife habitat types crossed by the proposed Project route are summarized in Table 4.6-2.

Table 4.6-2 Habitat Types and Related Fragmentation Issues

Habitat Type	Breaking Large Habitat into Smaller Areas	Hindered Movements	Nest Parasitism	Facilitated Predator Movements	Disturbance-Construction Maintenance	Human Intrusions
Upland Forests	x	x	x	x	x	x
Wetland Forests	x	x	x	x	x	x
Scrub-shrub Wetlands	x	x	x	x		x
Wetlands/Swamps	x	x				x
Aquatic/Riverine	x	x	x			x
Grassland/Prairie	x	x	x		x	x
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 the U.S. Geological Survey's (USGS) Gap Analysis Program (USGS 2009) indicates that the proposed Project could potentially contribute to increased fragmentation of several contiguous areas (≥ 0.2 mile) of native grassland, shrubland, or forestland that would be crossed by the Project route within the important wildlife habitats identified in Table 4.6-1. 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 (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 4.6-1 and 4.6-2).

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 construction. During restoration, the area would be reseeded as directed by the landowner or land management agency, such that in some instances 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, other than maintenance and pipeline inspections, of the proposed pipeline would generally 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. Some adverse effects to wildlife due to noise generated at pump stations may occur. High noise levels potentially can mask wildlife communications that are used to attract mates and defend territories. Increased noise and activity levels during construction and development could result in nest abandonment and decreased reproductive success if such activity occurs during the breeding season (Bureau of Land Management [BLM] 2000). Additionally, vibration detected in the soils surrounding roadways have been shown to cause certain invertebrates to ascend to soil surfaces allowing them to become prey to birds (U.S. Department of Transportation [USDOT] 2004). Potential impacts associated with the potential accidental release of petroleum products, hazardous materials, or crude oil during construction and operation of the proposed Project are addressed in Section 4.13, Potential Releases. Appropriate federal and state wildlife management agencies would be consulted prior to initiation of maintenance activities beyond standard inspection procedures.

4.6.3.1 Big Game Species

The primary big game species occurring in the proposed Project area include white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), mule deer (*Odocoileus hemionis*), bighorn sheep (*Ovis canadensis*), and pronghorn antelope (*Antilocapra americana*). Gray wolf (*Canis lupus*) may also be present in Montana and mountain lion (*Puma concolor*) may also be present in Montana and South Dakota. Impacts to big game may be both short term and long term, such as habitat loss and fragmentation, physiological stress, and forage loss.

For big game species, construction activities could result in increased agitation, physiological stress, and use of sub-optimal habitat. Animals can become physiologically stressed when energy expenditures increase due to alarm or behavioral avoidance (Lutz et al. 2011). These responses are often attributed to interactions with humans or activities associated with human presence such as traffic and noise. Physiological stress diverts time and energy away from critical activities such as foraging and resting, both of which are important to maintain or improve fitness (Gill et al. 1996, Frid and Dill 2002).

Construction of the proposed Project may alter migration routes and displace wildlife from preferred habitats (Sawyer et al. 2006) by creating barriers that hinder migration and use of these habitats (Sawyer et al. 2009).

Construction of permanent aboveground facilities would result in the permanent loss of undeveloped habitat for big game. Approximately 285 acres of undeveloped habitat (113 acres in Montana, 90 acres in South Dakota, 67 acres in Nebraska, and 15 acres in Kansas) would be

permanently lost due to the construction of permanent aboveground facilities. This loss of habitat would constitute a very small percentage of available habitats on a regional basis and would not likely affect big game populations in the proposed Project area.

Construction of the proposed Project could impact hunter success rates within the Project area. Hunting could be adversely affected due to construction activities occurring during hunting seasons, primarily due to the displacement of big game animals from construction and noise disturbance. Once the proposed pipeline is constructed, harvest rates could potentially increase after construction because of increased access by hunters using the pipeline ROW to access remote areas (Comer 1982). In addition, big game species that use a cleared ROW could be more likely to be hunted than animals in forested habitat. Increased hunting along cleared ROWs in the fall hunting season has been documented elsewhere (Crabtree 1984).

4.6.3.2 Small Game Species 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 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 could fall into and become trapped in the open trench during pipeline construction, potentially resulting in injury or mortality. Burrowing animals would be expected to return and recolonize 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 (*Taxidea taxus*), ground squirrel (*Spermophilus* spp.), 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, and spring months. The heat generated by the proposed pipeline would warm the soils within the proximity of the pipeline (see Appendix S, Pipeline Temperature Effects Study). 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 degrees Fahrenheit and at a depth of 6 inches by as much as 10 to 15 degrees Fahrenheit, (see Appendix S, Pipeline Temperature Effects Study).

For animals that use tree and shrub habitats for cover, food, 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 98 acres of forested habitats would be affected by construction of the proposed Project, of which an estimated 47 acres would be maintained as herbaceous vegetation. Those areas falling within the construction ROW would be cleared of trees and brush to provide access for construction equipment. Trees and shrubs would not be allowed to re-establish on the permanent ROW. Differences in vegetation cover between the ROW and the surrounding landscape could 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 (*Canis latrans*) and raccoons (*Procyon lotor*).

4.6.3.3 Waterfowl and Game Bird Species

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 (*Zenaida macroura*) nest in trees. Direct impacts on small game bird species could include nest or burrow abandonment, loss of eggs or young, or death. Habitat loss, alteration, and fragmentation could occur until vegetation is re-established. After revegetation, the habitat could still be degraded due to the spread of noxious and invasive species, noise, and human presence. 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 re-establish and the permanent ROW would be maintained free of trees and large shrubs. Migratory waterfowl could be attracted to the pipeline corridor during early spring if it becomes snow-free earlier than surrounding habitats. Communication towers at pump stations (generally 33 feet tall and no more than 190 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. Conversely, towers could provide vantage perches and artificial nesting habitat, depending on their configurations, for raptors and common ravens (*Corvus corax*) or crows (*Corvus brachyrhynchos*), which may prey on ground nesting upland game birds.

Sharp-tailed grouse (*Tympanuchus phasianellus*) inhabit native prairies and nest in grasslands. This species has disappeared from large portions of its historical range, primarily due 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 near leks (areas where birds congregate and conduct courtship displays to attract mates). 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. The proposed pipeline would cross at least 16 known sharp-tailed grouse leks through Montana and South Dakota. Additional leks may be located in Nebraska along the proposed route in Nebraska and surveys will be conducted in 2013 to identify their potential locations (Keystone 2012b).

4.6.3.4 Non-game Animals

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 their hibernation sites, 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 not survive 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. Ripping for construction through rock outcrops, which may provide hibernacula (winter hibernation locations) for snakes, could destroy all or portions of these habitats. Removal of trees from the construction ROW and extra workspaces in woodlots, riparian areas, and shelterbelts could also lead to the destruction of bat roosting habitats. Communication towers at pump stations could be a collision hazard to migrating birds and may provide vantage perches and

artificial nesting habitat for raptors, ravens, or crows, which may prey on grassland and shrubland small mammals.

Construction could cause direct and indirect impacts to raptors and migratory birds. Raptors and migratory birds would be affected by an overlap of the proposed Project construction schedule with nesting seasons of birds in the Project area. Indirect impacts could be associated with increased human presence and noise from construction activity close enough to disturb actively nesting birds. Additionally, construction activity near active nests during incubation or brood rearing could result in nest abandonment; overheating, chilling, or desiccation of unattended eggs or young causing nestling mortality; premature fledging; or ejection of eggs or young from the nest (U.S. Fish and Wildlife Service [USFWS] 2007).

Removal of trees from the construction ROW and extra workspaces in woodlots, riparian areas, and shelterbelts could lead to the destruction of raptor and owl nests, migrant bird nests, and great blue heron (*Ardea herodias*) habitat. About 28 large stick nests were found inside the survey area, which covered the area within about 0.25 to 1 mile of the proposed Project centerline in Montana and South Dakota. Nest and rookery surveys in Nebraska will be conducted in spring 2013. Migratory birds and their active nests are protected under the Migratory Bird Treaty Act (MBTA) (see discussion below). Direct impacts to nesting migratory birds would be avoided by limiting construction to non-nesting periods during late summer through winter. If any of these nests or rookeries were 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 were 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 (USFWS 2007). Losses of tree and shrub habitats used by migratory birds for cover, forage, and nesting would be long term because from 5 to 20 years or more would be required to re-establish 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 would depend 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 (Montana Department of Natural Resources and Conservation [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 habitat is fragmented (Vander Haegen 2007).

Habitats crossed by access roads and aboveground 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).

The MBTA (Title 16 of the United States Code 703-712) prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted by regulation. The MBTA was enacted in 1918; a 1972 agreement supplementing one of the bilateral treaties underlying the MBTA had the effect of expanding the scope of the Act to cover bald eagles and other raptors. Implementing regulations define *take* under the MBTA as "pursue, hunt, shoot, wound, kill, trap, capture, possess, or collect" (USFWS 2007). The Bald and Golden Eagle Protection Act (16 United States Code 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle . . . [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines take as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment (USFWS 2007).

The 1988 amendment to the Fish and Wildlife Conservation Act mandates that the USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." As a result of this mandate, the USFWS created the Birds of Conservation Concern list. The goal of this list is to prevent or remove the need for additional Endangered Species Act bird listings by implementing proactive management and conservation actions and coordinating consultations in accordance with Executive Order 13186. Migratory raptor species in the proposed Project area are generally considered sensitive and in need of specialized protective measures (USFWS 2007).

Nest and rookery surveys were conducted in 2008, 2009, and 2010 on the Final Environmental Impact Statement route. Additional nest surveys on the route through Montana and South Dakota were conducted in 2010, 2011, and 2012. Surveys for the Nebraska route that has changed from the route evaluated in the Final Environmental Impact Study are projected for completion in spring 2013. These surveys will assist in identifying where construction may affect active nests

(and, in the case of burrowing owls, cause direct impacts on nests and nesting habitat) and where buffer zones may be required (Table 4.6-3).

Table 4.6-3 General Spatial Buffer Restrictions[a] and Nesting Seasons for Raptors Potentially Present in the Project Area

Species	Spatial Buffer (Miles)	Nesting Season
Osprey (*Pandion haliaetus*)	0.25	April 1–August 31
Bald Eagle (*Haliaeetus leucocephalus*)	0.5-1.0	January 1–August 31
Northern Harrier (*Circus cyaneus*)	0.25	April 1–August 15
Sharp-shinned Hawk (*Accipiter striatus*)	0.25	March 15–August 31
Cooper's Hawk (*Accipiter cooperii*)	0.25	March 15–August 31
Northern Goshawk (*Accipiter gentilis*)	0.5	March 1–August 15
Broad-winged Hawk (*Buteo platypterus*)	NA[a]	NA[a]
Swainson's Hawk (*Buteo swainsoni)*	0.25	April 1–August 31
Red-tailed Hawk (*Buteo jamaicensis*)	0.33	March 15–August 15
Ferruginous Hawk (*Buteo regalis*)	1.0	March 1-August 1
Rough-legged Hawk (*Buteo lagopus*)	NA[a]	NA[a]
Golden Eagle (*Aquila chrysaetos*)	0.5	January 1–August 31
American Kestrel (*Falco sparverius*)	0.125	April 1-August 15
Merlin (*Falco columbarius*)	0.25	April 1–August 31
Gyrfalcon (*Falco rusticolus*)	NA[a]	NA[a]
Peregrine Falcon (*Falco peregrinus*)	1.0	February 1–August 31
Prairie Falcon (*Falco mexicanus*)	0.5	April 1-August 31
Barn Owl (*Tyto alba*)	0.125	February 1–September 15
Eastern Screech-Owl (*Megascops asio*)	0.125	Varies
Great Horned Owl (*Bubo virginianus*)	0.125	December 1–September 31
Snowy Owl (*Bubo scandiacus*)	0.125	May 1–September 31
Burrowing Owl (*Athene cunicularia*)	0.25	March 1–August 31
Barred Owl *(Strix varia*)	0.25	February 1–August 31
Long-eared Owl (*Asio otus)*	0.125	February 1–August 15
Short-eared Owl (*Asio flammeus*)	0.25	March 1–August 1
Northern Saw-whet Owl (*Aegolius acadicus*)	0.125	March 1-August 31

Source: Whittington and Allen 2008, Cornell Lab of Ornithology 2012.

[a] This species does not nest within the proposed Project area; NA = not applicable.

Based on nest surveys conducted to date, known areas where construction activities may coincide with raptor nesting on rock outcrops or clay ridges include:

- One inactive unidentified hawk (*Buteo* sp.) nest, Valley County, Montana;
- One active red-tailed hawk (*Buteo jamaicensis*) nest, Prairie County, Montana;
- One inactive unidentified hawk nest, Prairie County, Montana;
- Four inactive unidentified hawk nests, Fallon County, Montana;
- Three inactive ferruginous hawk (*Buteo regalis*) nests, Harding County, South Dakota; and
- One inactive unidentified hawk nest, Tripp County, South Dakota

Additional discussion of impacts to listed threatened and endangered species is provided in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern.

4.6.3.5 Mitigation Measures

The proposed pipeline has been carefully designed to avoid most state, federal, and local managed habitat. To reduce potential construction- and operations-related effects where habitat is crossed, procedures outlined in the proposed Project Construction, Mitigation, and Reclamation Plan (CMRP) (Appendix G) would be implemented. Measures to minimize adverse effects to wildlife habitats, including shelterbelts, windbreaks, and living snow fences, are identified in the CMRP. Pipeline construction would be conducted in accordance with required permits. The following measures to minimize impacts to wildlife, as identified in the CMRP, 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.
- Coordinate the suitability of fertilizers and pH modifiers in native rangelands to minimize the potential spread of non-native and invasive species with agricultural agents/rangeland experts and manage accordingly.
- Coordinate with landowners to discourage intensive grazing in the restored forested areas along the construction ROW during the first five growing seasons.
- Control unauthorized off-road vehicle access to the construction ROW through use of signs, slash and timber barriers, pipe barriers, boulders, or planted conifers or other appropriate trees or shrubs in accordance with landowner or manager request.
- To prevent unauthorized access, and to the extent permitted by landowners, TransCanada Keystone Pipeline, LP (Keystone) would secure/lock temporary gates when construction activities are not occurring. Also to the extent permitted by landowners, Keystone would make reasonable efforts to restrict access to the pipeline corridor via access roads after construction to minimize increased human use in formerly inaccessible areas.
- Develop a Migratory Bird Conservation Plan in consultation with USFWS to comply with the MBTA and implement provisions of Executive Order 13186 by providing benefits to migratory birds and their habitats within the states where the proposed Project would be constructed, operated, and maintained.
- Develop construction timing restrictions and buffer zones, such as those described in Table 4.6-4, through consultation with regulatory agencies for the proposed Project.
- 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, complete nest-drag surveys to determine the presence or absence of nests on BLM lands in Phillips County, Montana.
- If construction would occur during the raptor nesting season during January to August, complete pre-construction surveys to locate active nest sites to allow for appropriate construction scheduling.

Table 4.6-4 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) and December 1 to May 15 (BLM)
Snakes–hibernacula	Montana	NA	October 1 to May 1 (MFWP)
Sharp-tailed Grouse–active lek and nesting habitat	Montana South Dakota	0.25 mile (MFWP & BLM)	March 1 to June 15
Rookeries–Great Blue Herons or Double Crested Cormorants	Montana	0.31 mile (MFWP)	May 1 to July 31 (MFWP)
Raptors and Herons–active nests and rookeries	Entire ROW	0.5 mile (MFWP) 0.25 mile no surface occupancy (MWFP & BLM) 0.5 mile timing limitations (BLM)	March 1 to August 1 (MFWP) March 1 to July 31 (BLM) February 1 through August 15 (USFWS)

[a] Timing restrictions for federal and state-listed endangered, threatened, or candidate species and species identified as conservation concerns or priority are discussed in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern. Timing restrictions for aquatic animals are discussed in Section 4.7, Fisheries.

In Montana, the proposed Project would employ the wildlife mitigation measures included in Appendix A to the Environmental Specifications developed for the Project by the Montana Department of Environmental Quality (MDEQ) (see Appendix N, Supplemental Information for Compliance with MEPA). On federal lands in Montana and South Dakota, the proposed Project would employ wildlife mitigation measures attached to the federal grant of ROW. In South Dakota, the proposed Project would employ mitigation measures to satisfy the conditions that were developed by the South Dakota Public Utility Commission and attached to its Amended Final Decision and Order, Notice of Entry HP09-001. Additional wildlife mitigation measures would include the following:

- In Montana, 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 (MDEQ and Montana Fish, Wildlife, and Parks [MFWP]).
- From March 1 to June 15, prohibit construction and routine maintenance activities within 0.25 mile of an active sharp-tailed grouse lek that can be seen from the construction ROW (MDEQ, MFWP, and BLM).

- Avoid construction and reclamation activities within 0.62 mile of active raptor nests between March 15 and July 15 (MDEQ and MFWP).
- Avoid great blue heron rookeries by at least 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).
- 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).

4.6.4 Recommended Additional Mitigation

No additional mitigation measures are recommended or required.

4.6.5 Connected Actions

4.6.5.1 Bakken Marketlink Project

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. The property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields and a survey of the property indicated that there were no observations of listed species or listed species habitat, nor were there raptors, waterbodies, or wetlands observed on the property. Additional relevant information is pending and will be included in this review as part of the Final Supplemental EIS.

4.6.5.2 Big Bend to Witten 230-kV Transmission Line

Upgrades to the power grid in South Dakota to support power requirements for pump stations would include construction of a new 230-kilovolt (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 for the 230-kV line would be larger and that the area disturbed around the installation site would likely be larger.

The transmission poles along the line would be a maximum of 115 feet tall with an average span of approximately 800 feet and there are no guy wires proposed. Lengths of vegetation communities crossed by the preferred route are presented in Table 4.5-4. The preferred route would cross approximately 76 miles of habitat. Over 99 percent of impacts to habitat occur to grassland/pasture, developed land, and agricultural lands. The transmission line route would cross the White River and several smaller streams. Transmission line crossings of the larger rivers 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 through implementation of the same mitigation measures discussed above for power distribution lines to pump stations.

Additional relevant information is pending and will be included in this review as part of the Final Supplemental EIS.

4.6.5.3 Electrical Distribution Lines and Substations

Electrical distribution line construction and operation would require 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 the following:

- 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 377 miles of new electric distribution lines would be necessary to power pump stations along the proposed pipeline ROW for the Project (see Section 2.1.12.3, Electrical Distribution Lines and Substations) in Montana, South Dakota, Nebraska, and Kansas. Wildlife habitats potentially affected by construction and operation of distribution lines include 119 miles of grassland/rangeland, 22 miles of cropland, less than 1 mile of upland forest, 2 miles of wetland and water, and 8 miles of developed land. Locations for electric distribution lines through Nebraska have not yet been determined but they would likely impact croplands and grassland/rangelands.

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 approximately 15 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 approximately 19 miles of the North Valley Grasslands IBA and may impact survival and reproduction for ground nesting grassland birds; and approximately 2 miles of the Charles M. Russell National Wildlife Refuge, an IBA that supports 15 birds of global conservation concern (Montana Audubon 2008). Other power distribution line routes would also cross smaller rivers and streams that are likely to attract raptors and migratory birds. Raptor nest surveys of power line routes for Pump Stations 9 to 20 identified 13 active raptor nests within 1 mile of proposed power line routes. Six of these nests occurred within 0.5 mile of a proposed power line route.

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 could be used as vantage perches by raptors, facilitating predation on these ground-nesting birds. Location of poles across grassland and shrubland habitats would reduce 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 (Avian Power Line Interaction Committee [APLIC] and USFWS 2005).

Birds are electrocuted by power distribution lines principally because of two factors: 1) environmental factors such as topography, vegetation, available prey, and other behavioral or biological factors that influence avian use of power poles; and 2) inadequate separation between energized conductors or energized conductors and grounded hardware that provide two points of contact (APLIC and USFWS 2005). Raptors are opportunistic and may use power poles for nesting sites, vantages for territorial defense, or vantages for hunting. Power poles and lines may provide perches for hunting that offer a wide field of view above the surrounding terrain (APLIC and USFWS 2005). Collision and electrocution impacts on birds resulting from construction of distribution lines would be reduced by mitigation requirements imposed by state and federal regulatory agencies, including the following:

- Incorporate Avian Protection Plan Guidelines (APLIC and USFWS 2005) into the routing, design, and operation of the electrical distribution lines to reduce likelihood for collision and electrocution mortality of migratory birds, which could 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;
  - Reduction of the 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
  - Reduction of the 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 and USFWS 2006, APLIC and USFWS 2005), into the design of electrical distribution lines in areas of identified avian concern to prevent electrocution, including:
  - Use of a minimum 60-inch separation between energized conductors/hardware and grounded conductors/hardware to protect eagles;
  - Increased separation where necessary to achieve adequate separation for types of birds involved;

- Covering energized parts and/or grounded parts to provide incidental contact protection for birds; and
- Application of perch management techniques where appropriate.

Additional relevant information is pending and will be included in this review as part of the Final Supplemental EIS.

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4.7 FISHERIES

4.7.1 Introduction

This section describes potential impacts to Fisheries resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize those impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS, and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to Fisheries resources:

- A new section (Section 4.7.2, Impact Assessment Methodology) was added to explain the assessment methodology used to evaluate potential fisheries impacts associated with the proposed Project;
- The number and type of stream crossings and stream crossing methods have changed due to changes in the proposed Project route as well updated field survey information provided by Keystone. The Supplemental Environmental Impact Statement (Supplemental EIS) stream crossing assessment is comprised of a desktop analysis based on National Hydrologic Dataset (NHD) information and supplemented by Keystone field survey descriptions where available;
- A discussion of the potential impacts of the installation of culverts or bridges for newly constructed access roads was included;
- A discussion of the impacts associated with the potential increase in stream water temperature associated with the elevated temperature of the oil in the proposed pipeline was included; and
- Section 4.7.4, Recommended Additional Mitigation, provides a list of additional mitigation measures to further reduce impacts to fisheries.

4.7.2 Impact Assessment Methodology

The impacts of the proposed Project on fisheries, aquatic resources, and protected species have been evaluated using a qualitative assessment of the potential direct and indirect impacts to species and their habitat through literature review and consultation with regional biologists. Field studies continue to be conducted along the proposed Project route, the results of which will be reported in fall 2012 and spring 2013. The potential impacts would result from the construction and operation of the proposed Project.

4.7.3 Potential Impacts

Potential impacts to fisheries resources associated with construction and operation of the proposed pipeline are addressed in this section. Impacts associated with potential spills of oil or other hazardous substances are addressed in Section 4.13, Potential Releases.

The proposed Project has the potential to impact special-status fish including threatened and endangered species under the Endangered Species Act, BLM sensitive species, and individual states' species of conservation concern. The potential impacts to these species are discussed in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern.

Disturbance to upland plant communities and soil could have indirect impacts on aquatic habitats through increased sedimentation due to wind and water erosion and a reduction in filtering capacity and infiltration of runoff due to reduced vegetative cover. Impacts to upland areas and measures to minimize erosion associated with disturbance of upland areas are discussed in Section 4.3, Water Resources, and Section 4.5, Terrestrial Vegetation.

To minimize potential impacts to fisheries resources, TransCanada Keystone Pipeline, LP (Keystone) would implement a Construction, Mitigation, and Reclamation Plan (CMRP) (see Appendix G), which contains measures for use at and near waterbody crossings to reduce potential effects on fish and aquatic/stream bank habitat.

4.7.3.1 Introduction of Invasive/Non-Native Species

Introduced non-native species can compete with native species and transmit diseases (e.g., whirling disease) that could adversely impact sensitive fish species. Invasive aquatic species (either plant or animal) can be introduced into waterways and wetlands and can be spread by improperly cleaned vehicles and equipment operating in water, stream channels, or wetlands (Cowie and Robinson 2003, Fuller 2003). Some invasive organisms can live in dry equipment for several days. Whirling disease in salmonids is caused by a protozoan parasite (*Myxobolus cerebralis*) that has a resistant myxospore stage. The disease causes skeletal deformation and neurological damage in juvenile fish. Myxospores can be transmitted in mud from infected streams on equipment used in water and on vehicles between watersheds. Whirling disease occurs in over 100 different streams with only a few major river drainages uninfected in Montana (Montana Aquatic Nuisance Species Technical Committee 2002). New Zealand mudsnails (*Potamopyrgus antipodarum*) have been reported from the Big Horn River drainage, a tributary to the Yellowstone River in Montana (Benson 2009a), which is over 160 river miles upstream of the proposed Project area. Quagga mussels (*Dreissena rostriformis bugensis*) have been reported from the South Platte River, a tributary to the Platte River in Nebraska (Benson 2009b), which is over 150 river miles upstream of the proposed Project area.

To reduce the potential for transfer of aquatic pathogens, temporary vehicle bridges would be used to cross waterbodies to limit vehicle contact with surface waters and sediments. During open-cut pipeline installation, in-stream activities would be conducted outside of the waterbody channel as much as practical and would limit the use of equipment within waterbodies. Workspaces would be located at least 10 feet from waterbodies and would implement erosion-control measures to reduce suspended sediment loading in waterbodies. These measures would also limit waterbody contact with vehicles and mud that could potentially serve as vectors for invasive species and whirling disease. Construction vehicles would be washed to remove mud and dirt that may collect on equipment. Washing would be accomplished in specified areas as described in the CMRP (Appendix G).

4.7.3.2 Construction Impacts

The degree of construction-related impacts to fisheries resources within waterbodies that would be crossed by the proposed Project route would depend on the crossing method, site-specific

streambed conditions at each crossing, the duration of instream activity, and application of impact reduction measures. Crossing techniques for waterbodies would depend on stream size, the presence of sensitive resources, protection status, classification of the waterbody, and permit requirements (see Section 2.1, Overview of the Proposed Project, for construction method details). The proposed Project would cross waterbodies along the Project route using one of the following techniques:

- Non-flowing open-cut crossing method;
- Flowing open-cut crossing method;
- Dry flume open-cut crossing method;
- Dry dam-and-pump open-cut crossing method; and
- Horizontal directional drilling (HDD) crossing method.

Crossing methods for each waterbody potentially containing fishery resources are identified in Table 4.7-1. Keystone proposes to use HDD techniques at 13 of the perennial waterbody crossings and various open-cut methods at the remaining 43 perennial stream crossings. In addition, the HDD method would be used to cross one intermittent waterbody, Bridger Creek (MP 433.6). Aquatic surveys in those waterbodies where open-cut methods have been proposed have been conducted since 2008, and surveys for the proposed Nebraska reroute were conducted in summer 2012 and will continue into fall 2012 and summer 2013. In accordance with the CMRP (Appendix G) and based on field survey results, site-specific crossing plans would be developed for each waterbody that would be crossed by the proposed pipeline. Several site-specific crossing plans for HDD crossings have been developed and are presented in the CMRP. Further, state agencies would be consulted and relevant U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service (USFWS) permitting and consultation would be completed to determine specific open-cut crossing and construction methods to reduce proposed Project impacts to fishery resources. As an example, the State of Montana noted in their proposed Environmental Specifications (Appendix N, Supplemental Information for Compliance with MEPA) that no flowing open-cut crossing methods would be allowed in Montana.

To minimize the amount of sediment from stream bank and upland erosion entering waterbodies, the Best Management Practices (BMPs) described in the CMRP (Appendix G) would be implemented, as well as any additional measures mandated within stream crossing permits issued by state and federal regulatory agencies. Measures specified in the CMRP include the following:

- Installation of sediment barriers immediately after initial disturbance of waterbodies or adjacent uplands;
- Minimization of grading and grubbing along stream banks; and
- Prompt removal of plant debris or soil inadvertently deposited at or below the high water mark.

Implementation of these and other similar measures to reduce suspended sediment loads would result in proposed Project impacts to fisheries resources that would be short term and temporary.

Table 4.7-1 Proposed Perennial Stream Crossings along the Proposed Project Route

County	Approximate Milepost	Waterbody Name	Proposed Crossing Technique[a,b,c]	Relevant Surface Water or Fishery Class/Rating[d]
Montana				
Phillips	25.3	Frenchman River	HDD	Non-Salmonid
Valley	39.0	Rock Creek	Open Cut	Non-Salmonid
Valley	40.4	Willow Creek	Open Cut	Non-Salmonid
Valley	83.4	Milk River	HDD	Non-Salmonid
Valley/ McCone	89.7	Missouri River	HDD	Marginal Salmonid/Red Ribbon, Class II Recreational Fishery
Dawson	198.1	Yellowstone River	HDD	Non-Salmonid/Blue Ribbon, Class I Recreational Fishery
Fallon	247.1	Sandstone Creek	Open Cut	Non-Salmonid
Fallon	265.3	Little Beaver Creek	Open Cut	Non-Salmonid
Fallon	284.5	Boxelder Creek	Open Cut	Non-Salmonid
South Dakota				
Harding	292.6	Shaw Creek	Open Cut	Fish Propagation
Harding	295.0	Little Missouri River	HDD	WW Semi-permanent
Harding	300.4	Kimble Creek	Open Cut	Fish Propagation
Harding	303.5	Unnamed Tributary to Dry House Creek	Open Cut	Fish Propagation
Harding	321.6	South Fork Grand River	Open Cut	WW Semi-permanent
Harding	326.4	Clarks Fork Creek	Open Cut	WW Marginal
Butte	361.0	North Fork Moreau River	Open Cut	WW Marginal
Perkins	368.9	South Fork Moreau River	Open Cut	WW Marginal
Meade	387.8	Pine Creek	Open Cut	WW Marginal
Meade	428.1	Narcelle Creek	Open Cut	Fish Propagation
Meade	430.1	Cheyenne River	HDD	WW Permanent
Haakon	486.0	Bad River	HDD	WW Marginal
Jones	498.3	Dry Creek	Open Cut	Fish Propagation
Tripp	541.3	White River	HDD	WW Semi-permanent
Tripp	547.3	Cottonwood Creek	Open Cut	Fish Propagation
Tripp	600.0	Buffalo Creek	Open Cut	Fish Propagation
Nebraska				
Keya Paha	602.1	Unnamed Tributary to Buffalo Creek	Open Cut	Class B Warmwater
Keya Paha	610.6	Wolf Creek	Open Cut	Class B Coldwater

County	Approximate Milepost	Waterbody Name	Proposed Crossing Technique[a,b,c]	Relevant Surface Water or Fishery Class/Rating[d]
Keya Paha	612.5	Unnamed Tributary to Keya Paha River	Open Cut	None
Keya Paha	613.7	Spotted Tail Creek	Open Cut	Class B Coldwater
Keya Paha	614.1	Unnamed Tributary to Spotted Tail Creek	Open Cut	None
Keya Paha	617.0	Alkali Creek	Open Cut	Class B Warmwater
Boyd	618.1	Keya Paha River	HDD	Class A Warmwater
Holt	626.1	Niobrara River	HDD	Class A Warmwater
Holt	626.9	Beaver Creek	Open Cut	Class B Coldwater
Holt	632.7	Big Sandy Creek	Open Cut	Class A Warmwater
Holt	640.0	Unnamed Tributary to Brush Creek	Open Cut	Class B Coldwater
Holt	640.3	Unnamed Tributary to Brush Creek	Open Cut	Class B Coldwater
Holt	646.8	North Branch Eagle Creek	Open Cut	Class B Coldwater
Holt	649.3	Middle Branch Eagle Creek	Open Cut	Class B Coldwater
Holt	653.1	East Branch Eagle Creek	Open Cut	Class B Coldwater
Holt	663.0	Redbird Creek	Open Cut	Class B Warmwater
Holt	680.0	South Branch Verdigre Creek	Open Cut	Class B Coldwater
Antelope	683.1	Big Springs Creek	Open Cut	Class B Coldwater
Antelope	713.3	Elkhorn River	HDD	Class A Warmwater
Boone	743.8	Beaver Creek	Open Cut	Class A Warmwater
Nance	759.6	Plum Creek	Open Cut	Class B Warmwater
Nance	761.7	Loup River	HDD	Class A Warmwater
Nance	766.7	Prairie Creek	Open Cut	Class B Warmwater
Polk	775.1	Platte River	HDD	Class A Warmwater
York	803.4	Beaver Creek	Open Cut	Class B Warmwater
York	812.8	West Fork Big Blue River	Open Cut	Class A Warmwater
Fillmore	831.8	Turkey Creek	Open Cut	Class B Warmwater

Sources: Geographic Information System data source for waterbody name—U.S. Geological Survey National Hydrography Dataset (USGS 2012); data source for Montana—Montana Department of Environmental Quality 2012; data source for South Dakota—South Dakota Department of Environment and Natural Resources 2012 and South Dakota Legislature 2012; data source for Nebraska—Nebraska Department of Environmental Quality 2012.

[a] Open cut—One of the four open-cut methods (non-flowing, flowing, dry flume, or dry dam-and-pump) to be used for these crossings.
[b] HDD = horizontal directional drilling.
[c] The HDD method would also be used to cross one intermittent waterbody, Bridger Creek (MP 433.6).
[d] WW = warmwater.

To further reduce the potential impacts to fisheries habitat caused by removal of riparian cover, grading and grubbing of waterbody banks would be minimized. For the most part, grubbing would be limited to the proposed pipeline trench and vehicle access areas. Additional workspace would be located at least 10 feet from waterbodies to minimize riparian disturbance. The banks of the waterbodies would be stabilized with temporary sediment barriers within 24 hours of completing proposed construction activities and most minor and intermediate waterbody crossings would be completed within 2 to 3 days. Where conditions allow, riparian vegetation would be restored with native plants; reclamation seed mixes would be determined through consultation with the local Natural Resources Conservation Service and relevant state and local agencies. In the event that a waterbody crossing would be located within or adjacent to a wetland crossing, wetland crossing impact reduction measures would be implemented to the extent practicable.

Compliance with mitigation measures mandated in permit conditions established by state and federal agencies would occur in addition to the measures included in the CMRP (Appendix G) to protect fisheries resources. In Montana, compliance with fisheries and waterbody protection measures (as described in Appendix N, Supplemental Information for Compliance with MEPA) would be required. On BLM lands in Montana, consistency with fisheries mitigation measures attached to the federal grant of right-of-way (ROW) would be required. Also required would be compliance with conditions in South Dakota that were developed by the South Dakota Public Utility Commission and attached to its Amended Final Decision and Order, Notice of Entry HP09-001.

Impacts and mitigation measures for specific waterbody crossing methods are described in the following sections. As required by the Montana Department of Environmental Quality (MDEQ) for Nationwide Permits, water must be diverted, pumped or flumed around the trench at pipeline crossings where water is present. Therefore, the non-flowing open-cut and flowing open-cut crossing methods may not meet the Section 401 requirements of the MDEQ for Nationwide Permits. For Standard Permits, separate Section 401 verification from the MDEQ would be required.

Potential Impacts Associated with Open-Cut Crossings

Potential impacts resulting from all open-cut crossing methods include disturbance of the streambed, resulting in impacts to subsurface macroinvertebrates (invertebrates that can be seen without the use of a microscope) and potential interference with hyporheic flows (mixing of shallow groundwater and surface water). Construction would result in a potential reduction of habitat, alteration of habitat structure, alteration of substrate and bank structure, and changes in the benthic invertebrate community (Levesque and Dube 2007, Brown et al. 2002, Chutter 1969, Cordone and Kelley 1961).

Open-cut methods could potentially increase the amount of sediment entering waterbodies during construction due to erosion of the excavated bank and streambed. The level of temporary elevated suspended sediment loading would depend upon the open-cut method selected and characteristics of the stream and adjacent uplands. Excessive suspended sediment can interfere with respiration in fish and invertebrates, leading to mortality or reduced productivity in rearing and spawning (Newcombe and Jensen 1996, Sutherland 2007, Wood and Armitage 1997). Suspended sediment could result in short-term impairment of foraging efficiency for species that

are visual predators. Longer-term effects could occur if sediment covers spawning gravels, preventing water exchange and oxygen to developing eggs or young fish (sack or emerging fry), causing increased mortality, and reducing recruitment to the population (Newcomb and MacDonald 1991).

The quantity, cover, and type of riparian bank vegetation vary depending upon site-specific waterbody conditions and locations. Removal of bank vegetation (including overhead cover) could lead to bank instability and erosion. Loss of riparian vegetation reduces shading, causing an increase in water temperature and a reduction in dissolved oxygen, nutrient input, food input, and hiding cover (Brown et al. 2002, Ohmart and Anderson 1988). A reduction in escape cover can increase vulnerability of certain species to predation. Loss of riparian vegetation and disturbance to the bank and substrate can alter benthic communities and change food availability (Brown et al. 2002). Trenching in the stream could cause a local increase in water temperature due to increased turbidity; the increased temperature as well as the turbidity could result in a temporary reduction in water quality and short-term impacts to fish and macroinvertebrates.

Planned mitigation measures include revegetation of riparian areas upon construction completion (as described in Section 4.5, Terrestrial Vegetation), limiting the extent of riparian vegetation loss during construction, maintaining a narrow ROW width, and timing the crossing of intermittent or ephemeral streams for when they are dry (to the extent reasonably practicable). These mitigation measures would reduce the potential impacts associated with all open crossing methods.

Non-Flowing Open-Cut Crossings

The non-flowing open-cut method would be used in dry washes, swales, ephemeral streams, and other drainages when there is no flowing water. Impacts to aquatic resources would be minimal during construction activities as few, if any, aquatic resources would be present. There may be viable benthic organisms if the moisture content of the streambed is sufficient in the area being trenched, resulting in a short-term, direct impact to these animals. Once water returns to the crossing site, sediment loosened by trenching activities, bank erosion, and wind-driven erosion could wash sediments downstream, causing an increase in sediment deposition downstream. This could affect fish and benthic communities, if any are present, downstream of the crossing.

Typical mitigation measures would include installation of sediment barriers, temporary slope breakers (water bars), mulching, stabilization of slopes including initiation of revegetation of disturbed soils within 24 hours of completion of the pipeline crossing, at steep slopes the installation of rip rap or rock gabions, grading to keep sediments from entering the water course, and restoration of the banks to as close to the original slope and contours as practicable. In addition, each crossing would have a specific crossing plan that will outline the appropriate mitigation to be employed. These mitigation measures are discussed in greater detail in the CMRP (Appendix G).

Implementation of the mitigation measures would result in temporary impacts to fisheries and aquatic organisms associated with this crossing technique. The primary potential impact would be an increase in sedimentation to downstream habitats. As water returns to the dry streambed, however, a naturally occurring increase in sedimentation would be expected as dry sediments are re-suspended and carried downstream with the flow. The potential increase in sediment load from the trenching activities would likely be negligible as it mixes with natural streambed

materials, provided that bank stabilization methods have been employed such that there is not a significant increase in bank erosion.

Flowing Open-Cut Crossings

The typical flowing open-cut crossing method allows the construction spread to move more quickly and reduces the amount of time the waterbody is subjected to construction disturbance. It is generally the preferred construction crossing method to reduce construction time and expense. However, it is not always practicable and construction of flowing open-cut crossings may result in additional short-term impacts, including direct mortality to fishery and aquatic resources from direct in-stream trenching and backfilling. Sediment released during trenching of the proposed pipeline crossings would be transported by the water flowing through the trench and has the potential to affect downstream aquatic life and habitat through either direct exposure or sediment deposition (Schubert et al. 1985, Anderson et al. 1996, Reid et al. 2004). Biological effects associated with fine sediment on fishes can vary and include gill irritation, avoidance behaviors, stress, and in extreme cases, long durations of exposure to suspended sediments, which can have lethal effects on individuals (Newcombe and MacDonald 1991, Wood and Armitage 1997, Waters 1995).

The length and extent of direct elevated suspended sediment plumes (and associated biological impacts) would depend upon the waterbody flow, disturbed sediment particle size, implementation of BMPs, type of installation activity, and duration of instream disturbance (Reid and Anderson 1998, Levesque and Dube 2007). Sediment deposition and elevated suspended sediment from open-cut trenching and backfilling have been shown to have effects on waterbody substrates and benthic invertebrate communities that can last from hours to years depending on site-specific conditions and installation activities (Levesque and Dube 2007). The highest rate of suspended sediment elevation (and associated potential impacts on aquatic resources) from open-cut installation typically occurs during instream trenching. Typically, the sedimentation effects from instream trenching on aquatic biological resources are minor and elevated suspended sediment in the water column returns to background levels within hours to days of instream disturbance (Levesque and Dube 2007).

As described in the CMRP (Appendix G), instream trenching and backfill work periods would be carried out quickly (24 hours for minor, 48 hours for intermediate, and in accordance with site-specific plan for major waterbodies, as practical) to minimize the time period in which sediment could be suspended by construction activities. BMPs would be implemented, as described in the CMRP, to minimize sediment from stream bank and upland erosion entering waterbodies. Based on the implementation of the measures described in the CMRP and additional measures mandated by state and federal permit agencies, elevated suspended sediment from proposed Project construction would be short term and temporary. To minimize effects of suspended sediment on eggs and young fish, appropriate construction windows would be determined for each crossing. As indicated in Table 3.7-2, the majority of fish associated with the proposed Project spawn in April, May, June, and July. Not all fish spawn in all those months. This would allow installation of the proposed pipeline during much of the year when no spawning fish are present and would reduce potential impacts during this critical life stage. Potential longer-term impacts after construction could include scouring of downstream areas or streambed disturbance if streambed modifications occur.

Dry Flume and Dry Dam-and-Pump Open-Cut Crossings

The dry flume or dry dam-and-pump open-cut methods would be used when crossing selected environmentally sensitive waterbodies. These methods have a potential to temporarily affect fishery resources, possibly resulting in behavioral changes such as avoidance or stress on individuals. Pump failure during flowing open-cut dam-and-pump crossings may result in overtopping of the coffer dam, causing erosion and subsequent transport of suspended and fine sediment. To address this potential impact, a pump capable of maintaining 1.5 times the ambient flow rate at the time of construction would be used (see Appendix G, CMRP). Additionally, at least one backup pump would be available on site and coffer dams would be constructed with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner). Intake hoses would be screened to prevent entrainment of fish, although microinvertebrates (invertebrates of microscopic size, too small to be seen with the naked eye) may be transferred through the pump. In summary, the dam-and-pump open-cut crossings have a potential to temporarily affect fishery resources. Dam-and-pump crossings may block or delay normal fish movements. Short-term delays in movements of spawning migrations could have adverse impacts on fisheries; however, most crossings of streams less than 100 feet (minor and intermediate waterbodies) would be completed in less than 48 hours and potential impacts would be temporary.

HDD Crossings

The HDD method for crossing waterbodies would be used to minimize disturbance to aquatic habitat, stream banks, and recreational or commercial fisheries. Impacts could occur if there is an unintended release of drilling fluids (i.e., a *frac out*) during the HDD operation. A frac out could release bentonitic drilling mud into the aquatic environment. The released drilling mud would readily disperse in flowing water or eventually settle in standing water. Although bentonite is non-toxic, suspended bentonite may produce short-term impacts to the respiration of fish and aquatic invertebrates due to fouled gills. Longer-term effects could result if larval fish are covered and suffocate due to fouled gills and/or lack of oxygen. If the frac out occurred during a spawning period, egg masses of fish could be covered, thus inhibiting the flow of dissolved oxygen to the egg masses. Benthic invertebrates and the larval stages of pelagic organisms could also be covered and suffocate.

To minimize the potential for these impacts to occur, a contingency plan would be implemented to address an HDD frac out. This plan would include preventive and response measures to control the inadvertent release of drilling fluids. The contingency plan would also include instructions for downstream monitoring for any signs of drilling fluid during drilling operations and would describe the response plan and impact reduction measures in the event that a release of drilling fluids occurred. Drill cuttings and drilling mud would be disposed of according to applicable regulations; disposal/management options may include spreading over the construction ROW in an upland location or hauling to an approved off-site, licensed landfill or other approved sites.

Water Withdrawals

Water would be withdrawn for hydrostatic testing, HDD operations (drilling mud) and dust control from nearby rivers and streams, privately owned reservoirs, and/or municipal sources. These withdrawals would avoid spawning periods for most recreational important fishers. At this time, Keystone has identified the following waterbodies for potential water withdrawal sources:

- Frenchmen River
- Milk River
- Missouri River
- Yellowstone River
- Little Missouri River
- Gardner Lake
- North Fork Moreau River
- Cheyenne River
- Bad River
- White River
- Keya Paha River
- Niobrara River
- Elk Horn River
- Loup River
- Platte River

Water withdrawal rates would be controlled to be less than 10 percent of the base flow of the source waterbody at the time of testing. Minor waterbodies generally would not contain sufficient water for use in hydrostatic testing. Surface water withdrawal permits from larger rivers with existing water rights would be regulated by state regulatory agencies to preserve existing water rights and environmental requirements. If inadequate water is available from rivers, Keystone would use alternative water sources nearby such as local private wells or municipal sources for HDD operations, hydrostatic testing the mainline, and dust control, as allowed by regulatory agencies. Keystone has indicated that in the event surface water is unavailable, groundwater would be used for HDD operations, hydrostatic testing, and dust control. Water would be purchased from nearby willing sellers with available water rights and would not increase overall groundwater use. Additional discussion of water sources is provided in Section 4.3.3.2, Surface Water.

Water withdrawal from well sources adjacent to stream and river can influence stream flows. This would only occur in if the well is hydraulically connected to the stream or river and associated with a shallow aquifer. Reductions in streamflows can reduce aquatic habitat quantity and quality. It can cause an increase in temperature, reduce juvenile rearing habitats, elevate suspended sediment concentrations and reduce spawning and egg development habitats. Mitigation for this potential impact include limiting water withdrawals to wells that are not

hydraulically connected to the adjacent stream or river and limiting the water withdrawal such that less than 10% of the flow of the stream is effected (this is only applicable to rivers with substantial flows). Further, aquatic resources would be protected as withdrawal rates could be limited by conditions mandated by applicable local, state and federal permits.

If water is withdrawn from a surface water source during a low-flow period or at a time when particular flow ranges are needed for other uses, habitat reductions for fisheries and aquatic invertebrates could occur. This potential impact could be mitigated though proper timing of water withdrawal or the selection of an alternative water source. Keystone proposes to equip the hydrostatic test water intake structure (often a large box-type structure) with 500 mesh (0.001 inch, 0.025 millimeter, 25 microns) screens to prevent the entrainment of fish and macroinvertebrates. Although some eggs, ichthyoplankton (drifting fish eggs and larvae), and drifting microinvertebrates could still be entrained, eggs would not be captured if water is withdrawn outside of the spawning and egg development timing window, and the abundance and rapid reproduction rate of microinvertebrates would limit impacts to these species.

To reduce the potential for the transfer of aquatic invasive species resulting from hydrostatic testing, hydrostatic test waters would not be discharged to watersheds outside of the withdrawal basins (i.e., no inter-basin transfers). In some locations, hydrostatic test water would be discharged to upland locations within the same basin, relying on infiltration for eventual return to the basin. In other locations, water would be returned to its waterbody of origin. Proportionally high discharge volumes to source areas could displace fish or disrupt spawning, rearing, or foraging behavior (Manny 1984). Discharged water may dislodge sediment, leading to an increase in suspended sediment. The discharge of large volumes of hydrostatic test waters into surface waters could temporarily cause a change in the water temperature and dissolved oxygen levels, could increase downstream flows, and could increase stream bank and substrate scour. Energy dissipating devices and dewatering structures would be used to dissipate and remove sediment from hydrostatic test water discharges. Guidelines for water discharge in overland areas and absorption back through the ground would allow water temperatures to reach pre-withdrawal conditions prior to entering streams. No chemicals would be used in hydrostatic test water.

All permits required by federal, state, and local agencies for procurement of water and for the discharge of water used in the hydrostatic testing operation would be acquired prior to hydrostatic testing. Any water withdrawal or discharge would be performed consistent with permit notice requirements and with sufficient notice to make water sample arrangements prior to obtaining or discharging water. Water samples for analysis would be obtained from each source before filling the pipeline. In addition, water samples would be taken prior to discharge of the water, as required by state and federal permits. National Pollutant Discharge Elimination System (NPDES) permits are required for the discharge of both hydrostatic testing fluids and any water obtained during construction dewatering. Both of these activities can be authorized under an NPDES General Permit for Hydrostatic Testing and an NDPES General Permit for Dewatering. U.S. Environmental Protection Agency Regions 7 and 8 would issue a Section 402, Clean Water Act NPDES permit for the discharge of hydrostatic test water.

The U.S. Fish and Wildlife Service (USFWS) has expressed concerns about any water withdrawals from the Platte River. They were requested to provide informal section 7 consultation and technical assistance for the Project. In their response letter dated September 4, 2012 (FWS NE: 2013-013) from Michael D. George to K. Nicole Gibson, Ph.D., they state: “Since 1978, the USFWS has concluded in all of its section 7 consultations on water projects in

the Platte River basin that the Platte River ecosystem is in a state of jeopardy, and any federal action resulting in a water depletion to the Platte River System will further or continue the deterioration of the stressed habitat conditions." They go on the say that any depletion of flows, either direct or indirect, from the Platte River System would be considered significant and they consider the river and associated wetland habitats to be "resources of national and international importance." To mitigate any impacts to the Platte River ecosystem, Keystone would coordinate with the USFWS before any water withdrawals.

During construction activities, there is also the potential for spills of fuel or other hazardous liquids. Impacts from fuel spills are assessed in Section 4.13, Potential Releases.

Access Roads

The proposed construction of new access roads could cross waterbodies that contain fish species of recreational or commercial significance. Depending on site-specific conditions, bridges or culverts may need to be installed to cross the waterbodies. Construction of these structures would cause an increase in sediment load due to work directly in the waterbody (culvert placement) or disturbance to the banks (bridge installation). Impacts to the aquatic resources from these activities would be similar to those described above for open-cut crossings. Potential impacts to the resources would be short term and minor if similar mitigation measures for open-cut crossings, including implementation of the mitigation measures outlined in the CMRP, are used. Furthermore, all bridge and culvert installations would require specific permits from respective state agencies, with each permit containing specific stipulations to protect aquatic resources. Most access to the proposed Project ROW is along existing roads where waterbody crossings are established. The proposed Project would cause an increase in traffic along existing roads, but impacts from increased traffic would not add to impacts on aquatic resources.

4.7.3.3 Proposed Project Operational Impacts

During operation of the proposed Project, non-forested vegetation would be maintained along the permanent ROW. The reduction of trees in the permanent ROW could result in a permanent loss of shading, nutrients, and habitat enrichment features for fish at some waterbody crossings. Impacts associated with the permanent removal of riparian vegetation would be similar to those described in Section 4.7.3.2, Construction Impacts. A permanent ROW would not be maintained in those areas that would be crossed using the HDD method; therefore, no permanent riparian vegetation impacts are anticipated in these areas. Herbicides would be used to control vegetation within the permanent ROW during proposed Project operation. The use of herbicides near a waterbody could harm aquatic organisms, including fish. Herbicides could enter a waterbody through runoff, seepage through the soil, and direct introduction to water during application through overspray or wind drift. In accordance with the CMRP, no herbicides would be used within 100 feet of a wetland or waterbody and all herbicide application would be performed by a state-licensed pesticide applicator.

Restored stream banks could be vulnerable to erosion during the first few years after revegetation and stabilization, potentially leading to sediment entering waterbodies and impacting fisheries habitat. The restoration and revegetation measures presented in the CMRP would be implemented to minimize soil erosion including in riparian areas.

Routine aerial and ground surveillance inspections would be used to identify areas of erosion, exposed pipeline, and nearby construction activities. These practices would allow for early

identification of bank stability problems and would minimize the potential for continuing environmental effects during proposed pipeline operation.

To reduce potential impacts to sensitive aquatic resources as a result of maintenance activities, the appropriate state agency would be consulted prior to initiation of maintenance activities beyond standard inspection measures.

Due to the elevated temperature of the oil in the proposed pipeline, water temperatures at stream crossings could potentially increase. Appendix S presents a pipeline temperature effects study. This study focused on the potential effects to soil temperatures as a result of the buried pipeline. The study concluded that the proposed pipeline would increase soil temperature. Given this, it is reasonable to conclude that the proposed pipeline could also elevate stream temperatures. Studies along the Trans-Alaska Pipeline System (BLM 2002) indicate that groundwater temperatures are elevated by the heat from the pipeline (the Trans-Alaska Pipeline System is also a heated pipeline that is buried in several river drainages).

The degree of heating would be dependent upon river discharge. Temperature impacts would likely only occur in streams with very low flows or isolated pools and would be more likely to occur in spring and fall based on the soil temperature profiles presented in Appendix S, Pipeline Temperature Effects Study. Increases in water temperature can affect fish by decreasing oxygen supply, causing premature movements of juvenile fish, and reduced food supply. Aquatic insects could mature more rapidly and be less available as food for the local fish population outside the immediate vicinity of the crossing.

The burial depth of the proposed pipeline could mitigate these potential temperature impacts. Typical pipeline burial depth is 48 inches; however, Keystone has indicated that burial depth under streams would be a minimum of 60 inches. Additionally, HDD installation would locate the pipeline well below the river bottom, further mitigating potential impacts. If impacts were to occur, they would be expected to be isolated due to the likelihood of few fish in the stream reaches. Larger rivers would not be affected by temperature changes because the volume of water flowing over the proposed pipeline would be great enough to compensate for any increases in the local temperature profile.

4.7.4 Recommended Additional Mitigation

Proposed impact reduction measures would result in the proposed Project having low potential to adversely affect recreationally or commercially important fisheries as a result of construction and normal operation. The combination of fish life history stage timing considerations, construction impact mitigation, site-specific crossing techniques, seasonal conditions, contingency plans, water quality testing, and water quality compliance results in a low potential effect on fisheries resources from proposed Project construction and normal operation.

In addition to the mitigation measures that Keystone would implement as discussed above, the following additional mitigation measures are recommended to minimize adverse impacts to fisheries during the construction and operational phases:

- Construction at open-cut river crossings should be planned to take advantage of non-spawning time frames (August through March), thus reducing impacts during this critical life stage.

- To reduce the potential impacts of hydrostatic water withdrawal on eggs and drifting macroinvertebrates in sensitive surface water sources, water withdrawal should be avoided during any low-flow periods that coincide with the spawning and egg development timing window. This can be achieved through timing of water withdrawal or the selection of an alternative water source.

4.7.5 Connected Actions

4.7.5.1 Bakken Marketlink Project

The Bakken Marketlink Project would include construction of a new, approximately 5-mile pipeline, metering systems, three new storage tanks near Baker, Montana, and two storage tanks in Cushing, Oklahoma. Keystone reported that the property proposed for the Bakken Marketlink Project facilities near Pump Station 14 is currently used as pastureland and hayfields and that a survey of the property indicated that there are no waterbodies or wetlands on the property.

The Bakken Marketlink Project route would cross one perennial stream (Sandstone Creek) which supports several of the same recreational and commercial fish species identified on Table 3.7-1, including black bullhead (*Ameiurus melas*), channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), northern pike (*Esox lucius*), and yellow perch (*Perca flavescens*).

The permit applications for the Bakken Marketlink Project would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental review of the Bakken Marketlink Project. If the project crosses or disturbs aquatic resources, the potential impacts to sensitive fisheries and aquatic habitat would be evaluated during the environmental reviews. Potential fisheries impacts would be evaluated and avoided, minimized, or mitigated, as appropriate, during state and federal consultation and permitting for the project. Many of the potential impacts of the connected action would be similar to those described above.

4.7.5.2 Big Bend to Witten 230-kV Transmission Line

Upgrades to the power grid in South Dakota to support power requirements for its pump stations would include a new 230-kilovolt transmission line that would be constructed and operated by the Basin Electric Power Cooperative and a new substation that would be constructed by the Western Area Power Administration and owned and operated by Basin Electric Power Cooperative.

The Big Bend to Witten 230-kilovolt (kV) electrical transmission line would cross three perennial streams along the preferred route (Basin Electric Power Cooperative, 2011). Potential impacts to fisheries and aquatic resources would be minimized by spanning them entirely. Project construction would use a span length between 650 and 950 feet. The largest perennial stream crossed is the White River, which has a maximum waterbody width of 570 feet. In addition, the transmission line would run parallel to and within 100 feet of perennial and intermittent streams for a cumulative distance of 28,000 feet. An adequate buffer between the transmission line corridor and adjacent surface waters would be needed to minimize continued impacts to fisheries and aquatic habitat during initial construction and long-term operation and maintenance activities.

In general, transmission line construction impacts are short term and/or negligible to waterbodies and associated fisheries and aquatic habitat because these lines typically span surface water

bodies, many lines would parallel existing roadways or ROWs, and power lines would be installed by local providers under local permitting requirements. Compliance with federal, state, and local agency requirements for water crossings would ensure that activities that are the most feasible and of lowest impact are performed at the site.

4.7.5.3 Electrical Distribution Lines and Substations

The proposed Project would require electrical service from local power providers for pump stations and other aboveground facilities in Montana, South Dakota, and Nebraska. At the time this report was prepared, there was no information regarding the planned locations of electrical distribution lines and substations in Nebraska and Kansas.

Based on a geographic information system analysis of the planned locations for electrical lines and substations and intersections with waterbodies identified in the 2012 National Hydrography Dataset (U.S. Geological Survey 2012), there would be a total of 217 waterbodies crossed in Montana. Of these, Duck Creek is the only waterbody classified as perennial. Using the same geographic information system comparison, there would be a total of 250 waterbodies crossed in South Dakota, of which 16 are perennial.

Proposed construction and operation impacts on waterbodies potentially containing fisheries would be similar to those described for the transmission line discussed above; however, it is likely that the poles would be smaller and that the stringing and staging areas disturbed around the pole installation sites would likely be smaller.

4.7.6 References

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4.8 THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONSERVATION CONCERN

4.8.1 Introduction

This section addresses impacts to the following:

- Federal endangered, threatened, proposed, or candidate species, in addition to species under consideration (Section 4.8.3.1);
- State endangered or threatened species (Section 4.8.3.3);
- Federally designated critical habitat;
- Bureau of Land Management (BLM) sensitive species (Section 4.8.3.2); and
- Species of conservation concern (Section 4.8.3.4).

Assessments for species of conservation concern include those species that have been specifically identified in Montana, North Dakota, South Dakota, Nebraska, and Kansas as sensitive or species of conservation concern.

4.8.2 Impact Assessment and Methodology

The impacts of the proposed Project on federal or state-listed endangered, threatened, proposed, or candidate species, BLM sensitive species, and species of conservation concern have been evaluated using a qualitative evaluation of the potential direct and indirect impacts to species and their habitats resulting from the Project's construction and operation activities. In addition to information provided by TransCanada Keystone Pipeline, LP (Keystone), information was provided by the USFWS, BLM, Montana Fish, Wildlife, and Parks (MFWP), South Dakota Game, Fish and Parks (SDGFP), North Dakota Game and Fish Department (NDGFD), Nebraska Game and Fish Commission (NGFC), and Kansas Department of Wildlife, Parks and Tourism (KDWPT).

4.8.3 Potential Impacts

Types of potential impacts to threatened and endangered species and species of conservation concern are similar to those described for vegetation in Section 4.5 and wildlife in Section 4.6. The following describes ways in which the proposed Project could impact species:

- 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, and from increased human activity;
- Reduced breeding success from exposure to construction and operations noise, and/or from increased human activity;
- Reduced survival or reproduction due to decreased abundance of food species or reduced cover;

- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 4.13, Potential Releases); and
- Direct mortality due to collision with or electrocution by power lines associated with pump stations.

Habitat loss or alteration from construction of the proposed Project is described in Section 4.6, Wildlife. Construction of the proposed pipeline and the associated access roads would increase habitat fragmentation by reducing the size of contiguous patches of habitat and through loss of habitat or changes in habitat structure. Construction of the proposed pipeline right-of-way (ROW) through native grassland, shrub, and forest communities would remove vegetation, resulting in temporary unvegetated areas over the pipeline trench and adjacent construction areas. Management actions on the ROW include removal of trees and shrubs. Loss of shrublands and wooded habitats would be long term (5 to 20 years) in restored areas of the construction ROW. Restoration of construction areas would include revegetation of the ROW using seed mixes based on input from the local U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) and specific seeding requirements as requested by the landowner or the land management agency, as described in Appendix G, the Construction, Mitigation and Reclamation Plan (CMRP).

In addition to these general impacts, specific impacts and conservation measures that have been identified for threatened and endangered species and species of conservation concern are described in the following sections. Where applicable, specific impacts to threatened and endangered species and species of conservation concern that would result from construction and operation of the connected actions of the proposed Project (electrical transmission and distribution lines) are also identified.

4.8.3.1 *ESA Federally Protected and Candidate Species*

The USFWS is responsible for ensuring compliance with the Endangered Species Act (ESA) for species under their jurisdictions. The U.S. Department of State (Department), as the lead federal agency, is responsible for initiating Section 7 ESA consultation with the USFWS to determine the likelihood of effects on federally protected species. For the proposed Project, the Department, the USFWS, and Keystone worked to identify the potential occurrence of federally protected species along the proposed pipeline route. Thirteen federally protected or candidate species under the jurisdiction of USFWS were initially identified as being potentially affected by the proposed Project, of which nine were determined to require further analysis. Table 4.8-1 provides a summary of these 13 species. Described in this section are the distribution of the 13 federally protected and candidate species potentially occurring in the proposed Project area, reasons for their decline, potential impact summary, proposed mitigation, and preliminary effect determinations. The northern long-eared bat (*Myotis septentrionalis*) is also discussed in this section; although this species is not currently listed as a federally-protected species, it was recently petitioned for listing and is currently under review for listing by the USFWS, and may be listed as a threatened or endangered species in 2013.

Table 4.8-1 Summary of ESA Federally Protected and Candidate Species Potentially Occurring along the Proposed Project Route

Common Name	Federal Status	Project Conservation Measures Developed	Preliminary Findings Summary[a]
Mammals			
Black-footed ferret (*Mustela nigripes*)	Endangered/Experimental	Yes	NLAA/NLAA
Gray wolf (*Canis lupus*)	Endangered/Experimental	No	No Effect/No Effect
Birds			
Eskimo curlew (*Numenius borealis*)	Endangered	No	No Effect
Greater sage-grouse (*Centrocercus urophasianus*)	Candidate	Yes	NLAA
Interior least tern (*Sternula antillarum*)	Endangered	Yes	NLAA
Piping plover (*Charadrius melodus*)	Threatened	Yes	NLAA
Sprague's pipit (*Anthus spragueii*)	Candidate	Yes	NLAA
Whooping crane (*Grus americana*)	Endangered	Yes	NLAA
Invertebrates			
American burying beetle (*Nicrophorus americanus*)	Endangered	Yes	MALAA
Fish			
Pallid sturgeon (*Scaphirhynchus albus*)	Endangered	Yes	NLAA
Topeka shiner (*Notropis topeka*)	Endangered	No	No Effect
Plants			
Blowout penstemon (*Penstemon haydenii*)	Endangered	No	No Effect
Western prairie fringed orchid (*Platanthera praeclara*)	Threatened	Yes	NLAA

[a] NA = Not Applicable (determinations are not applied to candidate and unlisted species); NLAA = May affect, but not likely to adversely affect; NLAM = Not likely to adversely modify; MALAA = May affect, and likely to adversely affect.

The Department and the USFWS are in informal consultations regarding the 13 federally protected or candidate species. The American burying beetle (*Nicrophorus americanus*) was the only species determined to be potentially adversely affected by the proposed Project. The Department, the USFWS, and Keystone are developing conservation measures and compensatory mitigation. Three proposed implementing agreements are being developed that would go into effect only if the Department determines to issue a permit for the proposed Project. These proposed implementing agreements concern: 1) a Trust for temporary and permanent impacts; 2) a fund for monitoring habitat restoration; and 3) a restoration performance bond. Once formal consultation begins, the USFWS will formulate a Biological Opinion that would be required prior to the issuance of a Record of Decision under the National Environmental Policy Act (NEPA) by the Department or any other federal cooperating agency.

The Department has developed a draft 2012 Biological Assessment (BA) (Appendix H) working closely with USFWS, which includes assessments of potential Project impacts to federally protected species, recommended conservation measures, and final determinations. Additional information requests and conservation measures were developed during these consultation meetings.

The USFWS provided input relative to the ESA, the Fish and Wildlife Coordination Act (FWCA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and NEPA. USFWS-approved surveys were initiated in the summer and fall of 2008, spring through fall 2009, and spring and summer 2010. Supplemental filing data from July 2009 and June 2010 included survey reports for piping plover (*Charadrius melodus*), interior least tern (*Sternula antillarum*), American burying beetle, and western prairie fringed orchid (*Platanthera praeclara*). Additional surveys for various species were conducted in 2011 and 2012, including surveys for the American burying beetle in the summer of 2012 for the proposed reroute in Nebraska (Hoback 2012). Additional surveys are planned along the proposed Project route for 2013 for special-status plant species and special-status fish species. Potential impacts and mitigation measures that were identified during these surveys and through consultations with federal and state agencies are discussed below.

Federally Protected Mammals

Preliminary evaluations identified only one federally protected mammal, black-footed ferret (*Mustela nigripes*), which could potentially occur within the proposed Project area (Table 4.8-1). The gray wolf (*Canis lupus*) was eliminated from further analysis based on a No Effect determination.

Black-Footed Ferret

The primary threat to the black-footed ferret *(Mustela nigripes)* is loss of habitat via conversion of grasslands to agricultural uses. Also, widespread prairie dog eradication programs have reduced black-footed ferret habitat to less than 2 percent of what once existed.

The proposed route would cross one county in Montana and four counties in South Dakota with black-tailed prairie dog colonies. Remnant black-footed ferret habitat may occur where there are black-tailed prairie dog colonies within the proposed Project ROW. If black-footed ferrets are present in prairie dog colonies along the proposed Project route, direct impacts could include increased habitat loss and fragmentation from the disturbance of prairie dog colonies or complexes. Construction and operation activities associated with the proposed Project could cause direct mortalities resulting from collisions with construction equipment and vehicles. Other indirect impacts could include habitat alteration due to fragmentation, dust deposition, and spread of noxious and invasive plants; and disturbance due to noise and human presence. Indirect impacts could also include a reduction of prairie dog colonies (i.e., a reduction in black-footed ferret food source) due to the spread of infectious diseases such as canine distemper and sylvatic plague diseases (which could be spread from domestic animals if these are allowed to come into contact with prairie dog populations).

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, and detailed in the Biological Assessment (Appendix H), from 2008 to 2012, surveys were conducted for active prairie dog towns that could support black footed ferrets. No black-footed ferrets or active prairie dog towns suitable for supporting black-footed ferrets were

identified in the proposed Project ROW, and black-footed ferret surveys are no longer recommended in prairie dog towns in Nebraska and South Dakota.

Although the USFWS has indicated that black-footed ferrets have not been observed in the proposed Project area in South Dakota, and this area is no longer required to meet USFWS guidelines under Section 7 of ESA, the SDGFP has requested an estimate of the number of prairie dog habitat acres that would be lost to pipeline construction and operation and that additional surveys be conducted to determine the presence of blackfooted ferrets in this habitat before any construction activity occurs.

Prairie dog colonies found in South Dakota and Nebraska would not require conservation measures or additional consultation under the ESA because any black-footed ferrets potentially associated with these prairie dog colonies are reintroduced and designated as non-essential experimental populations. One prairie dog town in Montana was identified near the proposed Project; however, this town was determined to be too small to support black-footed ferrets and would not be impacted by construction.

To prevent potential direct or indirect impacts to the black-footed ferret population in Montana from construction activities, should they occur close enough to the proposed Project to be potentially impacted, the following mitigation measures would be adopted and implemented by Keystone:

- Provide the USFWS with the results of Montana prairie dog colony surveys, and continue coordination with Montana USFWS Ecological Services Office to determine the need for black-footed ferret surveys in accordance with the Black-footed Ferret Survey Guidelines (USFWS 1989). Based on feedback from the USFWS, the Department has currently determined that no black-footed ferret surveys would be required.
- Complete surveys to identify prairie dog colonies in Fallon County, Montana consistent with the Final EIS to determine if any Category 3 colonies or complexes occur and could be avoided.
- Prohibit workers from keeping domestic pets in construction camps and/or worksites.
- Educate workers of how canine distemper and sylvatic plague diseases are spread (domestic pets and fleas).
- Prohibit workers from feeding wildlife.
- Report concentrations of dead and/or apparently diseased animals (prairie dogs, ground squirrels, others) to the appropriate state and federal agencies.

The proposed Project may affect, but is not likely to adversely affect, wild or reintroduced non-essential experimental populations of the black-footed ferret. This determination is based on agency provided information, the lack of potential for occurrence of wild populations of black-footed ferrets within the proposed Project area, and the commitment to follow recommended conservation measures described above. No prairie dog towns would be crossed or impacted by the proposed Project.

Northern Long-eared Bat

The northern long-eared *(Myotis septentrionalis)* bat occurs throughout North Dakota, South Dakota, and parts of Nebraska, Kansas, and Montana, although many species range maps do not include Montana as part of their range (Bat Conservation International 2012, MNHP and MFWP 2012d). Although northern long-eared bats were once common across the eastern United States, their population has recently seen a sharp decline in numbers. This decline is largely due to the rise of the fungal disease known as white-nose syndrome. The northern long-eared bat has small populations, and their tendency to hibernate in groups causes them to be very susceptible to this spreading disease. Other potential threats to northern long-eared bats include development of wind power, habitat destruction and fragmentation, hibernacula and roost disturbance, environmental contaminants, and logging. These threats, paired with the species low birth rate, can have detrimental effects on northern long-eared bats.

No adverse impacts to the northern long-eared bat are expected from proposed Project construction or operations because no summer or winter roosts are known or expected to occur in the proposed Project area, any bats that fly over the pipeline route would avoid the ground-based construction and operation activities, and Keystone would use the horizontal directional drilling (HDD) method to cross rivers thereby avoiding riparian vegetation used by the northern long-eared bat. In addition, no federally-designated critical habitat has been identified for this species, so no impacts to critical habitat for the northern long-eared bat would occur.

Federally Protected and Candidate Birds

Preliminary evaluations identified four federally protected birds (not including bald eagle, which is protected under the BGEPA, but not the ESA) and two candidate birds that could potentially occur within the proposed Project area (Table 4.8-1). In addition to federal ESA protections, all of the birds listed in this section are also federally protected under the MBTA, except for the greater sage-grouse (*Centrocercus urophasianus*). Additional federal protections under the MBTA and the BGEPA are discussed in Section 4.8.3. The Eskimo curlew *(Numenius borealis)* was eliminated from further analysis based on a No Effect determination.

Greater Sage-Grouse

Populations of greater sage-grouse *(Centrocercus urophasianus)*, which depend on large areas of contiguous sagebrush, have continued to decline during the last century primarily due to habitat loss and alteration, and they now occupy about 56 percent of their original range (USFWS 2010). Primary threats to greater sage-grouse include sage brush habitat loss and fragmentation resulting from wildfire, energy development, urbanization, agricultural conversion, and infrastructure development (USFWS 2010).

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, greater sage-grouse surveys of the proposed Project route have been conducted annually since 2010, and Montana Fish, Wildlife and Parks (MFWP) and SDGFP consider 28 leks along the proposed Project route to be active in any given year. Details of these surveys, including survey results, are provided in Appendix H, the Biological Assessment.

Approximately 190 miles of the proposed pipeline route extend through areas with greater sage-grouse habitat in Montana (MFWP 2001). Of this distance, 94 miles are classified as moderate to high-quality habitat for greater sage-grouse, and 96 miles are classified as marginal habitat for

greater sage-grouse. Ground-verification surveys of habitats found that the proposed pipeline route would cross only 35.9 miles of suitable habitat, of which half of this area was considered high-quality habitat. Modifications of the previously proposed route have been made in Montana and South Dakota, to create the current proposed Project route; these modifications fall within the corridor surveyed since 2010 and would not result in any additional effects on greater sage-grouse habitat.

MFWP (2009) has mapped core greater sage-grouse habitat in Montana, which includes habitats associated with: 1) Montana's highest densities of greater sage-grouse (25 percent quartile) based on male counts; and/or 2) greater sage-grouse lek complexes and associated habitat important to greater sage-grouse distribution. The proposed route would pass through approximately 20 miles of core greater sage-grouse habitat in Montana. One approximately 3-mile-long permanent access road and one pump station would also occur within core greater sage-grouse habitat in Montana.

Based on a 3-mile buffer centered on each confirmed active lek, each unconfirmed active lek with recent greater sage-grouse observations, or each priority lek the proposed Project route would impact, there would be a total of about 86 miles of the proposed Project route overlapping a greater sage-grouse lek buffer (including 29 separate greater sage-grouse lek locations) in Montana and South Dakota (see Appendix H, Biological Assessment, for more information on greater sage-grouse lek buffer zones crossed by the proposed Project route)[1].

Studies of the effects of energy development on greater sage-grouse indicate a variety of adverse impacts to sage-grouse from sources of disturbance, such as construction and operation of facilities, road construction, and use and development of transmission lines (Naugle et al. 2009). However, many studies evaluated impacts resulting from different and higher-density types of disturbance and development than would be associated with the proposed Project (i.e., a single pipeline as compared to oil and gas field developments). Although similar types of impacts would be expected to result from construction of the proposed Project, the magnitudes would be expected to be different.

Greater sage-grouse would be especially vulnerable to pipeline construction activities in spring, when birds are concentrated on leks and where the pipeline and access roads are constructed through sagebrush communities with leks and nesting greater sage-grouse. While surveys in 2009 and 2010 verified activity at nine leks within 4 miles of the proposed Project route in Montana and South Dakota, an estimated 40 recently active lek sites within 4 miles of the proposed Project could potentially be occupied by greater sage-grouse (WESTECH 2010a). Additional greater sage-grouse surveys were conducted in 2012 (WESTECH 2012a). Construction near active leks could displace breeding birds from leks or disturb nests, resulting in a decrease in local reproduction. Traffic on roads near active leks could cause vehicle collision and/or mortality.

[1] Confirmed active lek—MFWP considered leks to be confirmed active if there is a minimum of 2 years of observation with two or more males displaying on the site, or if a single year's observation with two or more males displaying on the site was followed with evidence of lekking behavior (vegetation trampling, feathers, and droppings) during the subsequent year. Unconfirmed lek—MFWP considered leks to be unconfirmed if either the lek had not been surveyed in recent years, or if males were observed, but there was insufficient information to confirm lek activity.

Disruption of courtship and breeding behavior would be reduced by scheduling construction after 10:00 am if greater sage-grouse are observed and after mating season (usually by mid-May). Mortality to greater sage-grouse and loss of nests, eggs, and young could be avoided by scheduling construction through occupied sagebrush steppe habitats after young greater sage-grouse have become mobile and are able to fly (usually by mid-August). Greater sage-grouse chicks are precocious and are capable of leaving the nest shortly after hatching, but they may not be sufficiently mobile to avoid construction related-impacts until after they can fly.

After construction, re-establishment of sagebrush to pre-disturbance cover levels on the ROW may take 15 to 20 or more years depending on the type of sagebrush, subsequent soil moisture, extent of invasion by cheatgrass (*Bromus tectorum*), and other factors (MNHP and MFWP 2010). During this period, vegetation on reclaimed areas would likely be dominated by grasses with low densities of native forbs and shrubs. Typically, communities of big sagebrush have proven difficult to re-establish on reclaimed mining lands (Schuman and Booth 1998, Vicklund et al. 2004), and restoration may not always be possible (USFWS 2010). Growth of big sagebrush on reclaimed mining land has been shown to benefit from the application of mulch, compacting soil after seeding, and reduced competition with herbaceous species (lower seeding rate of grasses and forbs) (Schuman and Booth 1998).

New permanent access roads would be constructed in Montana and in South Dakota. One new access road in Montana would be within 4 miles of a confirmed active sage-grouse lek. A new access road in South Dakota would be within 4 miles of a lek located in Montana where greater sage-grouse were observed in 2010. The cleared ROW and the new permanent access roads in Montana and South Dakota may encourage recreational use of the ROW. Recreational use (motorized vehicles, wildlife viewing, etc.) of the area during the breeding season could have an adverse effect on greater sage-grouse reproduction.

Three of the six proposed pump stations in Montana (PS-10, PS-11, and PS-14) would be constructed within 4 miles of confirmed active leksk. PS-10 is approximately 3.4 miles from Lek 744 and is not visible from the lek. PS-11 is approximately 2.9 miles from Lek 619, a confirmed active lek in the agency database, but one which has not been surveyed by agencies since 1996 and where Keystone has not observed greater sage-grouse for 3 consecutive years. PS-11 is also within 3.7 miles of Lek 1738, a lek of unconfirmed activity status where Keystone has not observed greater sage-grouse in 3 consecutive years. The pump station is not visible from either of these lek sites.

PS-14 is approximately 2.7 miles from confirmed active leks 1805 and 1430, but is not visible from either lek. PS-14 is also within 2.4 miles of Lek 1725 which has unconfirmed activity. Keystone surveys have not observed any greater sage-grouse at Lek 1725 for 3 consecutive years, and agency surveys at this lek did not observe greater sage-grouse in 2011.

One new pump station in South Dakota (PS-15) would be constructed within 3.2 miles of Lek 1437, a confirmed active lek in Montana. The pump station is not visible from Lek 1437 because of terrain. A second pump station in South Dakota (PS-16) would be constructed within 1.3 miles of the active Squaw Creek Lek.

Pipe yard 12 in South Dakota is 1 mile away from the KXL-195 Hoover lek where greater sage-grouse have been observed for 3 consecutive years. This pipe yard is dominated by grasses and is not high-quality greater sage-grouse habitat. Pipe yards are cleared of vegetation and are used to store and retrieve pipes for pipeline construction.

Based on preliminary estimates, noise from the pump stations would attenuate to approximately 55 A-weighted decibels during a 24-hour period at 0.5 mile from the proposed pump stations and would not be expected to cause disturbance to greater sage-grouse leks (Blickley and Patricelli 2012). Keystone would observe the USEPA standard of 55 dBA Ldn measured at the nearest sensitive receptor (see Section 4.12, Air Quality and Noise, for additional discussion of noise impacts and mitigation). Communication towers associated with the proposed pump stations could lead to increased collision hazard and increased predation by raptors by providing vantage perches.

Conservation measures, such as limiting construction in active lek areas to periods outside the breeding season, were designed to avoid, minimize, and compensate for impacts to the sage-grouse. Many of these measures were described in *An Approach for Implementing Mitigation Measures to Minimize the Effects of Construction and Operations of the Keystone XL Pipeline Project on Greater Sage-Grouse* (WESTECH 2010b) and *An Approach for Implementing Mitigation Measures to Minimize the Effects of Construction and Operation of the Keystone XL Pipeline Project on Greater Sage-Grouse in South Dakota* (WESTECH 2011b) which are appendices to Appendix H, the 2012 Biological Assessment. In South Dakota, Keystone worked with SDGFP to develop supplemental compensatory mitigation, which was finalized in 2012. These measures, as well as measures identified in the 2012 Final EIS, include the following:

- Conduct surveys of greater sage-grouse leks prior to construction using approved methods to determine lek locations and peak number of males in attendance: a) within 3 miles of the facility (unless the facility is screened by topography); and b) at leks identified by MFWP, BLM, and SDGFP more than 3 miles from the facility (for use as a baseline to determine construction effects on sage-grouse abundance).
- Develop a conservation plan with MFWP, SDGFP, USFWS, and BLM to address impacts to greater sage-grouse, including construction timing restrictions, habitat enhancement, and any mitigation measures that would be necessary to maintain the integrity of Core Areas or Preliminary Priority Habitat, which encompasses lek habitats and other habitat necessary for greater sage-grouse during other life stages.
- Follow all protection and mitigation efforts as identified by USFWS and SDGFP including: a) identify all greater sage-grouse leks within the buffer distances from the construction ROW set forth for the greater sage-grouse by USFWS; and b) avoid or restrict construction activities as specified by USFWS within buffer zones, between March 1 and June.
- Prohibit construction within 3 miles of active greater sage-grouse leks in suitable nesting habitat from March 1 to June 15, with an allowance for one-time equipment movement during mid-day hours through ROW areas with a timing restriction that does not require grading for equipment passage to lessen disturbance to sage-grouse leks.
- Prohibit construction within 2 miles of active greater sage-grouse leks on federal lands from March 1 to June 15.
- Reduce the mound left over the backfilled trench in areas where settling would not present a path for water runoff down slopes into sagebrush habitat; additional measures will be taken to compact backfilled spoils to reduce settling.
- Establish a compensatory mitigation fund for use by MDEQ, MFWP, and BLM to enhance and preserve sagebrush communities for greater sage-grouse and other sagebrush-obligate

species in eastern Montana (the size of the fund to be based on acreage of silver sagebrush and Wyoming big sagebrush habitat disturbed during pipeline construction within greater sage-grouse core habitat mapped by MFWP and other important habitat between approximate mileposts 95–98 and 100–121).

- To the extent practicable, limit inspection overflights of sagebrush habitat designated by MFWP to afternoons from March 1 to June 15, during operations.
- Fund a 4-year study, under the direction of MDEQ, MFWP, and BLM, to assess whether the presence of Project facilities have affected greater sage-grouse numbers based on the trends in peak number of male greater sage-grouse in attendance at leks.
- Implement restoration measures (i.e., application of mulch or compaction of soil after broadcast seeding, and reduced seeding rates for non-native grasses and forbs) that favor the establishment of silver sagebrush and big sagebrush in disturbed areas, where compatible with the surrounding land use and habitats, unless otherwise requested by the affected landowner.
- Prior to construction, conduct studies along the proposed route to identify areas that support stands of silver sagebrush and big sagebrush and incorporate these data into restoration activities to prioritize re-establishment of sagebrush communities.
- Monitor and report on establishment of sagebrush in restored areas, unless otherwise requested by the landowner, annually for at least 4 years to ensure that sagebrush plants become established at densities similar to densities in adjacent sagebrush communities. Implement additional seeding or plantings of sagebrush if necessary.
- Establish criteria in conjunction with MDEQ, MFWP, and BLM to determine when restoration of sagebrush communities has been successful based on pre- and post-construction studies in addition to revegetation standards.
- Use locally adapted sagebrush seed, collected within 100 miles of the areas to be reclaimed, unless otherwise requested by the affected landowner (seed would be collected as close to the proposed Project route as practicable, based on regional seed production and availability).
- Monitor cover and densities of native forbs and perennial grasses exclusive of noxious weeds on restored areas and reseed with native forbs and grasses where densities are not comparable to adjacent communities.
- Work in conjunction with the landowner to appropriately manage livestock grazing of reclaimed areas until successful restoration of sagebrush communities has been achieved (livestock grazing in restored sagebrush communities may promote establishment of sagebrush—see greater sage-grouse implementation plan in Montana in Appendix H, 2012 Biological Assessment.
- Implement measures to reduce or eliminate colonization of restored areas by noxious weeds and invasive annual grasses such as cheatgrass to the extent that these plants do not exist in undisturbed areas adjacent to the ROW (noxious weed management plans would be developed and reviewed by appropriate county weed specialists and land management agencies for each state crossed by the proposed Project route).

- Establish a compensatory mitigation fund for temporary and permanent impacts to greater sage-grouse habitat for use by SDGFP to enhance and preserve sagebrush communities within the sagebrush ecosystem in South Dakota, which is found within the following counties: Butte, Custer, Fall River, and Harding counties and, to a lesser degree, Perkins and Meade counties.
- Develop a research fund, in consultation with SDGFP, and managed by a third party to evaluate the effects of pipeline construction on greater sage-grouse.
- Monitor leks that are within 3 miles of the project footprint in South Dakota that are within the viewshed of the construction ROW if construction takes place between March 1 and June 15.
- Implement, in consultation with SDGFP, a modified 3-mile buffer between March 1 and June 15 around active greater sage-grouse leks. The buffer would be modified on a lek-by-lek basis to account for differences in topography, habitat, existing land uses, proximity of the Project to the lek, and line-of-sight between the proposed Project and each lek.
- Restrict construction equipment activity in South Dakota to occur only between 10 am and 2 pm to avoid impacts to breeding greater sage-grouse from March 1 through June 15 in areas where a lek is either within 3 miles of the ROW and visible from the ROW; or within 1 mile of the ROW.

With incorporation of the proposed Project CMRP (Appendix G) and the mitigation measures described above, construction and operation of the proposed Project would not likely affect greater sage-grouse courtship activities on leks and would likely result in a minor impact on nesting birds. However, construction would likely result in an incremental loss of sagebrush habitat that is currently used for feeding and nesting by greater sage-grouse, and re-establishment of that habitat could require 15 to 20 years or longer.

Interior Least Tern

Primary threats to the interior least tern *(Sternula antillarum)* are channelization of river systems and construction of dams that alter the rivers' natural flow regimes. This can cause water levels to remain high during the nesting season, eliminating nesting areas and forcing the birds to choose less ideal nest sites. Flood control has also caused nesting habitat to decline due to vegetation encroachment on river banks. River recreation has increased in recent decades, causing more disturbances to prime nesting habitats by boaters, fishers, campers, and all-terrain vehicles. Excessive human disturbance has been shown to decrease nesting success and productivity, and this remains a threat to the interior least tern population throughout its range (NGPC 2012).

The proposed Project route would cross several rivers at which suitable feeding and nesting habitat exists for the interior least tern. These areas include the Yellowstone River and the Missouri River below Fort Peck dam, in Montana; the Cheyenne River in South Dakota; and the Platte River, Loup River, and Niobrara River in Nebraska. As noted in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, recent surveys for this species identified least terns along the Niobrara River in Keya Paha and Rock counties, and along the Loup River in Nance County. However, additional surveys are needed along the Missouri, Yellowstone, and Cheyenne rivers in Montana and South Dakota to verify presence/absence,

because previously conducted surveys along these rivers occurred during a flood event when no habitat was viewable for this species.

Potential impacts from construction of the proposed Project could include disturbance to interior least tern habitat. The rivers listed above that are associated with interior least tern habitat would all be crossed using the HDD method to reduce disturbance to nesting and feeding habitats. However, proposed Project construction near these rivers could potentially cause temporary impacts to breeding and nesting interior least terns. Nest abandonment or predation could occur if construction is scheduled during the breeding season (April 15 through August 15), although construction is expected to be complete prior to active nesting. Limited clearing of vegetation and limited human access would be required within the riparian areas of these rivers for the TruTracker® System (a wire used to guide the HDD). A maximum 3-foot-wide hand-cleared path would be used for this purpose during HDD drilling.

Indirect construction impacts could result from the withdrawal of water for hydrostatic testing (pressure testing of the new pipeline) from each of the rivers used as a water source. Food supplies (fish) could be reduced and predators may be afforded easier access to nest sites. However, impacts to the interior least tern from temporary water reductions during hydrostatic testing would be avoided since the volume of water needed would be withdrawn at a rate less than 10 percent of the baseline daily flow and returned to its source within a 30-day period. The one-time water use for hydrostatic testing, the low volume of water used (compared to daily flows in the river basin), and the return of water to its source would not be expected to impact least tern nesting or feeding habitats.

The following USFWS conservation measures would apply if construction-related activities, including HDD and hydrostatic testing, were to occur during the interior least tern nesting season (April 15 to September 1):

- Conduct pre-construction surveys within 0.25 mile from suitable breeding habitat at the proposed Platte, Loup, and Niobrara river crossings in Nebraska; the proposed Cheyenne River crossing in South Dakota; and the proposed Yellowstone River crossing in Montana.
- Conduct daily surveys for nesting terns when construction activities occur within 0.25 mile of potential nesting habitat.
- Prohibit construction within 0.25 mile of any occupied nest until the young have fledged or otherwise abandoned the nest.
- Down-shield lights if HDD occurs at night, if the site lacks vegetative screening, and if an active interior tern nest is located within 0.25 mile from the HDD site(s).

The proposed Project could affect, but is not likely to adversely affect interior least terns based on the use of the HDD crossing method at the proposed Missouri River, Yellowstone River, Cheyenne River, Niobrara River, Platte River, and Loup River crossings, and based on implementation of the recommended conservation measures identified by the USFWS.

Piping Plover

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, potential habitat for piping plover *(Charadrius melodus)* is present in the proposed Project ROW along the Niobrara, Loup, and Platte rivers in Nebraska. Keystone surveyed for

piping plovers at the proposed crossings of the Missouri, Platte, Loup, and Niobrara rivers in July 2008, June 2011, and June and July 2012. No nesting piping plovers were identified within sight of the proposed crossings of any of these rivers. Surveys would be repeated at these river crossings prior to construction to ensure that no nests have been built within 0.25 mile of the proposed ROW or any areas that would be affected by construction activities.

No direct impacts to piping plover breeding habitats would occur in Nebraska at the Niobrara, Loup, or Platte rivers because pipeline construction across these rivers would be completed using the HDD method. Construction is expected to be complete prior to the time of year when nests would potentially be active. Limited clearing of vegetation and limited human access would be required within the riparian areas of these rivers for the TruTracker® System (a 3-foot hand cleared path would be created) used during HDD drilling and to access these rivers to withdraw water for hydrostatic testing.

Indirect impacts to breeding habitats could result from increased noise and human presence at work sites if breeding piping plovers occur within 0.25 mile of these sites.

Indirect impacts to piping plovers from temporary water reductions during hydrostatic testing would be negligible since the volume of water needed would be withdrawn at a rate less than 10 percent of the baseline daily flow and returned to its source within a 30-day period.

The following conservation measures were developed in consultation with the USFWS, and would apply if construction-related activities, including HDD and hydrostatic testing, were to occur in suitable habitat during the piping plover nesting season (April 15 through September 1):

- Conduct pre-construction surveys within 0.25 mile of the construction ROW at the Niobrara, Loup, and Platte rivers in Nebraska.
- Conduct daily surveys for nesting piping plovers when construction activities occur within 0.25 mile of potential nesting habitat.
- Suspend construction within 0.25 mile of active nests, until the fledglings have left the nest area.
- Use directional lighting if night time operations occur during HDD and a vegetative screen is limited.

Sprague's Pipit

As of 2010, there were an estimated 870,000 Sprague's pipits (*Anthus spragueii*) in North America, with populations declining approximately 3 percent per year since 1980 in the United States (Jones 2010). The species decline is primarily attributable to agriculture and subsequent habitat loss, degradation, and fragmentation through conversion to seeded pasture, hayfields, and croplands, as well as overgrazing by livestock (Jones 2010). Sprague's pipits are also threatened by habitat loss and degradation from overgrazing, mowing, and reduced fire frequency; energy development; introduced and invasive plants; and drought (Jones 2010).

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, Sprague's pipits are known to occur in the Project area, based on relative density and recent observations contained in the Montana Field Guide (MNHP and MFWP 2012b). Data indicate that the highest likelihood of Sprague's pipit in the proposed Project area is in native grasslands north of the Missouri River (MNHP and MFWP 2012b) although the species is also

known to occur in native grasslands in eastern Montana and northwestern South Dakota. In Montana, the proposed Project route would cross and may contribute to fragmentation of an estimated 164.4 miles of high-quality native grasslands, and outside of the habitat north of the Missouri River there are approximately 87 miles of native, mixed-grass prairie that could serve as suitable habitat depending on grazing regimes and adjacent human activity. In South Dakota, the proposed Project route would cross and may contribute to fragmentation of an estimated 103.6 miles of high-quality native grasslands in 17 locations in South Dakota. In Nebraska, Sprague's pipits are considered uncommon migrants.

The proposed Project may cause grassland habitat loss, alteration, and fragmentation; loss of eggs or young during construction; and facilitated raptor predation from power poles from associated power lines. To reduce impacts to native grasslands and wildlife, the following measures identified in the proposed Project CMRP (Appendix G) would be implemented:

- Seed disturbance areas in native range with a native seed mix after topsoil replacement.
- Monitor the ROW to determine the success of revegetation after the first growing season, and for areas in which vegetation has not been successfully re-established, reseed the area.
- 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 though planting conifers or other appropriate trees or shrubs in accordance with landowner or manager request.

The following additional measures would be employed to protect Sprague's pipit:

- Develop a Migratory Bird Conservation Plan in consultation with USFWS to comply with the MBTA and implement provisions of Executive Order 13186 by providing benefits to migratory birds and their habitats within the states where the proposed Project would be constructed, operated, and maintained.
- If construction occurs during the April 15 to July 15 grassland ground-nesting bird nesting season, complete nest-drag surveys to determine the presence or absence of nests on federal land in eastern Montana.
- Delay construction activity between April 15 and July 15, within 330 feet of discovered active nests in eastern Montana (MDEQ and MFWP).

Whooping Crane

Power lines associated with the proposed Project are collision hazards to migrant whooping cranes (*Grus americana*). Recent studies conducted by the USFWS in conjunction with University of Nebraska researchers have documented migratory bird mortalities, including cranes, from collisions with two existing 69-kV transmissions lines that cross the Platte River (Murphy et al. 2009; USFWS 2009; Wright et al. 2009). One study conducted during the spring whooping crane migration in 2007 estimated that 165 to 210 sandhill cranes did not survive collisions with two power lines (Wright et al. 2009). No evidence of whooping crane mortality was observed during that study. Bird diverter devices (such as FireFly™ bird diverters) may reduce crane collisions and mortality from power lines by alerting cranes to the presence of power lines in their flight path (Murphy et al. 2009).Primary threats to the whooping crane are

habitat loss and alteration. Habitat alteration through water diversion is a major threat along the Platte River and other large riverine migration stopover habitats.

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, the proposed Project in South Dakota would cross through both the 75 percent (60 mile wide corridor) and 90 percent (170 mile wide corridor) central flyway whooping crane migration corridor, and most of the proposed Project route in Nebraska would be within the 90 percent migration corridor. The proposed Project route in Montana is west of the whooping crane migration corridor. Migrating whooping cranes could roost or feed in suitable habitat within the proposed Project area.

Temporary displacement of migrating whooping cranes from construction noise could occur if construction occurred near migratory stopover habitats. The use of the HDD method at major river crossings would prevent potential roosting and feeding habitat loss or alteration. In other areas along the proposed Project route, revegetation (particularly within riparian zones and in wetland habitats) would reduce habitat impacts. Temporary water withdrawals to support hydrostatic testing are not expected to result in impacts to the whooping crane since the volume of water needed would be withdrawn at a rate less than 10 percent of the baseline daily flow and returned to its source within a 30-day period.

The following conservation measures, based on USFWS consultation, would apply if pipeline construction-related activities were to occur in close proximity to migrating whooping cranes:

- During spring and fall whooping crane migration periods (March 15–May 31, and September 1–November 31, respectively), Environmental Monitors would complete a survey of any wetland or riverine habitat areas potentially used by whooping cranes in the morning (prior to sunrise) and afternoon (after 4:00 pm), before starting equipment. These surveys would follow the Whooping Crane Survey Protocol previously developed by the USFWS and NGPC (USFWS 2012).
- Cease work if whooping cranes are spottedand contact the USFWS and appropriate state agency representative in Montana, South Dakota, or Nebraska for further instruction. Work could proceed if whooping cranes leave the area. The compliance manager[2] would record the whooping crane sighting, bird departure time, and work start time would all be recorded on a survey form.
- The USFWS would notify the compliance manager if whooping cranes are within the construction area by using data gathered from the whooping crane tracking program. If whooping cranes land within an area where an HDD crossing is already in progress or where construction is active, this activity would be allowed to continue.

Down-shield lights if HDD occurs at night during the spring and fall whooping crane migrations, in areas that provide suitable habitat.The proposed Project could affect, but is not likely to adversely affect whooping cranes. This determination is based on the rarity of the species, its status as a migrant through the proposed Project area, Keystone's commitment to follow recommended conservation measures identified by the USFWS, and that power providers will

[2] The compliance manager for Keystone will be the point person for communication with the USFWS as required. The monitors that will be used in the field will be reporting to the environmental inspectors, who in turn report to the compliance manager. If required, the monitors will discuss any required interpretation or issues with the USFWS with the compliance manager.

consult with the USFWS regarding ways to minimize or mitigate impacts to the whooping crane and other threatened and endangered species for new distribution lines to the pump stations and follow recommended avoidance and conservation measures of the USFWS.

Federally Protected Reptiles

There are no federally protected reptiles associated with the areas that would be crossed by the proposed Project route.

Federally Protected and Candidate Fish

Preliminary evaluations identified one federally protected fish that could potentially occur within the proposed Project area (Table 4.8-1). The Topeka shiner *(Notropis topeka)* was eliminated from further analysis based on a No Effect determination.

Current distribution of the pallid sturgeon *(Scaphirhynchus albus)* includes the upper and lower Missouri River drainage, the lower Yellowstone River drainage, the upper and lower Mississippi River drainages, and the lower Ohio River drainage (NatureServe 2009). The pallid sturgeon is one of the rarest fish of the Missouri and Mississippi rivers. This sturgeon is adapted to habitat conditions that existed in these large rivers prior to their wide-scale modification by dams, diversions, and flood control structures.

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, the pallid sturgeon occurs within the proposed Project area at the proposed crossing of the Missouri River below (east of) Fort Peck Dam, the proposed crossing of the Milk River in Valley County, Montana, and the proposed crossing of the Yellowstone River downstream of Fallon, Montana (MNHP and MFWP 2012a). Pallid sturgeon also occur in the lower Platte River downstream from the proposed Project crossing in Nebraska (NGPC 2011).

Potential impacts to pallid sturgeon would be reduced as a result of using the HDD crossing method at the Milk, Missouri, and Yellowstone rivers. The proposed minimum depth for HDD pipeline sections is 25 feet below the streambed, which should provide substantial margin of safety during potential river scour during peak flood events. The HDD method avoids any direct disturbance to the river, channel bed, or banks. While the HDD method poses a small risk of frac-out (i.e., release of bentonite-based drilling fluids), potential releases would be contained by best management practices that are described within the HDD Contingency Plans required for drilled crossings. Most leaks of HDD drilling fluids occur near the entry and exit locations for the drill and are quickly contained and cleaned up. Frac-outs that may release drilling fluids into aquatic environments are difficult to contain primarily because bentonite readily disperses in flowing water and quickly settles in standing water. Should this type of release occur, bentonite is non-toxic but in sufficient concentration may physically inhibit respiration of adult fish and eggs.

The Platte, Missouri, and Yellowstone rivers have been identified as potential water sources for hydrostatic testing. Surface water depletions associated with the Platte River basin in Nebraska may affect pallid sturgeon habitats by reducing the amount of water available for this species in the lower Platte River. Impacts to the pallid sturgeon from temporary water withdrawals during hydrostatic testing in the lower Platte River Basin would be avoided since the volume of water needed would be withdrawn at a rate less than 10 percent of the baseline daily flow and returned to its source within a 30-day period.

Larval life stages could be entrained (captured in the pumps) through water withdrawals for both HDD and hydrostatic testing in the Missouri and Yellowstone rivers, and would not likely survive. Newly emerged pallid sturgeon larvae drift with currents for many days and over large distances before they achieve any volitional movements (Braaten et al. 2008).

The following conservation measures would avoid or minimize potential impacts to the pallid sturgeon, which could occur through HDD or hydrostatic testing of the Milk, Missouri, and Yellowstone rivers:

- At streams and rivers that would be crossed by the HDD method, screen the water pump intake hose using an appropriate mesh size approved by the USFWS, to prevent entrainment of larval fish or other aquatic organisms.
- Control pump withdrawal rates, reducing the potential for entrainment or entrapment of aquatic species.
- Periodically check all water pump intake screens for entrainment of fish during water withdrawals, and care would be taken to prevent erosion or scouring of the waterbody bed and banks during discharge. Should a sturgeon become entrained, all pumping operations would immediately cease and the compliance manager for Keystone would immediately contact the USFWS to determine if additional protection measures would be required.
- Use at least a 100-foot setback from the water's edge for the HDD drill pads, at the HDD crossings at the Yellowstone and Missouri rivers in Montana.

The proposed Project could affect, but is not likely to adversely affect the pallid sturgeon. This determination is based on implementation of the HDD crossing method at the Milk, Missouri, and Yellowstone rivers; the screening of water pump intakes to prevent entrainment of larval fish or debris; and implementation of USFWS recommended conservation measures. The connected actions would not likely coincide with the distribution of the pallid sturgeon in Montana and North Dakota and would likely have no effect on the pallid sturgeon, although full environmental review of these actions would be conducted separately during the permitting process for these actions.

Federally Protected Invertebrates

Preliminary evaluations identified one federally protected invertebrate species that could potentially occur within the proposed Project area (Table 4.8-1). The American burying beetle *(Nicrophorus americanus)* is known to exist in isolated colonies in at least six states, among them South Dakota, Nebraska, and Kansas (Backlund and Marone 1997, Bedick et al. 1999). American burying beetles have disappeared from over 90 percent of their historical range, even though they are considered feeding habitat generalists. The decline of the American burying beetle has been attributed to habitat loss, alteration, and degradation. Developed land and land that has been converted from agricultural, grazing, and other uses, often favors scavenging mammals and birds that compete with carrion beetles for carrion. Additionally, these types of habitat alterations have generally led to declines in ground nesting birds, which probably historically provided a large portion of the carrion available.

Fire suppression in prairie habitats allows the encroachment of woody plant species, particularly the eastern red cedar (*Juniperus virginiana)*, which is thought to degrade habitat for burying beetles by limiting their range to forage for carrion. The red-imported fire ant (*Solenopsis*

invicta), which has extended its range in the southeastern and south central United States and is most numerous in open, disturbed habitat, has also been identified as a cause for the decline of the American burying beetle (USFWS 2008).Surveys for the American burying beetle occurred in suitable habitat (rangeland, hay meadows) in Antelope, Holt, Keya Paha, and Boyd counties in Nebraska during the summer of 2012 (see Appendix H, the Biological Assessment, for detailed information on these surveys). As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, these surveys identified low numbers of American burying beetles in Holt and Keya Paha counties of Nebraska, and none in Antelope and Boyd counties. The proposed Project would cross approximately 50 miles of suitable habitat for this species in Nebraska.

American burying beetle surveys were not conducted in South Dakota specifically for this Project, but surveys in 2005 for this species identified a relatively high concentration of American burying beetles in southern Tripp County, which the Project route would cross through. The proposed Project route would cross through approximately 33 miles of suitable habitat for this species in South Dakota.

The proposed Project would temporarily impact approximately 408 acres of habitat and permanently impact approximately 221 acres of habitat in South Dakota, and would temporarily impact approximately 727 acres and permanently impact approximately 372 acres of habitat in Nebraska (1,768 acres total).

Direct impacts to American burying beetles could occur as a result of proposed Project construction during vegetation clearing, site grading, and trench excavation, which could result in temporary habitat loss, potential alteration of suitable habitat to unsuitable habitat, temporary habitat fragmentation where the pipeline is not already located next to other utilities, and potential mortality to eggs, larvae, and adults through construction vehicle traffic and exposure during excavation. In addition, artificial lighting has the potential to disrupt American burying beetle feeding behavior and increase mortality through predation. Most normal construction would take place during the daylight hours and construction areas would use artificial lighting infrequently. Activities that could potentially require artificial lighting include critical pipeline tie-ins, HDD crossings, and certain work required after sunset due to weather, safety, or other requirements. HDD crossings would require 24-hour operation until the crossing is completed.

Burying beetles, including the American burying beetle, are sensitive to soil moisture and die quickly when desiccated (Bedick et al. 2006). During construction, soil moisture may be reduced across the ROW as the site is prepared by removing topsoil and grading. Equipment operations within the ROW could compact the substrate. During reclamation, sub-soil and top-soil would be de-compacted and vegetation cover would be re-established within both the temporary and permanent ROW. Sub-soil and top-soil compaction would be relieved by discing, or chiseling using a disc or harrow pulled by a tractor. Native vegetation seed would be used, unless otherwise directed by landowners, land managers, or regulatory agencies with jurisdiction. These actions would prevent compaction of the soil and would allow vegetation types beneficial to the beetle to establish.

The activity period for the American burying beetle across its range is generally late April through September (USFWS 1991) and is associated with air temperature. Peak activity occurs when temperatures are 60 degrees Fahrenheit (°F) or greater at midnight. The American burying beetle overwinters as an adult by burrowing in soil (Schnell et al. 2008). Schnell et al. (2008)

found that in Arkansas, surviving American burying beetles overwintered at an average depth of 6 centimeters (2.4 inches) with some as deep as 20 centimeters (6 inches). Thermal models indicate that heat generated by the proposed Project pipeline would warm soil surface temperatures by as much as 10°F in northern latitudes during January to April (Appendix S, Pipeline Temperature Effects Study). The thermal models indicate that heat dissipation effects would occur primarily within approximately 3.5 feet of the pipeline compared to background temperatures (Appendix S, Pipeline Temperature Effects Study). Soil heating associated with proposed Project operation could increase American burying beetle mortality by triggering early emergence when prey are scarce and cold air temperatures cause emergent adult mortality; elevated temperatures could also increase metabolic rates such that overwintering beetles starve prior to emergence, and they could also cause drying of soils, causing beetles to desiccate (Bedick et al. 1999).

During operations, lights associated with aboveground facilities may attract American burying beetles, particularly if the lights emit wave lengths in the ultraviolet spectrum. Facilities associated with the pipeline would generally not be lighted, although a single light would be used above pump station doors for employee safety. One pump station in Holt County, Nebraska occurs in habitat within the known or suspected range of the American burying beetle. This is not expected to cause a substantial issue with regard to American burying beetle attraction.

It is likely that all direct impacts to the American burying beetle may not be avoided during construction activities. In compliance with the ESA, Keystone has agreed to develop in conjunction with the USFWS a habitat conservation Trust to provide monetary compensation that would be used by a third-party non-profit organization for habitat acquisition or other conservation measures as compensatory mitigation.

General conservation measures that have been discussed during consultation between USFWS, the Department, state resource agencies, and Keystone that would avoid or minimize potential impacts to the American burying beetle include:

- Prior to construction disturbance and grading of the ROW, trap adult American burying beetles along and relocate them from the construction ROW in Nebraska, where access is available. Trapping and relocation would adhere to the Nebraska American Burying Beetle Trapping Protocol (USFWS and NGPC 2008)[3]. Trapping and relocating American burying beetles is not authorized in South Dakota.
- Mow and windrow vegetation during the trap and relocate period to temporarily reduce habitat suitability by drying out the soil surface. Conduct mowing so that vegetation is at most 8 inches in height. Conduct windrowing to remove vegetation residue. Implement mowing and windrowing only in Nebraska, not in South Dakota.
- After trap and relocate efforts are completed in Nebraska, a biologist would travel the ROW to remove any carcasses that may be present within the ROW to avoid attracting American burying beetles back to the ROW.

[3] Trapping and relocation of American burying beetles would result in the take of American burying beetles , through handling and release away from the proposed project site. Such take may be authorized only in a USFWS Biological Opinion incidental take statement.

- During construction in the American burying beetle range in Nebraska, a biologist would travel the ROW weekly to remove any carcasses that may be present within the ROW to avoid attracting American burying beetles back to the ROW.
- Train all workers operating in American burying beetle habitat along the proposed Project ROW in American burying beetle conservation efforts. In the training, include a discussion of American burying beetle habitat, biology, reasons for their decline, and worker requirements relative to American burying beetle protection (e.g., removing food wastes from the ROW each day, reporting any American burying beetle sightings to an Environmental Inspector, and avoiding bringing dogs and cats to the ROW). Provide each construction worker operating in American burying beetle habitat with a full color Endangered Species Card, which includes a picture of the American burying beetle and a summary of relevant conservation information and requirements.
- In American burying beetle habitats, post signs at all access points to the ROW identifying the areas as American burying beetle habitat and reminding workers to follow special restrictions in the area.
- Down-shield lighting and use sodium vapor-type lights at ancillary facilities in American burying beetle habitat, to avoid attracting American burying beetles to the construction or operation site.
- Keystone would provide compensation for temporary construction and permanent operations impacts to the American burying beetle as part of a habitat conservation trust in areas where American burying beetles are likely to be impacted, including southwest of Highway 18 in Tripp County, South Dakota, and Keya Paha and Holt counties, Nebraska. Base compensation on total acres impacted where American burying beetle presence is confirmed; no compensation would be required for poor habitat. Modify compensation by habitat quality rating multipliers, with prime habitat compensation at 3 times the total impact acres; good habitat at 2 times the total impact acres; fair habitat at 1 times the total impact acres; and marginal habitat at 0.5 times the total impact acres. In Nebraska only, no compensation would be provided for habitat where no American burying beetles have been found. In South Dakota, compensation would be provided based on only habitat quality rating multipliers and not American burying beetle survey information. Temporary habitat impacts would be scaled for the period of time anticipated for recovery of vegetation cover at 4 years over the 50-year life of the proposed Project, or 8 percent of total calculated impacts. All compensation would be compliant with agreements between the Department, the USFWS, and Keystone.
- Provide funding for compliance monitoring. The Department would designate an agreed upon third-party that would work with the Department and the USFWS to ensure that vegetation restoration efforts are successful for American burying beetle habitat, as discussed during consultation among the Department, the USFWS, and Keystone.
- Keystone may set aside a reclamation performance bond. The bond would be applied to supplemental vegetation restoration that may be necessary if restoration for American burying beetle habitat fails, as discussed during consultation among the Department, the USFWS, and Keystone.

In addition to the conservation measures outlined above, state-specific conservation measures for the American burying beetle have been recommended by respective USFWS offices and state resource agencies. In South Dakota, these include:

- Build the construction camp near Winner, South Dakota on cropland very close to Winner, and/or north of Highway 18 in Tripp County.
- Place the two pipe stockpile sites planned for Tripp County on cropland, or north of Highway 18.
- Build the Gregory County, South Dakota contractor yard on cropland, or north of Highway 18.
- Avoid working at night in Tripp County if possible, because the American burying beetle is attracted to light at night. If working at night cannot be avoided, only use lighting between September 1 and June 1.

In Nebraska, state statutes do not provide for the incidental take of state-protected endangered species. The combined guidance plan of the Nebraska Game and Parks Commission (NGPC) and the USFWS Grand Island Field Office requires the implementation of two conservation measures: a measure entitled Capture and Relocation Conservation Measures and a measure entitled Maintaining Clear Activities (USFWS and NGPC 2008). These measures would be implemented prior to construction through areas occupied by the American burying beetle as directed to reduce the incidental take of the species in Nebraska. In addition, to offset unavoidable impacts to American burying beetles, compensatory mitigation for species take would be provided.

The proposed Project may affect, and is likely to adversely affect, the American burying beetle. This determination is based on the location of the proposed Project within the known range and habitat of the American burying beetle and the results from surveys. Even if trap and relocation efforts were to occur along the proposed construction ROW in these segments, the proposed Project could result in the incidental take of American burying beetles during construction or operations. The Department and Keystone would continue to work with the USFWS to refine conservation measures for minimizing incidental take and to quantify estimated incidental take for development of compensatory mitigation, through the formal Section 7 ESA consultation process for the American burying beetle.

Federally Protected Plants

Information on federally protected and candidate plants potentially found along the proposed Project route was provided by the USFWS, the various state Natural Heritage Programs (NHPs), state agencies, and field surveys. The NHPs provided information on the status of plant populations within individual states and, in some cases, surveys were completed along the proposed Project route. Potential occurrence within the ROW was evaluated for each plant based on its known distribution and habitat requirements. One federally protected plant is expected to potentially occur within the proposed Project area—the western prairie fringed orchid (*Platanthera praeclara*). The blowout penstemon (*Penstemon haydenii*) was eliminated from further analysis based on a No Effect determination.

The western prairie fringed orchid is presently known to occur in six states (Iowa, Kansas, Minnesota, Missouri, Nebraska, and North Dakota), and appears to be extirpated from South

Dakota (USGS 2006b, USFWS 1996). Most remaining populations are found in North Dakota and Minnesota, with about three percent of the populations found in the southern portion of its historical range (USFWS 1996). The spread of invasive plants into prairie swales has had a negative effect on western prairie fringed orchid populations (USFWS 2007b). Invasive plants which may displace the western prairie fringed orchid through competition include: leafy spurge (*Euphorbia esula*), Kentucky bluegrass (*Poa pratensis*), and Canada thistle (*Cirsium arvense*) (USFWS 2007b). Other threats to the long-term survival of western prairie fringed orchid include the use of herbicides, heavy livestock grazing, early haying, habitat fragmentation, river channelization, river siltation, and road and bridge construction (USGS 2006b).

As discussed in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern, no western prairie fringed orchids were located along the proposed Project route in Nebraska in 2012, although suitable habitat was present in several areas, while other areas of potentially suitable habitat were not surveyed due to access denial. The western prairie fringed orchid will be assumed to be present if suitable habitat is present but access to survey for the species was denied.

Pipeline construction could potentially disturb western prairie fringed orchids when vegetation is cleared and graded. Construction of permanent ancillary facilities could displace plant communities for the lifetime of the proposed Project. Revegetation of the proposed pipeline ROW could introduce or expand invasive species, especially leafy spurge, Kentucky bluegrass, and Canada thistle, into the proposed Project area, potentially contributing to the decline of western prairie fringed orchid. Weed and vegetation monitoring plans would be implemented to prevent the spread of invasive species as a consequence of proposed Project construction and operation (see Appendix G, CMRP).

The species can be impacted through disturbance to its habitat. This plant may also be impacted by alterations to the hydrology of sub-irrigated wetland habitat areas along the Platte River resulting from depletions to the Platte River system. Operation of the proposed Project would not be expected to result in impacts to the western prairie fringed orchid. Clearing of trees and shrubs in the permanent ROW would be required for operational monitoring. However, since this species inhabits open native prairie, no tree or shrub clearing would occur within habitat suitable for the species. If herbicides must be used for noxious weed control, application would be conducted by spot spraying. Populations of western prairie fringed orchid would be identified prior to herbicide application and herbicides would not be used in these areas.

According to a Pipeline Temperature Effects Study (Appendix S), the pipeline does have some effect on surrounding soil temperatures, primarily at pipeline depth, in an area surrounding the pipe. Effects of pipeline-elevated soil temperatures vary seasonally. Heat effects in soil near the surface, where most plant root systems are located, are less pronounced than near soil around the pipe. Surficial soil temperatures relevant to vegetation are impacted mainly by climate (such as air temperature and plant water availability) with negligible effect attributed to the operating pipeline. This is because the largest increase in temperature, in the summer months, is found within 24 inches of the pipeline. In addition, a minimum of 4 feet of cover over the top of the pipeline would result in minimal impacts to vegetation. Therefore, there would be no effects of heat dissipation from the pipeline for the western prairie fringed orchid.

The following mitigation measures would be implemented where the western prairie fringed orchid has been identified in the proposed Project area, or where suitable habitat was identified

for the species but species surveys have not been conducted when the plant was flowering to verify presence/absence:

- Complete presence/absence surveys prior to construction within areas identified with potentially suitable habitat where access has been denied. Survey results would be submitted to the USFWS for review.
- Route the pipeline around individual plants or populations within the proposed Project footprint.
- Transplant individual plants that would be affected by construction activities to other locations where suitable habitat is available, when feasible and/or when approved by land owner if on private land.
- Reduce the width of the construction ROW in areas where populations have been identified, to the extent possible.
- Salvage and segregate topsoil appropriately where populations have been identified to preserve native seed sources in the soil for use in re-vegetation efforts in the ROW.
- Restore wet meadow habitat using a seed mix approved by the NRCS and USFWS.
- Monitor restoration of construction-related impacts to wet meadow habitats along the proposed Project route, that were identified as suitable for the western prairie fringed orchid, consistent with U.S. Army Corps of Engineers (USACE) guidelines which indicate monitoring for a five-year period for successful re-establishment of wetland vegetation.
- Provide compensation for temporary construction and permanent operational impacts to the western prairie fringed orchid as part of a Trust. Compensation would be based on total acres impacted where western prairie fringed orchid presence was confirmed and in areas with suitable habitat that were not surveyed during the blooming period. Compensation would not be provided for habitat in areas where surveys were completed for western prairie fringed orchids and they were not detected.

The proposed Project may affect, but is not likely to adversely affect the western prairie fringed orchid. This determination is based on the route's proximity to the extant western prairie fringed orchid range, the presence of an identified and avoided population, the existence of suitable habitat within the proposed Project area, Keystone's commitment to implement avoidance and conservation measures that includes providing compensation for impacts to the western prairie fringed orchid where presence has been confirmed and where suitable habitat as identified by the USFWS has not been surveyed, and power providers will consult with the USFWS regarding ways to minimize or mitigate impacts to the western prairie fringed orchid and other threatened and endangered species affected by construction and follow recommended avoidance and conservation measures of the USFWS.

4.8.3.2 *Bureau of Land Management Sensitive Animals and Plant Species*

BLM has responsibility for the designation and protection of sensitive species on federal lands that require special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. The proposed Project route would cross federal lands in Montana. BLM Montana offices evaluate potential Project impacts on BLM sensitive species, which include species that have been determined, in coordination with the

Montana National Heritage Program (MNHP), MFWP, and the U.S. Forest Service, to be recommended for sensitive designation. BLM also evaluates both federal candidate species and federal delisted species within five years of delisting. Federal candidate species are addressed in Section 4.8.3.1 and the federal delisted bald eagle and peregrine falcon are discussed in more detail in Section 4.8.3.3. The proposed Project route would cross about 42.5 miles of BLM land in Montana. All BLM designated sensitive animals and plants in Montana are also Montana-designated species of concern. Analyses and discussions of state protected species, some of which are also BLM sensitive species, are presented in Section 4.8.3. The BLM sensitive species that have the potential to occur within the proposed Project area include 8 mammals, 29 birds, 5 reptiles, 3 amphibians, 5 fish, and 4 plants. These species are discussed in detail in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern.

Of these BLM sensitive species discussed in Section 3.8, conservation measures were developed for three of them—the greater sage-grouse, swift fox (*Vulpes velox*), and mountain plover (*Charadrius montanus*). Proposed Project-related impacts and conservation measures developed in conjunction with the MDEQ, MFWP, and USFWS specific to the greater sage-grouse, and sagebrush habitats, are described in Section 4.8.3.2. Proposed Project-related impacts and conservation measures developed in conjunction with the MDEQ and MFWP, specific to the swift fox, are described in Section 4.8.3.3. Proposed Project-related impacts and conservation measures developed for the mountain plover are described below.

Mountain plovers are not expected to occur in the proposed Project area in South Dakota, Kansas, or Nebraska. This species occurs west of the proposed Project area during nesting, migration, or wintering in Kansas and Nebraska (Andres and Stone 2009).

In Montana, the proposed Project route would cross habitats that may support nesting mountain plovers such as prairie dog towns or ground-squirrel burrows. Mountain plovers also are known to occur in flat barren areas that are underlain with bentonite in Valley County, Montana, but the proposed Project route would not cross through bentonite fields in Valley County. Most mountain plover nesting in Montana is concentrated south of the proposed Project route in southern Phillips and Valley counties (Childers and Dinsmore 2008, Andres and Stone 2009).

Construction through prairie dog towns or other suitable nesting habitats in Montana could affect nesting mountain plovers if they are present and if construction occurs during the nesting season. Nests, eggs, and young could be lost during construction. Disturbance could lead to nest abandonment resulting in loss of eggs or young. In Montana, mountain plover surveys are recommended within suitable habitats in Valley and Fallon counties during the May 1 to June 15 breeding season.

To avoid impacts to mountain plovers, the following measures would be implemented:

- Prohibit construction, reclamation, and other ground disturbing activities from April 10 to July 10, to minimize destruction of nests and disturbance of breeding mountain plovers unless surveys consistent with the Plover Guidelines or other methods approved by the USFWS find that no plovers are nesting in the area. Potential mountain plover habitat must be surveyed three times between April 10 and July 10, with each survey separated by at least 14 days. The earlier date will facilitate detection of early-breeding plovers.

- Schedule routine maintenance activities outside the April 10 to July 10 period in mountain plover nesting habitat unless surveys were conducted that indicate that no plovers were nesting in the area and that flightless chicks were not present.
- Delay construction activities within 0.25 mile of active nests for 37 days (typical fledging duration) or until fledging, whichever is sooner.
- Delay construction activities in the vicinity of a brood of flightless chicks for at least seven days or until fledging, whichever is sooner.

The proposed Project could affect, but is not likely to adversely affect mountain plovers based on implementation of the recommended conservation measures identified by the MFWP and the USFWS.

4.8.3.3 *State Protected Animals and Plants*

All states crossed by the proposed Project route, except Montana, maintain listings of endangered and threatened species and afford protections to these species. Montana maintains a listing of species of concern and those species that are only listed in Montana are discussed in Appendix N, Supplemental Information for Compliance with MEPA. Those species that are listed in Montana and are also state-protected in other states are presented here. The protections afforded animals and plants on these lists are established within the statutes for each state. Further, each state that would be crossed by the proposed Project route maintains a comprehensive wildlife conservation strategy (including a state wildlife action plan), as charged by Congress. These wildlife action plans identify the condition of each state's wildlife and habitats (including low and declining populations) and identify the challenges to these resources and long-term conservation strategies. Table 4.8-2 lists state endangered and threatened species that have been identified through consultations with state resource agencies as potentially occurring along the proposed Project route.

Table 4.8-2 State-Listed Animals and Plants Potentially Occurring along the Proposed Project Route

Species	Federal and BLM Status[a]	State Status and Occurrence				Comments
		MT	SD	NE	KS	
Mammals						
Black-footed ferret (*Mustela nigripes*)	E	SC	E	E	E	Inhabits prairie dog towns of the Central Plains grassland habitat, and feeds primarily on prairie dogs.
River otter (*Lontra canadensis*)			T	T		North America, uses aquatic and riparian habitats, burrows along shorelines, eats fish.
Swift fox (*Vulpes velox*)	BLM-S	SC	T	E		Central Plains, uses habitats with high densities of small mammal prey, uses dens year-round.
Birds						
Bald eagle (*Haliaeetus leucocephalus*)	DL BLM-S	SC	T		T	North America, breeds and winters in areas near water, eats fish and waterfowl; resident and migrant populations.

Species	Federal and BLM Status[a]	State Status and Occurrence				Comments
		MT	SD	NE	KS	
Eskimo curlew (*Numenius borealis*)	E		E	E	E	Inhabit grasslands of North America (summer) and South America (winter).
Interior least tern (*Sternula antillarum*)	E	SC	E	E	E	Inhabit barren to sparsely vegetated sandbars along rivers, sand and gravel pits, or lake and reservoir shorelines.
Peregrine falcon (*Falco peregrinus*)	DL BLM-S	SC	E			North America, nests on ledges, cliffs; eats birds, winters coastal proposed Project area, resident and migrant.
Piping plover (*Charadrius melodus*)	T	SC	T	T	T	Central Plains, inhabits sand and gravel bars and beaches along major rivers and around lakes, reservoirs, ponds, and alkali wetlands.
Whooping crane (*Grus americana*)	E	SC	E	E	E	Central United States and Canada, use a variety of habitats during migration, including a variety of croplands for feeding, and wetlands that are generally 10 acres or less for roosting. Breed in isolated marshes.
Reptiles						
Massasauga (*Sistrurus catenatus*)				T		Central United States, Great Lakes region; wet prairies, marshes, uplands; uses burrows, eats animals, short migrations.
Fish						
Blacknose shiner (*Notropis heterolepis*)			E	E		Northern United States; Keya Paha, Niobrara rivers and tributaries, Spring Creek, SD, NE; weedy lakes streams; eats insects.
Blackside darter (*Percina maculata*)					T	Central US; clear gravel or sand bottom streams, eats insects.
Finescale dace (*Phoxinus neogaeus*)			E	T		North United States; Keya Paha, Niobrara, South Fork Elkhorn rivers, Spring Creek, SD, NE; bogs, creeks, rivers, eats invertebrates.
Northern redbelly dace (*Phoxinus eos*)	BLM-S	SC	T	T		North United States; Upper Missouri River and tributaries, Frenchman's Creek, Yellowstone River and tributaries east of the Powder River, MT; Keya Paha, Niobrara rivers and tributaries, Spring Creek, SD, NE; boggy lakes, streams; herbaceous.
Pallid sturgeon (*Scaphirhynchus albus*)	E	SC	E	E	E	Inhabit large, free-flowing, warm-water stream systems, where they live close to the bottom of the rivers, where there are sand and gravel bars.
Pearl dace (*Margariscus margarita*)	BLM-S	SC	T			North United States; Missouri River, Milk River, Rock Creek, Willow Creek, and Frenchman's Creek, MT; Keya Paha tributaries, SD; bogs, clear streams, spawns on sand-gravel; omnivorous.
Sicklefin chub (*Macrhybopsis meeki*)		SC	E		E	Missouri River, MT, SD, NE, KS; Yellowstone, Milk rivers, MT; large warm rivers with gravel, sand; bottom feeder.

Species	Federal and BLM Status[a]	State Status and Occurrence				Comments
		MT	SD	NE	KS	
Sturgeon chub (*Macrhybopsis gelida*)	BLM-S	SC	T	E	T	Missouri River; Yellowstone and Powder Rivers, MT; Cheyenne and White rivers SD; large turbid rivers; bottom feeder.
Topeka shiner (*Notropis topeka*)	E			E	T	Occurs in portions of South Dakota, Minnesota, Kansas, Iowa, Missouri, and Nebraska, primarily in small prairie (or former prairie) streams in pools containing clear, clean water. Topeka shiner streams generally have clean gravel, rock, or sand bottoms.
Invertebrates						
American burying beetle (*Nicrophorus americanus*)	E			E	E	Inhabits grassland prairie, forest edge, and scrubland, in Arkansas, Kansas, Nebraska, Oklahoma, South Dakota, and Rhode Island.
Plants						
Small white lady's slipper (*Cypripedium candidum*)				T		North Central, Northeast United States; perennial orchid, mesic-to-wet native prairie, flowers May to June.

[a] FC = Federal Candidate; DL = Federally Delisted; BLM-S = BLM Sensitive; E = Endangered; T = Threatened; SC = Species of Concern).

State-protected animals and plants that are also federally protected or candidates for federal protection are discussed in Section 4.8.3.1. State-protected species (not including species designated solely as Montana species of concern) potentially occurring along the proposed Project route include two mammals, three birds, one reptile, eight fish, and one plant. Potential Project-related impacts to state-protected animals and plants, in addition to the proposed conservation measures, would be similar to impacts and mitigation discussed in Section 4.6 for wildlife and Section 4.5 for plants. Additional occurrence information, impact discussions, and conservation measures for state-listed species are presented in the following sections.

State-Protected Mammals

River Otter

River otters (*Lontra canadensis*) are adaptable and use a variety of habitat types, but require aquatic habitats. Although they frequent lakes and ponds, river otters typically live in marshes and along wooded rivers and streams with sloughs and backwater areas. Otters use dens in the ground that were previously built by beavers or other animals. Denning occurs during March to September. Most river otter mortality is related to human activity. In Nebraska, accidental trapping has been the largest known mortality factor for reintroduced animals. Habitat destruction, pesticide use, and pollutants also affect the species (NGPC 2009). River otters are likely to occur throughout the proposed Project area along large rivers. To reduce impacts to river otters, the following measures would be implemented:

- Conduct river otter surveys prior to proposed Project construction along the Bad River, White River, and Cheyenne River in South Dakota and along the Niobrara River, Loup River, North Branch Elkhorn River, South Fork Elkhorn River, Cedar River and Platte River

in Nebraska (if suitable den habitat occurs near the river crossings and if construction would occur during the denning period).

- Restrict construction activities within 0.25 mile of active natal dens.
- Use the HDD method to cross under all of the rivers identified as potentially supporting river otters, except the Bad River in South Dakota and the North Branch and South Fork Elkhorn rivers in Nebraska. This would avoid impacts to shoreline habitats that could potentially be used by denning river otters.

Swift Fox

Swift foxes *(Vulpes velox*) are declining due to habitat loss, alteration, and fragmentation due to agriculture and mineral extraction and collision with automobiles (NatureServe 2009).

As discussed in Section 3.8, the proposed Project occurs within swift fox range in eastern Montana and western South Dakota, and there are several records of this species occurring within the last five years in northern Phillips and Valley counties (MNHP and MFWP 2012c). The proposed Project route would not cross the known distribution of the swift fox in Nebraska.

Potential impacts to swift foxes occurring along the proposed Project route include a temporary loss of feeding and/or denning habitat. Adult foxes could be disturbed by increased human presence and associated construction activities (noise, dust); however, because they are mobile, displacement would likely be temporary, and foxes would likely return to the proposed Project area after construction is completed.

If occupied swift fox dens occur within the proposed Project construction ROW, construction could result in a loss of individual animals and young. It is assumed that both adults and young would not avoid construction activities and would remain in or near natal den sites that could be directly removed by trenching activities or collapsed due to vehicle operation. Construction activities prior to March would avoid direct effects to pups, if present. Loss of individual animals would result in an incremental reduction in the local population; however, no significant population effects are anticipated. If construction activity would occur in suitable habitat in the counties mentioned above during the breeding season (spring/summer), where dens are present, restrictions on construction activities would be required.

To reduce impacts to swift foxes, the following measures would be implemented:

- Revegetate the ROW to support small mammal and insect prey.
- Conduct surveys of potential den sites on federal land and within suitable habitat in the Project footprint in South Dakota.
- Restrict construction activities within 0.25 mile of active natal dens between April 1 and August 31.

Additional mitigation measures recommended by Montana state agencies include:

- Conduct surveys of potential den sites between February 15 and July 31 in suitable habitat in the Project footprint Phillips, Valley, Prairie, Dawson, and Fallon counties in Montana (MDEQ and MFWP).
- Restrict construction activities within 0.31 mile of active dens from February 15 to July 31 in Montana on state or federal land (MDEQ and MFWP).

State-Protected Birds

Two state-protected birds that are not federally listed could occur in the proposed Project area: peregrine falcon (*Falco peregrinus*) and bald eagle (*Haliaeetus leucocephalus*). Occurrence information, impact discussions, and conservation measure descriptions are presented in the following section. Both species are considered migratory and are federally protected under the MBTA. In addition, bald eagles are also federally protected under the BGEPA. A Migratory Bird Conservation Plan would be developed in consultation with the USFWS to comply with the MBTA and implement provisions of Executive Order 13186 by providing benefits to migratory birds and their habitats within the states where the proposed Project would be constructed, operated, and maintained.

Peregrine Falcon

The peregrine falcon is a non-breeding resident, breeding resident, permanent resident, or migrant throughout the United States, primarily west of the proposed Project area; non-breeding residents are found throughout the east and Gulf of Mexico coasts. Two of the three recognized subspecies could occur within the proposed Project area: the American peregrine falcon (*Falco peregrinus anatum*) and the Arctic peregrine falcon (*F.g. tundrius*). Both subspecies were previously federally protected as endangered under the ESA but have been delisted.

Raptor surveys along the proposed Project route did not identify any nesting peregrine falcon nests, and no breeding records of peregrine falcons exist along the proposed Project route; therefore, the proposed Project is not likely to affect nesting peregrine falcons.

Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) occur throughout the United States and the proposed Project area. Four active bald eagle nests were documented during raptor nest surveys for the previously proposed Project during April 2009: two in Montana and two in Nebraska. Five active bald eagle nests were documented during raptor nest surveys during April 2010.

Twelve bald eagle winter roost sites were identified during surveys during February 2009, including three at proposed river crossings in Montana (Yellowstone River, Missouri River, and Frenchman Reservoir); three at proposed river crossings in South Dakota (White River, Cheyenne River, South Fork Moreau River); and six at proposed river crossings in Nebraska (Platte River, Loup River, Cedar River, Dry Creek, Niobrara River, Keya Paha River). Note that the two eagle nests and six winter roost sites in Nebraska were along the previously proposed route, not the currently proposed Project route.

To reduce impacts to bald eagles, the following measures would be implemented:

- Conduct additional nest/roost surveys within one mile of the ROW prior to construction. Surveys would be conducted aerially (preferably by helicopter) between March 1 and May 15, before tree leaf-out to ensure nests are more visible. These aerial surveys would include the following:
- Use helicopters instead of fixed-wing aircraft when possible, since helicopters have the ability to hover and facilitate ground observations. Regardless of aircraft, whenever possible, use two observers to conduct the surveys. Experienced observers may only find 50 percent of

nests on a flight; therefore, two flights would be performed prior to any on-the-ground Project activities, including other biological surveys.

- Record observations of any eagles and/or nest sites using geographic positioning system equipment. The date, location, nest condition, activity status, raptor species, and habitat would be recorded for each sighting.
- Submit the biologist(s) qualifications, survey methods, and survey results to the USFWS.
- Report the location of any active bald eagle nests identified during nest/roost surveys to the USFWS and appropriate state agencies, and, if possible, reroute the pipeline to avoid any nests that occur within 600 feet of the proposed ROW;
- Maintain a no-disturbance buffer of at least 600 feet around active nests, during the nesting season (January 1 through August 15); and
- Consult with USFWS under the BGEPA regarding required buffers and construction activities within 600 feet of active winter roost sites during the winter roosting season (November 1 through April 1) and the ability to conduct construction activities within 600 feet of active winter roosts between 10 a.m. and 3 p.m.

The above measures would be implemented on a site-specific basis in consultation with the USFWS and states that list bald eagles as threatened including South Dakota and Kansas. BLM would be consulted for any bald eagle nest or roost sites that occur within 0.5 mile of the proposed Project route on federal lands in Montana. Additional mitigation measures recommended by MFWP include:

- In Montana, implement measures in the Montana Bald Eagle Management Plan if applicable, or apply current guidance from the USFWS.
- In Montana, restrict construction activities within 0.62 mile of all active territories from March 15 to July 15 including documented sites within 0.5 mile of the Project route on the Missouri River in Montana.

State-Protected Reptiles

The massasauga (*Sistrurus catenatus*), or pygmy rattlesnake, has suitable habitat known to occur along the proposed Project route within Jefferson County, Nebraska, along waterbody shorelines. To reduce impacts to the massasauga in Nebraska, the following measures would be implemented:

- Complete surveys of suitable habitats to identify areas potentially containing the massasauga along the proposed Project route in Jefferson County, Nebraska to clear the area for the massasauga prior to construction.
- Continue consultations with the NGPC.
- Locate the power line to Pump Station 26 in Jefferson County, Nebraska next to a road.

State-Protected Fish

There are seven species of state-protected fish that are not federally listed species potentially occurring within the proposed Project area. These species are within two fish families: minnows

and sturgeon. Additional occurrence information, impact discussions, and conservation measure descriptions are presented in the following section.

Minnows

Six state-protected minnows potentially occur in waters crossed by the proposed Project including: one shiner, two chubs, and three dace.

Blacknose Shiner

The blacknose shiner (*Notropis heterolepis*) potentially occurs within suitable habitat in waterbodies crossed by the proposed Project route in South Dakota and Nebraska. There are five known populations in Nebraska. Occurrence and habitat surveys completed in 2009 identified four previously proposed stream crossings containing marginally suitable habitat and one currently proposed stream crossing with good habitat in Nebraska, and two proposed stream crossings containing suitable habitat in South Dakota. Surveys are planned for 2013 in suitable habitat along the currently proposed Project route.

Finescale Dace

Populations of the finescale dace (*Phoxinus neogaeus*) in South Dakota and Nebraska occur as small, isolated pools that have been declining steadily since European settlement of this region over 100 years ago. Primary threats to finescale dace include habitat alteration and the introduction of non-native fishes. Finescale dace occur in small, confined habitats with permanent spring seeps, usually at the headwaters of small streams. In accordance with recommendations by the SDGFP and NGPC, field surveys of waterbodies identified as potentially containing finescale dace or habitat suitable for this minnow were conducted. No finescale dace were found during fall 2009 field surveys, although two locations contained habitat suitable for this species in South Dakota. Surveys did not identify suitable habitat for this species along the previously proposed Project route in Nebraska, and surveys planned for 2013 would determine the habitat suitability for this species along the currently proposed route through the state.

Northern Redbelly Dace

The northern redbelly dace (*Phoxinus eos*) has suffered population declines as a result of habitat alteration and the introduction of non-native fishes. In some parts of the northern United States and Canada, the northern redbelly dace hybridizes with its close relative, the finescale dace. The resulting hybrids are all females and produce female clones as offspring. The northern redbelly dace potentially occurs in: the Upper Missouri River and tributaries, including Frenchman's Creek, and the Yellowstone River and tributaries east of the Powder River, Montana; in tributaries of the Keya Paha River in South Dakota; and in tributaries of the Niobrara River, and South Fork Elkhorn River in Nebraska.

Surveys of stream crossings identified as potentially containing the northern redbelly dace or its habitat, as identified by the SDGFP and NGPC, did not find this minnow, although two stream crossings contained suitable habitat in South Dakota. In Nebraska, surveys along the previously proposed Project route did not identify suitable habitat for this species; surveys planned for 2013 would determine the habitat suitability for this species along the currently proposed route through the state.

Pearl Dace

The pearl dace (*Margariscus margarita*) potentially occurs in suitable habitat in the proposed Project area in the Missouri River, Milk River, Frenchman's Creek, Rock Creek, and Willow Creek in Montana, and tributaries to the Keya Paha River in South Dakota.

Surveys of waterbodies identified as potentially containing pearl dace or their habitat were conducted in 2009 and found no pearl dace, although two proposed stream crossings in South Dakota contained suitable habitat. In Nebraska, surveys along the previously proposed route did not identify suitable habitat for this species; surveys planned for 2013 would determine the habitat suitability for this species along the currently proposed route through the state.

Sicklefin Chub

The sicklefin chub (*Macrhybopsis meeki*) potentially occurs in the Missouri, Milk, and Yellowstone rivers in Montana, and in the Cheyenne and White rivers in South Dakota. This species is not expected to occur in South Dakota along the proposed Project route (USGS 2006a).

Sturgeon Chub

The sturgeon chub (*Macrhybopsis gelida*) occurs in the Yellowstone, Powder, and Missouri rivers and some of their tributaries in Montana, the Cheyenne and White rivers in South Dakota, and the Platte River in Nebraska.

For the minnows listed above, construction through streams during spawning periods could result in disruption of spawning and loss of eggs and young. Additionally, construction methods that lead to increased siltation and turbidity (cloudiness in the water) could temporarily displace these fish. Construction conservation measures to reduce fine sediment would minimize displacement of feeding minnows. Water withdrawals for use in the HDD crossing method or for hydrostatic test purposes could lead to fish entrainment. Water withdrawal would be performed consistent with permit requirements and intake hoses would be screened to prevent entrainment of fish. Protections for aquatic life during water withdrawal for HDD and hydrostatic testing would be implemented for all proposed water sources. Construction timing considerations and BMPs for maintaining water quality and flow would reduce potential impacts on state-protected minnows.

Mitigation measures for these fish may vary from state to state. In South Dakota, the following conservation measures would apply:

- Suitable habitat determinations along the route would be made by SDGFP.
- Conduct presence/absence surveys if suitable habitat is present .
- If surveys results are negative for these minnows, no further conservation measures would be required.
- If survey results are positive for these minnows, exclude construction activities during the spawning period (to be provided by SDGFP), and/or salvage and relocate the minnows.

In addition, surveys have been recommended in South Dakota for the blacknose shiner, northern redbelly dace, and pearl dace in tributaries of the Keya Paha River that would be crossed by the proposed Project route in South Dakota. In response to these survey recommendations by the

SDGFP, presence/absence and habitat surveys were completed in tributaries to the Keya Paha River for blacknose shiner, northern redbelly dace, finescale dace, and pearl dace. As described above, none of these minnows were found during the survey, but two proposed stream crossings in South Dakota, Lute Creek and Buffalo Creek in Tripp County, contained habitat suitable for blacknose shiner, northern redbelly dace, and pearl dace.

In Nebraska, NGPC recommended surveys for the blacknose shiner, northern redbelly dace, and finescale dace in tributaries of the Niobrara and South Fork Elkhorn rivers that would be crossed by the proposed Project route. NGPC has requested that Keystone re-consult to identify additional conservation measures if any of these species are found within any streams surveyed for the proposed Project. In accordance with NGPC's recommendation, presence/absence and habitat surveys for these species were conducted in 2009, at several previously proposed Project waterbody crossings. These species were not identified in any of the surveyed streams, but potential habitat for the blacknose shiner was identified at five proposed waterbody crossings along the previously proposed Project route. Additional surveys for these species are planned for 2013 in suitable habitat along the currently proposed Project route through Nebraska.

Pipeline crossing method selection for non HDD streams would be based on site-specific fish surveys during the year of construction, as it is difficult to predict future stream flow conditions and appropriate construction techniques.

The use of HDD stream crossing technology would avoid impacts to these minnows and their habitats. Most large rivers along the pipeline corridor would be crossed using HDD technology. In Nebraska, NGPC recommends HDD methods for any stream crossings occupied by these minnows, as open-cut crossings typically cause effects from increased turbidity and suspended sediment (such as avoidance and gill irritation).

State-Protected Invertebrates

There are no state-protected invertebrate species in Montana, South Dakota, or Nebraska that are potentially present along the proposed Project route.

State-Protected Plants

The small white lady's slipper *(Cypripedium candidum)* may occur within suitable habitat along the proposed Project route in Nebraska.

Potential impacts to the small white lady's slipper include habitat disturbance, trampling, and excavation disturbance. Surveys would be conducted for presence/absence within suitable habitat prior to the proposed Project construction in Antelope, Boyd, Holt, Keya Paha, Nance, and Merrick counties in Nebraska. If this plant is observed within the proposed Project ROW in Nebraska, appropriate mitigation measures would be developed and implemented in consultation with the NGPC.

4.8.3.4 *Animals and Plants of Conservation Concern*

Animals and plants identified during consultations with resource agencies as species of conservation concern that potentially occur along the proposed Project route, but that are not federal- or state-listed species, BLM sensitive species, or Montana species of concern discussed in Appendix N, Supplemental Information for Compliance with MEPA, are evaluated in Table 4.8-3 below.

Table 4.8-3 Species of Conservation Concern

Species	Threats	Potential Impacts	Proposed Mitigation
Birds			
Golden eagle (*Aquila chrysaetos*)	Illegal killing, powerline electrocution, poison intended for coyotes, habitat loss due to conversion to agriculture or suburbs.	Eight nest sites identified along proposed Project route: 2 in MT and 6 in SD, nesting and prey habitat loss or alteration, disturbance to breeding, foraging areas during construction, electrocution or collision mortality from project associated power lines.	Pre-construction raptor surveys. Pre-construction survey prior to March 15; restrict activity within 0.62 mile of active nests from March 15 to July 15 in Montana (MDEQ, MFWP).
Great blue heron (*Ardea herodias*)	Nest habitat destruction; human disturbance of rookeries; aquatic habitat degradation.	Eleven rookeries identified along proposed Project route: 1 in MT, 1 in SD, 1 in NE, 8 in TX; nesting and prey habitat loss or alteration, disturbance to breeding, foraging areas during construction, electrocution or collision mortality from project associated power lines.	Pre-construction surveys; adjust route to avoid rookery by 500 feet in Montana (MFWP).
Raptor nests (except eagles)	Nest habitat destruction; human disturbance; prey habitat loss or alteration.	~230 nest structures, 38% active along proposed Project route; nesting and prey habitat loss or alteration, disturbance to breeding and foraging areas during construction; electrocution or collision mortality from project associated power lines.	Pre-construction surveys. Restrict activity with 0.62 mile from active nests during March 15 to July 15 in Montana (MFWP).
Fish			
Plains topminnow (*Fundulus sciadicus*)	Impoundment, channelization, agricultural runoff, dewaters, siltation, introduction and competition from western mosquitofish (Gambusia affinis).	Concern in northwestern two-thirds of Nebraska; dewatering of habitat, mortality during construction, spread of mosquitofish.	Pre-construction surveys completed. Occurrence at one crossing location in SD. Surveys for plains topminnows and other fish species are planned for 2013, to determine if this species occurs in suitable habitat along the proposed Project route in Nebraska.

4.8.4 Recommended Additional Mitigation

No additional mitigation measures are recommended.

4.8.5 Connected Actions

4.8.5.1 *Bakken Marketlink Project*

Construction and operation of the Bakken Marketlink Project would include approximately a 5-mile-long pipeline (route not yet determined) and three crude oil storage tanks and associated facilities near Baker, Montana, adjacent to the proposed Pump Station 14, and two crude oil storage tanks and associated facilities at the proposed Cushing tank farm in Cushing, Oklahoma, to store and deliver Bakken oil production from producers in North Dakota and Montana through the proposed Project pipeline. The potential impacts associated with expansion of the pump station site and tank farm to include the Bakken Marketlink facilities would likely be similar to those described above for the proposed Project pump station, tank farm, and pipeline ROW in those areas.

Currently, there is insufficient information to complete an environmental review of this project. The federal and state permit applications for this project would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental reviews of the Bakken Marketlink Project. Preliminary assessments of select species are provided below.

Greater Sage-grouse

The Bakken Marketlink facilities would be constructed near known greater sage-grouse lekking sites, and, therefore, construction could affect greater sage-grouse or their habitat.

Interior Least Tern

The Bakken Marketlink Project is not likely to impact the interior least tern, as these facilities would not be located within areas used by this species.

Piping Plover

The Bakken Marketlink facilities near Baker would not be likely to affect the piping plover, as this region is used during migration.

Sprague's Pipit

The Bakken Marketlink facilities near Baker would be located within a region used by Sprague's pipit, and, therefore, construction and operation of these facilities could adversely affect this species.

Whooping Crane

The Bakken Marketlink facilities near Baker would not likely affect the whooping crane, as this region is not within the primary whooping crane migration corridor.

4.8.5.2 *Big Bend to Witten 230-kV Transmission Line*

Upgrades to the power grid in South Dakota to support power requirements for pump stations would include construction of a new 230-kilovolt (kV) transmission line and a new substation. Currently, there is insufficient information to complete an environmental review of this project. The federal and state permit applications for this project would be reviewed and acted on by other agencies, including the Rural Utilities Service. Those agencies would conduct more detailed environmental reviews of the Big Bend to Witten Transmission Line Project. Preliminary assessments of select species are provided below.

Greater Sage-grouse

The proposed alternative corridors for the 230-kV transmission line in southern South Dakota are generally outside of the range of breeding greater sage-grouse (USFWS 2010), and construction of a transmission line would be unlikely to affect the greater sage-grouse.

Interior Least Tern

Construction of the proposed 230-kV transmission line in southern South Dakota during the breeding season could potentially disturb nesting and brood-rearing interior least terns. Operation of the line would increase the collision and predation hazards for feeding and nesting interior least terns in the Project area.

Whooping Crane

Operation of the proposed 230-kV transmission line in southern South Dakota may increase the collision hazards for migrating whooping cranes, which could adversely affect populations of this species.

4.8.5.3 *Electrical Distribution Lines and Substations*

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.

Most of the proposed new electrical distribution lines to service pump stations would be 115-kV lines strung on 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 about 250 to 400 feet. Communication towers at pump stations would generally be approximately 33 feet in height. However, antenna height at select pump stations, as determined upon completion of a detailed engineering study, may be taller, but in no event would exceed a maximum height of 190 feet. Communication towers would be constructed without guy wires. The pipe entering and exiting the pump station sites would be located below grade. The pipe manifolding connected with the pump stations would be above ground.

Greater Sage-grouse

The construction of electrical distribution lines to pump stations in Montana and South Dakota would incrementally increase habitat alteration and predation hazards for feeding and nesting

greater sage-grouse in the proposed Project area. Construction of these distribution lines during the breeding season could also potentially disturb breeding, nesting, and brood-rearing birds. Keystone would not construct or operate these electrical distribution lines, but would inform electrical power providers of the candidate status of the greater sage-grouse, and would encourage consultations with Montana and South Dakota regulatory agencies for the electrical infrastructure components constructed for the proposed Project, to prevent impacts to greater sage-grouse.

Based on a 4-mile buffer centered on each confirmed active lek, each unconfirmed active lek with greater sage-grouse observations, or each priority lek, lek buffers would be overlapped by approximately 41 miles of the proposed power distribution lines to pumps (including nine separate leks). The power distribution line to Pump Station 14 in Montana would cross within several hundred feet of an active lek site, and because sage-grouse reportedly avoid tall structures, it could negatively affect activity at this site.

Additional mitigations recommended by the MDEQ to protect greater sage-grouse leks from power distribution lines to pump stations and remote valve locations in Montana, which may be required if the distribution line is considered an associated facility covered by the Major Facilities Siting Act, could include the following:

- Reroute the power distribution line to Pump Station 14, to avoid crossing within 1 mile of active greater sage-grouse leks.
- Review all power distribution line routes to pump stations and remote valve locations for proximity to active greater sage-grouse leks, and develop alternative routing or other mitigation to avoid placement of perches for predators near active greater sage-grouse leks.

Interior Least Tern

The construction of electrical distribution lines across the Platte River in Nebraska would incrementally increase the collision and predation hazards for feeding and nesting interior least terns in the proposed Project area. Construction of these distribution lines during the breeding season could also potentially disturb nesting and brood-rearing birds. Keystone would not construct or operate these electrical distribution lines, but would inform electrical power providers of the requirement to consult with USFWS for the electrical infrastructure components constructed for the proposed Project to prevent impacts to feeding least terns.

The following USFWS conservation measure would apply to power distribution lines to Pump Station 23 and Pump Station 24 in Nebraska:

- Mark distribution lines supplying power to Pump Station 23 and Pump Station 24 with bird deflectors where they cross rivers and within 0.25 mile of each side and between rivers and sand and gravel mining areas to reduce potential injury or mortality to interior least terns.

Additional conservation measures to avoid or minimize adverse impacts to interior least terns from new power lines would vary depending on the circumstances, but may also include the following measures:

- Mark new power lines with bird flight diverters (preferably Swan Spiral diverters or Firefly diverters) within ¼ mile of interior least tern nesting sites, on river systems and commercial sandpit areas.

- If construction of power lines occurs during the least tern breeding season, survey potential riverine or sand pit interior least tern nesting areas within 0.25 mile of new power lines and within 2 weeks of construction, to determine presence of nesting interior least terns. If nesting interior least terns are present, cease construction until all chicks fledge from the site.
- Mark distribution lines supplying power to Pump Station 23 and Pump Station 24 with bird deflectors where they cross rivers and within 0.25 mile of each side and between rivers and sand and gravel mining areas, to reduce potential injury or mortality to interior least terns.

Piping Plover

The construction of electrical distribution lines across the Platte River in Nebraska would incrementally increase the collision and predation (feeding) hazards for feeding and nesting piping plovers in the proposed Project area. Construction of these distribution lines during the breeding season could also potentially disturb nesting and brood-rearing birds. Keystone would not construct or operate these electrical distribution lines, but would inform electrical power providers of the requirement to consult with USFWS for the electrical infrastructure components constructed for the proposed Project to prevent impacts to nesting and feeding piping plovers.

The following recommended conservation measure to reduce current and future potential for injury or mortality to piping plovers would apply to power distribution lines that would serve proposed pump stations and that would cross rivers with good breeding habitat (within a quarter mile of each side of the proposed distribution lines) or that would cross between rivers and sand and gravel mining areas:

- Mark distribution lines supplying power to pump stations with bird deflectors where they cross rivers and within a quarter mile of each side, as well as between rivers and sand and gravel mining areas to reduce potential injury or mortality to piping plovers.

Additional conservation measures to avoid or minimize adverse impacts to piping plovers from new power lines will vary depending on the circumstances, but may also include the following measures:

- Re-route power lines to avoid construction within 0.5 mile of piping plover nesting areas in alkali wetlands in Montana.
- Mark new power lines with bird flight diverters (preferably Swan Spiral diverters- visible plastic spirals or Firefly diverters-bird flapper device,) within 0.25 mile of piping plover nesting sites on river systems and commercial sandpit areas.
- Survey potential riverine or sand pit piping plover nesting areas within 0.25 mile of new power lines and within 2 weeks of construction to determine presence of nesting piping plovers, if power line construction occurs during the piping plover breeding season,. If nesting piping plovers are present, cease construction until all chicks fledge from the site.

Sprague's Pipit

The construction of electrical distribution lines would incrementally increase the collision and predation hazards for breeding Sprague's pipits in the proposed Project area. The power distribution line to proposed Pump Station 10 would cross 18.6 miles of the North Valley Grasslands important bird area (IBA) and may impact survival and reproduction for ground

nesting grassland birds; the same line would cross 2.1 miles of the Charles M. Russell National Wildlife Refuge IBA, which supports 15 birds of global conservation concern (Montana Audubon 2008). Both of these IBAs support breeding Sprague's pipits. Construction of these distribution lines during the breeding season could potentially disturb nesting and brood-rearing birds. Power lines across native grassland habitats may contribute to fragmentation. Keystone would not construct or operate these electrical distribution lines, but would inform electrical power providers of the requirement to consult with USFWS for the electrical infrastructure components constructed for the proposed Project to prevent impacts to nesting and migrant Sprague's pipits.

Whooping Crane

Electrical distribution lines associated with the proposed Project are collision hazards to migrant whooping cranes. The construction of new electrical distribution lines, especially those across riverine or wetland roosting habitats (Yellowstone River in Montana, Missouri River in South Dakota, and Platte River in Nebraska) or between roosting habitat and nearby feeding habitat (including wetlands and grain fields), would incrementally increase the collision hazard for migrating whooping cranes because a portion of the proposed Project area is located within the primary migration corridor for this species. The Platte River electrical distribution line crossing is within the primary migration corridor for whooping cranes, and the Yellowstone and Missouri river electrical distribution line crossings are on the western edge. An analysis of suitable migration stop-over habitat (e.g., large waterbodies, wetlands, and associated agricultural fields) during migration, in relation to preliminary electrical distribution line routes, identified multiple locations within the primary migration corridor for 19 pump stations where electrical distribution lines could potentially increase collision hazards for migrating whooping cranes. Keystone would inform electrical power providers of the requirement to consult with the USFWS for the electrical infrastructure components constructed for the proposed Project to prevent impacts to the whooping crane. The following conservation measures would apply to power distribution lines that would serve proposed Project pump stations within the whooping crane migration route:

- Avoid overhead power line construction within 5.0 miles of designated critical habitat and documented high use areas (locations may be obtained from local USFWS Ecological Services field office).
- Bury all new power lines to the extent practicable, especially those within 1.0 mile of potentially suitable migration stopover habitat.

If it is not economically or technically feasible to bury the power distribution lines, conservation measures to minimize or avoid impacts to migrating whooping cranes would vary depending on the circumstances, but may include the following:

- Within the 95 percent migration corridor, mark new lines within 1.0 mile of potentially suitable habitat and an equal amount of existing line within 1.0 mile of potentially suitable habitat within the identified migration corridors (at a minimum within the 75 percent corridor, preferably within the 95 percent corridor).
- Within the 95 percent migration corridor, install bird flight diverters to minimize the risk of collision.

- Outside the 95 percent migration corridor, mark new lines within 1.0 mile of potentially suitable habitat at the discretion of the local USFWS Ecological Services field office, based on the biological needs of the whooping crane.
- Develop a compliance monitoring plan that requires written confirmation that the power lines have been marked, and that the markers are maintained in working condition.

American Burying Beetle

Some power distribution lines to pump stations coincide with areas of potentially suitable habitat or occupied habitat, including:

- Tripp County, South Dakota—Pump Station 21—good habitat.
- Holt County, Nebraska—Pump Station 22—low quality habitat.

Construction and maintenance of power lines to these pump stations could affect the American burying beetle. Keystone has informed power providers of the requirement to consult with USFWS concerning the construction and operation of the power distribution lines. No other actions connected to the proposed Project would coincide with the currently occupied range of the American burying beetle.

Western Prairie Fringed Orchid

Construction and operation of the new electrical power lines could impact the western prairie fringed orchid if power line ROWs were to disturb potential habitat for this plant. Power providers have committed to consult with the USFWS and to follow recommended avoidance and conservation measures of the USFWS. No other actions connected to the proposed Project coincide with the known distribution of the western prairie fringed orchid.

Peregrine Falcon

Surveys of power distribution line routes associated for the proposed Project did not identify any nesting peregrine falcon nests. Migrant and feeding peregrine falcons could use power poles as vantage perches and could collide with power lines.

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4.9 LAND USE, RECREATION, AND VISUAL RESOURCES

4.9.1 Introduction

This section describes potential impacts to land use, land ownership, recreation, and visual resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS and, in many instances, replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, impacts to land use, land ownership, and recreation and special interest area acreages have changed since the Final EIS due to the revised pipeline route. Specifically, the following item has been substantially updated from the 2011 document related to impacts to land use, recreation, and visual resources:

- A new section (Section 4.9.2, Impact Assessment Methodology) was added to explain the assessment methodology used to evaluate potential land use, recreation, and visual resources impacts associated with the proposed Project.

4.9.2 Impact Assessment Methodology

The impacts of the proposed Project, connected actions, and alternatives on land ownership, land use, recreation, and visual resources are evaluated using a combination of quantitative and qualitative methods, including the following:

- Calculation of changes in land ownership acreage, by type;
- Calculation of changes in allowable and feasible land use, by type and phase (e.g., agriculture may be allowed on top of the pipeline, but construction activities or access requirements may limit such activity);
- Evaluation of the relationship between proposed activities and relevant land use policies and initiatives;
- Calculation of acres of designated recreational areas that would be affected by proposed activities and alternatives;
- Evaluation of indirect impacts of the proposed Project on recreational activity (e.g., recreational facilities that are not within the proposed Project's right-of-way (ROW), but that are close enough to be affected by noise or other disturbances); and
- Qualitative evaluation of changes to the visual environment caused by construction and operation of the proposed Project, connected actions, and alternatives, especially those resulting from proposed/modified aboveground facilities.

4.9.3 Potential Impacts

4.9.3.1 Land Ownership

The proposed Project would require the acquisition of temporary and permanent easements from landowners and land managers along the pipeline ROW and at the locations of proposed ancillary facilities. Table 4.9-1 shows the land ownerships that would be affected by the proposed Project. Most affected lands are owned privately, with some federal, state, and local government ownership.

Table 4.9-1 Land Ownership Affected by the Proposed Project (acres)

	Easement Acquired (Ownership Type), Construction (Temporary)[a]				
State	**Federal**	**State[b]**	**Local[c]**	**Private**	**Total[d]**
Montana	779.8	488.6	89.6	4,108.0	5,466.1
South Dakota	0.0	398.1	47.3	5,315.2	5,760.5
North Dakota[e]	0.0	2.0	0.0	54.1	56.1
Nebraska[f]	0.0	56.2	0.7	3,877.9	3,934.8
Kansas	0.0	0.0	0.0	15.2	15.2
Total	**779.8**	**944.9**	**137.5**	**13,355.9**	**15,232.6**
Percent of Total	**5.1%**	**6.2%**	**0.9%**	**87.7%**	**100%**
	Easement Acquired (Ownership Type), Operations (Permanent)				
State	**Federal**	**State[b]**	**Local[c]**	**Private**	**Total**
Montana	287.6	200.2	4.7	1,348.5	1,841.0
South Dakota	0.0	164.6	30.8	1,801.4	1,996.8
North Dakota	0.0	0.0	0.0	0.0	0.0
Nebraska	0.0	24.9	0.3	1,638.4	1,663.7
Kansas	0.0	0.0	0.0	15.2	15.2
Total	**287.6**	**389.7**	**35.8**	**4,803.5**	**5,516.6**
Percent of Total	**5.2%**	**7.1%**	**0.6%**	**87.1%**	**100%**

Source: exp Energy Services, Inc. 2012b, exp Energy Services, Inc. 2012c.

[a] All acreages assume a 110-foot-wide construction ROW and do not include access roads; rail sidings, the worker camp, or permanent easements on federal- or state-owned road ROWs.
[b] Includes state highway ROWs.
[c] May not include all county road ROWs.
[d] Totals may not match due to rounding. Totals for water bodies are incorporated into other land use categories, and could not be segregated.
[e] Includes pipe stockpile sites and contractor yards, but no pipeline ROWs.
[f] Excludes ancillary facilities in Nebraska, where locations have not been identified.

4.9.3.2 Land Use

Table 4.9-2 summarizes the acreages affected by construction and operation of the proposed Project and by land use type. Most of the affected land is used for agriculture and rangeland. The remainder of this section describes land use impacts during construction and operations phases, and then discusses specific impacts (during both phases) for selected land use types.

	Land Use Type Affected—Construction						
State	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water**	**Wetlands**	**Total[a]**
Montana	1,326.2	396.1	22.3	3,689.5	28.6	4.4	**5,467.1**
South Dakota	1,661.3	171.2	9.9	3,884.6	21.6	8.8	**5,757.4**
North Dakota [a]	0.0	56.1	0.0	0.0	0.0	0.0	**56.1**
Nebraska	2,854.6	62.5	57.3	931.5	14.8	14.1	**3,934.8**
Kansas	0.0	0.0	0.0	15.2	0.0	0.0	**15.2**
Total	**5,842.1**	**685.9**	**89.5**	**8,520.8**	**65.0**	**27.3**	**15.230.6**
Percent of Total	**38.4%**	**4.5%**	**0.6%**	**55.9**	**0.4%**	**0.2%**	**100%**
	Land Use Type Affected—Operation						
State	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water**	**Wetlands**	**Total**
Montana	443.0	51.0	5.6	1,321.7	13.6	3.0	**1,837.9**
North Dakota	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
South Dakota	508.5	25.0	6.2	1,440.5	10.6	6.0	**1,996.8**
Nebraska	1,198.3	28.2	25.3	395.2	8.6	11.1	**1,666.7**
Kansas	0.0	0.0	0.0	15.2	0.0	0.0	**15.2**
Total	**2,149.8**	**104.2**	**37.1**	**3,172.6**	**32.8**	**20.1**	**5,516.6**
Percent of Total	**39.1%**	**1.9%**	**0.7%**	**57.5**	**0.6%**	**0.4%**	**100%**

Sources: exp Energy Services, Inc. 2012b, exp Energy Services, Inc. 2012c.

[a] Totals may not match due to rounding.

Construction

Construction of the proposed pipeline would involve several key land use issues and impacts, including:

- Lease or acquisition and development of the pipeline ROW and land for appurtenant facilities;
- Possible damage to agricultural features such as irrigation systems or drain tiles;
- Temporary loss of the agricultural productivity of the land;
- Potential visual impacts attributable to removal of existing vegetation and visibility of exposed soil; and
- Increased dust and noise to neighboring residential and commercial areas.

The duration of the construction phase would affect the degree of land use impact.

In the currently proposed schedule, the proposed Project would be constructed in 10 separate spreads. As stated in the Final EIS, it is anticipated that each spread would require from 6 to 8 months for construction and that all pump stations would be completed in 18 to 24 months.

A 110-foot-wide construction ROW would be required for installation of the 36-inch-diameter pipeline (see Section 2.1.2, Land Requirements), including a 60-foot-wide temporary easement—secured through a temporary use permit—and a 50-foot-wide permanent easement.

The construction ROW width could be reduced to 85 feet to avoid or reduce impacts in some areas, including wetlands, cultural sites, and residential and commercial/industrial areas. Construction of the proposed Project would affect approximately 15,217 acres.

Changes in land use due to construction would for the most part be temporary, and would include loss of agricultural productivity, potential damage to drain tiles or other irrigation systems, visual impacts from the removal of vegetation within the ROW, and increased noise and dust. Existing commercial or industrial sites with public or private road access would be used when practical, and temporary workspaces would be restored to preconstruction levels.

Temporary and permanent changes in vegetation due to the clearing of trees and shrubs, pipeline excavation, and general construction activity are expected within the ROW. It is estimated that disturbed pastures, croplands, and grassy rangelands may take 1 to 5 years to recover to preconstruction levels. Herbaceous vegetation, prairie grasses, low shrubs, and forest lands are estimated to take from 1 to 20 or more years to recover, depending upon the species. The permanent pipeline ROW would require occasional trimming to remove woody vegetation and trees from the permanent easement/ROW to facilitate aerial inspection. Landowners would be permitted to cultivate crops in the permanent easement. Easement agreements would typically include monetary compensation to landowners for long-term land use losses (e.g., property use during construction, operation, and maintenance), and for temporary land use losses (e.g., crop production impairment and private road damage or obstruction). Easements would also address restoration of land or compensation to landowners for any unavoidable construction-related damage to property.

Temporary Workspace Areas

Temporary workspace areas (TWAs) would necessitate negotiation of temporary ROW easements. Operation and maintenance of the pipeline and ancillary facilities would require permanent ROW easements for the proposed Project lifetime. For some areas such as water crossings, road/railroad crossings, and steep or rocky slopes, additional TWAs may be needed. In some cases, land would likely be purchased rather than controlled through easements. TWAs outside of the pipeline construction ROW would affect approximately 1,205 acres during construction (exp Energy Services, Inc. 2012b).

Access Roads

The construction ROW would be accessed by public and existing private roads. State transportation agencies would be consulted prior to construction to assess road infrastructure (e.g., bridges) to determine if it is suitable for potential construction loads. If infrastructure is insufficient to transport projected loads, a plan would be developed to avoid or reinforce the infrastructure. No improvement or maintenance is likely to be required for paved roads before or during construction, although gravel and dirt roads may require maintenance during that time. Private roads and temporary access roads would only be used with the permission of the affected landowner or land management agency. In the event that oversized or overweight loads would be needed to transport construction materials to the proposed Project work spreads, separate permit applications would be submitted to the appropriate state regulatory agencies.

Operations

Operation of the proposed Project would affect approximately 5,501 acres. As described in Section 2.1.1, Pipeline Route, this land consists of permanent easements for the pipeline ROW itself, pump stations, and other aboveground facilities, and permanent access roads.

Specific Land Uses Impacted

This section provides additional details on the proposed Project's impacts on selected land uses.

Agricultural Land, Rangeland and Prime Farmland

Agricultural land and rangeland together would comprise approximately 90 percent of the land affected by construction and operation of the proposed Project (Table 4.9-2). Prior to construction, agricultural land (where crops are present) would be disked or mowed to ground level to provide clear, safe, and efficient access for construction. Timber shelterbelts within the proposed construction ROW would be removed to the minimum extent practicable for pipeline construction. Additional construction impacts could include:

- Soil profile disturbance
- Irrigation system damage
- Drainage system damage

Impacts to soil profiles could include topsoil degradation, soil compaction, and rock introduction or redistribution. According to the proposed Project Construction, Mitigation, and Reclamation Plan (CMRP) (Appendix G), pipeline construction would not stop or obstruct active irrigation ditches except during the short (typically 1 day or less) time period needed to install the pipeline beneath the ditch. Additionally, drain tiles and fences would be repaired or restored using either original material or high quality new material, and farm terraces would be restored to their preconstruction functions. Construction could also cause temporary loss of crops and/or forage on affected lands.

Impacts to crops from operation of the proposed Project would be less than for construction because the ROW width would be reduced from 110 feet to 50 feet for the permanent ROW. Since the proposed pipeline would be buried to a nominal depth of 42 to 48 inches and maintained at a depth of 42 to 48 inches in cultivated agricultural areas pursuant to Special Condition 19 (the Special Conditions are presented in Appendix B, PHMSA Special Conditions), agricultural land use would be able to continue for the most part across the permanent ROW.

Prime Farmland

The U.S. Department of Agriculture defines prime farmland as, "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses" (Natural Resources Conservation Service [NRCS] 2012). Prime farmland includes cultivated land, pastures, or forests that are not located on developed land or in water and wetlands. Not all prime farmland soils are used for agricultural purposes. Table 4.9-3 summarizes the amount of prime farmland that would be affected by construction and operation of the proposed Project.

Table 4.9-3 Prime Farmland Affected by the Proposed Project (Acres)

State[a]	Construction	Operation
Montana	1,359.9	419.3
South Dakota	2,182.1	700.6
Nebraska	2,531.9	1,067.3
Total	**6,073.9**	**2,187.2**

Source: exp Energy Services, Inc. 2012a, exp Energy Services, Inc. 2012b

[a] Ancillary facilities in Kansas would occupy rangeland. The ancillary facility in North Dakota would occupy previously developed land. These facilities are therefore not expected to impact Prime Farmland.

As described above, much of the area that would be impacted during operations could be used for agriculture following the completion of pipeline construction, and thus would not necessarily experience a long-term change in land use. Section 4.2, Soils Impacts, discusses the degree to which these affected areas would still retain prime farmland characteristics following pipeline construction.

Conservation Programs

Pipeline construction and operation would have no effect on landowner participation in the Conservation Reserve Program (CRP). Low level grasses and plants would be allowed to regrow on the ROW; however, moderate to large vegetation would continue to be cleared from the permanent ROW and would not be allowed to re-establish. Affected landowners would be required to contact their local Farm Service Agency (FSA) offices as part of their contractual agreement for participation in the program. FSA would require that landowners, prior to pipeline construction, notify the FSA of the planned construction activities. Assuming the disturbance would have a minimal effect on the CRP and land would be restored to its pre-construction condition (i.e., vegetated), and that construction would not occur during primary nesting season, landowners would not lose their eligibility for participation in the CRP. The proposed action may affect a number of existing NRCS financial assistance conservation program agreements. Depending on the type of conservation practice for which cost-share is received by the program participant, the location of the practice relative to the pipeline ROW, and the timing of construction, the conservation agreement may need to be modified and the landowner may need to refund some or all of the financial assistance received. NRCS program participants are responsible for filing a written request with NRCS and receiving the State Conservationist's approval before allowing disturbance of a conservation practice implemented or maintained with NRCS financial assistance. When approval is received, the land must be returned to its pre-construction condition, including restoration of any affected conservation practices.

Developed Land

Within existing developed areas, some current land uses would be converted to long-term utility use for the life of the proposed Project (typically 50 years). The long-term conversion would put constraints on development of private land. To facilitate maintenance or emergency access, improvements including landscaping, catch basins, leaching fields, garages, guy wires, houses, utility poles, septic tanks, sheds, swimming pools, or any other structures that are not easily removed would be prohibited from the permanent ROW.

The number and types of structures within 25 and 500 feet of the proposed Project's construction ROW are described in the Land Use Affected Environment discussion (Section 3.9). Homes and residences within 25 feet of the proposed ROW would likely experience many temporary inconveniences during the construction period (typically 7 to 30 days) including disruptions to privacy and property ingress or egress. Homes within 500 feet of the ROW could experience temporary inconveniences such as construction dust and noise during the construction period. However, local noise restrictions would apply and the CMRP (Appendix G) includes best management practices (BMPs) to address dust suppression.

Forest

During construction, trees would be removed from the ROW. Landowners would be consulted to determine if timber within the ROW has a commercial or salvage value, and landowners could at their discretion contract with TransCanada Keystone Pipeline, LP (Keystone) to clear and harvest trees prior to removal. Tree removal and disposal would be accomplished consistent with all local, state, and federal permit requirements. Trees would be allowed to regrow only in the temporary ROW after construction, consistent with U.S. Department of Transportation pipeline safety standards and Keystone requirements for aerial pipeline safety inspections. Trees would not be allowed to regrow within the 50-foot permanent ROW.

Mitigation

To mitigate potential impacts, Keystone has committed to implement the procedures included in the CMRP (Appendix G) to reduce potential construction and operation impacts on land use. Procedures relevant to overall land use impacts include:

- General BMP measures, including worksite appearance, maintenance, and noise and dust control;
- Specific procedures that would be followed during construction within agricultural, forest, pasture, rangeland, grasslands, wetland crossings, waterbodies, and riparian lands; and
- Measures to avoid or minimize potential damage to drain tile systems.

As detailed in the CMRP, specific landowner requirements could occasionally supersede the procedures in the CMRP. However, the conditions of applicable federal, state, and local permits would apply in all cases. The remainder of this section describes mitigation measures that are applicable to specific land uses.

Agricultural Land, Rangeland, and Prime Farmland

Keystone would take reasonable steps to identify organic farms along the proposed Project route. Where Keystone is made aware of the presence of certified organic farms along the proposed Project route prior to construction, Keystone would work with those organic farm operations to ensure that pipeline construction does not impair the farm's organic status. If the proposed Project would cross an organic farm, Keystone would work with the landowner to take reasonable steps to avoid mixing organic soil and non-organic soil.

Construction could cause the temporary loss of crop production or forage on affected lands. According to the CMRP, landowners would be compensated for any construction-related crop or

forage loss. To minimize potential impacts to agricultural lands (including prime farmland), the CMRP commits Keystone to measures that would protect the soil profile, including:

- Segregating the upper 12 inches of topsoil during construction and replacing it during site restoration (Section 4.2, Soils Impacts, describes the topsoil segregation methods that would be used);
- Using soil ripping or chiseling to alleviate soil compaction and to return the soil to pre-construction conditions;
- Plowing wood chips, manure, or other organic matter into the soil to further enhance soil aeration, if required; and
- Removing excess rock that is greater than 3 inches in diameter from the top 12 inches of soil in all active agricultural fields, pastures, and hayfields.

If pipeline construction crosses active irrigation ditches, the ditches would not be stopped or obstructed except during the typical one day or less time period needed to install the pipeline beneath the ditch. Drain tiles and fences would be repaired or restored using either original material or high quality new material, and farm terraces would be restored to their preconstruction functions.

To minimize potential impacts to rangelands, the CMRP includes measures that would reduce impacts, including:

- Restoring disturbed areas with custom seed mixes (approved by landowners and/or land managers) to match the native foliage;
- Providing access to rangeland during construction when practicable;
- Installing temporary fences with gates around construction areas to prevent injury to livestock or workers;
- Leaving hard plugs (short lengths of unexcavated trench) or installing soft plugs (areas where the trench is excavated and replaced with minimally compacted material) to allow livestock and wildlife to cross the trench safely;
- Removing litter, garbage, and any pipeline shavings at the end of each construction day, to protect livestock and wildlife from accidental ingestion;
- Prohibiting construction personnel from feeding or harassing livestock or wildlife;
- Prohibiting construction personnel from carrying firearms or pets into the construction area;
- Securing rangeland fences to prevent drooping;
- Closing any openings in the fence at the end of each day to prevent livestock from escaping;
- Maintaining all existing improvements such as fences, gates, irrigation ditches, cattle guards, and reservoirs to the degree practicable; and
- Returning any damaged improvements to at least their condition prior to construction.

Forest Land

Potential adverse impacts to forest land would be reduced through protection, restoration, and remediation measures in the CMRP. Examples of protective or restorative measures on forest lands would include:

- Routing the proposed pipeline along existing ROWs in forest lands, when practicable;
- Felling trees toward the pipeline centerline to minimize additional tree disturbance;
- Recovering all trees and slash that fall outside of the ROW;
- Depositing all tree materials according to specific protection measures and in accordance with landowner, land manager and/or permit requirements;
- Removing stumps using equipment that helps to preserve organic matter; and
- Reversing effects on windbreaks, shelterbelts, and living snow fences to the degree practicable.

Developed Land

To minimize potential impacts to developed lands, the CMRP includes the following measures:

- Prior to construction, surveys would be conducted to confirm the locations of buildings near or within the proposed ROW and to ascertain whether the buildings are occupied residences or businesses;
- Site-specific protective constructions plans would be developed for residential and commercial/industrial structures within 25 feet of the construction ROW;
- Noise levels would be controlled around residential and commercial/industrial areas during non-daylight hours, consistent with applicable noise regulations;
- If noise levels are expected to exceed regulatory limits, advance notice would be provided to all residences within 500 feet of the construction ROW;
- High noise level activities would be limited in duration and coordinated to expedite the construction work through the area, reducing the length of time that receptors are exposed to noise;
- Siting of permanent components of the proposed Project that could generate noise (e.g., pump stations) would be based upon negotiations with landowners;
- Construction shielding would be provided for certain land improvements (e.g., fences and sheds) and to preserve landscaping and mature trees;
- Workspaces would be fenced off from residential areas;
- Traffic and vehicle access control would be provided in construction areas;
- Trash and debris would be removed and disposed from the construction site each day;
- Plating would be used to cover open trenches during non-construction times in developed areas;

- "In livestock grazing areas, unexcavated—or excavated and backfilled—sections of the trench [would] be maintained to allow the passage of livestock. Gaps would be left in the spoil piles and breaks would be left in the strung pipe at these locations to facilitate passage of livestock across the ROW" (exp Energy Services, Inc. 2012d);
- For areas in which the pipeline is within 25 feet of a residential structure, excavation of the pipeline trench would be delayed until the pipe was ready to be installed, then the trench would be quickly backfilled after installation;
- Following installation of the pipeline and backfilling, all fences, landscaping improvements, shrubs, lawn areas, and other structures would be restored to pre-construction conditions (or as otherwise negotiated with the landowner); and
- Knowledgeable individuals, such as local landscape restoration contractors, and consultants with "specialty expertise in restoration and revegetation" (exp Energy Services, Inc. 2012d) would be retained to assist in landscape restoration.

Public Services

To minimize potential impacts to public services Keystone would implement the following mitigation measures.

- Prior to construction, Keystone's contractors would develop detailed traffic plans that address all applicable laws, regulations, and ordinances. Keystone would take into account minimizing impacts to school bus routes in developing these traffic plans;
- Keystone would ensure that underground and overhead utilities are located and that Keystone avoids contact and damage during construction;
- Keystone would ensure that contactors have Site Specific Safety Plans in place before commencing work that will address locating, avoiding, and protecting utilities; and
- Keystone would dispose of construction camp trash (solid waste) by hauling to a licensed disposal facility.

Compensation

Agricultural Land, Rangeland, and Prime Farmland

Disturbed agricultural land and rangeland would be returned to approximate pre-construction use and capability. For agricultural land and rangeland requiring reseeding, an inspection after the first growing season would determine if additional revegetation would be required. If the landowner performs the required reseeding, monetary compensation would be provided. Revegetation would be considered successful when crop yields or vegetation are similar to those in adjacent undisturbed portions of the same field.

Landowners would be compensated for crop yields less than those on unaffected lands, where it can be demonstrated that the lesser yields are a result of the proposed Project. For the purpose of determining compensation for lesser yields, crop values would be assessed based upon the values of the affected crops in the specific area, as well as local crop prices at grain elevators. Landowners would be compensated for proposed Project-related crop yield effects over three years as follows: During the year of construction, 100 percent of calculated losses would be

compensated. In the second year, 75 percent of calculated losses would be compensated. In the third year, 50 percent of calculated losses would be compensated. If landowners demonstrate that proposed Project-related crop yield losses persist beyond three years, additional compensation would be negotiated.

Should CRP participants be required by the U.S. Department of Agriculture to leave the CRP because of the proposed Project, they would be compensated by Keystone. Compensation would be for any lost CRP payments, including retroactive forfeit payments.

Developed Land

Commercial and industrial landowners would be compensated for any construction-related impacts based upon land values determined by local professional appraisers. Any damaged infrastructure would be repaired or replaced or the owner would be compensated for the damage.

4.9.3.3 Recreation and Special Interest Areas

Construction activities would temporarily affect recreational traffic and use patterns in special management and recreational areas. Sightseers, hikers, wildlife viewers, fishers and hunters, and other recreationists would be temporarily dislocated. In some cases, construction of the proposed pipeline could cause disrupted or delayed recreational use of private lands. Construction scheduling would be coordinated with local, state, and federal agencies to reduce the conflicts with recreational users. Impacts are expected to be short term. Noise impacts from operating pump stations are expected to be minor and would be within appropriate regulatory levels. Recreational use access would not be affected by proposed Project operations within special management areas.

The proposed Project route would not cross rivers within any reaches that have been designated by federal, state, or local authorities as wild and/or scenic. It would cross the Niobrara River approximately 12 miles downstream from the end of the National Scenic River designation. Waterbodies with recreationally and/or commercially valuable fish species would be crossed using site specific waterbody crossing plans designed to reduce impacts to these important resources.

As described in the CMRP (Appendix G), compensation for damages associated with disruptions to recreational use, activity, and revenue would be negotiated with affected landowners.

4.9.3.4 Visual Resources

Construction and operation of the proposed Project would have some visual impacts, although most would be temporary. Temporary impacts associated with construction would include impacts within the construction ROW (e.g., clearing and removal of existing vegetation, exposure of bare soils, earthwork and grading scars, trenching, and rock formation alteration) and the presence of ancillary facilities such as machinery and pipe storage yards, new aboveground structures such as pump stations, pipeline markers, and construction worker camps. Given their size (50-100 acres) and population (approximately 600 workers), the camps may be the most visible evidence of the proposed Project, particularly for camps sited amid agricultural or rangeland areas.

Some of these visual effects, particularly those associated with ROW disturbance in agricultural areas, would endure beyond the construction period. Most of these longer-term effects would likely be substantially reduced with the first crop growth. Over the long term, perceptible changes resulting from construction and operation would largely be visible to travelers along the major transportation corridors in the vicinity of the proposed Project. Their views would typically be limited to short periods of time and small portions of the ROW.

Although recreational travelers are generally more sensitive to changes in scenic quality, there are no major recreation areas in the vicinity of the proposed route, and few recreationists would be affected. During the final stages of construction, backfilling and grading would restore the construction ROW to its approximate previous contours and restoration and revegetation would ultimately return the ROW to its approximate previous condition except in currently forested areas along the permanent ROW. In addition, vegetative buffers would be planted around pump stations to reduce the visual impacts of the facilities. No pump stations would be situated on federal lands or in visually sensitive lands.

Most of the landscape changes caused by the proposed Project would be visible as linear changes to vegetation patterns. The proposed Project route has been selected to reduce adverse aesthetic impacts where possible, and measures to reduce long-term visual impacts to insignificant levels would be implemented as described in the CMRP (Appendix G). Aboveground facilities would be painted in accordance with standard industry painting practices to further reduce visual impacts. Landowners would be consulted to address visual aesthetic issues that arise as a result of construction activities. Where restoration and revegetation result in returning the ROW to visual conditions similar to existing conditions, there would be either no impact or only minor impacts to visual resources during operation. For those segments of the proposed Project route on Bureau of Land Management (BLM)-managed lands in Montana, consistency with the CMRP would require that the Project remains consistent with the respective Visual Resource Management Class Objectives and applicable Resource Management Plans for BLM and other federal lands.

Mitigation measures in the CMRP (Appendix G) associated with visual resources are included along with those applicable to land use (see also Section 4.9.3.2, Land Use).

4.9.4 Recommended Additional Mitigation

Keystone has committed to the mitigation measures discussed in Section 4.9.3, Potential Impacts, and contained in the CMRP (Appendix G). No additional mitigation measures are recommended.

4.9.5 Connected Actions

4.9.5.1 Bakken Marketlink Project

The Bakken Marketlink pipeline would affect approximately 68 acres of private land, including the land use types shown in Table 4.9-4. This analysis assumed the same 110 foot buffer as for the proposed Project. No public land would be affected (exp Energy Services, Inc. 2012d). The permit applications for this project would be reviewed and acted on by other agencies. Those agencies would conduct more detailed environmental reviews of the Bakken Marketlink project. Potential impacts to land use, recreation, or visual resources of the Bakken Marketlink project

would be evaluated and avoided, minimized, or mitigated in accordance with applicable regulations during the environmental reviews for these projects. The potential impacts associated with the Bakken Marketlink project are likely to be similar to those described above for the proposed Project pump station and pipeline ROW in that area.

Table 4.9-4 Land Use Affected by the Bakken Marketlink Project[a,b]

Land Use (acres)					
Agriculture	**Developed**	**Forest**	**Rangeland**	**Water/Wetland**	**Total[c]**
13.2	0.5	0	54.0	0	67.8

Source: exp Energy Services, Inc. 2012e, U.S. Geological Survey (USGS) 2006

[a] Includes state highway ROWs.
[b] May not include all county road ROWs.
[c] Totals may not match due to rounding.

4.9.5.2 Big Bend to Witten 230-Kilovolt (kV) Transmission Line

Land Ownership

Except for a very small area of permanent disturbance associated with each transmission tower (approximately 8.7 square feet), ownership of land within the transmission line ROW would not be affected by this connected action. However, a permanent 125-foot-wide easement, similar to a pipeline, would need to be established for the entire length of the alignment, and would cover approximately 1,150 acres.

Land Use

Table 4.9-5 shows the acreages of each land type within the ROW that would be affected by the transmission line.

Table 4.9-5 Land Use Affected by Construction of the Big Bend to Witten 230-kV Transmission Line, Applicant Preferred Route

	Land Use (acres)					
	Agriculture	**Developed**	**Forest**	**Rangeland**	**Water/Wetland**	**Total[a]**
Length	368.9	111.5	2.2	662.3	5.2	1,150.1
Percent of Total	32.1%	9.7%	0.2%	57.6%	0.5%	100%

Source: BEPC Routing Report (Appendix J), USGS 2006.

[a] Totals may not match due to rounding.

Construction Impacts

Construction related land disturbances would be confined to a relatively small area needed for site access and equipment operations. The 75-mile transmission line would have a 125-foot-wide ROW; therefore, approximately 1,150 acres of land would be impacted by construction (Appendix J, Basin Electric Power Cooperative [BEPC] Routing Report). Of that total, approximately 145 acres would be disturbed by construction activity. Pulling and tensioning of the conductor wires would be required every 10,000 feet, resulting in approximately 35 to 40

pulling and tensioning sites, depending upon the alternative corridor and route option chosen. Each tensioning site could be located within the ROW, although angles in the route would require temporary use of an additional 1.8 acres outside of the ROW. Most construction impacts on land use would be temporary and may include short term disruptions to local traffic, land access, and agricultural practices. A small amount of land clearing would likely be required at support structure locations and other construction staging areas.

Operation Impacts

Operation of the transmission lines would permanently affect a relatively small amount of land. An average of 6.6 support structures per mile would be required. The average height of the structures would be 110 feet, and each would span an average of 800 feet. Permanent land disturbance would be approximately 8.7 square feet (0.0002 acre) per structure (BEPC 2009).

Impacts to land use are primarily based on surface disturbance areas. Operation of the 230-kV transmission line could lead to some impacts to vegetation within and outside of the ROW due to the need for tree trimming to reduce hazards to power line operations. However, the route would cross primarily agricultural land and rangeland; therefore, tree and brush removal would only be undertaken to avoid interference with the safe operation of the transmission line. Such cases would be infrequent and sporadic along the ROW. Forested land use areas associated with drainages were avoided during the preliminary routing process. Agricultural and rangeland activities would continue in the transmission line easement where permanent structures were not present. All operations-related impacts on land use would likely last through the useful lifetime of the 230-kV transmission line. Impacts associated with permanent access roads for use during transmission line operations are not estimated since the number and location of these roads are not currently known.

Mitigation

Mitigation for potential impacts from 230-kV transmission line construction, operation, and maintenance would include BMPs appropriate for transmission line activities, disturbed soil preservation and restoration, ROW revegetation, and repair of any roads, trails, fences, or other improvements affected by transmission line construction, operations, and maintenance.

Recreation and Special Interest Areas

Recreationists within the Lower Brule Reservation may be affected temporarily during construction activities. Impacts to recreation areas would result from both construction activities and the presence of workers, equipment, and vehicles along the construction route. However, disturbed land would be restored to pre-construction conditions. Western and BEPC would communicate with appropriate personnel from the Lower Brule Indian Reservation and relevant state and federal resource agencies to schedule construction work to reduce, to the extent practicable, disturbance to recreational uses.

Visual Resources

The analysis of environmental effects associated with the proposed 230-kV transmission line would be handled under a separate environmental review, likely conducted by the U.S. Department of Agriculture's Rural Utility Service and/or Western. Based on currently available information, it is likely that changes to visual resources would be both temporary (e.g., digging

the foundations for power poles) and permanent (e.g., erection of power poles and lines). Impacts to visual resources during construction would result from both construction activities and the presence of workers, equipment, and vehicles along the construction route. Visual impacts would also result from the clearing and removal of existing vegetation, exposure of bare soils, and the presence of machinery and new aboveground structures.

The majority of viewers of the 230-kV transmission line project during construction and operation would be travelers along the transportation corridors in the vicinity of the transmission line. Their views would typically be limited to short periods of time and small portions of the route. In addition, residents and recreationists using recreation areas within the Lower Brule Reservation could be affected by the addition of power poles and lines. Some individuals viewing the route from residences within 0.75 mile of the route might be able to observe portions of the construction activities throughout the construction period.

Potential mitigation measures to address any environmental impacts identified for the proposed 230-kV transmission line project would be identified in a separate environmental review, likely conducted by either or both Rural Utility Service and Western.

4.9.5.3 Electrical Distribution Lines and Substations

This section assesses impacts to land ownership, land use, recreation, and visual resources from the proposed power distribution lines. The pipe storage yard and rail siding in North Dakota would not require construction of electrical distribution lines or substations. At this time, the locations of transmission lines in Nebraska and Kansas have not been determined. Therefore, impacts related to distribution lines to Nebraska and Kansas pump stations are not discussed herein.

Land Ownership

Impacts on land ownership along electrical distribution lines are similar to, but likely less intense than those for the Big Bend to Witten 230-kV transmission line (Section 4.9.5.2). Permanent easements would be required to operate these facilities. The amount of land affected by these easements is summarized in Table 4.9-6.

Table 4.9-6 Land Ownership Affected by the Electrical Distribution Lines (Acres)

	Permanent Easement Acquired (Ownership Type)			
State[a]	**Federal**	**State/Local[b]**	**Private**	**Total[c]**
Montana	662.4	306.2	3,750.8	**4,719.4**
South Dakota	0.2	375.8	4,834.9	**5,210.9**

Source: exp Energy Services, Inc. 2012b; exp Energy Services, Inc. 2012c.; USGS 2006, USGS 2011.

[a] The locations of electrical distribution lines in Nebraska and Kansas have not been determined.
[b] Includes state highway ROWs, but may not include all county road ROWs.
[c] Totals may not match due to rounding.

Land Use

Areas of land disturbance associated with this set of connected actions are estimated based upon the number and type of proposed distribution line support structures. Table 4.9-7 shows the assumptions used to estimate temporary impacts. Table 4.9-8 shows the land use affected by construction and operation of the distribution lines, by land use category.

Table 4.9-7 Assumptions for Power Distribution Line Land Use Impact Estimates

Transmission Structure	Maximum Structure Height (feet)	Spacing Between Structures (feet)	Average Structure Span (feet)	Typical Disturbance (square feet)	
				Construction[a]	Operation
69-kV	40-60	350	300-400	11,300	12
115-kV	50-70	550	500-600	15,400	12
138-kV	60-80	650	600-700	20,100	12
H-frame	70-90	800	700-900	25,400	24

[a] Construction disturbance area estimated based on disturbance radii of 60, 70, 80, and 90 feet, respectively for 69 kV, 115 kV, 138 kV, and H-frame structures.

Table 4.9-8 Land Use Affected by Construction and Operation of Power Distribution Lines (Acres)

State[a]	Agriculture	Developed	Rangeland	Forest	Water/Wetland	Total[b]
Construction						
Montana	81.7	8.8	343.0	1.1	8.5	443.1
South Dakota	137.4	53.9	314.8	1.0	13.7	520.8
Operations						
Montana	6.5	60.5	253.4	4.1	6.6	331.1
South Dakota	40.0	101.8	233.2	3.6	10.7	389.3

Source: exp Energy Services, Inc. 2012b; exp Energy Services, Inc. 2012c; USGS 2006

[a] The locations of electrical distribution lines in Nebraska and Kansas have not been determined.
[b] Totals may not match due to rounding.

Construction Impacts

The ROW would be cleared to prepare for construction. Limited clearing would be required along existing roads in native and improved rangelands and agricultural lands. Some trees could require removal to provide adequate clearance between conductors and underlying vegetation. Where possible, trees would be trimmed to avoid removal.

Power distribution line construction would also require the development of temporary access roads, which would occupy a 20-foot-wide area within the ROW for all of the power poles. Pulling and tensioning areas would require one acre per change in direction. Turnaround areas would require a 30-foot radius at each structure. Construction staging areas would require one acre every 25 miles. Most of the affected land is either agricultural or rangeland (Table 4.9-8).

Aerial interpretation and field surveys were used to identify the number of buildings within 50 feet of the proposed power distribution lines. An estimated 14 structures in Montana and 48 structures in South Dakota are located within 50 feet of the proposed power distribution line ROWs.

Most construction impacts on land use would be temporary and may include short term disruptions to local traffic, land access, and agricultural practices. A small amount of land clearing would likely be required at support structure locations and other construction staging areas described previously. Short term noise and dust impacts may occur at one or more of the structures identified within 50 feet of the construction ROWs.

Operation Impacts

In forest lands, during power distribution line operations, each power provider would maintain a ROW free of woody vegetation. All operations-related impacts on land use would likely last through the useful lifetime of the power distribution lines. Impacts associated with permanent access roads for use during power distribution line operations are not estimated since the number and locations of these roads are not currently known.

Due to the need for a cleared power distribution line ROW, operational impacts in forested lands are greater than for other land uses (i.e., the disturbance areas in Table 4.9-7). ROW widths in forest lands for various types of power distribution line structures are provided in Table 4.9-9. As with construction, agriculture and rangeland make up most of the land use affected by operation. Actual impacted acreage may vary from the estimates based upon power distribution line designs to be developed by each power provider.

Table 4.9-9 Typical Disturbance Areas for Power Line Operation in Forested Areas

Structure	ROW (feet)	Average Disturbance (square feet)
69-kV	60-80	80
115-kV	60-80	80
138-kV	60-80	80
H-frame	100-150	150

Operation of the power distribution lines could lead to some impacts to vegetation external to the construction ROW due to the need for tree trimming to reduce hazards to power line operations. Impacts to land use are primarily based on surface disturbance areas. Agricultural and rangeland activities would continue in the transmission line easement where permanent structures were not present. Impacts associated with service drops (electrical lines running from a utility pole to a pump station) from adjacent distribution lines are expected to be minimal and comparable to those associated with supplying electricity to the average home or farm.

Mitigation

Once the power distribution poles are in place and the conductor wires are strung between poles, the construction ROW would be restored pursuant to each power provider's requirements as specified in easement agreements with landowners. This may include soil reshaping and contouring and reseeding, as specified by landowners. All remaining materials and litter would be removed from the construction area and properly disposed of.

Preliminary power line locations have been identified in consultation with each utility company. Where feasible, the entire length of each of these preliminary power line routes would be placed along existing county roads, section lines, or field edges to minimize interference with adjacent land uses. Upon completion, power providers would restore the work area around each new service drop as specified by applicable permit conditions.

Recreation and Special Interest Areas

Power distribution lines would cross a number of recreational and special interest areas (see Table 3.9-12). To the extent that the power distribution lines would change the character, general use, and/or recreation opportunities provided on special interest lands, this connected action would cause adverse impacts. Final design of the power distribution lines would likely include locational criteria to reduce potential impacts on recreation and special interest areas.

Visual Resources

It is possible that the proposed power distribution lines on BLM and U.S. Bureau of Reclamation land in Montana may not be consistent with Visual Resource Management Class Objectives, or that proposed power distribution lines on U.S. Forest Service land in South Dakota may not be consistent with Scenery Management System Scenic Integrity Objectives. In such cases, proposed power distribution lines could generate adverse impacts to visual resources due to their high visibility—although other power distribution lines are assumed to be present in the general area of the distribution lines. The assessment of visual impacts of the proposed power distribution lines would be included in the analysis conducted by BLM and U.S. Forest Service as part of the review of the electrical power providers BLM ROW grant applications.

Because potential impacts from the proposed power distribution lines have not been identified for visual resources, no mitigation measures are recommended at this time. Determination of any necessary mitigation measures for power distribution lines would be part of the environmental reviews required by applicable federal, state, and local regulations.

4.9.6 References

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BEPC. See Basin Electric Power Cooperative.

exp Energy Services, Inc. 2012a. TransCanada Keystone XL Pipeline Project, Supplemental Environmental Report for the Nebraska Reroute. September 5, 2012.

_____. 2012b. TransCanada Keystone XL Pipeline Project, Environmental Report. September 7, 2012.

_____. 2012c. TransCanada Keystone XL Pipeline Project, Response to Department of State Data Request 1.0, September 12, 2012.

_____. 2012d. TransCanada Keystone XL Pipeline Project, Response to Department of State Data Request 2.0, October 1, 2012.

_____. 2012e. TransCanada Keystone XL Pipeline Project, Map of Proposed Bakken Marketlink Pipeline, October 11, 2012.

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4.10 SOCIOECONOMICS

4.10.1 Introduction

This section describes potential impacts to socioeconomic resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS, and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to socioeconomic resources:

- Temporary housing in relation to Keystone's proposal to meet the project's housing need through a combination of construction camps and local housing;
- Economic activity expressed in terms of direct, indirect, and induced employment and earnings. These impacts are presented in response to comments received during scoping for the Supplemental EIS to provide additional detail regarding employment and economic effects of the proposed Project. The impacts are presented for different geographies; counties, state, and national;
- Economic activity expressed in terms of Gross Domestic Product. This is provided as it is the most common measure of economic activity in the United States;
- The environmental justice analysis using data from the 2010 U.S. Census and from the American Community Survey;
- Property tax and sales and use tax analyses. These impacts are presented in response to comments received during scoping for the Supplemental EIS to provide additional detail regarding the tax impacts of the proposed Project; and
- A new section, Section 4.10.2, "Impact Assessment Methodology," was added to describe the impacts used to evaluate potential socioeconomic impacts associated with the proposed Project. Detailed explanations of the methodologies used to evaluate each impact are included in the relevant subsections.

4.10.2 Impact Assessment Methodology

The following potential social and economic impacts were evaluated in the analysis:

- Overburdening of the local housing stock because of demand generated by the temporary and permanent workforces;
- Substantial burden on public service providers serving the proposed Project area, such that they would need to expand their service capacities to meet those demands;
- Substantial changes to local social or economic activities, including changes in employment and income levels, resulting from the proposed Project construction and operations;

- Substantial changes in economic impacts including output and spending;
- Substantial effects to potential environmental justice populations;
- Substantial changes in fiscal revenues, including tax receipts, of local jurisdictions;
- Substantial changes in private property values; and
- Substantial effects to transportation resources.

Impacts are characterized as positive (beneficial) or negative (adverse) and, where possible, are evaluated relative to regional conditions to help assess the magnitude of socioeconomic effects.

Socioeconomic impacts associated with potential releases are discussed in Section 4.13, Potential Releases. The economic effects of such releases historically have included impacts to agriculture, tourism, and a variety of other industries.

4.10.3 Impacts

4.10.3.1 Construction

The proposed Project would require construction of approximately 875 miles of pipeline, 20 pump stations, and other ancillary facilities, as listed in Table 4.10-1.

Table 4.10-1 Proposed Project Construction by State

	Montana	North Dakota	South Dakota	Nebraska	Kansas
Permanent Facilities					
Pipeline (miles)	286.2	0.0	315.2	274.0	0.0
Pump Stations	6	0	7	5	2
Mainline Valves (MLVs)	25	0	15	4[a]	0
Temporary Facilities					
Access Roads	84	0	59	48	0
Pipe Yards	9	1	11	TBD[b]	0
Contractor Yards	5	0	7	TBD[b]	0
Construction Camps	4	0	3	1	0
Railroad Sidings	3	0	3	TBD[b]	0

Sources: Keystone 2012a, 2012b.

[a] Number of MLVs is for Nebraska route proposed in the Final EIS. MLVs for the Nebraska Reroute are yet to be determined.
[b] Construction facilities (pipe yards, contractor yards, and railroad sidings) for Nebraska have not been determined.

TransCanada Keystone Pipeline, LC (Keystone) states that proposed Project construction is expected to take 1 to 2 years. While construction may occur across all five states concurrently, actual time to complete construction is uncertain. Various factors including weather, workforce constraints, and timing of permits would influence the duration of construction, as would finalization of the number of construction spreads that can be operated concurrently.

Population

The number of residents within the proposed Project area would increase temporarily during construction, primarily as a result of the influx of construction workers and future Project staff. The construction workforce would consist of approximately 5,000 to 6,000 personnel per

construction season,[1] including Keystone employees, contractor employees, and environmental inspection staff. This number is equivalent to approximately 2 percent of the population of the counties crossed by the proposed Project route (approximately 268,000) (Table 3.10-5). The workforce would be distributed across the proposed pipeline route by construction spread[2] (see Table 3.10-8 for spread locations), with approximately 900 to 1,300 personnel allocated to each spread. It is assumed that most would be housed in construction camps (see next section).

Population impacts in the proposed Project area would depend upon the composition of the construction workforce in terms of local versus non-local workers and the existing population of the area. Keystone estimates that approximately 10 percent of the total construction workforce could be hired locally (Keystone 2012c). It is assumed that because of the specialized nature of much of the construction, and because of the small labor force and relatively low unemployment rate in the economic corridor counties (counties that are likely to experience daily spending by construction workers, see Table 3.10-10), nearly all local hires would be from the *rest of state* area (i.e., counties outside the economic corridor, but within the same state; see definitions in Section 3.10.1, Potential Releases, Affected Environment, Introduction). It is expected that few workers would be accompanied by their families because of the short duration and mobile nature of the work.

Therefore, impacts to the proposed Project area population during construction would be minor and temporary.

Housing

The proposed Project would require 5,000 to 6,000 construction workers each year of the construction phase or 900-1,300 workers within any one construction spread (eight spreads total). Proposed project construction would require temporary housing for almost all of these workers.

The availability of short-term housing varies across the proposed pipeline route. As of 2012, there were approximately 2,000 available rental properties, 3,300 hotel/motel rooms, and 2,000 recreational vehicle (RV) sites (for a total of approximately 7,300 separate potential accommodations) within reasonable proximity (commuting distance) to the pipeline route (see Section 3.10.2.2, Housing). Actual vacancy rates vary by year and season, with the spring and fall seasons having the lowest vacancy rates. Therefore, the actual availability of temporary housing at any given time could be lower.

The proposed Project-related demand for housing (6,000 workers) would take up approximately 82 percent (6,000 divided by 7,300) of the estimated available temporary housing along the pipeline route, leaving only 18 percent to meet non-Project related needs. Therefore, the temporary housing available along the proposed pipeline route would likely be insufficient to meet the demand for housing resulting from construction activities. More urban areas, such as the central/south Nebraska spreads, have more short-term housing available, particularly hotel and motel rooms.

Keystone proposes to meet the housing need through a combination of construction camps and local housing.

[1] A total of 10,000 to 11,000 would be needed if the entire proposed Project was built concurrently.
[2] Lengths of pipeline that would be built under one contract or set of contracts. The proposed Project has 10 spreads.

Construction Work Camps

As discussed above, the proposed Project area counties do not have sufficient temporary housing to house all the necessary construction personnel. Keystone proposes to construct eight temporary construction camps to meet the housing needs in Montana, South Dakota, and northern Nebraska (see Table 4.10-2); approximately one camp per spread for construction spreads 1 through 8.

Table 4.10-2 Proposed Construction Work Camp Locations

County	State	Number of Construction Camps
Valley	Montana	2
McCone	Montana	1
Fallon	Montana	1
Harding	South Dakota	1
Meade	South Dakota	1
Tripp	South Dakota	1
Holt	North Nebraska	1

Source: Keystone 2012d.

Keystone states that each of the construction camps would typically house approximately 900 to 1,300 workers, including sleeping areas with shared or private baths. Approximately 100 of the workers would use on-site RVs, and the remainder would be housed in camp buildings. The camps would have recreation facilities, media rooms, kitchen/dining facilities, laundry facilities, a security/infirmary unit, offices, and wastewater treatment facilities. These temporary construction camps would be permitted, constructed, and operated consistent with applicable county, state, and federal regulations.

Other Temporary Housing

In central/south Nebraska, where no construction camps are planned, there are approximately 936 rental units, 839 hotel/motel rooms, and 740 RV sites (see Section 3.10.2.2, Housing). Additional temporary housing is available in surrounding counties that are in reasonable proximity. This temporary housing would be sufficient to accommodate the estimated 1,800 workers needed for spreads 9 and 10 in central/southern Nebraska.

Keystone estimates that approximately 200 workers over 34 weeks would be needed for the two pump stations in Kansas. Clay and Butler counties, with over 500 hotel/motel rooms, as well as the nearby metropolitan areas of Wichita and Manhattan, would have sufficient short-term housing to meet the needs of this workforce.

Local Economic Activity

Economic activity is defined as the production of goods and services required to meet the demand for construction by the proposed Project. Funds spent by Keystone would trigger production activity, which can be expressed in terms of employment and earnings. Employment is expressed as annual average jobs, including both full-time and part-time employment. A job consists of one position that is filled for one year. A job could consist of two positions filled for a period of six months each, three positions filled for four months each, or any combination that sums to a year of employment. *Earnings* is the value of all compensation paid to employees, or

alternatively the cost of payroll to the employer. In addition to wages and salaries, it includes such things as benefits, payroll taxes, bonuses, and retirement contributions.

The impacts discussed here include three distinct components of economic activity: direct, indirect, and induced. Direct economic activity associated with construction includes all jobs and earnings at firms that are awarded construction contracts for the Project. Indirect activity includes all goods and services purchased by these construction contractors in the conduct of their services to the Project. Examples of these types of activities related to pipeline construction include the goods and services purchased to produce inputs such as pipe, concrete, fuel, surveying, welding materials, and earth-moving equipment. Induced activity includes the spending of earnings received by employees working for either the construction contractor or for any supplier of goods and services required in the construction process. Examples of induced activities include access road construction crews, welders, employees of pipe manufacturers, and miners of iron ore used to make pipe. This section presents the sum of employment and earnings from all three types of effects.

Impacts were estimated using IMPLAN® (MIG, Inc. 2011), a proprietary input-output modeling system founded on data available from the U.S. Bureau of Economic Analysis, Bureau of Labor Statistics, U.S. Census Bureau, and others sources. IMPLAN® is regarded by government agencies and academic institutions as a highly credible economic modeling system. The most recent IMPLAN® data (2010) were used for the analysis.

Construction activities in Montana, South Dakota, and Nebraska were modeled at three geographic levels: at the economic corridor counties level within each state (see Table 3.10-8), at the state level, and at the national level. Some expenditures were modeled at the economic corridor level and then linked to the remaining area of each state to capture effects occurring outside the economic corridor. Some expenditures were only modeled at the state level when it was clear that the economic corridor was unlikely or unable to provide goods and services required for construction. Impacts modeled at the state level were linked to all remaining states in the country to capture national consequences of statewide spending. Expenditures on the two pump stations in Kansas were evaluated in the context of the Kansas economy as a whole due to the proximity of Clay and Butler counties to interstate highway corridors and to large, economically dominant, metro areas. Therefore, Kansas was modeled at the state level with links to the rest of the United States. Finally, some construction spending would occur only at unspecified locations nationally, and thus a single U.S. model was used to estimate these impacts. A total of 19 models were used in the analysis.

Table 4.10-3 presents a summary of construction activities that would occur in various locations. Construction contracts, materials, and support purchased in the United States would total approximately $3.1 billion ($1.532 billion in construction plus $0.75 billion for material plus $0.857 billion in support).[3] Support includes such items as construction management, inspections, and engineering. Another $233 million would be spent on camps for workers in remote locations of Montana, South Dakota, and northern Nebraska. Approximately 10,000 construction workers engaged for 4- to 8-month seasonal construction periods (approximately

[3] More detailed estimates were used in the models, but these are not included in the Supplemental EIS because they include confidential business information.

5,000 to 6,000 per construction period) would be required to complete the proposed Project. When expressed as average annual employment, this equates to approximately 3,900 jobs[4].

Table 4.10-3 Selected Characteristics of Proposed Project Construction Activity Occurring Within the United States

Characteristic		Location					
Description	**Units**	**Montana**	**South Dakota**	**Nebraska**	**Kansas**	**Rest of US**	**Total U.S.**
Construction cost	$ million	$494	$539	$464	$35	NA[a]	$1,532
Materials cost	$ million	NA	NA	NA	NA	$750	$750
Support cost	$ million	$273	$271	$275	$38	NA	$857
Construction workers	number	4,000	3,500	2,700	200	NA	10,400
Construction period	weeks	17-21	19-21	19-20	32-35	NA	17-35
Construction camps	number	4	3	1	NA	NA	8
Construction camp development and operations[b]	$ million	NA	NA	NA	NA	NA	$233

[a] Not applicable (NA).
[b] Construction camp development and operations estimates are not presented by state because they include confidential business information.

The economic analysis treats construction contracts, major material purchases, construction camps, and worker expenditures as distinct triggers of economic effects. Important assumptions used in the analysis include the following:

- National firms would be awarded construction contracts. Contractors would use local sub-contractors and state sources for common goods and services where available. The balance would be obtained from national sources.
- Approximately 10 percent of the workforce in each state would come from locations within that state. Because the proposed pipeline corridor includes primarily rural and sparsely populated areas, the 10 percent would likely reside in other parts of each state. The remaining 90 percent of the workforce would come from other United States locations outside the state. This share of the workforce accounts for a unique national labor force that is highly specialized in pipeline construction techniques.
- Where construction camps are provided, all workers (including any in-state workers) would reside in the camps during construction. Because the proposed construction is concentrated over 4 to 8 month periods over 1 to 2 years and the locations are remote, no commuting for in-state workers is assumed. Camps would accommodate both workers staying within built housing as well as those living in personal RVs. Because the work week would be six days and each workday would be long, all workers would eat in camp dining facilities.
- Construction camps would be built, assembled, operated, and decommissioned by U.S. firms located outside the corridor states. In-state firms would complete the site work for camp development (Morgan 2012, Olmsted 2012). For the purpose of this analysis, it is assumed that camp operations would hire half of the service personnel from within the state and half from other parts of the United States.

[4] This is based on the number of construction workers multiplied by the construction period in weeks divided by 52 weeks in a year.

- Commercial lodging and accommodations (not construction camps) would house the construction workforce in central and southern Nebraska (construction spreads 9b and 10) as well as in Kansas.
- Worker expenditures during construction would primarily go toward lodging, meals, and minor retail purchases. Worker compensation would be spent primarily in their states of residence.
- Major material purchases (e.g., pipe, pumps, valves, instrumentation) would be provided by national firms located throughout the United States.
- Most major support costs, such as construction management, inspections, engineering, and environmental services, are primarily provided in the United States either through contracts with United States firms or by proponent personnel residing in the United States.

Table 4.10-4 shows the total predicted impacts of the proposed Project on employment across all geographies. A total of 42,100 jobs throughout the United States would be supported by construction of the proposed Project. About 12,000 jobs, or 29 percent, would be held by residents of the four proposed Project area states.[5] The remaining 70 percent of all jobs would occur in other states across the country. A detailed breakdown of jobs by sector for each state (see tables in Appendix O, Socioeconomics) indicates that most jobs in the economic corridor states would occur in construction, trade, professional services, lodging, and food services. This mix of industry effects stems from both local suppliers to pipeline construction activity as well as household spending of worker income. In southern Nebraska, this pattern is supplemented by the anticipated use of commercial lodging and food service during pipeline construction.

Table 4.10-4 Total Employment Supported by Construction of the Proposed Project (average annual jobs)

	Total Jobs		
	Current (2010)	**Total Effects of Proposed Project[b, c]**	**Share of 2010 Total Jobs (percent)**
Project Area	4,211,000	12,000	0.28%
Montana[a]	623,600	3,700	0.59%
South Dakota[a]	556,500	3,500	0.62%
Nebraska[a]	1,225,700	4,400	0.36%
Kansas[a]	1,805,200	400	0.02%
Rest of U.S.	169,556,400	30,100	0.02%
Total U.S.	173,767,400	42,100	0.02%

[a] Excludes jobs held by non-residents of the state as part of a temporary construction workforce.
[b] Includes direct, indirect, and induced full-time and part-time jobs by place of work.
[c] Time period for realizing all effects is uncertain.

As noted above in Section 4.10.3.1, Construction, the time to complete construction is uncertain, ranging from estimates of 1 to 2 years. Throughout this section, the direct impacts of construction and subsequent indirect and induced impacts throughout the economy are summed and compared with annual totals for 2010. This comparison provides a context for understanding the magnitude of total impacts.

[5] This number reflects the *total* effects (direct, indirect, and induced) of the proposed Project and therefore exceeds the 3,900 direct construction jobs cited above.

Table 4.10-5 provides an industry breakdown of employment nationally. Construction and accommodations and food service would be the largest beneficiaries of the proposed Project, followed by professional services, manufacturing, and trade. Other industries with estimated impacts exceeding 2,000 jobs include health and social services, administrative and waste services, finance and insurance, and transportation and warehousing. Total estimated employment impacts triggered by the proposed Project would sum to about 0.02 percent of national employment in 2010.

Table 4.10-5 Total U.S. Employment and Earnings by Industry Supported by Construction of the Proposed Project

	Employment (average annual jobs)			Earnings (thousands of 2010 dollars)[c]		
	Current (2010)	Total Effects of Proposed Project[c]		Current (2010)	Total Effects of Proposed Project[c]	
Industry	Jobs[a]	Jobs[a]	Share of 2010 Total	$1,000[b]	$1,000[b]	Share of 2010 Total
Farm	2,665,000	300	0.01%	77,215,000	7,400	0.01%
Forestry, Fisheries, & Support, including Farm Support	835,800	100	0.01%	22,548,000	3,800	0.02%
Mining	1,185,500	300	0.02%	83,081,000	28,300	0.03%
Utilities	579,000	100	0.02%	73,306,000	18,400	0.03%
Construction	8,914,200	6,800	0.08%	479,541,000	419,500	0.09%
Manufacturing	12,206,900	4,600	0.04%	891,607,000	308,900	0.03%
Trade	23,808,200	4,400	0.02%	1,009,713,000	172,100	0.02%
Transportation & Warehousing	5,504,400	2,000	0.04%	295,408,000	110,400	0.04%
Information	3,210,700	600	0.02%	294,252,000	40,100	0.01%
Finance & Insurance	9,651,300	2,200	0.02%	647,655,000	131,400	0.02%
Real Estate & Rental	7,459,200	1,600	0.02%	148,119,000	31,200	0.02%
Professional Services & Management of Companies	13,765,700	5,100	0.04%	1,110,322,000	343,300	0.03%
Administrative & Waste Services (private only)	10,478,800	2,300	0.02%	353,648,000	71,100	0.02%
Educational Services (private only)	4,076,600	500	0.01%	146,724,000	18,000	0.01%
Health & Social Services (private only)	19,062,300	2,700	0.01%	1,000,258,000	141,000	0.01%
Arts, Entertainment & Recreation Services	3,777,100	600	0.02%	100,953,000	13,600	0.01%
Accommodations & Food Services	12,048,000	5,700	0.05%	278,844,000	103,300	0.04%
Other Services	9,858,700	1,800	0.02%	330,361,000	62,100	0.02%

	Employment (average annual jobs)			Earnings (thousands of 2010 dollars)[c]		
	Current (2010)	Total Effects of Proposed Project[c]		Current (2010)	Total Effects of Proposed Project[c]	
Industry	**Jobs[a]**	**Jobs[a]**	**Share of 2010 Total**	**$1,000[b]**	**$1,000[b]**	**Share of 2010 Total**
Government & Government Enterprises	24,680,000	400	< 0.01%	1,642,674,000	29,900	< 0.01%
Total	173,767,400	42,100	0.02%	8,986,229,000	2,053,800	0.02%

[a] Includes direct, indirect, and induced full-time and part-time jobs by place of work.
[b] Labor earnings by place of work.
[c] Time period for realizing all effects is uncertain.

Impacts on earnings follow a similar pattern as those for employment, but with some difference in percent shares between geographies (see Table 4.10-6). For comparability with baseline estimates, these are shown in 2010 dollars. About 22 percent of all earnings, or $408 million, would occur in the proposed Project area states of Montana, South Dakota, Nebraska, and Kansas. This compares with 29 percent of all jobs (12,000/42,100 per Table 4.10-4). A smaller share of earnings (compared to the share of jobs) for these states suggests that the largest impacts would occur in industries paying lower wages, such as trade and personal services, that are commonly associated with household spending. The remaining 78 percent of all earnings, or $1.6 billion, would occur in other locations around the country. These effects are primarily attributed to the manufacturers of major materials and construction support services for the Project plus their supply-chains.

Table 4.10-6 Total Earnings Supported by Construction of the Proposed Project (thousands of 2010 dollars)

	Total Earnings		
	Current (2010)[b]	Total Impacts of Proposed Project[b, c]	Share of 2010 Total (percent)
Project Area States	183,429,300	408,200	0.22%
Montana[a]	23,390,300	127,200	0.54%
South Dakota[a]	22,968,300	114,600	0.50%
Nebraska[a]	55,527,800	149,400	0.27%
Kansas[a]	81,542,900	14,000	0.02%
Rest of U.S.	8,802,799,700	1,648,600	0.02%
Total U.S.	8,986,229,000	2,053,800	0.02%

[a] Excludes labor earnings by non-residents of the state as part of a temporary construction workforce.
[b] Labor earnings by place of work.
[c] Time period for realizing all effects is uncertain.

As seen in Table 4.10-5, the distribution of earnings by industry in the United States shows construction, manufacturing, and professional services as the largest beneficiaries of the proposed Project. Earnings that exceed $100 million also would occur with trade, health and social services, finance and insurance, transportation and warehousing, lodging, and the food service industries. Total earnings impacts triggered by the proposed Project would amount to about 0.02 percent of national earnings in 2010.

National Economic Indicators

Gross Domestic Product, or GDP, is the most common measure of economic activity in the United States.[6] GDP can be derived in three ways: 1) by the sale of final goods and services to persons, businesses, governments, and foreigners; 2) by the income received by owners of labor (workers), land, and capital in the production of these goods and services; and 3) by the value that is added by at every stage of production when goods and services are produced. Earnings by workers, as presented in this Supplemental Environmental Impact Statement (Supplemental EIS), are the largest share of income included in GDP. It provides a strong indicator of the contributions made by any set of actions towards the economic activity of a state or the nation. It is also a measure that workers across the country can personally relate to and appreciate.

A complete measure of contributions to GDP by the proposed Project would include all changes in production during both construction and operations. It would also include changes in production by other firms prompted by market dynamics should the Project be implemented. Market dynamics are addressed in Section 1.4.10, Summary, but in qualitative terms only. Estimates of GDP provided here include construction impacts only.

In 2010, the base year of this analysis, the GDP of the United States was approximately $14,498.9 billion. Construction of the proposed Project would contribute approximately $3.4 billion to GDP if implemented (see Table 4.10-7). This figure includes not only earnings by workers, but all other income earned by businesses and individuals engaged in the production of goods and services demanded by the proposed Project, such as profits, rent, interest, and dividends. When compared with the GDP in 2010, the Project's contribution represents about 0.02 percent of annual economic activity across the nation.

Table 4.10-7 Gross State Product, Gross Domestic Product, and Earnings Supported by Construction of the Proposed Project (millions of 2010 dollars)

	GSP/GDP[a, b, c]	Earnings[a, b]
Montana	212.2	127.2
South Dakota	191.5	114.6
Nebraska	244.3	149.4
Kansas	18.3	14.0
Rest of U.S.	2,735.9	1,648.6
Total U.S.	**3,402.3**	**2,053.8**

Source: Table 4.10-3 and IMPLAN® (MIG, Inc. 2011).

[a] May not add due to rounding.
[b] Time period for realizing all effects is uncertain.
[c] GSP = Gross State Product; GDP = Gross Domestic Product.

[6] There are a variety of measures that can be used to gauge the level of economic activity in a geographic area. Production output, or sales, is a measure that is commonly found in economic studies. This measure sums the expected sale of all goods and services, whether they are sold as inputs for making a product or as a completed product to the final user. For example, the sale of wheat grown by the farmer to the miller, the sale of flour by the miller to the baker, and finally the sale of bread by the baker to the consumer would all be counted in the sum of output or sales. Other measures of economic activity, such as GDP, count only the value added at each step in the production process. To continue the example, the value added by the miller is grinding the wheat and the value added by the baker is mixing wheat with other ingredients and baking it to produce bread. The sum of value added will always be smaller than the sum of total sales.

Effects of the proposed Project in the State of Nebraska have been a concern expressed in public comments. In response to these concerns, the Nebraska Department of Environmental Quality (NDEQ) measured the economic activity of the proposed Project in a separate analysis (NDEQ 2012). Because Nebraska sought to understand the sum of all sales occurring in the state triggered by the proposed Project, it reported production output as an appropriate measure of economic activity.

For purposes of this environmental analysis, the economic effects of the proposed pipeline were compared with a national standard, the GDP. As shown above, the contribution to Gross State Product (GSP; the GDP equivalent for states) is smaller than the sum of total sales.

Previous Analysis of Economic Impacts

In 2010, The Perryman Group (TPG) released its analysis of impacts that the previously proposed Keystone project would have on business activity of the United States (TPG 2010). The TPG study considered the entire project from the Canadian border in Montana to the Gulf Coast, and it was summarized and reviewed in the Final EIS (Final EIS, Section 3.10.2.2). The proposed Project is smaller than the project analyzed by the TPG report (i.e., primarily the portion in Montana, South Dakota, and Nebraska).

Two measures common to the TPG analysis and the analysis in this Supplemental EIS are GSP and employment. Table 4.10-8 presents findings for pipeline construction and development by state.

Table 4.10-8 Comparison of Gross State Product (GSP) and Employment Supported by Construction of the Proposed Project in The Perryman Group (TPG) and in the Supplemental EIS

	GSP (millions of 2010 dollars)		Employment (average annual jobs during construction)	
State	**TPG[a,c]**	**Supplemental EIS [c]**	**TPG[b,c]**	**Supplemental EIS[c]**
Montana	$353.2	$212.2	5,232	3,700
South Dakota	$394.0	$191.5	4,826	3,500
Nebraska	$394.9	$244.3	7,143	4,400

[a] TPG results were originally expressed in 2009 dollars. To facilitate comparisons, they have been adjusted in this table using the GDP Implicit Price Deflator of 101.15.
[b] TPG analysis reported employment in terms of full-time equivalents. One job equals approximately 0.946 full-time equivalents (MIG, Inc. 2011).
[c] Time period for realizing all effects is uncertain.

The TPG impact estimates range from 1.4 to 2.0 times larger than those presented in this Supplemental EIS. Based on the description of the TPG model provided in its report (U.S. Multi-Regional Impact Assessment System), foundational elements appear to be similar to IMPLAN®, the modeling system used for analysis in the Supplemental EIS. Descriptions of the model, assumptions, and inputs used in the analysis were not provided in detail in the TPG report making it difficult to interpret the differences. However, the Final EIS noted that the TPG Report did not appear to separately calculate potential impacts for construction and operation, and, further, the TPG study assessed benefits over an assumed 100-year project lifetime.

Environmental Justice

As discussed in Section 3.10.2.4, Environmental Justice, within the socioeconomic analysis area, 16 census block groups were identified with minority populations that were meaningfully greater than their respective reference areas[7] and five census tracts were identified with low-income populations that were meaningfully greater than their respective reference areas. Of these 21 areas, four were duplicates (i.e., areas identified for both the meaningfully greater minority and low-income population sets). Accordingly, it was concluded that a total of 17 separate areas with environmental justice populations could potentially be affected by construction or operation of the proposed pipeline.[8] Table 4.10-9 lists these areas and specifies the following:

- If the proposed pipeline route intersects an area;
- Whether an ancillary facility is proposed to be located within an area; and
- Whether there is a minority population and/or a low-income population in the area.

Table 4.10-9 Locations of Construction Facilities Relative to Meaningfully Greater Populations[a]

Geographic Area	Intersects with Pipeline Route	Ancillary Construction Facilities in Area[b]	Minority Population	Low-Income Population
Montana				
Phillips				
Block Group 4, Census Tract 602	Yes	1 Pipe Yard	Yes	No
Valley				
Block Group 1, Census Tract 1001	Yes	1 Pipe Yard, 1 Contractor Yard	Yes	No
Block Group 1, Census Tract 9406	Yes	1 Pipe Yard	Yes	No
Block Group 2, Census Tract 9406	No	NA	Yes	No
Fallon				
Block Group 3, Census Tract 1	No	NA	Yes	No
South Dakota				
Butte				
Block Group 1, Census Tract 9676	Yes	1 Pipe Yard	Yes	Yes
Perkins				
Block Group 2, Census Tract 9683	Yes	NA	Yes	Yes
Ziebach				
Block Group 1, Census Tract 9416	No	NA	Yes	Yes
Pennington				

[7] Reference areas were block groups, census tracts, or states as appropriate (see Section 3.10.2.4, Environmental Justice).
[8] As noted in Section 3.10.2.4, Environmental Justice, NDEQ, using a different methodology, also identified a low-income population in Oakdale Township, Antelope County.

Geographic Area	Intersects with Pipeline Route	Ancillary Construction Facilities in Area[b]	Minority Population	Low-Income Population
Block Group 1, Census Tract 116	Yes	NA	Yes	No
Tripp				
Block Group 2, Census Tract 9716	Yes	1 Pipe Yard, 2 Contractor Yards	Yes	No
Block Group 1, Census Tract 9717	Yes	NA	Yes	Yes
Gregory				
Block Group 2, Census Tract 9717	Yes	NA	Yes	
Block Group 3, Census Tract 9717	Yes	NA	Yes	
Block Group 2, Census Tract 9712	Yes	NA	Yes	No
Nebraska				
Keya Paha				
Census Tract 9754	Yes	TBD	No	Yes
York				
Block Group 2, Census Tract 9698	Yes	TBD	Yes	No
Kansas				
Butler				
Block Group 2, Census Tract 206	No	NA	Yes	No

Source: Keystone 2012b.

Note: Access roads, which are located throughout the proposed Project area, may also impact minority and/or low-income populations.
[a] Construction facilities for Nebraska have not yet been determined.
[b] Abbreviations: Not Applicable (NA), TBD (to be determined).

Impacts to minority and low-income populations during construction could include exposure to construction dust and noise, disruption to traffic patterns, and increased competition for medical or health services in underserved populations. Positive impacts could include direct, indirect, and induced employment and earnings from construction spending.

Impacts to traffic patterns and medical or health services are discussed in this Section (4.10). Dust and noise impacts are discussed in Section 4.12, Air and Noise. To assess the potential impacts on minority and low-income populations in areas that could be underserved by health professionals, medical facilities, or other health services, the 17 areas with minority and/or low-income populations were compared to Health Professional Shortage Areas (HPSA) and Medically Underserved Areas/Populations (MUA/P) locations that are listed by the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA 2012a, 2012b). Any additional disruptions to medical service availability in these areas could impact these populations during the construction period. All 17 areas with minority and/or low-income populations are in counties that are or contain HPSAs and/or MUA/Ps.

Table 4.10-10 provides information about the HPSAs and MUA/Ps and they are shown spatially on Figure 4.10.3-1 in relation to areas with minority and/or low-income populations.[9]

At any given location along the proposed pipeline route, the duration of the construction period would typically range from 20 to 30 working days. In areas in Montana, South Dakota, and Nebraska where construction camps would be provided, minor medical needs of workers would be handled in these camps, thus reducing the potential need for medical services from the surrounding communities. As a result, the impact of increased demand for medical services on local minority and low-income populations would be minor and short-term.

The Final EIS (Section 3.10, Socioeconomics) acknowledged concern about impacts on environmental justice communities and described mitigation for these impacts. In addition to avoidance and mitigation measures that Keystone proposes to minimize negative impacts to populations in the proposed Project area, specific mitigation for environmental justice communities would involve ensuring that adequate communication in the form of public awareness materials regarding the construction schedule and construction activities is provided. Materials would be in appropriate languages and with information on how to seek needed services in the event of health or other social service disruption related to construction activities.

As noted below under Public Services, Keystone states that it would reach out to Local Emergency Planning Committees (LEPCs) during and after the development of its emergency response plan and produce public awareness materials with special emphasis on considerations of low income and minority communities in those preparedness efforts.

The Final EIS noted that a series of consultation meetings were conducted as part of the Section 106 National Historic Preservation Act consultation process to facilitate participation by consulting Indian tribes. Opportunities were provided at these consultation meetings to discuss issues associated with proposed Project construction and operation. Additional consultation was conducted as part of the proposed Project in the Fall of 2012.

The Department also requested that Keystone provide information on its commitment at the corporate level to addressing environmental justice concerns. The Final EIS summarized Keystone's response in Section 3.10.1.2 (Socioeconomics).

[9] Spatial information for HPSAs and MUA/Ps is only available at the county level. For reference, Figure 4.10.3-1 also shows Oakdale Township, Antelope County, NE a low-income population area identified by NDEQ (2012), see prior footnote. Figure 4.10.3-1 shows more medical shortage and underserved areas than shown by NDEQ (NDEQ 2012) because the figure shows primary medical care, dental, and mental health areas, whereas NDEQ (2012) shows primary medical care shortage areas only, and only for entire counties.

Table 4.10-10 Health Professional Shortage Areas and Medically Underserved Areas/ Populations in the Socioeconomic Analysis Area

			Health Professional Shortage Areas (HPSA)[a]		Medically Underserved Areas/Populations (MUA/P)[d]
County	**Census Block Groups Containing One or More Identified Minority Populations**	**Census Tracts Containing One or More Identified Low-Income Populations**	**Designation Name/ Facility Location[b]**	**Geographic Area or Facility Type[c] (P=Primary Medical Care; D=Dental; M=Mental Health)**	**Designation Name**
Montana					
Phillips	1	0	Phillips Eastern Montana	Single County (P, D) Geographical Area (M)	Phillips Service Area
Valley	3	0	Low-Income—Valley Eastern Montana	Population Group (P) Geographical Area (M)	Valley Service Area
Fallon	1	0	Low-Income—Fallon Fallon/Ekalaka Eastern Montana	Population Group (P) Geographical Area (D) Geographical Area (M)	Baker Service Area
Subtotal Montana	*5*	*0*			
South Dakota					
Butte	1	1	Newell Butte	Geographical Area (P) Single County (M)	Butte Service Area
Perkins	1	1	Faith Lemmon (SD/ND) Perkins Catchment Area 8	Geographical Area (P) Single County (D) Geographical Area (M)	Perkins County
Ziebach	1	1	Ziebach Catchment Area 8	Single County (P,D,M) Geographical Area (M)	Ziebach Service Area
Pennington	1	0	Community Health Center of Black Hill Rapid City HS Indian Health Hospital Wall Service Area	Comprehensive Health Center (P,D,M) Indian Health Service Facility (P,D,M) Geographical Area (P)	New Underwood Service Area Pennington Service Area

County	Census Block Groups Containing One or More Identified Minority Populations	Census Tracts Containing One or More Identified Low-Income Populations	Health Professional Shortage Areas (HPSA)[a]		Medically Underserved Areas/Populations (MUA/P)[d]
			Designation Name/ Facility Location[b]	Geographic Area or Facility Type[c] (P=Primary Medical Care; D=Dental; M=Mental Health)	Designation Name
Tripp	4	1	Low-Income—Tripp County Tripp Catchment Area 10	Population Group (P) Single County (D) Geographical Area (M)	Trip Service Area
Gregory	1	0	Fairfax Service Area Bonesteel Medical Clinic Burke Medical Clinic Low-Income—Gregory County Catchment Area 10	Geographical Area (P) Rural Health Clinic (P) Rural Health Clinic (P) Population Group (D) Geographical Area (M)	Gregory Service Area
Subtotal South Dakota	*9*	*4*			
Nebraska					
Keya Paha	0	1	Keya Paha Catchment Area 4	Single County (P) Geographical Area (M)	Keya Paha Service Area
York	1	0	Mental Health Catchment Area 5	Geographical Area (M)	NA
Subtotal Nebraska	*1*	*1*			

County	Census Block Groups Containing One or More Identified Minority Populations	Census Tracts Containing One or More Identified Low-Income Populations	Health Professional Shortage Areas (HPSA)[a]		Medically Underserved Areas/Populations (MUA/P)[d]
			Designation Name/ Facility Location[b]	Geographic Area or Facility Type[c] (P=Primary Medical Care; D=Dental; M=Mental Health)	Designation Name
Kansas					
Butler	1	0	El Dorado Clinic August Family Practice El Dorado Correctional Facility Mental Health Catchment Area 17—Butler County	Rural Health Clinic (P) Rural Health Clinic (P, D, M) Correctional Facility (P,D,M) Geographical Area (M)	Butler Service Area
Subtotal Kansas	*1*	*0*			

Sources: Race (U.S. Census Bureau, American FactFinder. 2012a, 2012b, 2012c); HPSA and MUA/P Areas (HRSA 2012a, 2012b).

[a] HPSAs are designated by HRSA as having shortages of primary medical care, dental, or mental health providers and may be geographic (a county or service area), demographic (low income population), or institutional (comprehensive health center, federally qualified health center, or other public facility). See Figure 4.10.3-1.
[b] Satellite sites of Comprehensive Health Centers automatically assume the HPSA score of the affiliated grantee. They are not listed separately.
[c] Geographic Single County is defined as a whole county designated as HPSA; Geographic Service Areas are portions of a county, or portions of multiple counties designated as a geographic HPSA; Population Groups are defined as a population within an area that is designated as an HPSA; Correctional Institutions are federal and state prisons and youth detention facilities; Rural Health Clinics are certified as Rural Health Clinics by the Centers for Medicare and Medicaid Services; Indian Health Service sites serve federally recognized tribes.
[d] MUA/Ps are areas or populations designated by HRSA as having: too few primary care providers, high infant mortality, high poverty, and/or high elderly population. See Figure 4.10.3-1.

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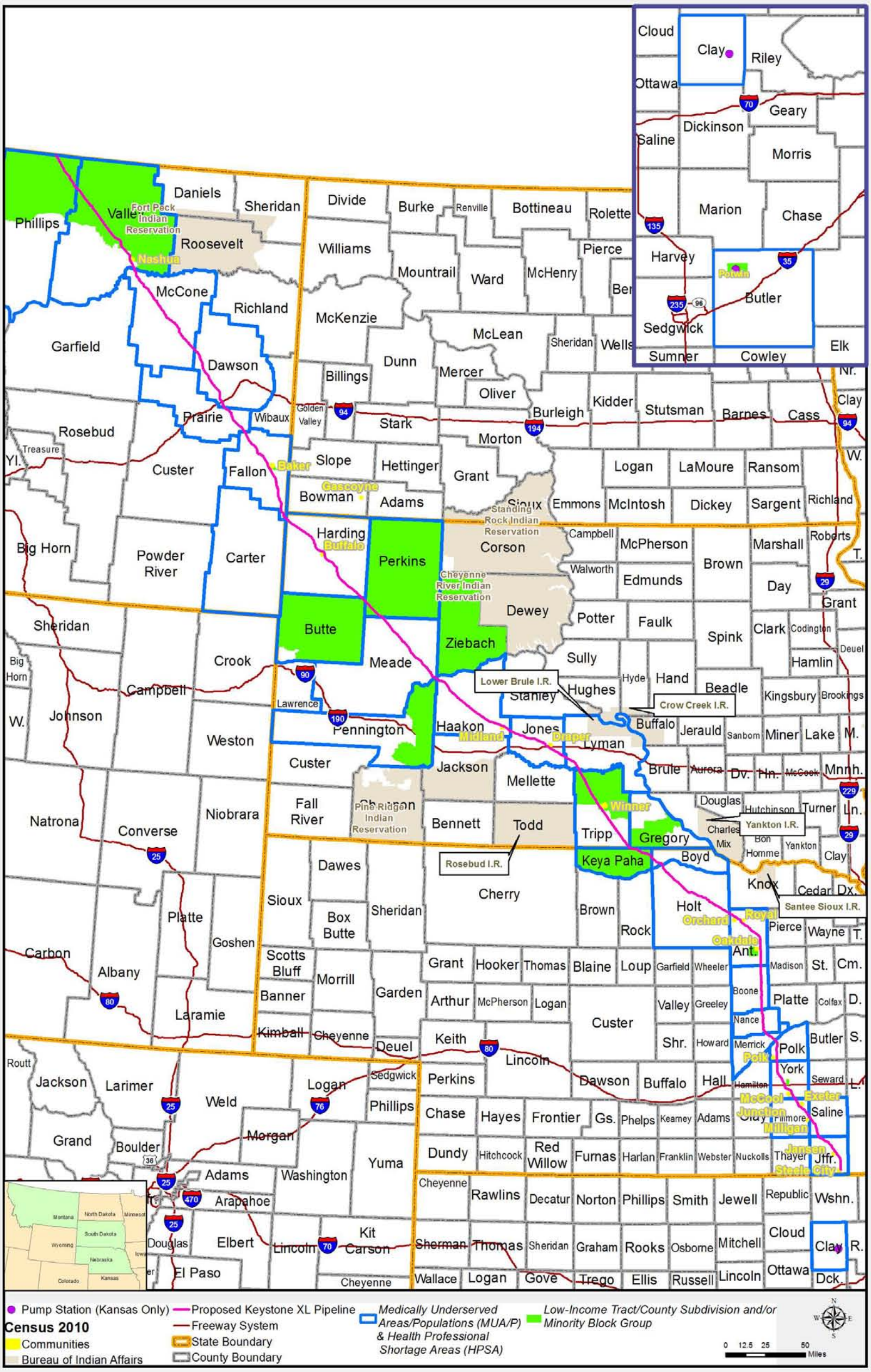

Source: HRSA 2012a, 2012b.

Figure 4.10.3-1 Health Professional Shortage Areas and Medically Underserved Areas/Populations in the Socioeconomic Analysis Area

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Public Services, Tax Revenues, and Property Values

Public Services

The Final EIS discussed impacts to public services in Section 3.10.2.2 (Socioeconomics). It noted that the influx of construction workers into local communities has the potential to generate additional demands on local public services (e.g., emergency response, medical, police, and fire protection services). The Department understands that Keystone would work with local law enforcement, fire departments, and emergency service providers, including medical aid facilities, to establish appropriate and effective emergency response measures. This information would be included in the emergency response plan developed prior to implementation of the proposed Project with special emphasis on considerations of low income and minority communities in those preparedness efforts. Keystone states that it would:

- Reach out to LEPCs during and after the development of its emergency response plan and produce public awareness materials with special emphasis on considerations of low income and minority communities in those preparedness efforts.
- Ensure that underground and overhead utilities would be located and that Keystone would avoid contact and damage during construction.
- Ensure that contractors have Site-Specific Safety Plans in place before commencing work, and that these plans would address locating, avoiding, and protecting utilities.

The need for public services would be reduced due to the eight construction camps. As described above under Housing, the camps would provide many of the necessary services to workers, thereby reducing the demand on public services in communities in the proposed Project area.

Tax Revenues

Property Tax

During construction of the proposed Project, situs taxing entities such as county governments, school districts, and special districts would be able to assess and tax the taxable property of the eight construction camps. The term *situs* means locations actually containing proposed Project facilities within their legal boundary.

Spreadsheet models were developed to estimate property taxes for situs counties in each state, reflecting the basic characteristics of the state's property tax system and effective rates in each county in 2010. However, the models necessarily stylize and simplify the values and calculations that state and local governments would take to value and tax real property in actual practice. The actual tax revenue the proposed Project could generate from construction camps may differ from the estimates because of the many factors that determine the timing of assessments, the valuation of property, and tax rates in force in a given year.

Based on these models, it is estimated that the eight camps could generate the equivalent of one full year of property tax revenue for seven situs counties, a total of about $2 million, distributed as follows: $62,000 in Phillips County, $13,000 in McCone County, and $51,000 in Fallon County, Montana; $519,000 in Harding County, $508,000 in Meade County, and $419,000 in Tripp County, South Dakota; and $460,000 in Holt County, Nebraska.

Other Taxes

The Final EIS Section 3.10.2.2, Socioeconomics Potential Impacts, states that other revenues generated by the proposed Project during construction would be sales/use and fuel taxes levied on goods and services purchased during the construction period. This would include, for example, taxes from construction materials and construction worker spending in the local economy for basic living expenses such as food, housing, gasoline, and entertainment. This type of tax revenue would last only as long as construction was in progress, or for about two years. The following estimates use data on taxable items provided by Keystone (Keystone 2012e).

In South Dakota the combination of a sales or use tax on all materials, equipment, and services, plus the contractors' excise tax on amounts received by contractors for work done in the state, would generate an estimated $45.6 million for state government over two years of construction on the proposed Project. This tax equates to an additional two percent per year when compared to South Dakota's annual revenue of this type of $1.08 billion in 2009, or about 0.6 percent per year when compared to state government's total general revenue resources in 2009 (see Table 3.10-17).

In Nebraska the sales or use tax on materials would generate an estimated $16.5 million for state government over two years of construction on the proposed project. This equates to 0.8 percent of additional revenue when compared to Nebraska's annual revenue of this type of $2.02 billion in 2009 and less than 0.2 percent when compared to state government's total general revenue resources in 2009 (Table 3.10-17).

In Kansas the sales or use tax on materials would generate an estimated $2.7 million for state government over two years of construction and a combined $360,000 for the county governments within whose taxing jurisdiction the construction would occur[10]. These amounts equate to a very small percentage of total state and local government revenues of this type, when compared to the data in Table 3.10-17. However, the effect of additional sales tax revenue though small and temporary may be noticeable during the two years of construction at the local government level in Kansas. This Supplemental EIS does not estimate the amount of other short-term tax revenue that the proposed Project could generate incidental to construction, including taxes on construction worker spending, because so many variables are involved that the results would be uncertain. Depending on the laws of each state, the additional short-term revenues could come from specific excise taxes on accommodations, rental vehicles, tobacco products, and alcohol in Montana (which does not have a general sales and use tax as do South Dakota, Nebraska, and Kansas); retail sales and motor fuel taxes in South Dakota; and retail sales, motor fuel, and cigarette taxes in Nebraska.

Property Values

As noted in the Final EIS (Sections 3.10 and 3.10.2.2, Socioeconomics), temporary effects during construction of the proposed Project could include isolated impacts on individual property owners and economic land use along the pipeline route. Potential damages to private property during proposed Project construction would be concentrated along the ROW and appurtenant facilities. Land disturbed by the proposed Project would be restored to the extent practicable; Keystone would repair or restore drain tiles, fences, and land productivity damaged or adversely

[10] Note that while Kansas has a county level sales tax, no such tax exists in South Dakota or Nebraska. Montana has no general sales tax at the state or local level.

affected during construction; and would compensate property owners for any additional damages caused by proposed Project construction. Construction of the proposed Project could lead to short-term impacts to property values due to short-term visual, noise, and land disturbance effects.

Traffic and Transportation

Construction activities would involve the movement of people, equipment, and materials on existing public and private roadways throughout the proposed Project area. Each state has various road construction projects planned or underway. However, because specific construction dates for the proposed Project are unknown, potential conflicts with state construction projects are uncertain.

As discussed in Section 3.10.3.2 (Socioeconomics) of the Final EIS, Keystone would identify and document routes that would be used for moving materials and equipment. After construction of the proposed Project is complete, Keystone would restore the roads to their preconstruction conditions or better. During construction, Keystone and the pipeline contractor would maintain roads used for construction in a condition that is safe for both the public and the workforce.

Construction would require crossing small unpaved roads. Open-cut methods would be used, requiring temporary closure of the road to traffic and use of detours; closures would typically last 1 to 2 days per crossing. Keystone would cross paved roads and railroads by boring beneath the roads, allowing traffic activity to continue. In some cases, construction could increase the demands for permits for oversize or wide vehicles. Some temporary traffic delays would be likely as a result of these movements.

Construction activities could result in short-term impacts to traffic and transportation infrastructure. Traffic volumes along roads proximate to the pipeline route could increase with movements of construction-related employees, equipment, and materials. Bored roadway crossings would reduce or eliminate the need for road closures, although temporary road closures could be required in some cases. Impacts to local traffic would be minor and temporary.

Keystone's construction contractors would be required to submit a road use plan prior to mobilization and to coordinate with the appropriate state and county representatives to develop a mutually acceptable plan. This plan, along with monitoring of road activity related to the proposed Project, would establish measures to reduce or avoid traffic and transportation impacts on local communities.

To mitigate potential impacts, Keystone has committed to implement the procedures included in its Construction, Mitigation, and Reclamation Plan (CMRP) to reduce potential construction and operation impacts on traffic and transportation. As detailed in the CMRP, specific landowner requirements could occasionally supersede the procedures in the CMRP; however, the conditions of applicable federal, state, and local permits would apply in all cases. The CMRP is included in this Supplemental EIS as Appendix G, CMRP.

Keystone has committed to a program that would include inspection of roadways and roadway structures, repair of damage that may occur to those facilities, establishment of an approved Traffic Management Plan, and coordination with state and local transportation agencies. Keystone states that before construction begins, its contractors would develop detailed traffic plans that address all applicable laws, regulations, and ordinances. Keystone states it would take into account minimizing impacts to school bus routes in developing these traffic plans.

4.10.3.2 Operations

Population

Keystone states that there would be an estimated 50 total employees during the operational phase of the proposed Project. Of these, 35 would be permanent employees and 15 would be temporary contractors. These employees would be distributed along the proposed pipeline route through Montana, South Dakota, and Nebraska, except for approximately 10 permanent employees in the Omaha, Nebraska office. Keystone states that contractors would provide additional specialized support for operations. Compared to the pipeline corridor population of approximately 268,000 (Table 3.10-5), the 35 new permanent employees associated with the proposed Project in these states would result in negligible impacts on population.

Housing

The 35 new permanent employees associated with the proposed Project would have a negligible impact on housing in the Project area, which includes approximately 155,000 units and a 9 percent rental unit vacancy rate, equivalent to approximately 3,700 units (see Table 3.10-7).

Local Economic Activity

The largest economic impacts of pipelines occur during construction rather than operations. Once in place, the labor requirements for pipeline operations are relatively small. Keystone states that 35 to 50 jobs, some of which may be located in Canada, would be required for annual operations, including routine inspections, maintenance, and repair (exp Energy Services Inc. 2012). Most of the U.S. jobs would be located along or near the proposed pipeline route. Based on the estimate of 35 to 50 total operational jobs, the employment and earnings impacts in the United States stemming from operations of the proposed Project would be negligible.

The economic effects of potential pipeline spills are beyond the scope of this operations summary. The economic effects of pipeline oil spills historically have included impacts to agriculture, tourism, and a variety of other industries (Skinner and Sweeney 2012). Depending on the size and location of spills, various U.S. firms would be engaged in cleanup and restoration.

Environmental Justice

The Final EIS Section 3.10.1.2 (Operations Impacts, Environmental Justice) discusses the potential effects of the proposed Project on minority and low-income populations. It concluded that it was not likely that proposed Project operation would disproportionately adversely impact such populations during normal operation of the proposed Project.

The Final EIS noted that as a result of the stringent safety and integrity measures incorporated into the design, construction, and operation of the proposed Project, as well as governing Pipeline Hazardous Material Safety Administration pipeline safety regulations, the proposed Project would not likely pose a significant risk to residents along the route, whether in rural or urban areas. It further stated that there was no evidence that such risks would be disproportionately borne by minority or low-income populations. Nonetheless, the Final EIS does state that the community outreach activities described in the environmental justice construction impacts discussion above would also continue throughout the proposed Project

operations. The revised environmental justice analysis in this Supplemental EIS does not change the conclusions in the Final EIS.

Socioeconomic impacts associated with potential releases are discussed in Section 4.13, Potential Releases. The economic effects of such releases historically have included impacts to agriculture, tourism, and a variety of other industries.

Public Services, Tax Revenues, and Property Values

Public Services

The operational workforce in the proposed Project area would comprise approximately 35 employees. This small number would result in negligible impacts on public services based on the law enforcement agencies, fire departments, and medical facilities in the proposed Project area. In addition, there is at least one acute care facility within every county along the proposed pipeline route, or nearby in a neighboring county. Therefore, impacts on public services associated with operation of the proposed Project would be negligible.

Tax Revenues

The largest tax revenue generated by the proposed Project during operations would be property taxes levied on proposed Project facilities by county governments, school districts, and other taxing entities in counties where the facilities are located (i.e., the situs counties). Table 4.10-11 presents estimates of the amount of property taxes that could go to situs counties in the first full year that facilities are fully in place and on the local tax roll. The estimates in the table are the sum total of the property taxes that could be collected by all of the taxing entities in each county, using effective tax rates derived from actual data in 2010. The total estimated property tax from the proposed Project in the first full year of operations would be about $34.5 million, spread across 31 counties in three states.[11] On a per capita basis for all situs counties, this equates to approximately $129.

Table 4.10-11 Estimated Property Tax from Proposed Project in Situs Counties Compared to Total County Property Tax Revenue in 2010 (in thousands of 2010 dollars)[a]

County	Actual Total Property Tax Revenue in 2010 from All Sources	Estimated Property Tax from Proposed Project in First Full Year of Operations	Impact as % of Total Property Tax Revenue in 2010 (rounded to the nearest percentage point)
Montana			
Phillips	$8,062	$545	7%
Valley	$14,706	$1,441	10%
McCone	$3,892	$1,010	26%
Dawson	$13,204	$811	6%
Prairie	$2,613	$353	14%
Fallon	$7,123	$1,975	28%
Total	**$49,602**	**$6,135**	**12%**

[11] See table note regarding the pump stations in Kansas.

County	Actual Total Property Tax Revenue in 2010 from All Sources	Estimated Property Tax from Proposed Project in First Full Year of Operations	Impact as % of Total Property Tax Revenue in 2010 (rounded to the nearest percentage point)
South Dakota			
Harding	$2,731	$3,974	146%
Butte	$9,498	$224	2%
Perkins	$4,468	$918	21%
Meade	$28,166	$3,802	13%
Pennington	$133,409	$104	< 0.1%
Haakon	$3,049	$2,274	75%
Jones	$1,982	$1,466	74%
Lyman	$4,240	$529	12%
Tripp	$7,413	$3,274	44%
Gregory	$5,549	$6	< 1%
Total	**$200,508**	**$16,570**	**8%**
Nebraska			
Keya Paha	$3,170	$436	14%
Boyd	$4,281	$311	7%
Holt	$25,510	$3,050	12%
Antelope	$17,676	$2,341	13%
Boone	$16,562	$943	6%
Nance	$9,021	$969	11%
Merrick	$16,488	$288	2%
Polk	$14,458	$481	3%
York	$27,568	$932	3%
Fillmore	$16,955	$500	3%
Saline	$23,050	$567	2%
Jefferson	$16,698	$993	6%
Total	**$191,442**	**$11,810**	**6%**

Sources: Nebraska Department of Revenue 2012; Montana actual total property tax revenue—Montana Department of Revenue 2010; South Dakota actual total property tax revenue—South Dakota Department of Revenue 2010a and South Dakota Department of Revenue 2010b; Nebraska actual total property tax revenue—Nebraska Department of Revenue 2010.

[a] Property tax estimates in the table for Montana and South Dakota use an estimate of the total valuation of the proposed Project provided by Keystone. Property tax estimates in the table for Nebraska use an estimate of the total valuation of the proposed Project extrapolated from the valuation of the existing Keystone pipeline (Nebraska Department of Revenue 2012). Section 3.10.2.2 of the Final EIS states that Keystone has applied for a property tax exemption in the state of Kansas, so the table omits an estimate of property taxes for two pump stations in Clay and Butler counties in Kansas.

The impact to local property tax revenue receipts would be substantial for many counties. The estimated property tax from the proposed Project in the first full year of operations would range from 6 percent to 28 percent of actual property revenue in 2010 in Montana, from less than 1 percent to 146 percent in South Dakota, and from 2 percent to 14 percent in Nebraska. The proposed Project would generate a property tax revenue impact of 10 percent or more in 16 of 29 situs counties for which there are estimates of expected property taxes.

The estimates in Table 4.10-11 also roughly approximate the property tax amount that could be generated annually by the proposed Project. However, the amount of property tax revenue that the proposed Project could generate in the first year or any subsequent year of operations will likely vary over time because of the many factors that determine how much a pipeline company must pay in local property taxes in any given year. In Nebraska, the amount of property tax revenue that the proposed Project could generate would likely decline year over year because more than 98 percent of the valuation is classified as personal property eligible for annual depreciation allowances.

The spreadsheet models used to estimate property taxes for situs counties in each state reflect the basic characteristics of the property tax system in each state. However, the models necessarily generalize the values and calculations that state and local governments would do to value and tax pipeline property in actual practice.

Property Values

As stated in the Final EIS (Section 3.10 Socioeconomics), long-term impacts could include impacts to property owners if there was any decrease in land value or usefulness as a result of the pipeline. However, tilled agricultural land would still be useable after construction.

Although the permanent ROW would be restored after construction, continued access to the proposed Project ROW would be required to support surface and aerial inspections and any necessary repairs or maintenance for the useful life of the proposed Project. Potential damages to private property during proposed Project operation would likely be concentrated along the permanent ROW and at appurtenant facilities.

The Final EIS (Section 3.10.2.2) discussed the results of a literature search conducted to assess impacts upon residential and agricultural property values associated with similar projects constructed in the recent past. Based on the literature search, the Final EIS stated that residential and agricultural properties located on or adjacent to pipeline easements could have property values worth more or less than comparable nearby properties that were not encumbered by pipeline easements. However, those differences generally were statistically insignificant and the absolute dollars involved were not significant relative to the overall property value and sales prices. The Final EIS concluded it did not appear that operation of the proposed Project would have a major impact on residential and agricultural property values. The analysis in this Supplemental EIS does not change this conclusion.

Traffic and Transportation

Operation of the proposed Project would involve infrequent vehicle trips associated with routine monitoring and maintenance of the Project facilities. These trips would not significantly affect traffic or the capacity of roads in the vicinity of the proposed Project and its ancillary facilities. Permanent access roads constructed as part of the proposed Project would not change traffic patterns on public roads. Operation of the proposed Project would not impact railroads.

4.10.4 Recommended Additional Mitigation

This Supplemental EIS does not recommend additional mitigation for socioeconomic resources.

4.10.5 Connected Actions

Table 4.10-12 presents a summary of construction activities for the connected actions associated with the proposed Project. The estimated total direct construction contracts and materials that would be purchased within the United States for connected actions sums to $499 million, and the actions would require approximately 1,860 construction jobs. As noted in the following sections, the indirect and induced impacts of this spending would be greater. Pipeline operations could not commence until the electrical lines and substations were in place. The Bakken Marketlink Project could not commence until the proposed pipeline was operational.

Table 4.10-12 Selected Characteristics of Connected Actions Construction Activity Occurring Within the United States

Connected Action	State	Construction and Materials Cost (millions of dollars)	Construction Jobs[a]
Bakken Marketlink Project	Montana	$56	20
	Rest of U.S.	$33	200
	Total U.S.	*$89*	*220*
Big Bend to Witten 230-kV Transmission Line	South Dakota	$130	440
	Total U.S.	*$130*	*440*
Electrical Distribution Lines and Substations	Montana	$122	530
	South Dakota	$138	560
	Nebraska	NA[b]	NA[b]
	Kansas	$20	110
	Total U.S.	*$280*	*1,200*
Total (all Connected Actions)	**Total U.S.**	**$499**	**1,860**

[a] Average annual employment including full- and part-time jobs.
[b] Information is not available at this time and will be addressed in greater detail in the Final SEIS.

4.10.5.1 Bakken Marketlink

Limited information is available regarding the location of the facilities in Oklahoma; therefore, the impacts from these facilities are not addressed in this section.

Construction

Population

Construction would take place in Fallon County, Montana (see Section 3.10.3, Connected Actions) and the local construction workforce would consist of approximately 20 workers. Therefore, impacts to the population in Fallon County during construction would be negligible.

Housing

As with population, because of the small demand for local housing during construction, impacts to housing in Montana during construction would be negligible.

Local Economic Activity

Definitions of employment and earnings as well as a description of modeling techniques are the same as described in Section 4.10.3.1, Construction. Assumptions particular to the Bakken Marketlink Project include the following:

- National firms would be awarded construction contracts. Contractors would use local subcontractors and state sources for common goods and services where available. The balance would be obtained from national sources.
- Workforce requirements are based on national output per employee relationships for nonresidential construction in the 2010 IMPLAN® data (MIG, Inc. 2011). Approximately 10 percent of the workforce would come from locations within Montana. The remaining 90 percent of the workforce would come from other U.S. locations outside the state. This

share of the workforce accounts for a unique national labor force that is highly specialized in pipeline and pump station construction techniques.

- Worker compensation would be spent primarily in workers' state of residence.
- Major material purchases (e.g., pipe, pumps, valves, instrumentation) and construction support (e.g. engineering, inspections, and construction management) would be provided primarily by national firms located throughout the United States.

Table 4.10-13 shows the total predicted impacts of the Bakken Marketlink Project on employment in Montana, and the entire United States. It is estimated that a total of 1,000 jobs throughout the United States would be supported by construction of this proposed Project. Of that total, only about 200 jobs, or 20 percent of all jobs from all impacts, would occur in Montana. Jobs in Montana would occur mostly in professional service, construction, and trade industries. Nationally, the same industries would most benefit from these expenditures. Appendix O, Socioeconomics, contains detailed tables.

Table 4.10-13 Total Employment Supported by Construction of the Bakken Marketlink Project (average annual jobs)

	Total Jobs		
	Current (2010)[b]	**Total Effects of Proposed Project[b]**	**Share of 2010 (percent)**
Montana[a]	623,600	200	0.04%
Rest of U.S.	171,008,500	800	<0.04%
Total U.S.	173,767,400	1,000	<0.04%

[a] Excludes jobs held by non-residents of the state as part of a temporary construction workforce.
[b] Includes direct, indirect, and induced full-time and part-time jobs by place of work.

Table 4.10-14 shows the total estimated impacts on earnings for the Bakken Marketlink Project. Impacts on earnings follow a similar pattern as those for employment. For comparability with baseline estimates, these are shown in 2010 dollars. About 17 percent of all earnings, or $10.3 million, would occur in Montana. The remaining 83 percent of all earnings, or $49.1 million, would occur in other locations around the country. These effects would be primarily realized in the construction and professional services industries as well as manufacturers of major materials for the Bakken Marketlink Project.

Table 4.10-14 Total Earnings Supported by Construction of the Bakken Marketlink Project (thousands of 2010 dollars)

	Total Earnings		
	Current (2010)[b]	**Total Effects of Proposed Action[b]**	**Share of 2010 (percent)**
Montana[a]	23,390,300	10,300	0.04%
Rest of U.S.	8,869,710,400	49,100	<0.04%
Total U.S.	8,986,229,000	59,400	<0.04%

[a] Excludes labor earnings by non-residents of the state as part of a temporary construction workforce.
[b] Labor earnings by place of work.

Environmental Justice

Fallon County, Montana contains minority and/or low-income populations meeting the meaningfully greater criteria established in this Supplemental EIS. Also, the county contains HPSAs and MUA/Ps. As with the proposed Project, in addition to avoidance and mitigation measures that Keystone proposes to minimize negative impacts to all populations near construction areas, specific mitigation for environmental justice communities would involve ensuring that adequate communication in the form of public awareness materials regarding the construction schedule and construction activities is provided.

Public Services, Tax Revenues, and Property Values

Public Services

Impacts on public services associated with construction of the Bakken Marketlink Project would be similar to the type of impacts associated with the proposed Project.

Tax Revenues and Property Values

The Bakken Marketlink Project is a large construction project representing a total investment of approximately $90 million in Montana. Montana does not have a sales and use tax to apply to materials purchases. However, the Bakken Marketlink Project could generate revenue in Montana during the construction period from contractor and construction worker spending through specific excise taxes on accommodations, rental vehicles, tobacco products, and alcohol. This analysis does not estimate these revenues because the amounts are likely to be relatively small, the calculations would require many assumptions, and the results would be uncertain.

Temporary impacts during construction of the proposed Bakken Marketlink Project could include isolated impacts on individual property owners from visual, noise, and land disturbance effects in developed areas along the proposed pipeline construction ROW. Less than 0.1 mile of the Bakken Marketlink Project pipeline would cross developed land (see Table 3.9-8). Therefore, any impacts to property values due to temporary visual, noise, and land disturbance effects would be small.

Traffic and Transportation

Impacts on traffic and transportation associated with construction of the Bakken Marketlink Project would be similar to the type of impacts associated with the proposed Project.

Operations

Population and Housing

Based on projected employment for the proposed Project, the Department anticipates that operations employment associated with the Bakken Marketlink Project would be small and would have a negligible impact on population and housing in Montana.

Local Economic Activity

The Department anticipates that operations employment associated with the Bakken Marketlink Project would be small and would have a negligible effect on employment or earnings.

Environmental Justice

As with the proposed Project, operation of the Bakken Marketlink Project is not likely to disproportionately adversely impact minority or low-income populations during normal operation. As with the proposed Project, community outreach activities described in the environmental justice operations impacts discussion above should also continue throughout the proposed Bakken Marketlink Project operations.

Public Services, Tax Revenues, and Property Values

Public Services

As noted above, the Department anticipates that operations employment associated with the Bakken Marketlink Project would be small, and, as a result, would have a negligible impact on public services in Fallon County, Montana.

Tax Revenues and Property Values

It is estimated that approximately $656,000 in property taxes could go to Fallon County, Montana, the pipeline situs county, in the first full year that pipeline facilities of the Bakken Marketlink Project would be in place and on the local tax roll. The estimate is the sum total of the property taxes that could be collected by all of the taxing entities in Fallon County, using the effective tax rates derived from actual data in 2010. This represents a substantial impact to property tax revenue, amounting to about 9 percent of total property tax revenue collected by the county in 2010.

These amounts are also roughly the amount of property tax revenue that could be generated annually by the Bakken Marketlink Project in Montana. However, the actual amount that this connected action could generate in the first year or any subsequent year of operations will likely vary over time from the estimate because of the many factors that determine how much a pipeline company must pay in local property taxes in any given year.

As noted in Section 4.10.3.2, Operations, above, the Final EIS concluded, based on a literature search, that the proposed Project would not have a major impact on residential and agricultural property values during operations. For the same reasons, the Bakken Marketlink Project pipeline would not be expected to have a major impact on residential and agricultural property values during operations.

Traffic and Transportation

Impacts on traffic and transportation associated with operation of the Bakken Marketlink Project would be similar to the type of impacts associated with the proposed Project (see Section 4.10.3.2, Operations).

4.10.5.2 Big Bend to Witten 230-kV Transmission Line

Construction

Population

Construction of the Big Bend to Witten 230-kV transmission line would take place in Lyman and Tripp Counties, South Dakota (see Section 3.10.3, Connected Actions). Tripp County would contain 70 miles (97 percent) of the transmission line, with the remaining 2 miles in Lyman County. The local construction workforce would consist of approximately 440 workers in South Dakota; therefore, impacts to the population in these counties during construction would be negligible.

Housing

As with population, because of the small demand for local housing during construction, impacts to housing in South Dakota during construction would likely be negligible. While Lyman and Tripp counties have limited temporary housing (approximately 800 rooms and RV sites per Table 3.10-7), one of the proposed construction camps would be located in Tripp County and could possibly be available for the Big Bend to Witten 230-kilovolt (kV) transmission line workforce (though the transmission line would not be constructed by Keystone).

Local Economic Activity

Definitions of employment and earnings as well as a description of modeling techniques are the same as described in Section 4.10.3.1, Construction. Assumptions particular to the Big Bend-Witten Transmission Line include the following:

- Local firms would be awarded the construction contracts. Contractors would use local subcontractors and state sources for common goods and services where available. The balance would be obtained from national sources.
- Total costs of the transmission line and substations were estimated using an average of costs for similar lines and substations obtained from several power providers across the United States (see Appendix O, Socioeconomics, for an electrical cost estimate memorandum).
- A recent study of transmission lines by the Montana Department of Labor and Industry (Wagner 2010) was used to establish both the number of direct construction jobs and input requirements.
- Worker compensation was based on national data for nonresidential construction in IMPLAN® (MIG, Inc. 2011). All workers would be residents of South Dakota.

Table 4.10-15 shows the total effects of the Big Bend to Witten 230-kV Transmission Line on employment in South Dakota and the entire United States. A total of 1,100 jobs throughout the United States would be supported by construction of this project. Of these, approximately 800 jobs, or 70 percent of all jobs, would occur in South Dakota. Both nationally and in South Dakota, most employment effects would be realized in the construction and professional services industries. Appendix O, Socioeconomics, contains detailed tables.

Table 4.10-15 Total Employment Supported by Construction of the Big Bend to Witten 230-kV Transmission Line (average annual jobs)

	Total Jobs		
	Current (2010)[b]	Total Effects of Proposed Action[b]	Share of 2010 (percent)
South Dakota[a]	556,500	800	0.14%
Rest of U.S.	173,210,900	300	<0.10%
Total U.S.	173,767,400	1,100	<0.10%

[a] Excludes jobs held by non-residents of the state as part of a temporary construction workforce.
[b] Includes direct, indirect, and induced full-time and part-time jobs by place of work.

Table 4.10-16 shows the total impacts on earnings for the transmission line. Impacts on earnings follow a similar pattern as those for employment. For comparability with baseline estimates, these are shown in 2010 dollars. Nearly 70 percent of all earnings, or $33 million, would occur in South Dakota. The remaining 30 percent of earnings, or $14 million, would occur in other locations around the country. These impacts would be primarily realized in construction and professional services industries.

Table 4.10-16 Total Earnings Supported by Construction of the Big Bend to Witten 230-kV Transmission Line (thousands of 2010 dollars)

	Total Earnings		
	Current (2010)[b]	Total Effects of Proposed Project[b]	Share of 2010 (percent)
South Dakota[a]	22,968,300	33,300	0.14%
Rest of U.S.	8,963,260,700	14,300	<0.10%
Total U.S.	8,986,229,000	47,600	<0.10%

[a] Excludes labor earnings by non-residents of the state as part of a temporary construction workforce.
[b] Labor earnings by place of work.

Environmental Justice

Tripp County contains environmental justice populations and there is potential for impacts to these populations from construction of the Big Bend to Witten 230-kV Transmission Line. Approximately 12 miles of the 72-mile transmission line route would pass through one of the areas with a meaningfully greater American Indian population (Block Group 2, Census Tract 9716). The route would also pass near several American Indian Tribal Subdivisions[12] near the Rosebud and Lower Brule Indian Reservations.

As stated in Section 2.1.12, Connected Actions, the U.S. Department of Agriculture's Rural Utility Service (RUS) is responsible for compliance with NEPA and related statutes for the Big Bend to Witten 230-kV Transmission Line. An Environmental Assessment with scoping is being prepared to assess potential impacts of this action on the human and natural environment. Since the Big Bend to Witten 230-kV Transmission Line would be constructed partly on the Lower Brule Indian Reservation, other cooperating agencies may be identified.

As with the proposed Project, in addition to avoidance and mitigation measures that Keystone proposes to minimize negative impacts to all populations near construction areas, specific mitigation for environmental justice communities for the transmission line would include

[12] American Indian Tribal Subdivisions are divisions of federally recognized American Indian reservations and off-reservation trust land areas.

ensuring that adequate communication in the form of public awareness materials regarding the construction schedule and construction activities is provided.

Public Services, Tax Revenues, and Property Values

Public Services

Impacts on public services associated with construction of the Big Bend to Witten 230-kV Transmission Line would be similar to the type of impacts associated with the proposed Project.

Tax Revenues and Property Values

The Big Bend to Witten 230-kV Transmission Line Project is a large construction project representing a total investment of about $130 million in South Dakota. Tax revenues from construction of the Big Bend to Witten 230-kV Transmission Line are not estimated due to the high number of variables involved. However, the principal taxes that could generate short-term revenues to the state of South Dakota include sales, use, contractors' excise, and fuel taxes that would be assessed on materials, contractor receipts in the state of South Dakota, and contractor and construction worker spending.

Temporary impacts to property values could occur during construction of the transmission line. Impacts could include isolated impacts on individual property owners from visual, noise, and land disturbance effects in developed areas along the power line construction ROW. Approximately 7 miles of the lines required by the Big Bend to Witten 230-kV Transmission Line would cross developed land. Impacts to property values due to temporary visual, noise, and land disturbance effects are possible but would be temporary during construction.

Traffic and Transportation

Stringing of electrical transmission lines would create temporary disruptions of traffic on roads and railroads that these lines cross; however, such disruptions would be temporary.

Operations

Population and Housing

The Department expects that the number of workers needed to operate the Big Bend to Witten 230-kV Transmission Line would be small and would have a negligible impact on population and housing in South Dakota.

Local Economic Activity

The Department expects that the number of workers needed to operate the Big Bend to Witten 230-kV Transmission Line would be small and would have a negligible impact on employment and earnings.

Environmental Justice

As noted above under Construction, Tripp County contains environmental justice populations and there is potential for impacts to these populations from operation of the Big Bend to Witten 230-kV Transmission Line.

Operation of the Big Bend to Witten 230-kV Transmission Line would not likely disproportionately adversely impact minority or low-income populations during normal operation.

Public Services, Tax Revenues, and Property Values

Public Services

As noted above, the Department anticipates that operations employment associated with the transmission line would be small, and, as a result, will have a negligible impact on public services in Fallon County, Montana, and in Lyman and Tripp counties, South Dakota.

Tax Revenues, Property Values

The Big Bend to Witten 230-kV Transmission Line is a large project, representing an investment of approximately $130 million. In South Dakota, the assets of rural electric cooperatives like Basin Electric Power Cooperative (BEPC), the prospective owner of the Big Bend to Witten facilities once they are built, are taxed in two ways. Real property (i.e., land, buildings, and land and ROW leases) are assessed and taxed like other real property in a county. Personal property, which includes all wires, lines transformers, meters, machinery, fixtures, and all attachments and appurtenances, is subject to a two percent gross receipts tax instead of a property tax. In the case of a power line, the taxable value of the real property would likely be very small compared to the value of the personal property, which is exempted from the property tax and taxed instead by the gross receipts method.

This Supplemental EIS does not estimate the amount of revenue from gross receipts taxes the Big Bend to Witten 230-kV Transmission Line project might generate because so many variables are involved that the results would be uncertain. It is likely that a large majority of the revenue would go to Tripp County, South Dakota, which would contain 70 miles (97 percent) of the transmission line, with the remaining 2 miles in Lyman County, South Dakota.

BEPC would pay taxes annually on a completed transmission line for as long as it is in operation. The timing of this potential long-term revenue is uncertain because construction of the transmission line is not associated with the initial operation of the pump stations of the proposed Project. Cooperatives like BEPC file annual reports of gross receipts, tax liability, and the counties due the proceeds. South Dakota law commits the proceeds to the school districts within the situs county.

The Final EIS concluded in Section 3.10.4.1, Power Distribution Lines and Substations, that based on a literature search, the power lines required for the Big Bend to Witten 230-kV Transmission Line would have a minor impact on property values due to the following factors: many of the power line ROWs would be located in rural areas; many of the power lines would be located more than 300 feet from residences; and most properties that would be crossed by power line ROWs are relatively large parcels/tracts.

Traffic and Transportation

Operation of the Big Bend to Witten 230-kV Transmission Line would have no impacts on traffic and transportation.

4.10.5.3 Electrical Distribution Lines and Substations

Construction

Population

Construction of the electrical distribution lines and substations would take place in approximately 21 counties in Montana, South Dakota, Nebraska, and Kansas (see Table 3.10-28). The local construction workforce would consist of approximately 450 workers. Therefore, impacts to the population in these counties during construction would be negligible. Information on the number of construction workers in Nebraska is not available at this time and will be addressed in greater detail in the Final Supplemental EIS.

Housing

As with population, because of the small demand for local housing during construction, impacts to housing in Montana, South Dakota, Nebraska, and Kansas would be negligible.

Local Economic Activity

Definitions of employment and earnings as well as a description of modeling techniques are described in Section 4.10.3.1, Construction. Assumptions particular to the electrical distribution lines and substations include the following:

- Local firms would be awarded the construction contracts. Contractors would use local subcontractors and state sources for common goods and services where available. The balance would be obtained from national sources.
- Total cost of the transmission line and substations were estimated using an average of costs for similar lines and substations obtained from several power providers across the United States (see Appendix O, Socioeconomics, for an electrical cost estimate memorandum).
- A recent study of transmission lines by the Montana Department of Labor and Industry (Wagner 2010) was used to establish both the number of direct construction jobs and input requirements for the distribution lines.
- Worker compensation was based on national data for nonresidential construction in IMPLAN® (MIG, Inc. 2011) All workers would be residents of the state in which the lines or substations are located.
- Data on proposed electrical distribution lines and substations were not available for Nebraska at this time and these impacts will be addressed in greater detail in the Final Supplemental EIS.

Table 4.10-17 shows the total effects of electrical distribution lines and substations on employment by state and by the entire United States. A total of 3,100 jobs throughout the United States would be supported by construction of this power infrastructure. Of that total, about 2,200 jobs or just over 70 percent of all jobs would occur in Montana, South Dakota, and Kansas. Both nationally and in each state, most employment effects would be realized in the construction and professional services industries. Appendix O, Socioeconomics, contains detailed tables.

Table 4.10-17 Total Employment Supported by Construction of Electrical Distribution Lines and Substations (average annual jobs)

	Total Jobs		
	Current (2010)[b]	**Total Effects of Proposed Action[b]**	**Share of 2010 (percent)**
Montana[a]	623,600	1,000	0.20%
South Dakota[a]	556,500	1,000	0.20%
Kansas[a]	1,805,200	200	0.01%
Rest of U.S.	170,782,000	900	< 0.01%
Total U.S.	173,767,400	3,100	< 0.01%

[a] Excludes jobs held by non-residents of the state as part of a temporary construction workforce.
[b] Includes direct, indirect, and induced full-time and part-time jobs by place of work.

Table 4.10-18 shows the total predicted impacts on earnings for electrical distribution lines and substations. Impacts on earnings follow a similar pattern as those for employment. For comparability with baseline estimates, these are shown in 2010 dollars. About two thirds of all earnings, or $91 million, would occur in Montana, South Dakota, and Kansas. The remaining third of earnings, or $46 million, would occur in other locations around the country. These impacts would be primarily realized in construction and professional services industries.

Table 4.10-18 Total Earnings Supported by Construction of Electrical Distribution Lines and Substations (thousands of 2010 dollars)

	Total Earnings		
	Current (2010)[b]	**Total Effects of Proposed Project[b]**	**Share of 2010 (percent)**
Montana[a]	23,390,300	42,500	0.20%
South Dakota[a]	22,968,300	39,900	0.20%
Kansas[a]	81,542,900	8,800	0.01%
Rest of U.S.	8,858,327,500	45,700	< 0.01%
Total U.S.	8,986,229,000	137,000	< 0.01%

[a] Excludes labor earnings by non-residents of the state as part of a temporary construction workforce.
[b] Labor earnings by place of work.

Environmental Justice

Many of the counties with electrical distribution lines and substations contain minority and/or low-income populations. As with the proposed Project, in addition to avoidance and mitigation measures that Keystone proposes to minimize negative impacts to all populations near construction areas, specific mitigation for environmental justice communities for the transmission line would involve ensuring that adequate communication in the form of public awareness materials regarding the construction schedule and construction activities is provided.

Public Services, Tax Revenues, and Property Values

Public Services

Impacts on public services associated with construction of electrical distribution lines and substations would be similar to the type of impacts associated with the proposed Project.

Tax Revenues and Property Values

Construction of the electrical distribution lines is a large project representing a total investment of about $280 million (not counting the lines in Nebraska). During the construction period, it would generate primarily sales/use and fuel taxes levied on goods and services purchased by contractors and construction workers, according to tax laws in each state. These kinds of tax revenue would last only as long as construction was in progress.

Tax revenues from electrical distribution lines and substations construction are not estimated due to the high number of variables involved. However, these are the principal taxes that could generate short-term revenues: specific excise taxes on lodging facilities, accommodations, rental vehicles, cigarettes and other tobacco products, and alcohol in Montana (which does not levy a general sales tax); sales, use, contractors' excise and fuel taxes in South Dakota; sales, use, motor fuels and cigarette taxes in Nebraska; general sales, motor fuel, and cigarette and tobacco products taxes in Kansas.

Temporary impacts to property values could occur during construction of the electrical distribution lines and substations. Impacts could include isolated impacts on individual property owners from visual, noise, and land disturbance effects in developed areas. Such impacts are expected to be small.

Traffic and Transportation

Stringing of electrical distribution lines would create disruptions of traffic on roads and railroads that these lines cross; however, such disruptions would be temporary.

Operations

Population and Housing

The Department expects that the number of workers needed to operate the electrical distribution lines and substations would be small and would have a negligible impact on population and housing in the affected counties.

Local Economic Activity

The Department anticipates that operations employment associated with the electrical distribution lines and substations would be small and would have a negligible effect on employment or earnings.

Environmental Justice

Operation of the electrical distribution lines and substations would not likely disproportionately adversely impact minority or low-income populations during normal operation.

Public Services, Tax Revenues, and Property Values

Public Services

As noted above, the Department anticipates that operations employment associated with electrical distribution lines and substations would be small, and, as a result, would have a negligible impact on public services in the affected counties.

Tax Revenues and Property Values

Local power providers in Montana, South Dakota, Nebraska, and Kansas would build the electrical distribution lines and substations required by the proposed Project. These facilities represent new investment ranging from about $20 million in Kansas to about $138 million in South Dakota. The method of taxing these power lines would differ from state to state, and those in Nebraska likely would be tax-exempt because the owners would be public power districts.

The amount of taxes that the owners of the electrical distribution lines and substations would pay is not estimated because so many variables are involved that the results would be unreliable. However, the applicable tax rules of each of the states involved are summarized as follows:

- Montana—the state of Montana centrally assesses the non-generating property of electric utilities if it crosses county boundaries; state law sets the taxable value at 12 percent of the market value of the transmission line; local entities levy their taxes on the taxable value;
- South Dakota—electric cooperatives, which are non-profits, would own the electrical distribution lines and substations in South Dakota; South Dakota taxes electric cooperatives as described in the previous section, Big Bend to Witten 230-kV Transmission Line;
- Nebraska—several public power districts would own the electrical distribution lines and substations in Nebraska; public power districts are political subdivisions of the state of Nebraska, so their property is tax-exempt; and
- Kansas—a municipal public utility would own one power line in Kansas, so the line would be tax exempt; an investor-owned utility would own the other line, so the state would appraise the property and apportion the value to taxing units, generally in proportion to original cost and miles of line.

Traffic and Transportation

Operation of the electrical distribution lines and substations would have no impacts on traffic and transportation.

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4.11 CULTURAL RESOURCES

4.11.1 Introduction

This section describes potential impacts to cultural resources associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following item have been substantially updated from the 2011 document related to impacts to cultural resources:

- A new section, Section 4.11.2, Impact Assessment Methodology, was added to explain the assessment methodology used to evaluate potential cultural resources impacts associated with the proposed Project.
- An updated description is provided of the cultural resources impacted within the proposed Project. Specific to Nebraska, this section provides new information on cultural resources impacted within the previously unsurveyed, proposed reroute.

The proposed Project might affect cultural resources on or near the pipeline right-of-way (ROW) and in the locations of ancillary facilities (e.g., access roads, pump stations, and construction camps). This section describes the types of potential impacts, types of avoidance, and effect minimization measures, as well as potential mitigation measures for cultural resources. This section also provides a state-by-state breakdown of proposed Project effects to cultural resources and what measures are proposed to avoid, minimize, or mitigate adverse effects, to the extent practicable.

4.11.2 Impact Assessment Methodology

To evaluate the potential impact on cultural resources, it is first necessary to evaluate the significance of the resources. Cultural resources are considered significant, in the context of National Environmental Policy Act and National Historic Preservation Act (NHPA) of 1986 discussions, if they appear to meet the criteria for listing in the National Register of Historic Places (NRHP). These criteria are discussed at length in Section 3.11.2.2, National Register of Historic Places. For each cultural resource identified within the Area of Potential Effect (APE), significance has been measured by applying these criteria. Each resource has been identified as either listed in the NRHP, eligible for NRHP listing, not eligible for NRHP listing, or unevaluated (the latter meaning that further information is required to determine potential NRHP eligibility). An important distinction must be made between sites within the actual footprint of the proposed Project and sites outside the actual construction footprint but within the APE. The APE includes a buffer to allow for minor route modifications, as described in Section 3.11.3.2, Area of Potential Effect, and sites within the APE but outside of the actual construction footprint may not be directly impacted by construction and operation of the proposed Project.

For significant or potentially significant cultural resources (those that are listed in the NRHP, those that are eligible for NRHP listing, and those that are unevaluated[1]), mitigation measures should be taken to avoid or minimize impacts, to the extent practicable. The following are available mitigation measures:

- Avoidance, which could be accomplished by shifting the proposed Project footprint away from the resource, by boring underneath/around the resource, by limiting activities in the vicinity of the resource, by monitoring construction activities near the resource, or by any combination of these techniques.
- Minimization, which would reduce to the extent possible the impact to the resource through avoidance measures as described above, but would not completely avoid the resource. Also, for historic structures, impacts to viewshed could be minimized by reducing the visibility of the proposed Project such as planting of trees as a visual barrier or through fencing.
- Mitigation, which, when impact to a resource could not be avoided, would offset that impact through some means such as protection of a similar resource nearby, detailed documentation of the resource through data recovery excavations in the case of archaeological sites or Historic American Buildings Survey/Historic American Engineering Record documentation in the case of historic structures, contributions to the preservation of cultural heritage in the affected community, interpretative exhibits highlighting information gained about cultural resources through the proposed Project, or some combination of these strategies.

Impacts to cultural resources have been assessed for NRHP-listed, NRHP-eligible, or unevaluated cultural resources by considering how effectively the impact to the resource is avoided, minimized, or mitigated, to the extent practicable.

4.11.3 NRHP Eligibility, Effects, and Mitigation

The U.S. Department of State (the Department), consistent with Section 106 of the NHPA, where appropriate (as codified in Title 36 of the Code of Federal Regulations [CFR] Part 800.5), applies the *criteria of adverse effect* to determine whether a project would affect historic properties. Effects are found when an undertaking changes, directly or indirectly, the characteristics of a historic property that qualify it for inclusion in the NRHP, in a manner that diminishes the historical integrity of the property. Reasonably foreseeable effects caused by the undertaking may occur later in time, be distant, or be cumulative. Federal agencies confer with consulting parties when there are potential adverse effects. The consultation attempts to resolve adverse effects and develop mitigation measures as necessary. For the proposed Project, the following are the principal types of effects that could occur:

- Physical destruction or damage to all or part of the property caused by trenching or related excavations or boring;
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features by short-term construction of the proposed Project or construction and operation of aboveground appurtenant facilities and roads; and

[1] Cultural resources that are considered "unevaluated" have not been sufficiently assessed at this time to finalize an eligibility determination for the NRHP. These sites must either be further assessed through NRHP evaluation procedures or would be treated by the Department as a historic property and avoidance or mitigation plans would be developed.

- Change of the character of the property's use or of physical features within the property's setting that contribute to its significance.

Historic properties under Section 106 of the NHPA are determined eligible by the lead federal agency in consultation with the applicable land managing agency (e.g., the Bureau of Land Management) and the State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO). A Programmatic Agreement (PA) has been prepared in order to provide a process for the Department and the Section 106 consulting parties to implement the avoidance or mitigation of adverse effects on historic properties, to the extent practicable. When the Final EIS route was revised to the proposed Project route, the status of the Final EIS PA was undetermined. The Department is actively consulting with the Final EIS PA signatory agencies and Native American tribes. For those historic properties where avoidance is not possible, a Treatment Plan would be prepared consistent with the stipulations of the PA. Cultural resources that are considered *pending* have not been sufficiently assessed at this time to finalize an eligibility determination for the NRHP. These sites must either be further assessed through NRHP evaluation procedures or would be treated by the Department as a historic property and mitigation plans would be developed.

Avoidance could be achieved by moving the proposed Project corridor or the location of proposed Project facilities. Avoidance could also be achieved by keeping construction activities away from NRHP-eligible properties, limiting the effect to existing demonstrated disturbance areas, or avoiding the cultural resources by boring or horizontal directional drilling.

If the Project could not avoid a particular cultural resource, the Department would consult with the Advisory Council on Historic Preservation, SHPOs, consulting Native American tribes, and other federal and state consulting parties to determine those measures to be implemented by TransCanada Keystone Pipeline, LP (Keystone) to minimize and mitigate adverse effects on affected historic properties identified in the APE. If, after consultation, the Department determines that the adverse effect could not be avoided, Keystone would draft a comprehensive Treatment Plan for each adversely affected historic property. The Treatment Plan would describe the measures to minimize and mitigate the adverse effect of proposed Project construction activities on historic properties, the manner in which these measures would be carried out, and a schedule for their implementation.

Keystone would submit the draft Treatment Plan at least 30 days prior to construction commencing in the area. Keystone would address timely comments and recommendations submitted by the Advisory Council on Historic Preservation, SHPOs, consulting Native American tribes, and other federal and state consulting parties in preparation of the Final Treatment Plan. Once it addressed all of the timely comments and recommendations, Keystone would submit the Final Treatment Plan to the Department for review and approval. Once the Department approves the Final Treatment Plan, mitigation would be conducted prior to construction following the Final Treatment Plan and the protocols outlined in the PA.

4.11.4 Types of Potential Impacts

The potential to impact cultural resources depends on the different stages and the types of development and use of the proposed Project. Discussion of potential impacts during the proposed construction and operations phases follows.

4.11.4.1 Construction

Construction of the proposed pipeline could involve various cultural resources impacts, including the following:

- Possible direct damage to cultural resources within the construction footprint;
- Possible indirect damage to cultural resources through vibrations caused by earthmoving and heavy equipment;
- Temporary loss of community access to cultural resources, such as traditional cultural properties, during construction;
- Potential visual impacts to cultural resources during construction while heavy equipment and numerous personnel are present;
- Increased dust and noise, potentially impacting historic structures or traditional cultural properties near the construction area; and
- Unanticipated discovery of previously unknown cultural resources within the construction footprint.

The duration of the construction phase would affect the degree of cultural resources impact. Indirect potential impacts during proposed construction such as noise, dust, vibrations, heavy equipment traffic, and changes in viewshed would be temporary, and would be expected to last for the duration of construction in specific areas for discrete periods of time.

Given the temporary nature of construction and use of the ancillary facilities, such as pipe and contractor yards, no permanent adverse effects to cultural resources, specifically historic structures, are anticipated. Potential temporary effects could include visual effects from the stacked pipe, noise effects associated with loading and unloading pipe from trucks, dust from the contractor yard surface, and increased truck traffic to and from the contractor yard. The low-rise of stacked pipe and vehicle equipment would have a minimal effect on the viewshed. Noise associated with these ancillary facilities generally would be intermittent and limited to daytime hours, when higher noise thresholds are permitted by federal agencies; therefore, noise was not expected to be significant factor in the development of the APE. Similarly, any increase in traffic, noise, or dust associated with truck traffic, in regards to cultural resources, would be intermittent and temporary, and should be limited.

Direct impacts, such as unanticipated discovery of previously unknown cultural resources during construction, could have a permanent impact on that resource. The various components of the proposed Project under construction would not have appreciably different potential cultural resources impacts.

4.11.4.2 Operations

During operation of the proposed Project, only previously disturbed areas would be expected to require periodic disturbance; therefore, the potential for additional direct impacts to cultural resources would be very limited.

Indirect impacts during operations could consist of a permanent change in viewshed to historic structures near permanent ancillary facilities, such as pump stations and mainline valves, and a periodic increase in noise, vibration, and dust created by pump stations or vehicular traffic

conducting operation and maintenance activities. Given the nature, location, and setting of permanent ancillary facilities, however, these facilities are unlikely to visually impact the setting and feeling of historic structures, due to their distance, their low-lying nature, and the various vegetative and topographic elements of the landscape in such areas. Similarly, periodic increase in noise, vibration, and dust created by ancillary facilities or vehicular traffic conducting operation and maintenance activities would not be expected to cause any adverse effects to such cultural resources.

4.11.5 Potential Impacts to Identified Cultural Resources

The proposed Project route was designed to avoid disturbing historic properties to the maximum extent possible. Since significance for cultural resources is determined by a resource's eligibility for inclusion in the NRHP, cultural resources that have been determined not eligible, and thereby not "historic properties," are not evaluated for proposed Project impacts. Additionally, the NRHP status of some cultural resources remains undetermined, and surveying in much of the proposed Project area is ongoing. For all cultural resources listed in the NRHP, considered to be eligible for the listing in the NRHP, or those that are unevaluated, avoidance would continue to be the preferred mitigation strategy. To mitigate potential impacts, Keystone has committed, whenever feasible, to avoid known cultural resources, minimize impacts when avoidance is not possible, and mitigate impacts when minimization is not sufficient. In addition, the proposed Project plans to implement Unanticipated Discovery Plans, to ensure minimization of impacts to unknown cultural resources that may be inadvertently encountered during construction or operation of the Project.

As outlined in Section 3.11, Cultural Resources, as of October 2012, 403 cultural resources have been identified within the proposed Project APE. After route modifications due to consultations with federal and state agencies, engineering refinements, and landowner discussions, 246 identified cultural resources are reported to be located within the APE but outside of the actual proposed construction footprint; these would not be directly impacted by construction and operation of the proposed Project. Of the 403 identified cultural resources, 157 are reported to be located within the actual proposed Project construction footprint and are the basis of the discussions concerning potential impacts below. The specific actions proposed for individual known sites are described in the following state-specific sections and tables.

4.11.5.1 Montana

As of October 2012, of the 148 cultural resources identified in the Montana Project APE, 70 cultural resources have been identified within the actual proposed Project construction footprint in Montana. Of these 70 cultural resources, 10 are recorded as eligible for inclusion in the NRHP and 38 are unevaluated. Avoidance is recommended for all eligible and unevaluated sites, to the extent practicable. By avoiding these sites, the proposed Project would have no effect on these historic properties. The remaining 22 cultural resources are recorded as not eligible for inclusion in the NRHP and impacts are not considered here. Of the 48 cultural resources that are recorded as eligible for inclusion in the NRHP, or are unevaluated, the proposed Project would have no effect on 37 cultural resources due to avoidance by route modification, narrowing of the ROW, boring, fencing/restricted access, or another approved avoidance method. Eleven sites are still pending further analysis and review and may be eligible for inclusion in the NRHP. The Department will continue to consult with state and federal agencies and Native American tribes

about the significance of the sites and would work to avoid to the extent practicable adverse effects to the resources. If impacts to sites could not be avoided, further evaluation of their NRHP eligibility may not be required. The recommendations of eligibility by Keystone's consultants, determinations of eligibility by the Department, recommended mitigation actions by Keystone, and concurrences from SHPO are shown in Table 4.11-1.

Table 4.11-1 Cultural Resources within the Project Construction Footprint of Montana

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Determination by Department	Action Recommended by Applicant	Montana SHPO/ THPO Concurrence with Department Findings
C57DA001	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C57DA008	Historic isolate	Not Eligible	Not Eligible	No Further Work	Concur
C277DA002	Precontact isolate	Not Eligible	Pending	No Further Work	Pending
24DE0555	Historic berm	Not Eligible	Pending	No Further Work	Pending
24DW0289 (five segments)	Previously recorded Historic canal	Eligible	Eligible	Avoidance with bore	Pending
24DW0419 (two segments)	Previously recorded Historic railroad	Eligible	Eligible	Avoidance with bore	Pending
24DW0426 (four segments)	Previously recorded Historic railroad	Eligible	Eligible	Avoidance with bore	Pending
24DW0524	Historic transportation corridor	Not Eligible	Not Eligible	No Further Work	Concur
24DW0530	Historic homestead	Not Eligible	Not Eligible	No Further Work	Concur
24DW0531	Historic homestead	Not Eligible	Not Eligible	Avoidance	Concur
24DW055*	Pending	Not Eligible	Pending	No Further Work	Pending
24DW0553	Historic road	Not Eligible	Not Eligible	No Further Work	Concur
C711DW001	Pending	Unevaluated	Pending	Pending	Pending
C711DW005	Pending	Unevaluated	Pending	Pending	Pending
C711DW006	Pending	Unevaluated	Pending	Pending	Pending
24FA0382	Previously recorded Historic railroad	Eligible	Eligible	Avoidance with bore	Pending
24FA0750	Precontact lithic scatter and possible pronghorn processing locale	Unevaluated	Pending	Avoidance	Pending
24FA0751	Historic debris scatter	Not Eligible	Not Eligible	No Further Work	Concur

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Determination by Department	Action Recommended by Applicant	Montana SHPO/ THPO Concurrence with Department Findings
24FA076*	Pending	Not Eligible	Pending	No Further Work	Pending
C58FA001	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C58FA004	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C711FA001	Pending	Unevaluated	Pending	Pending	Pending
24MC0485	Precontact open camp	Eligible	Pending	Avoidance, fence, and monitor	Pending
24MC0486	Precontact open camp	Eligible	Pending	Avoidance, fence, and monitor	Pending
24MC0628	Historic farmstead	Unevaluated	Pending	Artifact movement, fence, and monitor	Pending
C001MC003	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C54MC001	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C56MC007	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C277MC001	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Pending
C700MC001	Pending	Unevaluated	Pending	Pending	Pending
C711MC002	Precontact isolate	Unevaluated	Pending	Pending	Pending
C711MC003	Pending	Unevaluated	Pending	Pending	Pending
24PE0723	Historic ranch complex	Unevaluated	Pending	Avoidance, fence, and monitor	Pending
24PH0037	Previously recorded undated stone cairn and depression	Potentially Eligible	Pending	Avoidance	Pending
24PH1805	Previously recorded Historic homestead	Unevaluated	Pending	Avoidance, fence, and monitor	Pending
24PH4267	Historic farmstead	Eligible	Eligible	Avoidance, fence, and monitor	Concur
24PH4372	Precontact stone feature	Potentially Eligible	Pending	Avoidance	Pending
C001PR002	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C54VA008	Historic isolate	Not Eligible	Not Eligible	No Further Work	Concur

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Determination by Department	Action Recommended by Applicant	Montana SHPO/ THPO Concurrence with Department Findings
C55VA013	Precontact isolate	Not Eligible	Not Eligible	No Further Work	Concur
C512VA002	Historic Isolate	Not Eligible	Pending	No Further Work	Pending
C711VA004	Pending	Unevaluated	Pending	Pending	Pending
C711VA008	Precontact isolate	Unevaluated	Pending	Pending	Pending
C711VA010	Pending	Unevaluated	Pending	Pending	Pending
C711VA014	Pending	Unevaluated	Pending	Pending	Pending
24VL0099 (nine segments)	Previously recorded historic railroad	Eligible, contributing segment	Eligible	Avoidance with bore	Pending
24VL0938	Previously recorded precontact stone circle	Unevaluated	Pending	Avoidance	Pending
24VL0962	Previously recorded precontact /historic stone feature site, lithic scatter, historic artifact scatter	Potentially Eligible	Pending	Avoidance	Pending
24VL0972	Previously recorded precontact /historic stone circle and cairn, historic fence line	Potentially Eligible	Pending	Avoidance	Pending
24VL0979	Historic homestead	Eligible	Eligible	Avoidance	Concur
24VL1194	Previously recorded historic canal	Eligible	Eligible	Avoidance with bore	Concur
24VL1269/ 24VL1274	Previously recorded precontact stone circle	Potentially Eligible	Pending	Avoidance	Pending
24VL1628 (two segments)	Previously recorded historic railroad	Eligible, Non-contributing segment	Eligible	No Further Work	Concur
24VL1889	Historic canal	Not Eligible	Not Eligible	Avoidance	Concur
24VL1890	Historic artifact scatter	Not Eligible	Not Eligible	No Further Work	Concur
24VL1892	Historic artifact scatter	Not Eligible	Not Eligible	No Further Work	Concur
24VL1901	Historic fence line and associated debris	Not Eligible	Not Eligible	No Further Work	Concur
24VL1919	Precontact stone circle	Potentially Eligible	Pending	Avoidance	Pending
24VL1933	Precontact stone circle	Potentially Eligible	Pending	Avoidance, fence, and monitor	Pending

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Determination by Department	Action Recommended by Applicant	Montana SHPO/ THPO Concurrence with Department Findings
24VL1936	Precontact stone feature	Potentially Eligible	Pending	Avoidance, fence, and monitor	Pending
24VL1938	Historic ranch complex	Unevaluated	Pending	Avoidance	Pending
24VL1940	Historic farmstead	Unevaluated	Pending	Avoidance	Pending
24VL1942	Historic artifact scatter/precontact stone circle	Potentially Eligible	Pending	Avoidance	Pending
24VL1965	Precontact stone circle	Unevaluated	Pending	Avoidance	Pending
24VL1968	Precontact stone circle	Unevaluated	Pending	Avoidance	Pending
24VL1969	Historic stone alignment	Not Eligible	Not Eligible	Avoidance	Concur
24VL1972	Historic ditch	Not Eligible	Not Eligible	No Further Work	Concur
24VL1985	Historic road grade	Not Eligible	Pending	No Further Work	Pending
24VL1991	Saint Marie/ Glasgow Air Force Base	Eligible	Pending	Avoidance, fence, and monitor	Pending
Lewis and Clark National Historic Trail	Historic trail	Eligible	Eligible	Avoidance, monitor	Pending

Additional cultural resources surveys in Montana for the proposed Project corridor and access roads are ongoing. These reports will be reviewed by the Department and then forwarded to the applicable consulting parties consistent with 36 CFR 800. NRHP assessments and any resulting avoidance or mitigation plans will be reviewed by the Department and the consulting parties to evaluate the submitted information, following the protocols outlined in the PA developed for the proposed Project.

4.11.5.2 South Dakota

As of October 2012, of the 137 cultural resources identified in the South Dakota Project APE, 40 cultural resources have been identified within the actual proposed Project construction footprint in South Dakota. Of these 40 cultural resources, one is recorded as eligible for inclusion in the NRHP and 20 are unevaluated. Avoidance is recommended for all eligible and unevaluated sites, to the extent practicable. By avoiding these sites, the proposed Project would have no effect on these historic properties. The remaining 19 cultural resources are recorded as not eligible for inclusion in the NRHP and impacts are not considered here. Of the 21 cultural resources that are recorded as eligible for inclusion in the NRHP or are unevaluated, the proposed Project would have no effect on three cultural resources due to avoidance by route modification or boring. Eighteen sites are still pending further analysis and review and may be

eligible for inclusion in the NRHP. The Department will continue to consult with state and federal agencies and Native American tribes about the significance of the sites and would work to avoid to the extent practicable adverse effects to the resources. If impacts to sites could not be avoided, further evaluation of their NRHP eligibility may not be required.

The recommendations of eligibility by Keystone's consultants, determinations of eligibility by the Department, recommended mitigation actions by Keystone, and concurrences from SHPO are shown in Table 4.11-2.

Table 4.11-2 Cultural Resources within the Project Construction Footprint of South Dakota

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Determination by Department	Action Recommended by Applicant	South Dakota SHPO/THPO Concurrence with Department Finding
C710HA001	Historic can scatter	Unevaluated	Pending	Pending	Pending
C710HA003	Precontact isolate	Unevaluated	Pending	Pending	Pending
C710HA004	Precontact isolate	Unevaluated	Pending	Pending	Pending
C710HA005	Precontact site	Unevaluated	Pending	Pending	Pending
C710HA009	Precontact site	Unevaluated	Pending	Pending	Pending
C710HA010	European-American rock art	Unevaluated	Pending	Pending	Pending
C710HA011	Historic irrigation system	Unevaluated	Pending	Pending	Pending
C710HA013	Pending	Unevaluated	Pending	Pending	Pending
C710HA014	Precontact isolate	Unevaluated	Pending	Pending	Pending
C710HA015	Fire-cracked rock	Unevaluated	Pending	Pending	Pending
C710HA016	Precontact isolate	Unevaluated	Pending	Pending	Pending
39HK0144	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39HK2257	Historic road and artifact scatter	Not Eligible	Pending	No further work	Pending
39HN003	Homestead	Unevaluated	Pending	Avoidance	Pending
39HN1082	Precontact isolate	Not Eligible	Not Eligible	No further work	Concur
39HN1129	Precontact isolate	Not Eligible	Not Eligible	No further work	Concur
39HN1134	Historic rock art	Not Eligible	Not Eligible	No further work	Concur

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Determination by Department	Action Recommended by Applicant	South Dakota SHPO/THPO Concurrence with Department Finding
39HN1143	Precontact isolate	Not Eligible	Not Eligible	No further work	Pending
39HN1145	Precontact isolate	Not Eligible	Not Eligible	No further work	Pending
39HN1157	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39HN1158	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39HN1159	Precontact isolate	Not Eligible	Not Eligible	No further work	Concur
39HN1160	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39HN1174	Precontact isolate	Not Eligible	Pending	No further work	Pending
39JN0052	Historic trash dump	Not Eligible	Not Eligible	No further work	Concur
39JN0064	Historic artifact scatter	Not Eligible	Pending	No further work	Pending
39JN2007	Previously recorded historic railroad	Eligible	Eligible	Avoidance by bore	Concur
C710JO001	Pending	Unevaluated	Pending	Pending	Pending
39LM009	Historic farmstead	Unevaluated	Pending	Avoidance	Pending
39MD000*	Pending	Unevaluated	Pending	Pending	Pending
39MD0894	Historic trash dump	Not Eligible	Pending	No further work	Pending
39PE0399	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39PE0405	Precontact isolate	Not Eligible	Not Eligible	No further work	Concur
39PE0406	Historic depression and glass scatter	Not Eligible	Not Eligible	No further work	Concur
C710PE001	Precontact site	Unevaluated	Pending	Pending	Pending
39TP0056	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39TP0059	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39TP0060	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39TP0061	Historic isolate	Not Eligible	Not Eligible	No further work	Concur
39TP0062	Precontact isolate	Not Eligible	Not Eligible	No further work	Concur

Additional cultural resources surveys in South Dakota for the proposed Project corridor and access roads are ongoing. These reports will be reviewed by the Department and then forwarded to the applicable consulting parties consistent with 36 CFR 800. NRHP assessments and any resulting avoidance or mitigation plans will be reviewed by the Department and the consulting parties to evaluate the submitted information, following the protocols outlined in the PA developed for the proposed Project.

4.11.5.3 Nebraska

As of October 2012, of the 118 cultural resources identified in the Nebraska Project APE, 47 cultural resources have been identified within the actual proposed Project construction footprint in Nebraska. Of these 47 cultural resources, none are eligible for inclusion in the NRHP and seven are unevaluated. Avoidance is recommended for all unevaluated sites, to the extent practicable. By avoiding these sites, the proposed Project would have no effect on these historic properties. The remaining 40 cultural resources are recorded as not eligible for inclusion in the NRHP and impacts are not considered here. Of the seven cultural resources that are unevaluated, the proposed Project would have no effect on all seven cultural resources due to avoidance by route modification or an approved mitigation measure. The Department will continue to consult with state and federal agencies and Native American tribes about the significance of the sites and would work to avoid to the extent practicable adverse effects to the resources. If impacts to sites could not be avoided, further evaluation of their NRHP eligibility may not be required. The recommendations of eligibility by Keystone's consultants, determinations of eligibility by the Department, recommended mitigation actions by Keystone, and concurrences from SHPO are shown in Table 4.11-3.

Table 4.11-3 Cultural Resources within the Project Construction Footprint of Nebraska

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Eligibility Determination by Department	Action Recommended by Applicant	Nebraska SHPO/THPO Concurrence with Department Finding
25AP74	Precontact limited activity site	Not Eligible	Pending	No further work	Pending
25AP75	Historic farmstead; precontact isolate	Not Eligible	Pending	No further work	Pending
25AP78	Historic dump	Not Eligible	Pending	No further work	Pending
25AP79	Historic farmstead with outbuilding	Not Eligible	Pending	No further work	Pending
25AP83	Historic farmstead	Not Eligible	Pending	No further work	Pending
25AP84	Historic dump	Not Eligible	Pending	No further work	Pending
25AP88	Precontact field camp	Not Eligible	Pending	No further work	Pending

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Eligibility Determination by Department	Action Recommended by Applicant	Nebraska SHPO/THPO Concurrence with Department Finding
25AP89	Precontact camp; unidentified historic	Potentially Eligible	Pending	Avoidance or Evaluative Testing	Pending
25AP90	Historic dump	Not Eligible	Pending	No further work	Pending
25AP93	Historic farmstead	Not Eligible	Pending	No further work	Pending
25AP94	Historic farmstead	Potentially Eligible	Pending	Avoidance or Evaluative Testing	Pending
25BO60	Historic farmstead	Not Eligible	Pending	No further work	Pending
25BO61	Historic farmstead	Potentially Eligible	Pending	Avoidance or Evaluative Testing	Pending
25BO63	Historic farmstead	Not Eligible	Pending	No further work	Pending
25BO64	Historic farmstead	Not Eligible	Pending	No further work	Pending
25BO65	Historic farmstead	Not Eligible	Pending	No further work	Pending
25BO67	Historic farmstead	Not Eligible	Pending	No further work	Pending
25FM23	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25FM24	Active railroad	Not Eligible	Not Eligible	No further work	Concur
25FM27	Precontact limited activity site	Not Eligible	Not Eligible	No further work	Concur
25HT62	Historic farmstead with outbuilding	Not Eligible	Pending	No further work	Pending
25JF45	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25JF46	Active railroad	Not Eligible	Not Eligible	No further work	Concur
25JF47	Historic railroad bed	Not Eligible	Not Eligible	No further work	Concur
25JF48	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25JF49	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25JF50	Historic railroad bed	Not Eligible	Not Eligible	No further work	Concur
25SA87	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25SA89	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25SA90	Historic farmstead	Not Eligible	Pending	Pending	Pending

Site #	Description	NRHP Eligibility Recommendation from Applicant	NRHP Eligibility Determination by Department	Action Recommended by Applicant	Nebraska SHPO/THPO Concurrence with Department Finding
25YK20	Historic railroad	Not Eligible	Not Eligible	No further work	Concur
25YK24	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25YK25	Historic railroad bed	Not Eligible	Not Eligible	No further work	Concur
25YK28	Precontact field camp	Not Eligible	Not Eligible	No further work	Concur
25YK30	Historic farm outbuilding/ activity area	Not Eligible	Not Eligible	No further work	Concur
25YK31	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
25YK33	Historic farmstead	Not Eligible	Not Eligible	No further work	Concur
C501BO003	Historic trail	Not Eligible	Pending	No further work	Pending
C502AT005FS	Precontact isolate	Not Eligible	Pending	No further work	Pending
C502NA005FS	Historic isolate	Not Eligible	Pending	No further work	Pending
C502NA017	Historic artifacts	Not Eligible	Pending	No further work	Pending
C504AT005FS	Precontact isolate	Not Eligible	Pending	No further work	Pending
C504AT007AT	Historic trail	Not Eligible	Pending	No further work	Pending
California National Historic Trail	Historic trail	Unevaluated	Pending	Avoidance, Monitor	Pending
Mormon National Historic Trails	Historic trail	Unevaluated	Pending	Avoidance, Monitor	Pending
Oregon National Historic Trail	Historic trail	Unevaluated	Pending	Avoidance, Monitor	Pending
Pony Express National Historic Trail	Historic trail	Unevaluated	Pending	Avoidance, Monitor	Pending

Additional cultural resources surveys in Nebraska for the proposed Project corridor and access roads are ongoing. These reports will be reviewed by the Department and then forwarded to the applicable consulting parties consistent with 36 CFR 800. NRHP assessments and any resulting avoidance or mitigation plans will be reviewed by the Department and the consulting parties to evaluate the submitted information, following the protocols outlined in the PA developed for the proposed Project.

4.11.5.4 North Dakota

No historic properties have been identified within the construction footprint of the ancillary facility in North Dakota. If additional workspaces are required in North Dakota, cultural resources surveys would be required and resulting reports would be reviewed by the Department and then forwarded to the applicable consulting parties consistent with 36 CFR 800. NRHP assessments and any resulting avoidance or mitigation plans would be reviewed by the Department and the consulting parties to evaluate the submitted information, following the protocols outlined in the PA developed for the proposed Project.

4.11.5.5 Kansas

No historic properties have been identified within the construction footprint of the pump stations in Kansas. If additional workspaces are required in Kansas, cultural resources surveys would be required and resulting reports would be reviewed by the Department and then forwarded to the applicable consulting parties consistent with 36 CFR 800. NRHP assessments and any resulting avoidance or mitigation plans would be reviewed by the Department and the consulting parties to evaluate the submitted information, following the protocols outlined in the PA developed for the proposed Project.

4.11.6 Recommended Additional Mitigation

Should any unanticipated discoveries of cultural resources be made during construction or operation of the proposed Project, the terms of the Unanticipated Discovery Plans should be followed. Should a cultural resource discovered in this fashion appear to be significant, appropriate additional mitigation measures would be considered, as feasible and appropriate, consistent with the terms of the PA once finalized.

4.11.7 Connected Actions

4.11.7.1 Bakken Marketlink Project

A cultural resources survey of the proposed Bakken Marketlink Project in Montana has been completed. Additionally, due to previous disturbance, no cultural resources survey was needed for the proposed Bakken Marketlink Project in Oklahoma. The authorization and permit applications for this proposed connected action would be reviewed and acted on by other federal and state agencies. Potential impacts to cultural resources from the proposed Bakken Marketlink Project would be evaluated and avoided, minimized, or mitigated, to the extent practicable, in accordance with applicable regulations during the environmental review for this proposed connected action

4.11.7.2 Big Bend to Witten 230-kV Transmission Line

Cultural resources surveys for the proposed Big Bend to Witten 230-kV Transmission Line Project have yet to be performed. The authorization and permit applications for this proposed connected action will be reviewed and acted on by RUS, as lead federal agency, and other federal and state agencies. Those agencies may conduct more detailed cultural resources reviews of this proposed connected action. The potential impacts associated with the proposed Big Bend to Witten 230-kV Transmission Line Project are likely to be similar to those for the proposed

Project pump station and pipeline construction ROW near this area. Potential impacts to cultural resources from this proposed connected action would be evaluated and avoided, minimized, or mitigated, to the extent practicable, in accordance with applicable regulations during the environmental review for this proposed connected action. Additionally, RUS would lead the effort for the potential development of a separate PA between RUS; BLM; USACE; Lower Brule Sioux Tribe of the Lower Brule Reservation, South Dakota; and the project applicant, Basin Electric Power Cooperative. This would ensure that identification, evaluation, and mitigation of historic properties would occur prior to construction of these connected actions.

4.11.7.3 Electrical Distribution Lines and Substations

Cultural resources surveys for electrical distribution lines and substations have not been performed. The authorization and permit applications for this proposed connected action may be reviewed and acted on by RUS and other federal and state agencies, as appropriate. Those agencies may conduct more detailed cultural resources reviews of this proposed connected action. The potential impacts associated with the proposed electrical distribution line and substations are likely to be similar to those for the proposed Project pump station and pipeline construction ROW near this area. The authorization and permit applications for this proposed connected action would be reviewed and acted on by other federal and state agencies. Those agencies may conduct more detailed cultural resources reviews of the proposed electrical distribution line and substations. Potential impacts to cultural resources from the proposed electrical distribution line and substations would be evaluated and avoided, minimized, or mitigated, to the extent practicable, in accordance with applicable regulations during the environmental review for this proposed connected action.

4.12 AIR QUALITY AND NOISE

4.12.1 Introduction

This section describes potential impacts to air quality and noise resources associated with the construction and operation of the proposed Project and connected actions and discuss potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to impacts to air quality and noise resources:

- A new section (Section 4.12.2, Impact Assessment Methodology) was added to explain the assessment methodology used to evaluate potential air quality and noise impacts associated with the proposed Project;
- Revised air emission calculations (criteria pollutants, hazardous air pollutants and greenhouse gases [GHGs]) were performed for 10 construction spreads; the revised emissions reflect changes in Nebraska due to changes in the proposed Project route and account for the increased number of construction camps and emergency back-up generators within the proposed pipeline corridor;
- An air conformity analysis was not done for this Supplemental Environmental Impact Statement (Supplemental EIS) since the proposed Project would be located entirely within an attainment area and, as a result, this type of analysis is not applicable;
- Additional pump station noise data input such as number of pumps per station, pump size (horsepower), sound power levels of each pump, and closest receptor to each pump station were used to supplement previous information to allow for a more detailed and accurate assessment of noise impacts; and
- Section 4.12.4, Recommended Additional Mitigation, provides a list of additional mitigation measures to further reduce impacts to air quality and noise.

4.12.2 Impact Assessment Methodology

4.12.2.1 Air Quality

Air quality impacts associated with the proposed Project construction would include fugitive dust and emissions from fossil-fuel-fired construction equipment, open burning (if required and subject to local regulation), and temporary fuel transfer systems and associated storage tanks. During proposed Project operations, air quality impacts would mainly be fugitive volatile organic compound (VOC) and methane emissions from intermittent mainline valves along the proposed pipeline route and from valves, pumps, flanges, and connectors at the pump stations.

The ambient air impact assessment presents emissions of criteria pollutants, hazardous air pollutants (HAPs), and GHGs from sources within the boundary of the proposed Project and as a result of the proposed Project's activities. The GHG assessment is focused on Scope 1 direct emissions and Scope 2 indirect emissions (i.e., electricity consumption).

Air emissions generated on site (direct emissions) were calculated from activity data and emission factors associated with proposed Project construction and operations. Some of the activity data used in the calculations include area disturbed; tons of slash material burned (hay/grass, tree tops/ shrub); fuel use; equipment horsepower (hp); hours of operation; vehicle miles traveled; and number of valves, pumps, and flanges and connectors. Some inputs were estimated based on best available information where necessary data were unavailable. The proposed Project activity data used in the calculations were taken from sources including the Final EIS, the Supplemental Environmental Report for the Nebraska Reroute (exp Energy Services Inc. [exp Energy] 2012a), and the Environmental Report (exp Energy 2012b). As indicated above, the proposed Project also accounts for indirect GHG emissions from electricity produced off site (from a grid) to power the pump stations. Commissioning of the pipeline pumps and other infrastructures were accounted for in the operations phase.

Estimation of fugitive dust, VOCs, and methane emissions; open burning; and combustion emissions (e.g., construction camp generators, heavy construction equipment and vehicles) during proposed Project construction and operations involved the use of best available emission estimation techniques and factors for each activity/source, including Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (U.S. Environmental Protection Agency [USEPA] 2010a); Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling for Compression Ignition (USEPA 2010b) and Spark-Ignition Engines (USEPA 2010c); USEPA's AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.1, Paved Roads (USEPA 2011) and 13.2.3, Heavy Construction Operations (USEPA 1995); USEPA's Preparation of Fine Particulate Emissions Inventories, Student Manual, Air Pollution Training Institute Course 419B (USEPA 2004); air pollutant emissions associated with forest, grassland, and agricultural burning in Texas (Fraser et al. 2002); The Climate Registry (TCR) Reporting Protocol, version 1.1 (TCR 2008); and the Texas Commission on Environmental Quality (TCEQ) Equipment Leak Fugitives document (TCEQ 2008).

The analysis in this section of emissions from the proposed Project does not include emissions associated with the extraction of heavy crude in Alberta, Canada, the transport of crude via pipeline in Canada (and associated pump stations and other aboveground facilities in Canada), or the processing and refining of crude transported by the proposed Project. Information and analysis related to these activities are discussed in Section 4.15.3, Cumulative Impacts by Resource.

This analysis also does not include detailed data regarding emissions associated with backup emergency generators at the mainline valve (MLV) stations, on-site fueling of construction vehicles, and use of maintenance vehicles and aircraft for land-based and aerial inspection of the proposed pipeline route as these are expected to be minor. For example, the backup generators would only operate during upset conditions when commercial power is interrupted. The use of maintenance vehicles and aircraft during proposed Project operations would be infrequent.[1]

[1] Aerial inspection of the pipeline would be done approximately 26 times per year (every 2 weeks) and MLVs would be inspected at least twice per year (see Section 2.1.11.1, Normal Operations and Routine Maintenance).

Estimated air emissions from proposed Project construction and operation (i.e., criteria pollutants, HAPs, and GHGs) were compared to federal and state regulatory requirements (Section 3.12.2.2, Regulatory Requirements) to determine applicability and impacts.

4.12.2.2 Noise

Noise impacts associated with the proposed Project construction include noise from operation of heavy construction equipment, blasting, and horizontal directional drilling (HDD) activities. During proposed Project operations, noise impacts would include noise from operation of the pump stations. Noise impact on wildlife is discussed in Section 4.6, Wildlife.

The noise impact assessment for the proposed Project assesses impacts at the closest potential receptors to the proposed pipeline corridor and pump stations (e.g., residences, cabins, mobile homes). Noise impact on other receptors such as national historic trails and national scenic rivers were also assessed. Proposed Project noise levels were calculated from typical sound pressure level data at a reference distance from construction activities and pump station operations. The representative sound pressure level at 3.28 feet (1 meter) from a pump station assumes a maximum of five pumps would be operating simultaneously at each pump station and each 6,500 hp (4,847 kilowatts [kW]) electric pump is expected to have a sound pressure level of approximately 100 decibels on the A-weighted scale (dBA) at 3.28 feet.

The estimated sound pressure level was estimated as a function of pump power using the formula 89 dBA + 3LogkW for pumps greater than 75 kW and speeds ranging from 1,600 to 1,800 revolutions per minute (Bies and Hansen 2009). Sound-pressure levels for the five pumps were combined logarithmically to give a total of 107 dBA at 3.28 feet. During proposed Project operations, pump station sound pressure levels that would be experienced at closest receptors were estimated using hemispherical attenuation calculations, which assumes a typical 6-decibel reduction per doubling of distance from noise sources. Estimated noise levels from proposed Project construction and operation plus existing/ background noise levels were compared to applicable regulatory guidelines (see Section 3.12.3.2 Regulatory Requirements) to determine impacts.

4.12.3 Potential Impacts

4.12.3.1 Air Quality

Criteria pollutant and HAP emissions that would arise from the construction and operation of the proposed Project are quantified and summarized below.

Construction Impacts

Air quality impacts (criteria pollutants and HAPs) associated with construction of the proposed Project would include fugitive dust and emissions from fossil-fuel-fired construction equipment, open burning, and temporary fuel transfer systems and associated storage tanks.

Fugitive Dust

Fugitive dust is a source of respirable airborne particulate matter (PM), including PM with diameter of 10 microns or less (PM_{10}) and PM with a diameter of 2.5 microns or less ($PM_{2.5}$). Fugitive dust results from land clearing, grading, excavation, concrete work, blasting and

dynamiting, and vehicle traffic (including construction camp traffic) on paved and unpaved roads. The amount of dust generated is related to the type and duration of construction activities, silt, and moisture content of the soil, wind speed, frequency of precipitation, vehicle traffic, vehicle types, and roadway characteristics. Fugitive dust generation would be greater in fine-textured soils during drier summer and autumn months.

State and local agencies also regulate emissions of particulate matter arising from fugitive dust. Typically, the regulations require measures to prevent particulates from becoming airborne, such as application of dust suppressants. Specific requirements can also include development and approval of a fugitive dust control plan. The proposed Project would disturb approximately 16,000 acres of land during the construction phase. The majority of potential fugitive dust generation in a given location would occur within a 30-day construction period prior to final grading, seeding, and mulching of the right-of-way (ROW). Fugitive dust impacts during construction would therefore be temporary and localized.

Recommended fugitive dust mitigation measures during construction are listed in Section 4.12.4.1, Air Quality. Additional dust control measures may be required by state or local ordinances.

Fossil-Fueled Construction Equipment

Construction camp generators, large earth-moving equipment, skip loaders, trucks, non-road engines, and other mobile sources would be fueled by diesel or gasoline and are sources of combustion emissions, including nitrogen oxide (NO_x), carbon monoxide (CO), VOCs, sulfur dioxide (SO_2), PM_{10}, $PM_{2.5}$, and small amounts of HAPs. Gasoline and diesel engines must comply with the USEPA mobile source regulations in Title 40 of the Code of Federal Regulations (CFR) Part 86 for on-road engines and 40 CFR 89 and 90 for non-road engines. USEPA has established rules in 40 CFR 80 that require significant reductions in the sulfur content of diesel fuel used in on-road and off-road (non-road) engines. As of December 1, 2010, USEPA required that all on- and off-road diesel fuel would not exceed 15 parts per million (ppm) sulfur (i.e., ultra-low-sulfur fuel).

The construction equipment listed in Table 4.12-1 would be used in a typical construction spread. The proposed pipeline would be constructed in 10 construction spreads. Each spread would require approximately 6 to 8 months to complete. Recommended mitigation measures from combustion emission sources during construction are listed in Section 4.12.4.1, Air Quality. As stated in the Final EIS, Supplemental Environmental Report for Nebraska Reroute (exp Energy 2012a) and Environmental Report (2012b), TransCanada Keystone Pipeline, LP (Keystone) would install one 400-kW backup emergency generator engine at each of the eight proposed construction camps for use if commercial electrical power is interrupted . Keystone would ensure that contractors maintain all fossil-fueled construction equipment in accordance with manufacturer's recommendations and any applicable state and local regulations to minimize construction-related emissions.

Table 4.12-1 Construction Equipment per Spread for the Proposed Project

Equipment Description[a,b]	Units per Spread	Equipment Rating (hp)	Hours of Operation (hours/day)	Fuel Type
Automobile	50	500	2	Gasoline/ Diesel
Bus	7	190	3	Diesel
Pickup 4x4	100	500	5	Gasoline/Diesel
Welding Rig	30	400	10	Gasoline/Diesel
Winch Truck	3	650	8	Diesel
Dump Truck	1	650	8	Diesel
Flatbed Truck	8	650	9	Diesel
Fuel Truck	2	650	9	Diesel
Grease Truck	1	325	9	Diesel
Mechanic Rig	1	500	10	Diesel
Skid Truck	1	650	10	Diesel
Stringing Tr. and Tr.	15	650	10	Diesel
Truck and Float	9	650	10	Diesel
Truck and Lowboy	5	650	10	Diesel
D-7 Dozer	12	240	8	Diesel
D-8 Dozer	22	310	8	Diesel
D-8 Ripper	0	310	0	Diesel
D-5 Tow	2	90/120	8	Diesel
D-7 Tow	1	200/240	8	Diesel
D-6 Tack	3	200	8	Diesel
CAT 225	7	150	8	Diesel
CAT 235	26	250	8	Diesel
CAT 235 w/Hammer	0-1	260	8	Diesel
Bending Machine 22-36	1	159	8	Diesel
Crane LS-98A (35 ton)	0-2	230	8	Diesel
Farm Tractor	2	60	8	Diesel
Frontend Loader 977	2	190	8	Diesel
Motor Grader 14G	2	200	8	Diesel
Sideboom 571	1	200	8	Diesel
Sideboom 572	1	200/230	8	Diesel
Sideboom 583	22	300/310	8	Diesel
Sideboom 594	4	410	8	Diesel
Air Compressor 1750 cfm[c]	3-9	50	8	Gasoline
Generators	9	10	8	Gasoline
Pump—3"	1	20	8	Gasoline
Pump—6"	9	40	8	Gasoline

Source: Keystone 2009.

[a] Construction equipment does not include HDD, which would be used for portions of the pipeline corridor that requires waterbody crossings.
[b] Construction equipment does not include backup emergency generators proposed for construction camps (emissions from generators at construction camps are included in Tables 3.12-4 and 3.12-5).
[C] cfm = cubic feet per minute

Open Burning

The burning of slash materials (hay/grass, tree tops/stump) could occur along the route. However, the quantities and locations cannot be determined prior to construction since actual slash materials may be burned, chipped, or hauled for disposal in a suitable landfill depending on construction conditions and landowner requirements. Keystone would acquire necessary permits for slash burning prior to construction and would follow open burning regulations, including restrictions on burn location, material, and time, as well as consideration of local air quality. Required burning would be done within the ROW in small piles to avoid damage to trees or structures.

Temporary Fuel Transfer Systems and Associated Storage Tanks

Temporary fuel storage systems would be located at contractor yards and pipe yards. Although temporary fuel transfer systems and tanks have the potential to release VOC emissions, VOC releases would be minimal since low vapor pressure diesel fuels and gasoline would be the primary fuels stored.

Summary

Estimates of construction emissions of criteria pollutants and HAPs from the proposed Project are provided in Tables 4.12-2 and 4.12-3, respectively. Each table contains notes that provide information on the methodology, emission factors, activity data, and assumptions used for the air emission calculations during proposed Project construction. Construction emissions typically would be localized, intermittent, and temporary since proposed pipeline construction would move through an area relatively quickly. In addition, the emissions listed in Tables 4.12-2 and 4.12-3 would be the total from all 10 of the construction spreads along the proposed route. The localized emissions at each spread would be much less, roughly about 10 percent (1/10) of the values listed in Tables 4.12-2 and 4.12-3. None of the temporary construction camps in Montana, South Dakota, and Nebraska would trigger requirements for preconstruction permits. The construction-related emissions associated with the proposed Project would be temporary and localized and would be unlikely to produce long-term effects on local or regional air quality.

Table 4.12-2 Summary of Criteria Pollutants from Proposed Project Construction

	Criteria Pollutants (tons)						
Emission Source/Activity[a]	**HC[h]/VOC**	**CO**	**NO_x**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**
Construction Camp Generators[b]	0.56	6.2	6.5	0.012	0.35	0.35	0.35
Construction Non-road (Pipeline)[c]	88.7	1,353	1,065	44.4	44.7	44.7	44.7
Construction Non-road (Pump Stations)[c]	32.3	1,019	129	5.65	5.80	5.80	5.80
Construction On-road (Pipeline)[d]	5.95	115	10.3	0.079	0.41	0.41	0.41
Construction On-road (Pump Stations)[d]	1.36	25.4	3.02	0.020	0.12	0.12	0.12
Open Burning[e]	29.1	206	4.79	NA	21.2	18.5	18.1
Disturbed Land Fugitive Dust[f]	NA[i]	NA	NA	NA	19,220	6,727	1,345
Paved Road Dust (Personnel Commute)[g]	NA	NA	NA	NA	8.82	1.76	0.43
TOTAL	**158**	**2,724**	**1,218**	**50.2**	**19,301**	**6,799**	**1,415**

[a] Construction of the pipeline across Montana, South Dakota, and Nebraska would consist of 10 spreads being constructed simultaneously. Each spread would require an average of 7 months to complete. Pump station emissions include combined

emissions from 18 pump stations along the pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total).

[b] Construction camp emission estimates include eight camps (four in Montana, three in South Dakota, and one in Nebraska) with one 400 kW backup emergency generator engine per camp operating for a total of 500 hours (when commercial power is interrupted).

[c] Non-road adjusted emission factors for diesel and gasoline fuelled equipment were derived using methodology described in Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling for Compression Ignition (USEPA 2010b) and Spark-Ignition Engines (USEPA 2010c), respectively. The adjusted factors accounted for Transient Adjustment Factor values and Deterioration Factors. The Deterioration Factor was estimated by conservatively assuming the age factor for each equipment is greater than one (i.e., the equipment is approximately at the end of its useful life). Load factor for each piece of equipment is taken from Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (USEPA 2010a).

[d] On-road emission factors for on-road vehicles were obtained from USEPA's MOBILE6.2 model. Total miles traveled estimated based on number of equipment, daily hours of operation per equipment, each operating 6 days per week, 30 weeks (7 months) per spread, and an assumed 5 vehicle miles traveled per hour.

[e] Criteria pollutant emissions from open burning were calculated using equation from Air Pollutant Emissions associated with Forest, Grassland, and Agricultural Burning in Texas (Fraser et al 2002): Emissions (lb) = Emission Factor (lb/ton)* Fuel Consumption (tons/acre)* area burned (acres). Approximately 16,016 acres of land is expected to be disturbed in Montana (5,526 acres), South Dakota (5,817 acres), Nebraska (4,582 acres), Kansas (15 acres), and North Dakota (76 acres). Fuel load or consumption factors (ton/acre) for hay/grass were taken from Fraser et al 2002. Fuel load or combustion factor for tree tops and stumps were taken from USEPA AP-42 Table 13.1-1 (USEPA 1996c). Values applicable to Rocky Mountain Region (MT = Region 1; SD and NE = Region 2) were used.

[f] Disturbed land fugitive dust emission factor for PM was taken from USEPA AP-42, Section 13.2.3, January 1995, for heavy construction operation (USEPA 1995); fugitive dust emission factors for PM_{10} and $PM_{2.5}$ were taken from USEPA's Preparation of Fine Particulate Emissions Inventories, Student Manual, Air Pollution Training Institute Course 419B, September 2004, for road construction (USEPA 2004). Land (acres) disturbance would occur over a 1 month period; the remaining 5to 6 months of construction activity or spread would not result to land disturbance or fugitive dust generation (welding, tie-ins, seeding, mulching, construction camp erection, etc.).

[g] Paved road emissions were calculated using formulas and assumptions from USEPA AP-42, Section 13.2 (USEPA 2011).The total vehicle miles traveled during project construction in Montana, South Dakota, and Nebraska was estimated based on a maximum of 600 workers per construction spread (i.e.,6,000 workers for all 10 spreads), each traveling a roundtrip of 40 miles to work per day via a 12-seater company-owned bus (assume bus is always full), 6 days per week for 30 weeks (7 months).

[h] hydrocarbons (HC).

[i] not applicable (NA).

Table 4.12-3 Summary of Hazardous Air Pollutants from Proposed Project Construction

	Hazardous Air Pollutants (tons)								
Emission Source/Activity[a]	**Benzene**	**Toluene**	**Xylenes**	**Acrolein**	**PAHs[f]**	**1,3-Butadiene**	**Formaldehyde**	**Acetaldehyde**	**Total HAPs**
Construction Camp Generators[b]	0.028	0.012	0.009	0.0028	0.0050	0.0012	0.035	0.023	0.12
Construction Non-road (Main Pipeline)[c]	1.39	0.61	0.42	0.14	0.25	0.058	1.75	1.14	5.75
Construction Non-road (Pump Stations)[c]	0.18	0.078	0.054	0.018	0.032	0.0074	0.22	0.15	0.73
Construction On-road (Main Pipeline)[d]	0.17	ND[e]	ND	0.0028	ND	0.020	0.054	0.044	0.29
Construction On-road (Pump Stations)[d]	0.044	ND	ND	0.00081	ND	0.0053	0.015	0.012	0.078
TOTAL	**1.80**	**0.70**	**0.49**	**0.16**	**0.29**	**0.092**	**2.08**	**1.36**	**6.97**

[a] Construction of the pipeline across Montana, South Dakota, and Nebraska would consist of 10 spreads being constructed simultaneously. Each spread would require an average of 7 months to complete. Pump station emissions include combined emissions from 18 pump stations along the pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total).
[b] Construction camp emission estimates include eight camps (four in Montana, three in South Dakota, and one in Nebraska) with one, 400 kW backup emergency generator engine per camp operating for a total of 500 hours (when commercial power is interrupted).
[c] Non-road HAP emission factors (lb/MMBtu) were taken from USEPA AP-42, Section 3.3, Table 3.3-2 (USEPA 1996b); HAP emission factors for gasoline fired engines were not available. Annual HAP emissions (tpy) were calculated based on diesel density of 7.05 lb/gal; diesel heat input of 5.825 MMBtu/barrel from Table 13.1 of The Climate Registry General Reporting Protocol, version 1.1 (TCR 2008); and a brake specific fuel consumption obtained from USEPA's Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (USEPA 2010a).
[d] On-road emission factors for the on-road vehicles were obtained from USEPA's MOBILE6.2 model. Total miles traveled were estimated based on number of equipment, daily hours of operation per equipment, each operating 6 days per week, 30 weeks (7 months) per spread, and an assumed 5 vehicle miles traveled per hour.
[e] ND = Emission factors not available; no data.
[f] PAHs = polycyclic aromatic hydrocarbons.

Operations Impacts

A summary of estimated VOC emissions associated with the operation of the proposed Project is provided in Table 4.12-4. No other criteria pollutant or HAP would be emitted during the proposed Project operations. The table contains notes that provide information on the methodology, emission factors, activity data, and assumptions used for the VOC emission calculations during proposed Project operations. Operational impacts would include minimal fugitive emissions from intermittent MLVs along the proposed pipeline route and from valves, pumps, flanges, and connectors at the pump stations. Proposed pipeline pumps would be electrically powered. MLVs would have backup emergency generators, which would only be used during times of power interruption; therefore, emissions from these sources would be negligible. The use of mobile sources such as maintenance vehicles (at least twice per year) and aircraft for aerial inspections (once every 2 weeks) during proposed Project operations would be infrequent, so emissions from mobile sources would be negligible.

Table 4.12-4 Summary of Criteria Pollutants from Proposed Project Operation

	Criteria Pollutants (tons/year)						
Emission Source	**VOC[c]**	**CO**	**NO_x**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**
Fugitive Emissions (Pipeline)[a]	0.065	NA[d]	NA	NA	NA	NA	NA
Fugitive Emissions (Pump Stations)[b]	0.45	NA	NA	NA	NA	NA	NA
TOTAL	**0.51**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

[a] Pipeline VOC emissions include combined fugitive emissions from approximately 55 intermittent mainline valves along the pipeline route in Montana (25), South Dakota (15), and Nebraska (15).
[b] Pump station VOC emissions include combined fugitive emissions from 18 pump stations along the pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total). Each pump station was assumed to have the following components: 13 valves, 5 electric pumps, and 109 flanges and connectors.
[c] VOC emissions were estimated from the total organic carbon emission rates based on VOC's typical weight fraction of 0.85 (USEPA AP-42, Section 5.2, [USEPA 2006]). Total organic carbon emission factors taken from TCEQ's Equipment Leak Fugitives document, (TCEQ 2008). Emission factors pertaining to Oil and Gas Production Operations for Heavy Oil <20 degrees American Petroleum Institute (API) gravity were used.
[d] NA = Not applicable.

The estimated operational emissions in Table 4.12-4 indicate that the proposed Project would not cause or contribute to a violation of any federal, state, or local air quality standards, and that the proposed Project operations would not be expected to trigger the requirement for a Title V operating permit, minor operating permit, or a preconstruction permit in any of the affected states. No specific air quality mitigation measures are recommended for proposed Project operations.

4.12.3.2 Greenhouse Gases

The Supplemental Environmental Impact Statement (Supplemental EIS) evaluates the relationship between climate change and the proposed Project in several ways. First, the potential contributions of the proposed Project to greenhouse gas emissions are addressed below and in Section 3.12, Air Quality and Noise. Second, the potential impact of climate change effects (such as temperature and precipitation changes in the proposed Project area) on the construction and operation of the proposed Project itself is described in Section 4.14. Finally, Section 4.15, Cumulative Effects Assessment, presents information and analysis regarding indirect cumulative impacts and life-cycle greenhouse gas emissions including the potential impact of further

development of the oil sands on climate change. GHG emissions that would arise from the construction and operation of the proposed Project are quantified and summarized below.

Construction Emissions

The construction phase of the proposed Project includes GHG emissions arising from the following sources or activities:

- Clearing of land in the proposed ROW via open burning;
- Backup emergency generator engines running at seven construction camps;
- Indirect (off-site) electricity usage at the seven construction camps;
- On-road vehicles used for the construction of the proposed pipeline;
- On-road vehicles used for the construction of the pump stations;
- Non-road vehicles used for the construction of the proposed pipeline; and
- Non-road vehicles used for the construction of the pump stations.

The pipeline would be constructed in Montana, South Dakota, and Nebraska simultaneously in 10 construction spreads, of which each would require an average of 7 months to complete. Eight construction camps, which would house personnel working on the construction of the proposed Project, would be powered by electricity from the local utility (grid). During upset conditions when commercial power supply is interrupted (assume 500 hours per camp), one 400-kW backup emergency generator engine per camp would be used. On-road vehicles such as various types of diesel-powered trucks and non-road vehicles such as diesel-powered bulldozers and loaders would be used throughout the entire construction phase along the pipeline route and at the 20 pump stations in Montana, South Dakota, Nebraska, and Kansas.

For the entire duration of the construction phase, the estimated GHG emissions amount to 237,092 metric tons of carbon dioxide equivalents (CO_2e), which can be seen below in Table 4.12-5. Recommended GHG mitigation measures during proposed Project construction are listed in Section 4.12.4.2, Greenhouse Gases.

Table 4.12-5 Estimated Direct Construction Emissions for the Proposed Project

	Greenhouse Gas Emissions (Tons)				Greenhouse Gas Emissions (Metric Tons)
Emission Source/Activity	**CO_2**	**CH_4**	**N_2O**	**CO_2e[g]**	**CO_2e**
Construction Camp Emergency Generators[a]	4,871	0.20	0.07	4,896	4,441
Construction Camp Electricity Usage (Commercial Power Supply)[b]	79,893	1.41	1.36	80,345	72,888
Construction Non-road (Pipeline)[c]	147,155	14.3	6.41	149,443	135,574
Construction Non-road (Pump Stations)[c]	19,360	1.99	0.89	19,679	17,852
Construction On-road (Pipeline)[d]	5,197	0.30	0.53	5,368	4,870

Emission Source/Activity	Greenhouse Gas Emissions (Tons)				Greenhouse Gas Emissions (Metric Tons)
	CO_2	CH_4	N_2O	CO_2e[g]	CO_2e
Construction On-road (Pump Stations)[d]	1,427	0.066	0.11	1,463	1,327
Open Burning[e]	Biogenic (Net Zero Emissions)[f]	7.29	NA[h]	153	139
Total	**257,902**	**25.6**	**9.38**	**261,347**	**237,092**

[a] Construction camp emission estimates include eight camps (four in Montana, three in South Dakota, and one in Nebraska) with one 400-kW generator engines per camp operating for a total of 500 hours (when commercial power supply is interrupted).
[b] Electrical power requirement for each camp is assumed to be 1.6 MW. GHG emission factors were taken from USEPA's eGRID2012 version 1 data base (http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html).
[c] Non-road CO_2 emission factors for diesel and gasoline fuelled equipment were derived using methodology described in Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling for Compression Ignition (USEPA 2010b) and Spark-Ignition Engines (USEPA 2010c), respectively. CH_4 and N_2O factors taken from Table 13.6 of The Climate Registry General Reporting Protocol Version 1.1 (TCR 2008); converted from g/gal to lb/hp-hr based on a density of 7.05 lb/gal for diesel and 6.17 lb/gal for gasoline; and a brake specific fuel consumption obtained from USEPA's Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (USEPA 2010).
[d] On-road GHG emission factors taken from The Climate Registry - General Reporting Protocol, Version 1.1 (TCR 2008). Total miles traveled estimated based on number of equipment, daily hours of operation per equipment, each operating 6 days per week, 30 weeks (7 months) per spread, and an assumed 5 vehicle miles traveled per hour.
[e] CH_4 emissions from open burning calculated using equation from Air Pollutant Emissions associated with Forest, Grassland, and Agricultural Burning in Texas (Fraser, et al., 2002): Emissions (lb) = Emission Factor (lb/ton)* Fuel Consumption (tons/acre)* area burned (acres). Approximately 16,016 acres of land is expected to be disturbed in Montana (5,526 acres), South Dakota (5,817 acres), Nebraska (4,582 acres), Kansas (15 acres), and North Dakota (76 acres). Fuel load or consumption factors for hay/grass were taken from Fraser et al 2002. Fuel load or consumption factor for tree tops and stumps were taken from USEPA AP-42 Table 13.1-1 (USEPA 1996c). Values applicable to Rocky Mountain region (MT = Region 1; SD and NE = Region 2) were used.
[f] CO_2 emissions from biogenic sources are considered part of the natural carbon cycle and are not typically included in greenhouse gas emission inventories; see USEPA AP-42, Chapter 13.1.4 (USEPA 1996c).
[g] Carbon dioxide equivalents (CO_2e) calculated based on global warming potentials of 1, 21, and 310 for CO_2, CH_4, and N_2O, respectively.
[h] NA = Not applicable.

Operational Emissions

During the operation phase of the proposed Project, GHG emissions would arise from both direct (Scope 1) and indirect sources (Scope 2). A summary of these emissions can be found in Table 4.12-6. Direct operating emissions would include minimal fugitive methane emissions at connections both along the main proposed pipeline and at the pump stations. These fugitive methane emissions would be emitted from approximately 55 intermediate mainline valves along the pipeline route and from the 20 pump stations. Emissions from the use of maintenance vehicles (at least twice per year) and aircraft for aerial inspection (once every 2 weeks) during the proposed Project operations are expected to be negligible. Indirect operating emissions from the proposed Project would be associated with electric generation needed to power the pump stations. The proposed Project includes 20 pump stations: six in Montana, seven in South Dakota, five in Nebraska, and two in Kansas. Each pump station would consist of three to five pumps driven by electric motors (exp Energy 2012a). It was assumed for this calculation that each station would have five pumps in order to provide a conservative estimate of impacts. The pumps are rated at 6,500 hp and are assumed to be running 24 hours per day, 7 days per week, 52 weeks per year. Using USEPA's e-GRID factors for the regions in which the pump stations would be located, the indirect operating emissions for the proposed Project are estimated to be 3.19 million metric tons of CO_2e per year.

Table 4.12-6 Direct and Indirect Annual Operating Emissions for the Proposed Project

Emission Source/Activity	GHG Emissions (Tons/Year) CO_2	CH_4	N_2O	CO_2e	GHG Emissions (Metric Tons/Year) CO_2e
Direct Operating Emissions[a]					
Fugitive Emissions (Pipeline)[b]	NA[e]	0.011	NA	0.24	0.22
Fugitive Emissions (Pump Stations)[c]	NA	0.079	NA	1.65	1.50
Indirect Operating Emissions[d]					
Electricity Usage (Pump Stations)	3,498,672	59.5	59.3	3,518,291	3,191,773
Total	**3,498,672**	**59.6**	**59.3**	**3,518,293**	**3,191,774**

[a] Direct fugitive CH4 emissions were estimated from total organic carbon emission rates based on CH_4's typical weight fraction of 0.15 (USEPA AP-42, Section 5.2, [USEPA 2006]). Total organic carbon emission factors taken from TCEQ's Equipment Leak Fugitives document, (TCEQ 2008). Emission factors pertaining to Oil and Gas Production Operations for Heavy Oil <20 degrees American Petroleum Institute (API) gravity were used.
[b] Pipeline CH4 emissions include combined fugitive emissions from approximately 55 intermittent mainline valves along the pipeline route in Montana (25), South Dakota (15), and Nebraska (15).
[c] Pump station CH_4 emissions include combined fugitive emissions from 18 pump stations along the pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total). Each pump station was assumed to have the following components: 13 valves, 5 electric pumps, and 109 flanges and connectors.
[d] Indirect GHG emissions from electricity usage were estimated using appropriate regional e-Grid emission factors (USEPA eGRID2012 version 1 database for Year 2009) (http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html). Most parts of Montana fall under the NWPP eGRID region; however, the portion of the proposed pipeline that crosses Montana is within the MROW region. Carbon dioxide equivalents (CO_2e) calculated based on global warming potentials of 1, 21, and 310 for CO_2, CH_4, and N_2O, respectively.
[e] NA = Not applicable.

The total annual GHG emissions from the operation of the pipeline, as shown above, amount to 3.19 million metric tons per year of CO_2e[2]. The annual CO_2e emissions from the proposed Project is equivalent to CO_2e emissions from approximately 626,000 passenger vehicles operating for one year, or 398,000 homes using electricity for one year.[3] Recommended GHG mitigation measures during proposed Project operation are listed in Section 4.12.4.2, Greenhouse Gases.

4.12.3.3 Noise

Construction Impacts

Construction of the proposed Project would increase noise levels in the vicinity of Project activities. Construction noise levels are rarely steady in nature, but instead fluctuate depending on the number and type of equipment in use at any given time. There would be times when no large equipment is operating and noise would be at or near ambient levels. In addition, construction-related sound levels would vary by distance.

Pipeline construction generally proceeds at a rate of approximately 20 completed miles per calendar month per spread. However, due to the assembly-line method of construction, pipeline construction activities in any one area could last from 30 days up to 7 weeks. Construction of all pump stations would take approximately 18 to 24 months to complete. Construction-related

[2] In 2010 total U.S. GHG emissions (CO2e from anthropogenic activities) amounted to 6,821.8 million metric tons (USEPA 2012). Globally, approximately 30,326 million metric tons of CO2 emissions were added to the atmosphere via the combustion of fossil fuels in 2010 (IEA 2012).
[3] Equivalencies based on USEPA's GHG Equivalency calculator available at: http://www.epa.gov/cleanenergy/energy-resources/calculator.html.

noise impacts typically would be localized, intermittent, and short term since construction spreads move relatively quickly (several hundred feet to 1.5 miles or more per day).

There are no residences (i.e., homes, mobile homes, cabins) within 25 feet and 31 residences within 25 feet to 500 feet of the proposed ROW (Table 3.12-9). The 31 residences within 500 feet of the ROW would experience temporary inconvenience from the construction equipment noise (Table 4.12-7).

Table 4.12-7 Typical Noise Levels for Construction

Equipment	Typical Noise Levels (dBA at 50 feet)
Front loaders	85
Backhoes, excavators	80
Tractors, dozers	85
Graders, scrapers	85–89
Trucks	88
Concrete pumps, mixers	82–85
Cranes (movable)	83
Cranes (derrick)	88
Pumps	76
Generators	81
Compressors	81
Pneumatic tools	85
Jack hammers, rock drills	88–98
Pavers	89
Compactors	82

Source: USDOT 2006.

In general, average equivalent noise levels from typical construction sites range from 85 to 91 dBA at 50 feet (USEPA 1971). The closest receptors are located approximately 200 feet from the pipeline ROW. Using a typical 6 decibel reduction in noise level per doubling of distance, a worst-case pipeline construction noise level of 91 dBA at 50 feet from the construction site would be reduced to approximately 79 dBA at 200 feet. These noise levels could be perceived as moderately loud with a significant effect over existing levels; however, any peak noise levels would be temporary and intermittent, generally limited to daylight hours, and would decrease with distance. Although individuals and livestock in the immediate vicinity of the construction activities may be temporarily disturbed, the impact on the noise environment at any specific location along the proposed pipeline route would be short term.

There are approximately 14 residences (i.e., homes, mobile homes, cabins) within 0.5 mile (2,640 feet) and 46 residences within 1 mile (5,280 feet) of the proposed Project pump stations (Table 3.12-10). The closest receptors are located approximately 0.25 mile (1,320 feet) north-northeast of Pump Station 25 in Nebraska, 0.35 mile (1,848 feet) east and south-southeast of Pump Station 21 in South Dakota, 0.35 mile southwest of Pump Station 27 in Kansas, and 0.5 mile south-southeast of Pump Station 13 in Montana. The remaining 16 pump stations in the affected states are farther away from residences. Using a typical 6-decibel reduction in noise level per doubling of distance, a worst-case pump station construction noise level of 91 dBA at 50 feet from the construction site would be reduced to approximately 63 dBA at 0.25 mile, 59.6 dBA at 0.35 mile, 57 dBA at 0.5 mile, and 51 dBA at 1 mile. Like pipeline construction

noise, noise associated with construction of the proposed aboveground facilities (pump stations) would be intermittent during the construction period, but the overall impact would be temporary and is not expected to be significant. Further, nighttime noise levels would normally be unaffected because most construction activities would be limited to daylight hours. Potential exceptions include completion of critical tie-ins on the ROW; HDD operations if determined by the contractor to be necessary; and other work if determined necessary based on weather conditions, safety, or other proposed Project requirements.

Keystone is proposing to use HDD techniques at approximately 14 river crossings (Table 4.12-8). The proposed pipeline would not cross Kansas and North Dakota, so HDD activities would not occur in both states. Aerial photography was used to estimate the closest noise receptor distances and direction to the HDD activity sites. The closest residences are located at 0.14 mile (740 feet) and 0.15 mile (792 feet) from the Milk River HDD entrance and exit locations, respectively (Table 4.12-8). Noise impacts from HDD operations were estimated at the closest noise receptors using sound pressure level data of typical HDD operations (entrance and exit) at 300 feet (AES Sparrows Point LNG, LLC [AES] 2008). Table 4.12-8 shows the predicted noise levels from uncontrolled HDD activities at these distances. Without installing any noise barriers or controls, day-night sound levels (Ldn)[4] from HDD activities plus existing levels could be as high as 69 dBA at 740 feet or 0.14 mile (closest receptor located west of Milk River HDD entrance site). HDD activities would be conducted consistent with any applicable local noise ordinances. Recommended noise mitigation measures during proposed Project construction are listed in Section 4.12.4.3, Noise.

Blasting may be required in areas where conventional excavation methods cannot remove consolidated shallow bedrock or boulders. Blasting would also likely be required in areas where the bedrock type within 84 inches (7 feet) of the surface is lithic or very strongly cemented rock. (Keystone 2009). If blasting is required to clear the ROW and fracture rock within the pipeline trench, Keystone would follow strict safety precautions and exercise extreme care to avoid damage to underground structures, cables, conduits, pipelines, and underground watercourses or springs. To protect property and livestock, Keystone would provide adequate notice to adjacent landowners or tenants in advance of blasting. Blasting activity would be performed during daylight hours and in compliance with federal, state, and local codes and ordinances and manufacturer-prescribed safety procedures and industry practices (Keystone 2009).

As indicated above, during occasional, short-term intervals, construction-related noise levels along the proposed pipeline ROW could be as high as 79 dBA at 200 feet (closest receptors). Similarly, HDD-related noise levels associated with waterbody crossings could be as high as 69 dBA at 740 feet. However, such construction and HDD-related noise levels would be temporary and localized and would not result in long-term noise impacts. Noise from blasting would be periodic or impulsive (not continuous or steady) and would only occur during daylight hours when increases in noise levels are more tolerable.

[4] Ldn is the 24-hour equivalent noise levels (Leq[24]) with10 dBA added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. Daytime hours are between 7 a.m. and 10 p.m. while nighttime hours are between 10 p.m. and 7 a.m.

Table 4.12-8 Predicted Noise Levels at Closest Receptors from Uncontrolled HDD Activities

HDD Location[a]	Approximate Mile Post[a]	Closest Noise Receptor (mile)[b]	Direction[b]	Existing Ldn Levels (dBA)[c]	Reference Ldn Levels at 300 feet from HDD Activity (dBA)[d]	Reference HDD Activity Ldn at 300 feet plus Existing Ldn Levels (dBA)[e]	Ldn Levels at Closest Receptor from HDD Activity (dBA)[d]	HDD Activity Ldn at Closest Receptor plus Existing Ldn Levels (dBA)[e]
Montana								
Frenchman River entrance	25.20	1.48	S	35.0	77.0	77.0	48.7	48.9
Frenchman River exit	25.23	1.20	S	35.0	68.0	68.0	41.5	42.4
Milk River entrance	83.40	0.14	W	35.0	77.0	77.0	69.2	69.2
Milk River exit	83.42	0.15	NW	35.0	68.0	68.0	59.6	59.6
Missouri River entrance	89.60	0.91	NW	35.0	77.0	77.0	52.9	53.0
Missouri River exit	89.80	1.07	NW	35.0	68.0	68.0	42.5	43.2
Yellowstone River entrance	198.00	0.79	NW	35.0	77.0	77.0	54.1	54.2
Yellowstone River exit	198.17	0.87	NW	35.0	68.0	68.0	44.3	44.8
South Dakota								
Little Missouri River entrance	295.06	2.62	NW	35.0	77.0	77.0	43.7	44.3
Little Missouri River exit	295.13	2.64	NW	35.0	68.0	68.0	34.7	37.8
Cheyenne River entrance	430.07	3.58	SE	35.0	77.0	77.0	41.0	42.0
Cheyenne River exit	430.37	3.54	SE	35.0	68.0	68.0	32.1	36.8
Bridger Creek entrance	433.58	2.46	E	35.0	77.0	77.0	44.3	44.8
Bridger Creek exit	433.59	1.01	E	35.0	68.0	68.0	43.0	43.6
Bad River entrance	485.95	0.46	E	35.0	77.0	77.0	58.8	58.9
Bad River exit	485.98	0.41	NE	35.0	68.0	68.0	50.8	50.9
White River entrance	541.30	0.35	NW	35.0	77.0	77.0	61.2	61.2
White River exit	541.39	0.38	NW	35.0	68.0	68.0	51.5	51.6
Nebraska								
Keya Paha River entrance	618.10	0.85	NW	35.0	77.0	77.0	53.5	53.6
Keya Paha River exit	618.16	0.88	NW	35.0	68.0	68.0	44.2	44.7
Niobrara River entrance	626.00	0.95	SSE	35.0	77.0	77.0	52.5	52.6
Niobrara River exit	626.24	0.55	SSE	35.0	68.0	68.0	48.3	48.5
Elk Horn River entrance	713.30	1.34	E	35.0	77.0	77.0	49.5	49.7

HDD Location[a]	Approximate Mile Post[a]	Closest Noise Receptor (mile)[b]	Direction[b]	Existing Ldn Levels (dBA)[c]	Reference Ldn Levels at 300 feet from HDD Activity (dBA)[d]	Reference HDD Activity Ldn at 300 feet plus Existing Ldn Levels (dBA)[e]	Ldn Levels at Closest Receptor from HDD Activity (dBA)[d]	HDD Activity Ldn at Closest Receptor plus Existing Ldn Levels (dBA)[e]
Elk Horn River exit	713.45	1.24	E	35.0	68.0	68.0	41.2	42.2
Loup River entrance	761.60	0.43	SW	35.0	77.0	77.0	59.4	59.4
Loup River exit	761.83	0.38	SW	35.0	68.0	68.0	51.5	51.6
Platte River entrance	775.10	0.5	NW	35.0	77.0	77.0	58.1	58.1
Platte River exit	775.48	0.83	NW	35.0	68.0	68.0	44.7	45.1

[a] Aerial photography was used to determine all HDD entrance mile posts. The HDD exit mile posts were determined based on the width of each river or creek crossed.
[b] Aerial photography was used to estimate the closest noise receptor distances and direction to the HDD activity sites.
[c] Existing noise levels were estimated based on population density of each county crossed by the proposed pipeline using methodology described in U.S. Department of Transportation's (US DOT's) Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006). See Table 3.12.3-1 of this Supplemental EIS.
[d] Day-night (Ldn) levels at 300 feet from typical HDD activities (entrance and exit points) were taken from the Sparrows Point Liquefied Natural Gas and Power Plant Project Final EIS (AES 2008). HDD activity Ldn levels at other distances (0.5 mile and 1 mile) were estimated using the hemispherical spreading loss calculation methodology as described in Section 3.12.2.2, Regulatory Requirements.
[e] HDD activity Ldn at closest receptors plus existing noise levels were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Existing Noise/10) + 10^(HDD Noise/10))

The proposed Project would not affect any national parks or national forests; however, the Project would cross five national historic trails (one in Montana and four in Nebraska) (see Section 3.9.2.3, Recreation and Special Interest Areas). The proposed Project is also located approximately 11 miles from the Niobrara National Scenic River in Nebraska. As indicated in Section 3.12.3.2, Regulatory Requirements, the National Park Service prohibits the operation of motorized equipment or machinery such as an electric generating plant, motor vehicle, audio device in a manner that exceeds a noise level of 60 decibels at 50 feet; or if below that level nevertheless; makes noise which is unreasonable considering the nature and purpose of the actor's conduct, location, time of day or night, purpose for which the area was established, impact on park users, and other factors that would govern the conduct of a reasonably prudent person under the circumstances (National Park Service [NPS] 2012).The proposed Project construction would have a short-term noise impact on people using the five national historic trails . Noise from construction activities would have no impact on the Niobrara National Scenic River in Nebraska because it is located approximately 11 miles away from the proposed pipeline route and noise from the proposed Project would not be detected at that distance. There are no regulations in rural areas along the pipeline route applicable to construction noise, including noise from construction camps. In municipal areas, pipeline construction noise levels would comply with any applicable municipal regulations (there are no numerical state noise limits for construction activities in any of the five affected states). In areas near residences and businesses where construction activities or noise levels may be considered disruptive, pipeline work schedules would be coordinated to minimize disruption. Recommended noise mitigation measures from the proposed Project construction are listed in Section 4.12.4.3, Noise.

Operations Impacts

Noise impacts from operation of the proposed pipeline would be limited to the pump stations in four states: Montana, South Dakota, Nebraska, and Kansas. No pump station or other noise generating sources would be located in North Dakota. Crude oil traveling through the buried pipeline would not emit audible noise above the surface nor would there be perceptible levels of vibration associated with crude oil movement through the pipeline. MLVs would have backup emergency generators which would only be used during times of power interruption; however, noise impacts would be infrequent and negligible.

During operation of the proposed pipeline, the noise associated with the electrically driven pump stations would be limited to the vicinity of the facilities. The major source of noise at the pump stations are the pumps (maximum of five pumps each rated at 6,500 hp). In the absence of manufacturer-specific sound level data for the pumps, a sound pressure level (Leq(24))[5] of approximately 100 dBA at 3.28 feet (1 meter) was assumed for each pump. The estimated sound pressure level was estimated as a function of pump power using the formula 89 dBA + 3LogkW for pumps greater than 75 kW and speeds ranging from 1,600 to 1,800 revolutions per minute (Bies and Hansen 2009). Leq(24) levels for the five pumps were combined logarithmically to give a total of 107 dBA at 3.28 feet, which is equivalent to an Ldn level of approximately 113 dBA at 3.28 feet (Table 4.12-7).

There are approximately 14 residences (i.e., homes, mobile homes, cabins) within 0.5 mile (2,640 feet) and 46 residences within 1 mile (5,280 feet) of the proposed 20 pump stations

[5] Leq(24) is the equivalent sound energy of a source averaged over a 24-hour period.

(Table 3.12-10). As indicated earlier, the closest receptors are located approximately 0.25 mile north-northeast of Pump Station 25 in Nebraska, 0.35 mile east and south-southeast of Pump Station 21 in South Dakota, 0.35 mile southwest of Pump Station 27 in Kansas, and 0.5 mile south-southeast of Pump Station 13 in Montana. The remaining 16 pump stations in the affected states are farther away from residences. In addition to the residences, the proposed Project also crosses four national historic trails in Nebraska and one in Montana. Excluding existing/background Ldn levels and using a typical 6-decibel reduction in noise level per doubling of distance, each pump station Ldn level of approximately 113 dBA at 3.28 feet would be reduced to approximately 61, 58, and 55 dBA at the closest receptors within 0.25, 0.35, and 0.5 mile, respectively (Table 4.12-9). The logarithmic addition of the proposed Project Ldn levels at the closest receptors (55 to 61 dBA) with the existing Ldn levels (35 dBA) would not change the result in total Ldn levels (i.e., total Ldn levels would remain 55 to 61 dBA at the closest receptors) (Table 4.12-9).. The few residences and national historic trails located within 0.25 and 0.5 mile of each pump station could experience noise levels slightly above the recommended USEPA noise criteria of 55 dBA (Ldn). Noise impacts at residences and national historic trails located approximately 1 mile from the pump stations would be less than 55 dBA and would not be significant. The proposed pump station noise would have no noise impact on the Niobrara National Scenic River in Nebraska because it is located approximately 11 miles west of the proposed pipeline route and 19 miles south of the closest pump station (Pump Station 21 in South Dakota). Noise from the proposed pump stations would not be detected at those distances. Recommended noise mitigation measures during proposed Project operation are listed in Section 4.12.4.3, Noise.

Prior to construction, the presence of structures and residences in proximity to the proposed Project pump stations would be verified. As shown in Table 4.12-9, noise impacts from the electricity-powered pump stations could be significant at distances up to 0.5 mile, so Keystone would conduct noise assessment surveys during proposed Project operations at locations where nearby residents express concerns about pump station noise. These surveys would indicate actual operational noise levels and would be used to determine any necessary noise abatement measures to reduce noise to acceptable levels. Keystone would consider the following noise abatement options: aboveground pipe lagging, pump blankets, motor air intake enclosures, and engineering sound barriers. To the extent practicable, Keystone would not site pump stations close to noise-sensitive receptors. For all pump stations, Keystone would observe the USEPA noise standard of 55 dBA Ldn for each pump station. Recommended noise mitigation measures from operating the pump stations are listed in Section 4.12.4.3, Noise.

Table 4.12-9 Predicted Noise Levels at Closest Noise Receptors from each Pump Station

Location	Estimated Leq(24) Levels (dBA)[a]	Estimated Ldn Levels (dBA)[b]	Existing Ldn Levels (dBA)[c]	Pump Station plus Existing Ldn Levels (dBA)[d]
3.28 feet (1 meter) from each pump station (based on five pumps operating simultaneously)	107	113.4	35	113.4
Residences within 0.25 mile of pump stations (Pump Station 25 in Nebraska)	55.0	61.4	35	61.4
Residences within 0.35 mile	52.0	58.4	35	58.4

Location	Estimated Leq(24) Levels (dBA)[a]	Estimated Ldn Levels (dBA)[b]	Existing Ldn Levels (dBA)[c]	Pump Station plus Existing Ldn Levels (dBA)[d]
of pump stations (Pump Station 21 in South Dakota and Pump Station 27 in Kansas)				
Residences within 0.5 mile of pump stations (Pump Station 13 in Montana)	48.9	55.3	35	55.4
Residences within 1 mile of each pump station	42.9	49.3	35	49.5

[a] Estimated Leq(24) levels at 3.28 feet (1 meter) from pump station assumes a maximum of five pumps would be operating simultaneously at each pump station and each 6,500 hp (4,847 kW) electric pump is expected to have a sound pressure level of approximately 100 dBA at 3.28 feet. The estimated sound pressure level was estimated as a function of pump power using the formula 89 dBA + 3LogkW for pumps greater than 75 kW and speeds ranging from 1,600 to 1,800 revolutions per minute (Bies and Hansen 2009). Sound pressure levels for the five pumps were combined logarithmically to give a total of 107 dBA at 3.28 feet. Pump station Leq(24) levels at other distances were estimated using the hemispherical spreading loss calculation methodology described in Section 3.12.2, Air Quality. Actual sound pressure levels would likely be lower at pump stations that have less than five pumps.
[b] Ldn levels = Leq(24) levels + 6.4 dBA
[c] Existing noise levels were estimated based on population density of each county crossed by the proposed pipeline using methodology described in USDOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006). See Table 3.12.3-1 of this Supplemental EIS.
[d] Pump station plus existing noise levels were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Existing Noise/10) + 10^(Proposed Project Noise/10)).

4.12.4 Recommended Additional Mitigation

4.12.4.1 Air Quality

During proposed Project construction, the following mitigation measures are recommended to avoid or reduce the air quality impacts at the nearest receptors from the proposed Project:

- Ensure that contractors employ water trucks, sprinklers, or calcium chloride solution as necessary to reduce dust to acceptable levels, particularly in areas where work approaches dwellings, farm buildings, other areas occupied by people, and when the pipeline parallels an existing road or highway. Use of calcium chloride solution should be limited to roads.
- Ensure that contractors place curtains of suitable material, as necessary, to prevent wind-blown particles from blasting operations from reaching any residence or public building.
- Ensure that disturbed areas are stabilized as quickly as possible.
- Ensure that all construction equipment and vehicles are maintained in accordance with manufacturer’s recommendations.
- Turn off equipment when not in use and reduce idling of construction equipment as much as practicable.
- Offer selection preference for contractors who use energy efficient and low-emission equipment in their equipment/construction fleet during the construction bidding process.

- Encourage the use of locally available construction materials as much as possible.
- Ensure that contractors comply with all applicable state regulations and local ordinances with respect to truck transportation and fugitive dust emissions.

During proposed Project operations, criteria pollutant and HAP emissions would be negligible (see Table 4.12-4), so specific air quality mitigation measures are not recommended for proposed Project operations.

4.12.4.2 Greenhouse Gases

During the proposed Project construction, the following mitigation measures are recommended to reduce GHG emissions to the atmosphere:

- Minimize extent of land clearing for ROWs;
- Consider the use of low-emission generator engines for the construction camps, such as dual-fuel generators (95 percent natural gas and 5 percent diesel) instead of 100 percent diesel generator engines;
- Use of energy-efficient practices, such as maintaining construction equipment and vehicles in accordance with manufacturer's recommendations; and
- Turn off equipment when not in use and reduce idling of construction equipment as much as practicable.

During proposed Project operations, the following mitigation measures are recommended to reduce GHG emissions to the atmosphere:

- Ensure that all pumps are maintained in accordance with manufacturer's recommendations;
- Consider use of high efficient pump specifications;
- Consider arrangement of pumps to optimize efficiency; and
- Consider the purchase of green electricity from the grid.

4.12.4.3 Noise

During proposed Project construction, the following mitigation measures are recommended to minimize noise impact on individuals, sensitive areas, and livestock:

- Ensure the use of silencers or mufflers on heavy construction equipment engines;
- Ensure that the HDD contractor installs a full or partial barrier around HDD entry and exit sites within 1000 feet of a sensitive receptor (residence);
- Ensure that the HDD contractor installs exhaust mufflers on all HDD drill rig engines;
- Ensure the use of controlled blasting techniques such as blasting mats to reduce potential noise (impulsive) and vibration impacts as a result of blasting;
- Notify nearby residences/receptors (including people using the national historic trails) of the time of day and day of week blasts and HDD activity would occur; and

- Ensure that contractors comply with all state and federal regulations governing the use of explosives and procure all required state/local permits prior to implementing blasting.

During proposed Project operations, the following mitigation measures are recommended to minimize noise impact on individuals, sensitive areas, and livestock:

- Ensure that all pump stations are housed in an insulated building or berms are constructed around each pump station;
- Ensure that all pumps are maintained in accordance with manufacturer's recommendations; and
- To further reduce noise impacts to nearest residences, a toll-free telephone number should be provided for landowners to report any operational noise-related issues.

4.12.5 Connected Actions

4.12.5.1 Bakken Marketlink Project

The Bakken Marketlink Project would include construction of facilities (e.g., external floating roof fuel tanks, booster pumps) to provide crude oil transportation service from near Baker, Montana, to Steele City, Nebraska, for onward delivery to Cushing, Oklahoma, via the Keystone XL Project. The Bakken Marketlink Project would result in air and noise emissions from construction and operation. At Baker, Montana, the potential-to-emit fugitive VOC emissions from the Bakken Marketlink Project tanks (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 used for operational purposes; total throughput of 65,000 barrels per day or approximately 1 billion gallons per year) were estimated to be 21.9 tpy (see Keystone's Response to Data Request 2.0, dated October 1, 2012 [Keystone 2012]). At Cushing, Oklahoma, the potential-to-emit fugitive VOC emissions from the Bakken Marketlink Project tanks (two 250,953-barrel tanks each having a maximum annual throughput of approximately 119,000 barrels per day or 1.82 billion gallons per year) were estimated to be 27.3 tpy. All booster pumps would be electric-driven. Based upon preliminary design engineering, there will be no combustion equipment such as backup emergency generator engines or other add-on control devices such as emergency flares or vapor recovery units constructed at the facility. The Bakken Marketlink Project pipeline is approximately 5 miles in length, so the impact of this connected action to air quality (including GHGs) and noise is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. Applicable federal, state, and local regulations would be followed to achieve compliance with air quality, GHG, and noise requirements.

4.12.5.2 Big Bend to Witten 230-kV-Transmission Line

The Big Bend to Witten 230-kV Transmission Line would include the construction and operation of a new Big Bend substation and an approximately 70-mile-long 230-kV transmission line in in south-central South Dakota. The proposed substation and transmission line would be required to ensure future electric power requirements would be met at Pump Stations 20 and 21 without degrading system reliability when the proposed Project is operating at maximum capacity. The transmission line would result in air and noise emissions, particularly during construction. Construction impacts of this connected action to air quality, GHGs, and noise would be short

term and temporary. The extent of air and noise emissions is unknown at this time, but the impact of this connected action to air quality, GHGs, and the noise environment is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. Applicable federal, state, and local regulations would be followed to achieve compliance with air quality, GHG, and noise requirements.

The electric cooperatives servicing the transmission line or their contractors would use available methods and devices to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants. Dust control of access roads and work areas would occur when air quality is compromised by construction activities. Equipment and vehicles would be maintained in proper operating condition to minimize air and noise emissions.

4.12.5.3 Electrical Distribution Lines and Substations

The proposed Project would require electrical service from local power providers (see Section 2.2.4, Major Pipeline Route Alternatives, Connected Actions) for pump stations and other aboveground facilities. Construction and operation of these electrical lines and substations would result in air emissions and noise. Construction impacts of this connected action to air quality, GHGs, and noise would be short term and temporary. The extent of air and noise emissions is unknown at this time, but the impact of this connected action to air quality, GHGs, and the noise environment is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. The applicable federal, state, and local regulations would be followed to achieve compliance with air quality, GHGs, and noise requirements.

The electric cooperatives servicing the electrical lines or their contractors would use available methods and devices to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants, including greenhouse gases. Dust control of access roads and work areas would occur when air quality is compromised by construction activities. Equipment and vehicles would be maintained in proper operating condition to minimize air emissions and noise.

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4.13 POTENTIAL RELEASES

4.13.1 Introduction

This section describes potential releases associated with the construction and operation of the proposed Project and connected actions and discusses potential mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS and in many instances replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following items have been substantially updated from the 2011 document related to potential releases:

- Updated Pipeline Hazardous Material Safety Administration (PHMSA) data up to July 2012 were reviewed;
- Incident rate estimates from PHMSA were expanded to include linear and discrete pipeline elements, and the incident rate for pipeline systems that carry dilbit or heavy crude oil was evaluated;
- Spill volume distributions for both linear and discrete pipeline elements were expanded, and spill volume trends were summarized as derived from PHMSA incident data;
- PHMSA data were compared to other pipeline datasets, and databases were reviewed to assess dilbit/heavy crude oil corrosivity;
- Revised the spill occurrence interval for stream crossings;
- Spill transport modeling was completed for various spill volumes based on spill size distribution categories derived from PHMSA data to identify potential plume sizes, including surface plumes and ground water impact;
- Potential spill impacts to various resources were estimated, such as soils, vegetation, wildlife, wetlands, water wells, and cultural resources;
- Further explanation was provided on how the 57 Special Conditions would work to reduce the threat of a release and the benefits that would be created when the conditions are implemented; and
- Section 4.15.5 “Recommended Additional Mitigation” provides a list of additional mitigation measures to further reduce impacts from potential releases.

The scope of this assessment as it relates to pipeline risk and the potential for releases from proposed Project construction and operation within areas that would be crossed by the proposed pipeline route and connected actions is described below.

The proposed Project would include processes, procedures, and systems to prevent, detect, and mitigate potential oil spills that could occur during operation of the pipeline. These are summarized in the subsections below. An emergency response plan (ERP) would contain further

detail on response procedures and would be completed and reviewed by PHMSA prior to granting permission to operate the proposed pipeline.

To assess the likelihood of operational releases from the proposed Project, spill risk assessments were conducted as described below. These risk assessments addressed both the potential frequency of operational pipeline releases and the potential volumes of crude oil associated with the releases. The magnitude of a potential oil spill impact is primarily a function of size of the spill, type of oil, and sensitivity of the receptors affected (American Petroleum Institute [API] 1992, 1997; National Research Council 1985, 2003a, 2003b). Variations in spill size and receptor type are key variables for estimating the magnitude of potential environmental impacts of oil spills from the proposed Project.

Most spills ranging in magnitude from small to medium (up to 1,000 barrels [bbl]) would occur on construction sites or at operations and maintenance facilities. At these locations, spill response typically would be quick because of the presence of local staff and contractors. The quick containment and cleanup is expected to reduce surface oil spreading and its potential infiltration into the ground. For medium to large spills (greater than 1,000 bbl), especially those that reach water resources, the response time between initiation of the spill event and arrival of the response contractors would influence potential magnitude of impacts to environmental resources. Once the responders are at the spill scene, the efficiency, effectiveness, and environmental sensitivity of the response actions (e.g., containment and cleanup of oil, protection of resources from further oiling[1] would substantively influence the type and magnitude of potential additional environmental impacts.

The combined implementation of industry standards and practices aid in reducing the potential for spill incidents associated with the proposed Project; these include those developed by the National Association of Corrosion Engineers International and American Society of Mechanical Engineers, PHMSA regulatory requirements defined in Title 49 of the Code of Federal Regulations (CFR) Part 195, and the set of proposed Project-specific Special Conditions developed by PHMSA and agreed to by TransCanada Keystone Pipeline, LP (Keystone). The lower potential of a spill is due to the combined application of the design standards and the addition of the Special Conditions, which add a greater degree of safety over the pipeline systems with reported spill events in the PHMSA incident database. The additional design standards enable the entire length of the pipeline system to have a degree of safety similar to that which is required in a High Consequence Area (HCA) as defined in 49 CFR Part 195.450. Federal, state, and local agencies would participate in response activities consistent with their authorities and duties under applicable regulations and in accordance with the requirements of the ERP. Additional mitigation measures have been suggested by these regulatory agencies and are described in Section 4.14.5, Recommended Additional Mitigation.

[1] Covering with oil.

For the discussion on spills[2], the terms release, leak, and spill are used as follows:

- A release is a loss of integrity of a pipeline or its components;
- A leak is a release over time; and
- A spill is the liquid volume of a leak that escapes a designed containment system, if present, and enters the environment.

The total volume of a spill is a combination of the following:

- Size of breach;
- Pipeline pressure;
- Time to detect leak;
- Time to shut down pipeline and isolate leak after detection;
- Pipeline diameter;
- Distance between isolation valves; and
- Effectiveness of the isolation.

The hole size and pipeline pressure are the primary factors that determine the leak rate from the breach. Flow could continue until the leak is detected and isolated. After the leak is detected and isolated, the volume of liquid in the pipeline between the isolation valves (valves that stop the flow of pipeline contents) could be released unless otherwise controlled.

Leak detection depends on a number of factors. In modern pipeline systems, Supervisory Control and Data Acquisition (SCADA) sensors are designed to automatically detect leaks large enough to produce noticeable changes in pipeline pressure and flow rates. The sensors have a monitoring threshold because pipeline operating variables normally fluctuate within a working range. The SCADA system, in conjunction with Computational Pipeline Monitoring or model-based leak detection systems, would detect leaks to a level of approximately 1.5 to 2 percent of the pipeline flow rate. This range is consistent with the current technical standard range of 1 to 2 percent. Keystone has stated it could detect a leak of this size within 102 minutes. Computer-based, non-real time, accumulated gain/loss volume trending would be used to assist in identifying low rate or seepage releases below the 1.5 percent to 2 percent by volume detection thresholds. Smaller leaks may also be identified by direct observations by Keystone or the public. Until sensors detect a deviation in pressure below the monitoring threshold (which activates pipeline shutdown), oil can escape from the pipeline and create a spill.

Once the leak is detected and confirmed, the operator shuts down operating pumping units, which eliminates the force that will maintain pressure on the pipeline. Isolation valves are also closed as part of shutdown; however, if the valves do not close properly, outflow could continue after shutdown, either at a reduced or unabated rate. The volume that escapes through the ineffective valves adds to the spill.

[2] It applies to the entire pipeline system.

The volume contained in the mainline pipe between the isolation valves may contribute to the spill. The proportion of the volume that actually leaks into the surrounding environment will vary depending on characteristics such as the topographic location of the spill along that route.

4.13.2 Historical Pipeline Incidents Analysis

Analysis of historical pipeline incident data was done to understand what has occurred with respect to pipelines in the United States and to provide input for spill impact analysis in this Supplemental EIS. Details in the PHMSA incident and mileage reports were analyzed to show the distribution of historical spill volumes, and incident causes and frequencies of crude oil pipeline incidents contained in the PHMSA database. Although the results are not a direct indicator of the nature of possible incidents that could occur in association with the proposed Project, they can provide insight into what could potentially occur with respect to spill volume, incident cause, and incident frequency.

4.13.2.1 Background

PHMSA collects data on hazardous liquid pipeline systems operating in the United States. These data can be used to provide insight into spill volume, incident cause, and incident frequency. Although other information sources were reviewed (see Section 4.13.2.4 Pipeline Incident Information Sources), PHMSA information was the most relevant for this Supplemental EIS and the only database that contained raw data[3].

PHMSA collects information that is available to the general public on reportable pipeline incidents. Information collected for each incident includes the following:

- The date of each reportable incident;
- The type of hazardous liquid associated with the pipeline involved in the incident;
- The volume of hazardous liquid spilled in the incident;
- The part of the pipeline system from which the spill occurred;
- The diameter of the hazardous liquid pipeline involved in the incident; and
- The cause of the incident.

The total mileage of pipelines in operation in the United States is collected for each of the following:

- The type of hazardous liquid transported; and
- The diameter of the pipeline.

In addition, for each individual pipeline system in operation in the United States, the number of breakout tanks[4] in use is also collected. As defined for this discussion, linear elements refer to

[3] Raw data are data that have not been processed; they must be analyzed and/or manipulated for any meaningful information or conclusions to be drawn from them.
[4] Breakout tanks are those used to: a) relieve pressure surges in a hazardous liquid pipeline system; or b) temporarily receive and store hazardous liquid transported by a pipeline for continued transportation by pipeline.

mainline pipe and girth welds, and discrete elements are pipeline components such as pumping stations, mainline valves, and breakout tanks.

4.13.2.2 Objectives

The objective of this pipeline incident analysis was to use PHMSA hazardous liquid pipeline incident data and hazardous liquid pipeline annual (mileage) data to determine the historical spill volumes, incident causes, and incident frequencies of crude oil pipeline spills in the United States. Additionally, this analysis provides separate determinations for pipeline mainline pipe and pipeline system discrete components.

4.13.2.3 Method

The method used for this analysis was to filter the PHMSA hazardous liquid incident database covering a fixed period of time by commodity type to obtain a subset of data specific to crude oil pipeline systems. Subsequent filtering of pipeline system component, pipeline diameter, and incident cause resulted in separate subsets of incident counts and associated reported spill volumes for pipeline mainline pipe, mainline valves, pipeline system tanks, and other discrete pipeline components. The historical spill size distributions and incident cause distributions can then be summarized for the time period covered.

By filtering the pipeline mileage data by type and pipeline diameter, an estimate of the total mileage of pipeline in service over the same fixed time period was made. Dividing the number of incidents by the number of mile-years of pipeline in service provides the frequency of historical incidents per mile-year of pipeline (incidents per mile-year is a standard measure for pipeline incidents; it represents the number of incidents for every 1,000 miles of pipeline over a duration of 1 year). Dividing the pipeline tank incidents by the number of tanks in service over the time period provides the frequency of historical tank incidents per tank-year (i.e., per tank per year).

Finally, by estimating the average spacing of mainline valves and pumping stations on pipeline systems in service, the number of mainline valves and pumping stations in service can be approximated. Dividing the number of mainline valve incidents with the approximate number of mainline valves in service results in an approximate frequency of incidents per valve-year. Similarly, dividing the number of pipeline discrete incidents by the approximate number of pumping stations in service results in an approximate frequency of incidents per pumping station-year.

The number of incidents resulting from each filtering set is documented to provide a reference for error checking while performing the analysis.

4.13.2.4 Pipeline Incident Information Sources

Incidents that result in unintentional releases from hazardous liquid pipelines are reported by federal and some state and regional agencies.

National Data Sources

Pipeline and Hazardous Material Safety Administration

PHMSA is part of the U.S. Department of Transportation (USDOT). PHMSA is responsible for protecting the American public and the environment by ensuring safe and secure movement of

hazardous materials to industry and consumers by all transportation modes, including the nation's pipelines. It is responsible for regulations that require safe operations of hazardous liquid pipelines to protect human health and the environment from unplanned pipeline incidents. Through PHMSA, 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. PHMSA administers the national regulatory program to ensure the safe transportation of hazardous liquids, including crude oil, by pipeline. PHMSA develops regulations that address safety in the design, construction, testing, operation, maintenance, and emergency response for hazardous liquid pipelines and related facilities. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operators to use various technologies to achieve the required level of safety.

Among its functions, PHMSA prepares incident and mileage reports. PHMSA incident report files and their originating data are available to the general public. The incident data used to create the pipeline incidents and mileage reports are available online (PHMSA 2012). Reported incidents are available at the PHMSA Freedom of Information Act online library, which spans more than two decades. For the historical data review and historical frequency analysis sections of this report, significant incidents, as described below, in the PHMSA dataset were studied.

PHMSA distinguishes a serious incident as one that involves a fatality or injury requiring in-patient hospitalization. PHMSA designates significant incidents to include serious incidents as well as any one of the following:

- $50,000 or more in total costs, measured in 1984 dollars;
- Highly volatile liquid releases of 5 bbl or more or other liquid releases of 50 bbl or more; or
- Liquid releases resulting from an unintentional fire or explosion.

The pipeline incident data have been recorded with different reporting criteria in the past decades since the 1980s. Therefore, previous databases had different structures at different times. For this report, two PHMSA databases were used: one with data spanning from January 2002 to December 2009, and the other with data spanning from January 2010 to July 2012 (PHMSA 2012). Basic database fields are present in both regarding incident information, such as incident number, incident date, commodity type, part of system involved, reported spill volume, reported incident cause, and others incident information. However, the January 2010 to July 2012 dataset contains more fields with regard to loss estimation and root causes, which results in a more detailed characterization of the spill. Additionally, not all 2002-2012 incident records are complete. Several important fields, such as incident cause, system part, item involved, and pipeline diameter, are blank, unknown, miscellaneous, or incorrectly attributed, leaving the characterization of certain incidents undetermined or open to subjective interpretation.

Mileage reports, termed "Liquid Annuals Data," summarize pertinent information on a yearly basis, including commodity type, pipeline diameter, year of installation or fabrication, mileage, and other pipeline features. These reports summarize the total population of pipelines in which the relevant incidents occurred.

National Response Center

The National Response Center (NRC) is the primary point of contact in the federal government for reporting oil and chemical spills in the United States. A person may report a spill by contacting the NRC via a toll-free number or by filling out a reporting form at the NRC website (NRC 2012). The NRC operates 24 hours a day, 7 days a week, 365 days a year.

The NRC maintains a database of spill incident responses, where basic information of a significant spill provided by the pipeline operator's response team is logged. The report usually contains a brief incident description, location, information about released material, early estimations of released amounts, damages, and details of notifications to government agencies. NRC procedures call for notifying the USDOT regarding incidents related to facilities and operations under its jurisdiction. The NRC communicates with the USDOT at a rate of over 2,500 notifications per year.

Statistics maintained by NRC in cases of pipeline spill incidents are available to the public on an annual basis. Once USDOT is informed about a pipeline incident, PHMSA is the agency in charge of collecting the pertinent data after the spill. The NRC database is focused on emergency response details, and has more flexibility in record keeping than PHMSA. For instance, the material in crude oil spills may be logged as "oil crude," "crude oil," "crude water mixture," "crude mixed with water," or several other terms to represent the same spilled substance. In addition, emergency spill drills conducted during a year are also logged as "incidents" in the database. Information is recorded to clarify the virtual nature of the record, but it is apparent only after analyzing the data records individually. In brief, NRC incident data may not be comparable with PHMSA without previous manipulation. Drawing estimates from database records at face value may grossly misrepresent statistics about pipeline system incidents.

National Transportation Safety Board

The National Transportation Safety Board (NTSB) is an independent agency of the U.S. government. It is responsible for accident investigations in civil transportation (NTSB 2012a). In this role, NTSB investigates and reports on aviation incidents, on major highway crashes, ship and marine accidents, pipeline release incidents, and railroad accidents (NTSB 2012a). The NTSB is also in charge of investigating cases of hazardous materials releases that occur during transportation.

The following NTSB reports on two more recent large spills were reviewed (NTSB 2012b):

- NTSB/Pipeline Accident Report-12/01: Enbridge Incorporated Hazardous Liquid Pipeline Rupture and Release, Marshall, MI. July 25, 2010.
- NTSB/Pipeline Accident Report-04/01: Rupture of Enbridge Pipeline and Release of Crude Oil near Cohasset, MN. July 4, 2002.

The purpose of reviewing the incident reports was to gain a better understanding of these two spills. A familiarization of Enbridge pipeline integrity management was considered beneficial because their system carries diluted bitumen (dilbit) and synthetic crude oil (SCO) (see Section 3.13, Potential Releases, for further definitions) in the United States.

California State Fire Marshal

Outside of the national agencies, some states collect their own internal data. In California, the Office of the State Fire Marshal (SFM) acts as an agent of the PHMSA (formerly the federal Office of Pipeline Safety) for the state (California Department of Forestry and Fire Protection 2012). California data were evaluated in this Supplemental EIS because oil in these pipeline systems is typically heavy crude and has characteristics similar to those of dilbit and SCO.

The California SFM exercises safety regulatory jurisdiction over interstate and intrastate pipelines used for the transportation of hazardous or highly volatile liquid substances within California. In 1983, the Pipeline Safety and Enforcement Program was created to administer this effort (California Department of Forestry and Fire Protection 2012).

In 1987, SFM acquired the regulatory responsibility for interstate lines in California when an agreement was executed with the USDOT. In doing so, SFM became an agent of the USDOT responsible for ensuring that California interstate pipeline operators meet federal pipeline safety standards. Interstate pipelines under this agreement are subject to the federal *Pipeline Safety Act* (Title 49 of the United States Code Chapter 601) and federal pipeline regulations. SFM's responsibility for intrastate lines is covered in the *Elder California Pipeline Safety Act* of 1981 (Chapter 5.5, California Government Code, Section 51010-51019.1).

The agency's responsibilities are twofold:

- To enforce federal minimum pipeline safety standards over regulated interstate hazardous liquid pipelines within California; and
- To enforce pipeline safety federal standards as well as the *Elder California Pipeline Safety Act* of 1981 on regulated hazardous liquid intrastate pipelines.

SFM conducts studies and gathers incident data for the California pipeline system. For this report, the data of a study conducted over a period of 10 years were analyzed (EDM Services Inc. 1993). The data set used for the study was the only and most recent one with incident/temperature information, although limited to California 1981-1990 dataset.

International Data Sources

In Canada, where the proposed Project originates, there are three agencies with responsibility for regulating pipelines —the National Energy Board (NEB), Transportation Safety Board (TSB) and the Alberta Energy and Utilities Board (EUB).

National Energy Board

The NEB is an independent federal agency established in 1959 by the Parliament of Canada. The NEB regulates international and interprovincial pipelines, federal energy development, and federal energy trade. The NEB also regulates some aspects of the international electric utility industry. Under this mandate, the NEB carries out the organization's regulatory responsibilities in the Canadian public interest. The NEB reports to Parliament through the Minister of Natural Resources. The Board is made up of several Board members who come from the private or public sector and have various backgrounds and knowledge.

The NEB has identified four goals it hopes to achieve:

- NEB-regulated facilities and activities are safe and secure;
- The environment is protected throughout the lifecycle of NEB-regulated facilities and activities;
- Canadians benefit from efficient energy infrastructure and markets; and
- The rights and interests of those affected by NEB-regulated facilities and activities are respected.

Canadian Transportation Safety Board

The Canadian TSB is an independent agency, created by an act of the Canadian Parliament (the *Canadian Transportation Accident Investigation and Safety Board Act* that came into force on 29 March 1990) (Canadian TSB 2012a). The act granted the mandate to TSB to advance transportation safety in the marine, pipeline, rail, and air modes of transportation through the following:

- Conducting independent investigations, including public inquiries when necessary, into selected transportation occurrences (incidents) in order to make findings as to their causes and contributing factors;
- Identifying safety deficiencies, as evidenced by transportation occurrences;
- Making recommendations designed to eliminate or reduce any such safety deficiencies; and
- Reporting publicly on investigations and on their findings.

As part of its ongoing investigations, the TSB also reviews developments in transportation safety and identifies safety risks that it believes government and the transportation industry should address to reduce injury and loss. Since its creation, TSB has conducted periodic reports on the national Canadian pipeline system and for that purpose maintained a comprehensive database with incident statistics (Canadian TSB 2012b). Monthly and annual reports are available from the TSB website. Raw incident data are not available; therefore, analysis of that data cannot be done. Public reports summarize estimates that are created on data that are aggregated with different criteria and not solely on the characterization of specific crude oil types. In addition, the field reporting basis for Canadian incidents were incompatible with PHMSA requirements before 2010. Evaluation of data between these two datasets is not directly comparable. However, annual report data and statistical summaries related to accidents and incidents from 2002-2011 were reviewed and referenced as applicable in this Supplemental EIS.

Alberta Energy Resources Conservation Board

In Canada, the province of Alberta accounts for the overwhelming majority (more than 96 percent) of Canada's oil reserves (Alberta Energy 2012b). The Alberta Energy and Utilities Board (Alberta EUB) regulates the energy resource development, pipelines, transmission lines, and investor-owned electric, water, and natural gas utilities, as well as certain municipality-owned utilities in the province. The Alberta EUB reports to the Executive Council through the Ministry of Energy.

On January 1, 2008, the Alberta EUB was realigned into two separate regulatory bodies (Alberta Energy 2012a):

- The Energy Resources Conservation Board (ERCB), which regulates the oil and gas industry; and
- The Alberta Utilities Commission, which regulates the utilities industry.

The ERCB leads teams of engineers, geologists, technicians, economists, and other professionals at 14 locations in Alberta. The ERCB objectives include the following (ECRB 2012):

- To achieve high standards through effective and efficient regulation of public safety, environmental protections, and energy resource conservation;
- To be proactive in identifying and addressing emerging issues that face the industries the ERCB regulates and stakeholders affected by these issues;
- To provide its customers with easily accessible, relevant, and high-quality data, information, knowledge, and advice related to the energy sectors;
- To institute decision-making processes that are fair, efficient, and adaptable to the circumstances and that achieve a respected public interest balance; and
- To protect Albertans from exposure to long-term industry abandonment and decommissioning liabilities.

One of the reports, "Pipeline Performance in Alberta, 1990-2005" (EUB 2007), which was prepared by the EUB, was studied in detail for this Supplemental EIS. The purpose of reviewing that report was to compare PHMSA datasets and gain a better understanding of pipeline systems where dilbit, SCO, Bakken crude oil, and heavy crude oils are normally transported.

Other Data Sources

For some larger spills, other publicly available studies and reports were reviewed. These reports contained information regarding the effects to the environment as a result of a spill. The following spills were reviewed:

- Crude Oil Spill at Bemidji, Minnesota, August 29, 1979: Hult 1984 and U.S Geological Survey (USGS) 1998.
- Dilbit spill into Kalamazoo River, Michigan, July 26, 2010: Stratus Consulting Inc. 2005a and 2005b. Stage I Assessment Report, Volumes 1 and 2.
- Crude Oil Spill into Yellowstone River near Laurel, Montana, July 7, 2011: PHMSA 2011; U.S. Environmental Protection Agency (USEPA) 2012 and 2011; Center for Toxicology and Environmental Health 2011; Montana Department of Environmental Quality 2012.

The purpose of reviewing the studies and reports was to gain a better understanding of these spills and the results of these spills.

4.13.2.5 PHMSA Historical Data

PHMSA hazardous liquid pipeline incident reports include information on the type of hazardous material spilled, the estimated volume spilled, the part of the pipeline system that was the source of the release, and the probable cause of the incident. The PHMSA liquid incident dataset, which

includes incidents from hazardous liquid pipelines, can be filtered to include only crude oil pipeline incidents. The PHMSA hazardous liquid pipeline incident data do not detail the type of crude oil involved with each incident, and so the historical incident summaries cannot be specific to dilbit, SCO, or Bakken crude oil, but rather can only be specific to crude oil in general.

The historical incident data can be divided into discrete components (e.g., breakout tanks, pumping stations, and valves) and linear components (e.g., mainline pipe). This allows historical spill volumes and incident causes from the mainline pipe to be assessed separately from discrete elements such as pumping stations, breakout tanks, valves, and other associated equipment.

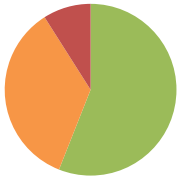
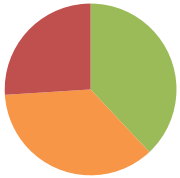
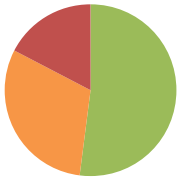
The incident and mileage reports were analyzed to show the distribution of historical spill volumes and incident causes and frequencies of crude oil pipeline incidents contained in the PHMSA database. This analysis was done to understand what has occurred historically with respect to pipelines in the United States and to provide input for spill impact analysis in this Supplemental EIS. The analysis of incident data was used to provide insight into what could potentially occur with respect to spill volume, incident cause, and incident frequency, and is not intended to predict or indicate that spill incidents would be the same for the proposed Project. Once a final project route is determined, Keystone would conduct a detailed spill risk assessment for the proposed Project. Appendix K, Historical Pipeline Incident Analysis, summarizes the objectives and results of the PHMSA data analysis.

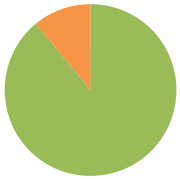
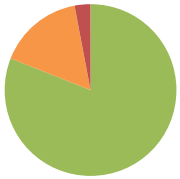
Spill Size Distribution

As discussed in Section 4.13.3, Spill Impact Assessment, spill impacts were analyzed for spill volumes of 0-50 bbl, 50-1,000 bbl and 1,000-20,000 bbl. Table 4.13-1 shows a summary of the spill size distribution, representative mileage, and frequencies for crude oil incidents in the PHMSA incident database. The estimates of pipeline mile-years shown in Table 4.13-1, along with the estimates of pipeline associated equipment-years, allow differentiating the incident rate between linear elements (mainline pipe and welds around the pipe's circumference) and discrete elements (such as pumping stations and breakout tanks). The incident frequencies contained in the table are the number of incidents divided by the associated mile-years or equipment-years. The summaries show that:

- Spill volumes from the mainline pipeline tend to be larger than spills from discrete elements, other than tanks;
- Spill volumes from larger diameter pipelines tend to be larger than spills from smaller diameter pipelines;
- Spill volumes from pipeline tanks tend to be larger than mainline pipe spills when considering all pipeline diameters;
- Spill volumes from pipeline tanks tend to be similar to mainline pipe spills for 16-inch and larger-diameter pipelines;
- The dominant causes for a release for the mainline pipeline (linear) element are corrosion and outside force;
- Equipment failure is the primary cause for discrete equipment elements; and
- Incorrect operations are recorded as the cause of a large proportion of reported incidents for tanks.

Table 4.13-1 Spill Volume[a] Distribution by Pipeline Component

Pipeline Component (number of reported incidents)	0–50 bbl	50–1,000 bbl	1,000–20,000 bbl	Volume Distribution[b]	Pipeline Mileage[c] or Equipment Exposure[d]	Incident Rate per Mile-Year[c] or Equipment-Year[d]
Pipeline, All Elements (1,692)	79%	17%	4%		537,295 mile-years	0.00313
Mainline Pipe (321)	56%	35%	9%		537,295 mile-years	0.00059
Mainline Pipe, 16-inch Diameter and Greater (71)	38%	36%	26%		287,665 mile-years	0.00025
Pipeline System, Tanks[e]	51%	30%	17%		537,295 mile-years	0.00017
Tanks[d] (93)					18,937 tank-years	0.0049

Pipeline Component (number of reported incidents)	0–50 bbl	50–1,000 bbl	1,000–20,000 bbl	Volume Distribution[b]	Pipeline Mileage[c] or Equipment Exposure[d]	Incident Rate per Mile-Year[c] or Equipment-Year[d]
Pipeline System, Mainline Valves (25)	89%	11%	0%		537,295 mile-years 26,865 valve-years	0.00005 0.00093
Pipeline System, Other Discrete Elements (909)	81%	16%	3%		537,295 mile-years 11,647 pumping station-years	0.00168 0.055

Source: PHMSA 2012.

[a] The volume reported is the estimated amount lost in an incident and is not based on the same definition of a spill as used in this Supplemental EIS.
[b] Green: 0-50 bbl, orange: 50-1,000 bbl, red: 1,000-20,000 bbl spill
[c] For linear elements.
[d] For discrete elements.
[e] Volume percentages do not add up to 100% because one incident, out of a total of 93, is greater than 20,000 bbl.

When comparing the frequencies in Table 4.13-1 to those frequencies developed in the Final EIS (Appendix Q, Pipeline Risk Assessment and Environmental Consequence Analysis), it is difficult to make a one-to-one comparison. The PHMSA data had a different dataset range (up to 2008). Thus, the Final EIS frequencies cannot be compared to the values above and in Appendix K, Historical Pipeline Incident Analysis, which were based upon PHMSA data from January 2002 through July 2012.

Comparison of Different Historical Data

As discussed, there are other sources for data on pipeline incidents. However, unlike PHMSA, the majority of these do not have publicly available raw data that can be analyzed in a similar manner. To aid in identifying the consistency in spill incidences from different sources and the reproducibility of those statistics, the PHMSA data were compared to the summary tables and figures in the EUB and SFM summary reports. In addition, these other data sources supplemented the PHMSA database because they reflect a heavy crude oil type similar to that which would be transported in the proposed Project.

EUB—Pipeline Performance in Alberta, 1990-2005

The EUB report, "Pipeline Performance in Alberta, 1990-2005," analyzed pipeline incident data in Alberta from January 1990 to December 2005.[5] The report contains 411 incidents related to crude oil systems in the province, which represents approximately 27 incidents per year. The following conclusions may be inferred from Figure 12a in that report (EUB 2007):

- Corrosion is the main cause of spills in Alberta crude oil pipelines, accounting for 37.7 percent of the incidents. This percentage is not significantly greater than the contribution found from U.S. data (34.4 percent in the PHMSA dataset). Therefore, no evidence is found that Alberta's pipeline contents are more corrosive than average crude oil.
- Third-party damage is the second highest cause of spills at 21.6 percent.
- The "other" category, which includes installation failure, operator error, and unknown and miscellaneous causes, is high in comparison with U.S. data (11.9 percent versus approximately 5 percent in the PHMSA dataset, with an average of 160 incidents per year).
- The natural forces cause, termed "earth movement"[6], is similar to the counterpart data from the United States (2.9 percent versus 4.1 percent in PHMSA).
- The EUB has several different scenarios for equipment-related incidents, including joint failure[7], valve/fitting,[8] and weld[9]. Grouping the categories related to equipment, the total contribution is 15.1 percent in the Alberta dataset. The contribution in the PHMSA dataset is approximately 31.9 percent for equipment-related incidents. The difference may be explained

[5] This is the most recent data available that had been processed and analyzed to provide meaningful information from which to compare.
[6] "Earth movement" includes watercourse change, slope movement, ground heave, and subsidence.
[7] Mechanical joint failure (e.g., gasket failure, o-ring failure) or miscellaneous joint failure (e.g., butt fusion, interference joints).
[8] Valve failure or installation failure.
[9] Girth weld failure, seam rupture, or other weld failure.

in part by undetermined, equipment-related incidents classified as "other" and by the smaller size of Alberta's crude oil pipeline system (only 677.3 mi [1,090 km]).

- The "incorrect operation" cause category is very small in the Alberta dataset. Only 1.5 percent is attributed to "overpressure" (presumably human-error related) against almost 9.5 percent in the PHMSA dataset.
- Figure 28 of the report provides estimates of incident frequencies from crude oil pipelines in Alberta. The 1990–2005 average is approximately three incidents per 1,000 mile-years. This is very similar to the PHMSA crude oil incident rate of 3.1 incidents per 1,000 mile-years for pipeline elements from 2002–July 2012, as shown in Appendix K, Historical Pipeline Incident Analysis, Table 4.

California SFM—Hazardous Liquid Pipeline Risk Assessment

The dataset contained in the report is considerably older than the PHMSA dataset. The California data from which the report draws its conclusions span from 1981 to 1990[10] (EDM 1993). Because the California pipeline system generally manages heavy crude oil, which is similar in character to dilbit, the California study and the conclusions drawn are useful to assess the effects of heavy oil on pipeline corrosion and potential effects on the pipe of the proposed Project. The California report states several conclusions for the analyzed incidents, as follows:

- Older pipelines had a significantly higher external corrosion leak incident rate than newer pipelines;
- Elevated pipeline operating temperatures significantly increased the frequency of external corrosion caused leaks;
- The external corrosion leak incident rate was less for pipelines greater than 16 inches in diameter than it was for smaller lines;
- Although a small number, pipelines without cathodic protection systems had a substantially higher frequency of external corrosion-caused leaks than protected lines; and
- In some cases, the pipe specification and type of external corrosion coating affected external corrosion leak incident rates.

The California report states that pipelines operating at higher temperatures are also the oldest. The oldest pipelines in the dataset (50+ years old at the time of the study) tended to leak up to 20 times more frequently than the youngest pipelines (less than 10 years old at the time of the study). Although the data also showed that systems operating at 130 degrees Fahrenheit (°F) and higher had from 8 to 23 times higher leak rates than those operated at ambient temperature, a direct cause-and-effect relationship between operating temperature and leak rate is not conclusive. The reported leak rate can be related to age, with the oldest pipelines having the higher leak rates.

Although temperature can increase the rate of a chemical reaction, such as corrosion for both steel pipe buried in the ground and unburied pipe exposed to the weather, the results of the California study must be evaluated with caution. The pipelines in the California study were

[10] This is the most recent dataset for which information was available.

installed with different design criteria than the proposed Project would be. Pipeline systems older than 20 years have different cathodic protection specifications, different external protective coatings, if any, different SCADA systems, and different pipe specifications. Pipeline systems greater than 40 years could have even less protection than 20-year-old systems, not to mention those that would be installed today. Pipe specification, coating, and cathodic protection are some factors that affect corrosion rates. Therefore, a conclusion that higher leak rates would occur at higher temperatures cannot be drawn based on the California study alone.

Temperature data are not available in the PHMSA dataset; therefore, it is not possible to directly determine if there is a relationship between operating temperature and incident frequency. Several PHMSA Special Conditions are to be in place for the proposed Project to mitigate pipeline aging (see Section 4.14.5.1, PHMSA 57 Special Conditions). The ultimate rate of corrosion may not be assessed at this time with the available data. However, as noted in Section 3.13.3.5, Acidity and Corrosivity Potential, a study on the corrosivity of dilbit is being conducted by the National Academy of Sciences (NAS).

4.13.2.6 Applicability of Crude Oil Data

Ideally, incident data from pipelines transporting dilbit, SCO, and Bakken crude oil would be available for the historical data analysis conducted in this report. However, given how incident data are reported, it is not possible to distinguish dilbit, SCO, and Bakken oil spills from the general population of crude oil spills, nor is it possible to distinguish pipelines carrying dilbit, SCO, or Bakken oil from other crude oil pipelines. However, insights can be made by comparing the proposed Project conditions with the historical data:

- The oil that would be transported by the proposed Project would include dilbit, SCO, and Bakken crude oil;
- As discussed in Section 3.13, Potential Releases, dilbit, SCO, and Bakken oil total acid number values are generally consistent with those of 18 international crudes, indicating that corrosivities would be similar;
- Alberta is a source of dilbit[11] and SCO[12]; incident statistics from Alberta show that incident frequencies and corrosion-based incidents are similar for pipelines in the United States and Alberta;
- The positive effects of the PHMSA Special Conditions are not reflected in the historical data, as there has not been a pipeline designed to these more rigorous set of specifications to date; and
- The integrity threats identified in Section 3.13, Potential Releases, from the dilbit, SCO, and light crude oil that would be transported by the proposed Project are the same as those for a crude oil pipeline.

[11] Bitumen is generally produced from deposits in Alberta, Canada, and the Orinco tar sands in Venezuela. The source for the proposed Project is Alberta.
[12] Almost all of Alberta’s proven oil reserves are found in Alberta's oil sands. Of Alberta's total oil reserves, 169.3 billion barrels, or about 99 percent, come from the oil sands; the remaining 1.5 billion barrels come from conventional crude oil (Alberta Energy 2012b).

The historical data do not reflect pipelines with the aforementioned PHMSA Special Conditions because they are new and go beyond typical pipeline safety measures. Section 4.14.5.1, PHMSA 57 Special Conditions, presents more detail on the Special Conditions and how they would be expected to affect the risk of a spill. In addition, there is another ongoing parallel study being done by a third party that is undertaking a detailed frequency analysis related to the nine threats identified in Section 3.13, Potential Releases. This Supplemental EIS may be updated with those findings after they are published.

4.13.3 Spill Impact Assessment

4.13.3.1 Spill Volumes and Potential Impact

Potential crude or refined oil released into the environment from the proposed Project during operations may affect natural resources, protected areas, human uses, and services. Although reported information on dilbit releases is scarce in the literature, once diluents and bitumen are mixed together to form dilbit, they behave as a conventional crude oil. Therefore, this assessment has focused on the impact of crude oil in general, but when applicable, evaluated the specific characteristics (i.e. viscosity) of dilbit. The degree of impact can vary depending on the cause, size, type, volume, location, season, environmental conditions, and the timing and degree of response actions. The discussion in this section presents the potential impacts of three categories of spills: small, medium, and large[13], which are defined below:

- Small spills: less than 50 bbl (2,100 gallons);
- Medium spills: greater than 50 bbl (>2,100 gallons) up to 1,000 bbl (42,000 gallons); and
- Large spills: greater than 1,000 bbl (>42,000 gallons) up to 20,000 bbl (840,000 gallons).

These categories were selected to be representative of the earlier Final EIS work, which used five categories; this Supplemental EIS reduced the categories to three to simplify the range of spill volumes provided in the PHMSA database. This simplification helps to facilitate assessing the spill-size propagation/migration along the proposed Project route.

According to PHMSA data, most small spills are related to pinhole-type corrosion leaks along the body of the pipe or by leaks from valves, flanges, pumps at pump stations, delivery type facilities, or other equipment. Medium spills are generally caused by damage from corrosion or by excavation/construction equipment damaging the body of the pipe.

The PHMSA data indicate that large spills are associated with severe damage to or complete failure of a major pipeline component (e.g., rupture in the pipe material, complete weld failures that cause pipe separation along seems or joints).

These categories represent approximately 79 percent, 17 percent, and 4 percent, respectively, of the 1,692 crude oil spills reported,[14] and capture the range of spill volumes provided in the PHMSA database, as shown in Table 4.13-1[15] and Appendix K, Historical Pipeline Incident

[13] The spill sizes of “small”, “medium”, and “large” are descriptors to facilitate an analysis of spill impact. These descriptors are not intended to be a measure of potential environmental impact should a spill of these sizes occur.
[14] For crude oil spills from a pipeline 16-inch-diameter and larger, the same spill categories represented 38 percent, 36 percent, and 26 percent of the 71 reported incidents.
[15] Table 4.13-1 provides various subsets of the data with percentages based on the three spill volume sizes.

Analysis. In addition to the volume of product spilled, the consequence of any of the above spill sizes would also be affected by response time and the response efforts.

Potential Impact of Small Volume Spills

The potential impacts from small drips of oil or fluids from equipment or small, intermittent leaks of oil from flanges or gaskets to soil would typically have little effect on nearby natural resources. These types of releases would generally be detected by maintenance or operations personnel and addressed through the repair of the leak. The area impacted by this type of spill would be remediated (e.g., excavation of impacted soil, cleaning of stained concrete or containment areas, etc.) and the waste disposed of, thus reducing the potential for environmental impact. Small spills of oil from a subsurface pipeline would disperse to the surrounding soil and the oil would generally remain in the immediate vicinity of the spill site or within the pipeline right-of-way (ROW). A slow subsurface release, characterized as a slow drip (e.g., gallons per year as opposed to gallons per minute), would infiltrate down into soil, and could potentially reach a groundwater resource. If the rate of the spill is faster than the amount that can percolate downward through the soil, the oil may surface and potentially flow away from the release site across the ground surface, potentially affecting nearby vegetation or other resources.

While impacts to groundwater from small spills would be unlikely, a subsurface release could go undetected by both SCADA and surface inspections, resulting in impacts to permeable, sandy soils and could reach shallow groundwater resources. Chemicals in the oil could dissolve into groundwater and then migrate away from the release site. The response action to small spills or releases is generally conducted relative quickly once the spill/release is detected, resulting in only short-term (e.g., days to weeks) disruptions to the environment. However, small spills released directly or indirectly (e.g., via runoff from stormwater or overland flow) to lakes, rivers, reservoirs, or other potential drinking water sources, wetlands or natural areas could potentially impact human health and/or the environment through the contamination of drinking water supplies or oiling of vegetation or wildlife (i.e., a longer-term disruption).

Potential Impacts of Medium Volume Spills

With medium spills, a release can occur as a subsurface or surface event depending upon the cause. A slow subsurface release would infiltrate down into soil and could potentially reach a groundwater resource. Similar to a small spill, if the rate of the spill is faster than the spill can percolate through the soil, the oil could also seep to the ground surface. Once the oil reached the ground surface it would behave similarly to that of a surface release and potentially flow away from the site, affecting nearby vegetation or other resources. Once the migrating oil leaves the release site, impacts to soil, vegetation, and surface water along the flow path would occur. Some of this volume of material would tend to pool in low areas and potentially infiltrate back into the soil and to groundwater depending on the depth to groundwater. Potential behavior in shallow groundwater would be the same as for small spills that reach groundwater; a plume of chemicals could form and migrate away from the release site. Because of the increased volume of oil released from the pipeline when compared to a small release, it is also possible that oil could pool on the groundwater surface.

If the release enters flowing water or other surface water features, the extent of the release could become large. Depending on the river's flow and the time to respond to the spill, the spill could potentially affect miles of river and shoreline. The same impacts to the shoreline of lakes or

ponds could occur if tributaries or wind-driven currents spread the spilled material. Many of these surface water features could serve as potable water sources, and spilled material could threaten water supplies for the local population. Oiling could occur on vegetation and soil along the banks or shore of surface waterbodies. Additionally, over time, oil would degrade as well as mix with particulates in water resulting in the oil sinking below the water surface. In flowing water systems, sinking oil could be transported downstream without the obvious surface oiling of stream banks.

Wetlands and other natural areas along with their inhabitants (e.g., amphibians, reptiles, fish, and aquatic plants) could be impacted if a medium volume spill entered these ecological systems. However, compared to channelized flowing surface water systems, an oil plume within a wetlands-like environment typically would migrate slowly, oiling surface vegetation, and wildlife. Additionally, impacts would not only occur from oiling of environmental features, but also from response actions and remediation following a medium spill. Releases resulting in medium-sized spills typically would be detected by the SCADA system as well as by routine visual inspections.

Potential Impacts of Large Volume Spills

In a large spill, very little of the oil released (relative to the size of the spill) would be contained in the immediate vicinity of the release point. The majority of the volume would migrate away from the release site. The distribution of the oil would be influenced by terrain, location, soil type, weather, soil cover, and the response of operators to the release as described above.

The potential impacts from a large spill would be similar to the impacts from the medium-sized spill, but on a much larger scale. More oil would seep into the soil over a larger area and could infiltrate deeper into the soil. More oil could enter surface water features and wetlands, if present in the release zone, and could also potentially affect drinking water resources to a larger extent. SCADA systems are designed to detect large volume oil releases, which are often detected as well by visual means.

4.13.3.2 Spill Propagation

The size or extent of a spill could be affected by the terrain or topography of the release site, release location (urban/suburban or remote), soil type and soil cover, weather, and the timing and effort of the response. Understanding the effects of these factors on the oil can aid in understanding the extent of coverage and the potential impacts to humans and the environment.

Overland Flow with Infiltration to Groundwater

In the event of an undetected leak along a section of buried pipeline, the oil could saturate nearby soil and initially expand both vertically and horizontally along the pipeline. Downward movement could occur until the material reaches groundwater. At the water table, the material potentially could pool and a plume of dissolved chemicals could form. The pool of oil on the groundwater surface could continuously supply the dissolved-constituent plume, which could be carried downward away from the release site by natural flow conditions. In a scenario where a nearby operating water well is using the same groundwater resource, the dissolved chemicals could potentially be drawn to the well, exacerbating migration and potentially exposing humans, animals, and crops to the oil. Oil that moves upward to the ground surface would be noticeable. However, should the release go unchecked for an extended period of time, the oil could flow

outside the proposed pipeline ROW and impact local vegetation and surface waterbodies. The oil would continue to spread until it has reached the physical limits of the volume spilled or is contained.

Overland Flow to Surface Water

The scenario discussed above has the potential to affect surface waterbodies such as streams and rivers. Once the spill reaches the surface, the oil would flow following the topographic gradient (i.e., lows). Topographic lows can be features such as gullies, roadside drainage ditches, culverts, or storm sewers. These drainage features can eventually connect to larger ditches and possibly streams, rivers, and lakes or reservoirs. If the release enters flowing water or other surface water features, the areal extent of the release could become large. Depending on the surface water feature's flow and the spill response time, the spill could potentially affect miles of the surface waterbody and shoreline. The same impacts to the shoreline of lakes or ponds could occur if tributaries or wind-driven currents spread the spilled material. Oiling could occur on vegetation and soil along the banks or shore of surface waterbodies. Additionally, over time oil could degrade as well as mix with particulates in water, resulting in the oil sinking below the water surface. In flowing water systems, sinking oil could be transported downstream without obvious surface oiling of stream banks. Sinking oil can be deposited in river or stream bottoms and become a continual source of oil as changing water flows release the deposited oil.

Degradation of Crude Oil in the Environment

Once oil is released to the environment, natural processes begin to break down the oil immediately. Many natural processes such as evaporation, biodegradation, dispersion, and dilution act upon the oil and its constituents to different degrees in soil or water. A release to subsurface soils from a buried pipeline would move throughout the nearby soil both laterally and vertically. Downward movement of oil could eventually impact groundwater resources. Crude oil that moves upward could be seen on the surface of the ground or water.

In surface soils, the constituents of the oil could be affected by evaporation, biological degradation (biodegradation), and photodegradation (e.g., degradation by ultraviolet light/sun light). The spreading and thinning of the oil increases the surface area exposed to these processes and could accelerate the degradation of the oil. Evaporation and photodegradation would generally affect the lighter hydrocarbons in the oil.

The remaining heavier, more complex hydrocarbons are typically referred to as weathered oil. This weathered oil would slowly degrade over time from biological processes. The effect these biological processes would have on the released oil would depend on the soil chemistry and the presence of suitable microbial populations.

Should oil reach groundwater or surface water, the more soluble components of oil (e.g., benzene, toluene, xylenes, among others) would dissolve in the water and form plumes that could flow away from the spill site. These dissolved plumes could continue to lengthen and spread until the all of the oil's soluble components dissolve into the surrounding water. In groundwater, natural processes such as dispersion, dilution, and in time, biodegradation, would begin degrading the plumes. In surface waters, the oil would be diluted as it spreads across the surface in a thin sheen. Currents and wind would affect the movement of the oil. Many of the constituents of the oil sheen will evaporate due to their volatility. As these components

evaporate, the oil could become heavier and sink to the bottom sediments where the oil would further degrade.

Topography of the Release Site

The topography or terrain near the spill would affect the potential impacts. Hills, valleys, low areas, and other land features can affect how a release is contained or migrates over the ground surface. A release in an area with a steep slope can accelerate the rate of oil migration and cause the spill to cover a greater area. Releases near low areas or confined valleys could pool and contain the oil and reduce aerial coverage of the release. A spill that flows into a drainage ditch or channel might flow greater distances from the release site due to the funneling of the oil in the channel as well as the slope of the channel. A spill released to level, flat ground would generally not migrate as far from the release site. Smaller drainage channels generally flow into larger channels, which potentially could empty to a surface water feature, thus increasing the impacts of the spill.

Location of Spill

Location is a key component of the consequence of a spill. A spill in an urban setting generally would have different effects on human health and the environment compared to a rural setting. The location of the release relative to areas of human activity can affect the overall extent of a spill. Generally, most spills would occur and be contained within or in close proximity to the pipeline ROW or ancillary facilities (e.g., construction yards, pump stations, maintenance yards). Because of the larger population, urban and suburban surface spills could be noticed earlier than those in a rural setting, thus shortening the response time and mitigating the size of the impact.

However, excavation or construction activities occur more frequently in urban or suburban settings, increasing the chances of pipeline damage and a release. Generally, the prompt reporting of the damage by the contractor would decrease the duration and size of the release in an urban or suburban setting, although the potential impact of the release could be greater depending upon the population associated with the urban/suburban areas.

In remote areas, spills may not be discovered immediately and a release may not be detected by leak monitoring systems; this could potentially allow a spill to continue for an extended period of time. In remote areas, it is possible that a larger volume of material could be released; however, the potential impacts could be less than a smaller urban-type spill due to a reduced number of receptors.

The locations of greatest concern for potential oil spills is whether the spill is in an urban setting or remote setting and if HCAs and Other Receptors are within the reach of the spill. Water intakes for public drinking water or commercial/industrial users and Unusually Sensitive Areas, especially wetlands, flowing streams and rivers, and similar critical habitats, are particularly important.

4.13.3.3 Effect of Soil Type, Soil Cover, and Temperature on Flow

Ground conditions and temperature can affect the size of the area affected. Ground conditions reduce spill extent by friction, which slows the movement of the oil. Two key types of ground conditions are addressed here, soil type and soil cover. Temperature also affects spill propagation

by reducing spreading in colder temperatures or increasing the potential for spreading in warmer temperatures.

Soil Type

The type of soil at the site of the release affects the spread of the spill. Sands and gravels have larger spaces between the particles of soil (pore size), which could increase the upward or downward movement of the oil. Clays and silts have much smaller pore sizes and do not allow the oil to move as much. A spill of equal volume on sandy soils would tend to penetrate deeper because clays and silts allow much less downward movement. In some areas along the route, a spill may potentially penetrate through the sandy soils and impact groundwater resources. The extent of spills of equal volume would be affected by the type of soil on which the release occurred. Because spills tend to move downward in sandy soil, there are generally fewer impacts on the surface, depending on the size of the spill. The reverse is true with clay soils. In areas with a rocky surface, spills would tend to cover the rocks (known as oiling) and pool between the individual rocks.

The moisture content of the soil will influence the spill. In wet or saturated soil, the pores between the soil particles are partially or completely filled by water, leaving little or no room for the less dense oil to move downward. The lack of downward movement in this case generally would lead to a spill covering a larger surface area.

Soil Cover

The surface over which the oil spreads can affect the extent of the spill. Soil covers can include grasses, saturated ground (i.e., wetlands and related vegetation), forests, and hardscape (e.g., concrete or asphalt). Different soil covers retain different amounts of oil. As a spill spreads over land, the oil adheres to dry surfaces. Because saturated soils are less susceptible to downward movement of the oil, they tend to allow the oil to flow over the ground surface. As the oil flows over the ground surface, it would coat vegetation (oiling). The surface area of the impacted plants and the amount of oil retained would affect the overall extent of the spill. Where the oil flows into forested areas, shallow root zones may act as conduits and allow the oil to penetrate deeper into the soil. The oiling of hardscapes (e.g., concrete, asphalt) would tend to be surficial, except where expansion joint seams, cracks, or other deformities in the cover's surface exist. Cracks and joints in roadways could allow the oil to reach the potentially more permeable underlying soils and increase the depth of the impact.

Temperature

The temperature at the time of a spill can influence the extent of the spill. Dilbit is comparable to a heavy, sour crude oil. The viscosity of the oil is such that the product would be transported through the pipeline at temperatures between 120°F (50 degrees Celsius [°C]) and 150°F (65°C). In this temperature range, the product flows. Ambient temperatures less than 120°F (50°C) would influence the spill by making the oil less apt to flow. In cold weather, dilbit will be far less mobile in the environment and may behave more like a solid (tar- or putty-like) than a liquid, potentially limiting the impacts and extents of a release to the environment.

Typically the areas traversed by the proposed pipeline experience very cold winters, which would limit the extent of a release during the colder months. The lower outside temperature would cool the product and increase its viscosity. This could inhibit the oil's ability to flow and

limit the extent of coverage. Should a release occur in extremely cold conditions, the potential impacts would be further limited as the product would cool very quickly and behave more like a tar- or putty-type material and would not be able to flow. Conversely, the potential impacts of a release during the summer could increase due to the higher summer temperatures. The higher outside temperature would allow the oil to stay fluid longer. Generally, the cooling process is expected to take longer in the summer and could allow the oil to flow more readily. In the summer, surface temperatures on roadways and other surface covers could nearly reach the oil's transport temperature and allow the oil to continue to flow over land until the source is interrupted.

4.13.3.4 Types of Spill Impact

There are three types of spill impacts that could affect the spill receptors: physical impacts, chemical and toxicity impacts, and biological (ecological) impacts.

Physical Impacts

Physical impacts of spills of crude oil or petroleum products to natural resources and human uses typically result from physical oiling of soils, sediments, plants, animals, or areas used by people or from fire or explosion.

Oiling

Oiling can affect both wildlife and the physical environment in which they live. The following are common oiling effects:

- Smothering living plants and animals so they cannot feed or obtain oxygen;
- Coating feathers or fur on animals, which reduces insulating efficiency and results in hypothermia;
- Adding weight to the plant or animal so that it cannot move naturally or maintain balance;
- Coating sediments and soils, which reduces water and gas (e.g., oxygen and carbon dioxide) exchange and affects subterranean organisms (e.g., insects);
- Oiling sediment and soils such that they could become a chronic source of oil and its dissolved constituents;
- Oiling livestock, crops, clothes, recreational equipment, pets, and hands/feet; and
- Oiling beaches, water surfaces, wetlands, and other resources used by people, which may result in nuisance odors and visual impacts.

In aquatic areas with high energy (e.g., turbulent river flows, and/or high sediment deposition), the oil may become buried under or mixed beneath stream sediment and soil along stream banks, where it may be trapped and remain for extended periods of time. This buried oil may later be slowly released from the sediment or soil to the environment to re-oil downstream habitats and resources. In some cases, the buried oil could be in an environment without oxygen (anaerobic) and would resist weathering by physical or biological processes, providing a source of nuisance discharges to the environment over several years.

Fire or Explosion

The PHMSA database for significant onshore hazardous liquid incidents indicates that since 2002, six of 3,916 (0.15 percent) reported incidents were attributed to fire. These six incidents were related to the release of flammable hydrocarbons, such as gasoline or liquid propane. Two of the incidences involved a subsequent release of crude oil (one less than 1 gallon and the other less than 10 gallons).

Crude oil is a flammable product; however, the appropriate concentrations of flammable vapors from the oil and oxygen would need to be available in the presence of an ignition source for a fire to occur. Oil spills released to confined areas (e.g. storm sewers and possibly some below ground spills) could potentially generate a sufficient concentration of flammable vapors and ignite. However, the flammable vapors released from a spill in an open environment would likely be dispersed throughout the surrounding area or diluted by the wind and not reach the concentration necessary to cause a fire or explosion. Inside the pipeline, the oxygen level is generally too low, making an explosion unlikely.

The pump stations for the proposed Project would be powered by electricity, although emergency generators would have integrated fuel tanks. As a result, there would not be natural gas or large quantities of other flammable fuel at the facilities. A crude oil spill at a pump station would likely result in the emission of some hydrocarbon vapors, but the vapors would emit into open atmosphere and be diluted to below explosive limits. Explosions at a pump station could potentially occur due to a fire unrelated to the pipeline such as at generator fuel tanks or local storage tanks. The fire, if uncontrolled for a prolonged duration, could affect the integrity of a pipeline, causing a leak and fuel for a pipeline fire and potentially an explosion. However, this scenario is hypothetical and there are no such recorded incidences in the PHMSA database.

Chemical and Toxicological Impacts

Toxicological impacts resulting from petroleum releases are a function of the chemical composition of the oil, the solubility of each class of compounds, and the sensitivity of the receptor. The chemical and toxicological characteristics of dilbit, SCO, and diluent are within the range for crude oils. Most crude oils are more than 95 percent carbon and hydrogen, with small amounts of sulfur, nitrogen, oxygen, and traces of other elements. Crude oils contain lightweight straight-chained alkanes (e.g., hexane, heptane); cycloalkanes (e.g., cyclohexane); aromatics (e.g., benzene, toluene); and heavy aromatic hydrocarbons (e.g., polycyclic aromatic hydrocarbons [PAHs], asphaltines). Straight-chained alkanes are more easily degraded in the environment than branched alkanes. Cycloalkanes are extremely resistant to biodegradation. Aromatics (i.e., benzene, toluene, ethylbenzene, and xylene compounds) pose the most potential for toxic impacts because of their lower molecular weight, making them more soluble in water than alkanes and cycloalkanes.

Toxicity to Environment

Toxicological impacts are the result of chemical and biochemical actions of petroleum-based compounds on the biological processes of individual organisms (e.g., API 1997, Muller 1987, Neff 1979, Neff and Anderson 1981, Neff 1991, Stubblefield et al 1995, Sharp 1990, Taylor and Stubblefield 1997). Impacts may include: various toxic effects to animals and birds as they try to remove the oil from their fur or feathers; direct and acute mortality; sub-acute interference with feeding or reproductive capacity; disorientation/confusion; reduced resistance to disease; tumors;

reduction or loss of various sensory perceptions; interference with metabolic, biochemical, and genetic processes; and many other acute or chronic effects. A description of toxicological effects of petroleum to both human and natural environment receptors is presented in Appendix Q, Pipeline Risk Assessment and Environmental Consequence Analysis.

While lightweight aromatics such as benzene tend to be water soluble and relatively toxic, they are also highly volatile. Thus, most or all of the lightweight hydrocarbons accidentally released into the environment evaporate, and the environmental persistence tends to be low. High molecular weight aromatic compounds, including PAHs, are not very water soluble, can be retained in soil, and persist in the environment longer than the lightweight aromatics such as benzene. Consequently, these compounds, if present, are substantively less mobile and toxic than more water-soluble compounds (Neff 1979). The concentration of any crude oil constituent in a spill would vary both over time and distance in surface water; however, localized toxicity could occur from virtually any size of crude oil spill.

In addition, these compounds generally do not accumulate in vegetation to any great extent because they are rapidly metabolized by plants (Lawrence and Weber 1984; West et al.1984). There are some indications, however, that prolonged exposure to elevated concentrations of these compounds may result in a higher incidence of growth abnormalities in aquatic organisms (Couch and Harshbarger 1985).

Significantly, some constituents in crude oil, such as PAHs, may remain in the environment longer than lightweight compounds (e.g. benzene). These constituents are generally less mobile through soil and less toxic than other more soluble compounds. Based on the combination of toxicity, solubility, and bioavailability, benzene was determined to dominate toxicity associated with potential crude oil spills.

The toxicity of crude oil is dependent on the toxicity of its constituents. Acute toxicity refers to the death or complete immobility of an organism within a short period of exposure. Most investigators have concluded that the acute toxicity of crude oil is related to the concentrations of relatively lightweight aromatic constituents, particularly benzene. Because the diluted bitumen crude oils have a significant amount of lighter hydrocarbons added, they tend to have higher benzene concentrations than many other heavy oils (such as Mexican Maya and Venezuelan Bachaquero), but lower than many light crude oils (such as Brent Blend or Alaska North Slope) (Environment Canada 2011).

Chronic toxicity values on freshwater plant and animal species most frequently represent levels at which concentrations result in reduced reproduction, growth, or weight due to benzene. Chronic toxicity from other oil constituents may occur if sufficient quantities of crude oil are continually released into the water to maintain elevated concentrations. Additional biological and ecological impacts may manifest in local populations, communities, or entire ecosystems depending on the location, size, type, season, duration, and persistence of the spill, as well as the type of habitats and biological resources exposed to spilled oil.

Birds typically are among the most affected wildlife if exposed to the chemical and toxicological effects of an oil spill, whether it is on land or on water (e.g., Holmes 1985, Sharp 1990, White et al. 1995). In addition to the potential for external oiling of the feathers and hypothermia or drowning due to loss of flotation, birds may suffer both acute and chronic toxicological effects. Birds are likely to ingest oil as they preen their feathers in an attempt to remove the oil. The ingested oil may cause acute liver, gastrointestinal, and other systemic impacts resulting in

mortality, reduced reproductive capacity, loss of weight, inability to feed, and similar effects. Oiled birds that are nesting or incubating eggs may, in turn, coat the eggs or young with oil. Oiled birds may be scavenged by other birds as well as mammals.

Fish and aquatic invertebrates could also experience toxic impacts of spilled oil, and the potential impacts would generally be greater in standing water habitats (e.g., wetlands, lakes, and ponds) than in flowing rivers and creeks. Also, in general, the impacts would be lower in larger rivers and lakes and much lower under flood conditions since the toxic hydrocarbon concentrations would likely be relatively rapidly diluted.

Dilbit released into an aquatic environment could sink to the bottom of the water column and coat the benthic substrate and sediments. Dilbit intermixed with sediment, trapped in the river bed or on an oiled shoreline would result in a persistent source of oil due to the slow rate of degradation of Dilbit in these environments. Dissolved components of the Dilbit such as benzene, PAHs, and heavy metals could be slowly released back to the water column for many years after the release. The dissolved components (e.g. benzene, PAHs, heavy metals) could allow for long term chronic toxicological impacts to many organisms (e.g. macro-invertebrates) in both the benthic and pelagic portions of the aquatic environment.

In aquatic environments, toxicity is a function of the concentration of a compound necessary to cause toxic effects combined with the compound's water solubility. For example, a compound may be highly toxic, but if it is not very soluble in water, its toxicity to aquatic biota is relatively low.

The physical and chemical impact processes described previously are manifested at the organism level. Additional biological and ecological impacts may manifest in local populations, communities, or entire ecosystems depending on the location, size, type, season, duration, and persistence of the spill, as well as the type of habitats and biological resources exposed to spilled oil. Except for some endangered, threatened, or protected species and their habitat, loss of a few individuals of a larger population of organisms would result in a minimal impact at a community or ecosystem level. On the other hand, reproductive impairment caused by toxicity could reduce an entire population or biological community, resulting in a significant environmental impact. The impact is likely to be greater if the species affected have long recovery times (e.g., low reproductive rates, adverse genetic mutations); limited geographic distribution in the affected area; are key species in the ecosystem; are key habitat formers (those animals that substantially contribute to the formation of an environment); or are otherwise a critical component of the local biological community or ecosystem. Furthermore, if the species or community is a key recreational or commercial resource (e.g. tourist draw, hunted resource), biological impacts manifested at the population or community level may constitute a significant impact to human uses of the resource.

Identification of Potentially Affected Spill Receptors

Spill impact was evaluated by developing distance buffers from the proposed Project route. A distance buffer is the zone where potential exposure from a spill could occur, considering a safety factor built-in such that the buffer distance is much greater than would reasonably be expected for an actual spill. This methodology assists in screening potential receptors at a general level. Site-specific impacts cannot be addressed at this stage because specific pipeline design elements are not available. Buffers are based upon data provided in the Final EIS,

technical comments by third parties, and the screening model work described below. This screening model work was performed to supplement the information in the Final EIS because of the significant public interest in the issue. A summary of the Final EIS buffers and the buffers developed as part of this work is shown below in Table 4.13-2.

Table 4.13-2 Spill Impact Buffers

Buffer Type	Impact Buffer Size	Basis for Buffer Size
Surface Waterbody (downstream distance)	10 miles	Final EIS, Third-Party Comment
Stream Crossing (width)	500 feet	Final EIS
Surface Water Drinking Water Resources	5 miles	Final EIS
Well Head Protection Area	State-specific	Final EIS, Third-Party Comment
Overland Spill (50 bbl)	112 feet	Screening Model
Overland Spill (1,000 bbl)	367 feet	Screening Model
Overland Spill (20,000 bbl)	1,214 feet	Screening Model
Dissolved-phase Flow (50 bbl)	640 feet	Screening Model
Dissolved-phase Flow (1,000 bbl)	820 feet	Screening Model
Dissolved-phase Flow (20,000 bbl)	1,050 feet	Screening Model

The screening modeling estimates that oil could spread on flat ground between 112 and 1,214 feet from the pipeline, depending on the volume spilled. If oil reached groundwater, screening modeling indicates that the components in the oil, such as benzene, could spread in groundwater between 640 to 1,050 feet downgradient of the spill point. Similarly, if oil accumulated on groundwater, then these dissolved phase components of oil could spread an additional 640 to 1,050 feet from the edge of the oil (i.e., farther from the release point, potentially as far as 2,264 feet based on modeling). Screening modeling also indicates that the three spill volumes could affect groundwater at a depth of 50 feet (15 meters) or less. Larger volumes could be expected to reach groundwater deeper than 50 feet below ground surface. This approach assists in identifying potentially affected receptors by identifying those receptors that are within the buffer limits. For an irrigation well, as an example, if a well is within 820 feet of a pipeline ROW it could potentially be affected by a 1,000 bbl spill that impacted groundwater. Similarly, the pipeline could affect a stream if a 50 bbl spill occurred within 612 feet of a river bank (500-foot buffer for the creek plus 112 feet for an overland spill).

The assumptions used for the screening model were conservative to build in an additional factor of safety. Model results show that the assumed spill impact distances used in the Final EIS exceed those that resulted from the modeling herein; accordingly, the Final EIS concludes a degree of impact to the environment and to sensitive receptors that is likely higher than would be expected under actual conditions.

Development of Spill Buffers

The spill impact assessment used PHMSA-defined HCAs within specified distances of the pipeline to assess potential impact. Several types of HCAs were considered, including populated areas, drinking water protection areas, and Unusually Sensitive Areas. In addition to the HCAs, the Final EIS identified buffers for surface waterbodies, stream crossings, and surface water drinking water resources. An additional 500 feet on either side of a stream crossing was added for stream crossing buffers. Doing so overestimates the calculated risk of the stream crossing pipeline segment to better highlight the potential threat to a waterbody. Additionally, to assess

downstream effects from a release at a stream crossing, a 10-mile buffer was used to aid in identifying the presence of sensitive receptors or HCAs along that stream reach.

PHMSA identifies certain surface water and groundwater resources as drinking water Unusually Sensitive Areas (49 CFR Parts 195.6 and 195.450). Surface water Unusually Sensitive Areas include intakes for community water systems that do not have an adequate alternative drinking water source. Groundwater Unusually Sensitive Areas include the source water protection area for community water systems that obtain their water supply from a potable aquifer and do not have an adequate alternative drinking water source. If the source water protection area has not been established by the state, the wellhead protection area becomes the Unusually Sensitive Area. Surface water Unusually Sensitive Areas identified for their potential as a drinking water resource have a 5-mile buffer placed around their intake location. The groundwater Unusually Sensitive Areas have buffers that vary in size. These buffers are designated by the state's source water protection program or their wellhead protection program and the buffer sizes vary from state to state.

Overland Flow and Groundwater Dispersion

The screening-level approach used in this Supplemental EIS evaluates potential receptors along the proposed Project route that could be affected by a spill. Establishing discrete site-specific scenarios or site-specific conditions for the entire length of the pipeline is beyond the scope of this evaluation. By identifying reasonable distances spill volumes could travel overland or dissolved-phase plumes could migrate in groundwater, the potential for impact to a receptor can be assessed. Spill volumes were assessed for overland spreading, impact to groundwater, and the resulting dispersion in groundwater of the dissolved-phase constituent benzene. This evaluation uses spill volumes of 50 bbl, 1,000 bbl, and 20,000 bbl as described in Section 3.13.3, General Description of Proposed Pipeline Transported Crude Oils, and shown in Appendix K, Historical Pipeline Incident Analysis. This evaluation is intended as a screening approach and is not intended to predict the actual spill fate and transport for every condition along the pipeline route. The approach used for screening is described below and the methodology is described in Appendix U, Screening Level Oil Spill Modeling.

Overland Flow

Overland spreading was evaluated by calculating the area of potential impact for each of the identified spill volumes (50 bbl, 1,000 bbl, and 20,000 bbl) using a formula proposed by Grimaz et al. (2007). The model proposed by Grimaz et al. was developed as a simplified technique for predicting the maximum potential oil seepage depth into soil immediately after a release. As part of this model, Grimaz et al. proposed a simplified predictive formula derived from gravity current theory to predict the extent of surface spreading after a release. This part of the model was used for the overland flow calculation. The overland flow estimation using Grimaz et al. was based on a heavy crude oil (Appendix U, Screening Level Oil Spill Modeling). Based on the approach by Grimaz et al., a light oil would result in a larger overland flow distance than would a heavier oil. This formula calculates the area of an instantaneous release of oil onto a surface. The calculated areas were used to derive the radial distance a spill would travel on a smooth, flat surface. These distances were added perpendicular to the centerline of the proposed Project route to assess possible impacts to receptors.

Groundwater Dispersion

The USEPA's Hydrocarbon Spill Screening Model (HSSM) was used to assess the potential impact to groundwater, and if groundwater is impacted, calculate the axial length of the resulting dissolved-phase plume. HSSM is intended to provide a practical approximation tool to estimate contamination levels for uses related to emergency response, initial phases of site investigation, facilities siting, and underground storage tank programs (Weaver et al. 2004). HSSM is not suitable for application to heterogeneous geological formations and is intended to provide order-of-magnitude estimates of contamination levels only. The model was developed for light nonaqueous-phase liquid and is not suitable for denser-than-water nonaqueous-phase liquids (dense nonaqueous-phase liquids) as the nonaqueous-phase liquids is assumed to "float" on the water table for modeling purposes. In addition, the model is not designed to address dynamic conditions such as fluctuating groundwater, changing gradient, or specific design conditions such as pipeline trench systems or pressurized leaks from a pipeline.

HSSM simulates the flow of a light nonaqueous-phase liquid (e.g., oil) and the transport of a chemical constituent of the oil (in this case benzene) from the surface to groundwater. Should the simulation lead to an impact to groundwater, HSSM simulates the oil spreading at the water table and the dispersion of a dissolved benzene plume in groundwater. To evaluate potential impact to a shallow aquifer, groundwater was assumed to be 0.3 meter (1 foot) below the base of a spill. Hydrologic parameters used in the model for permeable sands were based on Carsel and Parrish (1988). The input parameters for the model were modified (e.g. aquifer hydraulic conductivity and porosity, benzene concentration, and crude oil viscosity) to simulate the largest dissolved plume length that might occur for a 50bbl and a 20,000 bbl spill. The range of dissolved-phase spill plume lengths under these conditions was between 180 ft (55 m) and 1,608 ft (490 m). Other parameters along with their sources that were used to develop spill buffer and assess average impact are presented in Table 4.13-3 below.

Table 4.13-3 Summary of Key Input Values Used in HSSM Simulation[a]

Parameter	Input Value[b]	Source
Hydrologic Properties		
Depth to Groundwater (m)	0.3	
Horizontal Hydraulic Conductivity (m/d)	15	Gutentag et al. 1984; Stanton 2010
Vertical Hydraulic Conductivity (m/d)[c]	1.5	
Porosity (vol%)	15	Stanton 2010
Hydrocarbon Phase Properties[d]		
Viscosity—Dilbit (cP)[e]	325	Leis et al. 2012
Density—Heavy Crude Oil (g/cm^3)	0.93	exp Energy Services, Inc.2012; Attanasi et al. 2007; Enbridge 2011a
Benzene Concentration—Light Crude Oil (vol%)[f]	0.28	exp Energy Services, Inc.2012; Section 3.13, Potential Releases

[a] Input values used were representative values for the geology along the project route, except for depth to groundwater, which was selected to address immediate impact.
[b] % = percent; cP = centipoises; ft/d = feet per day; g/cm^3 = grams per cubic centimeter; m = meter or meters; m/d = meter per day.
[c] Assumed 1/10th of Horizontal Hydraulic Conductivity.
[d] These hydrocarbon phase properties represent the range of possible products being transported through the pipeline and are selected to increase the dissolved benzene plume length.
[e] The high-end viscosity of Dilbit was used to provide a larger plume size.
[f] Light crude oil was used since it has a higher benzene content than heavy crude oil or dilbit.

Degradation of oil can occur through weathering, which chemically and physically causes the spilled oil to break down and potentially become heavier than water. In open water, the oil can then sink into the water column. When oil mixes with water and oxygen, water-soluble compounds from the oil spread into the water. As the oil loses the water-soluble compounds, the oil becomes dense, sticky tar balls. Also, as oil moves with water, particles in the water, such as sand, clay, and plant matter, stick to the oil, increasing the oil's density. Examples of oil sinking are found for open water (e.g., lakes) and in rivers and streams. At present, there are no readily available studies indicating that degradation of oil in soil will convert into a dense liquid, reach groundwater, and sink through an aquifer. However, if the oil did degrade below the ground surface, as it degraded the oil would become sticky (increased interfacial tension), reducing the mobility of the oil.

The results of the HSSM simulations were used to identify reasonable benzene concentrations at the source from infiltrating oil and the distances the dissolved-phase benzene plume would migrate toward potential receptors. The model results show a spill could reach groundwater in all spill volume scenarios (e.g., 50 bbl, 1,000 bbl and 20,000 bbl) and migrate toward downgradient receptors. The configuration for the model is addressed further in Appendix U, Screening Level Oil Spill Modeling. The model was configured to assume groundwater was 1 foot (0.3 meter) below the spill source. It was also assumed that a small and medium plume would continue undetected for six weeks (detection by 2nd flyover) and large leaks would be detected immediately by the SCADA. The area of infiltration was based on one-half of the overland flow distance calculated using Grimaz et al (2007). Table 4.13-4 below summarizes the axial length of surface and dissolved-phase benzene plumes developed for each of the spill volumes assessed. These were the buffer distances perpendicular to the pipeline used to identify potential impact to receptors. Additionally, a high-level sensitivity analysis was conducted using the same parameters above. This analysis determined that the three spill volumes assessed would potentially affect groundwater at a depth of 50 feet (15 meters) below ground surface or less.

Table 4.13-4 Length of Potential Plumes

	50 bbl	1,000 bbl	20,000 bbl
Surface Plume Length in feet (meters)[a]	112 (34)	367 (112)	1,214 (370)
Dissolved-phase Benzene Plume Length in feet (meters)	640 (195)	820 (250)	1,050 (320)

[a] Calculated from the formula proposed by Grimaz et al. 2007.

The dissolved-phase plume length of crude oil constituents, such as benzene, stabilizes in groundwater due to a balance of several natural attenuation processes that degrade and dilute the crude oil dissolved components. These processes include biodegradation, evaporation, rate of dissolved components mixing with water, the affinity of the dissolved components to bind with the soil matrix, and the rate of fresh water entering the plume area. Contaminants other than those found in crude oil can sometimes spread over large distances due to the persistent nature of the dissolved components. These persistent plumes often are confused with the non-persistent plumes such as benzene. The following are two examples of persistent plumes:

- Former Nebraska Ordinance Plant Mead, Saunders County, Nebraska; and
- Former Cornhusker Army Ammunition Plant (CHAAP), Hall County, Nebraska.

From 1959 to 1960, reported information suggests that trichloroethylene (TCE, a synthetic, degreasing solvent) was released as ground spills and/or discharged into surface drainage features during the construction of the Atlas Missile facility at the Former Nebraska Ordinance Plant Mead, Saunders County, Nebraska. Other reported historical site information suggests that parts were cleaned with TCE in a laboratory and the used TCE was discharged into a sewer. In 1992, over 30 years after disposal, the U.S. Army Corps of Engineers began a groundwater investigation and discovered a TCE-contaminated groundwater plume extending over 27,000 feet (10 miles) downgradient of the facility. Other groundwater contaminants detected included explosives and metals.

The former CHAAP, which was owned by the U.S. Army, was built in 1942 to produce munitions and provide support functions during World War II. As a consequence of common disposal practices during wartime, groundwater was impacted by explosives. Groundwater containing explosive residue migrated from cesspools and leach pits located in the center of the plant approximately 2 miles beyond the CHAAP boundary into the Grand Island City limits. In 1994 (over 50 years since plant construction), the groundwater plume was 6 miles long and one-half mile wide. Other chemical materials used to support munitions production at CHAAP included Freon, paints, grease, oil, and solvents. Solvents reportedly used at CHAAP included acetone, TCE, and 1,1,1-trichloroethane.

4.13.4 Potential Impacts

Consequence on Receptors

The magnitude of oil spill impact is primarily a function of size of the spill, type of oil, and sensitivity of the receptors affected (API 1992; API 1997; National Research Council 1985, 2003a, 2003b). The crude oil that would be transported by the proposed Project would primarily consist of dilbit and SCO. Information on the chemical characteristics of these crude oils is provided in Section 3.13.3, General Description of Proposed Pipeline Transported Crude Oils, Table 3.13-1. Variations in spill size and receptor type are key variables for estimating the consequence of oil spills from the proposed Project. Spill volume categories used in this impact assessment are presented in Section 4.13.3.1, Spill Volumes and Potential Impacts.

Receptor sensitivity is subjective and is influenced by the perspectives and biases of evaluators and the actual sensitivity of the receptors to the oil. For example, a farmer whose grain field is oiled could consider impacts to a crop more significant than spill-related impacts on a wetland that supports threatened and endangered species, recreational hunting, and other recreational opportunities. Conversely, a national wildlife refuge manager could evaluate relative impacts very differently. In addition, different receptors could have different sensitivities to a specific compound such as benzene. Fish could be more sensitive to low levels of benzene where crops or mammals could be more tolerant of high concentrations of the same compound. In many oil spills, there are differences in the way that stakeholders (e.g., general public, non-governmental organizations, natural resource management agencies, regulatory agencies, enforcement agencies, private businesses, municipal agencies, and others) value spill-related impacts on natural resources and habitats compared to spill-related impacts on human uses.

The severity of an impact to a receptor from a spill can be described as a function of spill size and receptor sensitivity. Severity generally increases as spill size increases and as receptor sensitivity increases. Table 4.13.-5 presents, for each of three types of receptors and for each of

the three spill sizes, various descriptions of impacts to the receptor, and the qualitative severity levels (low, medium, high) that correspond to these descriptions. The severity levels are based on a subjective evaluation using experience from previous oil spills. This presentation allows for a general assessment of the risk to certain environmental receptors should a spill occur.

Table 4.13-5 Potential Impact to Resources[a]

	Resource	Potential Impact			Resource	Potential Impact			Resource	Potential Impact		
	Wildlife and Terrestrial Habitat	Small Spill	Medium Spill	Large Spill	Water, Wetlands, Aquatic Habitat/Organisms	Small Spill	Medium Spill	Large Spill	Land use	Small Spill	Medium Spill	Large Spill
Increasing Severity ↑	Complete loss of habitat (acreage or quality) and/or animal population; habitat restoration measured in terms of years.	low	low	low	Supplemental drinking water supply required. Complete loss of wetland and/or aquatic habitat and/or aquatic organisms	low	low	low	Permanent loss of land use.	low	low	low
	Substantial, clearly measureable change in habitat (acreage or quality) or animal population; occurs throughout key animal life stages (e.g. nesting, breeding)	low	low	medium	Substantial, clearly measureable change in ground water, surface water, wetland and aquatic habitat, or aquatic organism population; occurs throughout key life stages (e.g. spawning)	low	low	medium	Temporary loss of land use due to chemical effects of spill.	low	medium	medium
	Evident, measureable change in habitat (acreage or quality) or animal population; occurs for short period during key animal life stages (e.g. nesting, breeding)	low	medium	medium	Evident, measureable change in groundwater, surface water, wetland and aquatic habitat, or aquatic organism population; occurs for short period during key life stages (e.g. spawning)	medium	medium	medium	Disruption to land use for duration of recovery actions and remediation actions.	medium	medium	high
	Perceptible, but minor change in habitat (acreage or quality) or animal population; occurs only minimally during key animal life stages (e.g. nesting, breeding)	medium	medium	high	Perceptible, but minor change groundwater, surface water, in wetland and aquatic habitat, or aquatic organism population; occurs only minimally during key life stages (e.g. spawning)	medium	high	high	Disruption to land use for duration of recovery actions.	medium	high	high
	No perceptible change in habitat (acreage or quality) or animal population; does not occur during key animal life stages (e.g. nesting, breeding)	high	high	high	No perceptible change in groundwater, surface water, wetland and aquatic habitat or aquatic organism population; does not occur during key animal life stages (e.g. spawning)	high	high	high	Insignificant disruption to land use.	high	high	high

Notes: Land use = soils, vegetation, ecosystem, agricultural, recreational; Green = low potential for impact to be realized for the given spill; Yellow = medium potential for impact to be realized for the given spill; Orange = high potential for impact to be realized for the given spill; Small = <2,100 gallons; Medium = 2,100 to 42,000 gallons; Large - >42,000 to 840,000 gallons.

High Consequence Areas

As identified in Section 3.13.5, Potential Spill Receptors, HCA categories are identified and defined individually to analyze potential spill impact on each.

Populated Areas

In the event of a spill, the effects on populated areas would depend on the size of the spill and the size of the population in the impacted area. For this reason, populated areas are divided into two categories by the USDOT: High Population Areas and Other Populated Areas. This division is done to improve the accuracy of risk analysis of a direct impact by an oil spill. Spill impact buffers for the proposed pipeline route do not cross any populated area HCAs. However, for completeness, the potential impacts of a spill to this type of HCA are discussed below.

Potential effects of a spill on populated areas could include interruptions in daily activities such as access to safe drinking water (discussed in more detail in Drinking Water section below), decreased air quality, and socioeconomic effects (discussed in more detail in Socioeconomics

section below), or temporary relocation of population in impacted areas during spill containment and remediation procedures.

A 2003 report to USEPA prepared by the API compared the health effects of SCO with those of conventional crude oil and included the following statement (API 2003, page 9):

> Synthetic crude oil, from upgraded tar sands, is compositionally similar to high quality conventional crude oil (>33º API). The conventional technologies such as delayed and fluid coking, hydrotreating, and hydrocracking, used to upgrade heavy crude oils and bitumens, are used to convert tar sands into an essentially bottomless crude, consisting of blends of hydrotreated naphthas, diesel and gas oil without residual heavier oils . . . This information was supplied to USEPA . . . to support the position that tar sands-derived synthetic crude oil is comparable to conventional crude oils for health effects and environmental testing, a position with which USEPA concurred.

If oil were to be spilled into surface water or groundwater supplies that serve as human drinking water sources, use of these sources would be prohibited, and the sources would be monitored under state regulatory processes until the levels return to safe drinking water levels and the appropriate agencies authorize resumption of use of these water supplies. Water-related activities would be restricted in any area where there are contaminants present at levels deemed to be unsafe.

Background ambient levels of hydrogen sulfide in urban areas reportedly range from 0.11 to 0.33 parts per billion (ppb), while in undeveloped areas concentrations can be as low as 0.02 to 0.07 ppb (Skrtic 2006). A rotten egg odor characterizes hydrogen sulfide at low concentrations, and olfactory perception of hydrogen sulfide occurs for most people at concentrations in the air of approximately 0.2 parts per million (ppm). Some people can detect the gas by its odor at concentrations as low as 0.5 ppb (Skrtic 2006). In an assessment of risk to first responders at crude oil spill sites, Thayer and Tell (1999) modeled atmospheric emissions of hydrogen sulfide from crude oil spills using three different crude oil hydrogen sulfide concentrations (1 ppm, 20 ppm, and 350 ppm). The results of their analysis indicate that hydrogen sulfide levels in the immediate aftermath of a crude oil spill at the two higher levels of hydrogen sulfide concentration (20 ppm and 350 ppm) could pose short-term health risks (respiratory paralysis) to first responders at the spill site. However, since initial responders do not typically arrive at spill sites immediately and model results indicate that even under worst-case conditions (no wind), modeled exposures drop to non-toxic levels in less than 4 minutes after the oil stops entering the atmosphere for the first time, hydrogen sulfide exposures would not be expected to create substantive health hazards.

The rapid atmospheric dissipation of hydrogen sulfide levels indicated by these model results also suggests that risks to the general public would be very small to negligible in the event of an oil spill. Additionally, some commenters have expressed concern that in the event of a fire or explosion involving crude oil that would be transported by the proposed Project, hydrogen sulfide could be released. However, hydrogen sulfide is also flammable and would burn in an explosion or fire, combining with oxygen to form sulfur dioxide and water and greatly reducing the risk due to inhalation of the gas.

Unusually Sensitive Areas

An Unusually Sensitive Area includes a drinking water or ecological resource area that is particularly susceptible to environmental damage from a hazardous liquid pipeline release. These have been defined by the USDOT. Unusually Sensitive Areas are separated from other water resources due to their association with increased potential of direct impact to human health or particularly sensitive wildlife. Other water or ecological resources identified but not captured by the USDOT designated areas are addressed in the Other Resources discussion below.

Drinking Water

PHMSA identifies certain surface water and groundwater resources as drinking water Unusually Sensitive Areas (49 CFR Parts 195.6 and 195.450). An Unusually Sensitive Area drinking water resource includes a water intake for a Community Water System or a Non-Transient Non-Community Water System that obtains its water supply primarily from a surface water source and does not have an adequate alternative drinking water source. An Unusually Sensitive Area drinking water resource also includes a Source Water Protection Area (SWPA) for a Community Water System or a Non-Transient Non-Community Water System if the water supply is obtained from a USDOT Class I or Class IIA aquifer and does not have an adequate alternative drinking water source. Where a state has yet to identify a SWPA, a Wellhead Protection Area is used. In Nebraska, the Steele City Wellhead Protection Area is the only drinking water Unusually Sensitive Area that a spill buffer overlaps with the Wellhead Protection Area and could be affected by a release from the pipeline.

As discussed above, for the purpose of the analysis described herein, surface water Unusually Sensitive Areas identified for their potential as a drinking water resource have a 5-mile buffer placed around their intake location. Groundwater Unusually Sensitive Areas have buffers that vary in size. These buffers are designated by the state's source water protection program or their wellhead protection program and the buffer sizes vary from state to state.

Certain segments of the proposed Project route cross areas that are considered HCAs by the PHMSA due to potential risks to sensitive drinking water resources. Oil spilled onto surface water or into groundwater supplies that serve as human drinking water sources would interrupt drinking water supply for the impacted area. The impacted sources would be monitored under state regulatory processes until the levels return to safe drinking water levels and the appropriate agencies authorize resumption of use of these water supplies.

Water-related activities would be restricted in any area where there is oil present at levels that the health agencies consider unsafe for human exposure. Private landowners could choose to undertake activities that would increase exposure at their own risk.

Economic effects related to potential impacts to drinking water supplies could occur in the event of a large oil spill. However, the proposed Project route was selected to avoid water supply intakes and nearby potable groundwater well heads to the extent practicable. Nonetheless, numerous water wells exist within a mile on either side of the proposed pipeline centerline. Wells within the extent of groundwater impact as a result of a release could be affected. Large municipal supplies or intakes could potentially draw affected water to the well. In the event of oil spill impacts to water supplies for residential, agricultural (e.g. farming, ranching, and livestock grazing on wild land), commercial, or public uses, Keystone would provide alternate sources of

water for essential uses such as drinking water, irrigation and livestock watering, industrial cooling water, and water for firefighting and similar public safety services.

Ecologically Sensitive Areas

Impacts to ecologically sensitive areas would be similar to those impacts discussed in the Water Resources, Vegetation and Soil Ecosystems, and Wildlife sections of the Supplemental EIS. However, loss or reproductive impairment of any portion of a population of endangered, threatened, or protected species could result in a significant impact at a community to ecosystem level. The impact is likely to be even greater if the species affected have long recovery times (e.g., low reproductive rates); limited geographic distribution in the affected area; are key species in the ecosystem; are key habitat formers; or are otherwise a critical component of the local biological community or ecosystem. Furthermore, if the species or community is a key recreational or commercial resource, biological impacts manifested at the population or community level may constitute a significant impact to human uses of the resource

Federally protected threatened or endangered species and federal candidate species with the potential to occur in the proposed Project area include two mammals, six birds, two fish, one invertebrate, and two plants. Potential impact analysis and preliminary findings are summarized in Table 1.3-1 of the Keystone XL Project Biological Assessment Final (Appendix H, 2012 Biological Assessment).

Commercially Navigable Waterways[16]

Commercially navigable waterways (CNWs) are waterways where a substantial likelihood of commercial navigation exists. These areas are included in HCAs because these waterways are a major means of commercial transportation and are critical to interstate and foreign commerce, supply vital resources to many American communities, and are part of a national defense system. Areas defined as CNWs were provided by PHMSA. No CNW HCAs are located within a spill impact buffer as defined above.

The impact of an oil spill on CNWs is related to surface oil and the potential temporary closure of the CNWs to vessel traffic so that oil dispersion is not increased and response teams can contain oil safely without traffic hindering recovery operations. Temporary closure can be a few hours to a few days depending on the size of the spill.

Other Resources

Other Resources include environmental resources that are not included in the USDOT definition of HCAs but that are present along the proposed Project route and therefore have been included for evaluation. A more detailed discussion of these receptors is included in Section 3.13, Potential Releases, and in Appendix Q, Pipeline Risk Assessment and Environmental Consequence Analysis. Several categories of Other Resources are discussed below.

[16] Commercially navigable waterways are included because of their importance as a supply route of vital resources to many American communities as well as their role in the national defense system (49 CFR Part 195, Federal Register / Vol. 65, No. 232 / Friday, December 1, 2000 / Rules and Regulations, pg. 75392).

Soils

Soil includes the top layer of earth consisting of rock and mineral particles mixed with organic matter, containing living matter, and capable of supporting vegetation. For definition purposes, its upper limit is considered to be air or shallow water, and its lower limit is considered to be hard rock or earthen materials virtually devoid of biological activity. Soil ranges in depth from just a few inches to tens of meters along the proposed Project route. When discussing impacts to soil, this Supplemental EIS defines a release, leak, and spill as described in Section 4.14.3, Spill Impact Assessment.

Because the proposed Project pipeline is a buried structure, crude oil released from the pipeline would initially flow into the soil pore spaces. The impact of oil spills on soil would vary greatly depending on the type of soil, porosity (permeability), and water saturation of the soil at the time of the spill. Generally, subsurface releases to soil tend to disperse slowly and often preferentially flow into areas of less consolidated or higher porosity/permeability soils (such as sand layers). Most soils along the proposed route have low to moderate permeability, providing increased time to respond to the spill prior to extensive subsurface movement of the spilled material through soils.

Specific soil characteristics that were identified to be of particular interest were evaluated along the proposed Project route and included highly erodible; prime farmland; saturated; compaction-prone; stony/rocky; shallow-bedrock; and drought-prone soils. Some of these characteristics can cause a greater disturbance than others if impacted (detailed descriptions of each characteristic are provided in Section 3.2.2, Soils, Environmental Setting.). As part of the evaluation, the approximate lengths in miles of the proposed route that would cross the different soils were identified by state. Of the identified total miles that would cross the key soil types (Table 3.2-1), approximately 70 and 270 miles cross the more sensitive highly erodible by wind and highly erodible by water soil types, respectively. The proposed Project route also could cross approximately 350 miles of prime farmland. Based on these mileage and potential oil overland spreading distances of the three different spill volumes used in this Supplemental EIS shown in 4.14-2, an estimated total area of potential spill-sensitive soils is shown in Table 4.13-6.

Table 4.13-6 Total Estimated Erodible and Prime Farmland Soils in Potential Spill Areas (acres)[a]

	Small (0-50 bbl)			Medium (50-1,000 bbl)			Large (1,000-20,000 bbl)		
State[b]	Wind Erodible	Water Erodible	Prime Farmland	Wind Erodible	Water Erodible	Prime Farmland	Wind Erodible	Water Erodible	Prime Farmland
MT	76.8	1,651.7	932.2	253.1	5,440.9	3,070.9	836.0	17,974.5	10,144.8
SD	246.7	1,548.3	1,628.1	812.7	5,100.3	5,363.1	2,684.9	16,849.1	17,717.2
NE	715.1	851.0	2,598.7	2,355.5	2,803.2	8,560.4	7,781.4	9,260.6	28,280.1

[a] Values assume flat, level ground, with plume volumes resting at an equilibrium thickness based on the surface tension of heavy sour crude. No potentially affected erodible or prime farmland soils identified in Kansas or North Dakota.
[b] MT=Montana, SD=South Dakota, NE=Nebraska.

It is difficult to estimate the volume of soil that might be contaminated in the event of a spill. Site-specific environmental conditions (e.g., soil type, weather conditions) and release dynamics (e.g., leak rate, leak duration) would result in substantially different surface spreading and infiltration rates which, in turn, would affect the final volume of affected soil. Based on historical data (PHMSA 2012), soil remediation involved 100 cubic yards of soil or less at the majority of

spill sites where soil contamination occurred, and only 3 percent of the spill sites required remediation of 10,000 cubic yards or more (PHMSA 2012). These statistics suggest that the actual affected soils area would likely be significantly lower than the calculated areas shown in Table 4.13-6.

Spills could affect soils indirectly by affecting the vegetation, which in turn might not survive and expose the soil to water and wind erosion or solar heating, even if the soil itself was not directly affected by the spilled material. Spill cleanup could affect the soils more than the presence of the spilled material itself, unless the cleanup is well controlled and heavy traffic and digging are minimized (especially for summer spills). Oil that adheres to or is retained between soil grains may weather slowly over a period of years.

Soil productivity could be negatively impacted by oil contamination particularly in the event of large spills. If long-term remediation is required, beneficial uses of the soil could be restricted for the length of the remediation period or longer.

In accordance with federal and state regulations, Keystone would be responsible for cleanup of contaminated soils and would be required to meet applicable residential cleanup levels (listed below). The soil cleanup levels for benzene from petroleum hydrocarbon releases are based on the inhalation of vapors, ingestion of contaminated soil, and dermal contact exposure pathways and vary by state (Montana: 0.04 ppm; South Dakota: 17 ppm; Nebraska: 3.63 ppm; North Dakota and Kansas: no levels established).

Paleontological resources exposed to a spill could also be affected. Remediation activities could also damage paleontological resources. However, in the event of a spill, a paleontological mitigation plan would be prepared to protect significant fossil resources.

Sediments

Sediments (defined here as submerged soils in wetlands and aquatic habitats) are typically fine grained and saturated with water. Crude or refined oils typically do not penetrate beyond the surface layer in sediments unless: 1) there is a substantive amount of turbulence that mixes the oil and sediments, followed by deposition of the mixture in low turbulence areas; 2) the air pockets between grains are large enough (e.g., in gravel and coarse sand) to allow for penetration of the oil as it sinks; or 3) physical activities associated with spill response actions mix the surface-deposited oil-sediment mixture into deeper subsurface levels of the sediment profile. Refined products also typically would not penetrate sediments because of the water content but may penetrate or be mixed further into the sediments under the same turbulent conditions or cleanup actions as for crude oil.

The oil deposited on and remaining in the top sediment layer, especially in aerobic environments, may be subject to biodegradation by microbes, which would reduce or eliminate long-term impacts. Oil that is incorporated into sediments, especially in the anaerobic subsurface levels, may weather very slowly. Sediments of exposed shores can retain oil for extended periods of time, even in higher energy areas (Short et al. 2007).

For large spills that are not immediately or successfully remediated, crude oil constituents could remain in soil, aquatic sediments, or on plant tissues for several years. To the extent that residual oil leads to further contact or ingestion by mammals, effects to individual mammals could also continue.

Vegetation and Soil Ecosystems

An oil spill could result in impacts to vegetation in several ways, especially as it moves through multiple habitats. A surface release could produce localized effects on plant populations such as oil permeating through the soil affecting the root systems and indirectly affecting plant respiration and nutrient uptake. Also, without complete remediation of contaminated soil in a vegetation zone, long-term effects on vegetation could be expected. Tables 4.13-7, 4.13-8, and 4.14-9 summarize the estimated vegetation community acreage along the proposed Project route that could be affected by a surface spill. The acreage is based on spill distances shown in Table 4.13-2.

Crude oil released to the soil's surface could potentially produce localized effects on plant populations. Terrestrial plants are much less sensitive to crude oil than aquatic species. The lowest toxicity threshold for terrestrial plants found in the USEPA ECOTOX database (USEPA 2001) is 18.2 ppm in soil for benzene, higher than the 7.4 ppm threshold for aquatic species. Similarly, subterranean organisms such as earthworms could also be adversely affected by an oil spill. Spilled oil permeating through the soil could lead to sediments and soils being coated with oil, which reduces water and gas (e.g., oxygen and carbon dioxide) exchange and affects subterranean organisms. These organisms could also be coated, reducing their ability to function naturally or gain access to nutrients necessary for survival organisms.

Overall, most past spills on terrestrial habitats have caused minor ecological damage, and ecosystems have shown a good potential for recovery, with wetter areas recovering more quickly (Jorgenson and Martin 1997, McKendrick 2000). The length of time that a spill persists depends on several factors, including oil and soil temperature, availability of oleophilic (oil-loving) microorganisms, soil moisture, and the concentration of the product spilled. For the most part, effects of land oil spills would be localized and are not expected to impact vegetation and associated habitat outside the immediate spill area (assuming runoff is controlled to the extent necessary). Spills that occur within or near streams, rivers, and lakes could indirectly affect riparian vegetation and habitat along these waterbodies. Effects on vegetation from subsurface leaks that reach the root zones of surface vegetation could assist in leak detection as a result of visible patches of affected vegetation (often indicated by dying vegetation) along the proposed pipeline ROW resulting from oil interference with water and nutrient uptake by plant root systems.

Smaller spills during construction could occur within contractor yards, along access roads, at aboveground facilities and along the proposed pipeline construction ROW, and the spilled fuel or oil would generally remain localized near the release site. These spills would typically produce minor impacts on crops, native vegetation, and associated wildlife. However, large spills during operation would likely result in greater impacts to crops, native vegetation, and associated wildlife due to the larger area covered with oil.

Along the northern section of the proposed pipeline, winter snow cover may occasionally be sufficient to slow and limit the surficial flow of spilled oil, thus limiting the extent of damage to vegetation and habitat. In other seasons, the spilled oil may flow farther on the land surface. Spill response activities could cause impacts on vegetation and habitat if activities are not implemented carefully and with regard for minimal disturbance of the surface soils and vegetation.

Table 4.13-7 Total Estimated Vegetation Community Acreage in Potential Small Spill Areas

State[a]	Cultivated Crops	Grassland/Pasture	Upland Forest	Open Water	Forested Wetlands	Emergent Herbaceous Wetlands	Shrub-scrub Wetlands	Developed Land
MT	1654.97	5067.67	16.23	8.11	40.56	10.82	841.01	97.35
SD	1333.17	6936.27	13.52	8.11	40.56	35.15	81.13	100.06
NE	4881.08	2157.95	54.08	18.93	51.38	16.23	0.00	229.86

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

Table 4.13-8 Total Estimated Vegetation Community Acreage in Potential Medium Spill Areas

State[a]	Cultivated Crops	Grassland/Pasture	Upland Forest	Open Water	Forested Wetlands	Emergent Herbaceous Wetlands	Shrub-scrub Wetlands	Developed Land
MT	5451.67	16693.51	53.45	26.72	133.62	35.63	2770.37	320.69
SD	4391.62	22848.91	44.54	26.72	133.62	115.80	267.24	329.59
NE	16078.86	7108.55	178.16	62.36	169.25	53.45	0.00	757.18

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

Table 4.13-9 Total Estimated Vegetation Community Acreage in Potential Large Spill Areas

State[a]	Cultivated Crops	Grassland/Pasture	Upland Forest	Open Water	Forested Wetlands	Emergent Herbaceous Wetlands	Shrub-scrub Wetlands	Developed Land
MT	18009.98	55148.20	176.57	88.28	441.42	117.71	9152.13	1059.41
SD	14508.04	75482.99	147.14	88.28	441.42	382.56	882.84	1088.84
NE	53117.66	23483.60	588.56	206.00	559.13	176.57	0.00	2501.39

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

A large spill could spread over larger areas and coat vegetation, including row crops, wild lands, seasonal wetlands, and range lands, especially downslope from the spill site. The vegetation within the spill zone might not survive or be damaged or coated with oil, although population level vegetation effects are unlikely. Affected vegetation may not be suitable for grazing animals and any commercial row or field crops would not be marketable.

Wildlife

Spilled crude oil could affect wildlife directly and indirectly. Direct effects include physical processes, such as oiling of feathers and fur, and toxicological effects, which could cause sickness or mortality. Indirect effects are less conspicuous and include habitat impacts, nutrient cycling disruptions, and alterations in ecosystem relationships. The magnitude of effects varies with multiple factors, the most significant of which include the amount of material released, the size of the spill dispersal area, the type of crude oil spilled, the species assemblage present, climate, and the spill response tactics employed.

The 2010 Enbridge Line 6B spill in Michigan was a very large subsurface composite crude oil spill that emerged onto the ground surface and affected forested, scrub/shrub, wetlands, Talmadge Creek, and Kalamazoo River. By examining the effects from the 2010 Enbridge spill, the potential impacts to wildlife from a spill of similar size/magnitude can be evaluated. The Enbridge-specific impacts are detailed in the Enbridge 2011 Conceptual Site Model, where wildlife studies conducted during the response of that spill have shown that more than 90 percent of the animals (including reptiles, crustaceans, amphibians, birds, mammals, and fish) that were collected and rescued during response efforts, were subsequently released during active recovery efforts (Enbridge 2011b).

Table 4.13-10 provides an estimated potential acreage of habitat identified along the proposed Project route that could be affected by a surface release.

Table 4.13-10 Total Estimated Acreage of Habitat in Potential Surface Spill Areas

State[a]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	1814.52	5977.24	19746.23
SD	584.11	1924.12	6356.46
NE	3088.20	10172.88	33606.85

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

Wildlife, especially birds and shoreline mammals, are typically among the most visibly affected organisms in any crude oil spill. Effects of crude oil can be differentiated into physical (mechanical) and toxicological (chemical) effects. Physical effects result from the actual coating of animals with crude oil, causing reductions in thermal insulative capacity and buoyancy of plumage (feathers) and pelage (fur). Toxicological effects on birds and mammals can occur via inhalation or ingestion exposure. Ingestion of crude oil may occur when animals consume oil-contaminated food, drink oil-contaminated water, or orally consume crude oil during preening and grooming behaviors. Unlike aquatic organisms that frequently cannot avoid spills in their habitats, the behavioral responses of terrestrial wildlife may help reduce potential adverse effects as indicated in the Enbridge study. Many birds and mammals are mobile and generally could avoid oil-impacted areas and contaminated food (Sharp 1990; Stubblefield et al. 1995). Many terrestrial species have alternative, unimpacted habitat available, as will often be the case with

localized spills (in contrast to large-scale oil spills in marine systems); therefore, mortality of these species would be limited (Stubblefield et al. 1995).

Birds

Birds typically are among the most affected wildlife if exposed to the chemical and toxicological effects of an oil spill, as described in sections above, whether on land or on water (e.g., Holmes 1985, Sharp 1990, White et al. 1995). In addition to the potential for external oiling of the feathers and hypothermia or drowning due to loss of flotation, birds may suffer both acute and chronic toxicological effects. Birds are likely to ingest oil as they preen their feathers in an attempt to remove the oil. The ingested oil may cause acute liver damage, gastrointestinal and other systemic impacts resulting in mortality, reduced reproductive capacity, loss of weight, inability to feed, and similar effects. Oiled birds that are nesting or incubating eggs may coat the eggs or young with oil and injure or kill them. Dead oiled birds may be scavenged by other birds as well as mammals.

Potential adverse effects could result from direct acute exposure. Acute toxic effects include drying of the skin, irritation of mucous membranes, diarrhea, narcotic effects, and possible mortality. While releases of crude oil may have an immediate and direct effect on wildlife populations, the potential for physical and toxicological effects reduces with time as the volume of material diminishes, leaving behind more persistent, less volatile, and less water-soluble compounds. Although many of these remaining compounds are toxic and potentially carcinogenic, they do not readily disperse in the environment and, therefore, the potential for impacts is low.

Small spills on or near the roads, construction yards, or pump stations would not generally affect birds, although a few individual shorebirds, waterfowl, raptors, and songbirds could be exposed to the spilled oil. Exposed individuals could be exposed to hypothermia or from the toxic effects of ingesting the oil during preening, or from ingestion of oiled food and water. Potential impacts would likely be limited to a few individual birds, especially waterfowl and shorebirds that use small ponds and creeks affected by very small to small spills. If a very small to small-size spill occurred during migration periods, greater numbers of birds could be affected. There could also be an associated impact to a few individual scavenging birds and mammals if they feed on oiled carcasses. Small spills would not be expected to cause population-level impacts.

A medium to large spill in terrestrial habitats could cause mortality of birds that spend time foraging or nesting on the ground, such as shorebirds, grassland nesting songbirds (passerines), and upland game birds, where they would come into direct contact with oil and oiled prey or forage. If the spilled material entered wetlands or waters, water-dependent birds such as waders, seabirds, shorebirds, and waterfowl could be exposed. The numbers of individuals oiled would depend primarily on wind conditions and the numbers of birds within and proximate to the area affected by the spill. Impacts may be detectable at the local population level, especially for resident species with limited geographic distribution if the spill affected important breeding habitat for migratory birds, or if the spill occurred within migration staging habitats during active migration periods. The North Valley Grasslands, crossed by the proposed pipeline in Valley County, Montana (Montana Audubon 2011), is a designated globally Important Bird Area supporting resident and migrant grassland nesting birds. Although not designated as an Important Bird Area along the route of the proposed pipeline, the Platte River and associated wetlands in

central Nebraska are used for migration staging from mid-February to early April by more than 500,000 sandhill cranes during their northward migration (Audubon 2012).

If raptors, eagles, owls, ravens, crows, magpies, vultures, and other predatory or scavenging birds were present in the spill vicinity, they could become secondarily oiled by eating oiled prey. Mortality of breeding raptors likely would represent a minor loss for local populations but would not likely affect regional populations. Mortality of migrant or winter roosting aggregations of bald eagles attracted to waterfowl aggregations at migration staging and winter open water locations could result in more significant losses for regional bald eagle populations from exposure to oiled prey.

If a large spill moved into wetlands, adjacent riparian habitats, or open water habitats of major rivers along the ROW, waterfowl species that breed, stage, or congregate in these areas during migration could be at risk. A spill entering a major river in spring, especially at flood stage, could significantly affect waterfowl in the short term by contaminating overflow areas or open water where spring migrants of waterfowl and shorebird species concentrate before occupying nesting areas or continuing their migration.

Lethal effects would be expected to result from moderate to heavy oiling of birds. Light to moderate exposure could reduce future reproductive success because of pathological effects on liver or endocrine systems (Holmes 1985) caused by oil ingested by adults during preening or feeding that interfere with the reproductive process. Oiled individuals could lose the water repellency and insulative capacity of feathers and subsequently drown or experience hypothermia. Stress from ingested oil can be additive to ordinary environmental stresses, such as low temperatures and metabolic costs of migration. Oiled females could transfer oil to their eggs, which at this stage could cause mortality, reduced hatching success, or possibly deformities in young. Oil could adversely affect food resources, causing indirect, sub-lethal effects that decrease survival, future reproduction, and growth of the affected individuals.

In addition to the expected mortality due to direct oiling of adult and fledged birds, potential effects include mortality of eggs due to secondary exposure by oiled brooding adults; loss of ducklings, goslings, and other non-fledged birds due to direct exposure; and lethal or sub-lethal effects due to direct ingestion of oil or ingestion of contaminated foods (e.g., insect larvae, mollusks, other invertebrates, or fish). Taken together, the effects of a large spill may be significant for individual waterfowl and their post-spill brood. Population depression at the local or regional scale would be greater than for smaller spills. However, the effects of even a large spill would be attenuated with time as habitats are naturally or artificially remediated and populations recover to again use them. In general, losses from substantive to very large spills would likely result in negligible to minor impacts to regional bird population levels, but may result in significant impacts to local population levels.

The Biological Assessment (BA) prepared for the proposed Project identifies federally listed and candidate species that were identified by the Department, the U.S. Fish and Wildlife Service and state wildlife agencies as potentially occurring in the Project area (see Appendix H, 2012 Biological Assessment). Table 1.3-1 in the BA summarizes these species and the preliminary impact determinations based on: 1) correspondence with the U.S. Fish and Wildlife Service, the Bureau of Land Management, and state wildlife agencies; 2) habitat requirements and the known distribution of these species within the proposed Project area; and 3) habitat analyses and field surveys that were conducted for these species from 2008 through 2012. The BA includes two

mammal species, six bird species, two fish species, one invertebrate species, and two species of plants in the analysis and findings.

Mammals

Most oil spills, including medium to large spills (1,000 to 20,000 bbl), would result in a limited impact on most of the terrestrial mammals using the area affected by the spill. The extent of impacts would depend on the type and amount of oil spilled (see Table 4.13-5); the location and terrain of the spill; the type of habitat affected; mammal distribution, abundance, and activity at the time of the spill; and the effectiveness of the spill response. Typically, the proportion of habitat affected would be very small relative to the area of habitat available for most mammals.

A large spill could affect terrestrial mammals directly or indirectly through impacts to their habitat, prey, or food. For example, a large spill likely would affect vegetation, the principal food of the larger herbivorous mammals, both wild (e.g., deer, elk, and antelope) and domestic (e.g., cattle, sheep, horses). Some of these animals probably would not ingest oiled vegetation, because they tend to be selective grazers and are particular about the plants they consume. Many predators and scavengers could experience toxic effects through feeding on birds, other mammals, reptiles, and fish killed or injured by the oil spill. However, these effects would not generally be life threatening or long term (White et al. 1995). Spill response activities would typically frighten most large mammals away from the spill. As noted previously, vegetation could be affected by the spilled oil, thus temporarily reducing local forage availability, although it is unlikely that the overall abundance of food for large herbivorous mammals would be substantially reduced.

Small mammals and furbearers could be affected directly by spills due to oiling. Furbearers, especially river otters, mink, muskrat, raccoons, and beavers that depend on or frequently use aquatic habitats would likely be exposed to oil if spills reached aquatic habitats within their range. Oiled furbearers would be susceptible to hypothermia and oil toxicity from ingestion during grooming. Impacts to small mammals and furbearers would likely be localized around the spill area and would not cause population-level impacts.

Except for some endangered, threatened, or protected species, loss of a small fraction of a population of organisms would likely result in a minimal impact at a community to ecosystem level. Loss or reproductive impairment of a significant portion of a population or biological community from an oil spill could result in a significant environmental impact. The impact is likely to be greater if the species affected have long recovery times (e.g., low reproductive rates); limited geographic distribution in the affected area; are key species in the ecosystem; are key habitat formers; or are otherwise a critical component of the local biological community or ecosystem. Furthermore, if the species or community is a key recreational or commercial resource, biological impacts manifested at the population or community level may constitute a significant impact to human uses of the resource.

Cultural Resources

Most spills would be confined to a construction yard, access roadway, or pipeline ROW, or to an adjacent area, with primary exception being a large spill from pipelines that affect areas beyond the ROW. Large spills could impact cultural resources identified within the Area of Potential Effect or cultural resources located outside of the Area of Potential Effect that are currently

unidentified. Table 4.13-11 identifies the number of previously identified cultural resource sites that are within each of the spill size buffers.

Table 4.13-11 Number of Previously Identified Cultural Resource Sites in Potential Spill Buffers

State[a]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	84	145	145
SD	36	60	67
NE	66	95	95

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

Cultural resources affected by a crude oil release potentially might not be returned to their original state. However, the impacts would be mitigated through documentation and/or data recovery excavations consistent with the requirements of the Programmatic Agreement (see Section 4.11.3, NRHP Eligibility, Effects, and Mitigation).

Water Resources

Water resources are defined in Section 3.13, Potential Releases, as sources of water that are potentially useful to humans. This includes groundwater and surface water and the ecosystem that relies on these resources. For the purposes of the potential release analysis, groundwater is defined as the first water-bearing zone below the ground surface. Surface water includes open waterbodies such as rivers, lakes, and ponds, as well as wetlands where water or the capillary fringe is at ground level. This section also describes potentially impacted water resources adjacent to the proposed pipeline route, including major aquifers, wells, streams, and rivers that would be crossed, and reservoirs and large lakes downstream of these crossings.

The potential for crude oil to be released to water resources is present if the pipeline is breached and a spill occurs. Previous sections have discussed the potential for overland flow, the resultant vertical and horizontal migration of the released oil, and impacts of a spill on wetlands. Impacts largely depend on the size of the oil volume and the type of waterbody that the oil contacts. Surface waters with low energy (i.e., static waters, ponds, and small lakes) could result in high localized toxicity levels. Low energy surface waterbodies with more water volume for oil constituents would be more likely to encounter higher aquatic toxicity than creeks and rivers with turbulent flow, where there can be an increase in mixing and an increase in evaporation of constituents such as benzene. In aquatic areas with high energy (e.g., waves, turbulent river flows, and/or high sediment deposition), the oil may become buried under or mixed in the sediment.

If released to water, crude oil typically floats on the water's surface. If crude oil is left on the water's surface over an extended period of time, some constituents within the oil will evaporate, other fractions will dissolve, and eventually, some material may descend to the bottom. Oil can sink in the water column as it degrades and mixes with particulates in water. The following is a summary of the major processes that occur during crude oil dispersion and degradation, and these are factors that are considered when predicting impacts to receptors and resources:

- **Physical Factors**—Crude oil mobility in water increases with wind, stream velocity, and increasing temperature. Most crude oils move across surface waters at a rate of 100 to 300 meters per hour. Surface ice will greatly reduce the spreading rate of oil across a waterbody. Crude oil in flowing, as opposed to contained, waterbodies may cause transitory impacts. Although reduced in intensity (as a result of dilution), a crude oil spill into flowing waters tends to move over a much larger area.
- **Dissolution**—Dissolution of crude oil in water is a process in controlling the crude oil's fate in the environment, since most components of oils are relatively insoluble (Neff and Anderson 1981). Moreover, evaporation tends to dominate the reduction of crude oil, with dissolution slowly occurring with time. Overall solubility of crude oils tend to be less than their constituents and individual compounds are often more soluble in oil than in water, thus they tend to remain in the oil. Diluents and bitumen when mixed together to form dilbit behave as a conventional crude oil, with the more soluble compound tending to remain in oil. However, some compounds could dissolve in water (i.e., dissolution). Dissolution is one of the primary processes affecting the toxic effects of a spill, especially in confined waterbodies. Dissolution increases with decreasing molecular weight, increasing temperature, decreasing salinity, and increasing concentrations of dissolved organic matter. Greater photodegradation also tends to enhance the solubility of crude oil in water.
- **Sorption**—In water, heavy molecular weight hydrocarbons will bind or adhere (i.e., sorption) to suspended particulates, and this process can be significant in water with a high particulate concentration (i.e., suspended clay or plant matter). Organic particles (e.g., biogenic material) in soils or suspended in water tend to be more effective at binding to soils than inorganic particles (e.g., clays). Sorption processes and sedimentation reduce the quantity of heavy hydrocarbons present in the water column and available to aquatic organisms. These processes, however, also render hydrocarbons less susceptible to degradation. Sediment covered with oil can be highly persistent and can cause shoreline impacts.
- **Evaporation**—Over time, evaporation is the primary mechanism of loss of low molecular weight constituents and light oil products. As lighter components evaporate, remaining crude oil becomes denser and more viscous. Evaporation tends to reduce crude oil toxicity, but enhances crude oil persistence. In field trials, bulk evaporation of Alberta crude oil accounted for an almost 50 percent reduction in volume over a 12-day period, while the remaining oil was still sufficiently buoyant to float on the water's surface (Shiu et al. 1988). Evaporation increases with increased spreading of a spill, increased temperature, and increased wind and wave action.
- **Photodegradation**—Photodegradation of crude oil in aquatic systems increases with greater solar intensity. It can be a significant factor controlling the reduction of a slick, especially of lighter oil constituents, but it will be less important during cloudy days and winter months. Photodegraded crude oil constituents can be more soluble and more toxic than parent compounds. Extensive photodegradation, like dissolution, may thus increase the biological impacts of a spill event.
- **Biodegradation**—Soon after a crude oil spill, natural biodegradation of crude oil will not tend to be a significant process controlling the fate of spilled crude oil in environments previously unexposed to oil. Microbial populations must become established before

biodegradation can proceed at any appreciable rate. Also, prior to weathering (i.e., evaporation and dissolution of light-end constituents), oils may be toxic to the very organisms responsible for biodegradation and high molecular weight constituents tend to be resistant to biodegradation. Biodegradation is nutrient and oxygen demanding and may be constrained in nutrient-poor aquatic systems. It also may deplete oxygen reserves in closed waterbodies, causing adverse secondary effects to aquatic organisms.

Groundwater

Groundwater is defined here as the first water-bearing zone below the ground surface. Groundwater aquifers are underground geological formations able to store and yield water. A groundwater aquifer is predominantly characterized as a formation with its pore spaces filled with water. Groundwater resources are primary sources of irrigation and potable water in the vicinity of the proposed pipeline route and several primary aquifers and aquifer groups are located within the proposed Project area in Montana, North Dakota, Nebraska, North Dakota, and Kansas (see Section 3.3.2, Groundwater), including the following alluvial aquifers: Northern High Plains[17] Aquifer, Great Plains Aquifer, Western Interior Plains Aquifer, and the Northern Great Plains Aquifer System. Using the overland flow and groundwater spill impact buffers defined above in Table 4.13-2, the number of wells in the potential reach of a spill is shown below in Tables 4.13-12 through 4.13-14.

Table 4.13-12 Total Number of Wells in Potential Overland Flow Spill Impact Areas[a]

State[b]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	3	10	45
SD	0	4	26
NE	50	172	518

[a] Data obtained from respective State registered well databases.
[b] MT=Montana, SD=South Dakota, NE=Nebraska.

Table 4.13-13 Total Number of Wells in Potential Groundwater Spill Impact Areas[a]

State[b]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	35	51	57
SD	12	16	18
NE	260	334	399

[a] Data obtained from respective State registered well databases.
[b] MT=Montana, SD=South Dakota, NE=Nebraska.

[17] Thousands of miles of pipeline carrying crude and refined products traverse throughout the region where the Ogallala Aquifer, part of the High Plains Aquifer System, is present. Pipelines installed within the last 10 to 15 years are all generally constructed and operated under similar regulatory and engineering procedures and design as would be required of the proposed Project.

Table 4.13-14 Total Number of Wells in Combined Potential Combined Overland/Groundwater Spill Impact Areas[a]

State[b]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	41	76	184
SD	18	27	49
NE	308	562	1060

[a] Data obtained from respective State registered well databases.
[b] MT=Montana, SD=South Dakota, NE=Nebraska.

In general, the potential for groundwater contamination following a spill would be more probable:

- Where a relatively shallow water table is present (as opposed to locations where a deeper, confined aquifer system is present).
- Where soils with high permeability are present above groundwater.
- Where the PHMSA (in cooperation with the USGS and other federal and state agencies) has identified specific groundwater resources that are particularly vulnerable to contamination. These resources are designated by PHMSA as HCAs.

The potential for crude oil migration into groundwater is influenced by several factors. These factors include the areal extent of the oil spill, the viscosity and density of the material, the characteristics of the environment into which the material is released (particularly the characteristics of the underlying soils), and the depth to first groundwater. Groundwater in the alluvial aquifers along the ROW is characteristically shallow (typically less than 50 feet below ground surface) and often unconfined (meaning that groundwater can be recharged from water seeping from the ground surface). These aquifers are used as a primary source of groundwater for irrigation, domestic, and/or commercial/industrial use along much of the proposed Project route in Montana, South Dakota, and Nebraska. Table 3.3-1 in Section 3.3.2.2, Proposed Pipeline Hydrogeologic Conditions, identifies water-bearing zones shallower than 50 feet.

Generally, the crude oil being transported in the proposed pipeline would become increasingly viscous when released into the environment. As viscosity increases, the vertical migration rate decreases. In most cases, given that vertical migration is controlled by the infiltration rate of the oil into the underlying soil, the extent of vertical migration can be mitigated by quick emergency response measures that include rapid source control (containment and collection of the oil released) (see Appendix I, SPCC and ERP). Heavy crude oils likely to be transported by the proposed Project are less dense than water and would float on the surface of waterbodies. If the crude oil infiltrates into soil formations, it would most likely form a floating lens above and slightly below the water table when groundwater is present. The crude oil plume would generally move in the direction of groundwater flow, until it reaches a steady state based on the groundwater flow rate, crude oil characteristics and soil characteristics. Plume expansion can also be affected by the rate of water being pumped out of an aquifer.

Studies related to oil and oil product releases from over 600 underground storage tank leaks indicate that potential surface and groundwater impacts from these releases are typically limited to several hundred feet or less from the release site (Newell and Conner 1998, USGS 1998) and are useful in assessing potential plume migration distances from pipelines. These studies indicate that the size of the oil release is the key factor influencing the ultimate oil plume dimensions (including the dissolved phase plume). While there are differences in the rate of oil movement

through different soil types, hydrogeologic factors such as hydraulic conductivity (the rate that water moves through soil) and gradient are not as significant in determining ultimate plume length (Newell and Conner 1998, USGS 1998). However, on a localized basis, it is acknowledged that water withdrawals through extensive pumping can influence the gradient.

An example of a crude oil release from a pipeline system into an environment similar to the proposed Project's aquifers occurred on August 20, 1979, near Bemidji, Minnesota. In this large spill, approximately 449,400 gallons (10,700 bbl) of crude oil were released onto a glacial outwash deposit consisting primarily of sand and gravel. The water table in the spill area ranged from near the surface to about 35 feet below ground surface. As of 1996, the leading edge of the oil remaining in the subsurface at the water table had moved approximately 131 feet downgradient from the spill site, and the leading edge of the dissolved contaminant plume had moved about 650 feet downgradient.

The hydraulic conductivity of a soil is a property that describes the ease with which water can move through the spaces or pores between soil particles. Several hydraulic conductivity estimates for the soils in which the Bemidji spill occurred are provided below (converted from meters per second to feet per day [ft/d]); these indicate how hydraulic conductivity values can vary based on the measurement methodology:

- 1.59 ft/d estimated from particle-size distributions (Dillard et al. 1997);
- 19.85 ft/d based on a calibrated estimate (Essaid et al. 2003);
- 20.70 ft/d based on aquifer (slug) tests (Strobel et al. 1998); and
- 99.23 ft/d based on permeameter tests (Bilir 1992).

Along the proposed Project route, estimated aquifer hydraulic conductivities range from about 1 ft/d to over 200 ft/d. As an example of this variability, the High Plains Aquifer system exhibits hydraulic conductivities estimated to range from 25 to 100 ft/d in 68 percent of the aquifer, with an average hydraulic conductivity estimated at 60 ft/d (Weeks et al. 1988). In general, groundwater velocity (which also takes into account the porosity and the hydraulic gradient [slope of the water table]) in the High Plains Aquifer system is 1 ft/d and groundwater generally flows in a direction from west to east (Luckey et al. 1986).

Other shallow groundwater resources along the proposed pipeline route may occur within soil profiles somewhat dissimilar from the previously mentioned Bemidji site. In many areas, shallow unconfined aquifers occur within alluvium in flood plains near streams and rivers. Shallow aquifers can also occur under confined conditions. Under confined conditions, the confining layer (e.g., silt or clay) would impede or prevent vertical migration of the crude oil into the aquifer. Unconfined alluvial soils comprised a range of soil constituents, including gravels, sands, silts, and clays in various percentages. As a result, these alluvial soils exhibit a range of hydraulic conductivities, but it is expected that in general vertical and lateral oil migration would follow similar patterns.

Concern was expressed relative to risks of contamination in aquifer recharge areas. Aquifer recharge occurs when overlying permeable materials connect to an aquifer unit. Shallow unconfined aquifers are overlain by such permeable materials and therefore are at risk if contamination of the overlying soils occurs. In areas where parts of deeper bedrock aquifers are exposed at the surface, they could also be at risk if they lie within an oil spill zone. It should also

be noted that research by the USGS at the Bemidji site suggests that downward migration of nutrients to an oil spill in unconfined shallow aquifer recharge areas may actually increase the rate of natural biodegradation by microbes (Bekins et al. 2005) in the event of an oil spill.

Specific groundwater data for each shallow aquifer are presented in Section 3.3.2, Groundwater, of this report. A review of publicly available water well data within 1 mile of the proposed Project centerline shows the following results:

- **Montana**—No public water supply wells or SWPAs are located within 1 mile of the proposed pipeline centerline; and eight private water wells are located within approximately 100 feet of the proposed pipeline centerline within McCone, Dawson, Prairie, and Fallon counties.
- **South Dakota**—One public water supply well (associated with the Colome SWPA) is located within 1 mile of the proposed pipeline centerline in Tripp County (within the Tertiary Ogallala aquifer); the proposed pipeline passes through the Colome SWPA in Tripp County; and no private water wells are located within approximately 100 feet of the proposed pipeline centerline in South Dakota.
- **Nebraska**—Thirty-eight known public water supply wells are located within 1 mile of the proposed pipeline centerline in Boone, York, Fillmore, Saline, and Jefferson counties; there are nine SWPAs within 1 mile of the proposed pipeline centerline and the only SWPA traversed by the pipeline route in Nebraska is in Steele City in Jefferson County; there are a total of 32 private water wells located within approximately 100 feet of the proposed pipeline centerline within Holt, Antelope, Merrick, Polk, York, Fillmore, Saline, and Jefferson counties.

Flowing Surface Waters

Flowing surface water includes open waterbodies such as rivers and streams. There are several streams and bodies of water crossed by the proposed route. Table 4.13-15 summarizes the number of water crossings by state. Table 4.13-16 shows the estimated total miles of proposed pipeline from which a spill could affect waterbodies, based on the spill impact buffers listed in Table 4.13-2; note that the mileage is based on oil spreading on flat ground and effects of topography on spill flow were not addressed.

Table 4.13-15 Waterbody Crossings by the Proposed Project

State[a]	Number of Crossings
MT	459
SD	333
NE	281

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

Table 4.13-16 Estimated Total Pipeline Mileage that Could Affect Identified Waterbodies[a]

State[b]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	109.88	154.22	301.48
SD	79.72	111.88	218.72
NE	67.27	94.41	184.57

[a] Based on number of streams the buffer distance shown in Table 4.13-2.
[b] MT=Montana, SD=South Dakota, NE=Nebraska. There are no waterbodies crossed in North Dakota and Kansas.

The Final EIS Risk Assessment followed extremely conservative assumptions to overestimate potential spill effects including the following:

- The entire volume of a spill was released directly into a waterbody;
- Complete, instantaneous mixing occurred; and
- The entire benzene content was solubilized into the water column.

The Risk Assessment evaluated impacts to downstream drinking water sources by comparing projected surface water benzene concentrations with the national maximum contaminant level (MCL) for benzene (0.005 ppm). Similar to existing pipelines, the proposed Project would cross hundreds of perennial, intermittent, and ephemeral streams. The Risk Assessment evaluated categories of streams based on the magnitude of streamflow and stream width. These categories included Low Flow Stream, Lower Moderate Flow Stream, Upper Moderate Flow Stream, and High Flow Stream. A 1-hour release period for the entire spill volume was assumed to maximize the product concentration in water. The estimated benzene concentrations were then compared with the human health drinking water MCL for benzene.

This report updates the Risk Assessment from the Final EIS to include the revised spill volume categories (small, medium, and large) discussed above and to use the new calculated occurrence interval of 0.00025 incident/mile-year (Appendix K, Historical Pipeline Incident Analysis, Table 6). The incident frequency is based on historical data for mainline pipe. Results are presented in Tables 4.13-17 and 4.13-18.

Based on these conservative assumptions, results suggest that most spills that enter a waterbody could exceed the national MCL for benzene. Although the assumptions used are highly conservative and, thus, overestimate potential benzene water concentrations, the analysis indicates the need for rapid notification of managers of municipal water intakes downstream of a spill so that potentially affected drinking water intakes from affected surface waterbodies could be closed. Under anaerobic conditions (little to no dissolved oxygen), benzene typically degrades at a slower rate and could be more persistent in groundwater and travel longer distances than benzene in aerobic (normal or abundant dissolved oxygen) conditions. However, the distance of the migration is not unlimited and would be restricted by attenuating processes. In surface water, the mixing of benzene with fresh water, evaporation of benzene, and biodegradation would reduce the concentration of benzene in surface water quickly. Benzene, as a single component, would be reduced to non-detectable levels in a shorter distance in a flow surface water system than in a flowing groundwater system.

Table 4.13-17 Estimated Surface Water Benzene Concentrations Resulting from a Diluted Bitumen Spill[a]

			Product Released					
		Stream	Small Spill		Medium Spill		Large Spill	
Streamflow	Benzene MCL (ppm)	Flow Rate (cfs)[b]	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)
Low Flow Stream	0.005	10	10.9	25,461	218	118,319	2175.0	502,857
Lower Moderate Flow Stream	0.005	100	1.1	17,823	21.8	82,824	218.0	352,000
Upper Moderate Flow Stream	0.005	1,000	0.1	13,367	2.2	62,118	21.8	264,000
High Flow Stream	0.005	10,000	0.01	7,638	0.2	35,496	2.2	150,857

[a] Historical data indicate that the most probable spill volume would be 3 bbl or less. However, this analysis is based on conservative incident frequencies and volumes defined for this Supplemental EIS, which overestimates the proportion of larger spills. Consequently, the assessment is conservative in its evaluation of the magnitude of environmental consequences. Estimated concentration is based on release of benzene into water over a 1-hour period, with uniform mixing conditions. Concentrations are based on a 0.15 percent by weight benzene content of the transported material. Occurrence intervals are based on a historical incident frequency of 0.00025 incidents/mile-year (Appendix K, Historical Pipeline Incident Analysis, Table 6), projected frequencies of each spill volume, and estimated stream widths. Widths of higher flow streams are greater than widths of lower flow streams, with more distance where an incident might occur. This results in a greater predicted frequency for high flow streams and a corresponding lower occurrence interval.
[b] cfs = cubic feet per second.

Table 4.13-18 Estimated Surface Water Benzene Concentrations Resulting from a Synthetic Crude Spill[a]

			Product Released					
		Stream	Small Spill		Medium Spill		Large Spill	
Streamflow	Benzene MCL (ppm)	Flow Rate (cfs)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)
Low Flow Stream	0.005	10	0.2	25,461	3.6	118,319	725.0	502,857
Lower Moderate Flow Stream	0.005	100	0.02	17,823	0.4	82,824	72.5	352,000
Upper Moderate Flow Stream	0.005	1,000	0.002	13,367	0.04	62,118	7.2	264,000
High Flow Stream	0.005	10,000	0.0002	7,638	0.004	35,496	0.7	150,857

[a] Historical data indicate that the most probable spill volume would be three bbl or less. However, this analysis is based on conservative incident frequencies and volumes defined for this Supplemental EIS, which overestimates the proportion of larger spills. Estimated concentration is based on release of benzene into water over a 1-hour period with uniform mixing conditions. Concentrations are based on a 0.15 percent by weight benzene content of the transported material. Occurrence intervals are based on a historical incident frequency of 0.00025 incidents/mile-year (Appendix K, Historical Pipeline Incident Analysis, Table 6), projected frequencies of each spill volume, and estimated stream widths. Widths of higher flow streams are greater than widths of lower flow streams, with more distance where an incident might occur. This results in a greater predicted frequency for high flow streams and a corresponding lower occurrence interval.

Although toxicity threshold values could be exceeded based upon the conservative assumptions, the potential for a release is low based on the risk evaluation above (and described in Appendix K, Historical Pipeline Incident Analysis). Spill occurrence intervals for a diluted bitumen or synthetic crude spill are shown in Tables 4.13-17 and 4.13-18, respectively. For a representative stream size and spill size category, a potential spill occurrence was calculated from data obtained from the PHMSA database. To be conservative, a 500-foot buffer on either side of the river was added to the crossing widths. Conservative occurrence intervals for a diluted bitumen ranged from approximately one spill event in 8,638 years for a high-flow stream to one spill event in 502,857 years for a small low-flow stream. If a release did occur, it is likely that the total release volume of a spill would be 50 bbl or less based on PHMSA data for historical spill volumes (Appendix K, Historical Pipeline Incident Analysis, Figure 1).

In general, the impacts would be lower in flowing waters than in static water since constituent concentrations would be more rapidly diluted in flowing waters, although spills into rivers and creeks might result in some toxicity within the water column itself. Under certain conditions, oil may sink in the water column as previously described. In large rivers, the impact to the water column would be reduced. In small streams, an oil spill could create direct aquatic toxicity in the water column because of the lower relative volume and rate of water flow. This would lead to a higher likelihood of direct contact between aquatic organisms and the dispersed oil. Some toxicity might persist in these streams for a few weeks to months, until toxic compounds trapped in the sediment were washed out or until impacted sediment was covered by cleaner sediment.

Spills could affect surface water quality if spilled material reaches waterbodies directly or from flowing over the land. However, the vast majority of spills would likely be confined to construction yards, areas in or adjacent to the proposed pipeline ROW, or along access roads. As shown on Table 4.13-1 and in Appendix K, Historical Pipeline Incident Analysis, the volumes of most spills would likely be small. In addition, for some portion of the winter months each year, spill responders could remove much of the spilled material from frozen ground or ice-covered waterbodies prior to snowmelt. During the rest of the year, spills could reach and affect wetlands, ponds, and lakes, as well as creeks and rivers before spill response is initiated or completed.

An oil spill that reaches a surface waterbody not only could cause oiling and constituent toxicity levels, but could also reduce dissolved oxygen (DO) concentrations, particularly from dissolved phase hydrocarbons (e.g., benzene, toluene, ethylbenzene, and xylene). A reduced DO concentration results in a lower sustainable capacity for the plant and aquatic life, thus reducing the overall waterbody population. Because oil slicks are less permeable to oxygen than water, spilled material that reaches wetlands, ponds, or small lakes could lower DO concentrations due to a decreased influx of atmospheric oxygen and the relatively high rate of natural sediment respiration in many shallow waterbodies. In small, shallow waterbodies with limited water movement and presence (e.g., small lakes, farm reservoirs, and stock ponds), the presence of oil can increase biodegradation activity, further reducing oxygen levels.

In winter, however, a small spill would not likely contribute substantively to an oxygen deficit in most waters because biological abundance and activity are lower than during other times of the year and the need for oxygen is reduced. Furthermore, sediment respiration has less relative effect in lakes that are too deep to freeze to the bottom. Such lakes tend to be supersaturated with DO in winter (Bureau of Land Management and Minerals Management Service 1998). An exception to such conditions could occur if spilled material were introduced to a waterbody

beneath the ice cover, in very restricted waters with depleted oxygen levels and a concentrated population of overwintering fish. During open water periods in most waterbodies, especially larger lakes, rivers, and streams, spilled materials would likely result in little detectable decrease in DO levels. The high water volume (relative to the volume of oil) or the high rate of water flow would disperse oil before it affected DO concentrations.

Long-term aquatic toxicity would be less likely to occur in larger lakes and rivers because oil would be diluted or dispersed within the sediment over large areas by currents and wind and wave action. Spills into larger rivers and creeks, especially during open water periods, might result in some toxicity within the water column itself. However, in larger rivers, because of the large and rapid dilution of the oil relative to the flow volumes, these impacts would likely be limited to back eddies, calm water regions, and reservoir pools down current of where the spill enters the river. In smaller flowing streams, an oil spill could create direct aquatic toxicity in the water column because of the lower relative volume and rate of water flow, and thus there would be a higher likelihood of direct contact between the biota and the dispersed oil. Some toxicity might persist in these streams for a few weeks or longer, until toxic compounds trapped in the sediment were washed out or until oiled sediment was covered by cleaner sediment.

Since the majority of oil spills are small in volume, these smaller spills, if reaching larger lakes, would result in minimal effects on overall water quality, assuming the lake volume is substantially larger than the volume of spilled oil. Decreases in DO levels would be negligible in most cases but may be greater in large to very large spills that cover much of the water surface for a day or more. Direct toxicity would be short term because of the high dilution volume in these lakes and the rapid evaporation of most of the potentially toxic lighter hydrocarbons. Spreading of a spill over a lake surface may have a minor to major effect on water aesthetics and recreational use. This effect could exist for days to a few weeks until the oil was removed. Removal could include both physical removal by response teams and natural attenuation. Natural attenuation could include biodegradation, evaporation, components dissolving in water and degrading naturally, and dispersion and dilution.

Minor temporary to short-term surface water quality degradation is possible from smaller maintenance equipment and vehicle spills or leaks. Longer-term water quality degradation could be associated with large to very large spills. A larger spill could also affect potable surface water sources and irrigation water supplies. As mentioned previously, the crude oils transported by the proposed Project would tend to float on the surface water column. However, as with any crude oil, over time key components of oil would evaporate and biodegrade resulting in a weathered oil that could potentially sink.

Aquatic Organisms

As defined in Section 3.13, Potential Releases, aquatic organisms include plants, animals, and microorganisms for which life is completely sustained within an aquatic habitat. There are three fish species listed with special status that were identified during field surveys, including Blacknose shiner, Finescale dace, and the Northern redbelly dace. Table 4.13-19 shows fish are among the most sensitive aquatic organisms, while aquatic clams, snails, etc., generally have intermediate sensitivities, and algae and bacteria tend to be the least sensitive. Nevertheless, even when major fish kills have occurred as a result of oil spills, population recovery has been observed and long-term changes in fish abundance have not been reported. Benthic (bottom-dwelling) aquatic invertebrates tend to be more sensitive than algae, but are equally as or less

sensitive than fish. Planktonic (floating) species tend to be more sensitive than most benthic insects, crustaceans, and mollusks.

Table 4.13-19 Acute Toxicity of Aromatic Hydrocarbons to Freshwater Organisms[a]

	Toxicity Values (ppm)				
Taxa/Species	**Benzene**	**Toluene**	**Xylenes**	**Naphthalene**	**Anthracene**
Amphipod/ (*Gammarus lacustris*)	NA[b]	NA	0.35	NA	NA
Amphipod/ (*Gammarus minus*)	NA	NA	NA	3.9	NA
Fish/Carp (*Cyprinus carpio*)	40.4	NA	780	NA	NA
Fish/Channel catfish (*Ictalurus sp.*)	NA[a]	240	NA	NA	NA
Fish/Clarias catfish (*Clarias* sp.)	425	26	NA	NA	NA
Fish/Coho salmon (*Oncorhyncus kisutch*)	100	NA	NA	2.6	NA
Fish/Fathead minnow (*Pimephales sp.*)	NA	36	25	4.9	25
Fish/Goldfish (*Carassius auratus*)	34.4	23	24	NA	NA
Fish/Guppy (*Poecilia reticulate*)	56.8	41	NA	NA	NA
Fish/Largemouth bass (*Micropterus sp.*)	NA	NA	NA	0.59	NA
Fish/Medaka (Oryzias sp.)	82.3	54	NA	NA	NA
Fish/Mosquito fish (*Gambusia affinis*)	NA	1,200	NA	150	NA
Fish/Rainbow trout (*Oncorhyncus mykis*)	7.4	8.9	8.2	3.4	NA
Fish/Zebra fish (*Therapon iarbua*)	NA	25	20	NA	NA
Insect/ *Chlorella vulgaris*	NA	230	NA	25	NA
Insect/ *Microcystis aeruginosa*	NA	NA	NA	0.85	NA
Insect/ *Nitzschia palea*	NA	NA	NA	2.8	NA
Insect/ *Scenedesmus subspicatus*	NA	130	NA	NA	NA
Insect/ *Selenastrum capricornutum*	70	25	72	7.5	NA
Insect/ (*Somatochloa cingulata*)	NA	NA	NA	1.0	NA
Midge/ (*Chironomus attenuatus*)	NA	NA	NA	15	NA
Midge/ (*Chironomus tentans*)	NA	NA	NA	2.8	NA
Rotifer/ (*Brachionus calyciflorus*)	>1,000	110	250	NA	NA
Snail/(P*hysa gyrina*)	NA	NA	NA	5.0	NA

	Toxicity Values (ppm)				
Taxa/Species	**Benzene**	**Toluene**	**Xylenes**	**Naphthalene**	**Anthracene**
Zooplankton/ (*Daphnia magna*)	30	41	NA	6.3	0.43
Zooplankton/ (*Daphnia pulex*)	111	NA	NA	9.2	NA
Zooplankton/ (*Diaptomus forbesi*)	NA	450	100	68	NA

Source: Appendix Q, Pipeline Risk Assessment and Environmental Consequence Analysis, Table 4-4.

[a] Data summarize conventional acute toxicity endpoints from USEPA's ECOTOX database. When several results were available for a given species, the geometric mean of the reported LC50 values was calculated. The LC50 is the concentration of a compound necessary to cause 50 percent mortality in laboratory test organisms within a predetermined time period (e.g., 48 hours) (USEPA 1994).
[b] NA = not available. Indicates no value was available in the database.

The toxicity of crude oil is dependent on the toxicity of its constituents. Table 4.13-20 summarizes the toxicity of various crude oil hydrocarbons to the water flea, *Daphnia magna*. This species of water flea is used as a standard test organism to determine acute and chronic responses to toxicants. Most investigators have concluded that the acute toxicity of crude oil is related to the concentrations of relatively lightweight aromatic constituents, particularly benzene.

Table 4.13-20 Acute Toxicity of Crude Oil Hydrocarbons to *Daphnia magna*

Compound	**48-hr LC50[a] (ppm)**	**Optimum Solubility (ppm)**	**Relative Toxicity[b]**
Anthracene	3	5.9	2
Benzene	9.2	1,800	195.6
Biphenyl	3.1	21	6.8
Cumene	0.6	50	83.3
Cyclohexane	3.8	55	14.5
Decane	0.028	0.052	1.9
Ethylbenzene	2.1	152	72.4
Hexane	3.9	9.5	2.4
9-methylanthracene	0.44	0.88	2
Methyl cyclohexane	1.5	14	9.3
Octane	0.37	0.66	1.8
1-methylnaphthalene	1.4	28	20
2-methylnaphthalene	1.8	32	17.8
Phenanthrene	1.2	6.6	5.5
Pyrene	1.8	2.8	1.6
Toluene	11.5	515	44.8
1,2,4,5-tetramethylbenzene	0.47	3.5	7.4
1,2,4-trimethylbenzene	3.6	57	15.8
1,3,5-trimethylbenzene	6	97	16.2
p-xylene	8.5	185	21.8
m-xylene	9.6	162	16.9
o-xylene	3.2	175	54.7

Source: Appendix Q Pipeline Risk Assessment and Environmental Consequence Analysis, Table 4-5.

[a] The LC50 is the concentration of a compound necessary to cause 50 percent mortality in laboratory test organisms within a predetermined time period (e.g., 48 hours) (USEPA 1994).
[b] Relative toxicity = optimum solubility/LC50.

While lightweight aromatics such as benzene tend to be water soluble and relatively toxic, they also are highly volatile. Thus, most or all of the lightweight hydrocarbons accidentally released into the environment evaporate, and the environmental persistence of this crude oil fraction tends to be low. High molecular weight aromatic compounds, including PAHs, are not very water-soluble and have a high affinity for organic material. Consequently, these compounds, if present, have limited bioavailability, which renders them substantially less toxic than more water-soluble compounds (Neff 1979). Additionally, these compounds generally do not accumulate to any great extent because these compounds are rapidly metabolized (Lawrence and Weber 1984; West et al.1984). There are some indications, however, that prolonged exposure to elevated concentrations of these compounds may result in a higher incidence of growth abnormalities and hyperplastic diseases in aquatic organisms (Couch and Harshbarger 1985).

A summary of chronic toxicity values (most frequently measured as reduced reproduction, growth, or weight) of benzene to freshwater biota is provided in Table 4.13-21. Chronic toxicity from other oil constituents may occur if sufficient quantities of crude oil are continually released into the water to maintain elevated concentrations.

Table 4.13-21 Chronic Toxicity of Benzene to Freshwater Biota[a]

Taxa	Test Species		Chronic Value (ppm)
Algae	Green algae	(*Selenastrum capricornutum*)	4.8*
Amphibian	Leopard frog	(*Rana pipens*)	3.7
Fish	Fathead minnow	(*Pimephales promelas*)	17.2*
	Guppy	(*Poecilia reticulata*)	63.0
	Coho salmon	(*Oncorhynchus kitsutch*)	1.4
Invertebrate	Zooplankton	(*Daphnia* spp.)	>98.0

Source: Appendix Q Pipeline Risk Assessment and Environmental Consequence Analysis, Table 4-6.

[a] Test endpoint was mortality unless denoted with an asterisk (*). The test endpoint for these studies was growth.

Significantly, some constituents in crude oil may have greater environmental persistence than lightweight compounds (e.g., benzene), but their limited bioavailability renders them substantially less toxic than other more soluble compounds. Based on the combination of toxicity, solubility, and bioavailability, benzene was determined to dominate toxicity associated with potential crude oil spills.

The potential impacts to aquatic organisms of various sized spills to waterbodies were modeled assuming the benzene content within each type of crude oil completely dissolved in the water. The benzene concentration was predicted based on amount of crude oil spilled and streamflow. The estimated benzene concentrations were compared to conservative acute and chronic toxicity values for protection of aquatic organisms. For aquatic biota, the lowest acute and chronic toxicity thresholds for benzene are 7.4 and 1.4 ppm, respectively, based on standardized trout toxicity tests (USEPA 1994). These toxicity threshold values are considered protective of acute and chronic effects to aquatic biota. Although trout are not found in many of the habitats crossed by the proposed project route, trout are among the most sensitive aquatic species and reliable acute and chronic trout toxicity data are available. Using trout toxicity thresholds, therefore, provides a conservative benchmark to screen for the potential for toxicity.

Tables 4.13-22 through 4.13-24 summarize a screening-level assessment of acute and chronic toxicity to aquatic resources.

Table 4.13-22 Comparison of Estimated Benzene Stream Concentrations Following a Diluted Bitumen Spill to the Chronic Toxicity Threshold for Aquatic Life (1.4 ppm)[a]

			Product Released					
			Small Spill		Medium Spill		Large Spill	
Throughput 435,000 bpd	Stream Flow Rate (cfs)	Acute Toxicity Threshold (ppm)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)
Low Flow Stream	10	1.4	0.06	25,461	1.3	118,319	12.9	502,857
Lower Moderate Flow Stream	100	1.4	0.006	17,823	0.13	82,824	1.3	352,000
Upper Moderate Flow Stream	1,000	1.4	0.0006	13,367	0.013	62,118	0.13	264,000
High Flow Stream	10,000	1.4	0.00006	7,638	0.0013	35,496	0.013	150,857

[a] Historical data indicate that the most probable spill volume would be 3 bbl or less. However, this analysis is based on conservative incident frequencies and volumes defined for this Supplemental EIS, which overestimates the proportion of larger spills. Estimated proportion of benzene in the transported material is 0.15 percent, and is assumed to be entirely water solubilized in the event of a spill. The resulting concentration was calculated by multiplying 0.15 percent of the total amount of material released divided by 7 days of stream flow volume. The model assumes uniform mixing conditions. The chronic toxicity value for benzene is based on a 7-day toxicity value of 1.4 ppm for trout. Exposure concentrations were estimated over a 7-day period since the chronic toxicity value was based on a 7-day exposure. Shading indicates concentrations that could potentially cause chronic toxicity to aquatic species. The darkest shading represents high probability of chronic toxicity (>10 times the toxicity threshold); lighter shading represents moderate probability of chronic toxicity (1 to 10 times the toxicity threshold); and unshaded areas represent low probability of chronic toxicity (<toxicity threshold). Occurrence intervals are based on a historical incident frequency of 0.00025 incidents/mile-year (Appendix K, Historical Pipeline Incident Analysis, Table 6), projected frequencies of each spill volume, and estimated stream widths. Widths of higher flow streams are greater than widths of lower flow streams, with more distance where an incident might occur. This results in a greater predicted frequency for high flow streams and a corresponding lower occurrence interval.

Table 4.13-23 Comparison of Estimated Benzene Stream Concentrations Following a Synthetic Crude Spill to the Acute Toxicity Threshold for Aquatic Life (1.4 ppm) [a]

			Product Released					
			Small Spill		Medium Spill		Large Spill	
Throughput 435,000 bpd	Stream Flow Rate (cfs)	Acute Toxicity Threshold (ppm)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)
Low Flow Stream	10	7.4	3.6	25,461	72	118,319	725	502,857
Lower Moderate Flow Stream	100	7.4	0.4	17,823	7.2	82,824	72.5	352,000
Upper Moderate Flow Stream	1,000	7.4	0.04	13,367	0.7	62,118	7.2	264,000
High Flow Stream	10,000	7.4	0.004	7,638	0.07	35,496	0.7	150,857

[a] Historical data indicate that the most probable spill volume would be 3 bbl or less. However, this analysis is based on conservative incident frequencies and volumes defined for this Supplemental EIS, which overestimates the proportion of larger spills. Estimated proportion of benzene in the transported material is 0.15 percent, and is assumed to be entirely water solubilized in the event of a spill. The resulting concentration was calculated by multiplying 0.15 percent of the total amount of material released divided by 7 days of stream flow volume. The model assumes uniform mixing conditions. The acute toxicity value for benzene is based on a 7-day toxicity value of 7.4 ppm for trout. Exposure concentrations were estimated over a 7-day period since the chronic toxicity value was based on a 7-day exposure. - Shading indicates concentrations that could potentially cause chronic toxicity to aquatic species. The darkest shading represents high probability of chronic toxicity (>10 times the toxicity threshold); lighter shading represents moderate probability of chronic toxicity (1 to 10 times the toxicity threshold); and unshaded areas represent low probability of chronic toxicity (<toxicity threshold). Occurrence intervals are based on an historical incident frequency of 0.00025 incidents/mile-year (Appendix K, Historical Pipeline Incident Analysis, Table 6), projected frequencies of each spill volume, and estimated stream widths. Widths of higher flow streams are greater than widths of lower flow streams, with more distance where an incident might occur. This results in a greater predicted frequency for high flow streams and a corresponding lower occurrence interval.

Table 4.13-24 Comparison of Estimated Benzene Stream Concentrations Following a Diluted Bitumen Spill to the Acute Toxicity Threshold for Aquatic Life (17.4 ppm)[a]

			Product Released					
			Small Spill		Medium Spill		Large Spill	
Throughput 435,000 bpd	Stream Flow Rate (cfs)	Acute Toxicity Threshold (ppm)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)	Benzene Concentration (ppm)	Occurrence Interval (years)
Low Flow Stream	10	7.4	0.06	25,461	1.3	118,319	12.9	502,857
Lower Moderate Flow Stream	100	7.4	0.006	17,823	0.13	82,824	1.3	352,000
Upper Moderate Flow Stream	1,000	7.4	0.0006	13,367	0.013	62,118	0.13	264,000
High Flow Stream	10,000	7.4	0.00006	7,638	0.0013	35,496	0.013	150,857

[a] Historical data indicate that the most probable spill volume would be 3 bbl or less. However, this analysis is based on conservative incident frequencies and volumes defined for this Supplemental EIS, which overestimates the proportion of larger spills.
Estimated proportion of benzene in the transported material is 0.15 percent, and is assumed to be entirely water solubilized in the event of a spill. The resulting concentration was calculated by multiplying 0.15 percent of the total amount of material released divided by 7 days of stream flow volume. The model assumes uniform mixing conditions.
The acute toxicity value for benzene is based on a 7-day toxicity value of 7.4 ppm for trout.
Exposure concentrations were estimated over a 7-day period since the chronic toxicity value was based on a 7-day exposure.
Shading indicates concentrations that could potentially cause chronic toxicity to aquatic species. The darkest shading represents high probability of chronic toxicity (>10 times the toxicity threshold); lighter shading represents moderate probability of chronic toxicity (1 to 10 times the toxicity threshold); and unshaded areas represent low probability of chronic toxicity (<toxicity threshold).
Occurrence intervals are based on an historic incident frequency of 0.00025 incidents/mile-year (Appendix K, Historical Pipeline Incident Analysis, Table 6), projected frequencies of each spill volume, and estimated stream widths. Widths of higher flow streams are greater than widths of lower flow streams, with more distance where an incident might occur. This results in a greater predicted frequency for high flow streams and a corresponding lower occurrence interval.

Broadly, acute toxicity could potentially occur if substantial amounts of crude oil were to enter rivers and streams. If such an event were to occur within a small stream, aquatic species in the immediate vicinity and downstream of the rupture could be killed or injured. Chronic toxicity also could potentially occur in small and moderate-sized streams and rivers. However, emergency response, containment, and cleanup efforts would help reduce the concentrations and minimize the potential for chronic toxicity. In comparison, small spills (less than 50 bbl) into moderate and large rivers would not pose a major toxicological threat. In small to moderate sized-streams and rivers, some toxicity might occur in localized areas, such as backwaters where concentrations would likely be higher than in the mainstream of the river. While a release of crude oil into any given waterbody might cause immediate localized toxicity to aquatic biota, particularly in smaller streams and rivers, the frequency of such an event would be very low. Nevertheless, streams and rivers with aquatic biota represent the sensitive environmental resources that could be temporarily impacted by a crude oil release. Environmentally, much information has and continues to be learned from the Marshall Michigan Dilbit spill. The release of Dilbit to a river or other aquatic environment introduces the potential for additional impacts and additional recovery challenges for responders of such an event to the environment.

The Department examined existing studies and information to evaluate the impacts of other components of Dilbit (e.g. PAHs, heavy metals, etc.). These impacts would generally be similar to those discussed in Section 4.14.3.3, Effect of Soil Type, Soil Cover, and Temperature Flow. Allowing for the specific chemical properties and toxicological effects of the other components of Dilbit, anecdotal comparisons could be made regarding the impacts of these components from a submerged Dilbit release on the environment and the organisms that inhabit the water column and the underlying sediments and soils.

As with some other types of oil, Dilbit will not float on water indefinitely. The Dilbit-specific characteristics, water temperature, and particulate load in the water could result in much of the oil being submerged in the water column. Submerged oil can be suspended in the water column, suspended just above the river bed, or intermixed with sediment and trapped in the river bed and shoreline. In flowing waters, the spreading of the oil in three dimensions creates many challenges for responders to minimize the impacts of the release. Consideration of submerged oil in a flowing water environment would require different response action planning and response equipment to contain and recover the submerged oil. Dilbit intermixed with sediment and trapped in the river bed and shoreline results in a persistent source of oil and will present new response and recovery challenges. The understanding and adaptation of response and recovery techniques to Dilbit spills in flowing water scenarios continues along the Kalamazoo River in response to the 2010 Enbridge release near Marshall, Michigan. As the response to the Marshall Michigan Dilbit spill continues to mature and evolve, the lessons learned from the response and recovery efforts should be considered to facilitate the implementation of proper response planning and response strategies to improve the overall response to Dilbit spills.

Wetlands/Reservoirs/Lakes

Wetlands are considered in this analysis as lands where saturation with water determines the type of soil, wildlife, and vegetation found in the area. Wetlands include swamps and marshes. Reservoirs are natural or artificial lakes used as a source of water. Lakes are a large body of water surrounded by land. Wetlands, reservoirs, and lakes are grouped together as semi-static waterbodies.

Although planning and routing efforts have reduced the overall number of wetlands and static waterbody environments crossed by the proposed Project route, wetlands and waterbodies with persistently saturated soils are present along and adjacent to the proposed route. The effects of crude oil released into a wetland environment will depend not only upon the quantity of oil released, but also on the physical conditions of the wetland at the time of the release. Table 4.13-25 identifies the total estimated potential wetland acreage along the proposed route that could be affected by a surface release, based on buffer distance assumptions.

Table 4.13-25 Total Estimated Wetlands Acreage in Potential Surface Spill Areas

State[a]	Small (0-50 bbl)	Medium (50-1,000 bbl)	Large (1,000-20,000 bbl)
MT	81.67	269.02	888.73
SD	197.14	649.39	2145.31
NE	108.98	358.99	1185.95

[a] MT=Montana, SD=South Dakota, NE=Nebraska.

An oil spill that reaches these types of waterbodies could result in reduction of oxygen levels within the water. In winter, however, a small spill would not have as much of an impact on oxygen levels due to the already lowered biological activity that is a part of the natural cycle of freezing waterbodies. If a spill were to occur underneath ice of a frozen lake, oil could accumulate under the ice, the temperature could reduce the viscosity, light components could dissolve in water, and recovery efforts could be slowed because of the location and characteristics of the oil. Spills in these conditions are addressed by the Keystone ERP, which will be updated for the proposed Project. For spills occurring during the rest of the year, most of the product would float on the water or wet soil surface, although some of the light components of the oil (e.g., benzene) could dissolve or disperse in water.

Since most oil spills are statistically small in size, there would be minimal effects in water quality in large lakes, assuming the lake volume is substantially larger than the volume of spilled oil. Decreases in oxygen levels would be negligible in most cases but may be greater in large to very large spills that cover much of the water surface for a day or more. Direct toxicity would be short-term because of the high dilution volume in these lakes and the rapid evaporation of most of the potentially toxic lighter hydrocarbons. Spreading of a spill over a lake surface may have a minor to major effect on water aesthetics and recreational use. This effect could exist for days to a few weeks until the oil was removed.

Impacts of crude oil spills or refined product spills on wetlands are influenced by the type of oil or oil product, the amount and proportion of water surface area covered, the type of vegetation present in the wetland, and cleanup response actions. Refined products tend to be more toxic than crude oil, while crude oil tends to cause more physical impacts (e.g., smothering). Most spilled oil would remain on the water surface where vegetation and wildlife may become coated as the oil disperses.

Spills of refined product (e.g., diesel, gasoline) would be more likely to occur during construction. The majority of these spills would be small spills from construction pads or access roads. If the spills occur in winter, the wetland may be covered in ice and spilled product may be contained by snow or remain on top of the ice. In either case, the spilled oil likely would be recovered before it directly affected wetland habitat and associated organisms. Although gasoline spills evaporate quickly, there may be short-term acute effects on wetland wildlife and

vegetation. Diesel spills tend to be more persistent, and diesel may infiltrate sediments as well as adhere to emergent vegetation.

Crude oil spills that occur during operation of the proposed Project could affect wetlands either where the proposed pipeline would cross wetlands or waterbodies (e.g., ponds, lakes, reservoirs, streams, rivers, or adjacent riparian habitats) or where the spill site is on land but upgradient of the wetland. Due to the viscosity of heavy crude oils, spills would likely be restricted in areal extent, particularly in colder months. Snow could serve as a medium to hold and further restrict the spill migration. Larger spills in open water seasons could flow into wetlands, cover the water surface, coat wetland wildlife and vegetation, and restrict oxygen exchange between air and water. Some spilled crude oil could sink through the water into underlying sediments and remain there for years, depending on the amount of biodegradation and chemical or physical weathering that takes place.

Smaller refined product or crude oil spills would generally produce minor impacts on wetlands unless the wetland is small and isolated from other waterbodies. In these cases, impacts could be substantive if the majority of the wetland is exposed to the oil. Substantive and large to very large crude oil spills could result in substantive impacts on wetlands due to the size of the spill and the proportion of the wetlands that would be affected. Impacts could approach a catastrophic level in areas where the wetlands are heavily used by migratory waterfowl and the spill occurred during the spring or fall migration.

Crude oil released from a subsurface pipe within a wetland could reach the soil surface. If the water table is at the ground surface, the release would manifest as floating crude oil. The general lack of surface flow within a wetland would restrict crude oil movement. Where surface water is present within a wetland, the spill would spread laterally across the water's surface and be readily visible during routine ROW surveillance. The depth of soil impacts likely would be limited to the depth to groundwater. Conversely, groundwater impacts within the wetland are likely to be confined to the near-surface, enhancing the potential for biodegradation. Spills to aquatic environments would trigger regulator involvement and assessment to implement remedial action. However, response and remediation efforts in a wetland have the potential for appreciable adverse effects from construction/cleanup equipment. Aggressive cleanup methods could mix oil and water, which may result in longer lasting impacts to sensitive wetland habitat. Physical disruption of wetland resources below the water line during spill response could be reduced in some cases through ignition of the oil floating on the water surface. Passive cleanup methods (including natural attenuation) are less likely to impact wetland resources. If no active remediation activities were undertaken, with concurrence of the regulatory body (e.g., state Department of Environmental Quality), natural biodegradation and attenuation would ultimately allow a return to preexisting conditions in both soil and groundwater. This would likely require a timeframe on the order of tens of years. In the unlikely event of a spill, Keystone would use the most appropriate cleanup procedures as determined in coordination with the applicable federal and state agencies.

Socioeconomics

The Final EIS (Section 3.13.6.7) discussed impacts of oil spills to components of the socioeconomic environment, including populated areas; agricultural activities, water intakes and water supplies, other commercial activities, and single-family home sales and property value. The Final EIS noted, and as stated above, that in the event of oil spill impacts to water supplies

for residential, agricultural, commercial, or public uses, Keystone would provide alternate sources of water for essential uses such as drinking water, irrigation, industrial cooling water, and water for firefighting and similar public safety services.

Economic impacts related to short-term disruption in local agricultural production could result from a spill that enters agricultural lands or wild lands used by grazing livestock. The extent and duration (e.g., short term or long term) of the economic impacts would depend on the number of productive acres affected, the response time, the remedial method selected and implemented by the response team, and the length of time required to return land services to conditions similar to those prior to the spill.

If a spill affected recreational lands and/or waterways, businesses relying on hunting, fishing, sightseeing, and other recreational activities could experience a short-term negative economic impact. During response and restoration actions, access to oil-impacted areas would generally be limited or prohibited to anyone except the cleanup and monitoring crews, thus limiting recreational access. Adverse publicity about the impacts of large to very large spills could reduce use by recreationists from the local and regional areas, or even from other areas in the United States for an extended period of time. For small to very small spills, there would likely be negligible economic impacts to businesses relying on recreational uses. In some cases, response to oil spills could generate positive local economic activity for the limited duration of the spill response activities as a result of the need for lodging, meals, equipment, and other facilities, materials, and logistic support for the cleanup crews and the incident command team.

The Final EIS also reviewed the findings of two studies of economic impacts to land and residence values in areas affected by oil spills the and concluded that the data suggest that the economic consequences of an oil spill could include a temporary reduction in housing prices that would likely decrease over time. Evaluation of the economic impacts of large-scale releases of crude oil is outside of the scope of the Supplemental EIS.

Environmental Justice Considerations

Information on minority and low-income populations within the proposed Project socioeconomics analysis area including locations that are designated as Health Professional Shortage Areas and Medically Underserved Areas/Populations are presented in Section 4.10, Socioeconomics. Depending on the location and volume of an accidental crude oil release from the proposed Project, it is possible that minority or low-income populations could be affected by the release. Minority and low-income populations could be more vulnerable to health impacts associated with the crude oil release, 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 emissions from the crude oil, or consumption of food or water contaminated by either the crude oil or components of the crude oil. Keystone would be liable for all costs associated with cleanup and restoration as well as other compensations for any release that could affect surface water. Therefore potential impacts to minority or low-income populations would be mitigated by the operator’s liability for the release. Additionally, Keystone has committed to provide an alternative water supply if an accidental release from the proposed Project contaminates groundwater or surface water used as a source of potable water or for irrigation or industrial purposes, which includes water uses by minority and low-income populations.

Given the potential vulnerability of these populations to health impacts, it is essential that spill response planning considers appropriate communications directed to these populations in the unlikely event of an accidental crude oil release. Emergency communications should be provided in languages appropriate for identified populations at risk. As a measure to avoid or minimize impacts to minority or low-income populations, response planning should include outreach to Local Emergency Planning Committees (see Sections 3.10.2.5, Public Services, Tax Revenues, and Property Values, and 4.14.5.2, Spill Response) to ensure due consideration of the potential issues involved in emergency response in areas where minority and low-income populations have been identified along the proposed Project corridor.

4.13.5 Recommended Additional Mitigation

This section addresses the additional measures that are recommended to increase safety and reduce the severity and likelihood of a spill. Increased levels of protection are provided by implementing the PHMSA 57 Special Conditions discussed below. These measures provide for an additional safety factor on the proposed Project that exceeds those typically applied to a domestic oil pipeline projects. If a spill occurred, pre-defined and systematic plan response actions can take effect to quickly mitigate the impact.

4.13.5.1 PHMSA 57 Special Conditions

PHMSA in consultation with the Department developed a set of 57 Special Conditions that increases public safety above current minimum requirements. Keystone agreed that if the Presidential Permit is granted, it would incorporate those conditions into the proposed Project and in its manual for operations, maintenance, and emergencies required by 49 CFR Part 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. The Department, 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 HCAs as defined in 49 CFR Part 195.450. Appendix B, PHMSA 57 Special Conditions, describes how each of the 57 Special Conditions increases public safety over and above the applicable current Code requirements.

The majority of the Special Conditions relate to reduction in the likelihood of a release occurring; in addition, some provide mitigation that reduces the consequences and impact of a spill, discussed earlier in this section, should such an event occur. To understand how each one acts, they were considered for their role as preventive controls for the loss of pipeline contents (barriers that could stop a possible threat) and controls in the event of a spill (controls used to mitigate the consequences of a spill). The basis for a barrier/control was if the Special Condition by itself or in conjunction with another reduces the likelihood of the pipeline threat from causing a release or acts to reduce the consequences of a spill once a release occurs. The following are criteria for identifying a condition as a barrier or control once implemented:

- **Independence**—For the Special Condition to be a barrier or control, it should be independent of other barriers and controls. It is independent if it accomplishes its function

without assistance from other barriers/controls, tasks not implied in the conditions, or external equipment.

- **Functionality**—A barrier or control should be able to prevent the threat from developing or progressing further and be capable of serving the purpose for which it was designed or implemented. In other words, the barrier could reduce or prevent a potential threat from becoming a release, and the control would reduce the severity of a release.

A Special Condition might be a barrier for more than one threat. It also could both prevent a release from occurring in certain situations and minimize the impact once a release occurs (i.e., it can act as both a threat barrier and a mitigating control). Table 4.13-26 shows that the Special Conditions provide 24 independent barriers, with one to five independent barriers for each threat. The Special Conditions that are considered controls and also work to reduce the consequences of a spill include Numbers 24, 25, 26, 30 and 53. Table 4.13.-27 describes the 24 barriers that develop by applying one or a combination of the Special Conditions. A brief description is provided, either of the Special Conditions or how the Special Condition can prevent threats and, therefore, affect the frequency of eventual spills. A detailed description of the PHMSA 57 Special Conditions is provided in Appendix B, PHMSA 57 Special Conditions.

Table 4.13-26 Special Conditions as Barriers to Threats[a]

Threat	Threat Category	Independent Barrier 1	Independent Barrier 2	Independent Barrier 3	Independent Barrier 4	Independent Barrier 5
Internal corrosion	Time-dependent	SC[b] 33 and 47	SC 34			
External corrosion		SC 9, 15 and 39	SC 10 and 11	SC 35, 36, 21, 37 and 38		
Stress corrosion cracking (SCC)		SC 3	SC 45, 44 and 46			
Materials-related	Stable	SC 1	SC 2 and 8	SC 4 and 12	SC 5	SC 6
Construction-related		SC 14	SC 17 and 18	SC 22 and 23	SC 42 and 43	SC 49 and 51
Equipment malfunction		SC 24-30, 50 and 53	SC 15, 16, 25-26 and 31			
Weather conditions	Time-independent	SC 24-30, 50 and 53				
Excavation/ third-party damage		SC 7, 19 and 53	SC 40-41, 48 and 54			
Operational error		SC 13, 20 and 53	SC 24-30, 50 and 53			

[a] Because not all Special Conditions are designed as a barrier, not all Special Conditions are listed
[b] SC = Special Condition number.

Table 4.13-27 Barrier Assessment of Special Condition Threat Mitigations

Threat	Independent Barrier	Brief Barrier Description	Special Condition Reference
Internal corrosion	1	The design of the pipeline, which would allow for 100% internal inspection by smart tools combined with periodic pigging to assess pipe thickness changes would facilitate the early detection of internal corrosion signs as implicit in the provisions of the referenced Special Conditions.	SCs[a] 33 and 47
	2	The following actions stated in the Special Condition are considered capable of decreasing the pipe corrosion rate: 1) limiting sediment and water content to 0.5% by volume; 2) running cleaning tools periodically; and 3) implementing a crude oil monitoring and sampling program that ensures transported products meet pipeline specifications.	SC 34
External corrosion	1	The application of corrosion resistant coating on pipes, and compliance to Canadian Standards Association, National Association of Corrosion Engineers, and International Organization for Standardization standards, plus controls for operating temperature and periodic coating surveys are considered the basis for a good external corrosion program as detailed in the referenced Special Conditions.	SCs 9, 15, and 39
	2	The use of abrasion resistant coating for trenchless installations and a field joint coating quality control program for holiday detection (a gap or hole in the coating) are considered complementary preventive measures for decreasing external corrosion rates.	SCs 10 and 11
	3	The installation of cathodic protection with periodic performance studies and stray current studies comprise a preventive control against pipe corrosion. Additional measures detailed in the referenced Special Conditions complement a cathodic protection program as a barrier against external corrosion.	SCs 35, 36, 21, 37, and 38
SCC	1	The implementation of fracture control and integrity verification plans addressing the steel pipe properties necessary to resist crack initiation and crack propagation will likely become a preventive control against the SCC threat as detailed in the referenced Special Condition.	SC 3
	2	Complete annual fatigue analysis and flaw growth assessment and periodic in-line inspections consistent with 49 CFR Part 195.452(j)(3), are considered preventive measures against SCC as explicitly stated in the referenced Special Conditions.	SCs 45, 44, and 46
Materials related	1	Steel must be of high quality with specific materials structure and composition, which are fundamental for meeting design specifications, and future pipe performance. This constitutes a barrier to manufacturing threat as implicit in the Special Condition provisions, and to some extent for future corrosion issues.	SC 1

Threat	Independent Barrier	Brief Barrier Description	Special Condition Reference
	2	Manufacturer's adherence to API 5L Product Specification Level 2, supplementary requirements for maximum operating pressures and minimum operating temperatures, and quality assurance/ quality control are considered complementary measures against manufacturing threat as outlined in the referenced Special Conditions.	SCs 2 and 8
	3	Steel plate/coil quality control, pipe mill quality assurance/quality control plan, and the implementation of procedures for high quality welding of components as explained in the referenced Special Conditions constitute a barrier against materials related issues.	SCs 4 and 12
	4	Specific pipe seam quality control requirements for pipe manufacturers are considered a barrier against seam welding issues.	SC 5
	5	Special monitoring for seam fatigue from transportation, traceability of tests, and manufacturing records will create a barrier against manufacturing defects as explicitly stated in the referenced Special Condition.	SC 6
Construction related	1	The post-construction survey to identify changes that would impact design, once implemented, would likely constitute a barrier against many construction related issues as implicit in the referenced Special Condition.	SC 14
	2	Submittal of construction plans and schedules to PHMSA, welding procedures, stress analysis, lowering-in procedures, and engineering critical assessments, are considered best industry practices that would reduce the risks of construction related defects as outlined in the referenced Special Conditions.	SCs 17 and 18
	3	Pipeline hydro-test to 100% specified minimum yield strength and conducting a failure analysis should a test failure occur are considered complementary measures that would assist in correcting construction related issues.	SCs 22 and 23
	4	Performing a baseline geometry tool run after completion of the hydrostatic strength test and backfill of the pipeline with a high-resolution magnetic flux leakage tool would assist in detecting construction flaws and serve for future reference of the system integrity baseline as detailed in in the referenced Special Conditions.	SCs 42 and 43
	5	Complete immediate dig-ups to investigate and/or repair as necessary based on anomalies reported by smart inspection, removal of dents exceeding 2%, and reporting on compliance to the conditions within 180 days of in-service are considered measures that would reduce the risk of construction related issues.	SCs 49 and 51

Threat	Independent Barrier	Brief Barrier Description	Special Condition Reference
Equipment malfunction	1	The installation of a sophisticated computerized SCADA system to provide remote control and monitoring of the entire pipeline system, the activities necessary to maintain it in optimum condition, and additional measures detailed in the referenced Special Conditions are measures against the threat of equipment malfunction.	SCs 24-30, 50, and 53
	2	Overpressure control requirements, pressure and temperature controls, enhanced SCADA scan rate to detect small leaks, alarm management policy, and trained personnel in leak detection per Canadian Standards Association guidelines are considered complimentary measures against the threat of equipment malfunction.	SCs 15, 16, 25-26, and 31
Weather conditions	1	The installation of a sophisticated SCADA system to provide remote control and monitoring of the entire pipeline system plus the activities necessary to maintain it in an optimum condition are measures to reduce the risk of a release due to natural forces as implicit in the referenced Special Conditions.	SC 24-30, 50, and 53
Excavation/ third-party damage	1	Specific requirements for steel pipe to be puncture-resistant to excavators, deeper pipeline cover depths, and the use of a threat matrix are considered measures to prevent loss of containment due to third parties as outlined in the referenced Special Conditions.	SC 7, 19, and 53
	2	Pipeline markers in addition to frequent ROW patrols constitute a proven barrier to prevent inadvertent third party damage as explicitly stated in the referenced Special Conditions.	SC 40-41, 48 and 54
Operational error	1	Traceability of components to the correct intended operating pressure, requirements for operator's qualifications, and the use of a threat matrix for the pipeline system are considered measures against inadvertent operational errors as detailed in the referenced Special Conditions.	SC 13, 20, and 53
	2	The installation of a sophisticated SCADA system to provide remote control and monitoring of the entire pipeline system plus the activities necessary to maintain it in an optimum condition would likely assist in detecting operational errors promptly. Additional measures detailed in the referenced Special Conditions would also assist in executing recovery procedures before the spill occurs.	SC 24-30, 50, and 53

[a] SC = Special Condition

4.13.5.2 Spill Response

In the event of a spill during construction and reclamation activities, Keystone has identified and prepared written procedures to address a response action. These activities are provided in Keystone's Draft Spill Prevention, Control, and Countermeasures Plan (Appendix I, SPCC and ERP). This document has been submitted as a template for the proposed Project Spill Prevention, Control, and Countermeasures Plan. PHMSA regulations require approval for an ERP for the proposed Project at least 6 months prior to beginning pipeline operation. As such, a formal plan is not included in this Supplemental EIS although the initial response actions for a variety of

emergency conditions are provided in the Keystone ERP (not the Keystone XL-specific plan) in Appendix I, SPCC and ERP. There are four key measures addressed in the responsive portion of the Keystone ERP:

- Notification procedures;
- Response actions;
- Response teams; and
- Spill impact considerations.

Notification Procedures

According to the ERP, for the purpose of this notification procedure, immediate reporting means reporting the instant a person (Keystone personnel, public, industry partners, or emergency response agencies) has knowledge of an actual or suspected leak, uncontrolled release of product, any unplanned spill, or other pipeline system failure (Appendix I, SPCC and ERP, Section 1.2, pp. 1-6). The internal and external notification procedures in the ERP are separated to provide clarity with no implied preference. All notifications are of extreme importance and must be completed in a timely manner (Appendix I, SPCC and ERP, Section 1, pp. 1-2).

Upon discovery of a leak or if a leaked is suspected, reporting procedures call for contacting Keystone's Oil Control Center initially followed by local emergency services (e.g., fire department, police or sheriff, emergency medical technicians, as needed). The Keystone Oil Control Center is contacted first to engage Keystone's internal response units, who provide support and response action guidance to first responders (local emergency services, emergency response contractor, and spill management team). In addition, the NRC, appropriate federal agencies, county emergency management, state environmental management, and utilities services are contacted. The internal response units establish the command structure, engage the appropriate internal support teams, contact emergency spill response contractors, and fulfill federal and state notification obligations. The ERP lists contact phone numbers for the Local Emergency Planning Committees in each county through which the proposed Project runs.

On November 20, 2012, Keystone conducted an emergency response drill at their regional office in Omaha, Nebraska. The objective of the drill was to identify and distribute appropriate Material Data Safety Sheets (MSDS) to first responders at the scene of the spill based upon the time and location of the incident. The drill scenario was based on a third party severing a buried portion of a pipeline while excavating. The location of the strike was selected at random by an observer at the drill that was not a Keystone employee. The drill commenced with a simulated call from the equipment operator who severed the pipeline. The equipment operator called the number posted on the pipeline right-of-way signs who in turn contacted Keystone. Once this information was received by Keystone, a local first responder was called and sent to the site to confirm the leak and gather specific location information (the actual site inspection was not done for this simulation). The Keystone Oil Control Center was notified of confirmation of the release and the spill response process was initiated, which included simulated shut down of the pipeline and multi-level notifications by phone by local/regional representatives to local responders (law enforcement, local emergency responders, and officials). Simultaneously, while local contacts were being informed, notifications are being made by corporate team members to Nebraska Emergency Management Agency, NRC, PHMSA, state Department of Environmental Quality,

and the USEPA. The randomly selected location of the pipeline strike resulted in a scenario where the potential for two different types of oil could be present in the pipeline at the spill scene. The batches were identified by the Oil Control Center and the MSDSs for both products were distributed electronically to the first responders at the scene. Receipt of the MSDSs were confirmed by phone. The objective of the drill was achieved in roughly 17 minutes.

Response Actions

The ERP provides guidance on how first responders are to classify a spill to the environment or a complaint made within the community. These classifications—minor, serious, major, or critical—are based on the potential for impacts to public safety and the environment. Provided in the ERP is the checklist of actions to be taken to minimize the potential impacts of a release as shown below:

- Take appropriate personal protective measures;
- Secure the site;
- Call for medical assistance if an injury has occurred;
- Notify the Oil Control Center and area management of the incident;
- Eliminate possible sources of ignition in the near vicinity of the spill;
- Take necessary fire response actions by trained staff and responding fire departments;
- Advise personnel or public in the area of any potential threat and/or initiate evacuation procedure;
- Identify/isolate the source and minimize the loss of product;
- Restrict access to the spill site and adjacent area as the situation demands;
- Take additional steps necessary to minimize any threat to health and safety; and
- Verify the type of product and quantity released (Material Safety Data Sheet(s) are available).

There are 11 potential emergencies that could be presented in the ERP (listed below) that have been identified and response guidance is provided on each:

- Initial response for public safety measures
- Fire
- Line break or leak
- Release to groundwater
- Severe thunderstorm/flash flooding/landslide
- Winter storm
- Tornadoes
- Earthquake
- Volcanic eruptions

- Bomb threat/terrorist activity
- Abnormal operations

Guidance is also provided to document initial response actions, oil containment, recovery and waste minimization, and management procedures. Emergency medical treatment and safety awareness are also addressed (e.g., first aid, site safety plan, air monitoring, decontamination procedures, personal protective equipment).

Prior to PHMSA granting permission to operate the proposed Project, Keystone would be required to prepare the Project-specific ERP to facilitate rapid response in the event of an oil release. However, there are many factors that could affect a response action and the extent of the release. Some of these include:

- Geographic location and site access;
- Position of the leak (surface or subsurface leak);
- Time to expose a leak (subsurface location);
- Time of day (night versus day);
- Terrain, topography, or geomorphology;
- Weather; and
- Natural disaster-related causes (e.g., flooding, landslides, excessive snow fall, earthquake).

Based on the response time to a release site, level of effort needed for containment measures, characteristics of the spill location and containment location, and the volume of spilled material, the areal extent and receptors affected can be significantly different for every potential spill.

Response Teams

The initial response to a release would be provided by the local Keystone personnel, whose tasks include initiating the notification process and providing pertinent release information to the Operations Control Center. The Operations Control Center would engage response team members to provide the appropriate level of support, personnel and contractors, emergency services, and resources needed to address the release. As part of Keystone's implementation of the Incident Command System, the first company employee onsite would become the Incident Commander and the duties of the Incident Commander are transferred to more senior company personnel as they arrive on site. The effective execution of the Incident Command System would generally lead to safer, more organized, and more focused response action. With an authoritative command structure established and support roles defined, this focused effort would have the potential to reduce response time and potential impacts and increase the confidence and support from local, federal, state, and public sector emergency response personnel.

The Keystone Oil Pipeline System ERP was previously developed for the existing Keystone Mainline and Cushing Extension project and approved by PHMSA. The Keystone ERP would be used as a template for the Keystone XL ERP and would include the necessary proposed Project-specific information. The ERP for the proposed Project would have the same general approach as presented in the Keystone ERP but would have many specific differences, such as the names and contact information for responders along the proposed Project route and the differing

environmental and public health vulnerabilities along the pipeline corridor. Once the proposed Project route is finalized, fieldwork would commence to collect relevant information to be incorporated into the Project ERP, which would then be submitted to PHMSA for review and approval. Keystone has committed to consult and communicate with the Local Emergency Response Planning Committees (LEPCs) and other emergency service agencies during ERP development to ensure emergency response plans are aligned. During an emergency, Keystone would form a Unified Command with local first responders and liaise with all impacted community stakeholders, including the LEPCs.

A spill response is initiated by the reporting of a suspected or confirmed release (e.g., direct observation, SCADA detection, community report, or other notification). As stated in the Keystone ERP, "For the purpose of this procedure, immediate reporting means reporting the instant a person has knowledge of an actual or suspected leak, uncontrolled release of product, any unplanned spill or other pipeline system failure. Information that causes any employee to reasonably suspect a leak or uncontrolled release of product must be immediately reported, even when the actual existence or location of a leak or release cannot yet be confirmed."

As discussed above, many factors influence the response to a release. The time between the actual occurrence of the release and the reporting of the release is critical to the response effort and the potential impacts from the spill to human health and the environment. In general, the sooner an effective, efficient response action begins, the sooner the impacts from a release can be addressed, reduced, or eliminated. Keystone's response times to transfer the necessary resources to a potential release site as required by 49 CFR Part 194.115 are shown in Table 4.13-28 below. Depending on the nature of site-specific conditions and resource requirements, Keystone would meet or exceed the requirements along the entire length of the proposed pipeline system.

Table 4.13-28 Response Time Requirements of 49 CFR Part 194.115

Area	Tier 1 Resources	Tier 2 Resources	Tier 3 Resources
High-volume area[a]	6 hours	30 hours	54 hours
All other areas	12 hours	36 hours	60 hours

[a] High-volume area indicates an area where an oil pipeline with a nominal outside diameter of 20 inches or more crosses a major river or other navigable waters; because of the velocity of the river flow and vessel traffic on the river, this area would require a more rapid response in the case of a worst-case discharge or the substantive threat of such a discharge.

As stated above, as soon as an effective, efficient response action begins, the sooner the impacts from a release can be addressed, reduced, or eliminated. For releases to streams or rivers, these response times affect the distance which oil could be transported downstream before an effective containment system is encountered. For overland flow, these response times affect where nearby streams or rivers could be affected or if spreading is contained before a sensitive receptor is impacted. Once the flow is controlled and containment of the spill is achieved, reclamation, remediation, and restoration of the release site and affected areas can begin.

In general, Tier 1 emergency response equipment would be pre-positioned for access by Keystone along the proposed route. Equipment can include pick-up and vacuum trucks; containment boom, skimmers, pumps, hoses, fittings, and valves; communications equipment including cell phones, two-way radios, and satellite phones; containment tanks and rubber bladders; expendable supplies including absorbent boom 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; personnel protective equipment including rubber

gloves, chest and hip waders; and air monitoring equipment to detect hydrogen sulfide, oxygen, lower explosive level, and benzene.

Additional equipment, including helicopters, fixed-wing aircraft, all-terrain vehicles, snowmobiles, backhoes, dump trucks, watercraft, bull dozers, and front-end loaders also may be accessed depending on site-specific circumstances. Other types, numbers, and locations of equipment would be determined upon concluding the detailed design of the proposed pipeline and completing Keystone‘s final ERP. This plan would be completed and submitted to PHMSA for review prior to commencing operations as described above.

The primary task of the Tier 1 response team is to reduce the spread of the spill on the ground surface or water to protect the public and Unusually Sensitive Areas, including ecological, historic, and archeological resources and drinking water locations. The Emergency Site Manager would perform an initial assessment of the site for specific conditions, including the following:

- The nature and amount of the spilled material;
- The source, status, and release rate of the spill;
- Direction(s) of spill migration;
- Known or apparent impact of subsurface geophysical features that may be affected;
- Overhead and buried utility lines and pipelines;
- Nearby population, property, or environmental features and land or water use that may be affected;
- Location of HCAs including Unusually Sensitive Areas down current or downgradient from the spill site; and
- Concentration of wildlife and breeding areas.

The Emergency Site Manager would request additional resources in terms of personnel, equipment, and materials from the Tier 2 and if necessary, the Tier 3 response teams. Once containment activities have been successfully concluded, efforts would then be directed toward the recovery and transfer of free product. Site cleanup and restoration activities would then follow, all of which would be conducted in accordance with the ERP and in conjunction with regulatory agencies having jurisdiction. Keystone is required to prepare to respond to a worst-case discharge (WCD) by regulations in 49 CFR Part 194. This consists of calculating and identifying where the WCD may potentially occur, plans to ensure that adequate personnel and equipment resources are available to respond, and scenario development. By developing such plans for a WCD, Keystone can be better prepared to respond to a large-scale incident such as the 20,000 bbl spill on the Kalamazoo River in Marshall, Michigan, in 2010. Keystone would ensure internal personnel are trained to respond to oil spills through annual exercises and training sessions including full scale field exercises held in various locations in various operating environments and weather.

When developing the ERP, Kalamazoo River Spill lessons learned would be considered, including ensuring consultants are contracted as appropriate to facilitate a large-scale and prompt response; developing source containment plans including strategies and tactics; minimizing response times with appropriate equipment; identifying equipment resources required to respond to sunken and submerged oil, and ensuring personnel are appropriately trained.

Spill Response Considerations

The ERP would address spill impact response requirements including oil containment and removal for land or surface spills, spills occurring in waterbodies, on or under ice, urban areas, and wetlands. The ERP would also address socioeconomic sensitivities by providing guidance and procedures to reduce or mitigate impacts to heritage resources, archeological sites, fisheries, and wildlife in the event of a spill or when conducting reclamation or remediation activities (Appendix I, SPCC and ERP)

As identified above, response action and remediation potentially can have a deleterious effect on receptors or the environment. There are potential impacts that could occur during the remediation of a spill to any of the receptors or Unusually Sensitive Areas listed above (e.g., wetlands, beneficial soils, highly erodible soils, paleontological resources). Care should be exercised when conducting response actions and remediation efforts to limit the impacts to the surrounding areas. Proper use of mats or other materials when moving or operating heavy equipment can minimize potential impacts to soils by reducing ruts and damage to soil cover. Similar means can be used for drill rigs installing monitor or recovery wells and treatment systems to reduce the potential impacts to the area surrounding a spill response action. In waterbodies, the use of flat-bottom, shallow draft boats, which reduce the potential for damage to shorelines, aquatic plants and animals, should be considered.

The methods for remediating spills in both construction and operation phases of the proposed Project would generally vary only in the magnitude of the effort. As discussed in the Construction, Mitigation and Reclamation Plan (Appendix G, CMRP), many of the spills that occur during construction would be generally small in volume and could be addressed by containment, excavation, and other remedial processes. Many of these same processes are also discussed in the ERP (Appendix I, SPCC and ERP) as related to potentially larger spill volumes. Recovery, reuse, and recycling are the best choices for remediation of a spill. The more effort applied to recovery of spilled product generally means shorter-lived remediation efforts and less impact to the environment.

The use of skimmers, vacuums, sorbent materials, and other means of recovery of spilled products should be managed during remediation efforts and care should be exercised to not cause further impacts to the local environment or receptors. The reuse of hydrocarbon-affected soils as road base or in asphalt mixtures (as approved by the appropriate agencies) is another way to remediate affected soil at a spill site. Recovered product from skimming or vacuum operations can be recycled by removing water and debris and re-blending for use. Incineration or burning to oiled media for energy recovery may be options to consider. However, there can be limitations in incineration and local air quality authorities would need to be contacted. Disposal of oiled soil and debris at a solid or dangerous waste landfill is the least environmentally sound method of disposal and should be considered only as the last option. Once the spill recovery effort is no longer effective or efficient, more passive remediation methods can be implemented to further the remediation and restoration of affected soil, groundwater, and surface water.

There are many ways to remediate hydrocarbon-affected soil, groundwater, and surface water. Action would include: soil excavation, bioremediation of oil, groundwater recovery with pumps and water treatment, oil recovery from surface water as well as groundwater, degradation of oil compounds using other chemical compounds, and natural degradation.

In considering the treatment methods listed above, it would be necessary to weigh the effectiveness of the remediation technique used against the intrusiveness of the remedial effort on the environment and potential receptors. These methods would be implemented following approval of the appropriate agencies and managed by qualified persons knowledgeable in the application of the technology.

Pipeline Spill Response Plan

In addition to the ERP, a Pipeline Spill Response Plan (PSRP) would be prepared and submitted to PHMSA prior to initiating operation of the proposed Project, in accordance with requirements of 49 CFR Part 94. The PSRP would not necessarily need to be a separate report from the ERP. The PSRP would detail Keystone's spill response and describe the worst case scenario discharge, as well as the procedures in place to manage the discharge. The PSRP requires PHMSA review and approval; however, there is a 2 year grace period under which operation of the pipeline can proceed while PHMSA reviews and approves the PSRP. This period would allow PHMSA to review the proposed Project in its final, as-built state.

Spill Liability and Responsibility

In addition to Keystone staff and resources and consistent with the requirements of the proposed Project's ERP, federal, state, and local agencies would engage in response activities where soil, surface water, and groundwater cleanup are needed. Participation would be within agencies' authorities and duties under applicable regulations. Required mitigation for crude oil or oil products spill impacts would be determined by these agencies. In addition, the state, tribal, and federal natural resource trustee agencies could require a Natural Resource Damage Assessment under either the Oil Pollution Act (OPA 90) or the Comprehensive Environmental Restoration Compensation and Liability Act, depending on the types of materials spilled and the assessment of the magnitude of the impacts and the type/amount of suitable restoration actions to offset the loss of natural resource services resulting from a spill. The Nebraska Environmental Protection Act, Nebraska RRS S 81-1501, et seq. and the Nebraska Administrative Code Title 126, Chapter 18, provide for operator liability in the event a pipeline spills oil or a hazardous substance in or on land or waters of the state. Table 4.13-29 summarizes potentially applicable federal and state soil, surface water, and groundwater cleanup regulations.

Section 1001(32)(B) of the OPA 90 states that in the case of an onshore facility, any person owning or operating the facility is the responsible party. Additionally, under Section 1002 of OPA 90, Keystone would be liable for discharge of oil (or threat of discharge) to navigable waters of the United States and their adjoining shorelines. The term navigable waters is defined in OPA 90 as the waters of the United States, including the territorial sea. Groundwater is not within the scope of the OPA unless a direct connection to surface waters can be affirmed.

If there is an accidental release that could affect surface water, no matter what the reason, Keystone would be liable for all costs associated with cleanup and restoration as well as other compensations, up to a maximum of $350,000,000 per OPA 90 (U.S. Department of Homeland Security 2012). However this statutory liability limit does not apply where the incident was proximately caused by 1) gross negligence or willful misconduct, or 2) the violation of an applicable federal safety construction or operating regulation by Keystone or a person acting pursuant to a contractual relationship with Keystone.

Table 4.13-29 Potentially Applicable Federal and State Soil, Surface Water, and Groundwater Clean-up Regulations

Statute/Regulation	Description
Resource Conservation and Recovery Act, 42 United States Code (USC) § 6973.	USEPA may issue an order or bring a suit in district court against any person who has contributed or who is contributing to the handling, treatment, storage, transportation, or disposal of solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment. Persons who violate an order are subject to civil penalties of up to $7,500 per day. Section 7003(a) of Resource Conservation and Recovery Act, 42 USC 6973(a), authorizes USEPA upon receipt of evidence that the past or present handling, storage, treatment, transportation or disposal of any solid waste or hazardous waste may present an imminent and substantial endangerment to health or the environment, to bring suit in district court or to issue an administrative order to any person who contributed or is contributing to that handling, storage, treatment, transportation to restrain or take any other action in response. Oil released from a pipeline would constitute solid or hazardous waste, and the authority allows USEPA to require action even if the spill may present an imminent and substantial endangerment.
Safe Drinking Water Act (SDWA), 42 USC §§ 300f, et seq.	USEPA may issue orders to any person in circumstances where contaminant is present in or is likely to enter a public water system or an underground source of drinking water (defined broadly to include virtually almost all groundwater) which may present an imminent and substantial endangerment to the heal of persons and states (to whom primary responsibility is granted under the SDWA) are not acting. The orders may require that person to take such actions as USEPA deems necessary to protect health. 42 USC § 300i (a). Civil penalties are available for failure to comply with such an order. Section 1431(a) of SDWA, 42 USC 300i(a), authorizes USEPA upon receipt of information that a contaminant which is present in or is likely to enter a public water system or an underground source of drinking water which may present an imminent and substantial endangerment to the health of persons, to take such actions as [it] deems necessary, including issuance of orders and civil judicial actions. Again, this authority is quite broad. An underground source of drinking water is virtually any underground water that has the potential to be used for drinking water, and a contaminant is any biological, chemical, or physical substance in water.
Pipeline Safety Act, 49 USC §§ 60101, et. seq.	The Pipeline Safety Act provides authority for PHMSA to establish minimum safety standards for interstate hazardous liquid pipelines, including petroleum pipelines. The standards may apply to the design, installation, inspection, emergency plans and procedures, testing, construction, extension, operation, replacement and maintenance of pipeline facilities. § 60102(a)(2). Penalties Violations of PHMSA requirements are subject to civil judicial enforcement actions, with varying penalty amounts depending on the nature of the violation (generally, $100,000 for each violation, with a maximum of $1,000,000 for a related series of violations). Written Procedures Regulations require that a pipeline operator prepare and implement a manual for operations, maintenance and emergencies. 49 CFR Part 195.402. For emergencies, the manual must include procedures for (a) receiving, identifying and classifying notices of events which need immediate response and (b) responding promptly to the emergency, including fire or explosion near or involving a pipeline, accidental release of materials from a pipeline, operational failures and natural disasters. 49 CFR Part 195.402(e).

Statute/Regulation	Description
	Notification Regulations require that a pipeline operator make an accident report, including telephonic report, for pipeline failures which result in (a) explosion or fire, (b) release of 5 gallons or more of petroleum (with certain exceptions), (c) death, (d) personal injury necessitating hospitalization, or (e) property damage (including cleanup) in excess of $50,000. 49 CFR Parts 195.50-195.54.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC §§ 9601, et. seq.	Similar to the OPA 90, but addresses releases of hazardous substances and specifically excludes oil and petroleum. Provides for liability for response costs and natural resource damages against owners or operators of a vessel or facility and persons who arranged for disposal of hazardous substances. The act contains similar defenses as for the OPA 90, as well as contribution rights. Also provides USEPA authority to issue administrative orders requiring response actions.
Montana	There is no single statutory scheme under Montana law governing liability for pipeline spills on land and in groundwater, but one or more of the following provisions could apply depending on the circumstances: Montana Code Annotated (MCA) 75-10-705 et seq., Montana‘s ―Comprehensive Environmental Clean-up and Responsibility Act (Montana‘s version of CERCLA) MCA 75-10-401 et seq., the ―Montana Hazardous Waste Act – while crude oil is not specifically listed in the definition of hazardous waste‘ the definition may be broad enough to apply to a crude oil spill MCA 75-5-101 et seq., Montana‘s water quality statutes – applicable to both surface water and groundwater MCA 75-20-101 et seq., the ―Montana Major Facility Siting Act – applicable to ―facilities, including pipelines, that fall under the Major Facilities Siting Act (MFSA). Keystone XL falls under MFSA. The regulations that relate to the statutes and may apply are: Administrative Rules Montana (ARM) 17.55.101 et seq. dealing with Comprehensive Environmental Clean-up and Responsibility Act ARM 17.53.101 et seq. dealing with hazardous waste ARM 17.30.101 et seq. dealing with water quality ARM 17.20.101 et seq. dealing with MFSA There are also various common law grounds under Montana law for asserting liability for pipeline spills, and Montana also has clean and healthful environment constitutional provisions that could be used to assert liability.
South Dakota	First, South Dakota Public Utilities Commission permit HP09-001 authorizing the project in the state, issued in final form June 29, 2010, provides at Condition 48: No person will be held responsible for a pipeline leak that occurs as a result of his/her normal farming practices over the top of or near the pipeline. The permit provides further at Condition 49: Keystone shall pay commercially reasonable costs and indemnify and hold the landowner harmless for any loss, damage, claim or action resulting from Keystone‘s use of the easement, including any resulting from any release of regulated substances . . . except to the extent such loss, damage claim or action results from the gross negligence or willful misconduct of the landowner or its agents. Second, statutes contained in South Dakota Codified Law (SDCL) Chapter § 34A-12, which create the regulated substance response fund, provide for corrective action in case of a spill or leak from a tank. The definition of tank includes pipeline facilities

Statute/Regulation	Description
	which transport and store regulated substances. SDCL § 34A-12-1(12). A regulated substance is defined to include crude oil. SDCL § 34A-12-1(8). Under the chapter, the Department of Environment and Natural Resources is directed to take corrective action to clean up any unauthorized discharge of a regulated substance, but only after first ordering the responsible person to take corrective action. A responsible person is as a person who has caused a discharge of a regulated substance, or a person who is an owner or operator of a tank at any time during or after a discharge. SDCL § 34A-12-1(10). If the responsible person fails to act, then the department may seek injunctive relief to compel corrective action. SDCL § 34A-12-10. If a responsible person cannot be identified or refuses to undertake corrective action, or if emergency action is needed to prevent an imminent threat to public health or safety, then the department may undertake correction action with funds from the response fund. SDCL § 34A-12-4(2), (3). The department may recover corrective action costs from either the responsible person, SDCL § 34A-12-6, or from any person who has caused a discharge of a regulated substance. SDCL § 34A-12-12. That statute also provides that the person causing a discharge is strictly liable for the corrective action costs expended by the department. Third, SDCL Chapter § 34A-2 addresses the discharge of petroleum substances into state waters. SDCL § 34A-2-96 imposes liability on the owner or operator of a facility that stores or transports petroleum substances for the costs of containment and recovery of discharges into the waters of the state. SDCL § 34A-2-96. This section also provides that ―any person causing the discharge shall be strictly liable to the owner or operator for all costs and proximate damages resulting from the discharge. A violation of an order issued pursuant to the statute is a class 1 misdemeanor. SDCL §§ 34A-2-96, 34A-2-75. Finally, landowners who experience a discharge have civil court remedies for damage to their property, including loss of use and loss of future productivity. Clean-up costs incurred by the landowner are a recoverable element of damage.
Nebraska	The Nebraska Environmental Protection Act, Nebraska RRS § 81-1501, et seq. (Act) and the Nebraska Administrative Code Title 126, Chapter 18, provide for liability in the event a pipeline spills oil or a hazardous substance in or on land or waters of the State. Waters of the State include both surface waters and groundwater. In the event of a release, the person responsible for the release has various responsibilities. Responsible person means any person producing, handling, storing, transporting, refining, disposing of an oil or hazardous substance when a release occurs, either by accident or otherwise. This includes carriers or any other person in control of an oil or hazardous substance when a release occurs, whether they own the oil or hazardous substances or are operating under a lease, contract, or other agreement with the legal owner thereof. Nebraska Administrative Code Title 126, Chapter 18-038. The responsible person must: (1) notify the Nebraska Department of Environmental Quality (NDEQ) if the release exceeds threshold quantities, or, regardless of quantity, if the release occurs beneath the surface of the land or impacts or threatens waters of the State or threatens the public health and welfare, (2) must take all necessary steps to stop the release and contain all released material, and take action to preclude continued or future releases, (3) investigate the release, to determine its impact, and the investigation must be reported to NDEQ, (4) take remedial action, which remedial action is subject to the review and approval of NDEQ, (5) properly dispose of any waste generated from the clean-up. Compliance with these requirements does not relieve the responsible person from liabilities, damages, or penalties resulting from the release, clean-up and disposal. The Act also has civil and criminal penalties that may be assessed in the event of a release. The Act further provides for reimbursement to the State for any loss of fish or wildlife as a result of a release.

Additionally, under the Clean Water Act, Keystone would be liable for up to $50,000,000 for United States removal costs for harmful quantities of oil discharged from a Keystone-owned or operated facility unless the discharge was caused solely by an act of God, an act of war, negligence by the United States, or the act or omission of a third party. Liability for the full cost of oil removal applies if the discharge resulted from Keystone‘s willful negligence or willful misconduct.

Keystone would also be liable for damages to natural resources, to real or personal property for the loss of subsistence use of natural resources, for the net loss of taxes, royalties, rents, fees or net profit shares from injuries to real or personal property or natural resources, for loss of profits or impairment of earning capacity by any claimant, or for net cost of providing increased or additional public services. There are no limits to these liabilities. Keystone would also be subject to penalty provisions of the Rivers and Harbors Act and the Pipeline Safety Act. In addition to the provisions described above, in the event that a release of crude oil contaminates groundwater, Keystone has agreed that it would be responsible for clean-up and restoration, and for providing an appropriate alternative water supply for groundwater that was used as a source of potable water, or for irrigation or industrial purposes.

However, if a release is caused by negligent or willful acts of others, Keystone may ultimately recover costs from those committing the acts since individuals are not automatically protected from liability associated with negligent acts or willful misconduct leading to property destruction and environmental damage. Specific liability warrants and indemnifications are included within individual easement agreements. The Department has no regulatory authority to intervene in the negotiation of those agreements. In addition, consideration of liability is beyond the scope of National Environmental Policy Act environmental reviews and is therefore not addressed in this Supplemental EIS.

Recommendations

In addition to the mitigation measures that Keystone would implement as discussed above, the following additional mitigation measures are recommended and/or could potentially be required based on input received from regulatory agencies and local experts.

- Spill response should include coordination with statutory authorities of other agencies with responsibility for conducting response to and/or response oversight for an oil discharge. The development of an emergency response plan could be incomplete without this coordination and potentially limit its effectiveness and efficiency of implementation. It is likely that interaction, coordination and communication with governmental regulators and/or response authorities (i.e., USEPA, USDOT, and United States Coast Guard (USCG)) for a potentially integrated response would be necessary. For example, under the Federal Emergency Management Agency’s (FEMA) Incident Command System (ICS), a response to a spill of sufficient scope/magnitude would most likely involve unified command.
- The emergency response plan and oil spill response plan should address a submerged oil as well as floating oil in a surface water release scenario. The USDOT Pipeline Response Plan should be reviewed in coordination with USEPA and include contingency plans to address a submerged oil response and cold weather response. Section 4.13.5.2, Spill Response, focuses on a traditional oil spill response and not a strategy to address submerged oil or cold weather.

- Pre-positioned response assets should include equipment that could address submerged oil. Response strategies, such as pre-positioning of equipment to address submerged oil should be considered and may be fine-tuned with USEPA consultation.
- Spill drills and exercises should include strategies and equipment deployment to address floating and submerged oil.

4.13.6 Connected Actions

4.13.6.1 Bakken Marketlink Project

A spill from the Bakken Marketlink Project would potentially impact similar receptors as the proposed Project. Groundwater, surface water, and soil impact would be the key affected media with consequence on resident receptors (e.g., birds, fish, and snails) dependent upon spill size.

Spills from the pipeline could result in surface spreading or infiltration to groundwater. Surface spreading could potentially reach nearby creeks. Groundwater of the Upper Cretaceous Hells Creek/Fox Hills Aquifer shallower than 50 feet potentially could be affected by a small spill volume (less than 50 bbl). Spills at water crossings could affect larger downstream surface waterbodies. These spill migration pathways are the same as those of the proposed Project.

Leaks or spills from storage tanks would be contained within regulatory required berm or containment system. Therefore, overland spreading would be restricted. The threat of infiltration to groundwater and soil impact would still remain.

High quality groundwater is not present in the area, and therefore, drinking water users are limited.

4.13.6.2 Big Bend to Witten 230-kV Transmission Line

A spill along the Big Bend to Witten 230-kilovolt (kV) Transmission Line would be related to construction and maintenance activities. If a spill occurred, groundwater might be affected; however, because construction and maintenance activities are managing hundreds of gallons of fuel or less related to vehicles, temporary localized refueling tanks, fuel powered equipment, etc., the impact from a release by one of these sources would be much less than from proposed pipeline construction and operation activities. In addition, spill response would generally be immediate because of the presence of staff during these activities.

4.13.6.3 Electrical Distribution Lines and Substations

Potential spill impacts for electrical distribution lines and substations would be similar to those associated with construction and maintenance activities as described above for the Big Bend to Witten 230-kV Transmission Line.

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4.14 CLIMATE CHANGE IMPACTS ON THE PROPOSED PROJECT

The Supplemental Environmental Impact Statement (Supplemental EIS) evaluates the relationship between climate change and the proposed Project in several ways. First, the potential contributions of the proposed Project to greenhouse gas emissions are addressed in the air quality analysis found in Section 3.12 and Section 4.12. Second, the potential impact of climate change effects (such as temperature and precipitation changes in the proposed Project area) on the construction and operation of the proposed Project itself is described in this section. Finally, Section 4.15, Cumulative Effects Assessment, presents information and analysis regarding indirect cumulative impacts and life-cycle greenhouse gas emissions including the potential impact of further development of the oil sands on climate change.

This section has been structured to present both the setting and context of climate change, and then an analysis of the potential impacts on the construction and operation of the proposed Project. There is no corresponding section in Chapter 3, Affected Environment.

The setting is discussed first, followed by an analysis of the potential impacts of climate change on the construction and operation of the proposed Project.

4.14.1 Setting and Context

4.14.1.1 Historical Climate Trends

Changes to the global climate have been observed over the past century. Between 1895 and 2009, the annual average global temperature has increased, and the states in which the proposed Project would be constructed and operated are, on average, warmer than they have been in the past. The northern states (i.e., Montana and North Dakota) have experienced relatively greater warming compared to southern states (U.S. Bureau of Reclamation [USBR] 2011a). In addition, more of that warming has been observed in the winter. In North Dakota, the average temperature in the winter increased by 5 degrees Fahrenheit (˚F) between 1895 and 2009, while in Nebraska there was only a 1.8°F increase over the same period. The historical changes in temperature are presented for each of the proposed Project states in Table 4.14-1. These historical climate trends are expected to continue and to intensify according to greenhouse gas emissions levels (both man-made and natural) and the associated climate change projections (Intergovernmental Panel on Climate Change [IPCC] 2007 and 2012).

Table 4.14-1 Historical Changes in Temperature by State (1895-2009)

State	Annual Average Increase (°F)	Summer Average Increase (°F)	Winter Average Increase (°F)
Montana[a]	1.6	1.0	1.7
North Dakota[b]	2.9	1.8	5.0
South Dakota[b]	2.2	1.6	3.9
Nebraska[b]	1.2	0.7	1.8
Kansas[b]	1.1	0.6	2.0

[a] Source: Breckner 2012.
[b] Source: High Plains Regional Climate Center (HPRCC) 2012.

4.14.1.2 Projected Climate Change Effects

Climate changes can produce a range of effects, such as direct effects that include increases/decreases in temperature and precipitation on a seasonal basis, as well as indirect effects including increases in freeze-thaw cycles along with increased occurrences of flooding/drought and wind erosion of soil. It can also lead to broader effects such as changes to the natural environment (e.g., vegetation changes).

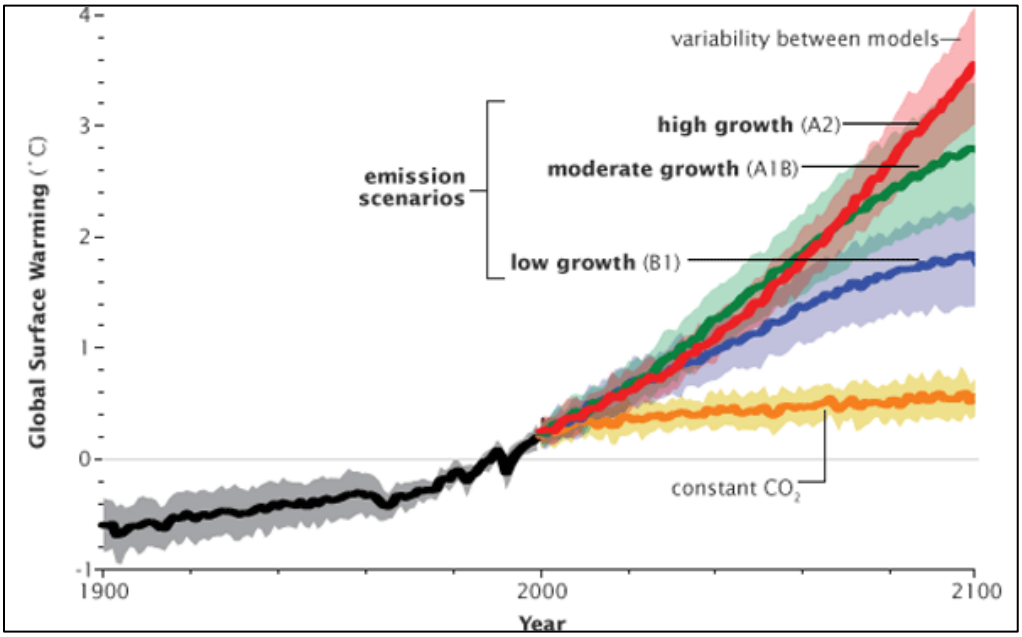
As part of preparation of this Supplemental EIS, an analysis was performed to evaluate the potential impacts of climate change on the proposed Project construction and operations. The analysis identified available, credible information on the projected climate change effects and the time horizons of these changes, to identify potential impacts. The climate projections examined as part of this analysis were "downscaled" from general circulation models for North America. Downscaling disaggregates and refines climate modeling results from a global to a regional scale of relevant interest, or to a finer scale. Since this analysis relied on the downscaled model results reported by existing studies, less information was available on the possible extreme conditions and, by extension, the "worst-case" scenarios. There is, however, general consensus among the downscaled general circulation models[1] about future climate change effects.

A number of sources were reviewed and cited as part of this analysis. The recent IPCC report (IPCC 2012) reviews existing studies, multiple global climate models, and multiple regional climate models and generates non-numerical confidence levels for heat waves and extreme weather events for North America. The High Resolution Interpolation of Climate Scenarios for the Conterminous United States and Alaska Derived from General Circulation Model Simulations study (Joyce et al. 2011) downscaled four global climate models and averaged the model results for eight climate regions in the United States. Of the sources reviewed, it was determined that this study provides the most complete set of data available for application to the proposed Project across all the climate regions. However, due to the averaging of all the models, it likely underestimates the possible climate extremes. Where possible, other studies such as those from the United States Global Change Research Program (USGCRP 2009) and the USBR (2011a and 2011b) were referenced to obtain further detail on the possible extremes. Cumulatively, these studies covered the proposed Project areas with respect to projected climate effects.

Climate change projections have been included for a range of future carbon emissions scenarios. The IPCC developed several future scenarios for greenhouse gas emissions; these were dependent on population and economic growth, as well as technology for fuel use and fuel production (IPCC 2007). These scenarios are used to project the degree and severity of climate change effects.

[1] The term 'downscaled general circulation models' is generally applied to models and studies where future climate predictions are downscaled from the global to regional level.

The emissions scenarios examined for this Supplemental EIS included a high (A2) scenario, a medium (A1B) scenario, and a low (B1) scenario.[2] These emissions scenarios are presented in Figure 4.14.1-1.



Source: IPCC 2007.

Figure 4.14.1-1 Emissions Scenarios

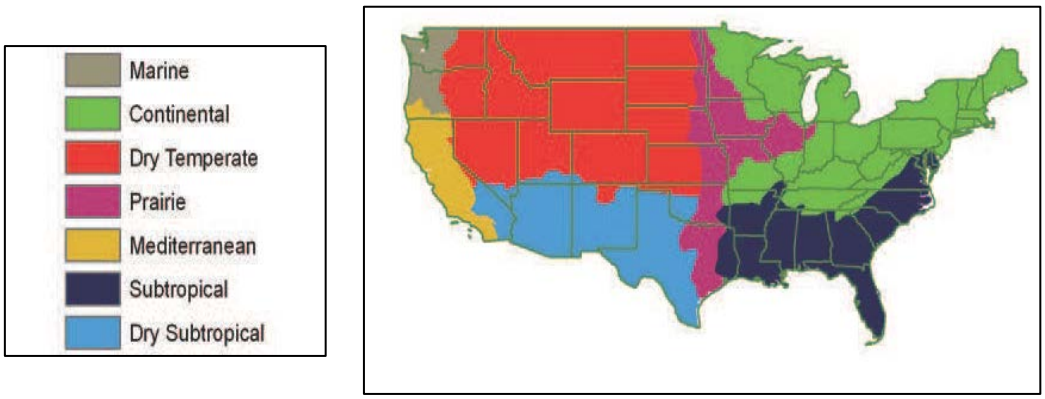
It should be noted that the global climate model results reviewed used a baseline level for carbon dioxide (CO_2) of 350 parts per million (ppm), the level cited in the Kyoto Protocol for Greenhouse Gas Emissions. The actual annual average ambient levels of baseline CO_2 in the atmosphere in 2010 and 2011 (as recorded at the Mauna Loa Observatory, Hawaii) were 390 ppm and 392 ppm, respectively; accordingly, the projected future climate change effects described herein may be greater than those predicted in the IPCC modeling results. Calendar year 1997 was the last year the annual average CO_2 level was less than 350 ppm (Tans 2012), the level cited in the Kyoto Protocol for Greenhouse Gas Emissions. Acknowledging that actual CO_2 levels are currently higher than what was projected in the IPCC models, this analysis has taken a precautionary approach by using the worst-case projections (A2 scenario) to ensure potential

[2] The three selected scenarios are described in the 2007 IPCC report as follows: The A2 scenario is a heterogeneous world with rapid population growth and slow economic development and technological innovation rates. The A1B scenario assumes rapid economic growth and a world population that peaks around 2050. Technological innovation and adoption of energy-efficient technologies is balanced and does not rely on any one energy source. The B1 scenario assumes very rapid economic growth, a world population that peaks around 2050, and a very fast innovation and adoption of energy-efficient technologies. The economy makes rapid changes toward services and information.

impacts and outcomes are not underestimated. The climate change effects examined as part of this study can be broadly grouped into two categories: temperature and precipitation.

The proposed pipeline route crosses through Montana, South Dakota, and Nebraska, with ancillary facilities in North Dakota and Kansas. These areas correspond to the Dry Temperate and Prairie climate regions referenced in Joyce et al. 2011. These region designations are specific to this section on climate change impacts, and do not correspond with region designations discussed in other sections of the Supplemental EIS. The proposed pipeline route is primarily in the Dry Temperate climate region and crosses into the Prairie climate region toward the southern end of the route.

In general, A2 scenario modeling results for each of these two climate regions show the same overall trends in temperature and precipitation, with some variation in the magnitude of the change. Therefore, for each category of climate effect, general changes for the United States are summarized below prior to a review of the projections for each climate region. A map further detailing the locations of the climate regions relative to the states is presented in Figure 4.14.1-2.



Source: Joyce et al. 2011.

Figure 4.14.1-2 Climate Regions of the United States

The climate projection data for the two climate regions (from Joyce et al. 2011) are presented in Appendix T, Literature Review. Further summaries and analysis of these data are presented by climate effect category in the following sections. Given that the proposed Project has a nominal operating life of 50 years, from 2015 to 2065, the most relevant of the data are in the 2010–2039 and 2040–2069 timeframes. However, projected data from 2070-2099 are also included because historically pipelines have been known to remain in service longer than 50 years.

Temperature

By 2040–2069, the national average annual temperature is predicted to increase above the baseline of 1980 to 2009[3] by between 2.8°F and 6.6°F, depending on the model and the emissions scenario evaluated (USGCRP 2009). These changes would modify the seasonal patterns such that spring arrives earlier and summer lasts longer and is generally hotter, both in terms of its average and peak temperatures. Winters have already experienced and are expected to continue to experience the greatest degree of change from historical norms and these changes would result in the winter season becoming shorter and warmer than in the recent past (USGCRP 2009).

For western and central North America, multiple general circulation models predict, with high confidence in the opinion of IPCC, that heat waves and warm spells will likely be more frequent, more intense, and longer in duration (IPCC 2012). Increased temperature over a shortened time span would be expected to have a number of implications included increase in the likelihood of soil contraction, a shorter cool season, a shorter duration of frost periods, and more freeze-thaw cycles. The predicted average incremental temperature increases in the two climate regions for the three scenarios referenced above are presented in Table 4.14-2. Predicted temperatures for the two regions are discussed below.

Table 4.14-2 Projected Changes in Average Mean Daily Maximum Temperatures (2010-2099)

		Climate Regions					
Temperature Changes		**Dry Temperate**			**Prairie**		
		High Emissions A2	**Medium Emissions A1B**	**Low Emissions B1**	**High Emissions A2**	**Medium Emissions A1B**	**Low Emissions B1**
Annual Mean Daily Max Temp Δ[a] from 1980-2009 (°F)	Baseline	59.2	59.2	59.1	65.8	66.0	66.0
	2010-2039	1.8	2.4	2.0	2.1	2.4	1.8
	2040-2069	4.6	4.6	3.3	4.6	4.6	3.1
	2070-2099	7.7	6.4	4.4	7.8	6.4	4.1
Winter Mean Daily Max Temp Δ from 1980-2009 (°F)	Baseline	36.3	36.3	36.2	41.2	41.1	41.1
	2010-2039	1.3	1.8	1.3	1.5	2.1	1.2
	2040-2069	3.8	3.9	3.0	4.0	4.4	3.1
	2070-2099	6.3	5.4	4.1	6.9	6.3	4.2
Summer Mean Daily Max Temp Δ from 1980-2009 (°F)	Baseline	82.4	82.4	82.5	87.7	88.2	88.3
	2010-2039	2.6	3.0	2.3	2.7	2.7	2.1
	2040-2069	5.5	5.5	3.5	5.2	4.7	2.7
	2070-2099	8.8	7.4	4.5	8.6	6.5	3.9

Source: Joyce et al. 2011.

[a] **Δ** = change.

[3] A lengthy period of climate data is used as a baseline because for long term climate modeling, a single baseline year is typically not used. A time period of historical data is used for long term climate modeling, since these will show the historical trend line as a starting point.

Dry Temperate Climate Region

Under the A2 scenario, by 2040–2069, the annual maximum mean daily summer temperature is projected to increase by as much as 5.5°F in the Dry Temperate climate region (Joyce et al. 2011). This would result in a new daily mean summer maximum temperature of 88°F. This would also mean that the temperature extremes for the region would be expected to be greater than historical extremes. The Dry Temperate climate region is expected to have more frequent, longer, and more extreme (intense) events including days with extreme cold and frosts (HPRCC 2012).

Prairie Climate Region

For the Prairie climate region, the A2 scenario predicts an annual maximum mean daily summer temperature increase of as much as 5.2°F for the region by 2040–2069. The inter-annual temperature variability[4] is projected to increase by 15 to 40 percent under the A2 scenario (Joyce et al. 2011) suggesting that although temperature is expected to rise, it could vary widely between seasons.

Precipitation

Annual precipitation is expected to increase across most of the climate regions from the 1980-2009 baseline depending on the emissions scenario. More of the precipitation is predicted to be associated with severe storm events (USGCRP 2009), which are projected to increase in frequency over future time periods. The model projections also indicate a greater inter-annual variability, suggesting that there might be more variability between seasons, for example, periods of drought interspersed by heavy precipitation events.

Increased rainfall in a shortened time span increases the likelihood of flooding, soil submersion, heavy snow, runoff, sinkholes, riverbed scour, washouts, landslides, and (in mountain regions) avalanches (USGCRP 2009). The predicted precipitation changes in the two climate regions for the three scenarios referenced above are presented in Table 4.14-3. Predicted precipitation for the two regions is discussed below.

Table 4.14-3 Projected Changes in Precipitation by Climate Region (2010-2099)

		Climate Regions					
Precipitation		**Dry Temperate**			**Prairie**		
		High Emissions A2	**Medium Emissions A1B**	**Low Emissions B1**	**High Emissions A2**	**Medium Emissions A1B**	**Low Emissions B1**
Annual Precipitation Δ in inches from 1980-2009	Baseline	16.7	16.7	16.7	35.1	34.7	34.7
	2010-2039	0.5	0.2	0.3	0.2	0.2	0.0
	2040-2069	0.5	0.9	1.0	0.6	0.8	1.8
	2070-2099	0.9	0.9	0.9	0.6	1.7	1.3

Source: Joyce et al. 2011.

[4]Inter-annual temperature variability is the relative change in temperature that occurs between years.

Dry Temperate Climate Region

Precipitation increases are expected between 2010 and 2099. Under the A2 scenario, the increase in average annual precipitation for the Dry Temperate climate region by 2040–2069 is projected to be 0.5 inch. For parts of the Dry Temperate climate region in the Missouri River Basin, by 2050, the projected increases in temperature will offset increases in precipitation, in that evapotranspiration is predicted to result in a net loss in the water balance. The net loss in the water balance would be further compounded by less snowpack accumulation and more precipitation falling as rain earlier in the season. Though there is less certainty around this prediction, this phenomenon could result in more acute runoff events. An increase in the intensity of precipitation events is also predicted with each successive decade (USBR 2011b).

Prairie Climate Region

Precipitation increases are also expected between 2010 and 2099. Under the A2 emissions scenario, the increase in average annual precipitation for the Dry Temperate climate region by 2040–2069 is projected to be 0.6 inch. The studies examined did not include an evaluation of the net impact upon the water balance in this portion of the Missouri River Basin.

4.14.2 Impacts on the Proposed Project

This section discusses the potential for impacts to construction and operation of the proposed Project from the expected future climate changes described above.

The climate modeling results described above show that there are relatively small differences between projected temperature changes across the two climate regions. For precipitation, the relative differences are greater, mainly due to the differences in the baseline precipitation rates for the two climate regions.

The sections below present the potential impacts of climate change on construction and operation of the proposed Project.

4.14.2.1 Construction

The construction of the proposed pipeline is planned to occur in 2015; if construction occurs on that schedule, climate conditions during the 1- to 2-year construction period would not be expected to differ much from current conditions, even under worst-case modeling scenarios. TransCanada Keystone Pipeline, LP (Keystone) has confirmed that the measures identified in the Construction, Mitigation, and Reclamation Plan (Appendix G) are sufficient to deal with any potential predicted effects as described above (Keystone 2012).

4.14.2.2 Operation

From a temperature perspective, projections suggest warmer winter temperatures, a shorter cool season, a shorter duration of the time period that frost occurs and more freeze-thaw cycles per year, which could lead to an increased number of episodes of soil contraction and expansion. In summer, warmer summer temperatures, increased number of hot days, increased number of consecutive hot days and longer summers are predicted, which could lead to impacts associated with heat stress and wildfire risks. Keystone has confirmed that the proposed Project is designed in accordance with U.S. Department of Transportation (USDOT) regulations and the PHMSA 57 Special Conditions (Appendix B), and that these design standards are sufficient to accommodate

an increased number of hot days or consecutive hot days. Keystone has also stated that because the proposed pipeline would be buried to at least 4 feet of cover to the top of the pipe, it would be below most surface temperature impacts, including wild fires and frequent freezing and thawing (Keystone 2012).

With respect to precipitation, the potential for increased winter and spring precipitation with increase in frequency of heavy precipitation events, could result in increased runoff and stream flow; increased potential for flooding, erosion, washouts, and hydraulic scour in streambeds, as well as increased periods of soil saturation and increased risk of subsidence. The potential for increased severity, frequency, and duration of droughts, could lead to an increase in episodes of soil contraction and movement. Keystone has confirmed that the design of the proposed Project in accordance with USDOT regulations and the 57 Special Conditions (Appendix B) is sufficient to accommodate the effects of increased precipitation and increased drought. In addition, Keystone has confirmed that the design of pipeline crossings of all waterbodies is required (through these design standards in conjunction with the state permit conditions) to accommodate lateral stream migration and scour. In addition, areas where subsidence is known to be present will be designed accordingly (Keystone 2012).

4.14.3 References

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4.15 CUMULATIVE EFFECTS ASSESSMENT

A cumulative effects assessment (CEA) considers the residual impacts of the proposed Project in combination with the residual impacts from the connected actions and actions from other "past, present, and reasonably foreseeable future" projects, as outlined in the Council on Environmental Quality (CEQ) guidance on Considering Cumulative Effects under the National Environmental Policy Act (NEPA). Cumulative effects, by definition, are residual in nature because they occur, or continue to occur, long after the construction of a project is completed. In the Final Environmental Impact Statement (Final EIS) the CEA focused on existing, under construction, and planned linear energy transportation systems, including natural gas pipelines, crude oil pipelines, and electric transmission lines, water delivery projects, and a number of energy development projects.

The CEA presented in this Supplemental Environmental Impact Statement (Supplemental EIS) seeks to focus the list of projects from the Final EIS as they pertain to the proposed Project, and broaden the scope of past, present, and reasonably foreseeable future projects under consideration to include non-linear projects and other development activities with the potential to contribute to overall cumulative effects within the Project area. In addition, the Final EIS focused on projects that geographically intersected with the proposed Project; the Supplemental EIS CEA broadens the geographic boundary of the projects and activities considered to have the potential to contribute to cumulative effects. This broader perspective is provided to supplement the analysis provided in the Final EIS to support decision-making. Within this context, although geographically widely separated, this CEA also considers the potential for impacts associated with the proposed Project in combination with the TransCanada Gulf Coast Pipeline, which began construction in August 2012. This was done in response to public comment received on the scope of work for this Supplemental EIS, which indicated a concern that impacts from both projects (proposed Project plus the Gulf Coast Pipeline) would be additive, because when completed, they would be part of one larger system of crude oil transportation pipelines. Keystone has indicated that it considers the Gulf Coast Pipeline to have independent utility, and construction is underway. Therefore, impacts associated with the Gulf Coast Pipeline were not evaluated beyond this CEA.

As a matter of Department policy, extraterritorial considerations related to the Canadian portion of the TransCanada Keystone Pipeline, LP (Keystone) proposed Project are evaluated in Section 4.15.4, Extraterritorial Concerns, to the extent that the proposed Project would contribute to cumulative environmental impacts within Canada.

Accidental or emergency events may arise due to an unforeseen chain of events during the proposed Project's operational life. For an assessment of the potential short- and long-term effects of oil releases to the environment, see Section 4.13, Potential Releases, for a discussion of potential cumulative effects of oil releases to the environment, see Section 4.15.3.13, Potential Releases.

Potential long term or permanent beneficial impacts of proposed pipeline construction could occur in the form of increased tax revenues, the focus of this CEA is on potential adverse effects that may result from the proposed project on resources, ecosystems, and human communities. In addition, ancillary facilities in North Dakota and Kansas are not included in this CEA since the activities in these states would occur on previously developed/disturbed lands and/or are

geographically small areas. Therefore, these facilities would have negligible contributions to overall cumulative effects.

4.15.1 Methods and Scope of the Cumulative Impacts Analysis

In general, the analysis of cumulative impacts in this CEA follows the processes recommended by CEQ (1997 and 2005) and the regulations at Title 40 of the CFR Part 1508.7. The scope of the CEA is governed by the geographic and temporal boundaries that correlate to the resources impacted by the proposed Project, and how the proposed Project intersects with connected actions and other projects across these resources. In general, the geographic limits of the area evaluated in the CEA can be organized into three categories:

- Project Area—Defined as the area of physical disturbance associated with the proposed Project limits; that is, in and along the pipeline right-of-way (ROW) construction corridor and its ancillary facilities, e.g., access roads, pump stations, and construction camps.
- Local Area[1]—Defined as a 2-mile distance on either side of the proposed pipeline ROW corridor, and its ancillary facilities.
- Regional—Defined by the potentially impacted resource, e.g., home range of a wildlife species, bird migration corridor, or a regional airshed.

Activities within what is termed the Project Cumulative Impact Corridor (PCIC) indicate geographic proximity to the proposed Project (e.g., project area or local area as noted above). The temporal boundaries for this analysis reflect the nature and timing of the proposed Project activities as they relate to knowledge of past and present projects, and the availability of information on future projects that have a high probability of proceeding. For any given project, the duration of potential impacts is typically categorized as temporary, short-term, long-term, or permanent. Temporary impacts would likely occur during construction, with the resources returning to pre-construction conditions almost immediately afterward. Short-term impacts are defined as those that would continue for approximately 3 years following construction. Long-term impacts are those where the resource would require longer than 3 years to recover. Permanent impacts occur as a result of activities that modify resources to the extent that they would not return to pre-construction conditions during the design life of the proposed Project (50 years), such as with construction of aboveground structures.

When considering the broad scope of evaluating the combined effects of past, present, and reasonably foreseeable future projects, it is the long-term and permanent impacts of individual projects that would have the greatest potential to combine with one another to create significant cumulative impacts. Therefore, the primary focus of this CEA is to gain an understanding of the potential combined long-term or permanent impacts to resources, ecosystems, and human communities from the proposed Project, connected actions, and other past, present, and reasonably foreseeable future projects (federal, non-federal, and private actions). Temporary and/or short-term impacts, which could occur concurrently (geographically and temporally) between the proposed Project, connected actions, and other projects to produce short term cumulative impacts, are considered qualitatively.

[1] Correlates to the socioeconomic analysis area as defined in Section 3.10, Socioeconomics.

Key factors in controlling the temporal scale of cumulative effects are several measures designed to mitigate, offset, and/or restore impacted resources to pre-construction conditions. Keystone's Construction, Mitigation, and Reclamation Plan (CMRP) (see Appendix G), additional mitigations, individual federal and state agency permitting conditions, and/or existing laws and regulations all function to control potential impacts and reduce long-term and permanent effects. Therefore, this CEA incorporates the implementation of these measures in the evaluation of anticipated resource impacts, specifically as they affect the duration of impacts and their potential to contribute significantly to cumulative effects. The attribution of significance requires the assessment and integration of a number of lines of evidence:

- The effectiveness of mitigation measures or other embedded controls;
- The geographic context of where the activities are taking place (e.g., pristine land versus previously disturbed areas); and
- The degree to which residual impacts on a local scale are additive with similar impacts from other projects and activities, and their magnitude (i.e., relative contribution).

This analysis is enhanced through the use of geographic information system mapping, which is presented where applicable.

The remaining sections of this CEA are organized as follows:

- Section 4.15.2, Past, Present, and Reasonably Foreseeable Projects: This section evaluates reasonably identifiable federal, state, local, and private projects and/or development activities based on publically available information with possible effects that could be temporally and/or geographically coincident with those of the proposed Project on resources, ecosystems, and human communities. The discussion in this section is organized by the project/activity timeframe: past, present or future, with an accompanying table listing the identified project/activity. Connected actions to the proposed Project are presented separately following the other future project/activity descriptions.
- Section 4.15.3, Cumulative Impacts by Resource: This section discusses the potential cumulative impacts of the proposed Project and other actions by resource area, along with any pertinent mitigation actions, and how these anticipated cumulative impacts interact with the other past, present, and reasonably foreseeable future projects/activities described in Section 4.15.2.
- Section 4.15.4, Extraterritorial Concerns: This section discusses the potential extent to which the proposed Project would contribute to cumulative environmental impacts within Canada.

4.15.2 Past, Present, and Reasonably Foreseeable Projects

The proposed Project would occur in locations that include numerous existing, under construction, and planned major capital public and private projects, including oil and gas well fields, major product pipelines, water distribution lines, energy development projects (including wind farms) and associated electric transmission lines, and mining projects. The identification of the projects and/or activities to be included in the cumulative impact analysis was accomplished through independent research, beginning with review of the Pipeline and Hazardous Materials Safety Administration (PHMSA) National Pipeline Mapping System (U.S. Department of Transportation 2012). This was followed by queries of the Montana, South Dakota, and Nebraska state government websites, and private company websites providing publically

available data and details on projects and activities within the geographic boundaries of interest. Please see Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions, for a more detailed description of the projects identified, as well as a complete list of the data sources accessed for this CEA.

As previously mentioned, the discussion in this section is organized by the project/activity timeframe: past, present, or future, with an accompanying table listing the identified project/activity. Connected actions to the proposed Project are presented separately following the other future project/activity descriptions.

4.15.2.1 Cumulative Impacts from Past Projects

Past projects and activities considered in the CEA are those that have been completed and their physical features are part of the current/existing landscape. Residual (i.e., permanent) effects from these projects/activities are considered to be potentially cumulative with the effects of the proposed Project. These projects are further described in Table 4.15-1 below. Unless otherwise noted, it is assumed the impacts of these projects are reflected in existing environmental conditions as described in Chapter 3, Affected Environment.

Table 4.15-1 Representative Past Projects Considered in the Cumulative Effects Assessment

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Crude Oil Pipelines and Storage Facilities			
Express-Platte Pipeline System	Two pipelines: the Express has been in operation since 1997, the Platte since 1952. Approximately 1,700 miles total of crude oil pipelines that are 20 (Platte) and 24 (Express) inches in diameter.	Southeastern Alberta; central Montana; northeastern Wyoming; south-central Nebraska; northeastern Kansas; north-central Missouri.	The Express-Platte system would be within the PCIC for the proposed Project near Steele City, Nebraska.
Keystone Mainline Oil Pipeline	Approximately 1,379-mile-long crude oil pipeline has a design capacity between 435,000 barrels per day (bpd) to 591,000 bpd.	Southeastern Alberta; southern Saskatchewan; southwestern Manitoba; eastern North Dakota; eastern South Dakota; eastern Nebraska; northeastern Kansas; central Missouri; central Illinois.	The Keystone Mainline Oil Pipeline would be within the PCIC near Steele City, Jefferson County, Nebraska.
Keystone Cushing Extension	298-mile-long, 36-inch-diameter crude oil pipeline from Steele City, Nebraska, to Cushing, Oklahoma.	Southern Nebraska; central Kansas; central Oklahoma.	The northern portion of the Cushing Extension would be within the PCIC in Steele City, Jefferson County, Nebraska.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
True Company Pipelines and Crude Oil Storage Facility	A system of more than 3,400 miles of crude oil gathering and transportation pipelines, including Bridger Pipeline, LLC that owns and operates the Poplar, Little Missouri, Powder River, Butte, Belle Fourche, Four Bears, Parshall, and Bridger pipeline systems. Three collector pipelines to transport production from the north, west, and east into the Butte Pipeline near Baker are under construction.	Throughout Wyoming; eastern Montana; western and central North Dakota.	Portions of the pipeline systems owned and operated by True Companies would be within the PCIC in near Baker, Fallon County, Montana.
Refined/Finished Product Pipelines			
Cenex Pipeline	Eight-inch products pipeline running from Fargo, North Dakota, at Williams Pipeline Terminal to Laurel Station at the Cenex Refinery in Montana.	Western North Dakota and eastern Montana.	Within PCIC in southwestern Dawson County, Montana.
Magellan Pipeline	Total of 9,600 miles of refined product pipelines, including 50 terminals (four in Nebraska) and seven storage facilities.	The Magellan Pipeline system is located in the following states: North Dakota, Minnesota, South Dakota, Nebraska, Colorado, Iowa, Illinois, Missouri, Kansas, Oklahoma, Arkansas, and Texas.	Magellan Pipeline crosses the PCIC in southern York County, Nebraska.
NuStar Pipeline	Central East Region—East Refined Products Pipeline system transports refined petroleum products, including gasoline, diesel, and propane. The system includes 2,530 miles of pipelines that transport an average of 203,000 bpd and 21 distribution terminals (five in Nebraska, five in South Dakota) with a storage capacity of 4.8 million barrels.	Pipeline system runs north-south from central North Dakota to eastern South Dakota, western Iowa, eastern Nebraska, southern Nebraska, central Kansas.	NuStar Pipeline is within the PCIC in Fillmore and York counties, Nebraska.
Natural Gas Pipelines			
Williston Basin Interstate Pipeline Company System	A 3,364-mile-long natural gas pipeline transmission system.	Pipeline system runs through Montana, North Dakota, Wyoming, and South Dakota.	Portions of the Williston Basin System would be within the PCIC in Valley and Fallon counties, Montana and Harding County, South Dakota.
Northern Border Pipeline	A 1,249-mile-long interstate natural gas pipeline with a design capacity of approximately 2.4 billion cubic feet of gas per day (bcf/d).	Pipeline runs generally northwest to southeast through Montana, North Dakota, South Dakota, Minnesota, Iowa, Illinois, and Indiana.	Portions of the Northern Border Pipeline would be in the PCIC in Phillips and Valley counties, Montana, and would be near and parallel to the proposed Project for approximately 21.5 miles.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Northern Natural Gas	14,900 miles of pipeline, operational since 1930, 2- to 36-inch diameter. 2,357 receipt and delivery points.	Minnesota, Wisconsin, Michigan, Iowa, South Dakota, Nebraska, Kansas, Oklahoma, Texas, and New Mexico.	The Northern Natural Gas Pipeline system is within the PCIC in Jefferson and Saline counties, Nebraska.
Rockies Express West	A 713-mile-long 42-inch-diameter interstate natural gas transmission pipeline with a capacity of approximately 1.5 bcf/d. The project includes five compressor stations.	Colorado, Wyoming, southern Nebraska, northeastern Kansas, Missouri, Illinois, Indiana, and Ohio.	Rockies Express West is within the PCIC in a generally west-to-east direction in the vicinity of Steele City, Nebraska.
Bison Natural Gas Pipeline	A 302-mile-long, 30-inch-diameter pipeline with a capacity of 500 million cubic feet per day (MMcf/d). Pipeline system and related facilities that extend northeastward from the Dead Horse Region near Gillette, Wyoming, through southeastern Montana and southwestern North Dakota where the system connects with the Northern Border Pipeline system near Northern Border's Compressor Station No. 6 in Morton County, North Dakota. 407 MMcf/d capacity currently; with compression (approved but not yet built) capacity will be approx. 477 MMcf/d , with potential expandability to approx. 1 bcf/d.	Southwestern North Dakota, southeastern Montana, and northeastern Wyoming.	The Bison pipeline intersects the PCIC in southern Fallon County, Montana.
Kinder-Morgan Interstate Gas Transmis-sion (KMIGT)	Approximately 5,100 miles of transmission lines in Colorado, Kansas, Nebraska, Michigan, and Wyoming. The Huntsman natural gas storage facility, located in Cheyenne County, Nebraska, with approximately 10 billion cubic feet of firm capacity commitments is also part of the system.	Transmission system comprised of west zone (central Wyoming); central zone (southeastern Wyoming, southwestern Nebraska, and northeastern Colorado); east-north zone (southern and eastern Nebraska); and east-south zone (northwestern Kansas).	KMIGT within the PCIC in the following counties: northern Fillmore County, Nebraska; central York County, Nebraska; eastern Boone County, Nebraska; eastern Antelope County, Nebraska; and northern Holt County, Nebraska.
Trailblazer Pipeline	436 miles of 36-inch pipe. Certificated capacity of 522,000 decatherms per day (Dth/day). Expansion planned: Expand TB by 324,000 Dth/day to bring total capacity to 846,000 Dth/day.	Runs generally east-west from Cheyenne, Wyoming along the Wyoming/Colorado border through southern Nebraska.	Trailblazer Pipeline crosses the PCIC in southern Saline County, Nebraska.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Natural Gas Pipeline Co. of America—Amarillo Line	Total network: 10,000+ miles of pipelines, 265 billion cubic feet of working gas storage capacity. Amarillo Line (based on 2002 stats) produces 1.6 bcf/d.	Runs generally northeast to southwest from Chicago, Illinois through southern Iowa, across southeast Nebraska (at Steele City), central Kansas, western and southern Oklahoma, northwestern Texas, and southeastern New Mexico.	The line is within the PCIC at Steele City, Jefferson County, Nebraska.
Central City Gas System	Natural gas pipeline system owned and operated by the city of Central City, Nebraska. 2- to 6-inch-diameter transmission line.	Serves Central City, Nebraska.	Central City Gas Pipeline system is within the PCIC in southwestern Polk County, Nebraska.
SourceGas LLC	SourceGas - Nebraska transmission system consists of approximately 5,000 miles of transmission and distribution pipeline in 57 counties across Nebraska. The system has interconnections with or laterals off the KMIGT, Pony Express, and Trailblazer pipelines.	Serves the western 2/3 of Nebraska.	SourceGas pipelines within the PCIC in northwestern Holt County, Nebraska and southeastern Boone County, Nebraska.
Ammonia Pipelines			
NuStar Pipeline	2,000 miles total, ranging from 4- to 10-inch carrying anhydrous ammonia, with a terminal at Aurora, Nebraska.	Pipeline extends through Indiana, Illinois, Missouri, Arkansas, Louisiana, and Nebraska. Specific cities impacted in Nebraska: Blair, Fremont, and Aurora.	Anhydrous ammonia pipeline is within the PCIC in northwestern York County, Nebraska.
Water Delivery Systems			
Perkins County Rural Water System	Extension of Southwest Pipeline from Lake Sakakawea, North Dakota.	Map of pipeline or system area not readily available; however, project is in Perkins County, South Dakota.	Project route is through southwestern Perkins County, South Dakota. Water pipeline possibly within the PCIC depending on location.
Mni Wiconi Rural Water System[2]	4,400 miles of pipeline through southwest and south-central South Dakota. 12- to 24-inch PVC water pipeline, which provides water to Pine Ridge, Rosebud, and Lower Brule Indian Reservations, along with other communities. Federally funded project. Estimated delivery volume 8,591-12,474 acre feet per year. Water source is Missouri River. Portions are still under construction and are estimated to be completed by 2013.	Haakon, Stanley, Jones, Lyman, Mellette, Todd, Jackson, Bennett, and Shannon counties, South Dakota. Portions of Pennington and Tripp counties, South Dakota.	Mni Wiconi water pipeline possibly within the PCIC in Haakon, Jones, Lyman, and Tripp counties, South Dakota.

[2] Although some portions of the Mni Wiconi Rural Water System are expected to be completed in Fiscal Year 2013, the portions of the system that are crossed by the proposed Project have been completed.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Electrical Transmission Lines			
345-499-kilovolt (kV) Transmis-sion Lines	The U.S. electric grid consists of independently owned and operated power plants and transmission lines.	The transmission lines affect the entire United States.	Transmission lines would affect the PCIC in Boyd, Antelope, Boone, Holt, Nance, Merrick, Hamilton, York, Fillmore, and Jefferson counties in Nebraska. The PCIC would also be affected in Fallon and McCone counties in Montana. In South Dakota, the PCIC is affected in Perkins, Meade, Haakon, and Jones counties.
Railroads			
Union Pacific Railroad (UP)	The UP spans 31,900 miles and is the largest railroad network in the United States.	The UP operates in 23 states throughout the central and western United States.	Rail is within the PCIC in Jefferson and Merrick counties, Nebraska.
BNSF Railway (BNSF)	BNSF owns rail lines running through multiple areas of Montana, primarily east-west along the northern border; northwest to southeast across the central portion of the state; and southwest to northeast in the southeastern portion of the state. BNSF-owned lines also run generally northwest to southeast across Nebraska, with heavier rail line concentration around Lincoln.	The BNSF railway operates throughout the central and western United States.	The railway falls within the PCIC in Fillmore and York counties, Nebraska, and the following counties in Montana: Baker, Prairie, Dawson, and McCone.
Nebraska Central Railroad Company (NCRC)	The NCRC operates over 340 miles of track on three lines concentrated northwest of Lincoln.	The NCRC operates in northeastern and central Nebraska.	Rail is within the PCIC in Polk, Nance, and Boone counties, Nebraska.
Nebraska North-eastern Railway Company (NNRC)	The NNRC operates on approximately 120 miles of northeastern Nebraska. Runs generally east-west across northeastern Nebraska from the Missouri River to O'Neill, Nebraska.	The NNRC operates in northeastern Nebraska.	Rail is within the PCIC in Antelope County, Nebraska.
Canadian Pacific/ Dakota, Minnesota & Eastern	A 574-mile line that runs north-south along the western South Dakota border and east-west through central South Dakota.	Western and central South Dakota.	Rail is within the PCIC in Haakon County, South Dakota.
South Dakota Owned/ Dakota Southern Operated	A 190-mile line that runs generally east-west across south-central South Dakota.	South-central South Dakota.	Within the PCIC in Jones and Valley counties, South Dakota.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Wind Farms			
Diamond Willow Windfarm	Operated by Montana-Dakota Utilities. The first phase began commercial operation in 2008. Expanded in 2010, for a total capacity of 30 megawatts (MW), by 20 General Electric 1.5 MW turbines.	South of Baker, Montana in Fallon County.	Potentially within the PCIC in Fallon County (Baker), Montana.
Laredo Ridge	7,600 acre site. Approximately 3 miles northeast of Petersburg, Nebraska, in Boone County, Nebraska. 81 MW capacity.	North of Petersburg, Nebraska, in northern Boone County, Nebraska.	Possibly within the PCIC in Boone County, Nebraska.
Landfills			
City of Baker	Closed landfill, located approximately 2 miles southwest of the city of Baker, Montana.	Baker, Fallon County, Montana.	Closed landfill is within the PCIC near Baker, Fallon County, Montana.
Town of Nashua	Closed Class III Landfill located approximately 2 miles west of the town of Nashua, Montana.	Nashua, Valley County, Montana.	Closed landfill is within the PCIC near Nashua, Valley County, Montana.
City of O'Neill	Waste disposal area for construction and demolition debris, generally described as the SE 1/4 Nebraska 1/4 Section 29 Township 29 North Range 11 West of the 6th Principal Meridian, located in the City of O'Neill, Nebraska.	O'Neill, Holt County, Nebraska.	Landfill is potentially within the PCIC.
Power Plants			
Nebraska Public Power District Petroleum Plant	The Nebraska Public Power District operates a mobile petroleum plant within York, Nebraska. This plant provides a maximum of 3.1 MW of electricity generated from petroleum to the surrounding residential and industrial facilities.	York, Nebraska.	Within the PCIC in York, Nebraska.
Grazing Land			
Montana Grazing Lands	The state of Montana has extensive lands used by ranchers for the grazing of herds of animals.	Multiple	Grazing lands would fall within the PCIC in Valley, McCone, Dawson, Prairie, and Fallon counties.
South Dakota Grazing Lands	The use of lands for grazing herds of animals is widespread in the state of South Dakota.	Multiple	The PCIC would be affected by grazing lands in Harding, Butte, Perkins, Meade, Haakon, Jones, and Tripp counties.
Nebraska Grazing Lands	The state of Nebraska has extensive lands used by ranchers for the grazing of herds of animals.	Multiple	Grazing lands would fall within the PCIC in Keya Paha, Boyd, Holt, Antelope, Boone, Nance, Merrick, Polk, York, Fillmore, Saline, and Jefferson counties.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Oil and Gas Storage Facilities			
Baker Facility	Natural gas storage facility in Baker, Fallon County, Montana. Owned and operated by Williston Basin Interstate Pipeline Company, with a total capacity of 287.2 billion cubic feet.	Baker, Fallon County, Montana.	Baker natural gas storage facility is within the PCIC near Baker, Fallon County, Montana.
Oil and Gas Well Fields			
Wildcat and Buffalo	Oil and gas wells in central South Dakota.	Central South Dakota and northwestern Harding County, South Dakota.	Oil and gas wells within the PCIC in northwestern Tripp County, South Dakota; southeastern Jones County, South Dakota; south-central Jones County, South Dakota; northwestern Harding County, South Dakota; and north-central Meade County, South Dakota.
Wildcat Phillips, Fallon, Valley, McCone County fields	Oil and gas fields in Montana.	Southeastern Fallon County, southwestern Dawson County, southeastern McCone County, eastern Valley County, northeastern Phillips County, Montana.	Oil and gas wells within the PCIC (Gas Light, Plevna, Plevna South, Cedar Creek, Weldon, McCone, and Wildcat) in southeastern Fallon County, southwestern Dawson County, southeastern McCone County, Valley County, northeastern Phillips County, Montana.
Mine and Mineral Extraction Sites			
Montana gravel pits	Active surface gravel pits.	Southern Valley County, Southeastern McCone County, Montana.	Gravel pits within the PCIC through southern Valley County, Montana.
Weldon Timber Creek Coal Field	Active surface coal field in northwestern McCone County, Montana.	Northwestern McCone County, Montana.	Coal field within the PCIC through northwestern McCone County, Montana.
Abandoned coal fields	Eighteen abandoned coal fields.	Northwestern and southeastern McCone County, western and southwestern Dawson County, Montana.	Abandoned coal fields within the PCIC through northwestern and southeastern McCone County, western and southwestern Dawson County, Montana.
Fallon County Bentonite Deposit	Active bentonite surface mine in southeastern Fallon County, Montana.	Southeastern Fallon County, Montana.	Active bentonite mine within the PCIC through southeastern Fallon County, Montana.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Fallon County abandoned surface mines and coal fields	One abandoned coal field and five abandoned surface mines in southeastern Fallon County, Montana.	Southeastern Fallon County, Montana.	Abandoned coal field and surface mines within the PCIC through southeastern Fallon County, Montana.
Nebraska active sand and gravel mines	Active sand and gravel mines in Nebraska.	Northeastern Keya Paha County, northern and central Holt County, southern Jefferson County, Nebraska.	Active sand and gravel mines within the PCIC.
Nebraska abandoned sand and gravel pits	Abandoned sand and gravel pits in Nebraska.	Eastern Boyd County, northern and central Holt County, central and southern Antelope County, southern York County, eastern Fillmore County, southern Jefferson County, Nebraska.	Abandoned sand and gravel pits within the PCIC in northern and central Holt County, Nebraska.
Nebraska inactive sand and gravel pits	Inactive sand and gravel pits in Nebraska.	Southern Jefferson County, Nebraska.	Abandoned sand and gravel pits within the PCIC.
South Dakota active sand and gravel pits	Active sand and gravel pits in South Dakota	Southeastern and central Tripp County, southeastern Haakon County, eastern Haakon County, northeastern Meade County, northwestern Harding County, South Dakota.	Active sand and gravel pits within the PCIC.
South Dakota inactive sand and gravel pits	Inactive sand and gravel pits in South Dakota.	Southeastern Tripp County, central Jones County, southeastern Haakon County, northeastern Meade County, South Dakota.	Inactive sand and gravel pit within the PCIC.
Feedlots			
Nebraska Feedlots	A feedlot is a type of animal feeding operation which is used in farming. Very large feedlots are classified as concentrated animal feeding operations (CAFOs), and are used to increase the size of livestock before slaughter.	Feedlots are used across the state of Nebraska and have an impact throughout.	The PCIC of the proposed pipeline route would be affected by large feedlots, or CAFOs, southwest of Naper, north of Atkinson, northeast of O'Neill, east of Page, near Orchard, west of Tilder, north of Clarks, near McCool Junction, and near Milligan, Nebraska.
Mt. Echo Feedlot and Beaver Valley Pork	Additional CAFOs	Feedlots are used across the state of Nebraska and have an impact throughout.	The Mt. Echo feedlot falls within the PCIC near St. Edward, Nebraska. The Beaver Valley Pork feedlot falls within the PCIC near St. Edward, Nebraska.

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Grain and Agronomy Hubs			
Central Valley Agriculture (CVA)—multiple locations	The CVA Clarks location is an agronomy hub that offers fertilizers, chemicals, insecticides, seed and seed treatments, custom application, and precision technology and scouting services to the agricultural sector in central Nebraska.	CVA is located throughout central Nebraska and affects multiple localities in Nebraska.	This CVA Clarks location falls within the PCIC for the proposed Project. The location of the agronomy hub is 2947 26th Road, Clarks, Nebraska

A summary of the residual impacts associated with the general types of projects listed in Table 4.15-1 as well as the potential for these residual effects to be cumulative with the effects of the proposed Project is presented below. While some residual effects associated with past projects may be long-term and/or permanent, many of the residual effects of past projects and effects of the proposed Project are localized. In these situations, the greatest potential for cumulative effects across a broad range of resources from the proposed Project occurs where there is geographic proximity of past projects with the proposed Project. Where appropriate, such as greenhouse gas (GHG) emissions and effects to threatened and endangered species, cumulative effects are considered across a larger geographic scale.

Pipeline and Storage Facility Projects

Pipeline and storage facility projects considered in the CEA include transportation and storage of crude oil, refined/finished products, natural gas, and ammonia. With respect to past (existing) pipeline and storage systems, such as those summarized above in Table 4.15-1, construction and operation of these types of systems may result in permanent alterations to terrestrial vegetation (primarily the conversion of forest cover), as well as impacts to wildlife habitat, land use, visual resources, noise, and air quality. These impacts are related to storage facilities, other aboveground facilities (such as compressor and pump stations) and maintained ROWs. Where multiple past (existing) pipeline and storage systems occur within geographic proximity of the proposed Project, cumulative impacts would be additive among the resource impacts described above. The nature and degree of cumulative impacts depends, in part, on the proximity of the proposed Project facilities to past (existing) facilities. For example, where the proposed Project is located within or directly adjacent to past (existing) pipeline ROWs and storage systems, the effects to terrestrial vegetation, with associated impacts to wildlife habitat, land use, and visual resources would represent a contiguous increase of existing impacts through the creation of a wider, permanent ROW. However, where the proposed Project is not within or directly adjacent to past (existing) pipeline ROWs and storage systems, there would be potential cumulative effects to vegetation, wildlife habitat, and land use that contribute to further habitat fragmentation and associated impacts.

Water Delivery Systems

Cumulative impacts associated with existing water delivery systems are similar in nature to those discussed above related to pipeline and storage facility projects. Impacts of operational water delivery systems include past alterations to terrestrial vegetation, wildlife habitat, land use, and visual resources. Cumulative impacts are possible across these resources where existing systems,

both aboveground facilities (e.g., pump stations, treatment facilities, and storage tanks) and water pipeline ROWs, occur within geographic proximity of the proposed Project.

Electrical Transmission Lines

The most notable impacts associated with existing electrical transmission lines are the permanent effects on terrestrial vegetation, land use, and visual resources. Additional minor impacts to soils (compaction and erosion), wetlands, and wildlife (particularly raptor and other avian species) could also be expected, as well as indirect air quality and GHG impacts in the region associated with the generation of electricity that would be transmitted through power lines. The potential for cumulative impacts exists where multiple or large existing electrical transmission lines occur within geographic proximity of the proposed Project. As discussed above related to pipeline and storage facility projects, the nature and degree of cumulative impacts depends, in part, on the proximity of the proposed Project facilities to existing electrical transmission line ROWs. Cumulative impacts would primarily be associated with permanent alterations to rangeland/grassland vegetation, land use, and visual resources.

Railroads

Cumulative impacts associated with existing railroad features are similar in nature to those discussed above related to various linear features. Impacts of operational railroads include past alterations to terrestrial vegetation, wildlife habitat, land use, noise, and visual resources. Cumulative impacts are possible across these resources where existing systems occur within geographic proximity of the proposed Project.

Wind Farms

Primary residual impacts associated with operating wind farms include effects on terrestrial vegetation, wildlife (notably avian species and bats) and habitat fragmentation, and visual resources. Additional minor impacts to soils (compaction and erosion), wetlands, noise, and land use could also be expected associated with existing wind farms; however, cumulative effects to these resources are not expected based on the minor nature of these residual impacts and the nature of the long-term and permanent impacts associated with the proposed Project. Cumulative impacts would primarily be associated with permanent alterations to terrestrial vegetation, habitat fragmentation, and visual resources where existing wind farms occur within geographic proximity of the proposed Project.

Landfills

Three landfills were identified within the PCIC of the proposed Project. Two of the landfills in Montana are closed, and one active landfill is located in Nebraska. Primary residual impacts associated with landfills include permanent alterations to land use and visual resources, as well as potentially long-term impacts to water resources. The likelihood of water resource impacts associated with landfills is in large part related to the age of the landfill. Historic landfills (in contrast to newer facilities) have a greater potential to contribute to cumulative effects to water resources as a result of potentially inadequate design and controls. Additional minor impacts to soils (compaction and erosion), terrestrial vegetation, wildlife, and wetlands could also be expected associated with existing landfills. Additional impacts associated with the active landfill would include effects on air quality (particularly dust) and noise from operations. Given the discrete and localized extent of landfills and their associated impacts, cumulative impacts would

primarily be associated with permanent alterations to land use and visual resources where existing landfills occur within geographic proximity of the proposed Project. Additional cumulative impacts to water resources, air quality, and noise could potentially occur in proximity to older active landfill sites.

Power Plants

One power generation facility was identified within the PCIC of the proposed Project in York, York County, Nebraska. Primary residual impacts associated with power plants include alterations to terrestrial vegetation, water resources (intakes and thermal discharges), fisheries, land use, air quality and GHG emissions, noise, and visual resources. Additional minor impacts to soils (compaction and erosion), wildlife, and wetlands could also be expected associated with existing power plants; however, cumulative impacts to these resources are not expected. The majority of the primary residual impacts associated with power plants are localized. As a result, potential cumulative impacts would primarily be associated with permanent alterations to land use, air quality, noise, and visual resources where existing power plants occur within geographic proximity of the proposed Project. Additional cumulative impacts to GHG emissions and climate change could occur on a regional scale.

Grazing Lands

Land use data indicate that the majority of undeveloped land in Nebraska, South Dakota, and Montana is used for grazing herd animals. Grazing lands are present within the PCIC in undeveloped portions of the counties through which the proposed pipeline would run. Primary residual impacts of the use of lands for grazing include alterations to soils (erosion), terrestrial vegetation, and water resources (water quality). Cumulative impacts are possible across these resources where existing grazing lands occur within geographic proximity of the proposed Project.

Oil and Gas Well Fields

Multiple oil and gas well fields are located in proximity to the proposed Project. The Williston Basin is located in northwestern South Dakota and northeastern Montana, and the Buffalo field, located in Harding County, South Dakota, contains many wells within the PCIC of the proposed Project. Primary residual impacts associated with oil and gas well field activities include alterations to geological resources, soils (erosion), terrestrial vegetation, water resources, land use, air quality and GHG emissions, noise, and visual resources. Additional minor impacts to wildlife and wetlands could also be expected associated with oil and gas well field activities; however, cumulative impacts to these resources are not expected. The majority of the primary residual impacts associated with oil and gas well field activities are localized. As a result, potential cumulative impacts would primarily be associated with permanent alterations to geological resources, soils (erosion), terrestrial vegetation, water resources, land use, air quality, noise, and visual resources where existing oil and gas well fields occur within geographic proximity of the proposed Project. Additional cumulative impacts to GHG emissions and climate change could occur on a regional scale.

Mine and Mineral Extraction Sites

Numerous active and abandoned mine and mineral extraction sites are located within the PCIC in Montana, South Dakota, and Nebraska. Primary residual impacts associated with mine and mineral extraction sites include alterations to geological resources, soils, terrestrial vegetation, water resources, land use, air quality, noise, and visual resources. Additional minor impacts to wildlife and wetlands could also be expected associated with mine and mineral extraction activities; however, cumulative impacts to these resources are not expected. The majority of the primary residual impacts associated with mine and mineral extraction sites are localized. As a result, potential cumulative impacts would primarily be associated with permanent alterations to geological resources, soils, terrestrial vegetation, fisheries, water resources, land use, air quality, noise, and visual resources where existing mine and mineral extraction activities occur within geographic proximity of the proposed Project.

Feedlots

A feedlot is a type of animal feeding operation which is used in high-density industrial farming (sometimes called factory farming). Very large feedlots are classified as concentrated animal feeding operations, or CAFOs, and are used to increase the size of livestock before slaughter (National Agricultural Statistics Service 2012). Primary residual impacts associated with feedlot sites include direct effects to soils (compaction and erosion), terrestrial vegetation, land use, air quality, noise, and visual resources, and potential indirect effects to fisheries, wetlands and water resources through storm water runoff. The majority of the primary residual impacts associated with feedlots are localized. Cumulative impacts are possible across these resources where existing feedlots occur within geographic proximity of the proposed Project.

Grain and Agronomy Hubs

Grain and agronomy hubs offer fertilizers, chemicals, insecticides, seed and seed treatments, custom application, precision technology, and scouting services to the agricultural sector in central Nebraska (Central Valley Agriculture 2011 and 2012). Primary residual impacts associated with grain and agronomy hubs include alterations to terrestrial vegetation, land use, and visual resources. Additional minor impacts to soils (compaction and erosion), wildlife, and wetlands could also be associated with grain and agronomy hubs; however, cumulative impacts to these resources are not expected. The majority of the primary residual impacts associated with grain and agronomy hubs are localized. As a result, potential cumulative impacts would primarily be associated with permanent alterations to terrestrial vegetation, land use, and visual resources where existing grain and agronomy hubs occur within geographic proximity of the proposed Project.

4.15.2.2 Cumulative Impacts from Present Projects

Present projects and activities considered in the CEA are those that have been approved and are under construction. Potential residual (i.e., long-term or permanent) effects from these projects/activities are considered to be potentially cumulative with the effects of the proposed Project. These projects are further described in Table 4.15-2 below.

Table 4.15-2 Representative Present Projects Considered in the Cumulative Effects Assessment

Project Name	Description	Localities Impacted	Geographic Relationship to Proposed Project
Crude Oil Pipelines and Storage Facilities			
TransCanada Gulf Coast Pipeline and Oil Storage Facility	The Gulf Coast Pipeline would construct 484 miles of new crude-oil pipeline from Cushing, Oklahoma, to Nederland, Texas, and a new tank farm on an approximately 74-acre site at Cushing, Oklahoma.	Oklahoma, Texas.	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. A tank farm would be constructed on an approximately 74-acre site at Cushing, Oklahoma, adjacent to the existing Cushing Oil Terminal.
Natural Gas Pipelines			
Bakken NGL Pipeline	An approximately 500-mile long natural gas liquids (NGL) pipeline running from northeastern Montana, south to Colorado. Currently under construction and estimated to begin operations in the first half of 2013.	Montana, Wyoming, Colorado.	Within the PCIC of the proposed pipeline route near Baker, Fallon County, Montana.
Water Delivery Systems			
Dry Prairie Rural Water System	System to provide drinking water to approximately 27,434 people in eastern Montana. The system would consist of 12- to 15-inch-diameter PVC water delivery pipelines throughout the service area. Project is 30% complete (off-reservation portions); fiscal year 2013 funded and construction on-going.	Montana: Daniels, Sheridan, and Roosevelt counties and portions of Valley County.	Portions of the water system west of the Fort Peck Indian Reservation may be within the PCIC in northeastern Montana, specifically in Valley County.
Highway Construction			
I-80 Construction	The State of Nebraska is undertaking highway repairs and maintenance along the I-80 interstate highway.	Along the I-80 route in Nebraska.	Highway construction would potentially be within the PCIC in Hamilton County, Nebraska.
US Route 85 Construction	The State of South Dakota is undertaking highway repairs and maintenance along the US-85 highway.	Along the US-85 route in South Dakota.	Highway construction would be within the PCIC in Harding County, north of Buffalo, South Dakota.
SD Route 79 Construction	The State of South Dakota is undertaking highway repairs and maintenance along the SD-79 highway.	Along the SD-79 route in South Dakota.	Highway construction would potentially be within the PCIC in Harding County, south of Reva, South Dakota.

Project Name	Description	Localities Impacted	Geographic Relationship to Proposed Project
I-90 Construction	The State of South Dakota is undertaking highway repairs and maintenance along the I-90 interstate highway.	Along the I-90 route in South Dakota.	Highway construction would be within the PCIC in Jones County, near Murdo, South Dakota.
Grain and Agronomy Hubs			
CVA—Royal Location	The CVA Royal location would be an agronomy and grain hub that would offer and ship grain, fertilizers, chemicals, insecticides, seed and seed treatments, custom application, and precision technology and scouting services to the agricultural sector in central Nebraska. CVA's Royal location would include rail terminals that would be constructed along the NENE Railway, which connects to the Burlington Northern.	CVA is located throughout central Nebraska and affects multiple localities. The Royal location affects Royal, Nebraska, in Antelope County.	This CVA location falls within the PCIC for the primary proposed pipeline route. The construction for this hub is taking place 3 miles west of Royal, Nebraska.

The impacts associated with the general types of other present projects listed in Table 4.15-2, as well as the potential for these impacts to be cumulative with the effects of the proposed Project, are discussed below.

For the Gulf Coast Pipeline and Natural Gas Pipelines, the residual impacts associated with operation of these types of facilities was previously described in the Pipeline and Storage Facility Projects section of Section 4.15.2.1, Cumulative Impacts from Past Projects. However, additional details on the construction of Gulf Coast Pipeline project are provided below. The residual impacts associated with operation of the water delivery system projects and grain and agronomy hubs presented in Table 4.15-2 were previously described in Section 4.15.2.1 related to past (existing) projects, and are not repeated here. The remaining projects in Table 4.15-2 are highway construction projects. A summary of the residual impacts associated with existing highway construction projects is provided below.

In addition to operational residual impacts associated with the projects listed in Table 4.15-2, when considering the cumulative impacts of these projects in terms of present activities, additional short-term impacts associated with concurrent and/or successive construction schedules also needs to be addressed. Cumulative impacts associated with concurrent construction projects within geographic proximity of the proposed Project include short-term alterations to soils, terrestrial vegetation, wildlife, wetlands, land use, visual resources, water resources, air quality (primarily dust), noise, and socioeconomics (predominantly positive impacts on local economies). Where construction projects are successive (as opposed to concurrent) and within geographic proximity of the proposed Project, similar short-term impacts would occur across these resources. While successive construction timeframes would result in reduced magnitude of concurrent short-term impacts, the time period over which short-term impacts would occur would increase.

Crude Oil Pipelines and Storage Facilities

Construction on the TransCanada Gulf Coast pipeline began in August 2012 and is anticipated to be complete and operational by mid- to late 2013. The Gulf Coast project would construct 484 miles of new pipeline through Oklahoma and Texas, and would transport crude oil from Cushing, Oklahoma, south to Nederland, Texas. Approximately 82 percent of the total pipeline length would be within approximately 300 feet of existing pipelines, utilities, or road ROWs. The Gulf Coast project would affect approximately 8,542 acres during construction. After project completion the temporary 110-foot ROW that is necessary during construction activities would be reduced to a 50-foot-wide permanent ROW, which would be maintained for the life of the project. Total acreage that would be permanently affected is 3,121 acres. Additionally, the pipeline would require the construction of several ancillary facilities such as pump stations, tank farms, intermediate mainline valves, and access roads.

The vast majority of the impacts associated with the construction and operation of the Gulf Coast pipeline project would be short-term, temporary impacts caused during pipeline installation. Extensive effort went into routing pipeline around sensitive areas such as wetlands and critical habitats to minimize potential impacts to these resources. After completion, the temporary ROW would be restored, and permanent wetland impacts would be approximately 217 acres. The Gulf Coast pipeline project would impact several diverse land areas known to be or potentially inhabited by federally and state-protected species of flora and fauna. Most impacts would be short term and related to construction activities; however, conversion of mature forest to other habitat types would cause long-term to permanent effects on species that rely on this habitat. Careful planning was done to ensure that the timing of intrusive construction activities does not coincide with critical migration or mating periods.

Highway Construction Projects

Present highway construction projects include highway repairs and maintenance and not the construction of large-scale new infrastructure projects. Primary impacts of these highway construction projects are similar to those discussed above for general construction projects and include short-term alterations to soils, visual resources, water resources, air quality (primarily dust), and noise. Cumulative impacts are possible across these resources where highway construction projects occur within geographic proximity of the proposed Project.

4.15.2.3 Cumulative Impacts from Reasonably Foreseeable Future Projects

Future projects and activities considered in the CEA are those that are reasonably likely to be constructed or take place in the foreseeable future (based on permit applications or similar indication of significant intent). Potential residual (i.e., long-term or permanent) effects from these projects/activities are considered to be cumulative with the effects of the proposed Project. These projects are further described in Table 4.15-3 below. The impacts associated with the general types of projects listed in Table 4.15-3, as well as the potential for these impacts to be cumulative with impacts of the proposed Project, are discussed by resource in Section 4.15.3, Cumulative Impacts by Resource, below. For the types of projects presented in table 4.15-3, the residual impacts associated with construction and operation of these facilities were previously described in the discussion above regarding past and present projects. Cumulative impacts of these projects in terms of future activities would occur where long-term and permanent residual impacts of the proposed Project are additive with long-term and permanent impacts of construction and operation of the above projects.

Table 4.15-3 Representative Future Projects Considered in the Cumulative Effects Assessment

Project Name	Description	Regions Impacted	Geographic Relationship to Proposed Project
Crude Oil Pipelines and Storage Facilities			
BakkenLink Pipeline (connected action)	Approximately 144-mile-long,12-inch-diameter oil gathering system to move Bakken crude within North Dakota to a rail loading station that is being developed near Fryburg, about 30 miles west of Dickinson in southwestern North Dakota.	Western North Dakota and southeastern Montana.	The BakkenLink Pipeline would be within the PCIC near Baker, Fallon County, Montana.
Bakken Crude Express Pipeline	A 1,300-mile-long pipeline from North Dakota to Cushing, Oklahoma.	North Dakota, Montana, Wyoming, Colorado, Kansas, and Oklahoma.	The Bakken Crude Express pipeline would be within the PCIC in eastern Montana.
Water Delivery Systems			
Dry-Redwater Water Authority	Proposed water pipeline with initial feasibility study and appraisal investigation completed; currently working with Bureau of Reclamation on a feasibility study.	Richland, Dawson, McCone, Garfield, and Prairie counties, Montana.	Proposed water pipeline route falls within the PCIC in McCone and Dawson counties, Montana.
Electrical Transmission Lines			
Big Bend to Witten 230-kV Transmission Line (connected action)	Proposed 70-mile transmission line from a new substation near the Big Bend Dam to an existing substation in Witten, South Dakota.	Lyman and Tripp counties, South Dakota	The proposed transmission line would cross the PCIC of the proposed Project route.
Chinook Project (proposed, on hold)	A 500-kV electrical transmission line over 1,000 miles long. Estimated in-service date is 2015. The line would be rated approximately 3,000 MW.	Montana, Idaho, and Nevada.	The Chinook project would extend to southeastern Montana, and is not likely within the PCIC. No specific city is provided as the starting point for the transmission line.
New 765-kV Lines (proposed)	Proposed expansion of the U.S, electric grid that would create new 765-kV lines throughout the country.	Multiple.	The PCIC would be affected in Fallon, Prairie, Dawson, and McCone counties, Montana; Haakon, Jones, and Lyman counties, South Dakota; and Greeley and York counties, Nebraska.

Project Name	Description	Regions Impacted	Geographic Relationship to
Wind Farms			
New Underwood North & South	Proposed wind farms located in southeastern Haakon County, South Dakota. Planned capacity of 10 to 50 MW each.	Southeastern Haakon County, South Dakota.	New Underwood North is potentially located north of the proposed Project, and possibly within the PCIC. New Underwood South is potentially located south of the proposed route, and possibly within the PCIC in Haakon County, South Dakota.
Basin Electric SD-2	Proposed wind farm located in central Tripp County, South Dakota, with generating power of 125 to 200 MW	Central Tripp County, South Dakota.	Potentially within PCIC through Tripp County, South Dakota.
Basin Electric SD-3	Proposed wind farm located in south-central Jones County, South Dakota, with generating power of 125 to 200 MW.	South-central Jones County, South Dakota.	Potentially within PCIC through Jones County, South Dakota.
Grand Prairie	50,000+ acre site. Approximately 12 miles northeast of O'Neill, Nebraska, in Holt County, Nebraska. Proposed project is in process of completing EIS and public review. Project construction is expected to begin in early 2014, with the farm operational by fall 2014.	Holt County, Nebraska.	Within the PCIC in Holt County, Nebraska.
Unnamed Wind Farm Project	Proposed to be constructed on state-owned land and is anticipated to have a 100-299 MW capacity.	Valley County, Montana.	Potentially within the PCIC.
Oil and Gas Well Fields			
Wildcat Fields	Oil and natural gas wells outside of high-production field areas. Located throughout South Dakota and Montana.	Throughout South Dakota and Montana.	New wells permitted on a regular basis by Montana and South Dakota regulators. Possibility for future well installation and development within the PCIC through South Dakota and Montana.
Buffalo	Oil and gas field in western South Dakota.	Northwestern Harding County, South Dakota.	New wells permitted on a regular basis by South Dakota regulators. Possibility for future well installation and development within the PCIC in northwestern Harding County, South Dakota.

Project Name	Description	Regions Impacted	Geographic Relationship to
Fallon County Fields	Gas Light, Plevna, Plevna South, Cedar Creek, and Wildcat Fallon oil and gas fields in southeastern Fallon County, Montana.	Southeastern Fallon County, Montana.	Oil and gas wells within the PCIC in southeastern Fallon County, Montana.
McCone County Fields	Weldon and Wildcat McCone oil and gas wells in central and southeastern McCone County, Montana.	Southeastern McCone County, Montana.	Oil and gas wells within the PCIC of the proposed Project in southeastern McCone County, Montana.

4.15.2.4 Cumulative Impacts from Connected Actions

There are three actions that are separate from the proposed Project that are included in the evaluation of potential cumulative impacts to the extent that information on the projects is available:

- Bakken Marketlink Project: Consists of constructing approximately a 5-mile-long pipeline and three crude oil storage tanks and associated facilities near Baker, Montana, adjacent to the proposed Pump Station 14 to store and deliver Bakken oil production from producers in North Dakota and Montana into the proposed Project pipeline for delivery to Cushing, Oklahoma.
- Big Bend to Witten 230-kV Transmission Line: Consists of constructing approximately 2 miles of double-circuit 230-kV transmission line from the south side of the Big Bend Dam to the new Lower Brule Substation in south-central South Dakota, and then 74 miles south-southwest to the existing Witten Substation.
- Electrical Distribution Lines and Substations associated with proposed pump stations.

Connected action project details are presented in Section 2.1.12, Connected Actions, and also in Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions.

Cumulative impacts of these projects in terms of future activities would occur where long-term and permanent residual impacts of the proposed Project are additive with long-term and permanent impacts of construction and operation of the above projects. The residual impacts associated with operation of these types of facilities were previously described in Section 4.15.2.1, Cumulative Impacts from Past Projects, related to past (existing) projects; a summary of general construction impacts was previously described in Section 4.15.2.2, Cumulative Impacts from Present Projects.

4.15.2.5 Summary of Key Geographically Overlapping Project Areas

Past, present, and future projects and development activities are heavily concentrated in key areas of the PCIC. These key areas are characterized by larger populations, which generally have greater transportation (road, rail), energy source (oil, gas, wind, mineral, electrical) generation and transmission, and waste disposal demands.

Montana

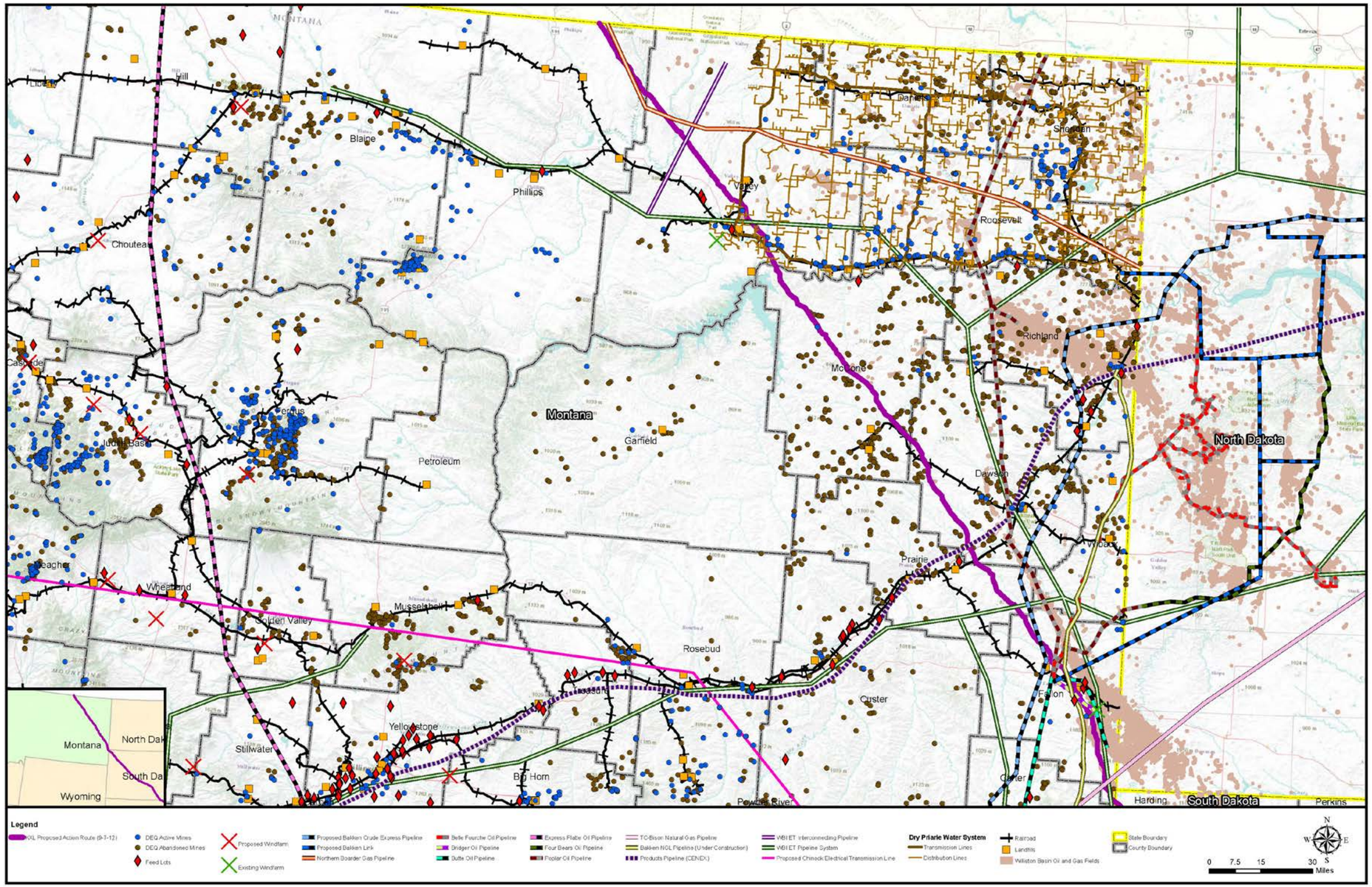
Fallon County, Montana, has been identified as a primary area for the occurrence of cumulative impacts because of its proximity to the Williston Basin oil and gas fields and its population center of Baker. One closed landfill associated with the town of Baker is located within the PCIC of the proposed Project. The area is also served by the BNSF rail line, which runs northwest-

southeast across Fallon County. The area also supports mining, and one active bentonite mine and six abandoned coal fields were identified within the PCIC in Fallon County. Fallon County also supports wind farm developments, including the Diamond Willow Wind Farm, located southeast of Baker and within the PCIC.

The Williston Basin oil and gas fields extend from South Dakota, through North Dakota and Montana, and into Canada. Several highly productive gas fields are located in Fallon County, and as a result a large number of gas wells are located within the PCIC of the proposed Project route in the county. Because of the proximity to these well fields, a number of natural gas and oil-related transmission, storage, and associated facilities are also located in Fallon County. An underground natural gas storage field is operated by WBI Energy Transmission (formerly Williston Basin Interstate Pipeline Company) near Baker, which is tied in with WBI's total of 3,700 miles of natural gas transmission lines, portions of which also cross the PCIC in and around Baker (WBI Energy Transmission 2012). A portion of another natural gas pipeline, the Bison pipeline, also crosses the PCIC of the proposed project in southeastern Fallon County. Lastly, Oneok Partners is currently constructing an approximately 500-mile-long NGL pipeline that would cross the PCIC near Baker, Montana.

In addition to natural gas, crude oil from the Williston Basin is transported via a number of pipelines owned and operated by True Companies, which include the Belle Fourche, Butte, Four Bears, and Poplar pipelines (Bridger Pipeline LLC 2012). These pipelines converge in Fallon County, Montana, at the Bridger Gathering station near Baker and cross within the PCIC at several locations. Oneok Partners has proposed to construct a crude oil pipeline, the Bakken Crude Express, through Fallon County, near Baker. The town of Nashua, in southern Valley County, Montana, is also a primary cumulative impact area. Linear and non-linear projects within the PCIC in southern Valley County include a section of the BNSF rail line, portions of the WBI Energy Transmission natural gas pipeline system, a closed landfill, three active surface gravel pits, a wind farm, and several water delivery pipelines associated with the Dry Prairie Rural Water system, which is currently under construction.

It should be noted that Keystone was issued a Certificate of Compliance in 2008 by the Montana Department of Environmental Quality under the Major Facility Siting Act, Section 75-20-101, et seq., Montana Code Annotated. The Certificate of Compliance authorizes the construction, operation, and maintenance of the Montana portion of the proposed Project. The certification report indicates that 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 Project. Cumulative impacts of the proposed Project and operation of new transmission lines could include impacts to air quality, viewshed degradation, changes to land uses and vegetation, and impacts to migratory birds. The Montana Department of Environmental Quality specifies the mitigation measures to be implemented in order to minimize potential impacts. Their findings concluded that final location for the proposed Project would result in fewer cumulative adverse environmental impacts and economic cost than siting the facility in another reasonable location. Figure 4.15.2-1 shows the known locations of past, present, and reasonably foreseeable future projects in Montana.



Source: See Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions.

Figure 4.15.2-1 Known Locations of Past, Present, and Reasonably Foreseeable Future Projects in Montana

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South Dakota

In general, the proposed Project route through South Dakota does not coincide with other past, present, and future projects and development areas. Therefore, the potential for cumulative impacts within South Dakota is not anticipated to be significant. Figure 4.15.2-2 shows the known locations of past, present, and reasonably foreseeable future projects in South Dakota.

Nebraska

Due to its central location between northern oil and gas fields and southern refineries, numerous natural gas, crude oil, and refined product pipelines crisscross the state of Nebraska. Specifically, existing infrastructure/development is concentrated in the southern portion of the PCIC, which is the primary area for the occurrence of cumulative impacts.

Steele City, in Jefferson County, Nebraska, is a natural gas and oil transfer location through which the proposed Project crosses, and through which the Rockies Express West, Express-Platte, Northern Natural Gas Company, and Natural Gas Pipeline Co. of America pipelines cross. A segment of the UP rail line also passes through Steele City and within the PCIC of the proposed Project. Additionally, several abandoned and one active sand and gravel pit were identified within the PCIC in southern Jefferson County, near Steele City.

Other areas of concentrated infrastructure occur in Nebraska. Projects within the PCIC of the proposed Project in Saline County, Nebraska, include the Trailblazer and Northern Natural Gas Company natural gas transmission lines, the Keystone Mainline crude oil pipeline, a section of BNSF rail line, abandoned sand and gravel pits, and highway construction on US-6 and I-80. Projects with cumulative impact within the PCIC of the proposed Project in Fillmore County, Nebraska, include the KMIGT system, NuStar refined products pipeline, BNSF rail line, and abandoned sand and gravel pits. Projects within the PCIC of the proposed Project in York County, Nebraska, include the Magellan and NuStar refined petroleum products pipelines, the NuStar anhydrous ammonia pipeline, portions of the KMIGT, the BNSF rail line, a petroleum-operated power generation facility, and abandoned sand and gravel pits. Cumulative impact projects within the PCIC of the proposed Project in Merrick County, Nebraska, include sections of the UP and NCRC rail lines, and abandoned sand and gravel pits. Cumulative impact projects within the PCIC of the proposed Project in Boone County, Nebraska, include portions of the KMIGT, SourceGas natural gas transmission lines, the NCRC rail line, and the Laredo Ridge wind farm. Figure 4.15.2-3 shows the known locations of past, present, and reasonably foreseeable future projects in Nebraska.

4.15.3 Cumulative Impacts by Resource

An analysis of the resources potentially sensitive to cumulative effects from past, present, and reasonably foreseeable future projects is addressed in this section. To organize the discussion, a CEA matrix is presented at the beginning of each resource section that identifies the primary resource components that are subject to potential adverse effects from the proposed Project and connected action activities, whether these effects are direct or indirect, and the anticipated duration and geographic extent of the effects. The last column in the CEA matrix indicates if the resource component is potentially subject to cumulative impacts based on this information.

The discussion that follows the matrix focuses on the identified resource areas with potential cumulative impacts and their significance, both for the proposed Project, as well as overall in the

context of effects from past, present, and reasonably foreseeable future projects described in Section 4.15.2, Past, Present, and Reasonably Foreseeable Projects. The CEA matrix serves as a tool for the consistent and transparent documentation of the CEA process, and supports the conclusions regarding the assessment of cumulative effects to important resource areas. It should be noted that the matrices provide a preliminary indication as to the potential for cumulative effects based on whether or not long-term or permanent impacts are anticipated for a particular resource area. This does not represent a conclusive determination that cumulative effects are, in fact, occurring. Rather, it directs the discussion of the resource area that follows, where an indication of the significance of the potential for cumulative effects is provided.

Potential spills are not discussed on a resource-specific level. For an assessment of the potential short- and long-term effects of oil releases to the environment, see Section 4.13, Potential Releases; for a discussion of potential cumulative effects of oil releases to the environment, see Section 4.15.3.13, Potential Releases.

4.15.3.1 Geology

A summary of potential environmental consequences of the proposed Project and connected action activities to geological resources is presented in Table 4.15-4. As further discussed below, the anticipated overall absence of long-term or permanent impacts to geological resources from the proposed Project indicates that cumulative effects to this resource area are not expected. Although, as indicated in Table 4.15-4, permanent access restrictions to mineral/fossil fuel resources within the pipeline ROW may occur, these effects are considered negligible in the context of the amounts available for extraction underneath the proposed Project permanent ROW and ancillary facilities. Where long-term or permanent impacts are absent, the potential for additive cumulative effects with other past, present, and reasonably foreseeable future projects is also negligible.

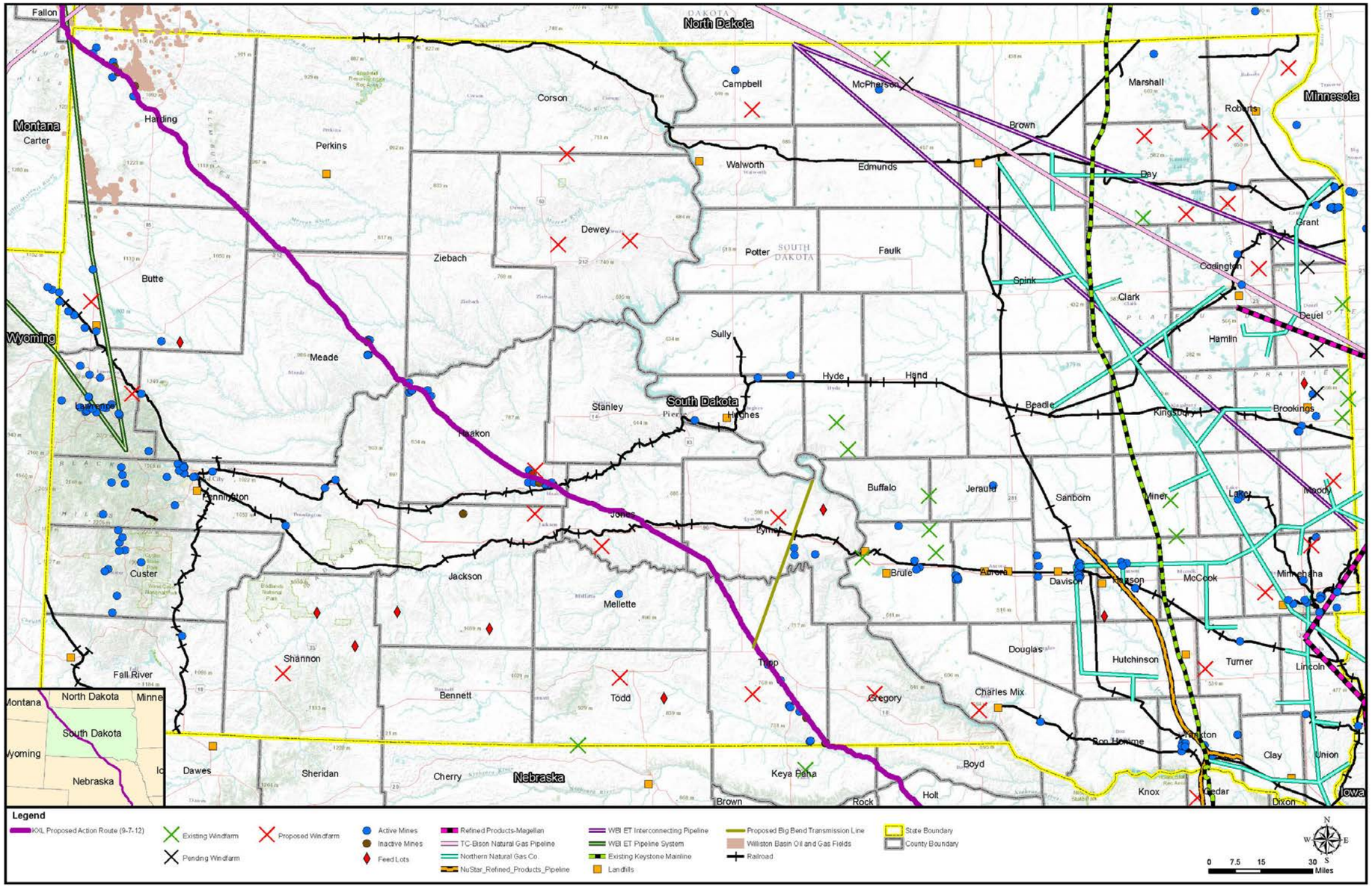
Table 4.15-4 CEA Matrix—Geology

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Rock Ripping/Horizontal Directional Drilling	D	N	PA	No
Access to Mineral/Fossil Fuel Resources	D	D	PA	Yes
Paleontological Resources	(D)	N	PA	No
Geologic Hazards (seismic, landslides, subsidence, floods)	(I)	N	PA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps.



Source: See Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions.

Figure 4.15.2-2 Known Locations of Past, Present, and Reasonably Foreseeable Future Projects in South Dakota

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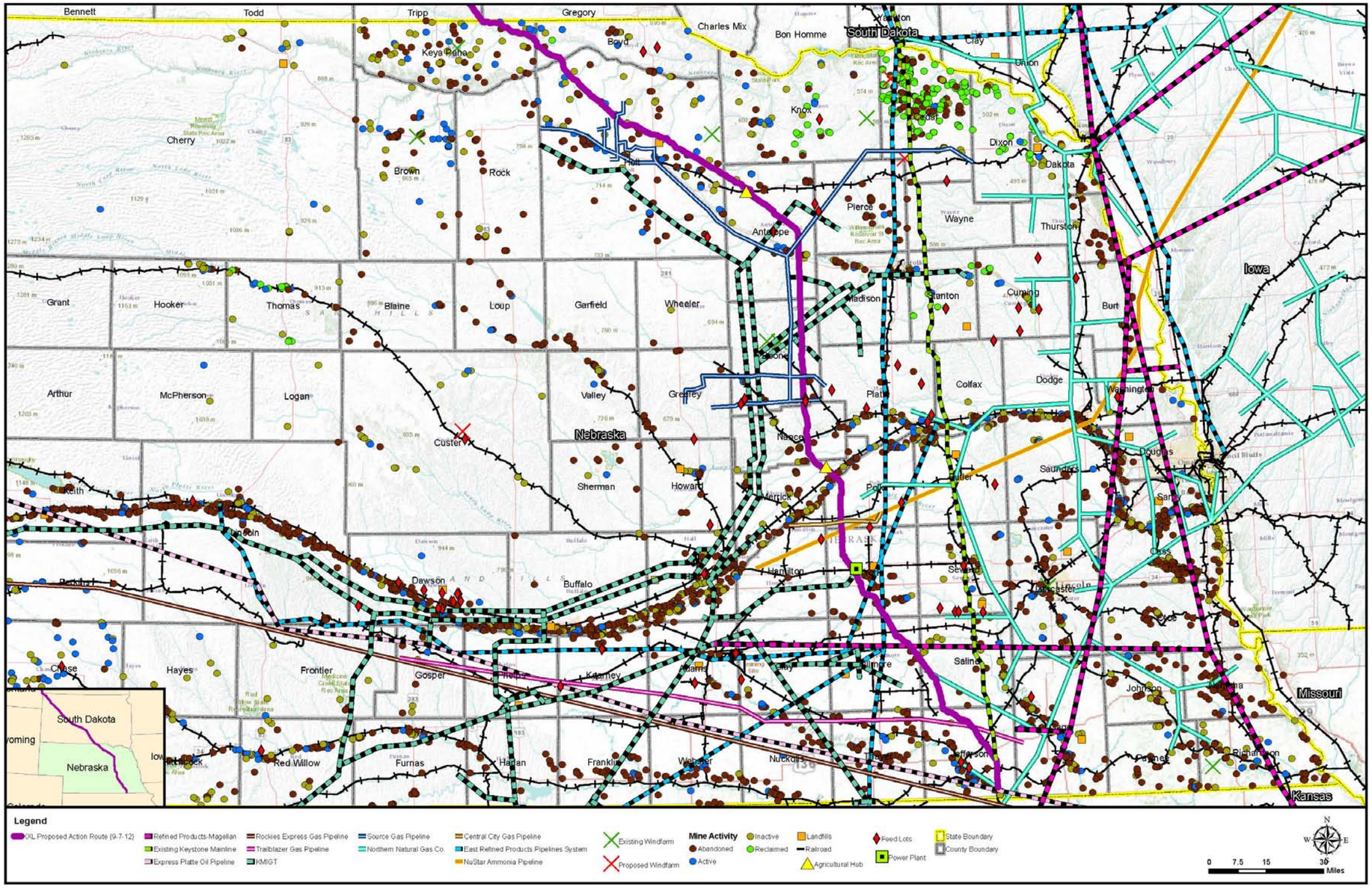

Source: See Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions.

Figure 4.15.2-3 Known Locations of Past, Present, and Reasonably Foreseeable Future Projects in Nebraska

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The majority of the potential effects to geological resources are short term, limited in geographic extent, and associated with the construction phase of the proposed Project only. Potential effects to geological resources could include direct impacts to the subsurface through rock ripping (the break up and removal of rock material with an excavator) or horizontal directional drilling (HDD). These activities would involve some disturbance and modification of the shallow subsurface geology but would not have substantive impacts to the local geology. Although the proposed Project would cross oil- and gas-producing areas, it would not cross any active surface mines or quarries, or the well-pads of any active oil and gas wells.

The proposed Project route would cross underlying coal-bearing formations in South Dakota. Therefore, although not currently planned, if surface mining was proposed for this area in the future, the proposed Project could limit access to these resources. Overall, however, the acreage of deposits covered by the proposed Project and ancillary facilities is minimal when compared to the amounts available for extraction throughout the proposed Project route. Paleontological resources can be damaged or destroyed during construction by excavation activities, erosion of fossil beds exposed due to grading, and unauthorized collection (i.e., direct impacts to paleontological resources). Keystone would prepare a Paleontological Monitoring and Mitigation Plan prior to construction on federal and certain state and local government lands to offset the potential for these impacts. In addition, several existing laws and regulations apply to paleontological resources to offset the potential for these impacts. Paleontological resources identified on federal lands are managed and protected under the Paleontological Resources Preservation Act as part of the Omnibus Public Land Management Act of 2009, and both Montana and South Dakota have enacted legislation to manage and protect paleontological resources on state-managed lands. With these mitigations and regulations in place, direct impacts to paleontological resources are considered minimal.

Based on the evaluation of potential seismic hazards along the proposed Project, the risk of the proposed Pipeline rupture from earthquake ground motion is considered to be minimal. The proposed Project route would not cross any known active faults and is located outside of known zones of high seismic hazard. In addition, the pipeline would be constructed to withstand probable seismic events within the seismic risk zones crossed by the proposed Project (according to existing regulations). Erosion control measures such as trench breakers, slope breakers or water bars, erosion control matting, and mulching would reduce the likelihood of construction-triggered landslides. In addition, areas disturbed by construction along the proposed Project would be revegetated consistent with the Keystone's CMRP (Appendix G) and specific landowner or land manager requirements. Further, regulations 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 could cause the proposed pipeline facilities to move or sustain abnormal loads. Because there no appreciable limestone areas in states along the proposed Project route, the risk of subsidence from karst features along the proposed Pipeline route is negligible.

Impacts to geological resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. The duration of impacts are primarily temporary and short term, with negligible effects on geological resources, with the possible exception of access to mineral and/or fossil fuel resources located below permanent structures. In summary, with respect to geological resources, long term/permanent impacts are limited to the restriction of access to mineral and/or fossil fuel

resources located within the permanent pipeline ROW (50 feet wide) and under ancillary facilities. Thus, this is the only potential area for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects.

Past projects would concurrently affect this aspect of geological resources to the extent that there is a high density of past project activity in a geographic area having a similar impact. As shown on Figures 4.15.2-2 and 4.15.2-3, southern and eastern Nebraska and the east/southeastern region of Montana are candidate areas for cumulative impacts associated with concurrent projects, including the proposed Project. For current projects, although not geographically connected, construction of the TransCanada Gulf Coast pipeline project would also permanently limit access to mineral resources in Oklahoma and Texas. Approximately 82 percent of the Gulf Coast pipeline project is planned to be constructed within approximately 300 feet of existing pipelines, utilities, or road ROWs, which could potentially increase the area of restricted access to mineral and/or fossil fuel resources beyond the typical 50-foot ROW width. No other current projects identified have a potential to significantly add to cumulative impacts to geological resources with the proposed Project.

Future projects could potentially contribute to cumulative impacts to mineral and/or fossil fuel resources including the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects, in addition to water delivery and wind power projects, particularly where they might overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska. Overall, however, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, the acreage of restricted mineral and/or fossil fuel resources is minimal when compared to the amounts available for extraction surrounding the areas directly affected.

4.15.3.2 Soils

A summary of potential environmental consequences of the proposed Project activities to soil resources is presented in Table 4.15-5.

Table 4.15-5 CEA Matrix—Soils

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Soil Erosion	(D)	I	PA	No
Soil Compaction	(D)	N	PA	No
Loss of Topsoil/Topsoil Degradation	(I)	N	PA	No
Agricultural, Range, Pasture Land Soil Degradation	(I)	N	PA	No
Fragile Soils	(D)	N	PA	No
Soil Productivity (Temperature)	N	D	PA	Yes

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps.

Potential effects to soil resources from the proposed Project are limited to the general footprint of the Project ROW and ancillary facilities. As a result, the potential for additive cumulative effects to these resources is also limited. Change to soil productivity due to localized increased temperature is the one area considered to have potential permanent effects when the pipeline is in operation. Potential effects on other aspects of soil resources from the proposed Project are limited in geographic extent and the majority are associated with the construction phase of the proposed Project only. As further discussed below, potential cumulative effects to soil resources are localized and otherwise considered negligible. 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, causing indirect affects to terrestrial vegetation. This is the only potential impact to soil that is considered permanent for the design life of the proposed Project. Permanent changes to soil productivity within the pipeline ROW are considered to have low cumulative impact, assuming effective restoration efforts and when considered in the context of the large soil resources throughout the proposed Project route.

Outside of productivity issues, potential direct effects to soil resources include clearing, grading, trench excavation, backfilling, equipment traffic, and restoration along the proposed Project ROW and ancillary facilities during construction activities. Potential impacts could include temporary and short-term direct impacts associated with soil erosion and soil compaction; and short- to long-term direct and indirect impacts associated with topsoil loss and/or degradation (including fragile soils and agriculture, range, or pasture soils). Impacts to soil resources during operation include temporary and short-term indirect impacts associated with soil erosion (from pipeline maintenance traffic and incidental repairs). However, Keystone's proposed Project CMRP (Appendix G) includes construction procedures that are designed to reduce the likelihood and severity of proposed Project impacts to soil resources. For example, the CMRP requires the use of erosion control measures (such as the installation of sediment barriers, trench plugs, temporary slope breakers, drainage channels or ditches, and mulching), as well as soil compaction control and topsoil salvage measures. Special handling and additional soil salvage techniques would be implemented to conserve agricultural soil capability where appropriate. Special considerations and measures would also be undertaken in proposed Project areas in southern South Dakota and northern Nebraska where the soils are fragile (i.e., sandy soils that are highly susceptible to erosion by wind). These embedded controls would serve to reduce the severity and duration of potential impacts to soil resources during construction and operation activities.

Impacts to soil resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project with the exception of impacts associated with soil temperature, and impacts to fragile soils and agriculture, range, or pasture soils. These soil resources would not be impacted by the connected actions to the proposed Project. Where remaining impacts listed in Table 4.15-5 overlap between the proposed Project and the connected actions, these are considered collectively in the overall discussion of the proposed Project.

In summary, long-term/permanent impacts are limited to potential productivity issues (defined as localized increases in soil temperatures and decrease in soil moisture content), which are localized to the area of the permanent pipeline ROW and ancillary facilities. Past projects would concurrently affect soil productivity and its indirect effect on terrestrial vegetation to the extent that there is a high density of activity in a geographic area having a similar impact. As shown on

Figures 4.15.2-2 and 4.15.2-3, southern and eastern Nebraska and the east/southeastern region of Montana are candidate areas for cumulative impacts associated with concurrent projects, including the proposed Project. The project type affecting soil productivity through temperature would be limited to crude oil pipelines. However, to the extent that past projects also have soil productivity concerns through other direct or indirect alteration of terrestrial vegetation, they could also be considered cumulative. However, reclamation measures are available for this resource within the context of all of these activities, thus reducing the possibility for permanent impacts, and lessening their significance to overall cumulative impacts.

Currently, although not geographically connected, construction of the TransCanada Gulf Coast pipeline project is included in the consideration of soil productivity impacts. However, year-round soil surface temperatures over the Gulf Coast pipeline route would remain unchanged in Oklahoma and Texas. Other current projects such as water delivery systems and highway maintenance and repair are also not expected to result in permanent impacts to terrestrial vegetation. Therefore, current projects would not contribute to cumulative impacts to soil productivity, or the associated indirect impacts to terrestrial vegetation.

Future projects that could potentially contribute to cumulative impacts to soil productivity include the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects. Electrical transmission lines, wind power projects, and oil and gas mining activities may also contribute to cumulative impacts to soil productivity through the indirect alteration of terrestrial vegetation, particularly where projects could overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska.

Overall, however, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, permanent changes to soil productivity within the pipeline ROW are considered negligible assuming effective restoration efforts and in the context of the large extent of soil resources throughout the proposed Project route. Where restoration efforts are not feasible, landowner compensation for demonstrated losses from decreased productivity resulting from pipeline operations would be implemented to the extent required by easement or ROW agreements.

4.15.3.3 Water Resources

Surface Water

A summary of potential environmental consequences of the proposed Project activities to surface water resources is presented in Table 4.15-6. As further discussed below, routine proposed pipeline operation and maintenance activities would have negligible effect on surface water resources with properly implemented and maintained mitigations; therefore, the overall potential for cumulative effects to surface water resources is considered low. No permanent effects during the operation of the pipeline are expected. Generally speaking, the proposed Project route has been selected and modified to minimize the potential for impacts to surface water resources, as well as other sensitive environments, by avoiding them whenever possible and shifting the route to limit the area affected. There are a number of waterbodies that would be crossed by the proposed pipeline where mitigation measures would be used to reduce or minimize impacts. To the extent that one or more projects cross the same waterbody in the same watershed, implementation of appropriate construction practices and permit processes through the U.S. Army Corps of Engineers would minimize the potential for localized cumulative impacts. The introduction and transportation of invasive aquatic and plant species, respectively, are considered

the only potential long-term, indirect impacts when the pipeline is in operation. The remaining surface water resource areas are potentially affected on a long-term basis primarily during the period of construction, with low potential to persist in the pipeline operation phase.

Table 4.15-6 CEA Matrix—Surface Water

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Bank Stability	(D)	N	PA	No
Channel Morphology	(D)	N	LA	No
Channel Bed Scour	(D)	N	LA	No
Increased Sedimentation	(D)	(I)	LA	No
Water Temperature Alteration (Channel Construction)	D	N	LA	No
Water Temperature Alteration (Pipe Testing)	I	N	LA	No
Reduced Flow	(D)	N	LA	No
Dewatering	D	N	LA	No
Transportation of Invasive Plant Species	(I)	(I)	R	Yes
Introduction of Invasive Aquatic Species	(I)	I	R	Yes
Increased Total Dissolved Solids	(D)	I	R	No
Increased Total Suspended Solids (Riparian)	(D)	(D)	R	No
Increased Total Suspended Solids (General ROW)	(D)	(I)	R	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.

Depending on the type of stream crossing, one of six construction methods would be used: non-flowing open-cut, flowing open-cut, dry flume, dry dam-and-pump, HDD, or horizontal bore crossing. At the 15 major and sensitive waterbody crossings, the HDD method would be used. Where conditions warrant the use of the HDD crossing method, waterbody impacts of construction would be minimal since no direct contact would occur with stream banks, channel bed, or waters. In the event that a frac-out (accidental release of drilling fluids from the borehole up to the surface) were to occur during HDD, there would be short-term impacts within the proposed Project cumulative impact corridor, but conditions would be expected to return to pre-construction conditions after mitigation and restoration measures were implemented, making their overall contribution to cumulative impacts negligible.

Potential impacts on surface water resources during construction activities would include temporary increases in total suspended solids concentrations and sedimentation during non-HDD stream crossings or at upland locations with soil erosion and transport to streams; temporary to long-term changes in channel morphology and stability caused by channel and bank modifications; temporary to long-term decrease in bank stability and resultant increase in total suspended solids 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 and stream crossing construction. Full shrub and vegetation restoration in riparian areas is expected to take more than 3 years; however, the establishment of herbaceous ground cover and other temporary stabilization measures very soon after completion of crossings would ensure that there are no long-term effects to bank stability and sedimentation.

Keystone's proposed Project CMRP (see Appendix G) includes construction procedures that are designed to reduce the likelihood and severity of proposed Project impacts to surface water resources. For example, the CMRP identifies procedures to limit erosion and land disturbances, including the use of buffer strips, drainage diversion structures, sediment barrier installations, and clearing limits, as well as procedures for waterbody restoration at crossings. In floodplain areas adjacent to waterbodies, the contours would be restored to as close to previously existing contours as practical and the disturbed area would be revegetated during construction of the ROW in accordance with the CMRP. Implementation of CMRP construction and operating requirements would lead to minimal impacts to waterbodies under normal construction and operating conditions; therefore, the contribution to cumulative impact would be negligible.

Potential surface water impacts are fundamentally the same for the proposed Project construction components and the connected actions. Where remaining impacts listed in Table 4.15-6 overlap between the proposed Project and the connected actions, these are considered collectively in the overall discussion of the proposed Project.

In summary, with respect to surface water resources, permanent impacts are not expected. The introduction and transportation of invasive aquatic and plant species is the primary long-term impact concern, and is the only potential area for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects. Past projects would concurrently affect invasive species to the extent that there is a high density of activity in a geographic area having a similar impact. As shown on Figures 4.15.2-2 and 4.15.2-3, southern and eastern Nebraska and the east/southeastern region of Montana are candidate areas for cumulative impacts associated with concurrent projects, including the proposed Project. Although existing projects are not noted to have had long-term impacts to surface water with respect to invasive species, mitigation and restoration measures are available to address these concerns within the context of all of these project activities; thus the overall significance to cumulative impacts is low.

Currently, although not geographically connected, construction of the TransCanada Gulf Coast pipeline project is included in the consideration of invasive species impacts on surface water resources. However, similar to that described above, mitigation and restoration measures are available to address these concerns. Other current projects such as water delivery systems and highway maintenance and repair are also not expected to result in long-term impacts with respect to invasive species. Therefore, current projects would not contribute to cumulative impacts to surface water resources.

Future projects that could potentially contribute to cumulative impacts to surface water resources with respect to invasive species include the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects. Other future projects such as electrical transmission lines, wind power projects, and oil and gas mining activities may also contribute to cumulative impacts where projects could overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska. However, similar to that described above, mitigation and restoration measures are available to address these concerns.

Overall, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, permanent changes to surface water resources within the pipeline ROW are considered negligible assuming effective mitigation and restoration efforts with the proposed Project and other projects throughout the proposed Project route.

Groundwater/Hydrogeology

A summary of potential environmental consequences of the proposed Project activities to groundwater resources and hydrogeology is presented in Table 4.15-7. Permanent direct impacts to groundwater/hydrogeology from the proposed Project include the direct continuous or intermittent contact of the pipeline with groundwater in shallow water settings. In addition, permanent impacts would occur to existing wells that are in conflict with the proposed Project ROW or ancillary facilities, which would be decommissioned. Long-term impacts to groundwater could result from groundwater mixing (between aquifers) during HDD, although this would be minimized by the drilling fluids and muds that would seal the pipe in place. These aspects, however, are not considered significant with respect to cumulative effects because they would be generally localized to the footprint of proposed Project activities and are not likely to be additive between past, present, or future projects. Groundwater/hydrogeology impacts are further discussed below.

Table 4.15-7 CEA Matrix—Groundwater/Hydrogeology

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Water used for HDD	(D)	N	LA	No
Water extraction and use for construction housing camps and hydrostatic testing	D	N	LA	No
Groundwater mixing	I	I	PA	Yes
Dust suppression along access roads	(D)	N	PA	No
Dewatering during construction	(D)	N	PA	No
Decommissioning of existing wells in conflict with alignment	(D)	(D)	PA	Yes
Water disposal during hydrostatic testing of pipeline and at the construction camps	(D)	(D)	R	No
Changes to characteristics of shallow groundwater aquifers	I	I	LA	No
Pipeline in direct contact with shallow groundwater	D	D	PA	Yes

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.

The remaining potential impacts to groundwater/hydrogeological resources are short term in duration. In addition, Keystone's proposed Project CMRP includes construction procedures that are designed to reduce the likelihood and severity of proposed Project impacts to water resources. The proposed Project would be required to adhere to applicable local, state, and federal regulations and permit conditions. All water resources used for hydrostatic testing, construction camp use, dust suppression, or HDD would be approved by the appropriate permitting agencies prior to initiation of any withdrawal activities. As described in the proposed Project CMRP, surface and/or groundwater withdrawal methods would be implemented and followed, including 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 (from pipe manufacturing activities) following testing activities. Required water analyses would be obtained prior to any water discharging operations associated with hydrostatic testing or construction camp water disposal.

Impacts to groundwater/hydrogeological resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. No significant large-scale potable water aquifers underlie the Bakken Marketlink Project area, and well depths are typically greater than 50 feet. Because of the limited amount of potable water directly beneath the Bakken Marketlink Project area and the significant depth to groundwater in this area, it is not likely that potential releases would significantly impact groundwater resources in the area. Where remaining impacts listed in Table 4.15-7 overlap between the proposed Project and the connected actions, these are considered collectively in the overall discussion of the proposed Project.

In summary, with respect to groundwater/hydrogeological resources, long-term/permanent impacts are related to contact of the pipeline with groundwater in shallow water settings, the decommissioning of existing wells that are in conflict with the proposed Project, and groundwater mixing (between aquifers) during HDD. Where avoidance of an existing groundwater well is not feasible, compensation for the loss resulting from pipeline and ancillary facility construction would be implemented to the extent required by easement or ROW agreements. Pipeline contact with shallow groundwater and groundwater mixing between aquifers are localized impacts with little to no significant cumulative impact potential with other projects. Therefore, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, cumulative impacts to groundwater resources are considered negligible.

4.15.3.4 Wetlands

A summary of potential environmental consequences of the proposed Project activities to wetland resources is presented in Table 4.15-8 below. Table 4.15-8 summarizes the estimated duration, geographic extent, and cumulative impact potential for Project-related wetland impacts. This discussion focuses on those wetlands that would be affected on a long-term or permanent basis and could potentially contribute to cumulative wetland impacts regionally. Refer to Section 4.4, Wetlands, for a detailed discussion of the wetlands that would be affected by the proposed Project as well as the proposed impact minimization and restoration measures. Temporary, short-term, and long-term impacts discussed here and in Section 4.4 are based on the assumption that post-construction restoration efforts would be successful and no unforeseen conditions resulting

from proposed pipeline operations (e.g., pipeline soil temperature effects, potential spills) delay anticipated recovery rates. Note that a long-term or permanent effect or impact does not necessarily mean a permanent loss of wetland habitat. For example conversion of scrub-shrub or forested wetlands to herbaceous wetlands is considered a permanent impact to those woody wetland classes, but does not represent a complete loss of wetland habitat, whereas a permanent wetland loss would be a conversion of a wetland community to an upland as a result of the construction of a pump station or access road.

Table 4.15-8 CEA Matrix—Wetlands

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Wetland loss (conversion of wetland to upland communities)	(D)	(D)	PA	Yes
Conversion of forested to emergent wetlands	(D)	D	PA	Yes
Conversion of scrub-shrub to emergent wetlands	(D)	D	PA	Yes
Loss of or change in hydrology	(I)	(I)	LA	No
Loss of or change in hydric soil integrity	(I)	(I)	PA	No
Change in forested wetland function (non-HDD areas)	(D)	D	LA	Yes
Change in forested wetland function (HDD areas)	(D)	(D)	LA	Yes
Change in scrub-shrub wetland function (non-HDD areas)	(D)	D	LA	Yes
Change in scrub-shrub wetland function (HDD areas)	(D)	(D)	LA	Yes
Change in emergent wetland function	(D)	(D)	LA	Yes
Change in wetland species diversity (not including PFO or PSS conversion issues)[a]	(D) and (I)	(D) and (I)	LA	No
Changes in water quality	(D) and (I)	(D) and (I)	PA	No
Soil biological, chemical, hydrologic conditions/activity (above pipeline resulting from pipe-generated heat)	N	D	PA	Yes
Increased weed infestation	(I)	(I)	LA	Yes

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities.
[a] PFO = palustrine forested wetland; PSS = palustrine scrub shrub wetland.

Impacts to emergent wetlands affected within the proposed construction corridor width, which would encompass the permanently maintained operations ROW, would likely be short-term to long-term, with likely successful re-establishment within 3 to 5 years, assuming mitigation is successful and near pre-construction conditions are restored and maintained within the anticipated timeframes. All impacted emergent wetlands within the construction and permanent

ROW would be restored to near pre-construction conditions following proposed pipeline installation. Emergent wetlands would be allowed to persist outside of and within the permanent operations ROW for the life of the proposed Project. Herbaceous wetland vegetation in the proposed pipeline ROW generally would not be mowed or otherwise maintained, although the CMRP (Appendix G) allows for annual maintenance of a 30-foot-wide strip centered over the pipeline to mow or clear tall vegetation if necessary. The only permanent loss of emergent wetlands would be associated with the construction of permanent ancillary facilities such as permanent access roads, emergency response staging areas, and pump stations.

In forested and scrub-shrub wetlands, the effects of proposed construction would be extended due to the longer period needed to regenerate a mature forest or shrub community. Prior to proposed pipeline installation, scrub-shrub and forested wetland vegetation within the construction corridor (area between the approximate 30-foot permanently maintained strip within the operations ROW and 110-foot construction corridor limit) would be cut to ground level and root systems would be left in place. Once construction activities were completed, woody vegetation outside of the permanent wetland operations ROW would be restored to near pre-construction conditions and woody vegetation would be allowed to regrow. This would be considered a long-term impact based on the slower growth rate of trees and shrubs, which may require decades for complete regeneration. Within the operations ROW, a 30-foot-wide strip centered over the pipeline would be kept free of tall vegetation for the life of the project. Woody vegetation and rootmass within this 30-foot strip would be completely removed and not allowed to regrow. Scrub-shrub and forest wetlands within this 30-foot-wide strip would be converted to emergent wetlands, which represents a permanent impact to the woody wetland class, but does not necessarily represent a permanent loss of wetland habitat. The only exception to this would be at HDD locations where shrubs and trees would be allowed to regenerate within the permanent ROW after construction activities are complete. In this case, impacts to scrub-shrub and forested wetlands at HDD locations would be considered long-term. The only permanent conversion of scrub-shrub and forested wetlands to uplands would be associated with the construction of permanent ancillary facilities such as permanent access roads, emergency response staging areas, and pump stations.

Construction and operation of ancillary facilities would result in short-term, long-term, and permanent impacts. Impacts associated with non-permanent ancillary facilities (i.e., temporary access roads) would be similar to those described above for emergent wetlands (short-term to long-term with recovery in 3 to 5 years), and long-term to permanent for scrub-shrub and forested wetlands. The construction of permanent ancillary facilities (i.e., permanent access roads, emergency response staging areas, and pump stations) would require wetland fills and represent a permanent wetland loss (wetland to upland conversion); however, these areas are small. Permanent wetland losses due to operational ancillary facilities are estimated to be 0.82 acres in Montana, 1.2 acres in South Dakota, and no acres in Nebraska (see Wetland to Upland Conversion in Table 4.4-2).

With respect to long-term and permanent impacts in Montana, there is an estimated 32.3 acres of wetlands (herbaceous, scrub-shrub, forested, and riverine-openwater) that would be affected by the permanent operations of the proposed Project (see Table 4.4-1 in Section 4.4, Wetlands). Of the 32.3 acres, approximately 4.3 acres of scrub-shrub and forested wetlands would be converted to emergent wetlands, and 0.82 acre of wetlands (all types) would be permanently filled and converted to upland as a result of the construction of ancillary facilities. Similarly in South Dakota, there is an estimated 56.1 acres of wetlands that would be affected by the permanent

operations of the proposed Project. Of these 56.1 acres, approximately 5.1 acres of scrub-shrub and forested wetlands would be converted to emergent wetlands, and 1.2 acres of wetlands (all types) would be permanently filled and converted to upland as a result of the construction of ancillary facilities (Table 4.4-1 in Section 4.4, Wetlands). In Nebraska, approximately 32 acres of wetlands would be affected by the permanent operations of the proposed Project. Of that total, approximately 6.5 acres of scrub-shrub and forested wetlands would be converted to emergent wetlands. Where required, all permanent wetland impacts would be mitigated by following standard U.S. Army Corps of Engineers-required mitigation protocols and ratios, negotiated during the proposed Project permitting.

The long-term and permanent impacts described above and presented in Table 4.15-8 have the potential to contribute towards the cumulative impacts on wetlands as summarized below:

- Potential cumulative effects associated with wetland to upland conversion would be considered to have low overall cumulative significance considering the relatively small total for wetland loss due to proposed Project. In addition, the proposed Project would mitigate for these losses per federal and state requirements.
- Potential cumulative effects associated with conversion of forested to emergent wetlands would be considered to have a greater overall cumulative significance because forested wetlands are a limited resource within the proposed Project area. The proposed Project would mitigate for these losses according to the CMRP and in accordance with state and federal requirements.
- Potential cumulative effects associated with conversion of scrub-shrub to emergent wetlands would be considered to have low overall cumulative significance considering the relatively small area of foreseeable conversion due to proposed Project. In addition, the proposed Project would mitigate for these losses according to the CMRP and in accordance with state and federal requirements.
- Change in forested wetland function would be long-term (>3 years) in areas where regrowth would be allowed and permanent in areas where regrowth would be prohibited. Impacts to function would be minimized and restored according to the CMRP. There is a greater potential for cumulative impacts due to forested wetland conversion because forested wetlands are a limited resource in the proposed Project area.
- Change in scrub-shrub wetland function would be long-term (>3 years) in areas where regrowth would be allowed and permanent in areas where regrowth would be prohibited. Impacts to function would be minimized and restored according to the CMRP. Potential cumulative effects would be considered to have low overall cumulative significance considering the relatively small area of foreseeable functional change due to proposed Project.
- Emergent wetland vegetation would be allowed to regrow in the construction and operations ROW with recovery expected in 3 to 5 years; therefore, impacts to emergent function would be long term, but not permanent. Impacts to function would be minimized and restored according to the CMRP. Potential cumulative effects would be considered to have low overall cumulative significance considering the shorter recovery period of affected emergent wetlands.

- Weeds would be controlled during the construction and operational phases per the CMRP. Weeds have the potential to encroach within disturbed areas despite control efforts over the long-term and spread into areas adjacent to the proposed Project area. Potential cumulative effects would be considered to have low overall cumulative significance considering the Project's stated commitments to controlling weeds.

The potential for a given impact to contribute to cumulative impacts is based on the assumption that the CMRP (Appendix G) is successful and near pre-construction conditions are restored and maintained within the anticipated timeframes. Impacts to wetland resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. Most wetlands would be spanned, avoided, minimized, and/or mitigated.

In summary, with respect to wetland resources, the primary impact concern with respect to potential cumulative effects is the conversion of wetlands to uplands, and the conversion of forested wetlands to emergent wetlands. These impacts represent the primary area for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects. As described above, the proposed Project would mitigate for wetland losses per federal and state requirements, as well as the CMRP (Appendix G). However, it is noted that there is a greater potential for cumulative impacts as a result of forested wetland conversion, because forested wetlands are a limited resource in the proposed Project area. Historical activities and past projects are linked to wetland losses (although the proportion of forested wetland acres impacted is unknown). In the mid-1950s through the mid-1970s, there were major wetland losses, although since then the rate of loss has decreased dramatically, primarily through the implementation and enforcement of wetland protection measures, public outreach/education, and restoration programs (U.S. Environmental Protection Agency [USEPA] 2012a). In Montana (particularly in north-central and eastern Montana), South Dakota (notably in the prairie pothole region), and Nebraska, wetlands conversion to agricultural use (assumed to include livestock grazing) accounts for most historic wetland losses (U.S. Geological Survey [USGS] 1996); other development activities and urbanization follow in significance.

The relatively low numbers of wetland acres permanently impacted by the proposed Project heavily influences the evaluation of cumulative effects to wetlands overall. The relative contribution to wetland loss or conversion by the proposed Project in the larger regional context is negligible (<1–2 acres wetland to upland conversion in Montana, South Dakota, and Nebraska each; 4.3, 5.1, and 6.5 acres forested wetland conversion to emergent wetland in Montana, South Dakota, and Nebraska, respectively). Therefore, even though the southeastern Nebraska and east/southeastern Montana regions are candidate areas for cumulative impacts associated with past projects including the proposed Project (as shown on Figures 4.15.2-2 and 4.15.2-3), the incremental effect of the proposed Project is negligible.

Although not geographically connected, wetland impacts associated with the concurrent construction of the TransCanada Gulf Coast pipeline project are considered. Similar to that described above, these pipeline projects would mitigate for wetland losses per federal and state requirements. Impacts to forested wetlands are the highest in Texas (156 acres), whereas forested wetland impacts in Oklahoma are expected to affect 8 acres. It should be noted that these acres represent forest to emergent wetland conversions and not loss. The relative contribution to wetland loss or conversion from these projects is not significant enough to produce incremental cumulative impacts on wetland resources, as there are 5,973,000 acres of bottomland hardwood and other forested riparian vegetation, and 95,000 acres of swamps in Texas (Texas Parks and

Wildlife Division 1994). Other current projects such as water delivery systems and highway maintenance and repair in Montana, South Dakota, and Nebraska are also not expected to result in permanent impacts to wetlands. Therefore, current projects would not contribute to cumulative impacts to wetlands resources.

Future projects that could potentially contribute to cumulative impacts to wetland resources include the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects. Other future projects such as electrical transmission lines, wind power projects, and oil and gas mining activities may also contribute to cumulative impacts where projects could overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska. However, similar to that described above, future projects would be required to implement avoidance and mitigation measures designed to minimize potential impacts to wetland resources, which would limit the contribution of those projects to cumulative impacts.

Overall, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, permanent changes to wetland resources within the pipeline ROW are considered negligible assuming effective mitigation and restoration efforts with the proposed Project and other projects throughout the proposed Project route.

4.15.3.5 Terrestrial Vegetation

A summary of potential environmental consequences of the proposed Project activities to terrestrial vegetation resources is presented in Table 4.15-9.

Table 4.15-9 CEA Matrix—Terrestrial Vegetation

Potential Impact Area	Proposed Project and Connected Action Impacts: Construction	Proposed Project and Connected Action Impacts: Operation	Geographic Extent	Cumulative Impact Potential (Yes/No)
General Vegetation Impacts				
Cultivated Crops	D	D	PA	No
Grassland/Pasture	(D)	(D)	PA	Yes
Upland Forest	(D)	D	PA	Yes
Open Water	D	D	PA	No
Forested Wetlands	(D)	D	PA	Yes
Herbaceous Emergent Wetlands	(D)	(D)	PA	No
Shrub/Scrub	(D)	(D)	PA	Yes
Developed Land	D	D	PA	No
Potential Impacts to Biologically Unique Landscapes and Vegetation Communities of Conservation Concern				
Forest Communities	(D)	D	PA	Yes
Riparian Forest	(D)	D	PA	Yes
Native Grasslands	(D)	(D)	PA	Yes
Sagebrush Steppe	(D)	(D)	PA	Yes

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations. Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps.

Permanent effects to terrestrial vegetation resources from the proposed Project are limited to the general footprint of the Project ROW and ancillary facilities. As a result, the potential for additive cumulative effects to these resources is also limited. Forested habitats, including biologically unique forested habitats, could be permanently impacted by the construction and operation of the pipeline. Additionally, shrublands (including Sagebrush Steppe communities) and grasslands could be impacted for the long term due to the slow recovery from the impacts of construction. However, most of the land affected by the proposed Project is used for agriculture and rangeland (approximately 90 percent). Disturbed agricultural land and rangeland would be returned to approximate pre-construction use and capability. Permanent impacts to only 47.3 acres of forested areas spaced across Montana, South Dakota, and Nebraska (includes forested upland and wetland acres) would occur within the 30-foot-wide permanent easements centered on the pipeline. It should be noted that this acreage represents forest conversion to other habitat and not habitat loss.

Forested habitats within the ROW of the proposed Project would be permanently converted to herbaceous habitats so that pipeline access and maintenance is manageable. During the construction phase, larger expanses of habitat would be cleared for access and use. Forested areas that are not within the permanent ROW would be replanted, reseeded, and restored. The proposed pipeline route would also cross an estimated 355 miles of 1,054 individual native grassland communities through Montana, South Dakota, and Nebraska. Clearing of native grasslands along portions of the proposed Project ROW could contribute to the cumulative decline of native grasslands. Although most native grasslands would be restored, the effects of land clearing on previously untilled native prairies may be irreversible. Although native grasslands would be reseeded with native seed, shortgrass prairie and mixed-grass prairie areas could take up to 100 years to become re-established due to poor soil conditions and low moisture levels. Construction would also involve removal of woody shrubs in sagebrush grasslands. Restoration of these habitats would be long term. Conservation efforts implemented to offset potential losses would reduce the cumulative impacts associated with the proposed Project.

The proposed pipeline route would cross an estimated 55.5 miles of Inter Mountain Basins Big Sagebrush Steppe ecosystem habitat. Construction through this ecosystem habitat would remove sagebrush shrubs. The sagebrush shrubland disturbed in the construction phase would typically become re-established within 5 to 15 years. The sagebrush shrubland in the permanent easement would not be regularly mowed and would also be allowed to revegetate with sagebrush. Although minimal maintenance would be necessary, sagebrush may require 20 to 50 years to re-establish in the permanent ROW.

Introduced, non-native species and noxious weeds can compete with native vegetation in native habitats. Invasive plants and noxious weeds can be introduced into habitats and can be spread by improperly cleaned vehicles and equipment. Some invasive organisms can live in dry equipment for several days. To reduce the potential for transfer of non-native species and noxious weeds, mitigation measures would be implemented. Mitigation efforts implemented would reduce the cumulative impacts associated with the proposed Project. Any additional projects located within the vicinity would likely require similar conservation methods and mitigations, thus reducing overall cumulative impacts associated with the spread of invasive species and noxious weeds.

Impacts to terrestrial vegetation resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project.

In summary, with respect to terrestrial vegetation resources, the primary impact concern with respect to potential cumulative effects is the conversion of forested uplands to herbaceous habitats (reducing and fragmenting forested habitats) and long-term impacts to shrublands and grasslands (which would be restored). These impacts represent the primary areas for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects. Past projects in the area that have historically reduced and fragmented forested habitat may provide the potential for additive cumulative effects; however, the relatively low numbers of forested acres permanently impacted by the proposed Project heavily influences the evaluation of cumulative effects to this habitat overall. The relative contribution to forested wetland loss or conversion (as discussed in the Section 4.15.3.4, Wetlands) or upland forest conversion (3.4, 3.0, and 12.1 acres in Montana, South Dakota, and Nebraska, respectively) by the proposed Project in the larger regional context is negligible. Therefore, even though southeastern Nebraska and east/southeastern Montana are candidate areas for cumulative impacts associated with past projects including the proposed Project (as shown on Figures 4.15.2-2 and 4.15.2-3), the incremental effect of the proposed Project is negligible. Long-term impacts to shrublands and grasslands (which would be restored) are considered to have low cumulative significance overall when considered in combination with the effects of other past projects based on the assumption that "near pre-construction" conditions are restored and maintained within the anticipated timeframes.

Although not geographically connected, terrestrial vegetation impacts associated with the concurrent construction of the TransCanada Gulf Coast pipeline project are also considered. Impacts to forested wetland conversions were discussed in Section 4.15.3.4, Wetlands, and were not considered to be significant with respect to cumulative impacts. Forested upland impacts are greater for the TransCanada Gulf Coast pipeline project (approximately 900 acres permanently impacted). Forest fragmentation in Oklahoma and Texas is mitigated by the fact that large portions of the TransCanada Gulf Coast pipeline project would use existing pipeline ROWs, minimizing new impacts in undeveloped areas. In addition, the total amount of forested upland vegetation that may be affected is relatively small compared to the abundance of similar vegetation in these areas. Forest fragmentation and conversion impacts are not directly cumulative with the proposed Project, since impacts are limited to the footprint of pipeline operations. Other current projects such as water delivery systems and highway maintenance and repair in Montana, South Dakota, and Nebraska are also not expected to result in significant impacts to forested habitats. These projects would be required to implement mitigation and conservation measures designed to minimize potential impacts to forested habitats, which would limit the contribution of those projects to cumulative impacts. Therefore, current projects would not contribute to cumulative impacts to terrestrial vegetation resources.

Future projects that could potentially contribute to cumulative impacts to terrestrial vegetation include the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects. Other future projects such as electrical transmission lines, wind power projects, and oil and gas mining activities may also contribute to cumulative impacts where projects could overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska. Although the predominant vegetation type is agriculture and rangeland through much of the geographic region (which would be restored to pre-construction conditions), where reductions and fragmentation of forested habitat occurs, this could result in cumulative impacts to this resource. However, similar to that described above, future projects would be required to implement avoidance, mitigation, and conservation measures designed to minimize potential

impacts to terrestrial vegetation resources, which would limit the contribution of those projects to cumulative impacts.

Overall, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, changes to terrestrial vegetation within the pipeline ROW are considered to have low cumulative impact significance, assuming effective mitigation and restoration efforts with the proposed Project and other projects throughout the proposed Project route. It should be noted that the potential for a given impact to contribute to cumulative impacts is based on the assumption that the CMRP (Appendix G) is successful and near pre-construction conditions are restored and maintained within the anticipated timeframes.

4.15.3.6 Wildlife

A summary of potential environmental consequences of the proposed Project activities to wildlife resources is presented in Table 4.15-10. Impacts associated with threatened and endangered species are addressed in Section 4.15.3.8, Threatened and Endangered Species. The anticipated overall absence of permanent impacts to wildlife resources from the proposed Project indicates that cumulative effects to this resource area are expected to be minimal. Although, as indicated in Table 4.15-10, anticipated long-term impacts include the increase in invasive plants, animals, and nest parasites; creation of edge effects; and the facilitation of predator movements, these indirect effects to the local area may be negligible given the mitigation efforts associated with the proposed Project as well as the small size of the affected areas. Where long-term or permanent impacts are absent, the potential for additive cumulative effects with other past, present, and reasonably foreseeable future projects is also negligible. These conclusions are further discussed below.

The majority of the potential effects to wildlife resources are indirect, short term or negligible, limited in geographic extent, and associated with the construction phase of the proposed Project only. Indirect and short-term impacts associated with construction of the proposed Project may include reduced wildlife use due to increase human interaction; habitat fragmentation, alteration, and loss; stress and reduced breeding success due to noise, vibration, and human activity; creation of barriers to movement; and reduction in patch size of available habitat.

The only potential direct impacts to wildlife resources are the short-term direct impacts associated with small and immobile wildlife that may not be able to relocate out of construction activities. The overall impacts to populations of wildlife species are not expected to be significant and cumulatively should be negligible.

The proposed Project would produce a minor contribution to the cumulative effects on resident and migrant wildlife potentially resulting in somewhat reduced abundance and productivity within the proposed Project cumulative impact corridor. Displacement of wildlife that depends on the carrying capacity of habitats that would be disturbed by the proposed Project could result in reduction of reproductive effort or survival, thus producing a minor contribution to cumulative impacts on wildlife within the proposed Project cumulative impact corridor. This potential is greater for wildlife for which suitable habitat is limited in the Project area or that are otherwise sensitive to disturbance.

Table 4.15-10 CEA Matrix—Wildlife

Potential Impact Area	Proposed Project and Connected Action Impacts: Construction	Proposed Project and Connected Action Impacts: Operation	Geographic Extent	Cumulative Impact Potential (Yes/No)
Habitat loss, alteration, and fragmentation	I	I	LA	No
Direct mortality during construction and operation	D	N	PA	No
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	I	I	LA	No
Reduced breeding success from exposure to construction and operations noise and from increased human activity	I	I	LA	No
Reduced survival or reproduction due to less edible plants or reduced cover	I	I	LA	No
Reduction in patch size of remaining available habitats	I	I	LA	No
Creation of edge effects	I	I	LA	Yes
Creation of barriers to movement	I	I	PA	No
Intrusion of invasive plants, animals, and nest parasites	(I)	(I)	LA	Yes
Facilitation of predator movements	I	I	LA	Yes
Habitat disturbance	I	I	LA	No
Intrusion of humans	I	I	PA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.

Impacts to wildlife resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. The duration of impacts are all temporary and short term, with negligible effects on wildlife resources. The issues that may cause a cumulative effect are an increase in invasive plants, animals, and nest parasites; creation of edge effects; and the facilitation of predator movements.

As indicated in the Final EIS, commenters have suggested that mitigations for cumulative effects to migratory bird species should be considered. In response to these suggestions, the Department requested that Keystone provide a synopsis of activities at the corporate level that TransCanada supports to provide broad scale mitigations for cumulative impacts to migratory species. In response, TransCanada provided the information below.

TransCanada has partnered with Ducks Unlimited to provide assistance for the Oak Hammock Marsh Interpretative Centre, educational laboratories, and the Watershed Legacy program, all located in Winnipeg, Manitoba. TransCanada has contributed $1 million to Ducks Unlimited as

part of a 5-year commitment running from 2009-2013 to launch the Ducks Unlimited/TransCanada Partnership regarding Habitat Conservation in the Missouri Coteau conservation in Saskatchewan and the Grand Bayou Hydrology Restoration project in Louisiana.

The Missouri Coteau is a 25,000-square-mile tract stretching across south-central Saskatchewan and is internationally recognized as a critical wildlife habitat area. The region consists mainly of native grassland and pothole wetlands capable of supporting vast populations of breeding waterfowl and providing prime habitat for other wildlife. This project would focus on retaining existing uplands and wetland habitat through conservation easements and land purchases; restoring lost habitats through forage conversion programs; and delivering rangeland stewardship programs by working with landowners to improve ecological function and reduce the risk of native habitat loss.

The Grand Bayou project is located on the Pointe-aux-Chenes Wildlife Management area in Louisiana and includes two management units totaling 4,568 acres of coastal marsh habitat. The area is managed for furbearers, waterfowl, alligators, and other wildlife as well as being open to the public for recreational purposes. The area has seen significant habitat deterioration due, in part, to damaged levees from Hurricane Rita and to increased salinity levels and excessive tidal fluctuations. Coastal marsh restoration would involve the installation of levees and installation of new water control structures in order to manage salinity and water levels and encourage production of desirable vegetation. This project would focus on restoration of approximately 4,575 acres of coastal marsh; construction of one 24,000-foot earthen levee and one 25,000-foot earthen levee; installation of three new water control structures, and backfilling portions of an abandoned oilfield access canal.

In summary, with respect to wildlife, permanent impacts are not expected. Indirect effects associated with invasive plants, animals, and nest parasites; creation of edge effects; and the facilitation of predator movements are the primary long-term impact concerns, and these are the potential areas for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects.

Past projects would concurrently affect invasive species, edge effects, and predator movements to the extent that there is a high density of activity in a geographic area having similar impacts. As shown on Figures 4.15.2-2 and 4.15.2-3, the southeastern region of Nebraska and the east/southeastern region of Montana are candidate areas for cumulative impacts associated with concurrent projects, including the proposed Project. Existing pipelines, active and abandoned mining sites, Williston Basin oil and gas fields, railroads, and landfill sites could have long-term impacts to these wildlife resource aspects; however, mitigation and restoration measures are available to address these concerns within the context of all of these project activities, and the anticipated area of potential impacts as a result of the proposed Project is relatively small and not expected to be permanent, thus reducing the possibility for long-term impacts and lessening their significance to overall cumulative impacts.

Although not geographically connected, the current construction of the TransCanada Gulf Coast pipeline project is included in the consideration of wildlife impacts. Long-term impacts associated with invasive species, edge effects, and predator movements are considered to have low overall cumulative significance. In addition, similar to that described above, mitigation and restoration measures are available to address these concerns. Other current projects such as water delivery systems and highway maintenance and repair are also not expected to result in

permanent impacts with respect to wildlife. Therefore, current projects would not contribute to cumulative impacts to wildlife resources.

Future projects that could potentially contribute to cumulative impacts to wildlife with respect to invasive species include the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects. Other future projects such as electrical transmission lines, wind power projects, and oil and gas mining activities may also contribute to long-term impacts where projects could overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska. However, similar to that described above, mitigation and restoration measures are available to address these concerns.

Overall, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, permanent changes to wildlife resources within the pipeline ROW are considered cumulatively negligible assuming effective mitigation and restoration efforts with the proposed Project and other projects throughout the proposed Project route.

4.15.3.7 Fisheries

A summary of potential environmental consequences of the proposed Project activities to fisheries resources is presented in Table 4.15-11.

Table 4.15-11 CEA Matrix—Fisheries

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Increased sedimentation	(D)	(I)	LA	No
Increase in total suspended sediment	(D)	(I)	R	No
Streambed scouring and disturbance	(D)	N	PA	No
Fish behavioral changes, avoidance, stress	(D)	N	PA	No
Restriction or delay of fish movement	(D)	N	LA	No
Disruption of fish spawning	(D)	N	LA	No
Direct mortality of fish, eggs, and larvae	(D)	N	LA	No
Direct mortality of other aquatic organisms	(D)	N	LA	No
Water temperature alteration	(D)	(D)	PA	Yes
Transfer of non-native or invasive plants, animals or pathogens	(D)	(D)	R	Yes
Bank/flood plain alteration, loss of shading, nutrients, cover	(D)	(D)	PA	Yes
Reduction of aquatic habitat	(D)	N	LA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.

Potential long-term and permanent effects to fisheries resources from the proposed Project are limited to a potential rise in water temperature; loss of shading, nutrients, and cover; transfer of non-native or invasive plants, animals, and pathogens. However, the potential impacts to these fisheries resources would be reduced through protection, mitigation, and remediation measures in the CMRP. The aggregate contribution of impacted fisheries resources during the life of the proposed Project would be small in relation to the overall resources available within the cumulative project impact corridor. As a result, the potential for additive cumulative effects to these resources is limited. Potential effects on other aspects of fisheries resources from the proposed Project are either short term or negligible and cover a limited geographic extent. As further discussed below, potential cumulative effects to fisheries resources are localized and otherwise considered negligible.

With regard to the permanent effects of a potential rise in water temperature due to the pipeline temperature, an increase in water temperature can affect fish by decreasing oxygen supply, causing premature movements of juvenile fish and reduced food supply. Aquatic insects could mature more rapidly and be less available as food for the local fish population outside the immediate vicinity of the crossing. The burial depth of the proposed pipeline could mitigate these potential temperature impacts. Typical pipeline burial depth is 48 inches; however, Keystone has indicated that burial depth under streams would be a minimum of 60 inches. Additionally, HDD would bury the pipeline well below the river bottom, further mitigating potential impacts. If impacts were to occur, they would be expected to be minor to fish populations because of the isolated nature of the potential impact stream section and the likelihood of few fish in the stream reaches. Larger rivers would not be affected by water temperature changes because the volume of water flowing over the proposed pipeline would be great enough to compensate for any increases in the local temperature profile. Therefore, the cumulative impact associated with water temperature increases on fisheries is expected to be negligible.

Removal of bank vegetation (including overhead cover) could lead to bank instability and erosion. Loss of riparian vegetation reduces shading, causing an increase in water temperature and a reduction in dissolved oxygen, nutrient input, food input, and hiding cover (Brown et al. 2002, Ohmart and Anderson 1988). A reduction in escape cover can increase vulnerability of certain species to predation. Loss of riparian vegetation and disturbance to the bank and substrate can alter benthic communities and change food availability (Brown et al. 2002). Planned mitigation measures include revegetation of riparian areas upon construction completion (as described in Section 4.5, Terrestrial Vegetation), limiting the extent of riparian vegetation loss during construction, maintaining a narrow ROW width, and crossing intermittent or ephemeral streams when they are dry. These mitigation measures would minimize the potential impacts associated with the loss of shading, nutrients, and cover by making them short term. Therefore, the cumulative impact associated with the loss of shading, nutrients, and cover on fisheries is expected to be negligible.

Introduced non-native species can compete with native species and transmit diseases (e.g., whirling disease) that could adversely impact sensitive fish species. Invasive aquatic species (either plant or animal) can be introduced into waterways and wetlands and can be spread by improperly cleaned vehicles and equipment operating in water, stream channel, or wetlands (Cowie and Robinson 2003, Fuller 2003). Some invasive organisms can live in dry equipment for several days. To reduce the potential for transfer of aquatic pathogens, temporary vehicle bridges would be used to cross waterbodies to limit vehicle contact with surface waters and

sediments. During open-cut pipeline installation, in-stream activities would be conducted outside of the waterbody channel as much as practical and would limit the use of equipment within waterbodies. Workspaces would be located at least 10 feet from waterbodies and would implement erosion-control measures to reduce suspended sediment loading in waterbodies. These measures would also limit waterbody contact with vehicles and mud that could potentially serve as vectors for invasive species and whirling disease.

Impacts to fisheries resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. Impacts listed in Table 4.15-11 overlap between the proposed Project and the connected actions, and are considered collectively in the overall discussion of the proposed Project.

Overall, considerations such as fish life history stage timing, construction impact mitigation, site-specific crossing techniques, seasonal conditions, contingency plans, water quality testing, and water quality compliance would result in the proposed Project having low potential to adversely affect recreationally or commercially important fisheries as a result of construction and normal operation. As discussed in Section 4.15.3.3, Water Resources, past projects would concurrently affect invasive species to fisheries resources to the extent that there is a high density of activity in a geographic area having a similar impact. As shown on Figures 4.15.2-2 and 4.15.2-3, southeastern Nebraska and east/southeastern Montana are candidate areas for cumulative impacts associated with concurrent projects, including the proposed Project. Existing pipelines, active and abandoned mining sites, Williston basin oil and gas fields, and landfill sites are not noted to have had long-term impacts to fisheries with respect to invasive species. However, mitigation and restoration measures are available to address these concerns within the context of all of these project activities, thus the overall significance to cumulative impacts is low.

Potential impacts to fisheries associated with the current construction of the TransCanada Gulf Coast pipeline project are considered to have low overall cumulative significance. The low potential for cumulative impacts is based on the assumption that the planned mitigation measures are successful and near pre-construction conditions are restored and maintained within the anticipated timeframes. Similarly, other current water delivery system or highway maintenance and repair projects that would be constructed within or in the vicinity of the proposed Project cumulative impact corridor could result in small cumulative impacts to fisheries resources to the extent that projects are temporally concurrent. However, concurrent activities are not generally expected and mitigation measures are available to address these concerns within the context of all of these project activities, thus the overall significance to cumulative impacts is low.

Similarly, future projects could be constructed within or in the vicinity of the proposed Project cumulative impact corridor. However, future projects would occur after streams impacted by the proposed Project have recovered; therefore cumulative impacts on fisheries from reasonably foreseeable future projects are not anticipated. This conclusion is based on the assumption that the planned mitigation measures are successful and near pre-construction conditions are restored and maintained within the anticipated timeframes.

4.15.3.8 Threatened and Endangered Species

Consultation with the U.S. Fish and Wildlife Service, Bureau of Land Management, and state natural heritage programs and wildlife agencies identified 13 federally protected or candidate species that could be impacted by the proposed Project. Federally protected species are listed as

threatened or endangered under the Endangered Species Act (ESA); candidate species are actively being considered for listing. In addition, 13 state-listed species could also be impacted by the proposed Project.

Types of potential impacts to threatened and endangered (special status) species include:

- Habitat loss, alteration, and fragmentation3;
- Direct mortality during construction and operation, including collision with power lines;
- Indirect mortality due to stress or avoidance of feeding, and/or reduced breeding success due to exposure to noise and/or increased human activity; and
- Reduced survival or reproduction due to decreased abundance of food species or reduced cover.

A detailed discussion of the types of potential impacts to threatened and endangered listed above is provided in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern, and a summary of these potential impacts of the proposed Project are presented in Table 4.15-12. As indicated in Table 4.15-12, the anticipated overall absence of long-term and permanent impacts to most of the threatened and endangered species resources from the proposed Project indicates that cumulative effects to these species are expected to be minimal. However, the proposed Project may cumulatively contribute to impacts to the whooping crane (*Grus americana*) and the American burying beetle (*Nicrophorus americanus*), as further discussed below.

Table 4.15-12 CEA Matrix—Threatened and Endangered Species

Potential Species Impacted[a,b,c]	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Mammals:				
Black-footed ferret (*Mustela nigripes*)—F	(I)	(I)	PA	No
Gray wolf (*Canis lupus*)—F	(I)	(I)	LA	No
River otter (*Lontra canadensis*)—SD, NE	(I)	(I)	PA	No
Swift fox (*Vulpes velox*)—MT, SD, NE	(I)	(I)	PA	No
Birds:				
Eskimo curlew (*Numenius borealis)*—F	N	N	*	No
Greater sage grouse (*Centrocercus urophasianus*)—F	(D)	(I)	R	No
Least tern (*Sterna antillarum*)—F, MT, SD, NE, KS	(I)	(I)	LA	No
Piping plover (*Charadrius melodus)*—F	(I)	(I)	LA	No
Sprague's pipit (*Anthus spragueii)*—F	(I)	(I)	LA	No
Whooping crane (*Grus americana*)—F	(I)	(D)	LA	Yes
Bald eagle (*Haliaeetus leucocephalus*)—MT, SD, KS	(I)	(I)	LA	No
Mountain plover (*Charadrius montanus)*—NE	(I)	(I)	LA	No

[3] 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).

Potential Species Impacted[a,b,c]	Proposed Project and Connected Action Impacts: Construction	Proposed Project and Connected Action Impacts: Operation	Geographic Extent	Cumulative Impact Potential (Yes/No)
Peregrine falcon (*Falco peregrinus*)—MT, SD	(I)	(I)	LA	No
Fish:				
Pallid sturgeon (*Scaphirhynchus albus)*—F	(I)	(I)	PA	No
Topeka shiner (*Notropis topeka)*—F	(I)	(I)	PA	No
Black nose shiner (*Notropis heterolepis*)—SD, NE	(I)	(I)	PA	No
Blackside darter (Percina maculata)—KS	(I)	(I)	PA	No
Finsecale dace (*Phoxinus neogaeus*)—SD, NE	(I)	(I)	PA	No
Northern redbelly dace ((*Phoxinus eos*)—MT, SD, NE	(I)	(I)	PA	No
Pearl dace (*Margariscus margarita*)—MT, SD	(I)	(I)	PA	No
Sicklefin chub (*Macrhybopsis meeki*)—MT, SD, KS	(I)	(I)	PA	No
Sturgeon chub (*Macrhybopsis gelida*)—MT, SD, NE, KS	(I)	(I)	PA	No
Invertebrates:				
American burying beetle (*Nicrophorus americanus)*—F	(D)	(D)	LA	Yes
Reptiles:				
Massasauga (*Sistrurus catenatus*)—NE	(D)	(I)	LA	No
Plants:				
Blowout penstemon (*Penstemon haydenii)*—F	(I)	(I)	LA	No
White fringed prairie orchid (*Platanthera praeclara)*—F	(D)	(I)	LA	No
White lady's slipper (*Cypripedium candidum*)—NE	(D)	(I)	LA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.; *—The Eskimo curlew has not been found in Nebraska since 1926 (Gollop et al. 1986).
[a] Federally listed species are presented in alphabetical order first, followed by the state-listed species in alphabetical order.
[b] An F following the species name indicates a federal listing or proposed federal listing (may or may not also be a state-listed species).
[c] MT, SD, NE, KS following the species name indicates the state(s) in which the species is state-listed.

The American burying beetle could likely experience some direct mortality during construction with reduced habitat causing long-term impacts and a delay in population recovery. To minimize this impact several avoidance and mitigation measure (as discussed in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern) would be implemented. Additionally, in compliance with the ESA, Keystone has agreed to develop, in conjunction with the U.S. Fish and Wildlife Service, an American Burying Beetle Trust. This trust would provide

monetary compensation that would be used by a third-party nonprofit organization for habitat acquisition or other conservation measures as compensatory mitigation. Funds would be used to support conservation efforts of the American burying beetle within its historical range. Conservation efforts implemented to offset potential losses would reduce the cumulative impacts associated with the proposed Project. Any future projects in the area that reduce and fragment preferred habitat for the American burying beetle may provide the potential for additive cumulative effects to this species. Any additional potential losses would likely require similar conservation methods and mitigations, thus reducing overall cumulative impacts on the American burying beetle.

The whooping crane may experience long-term impacts associated with riparian areas that may be used for roosting and feeding. The use of the HDD method at major river crossings would reduce the probability of roosting and feeding habitat loss or alteration. In other areas along the corridor, revegetation (particularly within riparian zones and in wetland habitats) would reduce habitat impacts. The regeneration of revegetated areas may be slow, which may cause long-term roosting and feeding habitat loss. Future projects in the area that reduce and fragment preferred roosting and feeding habitat for the whooping crane may provide the potential for additive cumulative effects to this species.

Other than the whooping crane and the American burying beetle, the majority of the potential Project effects to threatened and endangered species resources would be indirect, short term or negligible, limited in geographic extent, and associated with the construction phase of the proposed Project only. Indirect and short-term impacts associated with construction of the proposed Project may include reduced threatened and endangered species use due to increased human interaction; habitat fragmentation, alteration, and loss; stress and reduced breeding success due to noise, vibration, and human activity; creation of barriers to movement; and reduction in patch size of available habitat. Thus, there is limited potential for cumulative effects of these impacts to be cumulative with other projects; however, additional discussion of threatened and endangered species of concern is presented below.

Incremental loss or alteration of black-tailed prairie dog colonies through prior project construction and operation in addition to similar effects from the proposed Project could lead to cumulative impacts on the black-footed ferret and the mountain plover in Montana and South Dakota. However, the black-tailed prairie dog colonies that would be crossed by the proposed Project were determined to be too small to support black-footed ferrets. Short, medium, or long-term loss or alteration of native grassland and sagebrush habitats through the spread of invasive plants in Montana and South Dakota from previous projects in addition to similar impacts from the proposed Project could contribute to cumulative habitat impacts for federal candidate-for-listing birds, including the greater sage-grouse and Sprague's pipit.

Incremental impacts to streams and riparian habitats from future linear project construction and the accidental spread of exotic aquatic invasive plants and animals could increase cumulative impacts to threatened and endangered species habitat. Increased competition from invasive species could contribute to cumulative impacts to native freshwater mollusks and prairie stream fishes, which have been increasingly recognized as vulnerable. Multiple stream and wetland crossings, especially those associated with small clear springs and streams or freshwater mussel beds, could result in impacts to habitat quality that could, in conjunction with the impacts of the proposed Project, affect federally protected aquatic species of conservation concern. The spread of invasive plants could also result in cumulative habitat impacts to federally and state-listed

plants, if present, including the western prairie fringed orchid (*Platanthera praeclara*) and the small white lady's slipper (*Cypripedium candidum*).

The proposed Project could potentially affect migratory birds within their migration range from Texas to Montana and/or within their breeding habitats. Conservation measures proposed for three of these birds (i.e., whooping crane, piping plover, and interior least tern) include protection of river and riparian nesting and migration staging habitats through use of HDD crossing methods and site-specific surveys to avoid disturbance to migration staging, nesting, and brood-rearing individuals. Habitat and disturbance impacts at major river crossings from future linear projects would likely incorporate similar conservation measures to avoid and minimize affects to these birds.

Implementation of appropriate conservation measures as determined through consultations with federal, state, and local agencies for state-protected sensitive species and federally protected threatened, endangered, or candidate species for the proposed Project and for future projects would include habitat restoration, impact avoidance, and impact minimization, which would ameliorate long-term cumulative impacts. Proposed Project reclamation includes restoration of native vegetation and soil conditions and prevention of spread and control of noxious weeds for disturbed areas. Unavoidable alteration and maintenance of vegetation structure to ensure pipeline safety and to allow for visual inspection would result in some conversion of tall shrub and forested habitats to herbaceous habitats. These conversions are not expected to adversely affect or contribute to cumulative impacts for any federally protected threatened or endangered species.

Impacts to threatened and endangered species from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) would be long term or permanent. The greater sage-grouse, Sprague's pipit, and threatened, endangered, or otherwise special-status species may be impacted by habitat loss resulting from construction of the Bakken Marketlink project, along with future projects in the area that reduce and fragment preferred habitat for these species. However, habitat loss would be mitigated and any additional potential habitat loss would likely require similar conservation methods and mitigations, thus reducing overall cumulative impacts on these species.

The transmission line, electrical distribution lines, and substations could result in long-term increased bird collisions, bird predation, and habitat loss. However, with implementation of mitigation measures described in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern, it is not expected that these lines would have cumulative impacts on birds protected under the U.S. Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act. Future electrical power transmission lines and the distribution lines that would serve pump stations and mainline valves (MLVs) of the proposed Project or any other future projects could incrementally increase the collision hazard for protected or candidate migratory birds. Cumulative collision mortality affects would be most detrimental to the whooping crane, interior least tern, and piping plover; while perches provided by towers and poles could increase the cumulative predation mortality for ground-nesting birds, including the greater sage-grouse, interior least tern, mountain plover, piping plover, and Sprague's pipit.

In summary, the primary impact concerns with respect to potential cumulative effects to threatened and endangered species is the direct mortality of the American burying beetle during construction and operation of the proposed Project, and the reduction and fragmentation of

preferred roosting and feeding habitat (riparian areas) for the whooping crane. These impacts represent the primary areas for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects and could occur where there is potential geographic overlap. Occurrences of these species, along with the known locations of past, present, and reasonably foreseeable future projects are shown on Figure 4.15.3-1 and Figure 4.15.3-2 for South Dakota and Nebraska, respectively (these species are not of concern in Montana). Other past, present, and foreseeable future projects in South Dakota (as indicated on Figure 4.15.3-1) are relatively sparse with significant geographic separation. However, American burying beetle locations in Nebraska occur within the proposed Project in addition to there being several other projects in proximity to these locations. Furthermore, there are potential impacts to the American burying beetle associated with the concurrent construction of the TransCanada Gulf Coast pipeline project. Construction of new pipelines or other ground-disturbing projects through southern South Dakota and north-central Nebraska could contribute to cumulative mortality and loss of habitat. Any additional potential losses within this species would likely require conservation methods and mitigations, thus reducing overall cumulative impacts on the American burying beetle. The central flyway whooping crane migration corridor overlaps with the proposed Project in Nebraska. Cumulative impacts to the whooping crane associated with the concurrent construction of the TransCanada Gulf Coast pipeline project are also considered. If construction periods between the TransCanada Gulf Coast pipeline project overlap with the proposed Project, they would likely do so for a short period of time only. It should be noted that the potential for a given impact to contribute to cumulative impacts is based on the assumption that the CMRP (Appendix G) is successful and 'near pre-construction' conditions are restored and maintained within the anticipated timeframes.

4.15.3.9 Land Use, Recreation, and Visual Resources

A summary of potential environmental consequences of the proposed Project activities to land use, recreation, and visual resources is presented in Table 4.15-13.

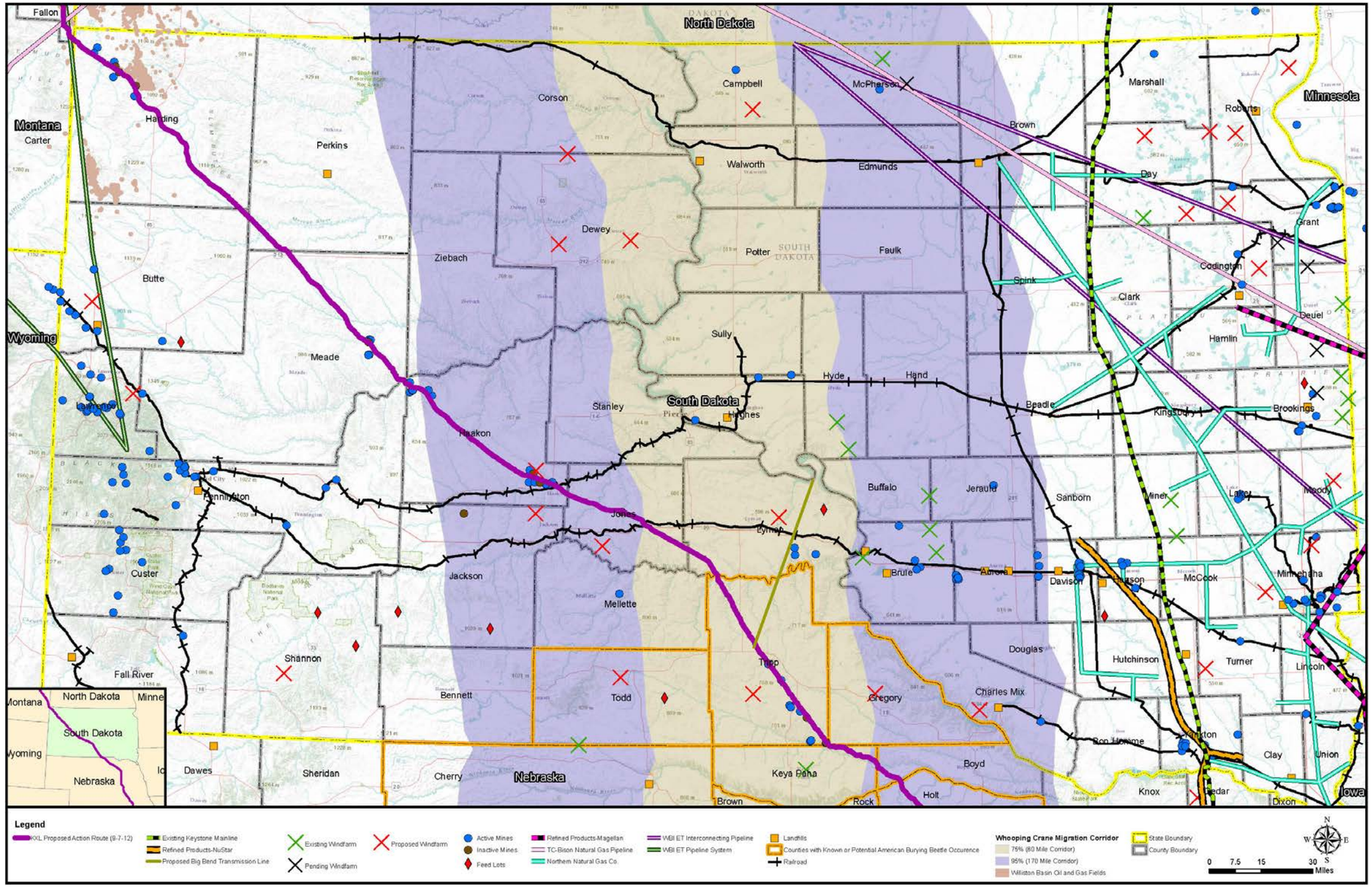
Table 4.15-13 CEA Matrix—Land Use, Recreation, and Visual Resources

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Land Ownership	(D)	(D)	PA	Yes
Agricultural Land, Rangeland, Prime Farmland	(D)	(D)	PA	No
Developed Land	(D)	(D)	PA	No
Forest	(D)	(D)	PA	Yes
Recreation and Special Interest Areas	(D)	(D)	PA	No
Visual Resources	(D)	(D)	LA	Yes

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities.



Source: See Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions.

Figure 4.15.3-1 Known Locations of Past, Present, and Reasonably Foreseeable Future Projects in South Dakota with American Burying Beetle Areas of Potential Occurrence and Central Flyway Whooping Crane Migration Corridor

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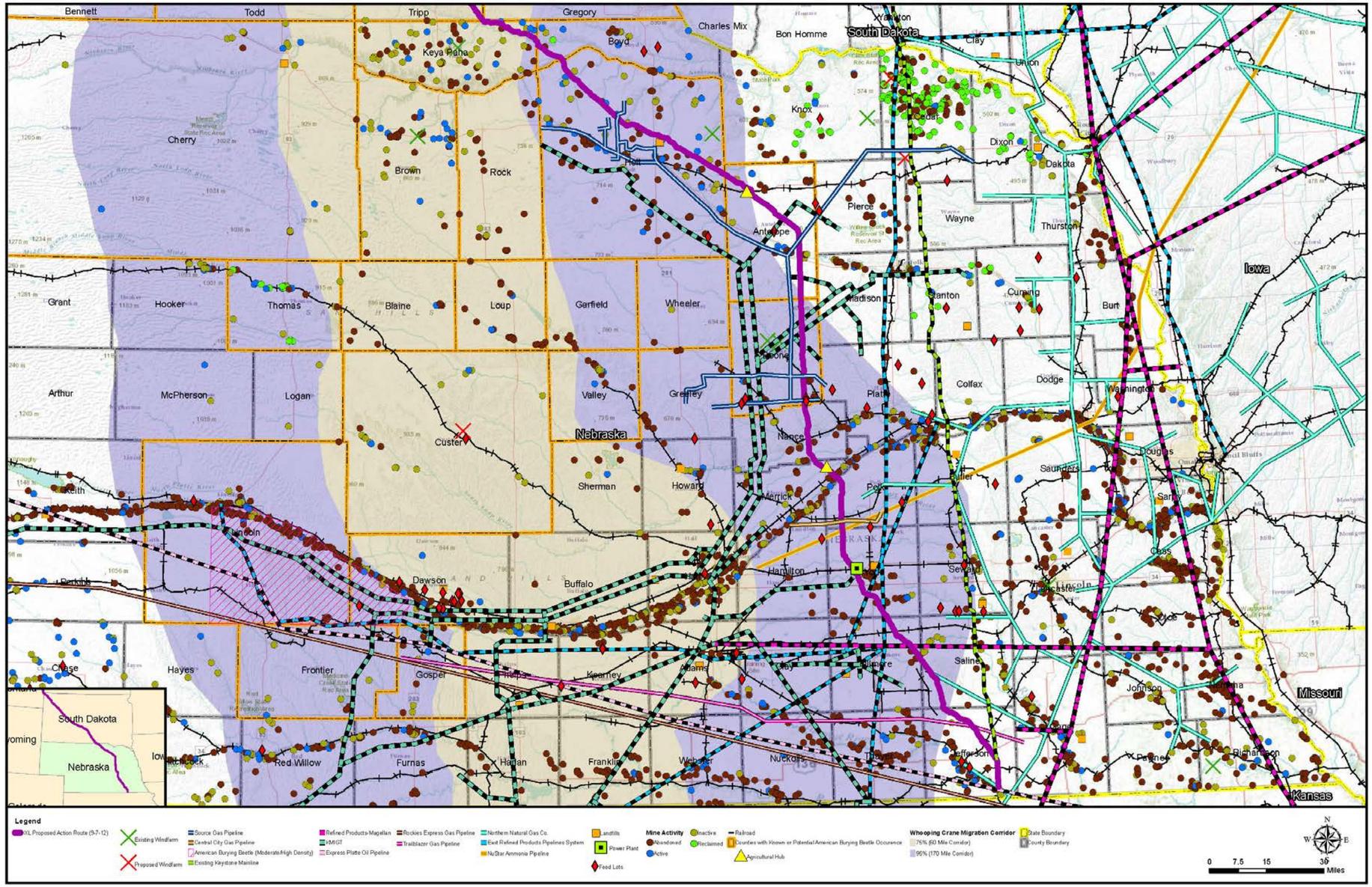

Source: See Appendix V, Past, Present, and Reasonably Foreseeable Future Project Descriptions.

Figure 4.15.3-2 Known Locations of Past, Present, and Reasonably Foreseeable Future Projects in Nebraska with American Burying Beetle Areas of Potential Occurrence and Central Flyway Whooping Crane Migration Corridor

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The proposed Project would require the acquisition of permanent easements from landowners and land managers along the pipeline ROW and at the locations of proposed ancillary facilities (approximately 5,501 acres). Long-term impacts are associated with changes in land use; however, most of the land affected by the proposed Project is used for agriculture and rangeland (approximately 90 percent). Disturbed agricultural land and rangeland would be returned to approximate pre-construction use and capability. Therefore, potential cumulative effects to land use are primarily localized and are considered to have low overall significance.

Permanent impacts to forested lands are associated with the clearing of trees and shrubs within the ROW, and permanent impacts to visual resources are associated with aboveground structures such as pump stations and transmission lines associated with connected actions to the proposed Project. These aspects are further discussed below.

Visual effects, particularly those associated with ROW disturbance in agricultural areas, would likely be substantially reduced with the first crop growth. Over the long-term, perceptible visible changes resulting from construction and operation would contribute, in the presence of similar facilities from past or future projects, to an intensified industrial character within the proposed Project cumulative impact corridor that could adversely affect the visual quality of the area. However, the proposed Project alignment has been selected to reduce adverse aesthetic impacts where possible, and measures to reduce long-term visual impacts to insignificant levels would be implemented as described in the proposed Project CMRP (see Appendix G). Visual effects would largely be limited to travelers along the major transportation corridors in the vicinity of the proposed Project. Their views would typically be limited to short periods of time and small portions of the ROW. Overall, as further discussed below, potential cumulative effects to land use, recreation, and visual resources are primarily localized and are considered to have low overall significance

Temporary changes in land use due to construction would include loss of agricultural productivity, potential damage to drain tiles or other irrigation systems, visual impacts from the removal of vegetation within the ROW, increased noise and dust, and disturbance of contracted conservation benefits during the construction period and until any contracted conservation benefits are restored. If the ROW requires maintenance, it may not be possible to restore certain types of contracted conservation benefits. Sightseers, hikers, wildlife viewers, fishers and hunters, and other recreationists would be temporarily dislocated, although impacts are expected to be short term. There are no major recreation areas in the vicinity of the proposed route; recreational use access would not be affected by proposed Project operations within special management areas; and the proposed Project would not cross rivers within any reaches that have been designated by federal, state, or local authorities as wild and/or scenic. Therefore, few recreationists would be affected. The proposed Project alignment has been selected to reduce adverse aesthetic impacts where possible, and measures to reduce long-term visual impacts to insignificant levels would be implemented as described in the proposed Project CMRP. In addition, potential adverse impacts to forestland would be reduced through protection, reclamation, and remediation measures in the CMRP. The aggregate contribution of lands committed to industrial uses during the life of the proposed Project would be small in relation to the number of acres available for these land uses.

Impacts to land use, recreation, and visual resources from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. Potential impacts to land use, recreation, or visual resources of the Bakken

Marketlink Project would be evaluated and avoided, minimized, or mitigated in accordance with applicable regulations during the environmental reviews for these projects. The analysis of environmental effects associated with the proposed 230-kV transmission line would be handled under a separate environmental review. Based on currently available information, it is likely that changes to visual resources would be both temporary (e.g., digging the foundations for power poles) and permanent (e.g., erection of power poles and lines). Most of the landscape changes caused by the proposed Project would be visible as linear changes to vegetation patterns. Due to the need for a cleared power distribution line ROW, operational impacts in forested lands are greater than for other land uses. As above, however, the aggregate contribution of forest lands converted to other land uses during the life of the proposed Project would be small in relation to the number of acres available. Where remaining impacts listed in Table 4.15-5 overlap between the proposed Project and the connected actions, these are considered collectively in the overall discussion of the proposed Project.

In summary, with respect to land use, recreation, and visual resources, long-term/permanent impacts include land use, forested lands within the ROW (already addressed in Section 4.15.3.4, Wetlands, and 4.15.3.5, Terrestrial Vegetation, and not further discussed here), and visual resources associated with aboveground structures such as pump stations and transmission lines associated with connected actions to the proposed Project. These are potential areas for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects.

Past projects would concurrently affect land use and visual resources to the extent that there is a high density of activity in a geographic area having a similar impact. As shown on Figures 4.15.2-2 and 4.15.2-3, southeastern Nebraska and east/southeastern Montana are candidate areas for cumulative impacts associated with concurrent projects, including the proposed Project. Existing and abandoned mining sites, Williston basin oil and gas fields, railroads, and landfill sites may all have a mixture of long-term to permanent impacts on land use and visual resources. However, given that most of the land affected by the proposed Project is used for agriculture and rangeland (approximately 90 percent), which would be returned to approximate pre-construction use and capability, potential cumulative effects to land use and visual resources are considered to have low overall significance. Although not geographically connected, current construction of the TransCanada Gulf Coast pipeline project is included in the consideration of land use and visual resource impacts. However, effects to land use and visual resources are primarily evaluated on a local level, and would not contribute to a geographically meaningful cumulative impact. Other current projects such as highway maintenance and repair (which does not involve new construction) would not cumulatively combine with land use and visual resources of the proposed Project. Water delivery systems are also not expected to result in significant impacts to land use and visual resources due to limited associated aboveground structures. Therefore, current projects would not contribute to cumulative impacts on land use and visual resources.

Future projects that could potentially contribute to cumulative impacts to land use and visual resources include the BakkenLink pipeline, the Bakken Marketlink, and the Bakken Crude Express pipeline projects. In addition, electrical transmission lines, wind power projects, and oil and gas mining activities could all have perceptible changes to land use and visual resources resulting from construction and operation, and would contribute to an intensified industrial character within the proposed Project cumulative impact corridor that could adversely affect the visual quality of the area. This effect may be particularly prominent where projects overlap geographically with the proposed Project in east/southeastern Montana and southeastern Nebraska.

4.15.3.10 Socioeconomics

The focus of the CEA is long-term or permanent adverse cumulative effects, and as noted at the beginning of this section, cumulative beneficial impacts are not addressed in this CEA. However, as discussed in Sections 3.10, Socioeconomics (Affected Environment), and 4.10, Socioeconomics (Environmental Consequences), it is noted that the positive economic impacts of the proposed Project as well as past and most present projects (up to 2010) are already reflected in existing conditions. Insufficient information is available for other present and reasonably foreseeable projects to quantify cumulative positive impacts of these projects in combination with the proposed Project; however, it should be noted that the proposed Project alone has significant temporary positive impacts (Section 4.10, Socioeconomics (Environmental Consequences)). A summary of potential environmental consequences of the proposed Project activities to socioeconomic resources is presented in Table 4.15-14.

Table 4.15-14 CEA Matrix—Socioeconomics

Potential Impact Area	Proposed Project and Connected Action Impacts: Construction	Proposed Project and Connected Action Impacts: Operation	Geographic Extent	Cumulative Impact Potential (Yes/No)
Population	N	N		No
Housing	N	N		No
Economic Activity	D	N	R	No
Environmental Justice	(D)	D	LA	No
Public Services, Tax Revenues, Property Values	D	D	R	Yes
Traffic and Transportation	(D)	N	PA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.

The only permanent socioeconomic impacts associated with the proposed Project, under normal operations would be the beneficial effects associated with property tax revenues and the small amount of employment and earnings associated with operations and maintenance of the pipeline. During construction, with respect to employment, the construction, accommodations and food services, professional services and manufacturing sectors would be the largest beneficiaries of the proposed Project, followed trade, and health and social services. Other industries with impacts exceeding 1,000 jobs would be real estate and rental, administrative and waste services, finance and insurance, transportation and warehousing, and other services. As further discussed below, the anticipated overall absence of long-term or permanent adverse socioeconomic impacts from the proposed Project indicates that adverse cumulative effects to this resource area are not expected. Where long-term or permanent adverse impacts are absent, the potential for additive cumulative effects with other past, present, and reasonably foreseeable future projects is also negligible.

The proposed Project area is predominantly rural and sparsely populated. The population density for the pipeline corridor counties is approximately eight persons per square mile. Keystone proposes to meet the housing need through a combination of construction camps and local housing. The influx of construction workers into local communities has the potential to generate additional demands on local public services (e.g., emergency response, medical, police, and fire protection services). The construction camps would reduce impacts on basic public services in nearby communities that could otherwise be incurred without construction camps. Therefore, impacts to proposed Project area population and housing during construction would be minor and temporary. Operation of the proposed Project would require relatively few permanent employees; thus, there would be little contribution to long-term cumulative impacts on population, housing, municipal services, or traffic in the proposed Project area.

Construction of the proposed Project could lead to short-term impacts to property values due to short-term visual, noise, and land disturbance effects. Land disturbed by the proposed Project would be restored to the extent practicable; to repair or restore drain tiles, fences, and land productivity damaged or adversely affected during construction; and to compensate property owners for any additional damages caused by proposed Project construction. The Final EIS concluded it did not appear that the proposed Project would have a major impact on residential and agricultural property values, and the analysis in this Supplemental EIS does not change this conclusion. Therefore, long-term impacts, and the potential for cumulative impacts to property values with other past, present, and reasonably foreseeable future projects are considered negligible.

Keystone would work with local law enforcement, fire departments, and emergency service providers, including medical aid facilities, to establish appropriate and effective emergency response measures. This information would be included in the emergency response plan developed prior to the implementation of the proposed Project with special emphasis on considerations of low income and minority communities in those preparedness efforts.

Similarly, construction activities could result in short-term impacts to traffic and transportation infrastructure. However, these impacts would be minor and temporary. Keystone's proposed Project CMRP includes measures to reduce or avoid traffic and transportation impacts on local communities. In addition, Keystone would submit a road use plan prior to mobilization of construction vehicles, and a monitoring plan that would include inspection of roadways and roadway structures, repair of damage that may occur to those facilities, establishment of an approved Traffic Management Plan, and coordination with state and local transportation agencies. Permanent access roads constructed as part of the proposed Project would not change traffic patterns on public roads.

With respect to environmental justice considerations, impacts to minority and low-income populations during construction could include exposure to construction dust and noise, disruption to traffic patterns, and increased competition for medical or health services in underserved populations. A total of 16 areas with environmental justice populations were identified as being potentially affected by construction activity or by the pipeline itself after it became operational. In areas in Montana, South Dakota, and Nebraska where construction camps would be provided, minor medical needs of workers would be handled in these camps, thus reducing the potential need for medical services from the surrounding communities. As a result, the impact of increased demand for medical services on local minority and low-income populations would be small and short term. In addition to avoidance and mitigation measures that Keystone proposes to minimize negative impacts to all populations in the proposed Project area, specific mitigation for

environmental justice communities would involve ensuring that adequate communication in the form of public awareness materials regarding the construction schedule and construction activities is provided.

Socioeconomic impacts, including environmental justice considerations, from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. Where impacts listed in Table 4.15-5 overlap between the proposed Project and the connected actions, these are considered collectively in the overall discussion of the proposed Project.

In summary, with respect to socioeconomics, permanent impacts associated with the proposed Project, under normal operations, would be the beneficial effects associated with property tax revenues and the small amount of employment and earnings associated with operations and maintenance of the pipeline. Additional consideration of beneficial impacts in combination with the effects of past, present, or reasonably foreseeable future projects is not addressed in this CEA. With respect to adverse effects, short-term impacts to minority and low-income populations may occur during construction of the proposed project. When considered in combination with other past, cumulative impacts would only occur where concurrent and/or successive construction schedules of other geographically overlapping projects. Thus environmental justice cumulative impacts are not expected associated with past and future projects where construction is complete or proposed in the future. With respect to short-term cumulative impacts associated with concurrent construction of geographically overlapping present projects, these projects include water delivery systems, highway maintenance and repair projects, and grain and agronomy hubs, and potential cumulative impacts are expected to be small and short-term. In addition to avoidance and mitigation measures that Keystone proposes to minimize negative impacts to all populations in the proposed Project area, specific mitigation for environmental justice communities would involve ensuring that adequate communication in the form of public awareness materials regarding the construction schedule and construction activities is provided.

4.15.3.11 Cultural Resources

A summary of potential environmental consequences of the proposed Project activities to cultural resources is presented in Table 4.15-15. Direct permanent impacts to cultural resources could include damage to cultural resources within the construction footprint, the loss of community access to cultural resources, and visual impacts to properties such as historic or traditional cultural properties within or immediately adjacent to the permanent ROW and ancillary facilities. However, the proposed Project route was designed to avoid disturbing historic properties to the maximum extent possible. Therefore, only a small number of properties designated as culturally significant are potentially impacted by the proposed Project, based on current survey information.[4] As a result, the potential for additive cumulative effects in terms of direct damage, access, and visual impacts to cultural resources is also limited. This is further discussed below

[4] Additional cultural resources surveys within the proposed Project corridor, access roads, and ancillary facilities are ongoing. The Department will continue to consult with state and federal agencies and Native American tribes about the significance of the sites and work to avoid any adverse effects to the resources, to the extent practicable.

Table 4.15-15 CEA Matrix—Cultural Resources

Potential Impact Area	Proposed Project and Connected Action Impacts: Construction	Proposed Project and Connected Action Impacts: Operation	Geographic Extent	Cumulative Impact Potential (Yes/No)
Damage/destruction of cultural resources, including previously undiscovered	(D)	(D)	PA	Yes
Vibrations from equipment during earthmoving activities	I	I	PA	No
Loss of access to cultural resources	(D)	(D)	PA	Yes
Visual impacts to cultural resources	I	(I)	LA	Yes
Increased dust and noise	(I)	(I)	PA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Notes: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Project Area (PA)—Defined by limits of ROW and ancillary facilities, e.g., access roads, pump stations, and construction camps; Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities.

The determination of significance for cultural resources is determined by a resource's eligibility for inclusion in the National Register of Historic Places (NRHP), although it should be noted that the NRHP status of some cultural resources remains undetermined in much of the proposed Project area, and surveying is ongoing. Direct impacts, such as unanticipated discovery of previously unknown cultural resources during construction, could have a permanent impact on that resource. For all cultural resources listed in the NRHP, considered to be eligible for the listing in the NRHP, or unevaluated, avoidance would continue to be the preferred mitigation strategy. For any historic properties unavoidably adversely affected by the proposed Project, mitigation measures would be developed as part of a Treatment Plan to be incorporated into the Programmatic Agreement.

To mitigate potential impacts, Keystone has committed, whenever feasible, to avoid known cultural resources, minimize impacts when avoidance is not possible, and mitigate impacts when minimization is not sufficient. Avoidance would be achieved by keeping construction activities away from NRHP-eligible properties, limiting the effect on existing demonstrated disturbance areas, and avoiding cultural resources by boring or HDD. In addition, the proposed Project plans to implement Unanticipated Discovery Plans, to minimize impacts to unknown cultural resources that may be inadvertently encountered during construction or operation of the proposed Project. Should a cultural resource discovered in this fashion appear to be significant, additional mitigation measures would be considered, as feasible and appropriate.

Indirect potential impacts during proposed construction such as noise, dust, vibrations, and heavy equipment traffic would be temporary, and would be expected to last for the duration of construction in specific areas for discrete periods of time. Given the temporary nature of construction of the pipeline and ancillary facilities, such as pipe and contractor yards, no permanent noise, dust, vibrations, and heavy equipment traffic effects to cultural resources, specifically historic structures, are anticipated.

During operation of the proposed Project, only previously disturbed areas would be expected to require periodic disturbance; therefore, the potential for additional direct impacts to cultural

resources would be very limited. Indirect impacts during operations could consist of a permanent change in viewshed to historic or traditional cultural properties near permanent ancillary facilities, such as pump stations and MLVs, and a periodic increase in noise, vibration, and dust created by pump stations or vehicular traffic conducting operation and maintenance activities. Given the nature, location, and setting of permanent ancillary facilities, however, these facilities are unlikely to significantly visually impact the setting and feeling of historic or traditional cultural properties, due to their distance, the low-lying nature of these facilities, and various vegetative and topographic elements of the landscape in such areas. Similarly, periodic increase in noise, vibration, and dust created by ancillary facilities or vehicular traffic conducting operation and maintenance activities would not be expected to cause any adverse effects to such cultural resources.

Cultural resource impacts from the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. Where impacts listed in Table 4.15-15 overlap between the proposed Project and the connected actions, these are considered collectively in the overall discussion of the proposed Project.

In summary, permanent impacts to cultural resources could include direct damage to cultural resources within the construction footprint, the loss of community access to cultural resources, and visual impacts to properties such as historic structures or traditional cultural properties within or immediately adjacent to the permanent ROW and ancillary facilities. These are potential areas for cumulative impacts to occur with other past, present, and reasonably foreseeable future projects.

Past projects in the area that have historically impacted cultural resources may provide the potential for additive cumulative effects; however, the relatively low likelihood of cultural resource impacts by the proposed Project, combined with the implementation of Unanticipated Discovery Plans (minimizing impacts to unknown cultural resources that may be inadvertently encountered), heavily influences the evaluation of cumulative effects to cultural resources overall[5]. There would be little incremental additive effect to cultural resources from the proposed Project with other past projects; therefore, overall cumulative significance is considered low.

Currently, although not geographically connected, construction of the TransCanada Gulf Coast pipeline project is included in the consideration of impacts to cultural resources. However, effects to cultural resources are primarily evaluated on a local level, and would not contribute to a geographically meaningful cumulative impact. Other current projects such as highway maintenance and repair (which does not involve new construction) would not cumulatively combine with land use and visual resources of the proposed Project. In addition, known sites would be avoided or mitigated to the degree practicable as required by Section 106 of the NHPA during implementation of all current projects.

Contribution to cumulative impacts on cultural resources could result from future projects to the extent that they disturb known or currently unidentified archaeological sites and historic structures, or degrade in-place mitigation for previously disturbed historical properties. However, known sites would be avoided or mitigated to the degree practicable as required by Section 106

[5] Additional cultural resources surveys within the proposed Project corridor, access roads, and ancillary facilities are ongoing. The Department will continue to consult with state and federal agencies and Native American tribes about the significance of the sites and work to avoid any adverse effects to the resources, to the extent practicable.

of the NHPA during future project implementation. Therefore, future projects are not expected to significantly contribute to cumulative impacts on cultural resources.

Overall, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, permanent changes to cultural resources within the pipeline ROW are considered negligible assuming effective mitigation and restoration efforts with the proposed Project and other projects throughout the proposed Project route.

4.15.3.12 Air Quality and Noise

A summary of potential environmental consequences to air quality and due to noise from the proposed Project activities is presented in Table 4.15-16.

Table 4.15-16 CEA Matrix—Air Quality and Noise

Potential Impact Area	Proposed Project and Connected Action Impacts		Geographic Extent	Cumulative Impact Potential (Yes/No)
	Construction	Operation		
Combustion emissions from contractor camp back-up emergency generators (criteria pollutants and hazardous air pollutants)	(D)		R	No
Combustion emissions from non-road and on-road sources and open burning (criteria pollutants and hazardous air pollutant s)	(D)		R	No
Fugitive dust emissions from disturbed land and paved roads (PM, PM_{10} and $PM_{2.5}$)[a]	(D)		R	No
Fugitive volatile organic compound (VOC) emissions from storage tanks, valves, pumps, flanges, and connectors	**N**	**N**	R	No
Combustion emissions from offsite electricity usage at construction camps and pump stations (as CO_2 equivalents)	(I)	(I)	R	Yes
Fugitive methane emissions from valves, pumps, flanges and connectors (as CO_2 equivalents)	**N**	**N**	R	No
Noise from heavy construction equipment and vehicles	(D)		LA	No
Noise from HDD	(D)		LA	No
Noise from blasting	(D)		LA	No
Noise from pump stations	(D)	(D)	LA	Yes
Noise from substations	(D)		LA	No

Duration of Impact
—Negligible
—Temporary/Short Term (<3 yr.)
—Long-Term (>3 yr.)
—Permanent

Type of Impact
N —Negligible Impact
D —Direct Impact
I —Indirect Impact

Note: Parentheses around impact indicates that it would be addressed by implementation of Keystone's CMRP, additional mitigations, and/or existing laws and regulations.
Geographic Extent of Potential Impact: Local Area (LA)—Defined as a 2-mile distance on either side of the pipeline ROW and ancillary facilities; Regional (R)—Defined by resource, e.g., home ranges of wildlife species, bird migration corridor, regional airshed, etc.
[a] PM = particulate matter; PM_{10} = particulate matter with aerodynamic diameter of 10 microns and less; $PM_{2.5}$ = particulate matter with aerodynamic diameter of 2.5 microns and less.

Noise

As further discussed below, the anticipated overall absence of permanent impacts due to noise generated from the proposed Project indicates that cumulative effects to this resource area are not expected. As indicated in Table 4.15-16, there may be long-term impacts due to noise from pump stations; however, these effects are considered negligible due to the low levels of noise generated at the pump stations throughout the proposed Project route. Where long-term or permanent impacts are absent, the potential for additive cumulative effects with other past, present, and reasonably foreseeable future projects is also negligible.

Most of the potential effects from noise are short term and associated with the construction phase of the proposed Project only. Short-term noise impacts may be generated during the construction phase by construction equipment and vehicles, HDD, blasting, pump stations, and substations. Potential effects from noise could include direct impacts to wildlife, residences, recreation, special interest areas, and livestock. The noise levels could be perceived as moderately loud with a significant effect over existing levels; however, any peak noise levels would be temporary and intermittent, generally limited to daylight hours, and would decrease with distance. Nighttime noise levels would normally be unaffected because most construction activities would be limited to daylight hours. Potential exceptions include completion of critical tie-ins on the ROW; HDD operations if determined by the contractor to be necessary; and other work if determined necessary based on weather conditions, safety, or other proposed Project requirements. To protect property and livestock, Keystone would provide adequate notice to adjacent landowners or tenants in advance of blasting. Blasting activity would be performed during daylight hours and in compliance with federal, state, and local codes and ordinances and manufacturer-prescribed safety procedures and industry practices. In areas near residences and businesses where construction activities or noise levels may be considered disruptive, pipeline work schedules would be coordinated to minimize disruption. In addition, noise mitigation would be implemented in accordance with Keystone's CMRP (see Appendix G) and specific landowner or land manager requirements.

Noise generated from the pump stations may be a source of long-term impacts to nearby resources. Keystone would consider the following noise abatement options: aboveground pipe lagging, pump blankets, motor air intake enclosures, and engineering sound barriers. To the extent practicable, Keystone would not site pump stations close to noise-sensitive receptors. For all pump stations, Keystone would observe the USEPA noise standard of 55 decibels on the A-weighted scale (day-night sound level) for each pump station. Recommended noise mitigation measures from operating the pump stations listed in Section 4.12.4.3, Noise, would be implemented. Mitigation efforts implemented to offset noise impacts would reduce the cumulative impacts associated with the proposed Project.

Impacts from noise associated with the construction and operation of the connected actions (Bakken Marketlink Project, Big Bend to Witten 230-kV Transmission Line, and Electrical Distribution Lines and Substations) are not substantially different from the proposed Project. The duration of noise impacts are all temporary and short term and associated with construction activities.

In summary, there is the potential for noise impacts from the long-term operation of pump stations to be cumulative with other past, present, and reasonably foreseeable future projects. However, because of planned mitigation measures (Section 4.12.4.3, Noise), only low levels of noise would be generated at the pump stations throughout the proposed Project route, and the

relative contribution (and incremental additive effect) of noise generated by the proposed Project is negligible. Currently, although not geographically connected, construction of the TransCanada Gulf Coast pipeline project is included in the consideration of impacts to noise. However, because noise impacts are primarily evaluated on a local level, they would not contribute to a geographically meaningful cumulative impact, in combination with the proposed Project. Other current or future projects in the area with potential long-term/permanent noise impacts may provide the potential for additive cumulative effects of noise. Here too, the relative contribution (and incremental additive effect) of noise generated by the proposed Project is negligible. Furthermore, additional potential noise contributors would likely implement similar mitigations, thus reducing overall cumulative impacts from noise.

Overall, with respect to the proposed Project in combination with the past, present, and foreseeable future projects, including the Gulf Coast pipeline project, permanent changes to noise levels within the pipeline ROW are considered negligible assuming effective mitigation efforts with the proposed Project and other projects throughout the proposed Project route.

Air Quality

Pipeline Construction and Operation

Contribution to cumulative air quality impacts resulting from construction of the proposed Project would be from activities that generate fugitive dust (e.g., excavation and materials handling) and combustion air emissions (criteria pollutants and GHGs) from construction camp generators, non-road sources, on-road sources, and open burning. Commercial power supply would be available for the construction camps, so indirect GHG emissions from electricity usage at the camps could be significant, and direct GHG emissions from backup generators would be negligible. Contractors would be required to implement dust-minimization practices to control fugitive dust during construction as described in Section 4.12.3.1, Air Quality, and follow local or state ordinances, including the application of water sprays and surfactant chemicals and the stabilization of disturbed areas. Contractors would also be required to maintain all fossil-fueled construction equipment in accordance with manufacturer's recommendations to minimize construction-related emissions. In general, construction activity would occur over a 6- to 8-month seasonal construction period; however, the majority of pipeline construction activity associated with land disturbance (clearing, trenching, and excavation) would generally pass by a specific location within a 30-day period before final grading, seeding, and mulching takes place, thereby resulting in minor short-term contributions to cumulative air quality impacts.

There would be no current contribution to cumulative impacts from the construction of past or future projects since the impacts of these projects are short-term and occur at the time of construction only. As a result, contributions to cumulative air quality impacts within the proposed Project cumulative impact corridor from construction of the proposed Project and past or future reasonably foreseeable projects would be negligible.

Contribution to cumulative air quality impacts resulting from operation of the proposed Project would include minimal fugitive emissions from intermediate MLVs along the proposed pipeline route and from valves, pumps, flanges, and connectors at the pump stations. Proposed pipeline pumps would be electric-powered. MLVs would have backup emergency generators, which would only be used during times of power interruption; therefore, emissions from these sources would be negligible. The use of mobile sources such as maintenance vehicles (at least twice per year) and aircraft for aerial inspections (once every 2 weeks) during proposed Project operations

would be infrequent, so emissions from these maintenance/mobile sources would be negligible and were not calculated.

Contribution to cumulative air quality impacts from ongoing operations of past projects within the proposed Project cumulative impact corridor, including existing oil and natural gas pipelines, and reasonably foreseeable future projects would likely be limited to emissions from any project facilities (pump stations, intermediate MLVs) and from vehicles and aircraft used during inspection and maintenance of project facilities.

As described in Section 4.12.3.2, Greenhouse Gases, the total annual GHG emissions from operation of the pipeline amount to 3.19 million metric tons per year or 3.52 million tons per year of carbon dioxide equivalent (CO_2e) (Table 4.12-6).[6] This is equivalent to annual GHG emissions from the combustion of fuels in approximately 626,000 passenger vehicles or the CO_2 emissions from combusting fuels used to provide the electricity consumed by approximately 398,000 homes for one year.[7]

Refineries

While the proposed Project does not include construction, retrofit, or operation of any refineries that could receive crude oil transported through the proposed Project, refinery operations could contribute to increased cumulative impacts to air quality in the vicinity of the proposed Project and/or in the areas around the refineries if changes in the type or quantity of refinery emissions occurred in the future as a direct result of refining crude oil transported by the proposed Project. Such changes could occur if the proposed Project induced construction of a new refinery, induced expansions of capacity in existing refineries, induced existing refineries to add new downstream processing units (such as cokers or fluid catalytic converters), and/or induced the refineries to process a different crude oil slate (e.g., one that was higher in sulfur content and lower in American Petroleum Institute (API) gravity with different heavy metals content).

As discussed in Sections 1.2, Overview of Proposed Project, and 1.4, Market Analysis, crude oil delivered to Petroleum Administration for Defense District (PADD) 2 and PADD 3 refineries would replace domestic crude oil supplies processed at these refineries or supplant existing supplies from overseas that are less stable, more costly, or otherwise less desirable to the refineries.

PADD 2 Refineries

The proposed Project would supply up to 155,000 bpd to the proposed Cushing tank farm in PADD 2. While the specific receiving refineries are not known at this time, there are some refineries or geographic areas proximal to the proposed Project that would be more likely to receive crude oil transported through the proposed Project. There are 27 refineries in PADD 2 that have a 2012 capacity to process almost 4 million bpd of crude oil (Table 4.15-17), and heavy crude oil deliveries to these refineries totaled 3.38 million bpd in 2011 (U.S. Energy Information Administration [EIA] 2012a). A significant portion of the heavy crude oil supply to PADD 2 is provided via pipelines from Canada.

[6] In 2010 total U.S. GHG emissions (CO_2e from anthropogenic activities) amounted to 6,821.2 million metric tons. Globally, approximately 30,313 million metric tons of CO_2 emissions were added to the atmosphere via the combustion of fossil fuels in 2009 (USEPA 2012b).
[7] Equivalencies based on USEPA's GHG Equivalency calculator (USEPA 2012c).

Table 4.15-17 PADD 2 Refinery Crude Capacity: 2012

Refineries	Crude Oil Capacity (thousand bpsd)[a]
ExxonMobil, Joliet, Illinois	248
Marathon, Robinson, Illinois	215
PDV Midwest Refining, Lemont, Illinois	171
WRB Refining, Wood River, Illinois	322
BP, Whiting, Indiana	430
Countrymark, Mount Vernon, Indiana	28
Coffeyville Resources, Coffeyville, Kansas	120
Frontier, El Dorado, Kansas	140
NCRA, McPherson, Kansas	88
Marathon, Catlettsburg, Kentucky	253
Continental, Somerset, Kentucky (idle)	0
Marathon, Detroit, Michigan	114
Flint Hills, Saint Paul, Minnesota	320
St. Paul Park, Saint Paul, Minnesota	85
Tesoro, Mandan, North Dakota	62
BP-Husky, Toledo, Ohio	160
Lima Refining, Lima, Ohio	170
Marathon, Canton, Ohio	87
Toledo Refining, Toledo, Ohio	175
ConocoPhillips, Ponca City, Oklahoma	215
Holly Refining, Tulsa (East), Oklahoma	76
Holly Refining, Tulsa (West), Oklahoma	90
Valero, Ardmore, Oklahoma	87
Ventura, Thomas, Oklahoma (idle)	0
Wynnewood Refining, Wynnewood, Oklahoma	75
Premcor, Memphis, Tennessee	190
Calumet Lubricants, Superior, Wisconsin	45
PADD 2 GRAND TOTAL	**3,966**

Source: EIA 2012a.

[a] bpsd = barrels per stream day. Defined as the quantity of oil product produced by a single refining unit during continuous operation for 24 hours.

Crude oil deliveries through the proposed Project to the Cushing tank farm would generally serve refineries in PADD 2, which includes 15 states in the Midwest from North Dakota to Oklahoma and east to Ohio. Crude oil refineries in those 15 states, including the crude oil capacity for each refinery, are presented in Table 4.15-17. In PADD 2, expansions and upgrades have been proposed or implemented in Oklahoma (Holly), Illinois (Wood River), 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 United States in 30 years).

PADD 3 Refineries

The proposed Project would supply up to 830,000 bpd of crude oil to customers along the Gulf Coast in PADD 3, which covers six states from New Mexico to Alabama. Because up to 100,000 bpd of capacity is reserved for crude oil from the Williston Basin, and 155,000 bpd of capacity is available to pick up crude oil from domestic producers that deliver to Cushing, Oklahoma, the quantity of oil sands crudes is more likely to be closer to 600,000 bpd maximum for the next decade or two. There are 57 refineries in PADD 3 with a 2012 refining capacity of

approximately 9.2 million bpd (Table 4.15-18). Heavy crude oil accounted for approximately 2.15 million barrels per day (mmbpd) of the crude oil refined in PADD 3 in 2006.

As identified in Table 4.15-18, a total of 15 refineries in PADD 3 would be connected directly to the hubs to which the proposed Project connects. These 15 refineries are in the Gulf Coast area[8] and have a total crude oil capacity of almost 4.2 mmbpd, including over 1.4 mmbpd of heavy crude oil capacity (EIA 2012a). Oil transported via the proposed Project could be delivered to other refineries in PADD 3 through the existing pipeline network that extends throughout those general areas, or by tanker, barge, or rail. The other refineries in PADD 3 have a total crude oil refining capacity of almost 5 mmbpd. Thus, crude oil deliveries from the proposed Project could be processed at any of the refineries with direct or indirect access to the delivery points of the proposed Project.

The crude oil capacity for each refinery in PADD 3, including refineries with direct access to the proposed Project, without direct access to the proposed Project, and with possible pipeline connection to the proposed Project, are identified in Table 4.15-18.

Table 4.15-18 PADD 3 Refinery Crude Capacity: 2012

Refineries	Crude Oil Capacity (thousand bpsd)[a]
Gulf Coast Refineries with Direct Pipeline Access to the Proposed Project	
Motiva Enterprises LLC; Port Arthur, TX	300
Total Petrochemicals; Port Arthur, TX	140
Premcor Refining Group; Port Arthur, TX	415
Exxon Mobil; Beaumont, TX	359
Pasadena Refining; Pasadena, TX	107
Houston Refining; Houston, TX	302
Valero Energy Corp.; Houston, TX	90
Deer Park Refining; Deer Park, TX	340
Exxon Mobil; Baytown, TX	584
BP; Texas City, TX	475
Marathon Petroleum Co; Texas City, TX	84
Valero Energy Corp.; Texas City, TX	233
Calcasieu Refining; Lake Charles, LA	80
CITGO; Lake Charles, LA	440
ConocoPhillips; Lake Charles/Westlake, LA	252
Sub-Total Group I	**4,201**
Gulf Coast Refineries in PADD 3 Without Direct Pipeline Access to the Proposed Project	
Hunt Refining Co.; Tuscaloosa, AL	40
Shell Chemical; Saraland, AL ConocoPhillips; Belle Chasse, LA	85 260
Exxon Mobil; Baton Rouge, LA	523
Alon Refining Krotz Springs.; Krotz Springs, LA	83
Valero Energy Corp.; St. Charles/Norco, LA	210

[8] The Gulf Coast area refers to the region from Houston, Texas, to Lake Charles, Louisiana. Gulf Coast area refineries include 12 refineries on the Gulf Coast in Texas and three refineries in Lake Charles, Louisiana.

Refineries	Crude Oil Capacity (thousand bpsd)[a]
Marathon Petroleum; Garyville, LA	518
Chalmette Refining; Chalmette, LA	195
Valero Energy Corporation; Meraux, LA	140
Motiva Enterprises LLC; Norco, LA	250
Motiva Enterprises LLC; Convent, LA	255
Placid Refining; Port Allen, LA	59
Shell Chemical; Saint Rose, LA	56
ChevronTexaco; Pascagoula, MS	360
ConocoPhillips; Sweeny, TX	260
CITGO; Corpus Christi, TX	165
Valero Energy Corp.; Three Rivers, TX	95
Flint Hills Resources; Corpus Christi, TX	288
Valero Energy Corp.; Corpus Christi, TX	205
Sub-Total Group 2	**4,047**
Inland PADD 3 Refineries with Possible Pipeline Connection to the Proposed Project	
Navajo Refining; Artesia, NM	115
WRB Refining; Borger, TX	154
Valero Energy Corp.; Sunray/McKee, TX	160
AlonUSA; Big Spring, TX	70
Delek; Tyler, TX	65
Sub-Total Group 3	**564**
Inland PADD 3 Refineries without Pipeline Access to the Proposed Project	
Other Refineries without Access	382
Sub-Total Group 4	**382**
PADD 3 GRAND TOTAL	**9,194**

Source: EIA 2012a.

[a] bpsd = barrels per stream day. Defined as the quantity of oil product produced by a single refining unit during continuous operation for 24 hours.

Future Projections of Refinery Crude Oil Slates, Expansions and Investments in PADD 3

The existing refineries processing heavy crude oil in PADD 2 and PADD 3 are designed and permitted to refine heavy crude oil. Details about the PADD 3 refineries' imports of heavy crude oil are provided in Section 1.4.3.1, PADD Supply Characteristics. As a result, the processing of heavy crude oil transported via the proposed Project would occur within existing permit thresholds, including USEPA consent decrees with the refiners that place additional limits on the emissions of many of the potential refinery customers.[9]

Permitting of these facilities is under the authority of USEPA as the federal agency that implements and enforces the requirements of the Clean Air Act. State agencies with delegated authority to administer air quality programs and with approved State Implementation Plans

[9] In PADD 3, 91 percent of the refining capacity is subject to consent decrees with the USEPA (including all of the refineries in the Gulf Coast area except Lyondell in Houston), which requires the addition of better pollution control technologies and emissions monitoring systems.

include Texas and Louisiana. The permitting process is designed to avoid significant cumulative impacts to regional air quality associated with air emissions.

To address the potential that the proposed Project could induce changes in crude oil slates, or induce refinery expansions and capital investments, an independent analysis of various aspects of the proposed Project was commissioned by the U.S. Department of Energy (DOE) Office of Policy and International Affairs (EnSys 2010). This analysis incorporated projections of likely future PADD 3 refinery operations, including total refinery throughputs and potential refinery expansions and investments (i.e., adding downstream processing units to process a different crude slate) and the average crude slate quality (measured by average API gravity and sulfur content).

As explained in more detail in Section 3.13.3 of the Final EIS, the results of that EnSys modeling, which were done with model inputs from 2010, indicated that even with some differences in the total volume of Western Canadian Sedimentary Basin (WCSB) crude oil refined in PADD 3 across the different scenarios, the average API gravity and the average sulfur content of the crude oil slate would be essentially the same with or without the proposed Project. Additionally, these modeling results suggest that construction of the proposed Project would not be expected to alter market conditions in PADD 3 to induce construction of a new refinery, to induce expansion of existing refineries, to induce significant differences in investment levels in refinery down-stream processing units, or to induce significant differences in average crude-slate quality. Therefore there would be little, if any, difference in emissions associated with crude oil refining in PADD 3 with or without the proposed Project.

Although the EnSys modeling was based on inputs from market conditions in 2010, the market analysis in Section 1.4 indicates that the EnSys conclusions that even without the proposed Project significant amounts of oil sands crude are likely to be delivered to the Gulf Coast area remain likely. As noted in Section 1.4, there are other pipeline connections being made between PADD 2 and PADD 3 that will be able to deliver oil sands crude, and even if additional pipeline capacity remains constricted, it would be likely be economic to transport oil sands crude to the Gulf Coast area by rail under current and a range of future market conditions.

These results are consistent with certain known attributes of world crude oil markets described in more detail in Section 1.4, Market Analysis:

- Refiners in the United States primarily serve the U.S. market for finished transportation fuel (gasoline, diesel, etc.). Thus, total throughput at U.S. refineries is determined largely by the U.S. demand for transportation fuel derived from crude oil. But as noted in Section 1.4, Market Analysis, as U.S. demand for transportation fuel declines, the refiners in the Gulf Coast are expected to increase exports of refined products.
- Crude oil is a relatively freely exchangeable (fungible) commodity, with low marine-shipping costs, and with prices set within a world market that consumes over 80 mmbpd. Therefore shipping 830,000 bpd from a particular source of crude oil to a particular set of refineries would not necessarily have a large impact on the overall crude market or the competitive position of the PADD 3 refiners relative to that market.

- Refineries are optimized to process a particular crude slate into a particular set of refined products, and it is not easy or economically efficient in the short to medium term for a refinery to make significant changes in its crude slate quality. Thus, refineries (particularly large refineries in the Gulf Coast) typically obtain crude oil from a variety of sources, and blend those crude oils to achieve a consistent crude oil feedstock quality.
- Many of the refineries in PADD 3 and PADD 2 have already made significant capital investments in the downstream processing units necessary to refine a relatively heavier, more sulfurous crude oil blend. Having made those investments, to operate the refineries most efficiently, those refineries have significant incentive to seek out a heavier slate of crude oil, regardless of whether there is increased transport capacity to deliver WCSB oil sands-derived crude oils to PADD 3.

The Final EIS also included analysis indicating that because the emissions from refineries are dependent not just upon the quality of the crude oil slate input, and the quantity of crude oil processed in a refinery, but also on emissions control technologies employed by the refineries. The data described in the Final EIS indicated that at both the national level and the Gulf Coast level, refinery emissions were not correlated with fluctuations in crude slate quality.

In addition to this information, in the Final EIS, the Department provided a review of various refinery expansions and upgrades in PADD 2 associated with increasing the capacity of heavy crude oil processing. Specifically, the Department quantitatively reported on the change in emissions of criteria pollutants associated with proposed refinery expansions in Illinois, Indiana, and Michigan. Any refinery expansions or upgrades at refineries that could receive crude oil from the proposed Project would likely be required to adhere to similar regulatory standards. As a result of improvements in control technologies and the use of offsets, these refinery upgrades and expansions generally resulted in an overall increase in carbon monoxide, and a decrease in emissions of particulate matter, sulfur dioxide, and nitrogen dioxides. Volatile organic emissions tended to decrease slightly, but not consistently.

Cumulative air emissions in PADD 3 are likely to change over time as a result of ongoing and planned refinery expansions, whether or not the proposed Project is implemented. The largest permitted refinery expansion for processing heavy crude oil in recent years is for the Motiva refinery in Port Arthur, Texas. This expansion, officially completed in 2012, increased the heavy oil refining capacity of Motiva by 325,000 bpd (from the original capacity of 275,000 to 600,000 bpd). The Motiva refinery would have direct access to the proposed Project and would have the largest heavy oil refining capacity in PADD 3. This expansion would result in increases in most criteria pollutants, although there would be a reduction in VOCs (Table 4.15-19). The likely reasons that this expansion would result in net increases in most emissions include the overall size of the expansion and the fact that the existing refinery was already using relatively modern emission controls. Any modification to the existing refining processes would therefore not produce emission reductions in the same proportion as would occur for more outdated refineries. Specific emission estimates are unavailable for other refinery expansions under consideration in PADD 3.

Table 4.15-19 Net Emissions for the Motiva Refinery Expansion

NO_x (tons)	CO (tons)	VOC (tons)	SO_2 (tons)	PM (tons)	C_6H_6 (tons)	H_2SO_4 (tons)	H_2S (tons)	NH_3 (tons)	Cl_2 (tons)
592.74	1,489.53	-116.73	1679.73	464.37	-0.47	22.24	4.33	125.69	3.77

[a] NO_x = Oxides of nitrogen; CO = Carbon monoxide; VOC = Volatile organic compounds; SO_2 = Sulfur dioxide; PM = Particulate matter; C_6H_6 = Benzene; H_2SO_4 = Sulfuric acid; NH_3 = Ammonia; Cl_2 = Chlorine.

Cumulative air impacts along the proposed Project cumulative impact corridor could change if new refineries are constructed in the future, although EnSys (2010) indicates such potential refinery construction is not sensitive to whether the proposed Project is implemented or not. There are currently no new refineries planned within about 500 miles of any delivery point for the proposed Project, although one new refinery is proposed in the northern portion of PADD 2, the Hyperion Energy Center in South Dakota. While no new refinery has been permitted and built in the United States in the past 30 years, estimates of emissions used in the permitting process for the proposed Hyperion project can be used to allow quantification of potential emissions from upgraded PADD 3 refineries that would use modern technology to process heavy crude oil. In fact, the calculated emissions presented in the permitting process for the proposed Hyperion refinery are generally comparable to those calculated for the ongoing 325,000-bpd Motiva expansion. The calculated emissions resulting from processing up to 400,000 bpd for the proposed Hyperion refinery (SDDENR 2011) are:

- 687 tons of NO_X;
- 810 tons of CO;
- 183 tons of SO_2;
- 536 tons of VOCs; and
- 1,035 tons of PM.

It is expected that most of the oil transported by the proposed Project would replace historic crude oil supplies or supplant supplies from less stable or more costly sources for the following reasons:

- The maximum volume of oil that would be transported by the proposed Project (830,000 bpd) represents approximately 6 percent of the overall crude oil refining capacity of PADD 2 and PADD 3 (over 13 million bpd);
- The current supply of heavy crude oil delivered to PADD 3 from current overseas sources is either declining or at risk for political reasons; and
- There is a well-developed existing regional infrastructure to facilitate distribution of crude oil transported by the proposed Project among existing PADD 2 and PADD 3 refineries.

Although the EnSys (2010) results, and economic analysis in Section 1.4, Market Analysis, indicate that the construction of the proposed Project is not likely to impact imported amounts of WCSB crude oil or refinery emissions, the following hypothetical emissions estimate is presented for illustrative purposes. A conservative hypothetical maximum emissions estimate could be developed by assuming that the entire crude oil volume transported by the proposed Project would be heavy crude oil and that it would be refined at upgraded refineries. Using the emissions estimates discussed above for the Motiva refinery upgrade and the proposed Hyperion refinery project, this hypothetical maximum emissions estimate can be calculated by multiplying

the maximum proposed Project throughput (830,000 bpd) by the emission rates per barrel reported for Motiva or Hyperion since these refineries are assumed to be typical for recently upgraded refineries implementing BACT. Hypothetical maximum annual emissions of NO_x would range between about 1,514 and 1,604 tons, CO emissions would range between about 3,804 and 4,148 tons; SO_2 emissions would range between about 1,791 and 4,290 tons, particulate matter emissions would range between 1,186 and 2,170 tons, and VOC emissions would be about 1,718 tons. However, since the crude oil transported by the proposed Project would be replacing or displacing crude oil from other sources, the majority of the emissions generated from refining crude oil transported by the proposed Project would not result in incremental increases to refinery emissions in either PADD 2 or PADD 3. Additionally, it is expected that approximately one-third of the volume transported by the proposed Project would not be heavy crude oil, particularly in light of the proposed Bakken Marketlink and Cushing Marketlink connected actions.

End Use

Some commenters on the Draft and Supplemental Draft EIS expressed concerns relative to indirect contributions to cumulative air quality impacts related to the combustion or other use of petroleum products refined from the crude oil that would be transported to PADD 2 by the proposed Project. The end use of refined petroleum products could include combustion (e.g., vehicles, power generation, or other industrial facilities) or non-combustion uses (e.g., asphalt, petroleum coke, liquefied refinery gases, and lubricants). The ultimate use of refined product originating from crude oil transported by the proposed Project would not produce different end use emissions. Criteria pollutant emissions from consumer and manufacturing use of refined petroleum products are regulated under permits for some uses (e.g., mass transportation vehicles and petrochemical processing) and not for others (e.g., private vehicles) beyond standard quality rules designed to reduce pollutants (e.g., oxygenated fuels, low-sulfur diesel, Corporate Average Fuel Economy standards).

Indirect Cumulative Impacts and Life-Cycle Greenhouse Gas Emissions

Overview and Summary

The Supplemental EIS evaluates the relationship between climate change and the proposed Project in several ways:

- First, the potential contributions of the proposed Project to greenhouse gas emissions are addressed in the air quality analyses found in Section 3.12 and Section 4.12, Air Quality and Noise.
- Second, the potential impact of future predicted climate change effects (such as temperature and precipitation changes in the proposed Project area) on the construction and operation of the proposed Project itself is described in Section 4.14, Climate Change Impacts on the Proposed Project.
- Finally, this section presents information and analysis regarding indirect cumulative impacts and life-cycle greenhouse gas emissions including the potential impact of further development of the Western Canadian Sedimentary Basin (WCSB) oil sands on climate change.

This discussion on GHG life-cycle emissions associated with oil sands is provided in response to comments received during the Final EIS process and scoping for the Supplemental EIS and to assess recent and updated studies undertaken by others that were referred to in this analysis. The comments received included requests for analysis of the potential climate impacts of increasing development of the WCSB oil sands associated with the proposed Project. While such a broad review is typically beyond the scope of NEPA, this Supplemental EIS nonetheless presents information and analysis related to the proposed Project's potential life-cycle climate impacts. The market analysis presented in Section 1.4 is a critical input to the analysis in terms of how the proposed Project is expected to impact further development of the WCSB oil sands compared to the No Action Alternative in which the proposed Project is denied.

The key findings from this analysis of the indirect cumulative impacts and life-cycle GHG emissions are:

- This Supplemental EIS examined the potential for growth-induced impacts that could be associated with the proposed Project in Section 1.4, and it is unlikely that the proposed Project construction would have a substantial impact on the rate of WCSB oil sands development. As described in Section 1.4, even when considering the incremental cost of non-pipeline transport options, should the proposed Project be denied, a 0.4 to 0.6 percent reduction in WCSB production could occur by 2030, and should both the proposed Project and all other proposed pipeline projects not be built, a 2 to 4 percent decrease in WCSB oil sands production could occur by 2030.[10]
- Based upon the market analysis in Section 1.4, the incremental life-cycle emissions associated with the proposed Project are estimated in the range of 0.07 to 0.83 million metric tons carbon dioxide equivalent ($MMTCO_2e$) annually if the proposed Project were not built, and in the range of 0.35 to 5.3 $MMTCO_2e$ annually if all pipeline projects were denied, based on the following: [11]
  - The full range of incremental GHG emissions associated with the more carbon-intensive WCSB oil sands that would be transported through the proposed Project across the analyzed reference crudes (which could be displaced at the Gulf Coast refineries) is estimated in the range of 3.3 to 20.8 $MMTCO_2e$ annually[12] (the methodology used to derive this range is explained further in this section).

[10] The International Energy Outlook extends to 2035. In 2035, the production change would be 120,000 bpd, which would be 2.4 percent of the total International Energy Outlook forecasted production for the oil sands.

[11] As discussed in 1.4.6.3, Rail Potential to Transport WCSB Crude, if it is assumed that the difference in the cost of transport by rail were $7.50 rather than $5.00 per barrel, then the reduction in production would be 50 percent more. Under such an assumption, this change in production would represent a 50 percent reduction in GHG emissions above those indicated in the text above. This would equate to 0.1 to 1.3 $MMTCO_2e$ should the proposed Project be denied, and 0.5 to 8.0 $MMTCO_2e$ should both the proposed Project and all other proposed pipeline projects not be built.

[12] As noted elsewhere in the Supplemental EIS, the near-term initial throughput of the proposed Project is projected to be 830,000 barrels of crude per day with 100,000 bpd supplied by Bakken crude production and the remaining 730,000 bpd supplied by the WCSB oil sands. However, the GHG emission estimates assume that the full 830,000 bpd pipeline capacity is used to transport only WCSB crude.

  - If the proposed Project was not built, analysis demonstrates that WCSB oil sands would likely be developed, but there is potentially a 0.4 to 0.6 percent reduction in production, and if all other proposed pipeline projects were not built, there would potentially be a 2 to 4 percent reduction in WCSB oil sands production.
  - The range of GHG emissions represents the incremental GHG emissions for displacement of the analyzed reference crudes for the stated scenarios.[13]

- The largest share, or approximately 70 to 80 percent, of WTW GHG[14] emissions from the fuel life-cycle occurs during fuel combustion itself, regardless of the study design and input assumptions.
- A large source of variance in fuel life-cycle GHG studies is the treatment of lower-value products such as petroleum coke, electricity exports from cogeneration, and secondary carbon effects such as land-use change and capital equipment. While the issue of petroleum coke is an important consideration to GHG lifecycle analyses, it is important when comparing WCSB oil sands and the reference crudes that the full life-cycle be evaluated, not just the upstream or refining stage. The issue of petroleum coke is not a standalone issue for the WCSB oil sands; it is also a LCA consideration for the heavy conventional crudes. The petroleum coke-associated GHG emissions from oil sands should fundamentally be similar to some heavy reference crudes.
- Producing a barrel of premium fuels (i.e., gasoline, diesel, and kerosene/jet fuel) from bitumen produces roughly the same amount of petroleum coke as a barrel of premium fuels refined from heavy crudes, such as Venezuelan Bachaquero or Mexican Maya. The actual net GHG emissions from petroleum coke, however, depend on the final end use of the petroleum coke (i.e., whether it is stockpiled or combusted) and how its end use affects demand for other fuels such as coal. Since a portion of the petroleum coke produced from upgrading WCSB oil sands bitumen is currently stockpiled and not combusted, whereas the petroleum coke produced from refining reference crudes at Gulf Coast refineries is combusted. As a result, GHG emissions from petroleum coke produced from WCSB oil sands crudes are slightly lower than petroleum coke GHG emissions from other heavy reference crudes.
- The relative GHG-intensity of both reference crudes and oil sands-derived crudes will change differently over time. Conventional (deep) crude reservoirs require higher energy intensive secondary and tertiary production techniques as the reservoirs deplete and as water cut of the produced reservoir fluids increases. Oil sands surface mining is expected to have a relatively constant energy intensity long into the future.

Further details of the indirect cumulative impacts and life-cycle GHG emissions analysis are provided in the following sections.

[13] Note that these estimates do not consider differences in transportation or refining GHG emissions for WCSB oil sands crude sent to non-U.S. Gulf Coast refineries and is based on average GHG emission estimates from near-term WCSB oil sands production.

[14] Reference to the various stages in the life cycle from crude extraction from the reservoir, to refining, and to combustion of the refined fuel products is typically referred to as a “well-to-wheels” (WTW) analysis.

Introduction to Indirect Life-Cycle GHG Emissions

To assist in providing information regarding the carbon intensity of WCSB oil sands crudes compared to other crude oils, the Final EIS included a key studies review in the existing literature that address life-cycle GHG emissions of petroleum products, including petroleum products derived from WCSB oil sands, and a comparison of life-cycle GHG emissions reported in the literature for WCSB oil sands-derived crude oil and refined products with those of reference crude oils. A summary of the analysis is presented in the following sections and the full report is presented in Appendix W, Life-Cycle Greenhouse Gas Emissions of Petroleum Products from WCSB Oil Sands Crudes Compared with Reference Crudes. Project-level GHG emissions are presented in Sections 3.12, Air Quality and Noise (Affected Environment); 4.12, Air Quality and Noise (Environmental Consequences); and 4.15.3, Cumulative Impacts by Resource, which provide a discussion of climate change-related risks on the proposed Project. The Department is providing this information as a matter of policy, although the proposed Project would not substantively influence the rate or magnitude of oil extraction activities in Canada, or the overall volume of crude oil transported to the U.S. or refined in the U.S. (see Section 1.4, Market Analysis).

Thus, while this section provides an assessment of the differences between the life-cycle GHG emissions associated with WCSB oil sands-derived crudes that may be refined in the United States versus reference crudes, it also specifically compares results from other literature against the National Energy Technology Laboratory (NETL) studies' base case. A more detailed description of the ICF review is provided in Appendix W, Life-Cycle Greenhouse Gas Emissions.

This analysis reflects recent updates to previous life-cycle assessments (LCAs) of GHG emissions from oil sands-derived crudes, such as the updated report by Jacobs (2012), which offers new analysis and correlates the results with data reported to and audited by the Canadian government. Findings based on these new data have been included in this assessment. This analysis also includes a discussion of the GHG emissions associated with the production and combustion of petroleum coke produced by refining crude oils.

Life-Cycle Carbon Overview

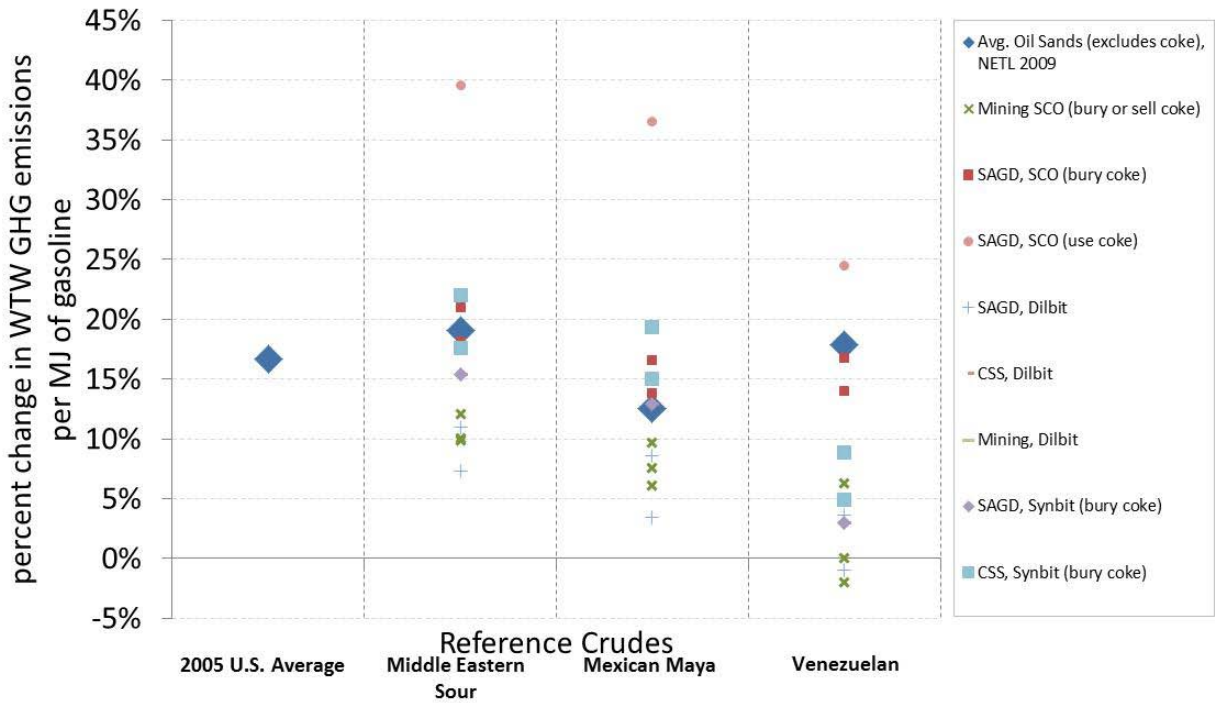
Evaluating life-cycle emissions provides a method to assess the relative GHG emissions between various sources of crude oil. The LCA methodology attempts to identify, quantify, and track carbon emissions arising from the development and use of a hydrocarbon resource. It is helpful to characterize carbon emissions into what can be considered primary and secondary flows. The primary carbon emissions are associated with the various stages in the life-cycle from the extraction of the crude from the reservoir to refining to combustion of the refined fuel products (typically referred to as a well-to-wheels analysis). The secondary carbon emissions are associated with activities (e.g., land use impacts) not directly related to conversion of the hydrocarbon resource into useful product fuels.

Most of the GHG emissions from hydrocarbon resource development result in three primary steps in the LCA: production of the crude oil, refining of the crude oil, and combustion of the refined products. Transportation of the crude oil to the refinery and transportation of the products to market also contribute to GHG emissions (discussions of these emissions for the proposed Project are presented in Sections 3.12 and 4.12, Air Quality and Noise), although these pieces of the life-cycle tend to be significantly smaller than the production, refining, and combustion stages referred to above.

The primary objective of refining crude oil is to produce three premium refined products: gasoline, diesel, and kerosene/jet fuel (i.e., gasoline and distillates). In addition to the primary emissions arising from the production, transportation, refining, and combustion steps of the LCA, a range of secondary carbon emissions should be considered. For example, extracting crude can influence secondary GHG emissions, such as changes in biological or soil carbon stocks resulting from land-use change during mining. In addition to premium fuels, typically 5 to 10 percent of the carbon in the petroleum resource ends up in co-products, such as petroleum coke, that are often (but not always) combusted and therefore emit carbon dioxide (CO_2). As discussed in greater detail below, these secondary flows are treated differently across the LCA literature and estimates of specific process inputs and emission factors vary according to the underlying methods and data sources used in each LCA.

The GHG emission factors modeled by NETL are based on a well-to-wheels (WTW) LCA. WTW assessments for petroleum-based fuels focus on the GHG emissions associated with extraction of the crude oil from reservoirs, transportation of crude oils to refineries, refining of the crude oil, distribution of refined product (e.g., gasoline, diesel, and jet fuel) to retail markets, and combustion of these fuels in vehicles or planes. For some WCSB oil sands crude oils, the assessment also addresses upgrading of the extracted crude oil (i.e., partial refining of some oil sands crude oils to produce synthetic crude oil). Other analyses (e.g., well-to-tank [WTT] analyses) establish different life-cycle boundaries and evaluate only the emissions associated with the processes prior to combustion of the refined products.

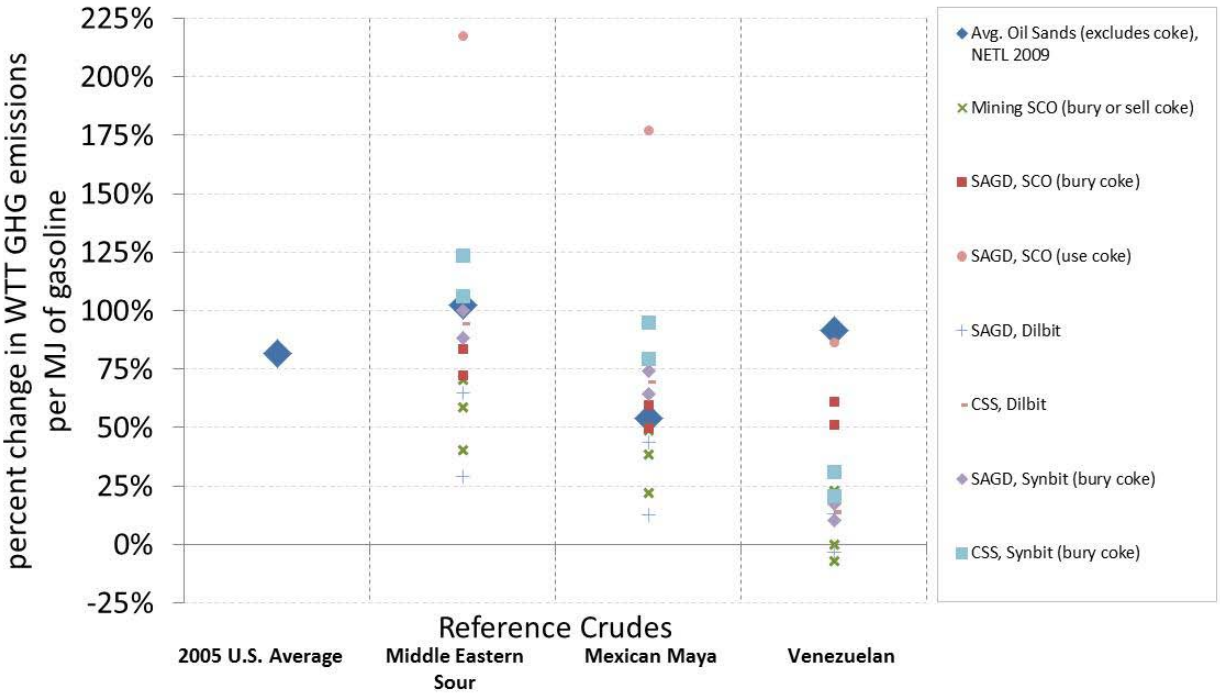
Inclusion of the combustion phase allows for a more complete picture of crude oil contribution to GHG emissions because this phase represents between approximately 70 to 80 percent (depending on crude source) of the WTW emissions (IHS CERA 2010, 2011). As a result, a WTW analysis reduces the percent differential in total GHG emissions between different crude oil sources. Because a WTT analysis focuses on pre-combustion processes, it highlights the differences in upstream life-cycle GHG emissions associated with the extraction, transportation, and refining of crude oils from different sources, as illustrated in a comparison of Figure 4.15.3-3 and Figure 4.15.3-4.



Sources: Data from NETL 2009, Jacobs 2009, TIAX 2009.

Notes: The percent differentials are calculated using the oil sands results relative to the corresponding study's reference crude. Only NETL (2008, 2009) provided a value for the 2005 U.S. average reference crude. A positive percentage indicates the oil sands' WTW is greater than the X-axis reference crude.
In this chart, all emissions are given per megajoule (MJ) of reformulated gasoline with the exception of NETL 2009, which is given per MJ of conventional gasoline.
"Venezuela Conventional" is used as the NETL reference crude for Venezuela Bachaquero in this analysis; this is a medium crude, not a heavy crude; thus, the NETL values are compared against a lighter Venezuelan reference crude than other studies.
Dilbit fuels do not include emissions associated with recirculating diluents back to Alberta. TIAX (2009) did not consider recirculation of diluent back to Alberta. Jacobs (2009) evaluated a scenario where diluent is recirculated to Alberta, which increased WTW emissions by 7 grams (g) CO_2/MJ (lower heating value [LHV]), or 7 percent, for reformulated gasoline relative to the case where diluent is not recirculated. This scenario has not been included in this figure because diluent would not be recirculated by the proposed Project.
SCO = synthetic crude oil; SAGD = steam-assisted gravity drainage; CSS = cyclic steam stimulation.

Figure 4.15.3-3 Comparison of the Percent Differential for WTW GHGs from Gasoline Produced from Various WCSB Oil Sands Relative to Reference Crudes



Sources: Data from NETL 2009, Jacobs 2009, TIAX 2009.

Notes: The percent differentials are calculated using the oil sands results relative to the corresponding study's reference crude. Only NETL (2008, 2009) provided a value for the 2005 U.S. average reference crude. A positive percentage indicates the oil sands' WTT is greater than the X-axis reference crude.
In this chart, all emissions are given per MJ of reformulated gasoline with the exception of NETL 2009, which is given per MJ of conventional gasoline.
"Venezuela Conventional" is used as the NETL reference crude for Venezuela Bachaquero in this analysis; this is a medium crude, not a heavy crude; thus, the NETL values are compared against a lighter Venezuelan reference crude than other studies.
Dilbit fuels do not include emissions associated with recirculating diluents back to Alberta. TIAX (2009) did not consider recirculation of diluent back to Alberta. Jacobs (2009) evaluated a scenario where diluent is recirculated to Alberta, which increased WTW emissions by 7 g CO_2/MJ (LHV), or 7 percent, for reformulated gasoline relative to the case where diluent is not recirculated. This scenario has not been included in this figure because diluent would not be recirculated by the proposed Project.
SCO = synthetic crude oil; SAGD = steam-assisted gravity drainage; CSS = cyclic steam stimulation.

Figure 4.15.3-4 Comparison of the Percent Differential for WTT GHGs from Gasoline Produced from Various WCSB Oil Sands Relative to Reference Crudes

Scope of Review of Life-Cycle Studies

A list of the reports reviewed for this assessment is presented in Table 4.15-20. The primary studies and additional supplemental reports for the assessment were selected on the following basis:

- The reports evaluate WCSB oil sands crude oils in comparison to crude oils from other sources;
- The reports focus on GHG impacts throughout the life-cycle of crude oils and their related products;

- The reports were published within the last 10 years (with one exception), and most were published within the last 5 years; and
- The reports represent the perspectives of various stakeholders, including industry, governmental organizations, and non-governmental organizations.

Table 4.15-20 Primary and Additional Studies Evaluated[a]

Primary Studies Analyzed	Type
NETL. 2008. Development of Baseline Data and Analysis of Life-cycle Greenhouse Gas Emissions of Petroleum-Based Fuels.	Individual LCA
NETL 2009. An Evaluation of the Extraction, Transport and Refining of Imported Crude Oils and the Impact of Life-cycle Greenhouse Gas Emissions.	Individual LCA
International Energy Agency (IEA). 2010. World Energy Outlook.	Meta-analysis
IHS CERA. 2010. Oil Sands, Greenhouse Gases, and U.S. Oil Supply: Getting the Numbers Right.	Meta-analysis
IHS CERA. 2011. Oil Sands, Greenhouse Gases, and European Oil Supply: Getting the Numbers Right.	Meta-analysis
Natural Resources Defense Council (NRDC). 2010. GHG Emission Factors for High Carbon Intensity Crude Oils ver. 2.	Meta-analysis
Energy-Redefined LLC for ICCT. 2010. Carbon Intensity of Crude Oil in Europe Crude.	Individual LCA
AERI/Jacobs Consultancy. 2009. Life-cycle Assessment Comparison of North American and Imported Crudes.	Individual LCA
Jacobs. 2012. EU Pathway Study: Life-cycle Assessment of Crude Oils in a European Context	Individual LCA
AERI/TIAX LLC. 2009. Comparison of North American and Imported Crude Oil Lifecycle GHG Emissions.	Individual LCA
Charpentier, et al. 2009. Understanding the Canadian Oil Sands Industry's Greenhouse Gas Emissions.	Meta-analysis
Brandt, A. 2011. Upstream greenhouse gas (GHG) emissions from Canadian oil sands as a feedstock for European refineries.	Meta-analysis
Additional Studies/Models Analyzed	**Type**
RAND Corporation. 2008. Unconventional Fossil-Based Fuels: Economic and Environmental Trade-Offs.	Individual LCA
Pembina. 2005. Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush.	Partial LCA
Pembina. 2006. Carbon Neutral 2020: A Leadership Opportunity in Canada's Oil Sands. Oil sands issue paper 2.	Partial LCA
McCann and Associates. 2001. Typical Heavy Crude and Bitumen Derivative Greenhouse Gas Life-cycles.	Individual LCA
Pembina. 2011. Life-cycle assessments of oil sands greenhouse gas emissions: A checklist for robust analysis.	White Paper
GHGenius. 2010. GHGenius Model, Version 3.19. Natural Resources Canada.	Model
GREET. 2010. Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model, Version 1.8d.1. Argonne National Laboratory.	Model
Rooney et al. 2012. Oil Sands Mining and Reclamation Cause Massive Loss of Peatland and Stored Carbon.	Land use change journal article
Yeh et al. 2010. Land Use Greenhouse Gas Emissions from Conventional Oil Production and Oil Sands.	Land use change journal article

[a] See Appendix W, Life-Cycle Greenhouse Gas Emissions, for more information on each study.

Evaluation of the results from the primary and additional studies included in this assessment must take into account the treatment of co-products in each study. In a refinery, gasoline, diesel, and jet fuel are all co-products; other co-products produced from upgrading and refining crude oil can include petroleum coke, liquefied petroleum gas (LPG), sulfur, and surplus cogenerated electricity. Three different approaches are used for handling co-products in LCAs: all co-products can be included within the LCA boundary (also known as system expansion); a process can be split or separated into two or more subprocesses that each describe an individual product; or, when neither of the previous options are possible, the allocation process can be used to attribute a portion of GHG emissions to each co-product.

Allocation allows LCA practitioners to exclude other co-products from the LCA system boundary and only consider the GHG emissions associated with making and consuming the co-product of interest. Some studies apply a substitution credit for the fuels that are offset in other markets by the use of co-products, such as petroleum coke. Although individual studies may be internally consistent in how they treat allocation and co-products, the different approaches to accounting for co-products can have a significant impact on life-cycle emissions,[15] and can result in apples-to-oranges comparisons across the studies. Therefore, this assessment has avoided direct comparisons between studies that use different methods to account for co-products. The first two columns in Table 4.15-21 show the variation in allocation and substitution approaches used in the various studies, particularly with regard to the treatment of petroleum coke and the electricity cogeneration. Several studies do not explicitly state how they have dealt with these issues.

The primary and additional studies list reflects recent updates to previous LCAs of GHG emissions from oil sands-derived crudes and information on GHG emissions associated with land use. Jacobs (2012) and IHS CERA (2011) both examined life-cycle GHG emissions from producing gasoline and diesel from WCSB oil sands derived crudes for European markets. Jacobs (2012) developed carbon intensities for Alberta crudes based on first order engineering principles and models and calculation methods used in the GREET (2010) model. Jacobs (2012) also correlated the results with data reported to and audited by the Canadian government.

Regulatory authorities in Alberta require extensive information on bitumen production ranging from fugitive and flaring data to the energy consumption and GHG emissions from bitumen production both from in situ mining and from mining-upgrading. Jacob's GHG emissions for producing the heavy Alberta crude oils by steam-assisted gravity drainage are based on engineering estimates using energy consumption that has a close correlation with data reported to the Alberta government (Jacobs 2012, p.5-41). Jacobs' evaluation of the carbon intensity of mining and upgrading is based on data from audited industry and government reports, and engineering estimates based on estimated parameters governing crude oil production.

Engineering models to estimate energy consumption and GHG emissions from bitumen production correlated well with energy use and GHG emissions reported to the Government of Alberta. Jacobs (2012) used a similar set of engineering models and industry literature as the previous Jacobs (2009) study, but correlated the results with data reported to and audited by the Canadian government. IHS CERA (2011) does not contain any changes in emission estimates

[15] For instance, IHS CERA (2010) found that including petroleum coke combustion would increase WTW GHG emissions for a barrel of refined products by 8 to 10 percent, depending on crude type.

from IHS CERA (2010) except for the combustion emissions from end use of refined products.[16] For WCSB oil sands crude oils, the assessment focused on those that could be transported through the proposed Project. Based on this criterion, the solid, raw bitumen from oil sands was eliminated except to the extent that it is included within averaged results (e.g., NETL provides a single WCSB oil sands estimate that represents a weighted average of 43 percent crude bitumen from in situ production and 57 percent synthetic crude oil [SCO] from mining).

This assessment addresses three types of WCSB oil sands crude oils that are extracted either by mining or the in situ thermal processes. Conventional strip-mining methods are used to extract oil sands deposits that are less than about 75 meters below the surface.[17] To recover deeper deposits of oil sands, in situ methods are used. In situ recovery methods typically involve injecting steam into an oil sands reservoir to heat—and thus decrease the viscosity of—the bitumen, enabling it to flow out of the reservoir sand matrix to collection wells. Steam is injected using cyclic steam stimulation (CSS), where the same well cycles between periods of steam injection and bitumen production, or by steam-assisted gravity drainage (SAGD), where a pair of horizontal wells is drilled. The top well is used for steam injection, and the bottom well for bitumen production. Due to the high energy demands for steam production, steam injection in situ methods are generally more GHG-intensive than mining operations. The WCSB crude oil types assessed in this study are described briefly below:

- Synthetic crude oil—SCO is produced from bitumen via a refinery conversion of heavy hydrocarbons to lighter hydrocarbons. While SCO can be sour, it is usually a light, sweet crude oil without heavy fractions.
- Dilbit (diluted bitumen)—Dilbit is bitumen blended with a diluent, usually a natural gas liquid such as condensate, to create a "lighter" product and to reduce viscosity so the dilbit can be transported via pipeline. Dilbit feedstock processing requires more heavy oil conversion capacity than most crude oils.
- Synthetic bitumen (synbit) —Synbit is usually a combination of bitumen and SCO. The properties of synbit blends vary greatly, but blending lighter SCO with heavier bitumen results in a product more similar to conventional crude oil than SCO or dilbit alone.

The reference crudes evaluated in the literature reflect a range of sources and GHG emissions:

- The average U.S. barrel consumed in 2005 (NETL 2008). This reference was selected because it provides a baseline for fuels produced from the average crude consumed in the United States.
- Venezuela Bachaquero and Mexico Maya, which are representative of heavy crudes currently refined in PADD 3 refineries. It is assumed that these crude oils would be displaced or replaced by the WCSB oil sands crude oil that would be transported by the proposed Project, although it is likely that they would find markets elsewhere and would still be produced.

[16] IHS CERA (2010) provides a value of 384 kilograms (kg) CO_2e per barrel of refined product; IHS CERA (2011) provides a value of 402 kg CO_2e per barrel of refined product. It is not clear from the 2010 report what refined product blend was used to estimate the combustion emissions value. However, it is clear that the refined product blend used in the 2011 study is different from the one used in the 2010 study. Combustion emissions from end use of refined products are assumed to be the same across all crudes examined in each study.

[17] Mining accounts for roughly 48 percent of total bitumen capacity in the WCSB oil sands as of mid-2010 (IEA 2010, p. 152).

- Saudi Light (i.e., Middle Eastern Sour), which is considered the balancing grade for world crude oil supplies. This crude may ultimately be backed out of the world market if additional supply of WCSB oil sands crudes is produced.

Evaluation of Key Factors Influencing the GHG Results

There are many differences in the study design factors and input assumptions for life-cycle GHG analyses of WCSB oil sands crude oils relative to the four reference crude oils.

Study Design Factors

Study design factors relate to how the GHG comparison is structured within each study. These factors include the overall purpose and goal of the study, the types of crudes and refined products that are compared to each other, the timeframe over which the results of the study are applicable, the life-cycle boundaries established to make the comparison, the functional units or the basis used for comparing the life-cycle GHGs for crudes or fuels to each other (e.g., expressing GHG emissions per unit of crude, SCO, all refined products, or specific refined products such as gasoline or diesel, in terms of volume, energy, or distance units), and the treatment of co-products other than gasoline, diesel, and jet fuels (e.g., asphalt, petroleum coke, liquefied refinery gases, and lubricants). Some studies allocate a fraction of the GHG emissions from refining to these co-products and exclude these emissions from the life-cycle boundary (i.e., they are not included within the studies' LCA results). Other studies include these emissions but assign credits for GHG emissions from other sources that are offset by combustion of the co-products (e.g., electricity exported from a refinery replaces natural gas-fired power generation, and petroleum coke from a refinery replaces coal).

Key design factors across the studies identified through this assessment are summarized in Table 4.15-21. In general, the studies reviewed are consistent in their treatment of some factors (e.g., generally excluding emissions associated with land-use changes) but, as noted above, vary in their treatment of other factors (e.g., emissions from petroleum coke and electricity cogeneration). Emissions arising from the construction of capital infrastructure are also generally excluded.

Most studies exclude land-use change, although recent studies have sought to characterize land-use carbon flows to examine the implications for GHG emissions and carbon sequestration (Rooney et al. 2012; Yeh et al. 2010). Comparing only those portions of the two papers that focus on peatland soil carbon loss, the results were within a similar range (384 to 1,600 metric tons of carbon per hectare for Rooney compared to 778 to 1,067 metric tons of carbon per hectare for Yeh). These Rooney and Yeh estimates are equivalent to the annual GHG emissions from fuels combustion in approximately 293 to 1,222 and 594 to 815 passenger vehicles, respectively.[18] The range in Rooney et al. (2012) is larger because the authors gave a wide range for the value of peatland soil carbon storage whereas Yeh et al. (2010) explicitly included estimates of aboveground carbon sequestration in addition to soil carbon sequestration.

[18] Equivalencies based on USEPA's GHG Equivalency Calculator (USEPA 2012c).

Table 4.15-21 Summary of Key Study Design Features that Influence GHG Results

Estimated Relative WTW Impact [a]:		High					Medium				Low
Source	**Data Reference Year(s)**	**Petroleum coke combustion[b]**	**Cogeneration credit[c]**	**Upstream production of fuels included[d]**	**Flaring/venting GHG emissions included**	**Capital equipment included[e]**	**Methane emissions from tailing ponds included**	**Fugitive leaks included**	**Local and indirect land use change included**	**Refinery emissions account for upgrading[f]**	**Methane emissions from mine face**
NETL 2008	2005	No	NS	Yes	Yes	No	NS	Yes	No	No	NS
NETL 2009	2005	No	NS	Yes	Yes	No	NS	NS	No	No	NS
IEA 2010	2005-2009	NS	NS	Yes	NS	NS	Yes	NS	No	NA	NS
IHS CERA 2010	~2005-2030	V	V	No	NS	NS	V	NS	No	NA	V
IHS CERA 2011	~2005-2030	V	V	No	NS	NS	V	NS	No	NA	V
NRDC 2010	2006-2010	NS[g]	NS[g]	P	NS	NS	NS	NS	No	NA	NS
ICCT 2010	2009	NS	No	P	Yes	No	NS	Yes	No	No	NS
AERI/Jacobs 2009	2000s	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No
Jacobs 2012	2000s	Yes	No[h]	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
AERI/TIAX 2009	2007-2009	P	P	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Charpentier et al. 2009	1999-2008	NS[7]	NS[7]	V	NS	V	NS	NS	No	NA	NS
Brandt 2011	V	V	V	NS[7]	V	NS[7]	V	V	V	V	V
RAND 2008	2000s	NS	NS	NS	Yes	No	Yes	Yes	No	No	Yes
Pembina Institute 2005	2000, 2004	NS	NS	NS	P	No	NS	P	No	No	NS
Pembina Institute 2006	2002-2005	NS	NS	No	P	No	Yes	Yes	No	No	Yes
McCann 2001	2007	P	NS	Yes	NS	No	NS	NS	No	NS	NS
GHGenius 2010	Current	Yes	No	Yes	Yes	No	Yes	Yes	Local	NS	Yes
GREET 2010	Current	NS	NS	Yes	Yes	No	NS	Yes	No	NS	NS
Rooney et al. 2012	1990s, 2000s	NA	NA	NA	NA	NA	No	NA	Local	NA	NA
Yeh et al. 2010	2000s	NA	NA	NA	NA	NA	Yes	NA	Local	NA	NA

Notes: Yes = included in life-cycle boundary; No = not included; P = partially included; NS = not stated; NA = not applicable; V = varies by study addressed in meta-study.

[a] High impact = greater than 3 percent change in WTW emissions. Medium impact = 1 to 3 percent change in WTW emissions. Low impact = less than 1 percent change in WTW emissions.

[b] "Yes" indicates that GHG results for products such as gasoline, diesel, and jet fuel do include petroleum coke production and combustion. "No" indicates that GHG emissions from petroleum coke production and combustion were not included in the system boundary for gasoline, diesel, or jet fuel. The effect of including petroleum coke depends on how much is assumed to be stored at oil sands facilities versus sold or combusted, and whether a credit is included for coke that offsets coal combustion.

[c] "Yes" indicates that the study applied a credit for electricity exported from cogeneration facilities at oil sands operations that offsets electricity produced by other power generation facilities. "No" indicates a credit was not applied. Including a credit for oil sands would reduce the GHG emissions from oil sands crudes relative to reference crudes.

[d] Indicates whether studies included GHG emissions from the production of fuels that are purchased and combusted on-site for process heat and electricity (e.g., natural gas).

[e] Indicates whether the study included GHG emissions from the construction and decommissioning of capital equipment such as buildings, equipment, pipelines, rolling stock.
[f] Indicates whether refinery emissions account for the fuel properties of SCO relative to reference crudes. Since SCO is upgraded before refining, it requires less energy and GHG emissions to refine into gasoline, diesel, and jet fuel products.
[g] Not discussed in the meta-study; may vary by individual studies analyzed.
[h] Jacobs (2012) did not apply a credit for export of excess electricity generated at SAGD or upgrading facilities. Where facilities do produce excess electricity, however, the study calculated the amount of natural gas that would be used to produce the excess electricity and subtracted this from total natural gas consumption.

Given the slight differences in the two approaches, the results are reasonably consistent with each other. Rooney et al. (2012) estimated GHG emissions and reduced carbon sequestration capacity from landscape changes due to currently approved mines. In absolute terms, Rooney et al. (2012) found that land use changes for approved oil-sands development could release 11.4 to 47.3 million metric tons (or 68 to 283 metric tons of carbon per hectare) of stored carbon and reduce future sequestration by 5,734 to 7,241 metric tons of carbon per year (or 34 to 43 kg of carbon per hectare), but the authors did not relate these effects to life-cycle GHG emissions associated with extraction, upgrading, transportation, refining, and combustion of refined products from oil sands-derived crudes. The primary driver for the release of stored carbon from land use change in Alberta is the replacement of carbon-rich peatland (containing 530 to 1,650 metric tons of carbon per hectare) with relatively low carbon post-mining soils (containing 50 to 146 metric tons of carbon per hectare). In three of the mines examined in Rooney et al. (2012), 67 percent of the peatlands were reclaimed; this land conversion proportion was then scaled by the total area permitted for oil sands mining to estimate the peatland loss for the entire region studied. The uncertainty in the carbon release estimate is derived from the wide range of carbon storage values for both the peatland and the post-mining soil.

The land disturbance emissions impact estimated by Yeh et al. (2010) was between 260 and 1,691 metric tons of carbon per hectare for surface mining production and between 6 and 135 metric tons of carbon per hectare for in situ.[19] The authors found that land use contributes to <0.4 percent of WTW life-cycle GHGs from in situ oil sands production, and between 0.9 to 2.5 percent of surface mining production over a 150-year modeling period. The larger contribution to surface mining life-cycle GHG emissions is due to the larger land use change impacts of these operations and that reclamation efforts may replace much of the disturbed peatland environment with upland forests that have lower stocks of carbon and do not provide long-term carbon sequestration benefits (Yeh et al. 2010).

Importantly, only a few studies modeled the effect that upgrading SCO has on downstream GHG emissions at the refinery. Several (but not all) studies include the following:

- Upstream production of purchased fuels and electricity used to power machinery in the oil fields and at refineries;
- Flaring and venting;
- Fugitive emissions; and
- Methane emissions from oil sands mining and tailings ponds.

Input Assumptions

Impact LCA results and assumptions are input at each life-cycle stage. Due to limited data availability and the complexity of and variation in the practices used to extract, process, refine, and transport crude oil, studies often use simplified assumptions to model GHG emissions. For example, for both WCSB oil sands crude oils and reference crude oils, assumptions about how much petroleum coke is produced, stored, and combusted at the upgrader or refinery, and how much is sold to other users, are key drivers of GHG emission estimates. Transportation

[19] The energy yields estimated by Yeh et al. for oil sands mining and in situ extraction were 0.92 petajoules per hectare and 3.3 petajoules per hectare, respectively.

assumptions have a more limited effect, but vary across the studies. The following are key input assumptions for WCSB oil sands-derived crude oils:

- Type of extraction process (i.e., mining or in situ production);
- Steam-oil ratio assumed for in situ operations;
- Efficiency of steam generation, and thus its energy consumption; and
- Upgrading processes modeled for SCO and whether or not estimated refinery GHG emissions account for upgrading.

For the reference crudes, key input assumptions include the oil-water and gas-oil ratios used to estimate reinjection and venting or flaring assumptions (e.g., stranded gas versus recovered gas, control levels on venting sources, the allocation of venting/flaring emissions to crude versus produced natural gas), and whether and what type of artificial lift (e.g., gas lift, water, steam, CO_2 flood) is considered for extracting crude oil. Life-cycle GHG emissions for gasoline produced from WCSB oil sands crude oils relative to other reference crude oils consumed in the United States, as reported by NETL (2009) are summarized in Table 4.15-22. The results are subject to several input assumptions that influence the results of the analysis. These assumptions and their estimated scale of impact on the WTW results are summarized in the last two columns of Table 4.15-22.

Table 4.15-22 GHG Emissions for Producing Gasoline from Different Crude Sources from NETL 2009 and Estimates of the Impact of Key Assumptions on the Oil Sands-U.S. Average Differential

	GHG Emissions (g CO_2e/MJ LHV gasoline)[a]					Findings on Key Assumptions Influencing Results	
Life-Cycle Stage	**2005 U.S. Average**	**Canadian Oil Sands**	**Venezuela Conventional**	**Mexico**	**Saudi Arabia**	**Description**	**Estimated Reference Crude WTW Impact**
Crude Oil Extraction	6.9	20.4[c]	4.5	7.0	2.5	Oil sands estimate assumes a weighted average of 43% crude bitumen (not accounting for blending with diluent to form dilbit) from CSS in situ production and 57% SCO from mining, based on data from 2005 and 2006	NA
Upgrading	NA	IE	NA	NA	NA		
Crude Oil Transport	1.4	0.9	1.2	1.1	2.8	Relative distances vary by study	Low increase or decrease
Refining	9.3	11.5d	11.0	12.9	10.4	Did not evaluate impact of upgrading SCO prior to refinery; only affects oil sands crudes	Medium decrease
Finished Fuel Transport	1.0	0.9	0.9	0.9	0.9	Transportation excluded co-product distribution	Low increase
Total WTT	**18.6**	**33.7**	**17.6**	**22.0**	**16.7**		

Life-Cycle Stage	GHG Emissions (g CO_2e/MJ LHV gasoline)[a]					Findings on Key Assumptions Influencing Results	
	2005 U.S. Average	Canadian Oil Sands	Venezuela Conventional	Mexico	Saudi Arabia	Description	Estimated Reference Crude WTW Impact
Fuel Combustion	72.6	72.6	72.6	72.6	72.6		
Total WTW	**91.2**	**106.3**	**90.2**	**94.6**	**89.3**	**All crudes other than SCO when petroleum coke is accounted in Gulf Coast refineries**	**High increase**
Difference from 2005 U.S. Average	**0%**	**17%**	**-1%**	**4%**	**-2%**		

Notes: IE = included elsewhere; NA = not applicable. LHV = lower heating value. WTT = well-to-tank; WTW = well-to-wheels.
[a] NETL 2009 values converted from kilograms (kg) CO_2e/MMBtu using conversion factors of 1,055 MJ/MMBtu and 1000 g/kg.
[b] Estimated impact on the WTW GHG emissions for reference crudes, except where noted (i.e., refining assumption affects oil sands crudes), as result of addressing the key assumptions/ missing emission sources. High = greater than approximated 3 percentage points change, Medium = approximated 1-3 percentage points change, and Low = less than approximated 1 percentage point change in WTW emissions.
[c] Included within extraction and processing emissions.
[d] Calculated by subtracting other process numbers from WTT total; report missing this data point.
[e] The effect that including petroleum coke manufacture, transportation and combustion has on WTW results depends upon assumptions about the replacement of petroleum coke supply from Gulf Coast refineries in its market by coal or fuel oil.

For example, NETL (2009) developed its weighted-average GHG emission estimate for oil sands extraction (including upgrading) from data on mining and cyclic steam stimulation (CCS) in situ operations in 2005 and 2006. The estimate that the NETL study used for mining oil sands was based on a 2005 industry report that estimates higher values than more recent estimates of surface mining GHG emissions (TIAX 2009; Jacobs 2009, 2012). The in situ GHG estimate is based on a CSS operation which, while CSS operations tend to be more GHG intensive than SAGD processes, is generally in the range of in situ estimates in other studies (e.g., TIAX 2009; Jacobs 2009). The NETL study, however, did not account for the fact that natural gas condensate is blended with crude bitumen to form dilbit, which is transported via pipeline to the United States. Since condensate has a lower GHG intensity than crude bitumen, per-barrel GHG emissions from dilbit are less than per-barrel emissions from crude bitumen.

The NETL study only considered combustion emissions from gasoline, diesel, and kerosene-type jet fuel and allocated the refinery emissions from co-products other than gasoline, diesel, and jet fuel to the co-products themselves. This approach removes the GHG emissions associated with producing and combusting co-products from the study's life-cycle boundary. This approach is consistent with DOE/NETL's objective of estimating the contribution of crude oil sources to the 2005 baseline GHG emissions profile for three transportation fuels (gasoline, diesel, and kerosene-type jet fuel). The treatment of co-products, in particular petroleum coke, can have an important effect on comparisons of the results of life-cycle assessments. Petroleum coke, discussed in further detail below, is produced by thermal decomposition of vacuum residuum into lighter hydrocarbons during bitumen upgrading and crude oil refining. It is approximately 95 percent carbon by weight. Heavier crudes would produce a larger fraction of coke than lighter fuels. Venezuela Bachaquero, Mexican Maya, and dilbit produce about 50 percent more coke than average U.S. 2005 crude or Saudi light crude (TIAX 2009). SCO has had all the vacuum residuum removed in the upgrader before it reaches the refinery, and thereby has no petroleum

coke manufacture in downstream refineries or petroleum coke transportation and combustion as do the average U.S. barrel, Mexican, Venezuelan, or Saudi reference crude oils.

The fates of petroleum coke are influenced by market effects, and differ depending on whether petroleum coke is produced at WCSB oil sands facilities in Alberta or at U.S. refineries in the Gulf Coast. In Alberta, petroleum coke produced from partial refining (upgrading) of oil sands crudes is either stockpiled or combusted for process heat and electricity. If stockpiled, the carbon contained in the coke is temporarily sequestered. Data from planned and operational upgraders in Alberta show that gasification of petroleum coke and other heavy ends at these facilities substantially increases GHG emissions ((S&T)2 Consultants 2008); however, the extent of consumption of petroleum coke at WCSB oil sands facilities may be influenced by the availability of low-cost natural gas to these facilities (Brandt 2011).

At U.S. refineries in the Gulf Coast, petroleum coke is shipped to overseas markets, primarily China where it is ultimately combusted as a fuel in industrial or electric power applications. Transporting raw or diluted bitumen to refineries in the Gulf Coast that sell coke to other markets may therefore cause a greater share of the coke to be consumed rather than stockpiled. As explained in more detail in Appendix W, Life-Cycle Greenhouse Gas Emissions, on GHG emissions, petroleum coke produced at the upgrader and not the Gulf Coast refineries may be offset by additional coal or fuel oil combustion in the market currently filled with Gulf Coast refinery petroleum coke; however, the net emissions from coke production and combustion at the upgrader would be much smaller (Appendix W, Life-Cycle Greenhouse Gas Emissions).

As a result, the effect of including petroleum coke combustion depends upon study assumptions about the end use of petroleum coke at both the refinery and upgrader, and whether petroleum coke use offsets other fuels, such as coal or fuel oil. These factors, in turn, depend on market interactions involving the supply of petroleum coke relative to the availability of other competing fuel substitutes. These dynamic market effects are difficult to characterize and are generally not explicitly modeled in existing LCAs (Brandt 2011, Jacobs 2012). These issues are discussed further in the Petroleum Coke Characteristics, GHG Emissions, and Market Effects section below.

Additionally, the NETL study used linear relationships to relate GHG emissions from refining operations to specific crudes based on API gravity and sulfur content. The study notes that these relationships do not account for the fact that bitumen blends (dilbits and synbits) and SCO in particular would produce different fractions of residuum and light ends than full-range crudes. Accounting for the variable properties of these crude oil types and resulting refinery GHG emissions would change the differences between WTW GHG emissions for premium fuels refined from WCSB oil sands derived crude oils relative to reference crude oils.

Petroleum Coke Characteristics, GHG Emissions, and Market Effects

The Final EIS, released in August 2011, found that the treatment of petroleum coke in LCA studies was an important factor that influences the life-cycle GHG emission results. It is important when comparing oil sands and the reference crudes that the full life-cycle is evaluated, not just the upstream or refining stage. The issue of petroleum coke is not a standalone issue for oil sands crudes; it is also an LCA consideration for the heavy conventional crudes. If the GHG emissions for the production and combustion of petroleum coke and other co-products are included within life-cycle boundaries for one type of crude, it must be done for the other crudes for an even comparison.

Producing a barrel of premium fuels (i.e., gasoline, diesel, and kerosene/jet fuel) from bitumen produces roughly the same amount of petroleum coke as a barrel of premium fuels refined from heavy crudes, such as Venezuelan Bachaquero or Mexican Maya. The actual net GHG emissions from petroleum coke, however, depend on the final end use of the petroleum coke (i.e., whether it is stockpiled or combusted) and how its end use affects demand for other fuels such as coal. Since a portion of the petroleum coke produced from upgrading WCSB oil sands bitumen is currently stockpiled and not combusted, whereas the petroleum coke produced from refining reference crudes at Gulf Coast refineries is combusted, GHG emissions from petroleum coke produced from WCSB oil sands crudes are slightly lower than petroleum coke GHG emissions from other heavy reference crudes.

Recent reports published since the Final EIS (Oil Change International 2013, Gordon 2012) have also recognized petroleum coke as an important source of GHG emissions in the crude oil life-cycle. To better understand the importance of petroleum coke in the life-cycle of both oil-sands-derived and reference crudes, this section describes:

- Petroleum coke characteristics relative to coal, for which it serves as a substitute in the electric power sector;
- The effect of including petroleum coke production and combustion in life-cycle GHG emission estimates of oil sands and other reference crudes; and,
- Market effects related to changes in the petroleum coke production, how these effects have been captured in existing LCA studies, likely markets for petroleum coke, and potential effects on the demand for other fuels.

Physical characteristics of petroleum coke are provided in Table 4.15-23, including heating value (on a higher heating value basis),[20] carbon content, and CO_2 emissions per unit energy. For comparison purposes, these characteristics are also provided for bituminous, sub-bituminous, lignite, and anthracite types of coal. The change in CO_2-intensity for these coals is provided relative to petroleum coke on an energy basis. Table 4.15-23 shows that bituminous, sub-bituminous, and lignite coal are between about 4 and 9 percent less CO_2-intensive than petroleum coke on an energy basis, while anthracite coal is approximately 2 percent more CO_2-intensive.

Recent reports (Oil Change International 2013, Gordon 2012) have critiqued existing LCA studies for allocating GHG emissions from producing and combusting petroleum coke outside the study boundaries, or for assuming that petroleum coke combustion substitutes or offsets coal combustion. Defined pathways for individual products are the cornerstone of LCA, and must be appropriate to the study's goal and scope. For example, NETL excluded GHG emissions from petroleum coke production and combustion because they are outside the boundary of premium fuel products (i.e., gasoline, diesel, and kerosene/jet fuel) (NETL 2008, 2009). This approach is consistent with the study's goal of estimating the contribution of crude oil sources to the 2005 baseline emissions profile for premium fuels.

[20] The heating value is the amount of heat released during the combustion of a specified amount of a substance, and the higher heating value is determined by bringing all the products of combustion back to the original pre-combustion temperature.

Table 4.15-23 Petroleum Coke and Coal Heating Values, Carbon Contents, and CO_2 Emissions per Unit Energy from USEPA (2012b)

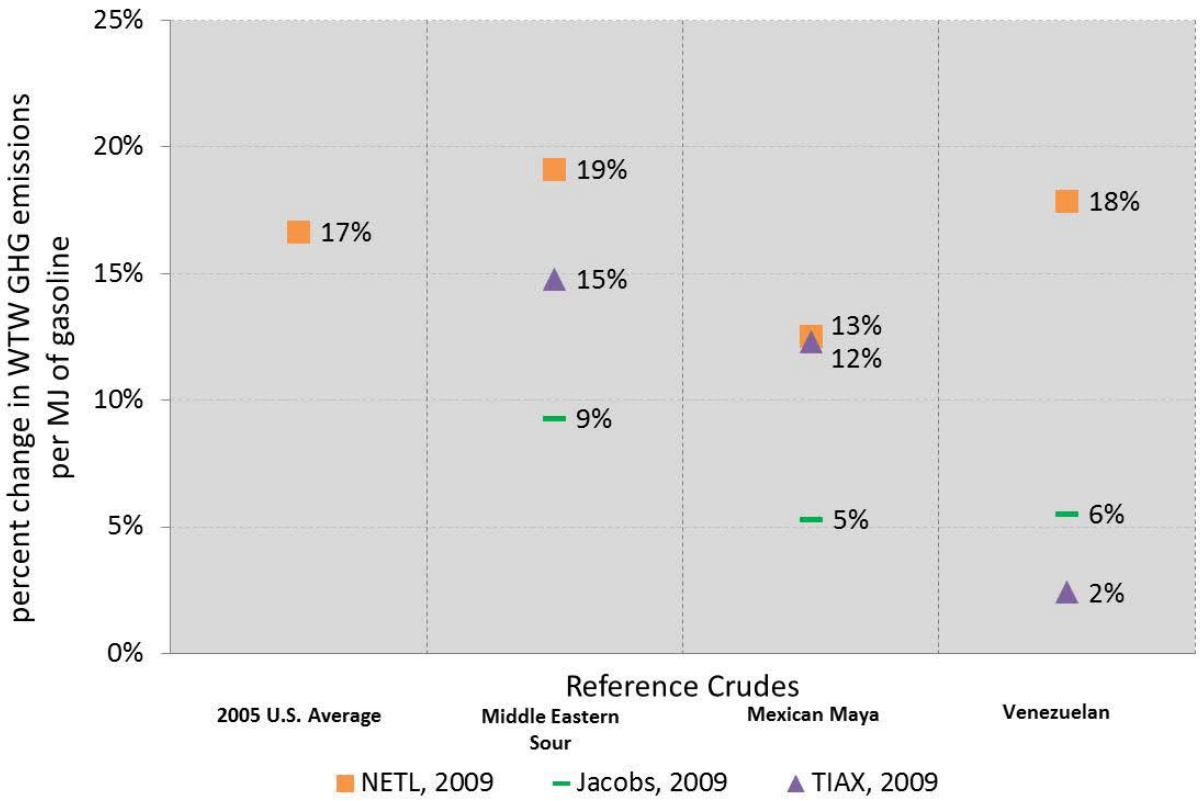
Characteristic	Units	Petroleum Coke	Bituminous Coal	Sub-bituminous Coal	Lignite Coal	Anthracite Coal
Heating value[a]	million Btu/ short ton	30.12[b]	23.89[c]	17.14[c]	12.87[c]	22.57[c]
Carbon content[d]	% carbon, by weight	92%	67%	50%	38%	70%
CO_2 emissions per unit energy	$kgCO_2$/ million Btu	102.10[e]	93.27[f]	97.17[f]	97.67[f]	103.67[f]
	grams CO_2/MJ	96.77	88.40	92.10	92.57	98.26
Change in emissions-intensity relative to petroleum coke	**% change**	**--**	**-9%**	**-5%**	**-4%**	**2%**

Notes: Data in table reflects national characteristics provided by USEPA (2012b) U.S. Inventory of Greenhouse Gas Emissions: 1990-2010. Original sources cited in USEPA (2012b) are provided below.
[a] On a higher heating value basis.
[b] EIA (2010). Annual Energy Review 2009. U.S. Energy Information Administration.
[c] EIA (1993). State Energy Report 1992. U.S. Energy Information Administration.
[c] Calculated from heating value and CO_2 emissions per unit energy.
[e] Based on data sourced from EIA (1994), EIA (2009), USEPA (2009) and USEPA (2010a)
[f] Calculated from USGS (1998) and PSU (2010); data presented in USEPA (2010b)

Other LCA studies do not exclude the GHG emissions from the production and combustion of petroleum coke and other co-products that leave the system boundary. Instead, these studies typically apply a substitution credit for the fuels that are offset in other markets by the use of petroleum coke and other co-products. To calculate the credit, studies generally assume one-to-one substitution on an energy basis (i.e., one Btu of coal is offset by one Btu of petroleum coke). Although some studies have assumed that the net GHG emissions from offsetting coal for coke are negligible (IHS CERA 2012), other studies have accounted for the fact that petroleum coke has a higher CO_2 intensity on an energy basis when compared to bituminous and sub-bituminous coal. For example, Jacobs found this net difference to be approximately 8 g CO_2/MJ (plus a small, unspecified adjustment to account for transportation of coke versus coal) (Jacobs 2009 p. 8-3); the most recent Jacobs report assumed that offsetting the combustion of coal with petroleum coke results in a small incremental net increase of approximately 2 g CO_2/MJ (Jacobs 2012, p. 9-12).

Since the treatment of petroleum coke and other co-products has a large effect on WTW GHG emissions, it is important to ensure that consistent system boundaries are applied when comparing GHG emissions from WCSB oil sands crudes to other reference crudes. For example, the GHG emissions from oil sands extraction and upgrading have been estimated as 3.2 to 4.5 times higher than conventional oil production (Oil Change International 2013; Huot 2011), but this comparison does not describe entirely equivalent crude oil types. The upstream LCA stage for some oil sands includes the process of upgrading, which removes the heavy coke bottom of the crude barrel. For conventional crudes, the extraction stage does not contain the equivalent process of upgrading or coking; instead, for conventional crudes the coking process occurs within the refining stage.

Since the boundaries across different LCA studies differs depending on the goal and scope of a particular study, the change in WTW emissions from oil sands crudes relative to other reference crudes is compared on an internally-consistent basis (i.e., by comparing the relative change within studies, not across different studies) in Figures 4.15.3-3, 4.15.3-4, and 4.15.3-5, and in the incremental assessment of GHG emissions in this section.



Source: NETL 2009; Jacobs 2009; TIAX 2009.

Notes: In this chart, all emissions are per MJ of reformulated gasoline with the exception of NETL 2009, which is per MJ of conventional gasoline. Venezuela Conventional is used as the NETL reference crude for Venezuela Bachaquero in this analysis. This is a medium crude, not a heavy crude; thus, the NETL values are compared against a lighter Venezuelan reference crude than other studies. The percent differentials refer to results for scenarios from the various studies and are calculated using the oil sands results relative to the corresponding study's reference crude. A positive percentage indicates the oil sands' near-term WTW weighted average is greater than the X-axis reference crude.

Figure 4.15.3-5 Percent Change in Near-Term WTW Weighted-Average GHG Emissions from the Mix of WCSB Oil Sands Crudes that may be Transported in the Proposed Project Relative to Reference Crudes

Virtually all crude oils, light, medium and heavy, including bitumen, contain a fraction of the raw oil out of the ground that does not boil even under full vacuum conditions. This fraction, called vacuum residuum, will thermally destruct into lower molecular weight hydrocarbon compounds and elemental carbon when heated above about 800°F. This fraction is commonly used for three products: asphalt, residual fuel oil (called No. 6 fuel oil or bunker fuel), and petroleum coke. The coking process takes advantage of the thermal destruction nature of vacuum residuum by heating the oil above the thermal destruction temperature and quickly discharging

the hot oil into a drum where the hydrocarbons exit the top as vapors and the elemental carbon settles to the bottom as petroleum coke.

Canadian oil sands bitumen contains about 40 percent vacuum residuum fraction. When this bitumen is blended with 30 percent diluent, creating what is referred to as dilbit, the dilbit contains about 30 percent vacuum residuum fraction. Venezuelan Bachaquero crude contains about 40 percent vacuum residuum, and Arab Light crude contains about 20 percent vacuum residuum. So the vacuum residuum of Canadian oil sands bitumen is within the range of crude oils commonly refined in the Gulf Coast area, which is the proposed destination of Canadian oil sands crudes transported by the proposed Project.

Domestic consumption of petroleum coke in the United States is unlikely to significantly increase, so petroleum coke exports are likely to continue, with China remaining a large importer of U.S. petroleum coke to meet its domestic energy demands. Since the USEPA specified sulfur limits on No. 6 fuel oil (which are very hard and expensive to achieve in anything but low sulfur crude oils), the U.S. electrical power industry largely abandoned use of No. 6 fuel oil for electricity generation. This limitation of sulfur in fuel oil did not solve the acid rain air pollution problem in the northeastern United States, so the USEPA specified SOx emissions controls on coal-fired power plants. Flue gas stack scrubbers remove the SOx, and hence, the acid rain problem is largely resolved today. Nevertheless, No. 6 fuel oil has not re-entered the power generation market because refineries have installed coking units to convert oil into petroleum coke. While coke can be used as a supplement to coal in electrical power plants, with declining reliance on coal and long term contracts with coal suppliers, petroleum coke has not significantly penetrated the U.S. power plant industry. For example, in 2011 petroleum coke consumption was equivalent to 0.5 percent of coal consumption for electricity generation across all sectors (EIA 2012b). Most of the Gulf Coast coke is exported to markets in China, Japan, and Mexico, which accounted for 35 percent of all exports in 2011 (EIA 2012c). China was the single largest importer of U.S. petroleum coke, accounting for approximately 14 percent of U.S. exports (EIA 2012c).

The sulfur content of petroleum coke in the United States is a consideration for coal-fired power plants as they must control SOx emissions with flue gas scrubbers. Consideration is also given to the sulfur content of No. 6 fuel oil, but the power industry is converting to plentiful and inexpensive natural gas, and the coking assets are in place to process virtually all vacuum residuum not destined for the asphalt market.

The proposed Project will transport a mix of SCO and dilbit.[21] Petroleum coke from the bitumen upgraded into SCO is produced at Canadian upgraders. A significant fraction of this petroleum coke—approximately 50 to 75 percent (ERCB 2010; Oil Change International 2013, citing Alberta ERCB)—is currently stockpiled because it faces the same barriers to penetrate the Canadian coal-fired power plant market as does petroleum coke in the United States and it cannot be economically transported by rail for export to overseas markets at current market prices.

[21] For the purposes of this GHG Section, a 50/50 mix of SCO and dilbit is assumed, representing a conservative approach to life-cycle GHG considerations. As described in Section 1.4, Market Analysis, there is a significant difference in the projected percentages (between the 2008 and 2012 CAPP forecasts) of the crude oil that would go to market as upgraded synthetic crude oil, the projections being 47% percent and 28% percent respectively.

The dilbit transported by the proposed Project would be transported to Gulf Coast refineries where it would produce approximately the same quantities of petroleum coke as other heavy reference crudes such as Venezuelan Bachaquero and Mexican Maya. So of the total WCSB oil sands throughput of the proposed Project, slightly more than half of the petroleum coke is produced in Canada, where approximately 50 to 75 percent of it is currently stockpiled and the rest used as a substitute for other fuels in the production and upgrader process. The remainder of the petroleum coke (all that is produced from the dilbit fraction and none in the SCO) is produced at Gulf Coast refineries where it is used as a fuel in domestic or overseas markets.

Petroleum refineries attempt to maximize the use of all assets. Therefore, Gulf Coast area refineries will choose blends of Canadian oil sands crudes (dilbit, SCO, synbit) with other domestic and imported crudes to fill out the refinery assets including the coker units. Hence, approximately the same quantity of petroleum coke would be produced from a mix of crudes that backs out imported crude oils such as Mexican Maya, Venezuelan Bachequero, and Saudi Arabian Light crudes. The coke produced from Canadian oil sands crudes would be marketed the same as current coke; most of it would be exported with China being a large importer of U.S. petroleum coke.

The petroleum coke-associated GHG emissions from oil sands would be fundamentally similar to some heavy reference crudes given the following:

- Accounting for the non-combustion for approximately half of the upgrader petroleum coke manufacture;
- The combustion of coke manufactured from reference crude oils (including transportation to the China market);
- The lower refining emissions of SCO (because all the residuum processing was done at the upgrader); and
- The likely transportation of displaced reference crudes to alternative markets (e.g., Mexican Maya transported 10,000 miles to China rather than 700 miles to the Gulf Coast.

The oil sands petroleum coke-associated GHG emissions would likely be higher than the U.S. average barrel, especially with rapidly expanding shale oil production in North America.

While certain LCA studies developed detailed data models of oil sands production, processing, transport, and refining processes, including petroleum coke, they do not have access to the detailed data of the processes used to produce other reference crudes. For example, all conventional crudes, such as Saudi Arab Light and most U.S. production prior to the shale oil boom, are in various stages of declining production requiring enhanced production techniques with larger energy intensities per barrel of oil produced. As a result, the conventional crude production carbon intensity can be expected to trend upward, whereas the WCSB oil sands carbon intensity can be expected to be relatively flat since the deposits are shallow, they can be extracted using mining or near-surface in situ methods, and new production methods could potentially reduce the energy intensity. Even Saudi Arab Light crude from the giant Ghawar field in Saudi Arabia, which is produced with a 10 million barrel per day water flood pumped from the Arabian Gulf, is rapidly increasing in water cut, such that it is possible in 10 years oil sands could be less energy intensive, well-to-wheels, than Saudi Arab Light delivered to the same Gulf Coast destination.

A large share of Gulf Coast petroleum coke is shipped to China for the following reasons:

- It is less expensive, including the shipping, than China's coal; and
- China is challenged to keep pace with its rapidly growing economy with equally rapid coal production growth.

Coal accounted for nearly half the increase in global energy use over the past decade, and China was responsible for nearly half the global coal use in 2009 (IEA 2011). China, alongside India, is expected to lead in energy consumption growth in non-OECD[22] Asian regions, which is projected to rise by 91 percent from 2010 to 2035 (EIA 2012d).

At the same time, Mexico, Venezuela, and other large petroleum producers depend heavily on their crude oil exports to support their national economies. Just as the Market Analysis (see Section 1.4, Market Analysis) found it unlikely that the proposed Project construction would have a substantial impact on the rate of the oil sands development, these other petroleum producers are unlikely to forego crude oil sales if the U.S. substitutes Canadian oil sands crudes for Mexican and Venezuelan crudes. They can be expected to sell their crudes for whatever price the market will bear, and that is probably to China. Similarly, all the production and transportation assets are in place for Saudi Arabia to supply the crude oil displaced from the U.S. market to any country in the world who will buy it.

Expanding electrical power generation in China is easier and more cost-effective with No. 6 fuel oil than coal. Both No. 6 fuel oil and coal have high sulfur contents, and China has significant air pollution problems primarily from coal power plants. Thus, when China chooses to invest in a solution to air pollution, installing power plant flue gas scrubbers is a leading option. That will make No. 6 fuel oil equally suitable for power generation, but more economical in new power plants than coal. Therefore, worldwide crude oils displaced from the Gulf Coast refineries with Canadian oil sands crudes would more likely find their way to China, along with roughly the same amount of petroleum coke from the Gulf Coast, both displacing coal production in China.

Supplementing the worldwide crude oil market, Canadian oil sand crude will more likely substitute for expanded coal production in China rather than expand the use of solid carbon fuels (coal and coke) used in power generation in North America or China. With the discovery of economic production of light, sweet crude oils from hydraulic fracturing shale, the combination of expanded light U.S. crude and heavy Canadian oil sands production would likely not alter petroleum refining assets in the Gulf Coast area with regard to coking capacity. Refineries designed to run primarily heavy crudes may have to add facilities to pre-distill light ends from light shale oil crudes, but the remaining secondary units of the refineries (vacuum distillation unit, gas oil cracking, coking, and hydrotreating distillate products) can be expected to be protected like any asset in place.

GHG Intensity of WCSB Crudes

The wide variation in design and input assumptions within the various studies leads to a wide divergence in calculated GHG emissions. Based on an extensive review of information provided in the studies reviewed, the WTW and WTT GHG emission estimates of gasoline produced from WCSB oil sands-derived crude oils were compared to similar emission estimates from four reference crude oils (see Figures 4.15.3-3 and 4.15.3-4). Additional information on the data

[22] Organization for Economic Cooperation and Development.

sources and assessment is available in Appendix W, Life-Cycle Greenhouse Gas Emissions. As shown in Figure 4.15.3-3, the NETL WTW GHG emission estimates from gasoline produced from WCSB oil sands derived crude oils are 17 percent higher than the GHG emission estimates for gasoline produced from the average mix of crude oils consumed in the United States in 2005, and are approximately 19, 13, and 16 percent higher than GHG emission estimates for Middle East Sour, Mexican Heavy (i.e., Mexican Maya), and Venezuelan[23] crude oils, respectively (NETL 2009). The WTW emission estimates for gasoline produced from SCO via in situ methods of oil sands extraction (i.e., SAGD and CSS) in general are higher than the GHG emission estimates for mining extraction methods (Figure 4.15.3-3). This difference is primarily attributable to the energy requirements of producing steam as part of the in situ extraction process.

Gasoline produced from dilbit generally has lower estimated GHG life-cycle emissions than gasoline produced from SCO extracted by mining and in situ methods. This is a result of blending raw bitumen with a diluent (e.g., gas condensate) for transport via pipeline. Diluent produces fewer GHG emissions than bitumen, so blending the two together results in lower WTW GHG emissions. This assessment evaluates the refining of both bitumen and diluent at the refinery, since diluent would not be separated from the dilbit blend and recirculated by the proposed Project. Wheel-to-wheel GHG emission estimates from gasoline produced from synbit, a blend of SCO and bitumen, are similar to WTW GHG emission estimates for gasoline produced from SCOs produced from bitumen extracted by either mining or in situ methods.

Similar trends were evident in the WTT GHG analyses (see Figure 4.15.3-4). The percentage increase in WTT GHG emission estimates for gasoline produced from WCSB oil sands-derived crude oils as compared to gasoline produced from reference crudes (Figure 4.15.3-4) is much larger than the percent increases for WTW GHG emission estimates (Figure 4.15.3-3). Most of the gasoline life-cycle WTW GHG emissions occur during the combustion stage irrespective of the feedstock (i.e., reference crude or oil sands). Because WTT GHG emission estimates do not include the combustion phase, the differences in GHG life-cycle emissions associated with crude oil extraction and refining are emphasized; when expressing the comparison in terms of percentage increases, the same incremental differences in the numerator are divided by a smaller denominator.

The GHG emissions associated with different oil sands extraction, processing, and transportation methods vary by roughly 25 percent on a WTW basis. Life-cycle GHG emission estimates for fuels produced from WCSB oil sands crude oils are higher than emission estimates for fuels produced from lighter crude oils, such as Middle Eastern Sour crudes and the 2005 U.S. average mix. Compared to heavier crude oils from Mexico and Venezuela, WTW emission estimates associated with fuels derived from WCSB oil sand-derived crude oils are 37 percent higher than for SAGD SCO (petroleum coke burned at the upgrader) and 2 percent lower for mining-derived SCO (including storing or selling the petroleum coke).

Estimates from recent LCA studies are within these ranges. A recent study by IHS CERA found that transportation fuels produced from oil sands result in average WTW GHG emissions that are 14 percent higher than the average crude refined in the United States (results range from 5 to 23 percent higher) (IHS CERA 2012). In addition, Jacobs found that WTW GHG intensities of

[23] NETL uses Venezuelan Conventional as a reference crude rather than Venezuelan Bachaquero.

transportation fuels produced from oil sands are within 7 to 12 percent of the upper range of the conventional crudes WTW intensity (Jacobs 2012).

Incremental GHG Emissions from Oil Sands Crudes Potentially Transported by the Proposed Project Compared to Reference Crudes

As noted earlier in this section, and in Section 1.4, Market Analysis, under most scenarios the proposed Project would be unlikely to substantially influence the rate or magnitude of oil extraction activities in Canada, or the overall volume of crude oil transported to the United States or refined in the United States. Although there have been developments in the North American crude market since that analysis was completed, those developments do not alter the conclusion reached (see Section 1.4, Market Analysis). Thus, from a global perspective, the decision whether or not to build the proposed Project would be unlikely to substantially affect the rate of extraction and combustion of WCSB oil sands crude and its impact on the global market. On a life-cycle basis and compared with reference crudes refined in the United States, the reliance on oil sands crudes for transportation fuels would likely result in an increase in incremental GHG emissions.[24]

Although an LCA is not strictly necessary for evaluating the potential environmental impacts attributable to the proposed Project under NEPA, it is relevant and informative for policy makers to consider in a variety of contexts. For illustrative purposes, this section provides information on the incremental life-cycle GHG emissions (in terms of the U.S. carbon footprint) from WCSB oil sands crudes that would likely be transported by the proposed Project (or any transboundary crude oil pipeline). The incremental emissions are a function of:

- Throughput of the pipeline
- Mix of oil sands crudes imported
- GHG intensity of the crudes in the pipeline compared to the crudes they displace

Acknowledging the methodological differences in GHG-intensity estimates among the studies, the weighted-average GHG emissions for selected studies were calculated to estimate the incremental GHG emissions from WCSB oil sands relative to displacing an equivalent volume of reference crudes in U.S. refineries.

Jacobs (2009), TIAX (2009), and NETL (2009) formed the subset of studies used to develop weighted averages for the carbon footprint analysis. These studies are independent analyses of WTW GHG emissions from oil sands and reference crudes that use consistent functional units for comparison with each other. The other studies included in this assessment either did not look at the full WTW fuel life cycle, did not evaluate emissions on a consistent functional unit basis for comparison, or are meta-analyses that include the results of the Jacobs and TIAX studies. Despite the underlying differences in study assumptions, the comparisons illustrated below are internally consistent and make comparisons between crudes from the same study. For illustrative purposes, Figure 4.15.3-5 shows the percent change in weighted-average GHG emissions from

[24] Note that a substantial share of these emissions would occur outside the United States. Also note that the U.S. National Inventory Report, like other national inventories, only characterizes emissions within the national border, rather than using a life-cycle approach. If the United States used a life-cycle approach, upstream emissions from other imported crudes would be attributed to the United States.

the mix of WCSB oil sands crude oil that may be transported in the proposed Project relative to each of the four reference crudes on a gasoline basis.

The change in GHG emissions is calculated for the Jacobs (2009) and TIAX (2009) values by weighting the WTW GHG intensity of individual oil sands crudes by the composition of oil sands crudes that could be transported in the proposed Project. For this GHG life-cycle assessment, 50 percent of pipeline throughput is assumed to be SCO, and 50 percent would be dilbit.[25] All WCSB dilbit is currently produced using in situ production and 12 percent of SCO is produced via in situ methods (Alberta Energy Resources Conservation Board [ERCB] 2010), yielding a final mix of 50 percent in situ-produced dilbit, 44 percent mining-produced SCO, and 6 percent in situ-produced SCO.[26] The results are representative of near-term expected WCSB oil sands composition and GHG intensities.

The Canadian oil sands average from NETL (2009) is also plotted on Figure 4.15.3-5 for comparison with Jacobs (2009) and TIAX (2009), although the NETL result assumes a mix of 43 percent crude bitumen and 57 percent SCO. The NETL study did not account for the fact that condensate is blended with crude bitumen to form dilbit, which is transported via pipeline to U.S. refineries. Since condensate has a lower GHG intensity than crude bitumen, per-barrel GHG emissions from dilbit are less than per-barrel emissions from crude bitumen. The results show a 2 to 19 percent increase in WTW GHG emissions from gasoline produced from the weighted-average mix of oil sands crudes that may be transported in the proposed Project relative to the reference crudes in the near term. Heavier crudes generally take more energy to produce and emit more GHGs than lighter crudes, and in particular, the weighted-average WCSB oil sands crude is currently more energy- and carbon-intensive than lighter crudes like Middle Eastern Sour.

For illustrative purposes, Table 4.15-24 shows the incremental annual WTW GHG emissions associated with displacement of 100,000 barrels of each reference crude per day with WCSB oil sands crude oil using the weighted-average estimate for the mix of WCSB oil sands crudes that may be transported in the proposed Project.

[25] As described in Section 1.4, there is a significant difference in the projected percentage of that crude oil that would go to market as upgraded synthetic crude oil, 47 percent in the 2008 CAPP forecast, dropping to 28 percent in the 2012 CAPP forecast.

[26] Of in situ WCSB oil sands production from SAGD and CSS facilities, CSS accounts for 47 percent of production, and SAGD accounts for 53 percent. This ratio was used to calculate an average for in situ-produced dilbit for TIAX, which provided separate estimates for CSS and SAGD dilbit. Primary in situ production of WCSB bitumen (i.e., using conventional oil production techniques) was not included since estimates were not provided in the studies included in the scope of this assessment. Primary production currently accounts for 32.9 thousand cubic meters per day, or 14 percent of total oil sands production (ERCB 2010).

Table 4.15-24 Incremental Annual GHG Emissions of Displacing 100,000 Barrels per Day of Each Reference Crude with WCSB Oil Sands ($MMTCO_2e$[a]) by Study

Reference Crude	Jacobs 2009	TIAX 2009[b]	NETL 2009[a]
Middle Eastern Sour	1.3	2.0	2.5
Mexican Maya	0.5	1.6	1.7
Venezuelan[c]	0.4	0.5	2.4
U.S. Average (2005)	NA	NA	2.3

Note: The incremental annual GHG emissions presented here are calculated using internally consistent comparisons for each reference crude and the weighted average WCSB oil sands crude using information from each respective study. The incremental annual GHG emissions estimates for displacing the U.S. average (2005) reference crude is only provided for NETL (2009) because only NETL included a U.S. average reference. NA = Not Applicable.
[a] $MMTCO_2e$ = million metric tons of CO_2 equivalent.
[b] The NETL and TIAX studies allocate a portion of GHG emission to co-products other than gasoline, diesel, and jet fuel products, which are not accounted for in these estimates. As a result, incremental GHG emissions are underestimated for those studies.
[c] Venezuelan conventional crude values for NETL refer to a medium crude, not the heavy crude Venezuelan Bachaquero.

The incremental GHG emissions were calculated by first multiplying the WTW GHG emission intensities per barrel of gasoline and distillates (i.e., gasoline, diesel, and kerosene/jet fuel) for WCSB and reference crudes from each study by the volume of premium fuel products produced by 100,000 barrels of WCSB oil sands crude. WTW GHG emissions from each reference crude were then subtracted from the WTW GHG emissions from the equivalent volume of WCSB oil sands crude to estimate incremental GHG emissions. The 100,000 barrels of crude were converted to an equivalent volume of gasoline and distillate products using yield data provided in each respective study. As previously noted, these incremental GHG estimates provide an example of the potential effect, on a life-cycle basis, resulting from displacement of reference crude oils in PADD 3 refineries; on a global scale, the decision whether or not to build the proposed Project would not affect the extraction and combustion of WCSB oil sands crude on the global market (see Section 1.4, Market Analysis).

The incremental GHG emissions in Table 4.15-24 are compared against four different reference crude oils. To the extent that Middle Eastern Sour is the world balancing crude (i.e., the crude oil that would most likely be replaced by WCSB crude and backed out of the global market), it may ultimately be the crude that is backed out of the world market by WCSB oil sands crudes. From another perspective, if the proposed Project is built and the PADD 3 refineries continue using about the same input mix of heavy crudes as they currently use, Venezuelan Bachaquero or Mexican Mayan are likely to be displaced by WCSB oil sand crudes. Finally, NETL (2009) estimated the GHG emissions intensity of the average barrel of crude oil refined in the United States in 2005. The Jacobs and TIAX studies are not compared to this reference crude because they did not include a U.S. average estimate.

The three studies referenced in Table 4.15-24 used different methods to allocate GHG emissions between premium fuels (e.g., gasoline, diesel, and jet fuel) and other co-products (e.g., light and heavy ends, petroleum coke, sulfur). Jacobs (2009) attributes all GHG emissions associated with extracting, refining, and distributing other co-products to premium fuels;[27] thus, the incremental

[27] Jacobs (2009) also applies a substitution credit for offsetting other products that are replaced by each of the co-products. For example, the production and use of petroleum coke is assumed to offset GHG emissions from coal-fired electricity production.

GHG emissions shown for Jacobs (2009) in Table 4.15-24 take into account the production and use of these co-products.

As noted elsewhere in the Supplemental EIS, the near-term initial throughput of the proposed Project is projected to be 830,000 barrels of crude per day with 100,000 bpd supplied by Bakken crude production and the remaining 730,000 bpd supplied by the WCSB oil sands. However, assuming that the full 830,000 bpd capacity of the pipeline is used to transport only WCSB crude, and based on the results in the Jacobs (2009) study, incremental GHG emissions from the proposed Project would be 11.1 $MMTCO_2e$ if the oil sands crude oil transported by the proposed Project offset an equivalent amount of Middle Eastern Sour crude oil. Incremental emissions would be 4.4 $MMTCO_2e$ annually if oil sands crude oil offset Mexican Maya crude oil and 3.3 $MMTCO_2e$ annually if Venezuela Bachaquero crude oil were offset.

Unlike the Jacobs study, the TIAX and NETL studies allocate a portion of GHG emissions to co-products other than gasoline, diesel, and jet fuel products, and these emissions are not included in the studies' WTW GHG results. As a result, the incremental GHG emissions estimates for TIAX and NETL in Table 4.15-24 may underestimate total incremental GHG emissions.[28]

TIAX (2009) found that the change in refinery energy use associated with an incremental barrel output of co-products other than gasoline, diesel, and jet fuel contributed to less than one percent of energy use and GHG emissions per barrel of refined product at the refinery, so any error introduced by the underestimate of GHG emissions attributed to co-products is negligible. According to the results of the TIAX study, incremental GHG emissions from the portion of WCSB oil sands crudes transported by the proposed Project would be 16.7 $MMTCO_2e$ if oil sands crude oil offset an equivalent amount of Middle Eastern Sour crude oil. Incremental emissions would be 13.4 $MMTCO_2e$ and 4.0 $MMTCO_2e$ annually if oil sands crudes offset Mexican Maya and Venezuelan Bachaquero crude oil, respectively.

Based on the results of NETL (2009), incremental emissions from the portion of WCSB oil sands crudes transported by the proposed Project would be 20.8 $MMTCO_2e$ annually if oil sands crude oil offset an equivalent amount of Middle Eastern Sour crude oil. Incremental emissions would be 13.8 $MMTCO_2e$ and 19.5 $MMTCO_2e$ annually if oil sands crudes offset Mexican Maya and Venezuelan Bachaquero crude oil, respectively. Compared to the average barrel of crude refined in the United States in 2005, incremental emissions from oil sands crudes would be 18.7 $MMTCO_2e$ annually.

The effect of allocating a portion of the life-cycle GHG emissions of refining crude oils to other, non-premium co-products was larger in the NETL study than in either of the studies by Jacobs (which did not allocate any emissions to other co-products) or TIAX (which allocated less than 1 percent of GHG emissions at the refinery to other co-products). To estimate the magnitude of this effect, the NETL results for WCSB oil sands and the 2005 U.S. average crude oils were adjusted to include other product emissions modeled in NETL's analysis. The lead NETL study author was contacted to vet the approach used to make this adjustment in order to ensure that it

[28] Adjusting the TIAX and NETL GHG emission estimates to include co-products other than gasoline, diesel, and kerosene/jet fuel would require two pieces of information: 1) the GHG intensity of the other products, for both WCSB crudes and reference crudes, and 2) the yield of the other products, for both WCSB crudes and reference crudes. TIAX (2009) and NETL (2008) do not provide explicit emissions intensity factors or product yields in a format that enables separate emissions estimates to be developed for these products. These products largely comprise the remaining fractions of the input crude that cannot be converted into premium products.

was made consistently with the NETL study framework (Personal communication, Timothy Skone 2011). Adjusting the NETL results to include other product emissions could increase the differential in incremental emissions from WCSB oil sands compared to the 2005 U.S. average crude oils by roughly 30 percent.

The full range of incremental GHG emissions associated with the displacement of the reference crudes by the WCSB oil sands crude estimated from the quoted subset of studies is 3.3 to 20.8 $MMTCO_2e$ annually. This is equivalent to annual GHG emissions from fuels combustion in approximately 770,800 to 4,312,500 passenger vehicles or the CO_2 emissions from combusting fuels used to provide the energy consumed by approximately 190,400 to 1,065,400 homes for one year.[29]

Section 1.4, Market Analysis, concludes construction of the proposed Project is unlikely to have a substantial impact on the development rate of the WCSB oil sands, and that even when considering the incremental cost of non-pipeline transport options, should the proposed Project be denied, a 0.4 to 0.6 percent reduction in WCSB production could occur by 2030, and in the scenario of all pipeline projects not being built, a 2 to 4 percent decrease in WCSB oil sands production could occur. This infers that of the 3.3 to 20.8 $MMTCO_2e$ annual incremental GHG emissions, the proposed Project would be responsible for incremental GHG emissions in the range of 0.07 to 0.83 $MMTCO_2e$ annually, and in the scenario where all pipelines were not constructed, the incremental GHG emissions would be 0.35 to 5.3 $MMTCO_2e$ annually.[30] The differentials presented here are based on life-cycle emission estimates for current or near-term conditions in the world oil market, as can be seen from the reference years used in each report. Over time, however, the GHG emission estimates for fuels derived from both WCSB oil sands crude oils and the reference crude oils are likely to change.

GHG emissions from the production phase for reference crude oils may become more energy-intensive over time due to the need to extract oil from deeper reservoirs by using more energy-intensive secondary and tertiary recovery techniques, such as CO_2 flood. Many of the reference crude oil reservoirs are 1 to 2 miles (or more) underground or under the ocean floor and exploration efforts for new deep oil reservoirs would continue as known reservoirs continue to deplete.

In contrast, the extent of the WCSB oil sands deposits is well understood and defined, where the deposits are much shallower and can be extracted using either surface mining or near-surface in situ methods. In the future, in situ extraction methods are projected to represent a larger share of the overall oil sands production, increasing from about 45 percent of 2009 oil sands production to an estimated 53 percent by 2030 (ERCB 2010). In particular, the share of SAGD in situ extraction methods are projected to rise from roughly 18 percent in 2009 to 40 percent of oil sands production in 2030 (IHS CERA 2011).[31] The GHG profile of this more energy-intensive oil sands extraction method may be reduced by new technologies and innovations to reuse steam

[29] Equivalencies based on USEPA's GHG Equivalency calculator (USEPA 2012c).

[30] In 2010, U.S. GHG emissions totaled 6,821.8 $MMTCO_2e$ (excluding emissions/removals from Land use, land-use change, and forestry) (USEPA 2012b). In 2010, global CO_2 emissions from fuel combustion were 30,326 $MMCO_2e$ (IEA 2012).

[31] Although the balance of mining and in situ extraction would change in the future, there are incentives for producers to keep GHG intensity as low as possible. For example, Alberta's climate policy requires that oil sands producers and other large industrial GHG emitters reduce their emissions intensity by 12 percent from an established baseline.

onsite and/or improve thermal recovery. However, surface mining is projected to remain a significant extraction method for WCSB crude oils for the next 20 years (IHS CERA 2010, 2011). Considering these factors, GHG intensity for future reference crude oils may trend upward while the GHG intensity for WCSB oil sands-derived crude oils may be relatively constant to slightly upward. If this is the case, the differential in life-cycle GHG emissions for fuels refined from these crude oils may decrease.

Conclusions

The studies show conclusively that combustion (i.e., tank-to-wheels) phase of the fuel life-cycle dominates the total GHG life-cycle emissions under all scenarios. Overall, it is clear that comparisons of GHG life-cycle emission estimates for fuels derived from different sources are sensitive to the choice of boundaries, consistent application of boundary conditions within studies, and to key input parameters. In particular, the results depend on assumptions regarding the uses of petroleum coke at oil sands facilities and at U.S. refineries, and upon the weighted-average mix of WCSB oil sands crude transported to the United States by the proposed Project or some other transboundary pipeline. SAGD and CSS in situ production methods are generally more GHG-intensive than mining, and while SCO requires upgrading prior to pipeline transport, bitumen blends such as dilbit and synbit require additional refining emissions and do not produce an equivalent amount of premium fuel products per barrel input.

Despite the differences in study design and input assumptions, it is clear that WCSB crudes, as would likely be transported through the proposed Project, are on average somewhat more GHG-intensive than the crudes they would displace in the U.S. refineries. As discussed in Section 1.4, Market Analysis, there would be no substantive change in global GHG emissions and, as explained in Section 4.15.3, Cumulative Impacts by Resource, there would likely be no substantial change in WCSB imports to PADD 3 with or without the proposed Project in the medium to long-term, the life-cycle GHG emissions associated with transportation fuels produced in U.S. refineries would increase if WCSB crude oils replace existing heavy crude oil sources for PADD 3.

It is also noted that the GHG intensity of reference crudes may increase in the future as more of the world crude supply requires extraction by increasingly energy intensive tertiary and enhanced oil recovery techniques,[32] although the latter can be in part act as a sequestration method. The energy intensity of surface-mined Canadian crudes would likely be relatively constant while higher energy intensive in situ production may increase somewhat; the proportion of in situ extraction is forecast to increase relative to the less energy-intensive surface mining. Although there is some uncertainty in the trends for both reference crudes and oil sands derived crude oils, on balance the gap in GHG intensity is likely to decrease over time.

[32] As with the producers of oil sands, however, in some cases producers of reference crudes are likely to face regulatory pressures or other incentives to lower the GHG intensity of their production process. Such a dynamic would counter the trend toward higher GHG intensities.

GHG Mitigation

The Government of Alberta has worked to mitigate and reduce the GHG emissions associated with oil sands production. In 2008, the Government of Alberta revised its Climate Change Strategy which aims to reduce 200 $MMTCO_2e$ of GHG emissions by 2050.[33] The strategy focuses three main policy initiatives as follows:

- First, the Climate Change and Emissions Management Act, enacted in 2003, establishes mandatory annual GHG intensity reduction targets for large industrial GHG emitters. Those emitters that fall short can either purchase credits from other companies that have reduced their emissions, or pay $15 for every metric ton of CO_2e above their target into a government-run clean energy technology fund (Government of Alberta 2010a).
- Second, the Government of Alberta has dedicated $1.55 billion to fund three large-scale CCS projects. Of these three projects, one involves oil sands producers. This project is expected to reduce 15.2 million metric tons of CO_2e per year (Government of Alberta 2012).
- Third, the funds collected as part of the Climate Change and Emissions Management Act are placed in the Climate Change and Emissions Management Fund, which is dedicated to investing in clean energy projects (Government of Alberta 2011a). In 2011 companies paid $55.4 million into the fund (Government of Alberta 2011b). Several projects selected for funding in 2011 focus on energy efficiency improvements and cleaner energy production at oil sands production facilities (Climate Change and Emissions Management Corporation 2010). CCS is expected to contribute 70 percent of the reductions, conservation and efficient energy use would contribute to 12 percent reduction, and greening energy production would contribute 18 percent (Government of Alberta 2008). Other GHG mitigation policy proposals could establish some form of broad fiscal or regulatory national GHG reduction policy that would incentivize or regulate lower GHG emissions from oil sands operations and other sectors of the economy. Canada is committed to meeting its emission reduction target under the Cancun Agreements of 17 percent below 2005 levels by 2020 using various approaches including provincial carbon taxes, cap and trade, feed-in tariffs, and regulatory approach by sector. Federal oil and gas sector GHG regulations are under development and draft regulations are expected in 2013. Additionally the Government of Canada is working with Alberta on a Joint Canada-Alberta implementation plan for oil sands monitoring which commits both governments to implement scientifically rigorous and comprehensive environmental monitoring programs (United Nations [UNFCC] 2012).

4.15.3.13 Potential Releases

The potential for cumulative impacts associated with the unintended operational releases from the proposed Project are addressed qualitatively because effects are heavily dependent upon how large the spills would be and where they might occur. Small to medium spills (up to 1,000 barrels), would more likely occur on construction sites or at operations and maintenance facilities, where in general, surface spreading is contained and infiltration into the ground

[33] In addition to mitigation initiatives, it is also worth noting that in September 2012 the Environmental ministers for Canada and Alberta together announced a joint environmental monitoring system of oil sands production that would include, among others, increased frequency of monitoring in the oil sands region, a doubling of the number of monitoring stations, and making data publicly available.

reduced by responders that are at these locations. For medium to large spills (greater than 1,000 barrels), the response time between the spill event and arrival of the response contractors would influence potential magnitude of impacts to environmental resources. Once the responders are at the spill scene, the efficiency, effectiveness, and environmental sensitivity of the response actions (e.g., containment and cleanup of oil, protection of resources from further oiling) would substantively influence the type and magnitude of potential additional environmental impacts.

Oil and hazardous materials spills as well as any inadvertent releases are a concern for fisheries habitats along the pipeline. Fish and aquatic invertebrates could experience toxic impacts of spilled oil, and the potential impacts would generally be greater in standing water habitats (e.g., wetlands, lakes, and ponds) than in flowing rivers and creeks. Also, in general, the impacts would be lower in larger rivers and lakes and much lower under flood conditions since the toxic hydrocarbon concentrations would likely be relatively rapidly diluted. Even when major fish kills have occurred as a result of oil spills, population recovery has been observed and long-term changes in fish abundance have not been reported (Kubach 2011); therefore, impacts of oil spills on fisheries resources is not expected to contribute significantly to cumulative effects.

Despite the uncertainty associated with the prediction of potential impacts from spills, historical pipeline incident data on existing crude oil pipelines indicate that impacts are typically localized, with short- and long-term effects to resources. If multiple spills occurred concurrently (geographically and temporally) in a region with a high density of oil pipeline routes and associated facilities, cumulative effects could occur to shallow groundwater and surface water resources, aquatic and/or terrestrial habitats, and wildlife. As shown in Figure 4.15.2-2 and 4.15.2-3, the southeastern region of Montana and the Steele City, Nebraska, area are candidate areas for cumulative impacts associated with concurrent spills. Larger spills could cause both local and regional disruption of human uses, as well as local and regional impacts to biological populations and communities. However, the effects would still be expected to diminish over time, and would not be expected to have permanent effects to resources, ecosystems, and human communities. Furthermore, the combined implementation of industry standards and practices, combined with design standards and the addition of the Special Conditions developed by the PHMSA and agreed to by Keystone, aid in reducing the potential for spill incidents associated with the proposed Project.

4.15.4 Extraterritorial Concerns

While the proposed Project analyzed in this Supplemental EIS begins at the international boundary where the pipeline would exit Saskatchewan, Canada, and enter the United States through Montana, the origination point of the pipeline system would be in Alberta, Canada. Neither NEPA nor Department regulations (22 CFR 161.12) nor Executive Orders 13337 and 12114 (Environmental Effects Abroad of Major Federal Actions) legally require that this Supplemental EIS include an analysis of the environment or activities outside of the United States. As a matter of policy, and in response to concerns that the proposed Project would contribute to certain continental scale environmental impacts, the Department has included a summary of information regarding environmental analyses and regulations related to the Canadian portion of the proposed Keystone XL Project and WCSB oil sands production. This section addresses 1) the Canadian National Energy Board (NEB) environmental analysis of the Keystone XL Project in Canada, 2) the potential influence of the proposed Project on oil sands development in Canada, 3) a summary of environmental impacts of oil sands development in

Alberta, and 4) protections for Canadian and U.S.-shared Migratory Bird and Threatened and Endangered Species resources.

4.15.4.1 Canadian National Energy Board Environmental Analysis of the Proposed Project

The analysis of the environmental effects of the overall proposed Project has been in progress on both sides of the international border under appropriate regulatory authorities (Appendix X, Canadian Environmental Assessment Act). In Canada, the NEB conducted that analysis, held public hearings in September 2009, and issued its findings in March 2010. The NEB identified the nine key issues listed below relative to the proposed Keystone XL Project:

- The need for the proposed facilities;
- The economic feasibility of the proposed facilities;
- The potential commercial impacts of the proposed project;
- The potential environmental and socioeconomic effects of the proposed facilities, including those to be considered under the Canadian Environmental Assessment Act (Appendix W, Canadian Environmental Assessment Act);
- The appropriateness of the general route of the pipeline;
- The method of toll and tariff regulation;
- The suitability of the design of the proposed facilities;
- The terms and conditions to be included in any approval the NEB may issue; and
- Potential impacts of the project on aboriginal interests.

Relative to impacts to aboriginal or indigenous peoples, the NEB granted intervener status to the following aboriginal groups in Canada:

- Moosomin First Nation;
- Neekaneet First Nation No. 380;
- Red Pheasant Band No. 108; and
- Sweetgrass First Nation.

In the March 2010 finding, the NEB determined that the proposed Keystone XL Project is required in Canada to meet the present and future public convenience and necessity, provided that the NEB terms and conditions presented in the project certificate are met, including all commitments made by Keystone during the hearing process. Pertinent NEB documents are provided in Appendix X, Canadian Environmental Assessment Act.

4.15.4.2 Influence of the Proposed Project on Oil Sands Development in Canada

As stated in Section 1.4, Market Analysis, approval or denial of any one crude oil transport project, including the proposed Project, remains unlikely to significantly impact the rate of extraction in the oil sands, or the continued demand for heavy crude oil at refineries in the U.S. Limitations on pipeline transport would force more crude oil to be transported via other modes of transportation, such as rail, which would probably (but not certainly) be more expensive. Longer term limitations also depend upon whether pipeline projects that are located exclusively in

Canada proceed (such as the proposed Northern Gateway, the Trans Mountain expansion, and the TransCanada proposal to ship crude oil east to Ontario on a converted natural gas pipeline).

If all such pipeline capacity were restricted in the medium-to-long-term, the incremental increase in cost of the non-pipeline transport options could result in a decrease in production from the oil sands, perhaps 110,000 to 220,000 barrels per day (bpd) (approximately 2 to 4 percent) by 2030. If the proposed Project were denied but other proposed new and expanded pipelines go forward, the incremental decrease in production could be approximately 17,000 to 30,000 bpd (from 0.4 to 0.5 percent of total WCSB production) by 2030.

In addition to the existing transport capacity into the United States, there would likely be market demand to put in place pipeline capacity into the United States similar to that of the proposed Project, including pipeline capacity to PADD 3. Also Canadian producers are actively seeking to develop alternative crude oil markets worldwide, including efforts to develop necessary transportation facilities to allow shipment of WCSB crude oil to British Columbia and onward to Asia, or eastward to Atlantic coast ports for marine shipment would continue. Other countries that would likely represent markets for WCSB crude oil are primarily located in Asia; those nations are experiencing increased demand for crude oil and are currently heavily dependent on OPEC for their supplies. In recent years, Chinese investment in WCSB crude oil production has greatly accelerated. Various pipeline projects have been proposed to transport crude oil from Alberta to the Canadian west coast, although they currently face significant opposition in the regulatory process (see Section 1.4, Market Analysis).

4.15.4.3 Environmental Effects of Oil Sands Development in Alberta

Many commenters on the Draft EIS and Supplemental Draft EIS documents prepared for the previously proposed project expressed concerns about impacts in western Canada related to the extraction of crude oil from oil sand deposits in the provinces of Alberta and Saskatchewan, Canada. Additionally, there has been much controversy over environmental impacts to wildlife, boreal forests, threatened and endangered species, and water resources related to oil sands production. Evaluation of impacts from extraction of crude oil from the oil sands is outside of the scope of analysis legally required under NEPA. Further, it is not expected that the proposed Project would have any impact on the rate of development of extraction in Canada. However, in response to comments and as a policy decision, a summary of general regulatory oversight and environmental impacts in Canada related to oil sands production has been included.

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 environmental regulations are administered by federal and provincial governments including the Ministry of the Environment, the Canadian Environmental Assessment Agency (which administers the Canadian Environmental Assessment Act), the Alberta Department of Environment, and the Alberta Department of Sustainable Resource Development. Oil sands deposits are located primarily in Alberta, but also extend into Saskatchewan. The Canadian Government and the Government of Alberta have a cooperative agreement to minimize regulatory overlap (the Canada-Alberta Agreement for Environmental Assessment Cooperation). Oil Sands development projects undergo an environmental review under Alberta's Environmental Protection and Enhancement Act and the Water Act, as well as the CEA and the Species at Risk Act (SARA). Other federal and provincial agencies may participate in the review as Responsible Authorities or as Federal Authorities with specialist advice.

In early April 2011, the Government of Alberta announced that it had prepared a draft development plan for the Lower Athabascan oil sands region. The plan would require cancellation of about 10 oil sands leases, set aside nearly 20,000 square kilometers (7,700 square miles) for conservation, and set new environmental standards for the region in an effort to protect sensitive habitat, wildlife, and forest land. On August 22, 2012, the Government of Alberta approved the Lower Athabasca Regional Plan. It became effective on September 1, 2012.

Bitumen, a heavy oil extract, is recovered from oil sands by either in situ (in place) recovery or surface mining. Most (80 percent) bitumen is recovered using in situ techniques that use SAGD to pump steam underground through a horizontal well to liquefy the bitumen, which is recovered by an extraction well. In situ recovery is less disturbing to the land surface than surface mining and does not require tailings ponds. Oil sands underlie 140,200 square kilometers ($km^{2)}$ (54,132 square miles [mi^2]) in three areas of northeast Alberta of which 602 km^2 (232 mi^2) has been disturbed by surface mining activity. Surface mining requires an open pit, similar to many coal, iron ore, copper, and diamond mines. Mined oil sands are then transported to a cleaning facility where they are mixed with hot water to separate the oil from the sand. There were 100 active oil sands projects in Alberta as of November 2011. Of these, six mining projects have been approved; five of these projects are currently producing bitumen (Government of Alberta—Energy 2012b).

The human footprint within Alberta's boreal forest natural region includes: 12 percent agriculture, 3 percent forestry, 2 percent energy, and 1 percent transportation infrastructure, leaving 82 percent of the region with no human footprint (Alberta Biodiversity Monitoring Institute [ABMI] 2009). The human footprint within the Alberta-Pacific Forest Industries Forest Management Agreement Area (Al-Pac FMA), a 57,331 km^2 (22,136 mi^2) area centered on the Athabasca oil sand deposit, includes: 4 percent forestry, 2 percent energy, and 1 percent transportation infrastructure, leaving 93 percent with no footprint (ABMI 2009). Cumulative impacts from oil sands development include GHG emissions and land surface alteration. Land surface alteration includes mine sites, tailings ponds, well sites, industrial roads, pipelines, power lines, seismic cut lines, and facilities. Biodiversity indicators evaluate ecosystem intactness or the proportion of human disturbance by assessing when common species become rare or disappear and when weedy or invasive species become common. Intactness indices for the Al-Pac FMA indicate:

- Intactness for 12 old-forest birds ranged from 96 to 100 percent with 7 of 12 old-forest birds less abundant than expected;
- Intactness for 11 winter-active mammals ranged from 89 to 100 percent with 3 of 11 winter-active mammals less abundant than expected;
- Percent occurrence of 16 non-native weeds ranged from 2 to 28 percent with non-native weeds detected across 39 percent of the Al-Pac FMA;
- For 4 of 17 species at risk that were evaluated, intactness was 97 or 98 percent, and 3 of the 4 species were less abundant than expected (the monitoring system is not designed to evaluate the other 13 species at risk);
- Intactness for four old-forest habitats ranged from 91 to 95 percent and for all old-forest habitats was 92 percent; and
- Intactness for live trees was 97 percent, for snags (standing deadwood) was 95 percent, and for downed deadwood was 98 percent (AMBI 2009).

The following cumulative statistics related to environmental effects from oil sands development in Alberta are derived from the records of the province of Alberta (Government of Alberta 2010b):

- Alberta's oil sands account for about 5 percent of Canada's overall GHG emissions and Canada is responsible for about 2 percent of global emissions;
- Oil sands mining projects have reduced GHG emissions intensity by an average of 39 percent between 1990 and 2008 and are working toward further reductions;
- All existing and approved oil sands projects may withdraw no more than 3 percent of the average annual flow of the Athabasca River (2008 usage was 0.7 percent of the long-term average annual flow);
- Water use by oil sands mining operations continues to decrease, despite significant increases in production;
- Many in situ projects recycle up to 90 percent of the water used in their operations, and use deep-well saline water as an alternative to freshwater wherever possible;
- Long-term air quality monitoring since 1995 shows improved or no change in CO, ozone, fine particulate matter, and SO_2, and an increasing trend in NO_2;
- Air quality in the oil sands region is rated good 95 percent of the time;
- Tailings (water, fine silts, left-over bitumen, salts and soluble organic compounds) ponds are constructed with groundwater seepage-capture facilities, and are closely monitored;
- Tailings settling ponds are designed and located after environmental review and bird deterrents are used to prevent birds from landing on tailings ponds;
- Currently, processing 1 tonne (1.1 tons) of oil sand produces about 94 liters (25 gallons) of tailings;
- About 602 km^2 (232 mi^2) have been disturbed by oil sands mining activity of which 67 km^2 (26 mi^2) has been or is in the process of reclamation (mine operators must provide a reclamation security bond);
- Alberta's boreal forest covers 381,000 km^2 (147,100 mi^2) of which the maximum area available for oil sands mining is 4,800 km^2 (1,854 mi^2) or about 1.25 percent of Alberta's boreal forest area;
- Alberta has committed to a cumulative effects approach that looks at potential impacts of all projects within a region; and
- 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.

With respect to potential impacts of oil sands development in Alberta on freshwater ecosystems, a joint study by the Queen's University in Kingston, Ontario and Environment Canada was published online in early January 2013 in the Proceedings of the National Academy of Sciences of the United States of America (PNAS) Early Edition that examined the effect of Athabasca Oil Sands development on lake ecosystems. The study found evidence of local industrial

contributions of Polycyclic Aromatic Hydrocarbons (PAHs) in aquatic ecosystems in the Athabasca oil sands region and concluded that atmospheric deposition of PAHs from upgrader emissions and unweathered bitumen dust from surface mining areas are likely major sources of PAHs entering regional aquatic ecosystems. The study concluded that the ecological consequences of increased PAH loadings to lakes in the region are unknown and require further assessment. In addition, the primary ecological changes noted in the lakes, increased primary production and shifts in targeted zooplankton assemblages, were attributed to 20th century climate change, and the study noted that increased PAH loadings have not yet resulted in decreases in the relative abundance of the targeted zooplankton evaluated in this study.

4.15.4.4 Protected Bird Species in Canada

Oil sands projects and oil transportation pipelines are evaluated and permitted by Canadian federal and provincial Canadian governments. Canada's version of the Migratory Bird Treaty Act is called the Migratory Bird Convention Act (MBCA). Both the U.S. and Canadian acts are based on the Migratory Birds Convention treaty signed in 1916 by the United States and the United Kingdom (on behalf of Canada). The Canadian Wildlife Service handles wildlife matters that are the responsibility of the Canadian federal government. Canadian regulations supporting the MBCA are available at http://laws.justice.gc.ca/en/M-7.01/C.R.C.-c.1036/. In addition, Canada's rare and endangered migratory birds are protected under the SARA (see http://www.sararegistry.gc.ca/default_e.cfm). Canadian protections for migratory birds are parallel to U.S. migratory bird protections. Canada also provides for protection of migratory bird habitat within government-recognized sanctuaries. Recent losses of migratory birds at WCSB oil sands tailings ponds have been cited as violations of the MBCA and have been prosecuted by the Canadian government.

Bird resources (waterfowl, waterbirds, shorebirds, and landbirds) are shared on a continental scale. The Tri-National North American Bird Conservation Initiative Committee was established to increase cooperation and effectiveness of bird conservation efforts among Canada, the United States, and Mexico. Partnership-based bird conservation initiatives have produced national and international conservation plans for birds that include species status assessments, population goals, habitat conservation threats, issues and objectives, and monitoring needs. Multi-national North American bird conservation plans include the North American Waterfowl Management Plan, North American Landbird Conservation Plan, United States and Canadian Shorebird Conservation Plans, Waterbird Conservation for the Americas, North American Grouse Management Strategy, and Northern Bobwhite Conservation Initiative. At the request of the Department, Keystone provided a synopsis of the TransCanada Corporation's participation in North American migratory bird conservation efforts.

The Partners in Flight conservation assessment concluded that nearly half of native landbirds in Canada, Mexico, and the United States depend on habitats in at least two of the countries and more than 200 species (more than 80 percent of all individual landbirds) use habitats in all three countries in at least one season (Berlanga et al. 2010). The landbird assessment identified 148 bird species in need of immediate conservation attention because of highly threatened and declining populations. The most imperiled species include 44 species with very limited distribution, mostly in Mexico, that are at greatest risk of extinction; 80 tropical residents dependent on deciduous, highland, and evergreen forests in Mexico; and 24 species that breed in temperate-zone forests, grasslands, and arid land habitats (Berlanga et al. 2010). Steep declines in 42 common bird species have occurred over the past 40 years with the majority of steeply

declining species breeding in the northern United States and southern Canada, and wintering in the southern United States and Mexico (Berlanga et al. 2010). Declining bird populations face a diversity of threats on breeding grounds from land-use policies and practices related to agriculture, livestock grazing, urbanization, energy development, and logging (Berlanga et al. 2010). Migratory species are threatened on their wintering grounds by loss of grasslands in northern Mexico and tropical forests in southern Mexico (Berlanga et al. 2010).

Oil sands development alters habitats through land surface alteration including: mine sites, tailings ponds, well sites, industrial roads, pipelines, power lines, seismic cut lines, and facilities. These land alterations reduce both the amount and the suitability of adjacent habitat available for migratory birds. Project components such as roads and power lines increase migratory bird collision mortality. Tailings ponds contain residual bitumen and are an exposure risk especially for migratory waterbirds. Alberta's oil sands lease areas cover about 21 percent of the 418,325 mi^2 Boreal Taiga Plains Bird Conservation Region (Government of Alberta—Energy 2010, U.S. NABCI Committee 2000). One hundred seventy migratory birds (49 waterbirds, 121 landbirds) have been recorded on 19 breeding bird survey routes concentrated within the southern portions of the leased area (Sauer et al. 2011, Government of Alberta—Energy 2010). Population trends for 9 of these 49 waterbirds and 29 of these 121 landbirds experienced significant declines within the Boreal Taiga Plains Region from 1999 to 2009; while nearly 70 percent of these birds showed no significant population trends (Sauer et al. 2010). Waterbirds and landbirds of moderate to high conservation concern present in the oil sands lease area based on the breeding bird survey data are listed in Table 4.15-25 (Kushlan et al. 2002, Berlanga et al. 2010, Brown et al. 2001, Sauer et al. 2011).

Table 4.15-25 Waterbirds and Landbirds of Conservation Concern Present in Alberta's Oil Sands Lease Areas

Common Name	Species Name	1999-2009 Trend	Relative Abundance	Average Birds/Route
Waterbirds				
Eared grebe	*Podiceps nigricollis*	NS +	4.0	0.93
Western/Clark's Grebe	*Aechmophorus spp.*	NS +	0.2	1.42
American White Pelican	*Pelecanus erythrorhynchos*	NS +	6.4	1.88
Brack-crowned Night-heron	*Nycticorax nycticorax*	UK	UK	0.17
Killdeer	*Charadrius vociferus*	-3.3	5.0	2.95
American Avocet	*Recurvirostra americana*	NS +	0.4	0.44
Greater Yellowlegs	*Tringa melanoleuca*	NS -	0.1	0.45
Lesser Yellowlegs	*Tringa flavipes*	-5.4	1.1	0.84
Solitary Sandpiper	*Tringa solitaria*	NS +	0.1	1.10
Willet	*Catoptrophorus semipalmatu*	NS -	0.2	0.91
Upland Sandpiper	*Bartramia longicauda*	NS +	0.1	0.17
Marbled Godwit	*Limosa fedoa*	NS +	0.5	0.81
Common Snipe	*Gallinago gallinago*	NS +	15.3	4.86
Wilson's Phalarope	*Phalaropus tricolor*	NS -	0.3	0.70

Common Name	Species Name	1999-2009 Trend	Relative Abundance	Average Birds/Route
Franklin's Gull	*Larus pipixcan*	-6.0	UK	34.51
California Gull	*Larus californicus*	NS -	11.7	1.77
Forster's Tern	*Sterna forteri*	NS +	0.3	0.25
Black Tern	*Chlidonias niger*	-1.6	11.1	8.16
Landbirds				
Olive-sided Flycatcher	*Contopus cooperi*	-2.8	0.9	0.53
Sprague's Pipit	*Anthus spragueii*	NS +	0.9	0.59
Canada Warbler	*Wilsonia canadensis*	NS +	0.5	3.93
Chestnut-collared Longspur	*Calcarius ornatus*	UK	UK	0.07

Source: Government of Alberta - Energy 2010, Sauer et al. 2011, Kushlan et al. 2002, Berlanga et al. 2010, Brown et al. 2001

Notes: 1999-2009 Population Trends in the Boreal Taiga Plains Bird Conservation Region: NS + = non-significant positive, NS - = non-significant negative, UK = unknown, numeric values are significant trends.
Numeric scale rating for relative abundance within the Boreal Taiga Plains 0 = least abundant
Average number of birds recorded for the 19 routes within the lease area

Oil sand operations are required to have plans to minimize their effects on wildlife and biodiversity, and Alberta's government monitors and verifies that industry adheres to these plans. Alberta's Biodiversity Monitoring Institute collects data and reports on thousands of species, habitats, and human footprint activities for evaluating changes to achieve responsible environmental management in the oil sands area. Techniques used to minimize impacts to migratory birds include: restricting industrial activity during nesting; maintaining the integrity of large river corridors for migration staging; restoring land in key habitat areas; deterring birds from industrial areas; reducing industrial footprints and use of low impact technology for seismic exploration; and constructing nesting sites to replace lost natural sites (Government of Alberta 2011c).

Neither Section 7 of the ESA nor the Section 7 consultation and analysis process under ESA implementing regulations address species outside the borders of the United States, and nothing in the language of Section 7 indicate that it would apply extraterritorially. Shared species currently covered by both the ESA and the Canadian SARA that could potentially occur within the U.S. and Canadian portions of the proposed Project are listed in Table 4.15-26.

Table 4.15-26 Federally Protected Bird Species of the Proposed Project

Common Name	Scientific Name	Status U.S./Status Canada	Preliminary Findings (U.S.)	Evaluation (Canada)
Piping Plover	*Charadrius melodus*	Threatened/Endangered	NLAA	NS
Whooping Crane	*Grus americana*	Endangered/Endangered	NLAA	Not Evaluated
Greater Sage Grouse	*Centrocercus urophasianus*	Candidate/Endangered	NLAA	NS
Sprague's Pipit	*Antus spragueii*	Candidate/Threatened	NLAA	NS

NLAA = may affect, not likely to adversely affect species
NS = effects not significant

Conservation measures developed to reduce impacts to these species for the proposed Project are described in Section 4.8, Threatened and Endangered Species and Species of Conservation Concern, and the 2012 BA, provided in Appendix H. Two U.S. federal candidate species (Greater sage-grouse [*Centrocercus urophasianus*] and the Sprague's pipit [*Antus spragueii*]) occurring in Montana and South Dakota are not yet eligible for protection under the ESA but are protected under Canada's SARA (Table 4.15-26). Required mitigation, including seasonal restrictions, to minimize impacts of the proposed Project to SARA-protected species is available in Appendix X, Canadian Environmental Assessment Act.

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4.16 SUMMARY OF IMPACTS

The analyses of potential impacts associated with construction and normal operation of the proposed Project suggest that there would be no significant impacts to most resources along the proposed Project route assuming the following:

- TransCanada Keystone Pipeline, LP (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, which is required by 49 Code of Federal Regulations 195.402, the set of 57 Project-specific Special Conditions developed by the Pipeline Hazardous Material Safety Administration (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 Supplemental Environmental Impact Study (Supplemental 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 the U.S. Department of State (Department); the additional measures identified in Chapter 4, Environmental Consequences, of this Supplemental EIS; the methods described in the Project Construction, Mitigation, and Reclamation Plan presented in Appendix G; and the construction methods described in Appendix Y, Pipeline Construction in Sand Hills Native Rangelands.

The remainder of this section summarizes the potential impacts of the proposed Project on a resource-by-resource basis. Table 4.16-1 provides a brief summary of the proposed Project's impacts on all resources considered.

Table 4.16-1 Summary of Potential Impacts

Resource	Construction	Operation	Connected Actions
Geology	Breakup and removal of rock material could occur along approximately 202 miles of the proposed Project route. Due to depth to bedrock, there will be minimal impacts to geologic resources along the remainder of the proposed Project route.	No effects.	Negligible impacts.

Resource	Construction	Operation	Connected Actions
Soils and Sediments	Potential (to varying degrees) for soil erosion, compaction, mixing, and/or contamination; loss of topsoil; and changes in soil composition. The proposed Project avoids the Nebraska Department of Environmental Quality-identified Sand Hills Region and Sand Hills-like soils in Keya Paha County, Nebraska; however, approximately half of the overall proposed Project route would cross highly erodible soils (most of which are water-erodible).	Maintenance and repair of pipeline would be similar to construction, but less extensive and widespread.	Negligible or similar to the proposed Project.
Water Resources: Groundwater	Potential impacts due to fuel spills from construction equipment. These effects could be similar to operation, but less extensive due to smaller potential spill volumes. Water withdrawals for hydrostatic testing could have minor temporary impacts.	Potential impacts due to releases of crude oil. Releases could potentially impact groundwater where the overlying soils are permeable and the depth to groundwater is shallow. Analyses in Section 4.13 suggest that large crude oil releases that do reach groundwater systems (including the Ogallala Aquifer) could result in oil spreading on the water table as far as 1,214 feet, and dissolved components of the oil, such as benzene, could spread as much as an additional 1,050 feet.	Limited potential impacts due to small potential volumes of spills during construction.
Water Resources: Surface Water	Potential impacts during construction of waterbody crossings, ranging from temporary (sedimentation and stream flow changes) to long-term (changes in channel morphology).	Potential impacts due to releases of crude oil. Releases could potentially impact open waterbodies such as rivers, lakes, and ponds, and the ecosystems that rely on them. Analyses in Section 4.13 suggest that crude oil releases that do reach surface waters are expected to be no greater than 1,214 feet from the release point; however, releases to a river will not float on water indefinitely and have the potential to be submerged introducing additional potential impacts and recovery challenges.	Similar to, but less extensive than, potential waterbody crossing impacts of the proposed Project.
Wetlands	Construction would impact approximately 262 acres of wetlands. Impacts would be site-specific, and could be negligible or more substantial—with some requiring post-construction reclamation.	Operation would impact approximately 120 acres of wetlands, including approximately 18 acres permanently converted to uplands. Most other wetland areas affected during operations would continue to be functional wetlands.	Similar to the proposed Project, but generally temporary.

Resource	Construction	Operation	Connected Actions
Terrestrial Vegetation	Most impacts would affect cropland and grassland/pasture. Vegetation removed from the construction right-of-way (ROW) could require 5-15 years to re-establish. Tree removal would be permanent. Noxious and invasive plants could delay re-establishment of natural communities.	Same as construction, but effects limited to the operation ROW. Increased soil temperature from operating pipeline could affect some species, including prairie grasses.	Similar to, but less extensive than the construction impacts from the proposed Project.
Wildlife	Potential impacts due to habitat loss and fragmentation, direct and indirect mortality, reduced breeding success, and reduced survival. Proposed Project route would cross more than 200 miles of important wildlife habitats.	Maintenance and repair of pipeline would be similar to construction, but less extensive.	Primary concerns involve direct mortality due to avian species collision with electrical lines.
Fisheries	Potential impacts associated with open-cut stream crossings and hydrostatic testing include changes in the benthic invertebrate community, mortality, feeding difficulty, and reduced productivity and spawning due to increased suspended sediments, temperature changes, physical disturbance of the streambed, changes in oxygen content, and other effects of the proposed Project.	Potential temperature increases around stream crossings, especially in low flow situations.	Similar to, but less extensive than the construction impacts from the proposed Project.
Threatened and Endangered Species	Same types of impacts as to Wildlife (see above). Thirteen federally-listed or candidate species could be affected, but only the American burying beetle is likely to be adversely affected. Thirteen state-listed species could potentially be affected.	Same types of impacts as to Wildlife (see above); however, maintenance and repair of pipeline may affect, and is likely to adversely affect the American burying beetle.	Similar to the proposed Project, but fewer species affected, and to a lesser extent.
Land Use, Recreation, and Visual Resources	Temporary change of land use within the construction ROW and at the locations of proposed aboveground facilities. Some potential reduction in use of recreational resources near proposed Project facilities under construction.	Permanent change in land use at the site of aboveground facilities. Some changes in visual character.	Negligible temporary changes in land use during construction. Potential long-term changes in visual character (in the case of transmission lines).

Resource	Construction	Operation	Connected Actions
Socioeconomics	Temporary socioeconomic benefits due to local employment, taxes, spending by construction workers, and spending on construction goods and services. Including direct, indirect, and induced effects, construction would support (over a 1-2 year construction period): • Approximately 42,100 jobs across the United States; • Approximately $2.05 billion in employee earnings; • Approximately $3.1 billion in direct expenditures; and • An undetermined amount of revenue from sales and use taxes. Other impacts include minor increases in demand for utilities and public services (e.g., police, fire, and emergency medical services), some temporary traffic delays, and minor and temporary impacts on environmental justice populations.	35 to 50 permanent jobs and negligible earnings and other revenues. Operation would support approximately $2 million in property taxes.	Similar to, but less extensive than the proposed Project.
Cultural Resources	No permanent adverse effects to known cultural resource sites. Temporary visual effects on structures eligible for inclusion in the National Register of Historic Places due to construction materials, vehicles, and dust.	Negligible effects.	Similar visual impacts as the proposed Project.
Air Quality and Greenhouse Gases	Temporary and localized fugitive dust and other emissions from construction equipment.	Minimal volatile organic compound and fugitive dust emissions associated with pump stations and other aboveground facilities. Combustion of fossil fuels such as crude oil is a major source of global greenhouse gas emissions, which contribute to human-caused climate change.	Construction emissions similar to, but less extensive than, the proposed Project. Minimal operations emissions.
Noise	Localized and intermittent noise due to construction activity.	Negligible noise from aboveground facilities.	Extent of impacts not known, but not anticipated to be significant.

Resource	Construction	Operation	Connected Actions
Climate Change Impacts on the Proposed Project	Climate change would have no substantive effects on construction of the proposed Project.	Climate change would have no substantive effects on operation of the proposed Project, and these effects would be even further reduced by implementation of the 57 PHMSA-approved design and operation conditions. The proposed Project's lifecycle greenhouse gas emissions (and their effects on global climate change) are discussed under Air Quality, above.	Not evaluated.
Potential Releases	See Water Resources: Groundwater, above.	Spills associated with the proposed Project that enter the environment are expected to be rare and relatively small. Industry standards and practices (including the 57 Project-specific Special Conditions developed by PHMSA) provide a level of protection above that of other pipeline systems in existence. Modeling shows that, exclusive of topography and groundwater flow, large spills (20,000 barrels) could spread up to 1,214 feet on the ground surface or on the water table, and up to 1,050 feet dissolved in groundwater. Spills reaching surface water could be transported greater distances.	No effect, except for Bakken Marketlink, which would be similar to the proposed Project.

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5.0 ALTERNATIVES

This chapter describes the analysis of the alternatives that were identified by the U.S. Department of State (Department) as reasonable alternatives for carrying forward for full analysis in the Supplemental Environmental Impact Statement (Supplemental EIS). The process used to identify and screen potentially reasonable alternatives was described in Section 2.2, Description of Reasonable Alternatives. Several alternatives, including both route alternatives and intermodal options, were eliminated from further consideration in this screening process. In addition to the proposed Project, alternatives carried forward for analysis include the No Action Alternative and two major route alternatives. The No Action Alternative includes three scenarios:

- Status quo scenario;
- Rail/pipeline scenario; and
- Rail/tanker scenario.

The major route alternatives include the following:

- The Keystone XL 2011 Steele City Segment Alternative (2011 Steele City Alternative), as proposed in the 2011 Final EIS, is provided as a reference point to illustrate the differences between it and the proposed Project and other alternatives; and
- I-90 Corridor Alternative.

The alternatives analysis relied on information obtained through independent research and analyses conducted by the Department and its third-party contractor, information provided to the Department, state permitting applications (including supplemental submittals), and information and comments provided during scoping for the Supplemental EIS. The analysis of the No Action Alternative is described in Section 5.1, and the analysis of the major route alternatives is described in Section 5.2.

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5.1 NO ACTION ALTERNATIVES

Under the No Action Alternative, the Presidential Permit would not be issued and/or the proposed Project would not be constructed for that or other reasons. Three scenarios, described below, have been carried forward for analysis under the No Action Alternative in the Supplemental Environmental Impact Statement (Supplemental EIS). See Section 2.2, Description of Reasonable Alternatives, for detailed descriptions of these scenarios and how they were developed.

Council on Environmental Quality guidance (1981) states that if denial of a Proposed Action would result in predictable actions by others, the consequences of adopting the No Action Alternative should be considered in the EIS. In this case, given the Government of Canada's (and Alberta) stated commitment to develop the oil sands, the global crude oil market dynamics, the economic modeling done as part of the Final EIS, and the examples of market responses over the past few years regarding crude oil transport in North America, it remains likely that if the proposed Project did not proceed, producers of Western Canadian Sedimentary Basin (WCSB) and Bakken crude oil production would continue to utilize alternative transport infrastructure to accommodate increasing production of WCSB and Bakken crude oils. Therefore, the No Action Alternative considers scenarios that include the reasonable consequences of denying the Presidential Permit for the proposed Project. It is important for both the policy makers (i.e., the Department of State) and the public to understand the potential effects of the implementation of other reasonable crude oil transport scenarios.

The Status Quo Scenario assumes the proposed Project is not approved, and/or is otherwise not constructed. This scenario provides the baseline against which the other No Action scenarios, as well as the proposed Project and other alternatives, can be compared. The environmental effects of this scenario are described in Section 5.1.1, Status Quo Scenario.

Although it is reasonable to expect the market to respond to denial of the proposed Project by seeking to implement alternative transport options, it is more difficult to predict exactly how that may occur. As mentioned above, there have been alternatives proposed that would transport crude oil by pipeline to the south (e.g., increases in Enbridge's pipeline system), to the east (e.g., conversion of TransCanada's Mainline natural gas pipeline system), and to the west (pipeline or rail to Pacific coast ports for transfer to tankers). Under some of these alternatives, it is likely that the crude oil would be transported for refining in countries other than the United States (e.g., it likely will be less expensive to ship crude oil by tanker from Canada's Pacific ports to Asia than from Canada's Pacific ports to the Gulf Coast area). In the past 2 years, there has been exponential growth in the use of rail to transport crude oil throughout North America, primarily originating from the Bakken in North Dakota and Montana, but also increasingly utilized in other production areas, including the WCSB. Because of the flexibility of rail delivery points, once loaded onto trains the crude oil could be delivered to refineries, terminals, and/or port facilities throughout North America, including the Gulf Coast area.

In developing alternative transport scenarios, efforts were made to focus on scenarios that would be practical (e.g., economically competitive), take advantage of existing infrastructure to the extent possible, used proven technologies, and are similar to transport options currently being utilized. To facilitate comparisons with the proposed Project, the scenarios were developed considering the following criteria:

- Transport similar quantities of crude oil as the proposed Project (e.g., up to 730,000 barrels per day (bpd) of WCSB crude oil and up to 100,000 bpd of Bakken crude oil);
- Transport the crude oil from generally the same locations as the proposed Project (i.e., Hardisty area of Alberta and Bakken area of Montana/North Dakota) to the same primary market as the proposed Project (i.e., Gulf Coast area refineries); and
- Transport scenarios that could be operational in approximately the same time frame as the proposed Project (e.g., late 2010s).

Based on these guidelines, two additional No Action Alternative scenarios were developed (see Section 2.2, Description of Reasonable Alternatives, for a detailed description):

- Rail/Pipeline Scenario[1]—assumes construction of new rail loading terminals in Lloydminster, Saskatchewan and Epping, North Dakota; transport of WCSB and Bakken crude oil via existing rail lines to new rail unloading terminals in Stroud, Oklahoma; a short pipeline interconnection to Cushing, Oklahoma; and onward delivery to the Gulf Coast area refineries via existing pipelines.
- Rail/Tanker Scenario—assumes construction of new rail terminals in Lloydminster, Saskatchewan; transport of WCSB crude oil via existing rail lines to Port Rupert, British Columbia; transfer of crude oil to tankers; and tanker transport of the crude oil down the Pacific Coast, through the Panama Canal, and up through the Gulf of Mexico for delivery to the TCG refineries; and construction of a new rail terminal in Epping, North Dakota, transport of Bakken crude oil via existing rail lines to a new rail terminal in Stroud, Oklahoma; a short pipeline interconnection to Cushing, Oklahoma; and onward delivery of Bakken crude oil to Gulf Coast area refineries via existing pipelines.

These scenarios are intended to be representative of likely market responses to extended constraints in additional pipeline capacity. In reality, these scenarios, modifications of these scenarios, or possibly other transport methods would be developed. For example, rather than all of the potential loading terminals being located in the Lloydminster area, they could also be in Hardisty, Edmonton, Fort McMurray, and/or some combination of those areas. Similarly, some rail transport may go all the way to the Gulf Coast area refineries and terminals (as well as refineries and terminals elsewhere on the Gulf Coast or in other refinery markets) rather than offloading in Stroud/Cushing for pipeline delivery to the Gulf Coast area refineries. The two scenarios developed are believed to reflect reasonable market responses and are presented here to represent the potential environmental consequences of likely market responses to demand for increased transport capacity for crude oil from the WCSB and Bakken basins. To evaluate these scenarios, assumptions were needed regarding the location and design of necessary transportation improvements (i.e., proposed new rail terminals and crude oil storage facilities in Lloydminster, Epping, and Stroud; proposed pipeline interconnection between Stroud and Cushing; and proposed expanded port facilities at Prince Rupert).

[1] To conduct the impact assessment, representative sites for the proposed rail terminals (i.e., Lloydminster, Stroud, and Epping); the proposed pipeline interconnection between Stroud and Cushing; and the expanded port in Prince Rupert were identified. These representative sites were selected solely for purposes of conducting this impact assessment. Use of these representative sites does not imply that they would ultimately be acceptable for these facilities, and for this reason the specific locations and ownership of these sites are not identified in this Supplemental EIS. The environmental effects of these scenarios are described in Sections 5.1.2, Rail/Pipeline Scenario, and 5.1.3, Rail/Tanker Scenario, respectively.

As a matter of policy, in addition to its environmental analysis of the proposed Project in the United States, the Department has incorporated the environmental review of the portion of the proposed Keystone XL Project in Canada conducted by the National Energy Board of Canada. In so doing, the Department was guided by Executive Order 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. In the consideration of the No Action Scenarios, information is provided about the potential effects in Canada associated with those scenarios.

5.1.1 Status Quo Scenario

Under the Status Quo Scenario, the proposed Project would not be approved and/or built. Under this scenario, there would be no new impacts to any resources from the proposed Project route. To the extent some impacts are occurring, or could occur, as a result of transporting WCSB and Bakken crude oil by existing pipelines and rail (i.e., air emissions, noise, and potential release risk), these impacts are assumed to continue.

5.1.2 Rail/Pipeline Scenario

Under the Rail/Pipeline Scenario, a similar volume of crude oil (e.g., up to 730,000 bpd of WCSB crude oil and up to 100,000 bpd of Bakken crude oil) would be transported by rail to Stroud, Oklahoma, and the majority of that crude oil would then be delivered by existing pipeline to the Gulf Coast area. The Rail/Pipeline Scenario is described in more detail in Section 2.2.3.2, Rail/Pipeline Scenario. In summary, this scenario would include the following components for transporting the WCSB crude oil:

- A new approximately 3,500 acre rail terminal and storage complex near Lloydminster, Saskatchewan, with access to both Canadian Pacific and Canadian National (CN) Class 1 major rail systems, where the WCSB crude oil would be loaded onto approximately thirteen 100-car unit trains per day; and
- Use of approximately 2,000 miles of existing rail lines from the proposed Lloydminster rail terminals to a new, approximately 3,500-acre rail terminal and oil storage complex near Stroud, Oklahoma, where the crude oil would be offloaded.

It should be noted that the two representative rail routes for WCSB transport from Lloydminster to Stroud were chosen for analysis purposes only. The exact routes and levels of use at any one time could be different in practice because of congestion on certain lines, track maintenance, and other factors outside the scope of this assessment. It should also be noted that while CN and Canadian Pacific are the two railroads used in this analysis, they may use the assets (i.e., tracks) of other carriers, such as BNSF Railway Company, Union Pacific, or other owners through the United States (Cambridge Systematics 2007.)

There are no Class I rail routes that serve both the Hardisty area and the Bakken area; therefore, it was assumed that an alternate rail route would be needed to serve the Bakken region. The components for transporting the Bakken crude oil include the following:

- A new approximately 500-acre rail terminal and storage complex near Epping, North Dakota (to accommodate increased rail volume), where the Bakken crude oil would be loaded onto approximately one to two 100-car unit trains per day[2]; and
- Use of approximately 1,350 miles of existing rail lines from the proposed Epping rail terminal to the same proposed rail terminal and oil storage complex used for the WCSB crude oil near Stroud, Oklahoma, where the crude oil would be offloaded. No specific railroad company or route between Epping and Stroud was identified for this segment, although it should be noted that Bakken crude oil is currently being transported via rail from Epping to Stroud.

Once the WCSB and Bakken crude oil reaches Stroud, Oklahoma, it would be stored temporarily and then transported as follows:

- Transported via a new approximately 17-mile-long pipeline (referred herein as the Cushing pipeline) from the proposed Stroud crude oil storage complex to the existing Cushing, Oklahoma, crude oil terminal, which would create an initial impact of 227 acres, of which 103 acres would remain permanently affected; and
- Temporarily stored in Cushing pending delivery via existing crude oil pipelines (e.g., Keystone Gulf Coast pipeline that is currently under construction) to Gulf Coast area refineries.

In summary, the Rail/Pipeline Scenario would take advantage of existing rail lines, existing crude oil pipelines, and the existing Cushing storage facility, and would require little if any new rail tracks, but would require the construction of new rail terminals and crude oil storage facilities in Lloydminster, Epping, and Stroud, as well as a new pipeline from the proposed Stroud rail terminals to the existing Cushing tank farm. There is the potential that some improvements may be required along the existing rail lines and crude oil pipelines included in this scenario; the location, scale, and timing of these improvements are unknown, but it is believed that they would be minor in comparison with the overall scale of the scenario, and they are thus not considered in this analysis.

The environmental setting and potential impacts for the Rail/Pipeline Scenario are described below for each resource. Since the rail lines from Lloydminster and Epping to Stroud and the existing Keystone pipeline from Cushing to the Gulf Coast area refineries already exist, with little or no improvements to these facilities assumed to be necessary, the discussion of environmental setting and impacts for the Rail/Pipeline Scenario focuses on the proposed new facilities (i.e., the three new rail terminals/oil storage complexes in Lloydminster, Epping, and Stroud and the new pipeline connections to Cushing). The existing rail line and pipeline segments are only discussed in terms of resources that would be affected by increased rail traffic (i.e., air, noise, climate change, and socioeconomics) and the increased potential for accidental releases (as a result of greater throughput). Since no new construction would be needed along these existing segments, it is assumed that there would be little potential for impacts to other resources (i.e., geology, soils, water, wetlands, vegetation, wildlife, fish, threatened and

[2] Because significant rail loading capacity exists in the Bakken area, a new terminal specifically to provide transport for the Bakken crude contracted to the proposed Project likely would not be required. Information about the impacts associated with a new terminal in that area are provided to present more complete information regarding the impacts associated with rail transport of crude oil from the Bakken.

endangered species, land use, and cultural resources) as a result of increased rail traffic along the existing rail lines, other than an increased potential for impacts from accidental releases.

5.1.2.1 Geology

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the geologic resources of these three areas is provided below.

The geology at the Lloydminster Terminal sites is predominantly composed of Cretaceous and Tertiary formations overlain with glacial till. The rock formations consist of sandstone, shale, and limestone. The geology in the vicinity of the Epping Terminal site is predominantly composed of Cretaceous sedimentary rocks such as the Dakota Group (predominantly sandstone and shale), in addition to aeolian (wind driven) deposits. At the site of the Stroud Terminals, Upper Paleozoic (Permian) rock is present. Earthquake potential and seismic activity are low for all three terminal sites (Earthquaketrack.com 2012).

Potential Impacts

During construction of the proposed rail terminals, oil storage facilities, and pipeline for the Rail/Pipeline Scenario, approximately 7,727 acres of land would need to be graded and shallow bedrock may be encountered. Rock ripping (the break up and removal of rock material with an excavator) could be necessary where dense material, paralithic bedrock, abrupt textural change, or strongly contrasting textural stratification is present. The impacts of rock ripping would be limited to the immediate construction area and would not result in any significant impacts to the underlying geology.

Excavation activities, erosion of fossil beds exposed due to grading, and unauthorized collection can damage or destroy paleontological resources during construction. The potential for finding paleontological resources in the areas that would be disturbed is unknown. Since the proposed construction would occur on privately owned land, construction under this scenario would only be subject to applicable provincial or state requirements regarding the protection of paleontological resources.

The proposed rail terminals, oil storage facilities, and pipeline would be located in areas where there would be no anticipated impact to access to any existing surface mines and quarries or known fossil fuel or mineral resources. In terms of geologic hazards, the proposed facilities would not be located near any known active faults and would be outside of known zones of high seismic hazard, landslides, and subsidence.

Routine operations of the Rail/Pipeline Scenario would not require disturbance of, or impacts to, the underlying geology, paleontological resources, or mineral and fossil fuel resources. The rail terminal and pipeline facilities would be designed to withstand potential seismic hazards and would be located in areas that are not susceptible to landslides or subsidence. Although the rail terminals would be located outside of designated floodplains, the pipeline would cross streams and there would be the potential for pipeline exposure as a result of erosion during high water events. As with the proposed Project, the pipeline would be designed to be buried below the calculated scour depth at stream crossings.

5.1.2.2 Soils

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the soil resources of these three areas is provided below.

The Lloydminster Terminal complex would be located in an area in the Saskatchewan Province where the soils consist primarily of Chernozemic soils. In general, these soils are deep with dark-colored surface horizons and brownish to lighted colored subsurface horizons that have high organic matter content with textures that range from heavy clays to sands.

The soils found in the general vicinity of the Epping Terminal site consist of the Williams-Bowbells association and the Williams-Zahill and the Zahl-Williams-Zahill complex. The Williams-Bowbells association soils are typically clay loams, deep, and moderately well drained and are found in landscapes with slopes that ranges from 0 to 6 percent slopes. The Williams-Zahill and Zahl-Williams-Zahill complex soils are found in knolls areas with slopes that range from 6 to 9 percent and are deep and well drained.

The soils found in the area in which the Stroud Terminal and Cushing pipeline would be located consist primarily of Port-Pulaski, Dornell-Stephville, and Renfrow-Vernon-Bonhan associations. In general, these soils are deep to shallow, loamy over sandstone, clay, or shale on nearly level to strongly sloping landscapes.

Potential Impacts

During construction of the rail terminals, oil storage facilities, and pipeline for the Rail/Pipeline Scenario, typical clearing, grading, trench excavation, and equipment traffic would disturb approximately 7,727 acres of land, which would likely result in soil erosion, loss of topsoil, soil compaction, and possibly soil contamination (e.g., fuel leaks, herbicide use). Most of these impacts can be mitigated by the use of standard construction erosion and sediment control methods (e.g., silt fences, sediment ponds) and soil remediation essentially identical to those proposed for the proposed Project. As construction is completed, the disturbed sites would be restored in a manner similar to that for the proposed Project. Approximately 7,603 acres of land, however, would be permanently impacted by this scenario as a result of construction of rail terminals and crude oil storage facilities.

During the operational phase of the Rail/Pipeline Scenario, there would remain the potential for minor soil erosion, compaction, differential settling, and contamination from vehicle/pipeline spills and leaks. Maintenance procedures as described for the proposed Project would be implemented to address these potential impacts.

5.1.2.3 Water Resources

Groundwater

Environmental Setting

The Lloydminster Terminals would be located in Saskatchewan where groundwater is perched on glacial till and more recent deposits that include glacial outwash and thin soils. Groundwater

is shallow or at the surface in many areas around the terminal as evident by the numerous shallow lakes, ponds, and wetlands. Shallow groundwater is reported to be high in nitrates, with drinking water pumped from deeper aquifers below the till. Because of the landscape and flatness of the till in this area, lateral groundwater flow (hydraulic conductivity) and gradient are low and shallow.

The Stroud Terminals would be located in a fairly flat area of Oklahoma. Pennsylvanian-age sandstone, shale, and limestone underlie Quaternary-age loess and alluvial deposits. The major water source for residences, crops, and industry in this part of central Oklahoma is the Ada-Vamoosa Aquifer, which consists of Pennsylvanian sandstones (Ryder 1996). In 1985 in Lincoln County, up to 2 million gallons per day of water were withdrawn from this aquifer; those withdrawal rates have increased substantially since 1985. Groundwater in the area is shallow (depth of about 50 feet) and deepens to the west of Stroud, Oklahoma. Dissolved solids are reportedly less than 500 milligrams per liter yielding high-quality freshwater. Groundwater in the area of the Cushing Terminal, located just northwest of Stroud, is similar in quantity and quality, although it occurs at a depth of about 100 feet.

The Epping Terminal would be located in a fairly flat agricultural area of northeastern North Dakota. Groundwater in the vicinity of the planned terminal near Epping, North Dakota, is within the Lower Tertiary Fort Union Formation, which consists of sandstone and shale beds within interbedded coal in some areas. This unit is part of the Northern Great Plains Aquifer System, and extends into Montana where the proposed Project pipeline crosses the unit. Wells extracting groundwater from this unit in North Dakota are typically greater than 300 feet deep and yield up to 100 gallons per minute. Groundwater in the vicinity may also be present in alluvium aquifers in unconsolidated sediments overlying the Tertiary rocks. These alluvial deposits consist of 100 feet or more of fine-grained glacial till with interbedded and overlying sand and gravel deposits. The permeability of these deposits is highly variable, with well yields ranging from 1 to 1,000 gallons per minute (Whitehead 1996).

Potential Impacts

Potential groundwater impacts related to terminal construction are anticipated to be related to releases of refined petroleum products used as vehicle fuels and lubricants, as well as releases of crude oil. In addition, there could be potential releases and/or spills associated with operations include crude oil loading/unloading of railcars, and railcar derailment or pipeline failure. The releases of refined petroleum products associated with construction activities would typically be relatively small in volume (less than 2,100 gallons); however, releases of crude oil associated with operations could be larger, ranging from 42,000 to 840,000 gallons.

Section 5.1.2.14, Potential Risk and Safety, discusses the potential risks of these releases during rail transport of the crude oil. Loading and unloading would only occur at the new rail terminals near Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud, Oklahoma. In addition to the risk of crude oil spills during loading and unloading, releases of refined petroleum products (e.g., diesel fuels, motor oils, and lubricants) may also occur during construction and operation of new rail terminals. Although the initial impacts of potential releases or spills at the rail terminals may be contained or limited to soil, potential impacts to groundwater may occur depending on the depth to groundwater, soil characteristics (porosity, permeability, etc.), spill volume and extent, and whether the spill reaches surface waterbodies, which can be interconnected to groundwater.

Downward migration of the releases to groundwater would be attenuated by intervals of fine-grained sediments and glacial till in unconsolidated deposits; however, there is the potential to impact groundwater quality. Migration characteristics of the release in groundwater would be expected to be similar to that discussed for other potential Project-related petroleum releases in Section 4.3.3.1, Groundwater.

Surface Water

Environmental Setting

The two representative rail routes between Lloydminster and Stroud would cross through a variety of surface water resources, including lakes, reservoirs, natural and man-made ponds, as well as intermittent and perennial streams and rivers. Some of the larger rivers that would be crossed in Saskatchewan and Manitoba include the North and South Fork of the Saskatchewan River in Saskatchewan and the Assiniboine River and Red River in Manitoba. In the United States, larger rivers that would be crossed include the Red River, which forms the border between Minnesota and North Dakota; the Mississippi River, Saint Louis River, and Vermilion River in Minnesota; the Des Moines River in Iowa; the Missouri River on the border of Nebraska and Iowa; the Platte River in Nebraska; and the Arkansas River in Oklahoma.

The Lloydminster Terminals location is characterized by existing energy wells, rail terminal infrastructure, agricultural, and livestock uses with intermittent streams and isolated open-water features that may be connected to shallow groundwater. Residential and park areas of Lloydminster are within 1 mile (1,400 meters) of the potential terminal complex. Large, open waterbodies are within 2 miles (3,200 meters) of the potential terminal complex. The relatively flat topography is likely conducive to sheet flow and infiltration. Surface waterbodies may have use as agricultural or stock water sources.

The Stroud Terminals region is characterized by open grassland with partial forest coverage. Surface water features include natural and manmade open waterbodies and intermittent grass-lined to bare stream courses with generally wide bed structures. The proximity to the community of Stroud varies based on the potential terminal sites. Surface waterbodies may have use as agricultural or stock water sources.

The Epping Terminal location is characterized by cultivated agricultural uses with grass-lined intermittent streams and isolated natural and manmade open water features. Large, open waterbodies are located within 2 miles of the community of Epping (approximately 12 miles northeast of Williston North Dakota) and the potential terminal site. Surface waterbodies may have use as agricultural or stock water sources.

Potential Impacts

Potential surface water impacts related to this scenario would primarily be related to releases and spills associated with crude oil loading/unloading of railcars, and railcar derailment or pipeline failure. Section 5.1.2.14, Potential Risk and Safety, discusses the potential risks of these releases during rail transport of the crude oil. The proper implementation of spill prevention, control, and countermeasures (SPCC) plans should minimize the potential for releases of crude oil or other hazardous materials (e.g., diesel fuel, motor oil, lubricants) to reach surface waterbodies during rail terminal construction and operations. Similarly, implementation of stormwater management should mitigate impacts to water quality and runoff volumes from the terminals.

5.1.2.4 Wetlands

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of wetland resources of these three areas is presented below.

The Lloydminster Terminals would be located in the Aspen Parkland Level III Ecoregion, which lies within an area with a moderately high concentration of prairie pothole wetlands, commonly referred to as the Prairie Pothole Region (PPR) (U.S. Environmental Protection Agency [USEPA] 2010, USEPA 2011). The PPR is not a USEPA ecoregion, but rather a general region of the United States and Canada where there is a high density of prairie pothole wetlands. While there is no exact boundary of the PPR, most government agencies and non-government organizations agree upon its general boundaries, which stretches through the Canadian provinces of Saskatchewan, Alberta, and Manitoba, and the U.S. states of North Dakota, South Dakota, Nebraska, Minnesota, Iowa, and Montana (USEPA 2011; Gleason et al. 2008; Kantrud at al. 1989). As discussed in Section 3.4.3.1, Sensitive Wetland Areas, and Section 3.5, Terrestrial Vegetation, prairie potholes are water-holding depressions of glacial origin (Sloan 1972). Prairie pothole wetlands associated the conceptual Lloydminster terminal complex include emergent (herbaceous) and scrub-shrub wetlands associated with wet meadows, streams, and open water features.

The Epping, North Dakota, Terminal would be located in the Northwestern Glaciated Plains Level III Ecoregion (USEPA 2011). This ecoregion is located within the broader PPR described above. Wetlands associated with the Epping, North Dakota, terminal include emergent (herbaceous) wetlands associated with prairie pothole wet meadows, streams, and open water features, most of which are managed for agricultural purposes.

The southern extent of the route would cross the northeast corner of Oklahoma to the Stroud, Oklahoma, terminals. Ecoregions include the Central Great Plains and Cross Timbers USEPA Level III Ecoregions (USEPA 2011), where the primary wetlands are forested and herbaceous wetlands.

Potential Impacts

Based on preliminary aerial photo interpretation, construction of the Lloydminster terminals could impact approximately 20 acres of herbaceous wetlands, 173 acres of scrub-shrub wetlands, and 60 acres of open water habitat. Construction of the Epping Terminal could result in approximately 6 acres of temporary or permanent impacts to herbaceous wetlands and associated shallow ponds (pothole wetlands) based on wetland coverage provided by the National Wetland Inventory (NWI) database (NWI 2012). Construction of the Stroud Terminals and along the Cushing pipeline could result in approximately 40 acres of temporary or permanent impacts to open water features and approximately 19 acres of temporary or permanent impacts to forested wetlands based on the wetland coverage provided by the National Wetlands Inventory database (NWI 2012). These estimates of potential wetland impacts at these representative rail station locations, which are based on aerial photo interpretations and secondary sources such as NWI mapping, are intended to be illustrative of the magnitude of actual impacts that may occur. Please note that wetland acreages estimated using the NWI (2012) database may differ from wetland acreages estimated using the National Land Cover Database (Fry et al. 2011) presented

in Section 5.1.2.5, Terrestrial Vegetation, below. If rail terminals were constructed, the actual acreage of wetland impacts would be determined through a formal wetland delineation.

5.1.2.5 Terrestrial Vegetation

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the terrestrial vegetation resources of these three areas is provided below.

The Lloydminster Terminal complex would be located in the Aspen Parkland Level III Ecoregion. The parkland is considered transitional between the boreal forest to the north and the grasslands to the south. Open stands of trembling aspen and shrubs occur on most sites, and bur oak and grassland communities occupy increasingly drier sites on loamy Black Chernozemic soils (The Ecological Framework of Canada [TEFC] 2012a). The Epping Terminal would be located in the Northwestern Glaciated Plains Level III Ecoregion and the Glaciated Dark Brown Prairie Level IV Ecoregion. Geographic information system analysis indicates the existing land cover of the approximately 500 acre terminal site is comprised of Grassland/Herbaceous, Developed Land, Cultivated Crops, Shrub/Scrub, and Emergent Herbaceous Wetlands. The Stroud Terminals would be located in the Central Great Plains and Cross Timbers Level III Ecoregions. Geographic information System analysis utilizing the 2006 NLCD (Fry et al. 2011) indicates the existing land cover of the approximately 3,500-acre Stroud Terminal complex is composed of Grassland/Herbaceous, Developed, Cultivated Crops, Deciduous Forest, and Open Water.

Potential Impacts

The Rail/Pipeline Scenario would impact approximately 7,727 acres of terrestrial vegetation where new facilities and the Stroud to Cushing pipeline would be built. Although the exact design and location for the terminals is not known, the general impacts to terrestrial vegetation associated with these facilities are presented below in Table 5.1-1. Deciduous forests within the Stroud Terminal sites may be considered biologically unique landscapes or vegetative communities of conservation concern.

Table 5.1.-1 Potential Impacts to Terrestrial Vegetation by Landcover Type under the Rail/Pipeline Scenario

	Acreage			
Land Cover	**Lloydminster**	**Stroud[a]**	**Epping**	**Total Acres**
Grassland/Pasture	2,756	2,101	40	4,897
Developed	493	127	6	626
Deciduous Forest	0	1174	0	1,174
Cultivated cropland	0	85	455	540
Open Water	60	13	0	73
Scrub/shrub wetlands	173	0	0	173
Emergent wetlands	20	0	0	20
Total	**3,500[b]**	**3,500[b]**	**500[b]**	**7,500[b]**

[a] Plus land for a new pipeline between Stroud and Cushing that would affect 227 acres.
[b] May not add up due to rounding.

5.1.2.6 Wildlife

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the wildlife resources of these three areas is presented below.

The Lloydminster Terminal area is home to large game, small game furbearers, upland game birds, waterfowl, and non-game wildlife. There are over 600 species of birds and mammals in Saskatchewan, and their territorial ranges in southern Saskatchewan are shrinking. Human activities and development over the last century (including roads, towns and cities, agriculture, and industry) have reduced 75 percent of the natural areas in the province's agricultural region (Government of Saskatchewan 2012). The Lloydminster area lies within the Central Flyway, which is a major migration route for birds (U.S. Fish and Wildlife Service [USFWS] 2012). The terminals would also lie within an ecoregion known as Aspen Parkland, which provides a major nesting habitat for waterfowl, and includes habitat for white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), snowshoe hare (*Lepus americanus*), cottontail (*Sylvilagus* spp.), red fox (*Vulpes vulpes*), northern pocket gopher (*Thomomys talpoides*), Franklin's ground squirrel (*Poliocitellus franklinii*), and bird species such as sharp-tailed grouse (*Tympanuchus phasianellus*) and black-billed magpie (*Pica hudsonia*) (TEFC 2012).

The Epping rail terminal would be located in the Prairie Potholes bird conservation region, which is an ecologically distinct region in North America with similar bird communities, habitats, and resource management issues as defined by the U.S. North American Bird Conservation Initiative (USNABCI). This conservation region provides breeding and migratory habitat to over 200 species of birds (USNABCI 2000).

The Stroud Terminals would be in an area that is home to large game, small game and furbearers, upland game birds, waterfowl, and non-game wildlife. This area also lies within the Central Flyway, which is a major migration route for birds (USFWS 2012). It would be located in two Level III Ecoregions: the Central Great Plains and the Cross Timbers (USEPA 2012). The Stroud Terminals would be located in the Oaks and Prairies bird conservation region, which is an ecologically distinct region in North America with similar bird communities, habitats, and resource management issues as defined by the USNABCI (2000). This conservation region serves as a transition zone between the Great Plains and the forests of the eastern United States and is a complex mix of prairie, savanna, cross timbers, and shrubland. Among the priority land birds that use this mix of woodland and open country are scissor-tailed flycatcher (*Tyrannus forficatus*), painted bunting (*Passerina ciris*), and Mississippi kite (*Ictinia mississippiensis*), with a small population of black-capped vireos (*Vireo atricapilla*) in areas of denser shrub. Agriculture and urbanization have made tremendous impacts on this region, leaving very little natural habitat available for healthy priority bird populations (USNABCI 2000).

Potential Impacts

Construction of the proposed rail terminals and pipeline for the Rail/Pipeline Scenario would have direct and indirect, and temporary and permanent impacts on wildlife resources and result in the clearing of approximately 7,727 acres of wildlife habitat, including approximately 4,997 acres of grasslands, 1,175 acres of forest habitat, and 83 acres of emergent and scrub/shrub wetland habitats. Approximately 7,603 acres of these impacts would be permanent. Direct

impacts could occur due to vegetation removal or conversion, obstructions to movement patterns, or the removal of native habitats that may be used for foraging, nesting, roosting, or other wildlife uses (Barber et al. 2010). Indirect impacts to wildlife are difficult to quantify and are dependent on the sensitivity of the species, individual, type and timing of activity, physical parameters (e.g., cover, climate, and topography), and seasonal use patterns of the species (Berger 2004). Short-term impacts on wildlife would occur during construction and may extend beyond construction activities. Long-term impacts on wildlife could extend through the life of a project and possibly longer for those habitats that require many years to be restored (Harju et al. 2010). Permanent impacts would result from construction of the rail terminals and oil storage facilities that convert natural habitat, and where operational maintenance of the pipeline right-of-way permanently alters vegetation characteristics (Braun 1998). The facilities would not affect any federal/national or provincial/state wildlife areas.

Operations at the rail terminals would generate noise, vibration, traffic, and human presence, which would have indirect impacts to surrounding habitats making them less attractive for more sensitive wildlife species. Since the rail terminals lie within the Central Flyway, it is possible that these operational impacts could affect migratory birds.

5.1.2.7 Fisheries

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the fishery resources of these three areas is provided below.

In the Lloydminster area, the provincial government of Saskatchewan manages fisheries within its borders except for aboriginal fishing and fish habitat protection, which are managed by the federal government of Canada and the Department of Fisheries and Oceans. Most of Canada's prairies have been converted to farmlands, and the fisheries therein have been subject to alterations brought about by agriculture such as channelization and sedimentation from run-off. Moreover, streams originating in Canada's interior plains have variable water quality and are usually high in suspended and dissolved solids, and high in turbidity due to erosion (Rosenburg et al. 2005). This is best exemplified by the silt-laden Saskatchewan River, whose prairie reaches contain warm water species like northern pike, walleye, sauger, carp, and yellow perch (Table 5.1-2). Upstream, forested reaches are dominated by cold water species such as cutthroat, rainbow, bull, brook and brown trout (Rosenburg et al. 2005) (Table 5.1-2).

Table 5.1-2 Common Representative Species of the Saskatchewan River[a]

Warm water fish species[a]	Cold water fish species[a]
northern pike (*Esox lucius*)	cutthroat trout (*O. clarki*)
walleye (*Sander vitreus*)	rainbow trout[b] (*O. mykiss*)
sauger (*Sander canadensis*)	bull trout (*Salvelinus confluentus*)
goldeye (*Hiodon alosoides*)	brook trout[b] (*S. fontinalis*)
yellow perch (*Perca flavescens*)	brown trout[b] (*Salmo trutta*)
lake sturgeon (*Acipenser fulvescen*)	mountain whitefish (*Prosopium williamsoni*)

Source: Rosenburg et al. 2005.

[a] List is non-inclusive. Some rivers in the basin are very species-rich (e.g., Assiniboine/Red River are represented by 94 fish species in 18 families).
[b] Non-native.

The Epping Terminal would be located in a prairie region of North America that shares many of the same fisheries characteristics and many of the same species that are expected to be present as in the proposed Project areas and is characterized by prairie streams draining the glaciated plains, with attendant low stream gradient, high sediment load (in many cases), subject to perennial drying and flooding, and flowing through sparsely populated agricultural lands. There are warm water and cold water fisheries present in the area, having commercial and recreational value.

The Stroud Terminals would be located in the Southern Plain Basin, which is drained by two large, separate river systems: the Arkansas and Red rivers. The entire state of Oklahoma is within the basin, and the basin includes many commercially and recreationally valuable fisheries. Streams of the Arkansas River drainage, which would be crossed by this scenario, contain many warm water, big river species such as paddlefish, gars, and river shad (Table 5.1-3). The Arkansas River system is fragmented by five major reservoirs on the mainstem (Matthews et al. 2005). A large tributary of the Arkansas River, the Neosho (Grand) River, originates in the Flint Hills of Kansas. Native and endemic fish species are represented in the headwaters and include isolated populations of formerly widespread species like the Topeka shiner (*Notropis Topeka*), and isolated populations of cardinal shiner (*Luxilus cardinalis*), southern redbelly dace (*Chrosomus erythrogaster*), and the endemic and federally threatened Neosho Madtom (*Noturus placidus*). The downstream river reaches are impounded by a series of five major reservoirs (Matthews et al. 2005).

Table 5.1-3 Representative Fish Species in the Stroud Area

Common Arkansas River Fish		
paddlefish (*Polyodon spathula*)	white bass (*Morone chrysops*)	channel catfish (*Ictalurus punctatus*)
gars (*Lepisosteus* sp.)	largemouth bass (*Micropterus salmoides*)	flathead catfish (*Pylodictis olivaris*)
gizzard shad (*Dorosoma cepedianum*)	spotted bass (*Micropterus punctulatus*)	blue catfish (*Ictalurus furcatus*)
smallmouth buffalo (*Ictiobus bubalus*)	striped bass[a] (*Morone saxatilis*)	
bigmouth buffalo (*Ictiobus cyprinellus*)	sunfishes (*family Centrarchidae*)	

Source: Matthews et al. 2005.

[a] non-native.

Potential Impacts

During construction, the Rail/Pipeline Scenario would disturb approximately 7,727 acres, which would increase the potential for erosion and for sediment to enter waterbodies. Excessive suspended sediment can interfere with respiration in fish and invertebrates, leading to mortality or reduced productivity in rearing and spawning (Newcombe and Jensen 1996, Sutherland 2007, Wood and Armitage 1997). Suspended sediment could result in short-term impairment of foraging efficiency for species that are visual predators. Longer-term effects could occur if sediment covers spawning gravels, preventing water exchange and oxygen to developing eggs or young fish (sack or emerging fry), potentially causing increased mortality, and reducing recruitment to the population (Newcomb and MacDonald 1991).

The quantity, cover, and type of riparian bank vegetation in the affected area vary depending upon site-specific waterbody conditions and locations. Removal of bank vegetation (including overhead cover) could lead to bank instability and erosion. Loss of riparian vegetation reduces shading, potentially causing an increase in water temperature and a reduction in dissolved oxygen; nutrient input, food input, and hiding cover (Brown et al. 2002, Ohmart and Anderson 1988). A reduction in escape cover can increase vulnerability of certain species to predation. Loss of riparian vegetation and disturbance to the bank and substrate can alter benthic communities and change food availability (Brown et al. 2002).

Most of these impacts can be mitigated by the use of standard construction erosion and sediment control methods (e.g., silt fences, sediment ponds) essentially identical to those proposed for the proposed Project, as well as maintenance of riparian buffers. These mitigation measures would reduce the potential impacts.

Most impacts to fish from this scenario would initially occur during construction, but are essentially permanent and would continue throughout operations. During operation, the reduction of trees along affected waterbodies could result in a permanent loss of shading, nutrients, and habitat enrichment features for fish. Herbicides would potentially be used to control vegetation during proposed Project operation. The use of herbicides near waterbodies could harm aquatic organisms, including fish. Herbicides could enter a waterbody through runoff, seepage through the soil, and/or direct introduction to water during application through overspray or wind drift. Mitigation measures would include maintenance of riparian buffers and the provision of appropriate stormwater management measures to control runoff volumes and improve water quality.

5.1.2.8 Threatened and Endangered Species

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the threatened and endangered species present in these three areas is presented below.

The Lloydminster Terminals would be located in one of the most altered landscapes in North America (Government of Saskatchewan 2012), which is generally unfavorable habitat for threatened and endangered species. The terminals would cover approximately 3,500 acres, which currently is primarily grassland/pasture according to aerial interpretation. Because Lloydminster

is in a grassland region of North America that shares many of the same qualities as the grasslands that would be traversed by the proposed Project, Lloydminster may be inhabited by many of the same protected species that are expected to occur in the proposed Project area. In particular, Lloydminster is within the whooping crane (*Grus americana*) central corridor (see Figure 3.8.3-1 in Section 3.8, Threatened and Endangered Species and Species of Conservation Concern). The nesting range for the piping plover (*Charadrius melodus*) (a federally threatened species, Saskatchewan endangered species, and Canada Species at Risk Act (SARA) endangered species), and the nesting range for the Sprague's pipit (*Anthus spragueii*) (a U.S. federal candidate species, and a Canada SARA threatened species), include the Lloydminster area (Saskatchewan Conservation Data Centre 2012). There is no federally designated critical habitat in the area where the Epping Terminal would be located.

The area around Stroud is inhabited by a variety of common wildlife species. Agriculture and urbanization have made tremendous impacts on this region, leaving very little natural habitat available for threatened and endangered species, which in general prefer habitat in its natural, unfragmented state. This area lies within the Central Flyway, which is a major migration route for birds (USFWS 2012). Of note, the Stroud Terminals would be within the flyway corridor for the Arkansas-Wood Buffalo population of the whooping crane (see Figure 3.8.3-1). There is no federally designated critical habitat in the area where the Stroud Terminals would be located.

Potential Impacts

Although no site specific surveys for the presence of any threatened or endangered species have been conducted, the Lloydminster, Epping, and Stroud terminals would be located in areas that have been already impacted by agriculture and urbanization, leaving little suitable habitat for threatened and endangered species. These terminal locations would not be located within designated critical habitat for any federally listed threatened or endangered species.

The Rail/Pipeline Scenario is located within the central migration corridor for the Arkansas-Wood Buffalo population of the whooping crane; however, the three terminal sites are already relatively disturbed, and they offer little habitat for the whooping crane. Detailed field surveys would need to be conducted to confirm the absence of any federal or state listed threatened and endangered species and consultation would need to occur with the USFWS, appropriate state agencies in North Dakota and Oklahoma, and appropriate Canadian agencies.

5.1.2.9 Land Use, Recreation, and Visual Resources

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the land use, recreation, and visual resources of these three areas is provided below.

Aside from developed areas in and around Lloydminster itself, the area surrounding the Lloydminster Terminal site is almost entirely used for cropland, with small patches of grassland and numerous small lakes and ponds (Natural Resources Canada 2012). However, some residential and park areas of Lloydminster are within 1 mile (1,400 meters) of the potential terminal complex.

Except for the developed areas in and near the town of Epping itself, the area surrounding Epping is primarily agricultural. Land within approximately 1 mile of Epping includes pasture land to the east, and grasslands and shrub/scrub areas to the north, south, and west. Cultivated crops surround these land uses (U.S. Geological Survey [USGS 2006]). Epping is approximately 12 miles northwest of Lake Sakakawea, a reservoir on the Missouri River used for flood control, hydroelectric power, irrigation, and recreation (North Dakota Parks and Recreation Department 2012). Lewis and Clark State Park, on the northern shoreline of Lake Sakakawea, is the closest land-based public recreation area. Other public lands with recreational value are found along the entire shoreline of the lake, which extends through much of North Dakota. There are no other regionally significant recreation areas near Epping.

The area around Stroud is primarily rangeland with developed and forest land comprising most of the remaining areas (USGS 2006). Portions of the Deep Fork Wildlife Management Area lie along the Deep Fork of the Canadian River, approximately 8 miles southeast of Stroud. Managed by the Oklahoma Department of Wildlife Conservation (ODWC), the Wildlife Management Area provides outdoor recreation and hunting opportunities (ODWC 2012). There are no other federal lands, state parks, or regionally significant recreation areas near Stroud.

The states of Oklahoma and North Dakota have no formal guidelines for managing visual resources on private or state-owned lands. The Historic Route 66 National Scenic Byway passes through Stroud. The Scenic Byway designation enables the State of Oklahoma to obtain grants from the Federal Highway Administration to upgrade the road in accordance with its Corridor Management Plan.

Potential Impacts

The only land use, recreation, and visual impacts from this scenario would be the construction and operation of the Lloydminster, Epping, and Stroud rail terminals. The Stroud Terminal complex area would encompass about 3 percent of the land in Creek and Lincoln counties. The 500-acre Epping Terminal would cover less than one-tenth of 1 percent of the approximately 1.4 million acres in Williams County, North Dakota. Similarly, the 3,500 acres needed for terminals near Lloydminster represent a fraction of 1 percent of the approximately 5.9 million acres of land in Census Division 17 of Saskatchewan—an approximate equivalent to a U.S. County (Statistics Canada 2012).

The Lloydminster Terminals would be located in an agricultural area, but along existing rail lines. Terminals in this location would be expected to result in some land use changes in the area as more land may be converted to crude oil storage and transport uses. The Epping and Stroud terminals would be located in areas that already have rail terminals transporting crude oil, so little land use, recreation, or visual impact would be anticipated.

5.1.2.10 Socioeconomics

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). This section also includes consideration of the rail lines and pipelines as operational use of these segments could affect socioeconomic resources. An overview of the socioeconomic resources of these areas is provided below.

This scenario would intersect 49 U.S. counties in six different states and 17 Canadian census divisions within three provinces (Table 5.1-4). It would go through seven metropolitan areas: Saskatoon, Saskatchewan; Winnipeg, Manitoba; Duluth, Minnesota/Wisconsin; Minneapolis-St. Paul, Minnesota/Wisconsin; Des Moines, Iowa; Kansas City, Kansas/Missouri; and Tulsa, Oklahoma. The Canadian Pacific Route would intersect 6,159 U.S. counties in eight states and eight Canadian census divisions within the Province of Saskatchewan (Table 5.1-5). It would go through eight metropolitan areas: Saskatoon, Saskatchewan; Regina, Saskatchewan; Fargo, North Dakota/Minnesota; Sioux City, Nebraska/Iowa; Omaha, Nebraska; St. Joseph, Kansas/Missouri; Kansas City, Kansas/Missouri; and Tulsa, Oklahoma. In comparison, the proposed pipeline Project would intersect 31 U.S. counties in four states and one metropolitan area: Rapid City, South Dakota.

Table 5.1-4 U.S. States and Counties and Canadian Provinces/Census Divisions within the Rail/Pipeline Scenario—Canadian National Route

State (U.S.)/ Territory (CA)	Number of Counties (U.S.)/ Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Rail/Pipeline Corridor		
Canada		
Saskatchewan	7	#17; #16; #12; #11; #10; #6; #5
Manitoba	9	#15; #7; #8; #9; #10; #11; #12; #2; #1
Ontario	1	Rainy River District
United States		
Minnesota	16	Roseau; Lake of the Woods; Koochiching; St. Louis; Carlton; Kanabec; Pine; Isanti; Anoka; Hennepin; Ramsey; Washington; Dakota; Rice; Steele; Freeborn
Wisconsin	1	Douglas
Iowa	10	Worth; Cerro Gordo; Franklin; Hardin; Story; Polk; Warren; Marion; Lucas; Wayne
Missouri	8	Mercer; Grundy; Daviess; Livingston; Caldwell; Clay; Ray; Jackson
Kansas	7	Johnson; Miami; Anderson; Linn; Allen; Neosho; Labette
Oklahoma	7	Craig; Mayes; Creek; Tulsa; Wagoner; Lincoln; Muskogee
Terminal Facilities		
Canada		
Saskatchewan	1	#17
United States		
Oklahoma	2	Lincoln; Creek

Table 5.1-5 U.S. States and Counties and Canadian Provinces/Census Divisions within the Rail/Pipeline Scenario—Canadian Pacific Route

State (U.S.)/ Territory (CA)	Number of Counties (U.S.)/ Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Rail/Pipeline Corridor		
Canada		
Saskatchewan	8	#17; #13; #12; #11; #6; #7; #2; #1
United States		

State (U.S.)/ Territory (CA)	Number of Counties (U.S.)/ Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
North Dakota	15	Burke; Renville; Williams; Mountrail; Ward; McHenry; Pierce; Wells; Eddy; Foster; Griggs; Steele; Barnes; Cass; Richland
Minnesota	14	Clay; Wilkin; Grant; Traverse; Stevens; Pope; Swift; Kandiyohi; Chippewa; Yellow Medicine; Lincoln; Lyon; Pipestone; Rock
South Dakota	1	Minnehaha
Iowa	6	Lyon; Sioux; Plymouth; Woodbury; Mills; Fremont
Nebraska	6	Dakota; Thurston; Burt; Dodge; Saunders; Cass
Missouri	7	Atchison; Holt; Andrew; Buchanan; Platte; Clay; Jackson
Kansas	7	Wyandotte; Johnson; Miami; Linn; Bourbon; Crawford; Cherokee
Oklahoma	7	Craig; Ottawa; Rogers; Delaware; Tulsa; Lincoln; Creek
Terminal Facilities		
Canada		
Saskatchewan	1	#17
United States		
North Dakota	1	Williams
Oklahoma	2	Lincoln; Creek

Population[3]

The population of the census divisions and counties that would be crossed by the CN route in 2010/2011 was approximately 8 million. The corresponding population of the Canadian Pacific route in 2010/2011 was just over 4.5 million (Table 5.1-6). In comparison, the pipeline corridor population under the proposed Project was 267,569 in 2010 (see Table 3.10-5). Of the rail corridor populations, a relatively small portion (about 166,000 persons) lives in the counties and census divisions adjacent to the terminals (Lloydminster 40,000; Williams County, North Dakota, 22,000; and Lincoln and Creek counties in Oklahoma 104,000).

Table 5.1-6 Rail/Pipeline Corridor Populations

CN Route		Canadian Pacific Route	
State (U.S)/Territory (CA)	**Population[a]**	**State (U.S)/Territory (CA)**	**Population[a]**
Rail/Pipeline Corridor		**Rail/Pipeline Corridor**	
Canada		Canada	
Saskatchewan	663,722	Saskatchewan	746,435
Manitoba	905,577	United States	
Ontario	20,370	North Dakota	297,431
United States		Minnesota	221,809
Minnesota	3,112,972	South Dakota	169,468
Wisconsin	44,159	Iowa	194,943
Iowa	694,980	Nebraska	117,516
Missouri	966,689	Missouri	1,102,508

[3] Population data were collected by county in the United States and by census division in Canada.

CN Route		Canadian Pacific Route	
State (U.S)/Territory (CA)	**Population[a]**	**State (U.S)/Territory (CA)**	**Population[a]**
Kansas	656,214	Kansas	820,037
Oklahoma	908,006	Oklahoma	882,912
Rail/Pipeline Corridor Total	*7,972,689*	*Rail/Pipeline Corridor Total*	*4,553,059*
Terminal Facilities[b]		**Terminal Facilities[b]**	
Canada		Canada	
Saskatchewan	40,135	Saskatchewan	40,135
United States		United States	
		North Dakota	22,398
Oklahoma	104,240	Oklahoma	104,240
Project Area Total	*7,972,689*	*Project Area Total*	*4,553,059*

Source: U.S. Census Bureau 2010; Statistics Canada 2012.

[a] Population data are from 2010 for U.S. areas and from 2011 for Canadian areas.
[b] Populations near terminal facilities are included in the corridor totals above.
Note: The table only includes the population of the counties and census divisions the route would go through, not the population of the states/provinces as a whole.

Environmental Justice

Populations near the terminal facilities were evaluated on a range of geographies: city, census division, province, county, and state. A total of two meaningfully greater minority populations were identified: an aboriginal population in Census Division 17 in Saskatchewan (12,000 persons out of a population of 40,000), and a multiracial population in Williams County, North Dakota (644 persons out of a population of 22,400) (see Appendix O), Socioeconomics, for detailed data).

Public Services

A total of 20 police/sheriff departments, 28 fire departments, and four medical facilities would be located near the terminals in the United States. Appendix O, Socioeconomics, includes a table listing these facilities.

Traffic and Transportation

In 2005, the existing railroads that would be utilized under this scenario had between 25 and 200 freight trains per day depending on the segment (Cambridge Systematics 2007). Some segments were near or above capacity, especially in the American Midwest between St. Paul, Minnesota, and Oklahoma and along the Gulf Coast area (Cambridge Systematics 2007, pp. 4-10.) An increase of between seven and 14 trains per day for crude by rail shipments from Lloydminster to Stroud would strain some segments of these rail networks by increasing volume anywhere from 7 percent to 56 percent.

Potential Impacts

The Rail/Pipeline Scenario would require new facilities in only three locations (terminal locations), as it would use existing rail lines for most of the crude oil transport. Thus, the analyses of potential socioeconomic impacts are focused on the immediately affected areas near Lloydminster, Epping, and Stroud/Cushing.

Population/Housing

The impacts of the Rail/Pipeline Scenario on population and housing would be small. This scenario is expected to bring over 4,000 construction jobs and 100 operations jobs to the areas of the terminals. The estimated peak employment of 1,700 persons in Lloydminster, Saskatchewan, would represent just over a 4 percent increase in the population of the census division. In Epping, North Dakota, the peak employment of 320 terminal construction jobs would represent a 1.5 percent population increase for Williams County. In Lincoln and Creek counties, the population influx from Stroud/Cushing terminal construction jobs would increase the population by less than 2 percent.

In Lloydminster, the number of hotel/motel rooms is approximately 1,075 (TripAdvisor 2012). This number would likely be insufficient to house the approximately 2,000 workers that would need lodging. In this area, additional lodging would need to be made available for workers. While the 287 hotel/motel rooms near Stroud/Cushing alone (see Final EIS Section 3.10) would not provide capacity for the over 2,000 workers needed, the cities of Tulsa and Oklahoma City, Oklahoma, are both within commuting distance, and would provide enough commercial housing to accommodate the workforce. Epping, North Dakota, has approximately 1,500 hotel/motel rooms (TripAdvisor 2012), suggesting it would be able to accommodate the approximately 300 workers that would be needed for terminal construction.

Local Economic Activity

Construction

Key components of this scenario would include new terminal facilities in Lloydminster, Saskatchewan; Stroud, Oklahoma; and Epping, North Dakota. These facilities would generate from $80 to $100 million in economic activity in each area to construct the infrastructure necessary to transfer and transport crude oil. Much of the construction workforce for each location would likely be local, which for Stroud would encompass the Tulsa and Oklahoma City metropolitan areas. The local workforce sourcing area for Epping would include cities and towns throughout North Dakota. It is uncertain how wide of an area would provide the construction workforce in Lloydminster, but given Lloydminster's relatively small population, it would likely encompass communities within Alberta and Saskatchewan.

As discussed in Section 4.10.3.1, Construction, economic effects are distinguished by whether they are direct, indirect, or induced. Direct employment effects of facility construction would include 1,900 jobs over a 2-year period at Lloydminster; 2,240 jobs over a 2-year period at Stroud; and 320 jobs over a single-year period at Epping. Indirect employment effects would include those triggered by the supply-chain for construction activity.

Developing terminal rail facilities is a process that requires a particular mix of inputs that may not be well represented by general construction for commercial facilities. Employment impacts in supply-chain industries, such as concrete, would certainly occur locally, but the mix, magnitude, and location of industry effects cannot be reliably estimated at this point. Induced effects are those triggered by construction workers and their households who spend income received for their construction labor. Estimates for Lloydminster could not be made because the models used for the economic analyses in this Supplemental EIS do not extend into Canada. In Stroud, it is estimated that about 300 additional jobs and $1.2 million of earnings would be supported each of the two years throughout Oklahoma, primarily in the Tulsa and Oklahoma

City metropolitan areas. In Epping, about 10 additional jobs and $0.5 million of earnings would be supported throughout North Dakota during the 1 year of facility construction.

Operations

Operations costs are estimated to range from $49 million annually for Lloydminster and Stroud to $7 million annually for Epping. Annual terminal employment would range from 50 jobs at each of the Lloydminster and Stroud facilities to 15 jobs at Epping (Table 2.2-2). The supply-chain characteristics of these rail facilities are sufficiently different from available, generalized operations data that effects could not be estimated. Effects triggered by worker spending in Oklahoma are estimated to be an additional 20 jobs and $800,000 annually. In North Dakota, effects are estimated to be less than 10 jobs and $200,000 annually. For the reasons mentioned above, worker spending effects in the Lloydminster area could not be estimated.

Operational socio-economic effects resulting from trains transporting WCS and Bakken crude oil daily could not be estimated. However, it is reasonable to expect annual increases in maintenance and other operational costs of track, crossings, bridges, and related facilities throughout the rail systems.

Environmental Justice

Portions of one or both of the two identified meaningfully greater minority populations could potentially be affected by construction or operations activities related to the terminals. No meaningfully greater low-income populations were identified. Impacts to minority and low-income populations would be similar to those described for the proposed Project and could result in increased competition for medical or health services in underserved populations. Williams County, North Dakota, which contains a minority population, is or contains Health Professional Storage Areas (HPSAs) and Medically Underserved Areas/Populations (MUA/Ps). Canada does not define HPSAs and MUA/Ps, so it is unknown whether or not the minority population in Saskatchewan exists in a medically underserved area. Appendix O, Socioeconomics, provides information about the HPSAs and MUA/Ps in relation to areas with minority and/or low-income populations.

Tax Revenues and Property Values

Under the Rail/Pipeline Scenario, the new terminal in Epping would cost $110 million and new terminals in Stroud would cost $700 million and would generate state and local government sales and use tax and fuel tax revenue during construction. During construction the terminals in Lloydminster would also cost about $700 million and generate provincial sales taxes, goods and services taxes, and hotel taxes. Once in operation and on the tax roll, the terminals would generate county property tax revenue. Many states along the rail routes would assess a property or similar tax on the new railcar traffic passing through, generating additional revenue. Railcar taxes typically go to a state fund for use according to each state's tax policy. The Canadian terminals would generate municipal property tax revenue. (Government of Saskatchewan 2012)

Impacts to private property values in North Dakota and Oklahoma could occur under the Rail/Pipeline Scenario if there are residential land uses that would experience offsite nuisance effects but would receive no offsetting consideration from being in the vicinity of the terminals, although there already are oil transportation facilities near these sites. Construction and operation of rail facilities, additional connecting pipelines, and additional train traffic could have an

adverse effect on local property values. These would be long-term impacts, extending through the operations phase.

Traffic and Transportation

Under this scenario, up to 15 unit trains per day would arrive at Stroud, including 13 from Lloydminster, Saskatchewan and up to two from Epping, North Dakota. Depending on the mix of train types and the type of control system used, a typical Class 1 railroad segment can accommodate up to 48 unit trains per day with one set of tracks or up to 100 trains per day with two sets of tracks (Cambridge Systematics 2007). To accommodate new rail traffic in this scenario, railroads may need to add infrastructure components (e.g., passing tracks or a second set of tracks) or upgrade control equipment. These upgrades would likely occur on property owned by the railroads. As of 2007, most of the rail corridors included in this scenario had (or, with upgrades already likely to occur regardless of crude oil transport, were likely to have) substantial available capacity (Cambridge Systematics 2007). Overall, the rail system could accommodate additional traffic under this scenario.

Construction of the rail terminals at Epping and Stroud would involve large numbers of road trips by heavy trucks to transport construction materials and equipment to and from the sites. Especially near Stroud, where seven rail terminals would be built, this increased traffic could cause congestion on major and local roadways, and could require temporary traffic management solutions such as police escorts for oversize vehicles.

Under the Rail/Pipeline Scenario, rail loading and offloading facilities would be sited to avoid disruption of major surface transportation routes. This scenario would marginally increase delays for motorists at at-grade railroad crossings by adding additional periods of time when trains use those crossings; however, most major roads (i.e., freeways and high-traffic arterial roads) have grade-separated railroad crossings. Increased crossing delays would therefore have negligible impacts on regional or metropolitan-scale traffic patterns.

5.1.2.11 Cultural Resources

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). A brief overview of the cultural resources in these three areas is provided below.

While no cultural resources studies have been conducted in the Lloydminster area for this Supplemental EIS, review of aerial photographs shows that a small portion of the approximately 3,500 acres that would potentially be developed has already been disturbed by development, including structures and roads. This preliminary review shows that most of the area appears undeveloped, and would have the potential for intact cultural resources.

No cultural resources studies have been conducted in Stroud, Oklahoma, or Epping, North Dakota. However, both areas have undeveloped land adjacent to a transportation corridor, with close proximity to water resources. The regional topography, proximity to a transportation corridor, access to water, and apparent lack of prior disturbance, appears to suggest a relatively high potential for intact cultural resources.

Potential Impacts

Any ground disturbance, especially of previously undisturbed ground, could potentially directly impact cultural resources. The Area of Potential Effect (APE) for this scenario has not been subjected to systematic cultural resources studies at this time. The potential of the APE to include intact buried cultural resources would require evaluation through research and cultural resources surveys. If cultural resources were identified, follow-up studies could be required. In general terms, the archaeological potential of heavily disturbed areas, such as might be found in active rail yards, or within developed transportation corridors, is normally lower than in undisturbed areas. Archaeological potential is also contingent upon factors such as access to water, soil type, and topography, and would have to be evaluated for each area to be disturbed. Aboveground facilities have the potential to indirectly impact cultural resources from which they may be visible or audible. The potential for increased rail traffic to contribute to indirect impacts would require consideration. The APE would have to be evaluated for historic structures and archaeological sites that could be impacted by this scenario.

5.1.2.12 Air and Noise

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas—Lloydminster (Saskatchewan), Epping (North Dakota), and Stroud/Cushing (Oklahoma). This section also includes consideration of the rail lines and pipeline as operational use of these segments could affect air and noise resources. An overview of the air and noise characteristics of these areas is provided below.

The areas around the Lloydminster, Epping, and Stroud terminal sites are generally rangeland and other agricultural uses. The rail routes associated with this scenario would cross multiple rural counties in Canada and the United States. The existing air quality (including greenhouse gases [GHGs]) in Lloydminster, Epping, and Stroud is expected to be similar to that of the proposed Project area due to the similarities in land use (i.e., rangeland and agriculture).

Potential Impacts

This scenario would include new rail terminals in Lloydminster, Epping, and Stroud. On an aggregate basis, criteria pollutant emissions, direct and indirect GHG emissions, and noise levels during the operation phase for this scenario would be higher than that of the proposed Project (see Section 4.12.3, Potential Impacts), mainly due to the increased regular operation and location of railcars and new rail terminals.

Air Quality

Emissions of criteria pollutants would be generated during the construction and operation of the Rail/Pipeline Scenario. Emissions attributed to construction of the new rail terminals and pipeline under this scenario were not quantified due to a lack of design data. However, construction-related emissions would be short-term and similar to those of the proposed Project.

During the operation phase, WCSB crude oil would be transported regularly over railroads extending from Lloydminster, Saskatchewan, to Stroud, Oklahoma; and Bakken crude would be transported via rail from Epping, North Dakota, to Stroud. Under this scenario, two railway

routes were evaluated from Lloydminster, to Stroud: Canadian Pacific Rail Route (1,903 miles); and CN Rail Route (2,008 miles). In terms of an air quality analysis, the only difference in the railway routes is the difference in route distances, so only one of the railway routes (Canadian Pacific Rail Route) was assessed in detail. Air quality impacts associated with the CN Railway Route would have a similar but slightly greater air quality impact as the Canadian Pacific Rail Route due to the longer rail length.

The trains transporting the WCSB and Bakken crudes would consume large amounts of diesel fuel each day, which equate to direct emissions of hydrocarbons (HCs) or volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulate matter (PM_{10} and $PM_{2.5}$). Emissions of VOCs would also be generated by "breathing" from 82 storage tanks holding over 6 million barrels (bbl) of crude oil. The total operational emissions (tons) estimated over the life of the project (50 years) presented in Table 5.1-7 are significantly greater than those associated with the combined construction and operation of the proposed Project.

Table 5.1-7 Comparison of Criteria Pollutant Emissions for the Rail/Pipeline Scenario and Proposed Project over a 50-Year Period

	Criteria Pollutant Emissions (tons)[a]					
Sources	**HC/VOC**	**CO**	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Rail/Pipeline Scenario (operation phase)[a]	123,324	467,617	2,030,351	1,693	37,921	36,783
Proposed Project (construction phase; 6-8 months)[b]	158	2,724	1,218	50.2	6,799	1,415
Proposed Project (operation phase)[b]	25.5	NA[c]	NA	NA	NA	NA

[a] Details of air emission calculations for the Rail/Pipeline Scenario, including activity data, emission factors, and assumptions used can be found in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions.
[b] Details of air emission calculations for the proposed Project, including activity data, emission factors, and assumptions used can be found in Tables 4.12-2 and 4.12-4.
[c] Not applicable (NA).

The rail emissions accounted for return trips (i.e., both loaded cargo going south and unloaded cargo going north). Detailed annual operational emissions (with activity data, emission factors, and assumptions) for this scenario can be found in Table 1 in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions. The proposed Project is expected to emit 0.51 tons of VOCs per year during operations or 25.5 tons over the life of the project (i.e., from approximately 55 intermediate mainline valves along the pipeline route and from pump station components such as valves, pumps, flanges, and connectors). No other criteria pollutants or hazardous air pollutants would be emitted during the proposed Project operations (see Section 4.12.3.1, Air Quality). Unlike the proposed Project, for which human receptors (residences) are located at least 200 feet away from the air emission sources described above (i.e., pumps, valves, flanges and connectors at the pump stations), this scenario has human receptors as close as 39 feet to some segments of the rail line (e.g., in Cass, North Dakota).

The Rail/Pipeline Scenario would also generate fugitive VOC and methane emissions (direct emissions) from equipment at the new rail terminals and potential pump stations required for pipeline interconnections. Due to the speculative nature of these facilities, fugitive emissions could not be quantified.

Greenhouse Gases

Direct emissions of GHGs would occur during the construction and operation of the Rail/Pipeline Scenario. GHGs would be emitted during the construction phase from several sources or activities, such as clearing and open burning of vegetation during site preparation, operation of on-road vehicles transporting construction materials, and operation of construction equipment for the new pipeline, rail segments, multiple rail terminals, and fuel storage tanks. Due to limited activity data, GHG emissions from construction of the Rail/Pipeline Scenario were not quantified; however, these emissions would occur over short-term and temporary periods, similar to the proposed Project.

During the operation of this scenario, GHGs would be emitted directly from the combustion of diesel fuel in railcars traveling approximately 1,903 to 2,008 miles from Lloydminster, Saskatchewan, to Stroud, Oklahoma, and 1,347 miles from Epping, North Dakota, to Stroud, Oklahoma. As indicated earlier, two railway routes were evaluated under this scenario from Lloydminster, Saskatchewan, to Stroud, Oklahoma: Canadian Pacific Rail Route (1,903 miles) and CN Rail Route (2,008 miles). GHG impacts associated with the CN Rail Route would have a similar but slightly greater regional/global GHG impact as the Canadian Pacific Rail Route due to the longer route distance. The operation of diesel-fueled trains hauling Bakken crude to Epping, North Dakota, would also result in GHG emissions. The rail emissions accounted for return trips (i.e., both loaded cargo going south and unloaded cargo going north). The resulting direct emissions of GHGs (2,955,857 metric tons of carbon dioxide equivalents [CO_2e] per year) from this scenario can be found in Table 2 in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions. The Rail/Pipeline Scenario would also result in indirect emissions of GHGs due to the operation of 15 new rail terminals and potential pumping stations. The new rail terminals would be required in Saskatchewan, North Dakota, and Oklahoma, and each is projected to require 5 megawatts (MW) of electric power to operate. Indirect GHG emissions (491,099 metric tons of CO_2e per year) for this scenario are presented in Table 5.1-8.

Table 5.1-8 Estimated Indirect Greenhouse Gas Electricity Emissions from the Rail/Pipeline Scenario

State/ Province	e-Grid Region[a]	No. of New Terminals	Power Requirement per Terminal (MW)	Annual Indirect Electricity Usage (MWh/yr)[b]	Greenhouse Gas Emissions (tons/year)[a]				Greenhouse Gas emissions (metric tons/year)
					CO_2	CH_4	N_2O	CO_2e	CO_2e
Saskatchewan	NA	7	5	306,600	256,856	13.5	6.6	259,235	235,175
North Dakota,	MROW	1	5	43,800	35,666	0.6	0.6	35,868	32,539
Oklahoma	SPSO	7	5	306,600	245,130	3.6	3.3	246,240	223,386
				TOTAL	**537,652**	**17.7**	**10.7**	**541,344**	**491,099**

[a] The e-Grid region for North Dakota and Oklahoma and emission factors and emission factors used in estimating annual emissions for each pollutant in both states were taken from USEPA's eGRID2012 version 1 database, Year 2009 (http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html). The GHG electricity factors used for estimating annual emissions for the terminal in Saskatchewan, Canada was taken from Environment Canada, National Inventory Report, 1990 - 2010, Annex 13 (Environment Canada 2012). The most recent GHG factors for Canada (Year 2010) were used. (http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php). [b] Annual indirect electricity usage was estimated based on the number of terminals, power requirements per terminal, and 8,760 hours of operation per year.

Notes: NA = Not applicable; MROW = Midwest Reliability Organization West; SPSO = Southwest Power Pool South; MW = megawatt; MWh/yr = megawatt-hour per year; CH_4 = methane; N_2O = nitrous oxides.

In aggregate, the total annual GHG emissions (direct and indirect) attributed to this scenario are approximately 3,447,000 metric tons CO_2e, which is about eight percent greater than for the proposed Project at just under 3,200,000 metric tons CO_2e (see Section 4.12.3.2, Greenhouse Gases).

Noise

Noise would be generated during the construction and operation of the Rail/Pipeline Scenario. Noise would be generated during the construction phase from the use of heavy construction equipment and vehicles for the new pipeline, rail segments, and multiple rail terminals and fuel storage tanks. Due to limited activity/design data, noise levels from the construction of this scenario were not quantified; however, this noise would occur over a short-term and temporary period, so construction noise impacts are expected to be comparable to those of the proposed Project.

During operation of the railcars that comprise this scenario, noise would be generated from the locomotives, movement of freight cars and wheels making contact with the rails as the train passes, train horns, and warning bells (crossing signals) at street crossings. People that live near rail yards, siding, or terminals likely would experience additional noise due to trains standing for extended periods with their engines idling, as well as from trucks and other mobile sources constantly moving in and out of the yard/terminal. As indicated earlier, two railway routes were considered under this scenario for the transfer of crude oil from Lloydminster, Saskatchewan, to Stroud, Oklahoma: Canadian Pacific Rail Route (1,903 miles); and CN Rail Route (2,008 miles). Both rail routes were evaluated separately for this noise assessment because both routes cross different states with different noise sensitive areas (NSAs) or receptors. Unlike the proposed Project, for which human receptors (residences) are located at least 200 feet away from the noise sources (pump stations), this scenario has human receptors as close as 39 feet to some segments of the rail line (e.g., in Cass, North Dakota).

The day-night sound levels (Ldn) from both rail routes were calculated in accordance with the methodology described by U.S. Department of Transportation (USDOT 2006) for commuter rail system. The calculation assumes up to 730,000 bbl of WCSB crude oil transported per day from Lloydminster, Saskatchewan to a storage facility at Stroud, Oklahoma, 581 bbl of crude oil per railcar, four diesel-powered locomotives per train unit with a speed of 40 miles per hour, and 100 railcars per train. Aerial photography was used to identify the closest NSAs within 0.5 mile of the rail corridor for both rail routes. The existing noise levels at the closest NSAs were estimated using the methodology described in USDOT 2006, which is based on the proximity of the NSAs to the existing rail routes. The noise calculations do not include potential noise from train horns, warning bells (crossing signals) at street crossings, and locomotive idling at layover tracks near terminals. The noise calculations also exclude potential noise attenuation from barriers such as vegetation blocking the line of sight between the source (train) and some receptors (NSAs).

Noise levels would vary depending on the distance of closest NSAs to the rail routes. This additional rail traffic could result to noise increases of approximately 10 decibels on the A-weighted scale (dBA) above existing levels (ambient noise levels are estimated to be 73 dBA at the closest NSA) at the source. Under the Canadian Pacific Route, Ldn levels could be as high as 83 dBA at the closest NSA in Cass, North Dakota (39 feet from the rail route). This level of Project-induced noise at an NSA is greater than the expected noise level at an NSA from pump station operations under the proposed Project, which was estimated to be approximately 79 dBA

at 200 feet (closest receptor) (see Section 4.12.3.3, Noise). Similarly, under the CN route, Ldn levels (including existing levels) could be as high as 82 dBA at the closest NSA in Marion, Iowa (47 feet from the rail route). The addition of noise from train horns, warning bells, and locomotive idling would further increase noise levels at these NSAs, unless there are barriers present such as vegetation that blocks the line of sight between the trains and the NSAs. Detailed operational noise emissions (with activity data, distance to closest NSA, and assumptions) for this scenario can be found in Tables 3 and 4 in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions.

This scenario also has the potential for noise due to the transport of 100,000 bpd of Bakken crude via trains from Epping, North Dakota to the storage facility at Stroud, Oklahoma (approximately 1,347 miles). Noise from the Epping-Stroud route was not quantified because approximately 90 percent of this rail route is the same as the Canadian Pacific route. The remaining 10 percent of this route goes through Williams, Mountrail, and Ward counties in North Dakota. The closest NSAs in these three counties are between 160 and 200 feet from the Epping-Stroud route, so Ldn levels for this portion of the Epping-Stroud route are expected to be lower than the Ldn levels for the nearest NSAs along the Canadian Pacific and CN rail routes. Based on the increased train traffic/volume and proximity of the NSAs to the rail routes, noise impacts from the Rail/Pipeline Scenario (i.e., Canadian Pacific route plus Epping-Stroud route or CN Route plus Epping-Stroud route) would be greater than those of the proposed Project.

5.1.2.13 Climate Change Effects on the Scenario

Environmental Setting

Historical Climate Trends

The historical changes in temperature for the region affected by the Rail/Pipeline Scenario are presented below in Table 5.1-9 and are similar to those discussed in Section 4.14, Climate Change Impacts on the Proposed Project. Overall, temperatures have been warming compared to historical averages. These historical climate trends are expected to continue and to intensify according to GHG emissions levels and associated projections of climate change (Intergovernmental Panel on Climate Change (IPCC) 2007 and 2012).

Table 5.1-9 Historical Changes in Temperature by State (1895-2009)

State	Annual Average (˚F[e] Increase)	Summer Average (˚F Increase)	Winter Average (˚F Increase)
Montana[a]	1.6	1.0	1.7
North Dakota[b]	2.9	1.8	5.0
South Dakota[b]	2.2	1.6	3.9
Nebraska[b]	1.2	0.7	1.8
Kansas[b]	1.1	0.6	2.0
Iowa[c]	1.0	0.4	1.5
Minnesota[c]	1.4	0.9	2.4
Missouri[c]	0.4	0.0	0.9
Oklahoma[d]	1.2	0.7	2.5

[a] Source: Breckner 2012; [b] Source: HPRCC 2012; [c] Source: SCIPP 2012; [d] Source: MRCC 2012; [e] Degrees Fahrenheit (˚F).

Projected Climate Trends

As part of preparation of this Supplemental EIS, an analysis was performed to evaluate the potential impacts of climate change on facilities that would be built under the Rail/Pipeline Scenario. The routes for the Rail/Pipeline Scenario would cross through several of the climate regions in the United States that were already discussed in Section 4.14, Climate Change Impacts on the Proposed Project. The Rail/Pipeline Scenario routes are east of the proposed Project pipeline route and pass through the Continental, Dry Temperate, and Prairie Climate Regions. In general, these climate regions are projected to experience the same overall trends in temperature and precipitation (see Tables 4.14-2 and 4.14-3).

Potential Impacts

The impacts of climate change on the pipeline portion (construction and operation) of the Rail/Pipeline Scenario would be similar to the proposed Project due to similarities in climate regions (see Section 4.14.2, Impacts on the Proposed Project). The climate modeling results described in Table 4.14-2, Projected Changes in Average Mean Daily Maximum Temperatures (2010-2099), show that there are very small relative differences between the affected climate regions in projected future temperature changes over baseline conditions by 2040. For precipitation, the relative difference is greater due to the differences in the baseline precipitation rates for each climate region (see Table 4.14-3, Projected Changes in Precipitation by Climate Region [2010-2099]). Increased high temperatures could have an impact on operation of the existing rail line. Increased hot temperatures above a certain level can cause compression and expansion of rail line (sun kinks or thermal misalignments). This can lead to service interruptions or derailment.

5.1.2.14 Potential Risk and Safety

Environmental Setting

The Rail/Pipeline Scenario would combine risk inherent in both pipeline and rail transport. However, the risks and consequences for using rail (freight trains) to transport hazardous materials are greater than those for the proposed Project, as crude oil transportation via rail has historically had a higher safety incident rate than pipelines, in terms of both fire/explosion and injuries (Trench 2003). Pipelines are the primary mode of transportation for crude oil, petroleum products, and natural gas; approximately 71 percent of crude oil and petroleum products are shipped by pipeline on a ton-mile basis. Tankers and barge traffic account for 22 percent of oil shipments. Trucking accounts for 4 percent of shipments, and rail for the remaining 3 percent (Furchtgott-Rott, 2012).

USDOT has compared the incident, injury, and fatality rates for oil and gas pipelines with those for transportation by road and rail for the period 2005 through 2009 (USDOT 2010). From these statistics, road has the highest rate of hazardous material incidents, with 651 incidents per billion ton-miles per year (Table 5.1-10). This is followed by rail, with 20 incidents per billion ton-miles per year. Natural gas transmission by pipeline has the next highest rate, with 0.89 incidents per billion ton-miles per year. Hazardous liquid product transmission by pipeline has the lowest rate of the four, with 0.61 incidents per billion ton-miles per year (Furchtgott-Rott 2012). The source reviewed for these incident rates does not distinguish between types of oil products, and pipeline

data are based upon all reported incidents in the PHMSA database. Oil-related incidents also are not distinguished from other products, such as chemicals, in the rail and road statistics.

Table 5.1-10 Comparative Statistics for Hazardous Material Transportation Incident Rates (2005-2009)

Transport Mode	Billion Ton-Miles of Shipments	Average Hazmat Incidents per Year	Average Hazmat Incidents per Billion Ton-Miles per Year
Road	23.0	14,963	650.60
Railway	35.1	713	20.50
Hazardous Liquid Pipeline (Onshore)	584.1	354	0.61
Gas Transmission Pipeline (Onshore)	338.5	300	0.89

Source: Furchtgott-Rott 2012

The principal reported cause of spills for transporting crude oil via rail is derailment. Spills due to overfilling a railcar or a leaking car tank primarily occur at loading/unloading facilities. Once a railcar is part of a train, the integrity of the railcar is assumed complete unless an accident occurs. The following are the main threats that could contribute to a rail spill:

- Derailment: railcar separates from train tracks due to track damage, vandalism, or other hazard event;
- Train-train collision: railcar separates from the train due to impact with another train;
- Motor vehicle-train collision: railcar separates from the train due to impact with a motor vehicle; and
- Other train collisions: railcar separates from the train due to impact with track obstructions such as a collapsed bridge or debris on the track.

The throughput of the proposed Project pipeline is estimated at 730,000 bpd of diluted bitumen (dilbit) and 100,000 bpd of Bakken shale oil. The maximum size railcar allowed by regulations in 49 Code of Federal Regulations 179.13 is 34,500 gallons (about 820 bbl). Use of these cars to ship 730,000 bpd would require approximately 850 railcars per day moving from the loading sites to delivery points. At maximum capacity, approximately 1,010 railcars would be required to unload at the delivery points each day. It is likely that unit trains would be created and devoted exclusively to the Project, with each train consisting of from 60 to 100 railcars. Transporting the maximum throughput of 830,000 bpd would require 10 to 17 unit trains moving from the loading sites to delivery points, and the same number of (empty) unit trains making the return trip each day. It is possible that for continuous operation, the transporters may need to have additional trains in transit along the route or routes selected.

Potential Impacts

Surface Water

The existing railroads that would be crossed under this scenario could be adversely affected if a derailment causing a large spill occurred. If a spill occurred along a small, low-gradient tributary, the impact would be confined to the local area. If the spill occurred in a major river, such as the Mississippi River or other waterbody, impacts could be large and wide ranging.

Wetlands

Spills within wetlands would most likely be localized, unless they were to occur in open, flowing water conditions such as a river. A crude oil spill in a wetland could affect vegetation, soils, and hydrology. The magnitude of impact would depend on numerous factors including but not limited to the volume of spill, location of spill, wetland type (i.e., tidal versus wet meadow wetland), time of year, and spill response effectiveness. The construction of additional passing lanes to accommodate increased train traffic resulting from this scenario could result in permanent impacts to wetlands if passing lanes were constructed where wetlands occur. However, as there is some flexibility regarding the exact location of the passing lanes, it is expected that wetlands would be avoided by design.

Fisheries

The Rail/Pipeline Scenario railroad route would cross numerous major streams and rivers in Canada and the United States. Under this scenario, current risks to fisheries would increase due to the increase in the number of trains that would use the routes.

Threatened and Endangered Species

The existing rail routes cross mostly prairies and some forested land that include habitat for certain threatened and endangered species. These species could be affected in the case of a spill in its habitat.

5.1.3 Rail/Tanker Scenario

Under the Rail/Tanker Scenario, it was assumed that crude oil production in the WCSB and Bakken basins would increase at least to the level proposed for transport in the proposed Project (e.g., up to 730,000 bpd of WCSB crude oil and up to 100,000 bpd of Bakken crude oil). The Rail/Tanker Scenario is described in more detail in Section 2.2.3.3, Rail/Tanker Scenario. In summary, this scenario would include the following components for transporting the WCSB crude oil:

- A new, approximately 3,500-acre rail terminal and storage complex near Lloydminster, Saskatchewan, with access to a Class I major rail system, where the WCSB crude oil would be loaded onto 100-car unit trains;
- Use of approximately1,100 miles of existing rail lines from the proposed Lloydminster rail terminal complex to a new approximately 3,500-acre rail terminal complex where the oil would be offloaded from the rail cars, with a short pipeline connection to the port at Prince Rupert;
- An approximately 1,200-acre expansion of the existing port at Prince Rupert, where the crude oil would be temporarily stored and then loaded onto crude oil tankers;
- Transport via Suezmax crude oil vessels south along the Pacific Coast, through the Panama Canal, and north into the Gulf of Mexico; and
- Off-loading of the crude oil onto smaller vessels for final transport to the Gulf Coast area refineries.

Under this scenario, Bakken crude oil would still be transported via rail to Stroud/Cushing as proposed in the Rail/Pipeline Scenario. The following are components for transporting the Bakken crude oil:

- A proposed approximately 500-acre rail terminal and storage complex near Epping, North Dakota (to accommodate increased rail volume), where the Bakken crude oil would be loaded onto one to two 100-car unit trains per day
- Transport along approximately 1,350 miles of existing rail lines from the proposed Epping rail terminal to a proposed approximately 500-acre rail terminal and oil storage complex near Stroud, Oklahoma, where the crude oil would be offloaded. No specific railroad company or route between Epping and Stroud was identified for this segment, although it should be noted that Bakken crude oil is currently being transported via rail from Epping to Stroud.
- Transport via a new approximately 17-mile-long pipeline from the proposed Stroud crude oil storage complex to the existing Cushing, Oklahoma, crude oil terminal (referred to herein as the Cushing pipeline).
- Temporary storage in existing facilities at Cushing pending delivery via existing crude oil pipelines (e.g., Keystone Gulf Coast pipeline that is currently under construction) to Gulf Coast area refineries.

The locations for proposed rail terminals and the expanded port in Prince Rupert are meant to provide representative examples. The exact rail routes used at any one time could differ from those presented here because of congestion on certain lines, track maintenance and other factors outside the scope of this document.

In summary, the Rail/Tanker Scenario would take advantage of existing rail lines and crude oil pipelines and the existing Cushing storage facility and require little if any new rail tracks, but would require the construction of new rail terminals and crude oil storage facilities in Lloydminster, Prince Rupert, Epping, and Stroud; port expansion in Prince Rupert; as well a new, approximately 17-mile-long Stroud-Cushing pipeline. There is the potential that some improvements may be required along the existing rail lines and crude oil pipelines included in this scenario; the location, scale, and timing of these improvements are unknown, but they are believed to be minor in comparison with the overall scale of the scenario, and are thus not considered in this analysis.

The environmental setting and potential impacts for the Rail/Tanker Scenario are described below for each resource. Since the rail lines from Lloydminster to Prince Rupert and from Epping to Stroud and the pipeline from Cushing to the Gulf Coast area refineries already exist or are under construction, little or no improvements to these facilities are assumed to be necessary. Since no new construction would be needed, it is assumed that there would be no construction impact to any resources along these segments. There would also be little potential for operational impacts from increased rail traffic along the existing rail lines for most resources (i.e., geology, soils, water, wetlands, vegetation, wildlife, fish, threatened and endangered species, land use, and cultural resources), other than an increased potential for impacts from accidental releases, which is described in Potential Risk and Safety (Section 5.1.3.14) below.

In addition, the transport of the crude oil via tankers from Prince Rupert to the Gulf Coast area refineries would not have any effects on geology, soils, groundwater, wetlands, vegetation, land use, socioeconomics, noise, or cultural resources, other than in the event of a spill, which is

discussed in Potential Risk and Safety (Section 5.1.3.14) below. The Gulf Coast area refineries already receive crude oil shipments via tankers from Mexico, Venezuela, and other locations; the Rail/Tanker Scenario is expected to simply displace these sources of crude oil with WCSB crude oil. Therefore, no new construction or new operational impacts are expected to occur as a result of this scenario at the Gulf Coast area refineries or surrounding habitats or communities.

The Rail/Tanker Scenario would include the construction of new facilities in four areas—Lloydminster (Saskatchewan), Prince Rupert (British Columbia), Epping (North Dakota), and Stroud/Cushing (Oklahoma). The resources of the Lloydminster, Epping, and Stroud/Cushing areas are the same as those described for the Rail/Pipeline Scenario, therefore the environmental setting discussion for each resource below only describes the setting for the Prince Rupert area. See Section 5.1.2, Rail/Pipeline Scenario, for a description of the environmental setting for the Lloydminster, Epping, and Stroud/Cushing areas.

In addition, the discussion of impacts for the Rail/Tanker Scenario below focuses on the proposed new rail terminals and expanded port facilities at Prince Rupert, as the impacts at the other proposed rail terminals and the Cushing pipeline would be the same as the for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is only receiving Bakken crude oil and not WCSB crude, and therefore the extent of the potential geologic impacts at this location would be proportionately less. Where applicable, impacts for the total Rail/Tanker Scenario (including impacts from construction at Lloydminster, Epping, Stroud/Cushing, and Prince Rupert) are referenced for comparison purposes (e.g., total wetland impacts). The existing rail lines are only discussed in terms of resources that would be affected by increased rail traffic (i.e., air, noise, socioeconomics) and the relative risk of accidental releases.

5.1.3.1 Geology

Environmental Setting

The local surface geology at the Prince Rupert site consists of bedrock (granitic rocks) overlain by glacial outwash and a thin soil cover. The local surface geology predominantly displays metamorphic formations overlain with colluvium and glacial till. The area is highly foliated, and topography is quite ridged (Environment 1995). Prince Rupert is located along the coastal region of Canada, which is seismically active.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb approximately 9,427 acres of land. The construction and operational impacts on resources at the Lloydminster, Epping, and Stroud terminals and the Cushing pipeline would be essentially the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of geologic impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

At Prince Rupert, depth to bedrock is expected to be relatively shallow, so rock ripping and some blasting could be necessary. The impacts of rock ripping and blasting are limited to the immediate area and would not result in any significant impacts to the underlying or nearby geology. Excavation activities, erosion of fossil beds exposed due to grading, and unauthorized collection can damage or destroy paleontological resources during construction. The potential for

finding paleontological resources in the areas that would be disturbed is unknown. The proposed Prince Rupert rail terminals and port complex would be located in areas that would not impact access to any existing surface mines and quarries or known fossil fuel or mineral resources. In terms of geologic hazards, the Prince Rupert terminals would be located along the coastal region of Canada, which is seismically active. In addition, the presence of steep slopes increases the risk of landslides and the port's coastal location increases the risk of flooding.

Routine operations of the Rail/Tanker Scenario would not involve disturbance of, or impacts to, the underlying geology, paleontological resources, or mineral and fossil fuel resources. The Prince Rupert rail terminals and port facilities would be designed to withstand potential seismic hazards and flooding, and would be located in areas that are not susceptible to subsidence.

5.1.3.2 Soils

Environmental Setting

The Prince Rupert terminals would be located in British Columbia. The soil groups that occur between Lloydminster and Prince Rupert include the Brunisols, Gray Luvisols, and Black Chernozemics. Podzols and Luvisols are the soil groups that would be traversed in British Columbia. In general, the Brunisols and Luvisols soil groups are associated with forest vegetation, are usually not well developed, and have a calcareous layer in the subsoil. The Podzol soils are relatively infertile and light-colored, and are typically found in coniferous forest areas in cool and humid regions. The Chernozemic soils are dark colored soils that have high organic matter content with textures that range from heavy clays to sands. The soils found within the Prince Rupert terminal and in the port area are typically organic soils over residual soils. These organic soils exhibit various stages of organic matter decomposition. The organic layer varies in depth, ranging from a thin veneer to about 12 inches.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb approximately 9,427 acres of land. The construction and operational impacts on soil resources at the Lloydminster, Epping, and Stroud terminal complexes and the along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of soil impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Construction of the proposed terminals and port expansion in Prince Rupert would result in the disturbance of approximately 3,500 acres of land for the construction of the rail terminal complex and approximately 1,200 acres for the expansion of the port. Potential impacts to the soils resources of the area could result from vegetation clearance, landscape grading, and re-contouring to ensure proper drainage, the installation of stormwater drainage systems, construction of the required infrastructure, and other construction activities.

One of the primary concerns during construction activities is soil erosion and sedimentation. Potential impacts to soils from erosion are expected to occur in areas where the slopes are greater than 20 percent and where the erosion potential due to their nature is high. Based on available landscape and soils information, the soils found in the area are not highly erodible and the required infrastructure would be located in areas that are relatively flat. Therefore, the impact of the proposed terminal complex and port construction activities on soil erosion would be minor.

Potential impacts resulting from the movement of heavy equipment required to support the planned clearance and construction activities may also impact the soil resources by causing the rutting (rutting occurs when soil strength is not sufficient to support the applied load from vehicle traffic) and compaction of susceptible soils. In general, compaction and rutting can affect hydrology and result in the loss of soil by erosion and productivity. Given that the soils of the area are primarily organic over residual material, which are less susceptible to compaction, compaction and rutting is not considered a widespread concern, and the impacts to the soil resources are expected to be minor.

5.1.3.3 Water Resources

Groundwater

Environmental Setting

The Prince Rupert Terminals and port expansion would occur in British Columbia on Kaien Island, which receives about 102 inches of rainfall per year. The terminals would be located on an inlet that is part of the eastern Pacific Ocean on the Venn Passage near the much larger Inland Passage, which extends from Washington State to Alaska along the islands and mainland of British Columbia, Canada. Venn and Inland Passages are marine (salt water) waterbodies. The islands consist of bedrock (granitic rocks) overlain by glacial outwash and a thin soil cover. Groundwater is shallow, poor quality, and unused. Drinking water is derived from lakes on the mainland. Water quality in the terminal complex area is seawater and inland brackish.

Potential Impacts

The construction and operational impacts on water resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is only receiving Bakken crude oil and not WCSB crude, and therefore the extent of the potential groundwater impacts at this location would be proportionately less. Because of this, the following discussion of impacts to groundwater resources for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

During construction of the facilities at Prince Rupert, the primary potential impacts to groundwater would be spills or leaks from construction equipment. Mitigation for these impacts includes having in place appropriate plans in place and appropriate cleanup materials available.

During operations of the facilities at Prince Rupert, the primary potential impacts to groundwater would again most likely be spills or leaks from operation equipment or associated with crude oil unloading of railcars. Although the initial impacts of potential releases or spills may be contained or limited to soil, potential impacts to groundwater may occur depending on the depth to groundwater, soil characteristics (e.g., porosity, permeability), spill volume and extent, and whether the spill reaches surface waterbodies, some of which are interconnected to groundwater. The potential impacts to groundwater from spills or releases of crude oil or refined petroleum products as part of construction and operation of the Rail/Tanker Scenario would be similar to those expected for the proposed Project. These effects are discussed in more detail in Potential

Risk and Safety (Section 5.1.3.14). Mitigation for these potential spills and leaks would be similar to those for the proposed Project.

Surface Water

Environmental Setting

The upland character surrounding the potential Prince Rupert terminal area is dominated by bog forest uplands and the flowing surface water bodies are predominantly precipitation- and shallow groundwater-fed intermittent streams. Some open waterbodies are present in the southeast portion of Kaien Island. Tidal shore zones are of a rugged and rocky nature and receive wave energy generated by naturally occurring fetch and large wakes from marine traffic. Winter winds are strong and from the southeast to southwest, with surface currents predominantly northward from the Hecate Strait. Lighter summer winds have less influence on currents and allow freshwater runoff from land and deep water tidal effects to exert more control and provide variation in summer current patterns. Significant wind and tidal mixing tend to occur where waters are shallow and around islands and rocky points of land. The coastal landscape is predominantly fjords carved into the granitic Coast Mountains, created by the last of several glacial periods approximately 12,000 years ago. Shores tend to be rocky and steep with beaches restricted to sheltered areas adjacent to estuaries and the navigable straits and channels provide a wide variety of exposures and habitats.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb approximately 9,427 acres of land. The construction and operational impacts on surface water resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is only receiving Bakken crude oil and not WCSB crude. Therefore the extent of the potential surface water impacts at this location would be proportionately less. Because of this, the following discussion of surface water impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Construction of the facilities at Prince Rupert would disturb approximately 4,700 acres. The primary potential impacts to surface waters include erosion and sedimentation and spills/leaks of hazardous materials. Mitigation for these impacts includes having in place appropriate SPCC plans in place and appropriate cleanup materials available.

During operations, the primary potential impacts to surface waters include stormwater runoff, spills, or leaks from operation equipment or associated with crude oil unloading of railcars. Provision of stormwater management measures would mitigate the impacts of stormwater runoff. The potential impacts to surface waters from spills or releases of crude oil or refined petroleum products as part of the operation of the Rail/Tanker Scenario would be similar to those expected for the proposed Project. These effects are discussed in more detail in Potential Risks and Safety (Section 5.1.3.14). Mitigation for these potential spills and leaks would be similar to those for the proposed Project.

5.1.3.4 Wetlands

Environmental Setting

Prince Rupert, British Columbia, is in the USEPA Level III Coastal Gap and Coastal Western Hemlock-Sitka Spruce Forest Ecoregion. These ecoregions contain extensive wetlands, including freshwater forested, scrub-shrub, and herbaceous wetlands associated with wet meadows, lakes, and rivers. These ecoregions are also characterized by intertidal marine wetlands and estuarine wetlands. Refer to Section 5.1.3.3, Water Resources for a general discussion of the surface water resources that are associated with the Rail/Tanker Scenario.

Potential Impacts

Potential adverse impacts to wetlands associated with this scenario are similar to those described in the Rail/Pipeline Scenario (Section 5.1.2.4, Wetlands), with the addition of new facilities in Prince Rupert, British Columbia. Overall, construction of the proposed rail terminals (including those for Lloydminster, Epping, Stroud, and Prince Rupert), oil storage facilities, an expanded port, and the pipeline for the Rail/Tanker Scenario would disturb about 9,427 acres of land, some of which include wetland habitat. The construction and operational impacts on wetland resources at the Lloydminster and Epping complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of wetland impacts for the Rail/Tanker Scenario focuses on potential impacts at the smaller Stroud, Oklahoma, terminal and the Prince Rupert facilities.

Construction of the 500-acre Stroud terminal for the Rail/Tanker Scenario would result in approximately 3 acres of temporary or permanent impacts to freshwater ponds, and additional impacts to streams, based solely on the presence of wetlands known to occur according to the NWI database (NWI 2012). New rail terminals and an expanded port would be required at Prince Rupert. Based on preliminary aerial photo interpretation, it is estimated that approximately 34 acres of emergent (herbaceous) wetlands, 124 acres of scrub-shrub wetlands, and 22 acres of open water habitat would be affected by permanent impacts as a result of the Prince Rupert terminal construction. Other wetland types likely present that were not readily identifiable using aerial photo interpretation may include freshwater forested wetlands, estuarine wetlands and intertidal wetlands.

These estimates of potential wetland impacts at these representative terminal locations, which are based on aerial photo interpretations and secondary sources such as NWI mapping, are intended to be illustrative of the magnitude of actual impacts that may occur. Please note that wetland acreages estimated using the NWI (2012) database may differ from wetland acreages estimated using the NLCD (Fry et al. 2011) presented in Table 5.1-2. If rail terminals are constructed, the actual acreage of wetland impacts would be determined through a formal wetland delineation.

5.1.3.5 Terrestrial Vegetation

Environmental Setting

The Prince Rupert terminals and port facilities would be located in the Coastal Gap Level III Ecoregion. The vegetation immediately adjacent to the Pacific Ocean includes stunted, open-growing western red cedar, yellow cedar, and western hemlock with some stunted shore pine and Sitka spruce (TEFC 2012b). There are also open areas present within the affected areas. It is

unclear if biologically unique landscapes or vegetation communities of concern exist within the proposed Prince Rupert terminal complex boundary.

Potential Impacts

Overall, construction of the proposed rail terminal complexes, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb about 9,427 acres (Table 5.1-11). The construction and operational impacts on terrestrial vegetation at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is only receiving Bakken crude oil and not WCSB crude, and therefore the extent of the potential terrestrial vegetation impacts at this location would be proportionately less. Therefore, the following discussion of terrestrial vegetation impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Table 5.1-11. Potential Impacts to Terrestrial Vegetation by Landcover Type under the Rail/Tanker Scenario

	Acreage				
Land Cover	**Prince Rupert**	**Lloydminster**	**Stroud[a]**	**Epping**	**Total Acres**
Grassland/Pasture	901	2,756	371	40	4,068
Developed	313	493	21	6	833
Deciduous Forest	3,307	0	106	0	3,413
Cultivated cropland	0	0	0	455	455
Open Water	22	60	0	0	82
Scrub/shrub wetlands	124	173	0	0	297
Emergent wetlands	34	20	0	0	54
Total	**4,700[b]**	**3,500[b]**	**500[b]**	**500**	**9,202**

[a] Plus land for a new pipeline between Stroud and Cushing that would affect 227 acres.
[b] May not add up due to rounding.

The proposed rail terminal complex and port facilities at Prince Rupert would require the clearing of up to 4,700 acres of natural vegetation, most of which is forested based on aerial photo interpretation. There does not appear to be any biologically unique landscapes or communities of conservation concern within the terminal complex boundary. Nearly all of these impacts would be permanent as natural habitats are converted for use as rail terminals and port facilities.

5.1.3.6 Wildlife

Environmental Setting

The habitat found in and around the Prince Rupert Terminals and along the Pacific Coast is in the Coastal Gap Ecoregion (TEFC 2012a). Many wildlife species use this coastal area for hunting, foraging, roosting, breeding, and nesting (Tourism Prince Rupert 2012). Wildlife characteristic of this ecoregion include grizzly bear (*Ursus arctos horribilis*), black bear (*Ursus americanus*), mountain goat (*Oreamnos americanus*), black-tailed deer (*Odocoileus hemionus columbianus*), wolf (*Canis lupus*), moose (*Alces alces*), mink (*Mustela* sp.), bald eagle

(*Haliaeetus leucocephalus*), seabirds, shorebirds, waterfowl, and grouse (*Tetraoninae*) (TEFC 2012a).

The Prince Rupert terminal complex would be located in the Northern Pacific Rainforest (Region 5) bird conservation region, which is an ecologically distinct region in North America with similar bird communities, habitats, and resource management issues as defined by the USNABCI (2000). The coast of the Northern Pacific Rainforest is characterized by river deltas and pockets of estuarine and freshwater wetlands set within steep, rocky shorelines. These wetlands provide critical nesting, wintering, and migration habitat for internationally significant populations of waterfowl and other wetland-dependent species. The area includes major stopover sites for migrating shorebirds, especially western sandpipers (*Calidris mauri*) and dunlins (*Calidris alpina*). Black oystercatchers (*Haematopus bachmani*), rock sandpipers (*Calidris ptilocnemis*), black turnstones (*Arenaria melanocephala*), and surfbirds (*Aphriza virgata*) are common wintering species. Nearshore marine areas support many nesting and wintering sea ducks. Many seabirds breed on offshore islands, including important populations of ancient murrelet (*Synthliboramphus antiquus*), rhinoceros auklet (*Cerorhinca monocerata*), tufted puffin (*Fratercula cirrhata*), common murre (*Uria aalge*), western gull (*Larus occidentalis*), glaucous-winged gull (*Larus glaucescens*), and Leach's storm-petrel (*Oceanodroma leucorhoa*). Pelagic waters provide habitat for large numbers of shearwaters (*Calonectris* spp. and *Puffinus* spp.), storm-petrels (*Hydrobatidae*), and black-footed albatross (*Phoebastria nigripes*) (USNABCI 2000).

Potential Impacts

Overall, construction of the proposed rail terminal complexes, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb approximately 9,427 acres. The construction and operational impacts on wildlife resources at the Lloydminster, Epping, and Stroud terminal complexes and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of wildlife resource impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Construction of the proposed rail terminal complex and port facilities at Prince Rupert would have impacts on wildlife resources, and result in the clearing of approximately 4,700 acres of wildlife habitat. Direct impacts could occur due to vegetation removal or conversion, obstructions to movement patterns, or the removal of native habitats that may be used for foraging, nesting, roosting, or other wildlife uses (Barber et al. 2010). Indirect impacts to wildlife are difficult to quantify and are dependent on the sensitivity of the species, individual, type and timing of activity, physical parameters (e.g., cover, climate, and topography), and seasonal use patterns of the species (Berger 2004). Most of these impacts would be essentially permanent.

5.1.3.7 Fisheries

Environmental Setting

Prince Rupert is an important deepwater port and transportation hub of the northern coast of British Columbia. It is located on the northwest shore of Kaien Island, which is connected to the mainland by a short bridge. The town of Prince Rupert is just north of the mouth of the Skeena River, a major salmon-producing river. Key commercial fisheries include Pacific salmon, halibut, herring, and groundfish, which are processed from Prince Rupert (Table 5.1-12). The

Prince Rupert area supports a high density of streams and rivers that host an array of valuable recreational fisheries for salmon, steelhead (anadromous rainbow trout), rainbow trout, lake trout, cutthroat trout, char, Arctic grayling, and northern pike (Table 5.1-12). These fisheries (both commercial and recreational) are managed by Canada's Department of Fisheries and Oceans.

Table 5.1-12 Fish Species Relevant to Prince Rupert Facilities

Pacific salmon/anadromous species[a]	Marine/Commercial Species[a]	Freshwater/Recreational Species[b]
Chinook salmon (*Oncorhynchus tshawytscha)*	walleye pollock (*Theragra chalcogramma)*	rainbow trout (*O. mykiss*)
sockeye salmon (*O. nerka*)	Pacific cod (*Gadus macrocephalus*)	lake trout (*Salvelinus namaycush*)
coho salmon (*O. kisutch*)	Pacific herring (*Clupea pallasi*)	cutthroat trout (*O. clarki*)
chum salmon (*O. keta*)	Pacific halibut (*Hippoglossus stenolepis*)	Arctic grayling (*Thymallus arcticus*)
pink salmon (*O. gorbuscha*)	Pacific sardine (*Sardinops sagax*)	northern pike (*Esox lucius*)

Sources: [a] Irvine and Crawford 2012; [b] Department of Fisheries and Oceans 2012.

Potential Impacts

The construction and operational impacts on fishery resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of fishery impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities. New impacts to commercial and recreational fisheries' habitats from the construction and operation of the facilities in Prince Rupert could include marine intertidal zones as well as fish spawning zones (e.g., herring), if present. There would likely be short-term impacts to the benthic (bottom dwelling) community during construction of the berths and mooring facilities. Bottom-dwelling fish (i.e., halibut, flounder, and rockfish) and marine invertebrates (i.e., clams, mussels, crabs, and other bivalves and crustaceans) could potentially be impacted during construction as well, but these affects are expected to be minor and temporary or short-term in duration.

Additional shipping traffic would increase underwater sound because large vessels, including tankers, put out relatively high noise levels (Popper and Hastings 2009). Fish and other aquatic organisms (including invertebrates and marine mammals) use sound as a means of communication and detection within the marine acoustic environment. Increased shipping traffic could mask natural sounds by increasing the ambient noise environment from Prince Rupert Harbor and along the marine route to the Gulf Coast area. Long-lasting sounds, such as those caused by continuous ship operation, can cause a general increase in background noise and there is a risk that such sounds, while not causing immediate injury, could mask biologically important sounds, cause hearing loss in affected organisms, and/or have an impact on stress levels and on the immune systems of aquatic species (Popper and Hastings 2009).

Exotic and invasive species are sometimes transferred in the ballast water of tanker ships. Monitoring and controls would need to be implemented to treat ballast water discharged into Prince Rupert Harbor such that invasive or exotic species would not be released into the marine environment.

5.1.3.8 Threatened and Endangered Species

Environmental Setting

This section focuses on animal and plant species present in the Prince Rupert area that are Canada SARA protected. As a coastal area along the Pacific Migratory Bird Route, and an area that receives a lot of precipitation and is heavily forested, many wildlife species inhabit the area, as discussed in Section 5.1.3.6, Wildlife. According to the British Columbia (B.C.) Conservation Data Centre (2012), only one SARA threatened/endangered species is known to occur in Prince Rupert—the green sturgeon (*Acipenser medirostris*), a Pacific Ocean inhabitant. In addition, several SARA special concern species occur in Prince Rupert, including western toad (Anaxyrus boreas), coastal tailed frog (*Ascaphus truei*), North American racer (*Coluber constrictor*), grey whale (*Eschrichtius robustus*), and Stellar sea lion (*Eumetopias jubatus*) (B.C. Conservation Data Centre 2012).

Potential Impacts

The construction and operational impacts on threatened and endangered species at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of threatened and endangered species impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

As indicated above, only one SARA threatened/endangered species is known to occur in the Prince Rupert area—the green sturgeon. The green sturgeon is typically found along nearshore marine waters, but is also commonly observed in bays and estuaries. The expansion of the proposed port facility could have minor adverse effects on the green sturgeon, but the sturgeon could readily avoid the port area.

Increased shipping traffic at Prince Rupert and as the vessels transit to the Gulf Coast area refineries may affect the feeding success of marine mammals (including threatened and endangered species) through disturbance, because the noise generated by tankers could reduce the effectiveness of echolocation used by marine mammals to forage for food. Whales use underwater vocalizations to communicate between individuals while hunting and while engaged in other behaviors. Increased underwater noise from additional shipping traffic could disrupt these vocalizations and alter the behavior of pods of whales. Moreover, additional boat and tanker traffic could also increase the potential for collisions between marine mammals and shipping vessels. These effects would be additive in nature and could potentially add to existing disturbance effects and collision risks caused by the current level of shipping traffic, commercial and recreational fishing, and cruise ship passage.

5.1.3.9 Land Use, Recreation, and Visual Resources

Environmental Setting

Land use, recreation, and visual resources for the Prince Rupert area where the new terminals and expanded port facilities would be built differ sharply from the other terminal sites. Prince Rupert is located on an inlet of the Pacific Ocean in a heavily forested area of British Columbia. Urban land use is generally limited to the communities in and around the city of Prince Rupert, with some small outlying communities and villages in the area. Given Prince Rupert's role as a

terminus of the Alaska Ferry System, many people see the port and surrounding areas in a recreational context. The area is largely undeveloped and would be sensitive to changes in the visual landscape.

Potential Impacts

Overall, construction of the proposed rail terminal complex, oil storage facilities, and port facilities for the Rail/Tanker Scenario would disturb approximately 9,427 acres of land in Prince Rupert (Natural Resources Canada 2012). If constructed on previously undeveloped land, the new facilities would primarily impact mixed forest (Natural Resources Canada 2012). The construction and operational impacts on land use, recreation, and visual resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario.

5.1.3.10 Socioeconomics

Environmental Setting

This route scenario intersects nine Canadian census divisions within three provinces: British Columbia, Alberta, and Saskatchewan (see Table 5.1-13). The Bakken to Stroud rail corridor would intersect 59 U.S. counties in eight states. This scenario provides for the construction of terminal facilities in Prince Rupert, British Columbia; Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. The terminus of the tanker route is along the Gulf Coast in Houston and Port Arthur, Texas. The route would affect two metropolitan areas: Edmonton, Alberta; and Port Arthur, Texas.

Table 5.1-13 U.S. States and Counties and Canadian census Divisions affected by the Rail/Tanker Scenario

State (U.S.)/Province (CA)	Number of Counties (U.S.)/Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Rail/Tanker Corridor		
Canada		
British Columbia	4	Skeena-Queen Charlotte; Kitimat-Stikine; Bulkley-Nechako; Fraser-Fort George
Alberta	4	#15; #14; #11; #10
Saskatchewan	1	#17
Bakken to Stroud Rail Corridor		
United States		
North Dakota	13	Williams; Mountrail; Ward; McHenry; Pierce; Wells; Eddy; Foster; Griggs; Steele; Barnes; Cass; Richland
Minnesota	14	Clay; Wilkin; Grant; Traverse; Stevens; Pope; Swift; Kandiyohi; Chippewa; Yellow Medicine; Lincoln; Lyon; Pipestone; Rock
South Dakota	1	Minnehaha
Iowa	6	Lyon; Sioux; Plymouth; Woodbury; Mills; Fremont
Nebraska	6	Dakota; Thurston; Burt; Dodge; Saunders; Cass
Missouri	7	Atchison; Holt; Andrew; Buchanan; Platte; Clay; Jackson

State (U.S.)/Province (CA)	Number of Counties (U.S.)/Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Kansas	7	Wyandotte; Johnson; Miami; Linn; Bourbon; Crawford; Cherokee
Oklahoma	7	Craig; Ottawa; Rogers; Delaware; Tulsa; Lincoln; Creek
Terminal Facilities		
Canada		
British Columbia	1	Skeena-Queen Charlotte
Saskatchewan	1	#17
United States		
North Dakota	1	Williams
Oklahoma	2	Lincoln; Creek
Texas	2	Jefferson; Harris

Population[4]

In 2010-2011, just over 1.5 million persons lived along the corridors in Canada affected by the Rail/Tanker Scenario (see Table 5.1-14) compared to approximately 268,000 persons for the proposed Project (see Table 3.10-5). The total population in the areas of the terminal facilities in Texas is approximately 4.3 million. Prince Rupert, Lloydminster, Epping, and Stroud contain much smaller populations.

Table 5.1-14 Population Affected Under the Rail/Tanker Scenario

State (U.S.)/Territory(CA)	Population[a]
Rail/Tanker Corridor	
Canada	
British Columbia	187,232
Alberta	1,360,721
Pipeline Corridor Total	*1,547,953*
Terminal Facilities	
United States	
North Dakota	22,398
Texas	4,344,732
Project Area Total	*5,915,083*

Source: U.S. Census Bureau 2010; Statistics Canada 2012.

[a] Population data are from 2011 for Canadian areas.
Note: The table only includes the population of the counties and census divisions the route would go through; not the population of the states/provinces as a whole.

Several areas potentially affected by this option contain meaningfully greater minority or low income populations:

- Prince Rupert City and the district in which it is located, Skeena-Queen Charlotte, contain aboriginal populations that exceed 35 percent of their total populations.
- Census Division 17 in Saskatchewan has an aboriginal population, 12,000 persons out of a population of 40,000.

[4] Population data were collected by county in the United States and by census division in Canada.

- Williams County, North Dakota, has a multiracial population 644 persons out of a population of 22,400.
- The cities of Port Arthur and Houston, as well as their respective counties, have aggregate minority populations, resulting from large numbers of African Americans. These cities also exceed criteria for multiple other populations as well as for low-income.

At the Epping Terminal in Williams County, North Dakota, the multiracial population is 644 persons out of a total population of 22,400. Detailed data for this environmental justice assessment are presented in Appendix O, Socioeconomics.

Traffic and Transportation

The Rail/Tanker Scenario would utilize existing Class I railroads to transport crude oil from Lloydminster to the Port of Prince Rupert, British Columbia, for shipment to new existing ports along the Gulf Coast area. As described in Section 5.1.2.10, Socioeconomics, the rail lines have capacity to accommodate substantial rail volumes. Prince Rupert and the Gulf Coast area both have substantial international shipping activity. The Gulf Coast area crude oil ports likely to be used under this scenario are already designed and configured to accept deliveries of crude oil, while the Prince Rupert port facilities are not configured in this way.

Potential Impacts

This section also includes consideration of the Lloydminster to Prince Rupert and Epping to Stroud rail lines; the Cushing pipeline; and the pipeline for onward delivery of crude oil from Cushing to Gulf Coast area refineries because socioeconomics is a resource that could be affected by scenario operations. Additionally, this scenario would include the transportation of crude from Epping, North Dakota, to Stroud/Cushing, Oklahoma, as detailed in the Canadian Pacific Rail/Pipeline Route (See Section 5.1.2.10, Socioeconomics). An overview of the potential construction and operational impacts is presented below.

Population/Housing

Construction and operations activities are not expected to have a significant effect on population and housing for this scenario. Because construction and operations job estimates have not yet been determined for this scenario, worker requirements for Prince Rupert, Lloydminster, and Epping are assumed to be minor, similar to those under the Rail/Pipeline Scenario. The counties surrounding Port Arthur and Houston have a combined population of over 4.3 million persons. Therefore, effects on the local population from an influx of workers would be negligible.

During construction, additional temporary housing could be needed in Lloydminster and in Prince Rupert. In Lloydminster, the number of hotel/motel rooms is approximately 1,075 (TripAdvisor 2012). This number would likely be insufficient to house the approximately 2,000 workers that would need lodging. Prince Rupert only has about 740 hotel/motel rooms (TripAdvisor 2012). Epping and the cities of Port Arthur and Houston have enough short-term housing so that additional accommodations would not be necessary in these areas. While the 287 hotel/motel rooms near Stroud/Cushing (see Final EIS Section 3.10) alone would not provide capacity for the over 2,000 workers needed, the cities of Tulsa and Oklahoma City, Oklahoma, are both within commuting distance, and would provide enough commercial housing to accommodate the workforce.

Local Economic Activity

This scenario would include transportation of WCSB crude oil that is primarily located outside the United States. New rail infrastructure and operations would occur in western Canada as crude oil would be transported to Prince Rupert. Tanker infrastructure and operations would be affected as ships transport crude oil from Prince Rupert through the Panama Canal to Texas ports near Houston. Other than U.S. firms that may own and operate tankers, U.S. industries would only become engaged in the transport of WCSB crude oil as tankers approach Gulf Coast area ports. Firms involved in lightering (off-loading onto smaller ships for final delivery in the Port of Houston), port management, unloading, and transport of the oil from the port to refineries would all realize workforce and payroll effects. Because details regarding port operations are beyond the scope of this analysis, economic effects were not estimated.

Direct capital costs and employment required by facility construction in Lloydminster are identical to those for the Rail/Pipeline Scenario, and would include 1,900 jobs over a 2-year period. Direct construction expenditures for facilities at Prince Rupert would be approximately $700 million, with approximately 1,400 annual construction jobs.[5]. Estimates of indirect or induced effects for Lloydminster and Prince Rupert could not be made because the models used for the economic analyses in this Supplemental EIS do not extend into Canada.

The transport of Bakken crude oil would require facilities identical to those described for the Rail/Pipeline Scenario. As discussed above, indirect effects could not be estimated although some local effects could be anticipated. Effects resulting from the expenditure of worker income would result in about 10 additional jobs and $0.5 million of earnings throughout North Dakota.

Environmental Justice

Minority and low-income populations could be potentially affected by construction and operations activities related to the terminals. Impacts to minority and low-income populations during construction and would be similar to those described for the proposed Project and could possibly result in increased competition for medical or health services in underserved populations. Williams County, North Dakota; Jefferson County, Texas; and Harris County, Texas, which contain one or more minority populations, contain HPSAs and MUA/Ps. Canada does not define HPSA and MUA/P, so it is unknown whether or not the minority populations in Prince Rupert or Lloydminster exist in a medically underserved area.

Tax Revenues and Property Values

Under the Rail/Tanker Scenario a variety of taxes would be paid to a range of different jurisdictions and entities:

- Construction of a new rail terminal in North Dakota costing $110 million would generate state and local government sales and use tax and fuel tax revenue. During operations, the facility would generate county property tax revenue.

[5] Cost estimates are based on the cost of the Enbridge Northern Gateway marine terminal in Kitimat (Enbridge 2010).

- The Panama Canal Authority is an autonomous entity of the Government of Panama that operates the Panama Canal on a for-profit basis. Ships pay a toll to use the canal. Tankers carrying petroleum pay tolls set per 10,000 tons of laden weight as defined in the Panama Canal Universal Measurement System (Panama Canal Authority 2012).

The Port of Houston comprises public docks and facilities owned, managed, and leased by the Port of Houston Authority and facilities owned by the Authority's partners and lessees located on the Houston Ship Channel (Port of Houston Authority 2012). Deliveries of crude oil could go to refineries fronting the Houston Ship Channel. The Port Arthur International Public Port is connected to the Gulf of Mexico Intracoastal Waterway and the Sabine-Neches Ship Channel. Deliveries of crude oil could go to a refinery with docks on the Sabine-Neches Ship Channel (Port Arthur International Public Port 2011).

Private companies located and operating at both Houston and Port Arthur are state and local government taxpayers. Some facilities are located within United States Foreign Trade Zones at each port, which allows United States tax-free import-export activity. The U.S. government through the U.S. Army Corps of Engineers develops, maintains, and operates the Houston Ship Channel, the Intracoastal Waterway, and the Sabine-Neches Ship Channel as tax-supported public waterways.

During construction the terminals in Lloydminster and Prince Rupert would generate provincial sales taxes, goods and services taxes, and hotel taxes. Once in operation and on the tax roll, the Canadian terminals would generate municipal property tax revenue (Government of Saskatchewan 2012; British Columbia 2012).

Impacts to private property values in North Dakota could occur because of the Rail-Tanker Scenario if there are residential land uses that would experience offsite nuisance effects but would receive no offsetting consideration from being in the vicinity of the Epping Terminal, though there already are rail transportation facilities near this site. Impacts to private property values that might have occurred during operations along the permanent right-of-way of the proposed Project or its appurtenant facilities would be avoided by the Rail/Pipeline Scenario.

Traffic and Transportation

This scenario would add approximately 13 unit train trips per day to the CN and Canadian Pacific rail lines between Lloydminster and Prince Rupert, and one to two unit trains from Epping, North Dakota, to the Gulf Coast area via existing Class I railways in the United States. As described in Section 5.1.2.10, Socioeconomics, these Class I railroads typically have adequate capacity to accommodate such increased demand with little or no infrastructure upgrades. New loading facilities would be required in Lloydminster, and new tank and marine terminals would be required in Prince Rupert.

Construction of the tank and marine terminals at Prince Rupert, and the rail terminal at Epping would involve large numbers of road trips by heavy trucks to transport construction materials and equipment to and from the sites. Construction in Prince Rupert could also potentially involve vessel deliveries of material. This traffic could cause congestion on major roadways, and would likely require temporary traffic management solutions such as police escorts for oversize vehicles.

One to two additional Suezmax tanker vessels per day (430 tankers per year) would travel between Prince Rupert and the Gulf Coast area refinery ports via the Panama Canal. The WCSB crude oil arriving by tanker vessels would be essentially displacing current tankers bringing crude oil from Mexico, Venezuela, and other countries; therefore, there would be no net increase in vessel traffic in the Gulf of Mexico or the refinery port areas.

5.1.3.11 Cultural Resources

Environmental Setting

No cultural resources studies have been conducted for the Prince Rupert area. Review of aerial photographs shows that a small portion of the area that could potentially be developed has already been disturbed by development, including port facilities, structures, and roads. This preliminary review shows that most of the area appears undeveloped and would have the potential for intact buried cultural resources.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb approximately 9,427 acres. The construction and operational impacts on cultural resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of cultural resources impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Any ground disturbance, especially of previously undisturbed ground, could potentially directly impact cultural resources. The APE for this scenario has not been subjected to systematic cultural resources studies at this time. The potential of the APE to include intact buried cultural resources would require evaluation through research and cultural resources surveys. If cultural resources were identified, follow-up studies could be required. In general terms, the archaeological potential of heavily disturbed areas, such as might be found in active rail yards or within developed transportation corridors, is normally lower than in undisturbed areas. Archaeological potential is also contingent upon factors such as access to water, soil type, and topography, and would have to be evaluated for each area to be disturbed. Aboveground facilities have the potential to indirectly impact cultural resources from which they may be visible or audible. The potential for increased rail traffic to contribute to indirect impacts would require consideration. The APE would have to be evaluated for historic structures and archaeological sites that could be impacted by this scenario.

5.1.3.12 Air and Noise

Environmental Setting

The areas surrounding the port at Prince Rupert and destination ports at the Gulf Coast area are mostly industrial due to the large marine vessel traffic and loading and unloading of cargoes. Due to the current industrial activities at the ports in Prince Rupert and the Gulf Coast area, the existing air emissions (including GHGs) and noise levels for this scenario are expected to be higher than for the area through which the proposed Project would pass.

Potential Impacts

This section also includes consideration of the Lloydminster to Prince Rupert and Epping to Stroud rail lines and the Cushing pipeline because air and noise is a resource that could be affected by scenario operations. A brief overview of potential construction and operational impacts is presented below. Under this scenario, Bakken crude oil would be transported from Epping, North Dakota, via existing railroad systems, and the air and noise impacts would be the same as described under the Rail/Pipeline Scenario above. The marine portion of this scenario is mostly located in open ocean away from receptors such as residences and businesses. On an aggregate basis, criteria pollutant emissions, direct and indirect GHG emissions, and noise levels during the operation phase for this scenario would be significantly higher than that of the proposed Project (see Section 4.12.3, Potential Impacts), mainly due to the increased regular operation of railcars, tankers, and new rail and marine terminals.

Air Quality

Emissions of criteria pollutants would be generated during the construction and operation of the Rail/Tanker Scenario. Emissions attributed to construction of the new rail, pipeline, and marine facilities under this scenario were not quantified due to a lack of design data. However, construction-related emissions would be short-term and temporary, like those of the proposed Project. Due to a significant portion of the transport route being located offshore, construction requirements likely would be less than those of the proposed Project, resulting in fewer construction-related emissions.

The rail cars and tankers transporting the crudes would consume large amounts of diesel fuel and fuel oil each day, which equate to direct emissions HC/VOCs, carbon monoxide (CO), NO_x, SO_2, PM_{10}, and $PM_{2.5}$. Emissions of VOCs would also be generated by the "breathing" of 85 storage tanks holding over 12 million bbl of crude oil. The criteria pollutant emissions would vary by transportation segment, particularly during marine-based transit. Oil tankers traveling from the Prince Rupert marine terminal through the Panama Canal to Houston/Port Arthur pass through several different operational zones, including reduced speed zones leading into and out of the ports, North American Emission Control Areas where the use of low-sulfur marine fuel is mandated, and offshore areas where the tankers travel at cruise speeds.

During the return trip, tankers are filled with seawater (ballast) to achieve buoyancy necessary for proper operation, which affects the transit speeds of the vessel. Furthermore, the tankers spend several days loading or unloading cargo at each marine terminal with auxiliary engines running (an activity called hoteling). The tanker emissions accounted for return trips (i.e., both loaded cargo going south and unloaded cargo going north). In aggregate, the total operational emissions (tons) estimated over the life of the project (50 years), presented in Table 5.1-15, are several times greater than those associated with the combined construction and operation of the proposed Project (see Section 4.12.3.1, Air Quality). Detailed operational emissions (with activity data, emission factors, and assumptions) for this scenario can be found in Tables 5 and 6 in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions. During its long-term operation, the proposed Project is expected to emit 0.51 tons of VOCs per year or 25.5 tons over the life of the project from approximately 55 intermediate mainline valves along the pipeline route and from pump station components (valves, pumps, flanges, and connectors). No other criteria pollutant or hazardous air pollutants would be emitted during the proposed Project operations (see Section 4.12.3.1, Air Quality). Fugitive VOC emissions (direct emissions) would

also be generated under this scenario from valves, pumps, flanges, and connectors at the new rail and marine port and potential pump stations. Due to limited design/activity data, these fugitive emissions could not be quantified.

Table 5.1-15 Comparison of Criteria Pollutant Emissions for the Rail/Tanker Scenario and Proposed Project over a 50-Year Period

	Criteria Pollutant Emissions (tons)[a]					
Sources	**HC/VOC**	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Rail/Pipeline Scenario[a]	136,313	435,039	2,921,989	1,278,777	187,381	173,734
Proposed Project (construction phase; 6-8 months)[b]	158	2,724	1,218	50.2	6,799	1,415
Proposed Project (operation phase)[b]	25.5	NA[c]	NA	NA	NA	NA

[a] Details of air emission calculations for the Rail/Tanker Scenario, including activity data, emission factors, and assumptions used can be found in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions.
[b] Details of air emission calculations for the proposed Project, including activity data, emission factors, and assumptions used can be found in Table 4.12-4.
[c] Not applicable (NA).

Greenhouse Gases

Direct emissions of GHGs would occur during the construction and operation of the Rail/Tanker Scenario. GHGs would be emitted during the construction phase from several sources or activities, such as clearing and open burning of vegetation during site preparation, operation of on-road vehicles transporting construction materials, and operation of construction equipment for the new pipeline, rail segments, multiple rail and marine terminals, and fuel storage tanks. Due to limited activity data, GHG emissions from construction of the Rail/Tanker Scenario were not quantified; however, these emissions would occur over a short-term and temporary period, so construction GHG impacts are expected to be comparable to the proposed Project.

During operation of the railcars and tankers that comprise this scenario, GHGs would be emitted directly from the combustion of diesel fuel in railcars traveling over 4,800 miles and fuel oil in marine tankers traveling over 13,600 miles round-trip. As indicated earlier, the emissions would vary by transportation segment, particularly during marine-based transit, which occurs in various segments. Oil-filled tankers traveling from the Prince Rupert marine terminal through the Panama Canal to Houston/Port Arthur pass through several different operational zones, including reduced speed zones leading into and out of the ports, North American Emission Control Areas where the use of low-sulfur marine fuel is mandated, and offshore areas where the tankers travel at cruise speeds. The tanker emissions accounted for return trips (i.e., both loaded cargo going south and unloaded cargo going north). The resulting direct GHG emissions (3,478,898 metric tons of CO_2e per year) from this scenario can be found in Tables 7 and 8 in Appendix Z, Estimated Criteria Pollutants, Noise, and GHG Emissions.

The Rail/Tanker Scenario would also result in indirect emissions of GHGs due to the operation of 16 new rail terminals, an expanded port, and potential pumping stations. The new rail terminals would be required in Saskatchewan, Prince Rupert Lloydminster, Saskatchewan, and Stroud, Oklahoma, and each is projected to require 5 MW of electric power to operate. Indirect GHG emissions (277,995 metric tons of CO_2e per year) for this scenario are presented in

Table 5.1-16. In aggregate, the total annual GHG emissions (direct and indirect) attributed to this scenario are approximately 3,757,000 metric tons CO_2e, which is approximately 17 percent greater than the proposed Project at just under 3,200,000 metric tons CO_2e (see Section 4.12.3.2, Greenhouse Gases).

Noise

Noise would be generated during the construction and operation of the Rail/Tanker Scenario. Noise would be generated during the construction phase from the use of heavy construction equipment and vehicles for the new pipeline, rail segments, and multiple rail and marine terminals, and fuel storage tanks. Due to limited activity/design data, noise levels from the construction of this scenario were not quantified; however, this noise would occur over a short-term and temporary period, so construction noise impacts are expected to be comparable to those of the proposed Project. During operation of the railcars and tanker ships that comprise this scenario, noise would be generated from the locomotives, movement of freight cars and wheels making contact with the rails as the train passes, train horns, warning bells (crossing signals) at street crossings, and tanker engines during hoteling and maneuverings at the new rail and marine terminals in Prince Rupert (British Columbia) and the existing terminals at the Gulf Coast area. Noise from the railcars would be similar to those described for the Rail/Pipeline Scenario, so NSAs in the immediate vicinity of the rail route in Canada would be impacted in a similar manner. The majority of the transport distance for this scenario (approximately 70 percent) is located in open ocean, away from receptors, such as residences and businesses.

5.1.3.13 Climate Change Effects on the Scenario

Environmental Setting

The climate change effects examined as part of this study can be broadly grouped into three categories:

- Temperature;
- Precipitation; and
- Sea level rise and coastal dynamics (tanker only).

Information on temperature and precipitation is presented in Section 4.14, Climate Change Impacts on the Proposed Project, and 5.1.2.13, Climate Change Effects on the Scenario. New information on sea level rise is presented in this section. Most of the Rail/Tanker Scenario is outside of the boundaries of this study, with the endpoint of this scenario in Texas, so consideration of climate effects in the subtropical climate region are included here. The tanker portion of this scenario is primarily affected by sea level rise and coastal dynamics.

Table 5.1-16 Estimated Indirect Greenhouse Gas Electricity Emissions under the Rail/ Tanker Scenario

State/ Province	e-Grid Region[a]	No. of New Terminals	Power Requirement per Terminal (MW)	Annual Indirect Electricity Usage (MWh/year)[b]	GHG Emissions (tons/year)[a]				GHG Emissions (metric tons/year)
					CO_2	CH_4	N_2O	CO_2e	CO_2e
Saskatchewan	NA	7	5	306,600	256,856	13.5	6.8	259,235	235,175
Prince Rupert	NA	8	5	350,400	11,201	2.3	0.3	11,333	10,281
North Dakota	MROW	1	5	43,800	35,666	0.6	0.6	35,868	32,539
				TOTAL	**303,723**	**16.5**	**7.6**	**306,436**	**277,995**

[a] The e-Grid region for North Dakota state and emission factors used in estimating annual emissions for each pollutant in the state were taken from USEPA's eGRID2012 version 1 database, Year 2009 (http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html). The GHG electricity factors used for estimating annual emissions for the terminals in Canada (Saskatchewan and Prince Rupert [British Columbia]) were taken from Environment Canada, National Inventory Report, 1990 - 2010, Annex 13 (Environment Canada 2012). The most recent GHG factors for Canada (Year 2010) were used. [b] Annual indirect electricity usage was estimated based on the number of terminals, power requirements per terminal, and 8,760 hours of operation per year.

Sea Level Rise and Coastal Dynamics

Sea level rise is a climate change effect applicable only to the tanker portion of the Rail/Tanker Scenario. Sea levels are projected to rise due to glacial melting and thermal expansion of the water. The rate, total increase, and likelihood of the rise is in part dependent on how rapid the ice sheets warm and is a source of ongoing scientific uncertainty. The United States Global Change Research Program (USGCRP) estimates that sea level rise could be between 3 to 4 feet by the end of the century. Table 5.1-17 presents the expected sea level rise for high and low emissions scenarios.

Table 5.1-17 Global Sea Level Rise Projections

Period	Emissions Scenarios	Global Sea Level Rise
2070/2099	Low Emission B1[a]	25 to 29 inches
2070/2099	Higher Emission A1F1[b]	37 to 41 inches

Source: USGCRP 2009.

[a] The B1 scenario assumes very rapid economic growth, a world population that peaks around 2050, and a very fast innovation and adoption of energy-efficient technologies.
[b] The A1F1 scenario assumes rapid economic growth, and a world population that peaks around 2050. Technological innovation and adoption of energy-efficient technologies is fossil intensive.

Subtropical Climate Region

Under the Rail/Tanker Scenario, the southern terminus would be located on the Gulf Coast area and would include ports in the Houston and Port Arthur, Texas area, which is in the subtropical climate region. Table 5.1-17 summarizes projected sea level rise for future scenarios of high and low GHG emissions. Any increase in sea level shifts the mean high tide, storm surge, and saltwater intrusion occur further inland.

Potential Impacts

The impacts of climate change effects on the construction and operation of the rail portion of the Rail/Tanker Scenario are similar to that of the proposed Project due to similarities in climate regions. However, the projected future climate change effect on sea level rise (i.e., tanker portion) does have the potential to adversely affect tanker ports in the Gulf Coast area. The region is in the Subtropical climate region, and along the coast of this region the sea level rise and subsidence already compound existing challenges. Increasing sea level projected due to climate changes as described above shifts the impact of mean high tide, storm surge, and saltwater intrusion to occur further inland and this would negatively affect reliable operation of the port infrastructure for tanker traffic. Mitigation of these climate effects could be addressed by making engineering and operational changes at the port.

5.1.3.14 Potential Risk and Safety

Environmental Setting

The Rail/Tanker Option would combine the risk inherent in both pipeline and oil tanker transport. However, the risks and consequences for using oil tankers to transport the hazardous materials are potentially greater than the proposed Project. Overall, crude oil transportation via oil tankers has historically had a higher safety incident rate than pipelines for fire/explosion,

injuries, and deaths (Trench 2003). Spills have been reported while the vessel is loading, unloading, bunkering, or engaged in other operations (International Tanker Owners Pollution Federation Limited [ITOPF] 2011). The main causes of oil tanker spills are the following:

- Collisions: impact of the vessel with objects at sea, including other vessels (allision);
- Equipment failure: vessel system component fault or malfunction that originated the release of crude oil;
- Fires and explosions: combustion of the flammable cargo transported onboard;
- Groundings: running ashore of the vessel; and
- Hull failures: loss of mechanical integrity of the external shell of the vessel.

From 1970 to 2011, historical data by ITOPF show that collisions and groundings were the main causes of oil tanker spills worldwide. More recently, for example, on December 22, 2012 an oil tanker carrying 279,000 barrels of Bakken crude from Albany, NY to eastern Canada ran aground in the Hudson River, puncturing the outer hull of the double-hulled barge, although the inner hull was not breached and no oil was spilled in this incident.

Two data sets were studied for crude oil spills, for tankers up to 700 tons[6] and larger than 700 tons as shown in Figure 5.1.3-1 and Figure 5.1.3-2 (ITOPF 2011). These causes accounted for 46 percent and 52 percent in each group respectively. The third main cause of spill is dependent upon vessel size. Oil tankers may carry up to 2 million bbl of crude oil in their cargo tanks (Swift et. al. 2011).

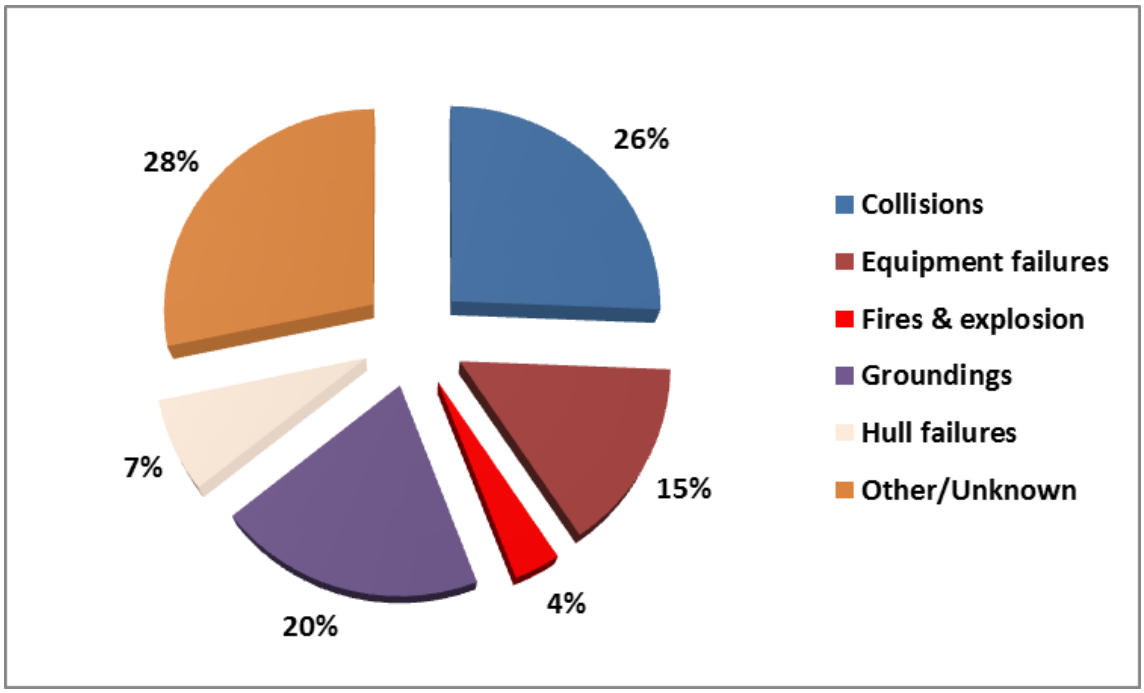
Potential Impacts

The spill migration and potential impacts of the rail portion of this option would be consistent with those described above in Section 3.13, Potential Releases. The only significant difference would be the loading and unloading of the railcars at tank farms near seaports. These areas could allow spills to migrate and impact seawaters and shorelines. However, the loading and unloading are generally carried out under supervision and would be addressed promptly by the operators, limiting the potential migration and impacts of the spill to the immediate area.

Once the tanker is loaded and at sea, the propagation and impacts of a spill could become significant. Oil tankers may carry up to 2,000,000 bbl of oil (Swift et al. 2011). A release of oil at sea would be influenced by wind, waves, and current. Depending on the volume of the release, the spreading of oil on the surface could impact many square miles of ocean and oil birds, fish, whales, and other mammals and could eventually impact shorelines. Oil would also mix with particulates in sea water and degrade. As this occurs some oil will begin to sink and either be retained in the water column (pelagic) or settle to the ocean floor (sessile). Pelagic oil could be consumed by fish or oil fauna passing though the submerged oil. Sessile oil could mix with bottom sediment and potentially consumed by bottom feeding fauna. Spills in ports-of-call could affect receptors similar to an open ocean release but also could temporarily affect vessel traffic and close ports for cleanup activities.

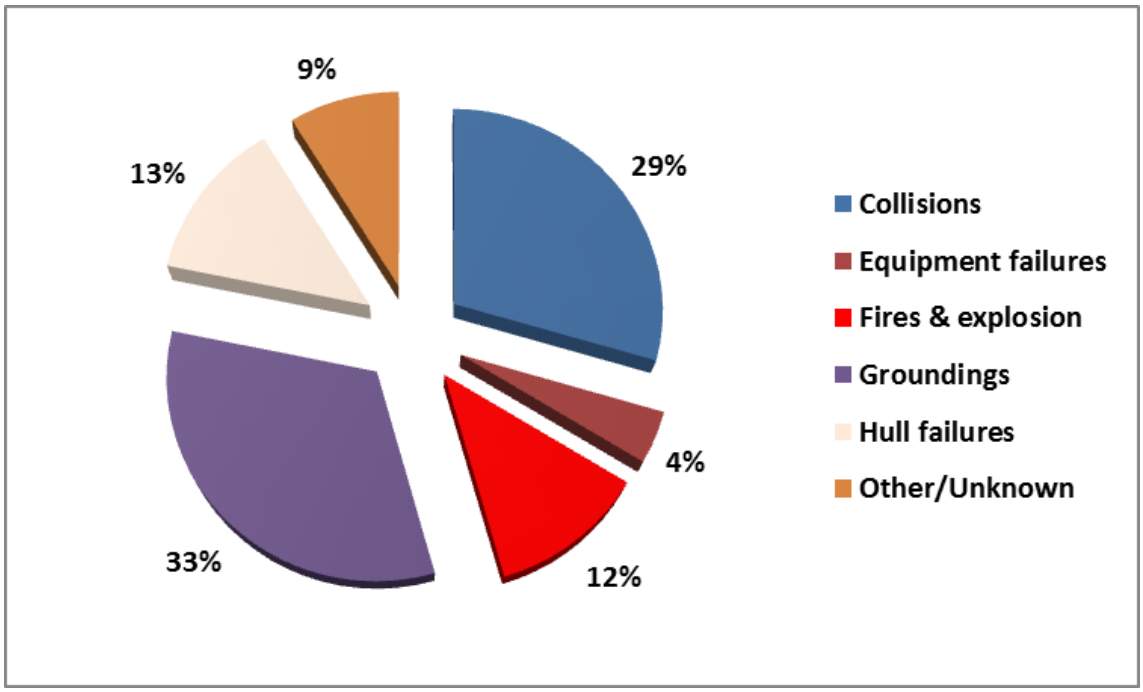
The identification of key receptors along the rail route alternative was not available for this evaluation. Therefore a comparison to the proposed project was not completed.

[6] Seven hundred tons capacity would be equivalent to 3,670 bbl of dilbit or 4,470 bbl of shale oil.



Source: ITOPF 2011.

Figure 5.1.3-1. Causes of Oil Tanker Spills Up to 700 Tons

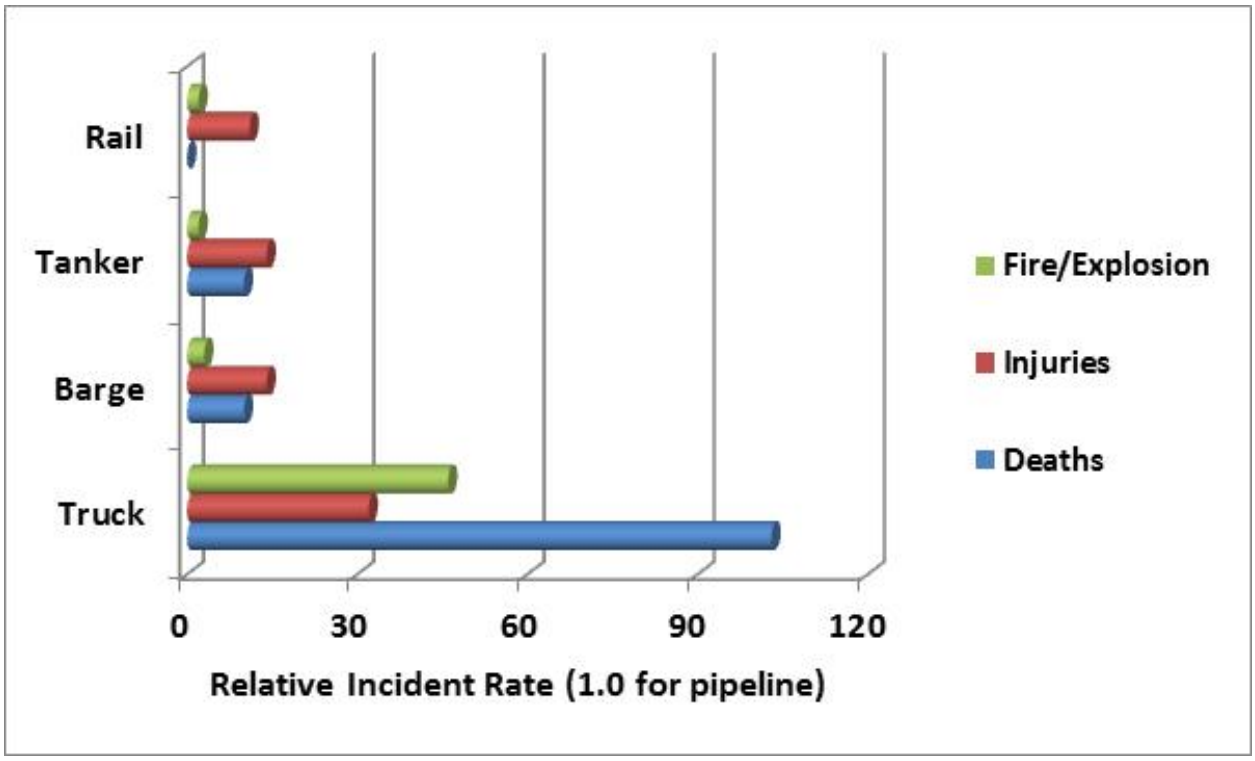


Source: ITOPF 2011.

Figure 5.1.3-2. Causes of Oil Tanker Spills Larger than 700 Tons

Safety

A study prepared for the Association of Oil Pipe Lines (Trench 2003) compared the safety record of U.S. pipelines with other hydrocarbon transportation modes. Between 1997 and 2001, the study showed that the tanker alternative transportation mode had a higher safety incident rate than pipelines. Figure 5.1.3-3 displays a graphical comparison of the oil transportation modes.



Source: Trench 2003.

Figure 5.1.3-3. Relative Incident Rates of Oil Transportation Modes (1997-2001)

The report results show that fires and explosions per ton-mile are 3 times higher, injuries per ton-mile are 14 times higher, and deaths per ton-mile are 10 times higher for both tank barge and tank ship operations than for pipelines (Trench 2003). A more recent study prepared by the AOPL (2012), which examined data from 1990-2009 for pipelines, water carriers, motor carriers, and railroads show that pipelines still transport the greatest volume of crude oil products, at 79.8 percent as of 2009, with water carriers transporting 19.4 percent.

Surface Water

The Lloydminster to Prince Rupert portion of this route would begin in the western plains at the Saskatchewan/British Columbia border and travel west through an area of high-relief mountains with large valleys, referred to as the Cordillera region. From a water resource perspective, the plains region of Canada is characterized by relatively large rivers with low gradients. The plains rivers drain the Rocky Mountains to the Arctic Ocean. The Cordillera region is largely composed

of northwest-southwest trending mountain ranges that intercept large volumes of Pacific moisture traveling from the west towards the east. River systems in this region are supplied by a combination of seasonal rainfall, permanent snowfields, and glaciers. The following are larger rivers crossed by the existing rail lines between Lloydminster and Prince Rupert:

- North Saskatchewan River, Alberta
- Pembina River, Alberta
- McLeod River, Alberta
- Fraser River, British Columbia
- Nechako River, British Columbia
- Skeena River, British Columbia

Wetlands

Spills within wetlands would most likely be localized, unless they were to occur in open, flowing water conditions such as a river or in the ocean. A crude oil spill in a wetland could affect vegetation, soils, and hydrology. The magnitude of impact would depend on numerous factors including but not limited to the volume of spill, location of spill, wetland type (i.e., tidal versus wet meadow wetland), time of year, and spill response effectiveness. The construction of additional passing lanes to accommodate increased train traffic resulting from this scenario could result in permanent impacts to wetlands if passing lanes were constructed where wetlands occur. However, as there is some leeway regarding the exact location of the passing lanes, it is expected that wetlands would be avoided by design.

Fisheries

The Rail/Tanker Scenario railroad route would cross numerous major streams and rivers in Canada, many of which support anadromous fish species such as salmon (Table 5.1-12). Anadromous species are those that spawn and rear in freshwater but migrate to the ocean at a certain size and age. Pacific salmon are large anadromous fish that support valuable commercial and recreational fisheries. Commercial fisheries for salmon occur in marine water and most recreational fishing for salmon occurs in freshwater. Salmon eggs are vulnerable to the effects of fine sediment deposition because female salmon deposit their eggs in streambed gravels. Despite this vulnerability, the overland railway route is not expected to present any new impacts to salmon unless there is a spill into its habitat, although the risk of spills does increase under this scenario due to the increase in the number of trains that would use the route. Potential new impacts under the Rail/Tanker Scenario on commercially or recreationally significant fisheries along the route would be minor because the railroads that would be used are already built and in operation. However, the risk of an oil spill or release of oil or other materials still exists. The tanker portion of this route scenario is also subject to oil spill risk.

Threatened and Endangered Species

The rail route would cross over the Rocky Mountain region of western Alberta, which is inhabited by species such as the woodland caribou (*Rangifer tarandus*) (a SARA threatened species) and grizzly bear (a SARA special concern species). This region of British Columbia is home to a number of SARA threatened/endangered species, including the peregrine falcon

(*Falco peregrinus anatum*) (SARA threatened), salish sucker (*Catostomus* sp.) (SARA endangered), white sturgeon (*Acipenser transmontanus*) (SARA endangered), caribou (southern mountain population) (SARA threatened), northern goshawk (*Accipiter gentilis laingi*) (SARA threatened), and Haller's apple moss (*Bartramia halleriana*) (SARA threatened). A number of additional SARA special concern species inhabit the regions of Canada that would be traversed by the Rail/Tanker Scenario, including but not limited to those special concern species expected to occur in the Prince Rupert region, and discussed above (B.C. Conservation Centre 2012).

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5.2 ROUTE ALTERNATIVES

The U.S. Department of State (the Department) considered eight route alternatives in addition to TransCanada Keystone Pipeline, LP's (Keystone's) proposed Project route. Based on screening and evaluation of these alternatives described in Section 2.2.4.1, Screening of Reasonable Major Route Alternatives, the Department identified two route alternatives as reasonable alternatives for evaluation in comparison to Keystone's proposed Project route:

- Keystone XL 2011 Steele City Segment Alternative (2011 Steele City Alternative), as proposed in the 2011 Final Environmental Impact Statement (Final EIS); and
- I-90 Corridor Alternative.

A detailed description of these two route alternatives is presented in Section 2.2.4, Major Pipeline Route Alternatives. The proposed Project and the alternatives are shown on Figure 5.1.2-1. The 2011 Steele City Alternative represents the project as previously proposed by Keystone and evaluated in the 2011 Final EIS. The previous application was denied on February 3, 2012, because as noted with greater specificity in Section 1.0, Introduction, there was insufficient time to complete the review. This alternative was carried forward for purposes of comparison with the proposed Project and the I-90 Corridor Alternative. To facilitate comparison with the proposed Project, each of the alternative routes would begin at the same border crossing as the proposed Project (near Morgan, Montana) and end at the same location as the proposed Project (near Steele City, Nebraska). Also to facilitate comparison between the various alternatives, impact areas for the proposed Project, the 2011 Steele City Alternative, and the I-90 Corridor Alternative were compared using the temporary and permanent right-of-way (ROW) area only. It was assumed that impact areas from ancillary facilities were similar among the three alternatives since exact number and locations of these facilities are not known for the I-90 Corridor Alternative, and these impact areas were not included in the comparison.

The analysis in this section provides a comparison between the potential environmental impacts associated with each route alternative and the proposed Project route. The environmental setting and potential impacts of both alternatives are discussed below. Since the alternatives follow portions of the same alignment as the proposed Project, the discussion of the environmental setting in this section focuses on those portions of the routes where the alternatives differ from the proposed Project. Please see Chapter 3, Affected Environment, for a description of the Environmental Setting where the alternative routes follow the same route as the proposed Project.

The potential impacts sections for each of the alternatives includes a description of the impacts of the entire route alternative, but then focuses primarily on the differences between the route alternatives and the proposed Project. Both of these major route alternatives would require essentially the same aboveground facilities, including the same two pumping stations for the Keystone Cushing Extension in Kansas. As part of the proposed Project, three connected actions were identified as integral to the Project:

- The Bakken Marketlink Project;
- The Big Bend to Witten 230-kilovolt (kV) Transmission Line; and
- Electrical Distribution Lines and Substations.

The Bakken Marketlink Project would be identical for both the 2011 Steele City Alternative and the I-90 Corridor Alternative to that described in Section 2.1.12.1, Bakken Marketlink Project, for the proposed Project (see Figure 2.1.12-1). Since both alternatives follow the same route as the proposed Project near Baker, Montana, the environmental setting and expected impacts for the proposed piping, booster pumps, meter manifolds, and two tank terminals would be the same as the proposed Project; therefore this connected action is not considered further in this alternatives analysis. Please see Chapter 4, Environmental Consequences, for a description of the environmental effects of the Bakken Marketlink Project.

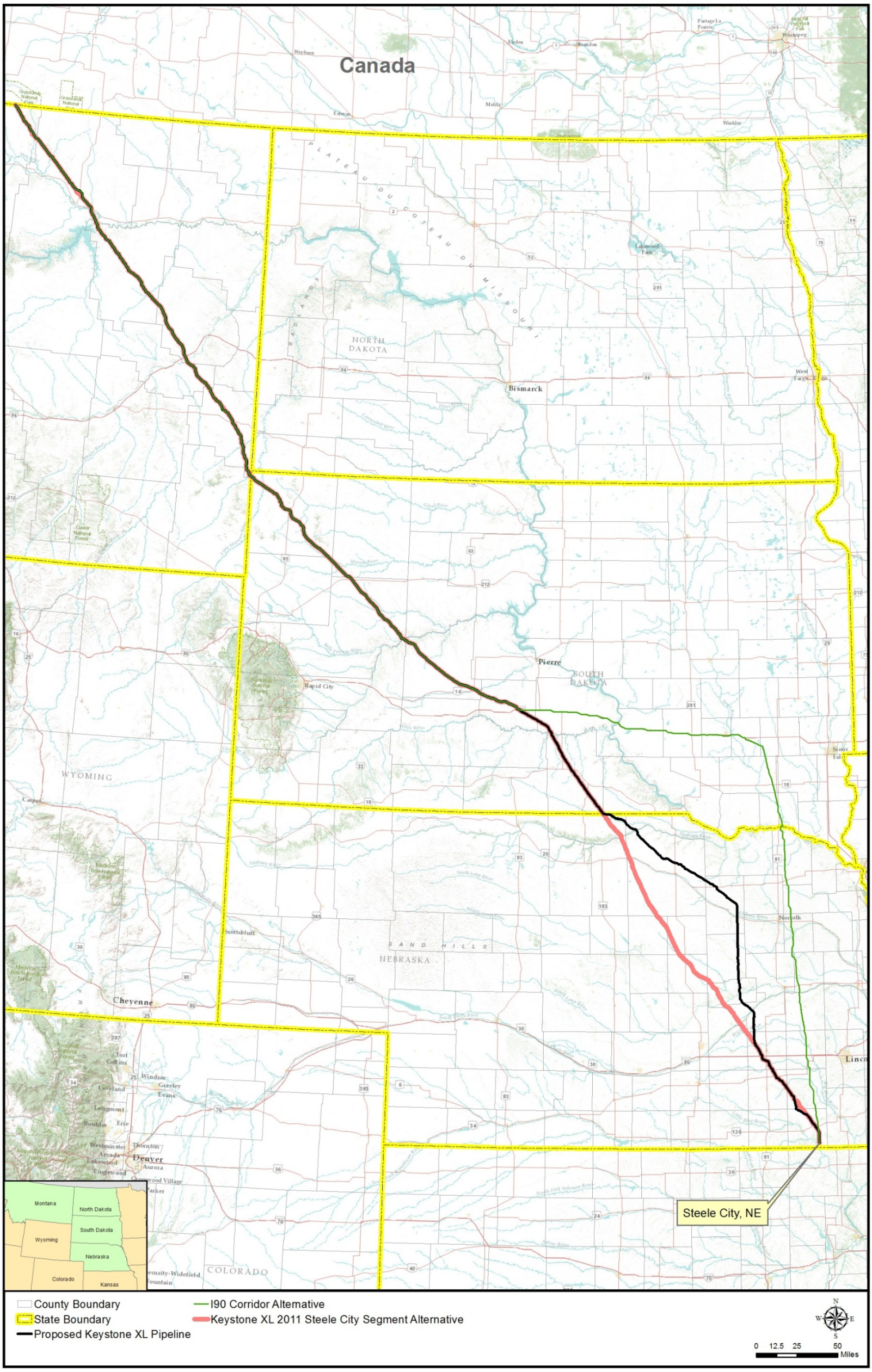
The Big Bend to Witten 230-kV Transmission Line connected action for the 2011 Steele City Alternative would be identical to the proposed Project. For the I-90 Corridor Alternative, however, pump stations 20 and 21 would be located between 40 and 80 miles further north than they would be for the proposed Project, but in the same Western Area Power Administration service area. For the purposes of this evaluation, it is assumed that the Western Area Power Administration system would need similar upgrades and that the impacts for this connected action would be similar to the proposed Project.

Similar to the proposed Project, new electrical transmission power lines with voltages of 69 kV or greater would be required to service each pump station for both of the major route alternatives. As with the proposed Project, electrical power for the alternatives would be obtained from local electric utilities. It is assumed that any routing, facilities siting, and approvals would be the responsibility of, or handled through, the local utilities. For these reasons, the impacts associated with these facilities would be essentially the same as the proposed Project (see Chapter 3, Affected Environment, and Chapter 4, Environmental Consequences) and they are not further evaluated in this section.

5.2.1 2011 Steele City Alternative

Overall, the 2011 Steele City Alternative is 854 miles long from milepost (MP) 0 at the Canadian border to the terminus of this alternative pipeline route at Steele City, Nebraska. The 2011 Steele City Alternative is approximately 20 miles shorter than the proposed Project. Other than minor route modifications, the 2011 Steele City Alternative and the proposed Project share a common alignment from MP 0 to approximately MP 602 in Nebraska. At MP 602 the 2011 Steele City Alternative diverges from the proposed Project route and takes a more direct southerly path. The 2011 Steele City alternative merges with the proposed Project route again at approximately MP 796 on the proposed Project route. The assessment of the 2011 Steele City Alternative below references the resource-specific impacts for the entire 854-mile alignment, but focuses on where this alternative differs from the proposed Project. This is limited to the pipeline segments in Nebraska between MP 602 and 796 of the proposed Project route. For the purposes of this analysis the effects of the 2011 Steele City Alternative and the proposed Project in Montana and South Dakota are considered identical.

The 2011 Steele City Alternative would cross the Nebraska Department of Environmental Quality (NDEQ)-identified Sand Hills Region and the northern High Plains region, which are subdivisions of the Great Plains province. The NDEQ-identified Sand Hills Region comprises one of the most distinct and homogeneous ecoregions in North America and includes one of the largest areas of grass-stabilized sand deposits in the world.



Source: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, Kadaster NL, Ordnance Survey, Esri Japan, METI, and the GIS User Community.

Figure 5.2.1-1 Proposed Project and Alternatives

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5.2.1.1 *Geology*

Environmental Setting

The majority of the state of Nebraska 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. The geology of the 2011 Steel City Alternative is the same as the proposed Project except in the three locations where the alignments diverge (the NDEQ-identified Sand Hills Region, the Clarks Well Head Protection Area (WHPA), and the Western WHPA). In those areas, there are more areas of shallow bedrock for the 2011 Steele City Alternative route (4.62 miles in Nebraska) compared to the proposed Project (0.27 miles in Nebraska). The predominant terrain associated with the 2011 Steele City Alternative includes rolling to steep, irregular sand dunes, and gently sloping valleys. Tertiary sedimentary formations of sandstones and conglomerates (sedimentary rocks that consist of at least thirty percent of their total mass in gravel-sized particles) are deeply covered by Quaternary clay-rich sedimentary deposits (aeolian sand and loess). Although the 2011 Steele City Alternative is approximately 20 miles shorter than the proposed Project, there are approximately 42 more miles of fossil-containing formations, but an equal number of oil and gas wells within 0.25 mile of both Alternative routes. However, along the 2011 Steele City Alternative, there are approximately 15 fewer miles of high-risk landslide areas.

Potential Impacts

The types of potential impacts to geological resources for the 2011 Steele City Alternative would occur during construction and are essentially the same as for the proposed Project (see Section 4.1, Geology), which include rock ripping and disturbance and modification of the surficial geology. There would not be any geology related environmental impacts associated with operations. The 2011 Steele City Alternative route would not cross any know active faults with confirmed surface offsets. Based on the FEMA Landscape Hazard Ranking System mapping, as described in Section 3.1.2.5, Geologic Hazards, the 2011 Steele City Alternative would cross approximately 323.6 miles of areas where, as described below, if steep slopes were encountered there could be a high risk for landslides. This is slightly less than for the proposed Project, which would cross approximately 338.8 miles of areas where steep slopes could present a high risk for landslides. See Table 5.2-1 for a comparison of the 2011 Steele City Alternative and the proposed Project.

Table 5.2-1 Geology: Comparison of the 2011 Steele City Alternative and Proposed Project

Resource Potentially Impacted/Risk	Proposed Project (all units in miles)	2011 Steele City Alternative (all units in miles)
High Risk Landslide Areas	338.8	323.6
Fossil Fuel and Mineral Resources	24 oil and gas wells within 0.25 mile; 1 gravel pit within 0.5 mile; 5 aggregate mines within 1 mile	24 oil and gas wells within 0.25 mile; 1 gravel pit within 0.5 mile
Fossil Containing Formations (Paleontology)	~599 miles occurring sporadically between MP 3.0 and 875	~641 occurring sporadically between MP 1.1 and 387 and between MP 595 and 850

Landslides typically occur on steep terrain (slopes of 20 percent or greater) during conditions of partial or total soil saturation, or during seismic activity (Geologic Hazards sections 3.1.2.5 and 4.1.3.4). Given the low likelihood of a significant seismic event and relatively limited extent of steep slopes along the 2011 Steele City Alternative route, the potential for earthquake-induced landslides is low.

As described in Section 4.1.3.4, Geologic Hazards, four miles of the terrain crossed by the proposed Project route contain steep slopes. Most of these steep sections are less than 0.1 mile in length and correspond to stream crossing locations. Based on a review of USGS topographic mapping, the terrain crossed by the 2011 Steele City Alternative where it diverges from the proposed Project is similar and the occurrence of steep slopes is anticipated to also be similar. If the 2011 Steele City Alternative was recommended, planning and design surveys would identify specific areas of steep slopes. Where steep slopes could not be avoided, the construction and operation methods required by 49 CFR Parts 192 and 193 and additional soil erosion, sediment control, and slope stabilization measures identified in Section 4.1.3.4, Geologic Hazards, would be implemented to minimize the risk of landslide associated with construction and operation on steep slopes.

The number of oil and gas wells within 0.25 miles of the 2011 Steele City Alternative and the proposed Project route would be the same (24); impacts to fossil fuel and mineral resources would still be limited for the 2011 Steele City Alternative. In Nebraska, there are no active oil, gas, or mining operations along the proposed Project or the Alternative route.

Valuable fossil-containing formations are classified as Potential Fossil Yield Classification (PFYC) Class 4 (geologic units containing a high occurrence of significant fossils) or Class 5 (highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils, invertebrate fossils, or plant fossils, and that could be at risk of human-caused adverse impacts or natural degradation). As several formations along the 2011 Steele City Alternative route have fossil-containing sediments, it is likely that PFYC Class 4 or 5 paleontological specimens and fossil-bearing formations would be encountered along the Alternative route. Since PFYC Class 4 and 5 fossils occur sporadically throughout the formations, which may or may not contain surficial fossils, for the purpose of this assessment, the entire formation was noted and included in the total mileage of potential fossil occurrence. Based on a geologic and topographic desktop analysis, the 2011 Steele City Alternative route would cross a total of 641 miles of PFYC Class 4 or 5 formations.

The proposed Project and the 2011 Steele City Alternative would cross a similar number of total miles affecting surface geology and a similar number of miles ranked as high risk landslide areas, in addition to having comparably low impacts on fossil fuel and mineral resources in the vicinity of the two routes. The most prominent difference between the routes with respect to geology is that there are fewer miles of fossil containing formations that would be crossed by the proposed Project (599 miles) than by the Steele City Alternative (641 miles).

The mitigation measures described for the proposed Project would also apply to the proposed 2011 Steele City Alternative. No additional mitigation measures would be required.

5.2.1.2 *Soils*

Environmental Setting

In northern and central Nebraska, the 2011 Steele City Alternative route would cross portions of the NDEQ-identified Sand Hills Region 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 NDEQ-identified Sand Hills Region consist of aeolian (wind deposited), 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 six 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."

Soils in central to southern Nebraska that would be crossed by the 2011 Steel City Alternative route generally consist of deep loess deposits that are susceptible to erosion. Soils in Hamilton County that would be crossed by the 2011 Steel City Alternative route, and extending to the state line, contain thick, dark, organically enriched layers of topsoil.

Potential Impacts

The types of potential impacts to soils for the 2011 Steele City Alternative are essentially the same as for the proposed Project (see Section 4.2, Soils) and 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 topsoil. Table 5.2-2 compares the impacts of the 2011 Steele City Alternative with the proposed Project for several key soil characteristics. These impacts would primarily occur during construction, with the potential for wind and water erosion in limited areas where restoration is not effective. Any areas subject to erosion would be identified during operational monitoring and stabilized.

Table 5.2-2 Soils: Comparison of the Steele City Alternative and Proposed Project

Resource Characteristics	Proposed Project (all units in miles)	2011 Steele City Alternative (all units in miles)
Total Miles	875.0	854.0
Highly Erodible (wind)	66.2	115.9
Highly Erodible (water)	375.5	298.8
Prime Farmland[a]	349.2	273.7
Hydric Soils[b]	53.6	28.5
Compaction Prone	626.1	603.9
Stony/Rocky	73.7	51.8
Shallow with Bedrock	5.3	5.5
Drought Prone	127.9	160.3

[a] Prime Farmland as defined by the Natural Resources Conservation Service are those areas that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these land uses.
[b] Hydric Soils are soils that developed under sufficiently wet conditions to support the growth and regeneration of wetland vegetation.

The primary difference between the 2011 Steele City Alternative route and the proposed Project route is that although the 2011 Steele City Alternative route is 20 miles shorter than the proposed Project route, it would cross the NDEQ-identified Sand Hills Region of Nebraska, which is particularly vulnerable to wind erosion. The 2011 Steele City Alternative route would cross approximately 116 miles of soils highly susceptible to wind erosion (approximately 90 miles of which are located in the NDEQ-identified Sand Hills Region) compared with approximately 66 miles for the proposed Project route (which does not cross the NDEQ-identified Sand Hills Region). Concerns about crossing the NDEQ-identified Sand Hills Region was a primary factor cited by the Department for not granting a Presidential Permit pursuant to the 2011 Final EIS.

5.2.1.3 *Water Resources*

Groundwater

Environmental Setting

The 2011 Steele City Alternative route would cross the Northern High Plains Aquifer (NHPAQ) in Nebraska, passing through an area immediately upgradient of the town of Clarks, Nebraska's wellhead protection area, and through a portion of the wellhead protection area for the town of Western, Nebraska. The NHPAQ is at or near the surface through much of the portion of the NDEQ-defined Sand Hills Region that would be crossed by the Alternative route. The proposed Project route would pass downgradient of the Clarks wellhead protection area, and several miles upgradient of the Western wellhead protection area. The proposed Project route would traverse approximately 89 miles of the NHPAQ in Nebraska. See Section 3.3.2.1, Hydrogeologic Setting, for a detailed description of the region's hydrogeology.

Potential Impacts

In Nebraska, more wells are within 1 mile of the proposed Project route (2,124 total, with 919 potentially less than 50 feet deep) than for the 2011 Steele City Alternative route (1,194 total, with 565 potentially less than 50 feet deep).

The NDEQ-identified Sand Hills Region, through which the 2011 Steele City Alternative route passes, is characterized by highly permeable sandy soils at the surface and by very shallow groundwater, especially in interdunal areas. Petroleum product releases in these areas could be expected to be conveyed to groundwater relatively rapidly. By avoiding the NDEQ-identified Sand Hills Region, the proposed Project reduces potential impacts to groundwater quality compared to the 2011 Steele City Alternative. With respect to groundwater resources, the 2011 Steele City Alternative has the following primary differences from the proposed Project:

- The Alternative route would cross the NDEQ-identified Sand Hills Region and the proposed Project route would not.
- The Alternative route would pass immediately upgradient of the Clarks WHPA and the proposed Project route would pass downgradient of this area.
- The Alternative route would cross a portion of the town of Western WHPA and the proposed Project route would not.

Although the 2011 Steele City Alternative route is only 20 miles shorter than the proposed Project route, it would cross 129 fewer waterbodies, including eight fewer perennial waterbody

crossings. In addition, the 2011 Steele City Alternative route would cross 57 fewer mapped floodplains than the proposed Project route.

Surface Water

Environmental Setting

The 2011 Steele City Alternative route would enter north-central Nebraska near the edge of the northern NDEQ-identified Sand Hills Region and the northern High Plains Region, both of which are subdivisions of the Great Plains province. As described earlier, the NDEQ-identified Sand Hills Region in north and central Nebraska comprises one of the most distinct and homogeneous ecoregions in North America and includes one of the largest areas of grass-stabilized sand deposits in the world. The area is relatively treeless with the exception of areas adjacent to streams and rivers (riparian areas, which are areas where birds of prey nest and or hunt). The predominant terrain includes rolling to steep, irregular sand dunes, and gently sloping valleys. Tertiary sedimentary formations of sandstones and conglomerates (gravel and stones larger than sand) are deeply covered by Quaternary clay-rich sedimentary deposits (aeolian[1] sand and loess[2]) (Wiken et. al 2011).

Large portions of the NDEQ-identified Sand Hills Region contain many lakes and wetlands that lack definitive surface drainage or a stream network because of the surface and near surface groundwater. The NDEQ-identified Sand Hills Region is a major recharge zone for the Ogallala Aquifer. The highly porous Aeolian deposits allow for infiltration of precipitation and lateral movement in the deposits. Because water can move so quickly into and within these loose sediments, there is not much overland flow.

Potential Impacts

Impacts to surface water that would occur during construction and operation of the 2011 Steele City Alternative are generally consistent with those for the proposed Project, as presented in Sections 4.3.3.3, Operational Related Impacts and 4.3.3.4, Floodplains, which include:

- Temporary increases in total suspended solid concentrations and increased sedimentation during stream crossings or at upland locations with soil erosion and transport to streams;
- Temporary to long-term changes in channel morphology and stability caused by channel and bank modifications;
- Temporary to long-term decrease in bank stability and resultant increase in total suspended solids 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 and stream crossing construction.

Construction impacts to surface water resources associated with hazardous liquids spills and leaks are discussed in Section 4.13, Potential Releases. Temporary impacts to floodplains would also occur during construction of both the 2011 Steele City Alternative and the proposed Project;

[1] Aeolian is the process by which wind-blown sand is moved and deposited.
[2] Loess is the deposited windblown materials including both silt and sand.

however, in both cases floodplains would be restored to as close to previously existing contours as practical and the disturbed areas would be re-vegetated.

Potential operational impacts would involve spills or damage to the pipeline caused by erosion and subsequent exposure. Impacts associated with potential crude oil releases from pipeline operation are addressed in Section 4.13, Potential Releases. Channel migration and streambed degradation could expose the pipeline. Mitigation measures, including accounting for each stream channel's vertical and lateral migration zone, as described in Section 4.3.3.4, Floodplains, and Section 4.3.4, Recommended Additional Mitigation, would be implemented to minimize the potential for exposing the pipeline.

Table 5.2-3 compares the surface water resources that would potentially be impacted for the 2011 Steele City Alternative and the proposed Project. As shown in the table, the 2011 Steele City Alternative route would cross 129 fewer waterbodies and eight fewer perennial stream crossings than the proposed Project. One key difference in potential impacts to surface water resources between the 2011 Steele City Alternative and the proposed Project is that the 2011 Steele City Alternative route would pass directly through the NDEQ-identified Sand Hills Region in Nebraska. Many riparian areas and banks of streams and rivers through this region are highly susceptible to erosion. The sensitive nature of the surface landscape and the relatively shallow groundwater tables would require additional mitigation measures to be implemented during and after construction of a buried pipeline. Additional mitigation measures would include preventing soil mixing and minimizing the loss and degradation of topsoil from erosion, implementing specific construction methods to ensure that disturbed areas are returned to pre-construction conditions, and conserving topsoil (through segregation and stockpiling) for post-construction replacement and reclamation. In areas with identified low-revegetation-potential soils, additional evaluation would be undertaken to identify recommended topsoil salvage depths sufficient to conserve the high-organic-content soils, which do not contain physical or chemical conditions that could inhibit soil capability. In addition, if trench dewatering is necessary, care would be taken to discharge water away from stored topsoil.

Table 5.2-3 Surface Water: Comparison of the Steele City Alternative and Proposed Project

Resources	Proposed Project	2011 Steele City Alternative
Waterbody Crossings	1,073	944
Perennial Waterbody Crossings	56	48
Other Waterbody Crossings	1,017	896
Waterbodies with Impairments Crossed	19	24
Mapped Floodplains Crossed	33	90
Nebraska Summary by Resource	**Proposed Project**	**2011 Steel City Alternative**
Nebraska Waterbody Crossings	281	157
Perennial Waterbody Crossings	31	28
Other Waterbody Crossings	250	129
Waterbodies with State Use Classifications	40	22
Waterbodies with Impairments	10	5
Mapped Floodplains	74	17

5.2.1.4 *Wetlands*

Environmental Setting

The U.S. Environmental Protection Agency (USEPA) has delineated Nebraska into several ecoregions, which are relatively large units of land and water delineated by biotic and abiotic factors (e.g., climate, topography, geology, vegetation) that regulate the structure and function of the ecosystems within them (Nebraska Game and Parks Commission [NGPC] 2005). The quantitative amount of distributed wetlands that would be crossed by the 2011 Steele City Alternative route and the proposed Project route differ, and are illustrated on Figure 5.2.1-2. Wetlands along the 2011 Steele City Alternative route in Nebraska are characterized by several regional complexes, including the NDEQ-identified Sand Hills Region, the Central Table Playas, and the Rainwater Basin (Nebraska Game and Parks Commission [NGPC] 2005). NDEQ-identified Sand Hills Region wetlands and wetlands adjacent to this region have similar characteristics and include saturated wet meadows, shallow marshes, and lakes supported by shallow aquifer conditions, as discussed in Section 3.3.2, Groundwater. Central Table Playa wetlands, located in the central portion of the state, are associated with loess (wind-deposited silt) deposits and are typically small, seasonally flooded wetlands. Wetlands in the Rainwater Basin of south-central Nebraska include wetlands associated with gently rolling loess-covered plains. In Nebraska, the 2011 Steele City Alternative route would cross the Prairie Pothole Region only for a few miles near the South Dakota border (USEPA 2010, USEPA 2011), based on the extent of the Northwestern Glaciated Plains Ecoregion (USEPA 2011).

There are many wetland areas located within the NDEQ-identified Sand Hills Region and the surrounding area which are considered sensitive wetland areas. These sensitive wetlands in Nebraska are regional wetlands that have been identified as being important natural resources and include the NDEQ-identified Sand Hills Region, the Rainwater Basin, and the Prairie Pothole Region; refer to Section 3.4.3.1, Sensitive Wetland Areas, for additional details. Protected wetlands (i.e., wetland easements) would occur along both routes; refer to Section 3.4.3.2, Protected Wetlands, for details regarding wetland easements that would occur along the proposed Project route.

Potential Impacts

Section 4.4.2, Impact Assessment Methodology, discusses the impact assessment methodologies used to determine the potential impacts related to the Steele City Alternative and the proposed Project. The types of potential impacts to wetlands for the 2011 Steele City Alternative are essentially the same as for the proposed Project (see Section 4.4.3.1, Potential Wetland Impacts) and include permanent loss of wetlands and vegetation as a result of permanent fill; temporary to permanent loss of surface and subsurface flow patterns; loss or alteration of wetland soil integrity; temporary increase in turbidity and water quality; and general wetland impacts associated with hazardous liquid spills and leaks during the construction and operational phases of the Project.

An estimate of wetland acreages that would be affected by the proposed 2011 Steele City Alternative and the proposed Project are summarized in Table 5.2-4. Estimated impacts are based on the impact analysis methods described in Section 4.4, Wetlands. Impacts are categorized by phase (construction versus operations).

Table 5.2-4 Wetlands: Comparison of the Steele City Alternative and Proposed Project

Wetland Type[a]	Proposed Project		2011 Steele City Alternative	
	Construction Impacts (acres)	Operations Impacts (acres)	Construction Impacts (acres)	Operations Impacts (acres)
PEM	127.6	55.2	410.5	186.4
PSS	53.3	22.5	56.9	24.1
PFO	7.1	5.0	4.4	1.9
Riv-OW	74.2	37.8	72.3	35.0
Total	262.2	120.5	544.1	247.4

Sources: exp Energy Services Inc. 2012a, and 2012 b; U.S. Fish and Wildlife Service (USFWS) 2012; Fry 2011; U.S. Geological Survey (USGS) 2010.

[a] Cowardin et al. 1979; PEM = palustrine emergent; PSS = palustrine scrub-shrub; PFO = palustrine forested; Riv-OW = riverine-open water.

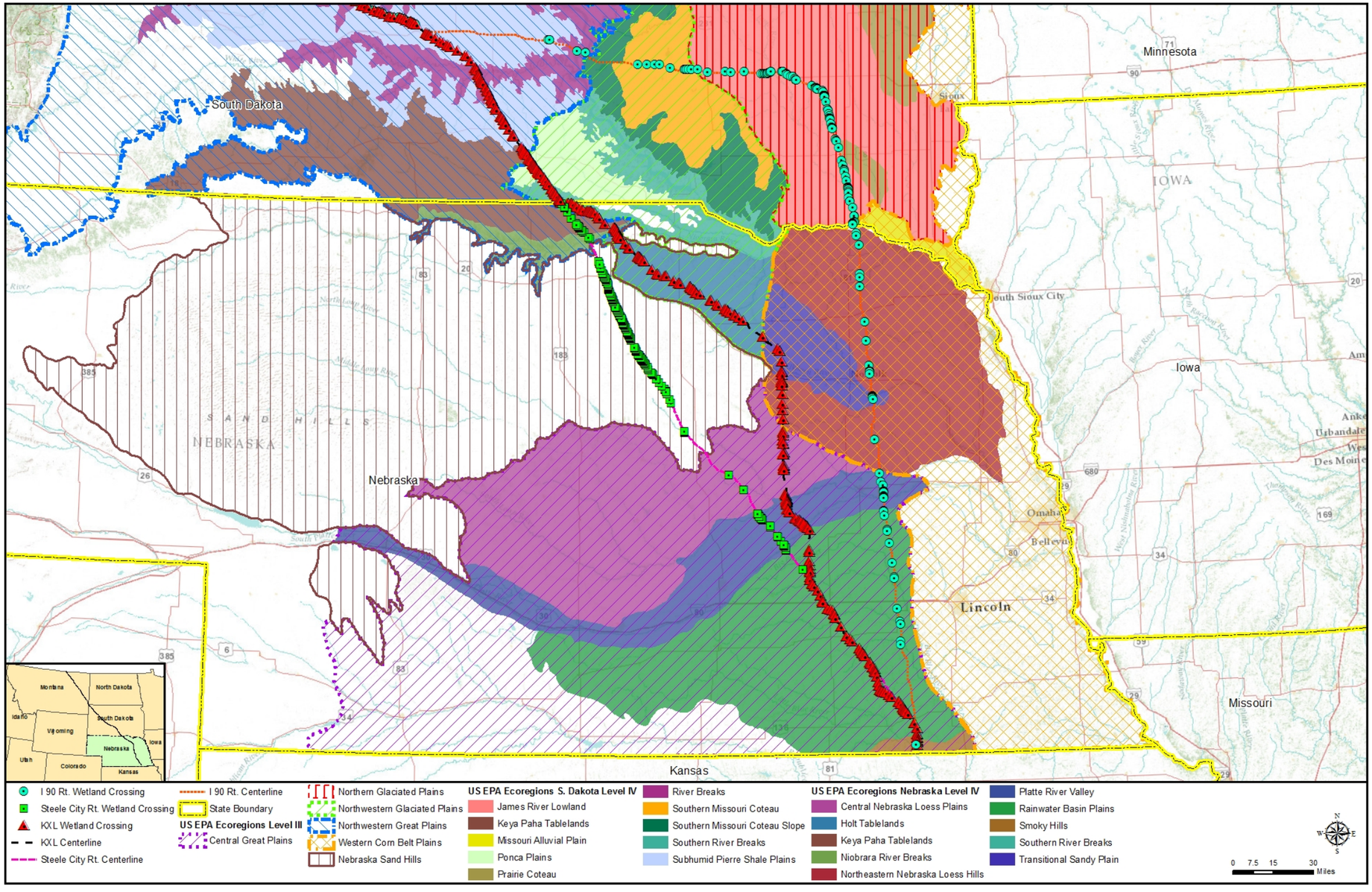
Approximately twice as many total wetlands would be affected within the operations ROW by the 2011 Steele City Alternative route (247.4 acres) than by the proposed Project route (120.5 acres). The comparison of total impacts within the construction ROW yields similar conclusions (i.e., approximately twice as much acreage impacted in the case of the 2011 Steele City Alternative route). Estimated impacts to PSS, PFO, and Riverine/Openwater wetlands are similar for both routes; however, over three times as many PEM (emergent wetlands), which primarily occur in the NDEQ-identified Sand Hills Region, would be impacted along the 2011 Steele City Alternative route.

The 2011 Steele City Corridor alternative would cross approximately 70 miles more of sensitive wetland regions than the proposed Project (see Table 5.2-5).

Table 5.2-5 Wetlands: Comparison of Sensitive Wetland Regions that would be Crossed by the 2011 Steele City Alternative and the Proposed Project

Wetland Region	Proposed Project	2011 Steele City Alternative
	(Miles Crossed)	(Miles Crossed)
Prairie Pothole	127	113
Rainwater Basin	96	90
Sand Hills	0	90
TOTAL	223	293

The mitigation measures described for the proposed Project in Section 4.4.3, Potential Impacts, and Section 4.4.4, Recommended Additional Mitigation, would also apply to the 2011 Steele City Alternative. No additional mitigation measures would be required.



Source: exp Energy Services Inc. 2012b; USFWS 2012; Fry 2011; USGS 2011; USEPA 2011a, b.

Figure 5.2.1-2 Route Alternatives and Proposed Project Route, USEPA Ecoregions, and Wetland Distribution

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5.2.1.5 *Terrestrial Vegetation*

Environmental Setting

The generalized vegetation cover and ecosystems that would be crossed by the 2011 Steele City Alternative route are similar to those that would be crossed by the proposed Project, but differ in two main ways: 1) The 2011 Steele City Alternative route would cross the NDEQ-identified Sand Hills Region; and 2) The proposed Project route would cross through the Keya Paha Watershed, Lower Niobrara River, and Lower Loup River unique landscapes in Nebraska with priority cottonwood-willow riparian woodlands.

Land cover types crossed by the proposed Project were identified and delineated based on review of desktop analysis and general observations during field reconnaissance. Vegetative cover is an important component in the classification of ecoregions that reflects differences in ecosystem quality and integrity (USEPA 2007). At the northern end of the proposed Project route, the vegetation is predominately comprised of mixed-grass prairies and sagebrush (*Artemisia* spp.), which transitions southerly to tallgrass prairies. These general landscapes are further classified into 11 USEPA-rated Level III Ecoregions, and the landscapes specific to Nebraska include: Northwestern Glaciated Plains (9 percent); Northwestern Great Plains (36 percent); Nebraska Sand Hills (7 percent); and Central Great Plains (11 percent). The remaining ecoregions occur to the south.

Potential Impacts

The data for the 2011 Steele City Alternative and the proposed Project are derived from a centerline provided by Keystone. Data presented for the 2011 Steele City Segment are based on literature review and consultation with regional scientists. The proposed Project route has been evaluated in the Supplemental EIS using geographical information system data. In an effort to accurately assess and compare the impacts for the 2011 Steele City Alternative route and the proposed Project route, both routes were analyzed using the 2011 National Land Cover Database (NLCD) (Fry et al. 2011). This database provides a more precise rendering of spatial boundaries between the land cover classes.

Section 4.5, Terrestrial Vegetation, discusses the impact assessment methodologies used to determine the potential impacts related to the 2011 Steele City Alternative and the proposed Project. Table 5.2-6 below provides a summary of the potential construction and operation impacts to vegetation (in acres) for the 2011 Steele City Alternative and the proposed Project. Similar vegetation types would be impacted (native grasslands; sagebrush grasslands; riparian habitats and bottom-wood hardwoods; and native forest communities) by the 2011 Steele City Alternative and the proposed Project. As shown in Table 5.2-6, the 2011 Steele City Alternative construction would involve fewer impacts to cultivated crops, areas of upland forest, forested wetlands, and developed lands than the proposed Project. Conversely, the proposed Project would impact less grassland/prairies, emergent herbaceous wetlands, and shrub/scrub-lands.

Table 5.2-6 Vegetation: Summary of Estimated Impacts on Vegetation Communities Crossed (Acres)[a] 2011 Steele City Alternative and Proposed Project

	Cultivated Crops	Grassland/ Pasture	Upland Forest	Open Water	Forested Wetlands[b]	Emergent Herbaceous Wetlands[b]	Shrub/Scrub	Developed Land	Total[d]
Totals Construction									
2011 Steele City Alternative	2,786	7,801	32	15	63	57	461	173	11,387
Proposed Project	3,873	6,983	38	15	63	29	452	214	11,667
Totals Operation[c]									
2011 Steele City Alternative	0	0	14.3	0	28.5	0	0	0	42.8
Proposed Project	0	0	17.1	0	28.4	0	0	0	45.5

Source: National Land Cover Database (Fry et al. 2011).

a Data for both alternatives is based on disturbance within a 110-foot construction and the 50-foot operation ROW. Acreage does not include disturbance associated with any ancillary activities outside of the ROWs.
b Wetland acreage is based on NLCD for comparison and does not reflect the specific data provided in the Wetlands Section 5.2.1.4.
c All non-forested areas would be restored to preconstruction conditions.
d Totals may not match due to rounding.

In addition to general vegetation impacts, vegetation communities of conservation concern would also be impacted, as shown in Table 5.2-7. The 2011 Steele City Alternative construction would impact an additional 135 acres of native grasslands (which are of conservation concern in Nebraska). This difference is because the 2011 Steele City Alternative would pass through the NDEQ-identified Sand Hills Region. In contrast, to avoid the NDEQ-identified Sand Hills Region, the proposed Project would extend outside of the NDEQ-identified Sand Hills Region as a means to avoid this environmentally sensitive landscape.

Table 5.2-7 Vegetation: Comparison of Estimated Impacts on Vegetation Communities of Conservation Concern[a] 2011Steele City Alternative and Proposed Project

	Forest Communities[b] Acres Impacted	Riparian Forest Acres Impacted	Native Grasslands[c] Acres Impacted	Sagebrush Grasslands[d] Acres Impacted
Total Construction				
2011 Steele City Alternative	141.4	88.7	4,814.9	740.6
Proposed Project	141.4	85.2	4,679.9	740.4
Total Operation[e]				
2011 Steele City Alternative	63.0	40.6	0	0
Proposed Project	63.0	85.2	0	0

Source: USGS GAP Analysis (USGS 2011).

[a] Data for both alternatives is based on disturbance within a 110-foot construction and the 50-foot operation ROW. Acreage does not include disturbance associated with any ancillary activities outside of the ROWs.
[b] All non-forested areas would be restored to preconstruction conditions.
[c] Native Grasslands include mixed-grass and tallgrass prairie ecosystems as identified in the GAP Analysis (USGS 2011).
[d] Sagebrush Steppe length and communities crossed based on Inter Mountain Basins Big Sagebrush Steppe Ecosystem layer (USGS 2011).
[e] All non-forested areas would be restored to preconstruction conditions.

The removal of vegetation and associated soils would create long-term impacts in the cases of both the 2011 Steele City Alternative and the proposed Project, as discussed in Section 4.5.4, Potential Impacts to Biologically Unique Landscapes and Vegetation Communities of Conservation Concern. Removing the native soils and clearing the vegetation may create instability within the soils and prevent re-establishment of the various grass mixtures. It may take between 1 and 5 years for the seed mixtures to become established or longer, depending on the nature of the routine maintenance and/or the introduction of invasive species. Shrub-land species may take between 5 and 15 years to re-establish, while trees may take between 20 to 50 years to re-establish, also based on whether restored areas are located within or outside of maintained ROW.

The mitigation measures described for the proposed Project would also apply to the proposed 2011 Steele City Alternative. No additional mitigation measures would be required.

5.2.1.6 *Wildlife*

Environmental Setting

The 2011 Steele City Alternative route and the proposed Project route would cross areas with a diversity of wildlife including big game animals, small game animals and furbearers, waterfowl and game birds, and many other nongame animals[3] (see Section 3.6, Wildlife) and their associated habitats (see Section 5.2.1.5). Some of these wildlife habitats discussed include threatened and endangered species' habitats, which are discussed below in Section 5.2.1.8. As shown in Table 5.2-6, approximately 24 percent of habitat (2,786 acres) that would be crossed by the 2011 Steele City Alternative has been converted to agricultural land with crops such as soybean, corn, and hay in various phases of production. Approximately 33 percent of habitat (3,873 acres) that would be crossed by the proposed Project has been converted to agricultural land.

In general, the same big game, small game, and furbearer species; waterfowl and game birds; non-game animals and mammals; raptors and other migratory birds (regulated under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act); and herpetiles (reptiles and amphibians) are found within the areas that would be crossed by the 2011 Steele City Alternative and the proposed Project. The only difference in the list of species that may be affected is the addition (for the 2011 Steele City Alternative route) of two more species, the American dipper (*Cinctus mexicanus*) and the olive-sided flycatcher (*Contopus cooperi*) (Nebraska Ornithologist Union 2012). A complete list of species found in areas that would be crossed by both the 2011 Steele City Alternative and the proposed Project is presented in Tables 3.6-2, 3.6-3, 3.6-4, 3.6-5, 3.6-6, and 3.6-7.

As with the proposed Project, the 2011 Steele City Alternative would also cross three bird conservation regions that are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues, as defined by the U.S. North American Bird Conservation Initiative (USNABCI 2012). These regions are Prairie Potholes (Region 11),

[3] Common names of animals are used in this section. Scientific names following nomenclature in the NatureServe Explorer database (NatureServe 2012) for most animals discussed in this section are listed in Tables 3.6-2, 3.6-3, 3.6-4, 3.6-5, 3.6-6, and 3.6-7. Where animals discussed in this section are not included in these tables, common names are followed by the scientific name.

which provides breeding and migratory habitat to over 200 species of birds; Badlands and Prairies (Region 17), which is habitat for some of the healthiest populations of high-priority dry-grassland birds; and Central Mixed Grass Prairie (Region 19), which acts as an important spring migration area (USNABCI 2012).

Potential Impacts

Similar to the proposed Project, the construction of the 2011 Steele City Alternative would have direct, indirect, temporary (short-term and long-term), or permanent impacts on wildlife resources (see Section 4.6, Wildlife, for additional information). The impacts of the proposed Project and of the 2011 Steele City Alternative on wildlife resources have been evaluated using a combination of quantitative and qualitative assessments of the potential direct and indirect impacts to species and their habitat through literature review and consultation with regional biologists. Potential impacts associated with the 2011 Steele City Alternative are essentially the same as for the proposed Project (see Section 4.6.3, Potential Impacts) and principally include fragmentation of wildlife habitat. The following are wildlife habitat fragmentation issues relevant for pipeline construction and operation:

- Reduction in patch size of remaining available habitats;
- Creation of edge effects;
- Creation of 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).

Additional impacts to wildlife include direct mortality during construction and operation; indirect mortality due to stress from construction and operations; reduced breeding success from exposure from construction and operation activities; and reduced survival due to overall disruption of habitat and food sources. Table 5.2-8 summarizes potential wildlife impacts for the 2011 Steele City Alternative and the proposed Project. Operational impacts would be limited to the permanent easement where maintenance activities would prevent the establishment of trees.

Table 5.2-8 Wildlife: Comparison of Types of Wildlife Impacts for Steele City Alternative and Proposed Project

Resource	2011 Steele City Alternative	Proposed Project
Big Game	Construction disturbance, habitat fragmentation, noise, human disturbance	Construction disturbance, habitat fragmentation, noise, human disturbance
Small Game and Furbearers	Habitat loss, direct mortality, human disturbance	Habitat loss, direct mortality, human disturbance
Waterfowl and Game Birds	Nesting, feeding, roosting disturbance	Nesting, feeding, roosting disturbance
Non-game Mammals	Habitat fragmentation	Habitat fragmentation
Raptors and Other Migratory Birds	Nesting, feeding, roosting disturbance	Nesting, feeding, roosting disturbance
Herpetiles	Habitat loss, direct mortality, human disturbance	Habitat loss, direct mortality, human disturbance
Insects	Habitat loss, direct mortality, human disturbance	Habitat loss, direct mortality, human disturbance

The NDEQ-identified Sand Hills Region is comprised of rolling sand dunes covered with grassland that is home to approximately 314 species of wildlife (USFWS 2012). This area is also important to migrating birds, as it lies in the middle of the Central Flyway. Use by mammals, herpetiles, and invertebrates in the NDEQ-identified Sand Hills Region may be higher than other regions due to the large expanses of undisturbed and undeveloped habitat. The proposed Project would avoid the NDEQ-identified Sand Hills Region.

Construction of the 2011 Steele City Alternative would result in disturbance of about 11,387 acres of various habitat types, including approximately 7,801 acres of grasslands and rangelands, 32 acres of upland forested habitat, and 120 acres of wetland habitats, including 63 acres of forested wetlands and 57 acres of emergent herbaceous wetlands (see Table 5.2-6). Construction of the proposed Project would result in disturbance of about 11,667 acres of various habitat types, including approximately 6,983 acres of grasslands and rangelands, 38 acres of upland forested habitat, and 92 acres of wetland habitats, including 63 acres of forested wetlands and 29 acres of emergent herbaceous wetlands. This indicates that the 2011 Steele City Alternative would impact less (approximately 280 acres) vegetation than the proposed Project.

Both the 2011 Steele City Alternative route and the proposed Project route would cross areas considered important habitats used by wildlife (see Table 5.2-9). Encompassing both public and private lands, these areas include wetland and conservation easements, Important Bird Areas (IBAs), river valleys, and state wildlife areas. The linear impacts described in this section apply equally to both construction and operation.

Table 5.2-9 Wildlife: Comparison of Important Wildlife Habitats that would be Crossed by the 2011 Steele City Segment Alternative Route and the Proposed Project Route

Name	Ownership and Description	Miles Crossed by 2011 Steele City Alternative Route	Miles Crossed by Proposed Project Route
Nebraska			
Keya Paya River Valley	Various	~0.4	22.4
Niobrara River Valley	Various	~0.5	5.7
Sand Hills	Various	46.8	NA[a]
Cedar River Valley	Various	~0.1	NA
Verdigris/Bazile	Various	NA	11.4
Loup River Valley	Various	~0.4	5.2
Platte River Valley	Various	~0.5	NA
Rainwater Basin	Various	50.0	69.5
Conservation Reserve Program	Private	5.2	na[b]

Source: Schneider et al. 2012, National Audubon Society 2012, Keystone 2012.

[a] NA = not applicable. Pipeline would not cross these areas, therefore, no acreage would be crossed.
[b] na = not available. Additional relevant information is pending and will be included in this review as part of the Final Supplemental EIS.

Mitigation measures similar to those described for the proposed Project would be required to minimize the potential wildlife impacts of the 2011 Steele City Alternative. The proposed Project attempts to reduce these impacts by avoiding the NDEQ-identified Sand Hills Region.

5.2.1.7 *Fisheries*

Environmental Setting

Fisheries information was derived primarily from fishery distribution maps available on agency websites supplemented by information provided by regional biologists. The 2011 Steele City Alternative would involve 48 perennial stream crossings (some crossed multiple times) including the Keya Paha River, Spring Creek, Niobrara River, Holt Creek, South Fork Elkhorn River, Cedar River, South Branch Timber Creek, Fullerton Canal, Loup River, Prairie Creek, Warm Slough, Platte River, Big Blue River, Lincoln Creek, Beaver Creek, West Fork Big Blue River, Turkey Creek, and various unnamed tributaries including the unnamed tributary to South Branch Timber Creek, the unnamed tributary to Platte River, and the unnamed tributary to Turkey Creek (see Section 3.7, Fisheries, Table 3.7-3). These creeks and rivers contain known or potential habitat for fish of recreational or commercial value. The proposed Project would have 56 perennial stream crossings, including one cold water stream, Spring Creek, which is rated as Class B water. Cold water fish that may be maintained year-round by stocking in Spring Creek could include brook trout, brown trout, or rainbow trout.

The 2011 Steele City Alternative route would cross many of the same streams and rivers as the proposed Project but would typically cross them further upstream. Additionally, the 2011 Steele City Alternative route would traverse portions of the NDEQ-identified Sand Hills Region while the proposed Project route would avoid the NDEQ-identified Sand Hills Region.

As a result of the relatively close proximity of the routes, in combination with the broad distributions of these species, the recreational and commercial fish species that occur along the 2011 Steele City Alternative route are the same species that occur along the proposed Project

route. These species are listed in Table 3.7-1 and are discussed in more detail in Section 3.7.2, Environmental Setting. Correspondingly, spawning periods and habitats for the recreational and commercial fish species that occur along the 2011 Steele City Alternative route are the same as for the proposed Project. The spawning periods and habitat are presented in Table 3.7-2 and are discussed in more detail in Section 3.7.2.1, Fisheries Resources.

Potential Impacts

The impacts of the proposed Project on fisheries and aquatic resources were evaluated through literature review and consultation with regional biologists. Field studies continue to be conducted along the proposed Project route, the results of which will be reported in fall 2012 and spring 2013. The types of potential impacts to fisheries for the 2011 Steele City Alternative are essentially the same as for the proposed Project (see Section 4.7.3, Potential Impacts) and include increased sedimentation, increased total suspended solids, restriction or delay of fish movement, water temperature alteration, bank alteration, riparian habitat alteration, potential for invasion of invasive species, and reduction of aquatic habitat. Table 5.2-10 provides a comparison between the 2011 Steele City Alternative and the proposed Project of the number of perennial stream crossings that contain known or potential habitat for fishes of recreational or commercial value.

Table 5.2-10 Fisheries: Comparison of the 2011 Steele City Alternative and Proposed Project

Resource Characteristics	Proposed Project	2011 Steele City Alternative
Perennial Stream Crossings	56	48
Open-cut Crossing Method[a]	43	36
HDD Crossing Method[b]	13	12

[a] Open cut = One of the four open cut methods (non-flowing, flowing, dry flume, or dry dam-and-pump) would be used for these crossings.
[b] The HDD method would also be used to cross one intermittent waterbody, Bridger Creek (MP 433.6). Bridger Creek will be crossed by both the Proposed project route and the Steele City Alternative.

The 2011 Steele City Alternative would have 48 perennial stream crossings, while the proposed Project route would have 56 perennial stream crossings. Two perennial fisheries streams would be crossed twice by the proposed Project route: an unnamed tributary to the South Branch Timber Creek and an unnamed tributary to the Platte River. The horizontal directional drilling (HDD) method would be used at 12 of the 48 perennial crossings for the 2011 Steele City Alternative, and at 13 of the 56 perennial crossings for the proposed Project. In addition, the HDD method would be used to cross one intermittent waterbody, Bridger Creek (MP 433.6), which would be crossed by both the Proposed project route and the Steele City Alternative. The HDD method would reduce the removal of vegetation and avoid impacts of sedimentation or temperature within the waterbodies. All other perennial stream crossings in Nebraska would use either the open-cut wet crossing method or an open-cut dry crossing method. Also as previously discussed, the 2011 Steele City Alternative would extend through the NDEQ-identified Sand Hills Region, which is comprised of environmentally sensitive landscapes. The proposed Project's route would avoid this Region and there would be correspondingly fewer impacts to associated creeks, rivers, and overall fisheries.

The mitigation measures described for the proposed Project would also apply to the proposed 2011 Steele City Alternative. No additional mitigation measures would be required.

5.2.1.8 *Threatened and Endangered Species*

Environmental Setting

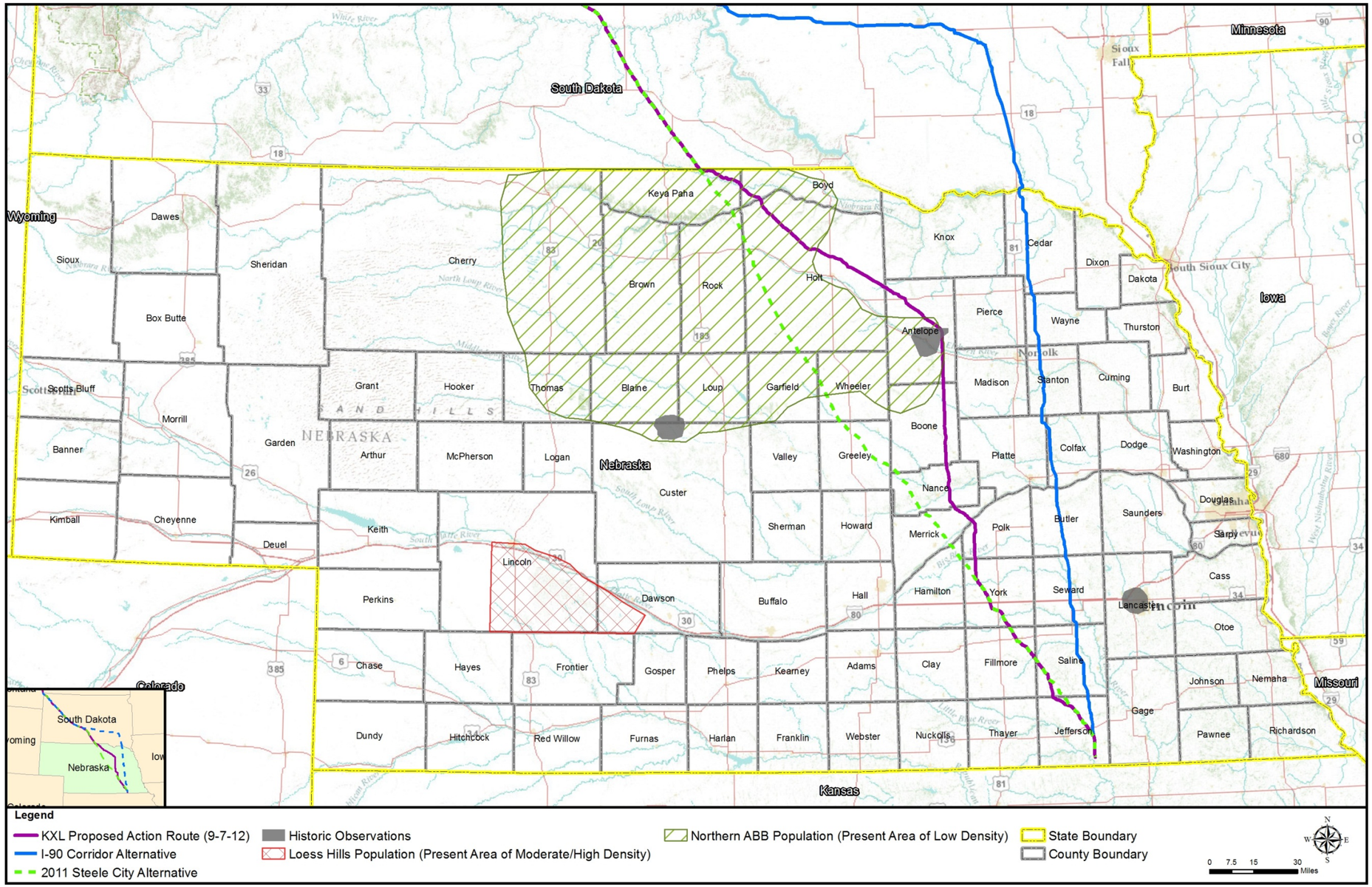
In northern and central Nebraska, the 2011 Steele City Alternative route would cross portions of the NDEQ-identified Sand Hills Region in Keya Paha, Rock, Holt, Garfield, Wheeler, Greeley, and Merrick counties. Most (95 percent) of the NDEQ-identified Sand Hills Region remains in a relatively natural 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 NDEQ-identified Sand Hills Region is one of the few remaining examples of a functioning prairie ecosystem. Of note, the NDEQ-identified Sand Hills Region has a large concentration of the American burying beetle (*Nicrophorus americanus*), a federal- and Nebraska-endangered invertebrate, and the blowout penstemon (*Penstemon haydenii*), a federal- and Nebraska-endangered plant. These two species are briefly discussed below.

There are two primary populations of American burying beetles occurring in Nebraska—a southern and a northern population (Figure 5.2.1-3 below; USFWS 2008). In the south, the American burying beetle occurs in loess canyons, and in the north a large population occurs in the NDEQ-identified Sand Hills Region, concentrated in Holt, Garfield, and Rock counties. The 2011 Steele City Alternative route would cross through all three of these counties, where most of the northern population occurs.

Another species that is strongly associated with the NDEQ-identified Sand Hills Region is the blowout penstemon. Stubbendieck's 2008 unpublished study of annual monitoring for this species indicates that there are currently 32 blowout penstemon populations (10 native population sites and 22 introduced population sites), all of which occur in the NDEQ-identified Sand Hills Region (USFWS 2012). This plant is a pioneer species that grows in shifting sand in blowouts, which are round or conical eroded areas formed in the sand when prevailing northwesterly winds scoop out the sides of dunes where vegetative cover is removed or disturbed. However, based on a review of the known occurrences of this species, the blowout penstemon is not known to occur within the area that would be crossed by the 2011 Steele City Alternative route.

Potential Impacts

The impacts of the proposed Project on federal or state-listed endangered, threatened, proposed, or candidate species, Bureau of Land Management sensitive species, and species of conservation concern have been evaluated using a qualitative evaluation of the potential direct and indirect impacts to species and their habitats resulting from the Project's construction and operation activities. Candidate species are those petitioned species that are actively being considered for listing as endangered or threatened under the Endangered Species Act, as well as those species for which agencies have initiated an Endangered Species Act status review that have been announced in the Federal Register.



Source: USFWS 2008.

Figure 5.2.1-3 2007 Estimated American Burying Beetle Distribution in Nebraska

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The Department and USFWS have had informal consultations regarding nine federally endangered species, two threatened species, and two candidate species for federal protection (see Table 4.8-1) along the length of the proposed Project route. Of these species, the American burying beetle is the only federally listed species determined to be potentially adversely affected by the proposed Project. As discussed in Section 4.8, Threatened and Endangered Species, the proposed Project could result in indirect and/or short-term impacts to federal or state-listed endangered, threatened, proposed, or candidate species, Bureau of Land Management sensitive species, and species of conservation concern, including:

- 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, and from increased human activity;
- Reduced breeding success from exposure to construction and operations noise, and/or from increased human activity;
- Reduced survival or reproduction due to decreased abundance of food species or reduced cover;
- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 4.13, Potential Releases); and
- Direct mortality due to collision with or electrocution by power lines associated pump stations.

The proposed Project would have direct, permanent, construction-related impacts and direct, long-term, operational impacts on the American burying beetle. American burying beetle surveys were conducted along the 2011 Steele City Alternative route and the proposed Project route. These survey results indicate that there is a higher density of American burying beetles along the 2011 Steele City Alternative route in Nebraska than along the proposed Project route in Nebraska. Thus, the 2011 Steele City Alternative would be expected to have greater impacts on this species.

In addition, the 2011 Steele City Alternative would cross through more grassland/pasture and less cultivated crops and developed land than the proposed Project (see Table 5.2-6). Grassland/pasture is more favorable habitat for protected species, and crops and developed land are generally unsuitable for protected species. As a result of crossing through a greater quantity of better quality habitat for protected species, the 2011 Steele City Alternative ROW would be expected to have greater potential impacts on protected species.

Surveys assumed that American burying beetles would likely occur in prime and good habitats and would not be expected to occur regularly in fair habitat, while marginal or poor habitats would be unsuitable for sustaining American burying beetles. Surveys for this species along the proposed Project route (see 2012 Biological Assessment in Appendix H of this Supplemental EIS for more information on these surveys) determined that the proposed Project route would cross approximately 50 miles (see Section 3.8.3.4) of habitat that supports low numbers of American burying beetle in Nebraska.

Surveys conducted in 2009 and 2010 along the 2011 Steele City Alternative route identified that there would be approximately 11.4 miles of fair/good habitat and 84 miles of prime habitat along the 2011 Steele City Alternative (Table 5.2-11).

Table 5.2-11 American Burying Beetle: Fair/Good and Prime Habitat along the Nebraska 2011 Steele City Alternative Route and Proposed Project Route

	Habitat Rating	
	Fair/Good	**Prime**
2011 Steele City Alternative Route	11.4 miles	84 miles
Proposed Project Route	50 miles	0 miles

Note: The impacts described in this table apply to both construction and operation.

Mitigation measures similar to those described for the proposed Project would be required to minimize potential impacts to American burying beetle, and all other protected species that may be impacted by the project construction and operation activities.

In summary, the 2011 Steele City Alternative would have greater impacts on the American burying beetle and other protected species habitat than the proposed Project. Neither route would be expected to impact any federally designated critical habitat.

5.2.1.9 *Land Use, Recreation, and Visual Resources*

Environmental Setting

The affected environment for land use, recreation, and visual resources for the 2011 Steele City Alternative is described in the Final EIS for the proposed Project. Table 5.2-12 summarizes the land ownership, and Table 5.2-13 summarizes land use that would be crossed by the 2011 Steele City Alternative route. Both tables also include similar information for the proposed Project (repeated from the Land Use Affected Environment discussion in Section 3.9; Land Use, Recreation, and Visual Resources).

Table 5.2-12 Land Use: Land Ownership Comparison of the 2011 Steele City Alternative and Proposed Project by ROW Length

	Existing Land Ownership Status (miles crossed)					
Alternative	**Federal**	**State[a]**	**Local (Public)[b]**	**Private**	**Waterbody[c]**	**Total[d]**
2011 Steele City Alternative	44.6	52.5	NA[e]	756.9	NA	854
Percent of Total	5.1%	6.1%	NA	88.8%	NA	100%
Proposed Project	46.4	60.9	2.3	763.6	1.8	875
Percent of Total	5.3%	7.0%	0.3%	87.2%	0.2%	100%
Difference[f]	1.7	8.4	2.3	6.4	1.8	21

Source: USGS 2011.

[a] Includes state highway ROW. The Final EIS did not distinguish between state and local public land; this analysis assumes that both were combined in the "State" category.
[b] May not include all county road ROW. The Final EIS did not report this information; local ownership is presumed to be incorporated into the "state" category ("n/a" indicates "not applicable").
[c] Includes waterbodies not located on a parcel under federal, state, or local ownership. The Final EIS did not report this information; waterbody crossings are assumed to be included in other categories.
[d] Totals may not match due to rounding.
[e] NA = not applicable.
[f] Proposed Project minus 2011 Steele City Route Alternative. Total rounded to nearest mile. .

Table 5.2-13 Land Use: Comparison of the 2011 Steele City Alternative and Proposed Project by ROW Length

	Land Use Type (miles crossed)					
Alternative	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water/Wetland**	**Total[a]**
2011 Steele City Alternative	264.4	10.3	6.5	554.7	18.1	854.0
Percent of Total	31.0%	1.1%	0.7%	65.1%	2.1%	100%
Proposed Project	344.6	10.2	6.5	505.5	8.2	875
Percent of Total	39.4%	1.2%	0.7%	57.8%	0.9%	100%
Difference[b]	80.2	-0.1	-0.2	-49.2	-9.4	21

Source: USGS 2006.

[a] Totals may not match due to rounding.
[b] Proposed Project minus 2011 Steele City Route Alternative. Total rounded to nearest mile.
The linear impacts described in this table apply to both construction and operation.

The 2011 Steele City Alternative route is slightly shorter than the proposed Project route, and would cross slightly less state-owned land; other land ownership is similar to the proposed Project. The 2011 Steele City Alternative route crosses less agricultural land and more rangeland than the proposed Project route.

The 2011 Steele City Alternative route would have 23 perennial river/stream crossings in Nebraska, compared to 31 for the proposed Project route. Otherwise, compared to the proposed Project, there is no substantial difference in the type and amount of recreational and special-use areas that would be crossed by the 2011 Steele City Alternative route. Similarly, there is little overall difference in the visual character of the landscape that would be crossed by the two routes.

Potential Impacts

The impacts of the 2011 Steele City Alternative are generally of the same type as the proposed Project, but differ slightly in intensity. Table 5.2-14 summarizes the acres of land ownership for construction and operation, and Table 5.2-15 summarizes the acres of land use for construction and operation that would be affected by the 2011 Steele City Alternative. Both tables also include similar information for the proposed Project (repeated from the Land Use impacts discussion in Section 4.9), for comparison. The 2011 Steele City Alternative would affect land ownership in approximately the same proportions (i.e., federal vs. private land), but would affect less land overall. The 2011 Steele City Alternative would affect approximately 2,100 fewer agricultural acres than the proposed Project during construction. The 2011 Steele City Alternative would permanently affect more rangeland and less agricultural land than the proposed Project. The 2011 Steele City Alternative effects on recreational and visual resources would largely be the same as for the proposed Project.

Table 5.2-14 Land Use: Land Ownership Comparison of the 2011 Steele City Alternative and Proposed Project by ROW Area

	Acres of Easement Required (Existing Ownership Type), Construction (Temporary)[a]				
Alternative	**Federal**	**State[b]**	**Local[b]**	**Private**	**Total**
2011 Steele City Alternative	523.8	649.0	NA	10,214.2	11,387
Percent of Total	4.6%	5.7%	NA	89.7%	100%
Proposed Project	595.0	723.4	105.0	10,243.6	11,667
Percent of Total	5.1%	6.2%	0.9%	87.8%	100%
Difference[d]	71.2	74.4	NA	-29.4	
	Acres of Easement Acquired (Existing Ownership Type), Operations (Permanent)[a]				
Alternative	**Federal**	**State[b]**	**Local[b]**	**Private**	**Total**
2011 Steele City Alternative	238.0	295.2	NA	4,642.8	5,176
Percent of Total	4.6%	5.7%	NA	89.7%	100%
Proposed Project	275.8	376.5	31.8	4,618.9	5,303
Percent of Total	5.2%	7.1%	0.6%	87.1%	100%
Difference[d]	37.8	81.3	n/a	(23.9)	127

Source: USGS 2011.

[a] For the 2011 Steele City Alternative, construction acreages are cited from the Final EIS, while operations acreages are estimated based on the difference between construction ROW (110 feet) and operations ROW (50 feet).
[b] The Final EIS did not call out locally owned public land. This Supplemental EIS assumes that local public land was incorporated into the State category.
[c] NA = not applicable.
[d] Proposed Project minus 2011 Steele City Route Alternative.

Table 5.2-15 Land Use: Comparison of the 2011 Steele City Alternative and Proposed Project by ROW Area

	Acres of Easement Required (Existing Ownership Type), Construction (Temporary)[a]					
Alternative	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water/Wetlands**	**Total[b]**
2011 Steele City Alignment	3,416.2	136.6	79.7	7,526.8	227.7	11,387
Percent of Total	30.0%	1.2%	0.7%	66.1%	2.0%	100%
Proposed Project	4,480.1	525.0	70.0	6,521.8	70.1	11,667
Percent of Total	38.4%	4.5%	0.6%	55.9%	0.6%	100%
Difference[c]	1,063.9	388.4	(9.7)	(1,005.0)	(157.6)	280
	Acres of Easement Required (Existing Ownership Type), Operations (Permanent)[a]					
Alternative	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water/Wetlands**	**Total[b]**
2011 Steele City Alignment	1,552.8	62.1	36.2	3,421.3	103.6	5,176
Percent of Total	30.0%	1.2%	0.7%	66.1%	2.0%	100%
Proposed Project	2,073.4	100.7	37.1	3,038.6	53.2	5,303
Percent of Total	39.1%	1.9%	0.7%	57.4%	1.0%	100%
Difference[c]	520.6	38.6	0.9	(382.7)	(50.4)	127

Source: USGS 2006.

[a] For the 2011 Steele City Alignment, construction acreages are cited from the Final EIS, while operations acreages are calculated based on the difference between construction ROW (110 feet) and operations ROW (50 feet).
[b] totals may not match due to rounding.
[c] Proposed Project minus 2011 Steele City Route Alternative.

5.2.1.10 *Socioeconomics*

Environmental Setting

The 2011 Steele City Alternative route would follow the same route as the proposed Project except that Gregory County, South Dakota, and three counties in Nebraska (Boyd, Antelope, and Polk) would not be affected in the case of the Alternative route, while five other Nebraska counties would be affected (Rock, Garfield, Wheeler, Greeley, and Hamilton). Table 5.2-16 summarizes the key socioeconomic characteristics of the areas that would be affected by the 2011 Steele City Alternative and the proposed Project.

Table 5.2-16 Socioeconomics: Comparison of Selected Characteristics of Areas that would be affected by the 2011 Steele City Alternative and Proposed Project

	Alternative		
Characteristic	**2011 Steele City Alternative**	**Proposed Project**	**Difference[b]**
2010 Population[a]	265,163	267,569	2,406
2010 At-Place Employment[a]	176,035	171,826	(4,209)
Property Value (billions)[a]	$30.5	$30.7	$0.2
Effective Property Tax Rate	1.8%	1.7%	(0.1%)
Road Crossings	720	840	120
Rail Crossings	14	19	5

[a] Total for all counties crossed by each route.
[b] Proposed Project minus 2011 Steele City Route Alternative.

Population and Socioeconomic Conditions

The affected populations along the route for the 2011 Steele City Alternative and proposed Project are very similar at 265,163 persons and 267,569 persons, respectively. There are 14 communities (i.e., cities and towns) within 2 miles of the 2011 Steele City Alternative route, while the proposed Project has 17 communities within 2 miles. Total employment in counties that would be affected by the 2011 Steele City Alternative is slightly higher than for counties that would be affected by the proposed Project.

Environmental Justice

The same environmental justice populations identified in Montana, South Dakota, and Kansas for the proposed Project could also be affected by the construction of the 2011 Steele City Alternative. Two additional environmental justice populations could be affected under the 2011 Steele City Alternative: a low-income population in Keya Paha County, Nebraska, and a minority population in York County, Nebraska (see Appendix O, Socioeconomics, for data).

Public Services

A total of 72 police/sheriff departments, 88 fire departments, and 24 medical facilities are located in the counties that would be crossed by the 2011 Steele City Alternative route. This compares to 67 police/sheriff departments, 86 fire departments, and 24 medical facilities for the proposed Project. The net difference in public service types is entirely in Nebraska (including a different set of medical facilities). Appendix O, Socioeconomics, includes a table listing these facilities.

Tax Revenues and Property Values

The importance of property tax revenue to local governments is the same under the 2011 Steele City Alternative as under the proposed Project. The local tax bases are similar in size, and effective tax rates fall within the same range among the counties in each state in the areas potentially affected by the 2011 Steele City Alternative and the proposed Project. Appendix O, Socioeconomics, includes a table with the 2010 data on local property taxes for potentially affected counties under the 2011 Steele City Alternative.

Traffic and Transportation

In the case of the 2011 Steele City Alternative, there would be approximately 720 road crossings and 14 rail crossings (Final EIS Table 3.10.3-1). This compares to 840 road crossings and 19 rail crossings under the proposed Project. Most of this difference is in the number of crossings of Category I roads (local roads).

Potential Impacts

Table 5.2-17 summarizes some of the key socioeconomic characteristics of the 2011 Steele City Alternative and the proposed Project. The impacts of the Alternative are generally of the same type as the proposed Project, but differ slightly in intensity. Those differences are discussed below.

Table 5.2-17 Socioeconomics: Comparison of Selected Impacts of the 2011 Steele City Alternative and Proposed Project

	Alternative		
Characteristic	**2011 Steele City Alignment**	**Proposed Project**	**Difference[b]**
Construction Workforce (average annual employment)	3,900	3,900	(0)
Capital Cost (billions)	$3.0	$3.1	($0.1)
Construction Earnings (billions)[a]	$1.98	$2.05	($0.07)
Gross Domestic Product (billions)	$3.29	$3.4	($0.11)
Property Tax Revenue (millions)	$34.1	$34.5	($0.4)

[a] Includes earnings (defined in Section 4.10.3.1, Local Economic Activity) for all industries in the United States as a result of the 2011 Steele City Alternative and proposed Project.
[b] 2011 Steele City Route Alternative minus Proposed Project.

Population/Housing

Construction of the 2011 Steele City Alternative route would require slightly less construction workers for the 1-2 year construction period than what would be required for the proposed Project. This number is equivalent to approximately 1.5 percent of the entire population along the 2011 Steele City Alternative route. As in the case of the proposed Project, the workers would be distributed along the route, and would also work on a single pipeline spread for 4-8 months, lessening the effects that the population would have on local areas.

There are approximately 74 more hotel/motel rooms along the 2011 Steele City Alternative route than the proposed Project; however, compared to the number of construction workers (slightly fewer), the alternative's effects on regional housing are expected to be the same as for the proposed Project.

Local Economic Activity

Definitions of employment and earnings as well as a description of modeling techniques are described in Section 4.10.3.1, Local Economic Activity. The primary difference in the construction cost of the proposed Project and 2011 Steele City Alternative is the difference in length—the 2011 Steele City Alternative is approximately 20 miles shorter.

The 2011 Steele City Alternative does not include a construction camp in Nebraska. Beyond the cost implications of this difference, the 2011 Steele City Alternative also assumes that existing commercial lodging and accommodations (not construction camps) would house the construction workforce in Nebraska, whereas the proposed Project includes a construction camp in northern Nebraska for this purpose. Net employment (including indirect and induced employment in other parts of the nation) triggered by construction of the 2011 Steele City Alternative would be approximately 1,700 less than under the proposed Project, primarily due to the shorter pipeline length and the difference in worker accommodations.

Earnings in the United States would be about $72 million lower under the 2011 Steele City Alternative, compared to the proposed Project, as a result of the fewer pipeline miles in the Alternative. This represents less than 4 percent of the total earnings for the Alternative.

Economic Indicators of National Interest

Definitions of Gross State Product (GSP) and Gross Domestic Product (GDP) as well as their relationship with earnings are described in Section 4.10.3.1, Local Economic Activity. Construction of the 2011 Steele City Alternative would contribute approximately $3.29 billion to GDP, compared to approximately $3.40 billion for the proposed Project. The GSP in Montana and South Dakota would be unchanged, while the GSP in Nebraska would be approximately $11 million less under the 2011 Steele City Alternative. The differences in GDP and GSP are primarily due to the shorter pipeline length and the difference in worker accommodations in the 2011 Steele City Alternative.

Environmental Justice

The types of impacts to minority and low-income populations that could occur during construction and operations of the 2011 Steele City Alternative would be the same as those described for the proposed Project, which could include increased competition for medical or health services in underserved populations.

The environmental justice populations present along the 2011 Steele City Alternative in Keya Paha and York counties, Nebraska could potentially be affected by construction activity or by pipeline operations (see Environmental Setting above). One railroad siding and one contractor yard would be located in York County, Nebraska, where a minority population is found (exp Energy Services Inc. 2012). Also, a pipe yard has been proposed for Keya Paha County, Nebraska, which contains a low-income population (Keystone 2012b). These two counties contain Health Professional Shortage Areas (HPSA) and Medically Underserved Areas/Populations (MUA/P).

Because the exact locations of the railroad siding, contractor yard, and pipe yard sites have not yet been determined, the potential effect of those facilities on the environmental justice populations is unknown. These facilities, however, would all be temporary, lasting only a few months during construction, and, therefore, any potential effects on environmental justice

populations would be short term. Should the 2011 Steele City Alternative be recommended, the potential effects would be evaluated based on the then proposed locations during siting and design. Appendix O, Socioeconomics, provides information about the HPSAs and MUA/Ps in relation to areas with minority and/or low-income populations.[4]

Tax Revenues

During construction, total state sales and use and contractors' excise tax revenue would be approximately the same for the 2011 Steele City Alternative as for the proposed Project. Construction-based taxes from the 2011 Steele City Alternative would be slightly higher in South Dakota than for the proposed Project and slightly lower in Nebraska, with the differences estimated roughly in proportion to differences in pipeline mileage in each state.

Total property tax revenue would be about the same for the 2011 Steele City Alternative as for the proposed Project in all states except Nebraska where total property tax revenue would be slightly lower because of less pipeline mileage in the state. Only counties with Keystone XL facilities (pipeline, pump stations, etc.) would receive property taxes associated with the 2011 Steele City Alternative. On a per capita basis for all situs counties, total property tax revenue for the 2011 Steele City Alternative would be approximately $128 versus $129 for the proposed Project.

Property Values

Impacts to private property values during construction and operations under the 2011 Steele City Alternative would be similar to the proposed Project in character and in the low level of impact, as described in Section 4.10.3.1, Construction—Public Services, Tax Revenues, and Property Values, and Section 4.10.3.2 Operations—Public Services, Tax Revenues, and Property Values. However, the impacts would occur in different counties in Nebraska under the 2011 Steele City Alternative, as previously described in this section.

Traffic and Transportation

Impacts on traffic and transportation under the 2011 Steele City Alternative would be similar to, but less extensive than, those described for the proposed Project, due to the reduced number of road and railroad crossings, required work areas, and access points. As with the proposed Project, the 2011 Steele City Alternative would create only short-term traffic congestion and delays during construction, and no appreciable impacts on traffic and transportation during operations.

5.2.1.11 *Cultural Resources*

Environmental Setting

The 2011 Final EIS evaluated the environmental setting and impacts to cultural resources based on a 300-foot-wide survey area, or area of potential effects (APE), that included the construction ROW. This same APE was used to compare the shared segments of the 2011 Steele City Alternative and the proposed Project. For segments of the proposed Project outside of the route

[4] Information for HPSAs and MUA/Ps is only available at the county level.

evaluated in the Final EIS, a 500-foot APE was used (based on Section 3.11, Cultural Resources). Table 5.2-18 summarizes existing cultural resources information for these two alignments.

Table 5.2-18 Cultural Resources: Comparison of Resources near the 2011 Steele City Alignment and Proposed Project

	Alternative		
Cultural Resource Type	**2011 Steele City Alignment**	**Proposed Project**	**Difference[a]**
Archaeological Sites	373	251	122
Historic Structures	120	147	-27
Historic Trails	5	5	0
Total	**498**	**403**	**95**
Eligible for National Register of Historic Places (NRHP)	69	45	24
Not Eligible for NRHP	267	205	62
NRHP Eligibility Undetermined	162	153	9

[a] Proposed Project minus 2011 Steele City Route Alternative.

Of cultural resources within the APE for the 2011 Steele City Alignment, the Final EIS identified 498 cultural resources, including 373 archaeological sites, 120 historic structures, and five historic trails. Of these cultural resources, 69 are eligible for inclusion on the NRHP, 267 are not eligible, and 162 were unevaluated or pending eligibility determinations/concurrence at the time of the Final EIS. As of October 2012, 403 cultural resources have been identified during the cultural resources surveys within the proposed Project APE, including 251 archaeological sites, 147 historic structures, and five historic trails. Of the 403 cultural resources, 45 are eligible for inclusion on the NRHP, 205 are not eligible, and 153 are unevaluated or pending eligibility determinations/concurrence.

Potential Impacts

Avoidance is recommended for all eligible and unevaluated cultural resources sites, regardless of the route selected. By avoiding these sites, the 2011 Steele City Alternative and proposed Project would have no effect on these historic properties during construction or operations. The Department will continue to consult with state and federal agencies and Native American tribes about the significance of sites and work to avoid any adverse effects to the resources, following the protocols outlined in the Programmatic Agreement developed for the proposed Project.

5.2.1.12 *Air Quality and Noise*

Environmental Setting

The 2011 Steele City Alternative is the same as described for the proposed Project (see Section 3.12, Air Quality and Noise), except in northern Nebraska where the 2011 Steele City Alternative diverts from the proposed Project at approximate MP 602 near the border with South Dakota. These affected areas in Nebraska are rural and their major sources of air pollution and noise are from agricultural activities. Further, these affected areas are located in areas designated as attainment (i.e., areas with good air quality). The low population densities in these affected areas and the lack of industrial facilities are similar to those of the proposed Project, so the existing air quality and noise levels for this alternative are expected to be similar to those of the proposed Project.

Potential Impacts

Air Quality

Air emissions (criteria pollutants, hazardous air pollutants, and greenhouse gases [GHGs]) from construction of the 2011 Steele City Alternative would be similar but slightly less than that for the proposed Project. This is due to the 2011 Steele City Alternative's shorter pipeline length (854 miles) in comparison to that of the proposed Project (875 miles). During the construction phase, similar to the proposed Project, the 2011 Steele City Alternative would occur over a short term and temporary period, and, as such, is expected to have similar but slightly less (approximately 2 percent lower) air quality and GHG impacts during the construction phase (for the proposed Project, see Section 4.12.3, Potential Impacts).

During the operational phase, the 2011 Steele City Alternative would generate less than 1 ton per year of fugitive volatile organic compounds and less than 1 metric ton per year of fugitive methane emissions from approximately 57 intermediate mainline valves (IMLVs) along the pipeline route and from valves, pumps, flanges, and connectors at associated pump stations. These minimal fugitive emissions (direct emissions) would be essentially the same as those generated by the proposed Project, which would have approximately 55 IMLVs along the pipeline route and the same number of components (valves, pumps, flanges, and connectors) per pump station. Like the proposed Project, the 2011 Steele City Alternative would have 20 pump stations.

The 20 pump stations associated with the Alternative would be located in the same e-GRID (Emissions & Generation Resource Integrated Database)[5] region as the proposed Project, and, as such, would generate the same amount of indirect GHG emissions from electricity consumption

[5] E-GRID is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the United States. These environmental characteristics include air emissions for nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and nitrous oxide; emissions rates; net generation; resource mix; and many other attributes. The United States is grouped into multiple e-GRID regions based on the different energy mix (i.e., percent of coal, natural gas, fuel oil, hydropower, wind power, etc.) in different parts of the country. For example regions with a high percent of coal in its energy mix would have higher e-GRID emission factors when compared to regions with high percent of natural gas or hydropower. See the following for more information: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_SummaryTables.pdf.

(3.19 million metric tons of carbon dioxide equivalent). Air emissions associated with refueling construction equipment/vehicles and use of maintenance vehicles (approximately twice per year) and aircraft for aerial inspections (once every 2 weeks) throughout the operation phase would be negligible. Compared to the proposed Project, the 2011 Steele City Alternative would be expected to have similar air quality and GHG impacts during the operational phase (see Section 4.12.3, Potential Impacts).

Noise

The level of noise generated from construction of the 2011 Steele City Alternative would be comparable to that of the proposed Project because of the similar types of construction equipment and activities, including HDD and blasting. Like the proposed Project, the 2011 Steele City Alternative would generate high noise levels in its immediate vicinity (approximately 79 decibels on the A-weighted scale at 200 feet) over a short term and temporary period, and, as such, would be expected to have similar noise impacts during the construction phase (see Section 4.12.3, Potential Impacts).

During operations, the only source of noise from the 2001 Steele City Alternative would be the pump stations. The 2011 Steele City Alternative would have the same number of pump stations (20 pump stations) and pump numbers and sizes (three to five pumps per station; each pump rated 6,500 horsepower) as the proposed Project, so the magnitude and extent of pump station noise would be similar to those of the proposed Project. Like the proposed Project, the pump stations for this alternative would be located in rural areas with low population densities. Therefore, the impact of the pump station noise from this alternative would be comparable to that of the proposed Project during the operation phase (see Section 4.12.3, Potential Impacts).

5.2.1.13 *Climate Change*

Environmental Setting

The 2011 Steele City Alternative is in the same climate regions (Dry Temperate and Prairie) as the proposed Project since the pipeline route crosses the same states. Therefore, the historical climate trends (i.e., temperature changes in the affected states) for this alternative are essentially the same as described for the proposed Project (see Section 4.14.1.1, Historical Climate Trends).

Potential Impacts

The projected climate change impact on the 2011 Steele City Alternative is similar to that of the proposed Project because of the similarities in climate regions crossed by the two routes (see Section 4.14.1.2, Projected Climate Change Effects).

5.2.2 I-90 Corridor Alternative

The I-90 Corridor Alternative would follow the same route as the proposed Project route in Montana and northern South Dakota. At approximately MP 516 in South Dakota, the I-90 Corridor Alternative would turn east and follow interstate I-90 for approximately 144 miles to mile post 660. The I-90 Corridor Alternative would then intersect an existing corridor shared by the BNSF railroad line and State Highway 262 (BNSF/262). From this location, the I-90 Corridor Alternative would travel southeast away from I-90, parallel and adjacent to the BNSF/262 corridor for approximately 13 miles until intersecting with the existing Keystone

Pipeline ROW at mile post 673. The I-90 Corridor Alternative would then head south along the existing Keystone pipeline for approximately 254 miles to Steele City, Nebraska, for a total length of approximately 927 miles. For the purpose of this analysis, it is assumed that the I-90 Corridor Alternative would be co-located with the existing Keystone pipeline for approximately 254 miles and the new ROW would occupy 25 feet of the existing Keystone ROW (i.e., only 25 feet of additional permanent ROW required instead of typical 50 feet). Overall, the I-90 Corridor Alternative would be 927 miles long, approximately 52 miles longer than the proposed Project alignment.

5.2.2.1 *Geology*

Environmental Setting

Even where the corridors differ, the regional surficial and bedrock geology for the I-90 Corridor Alternative is essentially the same as the proposed Project, with Quaternary deposits on the surface and Tertiary and Late Cretaceous bedrock formations below. The predominant terrain associated with this alternative includes rolling to steep, irregular hills, and gently sloping valleys. Tertiary sedimentary formations of sandstones and conglomerates (sedimentary rocks that consist of at least thirty percent of its total mass in gravel-sized particles) are deeply covered by Quaternary clay rich sedimentary deposits (aeolian sand and loess).

Geologic features that would be crossed or within 1 mile of the I-90 Corridor Alternative include high risk landslide areas, fossil fuel and mineral resources, and potentially important fossil containing formations that can be near the surface. The extent of these features associated with this alternative is summarized in Table 5.2-19.

Table 5.2-19 Geology: Comparison of the I-90 Corridor Alternative to the Proposed Project Alternative

Resource Potentially Impacted/Risk	Proposed Project (all units in miles)	I-90 Corridor Alternative (all units in miles)
		Total
High Risk Landslide Areas	338.8	337.1
Fossil Fuel and Mineral Resources	24 oil and gas wells within 0.25 mile; 1 gravel pit within 0.5 mile; 5 aggregate mines within 1 mile of Proposed route	24 oil and gas wells within 0.25 mile, 1 gravel pit, and 2 aggregate mines within 1 mile of this alternative
Fossil Containing Formations (Paleontology)	~599 miles sporadically between MP 3.0 and 875	~659 miles

Potential Impacts

A summary of potential geologic impacts that would be associated with the I-90 Corridor Alternative as compared to the proposed Project is presented in Table 5.2-19. As with the proposed Project, the I-90 Corridor Alternative would not cross any known active faults with confirmed surface offsets. Based on the FEMA landscape hazard ranking system (LSHR) mapping, as described in Section 3.1.2.5, the I-90 Corridor Alternative would cross approximately 337.1 miles of areas where conditions with a high risks for landslides could be encountered, which is slightly less than for the proposed Project, which would cross approximately 338.8 miles of these areas with these high risks.

Landslides typically occur on steep terrain (slopes of 20% or greater) during conditions of partial or total soil saturation, or during seismic activity (Section 3.1.2.5 and 4.1.3.4). Given the low likelihood of a significant seismic event and relatively limited extent of steep slopes along the I-90 Corridor Alternative route, the potential for earthquake-induced landslide potential is low.

As described in Section 4.1.3.4, four miles of the terrain crossed by the proposed Project route contain steep slopes. Most of these steep sections are less than 0.1 mile in length and correspond to stream crossing locations. Based on a review of USGS topographic mapping, the terrain crossed by the I-90 Corridor Alternative where it diverges from the proposed Project is similar and the occurrence of steep slopes is anticipated to also be similar.

If the I-90 Corridor Alternative was recommended, planning and design surveys would identify areas of steep slopes. Where steep slopes could not be avoided, the construction and operation methods required by 49 CFR Parts 192 and 193 and additional soil erosion, sediment control, and slope stabilization measures identified in Section 4.1.3.4 would be implemented to minimize the risk of landslides associated with construction and operation on steep slopes.

Mineral resources identified include 24 oil or gas wells within 0.25 mile of the I-90 Corridor Alternative as well as one gravel pit, and two aggregate mines, within one mile of that Alternative route. The actual impacts to these resources would be negligible. There should not be any geology related environmental impacts associated with operations.

Valuable fossil-containing formations are classified as PFYC Class 4 (geologic units containing a high occurrence of significant fossils) or Class 5 (highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils, invertebrate or plant fossils, and that could be at risk of human-caused adverse impacts or natural degradation). As several formations along the I-90 Corridor Alternative route have fossil-containing sediments, it is likely that PFYC Class 4 or 5 paleontological specimens and fossil-bearing formations would be encountered along the route. Since PFYC Class 4 and 5 fossils occur sporadically throughout the formations, which may or may not contain surficial fossils, for the purpose of this assessment, the entire formation was noted and included in the total mileage of potential fossil occurrence. Based on a geologic and topographic desktop analysis, the I-90 Corridor Alternative crossed a total of approximately 659 miles of PFYC Class 4 or 5 formations compared to approximately 599 miles for the proposed Project. Both the proposed Project and the I-90 Corridor Alternative cross a similar number of miles ranked as Landscape Hazard Ranking System high risk landslide areas, in addition to having comparable impacts on fossil fuel and mineral resources in the vicinity of the routes.

The mitigation measures described for the proposed Project would also apply to the proposed I-90 Corridor Alternative. No additional mitigation measures would be required.

5.2.2.2 *Soils*

Environmental Setting

In southern South Dakota and northern Nebraska, the soils crossed by the I-90 Corridor Alternative are generally well-drained to moderately well-drained, and loamy or clayey, with some clays having shrink-swell potential that formed in till, moraines, or till plains. Soils in central to southern Nebraska that would be crossed by the I-90 Corridor Alternative generally

consist of deep loess deposits with some organic matter enrichment. South of the Platte River to the state line, the soils are largely silty loams with fine sands.

Sensitive soil types crossed by the I-90 Corridor Alternative include highly erodible soils, prime farmland soils, hydric soils, compaction prone soils, stony/rocky soils, soils over bedrock at or within 80 inches of the surface, and drought-prone soils. A summary of the sensitive soil types crossed by the I-90 Corridor Alternative is presented in Table 5.2-20. The linear impacts described in this section apply equally to both construction and operation.

Table 5.2-20 Soils: Comparison of the I-90 Corridor Alternative and Proposed Project

Resource Characteristics	Proposed Project (all units in miles)	I-90 Corridor Alternative (all units in miles)
Total Miles	875.0	927.0
Highly Erodible (wind)	66.2	36.4
Highly Erodible (water)	375.5	234.1
Prime Farmland[a]	349.2	214.3
Hydric Soils[b]	53.6	7.2
Compaction Prone	626.1	584.5
Stony/Rocky	73.7	79.4
Shallow with Bedrock[c]	5.3	12.5
Drought prone	127.9	98.8

[a] Prime Farmland as defined by the Natural Resources Conservation Service are those areas that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these land uses.
[b] Hydric Soils are soils that developed under sufficiently wet conditions to support the growth and regeneration of wetland vegetation.
[c] Soils with bedrock at the surface and to a depth of 80 inches.

Potential Impacts

The types of potential impacts to soils for the I-90 Corridor Alternative are essentially the same as for the proposed Project (see Section 4.2, Soils) and 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. Table 5.2-20 compares potential impacts of the I-90 Corridor Alternative with the proposed Project for several sensitive soil characteristics. The I-90 Corridor Alternative would be approximately 52 miles longer than the proposed Project, which would result in approximately 677 acres of additional soil disturbance than the proposed Project. The I-90 Corridor Alternative, however, would cross 170 fewer miles of soils that are susceptible to wind or water erosion.

Mitigation measures to avoid or minimize soil impacts for this alternative would be similar to those described for the proposed Project. No additional mitigation measures would be required.

5.2.2.3 *Water Resources*

Groundwater

Environmental Setting

The I-90 Corridor Alternative route is situated in a similar regional hydrogeologic setting as the proposed Project area discussed in Section 3.3.2, Groundwater. In the western half of South Dakota, the hydrogeology along the I-90 Corridor Alternative route is similar to the hydrogeology that would be crossed by the proposed Project area. The eastern portion of the I-90 Corridor Alternative route in South Dakota and northeastern Nebraska has groundwater present in unconsolidated sand, gravel, and silt in valley-fill and sheet deposits of glacial outwash and recent alluvial sand and gravel deposits. In contrast to the proposed Project route, the I-90 Corridor Alternative route in eastern Nebraska is situated in areas of thick deposits of sandy sediment deposits with some clay (loess).

Although the NHPAQ is not present beneath the portion of the I-90 Corridor Alternative route that differs from the proposed Project in South Dakota, it is present beneath the I-90 Corridor Alternative in Nebraska. In addition, there are aquifers found along the I-90 corridor that are known to be important groundwater resources. The USGS Groundwater Atlas of the United States notes: "Unconsolidated deposits are widespread throughout [Montana, North Dakota, South Dakota, and Wyoming] and compose important aquifers either at the land surface or buried beneath low-permeability material. The aquifers are particularly widespread . . . in the subsurface, in buried glacial valleys, in eastern North Dakota, and South Dakota" (Whitehead 1996).

In addition, the I-90 Corridor Alternative would enter Nebraska in Cedar County, where heavily used shallow groundwater resources with high hydraulic conductivity are present in recent alluvium, including highly utilized alluvial aquifers in the Missouri River valley. Although these alluvial aquifers are not considered part of the NHPAQ, these aquifers are an important groundwater resource. Areas of shallow groundwater (between 0 feet and 50 feet) crossed by this alternative are presented in Table 5.2-21.

Table 5.2-21 Groundwater: Comparison of the I-90 Corridor Alternative and Proposed Pipeline

Resource Characteristics	Proposed Pipeline	I-90 Corridor Alternative
Total miles	875	927
Miles over the NHPAQ	261	158
Number of shallow and very shallow wells in alluvial aquifers in South Dakota	25-57[a]	180[b]

[a] Twenty-three wells are known to be very shallow or shallow and 34 are likely to be very shallow or shallow.
[b] Number is approximate.

Potential Impacts

Construction of the I-90 Corridor Alternative or the proposed Project would have negligible impacts to hydrogeologic resources. Potential impacts to groundwater resulting from a crude oil release associated with the I-90 Corridor Alternative would be similar to potential impacts associated with the proposed Project as discussed in Chapter 4, Environmental Consequences.

The I-90 Corridor Alternative route would have approximately 103 fewer miles of pipeline over the NHPAQ system (approximately 158 miles) as compared to the proposed Project. As stated above, although the NHPAQ is not present beneath the I-90 Corridor Alternative route in South Dakota, there are a significant number of shallow and very shallow wells situated in alluvial aquifers along the I-90 Corridor Alternative route. These shallow wells are located in aquifers that are known to be important groundwater resources.

Table 5.2-21 compares the impacts of the I-90 Corridor Alternative with the proposed Project route for several key characteristics. The impacts described in this section apply to both construction and operation.

Surface Water

Environmental Setting

Table 5.2-22 provides a summary of the surface water resources crossed by the I-90 Corridor Alternative. This I-90 Corridor Alternative would cross a total of 1,088 waterbodies within its 927 mile length.

Table 5.2-22 Surface Water: Comparison Between Water Resources in the I-90 Corridor Alternative and Proposed Project

Resource	I-90 Corridor Alternative	Proposed Project
Total Waterbody Crossings	1,088	1,073
Perennial Waterbody Crossings	61	56
Other Waterbody Crossings	1,027	1,017
Waterbodies with State Use Classifications	42	
Waterbodies with Impairments	24	19
Mapped Floodplains	87	33

Public drinking water is not withdrawn directly from the reservoir. However; protection of water quality in the watershed and in the lake is considered important for protection of local drinking water wells and municipal waters supplies downstream of the Fort Randall Dam.

One notable waterbody crossing in the I-90 Corridor Alternative would be Lake Francis Case, just south of the town of Chamberlain, South Dakota. This lake is a reservoir along the Missouri River formed by Fort Randall Dam located approximately 90 miles downstream of the potential crossing. The pipeline would remain parallel to the southern side of I-90 for the lake crossing. The lake is approximately 4,100 feet wide at this location. The Fort Randall Dam primary functions are flood control, hydroelectric power, navigation, fish and wildlife management, and recreation. The I-90 Corridor Alternative crossing of Lake Francis Case would be complex and site-specific studies would be required to validate the feasibility of crossing at this location. Based on a desktop review of the crossing conditions, the proposed crossing would approach the practical limits for horizontal directional drill methods of a 36-inch pipeline (approximately 6,000 feet). As a result, for the purposes of this evaluation, it is assumed that a wet-cut crossing method using barges and bottom dredging may be the needed to cross Lake Francis Case at this location.

Potential Impacts

Impacts to water resources would occur during construction and operation of the pipeline and are consistent with the types of impacts for the proposed Project, as presented in Sections 4.3.3.3, Operational-Related Impacts, and 4.3.3.4, Floodplains. Potential impacts on surface water resources during construction from the I-90 Corridor Alternative or the proposed Project would be similar and would include:

- Temporary increases in total suspended solid concentrations and increased sedimentation during stream crossings or at upland locations with soil erosion and transport to streams;
- Temporary to long-term changes in channel morphology and stability caused by channel and bank modifications;
- Temporary to long-term decrease in bank stability and resultant increase in total suspended solids 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 and stream crossing construction.

Construction impacts to surface water resources associated with hazardous liquids spills and leaks are discussed in Section 4.13, Potential Releases.

Reflecting its longer length, the I-90 Corridor Alternative would cross slightly more waterbodies and streams than the proposed Project (see Table 5.2-22), including a major crossing of Lake Francis Case. If a wet open cut crossing method was used for the crossing of Lake Francis Case, construction impacts would include temporary and localized increases in total suspended solid concentrations and increased sedimentation during stream crossings. Potential operational impacts would be similar to other waterbody crossings.

Temporary impacts to floodplains would also occur during construction of this alternative; however, these impacts would be mitigated by permit conditions that would require the floodplain to be restored to as close to previously existing contours as practical and the disturbed areas would be re-vegetated.

Potential operational impacts at surface water crossings include spills or damage to the pipeline caused by erosion and subsequent exposure. Impacts associated with potential crude oil releases from pipeline operation are addressed in Section 4.13, Potential Releases. Channel migration and streambed degradation could expose the pipeline. Mitigation measures, including accounting for each stream channel's vertical and lateral migration zone, as described in Section 4.3.3.4, Floodplains, and Section 4.3.4, Recommended Additional Mitigation, would be implemented to minimize the potential for exposing the pipeline.

5.2.2.4 *Wetlands*

Environmental Setting

The USEPA ecoregions (USEPA 2010) and the distribution of wetlands along the pipeline corridor are illustrated on Figure 5.2.1-2. The I-90 Corridor Alternative crosses a total of approximately 242 miles of the Prairie Pothole Region (USEPA 2010). The Prairie Pothole Region includes emergent wetlands, small lakes, and saline/alkaline wetlands that occur within a

landscape of glacial debris, rolling hills, depressions, and scars caused by glacial activity (U.S. Geological Survey [USGS] 2006, 1998). While no specific Prairie Pothole wetlands have been identified by the desktop survey, field surveys would be required to validate.

The I-90 Corridor Alternative would cross the Prairie Pothole Region and the Rainwater Basin Region, both of which support many sensitive wetlands (refer to Section 3.4.3.1, Sensitive Wetland Areas).

NRCS has identified a wetland easement within approximately 100 feet of the existing I-90 corridor at 395th Avenue in Davidson County, South Dakota, that is included in the NRCS Wetlands Reserve Program (WRP) (Section 30, Lots A and B) (NRCS Agreement 667409600C6G).

As currently drawn, the I-90 Corridor Alternative ROW could impact approximately 879 linear feet along the northern border of the WRP property easement. If this alternative was recommended for construction, site specific surveys would be conducted to verify the location of the I-90 Corridor Alternative ROW relative to the identified WRP easement boundaries. If impacts to this easement are identified, project modifications would be developed in cooperation with NRCS to avoid, or minimize and mitigate these impacts. This is also included in Table 5.2-28.

Potential Impacts

The I-90 Corridor Alternative would result in approximately 223 acres of temporary wetland impacts and approximately 101 acres of permanent wetland impacts, both of which are slightly less than the proposed Project (see Table 5.2-23). Approximately 20 percent more wetland impacts would occur within the operations ROW by the proposed Project route (120.4 acres) than by the I-90 Corridor Alternative route (100.9 acres).

Table 5.2-23 Wetlands: Comparison of Estimated ROW Wetland Impacts within the Proposed I-90 Corridor Alternative and proposed Project by Phase (Operations and Construction)

Wetland Type[a]	Proposed Project		I-90 Corridor Alternative	
	Construction (acres)	Operations (acres)	Construction (acres)	Operations (acres)
PEM	127.6	55.2	111.7	49.5
PSS	53.3	22.5	41.3	17.6
PFO	7.1	5.0	0.8	0.4
Riv-OW	74.2	37.8	69.6	33.4
Total	262.2	120.5	223.4	100.9

Sources: exp Energy Services Inc. 2012a, 2012b; USFWS 2012; Fry 2011; USGS 2011.

[a] Cowardin et al. 1979; PEM = palustrine emergent; PSS = palustrine scrub-shrub; PFO = palustrine forested; Riv-OW = riverine-open water.

The I-90 Corridor alternative would cross approximately 104 miles more of sensitive wetland regions than the proposed project (see Table 5.2-24).

Table 5.2-24 Wetlands: Comparison of Wetlands Regions Crossed

Wetland Region	Proposed Project	I-90 Corridor Alternative
	(Miles Crossed)	(Miles Crossed)
Prairie Pothole	127	242
Rainwater Basin	96	85
Sand Hills	0	0
Total	223	327

The mitigation measures described for the proposed Project in Section 4.4.3, Potential Impacts, and Section 4.4.4, Recommended Additional Mitigation, would also apply to the I-90 Corridor Alternative. No additional mitigation measures would be required.

5.2.2.5 *Terrestrial Vegetation*

Environmental Setting

The generalized vegetation cover and ecosystems that would be crossed by the I-90 Corridor Alternative are presented in Table 5.2-25. Vegetation communities of some conservation concern that would be crossed by the I-90 Corridor Alternative are shown in Table 5.2-26 and include forest communities, riparian forest, native grasslands, and sagebrush grasslands.

Table 5.2-25 Vegetation: Summary of Estimated Impacts on Vegetation Communities Crossed (Acres)[a]

	Cultivated Crops	Grassland/ Pasture	Upland Forest	Open Water	Forested Wetlands[b]	Emergent Herbaceous Wetlands[b]	Shrub/Scrub	Developed Land	Total
Total Acres Construction									
I-90 Corridor Alternative	3,586	6,071	57	22	43	27	454	2,100	12,360
Proposed Project	3,873	6,983	38	15	63	29	452	214	11,667
Total Acres Operation[c]									
I-90 Corridor Alternative	0	0	26	0	20	0	0	0	46
Proposed Project	0	0	17	0	29	0	0	0	46

Source: National Land Cover Database (Fry et al. 2011).

[a] Data for both alternatives is based on disturbance within a 110-foot construction and the 50-foot operation ROW. Acreage does not include disturbance associated with any ancillary activities outside of the ROWs.
[b] Wetland acreage based on National Land Cover Database and does not reflect the specific data provided in the Wetlands Section 5.2.1.4.
[c] All non-forested areas would be restored to preconstruction conditions.

Table 5.2-26 Vegetation: Estimated Impacts on Vegetation Communities of Conservation Concern[a]

	Forest Communities[b]	Riparian Forest	Native Grasslands	Sagebrush Grasslands[d]
	Acres Impacted	Acres Impacted	Acres Impacted	Acres Impacted
		Total Construction		
I-90 Corridor Alternative	127.8	85.2	4,932.9	740.4
Proposed Project	141.4	85.2	4,679.9	740.4
		Total Operation[e]		
I-90 Corridor Alternative	55.6	39.1	0	0
Proposed Project	63.0	85.2	0	0

Source: USGS GAP Analysis (USGS 2011.

[a] Data for both alternatives is based on disturbance within a 110-foot construction and the 50-foot operation ROW. Acreage does not include disturbance associated with any ancillary activities outside of the ROWs.
[b] Forest communities occur intermittently throughout the route in the state of Nebraska.
[c] Native Grasslands include mixed-grass and tallgrass prairie ecosystems as identified in the GAP Analysis (USGS 2011).
[d] Sagebrush Steppe length and communities crossed based on Inter Mountain Basins Big Sagebrush Steppe Ecosystem layer (USGS 2011).
[e] All non-forested areas would be restored to preconstruction conditions.

Potential Impacts

The I-90 Corridor Alternative and the proposed Project impacts are based on a 110 foot construction ROW created from the centerlines. These ROWs were subsequently analyzed using the 2011 National Land Cover Database (Fry et al. 2011). Table 5.2-25 provides a comparison of the miles crossed and the potential impacts to vegetation that would be associated with the I-90 Corridor Alternative during construction and operation and the proposed Project. Approximately 49 percent of the vegetation impacts from construction would be to grassland/pasture communities. In total, the I-90 Corridor Alternative is approximately 52 miles longer and would result in approximately 677 acres of increased construction impacts to vegetative communities.

The potential construction and operation impacts to the biologically unique landscapes and vegetation communities of conservation concern including native grasslands, Rainwater Basin, sagebrush grasslands, riparian habitats, and forest communities are presented in Table 5.2-26. With the exception of native grasslands, the I-90 Corridor and the proposed Project have very similar impacts to vegetation communities of conservation concern. The I-90 Corridor Alternative would cross approximately 17 more miles of native grassland than the proposed Project.

The mitigation measures described for the proposed Project would also apply to the proposed I-90 Corridor Alternative. No additional mitigation measures would be required.

5.2.2.6 *Wildlife*

Environmental Setting

The I-90 Corridor Alternative spans approximately 927 miles, and crosses areas with a diversity of wildlife including big game animals, small game animals and furbearers, waterfowl and game birds, and many other nongame animals[6] (see Section 3.6, Wildlife) and their associated habitats (see Section 5.2.2.5, Terrestrial Vegetation). Some of these wildlife habitats include threatened and endangered species' habitats, which are discussed below in Section 5.2.2.8, Threatened and Endangered Species. As shown in Table 5.2-25, approximately 29 percent of habitat (3,586 acres) crossed by the I-90 Corridor Alternative has been converted to agricultural land with crops such as soybean, corn, and hay in various phases of production. Approximately 17 percent of habitat (2,100 acres) crossed by the I-90 Corridor Alternative has been converted to various developed land uses.

The big game, small game, and furbearer species; waterfowl and game birds; non-game animals and mammals; raptors and other migratory birds (regulated until the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act); and herpetiles (reptiles and amphibians) found along the I-90 Corridor Alternative are essentially the same as those found along the proposed Project corridor. Similar to the proposed Project, the I-90 Corridor Alternative falls entirely within the Prairie Avifaunal Biome (Rich et al. 2004). Many migratory birds use habitats crossed by the I-90 Corridor Alternative for nesting, migration, and overwintering. A complete list of the species found along both the I-90 Corridor Alternative and the proposed Project is presented in Table 3.6-1 to 3.6.7.

Waterfowl follow distinct, traditional migration corridors or flyways in their annual travels between breeding and wintering areas. The I-90 Corridor Alternative is within the Central Flyway (USFWS 2012). Bird orders and the number of species that may use the areas near the I-90 Corridor Alternative are the same as those that may use the proposed Project as provided in Table 3.6-4, with the addition of 14 more species, which include three ducks, the brown pelican (*Pelecanus occidentalis*), the red-shouldered hawk (*Buteo lineatus*), eight gulls, and the Caspian tern (*Hydroprogn caspia*) (Nebraska Ornithologists Union 2012).

The I-90 Corridor Alternative would cross through three IBAs, as defined by the National Audubon Society (Audubon 2012). The North Valley Grasslands IBA in Montana and the Rainwater Basin IBA in Nebraska would both be affected by the I-90 Corridor and the proposed Project and are described in Section 4.6, Wildlife. The Missouri National Recreational River IBA in Nebraska would only be affected by the I-90 Corridor Alternative. This IBA is a 59-mile-long section of the Missouri River stretching from Gavins Point Dam on the eastern edge of Lewis and Clark Lake to Ponca, Nebraska. Covering over 33,000 acres, this section with its wide, meandering channel, shifting sandbars, and secondary channels contains some of the last forested floodplain and floodplain wetland habitats on the river. The Nebraska side of the river ranges from nearly level floodplain to steep, tree-covered bluffs. Riverbanks vary from flat, sandy beaches to vertical faces 10 to 15 feet high. This landscape has backwater marshes, open

[6] 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 Tables 3.6-2, 3.6-3, 3.6-4, 3.6-5, 3.6-6, and 3.6-7. Where animals discussed in this section are not included in these tables, common names are followed by the scientific name.

sandbars, and cottonwood forests that provide habitat for wildlife. This section of the Missouri River is remarkable for the number of least terns (*Sternula antillarum*) and piping plovers (*Charadrius melodus*) using the sandbars and river areas. According to biologists with the Army Corps of Engineers (USACE), 280 least tern nests were recorded in 2004, representing about half of all tern nests on the Missouri River. In this same year, over 160 piping plover nests were observed. Biologists also report many other species of waterbirds using the river section, such as snow and Canada geese, great blue heron (*Ardea herodias*) and belted kingfisher (*Megaceryle alcyon*), and there are as many as six bald eagle nests present (Audubon Nebraska 2012).

As with the proposed Project, the I-90 Corridor Alternative would also cross three bird conservation regions that are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues, as defined by the U.S. North American Bird Conservation Initiative (USNABCI 2012). These regions are Prairie Potholes (Region 11), which provides breeding and migratory habitat to over 200 species of birds; Badlands and Prairies (Region 17), which is habitat for some of the healthiest populations of high-priority dry-grassland birds; and Central Mixed Grass Prairie (Region 19), which acts as an important spring migration area (USNABCI 2012).

Potential Impacts

Construction of the I-90 Corridor Alternative would have direct and indirect, and temporary (short-term and long-term) and permanent impacts on wildlife resources. Potential wildlife impacts associated with the I-90 Corridor Alternative are essentially the same as for the proposed Project (see Section 4.6, Wildlife) and include fragmentation of wildlife habitat would result from the I-90 Corridor Alternative. The following are wildlife habitat fragmentation issues relevant for pipeline construction and operation:

- Reduction in patch size of remaining available habitats;
- Creation of edge effects;
- Creation of 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).

Additional impacts to wildlife includes direct mortality during construction and operation; indirect mortality due to stress from construction and operations; reduced breeding success from exposure from construction and operation activities; and reduced survival due to overall disruption of habitat and food sources. The I-90 Corridor Alternative would parallel approximately 411 miles of existing developed ROW (i.e., I-90 and the existing Keystone pipeline) so habitat fragmentation would be less for this alternative relative to the proposed Project (Table 5.2-27).

Table 5.2-27 Wildlife: Comparison of the Impacts Associated with the I-90 Corridor Alternative to the Proposed Project.

Resource	I-90 Corridor Alternative	Proposed Project
Big Game	Construction disturbance, habitat fragmentation, noise, human disturbance	Construction disturbance, habitat fragmentation, noise, human disturbance
Small Game and Furbearers	Habitat loss, direct mortality, human disturbance	Habitat loss, direct mortality, human disturbance
Waterfowl and Game Birds	Nesting, feeding, roosting disturbance	Nesting, feeding, roosting disturbance
Non-Game Mammals	Habitat fragmentation	Habitat fragmentation
Raptors and Other Migratory Birds	Nesting, feeding, roosting disturbance	Nesting, feeding, roosting disturbance
Herpetiles	Habitat loss, direct mortality, human disturbance	Habitat loss, direct mortality, human disturbance
Insects	Habitat loss, direct mortality, human disturbance	Habitat loss, direct mortality, human disturbance

Construction of the I-90 Corridor Alternative would result in disturbance of about 12,362 acres of various habitat types, including approximately 6,071 acres of grasslands and rangelands, 57 acres of upland forested habitat, and 70 acres of wetland habitats, including 43 acres of forested wetlands (see Table 5.2-24). Operational impacts would be limited to the permanent easement where maintenance activities would prevent the establishment of trees.

The I-90 Corridor Alternative would cross areas considered important habitats used by wildlife (see Table 5.2-28). Encompassing both public and private lands, these areas include wetland and conservation easements, IBAs, river valleys, and state wildlife areas. Wildlife effects due to the I-90 Corridor Alternative, when compared to the proposed Project, are anticipated to be less. Both of the routes avoid some of the most critical habitat, such as the NDEQ-identified Sand Hills Region. Where the I-90 Corridor Alternative would run parallel to the existing roadway (I-90) through much of South Dakota it is anticipated that long-term wildlife impacts would be minor in this area. Additionally, short-term impacts associated with construction in this area may not be as significant to wildlife since there is already ongoing traffic and noise and nearby development due to the roadway.

The mitigation measures described for the proposed Project would also apply to the proposed I-90 Corridor Alternative. No additional mitigation measures would be required.

Table 5.2-28 Comparison of Wildlife: Important Wildlife Habitats within or near the I-90 Corridor Alternative Area and the Proposed Project

Name	Ownership and Description	Miles in I-90 Corridor Alternative	Miles in Proposed Project
South Dakota			
Lake Andes Wetland Management District	USFWS	0.1	-
Cheyenne River Valley		-	~0.7
White River Valley		-	~0.2
Lake Francis Case	Department of Defense	~0.8	-
James River Valley		~1.0	-
State Wildlife Areas	South Dakota Game, Fish, and Parks	25.7	20.7
Missouri National Recreational River	National Park Service	~0.2	-
Conservation Reserve Program	Private	ND[a]	ND[a]
NRCS Wetlands Reserve Program	NRCS Agreement 667409600C6G	~0.2	-
Nebraska			
Missouri National Recreational River	National Park Service	2.0	-
Logan Creek Valley		<0.1	-
Elkhorn River Valley		~0.1	-
Shell Creek Valley		<0.1	-
Platte River Valley		~0.5	-
Keya Paya River Valley	Various	-	22.4
Niobrara River Valley	Various	-	5.7
Verdigris/Bazile	Various	-	11.4
Loup River Valley	Various	-	5.2
Rainwater Basin	Various	7.5	69.5
Big Blue River Valley		~0.2	-
Conservation Reserve Program	Private	ND[a]	ND[a]

Source: Schneider et al. 2012, National Audubon Society 2012, Keystone 2012.

[a] ND = no data. Conservation Reserve Program data are unavailable at this time.

5.2.2.7 *Fisheries*

Environmental Setting

As a result of the relatively close proximity of the routes, in combination with the broad distributions of these species, the recreational and commercial fish species that occur along the I-90 Corridor Alternative route are essentially the same species that occur along the proposed Project route. These species are listed in Table 3.7-1 and are discussed in more detail in Section 3.7.2.1, Fisheries Resources. Correspondingly, spawning periods and habitats for the recreational and commercial fish species that occur along this alternative route are the same as for the proposed Project route.

Potential Impacts

The types of potential impacts to fisheries for the I-90 Corridor Alternative are essentially the same as for the proposed Project (see Section 4.7, Fisheries) and include increased sedimentation, increased total suspended solids, restriction, or delay of fish movement, water temperature alteration, bank alteration, and reduction of aquatic habitat. Table 5.2-29 provides a comparison of the number of perennial stream crossings with known or potential habitat for

fishes of recreational or commercial value and the anticipated crossing methods that would be used on these streams for both the I-90 Corridor Alternative and the proposed Project. The impacts described in this section apply equally to both construction and operation.

Table 5.2-29 Fisheries: Comparison of the I-90 Corridor Alternative and Proposed Project

Resource Characteristics	Proposed Project	I-90 Corridor Alternative
Perennial Stream Crossings	56	53
Open-cut Crossing Method[a]	43	41
HDD Crossing Method[b]	13	12

[a] Open cut = One of the four open cut methods (non-flowing, flowing, dry flume, or dry dam-and-pump) would be used for these crossings.
[b] The HDD method would be used to cross one intermittent waterbody, Bridger Creek (MP 433.6) that would be crossed by both the Proposed project route and the I-90 Alternative.

It is assumed that one of the open cut crossings on the I-90 Corridor alternative route would be the Lake Francis Case reservoir on the Missouri River. The pipeline would remain parallel to the southern side of I-90 for the lake crossing. The lake is approximately 4,100 feet wide at this location. On the western side of Lake Francis Case, it is assumed that the alternative route would be moved several hundred feet south of the I-90 highway corridor to identified piping plover habitat adjacent to I-90. Lake Francis Case supports large regional recreational fishery. Based on state surveys an estimated 189,985 fish were harvested from the lake in 2009 (Sorensen and Knecht 2010).

Short-term, localized fisheries impacts would result from construction of the I-90 Corridor Alternative and the proposed Project related to noise, increased turbidity, and silt dispersion. No long-term fisheries impacts would be associated with normal operation of this alternative or the proposed Project. An accidental release from the pipeline at a perennial stream crossing would have long-term adverse impacts relative to the size and duration of the release.

The mitigation measures described for the proposed Project would also apply to the proposed I-90 Corridor Alternative. No additional mitigation measures would be required.

5.2.2.8 *Threatened and Endangered Species*

Environmental Setting

In general, the threatened and endangered species that may occur along the I-90 Corridor Alternative would be similar those species potentially affected by the proposed Project. The I-90 Corridor Alternative would cross the Missouri River at two locations—once in South Dakota at Lake Francis Chase, and a second time along the South Dakota/Nebraska border, at the Missouri National Recreational River IBA. Piping plovers (*Charadrius melodus*) (federally threatened species) have been observed at Lake Francis Chase, but not nesting in recent times (USFWS 2002). Piping plovers and least terns (*Sternula antillarum*) (federally endangered species) are known to nest on the sandbars and river areas in the Missouri National Recreational River IBA, and this portion of the IBA is USFWS-designated critical habitat for the piping plover (USFWS 2002).

According to biologists with the USACE, 280 least tern nests were recorded in the Missouri National Recreational River IBA in 2004, representing about half of all tern nests on the Missouri River. In this same year, over 160 piping plover nests were observed. Biologists also report many other species of waterbirds using the river section, such as snow and Canada geese, great blue heron (*Ardea herodias*), belted kingfisher (*Megaceryle alcyon*), and there are as many as six bald eagle (*Haliaeetus leucocephalus*) nests present (Audubon Nebraska 2012). Other protected species that are known to occur in this portion of the Missouri River include the scaleshell mussel (*Leptodea leptodon*) and the pallid sturgeon (*Scaphirhyncus albus*).

The scaleshell mussel is a species that was not expected to occur in the proposed Project ROW, but could occur in the I-90 Corridor Alternative ROW, where the Missouri National Recreational River IBA is located. The scaleshell occurs in medium to large rivers with low to medium gradients. It primarily inhabits stable riffles and runs with gravel or mud substrate and moderate current velocity. The scaleshell requires good water quality, and is usually found where a diversity of other mussel species are concentrated. This species once occurred in 56 rivers in the Mississippi River Drainage, but has undergone a dramatic reduction in its range. Where the I-90 Corridor Alternative would cross the Missouri National Recreational River IBA, survey efforts for the scaleshell mussel have not consistently found this species, indicating that it is very rare in this reach of the Missouri River (USFWS 2010).

Potential Impacts

The I-90 Corridor Alternative would avoid the habitat of the American burying beetle (*Nicrophorus americanus*), a federal- and Nebraska-endangered invertebrate. Unless stated otherwise impacts described in this section apply to both construction and operation.

Species that could be potentially impacted under the proposed Project would also be potentially impacted under the I-90 Corridor Alternative. The following describes ways in which the proposed Project could impact species:

- 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, and from increased human activity;
- Reduced breeding success from exposure to construction and operations noise, and/or from increased human activity;
- Reduced survival or reproduction due to decreased abundance of food species or reduced cover;
- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 4.13, Potential Releases); and
- Direct mortality due to collision with or electrocution by power lines associated pump stations.

As discussed in Section 4.8, Threatened and Endangered Species, the proposed Project would impact a number of species that are protected under federal or state law or are of concern by local, state, or federal agencies (hereafter referred to as *protected species*), but most of these

impacts would be indirect and short-term. Of the thirteen federally protected or candidate species, the American burying beetle was the only species determined to be potentially adversely affected by the proposed Project. However, because the I-90 Corridor Alternative would avoid the currently known range for this species, the I-90 Corridor Alternative would not be expected to have adverse effects on this species.

The major differences in vegetation communities that would be impacted by the I-90 Corridor Alternative compared to the proposed Project include fewer impacts to potential suitable habitat for protected species (approximately 508 miles of impacts compared to the proposed Project's 569 miles of impacts), including grassland/pasture, wetlands, forest, and shrub/scrub, and more impacts to unsuitable habitat for protected species (approximately 419 miles of impacts compared to the proposed Project's 307 miles of impacts), including developed land and cultivated crops (Table 5.2-30, below). More information on the potential impacts to terrestrial vegetation communities resulting from the I-90 Corridor Alternative are provided in Section 5.2.1.5, Terrestrial Vegetation.

Table 5.2-30 Threatened and Endangered Species: Comparison of Potential Protected Species Habitat Crossed (Miles) Under the I-90 Corridor Alternative and the Proposed Project in South Dakota and Nebraska

	Suitable Habitat (Miles)	Percent Suitable Habitat	Unsuitable Habitat (Miles)	Percent Unsuitable Habitat	Total Miles
I-90 Corridor Alternative	508	55%	419	45%	**927**
Proposed Project	569	65%	306	34%	**875**

In particular, the I-90 Corridor Alternative would run alongside I-90 for approximately 147 miles, and near highways, there is a greater percentage of non-native species and human disturbance, which is poor quality habitat for protected species. Therefore, although the I-90 Corridor Alternative is longer (927 mile-length compared to the proposed Project's 875 mile-length), it would pass through less suitable habitat for protected species (see Table 5.2-30, above) and would be expected to have fewer adverse impacts on protected species.

The I-90 Corridor Alternative would cross through federally designated critical habitat for the piping plover along the Missouri River that borders South Dakota and Nebraska (USFWS 2002). It is unknown at this time whether or not HDD would be used at this crossing. HDD would significantly reduce the potential temporary impacts to piping plovers and other protected species present along this river crossing. In particular, as discussed in Section 5.2.2.5, Terrestrial Vegetation, protected species such as the interior least tern, great blue heron, and bald eagle may also be present along this stretch of the Missouri River.

Mitigation measures and consultations with USFWS similar to those described for the proposed Project would be required to minimize potential impacts to all protected species that may be impacted by the project construction and operation activities.

5.2.2.9 *Land Use, Recreation, and Visual Resources*

Environmental Setting

Table 5.2-31 summarizes the land ownership, and Table 5.2-32 summarizes and land use categories that would be crossed by the I-90 Corridor Alternative. Both tables also include similar information for the proposed Project (repeated from Section 3.9, Land Use), for comparison.

Table 5.2-31 Land Use: Land Ownership Comparison of the I-90 Corridor Alternative and Proposed Project by ROW Length

	Existing Land Ownership Status (miles crossed)					
Alternative	**Federal**	**State[a]**	**Local (Public)[b]**	**Private**	**Waterbody[c]**	**Total[d]**
I-90 Corridor Alternative	46.2	56.1	0.4	824.3	NA[e]	927
Percent of Total	4.9%	6.1%	<0.1%	88.9%	NA	100%
Proposed Project	46.4	60.9	2.3	763.6	1.8	875
Percent of Total	5.3%	7.0%	0.3%	87.3%	0.2%	100%
Difference[f]	0.2	4.8	1.9	-60.7	NA	-53.8

Source: USGS 2011.

[a] Includes state highway ROW.
[b] May not include all county road ROW.
[c] For the Proposed Project, includes waterbodies not located on a parcel under federal, state, or local ownership. This information was not available for the I-90 Corridor Alternative, and waterbody crossings in this alternative are assumed to be included in other categories.
[d] totals may not match due to rounding
[e] NA = not applicable.
[f] Proposed Project minus I-90 Corridor Alternative.

Table 5.2-32 Land Use: Comparison of the I-90 Corridor Alternative and Proposed Project by ROW Length

	Land Use Type (miles crossed)					
Alternative	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water/Wetlands**	**Total[b]**
I-90 Corridor Alternative	270.6	148.9	4.3	496.2	7.0	927
Percent of Total	29.2%	16.1%	0.5%	53.5%	0.7%	100%
Proposed Project	344.6	10.2	6.5	505.5	8.2	875
Percent of Total	39.4%	1.1%	0.7%	57.8%	1.0%	100%
Difference[a]	74.0	-138.9	2.1	9.3	1.6	-51.9

Source: USGS 2006.

[a] Proposed Project minus I-90 Corridor Alternative.
[b] Totals may not match due to rounding.

The I-90 Corridor Alternative would be longer overall, and would cross more private land than the proposed Project and it would cross less agricultural land and more developed land than the proposed Project. Much of this additional developed land would be portions of the I-90 ROW and/or developed areas in and near cities and towns along I-90. The I-90 Corridor Alternative would cross the same recreation and special interest areas as the proposed Project. In South Dakota and Nebraska, crossings may occur at different locations, but the types of resources affected would generally be the same. In addition, the I-90 Corridor Alternative would also cross

the Lewis and Clark National Historic Trail in multiple locations in South Dakota and Nebraska (compared to twice for the proposed Project), as well as a portion of the Missouri National Recreational River (on the border between South Dakota and Nebraska), as part of the existing Keystone Pipeline corridor.

The existing visual landscape of the I-90 Corridor Alternative would be the same as the proposed Project from the Canadian border to south-central South Dakota. The land along the remaining portion is more heavily used for agriculture than for rangeland (as is the case for the proposed Project), and would pass closer to developed communities along I-90 (USGS 2006).

Potential Impacts

The impacts of the I-90 Corridor Alternative are generally of the same type as the proposed Project, but differ in intensity. Table 5.2-33 summarizes the acres of land ownership and Table 5.2-34 summarizes the acres of land use that would be affected by the I-90 Corridor Alternative. Both tables also include similar information for the proposed Project (repeated from the Land Use Impacts discussion in Section 4.9, Land Use of the Supplemental EIS), for comparison.

Table 5.2-33 Land Use: Land Ownership Comparison of the I-90 Corridor Alternative and Proposed Project by ROW Area

	Acres of Easement Required (Existing Ownership Type), Construction (Temporary)[a]				
Alternative	**Federal**	**State[c]**	**Local[d]**	**Private**	**Total[e]**
I-90 Corridor Alternative[b]	618.1	753.9	12.4	10,975.6	12,360
Percent of Total	5.0%	6.1%	<0.1%	88.8%	100%
Proposed Project	595.0	723.4	105.0	10,243.6	11,667
Percent of Total	5.1%	6.2%	0.9%	87.7%	100%
Difference[f]	(23.1)	(30.5)	92.6	(732.0)	(693)
	Acres of Easement Required (Existing Ownership Type), Operations (Permanent)				
Alternative	**Federal**	**State[c]**	**Local[d]**	**Private**	**Total[e]**
I-90 Corridor Alternative[b]	241.0	293.8	4.8	4,278.4	4,818
Percent of Total	5.0%	6.1%	<0.1%	88.8%	100%
Proposed Project	275.8	376.5	31.8	4,618.9	5,303
Percent of Total	5.2%	7.1%	0.6%	87.1%	100%
Difference[f]	34.8	82.7	27.0	340.5	485

Source: USGS 2011.

[a] For the I-90 Corridor Alternative, construction acreages are cited from the Final EIS, while operations acreages are estimated based on the difference between construction ROW (110 feet) and operations ROW (50 feet).
[b] The acreage cited here does not include portions of the existing Keystone corridor.
[c] Includes state highway ROW.
[d] May not include all county road ROW.
[e] For the purpose of this screening it is assumed that this Alternative could be co-located with the existing Keystone Pipeline. The permanent Corridor (50 feet) ROW would occupy 25 feet of the existing Keystone Pipeline ROW.
[f] Proposed Project minus I-90 Corridor Alternative.

Table 5.2-34 Land Use: Comparison of the I-90 Corridor Alternative and Proposed Project by ROW Area

	Acres of Easement Required (Existing Land Use), Construction (Temporary)[a]					
Alternative	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water/Wetlands**	**Total[a]**
I-90 Corridor Alternative[b]	3,586.6	2,105.7	56.6	6,519.3	91.8	12,360
Percent of Total	29.0%	17.1%	0.5%	52.7%	0.7%	100%
Proposed Project	4,480.1	525.0	70.0	6,521.8	70.1	11,667
Percent of Total	38.4%	4.5%	0.6%	55.9%	0.6%	100%
Difference[c]	893.5	-1,580.6	13.4	2.5	-21.7	-693.0
	Acres of Permanent Easement Required (Existing Land Use), Operations (Permanent) [a]					
Alternative	**Agriculture**	**Developed**	**Forest**	**Rangeland**	**Water/Wetlands**	**Total[a,d]**
I-90 Corridor Alternative[b]	1,398.1	820.1	25.1	2,540.1	34.6	4,818
Percent of Total	29.0%	17.1%	0.5%	52.7%	0.7%	100%
Proposed Project	2,073.4	100.7	37.1	3,038.6	53.2	5,303
Percent of Total	39.1%	1.9%	0.7%	57.3%	1.0%	100%
Difference[c]	675.3	-719.4	11.0	498.5	18.6	484.0

Source: USGS 2006.

[a] Totals for waterbodies are incorporated into other land use categories, and could not be segregated.
[b] The acreage cited here does not include portions of the existing Keystone corridor.
[c] Proposed Project minus I-90 Corridor Alternative.
[d] For the purpose of this screening it is assumed that this Alternative could be co-located with the existing Keystone Pipeline. The permanent Corridor (50 feet) ROW would occupy 25 feet of the existing Keystone Pipeline ROW.

Compared to the proposed Project, the I-90 Corridor Alignment would affect more developed land (due to the alignment's proximity to I-90 itself, which is considered a developed land use), but less land in other categories. The I-90 Corridor Alternative's effects on recreational resources would largely be the same as for the proposed Project. Additional scenic byway and river crossings would, for the most part, occur close to existing highway or existing Keystone Pipeline crossings of those facilities (e.g., the Missouri Recreational River). There are no state requirements for visual resource management in South Dakota and Nebraska (the states where the two alignments differ); therefore, I-90 Corridor Alternative's impacts on visual resources would also be similar to the proposed Project.

5.2.2.10 *Socioeconomics*

Environmental Setting

The I-90 Corridor Alternative would intersect a total of 33 counties, while the proposed Project would intersect 31. Table 5.2-35 summarizes the key socioeconomic characteristics of the I-90 Corridor Alternative and the proposed Project.

Table 5.2-35 Socioeconomics: Comparison of States and Counties within the I-90 Corridor Alternative and the Project Area

Characteristic	Alternative		
	I-90 Corridor	Proposed Project	Difference[b]
2010 Population[a]	354,237	267,569	86,668
2010 At-Place Employment[a]	232,742	171,826	(60,916)
Property Value (billions)[a]	$35.4	$30.7	($4.7)
Effective Property Tax Rate	1.8%	1.7%	(0.1%)
Road Crossings	790	840	50
Rail Crossings	24	19	(5)

[a] Total for all counties crossed by each alignment.
[b] Proposed Project minus 2011 Steele City Route Alternative.

Population

The affected population along the pipeline corridor for the I-90 Corridor Alternative is substantially higher than for the proposed Project, due to the alternative's length. There are 38 communities within two miles of the I-90 Corridor Alternative, compared to 17 for the proposed Project.

Socioeconomic Conditions

The I-90 Corridor Alternative would intersect counties with substantially higher existing employment in South Dakota and Nebraska. In part, this is because the I-90 Corridor Alternative includes five more urban counties: McCook (part of the Sioux Falls metro area), Davison and Hanson (part of the Mitchell micro area), Yankton (a one-county micro area), and Seward, part of the Lincoln metro area.[7]

Environmental Justice

Compared to the proposed Project, the I-90 Corridor Alternative route contains minority populations in an additional 28 block groups in South Dakota and Nebraska. However, some potentially affected minority and low-income populations under the proposed Project would not be affected under I-90 Corridor Alternative.

Public Services

A total of 73 police/sheriff departments, 111 fire departments, and 38 medical facilities are located in counties crossed by the I-90 Corridor Alternative. This compares to 67 police/sheriff departments, 86 fire departments, and 24 medical facilities for the proposed Project. Appendix O, Socioeconomics, includes a table listing these facilities.

[7] Metropolitan and micropolitan statistical areas are geographic entities defined by the Office of Management and Budget for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics. A metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population. A metro or micro area may contain one or more counties, one or more of which contain the urban core.

Tax Revenues and Property Values

The importance of property tax revenue to local governments is the same under the I-90 Corridor Alternative as under the proposed Project. The I-90 Corridor Alternative includes more *situs* counties in South Dakota and different counties in Nebraska. As a result, total property value in counties affected by the I-90 Corridor is somewhat larger than for the proposed Project, while effective tax rates fall within the same range among the affected counties, as compared to the proposed Project. Appendix O, Socioeconomics, includes a table with the 2010 data on local property taxes for potentially affected counties under the I-90 Corridor Alternative.

Traffic and Transportation

Under the I-90 Corridor Alternative, there would be approximately 790 road crossings and 24 rail crossings. This compares to 840 road crossings and 19 rail crossings under the proposed Project. Compared to the proposed Project, the I-90 Corridor Alternative would cross the same number of roads and railroads in Montana, more roads (257 versus 220) in South Dakota, and fewer roads (235 versus 323) in Nebraska. Most of this difference is in the number of Category I roads (local). The I-90 Corridor Alternative would cross more railroads in South Dakota (9 versus 2) and fewer in Nebraska (10 versus 12) compared to the proposed Project.

Potential Impacts

Table 5.2-36 summarizes some of the key socioeconomic characteristics of the 2011 Steele City Alternative and the proposed Project. The impacts of the alternative are generally of the same type as the proposed Project, but differ slightly in intensity. Those differences are discussed below.

Table 5.2-36 Socioeconomics: Comparison of Selected Socioeconomic Impacts of the I-90 Corridor Alternative and Proposed Project

	Alternative		
Characteristic	**I-90 Corridor Alternative**	**Proposed Project**	**Difference[b]**
Construction Workforce (average annual employment)	4,100	3,900	200
Capital Cost (billions)	$3.0	$3.1	$0.1
Construction Earnings (billions)[a]	$2.10	$2.05	$0.05
GDP (billions)	$3.47	$3.40	$0.07
Property Tax Revenue (millions)	$38.4	$34.5	$3.9

[a] Includes earnings (defined in Section 4.10.3.1, Local Economic Activity) for all industries in the United States as a result of the 2011 Steele City Alternative and proposed Project.
[b] I-90 Corridor Alternative minus Proposed Project.

Population/Housing

Construction of the I-90 Corridor Alternative route would require 5,000-6,000 construction workers for the 1-2 year construction period, the same as for the proposed Project. This number is equivalent to approximately 1.5 percent of the entire population along the I-90 Corridor Alternative route. The workers would be distributed along the alternative route, and would also work on a single pipeline spread for 4-8 months, lessening the effects that the population would have on local areas.

Workers in Montana and northern South Dakota would be housed in construction camps, the same as under the proposed Project. Workers in Nebraska would be housed in existing hotel/motel rooms along the I-90 corridor. There are about 1,665 more hotel rooms along the alternative route than along the proposed Project route (10,956 versus 9,283), and the overall hotel/motel capacity is sufficient to accommodate this workforce.

Local Economic Activity

Definitions of employment and earnings as well as a description of modeling techniques are described in Section 4.10.3.1, Local Economic Activity. The primary difference in the construction cost of the proposed Project and the I-90 Corridor Alternative is the difference in length—the I-90 Corridor Alternative is approximately 45 miles longer. In addition, the I-90 Corridor Alternative does not include a construction camp in Nebraska, and includes one fewer camp in South Dakota. Because the alternative route is longer than the proposed Project, one additional pump station would be required. Net employment (including indirect and induced employment in other parts of the nation) triggered by construction of the I-90 Corridor Alternative would be approximately 900 more than under the proposed Project.

Impacts triggered by construction activities would shift from Nebraska to South Dakota in the I-90 Corridor Alternative, due in part to the location of pipeline facilities and accommodations. In addition, Nebraska has a much larger and more diverse economy than South Dakota; thus the multiplier effects play a more important role in economic impacts

Overall, earnings in the United States would be about $48 million higher under the I-90 Corridor Alternative, compared to the proposed Project, primarily as a result of the increased pipeline miles in the alternative. This represents approximately 2 percent of total earnings for the Alternative.

Economic Indicators of National Interest

Definitions of GSP and GDP as well as their relationship with earnings are described in Section 4.10.3.1, Local Economic Activity. Construction of the I-90 Corridor Alternative would contribute approximately $3.47 billion to GDP, compared to approximately $3.40 billion for the proposed Project.

Environmental Justice

The types of impacts to minority and low-income populations that could occur during construction and operations of the I-90 Corridor Alternative would be the same as described for the proposed Project, which could include increased competition for medical or health services in underserved populations. Under the I-90 Corridor Alternative, 36 block groups and five census tracts with environmental justice populations could potentially be affected by construction activity or by pipeline operations. All geographic areas with minority and/or low-income populations are in counties that are or contain HPSAs and/or MUA/Ps.

Because the exact location of the construction sites, such as contractor yards and pipe storage yards, have not yet been determined, the potential effect of those facilities on the environmental justice populations is unknown. These construction facilities, however, would all be temporary, lasting only a few months during construction, and, therefore, any potential effects on environmental justice populations would be short term. Should the I-90 Corridor Alternative be

recommended, the potential effects would be evaluated based on the then proposed locations during facility siting and design. Appendix O, Socioeconomics, provides information about the HPSAs and MUA/Ps in relation to areas with minority and/or low-income populations[8].

Tax Revenues

During construction, total state sales and use and contractors' excise tax revenue would be higher by about $10 million for the I-90 Corridor Alternative than for the proposed Project. Construction-based taxes from the I-90 Corridor Alternative would be about 30 percent higher in South Dakota than for the proposed Project and about 25 percent lower in Nebraska, with the differences estimated roughly in proportion to differences in the pipeline mileage in each state.

Overall, the I-90 Corridor Alternative would generate more property tax revenue than the proposed Project. However, the I-90 Corridor Alternative would generate less property tax revenue than the proposed Project on a per capita basis ($108 per capita for all pipeline situs counties for the alternative compared to $129 for the proposed Project). Only counties with Keystone XL facilities (pipeline, pump stations, etc.) would receive property taxes associated with the I-90 Corridor Alternative.

Property Values

Impacts to private property values during construction and operation of the I-90 Corridor Alternative would be similar to the proposed Project in character and in the low level of impact, but would occur in different counties under the I-90 Corridor Alternative, as described for property taxes in the preceding paragraphs.

Traffic and Transportation

Impacts on traffic and transportation under the I-90 Corridor Alternative would be similar to those described for the proposed Project. The I-90 Corridor Alternative would cross fewer roads than the proposed Project, but its greater length could require additional work areas and access points. As with the proposed Project, the I-90 Corridor Alternative would create only short-term traffic congestion and delays during construction, and no appreciable impacts on traffic and transportation during operations.

5.2.2.11 *Cultural Resources*

Environmental Setting

Cultural resources surveys have catalogued the existing cultural resources along the I-90 Corridor Alternative from the Canadian border to central South Dakota. No such surveys have been conducted for the remainder of the I-90 Corridor Alternative. In general terms, the cultural resource potential of developed transportation corridors, existing pipeline corridors, and other heavily disturbed areas is normally lower than in undisturbed areas.

[8] Information for HPSAs and MUA/Ps is only available at the county level.

Much of the I-90 Corridor Alternative follows an existing developed highway ROW (I-90) or an existing pipeline corridor (the Keystone Corridor). Accordingly, the potential for intact buried resources along the southern segment of the I-90 Corridor Alternative would be lower, based on the anticipated prevalence of previously disturbed areas within the existing ROW.

Potential Impacts

The I-90 Corridor Alternative's impacts on cultural resources between the Canadian border and central South Dakota—the segment that the alternative shares with the proposed Project—would be the same as for the proposed Project. Because the remaining segment of the I-90 Corridor Alternative follows developed infrastructure corridors, the potential for the existence of intact cultural resources may be lower for this alternative than for the proposed Project. If the I-90 Corridor Alternative was recommended, a complete evaluation of the APE for archaeological sites and historic structures would be required. To the extent this evaluation would identify any archaeological sites or historic structures along the I-90 Corridor Alternative route, avoidance would be recommended for any eligible and unevaluated sites, to the extent practicable. By avoiding these sites, the I-90 Corridor Alternative would have no effect on historic properties. The Department will continue to consult with state and federal agencies and Native American tribes about the significance of sites and work to avoid any adverse effects to the resources, following the protocols outlined in the Programmatic Agreement developed for the proposed Project.

5.2.2.12 *Air Quality and Noise*

Environmental Setting

The portions of the I-90 Corridor Alternative that differ from the proposed Project in South Dakota and Nebraska are rural and their major sources of air pollution and noise are from agricultural activities. Further, these affected areas are located in areas designated as attainment (i.e., areas with good air quality). The low population densities in these affected areas and the lack of industrial facilities are similar to those of the proposed Project, so the existing air quality and noise levels for this alternative are expected to be similar to the proposed Project.

Potential Impacts

Air Quality

Air emissions (criteria pollutants, hazardous air pollutants, and GHGs) from construction of the I-90 Corridor Alternative would be similar but slightly more than that for the proposed Project. This is due to this alternative's longer pipeline length (927 miles) in comparison to the proposed Project (875 miles). Like the proposed Project, this alternative would occur over a short term and temporary period, and, as such, is expected to have a similar but slightly more air quality and GHG impacts (approximately 5 percent increase in emissions) during the construction phase (see Section 4.12.3, Potential Impacts).

During the operational phase, the I-90 Corridor Alternative would generate less than 1 ton per year of fugitive volatile organic compounds and less than 1 metric ton per year of fugitive methane emissions from approximately 70 IMLVs along the pipeline route and from valves, pumps, flanges, and connectors at associated pump stations. These minimal fugitive emissions

(direct emissions) would be similar to those generated by the proposed Project, which has approximately 55 intermediate IMLVs along the pipeline route and the same number of components (valves, pumps, flanges, and connectors) per pump station. Unlike the proposed Project which has 20 pump stations, this alternative has 21 pump stations. The 21 pump stations associated with this alternative would be located in the same e-GRID region as the proposed Project, but would generate slightly higher amount of indirect GHG emissions from electricity consumption due to the slight increase in the number of pump stations (3.35 million metric tons of carbon dioxide equivalent; 5 percent higher than proposed Project). Air emissions associated with refueling construction equipment/vehicles and use of maintenance vehicles (approximately twice per year) and aircraft for aerial inspections (once every two weeks) throughout the operation phase would be negligible. Compared to the proposed Project, this alternative is expected to have similar but slightly higher air quality and GHG impacts during the operational phase (see Section 4.12.3, Potential Impacts).

Noise

The level of noise generated from construction of this alternative would be comparable to the proposed Project because of the similar types of construction equipment and activities, including HDD and blasting. Like the proposed Project, this alternative would generate high noise levels in its immediate vicinity (approximately 79 decibels on the A-weighted scale at 200 feet) over a short term and temporary period, and, as such, is expected to have a similar noise impacts during the construction phase (see Section 4.12.3, Potential Impacts).

During operations, the only source of noise from this alternative would be the pump stations. This alternative has one pump station more than the proposed Project (21 vs. 20 pump stations). Like the proposed Project, each pump station under this alternative has the same number of pump size (3 to 5 pumps per station; each pump rated 6,500 horsepower), so the magnitude of pump station noise from this alternative would be similar to the proposed Project. However, the extent of pump station noise would be greater for this alternative due to the additional pump station. Like the proposed Project, the pump stations for this alternative would be located in rural areas with low population densities. Therefore, the impact of the pump station noise from this alternative would be comparable to the proposed Project during the operation phase (see Section 4.12.3, Potential Impacts).

5.2.2.13 *Climate Change*

Environmental Setting

The I-90 Corridor Alternative is primarily in the same climate regions (Dry Temperate and Prairie) as the proposed Project since the pipeline route crosses the same states. Therefore, the historical climate trends (i.e., temperature changes in the affected states) for this alternative are essentially the same as described for the proposed Project (see Section 4.14.1.1, Historical Climate Trends).

Potential Impacts

The projected construction and operation climate change impact on this alternative is similar to that of the proposed Project because of the similarities in climate regions (see Section 4.14.1.2, Projected Climate Change Effects).

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5.3 COMPARISON OF ALTERNATIVES

This section compares the proposed Project with other reasonable alternatives (Section 5.3.1) and the identified No Action scenarios (Section 5.3.2).

5.3.1 Proposed Project Versus Major Route Alternatives

Table 5.3-1 summarizes the impacts associated with the proposed Project, 2011 Steele City Alternative, and I-90 Corridor Alternative.

Table 5.3-1 Impacts Associated with Proposed Project and Alternatives

	Proposed Project	2011 Steele City Segment Alternative	I-90 Corridor Alternative
New Pipeline Length (miles)	875	854	927
Number of Aboveground Facilities	59	56	90
Length Co-located with Existing Keystone Pipeline (miles)	0	0	254
NDEQ[a]-Identified Sand Hills Region Crossed (miles)	0	90	0
Highly Erodible Soil (Wind) Crossed (miles)	66	116	36
Perennial Waterbody Crossings	56	48	61
Wetland Affected during Construction (acres)	262	544	223
Average Annual Employment During Construction	3,900	3,900	4,100
State Tax Revenues (millions)	$34.5	$34.1	$38.4
Construction Land Area Affected (acres)	11,667	11,387	12,360
Operations (permanent) Land Area Required (acres)	5,303	5,176	4,818

[a] Nebraska Department of Environmental Quality (NDEQ).

The proposed Project would be approximately 21 miles longer than the 2011 Steele City Alternative and therefore would affect more acres of land during construction and operations. The proposed Project route, however, avoids the sensitive Nebraska Department of Environmental Quality (NDEQ)-identified Sand Hills Region, which includes extensive areas of soils susceptible to wind erosion and provides habitat for the American Burying Beetle, which is federally listed as threatened. The proposed Project would cross a few more perennial waterbodies, but would impact fewer wetlands than the 2011 Steele City Alternative.

The proposed Project would be approximately 52 miles shorter than the I-90 Corridor Alternative and therefore would disturb fewer acres of land during construction. Despite being longer, the I-90 Corridor Alternative would require fewer acres of land in permanent easements as it would share approximately 254 miles of the existing Keystone Pipeline right-of-way. Like the proposed Project, the I-90 Corridor Alternative would also avoid the NDEQ-identified Sand Hills Region and would disturb even fewer linear miles of soils susceptible to wind erosion than the proposed Project. The proposed Project would cross fewer perennial waterbodies, but would result in more wetland impacts than the I-90 Corridor Alternative. Most notably, the I-90 Corridor Alternative would require two major crossings of the Missouri River—at Lake Francis Case (an approximately 4,100-foot-long crossing) in South Dakota and at the Missouri National

Recreational River at the South Dakota/Nebraska border. This National Recreational River segment is a designated Important Bird Area by the National Audubon Society and provides U.S. Fish and Wildlife Service-designated critical habitat for the federally threatened piping plovers (*Charadrius melodus*) and habitat for the federally endangered least terns (*Sternula antillarum*).

5.3.2 Proposed Project Versus No Action Scenarios

The Rail/Pipeline and Rail/Tanker Scenarios are very different from the proposed Project in terms of the types of impacts that would result, so it is difficult to do a direct comparison. Crude oil transportation by the Rail/Pipeline and Rail/Tanker Scenarios would primarily differ from the proposed Project in the following ways:

- Releases associated with crude oil loading/unloading of rail cars at new facilities near Lloydminster, Canada; Epping, North Dakota; Stroud, Oklahoma; and Port Rupert, British Columbia, would typically occur within contained areas or to the ground surface, making the releases more readily identifiable and easier to respond to and clean up at the terminals themselves.
- Crude oil releases during rail transportation would be limited to the crude oil volume contained within individual railcars, which would limit the total volume of crude oil that could potentially impact groundwater relative to the proposed Project. This is offset to at least some extent by the increased statistical likelihood of spills associated with these alternative modes of crude oil transport relative to pipelines.
- In terms of total disturbance, the proposed Project would result in approximately 11,667 acres of primarily temporary impacts along a relatively narrow (approximately 110-foot-wide) 875-mile-long corridor. The Rail/Pipeline Scenario would result in more concentrated permanent impacts at the proposed rail loading and off-loading terminals in Lloydminster, Epping, and Stroud, totaling approximately 7,727 acres. The Rail/Tanker Scenario would result in more concentrated permanent impacts at the proposed rail loading and off-loading terminals in Lloydminster, Prince Rupert, Epping, and Stroud, totaling approximately 9,427 acres as the rail lines already exist and no construction would be required for the tanker transport along the Pacific Coast and Gulf of Mexico.

Refer to Section 5.1, No Action Alternatives, for a discussion of the costs associated with these oil transportation scenarios.

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STATE AND LOCAL GOVERNMENT AGENCIES

Kansas

Kansas State Historical Society, KS

Montana

State Historic Preservation Officer (SHPO), Montana Historical Society, Helena, MT
State Archeologist/Deputy SHPO, Montana Historical Society, Helena, MT
Clerk, Fallon County, Baker, MT
Commissioner, Fallon County, Baker, MT
Mayor, City of Baker, Baker, MT
Sheriff, Fallon County, Baker, MT
Superintendent, Baker K-12 Schools, Baker, MT
Representative, Billings, MT
Representative, Box Elder, MT
Representative, Broadus, MT
Representative, Brockway, MT
Senator, Buffalo, MT
Clerk, McCone County, Circle, MT
Mayor, City of Circle, Circle, MT
Sheriff, McCone County, Circle, MT
Superintendent, Circle Public Schools, Circle, MT
Commissioner, Phillips County, Dodson, MT
Superintendent, Dodson Public Schools, Dodson, MT
Superintendent, Landusky Elementary, Dodson, MT
Commissioner, Prairie County, Fallon, MT
Superintendent, Frazer Public Schools, Frazer, MT
Superintendent, Lustre Christian High, Frazer, MT
Commissioner, Valley County, Ft. Peck, MT
Clerk, Valley County, Glasgow, MT
Commissioner, Valley County, Glasgow, MT
Senator, Glasgow, MT
Sheriff, Valley County, Glasgow, MT
Superintendent, Glasgow K-12 Schools, Glasgow, MT
Mayor, City of Glasgow, Glasgow, MT
Clerk, Dawson County, Glendive, MT
Commissioner, Dawson County, Glendive, MT
Mayor, City of Glendive, Glendive, MT
Representative, Glendive, MT
Sheriff, Dawson County, Glendive, MT
Superintendent, Glendive Public Schools, Glendive, MT
Chief Business Development Officer, Governor's Office of Economic Development, Helena, MT
Chief of Staff, Helena, MT
Commissioner, Montana Public Service Commission, Helena, MT
Governor, Helena, MT
Vice Chairman, Montana Public Service Commission, Helena, MT
Lt. Governor, Helena, MT
Commissioner, Valley County, Hinsdale, MT
Superintendent, Hinsdale Public Schools, Hinsdale, MT
Commissioner, Fallon County, Ismay, MT
Commissioner, McCone County, Lindsay, MT
Clerk, Phillips County, Malta, MT
Mayor, City of Malta, Malta, MT
Sheriff, Phillips County, Malta, MT
Malta K-12 Schools, Malta, MT
Mayor, City of Nashua, Nashua, MT
Superintendent, Nashua K-12 Schools, Nashua, MT
Mayor, City of Opheim, Opheim, MT
Superintendent, Opheim K-12 Schools, Opheim, MT
Senator, Otter, MT
Mayor, City of Plevna, Plevna, MT
Superintendent, Plevna K-12 Schools, Plevna, MT
Representative, Poplar, MT
Senator, Poplar, MT
Superintendent, Richey Public Schools, Richey, MT
Representative, Roundup, MT
Mayor, City of Saco, Saco, MT
Representative, Saco, MT

Superintendent, Saco Public Schools, Saco, MT
Senator, Sidney, MT
Commissioner, Prairie County, Terry, MT
Public Administrator, Prairie County, Terry, MT
Sheriff, Prairie County, Terry, MT
Superintendent, Terry K-12 Schools, Terry, MT
Commissioner, McCone County, Vida, MT
Commissioner, Phillips County, Whitewater, MT
Superintendent, Whitewater K-12 Schools, Whitewater, MT
Mayor, City of Wolf Point, Wolf Point, MT
Commissioner, McCone County, Brockway, MT
Public Service Commission, Helena, MT

Nebraska

SHPO, Nebraska State Historical Society, Lincoln, NE
Clerk, Boone County, Albion, NE
Commissioner, Boone County, Albion, NE
Sheriff, Boone County, Albion, NE
Commissioner, Holt County, Atkinson, NE
Superintendent, West Holt Public Schools, Atkinson, NE
Clerk, Hamilton County, Aurora, NE
Commissioner, Hamilton County, Aurora, NE
Sheriff, Hamilton County, Aurora, NE
Chairman, Village of Ericson, Bartlett, NE
Chairman, Village of Bartlett, Bartlett, NE
Clerk, Wheeler County, Bartlett, NE
Commissioner, Wheeler County, Bartlett, NE
Sheriff, Wheeler County, Bartlett, NE
Superintendent, Wheeler Central Schools, Bartlett, NE
Clerk, Rock County, Bassett, NE
Commissioner, Rock County, Bassett, NE
Sheriff, Rock County, Bassett, NE
Superintendent, Rock County Public Schools, Bassett, NE
Commissioner, Hamilton County, Bradshaw, NE
Clerk, Garfield County, Burwell, NE
Commissioner, Garfield County, Burwell, NE
Sheriff, Garfield County, Burwell, NE
Commissioner, Boone County, Cedar Rapids, NE
Commissioner, Nance County, Cedar Rapids, NE
Superintendent, Cedar Rapids Public Schools, Cedar Rapids, NE
Clerk, Merrick County, Central City, NE
Commissioner, Merrick County, Central City, NE
Sheriff, Merrick County, Central City, NE
Superintendent, Central City Public Schools, Central City, NE
Superintendent, Chambers Public Schools, Chambers, NE
Commissioner, Merrick County, Chapman, NE
Commissioner, Saline County, Crete, NE
Superintendent, Meridian Public Schools, Daykin, NE
Superintendent, Tri County Public Schools, Dewitt, NE
Commissioner, Saline County, Dorchester, NE
Commissioner, Holt County, Emmet, NE
Commissioner, Holt County, Ewing, NE
Superintendent, Exeter-Milligan Public Schools, Exeter, NE
Clerk, Jefferson County, Fairbury, NE
Commissioner, Jefferson County, Fairbury, NE
Sheriff, Jefferson County, Fairbury, NE
Superintendent, Fairbury Public Schools, Fairbury, NE
Superintendent, Friend Public Schools, Friend, NE
Clerk, Nance County, Fullerton, NE
Commissioner, Nance County, Fullerton, NE
Mayor, City of Fullerton, Fullerton, NE
Sheriff, Nance County, Fullerton, NE
Superintendent, Fullerton Public Schools, Fullerton, NE

Clerk, Fillmore County, Geneva, NE
Commissioner, Fillmore County, Geneva, NE
Sheriff, Fillmore County, Geneva, NE
Commissioner, Nance County, Genoa, NE
Chairman, Village of Greeley, Greeley, NE
Clerk, Greeley County, Greeley, NE
Commissioner, Greeley County, Greeley, NE
Sheriff, Greeley County, Greeley, NE
Superintendent, Greeley-Wolbach Public Schools, Greeley, NE
Commissioner, York County, Henderson, NE
Superintendent, Heartland Community Schools, Henderson, NE
Chairman, Village of Hordville, Hordville, NE
Chief of Staff, Lincoln, NE
Director, Nebraska Policy Research, Lincoln, NE
Governor, Lincoln, NE
Lt. Governor, Lincoln, NE
Senator, Lincoln, NE
Chairman, Village of McCool Junction, McCool Junction, NE
Superintendent, McCool Junction Public Schools, McCool Junction, NE
Chairman, Village of Milligan, Milligan, NE
Commissioner, Keya Paha County, Mills, NE
Chairperson, Village of Newport, Newport, NE
Clerk, Holt County, O'Neill, NE
Commissioner, Holt County, O'Neill, NE
Sheriff, Holt County, O'Neill, NE
Commissioner, Merrick County, Palmer, NE
Commissioner, Nance County, Palmer, NE
Commissioner, Boone County, Petersburg, NE
Commissioner, Jefferson County, Plymouth, NE
Congressman, Scottsbluff, NE
Governor, Scottsbluff, NE
Commissioner, Merrick County, Silver Creek, NE
Commissioner, Nance County, Silver Creek, NE
Chairperson, Village of Burton, Springview, NE
Clerk, Keya Paha County, Springview, NE
Commissioner, Keya Paha County, Springview, NE
Sheriff, Keya Paha County, Springview, NE
Superintendent, Keya Paha County Schools, Springview, NE
Chariman, Village of Steele City, Steele City, NE
Commissioner, Holt County, Stuart, NE
Superintendent, Stuart Public Schools, Stuart, NE
Chairman, Village of Tobias, Tobias, NE
Commissioner, Keya Paha County, Valentine, NE
Senator, Valentine, NE
Commissioner, York County, Waco, NE
Chairman, Village of Western, Western, NE
Sr. V.P. Transmission Tri-State, Westminster, NE
Clerk, Saline County, Wilber, NE
Senator, Wilber, NE
Sheriff, Saline County, Wilber, NE
Clerk, York County, York, NE
Commissioner, York County, York, NE
Mayor, City of York, York, NE
Sheriff, York County, York, NE
Superintendent, York Public Schools, York, NE
State Historic Preservation Officer, Nebraska State Historical Society, NE

South Dakota

SHPO, South Dakota State Historical Society, Pierre, SD
Auditor, Butte County, Belle Fourche, SD
Commissioner, Butte County, Belle Fourche, SD
Mayor, City of Belle Fourche, Belle Fourche, SD
Sheriff, Butte County, Belle Fourche, SD
Representative, Belvidere, SD
Auditor, Perkins County, Bison, SD
Board President, City of Bison, Bison, SD

Commissioner, Perkins County, Bison, SD
Sheriff, Perkins County, Bison, SD
Superintendent, Bison School District, Bison, SD
Commissioner, Meade County, Black Hawk, SD
Auditor, Harding County, Buffalo, SD
Board President, City of Buffalo, Buffalo, SD
Commissioner, Harding County, Buffalo, SD
Sheriff, Harding County, Buffalo, SD
Superintendent, Harding County Public Schools, Buffalo, SD
Senator, Burke, SD
Commissioner, Harding County, Camp Crook, SD
Commissioner, Tripp County, Colome, SD
Commissioner, Tripp County, Dallas, SD
Commissioner, Jones County, Draper, SD
Representative, Eagle Butte, SD
Superintendent, Faith School District, Faith, SD
Commissioner, Tripp County, Hamill, SD
Senator, Hermosa, SD
Commissioner, Meade County, Howes, SD
Representative, Ideal, SD
Senator, Isabel, SD
Superintendent, Kadoka Area School District, Kadoka, SD
Auditor, Lyman County, Kennebec, SD
Commissioner, Lyman County, Kennebec, SD
Sheriff, Lyman County, Kennebec, SD
Mayor, City of Lemmon, Lemmon, SD
Commissioner, Perkins County, Lemmon, SD
Commissioner, Perkins County, Lemmon, SD
Commissioner, Perkins County, Meadow, SD
Board President, City of Midland, Midland, SD
Commissioner, Haakon County, Midland, SD
Commissioner, Haakon County, Milesville, SD
Larry Lucas, Representative, Mission, SD
Auditor, Jones County, Murdo, SD
Commissioner, Jones County, Murdo, SD
Mayor, City of Murdo, Murdo, SD
Sheriff, Jones County, Murdo, SD
Superintendent, Jones School District, Murdo, SD
General Manager, West River/Lyman Jones RWS, Inc. Murdo, SD
Commissioner, Butte County, Newell, SD
Representative, Nisland, SD
Zimmer, Duncan & Cole, Parker SD
Auditor, Haakon County, Phillip, SD
Commissioner, Haakon County, Phillip, SD
Sheriff, Haakon County, Phillip, SD
Superintendent, Haakon School District, Phillip, SD
Commissioner, Meade County, Piedmont, SD
Chief of Staff, Pierre, SD
Director—Legislative Affairs & Special Projects, Pierre, SD
Governor, Pierre, SD
Representative, Pierre, SD
Senator, Pierre, SD
Representative, Pine Ridge, SD
Commissioner, Perkins County, Prairie City, SD
Representative, Prairie City, SD
Commissioner, Lyman County, Presho, SD
Commissioner, Harding County, Ralph, SD
Auditor, Pennington County, Rapid City, SD
Commissioner, Pennington County, Rapid City, SD
Representative, Rapid City, SD
Sheriff, Pennington County, Rapid City, SD
Commissioner, Lyman County, Reliance, SD
Commissioner, Harding County, Reva, SD
Auditor, Meade County, Sturgis, SD
Commissioner, Meade County, Sturgis, SD
Senator, Sturgis, SD
Sheriff, Meade County, Sturgis, SD

Superintendent, Meade School District, Sturgis, SD
Commissioner, Lyman County, Vivian, SD
Representative, Vivian, SD
Representative, Wall, SD
Commissioner, Pennington County, Wall, SD
Auditor, Tripp County, Winner, SD
Commissioner, Tripp County, Winner, SD
Mayor, City of Winner, Winner, SD
Sheriff, Tripp County, Winner, SD
Superintendent, Winner School District, Winner, SD
Commissioner, Tripp County, Winner, SD

LIBRARIES

Kansas

Kansas Clay Center Carnegie Library, Clay Center, KS
Potwin Public Library, Potwin, KS

Montana

Dodson Branch Library, Dodson, MT
Fallon County Library, Baker, MT
George McCone Memorial County Library, Circle, MT
Glasgow City County Library, Glasgow, MT
Glendive Public Library, Glendive, MT
Opheim Community Library, Opheim, MT
Phillips County Library, Malta, MT
Prairie County Library, Terry, MT
Richey Public Library, Richey, MT
Saco Branch Library, Saco, MT
Sharidan County Library, Plentywood, MT

Nebraska

Albion Public Library, Albion, NE
Alice M. Farr Library, Aurora, NE
Atkinson Public Library, Atkinson, NE
Brunswick Public Library, Brunswick, NE
Cedar Rapids Public Library, Cedar Rapids, NE
Central City Public Library, Central City, NE
Clarks Public Library, Clarks, NE
Clearwater Public Library, Clearwater, NE
Crete Public Library, Crete, NE
Davies Memorial Library, Butte, NE
Daykin Public Library, Daykin, NE
De Witt Public Library, De Witt, NE
Dorchester Public Library, Dorchester, NE
Dvoracek Memorial Library, Wilber, NE
Elgin Public Library, Elgin, NE
Ewing Public Library, Ewing, NE
Exeter Public Library, Exeter, NE
Fairbury Public Library, Fairbury, NE
Fairmount Public Library, Fairmount, NE
Fullerton Public Library, Fullerton, NE
Garfield County Library, Burwell, NE
Geneva Public Library, Geneva, NE
Genoa Public Library, Genoa, NE
Gilbert Public Library, Friend, NE
Giltner Public Library, Giltner, NE
Greeley Public Library, Greeley, NE
Gresham Public Library, Gresham, NE
Keya Paha County Library, Springview, NE
Kilgore Memorial Library, York, NE
Milligan Public Library, Milligan, NE
Neligh Public Library, Neligh, NE
Newman Grove Public Library, Newman Grove, NE
O'Neill Public Library, O'Neill, NE
Orchard Public Library, Orchard, NE
Osceloa Library, Osceloa, NE
Palmer Public Library, Palmer, NE
Pastfinder Library, Crete, NE
Perkins Library, Crete, NE
Petersburg Public Library, Petersburg, NE
Plymouth Public Library, Plymouth, NE
Primrose Public Library, Primrose, NE
Rock County Public Library, Bassett, NE
Saint Edward Public Library, St Edward, NE
Scotia Public Library, Scotia, NE
Silver Creek Public Library, Silver Creek, NE
Spalding Public Library, Spalding, NE
Spencer Township Library, Spencer, NE
Springview Public Library, Springview, NE
Stromsburg Public Library, Stromsburg, NE
Struckman-Baatz Public Library, Western, NE
Stuart Township Library, Stuart, NE
Sutton Public Library, Sutton, NE
Tilden Public Library, Tilden, NE
Tobias Public Library, Tobias, NE
Virgil Biegert Public Library, Shickley, NE
Wolbach Library, Wolbach, NE

North Dakota

Bowman Regional Public Library, Bowman, ND

South Dakota

Belle Fourche Public Library, Belle Fourche, SD
Bison Public Library, Bison, SD
Colome Branch Library, Colome, SD

Faith Public Library, Faith, SD
General Beadle Elementary School and Library, Rapid City, SD
Haakon County Public Library, Philip, SD
Hill City Public Library, Hill City, SD
Kennebec Public Library, Kennebec, SD
Keystone Town Library, Keystone, SD
Lemmon Public Library, Lemmon, SD
Midland Community Library, Midland, SD
Newell Public Library, Newell, SD
Northwest Regional Library, Buffalo, SD
Presho Public Library, Presho, SD
Rapid City Public Library, Rapid City, SD
Rawlins Municipal Library, Pierre, SD
South Dakota State Library, Pierre, SD
Sturgis Public Library, Sturgis, SD
Tripp County Library, Winner, SD
Wall Community Library, Wall, SD

MEDIA

Kansas

Abilene Reflector-Chronicle, Abilene, KS
KABI-AM, Abilene, KS
KSAJ-FM, Abilene, KS
Andover Journal Advocate, Andover, KS
Arkansas City Traveler, Arkansas City, KS
KSOK-AM, Arkansas City, KS
Augusta Daily Gazette, Augusta, KS
Nemaha County Journal-Leader, Centralia, KS
KCLY-FM, Clay Center, KS
KFRM-AM, Clay Center, KS
The Clay Center Dispatch, Clay Center, KS
The El Dorado Times, El Dorado, KS
Hiawatha World, Hiawatha, KS
Hillsboro Star Journal, Hillsboro, KS
Horton Headlight, Horton, KS
Marion County Record, Marion, KS
Marysville Advocate, Marysville, KS
Sabetha Herald, Sabetha, KS
Seneca Courier Tribune, Seneca, KS
Kansas Agriculture Network/Kansas Information Network, Topeka, KS
KDVV-FM, Topeka, KS
KJTY-FM, Topeka, KS
KMAJ-FM, Topeka, KS
KSNT-TV, Topeka, KS
KSNT-TV, Topeka, KS
KTOP-AM, Topeka, KS
KTPK-FM, Topeka, KS
KTWU-TV, Topeka, KS
The Associated Press, Topeka, KS
The Topeka Capital-Journal, Topeka, KS
The Topeka Capital-Journal Online, Topeka, KS
The Topeka Metro News, Topeka, KS
WIBW-AM, Topeka, KS
WIBW-TV, Topeka, KS
Washington County News, Washington, KS
KAKE-TV, Wichita, KS
KFDI-FM, Wichita, KS
KFH-FM, Wichita, KS
KMUW-FM, Wichita, KS
KPTS-TV, Wichita, KS
KQAM-AM, Wichita, KS
KRBB-FM, Wichita, KS
KSAS-TV, Wichita, KS
KSGL-AM, Wichita, KS
KSNW-TV, Wichita, KS
KZCH-FM, Wichita, KS
KZSN-FM, Wichita, KS
The Associated Press, Wichita, KS
The Wichita Eagle, Wichita, KS
KKLE-AM, Winfield, KS
KSWC-FM, Winfield, KS
Winfield Daily Courier, Winfield, KS

Maryland

WMAR-TV - Channel 2, Baltimore, MD
WBAL TV Channel 11, Baltimore, MD
WMPT - Channel 22, Owings Mills, MD
WOL 1450 AM, Lanham, MD
WIHT 99.5 FM, Rockville, MD
WBIG 100.3 FM, Rockville, MD

Montana

Fallon County Times, Baker, MT
Billings Gazette, Billings, MT
Billings Outpost, Billings, MT
Billings Times, Billings, MT
KBLG 910 AM, Billings, MT
KBUL 970 AM, Billings, MT
KTVQ TV 2 (CBS) , Billings, MT
KULR TV 8 (NBC), Billings, MT
KFBB, Helena, MT
KGR Radio, Helena MT
KMTF, Helena, MT
KMTX Radio, Helena MT
KNEH Radio, Helena MT
Helena Civic Television, Helena MT
Helena Independent Record, Helena, MT
KXLH TV Helena, MT
Yellowstone Public Radio, Billings, MT
Circle Banner, Circle, MT
Glasgow Courier, Glasgow, MT
KLTZ & KLAN, Glasgow, MT
Ranger-Review, Glendive, MT
Ranger-Review, Glendive, MT
Great Falls Tribune, Great Falls, MT
KRTV TV 3 (CBS), Great Falls, MT
Prairie Star, Great Falls, MT

Phillips County News, Malta, MT
Sheridan County News, Plentywood, MT
The Terry Tribune, Terry, MT

Nebraska

Beatrice Daily Sun, Beatrice, NE
The Burwell Tribune, Burwell, NE
Cedar County News, Hartington, NE
Colfax County Press, Clarkson, NE
Columbus Telegram, Columbus, NE
David City Banner Press, David City, NE
Fairbury Journal News, Fairbury, NE
Cedar County News, Hartington, NE
KBRL High Plains Radio, McCook, NE
KETV, Omaha, NE
KFAB 1110 News Radio, Omaha, NE
KFOR Radio/KX 96.9, Lincoln, NE
KFXL Fox Nebraska, Kearney, NE
KGFW 1340 AM, Tri-Cities
KGIN, Grand Island, NE
KHAS-TV, Hastings, NE
KIOS FM, Omaha, NE
KKAR 1290, Omaha, NE
KLIN News Talk 1400, Lincoln NE
KLKN-TV, Lincoln, NE
KMTV, Omaha, NE
KNCY 103.1 FM 1600 AM, Nebraska City, NE
KOLN, Lincoln, NE
KQCH-FM, Omaha, NE
KRGI FM Country 96, Grand Island, NE
The Lincoln Journal Star, Lincoln, NE
Milford Times, Milford, NE
Norfolk Daily News, Norfolk, NE
Omaha World-Herald, Omaha, NE
Seward County Independent, Seward, NE
South Sioux City Star, South Sioux City, NE
Stanton Register, Stanton, NE
WOWT, Omaha, NE
Wilber Republican, Wilber, NE
York News-Times, York, NE

South Dakota

Aberdeen American News, Aberdeen, SD
AberdeenNews.com, Aberdeen, SD
KSDN-AM/KGIM-AM, Aberdeen, SD
KSDN-FM, Aberdeen, SD
Alcester Union, Alcester, SD
Belle Fourche Post, Belle Fourche, SD
Beresford Republic, Beresford, SD
Bridgewater Tribune, Bridgewater, SD
Britton Journal and Britton Langford Bugle, Britton, SD
Nation's Center News, Buffalo, SD
Canistota Clipper, Canistota, SD
Canova Herald, Canova, SD
Centerville Journal, Centerville, SD
Clark County Courier, Clark, SD
KMEG-TV, Dakota Dunes, SD
De Smet News, De Smet, SD
The Leader Courier, Elk Point, SD
Faith Independent Newspaper, Faith, SD
Groton Independent, Groton, SD
Miner County Pioneer, Howard, SD
Huron Plainsman, Huron, SD
Lennox Independent, Lennox, SD
Marion Record, Marion, SD
Parker New Era, Parker, SD
Parkston Advance, Parkston, SD
The Pioneer Review, Philip, SD
Lyman County Herald, Presho, SD
KEVN-TV, Rapid City, SD
KOTA Radio and Television, Rapid City, SD
Rapid City Journal, Rapid City, SD
Salem Special, Salem, SD
Argus Leader, Sioux Falls, SD
Argus Leader Online, Sioux Falls, SD
Good Morning Dakota, Sioux Falls, SD
KAUR-FM, Sioux Falls, SD
KCLO-TV, Sioux Falls, SD
KDLT-TV, Sioux Falls, SD
KMXC-FM, Sioux Falls, SD
KNWC-AM, Sioux Falls, SD
KRSD-FM, Sioux Falls, SD
KSFY-TV, Sioux Falls, SD
KTWB-FM, Sioux Falls, SD
KWSN-AM, Sioux Falls, SD
KXRB-AM, Sioux Falls, SD
Midday News, Sioux Falls, SD
Morning News, Sioux Falls, SD
The 10PM News, Sioux Falls, SD
The 10PM News, Sioux Falls, SD
The 6PM News, Sioux Falls, SD

KBHE-FM, Vermillion, SD
KESD-TV, Vermillion, SD
KUSD-FM, Vermillion, SD
Plain Talk, Vermillion, SD
Webster Reporter & Farmer, Webster, SD
KVHT-FM/KVIA-AM, Yankton, SD
KYNT, Yankton, SD
Yankton Press & Dakotan, Yankton, SD

Virginia

Washington Business Journal, Arlington, VA
WJLA - TV Channel 7, Arlington, VA
WETA TV Channel 26, Arlington, VA

Washington DC

Washington Post, Washington DC
Washington Times, Washington DC
Washington Examiner, Washington DC
Washington City Paper, Washington DC
Roll Call, Washington DC
Voice of the Hill, Washington DC
WRC-TV - Channel 4, Washington DC
WTTG Fox - Channel 5, Washington DC
WUSA-Channel 9, Washington DC
WTOP 103.5 FM, Washington DC
WAMU 88.5 FM American University Radio, Washington DC
WHUR 96.3, Washington DC
MIX 107.3 FM –WRQX, Washington DC
WMAL 630 AM, Washington DC

TRIBES

Absentee-Shawnee Tribe of Indians of Oklahoma
Alabama-Coushatta Tribes of Texas
Apache Tribe of Oklahoma
Arapahoe Tribe of the Wind River Reservation, Wyoming (Northern Arapaho Tribe)
Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana (Fort Peck Tribes)
Blackfeet Tribe of the Blackfeet Indian Reservation of Montana
Cherokee Nation, Oklahoma
Cheyenne and Arapaho Tribes, Oklahoma
Cheyenne River Sioux Tribe of the Cheyenne River Reservation, South Dakota
Chippewa-Cree Indians of the Rocky Boy's Reservation, Montana
Confederated Salish and Kootenai Tribes of the Flathead Indian Nation, Montana
Crow Creek Sioux Tribe of the Crow Creek Reservation, South Dakota
Crow Tribe of Montana
Delaware Tribe of Indians, Oklahoma
Eastern Band of Cherokee Indians of North Carolina
Flandreau Santee Sioux Tribe of South Dakota
Fort Belknap Indian Community of the Fort Belknap Reservation of Montana (Gros Ventre and Assiniboine Tribe of Ft. Belknap)
Hannahville Indian Community, Michigan
Ho-Chunk Nation of Wisconsin
Iowa Tribe of Oklahoma
Jena Band of Choctaw Indians, Louisiana
Kaw Nation, Oklahoma
Kialegee Tribal Town, Oklahoma
Kickapoo Traditional Tribe of Texas
Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas
Kiowa Indian Tribe of Oklahoma
Lower Brule Sioux Tribe of the Lower Brule Reservation, South Dakota
Lower Sioux Indian Community in the State of Minnesota
Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan (Gun Lake Potawatomi)
Mille Lacs Band of Minnesota Chippewa Tribes, Minnesota
Modoc Tribe of Oklahoma
Nez Perce Tribe, Idaho
Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana
Nottawaseppi Huron Band of the Potawatomi, Michigan (Huron Potawatomi Nation)
Oglala Sioux Tribe of the Pine Ridge Reservation, South Dakota
Omaha Tribe of Nebraska
Osage Nation, Oklahoma
Otoe-Missouria Tribe of Indians, Oklahoma
Pawnee Nation of Oklahoma
Poarch Band of Creek Indians of Alabama
Pokagon Band of Potawatomi Indians of Michigan and Indiana
Ponca Tribe of Indians of Oklahoma
Ponca Tribe of Nebraska
Prairie Band of Potawatomi Nation, Kansas
Red Lake Band of Chippewa Indians, Minnesota
Rosebud Sioux Tribe of the Rosebud Indian Reservation, South Dakota
Sac & Fox Nation of Missouri in Kansas and Nebraska
Sac & Fox Nation, Oklahoma
Sac and Fox Tribe of the Mississippi in Iowa
Santee Sioux Nation, Nebraska
Shakopee Mdewakanton Sioux Community of Minnesota
Shoshone Tribe of the Wind River Reservation, Wyoming (Eastern Shoshone Tribe)
Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho
Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, South Dakota

Southern Ute Indian Tribe of the Southern Ute Reservation, Colorado
Spirit Lake Tribe, North Dakota
Standing Rock Sioux Tribe of North and South Dakota
Thlopthlocco Tribal Town, Oklahoma
Three Affiliated Tribes of the Fort Berthold Reservation, North Dakota
Tonkawa Tribe of Indians of Oklahoma
Turtle Mountain Band of Chippewa Indians of North Dakota
Upper Sioux Community, Minnesota
Ute Indian Tribe of the Uintah and Ouray Reservation, Utah (Ute Indian Tribe, Northern Ute Tribe)
Ute Mountain Tribe of the Ute Mountain Reservation, Colorado, New Mexico, Utah
Wichita and Affiliated Tribes (Wichita, Keechi, Waco, and Tawakonie), Oklahoma
Yankton Sioux Tribe of South Dakota
Ysleta del Sur Pueblo of Texas

OTHER INTERESTED PARTIES

National Wildlife Federation Public Lands Advocacy
Friends of the Earth
Bold Nebraska
American Wind Energy Association
Theodore Roosevelt Conservation Partnership
Natural Resources Defense Council
Kansas State Historical Society
Oregon-California Trails Association
American Wildlands
Audubon Society
Earth Justice Legal Defense Fund, Inc.
Foundation for Research of Economics and the Environment
Montana Petroleum Association
Montana Trout Unlimited
Montana Wilderness Association
Montana Wilderness Society
Montana Wildlife Federation
Northern Plains Resource Council
Keystone Conservation
Predator Conservation Alliance
Rocky Mountain Elk Foundation
Sierra Club
The Nature Conservancy
Wilderness Watch
Ducks Unlimited
Central Platte Natural Resources District
Little Blue Natural Resources District
Lower Big Blue Natural Resources District
Lower Loup Natural Resources District
Lower Niobrara Natural Resources District
National Resource Conservation Service
Nebraska Soil and Water Conservation Foundation
Nebraska Wildlife Federation
The Nebraska Environmental Trust
Upper Big Blue Natural Resources District
Upper Elkhorn Natural Resources District
Dell Rapids Society for Historic Preservation
South Dakota Wildlife Federation
Public Lands Foundation

8.0 INDEX

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