2.0 PROJECT DESCRIPTION

The following subsections describe the proposed project which DOS has chosen as the lead agency preferred alternative.

2.1 PROPOSED FACILITIES AND LAND REQUIREMENTS

Keystone proposes to construct and operate a crude oil pipeline and related facilities from an oil supply hub near Hardisty, Alberta in Canada to existing terminals in the United States. The Keystone Project as defined for this EIS consists of the Mainline Project (extending from the Canada/U.S. border to terminals and refineries in Illinois) and the Cushing Extension (extending from Steele City, Nebraska to Cushing, Oklahoma). The Project would have the capacity to deliver approximately 435,000 bpd, with the ability to increase the pumping capacity to approximately 591,000 bpd. See Figure 2.1-1 for a Project overview.

2.1.1 Mainline Project

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

2.1.1.1 Pipeline

The proposed Mainline Project comprises 1,082 miles of 30-inch-diameter pipeline from the Canada/U.S. border to Patoka, Illinois. Table 2.1-1 summarizes the pipeline mileage per state for the Mainline Project.

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

State	Length (miles)	Mileposts (From – To)
North Dakota	217.8	0–218
South Dakota	219.9	218–438
Nebraska	214.6	438–652
Kansas	98.7	652–751
Missouri	274.0	751–1,025
Illinois	56.9	1,025–1,082
Mainline Project total	**1,081.9**	

Sources: ENSR 2006a, TransCanada 2007d.

With the exception of urban/suburban areas around Troy and St. Charles, Missouri and Wood River and Edwardsville, Illinois, the pipeline would be constructed primarily in rural areas. Along the Mainline Project, approximately 705 miles would require new ROW. Figures 2.1-2 through 2.1-5 illustrate the typical construction ROW and equipment work locations in these areas. Approximately 377 miles would be collocated within an approximately 300-foot-wide corridor of existing ROWs for pipelines, utilities, and roads. Figures 2.1-6 through 2.1-9 illustrate the proposed construction ROW in areas where the pipeline would be located parallel to an existing pipeline.

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

2.1.1.2 Aboveground Facilities

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

Pump Stations

Keystone initially would construct 23 pump stations for the Mainline Project. Expansion to approximately 591,000 bpd would require one additional pump station in Bond County, Illinois (PS-38, see Table 2.1-2) and additional pumps at existing pump stations. Pump stations would be placed along the pipeline at locations necessary to maintain adequate flow. The pipe entering and exiting pump stations would be located below grade; the pipe within the pump stations would be aboveground. Two or three electric pumps driven by an electrical motor with a 3,000-kW rating would be located at each pump station. In total for the Keystone Project, the current design includes 58 motors installed for the initial phase and an additional 64 motors for the expansion (TransCanada 2007c). An electrical building and substation, two sump tanks, a small maintenance building, and parking area would complete each pump station.

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

Valves

Keystone would construct 57 MLVs along the Mainline Project (Table 2.1-2). Proposed MLV locations were determined by the hydraulic characteristics of the pipeline, DOT regulations, and environmental and safety concerns. In addition to the 57 MLVs, each pump station would have one block valve. When not located at pump stations, MLVs would be constructed within a fenced 50-foot- by 50-foot area centered on the 50-foot-wide permanently maintained ROW. Remotely activated valves would be located at pump stations, upstream of major river crossings and sensitive water bodies. These valves can be quickly activated to shut down the pipeline in the event of an emergency.

TABLE 2.1-2
Aboveground Facilities for the Keystone Mainline Project

Facility	Location (County, State)	Milepost
Pump Stations		
PS-15	Walsh, North Dakota	34.220
PS-16	Nelson, North Dakota	75.988
PS-17	Steele, North Dakota	123.614
PS-18 and pigging facility	Ransom, North Dakota	170.957
PS-19	Sargent, North Dakota	216.610
PS-20	Day, South Dakota	263.208
PS-21	Beadle, South Dakota	310.201
PS-22	Miner, South Dakota	358.786
PS-23 and pigging facility	Hutchinson, South Dakota	406.558
PS-24	Cedar, Nebraska	454.605
PS-25	Stanton, Nebraska	505.473
PS-26	Butler, Nebraska	552.878
PS-27	Saline, Nebraska	604.323
PS-28 and pigging facility	Jefferson, Nebraska	639.672
PS-29	Nemaha, Kansas	691.557
PS-30	Doniphan, Kansas	741.803
PS-31	Clinton, Missouri	786.631
PS-32	Carroll, Missouri	832.000
PS-33	Chariton, Missouri	867.583
PS-34	Audrain, Missouri	902.005
PS-35	Montgomery, Missouri	947.747
PS-36	Lincoln, Missouri	982.239
PS-37, Wood River Terminal	Madison, Illinois	1,026.814
PS-38	Bond, Illinois	1,053.604
Mainline Valves		
V-01	Cavalier, North Dakota	5.592
V-02	Pembina, North Dakota	8.223
V-03	Pembina, North Dakota	15.685
V-04	Pembina, North Dakota	19.496
V-47	Walsh, North Dakota	49.698
V-55	Steele, North Dakota	100.138
V-05	Barnes, North Dakota	167.877
V-06	Ransom, North Dakota	180.290
V-07	Ransom, North Dakota	185.421
V-51	Sargent, North Dakota	203.611
V-48	Marshall, South Dakota	240.447
V-52	Clark, South Dakota	277.441
V-08	Clark, South Dakota	293.950
V-09	Clark, South Dakota	302.103
V-49	Kingsbury, South Dakota	332.089
V-10	Miner, South Dakota	354.921
V-11	Hanson, South Dakota	373.902
V-12	McCook, South Dakota	389.386
V-13	Yankton, South Dakota	419.491
V-15	Yankton, South Dakota	432.135
V-16	Cedar, Nebraska	445.713

TABLE 2.1-2 (Continued)		
Facility	**Location (County, State)**	**Milepost**
Mainline Valves (continued)		
V-56	Wayne, Nebraska	479.927
V-17	Stanton, Nebraska	507.577
V-18	Colfax, Nebraska	534.378
V-19	Colfax, Nebraska	538.509
V-21	Butler, Nebraska	548.672
V-22	Seward, Nebraska	574.391
V-23	Seward, Nebraska	578.476
V-24	Seward, Nebraska	589.666
V-25	Saline, Nebraska	594.130
V-53	Saline, Nebraska	614.300
V-26	Marshall, Kansas	657.355
V-27	Marshall, Kansas	669.919
V-28	Nemaha, Kansas	684.318
V-29	Nemaha, Kansas	701.272
V-54	Brown, Kansas	720.756
V-30	Doniphan, Kansas	743.926
V-31	Buchanan, Missouri	752.296
V-32	Buchanan, Missouri	758.420
V-33	Buchanan, Missouri	766.318
V-57	Caldwell, Missouri	809.080
V-34	Carroll, Missouri	842.299
V-35	Chariton, Missouri	849.877
V-36	Chariton, Missouri	862.459
V-50	Randolph, Missouri	886.727
V-37	Audrain, Missouri	921.505
V-38	Audrain, Missouri	923.098
V-39	Lincoln, Missouri	971.366
V-40	Lincoln, Missouri	976.065
V-41	Lincoln, Missouri	987.053
V-46	St. Charles, Missouri	1,003.161
V-42	St. Charles, Missouri	1,018.380
V-43	Madison, Illinois	1,048.800
V-44	Bond, Illinois	1,069.347
V-45	Marion, Illinois	1,078.828
Terminals (including delivery sites)		
Wood River (includes PS-37)	Madison, Illinois	1,026.814
Patoka Terminal	Marion, Illinois	1,081.798

Sources: TransCanada 2007c, d.

Manually operated values would be installed in conjunction with a check valve, which instantaneously closes in the event of a drop in pressure upstream of the check valve. In essence, the manual valve and check valve combination has the same functionality as a remotely controlled valve. MLVs would be no more than 50 miles apart, with an average spacing of approximately 15 to 20 miles. Keystone's proposed MLV placement along the ROW complies with 40 CFR Part 195, "Transportation of Hazardous Liquids by Pipeline," Subpart A – General, Section 195.260, Valves: Locations, Items(c), (e), and (f) (TransCanada 2007b). This regulation requires valves at locations that:

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

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

Delivery Sites

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

Pigging Facilities

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

2.1.1.3 Ancillary Facilities

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

Additional Temporary Workspace Areas

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

TABLE 2.1-3
Additional Temporary Workspace Areas
for the Keystone Mainline Project

Type of Workspace Area	Typical Dimension (length by width in feet at each side of crossing)	Typical Acreage
Directionally drilled water bodies	300 x 140 on entry and exit sides	2.0
	Plus (length of drill plus 100) x 25 on exit side	Varies
Water bodies > 50 feet wide	250 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.6
	250 x 50 in two quadrants (working side, both sides of crossing)	0.6
Water bodies < 50 feet wide	125 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.3
	125 x 50 in two quadrants (working side, both sides of crossing)	0.3
Bored highways and railroads	175 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.5
	175 x 50 in four quadrants (working side, both sides of crossing)	0.5
Bored interstate and four-lane highways	(Width of crossing plus 50) x 25 in four quadrants (working and spoil sides, both sides of crossing), or	Varies
	(Width of crossing plus 50) x 50 in two quadrants (working side, both sides of crossing)	Varies
Open-cut or bored county or private roads	125 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.3
	125 x 50 in two quadrants (working side, both sides of crossing)	0.3
Push-pull wetland crossing	150 x 50 in two quadrants and center length at intersection point	0.2
	(Length of wetland plus 200) x 50 on working side	1.0
Stringing truck turnaround areas	Located adjacent to all-season hard-pack or paved road at spread breaks	5.0
	200 x 80 (working side)	0.4
Full right-of-way topsoil stripping/ steep or side slopes	Length of area x 25 (uphill side)	Varies
Merchantable timber stockpiling or marshalling areas	200 x 50	0.3

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

Pipe Storage and Contractor Yards

Keystone has identified required pipe storage and contractor yards for the construction phase of the Mainline Project (Table 2.1-4). Keystone estimates that 44 pipe storage and 36 contractor yards would be required for construction of the Mainline Project. Each 15- to 20-acre contractor yard would reduce construction worker transportation requirements. Each approximately 25-acre pipe staging yard would typically be located at 30-mile intervals along the pipeline route in proximity to railroad siding facilities.

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

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

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

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

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

TABLE 2.1-4
Potential Pipe Storage Yards and Contractor Yards
for the Keystone Mainline Project

Name and Type of Yard	County	Acreage
North Dakota		
Berea pipe yard	Barnes	30
Valley City-a contractor yard	Barnes	12
Valley City-b contractor yard	Barnes	6
Milton pipe yard	Cavalier	30
Oakes pipe yard	Dickey	30
Emerado contractor yard	Grand Forks	21
Grand Forks-1 contractor yard	Grand Forks	11
Grand Forks-2 contractor yard	Grand Forks	7
Larimore pipe yard	Grand Forks	30
Aneta contractor yard	Nelson	25
Walhalla pipe yard	Pembina	30
Devils Lake contractor yard	Ramsey	20
Lisbon contractor yard	Ranson	17
Verona pipe yard	Ranson	30
Luverne pipe yard	Steele	46
Dahlen pipe yard	Walsh	40
Grafton-a contractor yard	Walsh	15
Grafton-b contractor yard	Walsh	10
Lankin pipe yard	Walsh	30
North Dakota subtotal		*440*
South Dakota		
Yale pipe yard	Beadle	30
Bath contractor yard	Brown	30
Claremont pipe yard	Brown	30
Ashton pipe yard	Clark	30
Iroquois pipe and contractor yard	Kingsbury	50
Emery pipe yard	McCook	40
Mitchell contractor yard	McCook	3
Yankton pipe yard	Yankton	32
Yankton-2 contractor yard	Yankton	21
Yankton-1 contractor yard	Yankton	33
South Dakota subtotal		*299*
Nebraska		
Garrison pipe and contractor yard	Butler	65
Laurel pipe yard	Cedar	30
Columbus pipe and contractor yard	Colfax	50
Plymouth pipe and contractor yard	Jefferson	39
Humphrey pipe yard	Platte	40
Mulford pipe yard	Seward	30
Norfolk contractor yard	Stanton	38
Norfolk pipe yard	Stanton	30
Nebraska subtotal		*322*

TABLE 2.1-4 (Continued)		
Name and Type of Yard	**County**	**Acreage**
Kansas		
Hiawatha-1 pipe and contractor yard	Brown	61
Hiawatha-2 pipe and contractor yard	Brown	44
Woodlawn pipe yard	Brown	40
Highland pipe and contractor yard	Doniphan	63
Marysville pipe and contractor yard	Marshall	160
Summerfield pipe and contractor yard	Marshall	50
Hanover east pipe yard	Washington	40
Kansas subtotal		*458*
Missouri		
Mexico contractor yard	Audrain	20
Mexico east-a pipe and contractor yard	Audrain	45
Mexico east-b pipe and contractor yard	Audrain	30
Elmira pipe and contractor yard	Caldwell	50
Tina pipe yard	Carrol	49
Keytesville pipe and contractor yard	Chariton	56
Cameron east pipe and contractor yard	Clinton	5
Gower pipe yard	Clinton	88
Winston pipe and contractor yard	DeKalb	22
Troy contractor yard	Lincoln	33
Buell pipe yard	Montgomery	33
Clark-1 pipe and contractor yard	Randolph	109
Clark-2 pipe and contractor yard	Randolph	109
Renick pipe yard	Randolph	8
Old Monroe pipe yard	St. Charles	63
Missouri subtotal		*720*
Illinois		
Alton-2 contractor yard	Madison	42
Hartford pipe yard	Madison	60
Greenville contractor yard	Bond	23
Pocahontas pipe yard	Bond	50
Illinois subtotal		*175*

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

TABLE 2.1-5 Maximum Fuel Throughput – Temporary Fuel Transfer Systems for the Keystone Project		
Fuel	**Daily (gallons/site)**	**Annual (gallons/site)**
Gasoline	400	36,600
Off-road diesel	1,700	175,000
On-road diesel	7,000	723,000

Source: TransCanada 2007c.

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

Access Roads

The Mainline Project would require 142 temporary access roads or expansions of existing roads. The total length of the temporary access roads would be 58.8 miles, each one ranging from 0.01 to 13.5 miles and the majority being less than 0.5 mile. Only five of the access roads would be more than 1 mile. The temporary roads and upgrades to existing roads would disturb approximately 142 acres along the entire Mainline Project ROW. New temporary access roads or expansion of existing private or public roads would be used and maintained only with permission of the landowner or land management agency.

Keystone also would construct short permanent access roads from public roads to the Mainline Project's proposed pump stations, delivery sites, and MLVs. The permanent access roads would disturb approximately 3.5 acres along the entire Mainline Project ROW. Pre-construction drainage patterns would be maintained by installing culverts and ditches as necessary, and the roads would be surfaced with crushed rock (TransCanada 2007c). Prior to construction, Keystone would finalize the locations of the permanent access roads and any additional temporary access roads, and would obtain necessary federal, state, and local approvals. Keystone would be responsible for maintenance of newly created access roads.

2.1.2 Cushing Extension

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

2.1.2.1 Pipeline

The Cushing Extension would consist of 296 miles of 36-inch-diameter pipeline between Steele City in Nebraska near the Nebraska/Kansas border and the existing crude oil terminal in Cushing (Payne County) in Oklahoma. Table 2.1-6 summarizes the pipeline mileage by state.

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

State	Length (miles)	Mileposts (From – To)
Nebraska	2.5	0–3
Kansas	210.4	3–213
Oklahoma	83.1	213–296
Cushing Extension total	**296.0**	

Source: TransCanada 2007b.

Along the Cushing Extension route, approximately 48 miles of the 296 miles of pipeline route would be collocated within 300 feet of existing pipeline, utility, or road ROWs. Approximately 248 miles of the route ROW would be new ROW.

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

2.1.2.2 Aboveground Facilities

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

TABLE 2.1-7
Aboveground Facilities for the Keystone Cushing Extension

Facility	Location (County, State)	Milepost
Pump Stations		
CE-30	Dickinson, Kansas	94.459
CE-32 and pigging facility	Cowley, Kansas	186.583
CE-33	Kay, Oklahoma	240.929
Mainline Valves		
V-01	Washington, Kansas	15.674
V-14	Clay, Kansas	36.755
V-02	Clay, Kansas	50.063
V-03	Clay, Kansas	53.959
V-04	Dickinson, Kansas	67.529
V-05	Dickinson, Kansas	77.170
V-06	Marion, Kansas	102.544
V-07	Marion, Kansas	121.604
V-15	Butler, Kansas	145.960
V-08	Cowley, Kansas	194.624
V-09	Cowley, Kansas	210.911
V-10	Noble, Oklahoma	248.260
V-13	Noble, Oklahoma	260.315
V-11	Payne, Oklahoma	281.992
V-12	Payne, Oklahoma	289.209
Terminal (including delivery site)		
Cushing Terminal (includes a pigging facility)	Payne, Oklahoma	295.490

Sources: TransCanada 2007c, d.

Pump Stations

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

Valves

Keystone would construct 15 MLVs along the Cushing Extension (see Table 2.1-7). In addition, each pump station would have one block valve. Proposed MLV locations were determined by the hydraulic characteristics of the pipeline, DOT regulations, and environmental and safety concerns. The valves would be built and would operate as described for the Mainline Project in Section 2.1.1.2.

Delivery Sites

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

Pigging Facilities

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

2.1.2.3 Ancillary Facilities

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

Additional Temporary Workspace Areas

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

Pipe Storage and Contractor Yards

Keystone has identified required pipe storage and contractor yards for the construction phase of the Cushing Extension (Table 2.1-9). Keystone estimates that 10 pipe storage and six contractor yards would be required for construction of the Cushing Extension. Fuel transfer stations would be located only at contractor yards (TransCanada 2007c), and the pipe storage and contractor yards and temporary fueling stations would be constructed as described in Section 2.1.1.3.

Access Roads

Keystone does not plan to construct any permanent access roads to the construction ROW. Existing public and private roads would be used on a temporary basis. Thirty-one temporary access roads or expansions of existing roads would be required for the Cushing Extension. The total length of the temporary access roads would be 9.5 miles, each ranging from 0.06 to 1.10 miles and the majority less than 0.5 mile. Only one of the access roads would be more than 1 mile. The temporary roads and upgrades to existing roads would disturb approximately 22 acres along the entire Cushing Extension

ROW. New temporary access roads or expansion of existing private or public roads would be used and maintained only with permission of the landowner or land management agency.

TABLE 2.1-8
Additional Temporary Workspace Areas for the Keystone Cushing Extension

Type of Workspace Area	Typical Dimension (length by width in feet at each side of crossing)	Typical Acreage
Directionally drilled water bodies	300 x 140 on entry and exit sides	2.0
	Plus (length of drill plus 100) x 25 on exit side	Varies
Water bodies > 50 feet wide	250 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.6
	250 x 50 in two quadrants (working side, both sides of crossing)	0.6
Water bodies < 50 feet wide	125 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.3
	125 x 50 in two quadrants (working side, both sides of crossing)	0.3
Bored highways and railroads	175 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.5
	175 x 50 in two quadrants (working side, both sides of crossing)	0.5
Bored interstate and four-lane highways	(Width of crossing plus 50) x 25 in four quadrants (Working and spoil sides, both sides of crossing), or	Varies
	(Width of crossing plus 50) x 50 in two quadrants (Working side, both sides of crossing)	Varies
Open-cut or bored county or private roads	125 x 25 in four quadrants (working and spoil sides, both sides of crossing), or	0.3
	125 x 50 in two quadrants (working side, both sides of crossing)	0.3
Push-pull wetland crossing	150 x 50 in two quadrants and center length at intersection point	0.2
	(Length of wetland plus 200) x 50 on working side	1.0
Stringing truck turnaround areas	Located adjacent to all-season hard-pack or paved road at spread breaks	5.0
	200 x 80 (working side)	0.4
Full right-of-way topsoil stripping/ steep or side slopes	Length of area x 25 (uphill side)	Varies
Merchantable timber stockpiling or marshalling areas	200 x 50	0.3

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

TABLE 2.1-9
Potential Pipe Storage Yards and Contractor Yards for the Keystone Cushing Extension

Name and Type of Yard	County	Acreage
Kansas		
Augusta contractor yard	Butler	13
Towanda pipe yard	Butler	26
Broughton pipe yard	Clay	21
Junction City pipe yard	Dickinson	61
Concordia contractor yard	Cloud	22
Winfield pipe yard	Cowley	31
Grandview Plaza contractor yard	Geary	16
Junction City contractor yard	Geary	26
Florence pipe yard	Marion	42
Lost Springs pipe yard	Marion	55
Hanover SW pipe yard	Washington	26
Kansas subtotal		*339*
Oklahoma		
Ponca City contractor yard	Kay	21
Ponca City pipe yard	Kay	76
Morrison pipe yard	Noble	47
Cushing pipe yard	Payne	43
Stillwater-1 contractor yard	Payne	20
Oklahoma subtotal		*207*

Sources: ENSR 2006a, TransCanada 2007.

2.1.3 Land and Borrow Material Requirements

Table 2.1-10 summarizes the land requirements for the proposed Keystone Project. For the Mainline Project, approximately 17,607 acres of land would be disturbed during construction. This total includes temporary construction workspaces and the approximately 6,667 acres that would be retained as permanent ROW. All disturbed acreage would be restored and returned to its previous aboveground use after construction, except for approximately 109 acres of permanent ROW that would serve to provide adequate space for permanent access roads and aboveground facilities (including pump stations and valves) for the life of the Keystone Project. During construction of pump stations and valves along the Mainline Project, Keystone estimates the need for approximately 500,000 cubic yards of granular borrow material that would be obtained from existing local commercial aggregate suppliers (TransCanada 2007b).

TABLE 2.1-10
Summary of Land Requirements and Surface Disturbances for the Keystone Project

Facility	Land Affected during Construction[a] (acres)	Land Affected during Operation[b] (acres)
MAINLINE PROJECT		
North Dakota		
Pipeline right-of-way (ROW)	2,892	1,320
Additional temporary workspace areas[c]	121	0
Pipe and contractor yards	440	0
Pump station / delivery sites	25	25
Permanent access roads[d]	0.2	0.2
Temporary access roads[e]	40	0
North Dakota subtotal[f]	*3,440*	*1,342*
South Dakota		
Pipeline ROW	2,928	1,332
Additional temporary workspace areas[c]	129	0
Pipe and contractor yards	329	0
Pump station / delivery sites	19	19
Permanent access roads[d]	0.3	0.3
Temporary access roads[e]	20	0
South Dakota subtotal[f]	*3,377*	*1,349*
Nebraska		
Pipeline ROW	2,861	1,301
Additional temporary workspace areas[c]	123	0
Pipe and contractor yards	322	0
Pump station / delivery sites	25	25
Permanent access roads[d]	0	0
Temporary access roads[e]	7	0
Nebraska subtotal[f]	*3,335*	*1,323*
Kansas		
Pipeline ROW	1,314	598
Additional temporary workspace areas[c]	80	0
Pipe and contractor yards	458	0
Pump station / delivery sites	11	11
Permanent access roads[d]	1	1
Temporary access roads[e]	0	0
Kansas subtotal[f]	*1,871*	*608*
Missouri		
Pipeline ROW	3,646	1,660
Additional temporary workspace areas[c]	280	0
Pipe and contractor yards	800	0
Pump station / delivery sites	13	13
Permanent access roads[d]	2	2
Temporary access roads[e]	36	0
Missouri subtotal[f]	*4,675*	*1,687*
Illinois		
Pipeline ROW	655	345
Additional temporary workspace areas[c]	34	0
Pipe and contractor yards	175	0
Pump station / delivery sites	13	13
Permanent access roads[d]	0	0
Temporary access roads[e]	39	0
Illinois subtotal[f]	*909*	*358*
Mainline Project subtotal[e]	***17,607***	***6,667***

TABLE 2.1-10 (Continued)		
Facility	**Land Affected during Construction[a] (acres)**	**Land Affected during Operation[b] (acres)**
CUSHING EXTENSION		
Nebraska		
Pipeline ROW	34	15
Additional temporary workspace areas[c]	4	0
Pipe and contractor yards	0	0
Pump station / delivery sites	0	0
Permanent access roads[d]	0	0
Temporary access roads[e]	0	0
Nebraska subtotal[f]	37	15
Kansas		
Pipeline ROW	2,803	1,275
Additional temporary workspace areas[c]	149	0
Pipe and contractor yards	339	0
Pump station / delivery sites	10	10
Permanent access roads[d]	0	0
Temporary access roads[e]	15	0
Kansas subtotal[f]	3,266	1,275
Oklahoma		
Pipeline ROW	1,094	497
Additional temporary workspace areas[c]	52	0
Pipe and contractor yards	207	0
Pump station / delivery sites	8	8
Permanent access roads[d]	0	0
Temporary access roads[e]	7	0
Oklahoma subtotal[f]	1,363	502
Cushing Extension subtotal[f]	***4,666***	***1,801***
Keystone Project total[f]	**22,273**	**8,468**

[a] Disturbance is based on a total 110-foot-wide construction corridor for 30- and 36-inch pipe and a 95-foot-wide construction corridor in portions of Illinois, except in certain wetlands, shelterbelts, and other forested areas, residential areas, and commercial/industrial areas where an 85-foot-wide construction corridor would be used; or in areas requiring extra width for workspace necessitated by site conditions. Disturbance also includes pipe storage and contractor yards.

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

[c] Additional temporary workspace areas include temporary disturbance for construction of pump stations and/or delivery facilities.

[d] Acreage calculations assume 20-foot wide permanent access roads.

[e] Not all temporary access roads are new. Some temporary access roads are previously existing roads.

[f] Discrepancies in total acreages are due to rounding. Affected lands components total acreage is quantified by component and does not account for overlap between components. For example, portions of a pump station footprint could be located in the pipeline ROW. Therefore, the total acreage of affected lands per state will not be the same as the sum of the individual components.

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

For the Cushing Extension, approximately 4,666 acres of land would be disturbed during construction. This total includes temporary construction workspaces and the approximately 1,801 acres that would be retained as permanent ROW. All disturbed acreage would be restored and returned to its previous aboveground use after construction, except for approximately 18 acres of permanent ROW that would serve to provide adequate space for aboveground facilities for the life of the Keystone Project. During construction of pump stations and valves along the Cushing Extension, Keystone estimates the need for approximately 130,000 cubic yards of granular borrow material that would be obtained from existing local commercial aggregate suppliers (TransCanada 2007b).

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

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

2.1.4 Connected Actions

2.1.4.1 Power Lines and Substations

Keystone estimates that 23 new/upgraded transmission lines would be required to provide electrical power to the proposed pump stations along the Mainline Project. According to Keystone (ENSR 2006a), approximately 181 miles of new transmission lines and 22 miles of upgraded transmission lines would be constructed in North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Illinois for the Mainline Project. These would include one 25-kilovolt (kV), six 34.5-kV, eight 69-kV, seven 115-kV, and one 161-kV transmission lines. Pole heights would vary depending on line voltage between 40 and 80 feet, and pole spacing would vary between 300 and 400 feet. The width of the poles and attached electrical insulators would range from 4 to 15 feet.

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

The power lines would be permitted and built by various utility providers but would be considered a connected activity under NEPA. Keystone assumes that the majority of required transmission lines would parallel existing county road ROWs. Either steel or wooden poles would be used for power lines, with wire conductors installed through pulling or reeling, and insulators installed as needed. Poles would vary in height from 40 to 80 feet, depending on transmission line voltage. Additional power lines would be required for valve sites and would be supplied from distribution service drops from adjacent distribution power lines. Most of these service drops would require installation of one or two poles with a transformer and would typically be less than 200 feet in length.

Existing substations would need to be modified and new substations would need to be constructed in order to provide power to the proposed pump stations along the Mainline Project. Keystone does not anticipate that new substations would be required on any of these transmission systems along the Cushing Extension. Substation modification and construction activities would comply with Western's Construction Standard (Standard 13 – Environmental Quality Protection) and Western's Standard Mitigative Measures for Construction, Operation, and Maintenance of Western Facilities (see Appendix B). The area required for the substation modifications or construction would be surveyed, cleared, and graded prior to installation. The surface would be graded in compliance with storm water control plans and other applicable permit requirements. Gravel would be delivered to the site after all subsurface work is complete and leveled to create a surface for the installation of the above ground substation equipment. A secure chain-link fence would be installed to control and limit access during construction and maintenance activities. The substation equipment would be delivered on tractor-trailer trucks and installed on top of a concrete foundation in the graveled area. All areas would be graded to ensure proper drainage and runoff control in accordance with applicable regulations.

2.1.4.2 Wood River Refinery Expansion

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

Key elements of the CORE project include:

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

- Providing for additional sulfur processing capacity and additional amine treating and sour water stripping capabilities; and
- Modifying the wastewater treatment plant to handle the increased loads.

Additional upgrades proposed by ConocoPhillips to handle increased throughput include a new gasoline tank, two new ethanol tanks, and two new distillate oil tanks. The existing truck loading rack also would be expanded.

Approximately 95,000 bpd of the proposed pipeline's crude oil capacity would likely be shipped on a short-term spot-order basis to refineries throughout the country. The refineries receiving the oil would need to meet current permit requirements to receive and refine the new crude oil supply. If existing permits would not cover the refining of this new crude oil source or if refinery upgrades were required, permit upgrades would be required.

2.2 DESIGN AND CONSTRUCTION PROCEDURES

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

Throughout the Keystone Project, Keystone would implement:

- **Keystone's Construction Mitigation and Reclamation Plan (CMR Plan).** The CMR Plan contains construction and mitigation procedures that would be used throughout the Project to avoid and minimize impacts, with subsections to address specific environmental conditions. The current CMR Plan is included in Appendix B. Any additional mitigation measures agreed to by Keystone as a result of the EIS process or additional mitigations resulting from permit conditions imposed by regulatory authorities would be added to a revised CMR Plan prior to construction.
- **Keystone's Spill Prevention, Control, and Countermeasure (SPCC) Plan.** The SPCC Plan describes spill prevention practices, emergency response procedures, emergency and personnel protection equipment, release notification procedures, and cleanup procedures to avoid or minimize the potential for harmful spills and leaks. Keystone is required by regulation to submit an SPCC Plan to DOT/OPS prior to operation of the pipeline system (49 CFR Part 195). Although Keystone has not yet submitted a specific SPCC Plan, Section 3.0 of Keystone's CMR Plan (Appendix B) describes spill prevention and containment measures to be followed during construction activities. Other topics related to spill response can be found in Appendix B and in the Emergency Response Plan (ERP) (Appendix C [see below]).
- **Keystone's Emergency Response Plan.** The ERP identifies emergency personnel and the logical sequence of actions that should be taken in the event of an emergency involving the Keystone system facilities during construction or operation, including written emergency shutdown procedures, communication coordination, and cleanup responsibilities. A preliminary draft of Keystone's ERP was submitted to DOS on July 1, 2006 (Appendix C).

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

In the event that Keystone encounters abandoned solid waste burial sites during construction, the wastes would be handled according to applicable local, state, and federal laws and regulations.

2.2.1 Pipe Design and Wall Thickness

The regulations require the use of a design safety factor contained in 49 CFR 195.106 to establish a maximum operating pressure. This formula for calculating maximum operating pressure specifies a design safety factor of 0.72 for onshore pipelines. This factor of safety ensures that the maximum allowable operating pressure (MAOP) of the pipeline would not exceed 72% of the specified minimum yield strength (SMYS) of the steel used to construct the pipeline. Under the federal Pipeline Safety Act, a waiver of any regulatory requirement may be granted by the federal Pipeline and Hazardous Materials Safety Administration (PHMSA) if the agency finds that granting the waiver is not inconsistent with pipeline safety (49 USC 60118). On November 17, 2006, Keystone filed a request for waiver of 49 CFR 195.106, seeking permission to use an 0.80 design factor, meaning that the MAOP of the proposed Keystone pipeline would not exceed 80% of the SMYS of the steel used to construct the pipeline. If this waiver were to be granted, the Keystone pipeline at a maximum operating level would still be 20% below the yield strength of the steel used to construct the pipeline.

PHMSA undertook an extensive, detailed technical review of Keystone's request. PHMSA also engaged outside experts in the field of steel pipeline fracture mechanics, leak detection, and supervisory control and data acquisition (SCADA) systems to assist in the review of Keystone's application. PHMSA publicly noticed Keystone's application and incorporated the concerns expressed in public comment into its review. As a result of its review, PHMSA issued a Special Permit allowing Keystone to design, construct, and operate its crude oil pipeline project using a design factor and operating stress level of 80 percent of the steel pipe's SMYS in most areas.

In issuing the Special Permit, PHMSA found specifically that allowing Keystone to operate at 80 percent of SMYS is consistent with pipeline safety and that it "will provide a level of safety equal to or greater than that which would be provided if the pipelines were operated under existing regulations." The Special Permit contains 51 conditions that Keystone must comply with, addressing such areas as steel properties, manufacturing standards, fracture control, quality control, puncture resistance, hydrostatic testing, pipe coating, overpressure control, welding procedures, depth of cover, SCADA, leak detection, pigging, corrosion monitoring, pipeline markers, in-line inspection, damage prevention program, and reporting. Failure to comply with any condition may result in revocation of the Special Permit. In addition, the Special Permit is not applicable to certain sensitive areas, including commercially navigable HCAs; high population HCAs; highway, railroad, and road crossings; and pipeline located within pump stations, mainline valve assemblies, pigging facilities, and measurement facilities. Issuance of the Special Permit was based on PHMSA's determinations that the aggregate effect of Keystone's actions and PHMSA's conditions provide for more inspections and oversight than would occur on pipelines installed under the existing regulations, and that PHMSA's conditions would require Keystone to more closely inspect and monitor its pipeline over its operational life than similar pipelines installed without a Special Permit. Table 2.2-1 provides the approved pipe wall thickness for the Keystone Mainline Project for the length of pipe and type of run.

TABLE 2.2-1
Pipe Wall Thickness for the Keystone Mainline Project

Type of Run	Specified Minimum Yield Strength (SMYS)	Pipe Wall Thickness (inches)	Length of Pipe (miles)	Pipe Diameter (inches)
Rural Areas	80%	0.386	984.3	30
Urban Areas (HCAs)	72%	0.429	62.7	30
Pump Stations[a] and Valves	72%	0.429/0.437[b]	1.8	30
Road Crossings and Minor Rail Crossings	60%	0.515	24.5	30
Major Rail Crossings	60%	0.622	0.1	30
Pump Stations[c]	50%	0.622	1.0	30
HDDs	50%	0.622	8.7	30

Source: PHMSA Special Permit.

[a]Below ground piping.

[b]0.429" pipe will be used during 2009 construction and 0.437" pipe will be used during 2008 construction.

[c]Above ground piping.

2.2.2 Standard Pipeline Construction Procedures

Construction of the pipeline would proceed as shown in Figure 2.2-1. Keystone would construct the pipeline in 11 construction spreads or completed lengths, with eight spreads along the Mainline Project and three spreads along the Cushing Extension (Section 2.2.4). Separate crews would be used for construction of aboveground facilities. The entire process would be coordinated to minimize the total time a tract of land is disturbed and therefore exposed to erosion and temporarily precluded from normal use. Appropriate erosion and sediment control measures would be installed to control the discharge of pollutants from the construction site. In addition, all construction equipment would be completely washed down when transferring from one potential source of noxious weed contamination into another area.

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

2.2.2.1 Survey and Staking

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

2.2.2.2 Clearing and Grading

Removal of vegetation would be confined to those areas absolutely necessary for construction. Clearing and grading crews would protect existing land improvements to the degree practicable, including landowner fences and gates. Livestock would be contained if necessary by temporary gates and fences.

Vegetation and crops would be cleared and rocks, brush, trees, and other debris would be removed. Inadvertent discoveries of cultural resources would be managed as described in Section 3.11.4. If burning is conducted, it would comply with state and local regulations. Where open burning is permitted, such burning would occur within the 110-foot-wide cleared construction ROW, which would provide a buffer from adjacent agricultural or forested lands to prevent the spread of fire. Open burning would not be conducted adjacent to any structure that abuts the ROW.

In wetland or riparian zones, Keystone would install sediment control structures along the construction ROW edges prior to vegetation removal. Sediment control structures across the ROW would be installed immediately after vegetation removal, as specified in Sections 4.5 and 7.7 of Keystone's CMR Plan. Grading would occur in uneven grade areas to level the working surface, and disturbed topsoil would be segregated and piled to prevent mixing of the subsoil and topsoil. Steep side slope areas would require more severe grading due to the need to avoid unusual bending of the pipeline during installation.

2.2.2.3 Trenching

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

TABLE 2.2-2
Minimum Pipeline Cover for the Keystone Project

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

Source: ENSR 2006a.

Disturbed topsoil would be separated from underlying soils in agricultural and certain wetland areas, as specified in Keystone's CMR Plan. In areas where only the removal of trench topsoil is required, it would be stored in a pile on one side of the trench and the subsoil would be stored on the other side of the trench (see Figures 2.1-2 through 2.1-9). The location of topsoil placement and storage location would be based on site topography and other obstructions, and might therefore not always be as shown in the typical drawings. In areas where topsoil covering the trench and the spoil pile area would be removed, separated topsoil would be stored either on the edge of the spoil side of the construction ROW or on the edge of the working side of the construction ROW. This special handling of topsoil would ensure that it is replaced to the original soil sequence prior to disturbance. Gaps would be left between the spoil piles to prevent stormwater runoff from backing up or flooding.

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

2.2.2.4 Pipe Stringing, Bending, and Welding

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

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

2.2.2.5 Installing and Backfilling

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

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

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

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

After installation and before operation, the pipeline would be hydrostatically tested to verify that it can withstand the internal pressures expected during typical operations. Keystone has identified 41 surface water sources that could supply water for hydrostatic testing (32 along the Mainline Project route and nine surface along the Cushing Extension route), depending on the flows at the time of testing and the sensitivity of the individual water bodies for other uses (ENSR 2006a). These potential sources are listed in Section 8.2 of Keystone's CMR Plan (see Appendix B) and Keystone's Hydrostatic Test Plan (also in Appendix B). The testing would occur in approximately 30-mile isolated sections (up to a maximum of 50 miles). During testing, the pipeline segment would be filled with water and pressurized to at least

1.25 times the MAOP for at least 8 hours, in accordance with 49 CFR Part 195. If leaks are found through pressure loss, they would be repaired, and the pipe section would be retested until integrity is verified. Keystone would obtain the test water from rivers and streams along the pipeline route in accordance with federal, state, and local permit stipulations. After an individual test section is complete, test water would be transferred to another isolated pipe for additional testing for contaminants and harmful biota or would be discharged in compliance with NPDES permit requirements, including pre-treatment if necessary. Keystone estimates that a total volume of 78 million gallons of test water would be required for the Mainline Project and an additional 34 million gallons would be required for testing the Cushing Extension, assuming that test water could be reused in three test sections (TransCanada 2007b). After all hydrostatic testing is concluded, a caliper pig that detects any dents or flaws in the pipeline from fabrication or construction events would be launched. Any detected "out-of-round" problems that could affect pipe integrity would be repaired. Following successful hydrostatic testing and pipe geometry inspection, all hydrostatic test manifolds would be removed and the final pipeline tie-ins would be welded and inspected.

2.2.2.7 Commissioning

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

2.2.2.8 Cleanup and Restoration

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

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

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

2.2.3 Non-Standard Pipeline Construction Procedures

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

2.2.3.1 Road, Highway, and Railroad Crossings

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

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

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

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

2.2.3.2 Steep Terrain

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

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

2.2.3.3 Water Body Crossings

Site Preparation

Temporary workspace areas would be required on both sides of all water bodies to stage construction, fabricate the pipeline, and store materials. At HDD crossings, some trees and shrubs may be cleared, possibly by hand to minimize disturbance, to allow access along the pipeline route and to facilitate the HDD operation. A minimal amount of activity would take place on the ROW between the entry and exit points of the directional drills during the operation, including placement of tracking cables, placement of pumps and water lines to supply the HDD operation, and pump and hose set-up on the opposite side of the river. These workspace areas would be located at least 50 feet from the water's edge where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. Before construction, temporary bridges (e.g., subsoil fill over culverts, timber mats supported by flumes, railcar flatbeds, and flexi-float apparatus) would be installed across all perennial water bodies. Construction equipment would be required to use the bridges, except the clearing crew, which would be allowed one pass through the water bodies before the bridges are installed. Equipment refueling and lubrication typically would take place in upland areas that are 100 feet or more from the edges of lakes, streams, intermittent streams, and wetlands. Section 3.0 of Keystone's CMR Plan (Appendix B) provides procedures for refueling and lubrication of construction vehicles, and identifies spill prevention and contingency planning for these operations.

Perennial Stream and River Crossings

The Mainline Project would cross 213 perennial streams and rivers, and the Cushing Extension would cross 58, using one of four techniques: the open-cut wet method (Keystone's preferred method), the flume method, the dam-and-pump method, or the HDD method. Keystone intends to install the pipeline at an appropriate depth to address the potential hazard represented by scour during high-flow events as determined during final design (TransCanada 2007b). Detailed information on Keystone's proposed methodology for water crossings and general mitigation planning is presented in Appendix D (Site-Specific Water Body Crossing Plans) and in Appendix B (Keystone's CMR Plan).

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

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

Keystone occasionally would use the flume and dam-and-pump methods where technically feasible and where determined necessary based on permit stipulations. During flume construction, water would be diverted through the trenching area through one or more flume pipes. During dam-and-pump construction, pumps and hoses would be used to divert water around the trench area. In each method, water flow is not returned to the construction area until pipeline installation and backfilling is complete. These dry stream crossing methods are generally not feasible on streams greater than about 30 feet wide, due to the limitations on the volume of water that can effectively be transferred around the work area through flumes or by pumps, as well as limitations on the distance trenching equipment can reach under flume pipes for excavating/backfilling the trench. For this reason the open cut method would be used for all of the larger streams that are not being crossed by the HDD method.

To minimize any streambank, streambed, or water quality impacts, Keystone intends to use the HDD installation method for 13 crossings along the Mainline Project: the Pembina River, the South Branch Park River, the Missouri River (two crossings), the Elkhorn River, the Platte River, the Chariton River, the Cuivre River (two crossings), the Mississippi River, Silver Creek, the Kaskaskia River, and Hurricane

Creek. The HDD method will be used at four crossings along the Cushing Extension: the Republican River, the Arkansas River, the Salt Fork Arkansas River, and the Cimarron River (TransCanada 2007b, ENSR 2007i). Keystone also has committed to crossing the Sheyenne River in North Dakota using HDD, if determined feasible during future engineering studies. Detailed drawings depicting the HDD crossings for the Mainline Project are provided in Appendix D.

At an HDD crossing (Figure 2.2.5), a drilling unit would first set up on one of the river or stream banks. The setup for HDD would require clearing and disruption of several acres on the entrance side of the crossing and a segment of construction ROW aligned along the drilling trajectory on the exit side of the boring. These workspaces for HDD crossings are included in the overall project workspace disturbance areas. The ROW between the boring point of entry and the point of exit on the opposite side of the river or stream would not be cleared or graded. However, access to the water body is required during the HDD operation, likely resulting in minor disturbance to the vegetation, soils, and stream banks.

The minimum drilled length for a 30-inch-diameter pipeline crossing would be approximately 1,000 feet due to pipe bending constraints (TransCanada 2007b). A pilot hole is drilled under the crossing, using a rotary bit and clay slurry, and enlarged through repeated reamings. Pipe sections long enough to span the entire crossing would be staged and welded along the ROW on the opposite side of the water body and pulled through the drilled and reamed hole. Depth of cover over the pipeline beneath the proposed HDD river crossings would be approximately 45 feet.

Intermittent Water Body Crossings

The Keystone Project would cross approximately 605 intermittent water bodies on the Mainline Project and about 192 intermittent water bodies on the Cushing Extension. If dry during construction, Keystone proposes to cross these features using standard upland construction techniques. If flowing during construction, Keystone proposes to perform open-cut wet crossings, as previously described. When crossing water bodies, Keystone would adhere to the guidelines outlined in its Site-Specific Water Body Crossing Plans (Appendix D), Keystone's CMR Plan (Appendix B), and the requirements of its water body crossing permits.

Site Restoration

Temporary equipment bridges would be removed following construction. River and stream banks would be temporarily stabilized within 24 hours of completing instream construction. River and stream banks ultimately would be restored to pre-construction contours or another stable configuration. Erosion control measures (e.g., rock riprap or gabion baskets (rock enclosed in wire bins), log walls, vegetated geogrids, and willow cuttings) would be installed as necessary on steep water body banks, as stipulated in permits. Other stream or river banks not receiving structural erosion control would be seeded with native grasses or other species as requested by the landowners, and mulched or covered with erosion control fabric. Keystone would encourage private landowners to replant using native vegetation. Sediment barriers would be maintained across the ROW at all water body approaches until permanent vegetation is established.

2.2.3.4 Wetland Crossings

Keystone has mapped wetland crossing areas using data from wetland delineation field surveys, aerial photography, and National Wetland Inventory (NWI) maps. Acreages of wetlands potentially affected by construction and the specific impacts identified are described in Section 3.4. This section provides the general procedures Keystone intends to use to construct within wetland areas. Actual construction techniques may be modified by permit conditions imposed by USACE and relevant state or local authorities in jurisdictional wetland areas, and also in wetland areas included within easements administered by the USFWS or other state or federal resource agencies.

Site Preparation

Clearing of vegetation in wetlands would be limited to trees and shrubs cut flush with the ground surface and removed from the wetland. Stump removal, grading, topsoil segregation, and excavation would be limited to the area immediately over the trench. All stockpiles would be located at an upland site that is not a wetland, and measures would be taken to ensure that the material cannot enter the watercourse through erosion or any other means. During clearing, sediment barriers (silt fences and stacked straw bales) would be installed and maintained on down slopes adjacent to saturated wetlands, and within additional temporary workspace areas as necessary to minimize the potential for sediment runoff. Temporary workspace areas would be required on both sides of particularly wide saturated wetlands to stage construction, fabricate pipeline, and store materials. These temporary workspace areas would be located in upland areas a minimum of 10 feet and up to 50 feet from the wetland perimeter, as determined by the COE permit process. Typical ROW width in saturated wetlands would be 85 feet unless a wider ROW is needed to address non-cohesive soils.

Construction

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

Construction within wetland areas that can support construction equipment without equipment mats would be accomplished using upland cross-country construction techniques (Figure 2.2-6). Topsoil salvaging and stockpiling would occur to the extent feasible. All stockpiles would be located at an upland site that is not a wetland, and measures would be taken to ensure that the material cannot enter the watercourse through erosion or any other means. Where topsoil has been segregated from subsoil, the subsoil would be backfilled first—followed by the topsoil. Topsoil would be replaced to the original ground level, leaving no crown over the trench line. In some areas where wetlands overlie rocky soils, the pipe would be padded with rock-free soil or sand before backfilling with native bedrock and soil.

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

Restoration

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

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

In wetlands where no standing water is present, the construction ROW would be re-seeded as directed by the landowner, or in accordance with recommendations of the local soil conservation authorities or land management agency. Keystone would encourage private landowners to replant using native vegetation.

2.2.3.5 Blasting

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

2.2.3.6 Residential and Commercial/Industrial Areas

Keystone identified buildings located within 25 feet of the construction ROW, as summarized in Table 2.2-3. Keystone would develop site-specific construction plans to mitigate construction-related impacts on these areas. Further construction and mitigation measures are identified in Keystone's CMR Plan (Appendix B).

2.2.3.7 Fences and Pasture/Rangelands

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

TABLE 2.2-3
Areas with Buildings Located within 25 Feet of the Construction Right-of-Way for the Keystone Project

State	County	Milepost	Structures
Mainline Project			
North Dakota	NA	NA	None
South Dakota	Yankton	435.82	Residence
	Yankton	436.52	Commercial
	Yankton	436.55	Commercial
Nebraska	Cedar	472.78	Outbuilding
Kansas	Brown	720.76	Other
	Doniphan	736.21	Residence
	Doniphan	736.82	Outbuilding
Missouri	Buchanan	767.70	Outbuilding
	Buchanan	767.70	Outbuilding
	Buchanan	767.72	Residence
	Clinton	771.34	Residence
	Clinton	785.72	Residence
	Clinton	785.73	Outbuilding
	Clinton	791.53	Industrial
	Caldwell	807.77	Outbuilding
	Caldwell	815.71	Outbuilding
	Carroll	821.28	Residence
	Chariton	849.15	Residence
	Chariton	867.34	Residence
	Audrain	908.68	Residence
	Audrain	917.81	Residence
	Audrain	922.57	Residence
	Audrain	928.80	Outbuilding
	Audrain	931.86	Outbuilding
	Montgomery	939.04	Outbuilding
	Montgomery	939.09	Outbuilding
	Montgomery	939.11	Outbuilding
	Montgomery	949.98	Outbuilding
	Montgomery	952.70	Outbuilding
	Montgomery	954.02	Residence
	Montgomery	954.02	Outbuilding
	Montgomery	954.04	Outbuilding
	Montgomery	955.40	Outbuilding
	Montgomery	955.44	Outbuilding
	Lincoln	964.47	Outbuilding
	Lincoln	969.07	Residence
	Lincoln	970.14	Residence
	Lincoln	971.59	Residence
	Lincoln	973.87	Commercial
	Lincoln	973.93	Commercial
	Lincoln	979.98	Outbuilding
	St. Charles	987.00	Residence
	St. Charles	999.07	Residence
	St. Charles	999.56	Outbuilding
	St. Charles	1015.27	Residence
	St. Charles	1017.55	Other
Illinois	Bond	1059.66	Outbuilding
	Bond	1064.74	Residence
	Marion	1081.20	Residence

TABLE 2.2-3 (Continued)			
State	**County**	**Milepost**	**Structures**
Cushing Extension			
Nebraska	NA	NA	None
Kansas	Marion	124.6	Single
	Butler	156.4	Development
	Butler	162.0	Single
	Cowley	180.3	Single
	Cowley	208.3	Several
Oklahoma	Kay	233.2	Development
	Noble	241.9	Several
	Noble	246.7	Single
	Noble	258.7	Single
	Payne	269.7	Several
	Payne	270.5	Single
	Payne	274.5	Development
	Payne	279.4	Single
	Payne	289.6	Single
	Payne	291.7	Single

NA = Not applicable.

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

2.2.3.8 Forestlands

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

2.2.4 Construction Procedures for Aboveground Facilities

Keystone would construct aboveground facilities as described below.

2.2.4.1 Pump Stations

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

Pump station sites would be cleared and graded, and foundations for the pump supports, the electrical building, and the support building would be installed. The electrical building would include electrical systems, communications, and control equipment. The support building would house a small office and washroom. Each pump station would require electricity and telephone facilities, which would be obtained from local utilities. Table 2.2-4 summarizes electric power and distribution line requirements.

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

2.2.4.2 Mainline Valves

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

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

2.2.4.3 Delivery Sites and Pigging Facilities

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

2.2.4.4 Transmission Lines

Construction of transmission lines would be scheduled and performed by local power providers Each of the U.S. pump stations would require a new substation that would receive power from nearby transmission lines. Routing of the overhead transmission lines linking the substations and the existing lines were originally provided in the Keystone Pipeline Project Environmental Report (ENSR 2006a). Subsequent changes to the pump station locations and associated power line reroutes provided in ENSR 2006a have occurred due to reassessment of supply options, electrical loads, and proximity to existing lines (TransCanada 2007c, 2007d). The most recent information is summarized in Table 2.2-4. .

Currently, power providers are proposing to build 26 new/upgraded power lines; the voltage ratings of the lines would range from 25 to 230 kV, with the majority being either 69 or 115 kV. In addition to the substations associated with the pump stations, eight new source substations would be constructed: three in South Dakota, three in Nebraska, and two in Missouri.

TABLE 2.2-4 Summary of Pump Station Electrical Power Supply Requirements for the Keystone Project		
Station	**Local Utility**	**Service Description**
MAINLINE PROJECT		
North Dakota		
Pump station ML #15	NODAK Electric Cooperative	Approximately 7 miles of new 69-kilovolt (kV) transmission line from existing 69-kV line to main substation at pump station site. Main pump station substation with 15-million volt-amps (MVA) 69/4.16-kV transformer.
Pump station ML #16	NODAK Electric Cooperative	Approximately 1 mile of 69-kV transmission line from existing 69-kV line to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #17	NODAK Electric Cooperative	Approximately 12 miles of 69-kV transmission line from existing 69-kV line to main substation at pump station site. Approximately 18 miles of existing 69-kV line upgrades. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #18	Cass County Electric Cooperative	Approximately 16 miles of 115-kV transmission line to main substation at pump station site. Remote end upgrades. Main pump station substation with 12/16-MVA 115/4.16-kV transformer.
Pump station ML #19	Dakota Valley Electric Cooperative	Approximately 24 miles of 115-kV transmission line from Foreman substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 15/20/25-MVA 115/4.16-kV transformer.
South Dakota		
Pump station ML #20	Lake Region Electric Association, Inc.	Approximately 11.5 miles of 115-kV transmission line from Groten substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Pump station ML #21	Dakota Energy Cooperative, Inc.	Approximately 2.7 miles of 69-kV transmission line from a new 230/69-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #22	Central Electric Cooperative, Inc.	Approximately 31 miles of 115-kV transmission line from a new 230/115-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Pump station ML #23	Southeastern Electric Service Cooperative, Inc.	Approximately 19.4 miles of 115-kV transmission line from a new 230/115-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Nebraska		
Pump station ML #24	Cedar Knox Public Power District	Approximately 1.5 miles of 69-kV transmission line from a new 115/69-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #25	Stanton County Public Power District	Approximately 8 miles of new 34.5-kV transmission line from a new 115/34.5-kV substation to main substation at pump station site. Main pump station substation with 15-MVA 34.5/4.16-kV transformer.
Pump station ML #26	Butler Public Power District	Approximately 7 miles of new 34.5-kV transmission line tapping an existing 34.5-kV line to main substation at pump station site. Main pump station substation with 15-MVA 34.5/4.16-kV transformer.

TABLE 2.2-4 (Continued)		
Station	**Local Utility**	**Service Description**
MAINLINE PROJECT (CONTINUED)		
Nebraska (continued)		
Pump station ML #27	Norris Public Power District	Approximately 7 miles of 34.5-kV transmission line tapping an existing 34.5-kV line to main substation at pump station site. Remote end upgrades. Main pump station substation with 15-MVA 34.5/4.16-kV transformer.
Pump station ML #28	Norris Public Power District	Approximately 8.3 miles of 69-kV transmission line from local substation to main substation at pump station site. New 115/69-kV substation and rebuilding 4 miles of 34.5-kV line to 69-kV. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Kansas		
Pump station ML #29	Westar Energy	Approximately 6 miles of 115-kV transmission line from South Seneca substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Pump station ML #30	Doniphan Electric Cooperative	Approximately 11 miles of 115-kV transmission line from Walnut substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Missouri		
Pump station ML #31	Platte-Clay Electric Cooperative	Short 161-kV tap from new 161-kV substation serving Rocky Mountain Express to main substation at pump station site. Main pump station with 15-MVA 161/4.16-kV transformer.
Pump station ML #32	Kansas City Power & Light	Approximately 6.5 miles of 34.5-kV line from an existing substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 7.5-MVA 34.5/4.16-kV transformer.
Pump station ML #33	Kansas City Power & Light	Approximately 0.2 miles of 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 7.5-MVA 34.5/4.16-kV transformer.
Pump station ML #34	Consolidated Electric Cooperative	Approximately 0.3 mile of 69-kV transmission line tapping an existing 69-kV line to main substation at pump station site. Tap point switches and remote end upgrades. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #35	Consolidated Electric Cooperative	Approximately 0.7 mile of 69-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15-MVA 69/4.16-kV transformer.
Pump station ML #36	Central Electric Power Cooperative	Short 25-kV tap from a new 161/25-kV substation at Ethlyn to main substation at pump station site. Main pump station substation with 15-MVA 34.5/4.16-kV transformer.
Illinois		
Pump station ML #37	Ameren IP	Less than 0.3 mile of 34.5-kV transmission line from nearby utility line to main substation at pump station site. Remote end upgrades. Main pump station substation with 10-MVA 34.5/4.16-kV transformer.
Pump station ML #38 (future)	Southwest Electric Co-Operative, Inc.	Not required at this time.

TABLE 2.2-4 (Continued)		
Station	**Local Utility**	**Service Description**
CUSHING EXTENSION		
Kansas		
Pump station CE #30	To be determined by utility contacts	Approximately 2.6 miles of 230-kV transmission line from Hillsboro substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Pump station CE #32	To be determined by utility contacts	Approximately 8.3 miles of 138-kV transmission line from Cresswell substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.
Oklahoma		
Pump station CE #33	To be determined by utility contacts	Approximately 0.6 mile of 138-kV transmission line from Osage substation to main substation at pump station site. Main pump station substation with 15-MVA 115/4.16-kV transformer.

ML = Mainline Project.
CE = Cushing Extension.

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

Prior to power line construction, easements would be negotiated and that any necessary ROW clearing and grading would proceed after acquisition of required permits. The majority of the required transmission lines would parallel existing county road ROWs, and some substation upgrades would be necessary in addition to the construction of at least one new substation to accommodate Keystone Project power requirements. Steel or wood poles would be installed along the transmission corridors, embedded and anchored as required to achieve appropriate stability. Wire conductors would be installed through pulling or reeling, as determined by the selected contractors. Insulators also would be installed as needed.

2.2.5 Construction Schedule and Workforce

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

Keystone proposes to construct the Mainline Project using eight construction spreads and the Cushing Extension using three spreads (Table 2.2-5). Construction would occur simultaneously on Spreads 1 and 2 in 2008 and on Spreads 3, 4, 5, 6, 7, and 8 in 2009. Each spread would require 6 months to complete. Keystone anticipates a workforce of approximately 500 to 600 construction personnel per spread and a total peak work force of approximately 2,500 to 3,000 construction personnel. Construction personnel would consist of Keystone employees, contractor employees, construction inspection staff, and environmental inspection staff.

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

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

TABLE 2.2-5
Construction Spreads Associated with the Keystone Project

Spread Number	State	State MP	Location	End MP	Location	Spread Length (miles)
Mainline Project						
1	North Dakota	0.0	Canadian border	129.9	West side of 121st Ave SE, a N/S road	129.9
2	North Dakota	129.9	West side of 121st Ave SE, a N/S road	217.8	North Dakota/South Dakota state line	133.3
	South Dakota	217.8	North Dakota/South Dakota state line	263.2	South side of County Road 22 at PS-20	
3	South Dakota	263.2	South side of County Road 22 at PS-20	403.8	East side of 435th Avenue	140.6
4	South Dakota	403.2	East side of 435th Avenue	437.7	South Dakota/ Nebraska state line	130.6
	Nebraska	437.7	South Dakota/ Nebraska state line	534.4	South side of County Road J Valve 18	
5	Nebraska	534.4	South side of County Road J Valve 18	651.9	Nebraska/Kansas state line	140.7
	Kansas	651.9	Nebraska/Kansas state line	675.1	East side of County Road 99	
6	Kansas	675.1	East side of County Road 99	750.8	Kansas/Missouri state line	104.5
	Missouri	750.8	Kansas/Missouri state line	779.6	South side of NW 292nd Street	
7	Missouri	779.6	South side of NW 292nd Street	905.9	East side of County Road Ee	126.3
8	Missouri	905.9	East side of County Road Ee	1024.9	Missouri/Illinois state line	175.8
	Illinois	1024.9	Missouri/Illinois state line	1081.7	End of line in Patoka, Illinois	
Cushing Extension						
9	Nebraska	0.0	PS-28 in Jefferson, NE	2.4	Nebraska/Kansas state line	107.8
	Kansas	2.4	Nebraska/Kansas state line	107.6	South side of 290th Street in Marion, Kansas	
10	Kansas	107.6	South side of 290th Street in Marion, Kansas	211.9	South side of 322nd in Cowley, Kansas	104.9
11	Kansas	211.9	South side of 322nd in Cowley, Kansas	295.5	End of line in Cushing, Oklahoma	83.3

Sources: ENSR 2006a, TransCanada 2007d.

2.3 OPERATIONS AND MAINTENANCE

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

2.3.1 Normal Operations and Routine Maintenance

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

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

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

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

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

2.3.2 Abnormal Operations

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

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

The smallest leak that Keystone's SCADA system would be capable of detecting is in the range of 1.5 to 2 percent by volume in approximately 140 minutes (TransCanada 2007b). Therefore, assuming a full pipeline capacity of 435,000 bpd, a leak would be detected after a 635- to 845-barrel loss. It would constantly monitor pipeline operation to detect potential leaks greater than or equal to this minimum detection level. The SCADA system and leak detection software would fully comply with industry standards (API 1149). Using real-time dynamic-flow modeling software, line-pack compensated volumetric balancing, and a hydraulic gradient model, the SCADA system would check pipeline conditions (flow rates, pressure, temperature, and fluid density) every 3 to 5 seconds while the pipeline is actively transporting crude oil. Pressure transducers and other monitoring equipment would be located at pump stations, and data from these locations would be transmitted via satellite to the centralized SCADA location. If a real-time measurement exceeds a predetermined threshold, the information would be sent to the SCADA system and the operator would take corrective actions. It would take approximately 9 minutes to complete the emergency shut-down procedure (shut down operating pumping units) and an additional 3 minutes to close the isolation valves. Compared to older leak detection programs, line-pack compensated volume balancing represents an improved method for volume accounting that calculates changes in fluid volume in the pipeline.

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

2.3.2.1 Emergency Response Procedures

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

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

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

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

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

Furthermore, EPA and state agencies would monitor all activities to ensure that the spill is being contained and cleaned up appropriately.

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

2.3.2.2 Remediation

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

- A detailed remedial investigation of environmental contamination resulting from the release,
- Determination of the appropriate scope of cleanup and restoration for contaminated soils,
- Determination of the appropriate scope of cleanup of contaminated surface water and groundwater, and
- Implementation of soil and groundwater remediation.

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

2.4 FUTURE PLANS AND ABANDONMENT

The Keystone pipeline initially would be capable of transporting 435,000 bpd and could be expanded to a capacity of approximately 591,000 bpd. The expansion would require one additional pump station to be constructed in Bond County, Illinois and additional pumps at existing pump stations. Additionally, Keystone has determined that sufficient shipper support exists to warrant construction of the Cushing Extension.

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

2.5 REFERENCES

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