

4.0 ALTERNATIVES

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

The following criteria were used to determine whether alternatives would be environmentally preferable to the proposed action:

- Significant environmental advantage over the proposed Keystone Project,
- Ability to meet the proposed Keystone Project objectives, and
- Technical and economic feasibility and practicability.

Keystone participated in the process during the preliminary design stage for the Project. The process emphasized identification of potential stakeholder issues through open houses; scoping meetings held early in the development of the Project emphasized identification and evaluation of alternatives that may avoid or minimize these issues. As the preliminary analyses of possible routes were conducted, issues of concern were identified, and multiple stakeholders provided DOS with comments as route planning progressed. These early routes and analyses are described in detail in ENSR (2006a).

The DOS alternatives development process began by considering several objectives identified for the Keystone Project:

- Gas pipeline conversion: Converting an underutilized natural gas pipeline in Canada to crude oil. Use of this pipeline fixes the border crossing at Pembina County, North Dakota and constitutes a control point.
- Market endpoints at (a) Salisbury, Missouri; (b) a refinery at Wood River, Illinois; and (c) an interconnection point with other crude oil pipelines, as well as tank storage at Patoka, Illinois.
- An additional market endpoint at Cushing, Oklahoma to serve Gulf Coast refineries.

This section describes several types of alternatives (no action, system, and major route alternatives) and assesses whether they would meet the stated purpose and need for the project and the above objectives.

4.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the Keystone Project would not be constructed and operated as described in Section 2.0. Therefore, selection of the No Action Alternative would not require issuance of a DOS Presidential Permit for the specific action of building and operating the Keystone pipeline (the proposed action).

Denial of the proposed action would mean that the environmental impacts discussed in this EIS would not occur. While this alternative would eliminate the environmental impacts directly associated with the Keystone Project, it would not meet the purpose and need for the proposed action stated in Section 1.0 of the EIS. The purpose and need for the project involves both supply and demand components.

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

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

Although the Keystone Project would not be constructed and operated under this alternative, other reasonably foreseeable oil transportation projects may continue. Thus, the No Action Alternative would not necessarily result in an overall reduction in impacts to physical, biological, and human resources because crude oil likely would continue to be transported by other yet-to-be built pipelines, existing pipelines and routes, or alternative transportation methods (such as tank trucks or barges) to markets in the Midwest and Eastern United States.

While the increasing demand for refined crude oil products could be met by other projects or alternatives, it is purely speculative to predict the resulting effects and actions that could be taken by local governments and other suppliers or refineries in the region, as well as any associated direct and indirect environmental impacts of these actions. In addition, each of these actions may result in environmental impacts that are less than, equal to, or greater than those of the currently proposed Keystone Project. The No Action Alternative also could result in more expensive and less reliable crude oil supplies for Midwestern refineries, increasing costs and availability of the refined products for end-users. Because of these factors, the No Action Alternative is not considered preferable to the proposed action.

4.2 SYSTEM ALTERNATIVES

System alternatives are alternatives to the proposed action that would make use of other existing, modified, or proposed pipeline systems to meet the stated objectives of the proposed Project. A system alternative would make it unnecessary to construct all or part of the proposed Keystone Project, although some modifications or additions to other existing pipeline systems may be required to increase their capacity. These modifications or additions would result in environmental impacts that may be less than, similar to, or greater than those associated with construction of the proposed Project. The purpose of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with construction and operation of the proposed facilities would be avoided or reduced by using another pipeline system while still meeting the objectives of the proposed Keystone Project.

The analysis below examines several existing and proposed crude oil pipeline systems that currently or would eventually serve the markets targeted by the proposed Keystone Project. The analysis considers whether those systems would meet the proposed Project objectives while offering an environmental advantage over the proposed Project. Specifically, the system alternatives considered include:

- Expansion of existing pipeline systems (Express and Platte Pipeline System); and
- Construction of other pipeline systems (Southern Access, Southern Lights, Alberta Clipper, and the Spearhead Cushing Expansion).

4.2.1 Existing Pipeline System - Express and Platte Pipeline System

Kinder Morgan operates the Express pipeline (an existing 24-inch-diameter pipe), which interconnects with the Platte pipeline (an existing 20-inch-diameter pipe) at Casper, Wyoming (http://www.terasenpipelines.com/bins/nosidebar_page.asp?cid=38-69-94). This 1,700-mile pipeline system transports crude oil from Alberta's oil sands in Hardisty, Alberta to refineries in the U.S. Rocky Mountain and Midwest regions. In the United States, the pipeline crosses Montana, Wyoming, Nebraska, Kansas, and Missouri and terminates in Wood River, Illinois. The Express system has been in operation from 1997, with a current capacity of 280,000 bpd. The Platte pipeline was built in 1952, and its current capacity is 164,000 bpd. As operated today, neither of these existing systems would be able to provide the incremental capacity available from the proposed Keystone pipeline (435,000 bpd, with a potential increase to 591,000 bpd); therefore, they are not practicable alternatives to the proposed action. No further review of these alternatives was conducted.

4.2.2 New Pipeline System Alternative – Enbridge Projects

Four pipeline expansion projects are currently proposed by Enbridge in order to provide incremental pipeline capacity to supply future increases in refinery demand through transporting western Canada's increasing production from oil sands (<http://www.enbridge-expansion.com/expansion>). These expansion projects include:

- Southern Access, an expansion and extension of Enbridge's existing pipeline system, including new pipeline in Wisconsin and Illinois, to increase crude oil capacity to Midwest refineries and beyond.
- Southern Lights LsR is a 20 inch crude oil pipeline from the U.S. – Canada border at Cavalier County, North Dakota, to Clearbrook, Minnesota, to increase delivery capacity for existing crude oil sources.
- Alberta Clipper, a proposed new 36- inch crude oil pipeline from Alberta to Superior, Wisconsin that would, if approved, increase capacity of the Enbridge system by 450,000 bpd and later be expandable up to 800,000 bpd.
- Enbridge's existing Spearhead oil pipeline that extends southwest from Chicago, through Missouri, to Cushing, Oklahoma. The pipeline currently has a capacity of approximately 125,000 bpd and would require approximately 655 miles of new 30-inch-diameter pipeline to provide equal capacity to the Cushing Oklahoma area refineries (see Table 4.2-1.)

The Southern Access and Alberta Clipper projects propose to deliver crude oil directly to Midwestern markets. The proposed Enbridge pipelines would take a longer route to the Cushing refineries compared to the Cushing Extension portion of the Keystone Project, and the greater pipeline length would likely increase impacts to environmental resources. In addition, these projects are configured to serve different market demands and would not meet the market need and in-service date proposed by the Keystone Project. Market demand and supply needs for WCSB crude oil are expected to support both the Keystone Project and the proposed Enbridge projects.

<p style="text-align: center;">TABLE 4.2-1 Comparison of the Keystone Pipeline System with the Enbridge Projects</p>		
Comparative Category	Keystone Project	Enbridge Projects and Spearhead-Cushing Expansion
Delivery points	Midwestern United States and Cushing, Oklahoma	Midwestern United States and Cushing, Oklahoma
Miles of pipe to Midwestern markets (Canada and United States)	1,082	955
Additional miles of pipe to Cushing, Oklahoma	296	655
Total miles of pipe	1,378	1,610

4.3 MAJOR ROUTE ALTERNATIVES

Major route alternatives were considered to determine whether they would avoid or reduce impacts on environmentally sensitive resources that would be crossed by the proposed pipeline and in response to suggestions by the public. The origin and delivery points of a major route alternative are the same as for the corresponding portion of the proposed pipeline (i.e., a border crossing at Pembina County, North Dakota and main delivery points at Wood River and Cushing). However, the alternatives would follow significantly different routes from the proposed pipeline. Major route alternatives would not modify or make use of other existing or new pipeline systems.

In addition to the objectives that dictate the border crossing and delivery point locations, primary and secondary constraints to route location were recognized early during the route development process. Route development attempted to avoid the following primary constraints as much as possible:

- Federal, state, Native American, and military lands;
- Large water bodies and wetland complexes;
- Extreme terrain;
- Urban areas; and
- Wildlife refuges.

Route development attempted to minimize the extent of crossings and impacts related to secondary constraints, which included:

- Water and wetland crossings;
- Waterfowl production areas;
- Irrigated croplands;
- Bedrock;
- Rural communities;
- Aquifers;

- Extensive forested areas; and
- Residences and associated features, such as driveways, outbuildings, and windbreaks.

The process also considered features (opportunities) that are favorable for pipeline routing and generally simplify construction and decrease disturbance, including:

- Existing ROWs for linear features, such as pipelines, power lines, and roadways; (pipelines typically are preferred);
- Flat or gently rolling terrain;
- Easily excavated soils; and
- Non-forested areas.

Control points at specific locations along the pipeline route serve to anchor the route at beginning, end, and midpoints, thereby defining specific portions of the final route. They were considered in the route development process together with primary and secondary constraints. Initial control points were identified at the U.S./Canada border crossing near Gretna, Manitoba a delivery point at Wood River, Illinois; and a delivery point at Patoka, Illinois. The desire to transport crude oil to Cushing, Oklahoma also was considered as a control point.

This EIS considers three major route alternatives that would meet the objectives of the Keystone Project: the Iowa Route Alternative, the Proposed Route Alternative, and the Direct Alternative.

4.3.1 Iowa Route Alternative

Initial route development identified a ROW that avoided Nebraska and crossed Iowa into northern Missouri (Figure 4.3-1). Desktop data analysis and limited aerial and ground reconnaissance were used to identify this route. The Iowa Route entered the United States in Pembina County, North Dakota, just north of Walhalla, and ran due south to the North Dakota/South Dakota border. In South Dakota, the route ran generally south to the Spink County border before turning southeast toward Plymouth County, Iowa. From there, it crossed the South Dakota/Iowa border north of Sioux City, Iowa and continued in a southeasterly direction through Iowa and Missouri. Here, the Iowa Route was collocated with the existing Platte pipeline to Troy, Missouri. North of Troy, the route was moved to a power line ROW to avoid areas where the city has expanded. East of Troy, the route again collocated with the Platte pipeline, running east to the Missouri/Illinois border—where it deviated from the Platte pipeline and crossed the Mississippi River south of Wood River, Illinois. From Wood River, the route ran eastward through the Carlyle Lake WMA into Patoka, Illinois.

While the Iowa Route would meet the objectives of crude oil delivery to the refineries in Illinois, it would not efficiently deliver crude oil to Cushing, Oklahoma and therefore would not completely meet the Keystone Project purpose and need. Therefore, the Iowa Route Alternative is not considered further in the environmental consequences analysis for this EIS.

4.3.2 Proposed Route Alternative – DOS Preferred Alternative

The proposed route was developed because of shipper interest in providing crude oil transportation to storage terminals and pipeline interconnections in Cushing, Oklahoma as well as the original Project objective of delivering crude oil to Wood River and Patoka, Illinois.

Several key control points were considered during development of the proposed route:

- U.S./Canada border – Pipeline entry into the United States was at Pembina County, North Dakota.
- Delivery and interconnect points at Wood River and Patoka, Illinois.
- Final delivery point at Cushing, Oklahoma.
- Missouri River – To economically serve Cushing, the proposed route would cross the Missouri river in South Dakota/Nebraska. Much of the Missouri River in this area is designated as recreational under the Wild and Scenic Rivers Act. A number of technical issues also dictated effective crossing locations. Crossing locations for the Missouri River that are technically appropriate and permissible were strongly considered in the overall routing process.

To accomplish the objective of delivering crude oil to Wood River and Patoka, and eventually to Cushing, the proposed route follows the shortest route possible between the Canadian border and Cushing. The route crosses the U.S./Canada border at Pembina County North Dakota, and follows a southerly track through North Dakota, South Dakota, and Nebraska (see Figure 2.1-1). At Steele City on the Nebraska/ Kansas border, the Mainline Project of the proposed route turns east through the northeast corner of Kansas and crosses Missouri to terminals at Wood River and Patoka, Illinois. The Cushing Extension continues south from Steele City through Kansas to Ponca City and Cushing, Oklahoma. This route would facilitate access to Cushing while preserving access to the original markets in Illinois, and would provide collocation opportunities along the existing Platte pipeline. It also meets the key control points outlined above. Specifically, the proposed route would:

- Allow an HDD crossing of the Missouri River that could be approved and completed at a technically feasible location near Yankton, South Dakota;
- Provide the shortest route of the three alternatives and consequently would represent the least amount of potential disturbance; and
- Require generally fewer water body, railroad, and road crossings.

Therefore, the proposed route would allow the economical extension of the pipeline into Oklahoma (Cushing Extension) and would provide for a feasible crossing of the Missouri River in South Dakota. In addition, the Mainline Project would be collocated with existing and proposed pipeline alignments through Missouri. Due to its ability to meet shipper demand in Oklahoma and its collocation with other previously permitted ROWs and developed utility alignments, the proposed route has been analyzed for environmental consequences as described in Section 3.0 of this EIS. Further localized route variations on the proposed route are described in Section 4.4.

4.3.3 Direct Alternative

As part of the environmental analysis, DOS assessed a potential alignment that is named herein The Direct Alternative. The Direct Alternative was assessed to compare the proposed route to the shortest feasible route between the U.S./Canada border crossing and the delivery points at Patoka and Wood River, Illinois, and from there to the delivery point at Cushing, Oklahoma (Figure 4.3-2). The objective was to determine if there was an overall environmental advantage to the straight-line path was modified to skirt populated areas and to minimize the number of stream crossings by routing along drainage divides whenever possible. Between Wood River and Patoka, the Direct Alternative follows the same alignment as Keystone's proposed route.

Between Wood River and Cushing, the Direct Alternative generally parallels Enbridge’s Ozark pipeline corridor, but was not collocated with it.

A reconnaissance-level GIS analysis and comparison of the Direct Alternative and Keystone’s Proposed Route was performed (see Table 4.3-1). Based on this analysis, there is no clear environmental advantage associated with the Direct Alternative. The pipeline miles are very close, as are the approximate number of acres required for the pipeline ROW (acres required for ancillary facilities, access roads, work pads, etc. were not included in this assessment). The Direct Alternative would require an additional 48 water body crossings, and may require additional pump stations. It does not take advantage of collocation with other pipeline corridors. While slightly fewer miles of wetlands (based on available wetlands inventory mapping) and federal lands (based on available GIS coverage) may be crossed by the Direct Alternative, in a general sense this alternative would likely lead to more environmental impact than would construction of the Proposed Route.

TABLE 4.3-1 Comparison of the Proposed Route and Direct Alternative for the Keystone Project			
Comparative Category	Unit	Proposed Route	Direct Alternative
Facility Requirements			
Pipeline length	Miles	1,378	1,380
Pump station requirements	Number	24	29
Land Requirements ^a			
Construction ROW	Acres	18,300	18,303
Permanent ROW	Acres	8,350	8,362
Environmental Considerations			
Water body crossings ^b	Number	213	261
Wetlands crossed ^c	Miles	44.4	40.0
Federal lands crossed	Miles	4.9	2.2

Notes:

The Iowa Route described in Section 4.3.1 is not included in this table because the route does not meet the purpose and need for the Project and was rejected for further analysis.

- ^a Assumes a 110-foot-wide construction right-of-way (ROW) for the entire proposed route, except for the segment between Wood River and Patoka, Illinois, where it is 95 feet wide. The permanent ROW is 50 feet wide.
- ^b Perennial streams only no intermittent streams or man-made ditches..
- ^c National Wetland Inventory (NWI) data are not available for all areas in Nebraska, Kansas, and Oklahoma. For 240 miles of the proposed route, no NWI data are available; for 66 miles of the Direct Alternative route, no NWI data are available

Sources: NWI: USFWS May 2006; water bodies: ESRI & USGS 2006; tribal lands: USGS 2005; federal lands: USGS 2005.

Collocation of the pipeline reduces the cumulative impacts of pipeline construction, an advantage not available with the Direct Alternative. Keystone’s proposed alignment is also predominantly oriented north-south and east-west, while the Direct Alternative is oriented northwest-southeast and northeast-southwest (see

Figure 4.3-2). Alignment with the cardinal directions allows the proposed route to run parallel to section lines, property lines, and the boundaries of agricultural fields rather than cutting diagonally across them as would the Direct Alternative. The Direct Alternative would likely result in a greater disruption to existing land uses during construction than the proposed route.

4.4 ROUTE VARIATIONS – PROPOSED ROUTE ALTERNATIVE

Route variations differ from system or major route alternatives in that they are identified to resolve or reduce construction impacts to localized, specific resources such as cultural resource sites, wetlands, recreational lands, residences, landowner requests, and terrain conditions. While route variations may be a few miles in length, most are relatively short and in proximity to the proposed route. Because route variations are identified in response to specific local concerns, they are usually the result of landowner comments. A variety of factors are considered in identifying and evaluating route variations, including length, land requirements, and the potential for reducing or minimizing impacts to natural resources.

4.4.1 Proposed Route Variations

As part of the proposed route development and selection process, a number of route variations to the initial Mainline Project route and the Cushing Extension route were identified and evaluated; see Environmental Report filed on November 17, 2006 (ENSR 2006a) and subsequent filings (TransCanada 2006, 2007a, 2007b, and 2007d). These variations were developed based on discussions with landowners, resource stewards, and project engineers to avoid or minimize impacts to natural or cultural resources, reduce or eliminate engineering and constructability concerns, and avoid or minimize conflicts with existing or proposed residential and agricultural land uses. Each of these route variations, which are summarized in Table 4.4-1, has been incorporated into the Proposed Route Alternative.

In addition to the route variations described above, the scoping process identified public concerns related to route location. Many of these comments addressed specific route variations related to avoiding shelterbelts and aesthetic features, such as bike paths and parks. The Scoping Report is provided as Appendix A for reference. The final design alignment would, where feasible, consider these minor route variations and would attempt to address additional landowner requirements.

Additional minor alignment shifts would be required prior to and during construction to accommodate unforeseeable site-specific constraints related to other engineering, landowner, and environmental concerns.

**TABLE 4.4-1
Proposed Mainline Project Route Variations for the Keystone Project**

Proposed Route Mileposts	Route Variation	Reason for Route Variation
Milepost (MP) 0 to 263	The current alignment is located west of the Option B alignment and continues on in a southerly direction.	Avoids aquifers in North Dakota, Coteau Des Prairie, and the Sisseton-Wahpeton Indian Lands. The southerly route reduces length. The reroute also avoids drainage ditches, woodlots, grain bins, shelter belts, wetland easements, and the Tongue River tributaries.
MP 192.3 to 247.5 <i>(Hecla Sandhills Alternative)</i>	In the November 2006 filing, the original option B alignment was shifted west from MP 0 to 263. In the January 2007 filing, the November route was shifted back east, near the original Option B route.	Avoids U.S. Fish and Wildlife Service (USFWS) wetlands and grassland easements; also avoids shallow aquifers and an extensive area of wetlands in sandy substrates. The January route results in less surface disturbance in sensitive habitats.
MP 266 to 274.5	The current alignment is located west of the Option B alignment.	Avoids impact to the USFWS Day County Grasslands easement.
MP 279.3 to 295	The current alignment is located approximately 1 mile east of the Option B alignment.	Reduces impacts to the USFWS Raymond Prairie Chicken Leaks grassland.
MP 309 to 433	Several inflections were eliminated from the Option B alignment.	Reduces the overall length and provide a more direct path from MP 309 to the Missouri River crossing at Yankton, South Dakota.
MP 437 to 469	The current alignment is east of the Option B alignment.	Avoids high bluffs on the south side of the Missouri River, as well as general congestion.
MP 473 to 491	Several minor route refinements to Option B have occurred in this area.	Addresses engineering and construction concerns.
MP 495 to 501.5	The current alignment is west of the Option B alignment.	Avoids native grasslands per landowner request; also avoids a feedlot.
MP 501.5 to 512.5	The Option B alignment was moved approximately 1 mile east. The overall shift continues south to approximate MP 511.	Facilitates a better Elkhorn River crossing location; also reduces length and avoids the Nebraska Game and Parks Commission Lands.
MP 512.5 to 521	The current alignment was moved westward from the Option B alignment	Avoids the future site of Leigh Lake, as well as terraced farmlands.
MP 527 to 532	The current alignment is located west of the Option B alignment	Avoids future construction of a hotel.
MP 536 to 546	The current alignment is east of the Option B alignment.	Provides a better alignment for the Platte River crossing.

**TABLE 4.4-1
(Continued)**

Proposed Route Mileposts	Route Variation	Reason for Route Variation
MP 571.5 to 575.5	The current alignment is west of the Option B alignment.	Avoids two archeological areas.
MP 575.5 to 590	The current alignment shows minor reroutes from the Option B alignment.	Addresses engineering and construction concerns.
MP 590 to 605	The Option B alignment was shifted west.	Avoids flood irrigated agricultural lands in Saline County, Nebraska.
MP 637.5 to 920.5	The Option B alignment followed the existing Platte pipeline. The current alignment follows the proposed Rockies Express pipeline alignment.	Several reroutes deviate from the Rockies Express pipeline to avoid features such as residences and other buildings. Included is a reroute around Agency, Missouri.
MP 920.5 to 1018	The Rockies Express pipeline deviates to the north while the current (Keystone) alignment remains generally collocated with the Platte pipeline. Minor deviations exist in some areas. A major deviation is located at MP 964 to 975. In this area, a more northern route was taken along an existing power line.	Route deviations from the Platte pipeline from MP 964 to 975 avoid congestion associated with Troy, Missouri.
MP 976 to 987.5 <i>(Chain of Rocks Alternative)</i>	The route filed in November 2006 is parallel to the Platte pipeline in this area. The January 2007 filing moves the pipeline to the north.	Avoids residential developments adjacent to the Platte pipeline; the subsequent realignment provides a better location for crossing the Cuivre River. Also avoids a county road bridge and two archaeological sites near the river.
MP 1020.6 to 1024.4 <i>(Wood River Alternative)</i>	The January 2007 filing moves the November 2006 route to the north.	Improves pullback for horizontal directional drilling of the Mississippi River and allows for relocation of Pump Station 37 adjacent to the Wood River Refinery. Also provides for less disturbance at a state park near the confluence of the Mississippi and Missouri Rivers.
MP 1022 to 1081.9	The current alignment is located south of the Option B alignment.	Collocation with the existing Two Rivers and Marathon pipelines until terminating at Patoka, Illinois. Includes a more optimum location for the tie-in to the Patoka Terminal.

TABLE 4.4-1 (Continued)		
Proposed Route Mileposts	Route Variation	Reason for Route Variation
Cushing Extension		
MP 208.2 to 296	The original alignment crossed Native American tribal and allotted lands between these mileposts.	Avoids crossing these lands.
MP 204 to 208	The original alignment crossed the Wichita Audubon Society's Chaplin Nature Center near Arkansas City, Kansas. The current alignment is northwest of the original alignment.	Avoids crossing the Nature Center.

4.4.2 Seward Route Variations

Citizens of Seward, Nebraska, suggested two alternative route variations (Seward Alternatives #1 and #2) that would relocate the pipeline to the east of Seward (see Figure 4.4-1). The purpose of the suggested relocation would be to avoid routing the pipeline near the city's water supply well fields, avoid crossing a water main that connects Seward to its water treatment plant, avoid wetland and floodplain areas, and move the pipeline beyond the western boundary of the High Plains aquifer. The Draft EIS incorporated a reconnaissance-level GIS-based comparison of Seward Alternative #1 and the proposed Project alignment in the vicinity of Seward, Nebraska. Subsequent to the release of the Draft EIS, Keystone provided a more detailed comparison of both Seward Alternative routes with the proposed Project alignment.

A summary of the comparison of the Seward Alternatives and the proposed route follows:

- Seward Alternative #1 or #2 would be approximately 1.5 or 1.4 miles longer, respectively, than the proposed route (Table 4.4-2) and would thus require 19 or 17 additional acres of permanent ROW and 27 or 25 additional acres of construction ROW, respectively.
- The land east of Seward is generally steeper and more dissected than it is to the west (Figure 4.4-1), and the maximum slope crossed by either Seward Alternative is greater than that crossed by the Proposed Alternative. Nevertheless, none of the alignments traverse overly-steep slopes.
- Seward Alternative #1 impacts 103 landowners, significantly more than the Proposed Alternative (60 landowners) in the Seward area or Seward Alternative #2 (61 landowners). Twelve residential areas are within 500 feet of the Proposed Alternative, 22 are within 500 feet of Seward Alternative #1, and six are within 500 feet of Seward Alternative #2.
- Both Seward Alternatives would require one railroad crossing, while the Proposed Alternative would require two. Seward Alternative #1 would require nine more crossings of paved roads than the Proposed Alternative (33, as opposed to 24), but Seward Alternative #2 would require only four such crossings.

- The number of perennial stream crossings would be the same for all alternatives. Seward Alternative #1 would require 29 intermittent stream crossings, and Seward Alternative #2 would require five such crossings, compared to 12 for the proposed route. Seward Alternative #2 would require only five crossing of intermittent streams.
- Both Seward Alternatives would cross a greater length of wetlands than the Proposed Alternative.. Despite their greater overall length, the Seward Alternatives would cross fewer miles of cultivated cropland than the proposed route. The Seward Alternatives would instead cross greater lengths of developed land, grassland and pasture, and upland forest.
- Both Seward Alternatives would avoid the city’s water-supply well fields and water main, and would locate the pipeline beyond the eastern boundary of the High Plains aquifer (see Figure 4.4-1). By doing so, however, the Seward Alternatives would cross a greater length of shallow and vulnerable glacial-drift aquifers. South of the Big Blue River crossing, both the Seward Alternative and the Proposed Alternative are within the boundary of the High Plains aquifer; consequently, the environmental benefit of reduced risk to that aquifer is limited to the immediate vicinity of Seward.
- Keystone’s assessment of the potential impacts of a crude oil spill in the Seward area found that, in the unlikely event of a local spill or leak, it would take at least 3.6 years for any potential contamination to migrate to the nearest well, allowing a significant period for any contamination to be detected and remedial action to be taken in order to protect the water supply.

The Seward Alternatives would reduce a very minimal risk to the High Plains aquifer and water supply infrastructure in the vicinity of Seward. The reduction in risk would involve greater pipeline length, additional required ROW area, greater total length of wetlands crossed, and increased number of landowners and residences impacted. The proposed route was found to maintain a more favorable balance of reduced impacts versus reduced potential contamination risks. The Proposed Alternative was therefore not modified to incorporate either of the Seward Alternatives.

4.4.3 Western Fordville Route Variation

At the request of the North Dakota Public Service Commission, Keystone considered a proposed route variation in the vicinity of Fordville, North Dakota. The proposed route had previously been modified in this area following consultation with the North Dakota Department of Health, Division of Water Quality. The Western Fordville Conceptual Route (WFCR) was designed to locate the pipeline farther away from the Fordville Aquifer in order to reduce risk to groundwater resources.

The environmental impacts associated with the WFCR and risks to groundwater associated with both the WFCR and the Proposed Alternative were analyzed by Keystone and reviewed by DOS. This analysis found that the WFCR route variation would slightly reduce the potential that a spill could reach the Fordville Aquifer. Adoption of the WFCR variation would, however, increase overall environmental impacts and would require construction on steeper slopes with highly erodible soils. Because the likelihood that a crude oil release along the Proposed Alternative would reach and contaminate the Fordville Aquifer is low, increased impacts associated with the WFCR did not balance the reduction in risk, and the WFCR variation was not included in the Proposed Route Alternative.

**TABLE 4.4-2
Comparison of the Proposed Route Alternative
and Seward Alternatives #1 and #2**

Comparative Category	Unit	Proposed Route Alternative	Seward Alternative #1	Seward Alternative #2
Facility Requirements				
Pipeline length	Miles	22.2	23.7	23.6
Land Ownership				
Federal	Miles	0	0	0
State	Miles	0	0	0
Private	Miles	22.2	23.7	23.6
Landowners	Number	60	103	61
Water Resources Affected				
Perennial streams	Number	2	2	2
Intermittent streams	Number	12	29	5
Vulnerable aquifers ^a	Miles	1.5	3.0	3.6
Shallow groundwater ^b	Miles	7.6	15.8	11.0
Public water supply wells within 1 mile of centerline	Number	2	0	0
Wellhead protection areas	Number (Miles)	4 (5.4)	1 (2.0)	1 (1.5)
Land Cover				
Wetlands: palustrine emergent	Miles	0.04	0.14	0.16
Wetlands: palustrine forested	Miles	0.06	0	0.11
Cropland	Miles	21.3	18.8	20.0
Developed (right-of-way)	Miles	0.3	0.4	0.4
Developed (residential)	Miles	0	0.7	0.09
Grassland/pasture	Miles	0.4	2.7	2.1
Upland forest	Miles	0.1	0.9	0.6
Streams	Miles	0.08	0.06	0.10
Utility Crossings				
Railroad crossings	Number	2	1	1
Paved road crossings	Number	24	33	4
Public Safety				
Potential residences/residential areas within 500 feet	Number	12	22	6
Public assembly locations (schools, churches) within 500 feet	Number	0	0	0
High consequence areas	Miles	0	0	0
Drinking water (ground or surface water)	Miles	0	0	0
Populated areas	Miles	0	0	0
Ecologically sensitive areas	Miles	0	0	0

Notes:

^a U.S. Environmental Protection Agency DRASTIC Index 5 or higher.

^b Top of aquifer within 50 feet of ground surface.

4.4.4 Hecla Sandhills Variation

The original Presidential Permit application included an alignment in the Hecla Sandhills area east of the current alignment position (ENSR 2006a). In the Keystone Pipeline project Environmental Report updated in November 2006, the proposed alignment was moved west. The western alignment created concerns from USFWS, landowners, and local officials related to surface disturbances and potential groundwater contamination. In response to these concerns, Keystone conducted an alternatives analysis in the Hecla Sandhills area (TransCanada, 2007b). Based on that analysis, a new alignment in the Hecla Sandhills area was submitted and included in the Proposed Alternative. This new Hecla Sandhills alignment crosses 11 fewer miles of palustrine emergent wetlands, avoids USFWS grassland easements, crosses three miles fewer wetland easements, crosses three less miles of high quality native prairie, 5 fewer miles of sandy and gravelly soils, and 15 fewer miles of mapped shallow water supply aquifers.

4.5 ABOVEGROUND FACILITY ALTERNATIVES – PROPOSED ALTERNATIVE

Pump stations, valve sites, temporary worksites, and pipe and contractor yards are identified in the Environmental Report filed on November 17, 2006 (ENSR 2006a). The filing identified 23 (possibly 24) new pump stations, 44 pipe storage yards, 36 contractor yards, and 57 MLVs along the Mainline Project and 3 pump stations, 10 pipe storage yards, 6 contractor yards, and 15 MLVs along the Cushing Extension. Although the preferred locations for these facilities were chosen based on Project need, the proximity of public access, habitats, dwellings, and other land and ROW issues also were considered. Of the pump station locations identified in the November 17, 2006 filing (ENSR 2006a), alternative locations were evaluated for three stations and documented in the January 24 filing (TransCanada 2007a). These locations are described in the following sections and have been incorporated into the proposed Project.

4.5.1 Pump Station 19 – Hecla Sandhills

Pump Station 19 would be moved about 5 miles east of its initial location (Figure 4.5 1). As discussed in Section 4.4 and shown in Table 4.4-1, a route variation for the Hecla Sandhills Alternative (MP 192.3 to 247.5) has been adopted to reduce impacts in this area. Pump Station 19 falls within this variation and would be relocated. The previously filed location was situated over a mapped shallow aquifer; the new location avoids the aquifer, and the power line required by the alternative location is 5 miles shorter. A shift in local property tax benefits from Dicky County to Sargent County, North Dakota would result.

4.5.2 Pump Station 36 – Chain of Rocks

Pump Station 36 has been relocated northwest of its previously proposed location (Figure 4.5-2). As shown in Table 4.4-1, a route variation for the Chain of Rocks area (MP 976 to 987.5) has been adopted. The new location for the pump station is situated in an upland area; the old location was close to a large wetland complex (Horseshoe Lake). The pump station alternative would be collocated with a utility substation, and no additional power lines would be required.

4.5.3 Pump Station 37 – Wood River

Pump Station 37 would be moved northeast of its previously proposed location (Figure 4.5-3). As shown in Table 4.4-1, a route variation for the tie-in to the Wood River Terminal area (MP 1020.6 to 1024.4) has been adopted. As the route into the terminal was further refined, an opportunity to site Pump Station 37

adjacent to the Wood River Refinery became apparent. This would eliminate the need to construct an 0.8-mile lateral extension from the pump station to the terminus at the refinery.

The locations of this pump station in both the November 2006 and January 2007 filings are situated on cropland near industrially developed areas. While it appears that the alternative pump station location may be sited on a farmed wetland, it is likely that it could be oriented such that it is outside the wetlands but still close to the point of refinery storage. The exact orientation and location of Pump Station 37 would be refined following completion of site-specific wetland surveys.

While both the original and alternative locations for Pump Station 37 are located in an area with industrial development, the alternative location presented in the January 2007 filing is located within 1 mile of a larger number of residences, compared to the originally filed location. This pump station would represent a small addition to an existing refinery complex and, because additional laterals would not be needed, the overall footprint would be smaller. The incremental effect of Pump Station 37 on the residences would be minor based on the existing refinery setting.

4.6 REFERENCES

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

TransCanada Keystone Pipeline, L.P. 2006. Cushing Extension Reroute in Oklahoma. Supplemental Filing December 15. Submitted to the U.S. Department of State by TransCanada Keystone Pipeline, L.P. Updated information from Application for Presidential Permit.

TransCanada Keystone Pipeline, L.P. 2007a. Cushing Extension Environmental Report Tables. Supplemental Filing. Submitted to U.S. Department of State by TransCanada Keystone Pipeline, L.P. Updated Tables from Application for Presidential Permit. January 24.

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

TransCanada Keystone Pipeline, L.P. 2007d. Supplemental Filing #9. Submitted to U.S. Department of State by TransCanada Keystone Pipeline, L.P. Application for Presidential Permit. September 10.

Verstraeten, I. M., V. L. McGuire, and K. L. Heckman. 1998. Hydrogeology and Subsurface Nitrate in the Upper Big Blue Natural Resources District, Central Nebraska, July 1995 through September 1997. (U.S. Geological Survey Water-Resources Investigations Report 98-4207.) Denver, CO.

This page intentionally left blank.