4.0 ALTERNATIVES

Consistent with NEPA, DOS and the cooperating agencies conducted an analysis of alternatives to the proposed Project. The alternatives were developed based on the purpose and need for the proposed Project as discussed in Section 1.2. The alternatives analysis relied on information provided to agencies in the presidential permit and MFSA applications (including supplemental submittals), information and suggestions provided during scoping for the EIS and during the public comment period on the draft EIS, and information obtained through research and analyses conducted by DOS and its third-party contractor.

The alternatives analysis included a screening process that first considered a range of categories of potential alternatives. The categories of alternatives considered included:

- No Action Alternative (Section 4.1) − addresses projected beneficial and adverse environmental, social, and economic impacts that would result if the proposed Project were not implemented;
- System Alternatives (Section 4.2) − the use of other pipeline systems or other methods of providing heavy crude oil to the Cushing tank farm (PADD II) and the U.S. Gulf Coast market (PADD III);
- Major Route Alternatives and Route Variations (Section 4.3) − other potential pipeline routes for transporting heavy crude oil from the U.S./Canada border to the Cushing Tank Farm (PADD II) and the U.S. Gulf Coast Market (PADD III), and minor route adjustments along the proposed Project route;
- Alternative Pipeline Designs (Section 4.4) − aboveground installation of the pipeline and alternate pipeline diameters; and
- Alternative Sites for Aboveground Facilities (Section 4.5) − alternative sites for pump stations, MLVs, and the tank farm.

The alternatives analysis presented in the draft EIS was revised based on comments on the draft EIS and updated information or information unavailable at the time the draft EIS was issued. This information includes the recent EnSys Energy and Systems, Inc. report (EnSys 2010) on the need for the proposed Project and the relationship of the proposed Project to production of crude oil from the Canadian oil sands. DOE contracted EnSys to evaluate different WSCB crude oil transportation scenarios through 2030. DOE contracted the study to assist DOS in better understanding the potential impacts of the presence or absence of the proposed Project on U.S. refining and petroleum imports, international markets, and production of crude oil from the WCSB. The EnSys (2010) report is presented as Appendix V of this EIS. The conclusions reached in the revised assessment of alternatives remain the same as those presented in the draft EIS.

4.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the proposed Project would not be constructed and operated. Therefore, selection of the No Action Alternative would not require the issuance of a Presidential Permit for construction and operation of the proposed Project. Under the No Action Alternative, the environmental effects specific to the proposed Project described in this EIS would not occur. As described below, if the No Action Alternative is implemented it is likely that the other methods of transporting WCSB crude oil to the world marketplace would be implemented. Impact comparison scenarios in the U.S. associated with the No Action Alternative are presented in Table 4.1-1.

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

Resource	Summary of the Key Impacts of Proposed Project[a]	Impact Comparison for Scenarios Associated with the No Action Alternative[b]: No New or Expanded Pipelines in Canada or the U.S.[c]	New Pipeline Between PADDs II and III	New Pipeline from Canada/U.S. Border to PADD III	Transport by Existing Railroad and Barge Systems[d]
Geology	• Fossil damage or destruction and unauthorized collection.	No impact to Geology	Less than or equal to	Greater than or equal to	Less than
Soils and Sediments	• Temporary to short-term soil erosion; • Minor loss of topsoil; • Short-term to long-term soil compaction.	No impact to Soils and Sediments	Less than or equal to	Greater than or equal to	Less than
Water Resources	• Temporary to short-term surface water quality degradation and disturbance of areas with high water tables; • Temporary to short-term increase in surface water runoff in the ROW; • Temporary to short-term degradation of aquatic habitat; • Changes in channel morphology and stability; • Temporary to long-term decrease in bank stability; • Temporary reduced flow in streams during hydrostatic testing;	No impact to Water Resources	Less than or equal to	Greater than or equal to	Less than

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

Resource	Summary of the Key Impacts of Proposed Project[a]	Impact Comparison for Scenarios Associated with the No Action Alternative[b]			
		No New or Expanded Pipelines in Canada or the U.S.[c]	New Pipeline Between PADDs II and III	New Pipeline from Canada/U.S. Border to PADD III	Transport by Existing Railroad and Barge Systems[d]
Wetlands	• Loss of wetlands and modification to productivity; • Temporary to permanent change of wetland vegetation community, including forested wetlands • Wetland soil disturbance; • Temporary increase in turbidity and changes in wetland hydrology and water quality; • Permanent alteration in water-holding capacity due to alteration or breaching of water-retaining substrates in the Prairie Pothole and Rainwater Basin regions; • Minor long-term alteration in vegetation productivity and life stage timing due to increased soil temperatures; • Minor and long-term alteration in freeze-thaw timing due to increased water temperatures.	No impact to Wetlands			Less than

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

Resource	Summary of the Key Impacts of Proposed Project[a]	Impact Comparison for Scenarios Associated with the No Action Alternative[b]: No New or Expanded Pipelines in Canada or the U.S.[c]	New Pipeline Between PADDs II and III	New Pipeline from Canada/U.S. Border to PADD III	Transport by Existing Railroad and Barge Systems[d]
Vegetation	• Temporary to permanent modification of vegetation community composition and structure, including croplands, grassland/ rangeland, sagebrush, and riparian and upland forests, and CRP and WRP land; • Potential expansion of invasive and noxious weed populations along the pipeline ROW; • Minor short- to long-term soil and sod disturbance potentially altering hydrologic patterns, inhibiting water infiltration and seed germination, or increasing siltation; • Alteration in vegetation productivity and life stage timing due to increased soil temperatures.	No impact to Vegetation	Less than or equal to	Greater than or equal to	Less than
Wildlife	• Short-term disturbance and medium to long-term loss or modification of habitats, including fragmentation, that provide forage, cover, and breeding habitat for wildlife; • Direct mortality during construction and maintenance;	No impact to Wildlife	Less than or equal to	Greater than or equal to	Less than

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

		Impact Comparison for Scenarios Associated with the No Action Alternative[b]			
Resource	**Summary of the Key Impacts of Proposed Project[a]**	**No New or Expanded Pipelines in Canada or the U.S.[c]**	**New Pipeline Between PADDs II and III**	**New Pipeline from Canada/U.S. Border to PADD III**	**Transport by Existing Railroad and Barge Systems[d]**
	• Indirect mortality and reduced breeding success due to stress or avoidance of feeding during construction and from noise and human activity during operation; • Reduced survival or reproduction due to decreased abundance of forage species or reduced cover.				
Fisheries Resources	• Habitat loss, alteration, and fragmentation, including habitats for recreationally and commercially important species; • Short- to long-term changes in benthic invertebrate community; • Increased water temperature due to removal of vegetation; • Direct mortality to fishery and aquatic resources during construction; • Gill irritation, avoidance behaviors, and stress due to increase in suspended sediments potentially leading to mortality or reduced productivity;	No impact to Fisheries Resources	Less than or equal to	Greater than or equal to	No impact to Fisheries Resources

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

Resource	Summary of the Key Impacts of Proposed Project[a]	Impact Comparison for Scenarios Associated with the No Action Alternative[b]			
		No New or Expanded Pipelines in Canada or the U.S.[c]	New Pipeline Between PADDs II and III	New Pipeline from Canada/U.S. Border to PADD III	Transport by Existing Railroad and Barge Systems[d]
	• Minor reduction of population growth through burial of eggs or young fish by sediments; • Temporary blockage or delays to normal fish movements; • Entrainment of eggs, small fish, and drifting macroinvertebrates during withdrawal of hydrostatic test water.				
Threatened and Endangered (T&E) Species	• May affect, but not likely to adversely affect 11 species. American burying beetle potentially adversely affected; • Loss, alteration, and fragmentation of habitat supporting T&E species; • Stress to T&E species, reduced breeding success, and avoidance of feeding due to noise and increased human activity; • Reduced survival or reproduction due to decreased abundance of forage species or reduced cover.	No impact to T&E Species	Unknown	Unknown	Unknown

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

Resource	Summary of the Key Impacts of Proposed Project[a]	Impact Comparison for Scenarios Associated with the No Action Alternative[b]			
		No New or Expanded Pipelines in Canada or the U.S.[c]	New Pipeline Between PADDs II and III	New Pipeline from Canada/U.S. Border to PADD III	Transport by Existing Railroad and Barge Systems[d]
Land Use, Recreation, and Visual Resources	• Short- to long-term loss of agricultural productivity and crop loss; • Some current land uses would be converted to permanent utility use; • Temporary visual impacts due to construction, and short- to permanent visual impacts from changes in vegetation composition and structure and the presence of aboveground facilities; • Temporary impacts to recreation from increases in noise, dust, and construction activity and traffic.	No impact to Land Use, Recreation, and Visual Resources	Less than or equal to	Greater than or equal to	Less than or equal to
Socioeconomics	• Compensation to property owners for ROW easements; • Economic benefits from the purchase of goods and services during construction and operation; • Positive impact to employment opportunities and income levels; • Positive fiscal impacts associated with property, sales, and other tax revenue;s	No impact to Socioeconomics	Less than or equal to	Equal to	Less than

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

		Impact Comparison for Scenarios Associated with the No Action Alternative[b]			
Resource	**Summary of the Key Impacts of Proposed Project[a]**	**No New or Expanded Pipelines in Canada or the U.S.[c]**	**New Pipeline Between PADDs II and III**	**New Pipeline from Canada/U.S. Border to PADD III**	**Transport by Existing Railroad and Barge Systems[d]**
	• Minor, temporary adverse impacts on services associated with the needs of construction workers; • Minor, temporary impact on transient housing; • Potential changes in property values; • Impact to traffic and transportation; • Impacts to communities.	No impact to Socioeconomics	Less than or equal to	Equal to	Greater than or equal to
Air Quality and Noise	• Emissions from fossil-fuel fired construction equipment and vehicles; • Release of fugitive dust; • Emissions from open burning; • Emission of volatile organic compounds and hazardous air pollutants from temporary fuel transfer systems and storage tanks, surge relief tanks, and crude oil storage tanks; • Minimal fugitive emissions from pipeline connections and pumping equipment at the pump stations; • Minor, short-term, localized, and intermittent impacts from construction noise;	No impact to Air Quality and Noise	Less than or equal to	Equal to	Greater than

TABLE 4.1-1
Comparison of Key Impacts of the Proposed Project and the No Action Alternative During Construction and Normal Operation

Resource	Summary of the Key Impacts of Proposed Project[a]	Impact Comparison for Scenarios Associated with the No Action Alternative[b]			
		No New or Expanded Pipelines in Canada or the U.S.[c]	New Pipeline Between PADDs II and III	New Pipeline from Canada/U.S. Border to PADD III	Transport by Existing Railroad and Barge Systems[d]
	• Minor noise impacts from operation of the electrically-powered pump stations.				
Direct Greenhouse Gas (GHG) Emissions	• Minor emissions of GHG from construction and operation.	No direct impact to GHG emissions	Less than	Equal to	Greater than
Indirect (Well-to-wheels) GHG Emissions	• No effect on oil sands development or refinery emissions	Equal to	Equal to	Equal to	Equal to

[a] Definitions of duration of impacts:

Temporary impacts generally occur during construction, with resources returning to pre-construction conditions almost immediately afterward.

Short-term impacts last up to approximately 3 years after completion of construction.

Long-term impacts result when resources require more than 3 years to recover.

Permanent impacts occur when resources do not return to preconstruction conditions during the life of the proposed Project (e.g., impacts to vegetation due to construction of aboveground structures).

[b] For most resources, the type, magnitude, and duration of impacts to the resource areas for the scenarios listed would be similar to those of the proposed Project. Therefore, the table indicates the comparison to the suite of impacts listed for the proposed Project for each resource. Greater than, equal to, less than = the impacts of the No Action Alternative for the listed scenario are greater than, equal to, or less than those of the proposed Project.

[c] This alternative assumes that refineries in PADD III would continue to receive crude oil from foreign sources, with the decreasing supply from Mexico and Venezuela to be replaced by crude oil from more distant countries requiring longer shipping routes. EnSys (2010) reported that it is unlikely that there would be no expansion of existing pipelines or installation of new pipelines in both Canada and the U.S. to transport WCSB crude oil from Canada to world markets.

[d] More detailed information on the impacts of rail and barge transport is presented in Section 4.2.3.

4.1.1 PADD III Crude Oil Demand and Supply with the No Action Alternative

EnSys (2010) reported that in 2009, PADD III refineries imported 5.1 million bpd of crude oil, including 2.9 million bpd of heavy crude oil, obtained from more than 40 countries. The top 4 suppliers were Mexico (21 percent), Venezuela (17 percent), Saudi Arabia (12 percent), and Nigeria (11 percent) (EIA 2010b). PADD III refinery runs are projected to grow by over 500,000 bpd by 2020 (Purvin & Gertz 2009); however, Mexico and Nigeria face declining or uncertain production horizons and Venezuelan supplies are subject to both decreasing reserves and political uncertainty. As a result, the PADD III demand for substitute sources of crude oil, particularly the heavy crude oil currently sourced from Mexico and Venezuela, is expected to increase in the future (Sections 1.2 and 1.4) under the EIA (2010) reference case projections, that incorporate reasonably foreseeable energy projects, energy conservation efforts, and renewable energy resource development. Although some analysts project that in the short-term the worldwide crude oil slate could become somewhat lighter due to short-term increases in natural gas liquids and condensate supply, PADD III refiners may find a more competitive world market for heavy crude because there has been a worldwide trend in developing capacity to refine heavier grades of crude, including in countries that produce such heavier grades (e.g., Brazil, Saudi Arabia, Qatar, and Kuwait) (EnSys 2010). As a result, EnSys (2010) stated the following:

> "Taken together, these developments create an outlook where PADD III refiners could have difficulty in the future competing for and obtaining sufficient heavy crudes to fill available heavy crude processing and upgrading capacity, and therefore *a priori* could be expected to have an interest in acquiring heavy WCSB crudes."

Under the No Action Alternative, the PADD III refineries would continue to acquire heavy crude oil primarily from sources other than Canada to fulfill PADD III heavy crude oil demand and/or find alternative methods to deliver WCSB heavy crude oil to PADD III. Under the No Action Alternative, crude oil demand in PADD III would likely be met by one or more of the following options:

- Delivery by marine tankers from countries outside of North America (primarily from the Middle East);
- Delivery from the WCSB through the construction of alternative pipeline systems between the WCSB and PADD III;
- Delivery from the WCSB to PADD III via existing pipeline connections to PADD II and new onward pipeline connections to PADD III;
- Delivery of WCSB crude by other transportation methods (e.g., railroad tank cars, perhaps supported by barge transport); or
- Delivery from the WCSB through the construction of a pipeline to a port in Canada and subsequent shipment of the oil by marine tanker to PADD III.

The No Action Alternative would not provide PADD III with a stable, overland transportation system for access to a secure source of North American crude oil in the near term. As a result, in the near term PADD III would continue to be dependent on less reliable foreign oil supplies that require greater marine shipping distances and, thus, involve longer delays in finding substitute sources to respond to supply disruptions that may occur.

While at least in the short term projections are that world crude oil supplies may become somewhat lighter (EnSys 2010), the longer term trend towards exploitation of heavier crude oil resources and the geographically close supplies of heavy crude from Mexico and Venezuela has led to increased reliance on heavy crude oil at PADD III refineries. PADD III refineries already have substantial capacity at their existing facilities to allow the refinement of heavy crude oil (Gunaseelan and Buehler 2009, Sword 2008). In addition, major refinery upgrades representing a total of 365,000 bpd of new capacity are planned at Port Arthur, Texas refineries that would have direct pipeline access to oil transported through the proposed Project, and several PADD III refineries without direct pipeline access have either implemented or are planning upgrades to increase heavy oil refining capacity (e.g., Artesia, New Mexico, Garyville, Louisiana, Borger, Texas) (CAPP 2009 2010). Additionally, CAPP 2010 reports that plans for refinery upgrades to handle heavy crude oil have been revived in St. Charles, Louisiana and Tuscaloosa, Alabama.

Under the No Action Alternative, excess pipeline capacity into the northern U.S. from Canada, primarily into PADD II, would likely persist until at least 2020 (EnSys 2010), although the supply of WCSB crude oil to PADD III refineries would be constrained by existing pipeline capacity into PADD III (CAPP 2009, Purvin & Gertz 2009) unless an alternative pipeline from PADD II to PADD III were constructed. PADD III represents the largest refining capacity in the U.S. and therefore would continue to acquire heavy crude oil primarily from sources other than Canada to fulfill demand in the near term. The refineries receive WCSB heavy crude oil from the 96,000-bpd ExxonMobil Pegasus Pipeline, which is the only pipeline that provides PADD III refineries direct access to WCSB crude oil (CAPP 2009). Small volumes of WCSB heavy crude oil currently move to Gulf Coast refineries by barge from PADD II and by marine tanker from the Westridge dock near Vancouver, British Columbia, Canada (EnSys 2010).

If the constraints on delivery of WCSB crude oil into PADD III persisted, there would tend to be upward pressure on the price of heavy crude oil imported into PADD III and on the prices of refined products shipped out of PADD III, although the impact of this upward pressure is projected to be small over the longer term (EnSys 2010). If long-term constraints on delivery of WCSB crude oil to the U.S. Gulf Coast and the Canadian west coast persist, a glut of WCSB crude oil could develop in PADD II potentially leading to downward pressure on the price of crude oil in PADD II sometime after 2020 (EnSys 2010). Currently, the lack of transport capacity out of Cushing has substantially depressed the price of West Texas Intermediate (WTI) crude compared to other world benchmark crudes, such as Brent Blend. It is not yet clear if this is a short-term phenomenon, or whether or how the phenomenon might be reflected in refined fuel prices in the PADD II area.

Under the No Action Alternative, in the immediate future, the gap created by declining supply from traditional heavy crude suppliers, primarily Mexico and Venezuela, would likely be filled by increases in other foreign imports delivered by marine tanker, notably from the Middle East (EnSys 2010). Increased reliance on Middle East supply would lead to increased marine tanker traffic to PADD III and higher priced Middle Eastern medium crudes may not fit the crude slates of upgraded PADD III refineries that are better optimized to process heavy crude oil. In the medium- to long-term, a crude oil pipeline system from Canada to PADD III (other than the proposed Project) could be constructed to provide WCSB crude oil to PADD III refineries, and the EnSys (2010) report results indicate that there is a strong market preference to put in place a broadly similar capacity to that provided by the proposed Project. Alternatively, additional pipeline infrastructure could be constructed to provide greater pipeline capacity between PADD II and PADD III that, in conjunction with existing excess cross border pipeline capacity in PADD II, could meet short term heavy crude oil demand in PADD III (until approximately 2020).

4.1.2 WCSB Crude Oil Production and World Market Access under the No Action Alternative

4.1.2.1 WCSB Crude Oil Production and Existing Export Capacity

Currently, crude oil production from the WCSB totals approximately 2.4 million bpd, with approximately 55 percent coming from the oil sands (CAPP 2010). Forecasts by CAPP project growth in WCSB production to 4.19 million bpd by 2025, with the oil sands comprising 3.5 million bpd. These growth projections are based upon a survey of projects operating, projects under construction, and projects announced for construction. There are numerous logistical challenges to reaching such production numbers, including limited labor supply and long supply chains to get materials to northern Alberta, but other production outlooks, such as IEO (2010), have similar production amounts from the oil sands for 2025 time period. The other forecasts that include similar numbers for potential oil-sands sands production, show a rough correlation between world crude oil price and oil-sands production – higher world oil prices lead to higher production from the oil sands, lower world oil prices lead to lower production from the oil sands (IEO 2010, IEA 2010).

Currently, there is approximately 3.8 million bpd of existing pipeline capacity to transport crude oil produced in the WCSB into the United States. Comparing the projected production to existing capacity, EnSys (2010) stated that:

> "Under every scenario where pipeline expansion is not restricted, WCSB crude supply is projected to be maintained at the levels projected in 2010 by the Canadian Association of Petroleum Producers . . . [and] . . . current pipeline capacity would be sufficient to deliver projected WCSB production to market at least until 2020 even with no expansion."

Examining the existing cross-border pipeline capacity does not give the entire picture, because, as described in the previous section, there is market demand in PADD III for WCSB crudes, and the existing cross-border pipeline capacity does not deliver to PADD III. That market demand in PADD III is not dependent upon construction of the proposed Project, since market demand would exist to put in place similar capacity to deliver WCSB crudes to PADD III (EnSys 2010).

The United States is currently the only substantial export market for WCSB crudes, as there is limited transport capacity to move the crudes to the world market. However, there is interest on the part of crude oil producers to gain access to other markets.

4.1.2.2 WCSB Crude Oil Potential Access to World Markets

Producers in Canada have stated that if the U.S. market is not available to them, much of the WCSB crude oil would be shipped outside of North America, particularly to Asian markets including Japan, China, South Korea, and India, which are the world's third through sixth largest importers of oil, respectively (CIA 2010).

Under the No Action Alternative, it is likely that there would be an increase in market incentives for WCSB crude oil producers to seek access to Asian markets until sufficient alternative infrastructure becomes available to facilitate access to the U.S. PADD III market. According to EnSys (2010):

> "Over the next twenty years, the principal choice for WCSB exporters is between moving increasing crude oil volumes to the USA or to Asia. Led by China, which has already bought heavily into oil sands production, Asia constitutes the major region for future petroleum product demand and refining capacity growth and offers Canada diversification of markets. In addition, costs for transporting WCSB crudes to major markets in northeast Asia (China, Japan, South Korea, Taiwan) are lower than to transport the same crudes via pipeline to the US Gulf Coast. Projections from this study, which are supported by third party information, indicate that Asian markets are attractive and could absorb at least 1 mbd [million barrels per day] of WCSB crudes, potentially significantly more; this versus the less than 50,000 bpd of WCSB crude that moves to Asia today."

If large quantities of WCSB crude oil were to be shipped to Asia, the oil would likely move by pipeline to marine ports in Canada and would be transported from there by marine tanker to countries outside of North America. Within Canada, this would require construction of at least one new pipeline from the WCSB production area to a port on the Canadian west coast. It is likely that an existing port would have to be modified or a new port would have to be constructed in order to handle very large volumes of oil exports. Examples of potential world market access pathways based on currently available information are described below.

Northern Gateway Pipeline

In May 2010 Enbridge submitted an application to the NEB seeking approval for construction and operation of the Northern Gateway Pipeline. According to the application, this facility would initially transport up to 525,000 bpd of WCSB crude oil from Edmonton to a port in Kitimat, B.C. The ultimate destination of the crude oil transported by this project would be the Asia-Pacific Rim countries, particularly China and Korea, and to refineries on the U.S. West Coast. The project could be expanded to transport up to 800,000 bpd and would include a diluent pipeline that would transport 193,000 bpd of diluent from a port at Kitimat to the Edmonton area. The proposed route is depicted on Figure 4.1.2-1. The current target for startup is 2016, although the project is encountering strong resistance from First Nations and environmental groups that may delay or postpone the project.

Sinopec Corporation, the second-largest oil producer and largest refiner in China, announced that it is among a group of producers and refiners providing $100 million (Canadian $) to assist in financing the $5.5 billion (Canadian $) Northern Gateway pipeline project (Reuters 2011a). The financing is intended to be used for regulatory and development costs in exchange for guaranteed space on the pipeline and the right to an equity stake.

Kinder Morgan Trans Mountain Pipeline Projects

The existing Kinder Morgan Trans Mountain Pipeline transports WCSB crudes west from Edmonton to the 55,000 bpd Chevron refinery at Burnaby and to a dock at Westridge, both near Vancouver, B.C. The Trans Mountain pipeline also connects to the Puget Sound Pipeline, a spur that extends to four refineries at Ferndale, Anacortes, and Cherry Point in Washington. Crude oil can be shipped via the Westridge or Burnaby docks by barge or tanker to U.S. refineries in Washington, although historically this mode of transport has been primarily to California, the U.S. Gulf Coast, and Asia. Kinder Morgan expanded the Trans Mountain system to a maximum capacity of 300,000 bpd in 2008 via its TMX1 project. However even with that expansion, the system is over subscribed as reported by EnSys (2010):

> "According to a press announcement in late October 2010 [Reuters 2010], the Transmountain pipeline is running at 316,000 bpd, i.e. above nameplate capacity, and is 32% over-subscribed for the month of November as of the time of this report. This tends to reinforce that there is growing demand for the line's capacity."

That situation extended into early 2011, when Kinder Morgan informed shippers that they would only be able to ship approximately 75 percent of the volumes requested (Reuters 2011b).

Kinder Morgan has plans to further expand this pipeline system with its TMX2 looping project that would increase the capacity to 380,000 bpd, and further increase the capacity 700,000 bpd with its TMX3 project. However, as of the time this EIS was prepared, Kinder Morgan had not announced a decision to go forward with either project, and in January 2011, Petroleum News (2011) reported that "Kinder Morgan decided last year to slow plans to further increase Trans Mountain capacity." The routes of the existing Trans Mountain pipelines system and the planned expansions are depicted on Figure 4.1.2-1.

Based on existing information, it is assumed that the expansions would be implemented in the 2015 to 2020 time frame. Kinder Morgan also plans to upgrade the Westridge dock to allow use of larger tankers, although this proposed project faces strong opposition (as does the looping project that would expand capacity of the existing pipeline). In late November 2010, Kinder Morgan applied to the NEB to establish longer term "firm service" contracts for WCSB crude oil shipments across the Westridge Dock (EnSys 2010).

Kinder Morgan has also announced plans for a Northern Leg expansion of the Trans Mountain system. The Northern Leg would extend from Edmonton to near Valemont, B.C., then extend west to Kitimat (see Figure 4.1.2-1). As currently planned, the maximum capacity of the Northern Leg would be 400,000 bpd, and the port at Kitimat can accommodate very large crude carrier class tank ships. The Northern Leg expansion is considered by Kinder Morgan to be a longer-term project. It also faces strong opposition from First Nations and environmental groups. If regulatory approvals were obtained and all of the above expansions are constructed and operated, the Trans Mountain system would have a total capacity of 1.1 million bpd.

Other Potential Projects

There are several other potential projects announced previously that could transport WCSB crude oil that are presently dormant and may be revived in the future. These projects are considered potential System Alternatives and are described in Section 4.2.

4.1.2.3 Likely Future Impacts under the No Action Alternative

Any alternative pipeline system constructed to move WCSB crude oil directly to PADD III refineries would likely have environmental impacts that are similar to those of the proposed Project. Additional pipeline infrastructure constructed to provide greater pipeline capacity between PADD II and PADD III would likely produce environmental impacts similar to those of the Gulf Coast Segment of the proposed Project. Oil shocks (unanticipated supply reductions that result in price spikes) arise through unstable crude oil supplies and would be more likely to occur under the No Action Alternative, as compared to the proposed Project, since crude oil supplies would continue to be sought from unstable foreign sources and transported over longer distances in the near term. Oil shocks reduce the amount of goods and services the U.S. can produce given a fixed amount of other inputs and cause some inputs (e.g., land, labor, and capital) to be under-utilized. In contrast, projects which stabilize crude oil supply through diversification and increased access to politically stable regions, such as the proposed Project, benefit the U.S. economy.

Under the No Action Alternative, in the near term positive socioeconomic impacts associated with construction and operation of the Project would not be realized along the proposed route and elsewhere in the U.S. No annual property tax revenues would be generated, as opposed to an estimated $138.4 million in annual property tax revenues that would be generated by the proposed Project in the region of influence. The generation of local employment as well as substantial expenditures on goods and services would also not occur under the No Action Alternative. However, if an alternative pipeline is constructed at some later date, socioeconomic benefits would be realized as a result of construction and operation of that alternative at that time.

GHG emissions associated with the proposed Project would not occur under the No Action Alternative, but GHG emissions would result from implementation of any alternative transportation network. EnSys (2010) employed both its World Oil Refining Logistics & Demand (WORLD) model and the DOE Energy Technologies Perspective (ETP) model to analyze effects of different transportation scenarios for the delivery of WCSB crude oil to world markets, including a scenario that equates to the No Action Alternative. The EnSys results indicated that with or without the proposed Project, there would be no substantial change in total U.S. refining activity, total crude and product import volumes and costs, development rate in the oil sands, global refinery CO2 emissions, and total life-cycle GHG emissions. However, the No Action Alternative, combined with a freeze of transport capacity for WCSB crudes at existing levels for 20 years, could lead to a reduction in WCSB oil sands production in the 2025 to 2030 timeframe (EnSys 2010).

Construction of new pipelines, modification of existing ports, and/or the construction of new ports would produce environmental impacts within Canada or in the U.S. that would be similar in nature to those of the proposed Project in terrestrial environments. Port projects would also include construction impacts to marine environments and operational impacts associated with the handling and transport of crude oils in marine environments. In addition, the transport of crude oil by tanker would result in more GHG emissions than would transportation of crude oil by pipeline to the U.S.

Commenters on the supplemental draft EIS suggested that more detailed analysis should be done on potential indirect impacts of the proposed Project associated with upstream (extraction in the oil sands in Canada) and downstream (refining in the Gulf Coast) activities. In the EnSys (2010) analysis that examined the impact of different scenarios of pipeline construction on upstream and downstream activities, there were no differences in the rate of production in Canada in all scenarios where transportation capacity was added in response to projected market demand. Based on the EnSys (2010) modeling results of downstream refining activities, the presence or absence of the proposed Project would not influence the projected market demand for heavy oil-sands crude oils at Gulf Coast refineries. As discussed in Section 3.13.5, the EnSys (2010) report also indicated that overall crude slate quality in PADD III under different transportation scenarios was not particularly sensitive to the varying quantities of WCSB oil sands crude oils delivered to PADD III.

In the supplemental draft EIS, more detailed analysis on the upstream and downstream activities was not undertaken in part because the EnSys report considered the No Expansion Scenario to be unlikely, a judgment the supplemental draft EIS endorsed. In response to the comments received, and to address concerns expressed by EPA regarding the potential connection between the proposed Project and future PADD III refinery emissions, DOS re-examined the assumptions underlying the EnSys analysis in consultation with experts at DOE, including within EIA, and expanded its consideration of the potential for alternate modes of transport from the WCSB to PADD III. DOS and DOE (which had commissioned the original EnSys report) directed EnSys to further examine the No Expansion Scenario, including an assessment of the viability of alternative modes of crude oil transportation, such as rail or barge. As a result, the conclusion that the No Expansion Scenario was unlikely to occur over the 20-year time period examined in the study was confirmed and reinforced. EnSys (2011) states:

> "In summary, we believe a Total No Expansion scenario which freezes at current levels all capacity to transport Western Canadian crudes to market is essentially implausible."

EnSys also updated its earlier analysis of announced and potential pipeline projects and concluded:

> "The update thus reinforces the view expressed in our Keystone XL Assessment report that, while Keystone XL offers a high capacity and "shovel ready" route to move growing WCSB production and also Bakken and Midcontinent crudes to the Gulf Coast, if it were not built (as in our DOE No KXL scenario) then, over time, broadly comparable pipeline capacity would evolve. (The economic / market drivers would be the same.) The result would be broadly similar flows, including to PADD3, subject as before to developments in capacity west to the BC coast."

The EnSys (2011) analysis confirms that if a freeze of pipeline capacity in North America lasting 20 years did occur, the market would likely respond by transporting crude oil by other available, but relatively more expensive, transport options. This is precisely the response the market has had to the current situations of constrained pipeline capacity out of the Williston Basin in North Dakota and from Cushing, Oklahoma south to PADD III. It should be noted that the No Expansion Scenario is distinct from the No Action Alternative. The No Expansion Scenario includes numerous assumptions in addition to the proposed Project not being constructed, including:

- No addition of pipeline capacity to the Canadian West Coast;
- No addition of new pipeline capacity from Canada into the United States;
- No expansion of pipeline capacity from Canada into the United States;
- No addition or expansion of pipeline capacity within the United States, particularly between PADD II and PADD III; and
- No addition of transportation capacity on other proven modes of bulk-commodity transport such as rail or barge.

The EnSys WORLD model results indicated that if there were not widespread restrictions on crude-oil transport capacity, the market demand would support the expansion of production in the oil sands in line with the projected growth contained in the CAPP (2010) report and delivery to refineries in PADD III in similar amounts whether the proposed Project was constructed or not. Thus, the other assumptions underlying the No Expansion Scenario would be counter to projected market demand.

The EnSys (2010) No Expansion Scenario is not equivalent to the No Action Alternative. It is, however, the only scenario in the EnSys (2010, 2011) reports that showed potential differences in upstream or downstream indirect impacts versus other scenarios assessed in these reports. As crude oil is traded and transported in a relatively unregulated North American (and world) market, it is unlikely that crude oil originating in the oil sands would not be transported in accordance with the projected market demand by some existing or future transportation pathway as is assumed in the No Expansion Scenario. There are numerous potential transportation pathways that could move Canadian crude oil by pipeline to PADD III that are subject to varying levels of regulatory scrutiny.

With respect to the addition of new trans-boundary pipeline capacity, the Canadian NEB and the DOS possess the authority to approve or deny those projects within their jurisdictions. With respect to the potential transportation projects to the Canadian West Coast, there is considerable opposition from groups that could possibly delay or block projects during the Canadian NEB review process (although the different projects would likely face different levels of regulatory approval). Additionally, it is possible that the expansion of existing trans-boundary pipelines could be done without modification of existing permits. Whether that is true for the Presidential Permits issued by DOS would be determined on a case-by-case determination.

With respect to the addition or expansion of crude oil pipeline capacity within the U.S., there is no overall federal permitting authority. The states through which pipelines connecting PADD II to PADD III would most likely pass (Oklahoma, Texas, Missouri, Arkansas, and Illinois) currently do not have regulatory processes that require state approval of pipeline routing and construction. Additionally, there is the possibility of future projects making use of existing pipelines that may be reversed or converted from other uses and/or paralleling existing ROWs (EnSys 2011).

With respect to other modes of bulk-commodity transport such as rail and barge, there is no general regulatory review before increasing crude oil transport, so long as these transportation modes use existing infrastructure (i.e. the existing railroad tracks). The most efficient way of transporting crude by rail is by unit train, a train of cars that stays connected and ships one commodity. The construction of new loading terminals for unit-trains would likely be subject only to local zoning and building codes. Recent experience in the Williston Basin in North Dakota and Montana and in the Gulf Coast area, indicates that such terminals can be completed in 12 to 18 months (EnSys 2011).

Even in a situation where there was a total freeze in pipeline capacity for 20 years, it appears that there is sufficient capacity on existing rail tracks to accommodate shipping projected WCSB crude oil production through at least 2030, even taking into account CAPP's increased production forecasts in 2011 (EnSys 2011). The rail system in North America is extensive, well-integrated, and transports bulk commodities, (coal in particular) in far greater quantities than would be required to accommodate transporting additional crude oil production in the WCSB over the next several decades. A study conducted on behalf of the Association of American Railroads (Cambridge Systematics 2007) found that, as of 2005, much of the rail capacity in the U.S., including capacity across the border from Canada, was operating well below capacity. Based on that study, and statistics from the Department of Transportation, EnSys (2011) conservatively estimated that the existing cross-border rail lines from Canada to the U.S. could accommodate crude oil train shipments of over 1,000,000 bpd.

The rapid development of crude oil transport options in the Williston Basin in North Dakota and Montana provides a case study of how the market could be expected to respond to constraints in pipeline capacity to transport WCSB crude oils. Williston Basin production has increased very rapidly over the past several years and is projected to continue to increase over the next decade. In January 2007 production was approximately 200,000 bpd, in early 2011 it was approximately 400,000 bpd, and by 2021 the North Dakota Pipeline Authority forecasts it could be between approximately 900,000 to 1,100,000 bpd.1 Some private forecasts are projecting that level of production within 5 years.

The existing and projected pipeline capacity to transport crude oil out of the Williston Basin has not kept pace with this current or projected growth. In January 2007 there existed just over 200,000 bpd of pipeline takeaway capacity from the Williston Basin.[2] By June 2011, the pipeline capacity had increased to nearly 400,000 bpd, and projected projects (other than the Bakken Marketlink associated with the proposed Project) would increase capacity to approximately 620,000 bpd by the middle of 2013.

Rail capacity has increased rapidly to fill the gap between the increased crude oil production and pipeline transport capacity. The first rail shipments of crude oil out of the Williston Basin occurred in the latter half of 2008. By 2010 there was loading capacity of just over 100,000 bpd. By June 2011 there was nearly 300,000 bpd of rail capacity, and projects announced and under construction will increase that to 450,000 bpd by the end of 2012 (Figure 4.1.2-2). At least one of the rail projects is designed to be expandable to 750,000 bpd of rail capacity that could be available by 2013 if market conditions warranted (EnSys 2011).

Unit-train rail terminals are being built to receive the crude oil in PADD III – including in the Port Arthur and Houston areas (EnSys 2011). These terminals are generally associated with accommodating the shipments from the Williston Basin, but the operators have noted they will be configured to accept heavy WCSB crude oil.

Historically, rail has generally not played a significant role in shipping crude oil in the U.S. or Canada. One of the main reasons for this is that pipelines are less expensive and pipeline capacity has been available. The example of the Williston Basin, however, demonstrates that rail capacity can quickly increase if there are constraints on pipeline capacity. Two of the main reasons are because the rail

[1] NDPA 06-28-2011 Presentation, slide 13.
[2] This capacity, and other pipeline capacity figures, include deliveries to the existing Tesoro refinery in North Dakota.

infrastructure already exists and can generally accommodate additional train shipments and the capital investments in increasing rail capacity are relatively modest in the context of capital investments in the petroleum industry (EnSys 2011). As shippers move to unit trains the economics of rail shipment improves. Industry reports indicate that rail transport costs from the Williston Basin to PADD III are approximately $2 to 3 more expensive per barrel than pipeline transport costs, but that those costs are decreasing as the larger unit-train terminals are being completed. Canadian National rail has asserted that raw bitumen (undiluted) could be transported in heated, insulated tank cars at rates comparable to the rates paid for pipeline transport. The recent EnSys (2011) analysis supports this assertion. Thus, it appears unlikely that the cost of rail transport versus pipeline transport would pose any substantial economic disincentive to continue producing oil sands derived crude oils if there were a long-term freeze in pipeline capacity.

Another factor making the No Expansion Scenario extremely unlikely is the relatively long timeframe examined in the EnSys (2010) report. Based on the economic projections cited above, including CAPP (2011) increased forecasts of WCSB production, existing trans-boundary pipeline capacity could accommodate the projected increases in production (and increases in demand) until sometime shortly before 2020 (EnSys 2011). Thus, if the proposed Project were not constructed, there would be 5 to 8 years for additional transport capacity to become available before any curtailment of production would be experienced. With each incremental amount of capacity that becomes available, the time lag before curtailment of production is pushed back further. EnSys (2011) noted that if there were no additional pipeline capacity, rail transport could accommodate all of the projected increase in WCSB production through 2030, and likely longer, by adding 100,000 bpd of capacity per year beginning in 2016. This rate of rail expansion would be substantially slower than the rate of rail expansion experienced in recent years in the Williston Basin.

The EnSys (2010) report also took a conservative approach to the question of timing of other pipeline projects. In scenarios that did not include the construction of the proposed Project, but allowed for expansion of transport capacity to PADD III in response to projected market demand, the WORLD model did not make that transport capacity available until 2020. There are already multiple proposed projects to increase pipeline transport capacity from PADD II to PADD III. In scenarios that included additional pipeline capacity to the Canadian West Coast, the WORLD model did not add that capacity until 2020 or later (e.g., the TMX expansions was not added until 2020, the Northern Gateway was not added until 2025, and the Northern Leg was not added until 2030). The WORLD model consideration of these projects assumes at least 10 years to achieve needed regulatory approvals for these projects.

In the short term, approval or denial of the proposed Project could have market impacts that affect investment decisions of producers. The Purvin and Gertz (2009) study submitted by Keystone to the Canadian NEB noted that if constructing the proposed Project relieved the transportation bottleneck that was then artificially depressing prices of crude oil in the Midwest, then Canadian producers may obtain a better price of $3 to $4 per barrel for their crude oil. Some analysts have asserted that if the proposed Project raised the price of WCSB crude oil, this would send a clear market signal that would increase upstream production (Pembina 2011). While there is some validity in the points made in these analyses, they examine the proposed Project in isolation, and do not consider how the proposed Project compares to other transportation options (pipelines or otherwise) that would likely have similar impacts on the price of WCSB crude oil. The EnSys (2010) report indicated little difference in the price producers could obtain for their crude oil over the 20 year time frame of the analysis in any of the scenarios that allowed transport capacity for that crude oil to increase in line with projected market demand.

Also, in light of the lead times necessary to begin new WCSB oil sands projects and the long production lives of those projections, it appears unlikely that short term perturbations in the price of crude oil would substantially change oil sands production. Investments in currently operating oil sands projects are a sunk cost and as long as the operating cost of production and transportation is below the sales price, the oil sands operations would likely continue. Thus, it would likely take an extended period of low oil prices, and/or projections that such an extended period would occur, before a long-term impact on oil sands productions would be likely.

The economic incentive for producers to avoid a long-term No Expansion Scenario would be substantial. As long as sufficient transportation exists, oil sands producers would not set the price of their product but would receive its value in the world market. As has been observed in the past (and as is currently occurring as a result of the Cushing bottleneck), if transportation constraints exist, producers would likely be forced to compete with each other to sell their product in a smaller geographic area and could receive a discounted price relative to the world market. This means that in a long-term No Expansion Scenario, producers would be losing not only potential revenue by not investing in additional production projects, but also revenue on production from investments they had already made. The updated EnSys (2011) report evaluated the potential scope of the economic incentive for oil sands producers to alleviate transportation constraints in a No Expansion Scenario:

> "Under "No Expansion" there would substantial incentives to WCSB producers to relieve logistics constraints. Today's Cushing constraints are creating strains in the market and discounts for WCSB heavy grades versus normal conditions of around $10/bbl. In 2005-2008, when inadequate export capacity was leading to marginal shut-ins, discounts were in the $10 - $20/bbl range. These discounts apply to the total volume of WCSB heavy crudes. Based on our updated assessment, WCSB shut-in volumes under No Expansion could be around 1.4 mbd in 2030 out of around 4 mbd total WCSB supply. Thus, versus an average price of say $100/bbl in normal market conditions, this situation would cost WCSB producers 1.4 million b/d * $100/bbl lost production + 2.6 million b/d * (say) $10/bbl discount on the crudes still being produced, a total of around $166 million per day, $60 billion per year. The cost to relieve those discounts, and avoid the 1.4 mbd of production shut-in, would be the cost of transporting the 1.4 mbd that could not be fed through pipelines. Our estimates are that they could be moved to market at around $10/bbl transport cost. So incurring $14 million per day in incremental transport costs would restore $166 million per day of lost revenues [approximately $5 billion per year]. Even if the alternative transportation costs were appreciably above $10/bbl, (We find it difficult to envisage costs above the $10 to at most $20/bbl range), the incentive to use alternative transportation modes would still far outweigh the costs."

Based on the above considerations, and on the analysis in Section 3.14.3 regarding refinery emissions, it appears highly unlikely that implementation of the proposed Project would have a substantial effect on upstream (extraction of crude oil in the oil sands) or downstream (refinery operations or emissions in the Gulf Coast) activities.

Under the No Action Alternative, the potential adverse and positive impacts associated with the implementation of the proposed Project would not occur. However, impacts associated with the development and/or utilization of alternative transportation pathways from the WCSB oil sands to PADD II and PADD III would likely occur in order to satisfy market demand for heavy crude oil in PADD III. The comparative impacts of new pipelines are presented in Table 4.1-1.

4.1.3 Use of Alternative Energy Sources and Energy Conservation

Many commenters suggested that the use of alternative sources of energy and conservation of energy would either (1) eliminate the need for the proposed Project or alternatives to the proposed Project, or (2) reduce the market need for heavy crude oil to the extent that smaller scale projects could meet short- and long-term energy needs.

The market demand for crude oil, including the market demand for heavy crude oil by refineries in PADD III, is driven primarily by the demand for transportation fuels. Based on EIA (2010a, 2010b) statistics, approximately 78 percent of the refined product produced by PADD III refineries in 2009 was used for transportation fuel. The percentages of total production from PADD III refineries in 2009 for transportation uses in the EIA statistics are listed below:

- Finished motor gasoline – 42.9 percent;
- Distillate fuel oil – 24.9 percent (distillate production for all uses was 28 percent of total refinery production. Distillate fuel oil for transportation only was 89 percent of total distillate production, or 24.9 percent of total production);
- Kerosene-type jet fuel – 9.3 percent;
- Residual fuel oil – 1.0 percent (residual production for all uses was 4.1 percent of total refinery production. Residual fuel oil for transportation only was approximately 25 percent of total residual fuel production, or approximately 1.0 percent of total production); and
- Finished aviation gasoline – 0.1 percent.

The remaining 22 percent of PADD III refinery production in 2009 consisted primarily of specialized products (e.g., liquefied refinery gases, kerosene, and naphtha for feedstock).

The remainder of this section addresses (1) how the use of alternative fuels and energy conservation would affect market demand for refined products sold by PADD III refineries, and therefore the effect on market demand for crude oil by those refineries, and (2) whether or not the use of alternative fuels and energy conservation would result in a sufficient reduction of market demand for crude oil in PADD III to justify selection of the No Action Alternative as the preferred alternative. Although most refined products sold by PADD III refineries are used in transportation, the assessment of the impact of using alternative fuels and energy conservation was also addressed for refined products that are not used for transportation. Alternative fuels and energy conservation are addressed in the following subsections:

- Use of Alternative Fuels and Energy Conservation in Transportation (Section 4.1.3.1);
- Use of Alternative Energy Sources in Place of Distillate Fuel Oil for Non-Transportation Uses (Section 4.1.3.2);
- Use of Alternative Energy Sources in Place of Residual Fuel Oil for Non-Transportation-Related Uses (Section 4.1.3.3); and
- Use of Alternative Energy Sources in Place of Other Non-Transportation-Related Refined Products (Section 4.1.3.4).

4.1.3.1 Use of Alternative Fuel and Energy Conservation in Transportation

Worldwide demand for crude oil is generally projected to grow over the next 25 years unless countries, including developing economies where the majority of the growth is projected to occur, take substantial steps to address climate change. But even if there is a worldwide decline in crude oil consumption, projections indicate that there will be an increase in consumption of crude oil from unconventional sources, primarily from the Canadian oil sands, over the next several decades. In the United States, the overall demand for crude oil is projected to remain relatively flat over the next 25 years (EIA 2010a). However, IEA (2010) projected that if policies and legislation were adopted to more aggressively respond to climate change in the United States by promoting fuel efficiency, electrification of motor vehicles, and/or alternative fuels, there could be a substantial reduction in demand for crude oil in the coming decades.

In general, commenters raised two general questions relevant to the No Action Alternative and adoption of policies that would address climate change by reducing demand for crude oil:

- Would a reduction in U.S. demand for crude oil eliminate the need for the proposed Project; and
- Would proceeding with the proposed Project alter market conditions such that there would be less rapid adoption of fuel efficiency, alternate fuels, or other measures that would reduce the demand for crude oil?[3]

Outlooks for world and U.S. demand for crude oil indicate that even if there were a substantial reduction in U.S. consumption of crude oil (and/or relatively flat world-wide consumption), the market demand in PADD III that is driving the development of the proposed Project would likely remain. Also, as explained below, it does not appear that the proposed Project would have enough of an impact on refined fuel prices to alter the market incentives for more wide-spread adoption of fuel efficient vehicles, or deployment of alternate fuels (including vehicle electrification).

In early 2010, EPA prepared a report examining technically feasible measures that could reduce consumption of crude oil that is refined to produce transportation fuel (EPA 2010). The EPA study looked at two scenarios, which were informally characterized as somewhat aggressive and very aggressive, in attempting to reduce vehicle energy consumption and tailpipe emissions. In that report, EPA stated the following:

> “[The scenarios] do not reflect the entire range of possible outcomes, but rather, a set of outcomes that could occur, based on technical feasibility, if effective policy or market drivers were in place.”

Among other factors underlying the somewhat aggressive scenario’s assumptions were the following:

- Market penetration of just over 80 percent for hybrid electric, plug-in hybrid electric, and electric vehicles in the new light-duty vehicle sales in 2030;
- 5 percent annual improvement in GHG emission rates in light-duty vehicles through the 2030 time period;
- Current levels of household vehicle utility assumed to be maintained (e.g., range, towing capacity, and interior space);
- 2030 new vehicle fuel economy in light vehicles would be 36 miles per gallon (mpg) for gasoline vehicles, 60 mpg for hybrid electric vehicles, 74 mpg for plug-in hybrid electric vehicles, and a 150-mile range for electric vehicles;
- 12 percent annual reduction from light duty GHG emissions by 2030 from travel efficiency improvements (e.g., speed limit reductions, urban parking restrictions, congestion pricing, and eco-driving);

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[3] Commenters also expressed concern about the potential effect that implementation of the proposed Project would have on adoption of policies to reduce crude oil demand. It is too speculative for NEPA purposes to attempt to predict how political factors might result in different policies or legislation being adopted in different scenarios. This section focuses on market demand issues related to more definitive factors such as fuel efficiency and alternate fuels since there several publicly available studies addressing those economic issues.

- For medium- and heavy-duty trucks it includes technology improvements in aerodynamics, tires, powertrain, limited adoption of hybrid into medium-duty applications, weight reduction through improved materials, and travel efficiency scenarios; and
- Similar technology improvements in efficiency, powerplant, aerodynamics, and materials for aviation, rail, and marine sectors.

EPA (2010) reported that implementation of the above measures could result in a reduction in demand for crude oil in the United States of 4 million bpd as compared to the projected demand in the EIA AEO by 2030. The findings of this EPA report were relied upon to construct the low-demand outlook modeled in the EnSys (2010) report. The results of the economic modeling were that the low-demand outlook had little impact on the projected demand for oil sands crudes in the U.S. and little impact on the total production from oil sands throughout the study timeframe. In the AEO demand outlook, total production in the oil sands was projected to be approximately 4.42 million bpd in 2030, and with the low-demand outlook, the production was projected to be approximately 4.23 million bpd in 2030.

IEA (2010) also addressed energy demand and production in three world-wide policy scenarios:

- The Current Policies Scenario, which assumed no change from policies in place in mid-2010;
- The New Policies Scenario, which assumed that countries act on their announced policy commitments and plans to address climate change; and
- The 450 Scenario, which sets out a scenario consistent with the goal to limit climate change to 2^{o} C over pre-industrial levels, which equates to stabilizing GHG CO_2-equivalent emissions at 450 ppm.

The impact of the three policy scenarios on world-wide crude oil consumption in 2035 is substantial. Compared to the world-wide total oil production (crude oil, natural gas liquids and unconventional oil) of 83.3 million bpd in 2009, IEA projected the following levels of consumption in 2035:

- Current Policies Scenario – 107.4 million bpd;
- New Policies Scenario – 99 million bpd; and
- 450 Scenario – 81 million bpd.

The policy scenarios also have a substantial impact on projected consumption of oil-sands-derived crude oil in 2035:

- Current Policies Scenario – 4.6 million bpd;
- New Policies Scenario 4.2 million bpd; and
- 450 Scenario – 3.3 million bpd.

The projected 2035 consumption in each of these scenarios represents a substantial increase from 2009 consumption of approximately 1.3 million bpd oil-sands-derived crude oil. The difference in consumption of the oil-sands-derived crude oil among the different scenarios is largely attributable to the differing world oil price in each scenario (the 450 Scenario's substantially reduced demand for crude oil would result in reduced world oil prices), and the additional expense attributed to the oil sands projects that would be necessary to mitigate their relatively higher greenhouse gas emissions (IEA assumed carbon price of $60 per ton in the New Policies Scenario and $120 per ton in the 450 Scenario). If oil-sands production is reduced to approximately 3.3 million bpd, then existing transboundary pipelines could accommodate import of that volume of oil-sands-derived crude oil into the U.S. However, that crude oil would not reach the refineries in PADD III.

Based on the outcomes of the EnSys (2010) report and the analyses of policies and market-drivers that would lead to a reduction in the volume of crude oil refined to produce transportation fuel, it appears highly unlikely that the proposed Project would have enough of an impact on the prices of refined fuel to impact market drivers related to wider adoption of alternative fuels or more energy efficient vehicles. In a recent report examining economic implications of different policies to reduce CO2 emissions or petroleum imports, Morrow et al. (2010) stated:

> "A fundamental insight from this study is that if one wishes to reduce U.S. CO_2 emissions or net petroleum imports from the transportation sector, the costs of driving must be significantly higher than they currently are today. Increasing the cost of driving with higher fuel costs (or other operating fees) will be required to motivate deployment of fuel economy improving technologies in conventional vehicles, accelerate penetration of high-fuel economy vehicles into the existing fleet, and reduce vehicle-miles traveled."

Two of the scenarios examined in Morrow et al. (2010) focused on policies that would directly increase the cost of transport fuels. One scenario included carbon pricing in a cap-and-trade plan, which lead to a projected increase of $0.24 in the cost per gallon in 2020 and an increase of $0.46 per gallon in 2030. The second scenario included a direct fuel tax, which led to projected increases to the cost of gasoline of $1.42 per gallon in 2020 and $3.27 per gallon in 2030. The analysis considered how fuel price influenced increases in fuel efficiency (through increased purchases of more fuel efficient vehicles, hybrid vehicles, and electric vehicles) and reducing the projected increases in vehicle miles traveled. The report concluded that the carbon tax scenario had a marginal impact on GHG emissions from transportation. Imposing the transportation tax on fuel stimulated slightly larger improvements in fuel economy of new conventional vehicles than were projected to be achieved through imposition of only CAFÉ standards. In contrast, the EnSys (2010) analysis stated the following:

> "within each demand outlook, U.S. total [refined] product supply costs are insensitive to pipeline scenario, varying by less than 0.1% in any scenario where normal pipeline expansion is allowed."

The scenarios that included the proposed Project resulted in small reductions in product supply costs in PADD III (less than $0.10 per barrel), that would amount to approximately a ¼-cent impact on the price of a gallon of gasoline. The scenario with the largest variation in refined product supply costs was the No Expansion Scenario, which led to a 0.6 percent reduction in costs of total refined products in 2030 versus the scenario for the proposed Project because of the artificial discount in crude oil prices obtained from the shut-in of WCSB crude oil supply. Finally, the EnSys analysis found that the import to or export from the United States of refined products was not sensitive to the seven pipeline scenarios considered.

It is reasonable to infer based on the EnSys (2010) results, when viewed in combination with the results from the Morrow et al. (2010) study, that the proposed Project's likely impact on finished transportation fuel prices would not be large enough to influence market behavior in development of more fuel efficient vehicles, alternative transportation fuels (including electrification of the vehicle fleet), or total vehicle miles traveled. The Morrow et al. (2010) report concluded that increases in gasoline prices that would be orders of magnitude greater than likely price impacts of the proposed Project (a $0.42 increase in the cost of a gallon of gasoline in 2030 in the carbon tax scenario) and would only reduce light duty fuel efficiency and light duty total vehicle miles traveled by approximately 1 percent in 2030.

The above factors indicate that even if the United States, or countries around the world, adopt policies that would reduce the consumption of crude oil, there is likely to be a market demand for substantial increases in the volume in crude oil derived from the oil sands over the next 20 to 25 years. In addition, for all scenarios examined in the EnSys (2010) report, the total throughputs of oil-sands-derived crude oil at PADD III refineries was actually higher in the low-demand outlook than in the AEO outlook. This is because in the low-demand outlook, the reduction in demand for refined transportation fuels in PADD II leads to less oil-sands-derived crude oil being refined there. There would also be a reduction in demand for refined transportation fuels from PADD III refineries, but the volume of oil-sands-derived crude oil that would have been refined in PADD II would be rerouted to PADD III and would displace imports from other countries.

For these reasons, use of alternative energy sources and energy conservation in meeting needs for transportation fuel are not considered an alternative to the proposed Project.

4.1.3.2 Use of Alternative Energy Sources and Conservation in Place of Distillate Fuel Oil for Non-Transportation-Related Uses

Non-transportation uses of distillate fuel oil include space heating and electrical power generation, and represented approximately 3.1 percent of the production of PADD III refineries in 2009 (EIA 2010a, 2010b). The distillate fuel oil was sold for use in the following categories listed by EIA (2010b):

- "Oil company";
- Industrial use;
- Commercial;
- Electrical power; and
- Residential.

For the "oil company" category, it is likely that the distillate fuel oil was used primarily for heating purposes. As a result, natural gas would be a likely alternative fuel in most cases and it is possible that in the future, many facilities could be retrofitted to accommodate natural gas as a replacement fuel. This category accounted for about 0.2 percent of the total refinery output of PADD III refineries. Commercial and industrial use categories were also most likely used primarily for heating purposes. These two categories combined constituted approximately 0.2 percent of the total refinery production from PADD III. Distillate fuel oil in the residential category would likely be exclusively used for heating, and represents about 0.001 percent of the total production from PADD III refineries.

For each of these categories, both natural gas and biofuels (e.g., fuel from municipal solid wastes, wood, and other biomass [e.g., biodiesel from cooking oil]) are potential alternative fuels for heating purposes. However, conversion of heating units to burn natural gas or biofuels would require substantial investments by the users and it is unlikely that a majority of users would convert their heating units in the near term. In any case, the total volume of distillate fuel oil used for heating was only about 0.4 percent of the total PADD III refinery output in 2009. Assuming complete replacement of the distillate fuel oil used for heating by alternative fuels, there would be only a negligible reduction in the market demand for crude oil used by PADD III refineries. Similarly, conservation of energy for heating purposes would result in only negligible decreases in refinery output and would have very little effect on the crude oil needs of PADD III refineries.

The use of distillate fuel oil produced by PADD III refineries for the generation of electrical power represents about 0.01 percent of the total output of PADD III refineries. Electrical generation currently fueled by residual fuel from PADD III refineries could be generated in a variety of other ways, including natural gas-fired generators, wind farms, solar panels, tidal projects, hydroelectric projects, geothermal sources, nuclear power plants, and energy or fuel from municipal solid wastes, wood, and other biomass. However, use of non-transportation-related residual fuel for electrical power generation in 2009 was a negligible portion of the total output of PADD III refineries. With a complete replacement of this distillate fuel oil by alternative fuels to generate electrical power there would therefore be a negligible reduction in the crude oil market demand of PADD III refineries and there would be essentially no effect on the current and future crude oil needs of those refineries.

4.1.3.3 Use of Alternative Energy Sources in Place of Residual Fuel Oil for Non-Transportation-Related Uses

Residual fuel oil is used for the production of electric power, space heating, marine transportation, and various industrial purposes. Approximately 3.1 percent of total PADD III refinery production was used for electrical power generation, heating, and industrial uses (EIA 2010a, 2010b). The amount of fuel required for those uses could be reduced with conservation, and for some uses, alternative fuels could replace the residual fuel oil. However, as for distillate fuel oil, the actual volume represents a small portion of the total production of PADD III refineries and the use of alternative fuels and conservation would have a negligible effect on the market demand for crude oil in PADD III.

4.1.3.4 Use of Alternative Energy Sources in Place of Other Non-Transportation-Related Refined Products

As noted above, approximately 78 percent of the output of refineries in PADD II in 2009 was used for transportation purposes. The remaining 22 percent of PADD III refinery production consisted primarily of specialized products, including liquefied refinery gases, kerosene, naphtha for feedstock, other oils for feedstock, special naphtha products, lubricants, waxes, petroleum coke, asphalt and road oil, still gas, and miscellaneous products. The three largest production streams as a percentage of total production were the following:

- Petroleum coke (5.9 percent) – grades of coke produced in delayed or fluid cokers that may be recovered as relatively pure carbon;
- Liquefied refinery gases (5.2 percent) – this includes ethane/ethylene, propane/propylene, normal butane/butylene, and isobutane/isobutylene; and
- Still gas (4.6 percent) – still gas is used as a refinery fuel and a petrochemical feedstock.

These three categories accounted for nearly 16 percent of total PADD III production. For the most part, these three specialty products (as well the other specialty products produced by PADD III refineries) cannot be produced using alternative fuels and have not been further considered in this assessment of alternative energy sources. It is possible that conservation could reduce the need for some of these products (e.g., liquefied refinery gases) but that reduction in use would result in a negligible decrease in the market demand for crude oil in PADD III.

4.1.4 Summary

PADD III refineries currently import approximately 5.1 million bpd of crude oil, including 2.9 million bpd of heavy crude oil (EnSys 2010), the majority of which comes from Mexico, Venezuela, Saudi Arabia, and Nigeria. As reported by EnSys (2010), the demand for crude oil in PADD III is projected to increase and PADD III refinery runs are projected to grow over the next 10 years, even under the low demand outlook. At the same time, three of the four major PADD III crude oil suppliers currently face declining or uncertain production horizons (EnSys 2010). As a result, the market demand in PADD III for heavy crude oil from alternative sources is expected to increase in both the near term and further into the future. Implementation of the No Action Alternative would not meet this need for heavy crude oil in PADD III, unless a system alternative went forward to connect PADD II to PADD III or to directly transport WCSB crude oil to PADD III. Such alternatives would likely not receive regulatory approval prior to the proposed Project.

If the proposed Project, a similar pipeline system, or another transport mode is not constructed to transport WCSB crude oil to PADD III refineries, those refineries would be forced to rely on oil shipped by barge or tanker from areas outside of North America from regions which are experiencing declining production or are not secure and reliable sources of crude oil. As a result, in the near term, PADD III would continue to be dependent on less reliable and less stable foreign oil supplies from the Middle East, Africa, Mexico, and South America.

EnSys (2010) also projected that there would be no substantial change in total U.S. refining activity, total crude and product import volumes and costs, or global refinery CO2 and total life-cycle GHG emissions whether or not the proposed Project is implemented. Additionally, EnSys (2010) determined that with implementation of the No Action Alternative, the production of crude oil from the Canadian oil sands projects would not be affected and that production would continue at current or higher levels through 2030 unless no other pipeline system or other projects were implemented to transport crude oil from the oil sands projects, an outcome that EnSys considered unlikely.

Under the No Action Alternative, crude oil from the WCSB would not have a ready conduit for export to available refineries and markets in PADD III, and it is therefore likely that alternative transportation systems to move oil to other markets would emerge. Crude oil would be transported by other proposed, planned, or existing pipelines or by alternative transportation methods (such as railroad tank cars, barges, or crude oil tankers) to markets in the global marketplace (these system alternatives are discussed in greater detail in Section 4.2). Several projects have been proposed or are planned to transport WCSB crude oil from the oil sands projects to ports in Canada and in the northwestern and northeastern U.S. Although it is not possible to identify the specific impacts of such projects, it is likely that the impacts of other pipeline projects would be similar in nature to those of the proposed Project. The extent and magnitude of the impacts would likely be different from project to project and would depend on the environmental conditions along the proposed routes. In addition, the transport of crude oil by tanker rather than by pipeline would likely result in greater transportation-related GHG emissions. Under the No Action Alternative, the near-term positive socioeconomic impacts associated with construction and operation of the Project would not be realized along the proposed route and elsewhere in the U.S. No annual property tax revenues would be generated, as opposed to an estimated $138.4 million in annual property tax revenues that would be generated by the proposed Project in the region of influence. The generation of local employment as well as substantial expenditures on goods and services would also not occur under the No Action Alternative. However, if an alternative pipeline is constructed in the future, socioeconomic benefits would be realized as a result of construction and operation of that alternative.

Under the No Action Alternative, improved fuel efficiency and broader adoption of alternative fuels would not likely substantially alter the demand for WCSB heavy crude oil at PADD III refineries for the production of transportation fuels. Other energy sources could potentially replace the energy derived from non-transportation-related uses of PADD III refinery output. However, the non-transportation uses of PADD III refinery output represent a very small percentage of total PADD III refinery output. Therefore, the No Action Alternative would have little effect on overall demand for refinery products that are currently sold by PADD III refineries for non-transportation uses.

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

4.2 SYSTEM ALTERNATIVES

System alternatives to the proposed Project would make use of other existing, modified, proposed or planned pipeline systems, or other transportation systems to meet the purpose of and need for the proposed Project. With implementation of a system alternative to meet the objectives of the Project, the Project would not be constructed and the impacts described in this EIS would not occur. However, as noted below, there would be environmental impacts associated with any system alternative that would meet the purpose and need of the proposed Project. Each system alternative considered was screened for its potential environmental effects versus similar environmental effects for the proposed Project, technical and economic practicability, and the ability to meet the purpose of and need for the proposed Project.

The system alternatives screened include the following:

- Use of Existing or Expanded Pipeline Systems (Section 4.2.1);
- Use of Other Proposed or Planned Pipeline Systems (Section 4.2.2);
- Alternative Modes of Transportation (Section 4.2.3); and
- Intermodal and Combined Transport Systems (Section 4.2.4).

4.2.1 Use of Existing or Expanded Pipeline Systems

Four existing pipeline systems were considered as potential system alternatives. Those systems are described and assessed in the following sections:

- ExxonMobil Pegasus Pipeline (Section 4.2.1.1);
- Express-Platte Pipeline System (Section 4.2.1.2);
- Keystone Oil Pipeline Project (Section 4.2.1.3); and
- Alberta Clipper Pipeline Project (Section 4.2.1.4).

4.2.1.1 ExxonMobil Pegasus Pipeline

There is currently only one pipeline system that extends from the Midwest to the Gulf region: the ExxonMobil Pegasus Pipeline. That system currently transports up to 96,000 bpd of Canadian crude oil from Patoka, Illinois to Nederland, Texas. As described in Section 1.1 the proposed Project would initially transport approximately 535,000 bpd of crude oil to the Cushing tank farm and to delivery points in Texas. Therefore, the Pegasus pipeline would not be capable of delivering the proposed Project's WCSB crude oil volume even if used to full capacity, particularly since most of its capacity is already dedicated to crude oil transport from PADD II to PADD III. Delivering the volumes contracted to the proposed Project would require a substantial expansion of the Pegasus pipeline. Any future expansion of the Pegasus pipeline system would result in impacts along the 835-mile-long route between Patoka and Nederland that would be broadly similar to those of the proposed Project, albeit over a shorter total distance.

In summary, the existing Pegasus pipeline cannot be used to meet the proposed Project's objectives in the near term and there are no announced plans to expand the pipeline. Therefore, the Pegasus Pipeline was not further considered as a system alternative to the proposed Project.

4.2.1.2 Express-Platte Pipeline System

The Express-Platte Pipeline System is a 1,700-mile-long oil transportation network that connects Canadian and U.S. producers to refineries in the Rocky Mountain and Midwest regions of the U.S. The system consists of two crude oil pipelines – the Express Pipeline and the Platte Pipeline. The Express Pipeline transports a variety of light, medium, and heavy crude oil from Hardisty to markets in Montana, Wyoming, Utah, and Colorado, and has a capacity of 280,000 bpd. The Express Pipeline connects to the Platte Pipeline system at Casper, Wyoming. The Platte system transports crude oil from Casper to Wood River, Illinois and has a capacity of 164,000 bpd from Casper to Guernsey, Wyoming. From Guernsey to Wood River, the system has a capacity of 145,000 bpd.

The Express-Platte Pipeline System originates in Hardisty, as would the proposed Project, and passes close to the northern end of the Cushing Extension (near Steele City, Nebraska). However, the Express system has firm commitments for 235,000 bpd that will not expire until 2012 and 2015 and would therefore not have sufficient capacity to meet the market demand to which the proposed Project is responding without a major expansion of the system. In addition, to meet the market demand for heavy crude oil at PADD III refineries and to the Cushing area, use of the Express-Platte Pipeline System as a system alternative would require either (1) a short pipeline to connect to the northern end of the Cushing Extension along with a new pipeline to the Gulf Coast that would likely be similar to the proposed Gulf Coast Segment of the proposed Project, or (2) a new pipeline from the existing Express-Platte pipeline to the Gulf Coast. Either expansion alternative would result in environmental impacts from the northern end of the Cushing Extension to the Gulf Coast delivery points that would be broadly similar to or greater than the Gulf Coast Segment of the proposed Project.

In summary, the existing Express-Platte pipeline cannot be used to meet the proposed Project's objectives in the near term, and expansion of the system to meet the capacity requirements of the proposed Project would not be environmentally preferable to construction and operation of the proposed Project. Therefore, the Express-Platte Pipeline System was not further considered as a system alternative to the proposed Project.

4.2.1.3 Keystone Oil Pipeline Project

The existing Keystone Oil Pipeline Project extends from the U.S. border in North Dakota to Patoka, Illinois; it also includes the Cushing Extension which extends from Steele City, Nebraska to Cushing, Oklahoma. It currently has the capacity to transport 591,000 bpd of WCSB crude from Canada to refineries in PADD II. On December 22, 2010, Argus.com (2010) reported that the existing Keystone Oil Pipeline was transporting approximately 250,000 bpd of crude oil.

Keystone has firm contracts to transport 380,000 bpd on the proposed Project and intends to also transport 155,000 bpd of crude oil on the proposed Project to Cushing, Oklahoma that was originally contracted for transport on the existing Keystone Oil Pipeline for a total initial throughput of 535,000 bpd. For the existing Keystone Oil Pipeline to serve as a system alternative to the proposed Project, it would first need to accommodate its current obligations to ship 155,000 bpd to the existing Cushing terminal and 340,000 bpd to Wood River and Patoka, Illinois, or a total current commitment to ship 495,000 bpd. The excess capacity of the Keystone Oil Pipeline based on these commitments is 96,000 bpd. The Keystone Oil Pipeline does not have the capacity to transport the additional crude oil currently contracted on the proposed Project, and therefore this potential system alternative could not meet the proposed Project objectives without a major expansion in both Canada and the U.S. In addition to the expansion of existing facilities, it would be necessary to construct a pipeline from Cushing to the Gulf Coast area of PADD III that would be essentially the same as the Gulf Coast Segment of the proposed Project. The overall expansion would result in environmental impacts that would be similar to those of the proposed

Project, and would require federal permits in both Canada and the U.S. as well as applicable provincial, state, and local permits.

In summary, the existing Keystone Oil Pipeline cannot be used to meet the proposed Project's objectives in the near term, and due to the overall system expansion required, it would not offer an overall environmental advantage over the proposed Project. Therefore, the existing Keystone Oil Pipeline was not further considered as a system alternative to the proposed Project[4].

4.2.1.4 Alberta Clipper Pipeline Project

Commenters on the draft EIS and supplemental draft EIS have suggested that Enbridge's Alberta Clipper Pipeline Project could be used to transport crude oil from Hardisty to Cushing. The Alberta Clipper Pipeline extends from Hardisty to Superior, Wisconsin and has the current capacity to deliver an average of 450,000 bpd of crude oil from a supply hub near Hardisty to an existing terminal in Superior with a potential maximum capacity of 800,000 bpd assuming additional pumping capacity is added at appropriate locations along the pipeline corridor. During the NEB hearings on the proposed Project, Enbridge made public its position that Keystone could establish a connection to the Alberta Clipper Pipeline near Gretna, Manitoba, construct a pipeline adjacent to the existing Keystone Oil Pipeline to the Cushing Extension, and construct a new pipeline from the southern end of the Cushing Extension to PADD III delivery points. However, during the NEB hearings, Enbridge did not indicate what capacity it would make available to Keystone on its pipeline. To meet flow requirements of the proposed Project, the Alberta Clipper Pipeline would have to be expanded in Canada which would result in additional impacts from the U.S./Canada border to Hardisty. Keystone has stated that the concept introduced by Enbridge at the NEB hearings would require commercial negotiation of acceptable terms and conditions among Keystone, Enbridge and its stakeholders, and shippers on the proposed Project. Keystone and Enbridge discussed the concept further in March 2009 at a meeting arranged by CAPP. Minutes of the meeting were filed as part of the NEB record. As a result of that meeting, Keystone identified business issues of concern and requested a proposal from Enbridge to resolve those issues but did not receive a response. The NEB did not pursue this alternative to the proposed Project beyond limited questioning by the members of the NEB and its staff.

Using the Alberta Clipper Pipeline Project as a potential system alternative would require expansion of existing infrastructure and would produce impacts in Canada and the U.S. similar to those for the Keystone Oil Pipeline system alternative described in Section 4.2.1.3. Additionally, it is not clear that the initial committed flow volumes (535,000 bpd) of the proposed Project could be accommodated by this system alternative due to the contractual issues described above even if the Alberta Clipper system was expanded to its maximum capacity of 800,000 bpd. As a result, the Alberta Clipper Pipeline Project was not considered further as a reasonable system alternative for the proposed Project.

4.2.2 Use of Other Proposed or Planned Pipeline Systems

Other new pipeline system alternatives have been proposed or planned by proponents that if successfully designed, permitted, and constructed could transport crude oil from the oil sands of the WCSB to the PADD III market, either via a direct link from the WCSB to PADD III, or by interconnecting to existing pipeline systems that transport WCSB crude oil into PADD II. For a potential new pipeline system to be considered a viable alternative to the Project, it must meet the purpose of and need for the Project as described in Section 1.2.

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[4] An alternative route that would parallel the existing Keystone Oil Pipeline Project in the U.S. is addressed in Section 4.3.3.4.

The proponents of five of the potential system alternatives described below initially announced conceptual plans for the projects and then either abandoned the plans or put them on hold. None of those proponents have established commercial commitments through open seasons and have not submitted permit applications as of this writing. Although at this time the possibility of the future development of those projects is speculative, they are described below and assessed relative to their potential to meet the proposed Project's objectives. The eight potential pipeline system alternatives considered are described in the following sections:

- Altex Pipeline System (Section 4.2.2.1);
- Chinook-Maple Leaf Pipeline System (Section 4.2.2.2);
- Texas Access Pipeline (Section 4.2.2.3);
- Enbridge Trailbreaker Project (Section 4.2.2.4);
- Enbridge-BP Delivery System (Section 4.2.2.5);
- Enbridge Monarch Pipeline (Section 4.2.2.6);
- Seaway Pipeline (Section 4.2.2.7); and
- Double E Pipeline (Section 4.2.2.8).

4.2.2.1 Altex Pipeline System

Plans for the Altex (Alberta-Texas) Pipeline System were initially announced in 2005 by the Calgary-based energy infrastructure-development company, Altex Energy Ltd. The planned Altex Pipeline System included a 2,360-mile-long greenfield pipeline system that would originate north of Fort McMurray, Canada, extend to the Redwater-Fort Saskatchewan area, and from there to Hardisty, Alberta. From Hardisty south it would cross the U.S./Canada border in Montana and extend southeast through Montana, Wyoming, South Dakota, Nebraska, Kansas, Oklahoma, and Texas to the Port Arthur area. As initially planned, service would start no sooner than 2013, with a proposed initial crude oil capacity of 425,000 bpd. In 2008, Altex determined that the project as planned was not economically viable and therefore did not pursue it further. Thus, there has not been an open season, shipper commitments, or an application for a Presidential Permit or other permits in the U.S. and the planned Altex Pipeline System was not considered further as a system alternative to the proposed Project.

After determining that the Altex Pipeline System would not be viable in the near term, Altex concluded that it could develop an interim transportation system that would be financially acceptable during the period that oil sands production increased to the point of making the Altex Pipeline System economically viable. As stated by Altex, the plan would involve transporting bitumen by rail to virtually any market within North America. In 2008, the Canadian National Railway and Altex developed a conceptual plan to accomplish transport of bitumen, not crude oil (termed PipelineOnRailTM**).**

Altex has negotiated long-term rail rates with Canadian National and is offering transportation services in Canada to bitumen producers at rates less than the cost of their pipeline transportation alternatives. To support shippers' needs, Altex stated that it intends to construct terminals near Peace River, Ft. McMurray, and possibly Ft. Saskatchewan, Alberta. The use of rail as an alternate mode of transportation is addressed in Section 4.2.3.2 (Railroad Tank Car Transport).

4.2.2.2 Chinook-Maple Leaf Pipeline System

The Chinook-Maple Leaf Pipeline System was a conceptual project originally considered by Kinder

Morgan and TEPPCO (now merged with Enterprise Products Partners, LP). This 2,050-mile-long pipeline system would originate near Hardisty, Alberta and cross the U.S./Canada border from Alberta into Montana. It would then traverse Montana, Wyoming, Colorado, Kansas, Oklahoma, and Texas to deliver crude oil to the Houston area. The northern portion of the route would be adjacent to the existing Kinder Morgan Express Pipeline.

The Chinook-Maple Leaf Pipeline System was planned to have a capacity of 440,000 bpd between Hardisty and Cushing (Chinook Pipeline), and 550,000 bpd between Cushing and Houston (Maple Leaf Pipeline). If this system were not fully subscribed it could transport a portion of the oil planned for transport in the proposed Project; however, it would not have the capacity to meet the market demand to which the proposed Project is responding (firm contracts to deliver 535,000 bpd across the border, with 155,000 bpd delivered to Cushing and 380,000 bpd delivered to the Gulf Coast).

The proponents initially indicated a planned in-service date of late 2011 or early 2012 (CAPP 2008) for the Chinook-Maple Leaf Pipeline System. However, at the time this EIS was prepared the proponents had not announced an open season or shipper commitments or applied for a Presidential Permit or other permits in the U.S. In addition, neither company lists the Chinook-Maple Leaf Pipeline System as a potential future project. Therefore, the Chinook-Maple Leaf Pipeline System was not considered further as a system alternative to the proposed Project.

4.2.2.3 Texas Access Pipeline

In December 2007, Enbridge and ExxonMobil Pipeline Company announced plans for a new pipeline system that would transport crude oil from Patoka, Illinois to the Texas Gulf Coast. The proponents indicated that the crude oil transported in the Texas Access Pipeline from Patoka would originate in the Canadian oil sands region of Alberta. The conceptual plan included a 738-mile-long, 30-inch-diameter pipeline that would transport the oil from Patoka to refineries in Nederland, Texas, and an 88-mile-long, 24-inch-diameter pipeline that would transport crude oil from Nederland to a delivery point in an area east of Houston. The initial capacity of the Patoka-to-Nederland segment of the pipeline would be 445,000 bpd, and the initial capacity of the Nederland-to-Houston segment would be 169,000 bpd. If this system were not fully subscribed it could transport a portion of the oil planned for transport in the proposed Project. However, it would not have the capacity to meet the market demand to which the proposed Project is responding (firm contracts to deliver 535,000 bpd across the border, with 155,000 bpd delivered to Cushing and 380,000 bpd delivered to the Gulf Coast) without a major expansion.

The proponents did not receive sufficient interest in the project from shippers to justify the construction costs and the Texas Access Pipeline has not progressed. In 2008, Enbridge stated that, based on current market conditions, the project would not go forward and indicated that “it will likely be required as a large-volume solution, probably in the 2014 area.” Therefore, the Texas Access Pipeline was not considered further as a system alternative to the proposed Project.

4.2.2.4 Enbridge Trailbreaker Project

In 2008, Enbridge proposed the Trailbreaker Project as an interim option to the Texas Access Pipeline for supplying crude oil to PADDs II and III. As announced, the Trailbreaker Project would involve shipping crude oil by pipeline to the northeastern U.S. and transporting crude oil by tanker from there to PADD III as early as mid 2010. The project would have allowed the transport of WCSB oil production to refineries in Ontario, Quebec, the Canadian Maritime Provinces, and U.S. markets. It would have included an expansion of the existing Enbridge Line 6B from Chicago, Illinois to Sarnia, Ontario, as well as terminal expansions and upgrades, increasing the capacity of existing Enbridge Line 7 between Sarnia and Westover, Ontario, and the reversal of the existing Enbridge Line 9 to flow from Sarnia east to Montreal, Quebec. Another component of the Enbridge Trailbreaker Project would have been the reversal of the pipeline owned by Portland-Montreal Pipe Line (PMPL), which transports product from Portland, Maine to Montreal. In late 2008, PMPL completed an open season to gauge shipper interest in the proposed reversal; however, they did not receive the level of firm volume commitments required to proceed at that time. In January 2010, Enbridge announced that the Trailbreaker Project was dormant, and the project is no longer included in commercial opportunities in investor presentations. Therefore, the Enbridge Trailbreaker Project was not considered further as a system alternative to the proposed Project.

4.2.2.5 Enbridge-BP Delivery System

In 2008, Enbridge and BP announced that they had entered into an agreement to develop the Enbridge-BP Delivery System to transport WCSB heavy crude oil from Flanagan, Illinois, to Houston and Texas City, Texas, using a combination of existing facilities, new pipeline, and looped pipeline construction where required. As initially announced, the project would traverse parts of Illinois, Missouri, Kansas, Oklahoma, and Texas and would be in service by late 2012 with an initial total system capacity of 250,000 bpd to the Gulf Coast. Enbridge and BP intended to use the BP #1 System and other existing pipelines north of the Cushing crude oil hub with some new pipeline construction south of Cushing to connect to markets in Houston and possibly in Nederland. From Flanagan (where the system would interconnect with the Enbridge Southern Access pipeline) to Cushing the capacity would be approximately 140,000 bpd for further transport to Gulf Coast markets. The remaining 110,000 bpd would originate from interconnecting pipelines at Cushing.

At the NEB hearings for the proposed Project, Enbridge stated that the Enbridge-BP Delivery System is still on the books but is suspended. The project is not listed as a potential opportunity in investor presentations. Therefore, the Enbridge-BP Delivery System was not considered further as a system alternative to the proposed Project.

4.2.2.6 Enbridge Monarch Pipeline

In late 2010, Enbridge announced plans for a 24-inch-diameter pipeline that would extend from its oil terminal in Cushing to the Gulf Coast. The pipeline would have an initial capacity of approximately 150,000 bpd, with the ability to expand to about 350,000 bpd. The objective of the Enbridge Monarch Pipeline is to alleviate a bottleneck for light crude oil at Cushing and provide a transportation route from Cushing to the Gulf Coast refineries in PADD III. No further information was available on the project at the time this EIS was prepared.

Although Enbridge has stated that the Monarch Pipeline would transport some heavy crude oil, it is being designed and proposed to transport lighter crudes to the Gulf Coast. Even without the transport of lighter crudes, its maximum capacity would not be sufficient to satisfy market demand to which the proposed Project is responding (firm contracts to deliver 380,000 bpd to the Gulf Coast). Finally, it would be necessary to construct a pipeline to Cushing to supply the WCSB crude oil. Enbridge announced it was considering such a “full pass” solution to the Cushing bottleneck by also constructing a pipeline from the Chicago area to Cushing, but the proposal is still in preliminary stages. The impacts of construction of that pipeline and construction of the Monarch Pipeline would result in impacts that would be similar in nature and extent to those of the proposed Project along the same approximate distance.

Based on the above considerations, the Enbridge Monarch Pipeline was not further considered as a system alternative to the proposed Project.

4.2.2.7 Seaway Pipeline

ConocoPhillips owns the 530-mile-long Seaway pipeline system (operated by Enterprise Products Partners LP) which transports crude oil from the Houston area to storage facilities at Cushing. The pipeline has a capacity of approximately 350,000 bpd. The system also supplies crude oil to refineries in the Houston area and has a usable storage capacity of 3.4 million barrels. In 2007, the former operator of the Seaway Pipeline (Teppco Partners, LP) stated it would consider reversing the line to transport crude oil from Cushing to PADD III. However, Bloomberg (2011) stated that ConocoPhillips had decided that it would not reverse the pipeline. As a result, the Seaway pipeline was not further considered as a system alternative to the proposed Project.

4.2.2.8 Double E Pipeline

Enterprise Products Partners L.P. and Energy Transfer Partners, L.P. have formed a joint venture to design and construct a crude oil pipeline from Cushing, Oklahoma to Houston, Texas. The Double E Pipeline would provide up to 450,000 barrels per day of takeaway capacity for crude oil currently stranded at the Cushing storage hub due to a lack of southbound pipeline infrastructure. The pipeline would offer greater access to Gulf Coast refineries, while providing refiners with a reliable, domestic source of crude oil as an alternative to higher priced imported crude oil that currently represents their largest source of supply. The Double E Pipeline would utilize existing pipelines and construct 354 miles of new pipeline, to create a 584-mile long pipeline which would originate at crude oil storage facility owned by Enterprise in Cushing, Oklahoma and terminate at the ECHO crude oil storage and terminal facility owned by Enterprise in southeast Harris County, Texas. The ECHO crude oil terminal would offer access to major Texas Gulf Coast refining centers in Texas City, Pasadena/Deer Park, Baytown and on the Houston Ship Channel. The open season for the Double E Pipeline ended on August 12, 2011. Subject to shipper commitments during the open season and the required regulatory approvals, the proponents expect the new pipeline to begin service in the fourth quarter of 2012.

4.2.3 Alternative Modes of Transportation

Three modes of surface transportation of crude oil from the U.S./Canada border near Morgan to Cushing, Nederland, and Moore Junction were considered as alternatives to the proposed Project as described in the following sections:

- Truck Transport (Section 4.2.3.1);
- Railroad Tank Car Transport (Section 4.2.3.2); and
- Barge and Marine Tanker Transport (Section 4.2.3.3).

4.2.3.1 Truck Transport

The transport of crude oil by truck is occasionally done to serve as an interim transportation solution for smaller volumes of crude oil or petroleum product. For example, due to pipeline limitations in the Bakken oil field in Montana and North Dakota, a portion of the crude oil produced in that area is currently transported by tank truck. However, transport by truck is not a reasonable alternative to transport the volume of oil that would be shipped by the proposed Project. Large tank trucks have a maximum volume of about 9,000 gallons (about 214 barrels). It would therefore require about 2,500 trucks per day to transport the 535,000 bpd that the Project would initially transport. To sustain a delivery rate of 535,000 bpd, as many as twice that number of trucks would likely have to be devoted exclusively to traveling to and from the border and the delivery points.

Table 4.2.3-1 summarizes accident statistics by method of transport compiled by Association of Oil Pipe Lines (AOPL). As indicated in the table, transport of oil by pipeline is substantially safer than transport by trucking. AOPL reported that trucking is 87 times more likely than pipeline transport to result in a human fatality. In similar findings, fire and/or explosions are 35 times more likely when transporting crude oil via truck. Vehicle accidents and accidental releases are also concerns with surface transportation crude oil delivery. The Bureau of Transportation Statistics (2009) reported that the transport of hazardous liquids (including crude oil) on highways resulted in five times as many fatalities as transportation of hazardous liquids by pipeline between 1975 and 2007.

TABLE 4.2.3-1
Reported Incident Rates for Alternative Methods of Liquids Transport

Method of Transport [a]	Death	Fire/Explosion	Injury
Truck	87	35	2
Rail	3	9	0.1
Barge	0.2	4	4
Tank Ship	4	1	3
Pipeline	1	1	1

[a] Relative rates were calculated based on incidents per ton-mile for each transportation mode (AOPL 2004).

The trucking alternative would add substantial congestion to highways in all states along the route selected, particularly at and near the border crossing and in the vicinity of the delivery points. At those locations it is likely that there would be significant impacts to the existing transportation systems. The trucks would consume millions of gallons of fuel per year, with subsequent exhaust emissions (including GHG) and other negative environmental effects. Trucking would likely be subject to interruptions due to unfavorable weather and road conditions, especially in Montana and other northern states. At the Gulf Coast delivery points, surface transportation would necessitate substantial new transfer facilities and personnel.

As a result of these considerations, truck transportation was not considered a reasonable alternative to meeting the Project objectives and was not further evaluated.

4.2.3.2 Railroad Tank Car Transport

As noted in Section 4.2.2.1, Altex and the Canadian National Railway have developed a transportation strategy termed PipelineOnRailTM to move oil sands production to markets in North America or Asia. At the end of 2010, the system was shipping approximately 10,000 bpd within Canada from producers whose reserves are stranded without pipeline access. The system reportedly could have the capacity to ship up to 4 million bpd throughout North America (Financial Post 2009). Canadian National stated that it can ship crude oil directly into the U.S. or to the Canadian west coast for shipment to Asia. The system would use insulated and heated double-hulled tank cars to ship bitumen or would ship bitumen diluted with condensates or other diluents (CN 2010). Canadian National also stated that the rail system to the west coast of Canada is already in place and it could ship 2.6 million bpd to the west coast of Canada if 20,000 tank cars were added to its fleet. It further stated that the increase in the number of rail tank cars in use would not clog its system in Canada (Financial Post 2010). As noted in The Globe and Mail (2011), Canadian National is currently transporting crude oil from the Bakken area of southern Saskatchewan to the U.S. Gulf Coast. The current and projected takeaway capacity from the Williston Basin to PADD II and PADD III is discussed Section 3.14.2.1. As noted in that section, EnSys (2011) reported that the rail-loading capacity for Williston Basin crude oil could be as high as 750,000 bpd by

2013.

The maximum size tank car allowed by regulations in 49 CFR 179.13 is 34,500 gallons (about 820 barrels). Use of these cars to ship 535,000 bpd would require approximately 650 rail tank cars per day at the delivery sites and returning to Canada. At maximum capacity, approximately 1,010 rail tank cars 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 tank cars. Transporting the maximum throughput of 830,000 bpd would require from about 10 to 17 unit trains delivering oil to the receipt points each day, as well as at least the same number of trains making the return trip. It is possible that for continuous operation, the transporters may need to have additional trains in transit along the route or routes selected.

The number of train trips required would likely affect traffic on the existing rail system in the vicinity of the route used from the Canadian border to the Gulf Coast. For example, this volume of rail traffic may result in periodic or long-term rerouting of some existing train traffic in the regions of the route selected by Canadian National. This alternative would also directly affect communities that have rail lines that would be used for this transport or by creating delays on the rail lines due to the substantial increase in rail traffic across railroad crossings of roads. There could be indirect impacts to some communities due to the redirection of some existing rail traffic to other rail lines and due to increased traffic on those lines. This alternative would also substantially increase noise along the route selected and in communities indirectly affected due to increases in redirected train traffic. In addition, there would be an increase in the emission of combustion products due to the use of diesel engines which could have an adverse impact on air quality along the route selected. As compared to the proposed Project, this alternative would have substantially greater GHG emissions during operation due to the combustion of diesel fuel.

Interruptions in the delivery of crude oil would be more likely than with the proposed Project due to conditions such as weather and congestion of the rail lines. To meet the market demand that the proposed Project would meet, rail systems development would likely include new infrastructure such as spur lines, train storage yards at the delivery points, and additional oil storage facilities. Development of these facilities would likely produce localized impacts, but these impacts would not occur along the same distance as those of the proposed Project since many existing rail lines would be available for use. As noted above, during normal operations the impacts on communities in the vicinity of utilized rail lines and in communities affected by redirected rail traffic would likely be greater than those of the proposed Project during normal operations.

As noted in Table 4.2.3-1, rail transport of liquids is not as safe a mode of transportation as pipelines. With the number of trains and tank cars required to transport volumes of crude oil similar to those of the proposed Project, the safety of communities along the route could be an issue of concern. The maximum release of oil from a train accident would likely be less than the maximum possible release from the proposed Project.

The use of rail tank cars for delivery of WCSB crude oil may not be as cost-effective as transport by pipeline and may result in higher transportation costs. Although the Canadian National website has suggested that transport prices on rail are at least competitive with pipeline tariffs, the EnSys (2010) report states the following regarding PipelineOnRailTM:

> "This study did not allow for the expansion of the Pipeline*OnRail*™ capacity in any scenario because tariffs for rail are generally not considered attractive relative to pipelines. However, during a period of constrained pipeline capacity, the Pipeline*OnRail*™ could compete as an alternative."

EnSys 2011 did note that when considered on a cost per barrel of bitumen basis, the difference between pipeline tariffs and the cost of rail shipment narrows.

In summary, the use of existing or enhanced rail systems to transport the volume of crude oil that would be transported by the proposed Project would likely produce less impact from construction than would the proposed Project. However, there would likely be greater safety concerns and greater impacts during operation, including higher energy use and GHG emissions, greater noise impacts, and greater direct and indirect effects on many more communities than the proposed Project. Rail transportation would also be subject to more frequent delivery interruptions than the proposed Project. As a result, transportation of the volume of crude oil that would be transported by the proposed Project entirely by rail tank car would not offer an overall environmental or safety advantage over the proposed Project.

4.2.3.3 Barge and Marine Tanker Transport

As stated in EnSys (2011), a wide range of viable opportunities exists for moving potentially substantial volumes of WCSB crude oils to multiple markets using barges or tankers either in conjunction with or independent of existing pipelines. Options include:

- Moving both domestic and WCSB crude oils from PADD II to PADD III refineries along river systems;
- Intermodal transport of WCSB crude oils across the Great Lakes if pipelines running within Canada were extended to the Great Lakes or rail movements were employed. Destinations could include PADD II and PADD III refineries if barge transportation is included and to refineries in eastern Canada via the St. Lawrence Seaway; and
- Potential expansion of transport via tanker from British Columbia ports to PADD III refineries.

Inland transport of crude oil by barge to PADD III from the U.S./Canada border would require an inland waterway capable of supporting barge traffic to Cushing and to PADD III. However, there is no inland waterway that could accommodate that traffic and therefore barge transport of crude oil to the delivery points at Cushing and in Texas was not considered a reasonable alternative. Barge transport could serve as an element of intermodal transport of crude oil to PADD III in conjunction with railroad tank cars, trucks, or pipelines. Currently, trucks are transporting 5,000 bpd of crude oil from Cushing, Oklahoma in PADD II to the port of Catoosa in Tulsa, Oklahoma for barge shipment along the Arkansas and Mississippi Rivers to refineries in the Saint James, Louisiana area in PADD III.

Marine transport by either barge or marine tanker would require that crude oil be transported from the WCSB producers to ports on either the east or west coasts of Canada or the U.S. The Enbridge Trailbreaker, discussed in Section 4.2.2 as a system alternative, was a previously proposed transportation plan that would have transported crude oil to a northeast U.S. port and shipped it by marine tanker to PADD III. However, that project is not being actively pursued by Enbridge and was not further considered as a system alternative to the proposed Project. In addition, although marine transport by either barge or tanker to PADD III would be possible, it would require other forms of transport as well to reach Cushing, and therefore would not meet all proposed Project objectives without additional infrastructure.

As noted in Section 4.1, there are several proposed projects that would transport WCSB crude oil to the Canadian west coast for transport from existing, modified, or new marine terminals. Although those projects could be considered potential system alternatives, implementation of the projects would not be possible in the time frame necessary to meet the proposed Project objectives. Construction of those projects would have impacts that would be similar in nature, extent, and magnitude as those of the proposed Project, although the impacts would likely occur only in Canada.

Transport of crude oil by marine tanker or barge would result in substantially more energy consumption than transport by the proposed Project and would result in substantially more GHG emissions than during operation of the proposed Project. As noted in Table 4.2.3-1, both marine tanker and barge transport of hazardous liquids have greater safety concerns than transport by pipeline. Additionally, this method of transport to the Gulf Coast would be more costly than transport by pipeline.

In summary, marine transport of WCSB crude oil would not meet the proposed Project objectives, would result in greater energy consumption and GHG emissions, would increase the cost of delivered crude oil to the Gulf Coast refineries, and would have greater safety concerns than the proposed Project. Therefore, marine transport of WCSB crude oil was not further considered as a system alternative to the proposed Project.

4.2.4 Intermodal and Combined Transport Systems

None of the individual pipeline system alternatives considered in Sections 4.2.1 and 4.2.2 would supply a sufficient volume of crude oil to satisfy the near-term market demand of Gulf Coast refineries and therefore would not meet the purpose of the proposed Project. DOS then considered various combinations of those pipeline systems and determined that no combination of existing and proposed pipeline systems would deliver a similar volume of crude oil to PADD III without constructing more than one of the proposed pipelines from PADD II to PADD III. More than one new pipeline would be required based on the volumes that are planned for the pipelines as described in Section 4.2.2. A combination of the pipeline systems considered could, over time, deliver volumes of Canadian oil sands crude oil in volumes similar to the volumes that would be transported by the proposed Project. However, that would not meet the near-term need for heavy crude oil at the Gulf Coast refineries and the required construction of these new pipelines would likely produce, in combination, greater impacts than the proposed Project Gulf Coast Segment.

An intermodal crude oil transportation system that comprised some combination of new or expanded pipelines, railroad tank cars, trucks, and barges could potentially deliver a volume of WCSB crude oil and other crude oils to PADD III similar to or greater than the volume that would be transported by the proposed Project (EnSys 2011). However, in combination, the construction of additional pipeline capacity and additional railroad, barge and truck loading and unloading facilities would likely result in impacts similar to or greater than those of the proposed Project Gulf Coast Segment. Additionally, during operations, rail, barge and truck transport of substantial quantities of crude oil would not offer a similar level of safety as that of the proposed Project, and these combined transport modes would not offer an environmental advantage over the proposed Project, as described in Section 4.2.3.

4.3 MAJOR ROUTE ALTERNATIVES AND ROUTE VARIATIONS

4.3.1 Introduction

DOS considered potential alternative routes to determine whether or not there are route alternatives that would avoid or reduce impacts to environmentally sensitive resources as compared to the impacts of the proposed Project while meeting the objectives of the proposed Project. In identifying route alternatives, consideration was given to suggestions received from tribes, agencies, and the public during the scoping period and in comments on the draft EIS. In addition, variations to the proposed route were also considered. Variations are relatively short deviations from a proposed route that are developed to resolve or reduce construction impacts to localized, specific resources such as cultural resource sites, wetlands, recreational lands, residences, and terrain conditions.

This section addresses major route alternatives by segment and route variations in the following subsections:

- Approach (Section 4.3.2);
- Alternative Routes for the Steele City Segment (Section 4.3.3);
- Alternative Route for both the Steele City Segment and Cushing Extension (Western Alternative; Section 4.3.4);
- Alternative Routes for the Gulf Coast Segment (Section 4.3.5);
- Alternative Routes for the Houston Lateral (Section 4.3.6); and
- Route Variations (Section 4.3.7).

The agency preferred route is presented in Section 4.3.8.

4.3.2 Approach

The alternatives analysis was conducted as a screening process that involved the following steps:

- Establish criteria for screening alternatives;
- Identify potential alternatives that meet the criteria;
- Determine whether the potential alternatives could meet the purpose and need of the proposed Project and whether or not they would be technically and economically practicable; and
- For those alternatives that could meet the purpose and need of the proposed Project and appear to be technically and economically practicable, determine whether or not an alternative offers an overall environmental advantage over the proposed route. If it was determined that the potential alternative would not offer an overall environmental advantage, it was eliminated from further consideration.

4.3.2.1 Screening Criteria

Control Points Criterion

The control points are locations where alternatives would have to begin and end to meet the Project objectives. These fixed control points, which placed geographic constraints on potential alternatives, consisted of the following:

- The U.S./Canada border crossing between Saskatchewan and Montana near the town of Morgan, Montana where the pipeline of the Canadian portion of the proposed pipeline terminates (the Canadian portion of the pipeline has already been permitted) – that control point is the northern end of the Steele City Segment;
- The northern end of the existing Cushing Extension of the Keystone Oil Pipeline near Steele City, Nebraska – that control point is the southern end of the Steele City Segment;
- The southern end of the Cushing Extension in Cushing, Oklahoma – that control point is the northern end of the Gulf Coast Segment;
- The crude oil delivery point in PADD III at Nederland, Texas – that control point is the southern end of the Gulf Coast Segment; and

- The crude oil delivery point near Moore Junction, Texas – that control point is the southwestern end of the Houston Lateral.

These control points provide the basic framework for identifying alternative routes. However, as described in Section 4.3.3.1, in response to an agency scoping comment and comments on the draft EIS and supplemental draft EIS regarding alternatives, we also considered alternatives that originated at Hardisty, Canada and extended into the U.S. at a point other than near Morgan.

The control points at the northern and southern ends of the Cushing Extension were established to take advantage of the nearly 300 miles of 36-inch-diameter pipe that is currently in place and available for use by modifying the operation of the existing Keystone Oil Pipeline. Use of the Cushing Extension would avoid the impacts associated with construction of a pipeline of similar length. However, as described in Section 4.3.4, an alternative to using the Cushing Extension was also identified and evaluated.

Avoidance Criterion

The second criterion established was to avoid or minimize effects to or crossing of the following areas to the extent practicable:

- Public lands (except in Montana, where there is a state regulatory preference for the use of public lands; this issue is addressed in Appendix I and in Section 4.3.7);
- Large waterbodies and water control structures;
- Rugged terrain that could impact constructability;
- Large wetland complexes;
- Highly developed urban areas and urban infrastructure;
- Properties listed on the NRHP;
- Wildlife refuges and management areas;
- Key waterfowl use or nesting areas;
- Irrigated croplands;
- Forested areas, including commercial forest lands; and
- Residences and outbuildings.

Although the alternatives identified avoided or minimized crossings of these areas to the extent possible, the extent, shape, and prevalence of many resources (e.g., rivers, historical trails, wetlands, and farmlands) preclude completely avoiding impacts to them on any selected route, particularly for a route that would extend from the U.S./Canada border to the Gulf Coast.

Many commenters on the draft EIS and supplemental draft EIS requested that DOS consider avoidance of or minimization of pipeline length in the Sand Hills topographic region of Nebraska as well as areas in Nebraska underlain by the NHPAQ system. These commenters considered that the potential for accidental oil releases associated with the proposed Project operations would lead to unacceptable risk to the NHPAQ system and that the potential for erosion in the Sand Hills topographic region associated with the proposed Project construction would lead to unacceptable environmental degradation. The NHPAQ system extends across approximately 64,400 square miles of Nebraska, essentially underlying all but the eastern-most portion of the state. Almost all reasonable potential routes through Nebraska from the control point at Morgan, Montana to the control point at the northern end of the existing Cushing

Extension would cross the NHPAQ system, including the existing Keystone Oil Pipeline corridor. DOS has addressed these concerns in Sections 3.2, 3.3, and 3.13. Key findings of the analyses in these sections include:

- As discussed in Section 3.13, experience from previous oil pipeline releases in shallow groundwater areas with conditions similar, although not identical to those within the NHPAQ system indicates that the impacts from even very large spills would likely be limited to localized groundwater contamination that would not threaten the regional viability of the aquifer system.
- The proposed Project would be constructed and operated using standard PHMSA regulatory requirements for pipeline construction and operation in 49 CFR 195 as well as a set of 57 even more stringent Project-specific Special Conditions developed in consultation with PHMSA and agreed to by Keystone. Standard PHMSA requirements are described in greater detail in Sections 2.3 and 3.13.1 as are the Project-specific Special Conditions that are also provided in Appendix U. In aggregate, these procedures would substantially reduce the potential risk of an accidental oil release from the pipeline anywhere along the proposed Project corridor. As discussed in Section 3.13.4, DOS analyzed databases of historical spills on existing pipeline systems to establish annual spill frequencies per mile of existing pipeline in the U.S. and then applied that frequency to the length of the proposed Project. The DOS estimates of spill frequency based on the PHMSA database for significant spills range from 1.18 incidents per year for hazardous liquid spills to 1.83 incidents per year for crude oil spills greater than 50 bbl (see Table 3.13.4-1). Using the NRC database, DOS estimates of hazardous liquid spill frequencies range from 1.16 incidents per year for spills of any size to 0.6 incidents per year for spills up to 50 bbl. In addition, for crude oil spills, the NRC database estimates range from 1.38 incidents per year to 0.68 incidents per year for spills up to 50 bbl (see Table 3.13.4-2). The estimate of incident frequencies for hazardous liquid and crude oil spills of any size using both the PHMSA significant spill database for spills greater than 50 bbl and the NRC database for spills up to 50 bbl ranged from 1.78 hazardous liquid spills per year to 2.51 crude oil spills of any size per year.
- To assess a spill frequency for the proposed Project specific to the likelihood of a breach of the pipeline itself that would take into account specific design elements, materials strength, anti-corrosion measures, proposed construction and inspection procedures, and applicable regulatory requirements, Keystone performed a two step spill frequency assessment. Keystone initially calculated a baseline spill frequency using the PHMSA (2008) database of 1.38 spills per year. In addition, Keystone then adjusted that spill frequency based on the impact of these proposed Project-specific measures on the key threats to pipeline integrity as described in Section 3.13.4 of the EIS. The adjusted Project-specific spill frequency determined by Keystone for the entire pipeline is 0.22 spills per year (see Table 3.13.4-4).
- During the proposed Project design effort, local Natural Resources Conservation Service (NRCS) offices and regional experts on Sand Hills reclamation from the University of Nebraska, University of South Dakota, and Nebraska Department of Roads were consulted and their recommendations on routing, construction techniques, and restoration techniques to minimize potential damage to Sand Hills vegetation were incorporated into the proposed Project plan and would be incorporated into the implementation of any alternative route across the Sand Hills (see Section 3.2.2.1, Appendix B, and Appendix H for additional information). Specific construction, reclamation, and post-construction activities would be employed in the Sand Hills topographic region based on the recommendations of these experts. Keystone would incorporate these procedures into construction within the Sand Hills topographic region, for either the proposed Project route or any other alternative selected. With proper measures, risks of wind erosion during the time period when vegetation is being reestablished can be largely eliminated.

- The installation and operation of crude oil pipeline systems is a compatible land use in Nebraska under existing federal and state land use policies and regulations. Major pipelines currently overlie the NHPAQ system in Nebraska, including crude oil pipelines (e.g., Kinder Morgan's Express Platte Pipeline and TransCanada's Keystone Oil Pipeline Project) and oil products and ammonia pipelines (e.g., NuStar's pipeline and Magellan Pipeline Company's ammonia and petroleum pipelines (see Figure 4.3.2-1). These crude oil and petroleum products pipelines comprise approximately 1,160 miles of pipelines crossing the NHPAQ system in Nebraska.

As a result of these findings, avoidance of the Sand Hills topographic region and NHPAQ system are not considered appropriate screening criteria for the identification of alternative routes. Also, Keystone has committed to provide replacement water if an accidental release from the proposed Project that is attributable to Keystone's actions contaminates groundwater used for drinking water or irrigation. Nonetheless, DOS considered one potential alternative (Western Alternative) that would avoid the Sand Hills topographic region and NHPAQ system entirely and six potential alternatives (Alternative SCS-A, Alternative SCS-A1A, Keystone Corridor Alternatives 1 and 2, I-90 Corridor Alternatives A and B) that would reduce pipeline mileage crossing either the Sand Hills topographic region or the NHPAQ system. Four of the examined alternatives, the Keystone Corridor Alternatives 1 and 2 and the I-90 Corridor Alternatives A and B, were developed specifically in response to comments received on the draft EIS and supplemental draft EIS and the extensive public debate that has continued since that time. DOS has also considered concerns related to the Sand Hills topographic region and the NHPAQ system in its assessment of alternative routes that meet the four screening criteria for alternative routes.

Length of Alternative Routes Criterion

Within the constraints of the control point criteria, development of alternative routes considered minimizing the length of pipeline that would be required to reach the control points. As a general rule, construction of each mile of pipeline would impact approximately 13.3 acres, not including extra workspaces, access roads, construction yards, pipe yards, and rail yards. Operation of each mile of pipeline would affect approximately 6.0 acres. As a result, there usually are environmental advantages to keeping the length of pipe required to reach the control points as short as possible while considering all other issues of concern.

Distance Parallel to Existing Linear ROW Criterion

In determining potential route alternatives, the fourth criterion was to establish routes that would have all or part of their length parallel to existing linear facility ROWs. Routes were considered parallel to existing ROWs if they were overlapping, directly adjacent to, or within 150 feet of an existing ROW. The industry standard for new pipeline centerline separation from existing pipelines is 25 feet, a distance sufficient to provide room for maintenance and construction restrictions.

The rationale for siting a new pipeline parallel to an existing ROW is that concentrating linear facilities in or near existing linear corridors may reduce the impacts to resources that have not previously been disturbed by major linear project construction. Installation of a new pipeline along existing, cleared ROWs may be environmentally preferable to construction along new ROWs, and construction and operation effects and cumulative impacts can normally be reduced by the use of previously cleared ROWs. However, if the new pipeline is installed in a ROW that is not within the existing ROW, the impacts may be similar to those of new construction that is not parallel to an existing ROW. In addition, in some cases it may be advantageous to select a new pathway, depending on the number of miles of new construction that may be required to capitalize on existing development corridors and the specific effects of corridor expansion in areas with important human development, cultural resources, or environmental resources. For example, while a new corridor may contribute to habitat fragmentation in areas with currently uninterrupted species use areas, the lateral expansion of an existing corridor with a new ROW may exacerbate the problem along that linear corridor. This criterion addresses the concern of many commenters that DOS should consider an alternative route paralleling the existing Keystone Oil Pipeline along all or part of its route.

4.3.2.2 Identification of Route Alternatives

The four criteria listed in Section 4.3.2.1 were used in the screening process to identify potential alternative routes to the proposed Project route within each segment. As described in Section 4.3.2, the routes were evaluated based on technical and economic practicability, and whether the or not the route alternative would meet the purpose of and need for the proposed Project. Alternatives that met those criteria were then evaluated to determine whether or not they offered an overall environmental advantage over the proposed route, particularly with regard to the avoidance criterion. Consistent with 40 CFR 1502.14, the reasons for eliminating alternative routes from further detailed study are provided for each potential alternative in the comparison of potential alternatives to the proposed route presented below. Additional information on the proposed Project route is presented in Sections 2.0 and 3.0.

4.3.3 Alternative Routes for the Steele City Segment

The Steele City Segment extends from the U.S./Canada border near Morgan, Montana to the northern end of the Cushing Extension near Steele City, Nebraska. For the Steele City Segment, the following potential route alternatives were considered:

- Express-Platte Alternative Routes (Section 4.3.3.1);
- Steele City Segment (SCS) Alternative A (Section 4.3.3.2);
- Alternative SCS-A1A (Section 4.3.3.3);
- Keystone Corridor Alternatives 1 and 2 (Section 4.3.3.4);
- I-90 Corridor Alternatives A and B (Section 4.3.3.5); and
- Baker Alternative (Section 4.3.3.6).

These alternative routes are depicted in Figures 4.3.3-1, 4.3.3-2, and 4.3.3-3. All alternatives would require inclusion of a new pipeline from the southern end of the Cushing Extension to delivery points in PADD III. In this analysis, it has been assumed that the route of the Gulf Coast Segment and the Houston Lateral of the proposed Project would be included in the Steele City Segment alternatives and that the impacts of construction, operation, and maintenance of those portions of these alternatives would result in impacts that would be identical to those identified in Section 3.

To comply with the requirements of Montana's MFSA, MDEQ considered two other route alternatives in Montana as well as many minor route variations in Montana. The development and analysis of the MFSA-related alternatives and variations in Montana are described in Appendix I to the EIS and summarized in Section 4.3.7.

4.3.3.1 Express-Platte Alternatives

The Express-Platte Pipeline System is a 1,700-mile-long oil transportation network that connects Canadian and U.S. producers to refineries in the Rocky Mountain and Midwest regions of the U.S. The system consists of two crude oil pipelines – the Express Pipeline and the Platte Pipeline. The Express Pipeline extends from Hardisty, Alberta Canada to markets in Montana, Wyoming, Utah, and Colorado.

It crosses the U.S./Canada border near the Port of Wild Horse, Montana and connects to the Platte Pipeline system at Casper, Wyoming. The Platte system extends from Casper to Wood River, Illinois.

At the request of MDEQ, Express-Platte Alternative 1 was developed to parallel the Express-Platte System from Hardisty to a point near the northern end of the Cushing Extension where it would require a short new pipeline to connect with the Cushing Extension. Although this alternative would not meet the control point criterion of starting near Morgan, where the Canadian portion of the route ends, the alternative was compared to the proposed route at the request of MDEQ. In addition, Express-Platte Alternative 2 was developed to meet the control-point criterion; i.e., it would begin at the control point at Morgan. Both of these alternative routes would require construction of a new pipeline to connect the southern end of the Cushing Extension to the delivery points in Texas (Gulf Coast Segment). In the assessment of the two Express-Platte alternatives, it was assumed that the route of the Gulf Coast Segment would be the same as for the proposed Project.

The Express-Platte alternative routes are addressed below. The existing Express-Platte System and the two Express-Platte alternatives are depicted on Figure 4.3.3-1.

Express-Platte Alternative 1

The U.S. portion of Express-Platte Alternative 1 (i.e., the Steele City Segment of the alternative) would be approximately 1,049 miles long. The proposed Project route in this area (Alternative SCS-B) would be approximately 851 miles long. Express-Platte Alternative 1 would parallel the existing Express-Platte corridor through Montana, Wyoming, Nebraska, and Kansas before diverting to connect with the Cushing Extension at Steele City. In comparison, the proposed Project route would be parallel to about 30 miles of existing ROWs along its 851.6-mile length. Although Express-Platte Alternative 1 would parallel an existing pipeline corridor, the existing easements along that corridor are in the control of a different company and it may not be possible to construct the alternative pipeline within the existing ROW.

Comparisons of the impacts of Express-Platte Alternative 1 on key environmental resources with those of the proposed Project route are presented in Table 4.3.3-1. The alternative is about 234 miles longer than the proposed Project route and would affect about 3,200 more acres than the proposed Project route when considering the 110-foot-wide construction ROW, extra work spaces, additional contractor and pipe yards, and additional access roads over that distance. Express-Platte Alternative 1 would also affect more wetlands, developed land, forested lands, rangeland and grassland, agricultural land, and federal lands as compared to the proposed route. It would also cross more streams and rivers and would extend across approximately 439 miles of the NHPAQ system as opposed to the 247 miles of the proposed route that would extend over the aquifer (see Figure 4.3.3-2). The alternative would cross approximately 31.9 miles of the Sand Hills topographic region as compared to 68.1 miles for the proposed Project.

In comparison to the proposed route, Express-Platte Alternative 1 would cross fewer miles of the Sand Hills topographic region. However, it would be substantially longer, have a greater area of impact, affect more areas of key resources, and would extend over more land underlain by the NHPAQ system. Therefore, the Express-Platte Alternative 1 would not offer an overall environmental advantage over the proposed route and was eliminated from further consideration.

Additionally, Keystone has obtained the necessary permits to construct the proposed Project in Canada which terminates north of the U.S./Canada border near Morgan. Implementation of Express-Platte Alternative 1 would require submitting a new permit application to NEB for a revised route in Canada, and the approval process would not be completed in a time frame that would meet the proposed Project objectives. For the above reasons Express-Platte Alternative 1 was eliminated from further consideration.

Express-Platte Alternative 2

Express-Platte Alternative 2 was developed to provide an alternative route that would start at the control point near Morgan while still paralleling the existing pipeline system over much of its length. This alternative, which is depicted on Figure 4.3.3-1 and included in the impact comparisons in Table 4.3.3-1, would be approximately 1,085.5 miles long. It would not require a new route in Canada.

TABLE 4.3.3-1
Impact Comparisons for the Steele City Segment Alternatives

Characteristic	SCS-B (Proposed Route)	SCS-A	SCS-A1A	Express-Platte 1	Express-Platte 2	Keystone Corridor 1	Keystone Corridor 2
Total Length (Miles)	851.6	923.2	954.6	1,049.2	1,085.5	1,102.2	639.6
Land Use (Acres)[a]							
Agricultural Land	2,974.6	7,264.5	7,617.6	5,240.6	4,434.2	10,360.5	5,554.3
Barren Land	6.3	8.6	10.5	66.1	81.7	1.5	1.5
Developed Land	174.2	363.8	363.2	432.6	400.7	521.6	323.1
Forested	33.0	89.6	89.9	93.1	140.5	171.1	106.1
Rangeland/Grassland	8,002.7	4,369.0	4,431.7	7,843.3	9,165.2	3,041.3	2,260.6
Wetlands	148.1	150.2	147.9	290.3	229.2	486.7	246.9
Open Water	15.8	63.6	67.2	23.3	21.8	113.3	36.0
Total	11,354.7	12,309.3	12,728.0	13,989.3	14,473.3	14,696.0	8,525.5
Federal Land Ownership (Acres)[b]							
Bureau Land Management	595.2	271.9	283.4	1,380.7	1,957.3	331.7	0.0
Bureau of Reclamation	0.0	0.0	0.0	286.8	286.8	0.0	0.0
Department of Defense	0.0	16.2	16.2	0.0	0.0	0.0	0.0
Fish and Wildlife Service	0.0	0.0	2.9	0.0	0.0	0.0	0.0
Forest Service	0.0	97.5	97.5	0.0	0.0	0.0	0.0
National Park Service	0.0	18.9	18.9	0.0	0.0	18.9	18.9
Total	595.2	404.5	418.9	1,667.5	2,244.1	350.6	18.9
Fort Peck Indian Reservation (Acres)[c]	0.0	1,200.0	0.0	0.0	0.0	0.0	0.0
Number of Streams and Rivers crossed[d]	454	544	538	695	693	540	395

[a] Land use from U.S. Geological Survey (USGS) 2001. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[b] Federal lands from ESRI 2004a or National Park Service 2010a. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[c] Fort Peck Indian Reservation from ESRI 2004a. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[d] Streams and rivers from ESRI 2004b.

Comparisons of the impacts on key environmental resources of Express-Platte Alternative 2 with those of the proposed Project route are presented in Table 4.3.3-1. This alternative would be about 198 miles longer than the proposed route and would affect about 2,700 more acres when considering the construction ROW, extra work spaces, additional contractor and pipe yards, and additional access roads over that distance. In addition, it would cross the Antelope Creek Wilderness Study Area from MP 112.7 to MP 114.9. BLM manages wilderness study areas under the National Landscape Conservation System to protect their value as wilderness until Congress decides whether or not to designate them as wilderness. On the north side of the Missouri River, 9,600 acres of this 12,350-acre wilderness study area were recommended for full wilderness designation. The area has many opportunities for solitude and recreation such as hiking, hunting, rock climbing, and photography.

Although in comparison to the proposed route, Express-Platte Alternative 2 would cross fewer miles of the Sand Hills topographic region, it would be substantially longer, have a greater area of impact, affect more areas of key resources, and would extend over more of the NHPAQ system. It would also cross a National Wilderness Study Area that has been recommended for full wilderness status. As a result, Express-Platte Alternative 2 would not offer an overall environmental advantage over the proposed route and was eliminated from further consideration.

4.3.3.2 Steele City Segment Alternative A (SCS-A)

Alternative SCS-A would parallel the existing Northern Border Pipeline ROW in its northernmost section for approximately 555 miles. It would then intersect and parallel the ROW of the existing Keystone Oil Pipeline for approximately 368 miles until reaching the control point at the northern end of the Cushing Extension. In comparison, the proposed Project route would parallel about 30 miles of existing ROWs along its 851.6-mile length. Alternative SCS-A would cross parts of Montana, North Dakota, South Dakota, and Nebraska. It would also cross 90 miles of the Fort Peck Indian Reservation in Montana, affecting approximately 1,200 acres of the reservation when considering the 110-foot-wide construction ROW, extra work spaces, additional contractor and pipe yards, and additional access roads over that distance.

In Montana, Alternative SCS-A would cross the BLM-managed Bitter Creek Wilderness Study Area, an area designated under the Federal Land Policy and Management Act as having wilderness characteristics consistent with the provisions of the Wilderness Act of 1964. In North Dakota, Alternative SCS-A would cross the Little Missouri National Grassland managed by the USFS. It would also cross the Missouri River along the South Dakota-Nebraska border and the Missouri River National Recreational Area administered by the NPS. However, it would avoid a crossing of the Yellowstone River.

Comparisons of the potential impacts on key environmental resources of Alternative SCS-A to those of the proposed route are presented in Table 4.3.3-1. SCS-A would cross substantially more agricultural and developed land, more wetlands, more forested land, and approximately 110 more streams and rivers than the proposed Project route. It would cross substantially less rangeland and grass land than the proposed route.

Alternative SCS-A would cross approximately 2.4 miles of the Sand Hills topographic region, whereas the proposed route would cross approximately 68.1 miles of the Sand Hills topographic region. However, the proposed Project route in the Sand Hills topographic region was selected to reduce erosion problems to the extent practicable, although some minor route re-alignments may be required during construction to avoid particularly erosion-prone locations such as ridge tops and existing blow-out areas (see CMR plan, Appendix B). During the proposed Project design effort, local NRCS offices and regional experts on Sand Hills reclamation from the University of Nebraska, University of South Dakota, and Nebraska Department of Roads were consulted and their recommendations on routing, construction techniques, and restoration techniques to minimize potential damage to Sand Hills vegetation were incorporated into the proposed Project plan (see Section 3.2.2.1, CMR plan in Appendix B, Pipeline Construction in Sand Hills Native Rangelands in Appendix H for additional information). Specific construction, reclamation, and post-construction activities would be employed in the Sand Hills based on the recommendations of these experts. Keystone would incorporate these procedures into construction within the Sand Hills topographic region, for either the proposed Project route or Alternative SCS-A.

Alternative SCS-A would extend across approximately 145 miles of the NHPAQ system in comparison to the 247 miles of the proposed Project route that would extend over the aquifer (see Figure 4.3.3-2). The proposed Project route would be constructed and operated across the aquifer using standard PHMSA regulatory requirements for pipeline construction and operation in 49 CFR 195 as well as a set of even more stringent Project-specific Special Conditions developed by PHMSA and agreed to by Keystone. Standard PHMSA requirements are described in greater detail in Sections 2.3 and 3.13.1 as are the 57 Project-specific Special Conditions developed by PHMSA that are also provided in Appendix U. In aggregate, these procedures would substantially reduce the potential risk of an accidental oil release from the pipeline anywhere along the proposed Project corridor. Based on the most recent PHMSA data for incidents associated with hazardous liquid pipelines (see Section 3.13.3.2), there is a statistical probability of 0.0007 incidents per mile of pipeline per year. These incident statistics include all releases from pipelines of all ages and are therefore conservative when compared to the potential risks from new pipelines designed consistent with current regulations, industry standards, and with the 57 Project-specific Special Conditions developed by PHMSA that would apply to the proposed Project. The majority of pipeline releases are small as further discussed in Section 3.13.

In summary, although the proposed Project route would cross more of the Sand Hills topographic region and overlie more of the NHPAQ system than would Alternative SCS-A, Alternative SCS-A would be approximately 72 miles longer than the proposed route and would affect at least 1,000 more acres than the proposed route when including the 110-foot-ROW, extra work space areas along the ROW, additional pipe and construction yards, and additional access roads. It would also impact more than twice as many acres of agricultural land, developed land, and forested land. Alternative SCS-A would cross more open water, substantially more streams and rivers, and slightly more wetlands than the proposed route. It would also cross tribal lands, wilderness areas managed by BLM, grasslands managed by USFS, and a major recreational area under the jurisdiction of NPS. Therefore, route Alternative SCS-A would not offer an overall environmental advantage over the proposed route and was eliminated from further consideration.

4.3.3.3 Steele City Segment Alternative A1A

Except for a short distance along the northern portion of Alternative SCS-A1A, this route is the same as that of Alternative SCS-A (see Figure 4.3.3-1). Alternative SCS-A1A deviates from Alternative SCS-A to avoid affecting lands within the Fort Peck Indian Reservation in Montana. The deviation would begin in central Valley County, Montana and extend to the east along a path that would be north of the reservation. It would then turn south to pass to the east of the reservation in Sheridan County until crossing into Roosevelt County, Montana where it would extend to the southeast and cross into Williams County, North Dakota. From there, Alternative SCS-A1A would follow the same route as Alternative SCS-A to reach the control point at the northern end of the Cushing Extension.

Alternative SCS-A1A would cross Diversion Ditch No. 1 in the Medicine Lake National Wildlife Refuge (NWR), a canal that connects the refuge to Big Muddy Creek in Sheridan County and prairie potholes east of the Fort Peck Indian Reservation. Medicine Lake NWR is a 31,660-acre refuge established to provide breeding habitat for migratory birds and other wildlife. Prairie potholes are present in northeastern Montana and North Dakota. These are depressional wetlands (primarily freshwater marshes) that are either permanent or temporary potholes that provide breeding areas and habitat for migratory birds and help prevent downstream flooding. These sensitive habitats are more prominent in the eastern portion of Alternative SCS-A1A than other Steele City Segment alternatives.

Comparisons of the potential impacts on key environmental resources of Alternative SCS-A1A to those of the proposed Project route are presented in Table 4.3.3-1. Alternative SCS-A1A would cross substantially more agricultural and developed land, more forested land, and 84 more streams and rivers than the proposed route. However, the alternative would cross substantially less rangeland and grass land than the proposed route. Alternative SCS-A1A would be approximately 103 miles longer than the proposed Project route and would affect at least 1,400 more acres when including the 110-foot-wide construction ROW, extra work space areas, additional pipe and construction yards, and additional access roads. Alternative SCS-A1A would have the same route as Alternative SCS-A across the Sand Hills topographic region and the NHPAQ system.

In summary, the impacts to key environmental resources associated with Alternative SCS-A1A, including impacts to BLM-managed Bitter Creek Wilderness Study Area, the Little Missouri National Grassland managed by the USFS, and the Missouri River National Recreational Area administered by the NPS are similar to those of Alternative SCS-A. However, Alternative SCS-A1A would also cross the Medicine Lake NWR and would affect the environmentally sensitive prairie pothole areas. Therefore, as with Alternative SCS-A, Alternative SCS-A1A would not offer an overall environmental advantage over the proposed route and was eliminated from further consideration.

4.3.3.4 Keystone Corridor Alternatives

Although Alternatives SCS-A and SCS-A1A would parallel the existing Keystone Oil Pipeline ROW for about 368 miles, several commenters on the draft EIS and supplemental draft EIS requested that the proposed Project follow a route that would parallel the entire existing Keystone Oil Pipeline in the United States. Many commenters on the draft EIS and supplemental draft EIS expressed particular concerns about the risks to groundwater resources and recommended that the existing Keystone route be used to reduce the distance of pipeline that would overlay the Sand Hills topographic region of Nebraska and the NHPAQ system, which includes the Ogallala aquifer. As a result of these comments, a Keystone Corridor Alternative (now identified as Keystone Corridor Alternative 1) was examined in the supplemental draft EIS (see Figure 4.3.3-1).

Commenters on the supplemental draft EIS suggested that the border crossing at Morgan, Montana be replaced with a border crossing at Pembina, North Dakota, the border crossing location for the existing Keystone Oil Pipeline. In response to these comments, DOS examined Keystone Corridor Alternative 2 (see Figure 4.3.3-1) with a border crossing at Pembina, even though such an alternative would not meet the control point criterion (see Section 4.3.2.1) of starting near Morgan, Montana, where the Canadian portion of the proposed Project route would end.

Keystone Corridor Alternative 1 is approximately 251 miles longer in the United States than the proposed Project. Keystone Corridor Alternative 2 is approximately 212 miles shorter than the proposed Project route in the United States, but would increase the route of the proposed pipeline in Canada by approximately 250 miles. The proposed Project route and Keystone Corridor Alternative 1 would start near Hardisty, Alberta and would follow a relatively direct route that includes approximately 329 miles of new pipeline in Canada to the international border crossing near Monchy, Saskatchewan and Morgan, Montana. Keystone Corridor Alternative 2 would parallel the approximately 769-mile Canadian portion of the existing Keystone Oil Pipeline Project from Hardisty, Alberta to the international border crossing near Haskett, Manitoba and Pembina, North Dakota. Keystone Corridor Alternative 2 would therefore require an additional 440 miles of new pipeline in Canada.

Keystone Corridor Alternative 1 extends eastward approximately 463 miles from Morgan, Montana to Pembina, North Dakota but diverts southeastward and then northwestward along the route to avoid major national wildlife refuges and several smaller refuges as well as the Turtle Mountain Indian Reservation that are present near the northern border of North Dakota. From Pembina, North Dakota, both Keystone Corridor Alternatives 1 and 2 extend southward paralleling the existing Keystone Oil Pipeline route for about 640 miles to the control point at the northern end of the Cushing Extension. In comparison, the proposed Project route would parallel about 30 miles of ROWs of the existing Northern Border Pipeline and the existing Keystone Oil Pipeline along the proposed Steele City Segment.

Consistent with NEPA regulations, DOS requested that Keystone provide an assessment of the relative costs of Keystone Corridor Alternatives in comparison to the proposed Project, to consider the economic feasibility of those alternatives. The original Keystone Oil Pipeline crossed the border near Pembina, North Dakota because an existing 30 inch natural gas pipeline in Canada was converted for use as part of the original Keystone Oil Pipeline, thus reducing the need for new pipeline in Canada by the length of that converted pipeline segment. As explained above, following either of the Keystone Corridor Alternatives would require approximately 250 miles of additional new pipeline construction either in the United States or Canada compared to the proposed Project route. That additional mileage of new construction, as well as other modifications that would need to be made to the proposed Project, would produce additional costs of approximately $1.6 billion, approximately a 25 percent increase in the total cost of the proposed Project.

In comments on the supplemental draft EIS, Keystone stated that the added costs of the Keystone Corridor Alternatives would make those routes economically infeasible. In a subsequent email submitted to DOS, Keystone provided the following clarification:

> “The Keystone XL project that the shippers supported was the project as presented in the Presidential Permit application. A material departure from this proposal and the associated higher cost would have made the project commercially infeasible. . . . Contract shippers on Keystone XL pay a fixed and a variable toll to transport crude oil to market while spot shippers pay a toll higher than the combined contract toll. Both the fixed and spot tolls would have increased by approximately 25% from adoption of the Keystone Corridor Alternative at the initial routing stage as a result of the increase in capital costs. Transportation rates at this level would not have been acceptable and commercial support for the project would not have been received.”

There are a number of factors that must be evaluated when considering the economic feasibility of a privately funded project. In the case of a pipeline system, as indicated in Keystone’s comment, increased capital costs are passed along to shippers in the form of higher tariffs. Thus, the economics of a particular pipeline project involve both capital financing and the ability and/or willingness of shippers to pay higher tariffs resulting from increased capital costs of pipeline construction. The higher tariffs could impact the decisions of the shippers who signed binding contracts to ship crude oil on the proposed Project as well as future shippers who may purchase transport capacity on the pipeline on the spot market.

In the 2008 Keystone XL Project Open Season, the shippers who signed contractual commitments with Keystone to transport 380,000 bpd selected the proposed Project over several other planned or potential projects. Potential projects available to shippers at that time included, as explained in Section 4.2.2, the Chinook-Maple Leaf Pipeline System, the Texas Access Pipeline, the Enbridge Trailbreaker Project, the Enbridge-BP Delivery System, and the Canadian National and Altex PipelineOnRail concept. The shippers who selected the proposed Project over those planned or potential projects did so based on a range of potential tariff charges. A 25 percent increase in capital costs and a resultant similar increase in tariffs for the proposed Project would have substantially changed the economic choice for shippers.

The proposed Project would hold approximately 28 percent of its ultimate operating capacity (830,000 barrels per day) available for shippers to purchase on the spot market.5 Although many of the competing pipeline projects from 2008 are not currently active proposals, there are still many proposed pipeline options to transport WCSB crude oil, and those potential options have increased in the past 8 months (EnSys 2011). Further, the rapid development of crude oil rail transport capacity in the Williston Basin in North Dakota and Montana and the barge transport between PADD II and PADD III discussed in Section 4.2.3.3 demonstrate that alternate modes of transport can be a competitive option to pipeline transport in some circumstances. It is reasonable to infer that a 25 percent increase in tariffs for the proposed Project would have influenced shippers to select other pipeline projects, other modes of transport (particularly rail), or intermodal transport options.

This is consistent with the findings of EnSys (2011). The EnSys (2011) results suggest that a 25 percent pipeline tariff increase to approximately $8.75 per barrel would place pipeline transport tariffs only slightly below the range of railroad tank car transport costs for dilbits (estimated to be $9 to $12 per barrel). Additionally, EnSys (2011) estimated the cost of shipping raw bitumen to PADD III by rail to range from $6 to $10 per barrel, depending upon whether the train cars returned to the WCSB empty, or backhauled diluent. Further, EnSys (2011) notes that this is competitive with the net cost of diluting bitumen and transporting it by pipeline when accounting for the shipping cost of the diluent mixed with the bitumen. Given that these cost comparisons were based on tariff estimates for the proposed Project without an additional 25 percent tariff increase, it is reasonable to infer that the selection of either Keystone Alternative 1 or 2 would produce a tariff that would be much less competitive than rail transport.

In light of the above considerations, DOS determined that the Keystone Corridor Alternatives could have been eliminated without further evaluation as unreasonable route alternatives because they are not economically practical or feasible. In light of the intense public interest in those potential alternatives, and in response to comments received on the draft EIS and supplemental draft EIS on the topic, DOS further evaluated those alternative routes with a focus on a comparison of potential impacts to groundwater resources.

As noted in the discussion of the criterion regarding use of existing ROWs in Section 4.3.2.1, installation of a new pipeline along existing, previously cleared and maintained ROWs may be environmentally preferable to construction along new ROWs, and construction and operation effects and cumulative impacts can normally be reduced by the use of previously cleared ROWs. However, if a pipeline is installed in a ROW that is not within the existing ROW, the impacts may be similar to those of new construction that is not parallel to an existing ROW. It is possible that the route of the Keystone Corridor Alternatives could be included within part of the existing Keystone Oil Pipeline permanent ROW along some of the route since Keystone would be the owner of both pipelines. However, it is also likely that a 25-foot separation between pipelines would be required for safety. This would result in the alternative pipeline being installed no closer than at about the edge of the existing 50-foot-wide permanent ROW (25 feet on each side of the existing pipeline) except in areas where there are constraints outside of and adjacent to the existing ROW. In those areas the route would have to be aligned to be as close to the existing ROW as possible but would not be adjacent to it. In addition, to avoid damage to the existing pipeline, construction equipment and most construction activities would be limited to one side of that pipeline. Therefore, construction of either of the Keystone Corridor Alternatives would require an area outside of the permanent ROW of the existing Keystone Oil Pipeline to accommodate the construction equipment and activities. This area would also extend beyond the previously disturbed construction

[5] If increased tariffs made it economically infeasible for Keystone to transfer the 150,000 bpd it has contracted to deliver to Cushing, Oklahoma on the existing Keystone Oil Pipeline to the proposed Project, the planned available capacity for spot shipments could increase to approximately 46 percent.

ROW of the existing Keystone Oil Pipeline since the edge of that construction ROW was typically about 55 feet from the center of the pipeline. In addition, the portion of the construction ROW of the existing pipeline that is outside of the permanent ROW (i.e., the area typically 30 feet from the edge of the permanent ROW) has been reclaimed and would be cleared and disturbed again if either of the Keystone Corridor Alternatives were constructed, thus negatively affecting ROW restoration already implemented or ongoing along these corridors.

It is likely that construction of the Keystone Corridor Alternatives would require a construction ROW that is approximately the same width as the construction ROW of the proposed Project. Therefore, for comparison purposes, it was assumed that the Keystone Corridor Alternatives would have a construction ROW that would extend 110 feet from the existing pipeline and that there would be only minor disturbances to the existing permanent ROW between the edge of that ROW and the existing pipeline. The portion of the route between Morgan, Montana and the existing pipeline for Keystone Corridor Alternative 1 would also require a 110-foot-wide construction ROW. In addition, construction of the alternatives would require land for pipe rail yards, pipe storage yards, construction yards, temporary access roads, and in the portion of Keystone Corridor Alternative 1 between Morgan and the existing pipeline, construction camps would likely be required to house the workforce since that area is remote and there is little transient housing available.

As a result, construction of Keystone Corridor Alternative 1 between Morgan and the existing Keystone ROW and along the area adjacent to the existing 640-mile-long ROW would affect an area that would be approximately 3,400 acres larger in the United States than the area affected by construction of the proposed Project. Construction of Keystone Corridor Alternative 2 areas affected adjacent to the existing Keystone Oil Pipeline ROW would be approximately 2,822 acres smaller in the United States than the area affected by construction of the proposed Project, but would increase the acreage in Canada by an amount similar to the increased acreage of the Keystone Corridor Alternative 1.

Potential Risks to Groundwater Resources Associated with Proposed Project Corridor and Keystone Corridor Alternatives 1 and 2

As the Keystone Corridor Alternatives were developed primarily in response to comments expressing concern about the risk to groundwater resources, particularly the NHPAQ system, a comparison of potential risk to groundwater resources based on aquifer characteristics and existing groundwater use (as determined by number of wells and well density) was performed. Potential environmental consequences in the event of an accidental spill from the proposed Project are discussed in Section 3.13.6.3.

Both Keystone Corridor Alternatives would reduce mileage over the NHPAQ system from approximately 247 miles along the proposed Project route, to approximately 145 miles. Limiting mileage over the NHPAQ system, however, does not necessarily limit cumulative risk to groundwater resources. Although the NHPAQ does not extend under eastern North Dakota and South Dakota (see Figure 4.3.3-2), there are significant numbers of shallow and very shallow wells along the Keystone Corridor Alternatives in those states (see Figure 4.3.3-3). These shallow wells are completed in aquifers 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." (USGS 2009). In addition, the Keystone Corridor Alternatives would cross from South Dakota into Nebraska in Cedar County, Nebraska where heavily used shallow groundwater resources with high hydraulic conductivity are present and are not part of the NHPAQ system, including highly utilized alluvial aquifers in the Missouri River Valley (Olsson Associates 2010). These findings suggest that reduced mileage over the NHPAQ system does not necessarily equate to a reduction in risk to groundwater resources.

Groundwater resources at various depths are utilized in all states through which the proposed Project route and the Keystone Corridor Alternatives would pass. Well depth categories for groundwater wells within one mile of the centerline of the proposed Project route and the Keystone Corridor Alternatives are presented in Table 4.3.3-2 and in Figure 4.3.3-3. Within the U.S., Keystone Corridor Alternative 2 has the fewest wells within 1 mile on either side of the centerline. This is consistent with the fact that in the U.S. Keystone Corridor Alternative 2 is approximately 212 miles shorter than the proposed Project route and approximately 463 miles shorter than Keystone Corridor Alternative 1. As noted above, Keystone Corridor Alternative 2 minimizes total mileage in the U.S. by substantially increasing the mileage of new pipeline construction that would be required in Canada. Keystone Corridor Alternative 1 is the longest of the three alternatives in the U.S. (approximately 251 miles longer than the proposed Project) and also has the highest number of wells within 1 mile of either side of its centerline.

In Nebraska, the proposed Project route would be approximately 255 miles in length compared to approximately 204 miles (approximately 25 percent more mileage) for the Keystone Corridor Alternatives. This longer distance is reflected in 19 percent more nearby wells occurring along the proposed Project route than near the Keystone Corridor Alternatives.

Close examination of Figure 4.3.3-3 in light of the locations and number of wells provided above, provides insight relative to groundwater usage along the 2 mile wide corridors surrounding each centerline. For instance, while the number of shallow wells shown in Table 4.3.3-2 along the proposed Project is higher than the number of shallow wells along the Keystone Corridor Alternatives, these shallow wells are primarily concentrated in the Platte River Unit of the NHPAQ system, not within the Sand Hills Unit.

TABLE 4.3.3-2
Well Locations within 1 Mile of the Centerline for the Proposed Route and the Keystone Corridor Alternatives by Depth Category

Likely Depth to Groundwater Category[a]	SCS-B (Proposed Route)	Keystone Corridor 1	Keystone Corridor 2
Montana			
A	51	10	-
B	22	5	-
C	46	11	-
D	38	12	-
E	59	14	-
Total	216	52	-
North Dakota			
A	-	28	5
B	-	43	22
C	-	29	2
D	-	145	30
E	-	61	17
Total	-	306	76
South Dakota			
A	11	2	2
B	13	9	9
C	5	8	8
D	40	82	82
E	58	278	278
Total	127	379	379

TABLE 4.3.3-2 Well Locations within 1 Mile of the Centerline for the Proposed Route and the Keystone Corridor Alternatives by Depth Category			
Likely Depth to Groundwater Category[a]	**SCS-B (Proposed Route)**	**Keystone Corridor 1**	**Keystone Corridor 2**
Nebraska			
A	183	70	70
B	62	25	25
C	115	75	75
D	205	218	218
E	629	583	583
Total	1,194	971	971
Totals			
A	245	110	77
B	97	82	56
C	166	123	85
D	283	457	330
E	746	936	878
Total	1,537	1,708	1,426

[a] Categories are as follows:

Category A: very shallow water depth likely with reported water level less than or equal to 10 feet bgs and total well depth less than or equal to 50 feet bgs;

Category B: shallow water depth likely with reported water level between 10 and 50 feet bgs and total well depth less than or equal to 50 feet bgs;

Category C: water depth unclear but potentially very shallow since reported water level is less than or equal to 10 feet bgs and total well depth is greater than 50 feet bgs (reported water level could indicate very shallow water depth if well screened in upper 50 feet or deep water depth if well screened at deeper interval under artesian conditions);

Category D: water depth unclear but potentially shallow since reported water level is between 10 and 50 feet bgs and total well depth is greater than 50 feet bgs (reported water level could indicate shallow water depth if well screened in upper 50 feet or deep water depth if well screened at deeper interval under artesian conditions); and

Category E: deep water depth likely with reported water level greater than 50 feet bgs and total well depth greater than 50 feet bgs.

Likely depth to groundwater categories are described in more detail in Section 3.3.1.1.

In general, since well locations are not evenly distributed either along the overall proposed Project pipeline route or along the Keystone Corridor Alternatives, it is useful to compare the number of miles in particular categories of well density to determine which route would traverse areas of relatively heavier use. A comparison of the mileage along the proposed Project route and the Keystone Corridor Alternatives by well density category is shown in Table 4.3.3-3. Most of the distance for all three routes occurs in areas where the well density is 2 wells or less per square mile. The proposed Project route and Keystone Corridor Alternative 1 traverse approximately 107 miles with a well density of 2 or more per square mile and Keystone Corridor Alternative 2 traverses approximately 90 miles within the same well density category. Additionally, the proposed Project route traverses approximately 61 miles within the 0 to 1 well density category overlying the Sand Hills Unit of the NHPAQ system. Overall, the proposed Project route traverses the fewest miles with a well density of 4 or more wells per square mile (62 miles), compared to the Keystone Corridor Alternative 1 (83 miles) and Keystone Corridor Alternative 2 (69 miles).

TABLE 4.3.3-3
Miles Crossed per Well Density Category[a] for the Proposed Route and the Keystone Corridor Alternatives

Well Density	SCS-B (Proposed Route)	Keystone Corridor 1	Keystone Corridor 2
Montana			
0-1	253.5	153.9	-
1-2	13.9	0.3	-
2-4	11.5	1.2	-
4-8	1.2	2.2	-
8-16	1.4	0.9	-
> 16	0.0	0.3	-
Total	281.5	158.8	-
North Dakota			
0-1	-	494.8	199.9
1-2	-	2.9	1.5
2-4	-	3.7	1.9
4-8	-	9.6	2.2
8-16	-	6.1	2.6
> 16	-	0.1	0.0
Total	-	517.2	208.1
South Dakota			
0-1	309.1	195.1	195.1
1-2	5.2	5.0	5.0
2-4	0.0	6.3	6.3
4-8	0.0	9.5	9.5
8-16	0.0	3.4	3.4
> 16	0.0	1.0	1.0
Total	314.3	220.3	220.3
Nebraska			
0-1	136.1	129.7	129.7
1-2	26.7	9.9	9.9
2-4	33.3	13.4	13.4
4-8	45.1	27.8	27.8
8-16	11.2	20.1	20.1
> 16	2.8	2.1	2.1
Total	255.2	203.0	203.0
Totals[b]			
0-1	698.7	973.5	524.7
1-2	45.8	18.1	16.4
2-4	44.8	24.6	21.6
4-8	46.3	49.1	39.5
8-16	12.6	30.5	26.1
> 16	2.8	3.5	3.1
Total	851.0	1,099.3	631.4

[a] Well density is defined as the number of wells per square mile within a 2 mile corridor surrounding proposed route or alternative centerline. Sources for water wells by state are depicted in Figures 3.3.1-1 through 3.3.1-5. Wells per square mile were determined by using the ArcGIS Kernal Density tool. Well density categories were derived from those used for University of Nebraska-Lincoln study available at http://snr.unl.edu/data/download/water/GWMapArchives/2010GWMaps/Density.pdf.

[b] The ArcGIS Kernal Density tool estimated mileage for each route will not exactly match total mileage depicted in Table 4.3.3-1 due to missing density values.

In Nebraska, the NHPAQ system is extensively studied and has very complete publicly available information about hydraulic conductivity throughout the system (see Figure 4.3.3-4). Hydraulic conductivity is a mathematical expression of the ease with which water can move through the aquifer. There are areas along the Keystone Corridor Alternatives where the hydraulic conductivity of aquifers within the NHPAQ system is substantially higher than in the Sand Hills topographic region or along any other segment of the proposed Project route in Nebraska overlying the NHPAQ system (Figure 4.3.3-4). These areas tend to coincide with areas of shallow groundwater, as shown in Figure 4.3.3-5.

There are three segments of the proposed Project route in Nebraska where there is a relatively high well-density that coincides with very shallow groundwater (10 feet or less below the ground surface) (see Figure 4.3.3-5). Each of these segments is approximately 20 miles in length. They occur in Northwest Holt County within the Sand Hills topographic region, in Merrick County north of the Platte River crossing, and in York County. A close examination of Figures 4.3.3-4 and 4.3.3-5 indicates that the densest concentration of the very shallow wells along the proposed Project route does not occur within the Sand Hills topographic region, but rather where the proposed Project route crosses the Platte River Unit of the NHPAQ system in Merrick County. On the proposed Project route, other areas with relatively shallow groundwater occur within Northeast Garfield county and Saline County.

Along the Keystone Corridor Alternatives in Nebraska there are also three segments where relatively higher well densities coincide with very shallow groundwater. Two of these segments are associated with the alluvium of either the Platte or the Loup and Elkhorn River Valleys and exhibit higher hydraulic conductivities than the Sand Hills topographic region (see Figure 4.3.3-4). These segments comprise approximately 10 miles in central Stanton County along the Elkhorn and Loup Rivers, and approximately 20 miles across the border of Colfax and Butler counties within the Platte River valley. The third segment comprises approximately 20 miles within Seward and Saline counties. A study conducted as part of the Eastern Nebraska Water Resources Assessment (University of Nebraska-Lincoln 2010) reported that many areas that would underlie the Keystone Corridor Alternatives consist of unconsolidated sediments of ancient valleys (paleovalleys) which have high porosity and permeability. Other areas with relatively shallow groundwater also occur along these alternatives including segments along the Missouri River through most of Cedar County, and within Seward and Saline counties.

As stated above, many of the areas of very shallow groundwater and relatively high groundwater use along the Keystone Corridor Alternatives also coincide with areas within the NHPAQ that exhibit much higher rates of hydraulic conductivity (see Figure 4.3.3-4) than similar areas along the proposed Project route. In particular, the Keystone Corridor Alternatives pass through approximately 20 miles in Stanton, Colfax, and Butler counties where the hydraulic conductivities range from 100 to 300 feet per day. In contrast, the proposed Project route would traverse less than 3 miles of areas within the NHPAQ with shallow groundwater, relatively high well density, and hydraulic conductivities between 100 and 200 feet per day. Additionally, the proposed Project route would not cross any areas of the NHPAQ in Nebraska with hydraulic conductivities above 200 feet per day. Most areas with very shallow groundwater and high well density within the NHPAQ along the proposed Project route occur in areas where the hydraulic conductivity ranges between 25 and 50 feet per day.

At the suggestion of EPA, areas of potential groundwater recharge within Nebraska along the proposed Project route and the Keystone Corridor Alternatives were also assessed. The Sand Hills topographic region has very high recharge potential, including where the proposed Project route would traverse Holt County, Garfield County, and Wheeler County (Szilagyi et al. 2005). Other areas of high recharge potential along the proposed Project route include areas within the Niobrara River valley, and the Platte River valley in Merrick County. The Keystone Corridor Alternatives traverse areas of high recharge potential in the Missouri River valley in Northern Cedar County, in Central Stanton County in the area of the Loup and Elkhorn River valleys, in Southern Colfax and Northern Butler counties in the Platte River valley, and in Southern Seward County and the southern half of Saline County (Szilagyi et al. 2005). While the total mileage through areas of high recharge potential along the proposed Project route is higher, most of that mileage occurs in areas of the Sand Hills topographic region with very low well density (from 0-1 wells per square mile).

To summarize, the Keystone Corridor Alternatives would transfer groundwater risks to a route through North Dakota and South Dakota with increased mileage overlying shallow groundwater aquifers compared to the proposed Project route through Montana and South Dakota, and while the Keystone Corridor Alternatives would reduce the total mileage overlying shallow groundwater in Nebraska largely by avoiding the Sand Hills topographic region, they do not significantly reduce the total mileage across areas with shallow groundwater in Nebraska, and increase the mileage across areas with higher groundwater usage. Further, they would increase the mileage across areas of the NHPAQ system in Nebraska with substantially higher hydraulic conductivities than those in the Sand Hills topographic region. The Keystone Corridor Alternatives therefore would not eliminate the risk to groundwater resources. Rather, they would transfer that risk to other groundwater areas and other groundwater users, both within the NHPAQ system and elsewhere.

Comparative Assessment of Potential Impacts to Other Key Environmental Resources Associated with Proposed Project Corridor and Keystone Corridor Alternatives 1 and 2

A comparison of potential impacts to key environmental resources of the Keystone Corridor Alternatives to those of the proposed Project route is presented in Table 4.3.3-1.

The proposed Project route would affect about 2.6 times more rangeland and grassland than Keystone Corridor Alternative 1 (4,961 more acres) and about 3.5 times more than Keystone Corridor Alternative 2 (7,907 more acres). This would represent an increase in the potential for impacts to rangeland and grassland soils, lost grazing areas and grazing time, and other short- to long-term impacts to those areas as compared to the alternatives. However, Keystone Corridor Alternative 1 would affect about 3.5 times more agricultural land than the proposed Project route, or about 7,386 more acres. Similarly, Keystone Corridor Alternative 2 would affect about 1.8 times more agricultural land than the proposed Project route, or about 5,354 more acres. This would result in increasing the potential for short- to long-term impacts to soil, crop production, and other damages to agricultural land as compared to the impacts of the proposed Project.

The Keystone Corridor Alternative 1 would affect almost 3 times more acres of developed land than the proposed Project route, or about 523 more acres. Similarly, Keystone Corridor Alternative 2 would affect about 1.8 times more developed land than the proposed Project route, or about 149 more acres. Impacts in developed land would be associated primarily with construction, although it is possible that pump stations and MLVs could be in the vicinity of the developed areas and would affect visual quality and create noise impacts during operation. However, there has not been a hydraulic design of the Keystone Corridor Alternatives and it is not possible to identify the locations of pump stations or MLVs along the alternative routes.

The Keystone Corridor Alternative 1 would affect about 3.3 times more wetland area than the proposed Project route, or about 339 more acres. Similarly, The Keystone Corridor Alternative 2 would affect about 1.7 times more wetland area than the proposed Project route, or about 99 more acres. This is a substantially greater area of wetland, although mitigation measures would be implemented to avoid or minimize the impacts to wetlands and compensatory mitigation would likely be required as part of the USACE Section 404 permitting process.

The Keystone Corridor Alternative 1 would affect approximately 5 times more forested area, or about 138 more acres. Similarly, The Keystone Corridor Alternative 2 would affect approximately 3 times more forested area, or about 73 more acres. That is a substantially greater area of forest impact than that of the proposed Project and could affect visual resources, wildlife habitat, and habitat fragmentation.

Both Keystone Corridor Alternatives would apparently involve more acreage of open water crossings than the proposed route. However, while Keystone Corridor Alternative 1 would have approximately 86 more stream crossings than the proposed route, Keystone Corridor Alternative 2 would have approximately 59 fewer stream crossings than the proposed route.

Comments received in 2007 on the draft EIS for the Keystone Oil Pipeline Project are informative relative to the likelihood of public acceptance of a second pipeline paralleling that project. Specific concerns were expressed at that time from residents of North Dakota, South Dakota, and Nebraska relative to the possibility of future pipelines following the existing Keystone Oil Pipeline route. Commenters from North Dakota expressed concern about the project's effect on water supplies, including the water supplies for Fargo, North Dakota and the potential for contamination of the Sheyenne River drainage. Contamination of that drainage could lead to transboundary impacts to Lake Winnipeg and the Hudson Bay drainage in Canada, as well as potential contamination of shallow aquifers. Commenters from South Dakota were concerned about impacts of the Keystone Oil Pipeline Project crossing of the Missouri River, especially through a National Wild and Scenic River reach. The Keystone Corridor Alternatives would cross the Missouri River in the same reach.

Additional concerns were related to rural water supply impacts, including the WEB, Clark, Hanson, Turner McCook, Lewis and Clark, and B-Y water systems. Concerns raised in 2007 by commenters from Nebraska included the project route through Seward, Nebraska and potential impacts to the Seward water system. In all three states, the presence of shallow groundwater aquifers beneath the Keystone route was a concern, including concerns about potential impacts to the NHPAQ system, which includes the Ogallala Unit of the aquifer.

While the Keystone Corridor Alternatives would eliminate most disturbance of the Sand Hills topographic region, the proposed Project route was selected to reduce erosion problems to the extent practicable, although some minor route re-alignments may be required during construction to avoid particularly erosion-prone locations such as ridge tops and existing blow-out areas (see the CMR plan in Appendix B). During the proposed Project design effort, local NRCS offices and regional experts on Sand Hills reclamation from the University of Nebraska, University of South Dakota, and Nebraska Department of Roads were consulted and their recommendations on routing, construction techniques, and restoration techniques to minimize potential damage to Sand Hills vegetation were incorporated into the proposed Project plan (see Section 3.2 and Appendices B and H for additional information). Specific construction, reclamation, and post-construction activities would be employed in the Sand Hills topographic region based on the recommendations of these experts. Keystone would incorporate these procedures into construction within the Sand Hills topographic region, for either the proposed Project route or the Keystone Corridor Alternatives.

Summary

Groundwater information reflected by well depth data, well density data, and hydraulic conductivity data (where available) suggest that there is no overall environmental advantage to either Keystone Corridor Alternative 1 or Keystone Corridor Alternative 2 in terms of cumulative risk to groundwater resources overall or in Nebraska specifically.

Comparison of potential impacts to other key environmental resources, as well as public concerns relative to the existing Keystone Oil Pipeline Project as expressed in comments during that project's environmental review, also suggest that there is no overall environmental advantage to either Keystone Corridor Alternative 1 or Keystone Corridor Alternative 2 (see Table 4.3.3-1), although in general, shorter routes tend to produce fewer environmental effects, thus suggesting that in the U.S. Keystone Corridor Alternative 2 may provide an environmental advantage due to its shorter length. However, any environmental benefit from reduced mileage in the U.S. would be more than offset by increased mileage in Canada. Implementation of Keystone Corridor Alternative 2 would result in approximately 200-300 additional miles of pipeline from Hardisty, Alberta to Steele City, Nebraska.

As stated previously, DOS determined that the Keystone Corridor Alternatives are not reasonable route alternatives because they are not economically practical or feasible. In addition, after further evaluation of all screening level environmental impact comparisons, DOS determined that there would not be an overall environmental advantage to either Keystone Corridor Alternative 1 or Keystone Corridor Alternative 2 as compared to the proposed Project. For the above reasons, these alternatives were eliminated from further consideration.

4.3.3.5 I-90 Corridor Alternatives A and B

The I-90 Corridor Alternatives A and B were also developed as alternatives that would reduce the length of pipeline over the Sand Hills topographic region and the NHPAQ aquifer system, which includes the Ogallala formation. While these alternatives are not consistent with the screening criterion of avoiding major water bodies, they were developed largely in response to comments received on the draft and supplemental draft EIS expressing concerns regarding the risk of spills to the NHPAQ system.

The alternatives were developed to parallel I-90 or other existing ROWs to the extent possible to minimize new corridor development while avoiding to the extent practicable crossings of either the Sand Hills topographic region or the NHPAQ system. The I-90 Corridor Alternatives divert from the proposed Project route after crossing under I-90 in Nebraska and extend roughly eastward along the south side of I-90 to a point approximately 2 miles west of Alexandria, South Dakota. At that location, the Burlington Northern and Santa Fe (BNSF) railroad line diverts from the I-90 corridor and extends to the southeast parallel to State Highway 262 for approximately 16 miles. The I-90 Corridor Alternatives parallel the railroad/262 corridor to a point east of Emery, South Dakota where they intersect the existing Keystone Oil Pipeline Project ROW. From there, the alternative routes parallel the existing Keystone Oil Pipeline Project ROW to the control point at Steele City, Nebraska (see Figure 4.3.3-1 and Figure 4.3.3-6).

The pipeline for the I-90 Corridor Alternatives would not be installed within the existing highway ROW since the South Dakota Department of Transportation does not allow pipelines to be installed laterally within the I-90 ROW, although it does allow pipelines to cross the I-90 ROW. These alternatives would therefore require the development of new ROW in undisturbed land to the south of the existing highway ROW. The pipeline would not be installed within the BNSF railroad ROW but would be parallel to the ROW and would require the development of new ROW in undisturbed land near the existing railroad ROW.

The I-90 Corridor Alternatives would require two more crossings of the Missouri River than the proposed Project route, and these crossings would be within environmentally sensitive areas. One of these crossings would be at Lake Francis Case, a reservoir along the Missouri River formed by Fort Randall Dam. This dam is approximately 90 miles downstream of the potential crossing sites. Given the sensitivity of the crossing area, two variations of the I-90 Corridor Alternatives (A and B) were considered. I-90 Corridor Alternative A is parallel to I-90 through the Oacoma area and crosses Lake Francis Case adjacent to I-90. I-90 Corridor Alternative B parallels the South Dakota Highway 16/South Dakota Highway 50 alignment through the Oacoma area and across Lake Francis Case (see Figure 4.3.3-7). I-90 Corridor Alternative A avoids the downtown area of Chamberlain but requires crossing a steep bluff on the east side of the lake. I-90 Corridor Alternative B extends through the downtown area of Chamberlain but avoids the steeper portions of the bluff.

The two crossing sites are approximately 5,200 and 5,800 feet long and would likely involve the use of the HDD method if geotechnical considerations are appropriate. However, for large-diameter pipelines, the HDD method is limited to a distance of approximately 6,000 feet. When considering the onshore distance from the drill site to the exit hole, the height of the bluff, and the depth of the hole that would be bored, the aggregate distance could be too great for the HDD method. More detailed engineering studies would be required to determine whether or not the HDD method would be feasible for this crossing, assuming that geotechnical conditions were suitable for HDD. If the HDD method is not suitable, a wet-cut crossing method using barges and bottom dredging would likely be required. Such a wet-cut method would increase the construction impacts of constructing the pipeline in Lake Francis Case, and would not place the pipeline as far below the bottom of the lake as an HDD crossing.

Also, the steep bluff on the west bank of Lake Francis Case raises additional technical difficulties regarding the design of the pipeline to avoid slack line conditions (see Section 3.13.5.1). More detailed engineering studies would be required to determine whether a crossing of Lake Francis Case at the proposed locations is feasible, regardless of the method used for crossing the lake.

Keystone identified several additional technical difficulties for the two proposed crossings of Lake Francis Case. For the I-90 Corridor Alternative A crossing Keystone noted:

- Adequate workspace to facilitate an HDD pullback is not available based on the proposed crossing location, which poses a major safety risk to construction personnel and the drill installation;
- An HDD at this location would pose a risk of damage to existing road infrastructure such as piles and man-made road supporting berms with the pilot drill;
- The pullback drill string would block the highway; and
- A frac-out could cause unforeseen consequences to the man-made berm supporting the highway, the bridge supports, or to the towns in close proximity to the drill.

For the I-90 Corridor Alternative B crossing Keystone noted:

- The necessary pipeline inflection point cannot occur in the river;
- The drill would enter/exit in the town of Chamberlain which is not practicable; and
- Adequate workspace to facilitate an HDD pullback is not available based on the proposed crossing location which poses a major safety risk to construction personnel.

Keystone also noted that HDD crossings exceeding 4,000 feet, such as the two proposed crossings, tend to create additional installation stresses, which would be exacerbated by the significant elevation differentials on either side of the crossings. In light of those considerations, the likelihood of exceeding allowable limits for the loads and stresses on the pipe during installation is high. Further, paralleling an interstate highway makes it more likely that the pipeline ROW would encounter more developed lands and denser population centers. As a result, the I-90 Corridor Alternatives would cross within 1 mile of 5 more villages, 5 more towns, and 9 more cities than the proposed Project route.

Although other shorter potential routes through undeveloped land south of I-90 could be considered, they would likely have to cross either an extension of the NHPAQ system before meeting the existing

Keystone Oil Pipeline ROW or cross the Niobrara River, Niobrara State Park, and/or the Santee Sioux Indian Reservation. A route in that general area would also be in the watershed of and parallel to a portion of the Missouri River that is designated as the Missouri National Recreational River and is included in the National Wild and Scenic Rivers System. The Missouri National Recreational River was established by Congress to protect the natural, cultural, and recreational resources of two remaining free-flowing segments of the Missouri River in as natural a state as possible and to keep them available for the public. The goal is to preserve, protect, interpret, restore, and enhance the natural and cultural resources of those segments of the river for the enjoyment of present and future generations.

Consistent with NEPA regulations, DOS requested that Keystone provide an assessment of the relative costs of the I-90 Corridor Alternatives in comparison to the proposed Project. That assessment suggests that implementation of either I-90 Corridor Alternative would produce additional costs of approximately $473 million.

In light of the above considerations, DOS determined that the I-90 Corridor Alternatives could have been eliminated without further evaluation as unreasonable route alternatives they are not technically practical or feasible – particularly due to the inconsistency with the route screening criterion of avoiding major water bodies, the additional technical challenges associated with crossing Lake Francis Case, and the practical concerns associated with siting the pipeline ROW nearer denser population areas. In light of the intense public interest in those potential alternatives, and in response to comments received on the draft EIS and supplemental draft EIS on the topic, DOS further evaluated those alternative routes with a focus on a comparison of potential impacts to groundwater resources.

Potential Risks to Groundwater Resources Associated with Proposed Project Corridor and I-90 Corridor Alternatives A and B

A comparison between the number of wells by depth category for each I-90 Corridor Alternative and the proposed Project is shown in Table 4.3.3-4 and in Figure 4.3.3-8. Each I-90 Corridor Alternative has 67 (approximately 5 percent) more wells within 1 mile on either side of their centerlines than does the proposed route. This is not surprising since they are approximately 70 to 72 miles (approximately 22 percent) longer than the proposed Project route.

TABLE 4.3.3-4
Well Locations within 1 Mile of the Centerline for the Proposed Route and the I-90 Corridor Alternatives by Depth Category

Likely Depth to Groundwater Category[a]	SCS-B (Proposed Route)	I-90 Corridor Alternatives
South Dakota		
A	7	0
B	3	6
C	3	3
D	16	60
E	14	264
Total	43	333
Nebraska		
A	183	70
B	62	25
C	115	75
D	205	218
E	629	583

TABLE 4.3.3-4 Well Locations within 1 Mile of the Centerline for the Proposed Route and the I-90 Corridor Alternatives by Depth Category		
Likely Depth to Groundwater Category[a]	**SCS-B (Proposed Route)**	**I-90 Corridor Alternatives**
Total	1,194	971
Totals		
A	190	70
B	65	31
C	118	78
D	221	278
E	643	847
Total	1,237	1,304

[a] Categories are as follows:

Category A: very shallow water depth likely with reported water level less than or equal to 10 feet bgs and total well depth less than or equal to 50 feet bgs;

Category B: shallow water depth likely with reported water level between 10 and 50 feet bgs and total well depth less than or equal to 50 feet bgs;

Category C: water depth unclear but potentially very shallow since reported water level is less than or equal to 10 feet bgs and total well depth is greater than 50 feet bgs (reported water level could indicate very shallow water depth if well screened in upper 50 feet or deep water depth if well screened at deeper interval under artesian conditions);

Category D: water depth unclear but potentially shallow since reported water level is between 10 and 50 feet bgs and total well depth is greater than 50 feet bgs (reported water level could indicate shallow water depth if well screened in upper 50 feet or deep water depth if well screened at deeper interval under artesian conditions); and

Category E: deep water depth likely with reported water level greater than 50 feet bgs and total well depth greater than 50 feet bgs.

Likely depth to groundwater categories are described in more detail in Section 3.3.1.1.\

A comparison of the mileage within the proposed Project route and the I-90 Corridor Alternatives by well density category is shown in Table 4.3.3-5. These comparisons provide insight relative to the importance of groundwater resources along each centerline. For instance, while the wells in South Dakota are mostly deep along the proposed route and the I-90 Corridor Alternatives, the well densities are higher along the I-90 Corridor Alternatives.

TABLE 4.3.3-5 Miles Crossed per Well Density Category for the Proposed Route and the I-90 Corridor Alternatives		
Well Density[a]	**SCS-B (Proposed Route)**	**I-90 Corridor Alternatives**
South Dakota		
0-1	82.1	150.7
1-2	2.8	30.8
2-4	0.0	16.5
4-8	0.0	2.9
8-16	0.0	0.0
> 16	0.0	0.0
Total	84.9	200.9
Nebraska		
0-1	130.5	68.0
1-2	24.2	38.5
2-4	37.4	55.5
4-8	43.3	35.4

TABLE 4.3.3-5 Miles Crossed per Well Density Category for the Proposed Route and the I-90 Corridor Alternatives		
Well Density[a]	**SCS-B (Proposed Route)**	**I-90 Corridor Alternatives**
8-16	9.9	4.8
> 16	3.0	0.0
Total	248.3	202.1
Totals[b]		
0-1	212.6	218.7
1-2	27.0	69.3
2-4	37.4	72.0
4-8	43.3	38.3
8-16	9.9	4.8
> 16	3.0	0.0
Total	333.2	403.0

[a] Well density is defined as the number of wells per square mile within a 2 mile corridor surrounding proposed route or alternative centerline. Sources for water wells by state are depicted in Figures 3.3.1-1 through 3.3.1-5. Wells per square mile were determined by using the ArcGIS Kernal Density tool. Well density categories were derived from those used for University of Nebraska-Lincoln study available at http://snr.unl.edu/data/download/water/GWMapArchives/2010GWMaps/Density.pdf.

[b] The ArcGIS Kernal Density tool estimated mileage for each route will not exactly match total mileage depicted in Table 4.3.3-6 due to missing density values.

The I-90 Corridor Alternatives would follow the same route through Nebraska as the Keystone Corridor Alternatives. A comparison of the risks to groundwater resources in Nebraska was discussed extensively previously in the Keystone Corridor Alternatives comparison.

In summary, groundwater well and well density data indicate that there is no overall environmental advantage to either I-90 Corridor Alternative in terms of risk to groundwater resources overall or in Nebraska, other than the reduced mileage of both alternatives in Nebraska. The proposed route and the I-90 Corridor Alternatives cross the highly utilized Platte River Unit of the NHPAQ system. The I-90 Corridor Alternatives cross aquifers within the NHPAQ system with the highest hydraulic conductivities and the highest well densities and also cross an area of higher well concentration in South Dakota.

Comparative Assessment of Potential Impacts to Other Key Environmental Resources Associated with Proposed Project Corridor and I-90 Corridor Alternatives A and B

A comparison of the impacts on key environmental resources of the I-90 Corridor Alternatives to those of the proposed Project route is provided in Table 4.3.3-6. The I-90 Corridor Alternatives would be approximately 70 miles longer than the proposed Project route and would affect at least 1,000 more acres during construction than the proposed Project route, including the 110-foot-wide construction ROW, extra work space areas, additional pipe and construction yards, and additional access roads.

The I-90 Corridor Alternatives would parallel approximately 144.5 miles of I-90 or I-90 and state highways 16 and 50, about 12.1 miles of state highway 262 and the BNSF ROW, and about 246.4 miles of the existing Keystone ROW. In comparison, the proposed Project route would parallel about 30 miles of existing ROWs. As noted in the discussion of the criterion regarding use of existing ROWs in Section 4.3.2.1, installation of a new pipeline along existing, cleared ROWs may be environmentally preferable to construction along new ROWs, and construction and operation effects and cumulative impacts can normally be reduced by the use of previously cleared ROWs. However, if the new pipeline is installed in a ROW that is not within the existing ROW, the impacts may be similar to those of new construction that is not parallel to an existing ROW. In this case, the I-90 Corridor Alternatives would be installed outside of the existing ROW. As with the Keystone Corridor Alternatives, a portion of the I-90 Corridor Alternatives parallels the newly constructed Keystone Oil Pipeline Project. In this area, construction of either I-90 Corridor Alternative would likely impact previously implemented or ongoing restoration activities along that corridor.

The proposed Project route would affect almost 5 times more rangeland and grassland than the I-90 Corridor Alternatives, or about 1,956 more acres. This would represent an increase in the potential for impacts to rangeland and grassland soils, lost grazing areas and grazing time, and other short- to long-term impacts to those areas as compared to the alternatives. It would also increase the amount of compensation that Keystone would be required to provide for lost grazing opportunities and other damages. The alternative route would affect about 1.5 times more agricultural land than the proposed Project route, or about 835 more acres. This would result in increasing the potential for short- to long-term impacts to soil, crop production, and other damages to agricultural land as compared to the impacts of the proposed Project.

TABLE 4.3.3-6
Impact Comparisons of the I-90 Corridor Alternatives and the Associated Segment of the Proposed Project Route

Characteristic	Proposed Route	I-90 Corridor Alternatives
Total Length (Miles)	333.0	403.1 / 404.5[e]
Northern High Plains Aquifer System Crossed (Miles)[a]	247.2	144.9
Land Cover (Acres)[b]		
Agricultural Land	1,698.3	2,533.7
Developed Land	96.6	2,202.1
Forested	21.5	38.4
Rangeland/Grassland	2,521.3	564.7
Wetlands	92.0	21.9
Open Water	10.3	13.9
Total	4,440.0	5,374.7
Federal Land Ownership (Acres)[c]		
National Park Service (Missouri National Recreation Area)	0.0	26.4
U.S. Army Corps of Engineers (Lake Francis Case)	0.0	13.0 / 15.0e
Number of Stream Crossings[d]		
Perennial	22	25
Intermittent	157	200
Total	179	225

[a] Northern High Plains Aquifer from U.S. Geological Survey Water Resources Program.

[b] Land Cover from USGS 2001. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.

[c] Federal lands from ESRI 2004a or National Park Service 2010a. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.

[d] Streams and rivers from ESRI 2004b.

[e] I-90 Corridor Alternative B.

The I-90 Corridor Alternatives would cross 46 more streams and rivers than the proposed Project. Although HDD would be used to cross the major streams, about 43 of the additional crossings would be constructed using one of the wet open cut methods described in Section 2.3. As compared to the proposed Project route, this increase in the number of stream crossings represents a substantial increase in the potential for impacts to water quality, fisheries resources and the habitats that support the fisheries.

As mentioned previously, two of the river crossings added are at environmentally sensitive locations of the Missouri River. The first would be at Lake Francis Case, which extends about 107 miles from the Fort Randall Dam to the Big Bend Dam. The crossing would be approximately 20 river miles south of Big Bend Dam. Around 1 million people use the 19 recreation areas along the lake each year (USACE 2010). Recreational opportunities include boating, fishing, swimming, hunting (outside of recreational areas), geocaching, camping, and picnicking. Construction of the alternative route through this area on both sides of the reservoir would disrupt recreational traffic and recreational activities for the duration of the construction period in that area. Clearing the ROW would result in changes to the composition and structure of vegetation, including forested areas. This would result in changes to the visual character and may be considered adverse impacts to those using the area for recreation. It would also alter the habitats supporting species that are hunted. In addition, both crossing variations and the ROW of the alternatives are in the vicinity of historic American Island and other areas associated with the Lewis and Clark expedition. If the HDD installation method is used, the pipeline would be installed substantially below the bottom of the reservoir to minimize the potential for outside forces (e.g., anchor drag) that could cause an accidental release of crude oil from the portion of the pipeline under the lake during operation. However, the potential for such releases from the onshore portions of the pipeline adjacent to the crossing would be the same as for those within other terrestrial areas where the pipeline is buried.

The second crossing of the Missouri River would be near Yankton, South Dakota most likely adjacent to the existing Keystone ROW crossing. The crossing area is within the Missouri National Recreational River, a 98-mile-long portion of the river administered by the National Park Service that extends from Ponca, South Dakota on the southeast end to the Fort Randall Dam on the northwest end. As noted above, the Missouri National Recreational River was established by Congress to protect the natural, cultural, and recreational resources of two remaining free-flowing segments of the Missouri River in as natural a state as possible and to keep them available for the public. The second Missouri River crossing would likely be accomplished using the HDD method, the same installation method used for the existing Keystone Oil Pipeline Project, to minimize construction impacts.

The proposed Project would affect approximately 70 acres more wetlands than the I-90 Corridor Alternatives (92 acres and 21.9 acres respectively) based on data in the National Land Cover Dataset (USGS 2001). However, reviews of recent aerial photographs along the I-90 Corridor Alternatives suggest that there would be substantially more than 21.9 acres of wetlands affected by implementation of the alternatives, and USGS appears to have categorized some of the wetland areas as "developed land" that is adjacent to the I-90 corridor. In addition, I-90 Corridor Alternatives mileage of wetlands crossed in South Dakota was approximately 2.9 miles by the National Wetlands Inventory in South Dakota versus 0.9 mile for NLCD. Although it is likely that the proposed Project would affect more wetland area than the alternatives, the difference is likely less than 70 acres. Minor route adjustments and other mitigation measures would be implemented to avoid or minimize the impacts to wetlands, and compensatory mitigation would likely be required as part of the USACE Section 404 permitting process.

The alternative routes would also affect almost 20 times more acres of developed land (approximately 2,201 acres versus 92 acres), including land within or near several communities along the routes. These include Oacoma, Mitchell, Alexandra, and Emery, South Dakota. Impacts in those areas would be related primarily to construction, although it is possible that both pump stations and MLVs could be in the vicinity of the developed areas and would affect visual quality and create noise impacts during operation.

However, there has not been a hydraulic design of the I-90 Corridor Alternatives and it is not possible to identify the locations of pump stations or MLVs at this time.

Comments received in 2007 on the draft EIS for the Keystone Oil Pipeline Project are informative relative to the likelihood of public acceptance of a second pipeline paralleling that project. Specific concerns were expressed at that time from residents of South Dakota and Nebraska relative to the possibility of future pipelines following the existing Keystone Oil Pipeline route. Commenters from South Dakota were concerned about impacts of the Keystone Oil Pipeline Project crossing of the Missouri River, especially through a National Wild and Scenic River reach. The I-90 Corridor Alternatives would cross the Missouri River in the same reach, and as discussed earlier would also involve a second Missouri River Crossing to the north through Lake Francis Case (see Figure 4.3.3-7).

Additional concerns were related to rural water supply impacts, including the WEB, Clark, Hanson, Turner McCook, Lewis and Clark, and B-Y water systems. Concerns raised in 2007 by commenters from Nebraska included the project route through Seward, Nebraska and potential impacts to the Seward water system. In all three states, the presence of shallow groundwater aquifers beneath the Keystone route was a concern, including concerns about potential impacts to the NHPAQ system, which includes the Ogallala Unit of the aquifer. In essence, the I-90 Corridor Alternatives, while reducing the distance over the shallow groundwater of the Sand Hills Unit of the NHPAQ system and other portions of the NHPAQ system, do not eliminate the risk to areas of shallow groundwater; rather they would transfer any spill risks to aquifers in other regions, including other shallow aquifers within Nebraska.

While the I-90 Corridor Alternatives would eliminate most disturbance of the Sand Hills topographic region, the proposed Project route was selected to reduce erosion problems to the extent practicable, although some minor route re-alignments may be required during construction to avoid particularly erosion-prone locations such as ridge tops and existing blow-out areas (see the CMR plan in Appendix B). During the proposed Project design effort, local NRCS offices and regional experts on Sand Hills reclamation from the University of Nebraska, University of South Dakota, and Nebraska Department of Roads were consulted and their recommendations on routing, construction techniques, and restoration techniques to minimize potential damage to Sand Hills vegetation were incorporated into the proposed Project plan (see Section 3.2 and Appendices B and H for additional information). Specific construction, reclamation, and post-construction activities would be employed in the Sand Hills topographic region based on the recommendations of these experts. Keystone would incorporate these procedures into construction within the Sand Hills topographic region, for either the proposed Project route or the I-90 Corridor Alternatives.

Summary

Groundwater, well and well density data, and hydraulic conductivity data indicate that there is no overall environmental advantage to either I-90 Corridor Alternative in terms of risk to groundwater resources overall or in Nebraska. While the I-90 Corridor Alternatives would reduce the total mileage where the pipeline route would overlay shallow groundwater in Nebraska, largely by avoiding the Sand Hills topographic region, they do not significantly reduce the total mileage across areas with shallow groundwater in Nebraska where there is higher groundwater usage. Further, they would increase the mileage through areas of the NHPAQ system in Nebraska with substantially higher hydraulic conductivities than those in the Sand Hills topographic region. The Keystone Corridor Alternatives therefore would not eliminate the risk to groundwater resources. Rather, they would transfer that risk to other groundwater areas, including other areas of the NHPAQ system, and to other groundwater users in South Dakota and Nebraska.

The comparisons of other key environmental issues and the greater area of impact of the I-90 Corridor

Alternatives, as well as public concerns relative to the existing Keystone Oil Pipeline Project as expressed in comments during that project's environmental review, suggest that the alternatives would not offer an overall environmental advantage over the proposed Project route. Additionally, crossing Lake Francis Case using the HDD method may not be technically feasible due to the length of the crossing, the height of the bluff on the eastern shore of the lake, and the depth of required boring. Detailed engineering studies would be required to determine whether or not the HDD crossing is technically feasible, including geotechnical studies to determine whether or not the soil conditions in the bluff and under the river would be receptive to using HDD. If HDD is not suitable, a wet-cut crossing using barges and bottom dredging would likely be required. With this method there would be substantial construction impacts to water quality, fisheries habitats, benthic communities, and recreational uses as compared to the impacts of the proposed Project. Also, detailed engineering studies would be required to determine if the crossing could be made at those locations without creating a sudden elevation change in the pipeline that could increase the possibility of slack line conditions.

As stated previously, DOS determined that the I-90 Corridor Alternatives are not reasonable route alternatives because they are not technically practical or feasible. In addition, after further evaluation of all screening level environmental impact comparisons, DOS determined that there would not be an overall environmental advantage to either I-90 Corridor Alternative A or I-90 Corridor Alternative B as compared to the proposed Project. For the above reasons, these alternatives were eliminated from further consideration.

4.3.3.6 Baker Alternative

The Baker Alternative was developed in response to an agency request made during the scoping period. The alternative deviates from the proposed route in the vicinity of Baker, Montana and extends through an area that had previously been disturbed by ongoing construction and operation of oil production and delivery systems (see Figure 4.3.3-1 and Figure 4.3.3-9). The Baker Alternative would deviate from the proposed Project route in Fallon County, Montana and would extend for approximately 62.1 miles parallel to an existing pipeline ROW into Bowman County in southwest North Dakota. The alternative would return to the ROW of the proposed Project in Harding County, South Dakota. The Baker Alternative would be approximately 2.4 miles shorter than the segment of the proposed Project route it would replace. It would also cross an existing oil and gas field southeast of Baker. Within the existing oil and gas field, construction of the alternative would require special pipe crossing techniques. Construction could result in interruptions to crude oil production gathering systems and an increase in the potential for environmental impacts resulting from damage to gathering system pipelines. There would also be a human health and safety concern, including potential injury to pipeline construction workers and the public, due to the proximity of the Baker Alternative to existing oil wells with the potential to release hydrogen sulfide. A comparison of the impacts on key environmental resources of the Baker Alternative to those of the proposed route is provided in Table 4.3.3-7. This alternative would extend through the Baker Lake watershed and would cross substantially less agricultural land and less forested land and wetlands than the comparable segment of the proposed route. However, it would also cross more developed areas, rangeland and grassland, and streams and rivers than the proposed route and would affect a substantially larger area of BLM land.

TABLE 4.3.3-7 Impact Comparisons for the Baker Alternative and the Associated Segment of the Proposed Route		
Characteristic	**Proposed Route**	**Baker Alternative**
Total Length of Alternative (Miles)	851.6	849.1
Length of Segment of Proposed Route and Baker Alternative (Miles)	64.5	62.1
Land Use (Acres)[a]		
Agricultural Land	102.0	34.7
Barren Land	0.0	1.2
Developed Land	1.8	7.8
Forested	3.0	0.9
Rangeland/Grassland	747.9	781.2
Wetlands	5.3	2.2
Open Water	0.0	0.0
Total	860.0	828.0
Federal Land Ownership (Acres)[b]		
Bureau of Land Management	2.7	163.8
Number of Streams and /Rivers Crossed[c]	37	47

[a] Data in remainder of table are for the segment of the proposed route that would be replaced and for the Baker Alternative. Land use from USGS 2001. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[b] Federal lands from ESRI 2004a. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[c] Streams and rivers from ESRI 2004b.

Implementation of the Baker Alternative would create additional unique environmental risks and safety concerns by crossing an existing oil and gas field and the alternative would not offer an overall environmental advantage over the segment of the proposed route it would replace. Therefore the Baker Alternative was eliminated from further consideration.

4.3.4 Western Alternative (Alternative to Both Steele City Segment and the Cushing Extension)

The Western Alternative would substitute for both the Steele City Segment and the Cushing Extension. This approximately 1,277-mile-long alternative would enter the U.S. at Morgan and extend through Montana, Wyoming, Colorado, Kansas, and Oklahoma to the control point at the southern end of the Cushing Extension as depicted on Figure 4.3.3-1.

Although the Western Alternative would parallel the existing Express-Platte System corridor for approximately 350 miles, the existing easements along that corridor are in the control of a different company and it may not be possible to construct the alternative pipeline within the existing ROW. Therefore, construction of the alternative may result in the same impacts as construction of a pipeline of similar length that is not parallel and adjacent to an existing ROW.

A comparison of the impacts on key environmental resources of the Western Alternative to those of the proposed route is provided in Table 4.3.4-1. The Western Alternative would be approximately 426 miles longer than the proposed route and would affect about 6,000 more acres than the proposed route, including the 100-foot-wide construction ROW, extra work space areas, additional pipe and construction yards, and additional access roads. The Western Alternative would affect substantially more agricultural land, developed land, forested land, rangeland and grassland, and wetlands than the proposed route. It would also cross substantially more streams, rivers, and federal land than the proposed route. The Western Alternative would avoid crossing the NHPAQ system and the Sand Hills topographic region of Nebraska. The route would also avoid crossing the Charles M. Russell National Wildlife Refuge, the Medicine Bow National Forest, and the Pawnee National Grassland.

The Western Alternative is not considered a reasonable alternative to the proposed Project due to the financial impracticability of constructing a pipeline that would be substantially longer than the proposed route. In addition, the Western Alternative would not offer an overall environmental advantage over the proposed route. Therefore, this alternative was eliminated from further consideration.

TABLE 4.3.4-1
Impact Comparisons for the Proposed Route and the Western Alternative

Characteristic	Proposed Route	Western Alternative
Total Length (Miles)	851.6	1,277.4
Land Use (Acres)[a]		
Agricultural Land	2,978.6	4,672.2
Barren Land	6.3	55.3
Developed Land	174.2	505.0
Forested	33.0	327.8
Rangeland/Grassland	8,006.7	11,136.4
Wetlands	148.1	247.5
Open Water	15.8	87.8
Total	11,362.7	17,032.0
Federal Land Ownership (Acres)[b]		
Bureau of Land Management	595.2	2,250.8
Bureau of Reclamation	0.0	277.4
National Park Service	0.0	0.0
Total	595.2	2,528.2
Number of Streams and Rivers Crossed[c]	454	821

[a] Land use from USGS 2001. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[b] Federal lands from ESRI 2004a or National Park Service 2010a. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[c] Streams and rivers from ESRI 2004b.

4.3.5 Gulf Coast Segment Alternative Routes

The Gulf Coast Segment extends from the southern end of the Cushing Extension to the proposed Project's delivery point at Nederland, Texas. Two route alternatives for the Gulf Coast Segment were identified: the proposed route (Alternative GCS-A) and Alternative GCS-B. These alternatives are depicted on Figure 4.3.5-1 and compared below.

The proposed route would be approximately 480 miles long and would parallel an existing natural gas pipeline corridor (Texoma Pipeline) from Cushing to Nederland (portions of the Texoma line have been sold and are operated by other companies, but the corridor is still intact). The proposed Project route would avoid the Angelina National Forest in Angelina, Nacogdoches, San Augustine, and Jasper counties in east Texas along the shores of the Sam Rayburn Reservoir. Alternative GCS-B would be west of the proposed route and closer to the Dallas-Ft. Worth metropolitan area than the proposed route and would extend east of Durant, Oklahoma.

Both routes would extend through active and inactive oil and gas fields south of Cushing. Approximately 82 percent of the proposed route would parallel the existing ROWs of other linear facilities. Approximately 98 percent of Alternative GCS-B would parallel existing ROWs, including 190 miles of the Seaway Pipeline ROW south of Cushing before diverting to a path that would pass east of Lake Texoma. It is not known whether Alternative SCS-B would be constructed within existing ROWs and therefore it is not clear that it would offer an environmental advantage over the proposed route due to the use of more existing ROWs.

Both alternative routes would avoid the Big Thicket Natural Preserve in Liberty County, Texas by routing the pipeline along the Texas highway. The Big Thicket Natural Preserve is a combination of pine and cypress forest, hardwood forest, meadow, and blackwater swamp, and in 2001 the American Bird Conservancy designated the Big Thicket National Preserve as a Globally Important Bird Area (National Park Service 2010b). The predominant ownership along the proposed route is private land, with less than 1 percent of the ROW corridor owned by either the State of Oklahoma or Texas.

A comparison of the impacts on key environmental resources of the two Gulf Coast Segment alternatives is provided in Table 4.3.5-1. The proposed route would cross more wetlands and forested land than Alternative GCS-B. However, Alternative GCS-B would cross more agricultural land, rangeland and grassland, developed land, more open water and rivers and streams than the proposed route. In addition, Alternative GCS-B would be in close proximity to more developed areas along its route than the proposed route. Alternative GCS-B would be 6 miles longer than the proposed route and would affect about 90 more acres during construction, including the 110-foot-wide construction ROW, extra work spaces, additional contractor and pipe yards, and additional access roads.

As a result, Alternate GCS-B would not offer an overall environmental advantage over the proposed route and was eliminated from further consideration.

TABLE 4.3.5-1 Impact Comparisons for the Gulf Coast Segment Alternatives		
Characteristic	**Proposed Route (Alternative GCS-A)**	**Alternative GCS-B**
Length (Miles)	480	486
Land Use (Acres)[a]		
Agricultural Land	1,646.4	1,974.8
Barren Land	3.7	4.2
Developed Land	346.1	381.8
Forested	1,930.5	1,185.7
Rangeland/Grassland	1,767.8	2,378.8
Wetlands	747.6	552.8
Open Water	8.5	20.6
Total	6,450.6	6,498.7
Number of Streams and Rivers crossed[b]	246	255

[a] Land use from USGS 2001. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[b] Streams and rivers from ESRI 2004b.

4.3.6 Houston Lateral Alternative Routes

The Houston Lateral would extend from the Gulf Coast Segment to a point in the Moore Junction area east of Houston. Moore Junction is a large area that extends to the north and south of the Houston Ship Channel and includes a large number of oil industry facilities. Two route alternatives for the Houston Lateral were identified: the proposed Project route (Alternative HL-A) and Alternative HL-B. These alternatives are depicted on Figure 4.3.6-1 and compared below. As indicated on Figure 4.3.6-1, the alternatives have different starting and ending points.

The proposed route would be 48.6 miles long and would initiate at a point on the Gulf Coast Segment in central-east Liberty County. From there it would extend south and west through Chambers County to Harris County, ending near Moore Junction, north of the Houston Ship Channel. Approximately 40 percent of the proposed route would parallel other utility corridors.

Alternative HL-B would start at Nederland (Jefferson County) and extend in a west-southwest direction to a point north of the main body of Galveston Bay, then extend to the southwest and would terminate near Moore Junction, south of the ship channel. The route would be approximately 77.4 miles long with 97 percent of the route paralleling other utility corridors. It would extend through Jefferson, Liberty, Chambers, and Harris counties. Although Alternative HL-B would be parallel to substantially more existing ROWs, it is not known whether it would be constructed within existing ROWs and therefore it is not clear that it would offer an environmental advantage over the proposed route due to the use of more existing ROWs.

Alternative HL-B would be about 30 miles longer than the proposed route and would affect about 400 more acres during construction, including the 110-foot-wide construction ROW, extra work spaces, additional contractor and pipe yards, and additional access roads.

The southwestern end of the proposed route would extend through heavily developed urban areas in the east Houston area. Both the beginning and ending portions of Alternative HL-B would also extend through heavily developed urban areas.

The proposed route would extend through approximately 4 miles of land within the Texas Coastal Zone Boundary (TCZB) along the Gulf Coast and would be subject to regulation under the federally approved Texas Coastal Management Program. Any project that may affect land or water in the Texas coastal zone and that requires a federal license or permit must be reviewed for consistency with the Texas Coastal Management Program. Assuming a 110-foot-wide construction ROW, there would be approximately 60 acres affected within the TCZB in Harris County, including extra work spaces and additional access roads. It is not likely that contractor and pipe yards would be required within that distance.

Alternative HL-B would cross approximately 31 miles of land within the TCZB in Harris and Chambers counties, and construction would disturb about 450 acres, including the 110-foot-wide construction ROW, extra work spaces, additional contractor and pipe yards, and additional access roads. As a result, Alternative HL-B would affect about 390 more acres in the TCZB than the proposed route. Alternative HL-B would likely encounter greater regulatory barriers than the proposed route due to its proximity to the Gulf Coast and due to the area of the coastal zone that would be affected.

Alternative HL-B would require a marine crossing of an arm of Galveston Bay in the vicinity of the Houston Ship Channel. The crossing distance would be approximately 1.8 miles, and would produce impacts to benthic communities and nearshore environment along the proposed route. In comparison, the proposed Project route would not cross any portion of Galveston Bay.

A comparison of the impacts on key environmental resources of the two Houston Lateral alternatives is provided in Table 4.3.6-1. The proposed Project route would cross less agricultural land, less developed land, less rangeland and grassland, and fewer streams, rivers, and other open water than Alternative HL-B. However, it would also cross through more wetlands and federal lands than Alternative HL-B.

As compared to proposed route, Alternative HL-B would be longer and would have a larger area of impact due to construction, would have substantial coastal zone concerns, would cross more developed land in urban areas, and more rivers, streams, rangeland and grassland, and agricultural land. Most importantly, it would involve a marine crossing of an arm of Galveston Bay. As a result, Alternative HL-B would not offer an overall environmental advantage over the proposed route and was eliminated from further consideration.

TABLE 4.3.6-1
Impact Comparisons for the Houston Lateral Alternatives

Characteristic	Proposed Route (Alternative HL-A)	Alternative HL-B
Total Length (Miles)	48.6	77.4
Land Use (Acres)[a]		
Agricultural Land	286.5	438.7
Barren Land	0.0	0.3
Developed Land	27.4	208.5
Forested	27.1	11.7
Rangeland/Grassland	66.6	182.4
Wetlands	236.5	165.5
Open Water	3.9	24.9
Total	648.0	1,032.0

TABLE 4.3.6-1 Impact Comparisons for the Houston Lateral Alternatives		
Characteristic	**Proposed Route (Alternative HL-A)**	**Alternative HL-B**
Federal Land Ownership (Acres)[b]		
U.S. Fish and Wildlife Service	46.7	18.7
Number of Streams and Rivers crossed[c]	12	28

[a] Land use from USGS 2001. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[b] Federal lands from ESRI 2004a or National Park Service 2010a. Acres calculated based on a 110-foot-wide ROW and the pipeline miles of each land use crossed.
[c] Streams and rivers from ESRI 2004b.

4.3.7 Route Variations

A variation is a relatively short deviation from a proposed route that is developed to address state agency concerns and requirements or resolve or reduce construction impacts to localized, specific resources such as cultural resource sites, wetlands, recreational lands, residences, and terrain conditions. Variations are different from major route alternatives in that alternatives are typically substantial distances from proposed pipeline routes, are generally much longer than variations, and are developed to reduce overall environmental impacts, reduce or eliminate engineering and constructability concerns, and avoid or minimize conflicts with existing or proposed residential and agricultural land uses while meeting the goals of a project. Although route variations also may be many miles in length, they are typically shorter and nearer to a proposed route than a major route alternative. Many requests for variations were submitted by concerned landowners during the review period for the draft EIS as well as in direct negotiations with Keystone as design of the proposed route progressed.

Because most route variations were identified to avoid or minimize specific environmental impacts and land use conflicts, in response to landowner comments, and to increase the use of public land in Montana consistent with the requirements of MFSA, they may not in all cases display a substantial environmental advantage over the segments of the proposed Project route that they would replace. Since the variations are generally close to the route segments they would replace and for the most part extend across similar terrain, the construction methods would be essentially the same and the visual character of the variations would be essentially the same as that of the proposed Project after reclamation is complete. In most cases, the impacts associated with implementation of the variations would be essentially the same as the impacts that would result from construction and operation of the route segments that the variations would replace.

Route variations assessed in this analysis include:

- Variations in Montana (Section 4.3.7.1);
- Niemi Variation in South Dakota (Section 4.3.7.2); and
- Minor Realignments Negotiated with Landowners (Section 4.3.7.3).

4.3.7.1 Montana

In Montana, MFSA and MEPA require that MDEQ implement a specific process to identify landowner concerns, preferential use of public lands, and other considerations to develop alternatives to proposed routes. A detailed discussion of the requirements of MFSA and MEPA is included in Section 1.0 of Appendix I to the EIS. As noted in that section, MDEQ must identify the route that minimizes adverse environmental impacts and uses public land (which may include federal land) whenever the use of public lands is as economically practicable as the use of private land before it can approve the proposed Project or any alternative to the proposed Project.

In addition to the alternatives described in Sections 4.1, 4.2, and 4.3.1 through 4.3.6, MDEQ required that Keystone identify and assess two additional alternative routes in Montana that would increase the use of public lands in comparison to the proposed route. These alternative routes were developed using a GIS database model (i.e., ground surveys were not conducted) that incorporated a set of weighted environmental factors agreed to by MDEQ. Using that approach, the Canada to North Dakota (CND) and Canada to South Dakota (CSD) alternatives were developed and compared at a screening level to the proposed route relative to environmental impacts and the use of public lands. As described in detail in Section I-2.0 of Appendix I, both routes were eliminated from further consideration as a result of this screening analysis. However, MDEQ identified portions of the CSD Alternative that would cross more public land than the segments of proposed Project route they would replace and considered them as potential route variations. MDEQ also identified additional route variations that would avoid or minimize impacts to specific resources, minimize conflicts with existing or proposed residential and agricultural land uses, and that responded to requests submitted by concerned landowners during both the scoping period and the draft EIS comment response period.

In total, MDEQ identified 19 potential route variations in Montana and prior to the draft EIS, preliminarily selected 9 of these variations as preferable to the segments of the proposed route that they would replace. As a result of continuing review and analysis, MDEQ has revised its selection of potential route variations and will develop a preferred route that includes portions of the proposed Project route and selected route variations out of a total suite of nearly 100 potential route variations assessed. MDEQ mailed a certified letter to each of the landowners affected by these potential variations and requested comments. In addition, where requested, MDEQ staff met affected landowners in the field to further describe the routing variations and listen to landowner concerns and suggestions for further adjustments. These variations will be addressed in the final EIS. Beginning in mid to late April, these suggested routing variations in Montana can be viewed at MDEQ's web site: http://svc.mt.gov/deq/wmaKeystoneXL/. MDEQ will continue to consider these and other route variations prior to completing the MFSA review process and issuing a Certificate of Compliance. The variations that MDEQ may ultimately select are relatively close to the proposed Project route segments they would replace. Both DOS and MDEQ have conducted environmental reviews of the proposed Project route in Montana as reported in this EIS. MDEQ maintains information related to the proposed Project on its website located at: http://deq.mt.gov/MFS/KeystoneXL/KeystoneXLIndex.mcpx. Along with information related to Keystone's application and the EIS review and comment process, the website also provides an interactive map detailing available updates to the proposed Project variations in Montana and the MDEQ suggested variations. Though the website is intended to provide the most up-to-date data when available, information not provided on the site will be included in the final EIS.

4.3.7.2 South Dakota

As a result of negotiations with two landowners in the vicinity of Buffalo, South Dakota, Keystone surveyed the landowners' properties and developed a route variation that would avoid areas that were being developed for commercial excavations of paleontological resources. The variation, termed the

Niemi Route Variation, diverts from the proposed route just north of MP 309 on the Steele City Segment, and returns to the proposed route just north of MP 315. The segment of the proposed route that would be replaced is about 6.56 miles long, and the variation is about 7.02 miles long, or about 0.46 miles longer than the proposed route. The routes of the variation and the segment of the proposed route it would replace are depicted on Figure 4.3.7-1 and the impacts of the two routes on key environmental resources are compared in Table 4.3.7-1.

The variation is slightly longer than the proposed route, but would cross less state land than the segment of the proposed route it would replace. Both the variation and the segment of the route it would replace have one isolated cultural resources find, and neither is eligible for nomination to the NRHP. The Keystone survey identified a rock cairn along the route of the variation. The site is potentially eligible for the NHRP, but impacts would be mitigated through construction avoidance methods including necking and fencing.

As noted in Table 4.3.7-1, the variation would cross 4 more intermittent streams and 3 more wetlands than the proposed route. Impacts to these resources would be avoided or minimized by incorporating the permitting requirements of the USACE Nationwide Permit and the procedures described in Keystone's CMR plan (Appendix B).

During 2009 field surveys, sage grouse leks were not identified near either the proposed Project route or the Niemi Route Variation. However, data from the South Dakota Game, Fish and Parks Department indicates that there are two historic (inactive) leks about 0.2 mile southwest of the Niemi Route Variation. Raptors, raptor nests, or bald eagle winter roost sites were not identified during aerial raptor surveys conducted in February and April 2009 along either the proposed route or the Niemi Route Variation.

Field surveys conducted in November 2010 determined that (1) the proposed route would cross multiple locations of known paleontological resources as well as an ongoing commercial paleontological excavation, and (2) the variation would cross three "significant" (as defined by BLM) paleontological areas, all of which are on private land. Prior to construction surface collections of paleontological resources along the variation would occur and during construction the ROW would be monitored by a qualified paleontological expert.

The Niemi Route Variation would replace a short segment of the overall proposed Project, is relatively close to the proposed route; addresses a specific issue relevant to landowners; would be implemented in accordance with applicable regulatory requirements of federal, state, or local permitting agencies; and would have environmental impacts similar to those of the segment of the proposed route it would replace. As a result, incorporation of the Niemi Route Variation into the proposed Project, with implementation of the procedures described above, is acceptable to DOS.

TABLE 4.3.7-1
Comparison of Niemi Route Variation with the Segment of the Route it Would Replace

Item	Miles of Land Crossed (except where noted)		Difference
	Proposed Route Segment	Niemi Route Variation	
Length	6.56	7.02	-0.46
Land Cover[a]			
Agriculture	0.45	0.37	+0.08
Developed	0.13	0.08	+0.05
Rangeland	5.98	6.57	-0.59
Total	6.56	7.02	-0.46
Land Ownership[b]			
State of South Dakota	0.51	0.48	+0.03
Private Land	6.05	6.54	-0.49
U.S. Bureau of Land Management	0.00	0.00	0.00
Total	6.56	7.02	-0.46
Number of Private Properties	2	2	0
Number of Road Crossings[c]			
Major Roads	1	1	0
Minor Roads	1	0	+1
Total	1	0	+1
Number of Stream Crossings[d]			
Perennial Streams	0	0	0
Intermittent Streams	5	1	+4
Total	5	1	+4

Item	Miles of Land Crossed (except where noted)		Difference
	Proposed Route Segment	Niemi Route Variation	
Slope[e]			
< 5%	6.44	6.93	-0.49
≥ 5% and ≤ 15%	0.12	0.09	+0.03
> 15% and ≤ 30%	0.00	0.00	0.00
> 30%	0.00	0.00	0.00
Number of Water Wells within 100 ft[f]	0	0	0
Number of Residences			
Residences within 25 ft	0	0	0
Residences within 500 ft	0	0	0
Number of Structures			
Structures within 25 ft	0	0	0
Structures within 500 ft	0	0	0
Cultural Resource Findings			
Cultural Findings	1 Not Eligible	1 Not Eligible, 1 Potentially Eligible	-1 Potentially Eligible
Paleontological Findings	1 Significant, 2 Non-Significant	3 Significant	-2 Significant, +2 Non-Significant
Number of Grouse Leks[g]			
Sage-Grouse within 4 miles	0	0	0
Wetlands[g]	2 (PEM)	5 (PEM)	-3 (PEM)
Areas with Noxious Weeds[g]	1	0	+1
Number of Waterbodies[g]	5 ephemeral	1 stream, 1 ephemeral	-1 stream, +4 ephemeral

[a] Land use from USGS 2001.
[b] Federal lands from ESRI 2004a. State land from South Dakota GIS, 2010.
[c] Roads from ESRI 2003.
[d] Streams and rivers from ESRI 2004b.
[e] Slope from USGS 2002.
[f] Well Locations from South Dakota Department of Environment and Natural Resources 2010.
[g] Data from Trow Engineering Consultants 2010; Note: the variation was surveyed, the proposed route segment survey was incomplete.

4.3.7.3 Minor Realignments Negotiated with Landowners

During detailed design of the proposed route and the associated continuing field surveys, areas along the proposed route were identified that would require minor deviations to avoid small but sensitive resources, that would require difficult construction procedures, or that were concerns to landowners due to potential conflicts with existing land uses. As a result, many route variations were identified that would replace segments of the proposed Project route. These variations would replace short segments of the proposed Project, are relatively close to the proposed route and would be implemented in accordance with applicable regulatory requirements of federal, state, or local permitting agencies (see Appendix W). As a result, incorporation of these variations into the proposed Project in place of the segments they would replace is acceptable to DOS.

4.3.8 Agency-Preferred Route

Alternatives were developed and assessed based on information provided in the Presidential Permit application and supplemental submittals related to the application, information provided by the cooperating agencies, public comments received in the scoping process and on the draft EIS, and information obtained from research of relevant available information conducted by DOS and its third-party contractor.

Based on the assessment of alternatives described above, the DOS-preferred route consists of the following alternatives by segment:

- Steele City Segment: Alternative SCS-B (including route variations in Montana selected by MDEQ, the Niemi Route Variation, and minor route realignments listed in Appendix W);
- Existing Cushing Extension (including two new pump stations);
- Gulf Coast Segment: Alternative GCS-A; and
- Houston Lateral: Alternative HL-A.

4.4 ALTERNATIVE PIPELINE DESIGN

DOS received comments on the draft EIS requesting consideration of the alternative of constructing the pipeline above ground and comments requesting that we consider the alternative of using smaller diameter pipe for the Project. Those two alternatives are addressed in the following sections:

- Aboveground Pipeline (Section 4.4.1); and
- Smaller Diameter Pipe (Section 4.4.2).

4.4.1 Aboveground Pipeline

Although it is technically feasible to construct the proposed Project pipeline aboveground in most areas along the proposed route, there are many disadvantages to an aboveground pipeline. In comparison to an aboveground pipeline, burying a pipeline reduces the potential for pipeline damage due to vandalism, sabotage, and the effects of other outside forces, such as vehicle collisions. Further, there has been increased concern about homeland security since the September 11, 2001 attacks, and burying the pipeline provides a higher level of security.

In addition, an aboveground pipeline would be more susceptible to the effects of ambient temperature, wind, and other storm events. Construction of an aboveground pipeline would also require exposing the pipeline above rivers (e.g., hung from a bridge or constructed as a special pipeline span) and roadways where it would be more accessible to those intent on damaging the pipeline.

Nearly all petroleum transmission pipelines in the U.S. are buried. As stated in Section 2.3, the proposed Project would be constructed, operated, maintained, inspected, and monitored consistent with the PHMSA requirements presented in 49 CFR 195, relevant industry standards, applicable state standards, and a set of Project-specific Special Conditions developed by PHMSA and incorporated into the proposed Project design, operations, maintenance and monitoring commitments. Construction, operation, inspection, and maintenance of the Project in this manner would result in a pipeline system with a higher degree of safety than any other domestic oil pipeline system and with a higher degree of safety along the entire length of the pipeline system than is required in HCAs as defined in 49 CFR 195.450.

As a result, an aboveground pipeline is not a reasonable alternative for the proposed Project and was not further considered.

4.4.2 Smaller Diameter Pipe

As noted in Section 1.1, the proposed Project would transport a maximum capacity of 830,000 bpd of crude oil to meet current and future market demand for heavy crude oil in PADDs II and III. A pipeline system with a pipe diameter that is less than the proposed Project's 36-inch-diameter pipeline would have lower throughput capacities and would not be capable of providing this volume of crude.

Even if a smaller diameter pipe were commercially viable, construction of smaller lines would have essentially the same impacts as those of the proposed 36-inch-diameter pipe since the construction right-of-way width would be approximately the same for all but the smallest diameter pipe. The working ROW dimensions of pipeline construction are primarily related to the size of construction vehicles and the need for working space near the pipeline trench, not the diameter of the pipe itself. For all pipelines over 30 inches in diameter, the working ROW dimensions would be essentially the same.

The proposed pipeline is sized to efficiently deliver the volume of crude oil proposed to be transported by the proposed Project (i.e., an initial capacity of 700,000 bpd and an ultimate maximum capacity of 830,000 bpd with increase pumping capacity). While there are limitations to the ultimate capacity of throughput based on pipeline diameter, the operational throughput is a function of pipeline diameter, pipeline operating pressure, and crude oil flow velocity. Therefore, to achieve a throughput that would meet the purpose of the proposed Project, a smaller-diameter pipeline would have to operate at higher pressures and flow velocities, and it is not likely that those pressures and velocities would be in consistent with PHMSA regulations. Further, even with high pressure and velocity, it is unlikely that a 30-inch-diameter pipeline would be capable of transporting the volumes proposed for transport in the proposed Project. In addition, as of February 2011, Keystone had firm contract commitments to transport 600,000 bpd of crude oil to Cushing (155,000 bpd of WCSB crude oil for delivery to Cushing that is currently contracted for shipment on the Mainline of the existing Keystone Oil Pipeline Project, 380,000 bpd of WCSB crude oil for delivery to the Gulf Coast, and 65,000 bpd of Bakken crude oil). If a smaller-diameter pipeline were installed, it would likely be necessary to install an additional pipeline to meet those initial commitments.

As a result, use of a smaller diameter pipe for the proposed Project was not considered a reasonable alternative and installing more than one smaller diameter pipe to meet the purpose of and need for the proposed Project would not offer an overall environmental advantage over the proposed Project design. Therefore, this potential alternative was eliminated from further consideration.

4.5 ALTERNATIVE SITES FOR ABOVEGROUND FACILITIES

The major aboveground facilities of the proposed Project consist of pump stations, MLVs, and the Cushing Tank Farm. Alternative sites for those facilities are addressed in the following sections:

- Alternative Pump Station Sites (Section 4.5.1);
- Alternative MLV Sites (Section 4.5.2); and
- Alternative Tank Farm Sites (Section 4.5.3).

Pig launching and receiving facilities would be located within pump stations, and therefore alternate sites for those facilities are not addressed separately.

4.5.1 Alternative Pump Station Sites

All pump stations for the proposed Project would be sited within the permanent ROW. As a result, alternate locations for pump stations were included in general in the assessment of alternate pipeline routes discussed in Section 4.3. The specific sites selected for pump stations were based on system hydraulics, and there would be a minimal distance along the pipeline corridor for alternate pump station sites due to the pumping requirements of each portion of the system. Minor modifications in pump station footprint location may occur as a result of input from appropriate regulatory authorities.

4.5.2 Alternative MLV Sites

All MLVs for the proposed Project would be sited within the permanent ROW. As a result, alternate locations for MLVs were included in general in the assessment of alternate pipeline routes discussed in Section 4.3. In addition, the locations of MLVs must be consistent with 49 CFR 195.260 and the specific conditions related to MLVs included in the Project-specific Special Conditions developed by PHMSA that Keystone has agreed to incorporate into the Project (see Appendix U). As a result, there is little option to install MLVs at alternative sites. However, MLV locations have been selected to avoid sensitive environmental resources to the extent practicable while complying with the PHMSA regulatory requirements and will be modified to comply with the relevant Project-specific Special Conditions developed by PHMSA and incorporated into the proposed Project specifications.

4.5.3 Alternative Tank Farm Sites

Initially, the proposed Project included a tank farm at Steele City, Nebraska. That location would have provided opportunities for batch shipment on either the proposed Project or the existing Keystone Oil Pipeline Project. It was later determined that installing the tank farm at Cushing would be preferable from an operational perspective and would provide better options for delivery systems interconnection and tankage installation for the Bakken Marketlink and the Cushing Marketlink projects if either or both of those projects are implemented (see Sections 2.5.3 and 2.5.4 for information on the potential Bakken Marketlink and Cushing Marketlink projects).

The proposed Cushing tank farm site was selected to be adjacent to the proposed site of pump station 32. It is also less than 0.5 mile from the existing Cushing Oil Terminal, which is the largest oil terminal in the U.S. Siting near the pump station and the existing terminal would avoid disturbance to areas farther from the facility and would eliminate the need for a connecting pipeline extending beyond the proposed ROW. As described in Section 3, construction and operation of the Cushing tank farm would not result in substantial impacts. As a result, there do not appear to be any alternative tank farm sites that would offer an overall environmental advantage to the proposed site.

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