

3.7 FISHERIES

This section provides information on important fisheries resources in the Keystone Project area (also referred to as “species of special concern”). Species of special concern are those species that have been identified by state agencies as fish that occur in water bodies (e.g., streams, rivers, lakes, and ponds) at or immediately downstream of proposed crossings and have recreational or commercial value. The type of fishery present in a water body can be defined as coldwater or warmwater. No coldwater fisheries (e.g., trout and salmon) are found in the Keystone Project area. Warmwater fisheries present in the Project area include resident families (those that do not have extended migrations) such as Ictaluridae (catfish, bullheads, and madtoms), Centrarchidae (black bass and sunfish), Cyprinidae (carp and minnows), and Moronidae (temperate bass). Special-status species information is provided in Section 3.8. Special-status species include those listed by a state or listed under the federal ESA as threatened, endangered, or sensitive, in terms of the potential for a specific population of animals or plants to continue to exist.

3.7.1 Fisheries Resources

The Fisheries section examines water bodies that would be crossed by the proposed pipeline route and those located within approximately 0.5 mile of the pipeline ROW that are capable of supporting fish species with recreational (important as a sport fishery) or commercial (have a market value) significance. The types of water bodies discussed in this section include lakes, ponds, rivers, and perennial and intermittent streams. For the purposes of this section, the following definitions are assumed:

- “Lake” refers to any water body enclosed or partially enclosed where wind is the dominant mechanism in mixing (Goldman and Horne 1983).
- “Pond” refers to any enclosed or partially enclosed water body where convective mixing (i.e., temperature differences) predominates (Goldman and Horne 1983).
- “Perennial stream” refers to any free-flowing water body with a well-defined channel that contains water at all times, except in cases of extreme drought (Hewlett 1982).
- “Intermittent stream” refers to any free-flowing water body that does not always contain water (e.g., contains water only during the wet season) (Hewlett 1982).

The Mainline Project route would involve 213 perennial water body crossings and 605 intermittent water body crossings in the states of North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Illinois. The Cushing Extension would require an additional 58 perennial crossings in Nebraska, Kansas, and Oklahoma. An additional 192 intermittent water bodies would be crossed through Kansas, Oklahoma, and Nebraska. Table 3.7.1-1 lists the perennial crossings for each state, the proposed crossing method, and the presence or absence of a fishery of special concern. For detailed information on crossing methods for water bodies, refer to Section 2.2.2.3.

Table 3.7.1-2 provides the major recreational and commercial fish species located in the perennial streams and rivers along the Keystone Project route, as identified by the state agencies. While the species listed in Table 3.7.1-2 are not the only fish inhabiting those water bodies affected by the proposed pipeline, they are the ones designated as having recreational or commercial value. These fisheries are discussed in more detail in the following section (Section 3.7.2).

**TABLE 3.7.1-1
Stream Name, Crossing Methods, Number of Crossings, Presence or Absence
of Fisheries of Special Concern for Perennial Streams, by State along
the Mainline Project and Cushing Extension Pipeline Routes**

Stream Name	Crossing Method ^a	Number of Crossings	Fisheries of Special Concern Presence (Y) or Absence (N)
MAINLINE PROJECT			
North Dakota			
Goose River	O/C	1	N
Middle Branch Forest River	O/C	1	Y
Pembina River	HDD	1	Y
Sheyenne River	O/C	1	Y
South Branch Park River	HDD	1	N
Tongue River	O/C	1	Y
Unnamed	O/C	2	N
South Dakota			
Beaver Creek	O/C	1	Y
James River	O/C	1	Y
Missouri River	HDD	1	Y
Mud Creek	O/C	1	N
Unnamed	O/C	0	N
Wolf Creek	Dry crossing	1	Y
Wolf Creek	O/C	2	Y
Nebraska			
Unnamed	O/C	2	N
Antelope Creek	O/C	1	N
Cub Creek	O/C	1	N
Dry Creek	O/C	2	N
Elkhorn River	HDD	1	Y
Lincoln Creek	Dry crossing	1	N
Little Indian Creek	O/C	1	N
Middle Logan Creek	O/C	1	N
Missouri River	HDD	1	Y
North Fork Bow Creek	O/C	1	N
Norwegian Bow Creek	O/C	1	N
Platte River	HDD	2	Y
South Fork Bow Creek	O/C	1	N
Shell Creek	O/C	1	Y
Swan Creek	O/C	1	N
Turkey Creek	O/C	1	Y
Union Creek	O/C	1	N
Unnamed	O/C	1	N
West Bow Creek	O/C	1	N
West Fork Big Blue River	O/C	3	Y
Kansas			
Big Blue River	O/C	1	Y
Buttermilk Creek	O/C	1	N
Cedar Creek	O/C	1	N
Deer Creek	O/C	1	N
East Branch Walnut Creek	O/C	2	N
Gregg Creek	O/C	1	N
Halling Creek	O/C	2	N
Harris Creek	O/C	2	N
Indian Creek	O/C	1	N
Middle Fork Wolf River	Dry crossing	1	N
North Elm Creek	Dry crossing	2	N

**TABLE 3.7.1-1
(Continued)**

Stream Name	Crossing Method ^a	Number of Crossings	Fisheries of Special Concern Presence (Y) or Absence (N)
MAINLINE PROJECT (CONTINUED)			
Kansas (continued)			
North Fork Wildcat Creek	O/C	1	N
Robidoux Creek	O/C	1	Y
Rock Creek	O/C	1	N
South Fork Big Nemaha River	O/C	2	Y
Squaw Creek	O/C	1	N
Tributary to Gregg Creek	O/C	1	N
Tributary to Halling Creek	O/C	1	N
Tributary to Harris Creek	O/C	1	N
Tributary to Indian Creek	O/C	1	N
Tributary to Missouri River	O/C	4	N
Tributary to Squaw Creek	O/C	1	N
Tributary to North Branch Independence Creek	O/C	1	N
Walnut Creek	O/C	1	N
Wildcat Creek	O/C	1	N
Unnamed	O/C	3	N
Missouri			
Bean Branch	O/C	1	N
Bear Creek	O/C	1	N
Big Creek	O/C	4	N
Branch of Log Creek	O/C	1	N
Brush Creek	Dry crossing	1	N
Brush Creek	O/C	1	N
Castile Creek	O/C	1	N
Chariton River	HDD	1	Y
Contrary Creek	O/C	1	N
Coon Creek	O/C	1	N
Crabapple Creek	O/C	1	N
Cuivre River	HDD	2	Y
Dardenne Creek	O/C	1	N
Deer Creek	O/C	2	N
East Fork Chariton River	O/C	1	N
Elkhorn Creek	O/C	1	N
Goodwater Creek	O/C	1	N
Grand River	O/C	2	Y
Horse Fork	O/C	1	N
Jenkins Branch	O/C	1	N
Lake Creek	O/C	1	Y
Little Platte River	O/C	1	N
Little Shoal Creek	O/C	1	N
Littleby Creek	O/C	1	N
Log Creek	Dry crossing	1	N
Long Branch	O/C	1	N
Long Creek	O/C	1	N
Malden Creek	O/C	1	N
Middle Fork Chariton River	O/C	1	N
Missouri River	HDD	1	Y
Mud Creek	O/C	1	Y
Mussel Fork	O/C	1	N
Palmer Creek	O/C	1	Y
Peruque Creek	O/C	1	N

**TABLE 3.7.1-1
(Continued)**

Stream Name	Crossing Method ^a	Number of Crossings	Fisheries of Special Concern Presence (Y) or Absence (N)
MAINLINE PROJECT (CONTINUED)			
Missouri (continued)			
Pigeon Creek	O/C	4	N
Platte River	O/C	1	Y
Potter Slough	O/C	1	N
Puzzle Creek	O/C	2	N
Saline Creek	O/C	1	N
Salt Creek	O/C	1	Y
Shoal Creek	O/C	1	N
Skull Lick Creek	O/C	1	N
South Fork Salt Creek	O/C	1	N
Tributary to Big Creek	O/C	2	N
Tributary to Brush Creek	O/C	1	N
Tributary to Crabapple Creek	O/C	1	N
Tributary to Lake Creek	O/C	2	N
Tributary to Log Creek	O/C	1	N
Tributary to Mud Creek	O/C	2	N
Tributary to North Mud Creek	O/C	7	N
Tributary to Peruque River	O/C	1	N
Tributary to Pigeon Creek	O/C	3	N
Turkey Creek	O/C	2	Y
Unnamed	O/C	17	N
West Fork Salt River	O/C	1	N
Willow Creek	O/C	1	N
Wolf Branch	O/C	1	N
Wolfpen Creek	O/C	1	N
Youngs Creek	O/C	1	N
Illinois			
Beaver Creek	O/C	1	N
Cahokia Creek	O/C	1	Y
Hurricane Creek	HDD	2	N
Indian Creek	O/C	1	N
Kaskaskia River	HDD	1	Y
Little Beaver Creek	O/C	1	N
Mississippi River	HDD	1	Y
Mooney Creek	O/C	1	N
Sand Creek	O/C	1	N
Shoal Creek	O/C	1	Y
Silver Creek	HDD	1	Y
Spring Creek	O/C	1	N
Sugar Creek	O/C	5	N
Sugar Fork Creek	O/C	1	N
Tributary of Spring Branch	O/C	1	N
Tributary to Silver Creek	O/C	5	N
Tributary to Sugar Creek	O/C	1	N
Tributary to Sugar Fork Creek	O/C	1	N
Unnamed	O/C	6	N
Willet Road Creek	O/C	1	N

**TABLE 3.7.1-1
(Continued)**

Stream Name	Crossing Method ^a	Number of Crossings	Fisheries of Special Concern Presence (Y) or Absence (N)
CUSHING EXTENSION			
Nebraska			
Unnamed	O/C	1	N
Kansas			
Unnamed	O/C	9	N
Arkansas River	HDD	1	Y
Caitlin Creek	O/C	2	N
Cane Creek	O/C	1	N
Carry Creek	O/C	1	Y
Chapman Creek	O/C	1	N
Cottonwood River	O/C	1	N
Diamond Creek	O/C	1	N
Doyle Creek	O/C	1	N
Dry Creek	O/C	2	N
Eight Mile Creek	O/C	1	N
Four Mile Creek	O/C	1	N
Four Mile Creek Meander	O/C	2	N
Little Blue River	O/C	1	Y
Mill Creek	O/C	2	N
Mill Creek	O/C	1	N
Mud Creek	O/C	1	Y
Na Creek	O/C	1	N
Republican River	HDD	1	Y
Smokey Hill River	O/C	1	Y
Spring Branch Creek	O/C	1	N
Spring Creek	O/C	1	N
Unnamed	O/C	3	N
West Branch Lyon Creek	Dry crossing	1	Y
West Fancy Creek	O/C	1	N
Whitewater River	O/C	1	Y
Oklahoma			
Unnamed	O/C	10	N
Bois D' Arc	O/C	2	N
Cimarron River	HDD	1	Y
Long Branch Creek	O/C	1	N
Red Rock Creek	O/C	1	N
Salt Fork	HDD	1	Y

^a Stream crossing techniques include O/C = Open-cut construction techniques; Dry crossing = Dry crossing techniques (flume or dam and pump methods); HDD = Horizontal directional drill method. The construction techniques proposed for use in flowing water bodies (i.e., perennial streams) are described in the Project's Construction Mitigation and Reclamation Plan (Appendix B).

Source: TransCanada 2007a, ENSR 2007i

TABLE 3.7.1-2 Recreational and Commercial Species in Water Bodies Crossed by the Keystone Project												
Common Name	Scientific Name	Recreational Species	Commercial Species	Mainline Project Occurrence						Cushing Extension Occurrence		
				ND	SD	NE	KS	MO	IL	NE*	KS	OK
Bigmouth buffalo	<i>Ictiobus cyprinellus</i>	X	X			X	X	X	X			
Black buffalo	<i>Ictiobus niger</i>	X	X			X	X	X	X			
Black crappie	<i>Pomoxis nigromaculatus</i>	X			X						X	
Blue catfish	<i>Ictalurus furcatus</i>	X			X	X	X	X	X			X
Bluegill	<i>Lepomis macrochirus</i>	X		X	X						X	
Brook trout	<i>Salvelinus fontinalis</i>	X										
Channel catfish	<i>Ictalurus punctatus</i>	X			X	X	X	X	X		X	X
Common carp	<i>Cyprinus carpio carpio</i>	X	X			X	X	X	X			
Flathead catfish	<i>Pylodictis olivaris</i>	X			X	X	X	X	X			X
Freshwater drum	<i>Aplodinotus grunniens</i>	X	X			X	X	X	X			
Largemouth bass	<i>Micropterus salmoides</i>	X		X	X	X	X	X	X		X	X
Muskellunge	<i>Esox masquinongy</i>	X										
Northern pike	<i>Esox lucius</i>	X		X	X	X	X					
Paddlefish	<i>Polyodon spathula</i>	X			X			X	X			
Rainbow trout	<i>Oncorhynchus mykiss</i>	X										X
River carpsucker	<i>Carpionodes carpio</i>	X	X					X	X			
Rock bass	<i>Ambloplites rupestris</i>	X				X	X					X
Sauger	<i>Sander canadensis</i>	X				X	X	X	X			
Shovelnose sturgeon	<i>Scaphirhynchus platyrhynchus</i>	X	X			X	X	X	X			
Smallmouth bass	<i>Micropterus dolomieu</i>	X	X	X	X	X	X	X	X			X
Spotted bass	<i>Micropterus punctulatus</i>	X		X	X	X	X					X
Walleye	<i>Sander vitreus</i>	X			X	X	X	X	X		X	X
White bass	<i>Morone chrysops</i>	X		X	X			X	X			X
White crappie	<i>Pomoxis annularis</i>	X			X						X	
Yellow bullhead	<i>Ameiurus natalis</i>	X		X	X							
Yellow perch	<i>Perca flavescens</i>	X		X	X	X						

Note: Species information not available for stream crossing in Nebraska along the Cushing Extension route.

3.7.2 Fisheries of Special Concern

This section addresses fisheries of special concern found in perennial streams (including rivers), ponds, and lakes that would be directly crossed by the pipeline route and water bodies that are located within approximately 0.5 mile of the pipeline ROW. Although intermittent water bodies may be of substantial value in terms of fisheries resources, they are not addressed in this section because information is not available for these water bodies (ENSR 2006a).

Fisheries management in each state incorporates the respective surface water classification systems. The classifications are based on a water body's water quality and resource value and are intended to create an estimate of the potential use. The classification systems for each of the states crossed by the proposed pipeline route can be found through the following agencies:

- North Dakota Department of Health (2001),
- South Dakota Department of Environmental and Natural Resources (2004),
- Nebraska Department of Environmental Quality (2003),
- Kansas Department of Health and Environment (2004),
- Missouri Department of Conservation (MDC),
- Illinois Environmental Protection Agency (2006), and
- Oklahoma Water Resources Board (2006).

3.7.2.1 Mainline Project

The proposed Mainline Project route would involve 213 perennial and 605 intermittent water body crossings in the states of North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Illinois.

North Dakota

Seven perennial stream crossings and numerous intermittent streams and unnamed ponds occur in North Dakota along the proposed Mainline Project route (Table 3.7.1-1). Four of the seven perennial stream crossings have documented species of special concern. The Sheyenne River supports nine recreational fish species and has been given one of the highest ratings for surface water (Class IA) (ENSR 2006a). In contrast, the other perennial streams (Goose, Pembina, Tongue, and Middle Branch Forest Rivers) contain one to four game fish species.

Northern pike, yellow perch, and black bass species represent the most important species in the state in terms of fisheries management and recreational harvests. Other common recreational species in North Dakota include bluegill, largemouth bass, smallmouth bass, spotted bass, and yellow perch (Table 3.7.1-2). The only known stocking effort among these water bodies was for northern pike in the Sheyenne River in 2005 and 2006 (NDGFD 2006). Information on fish populations in the numerous small intermittent streams and ponds crossed by the proposed route is not available, but they could support recreational fisheries with species such as largemouth bass, bluegill, yellow perch, and black bullheads.

South Dakota

The proposed Mainline Project route includes seven perennial stream crossings, one lake (Amsden Lake), and numerous intermittent streams and small ponds in South Dakota. The Missouri River is the largest

water body and contains 19 recreational fish species (ENSR 2006a). The other streams support two to six recreational species.

The Mainline Project Route could affect 15 species of special concern, with all species having recreational fishing value and one species (smallmouth bass) with commercial value. Catfish, northern pike, and black bass species are also popular recreational fish species in these water bodies (Table 3.7.1-2). The only known stocking effort is for paddlefish in the Missouri River (ENSR 2006a). Amsden Lake provides valuable habitat for many species, including pike, bluegill, walleye, largemouth bass, and crappie. Data on species found in ponds within the proposed Project area are not available. However, these ponds probably contain many of the same recreational species found in North Dakota ponds.

Nebraska

Nebraska would require 25 perennial stream crossings along the proposed Mainline Project route. The Missouri River supports 19 recreational fish species, while other streams in the proposed Project area contain one to five recreational species (ENSR 2006a).

None of the fisheries that could be affected by the proposed crossings have been designated as having commercial value by the state. The primary species found in the Missouri River include catfish, yellow perch, sauger, walleye, northern pike, and black basses. The fish groups found in the other streams crossed by the pipeline include catfish, black basses, and sunfish (Table 3.7.1-2).

Kansas

Kansas has 38 perennial stream crossings along the proposed Mainline Project route. All of the streams have at least four recreational species, with the highest number (18) occurring in the Missouri River (ENSR 2006a).

The Missouri River contains both recreational and commercial fish species, including catfish, buffalofish, carp, freshwater drum, and shovelnose sturgeon. Channel catfish and flathead catfish are the primary recreational species in the Big Blue River, Robidoux Creek, Delaware River, and Missouri River. Walleye are caught in the Middle Fork Wolf River.

Missouri

The Missouri portion of the proposed Mainline Project route includes approximately 98 perennial stream and four unnamed perennial lake or pond crossings. Six major streams (rivers) would be crossed (the Missouri, Platte, Grand, Chariton, Cuivre, and Mississippi Rivers), while the others are tributaries in these drainages. All of the streams and rivers contain at least one recreational fish species; the Mississippi and Missouri Rivers have the most—with 17 and 18 species, respectively—followed by the Grand River, with 12 species (ENSR 2006a). While these rivers support many species of fish (100+), this analysis addresses only those that have been recognized by the state as important for recreation and commercial fisheries.

The most popular recreational fish species in these rivers include catfish, walleye, sauger, largemouth bass, and white bass. The Mississippi, Missouri, and Grand Rivers also contain important commercial fish species (ENSR 2006a). These include channel catfish, blue catfish, flathead catfish, paddlefish, and shovelnose sturgeon. Freshwater drum, black buffalo, smallmouth bass, bigmouth buffalo, common carp, and river carpsuckers also are harvested in the Mississippi River.

The Keystone Project would intersect or potentially affect eight aquatic streams designated by the Missouri Code of State Regulations (10-CSR 20-7.031) as “Outstanding State Water Resources.” These areas have been designated as having high integrity or minimal alterations and/or a high number of aquatic species. Potential crossings that contain important recreational or commercial species include Turkey Creek and Sugar Creek. The proposed pipeline route also crosses the Jentell Brees Access in Buchanan County, which is owned by the Missouri Department of Conservation and was developed with Sport Fish Restoration federal monies to provide access to fishing in the Missouri River.

Illinois

There are 35 perennial stream crossings and one lake (Highland Silver Lake) in the Illinois portion of the proposed Mainline Project route. The Mississippi River contains 19 recreational fish species and six commercial species (ENSR 2006a). Highland Silver Lake would be crossed by the pipeline on the East Fork of Silver Creek, located north of Highland, Illinois. The lake is a large reservoir approximately 10 miles downstream of the proposed Project crossing and is popular for recreational fishing.

In addition to the recreational species in the Mississippi River listed in the Missouri section, commercial species are harvested from the river. They include three species of buffalofish, common carp, carpsuckers, and catfish. Catfishes also support a primary recreational fishery in Cahokia Canal and Shoal and Silver Creeks, although the fishing use is lower than for the Mississippi River. Common species found in Amsden Lake include catfish, crappie, bluegill, rockbass, striped bass, largemouth bass, and walleye. The lake is also stocked with trout in the winter season.

3.7.2.2 Cushing Extension

The Cushing Extension would involve 58 perennial crossings in Nebraska, Kansas, and Oklahoma. An additional 192 intermittent water body crossings would occur through Kansas, Oklahoma, and Nebraska.

Nebraska

The proposed route for the Cushing Extension includes one perennial stream and one pond crossing in Nebraska. The water bodies are unnamed, and no fisheries resources information is available (ENSR 2007i).

Kansas

The Kansas portion of the proposed Cushing Extension would require 40 perennial stream crossings. The majority of these streams are minor (less than 10 feet wide) to intermediate (10 to 100 feet wide), with the exception of five streams (the Little Blue, Republican, Smokey Hill, Whitewater, and Arkansas Rivers) (ENSR 2006a). Keystone has proposed using the HDD crossing method at two locations, the Republican River and Arkansas River. Popular recreational fisheries in these streams include bluegill, channel catfish, crappie, largemouth bass, and saugeye (Table 3.7.1-2).

Oklahoma

The Cushing Extension would cross 16 perennial streams in Oklahoma. These streams are home to numerous warmwater recreational fisheries. Popular species include walleye, basses, sunfish, catfish, and rainbow trout (Table 3.7.1-2). Keystone has proposed crossing the Salt Fork Arkansas River and Cimarron River with the HDD method.

3.7.3 Potential Impacts and Mitigation

Keystone proposes five crossing techniques for water bodies, depending on stream size, water flow, and species present (see Section 2.2.2.3 for construction method details). The non-flowing upland cross-country crossing method would be used at all water body crossings with no perceptible flow at the time of construction. For flowing water bodies, Keystone may utilize one of four techniques:

- Flowing open-cut wet,
- Flowing open-cut dry flume,
- Flowing open-cut dry dam and pump, and
- Horizontal directional drill (HDD).

Keystone will develop crossing plans for those water bodies not already committed to HDD that contain recreationally or commercially important fisheries, in conjunction with the appropriate jurisdictional agency, and will utilize the crossing method approved by such agencies. Along the Mainline Project, one water body of particular concern is the Grand River in Missouri, which contains 12 game fish species. It has been recommended by USFWS and local agencies that Keystone consider using the HDD method at the crossings of larger water bodies and water bodies classified as special use. Specific recommendations include the Grand River, Little Blue River, Smokey Hill River, and Whitewater River (Willie R. Taylor, USFWS, October 11, 2007; H. Floyd Gilzow, Missouri Department of Natural Resources, April 27, 2007; Doyle Brown, MDC, April 27, 2007; Robert E. Robert, EPA, October 9, 2007). These four river crossings are not currently scheduled for HDD construction.

Potential impacts from the proposed Project include construction-related impacts as well as impacts due to the operation and maintenance of the pipeline and ROW. The Mainline Project and Cushing Extension pipeline could primarily affect fisheries resources by:

- Instream and streambank habitat loss, alteration, and fragmentation;
- Loss of spawning or rearing success from construction and operations noise and human activity;
- Direct mortality from Keystone Project construction and operation;
- Adverse health effects caused by decreased water quality due to construction;
- Indirect mortality because of stress or avoidance of feeding due to exposure to construction and operations noise, and from increased human activity; and
- Loss of individuals and habitats due to exposure to toxic materials or crude oil releases (addressed in Section 3.13, Safety and Reliability).

The degree of construction-related impacts would depend on the crossing method, existing conditions at each crossing, duration of instream activity, and mitigation measures implemented. The impacts will be avoided and minimized to the degree practical by employing Best Management Practices BMPs. These are accepted procedures that contractors would follow during construction. The proposed crossing methods for the perennial stream crossings can be found in Table 3.7.1-1. Potential operations- and maintenance-related impacts mainly are associated with vegetation control, potential temperature changes, and oil releases.

Keystone's CMR Plan (Appendix B) describes the BMPs that would be used for each type of water body crossing to reduce potential effects on fish and aquatic/streambank habitat. If the proposed mitigation procedures are followed for the crossings, there would most likely be minimal impact to the habitat and

aquatic organisms. The short-term disturbance that would be caused by instream activities would likely resemble natural high-flow events in the stream.

3.7.3.1 Non-Flowing Upland Cross-Country Crossing Method

The non-flowing upland cross-country crossing method would be used at water body crossings with no perceptible flow at the time of construction.

Construction Impacts

The non-flowing upland method of crossing dry streambeds would likely cause minimal short-term impacts on the aquatic environment because there would not be flowing water and therefore no species of special concern would be present. This method would also likely result in minimal long-term effects if BMPs are followed that include minimizing disturbance during construction of the crossing. Potential effects could include some increased sedimentation when flowing water returns to the streambed and the potential introduction of hazardous materials to streambed sediments should equipment leak during construction. Potential impacts related to construction activities are discussed in more detail in Section 3.7.3.3.

Operations/Maintenance Impacts

Operation and maintenance impacts would be similar to those described in Section 3.7.3.3. Potential impacts could result from vegetation control, increased temperatures from vegetation removal, oil spills, and introduction of exotic or invasive species of animals or plants. Because this method would be used on small streams and only when flowing water is not present, impacts would be minimal. Potential impacts associated with crude oil releases are addressed in Section 3.13, Reliability and Safety. Potential impacts related to operation and maintenance activities are discussed in more detail in Section 3.7.3.3.

Mitigation

Mitigation would include stabilization of the streambed and streambanks after construction to avoid or minimize erosion and resulting downstream sedimentation. Mitigation related to operation and maintenance would be the same as described in Section 3.7.3.3.

3.7.3.2 Flowing Open-Cut Wet

The flowing open-cut wet method involves trenching through the water body while the water continues to flow through the construction work area.

Construction Impacts

Potential effects associated with this method of construction include increased sedimentation, fragmentation of the stream habitat, and direct mortality due to construction equipment in the stream. The open-cut wet method has the greatest potential for short-term impacts, on the aquatic resources present in the area. These impacts would generally be limited to brief periods of instream construction. Typically, the open-cut wet method is used on streams with smaller channel widths. An advantage of the open-cut wet method is that in most circumstances the length of time that in-channel disturbance occurs is less than other methods. Potential construction impacts are discussed in more detail in Section 3.7.3.3.

Operations/Maintenance Impacts

Potential operation and maintenance impacts would be similar to those described in Section 3.7.3.3. Potential impacts could result from vegetation control, increased temperatures from vegetation removal, oil spills, and introduction of exotic or invasive species of plants. Typically, the open-cut wet method is used on streams with smaller channel widths. In addition to impacts immediately downstream of the construction zone, impacts could occur in downstream habitats where these smaller streams join larger water bodies. Potential impacts associated with crude oil releases are addressed in Section 3.13, Reliability and Safety.

Mitigation

Mitigation would include stabilization of the streambed and streambanks after construction to avoid or minimize erosion and resulting sedimentation. Mitigation related to operation and maintenance would be the same as described in Section 3.7.3.3.

3.7.3.3 Flowing Open-Cut Dry Flume, Dam and Pump

Flowing open-cut dry crossing methods involve allowing the water to continue to flow in the water body by diverting it around the trenching area through either a flume or dam-and-pump system. The dry flume method diverts the water across the trenching area through one or more flume pipes placed in the water body. The dam-and-pump method is similar to the flume, except that pumps and hoses would be used instead of the flumes to divert the flow of water. These methods have been designated for use on environmentally sensitive water bodies where technically feasible, with seven locations identified to date (Table 3.7.1-1).

Construction Impacts

One potential effect from flowing open-cut crossing techniques is an increase in sedimentation in the water body caused by trenching, backfilling, and streambank erosion. The extent of sedimentation would partially depend on the nature of the soil materials encountered during trenching and backfilling. Increases in instream sediment levels can alter a stream's substrate composition and fill inter-gravel spaces and pool habitats. They also can degrade the existing aquatic habitat by reducing spawning habitat, available rearing habitat, and benthic invertebrate production.

Fish populations can be directly affected by suffocation of eggs and newly hatched larvae living in gravels, and by abrasion of the sensitive gill membranes of both young and adult fish (Cordone and Kelley 1961, Chutter 1969, Sutherland 2007). As mentioned previously, fine sediments can reduce the productivity of benthic invertebrates, which would reduce forage available to insectivorous fish. Many fish rely on vision for locating prey and high concentrations of suspended sediments can negatively impact feeding behavior (Chutter 1969, Barrett et al. 1992).

Construction of the pipeline also would require clearing vegetation from the construction ROW. One of the greatest potential impacts related to removal of riparian cover is the direct loss of the bank features that are utilized by fish for cover, nesting, and feeding. An indirect effect would be the loss of larger structures (trees, boulders, and woody debris) that fall into the water body and create cover, as well as enhance the habitat complexity by creating pools and gravel bars (Angermeier and Karr 1984, Abbe and Montgomery 1998). Removal of vegetation also destabilizes the banks and increases the potential for additional erosion, resulting in sedimentation and turbidity in the water body (Tabacchi et al. 1998).

Construction activities in a water body have the potential for the introduction and spread of non-native and exotic species (Cowie and Robinson 2003, Fuller 2003). Introduced species threaten the health of the native species and habitat, human health, and economy (Lovell et al. 2006). In flowing open-cut stream crossings, equipment would have direct contact with the water body and sediments. Organisms can easily attach themselves or become lodged in equipment crevices such as tire treads.

Blasting operations could occur on or near potential water body crossings containing important fisheries. These are all located in the state of Missouri and include Malden Creek, Mud Creek, Lake Creek, Palmer Creek, East Fork Little Chariton River, Salt Creek, and Turkey Creek. Streamside blasting could indirectly affect fish and aquatic invertebrates; effects include increased sedimentation, noise, vibrations, and alteration of channel morphology (Wright and Hopky 1998). Blasting in or near water bodies can cause direct negative impacts on fish populations due to mortality associated with shockwaves propagating through the water (Teleki and Chamberlain 1978, Wright and Hopky 1998). The proposed blasting operations and mitigation measures are discussed in more detail in Section 3.1.1.2.

During construction activities, there is also the potential for spills of fuel or other hazardous liquids. Spills can occur during refueling and lubricating of construction equipment and from leaks from storage containers or equipment working in or near streams. As a general rule, any actions involving the use of hazardous materials would be restricted to areas at least 100 feet distant from the active channel. For a detailed examination of the effects and mitigation measures for spills, refer to Section 3.13 and the SPCC Plan.

Operations/Maintenance Impacts

Although oil spills are not considered a part of routine pipeline operations, a crude oil release would potentially affect nearby water bodies and the aquatic organisms in them. The specific effect depends on the concentration of petroleum present, the length of exposure, and the life stage of the species involved. Larval/juvenile fish are generally more sensitive than adults (Hose et al. 1996, Heintz et al. 1999). Sub-lethal effects include changes in overwintering and spawning behavior, reduction in food resources, consumption of contaminated prey, and temporary displacement (Morrow 1974, Brannon et al. 1986, Purdy 1989). A full discussion of the impacts and mitigation measures related to spills can be found in Section 3.13, Reliability and Safety.

Keystone found that near-surface soil temperatures would continue to be influenced mainly by climate (TransCanada 2007a), with minimal effects from pipeline operations. For all water body crossings, the pipeline would be installed with a minimum cover of 60 inches from the bottom of the water body. The combination of this depth and the flowing nature of the water body would result in minimal effects from the temperature of the pipeline.

During operation of the pipeline, vegetation would be maintained along the ROW. The reduction of large vegetative cover (i.e., trees) would result in a permanent loss of shading, nutrients, and habitat enrichment features for fish. The streambank is also more susceptible to erosion without the stability provided by larger vegetation species. Keystone has proposed that vegetation maintenance and control be accomplished through a combination of pesticides and mechanical methods. The use of pesticides near a water body can potentially affect the aquatic organisms. This can occur through runoff, seepage through the soils, and direct placement during the control operations. A noxious weed plan adopting BMPs for pesticide applications will be developed by Keystone prior to construction. For more information on vegetation control impacts and mitigation, refer to Section 3.5.

Mitigation

To minimize the impacts of construction activities on fish and their habitats, Keystone would complete all instream activity for minor water body crossings (less than 10 feet wide) within 24 hours and within 48 hours for intermediate water bodies (10 to 100 feet wide). Major water body crossings (greater than 100 feet wide) would be completed according to individual Site-Specific Crossing Plans. These plans would be reviewed by COE and relevant resource agencies as part of the permitting process prior to construction.

Spawning periods for most fish species in the Keystone Project area extend from April to July (ENSR 2006a). In the FERC Wetland and Water Body Construction and Mitigation Procedures (FERC 2003), instream work for warmwater fisheries is limited to the time window of June 1 through November 30, which avoids most of the sensitive spawning season. Keystone would follow a similar construction timeline to avoid the sensitive breeding periods of the species located in the water bodies.

To minimize streambank erosion, Keystone would use equipment bridges, mats, and pads to support construction equipment that must cross the water body at all perennial stream crossings using an open-cut method. Equipment bridges are not required at minor or dry crossings unless the water body supports a recreationally or commercially valuable fishery. Immediately after the initial disturbance of the soil at all flowing water body crossings, the contractor would install temporary sediment barriers across the entire construction ROW 10 feet from the water's edge to maximize the amount of runoff intercepted. The sediment barriers would act to stop the flow of sediments into the water body, prevent deposition of sediments into sensitive resources, and contain any spill within the construction ROW. All spoil from minor and intermediate water body crossings and upland soil from major water body crossings would be placed within sediment barriers in the construction ROW, at least 10 feet from the active channel or in an additional extra work area. No trench spoil, including spoil from the portion of the trench across the stream channel, would be stored within a water body unless crossing cannot be reasonably completed without doing so.

Flowing open-cut dry crossings generally produce less downstream sedimentation impacts than traditional open-cut methods. To reduce the risk of additional sedimentation in the dry flume method, the Keystone CMR Plan (Appendix B) states that sand bags or plastic sheeting would be used to develop an effective seal and to divert stream flow through the flume pipe. The flume pipe would be aligned to prevent bank erosion and streambed scour, and would not be removed until the final clean up of the streambed and bank is complete. When using the dam-and-pump method, sufficient pumps would be used to maintain 1.5 times the flow present in the stream at the time of construction. To minimize impacts to aquatic species, screening devices would be installed at the intakes.

To reduce the impacts caused by the removal of riparian cover, vegetation would be cut off at ground level, leaving the existing root systems in place to provide streambank stability. Pulling of tree stumps and rooting for grading activities would be limited to directly over the trench line. After construction is complete, the banks of the water bodies would be stabilized with temporary sediment barriers within 24 hours of completing the activities. Where conditions allow, riparian vegetation would be restored with native plant species or conservation grasses and legumes. In the event that a water body crossing is located within or adjacent to a wetland crossing, wetland crossing mitigation measures would be implemented to the extent practicable.

Keystone has proposed locating the primary staging areas for materials and equipment at least 10 feet from the active channel. To further reduce the impacts to the water body, Keystone is encouraged to locate all extra work areas (temporary staging areas, additional spoil storage areas) at least 50 feet from the active channel. If this is not possible, Keystone should coordinate with the appropriate local and state agency(ies) to develop proper buffer guidelines (Robert E. Robert, EPA, October 9, 2007; Willie R.

Taylor, USFWS, October 11, 2007). Relevant state and federal resource agencies would comment on the plan for individual stream crossings prior to the issuance of the COE permit for the crossings.

To reduce the chance of spreading organisms between water bodies, Keystone has agreed to inspect equipment that would be used at water crossings and any visible mud, plants, fish, or animals would be removed before transporting the equipment to the water crossing site.

3.7.3.4 Horizontal Directional Drill

The HDD crossing method would be utilized for certain major and sensitive water bodies. This method involves drilling a pilot hole under and across the water body and banks through which the pipe sections would be pulled through. Keystone has committed to using HDD at 13 crossings along the Mainline Project route (the Pembina River, South Branch Park River, two crossings of the Missouri River, Elkhorn River, Platte River, Chariton River, two crossings of the Cuivre River, Mississippi River, Silver Creek, Hurricane Creek, and Kaskaskia River). Four locations along the Cushing Extension will also be crossed by the HDD method (the Republican, Arkansas, Salt Fork Arkansas, and Cimarron Rivers).

Construction Impacts

HDD crossings would not alter or remove aquatic habitat and would not likely affect fisheries through construction activity. The use of this procedure is limited due to the increase in space requirements, time, cost, and materials needed. HDD crossings for selected major and sensitive water bodies would be constructed in accordance with a site-specific construction and mitigation plan produced by Keystone and approved prior to construction by COE with input from relevant state and federal resource agencies. HDD does carry a risk of the escape of drilling fluids into rivers at the crossings, which could result in short-term sediment transport and water quality impacts that could adversely affect fish.

Operations/Maintenance Impacts

Operational impacts on active stream channels where the HDD installation method is employed would be negligible. Impacts that would result in the unlikely event of an operational pipeline crude oil release are addressed in Section 3.13, Reliability and Safety.

Mitigation

The selection of the HDD crossing methodology is a mitigation for potential environmental impacts associated with other more invasive crossing techniques. This method does however involve longer construction times, specialized equipment, and increased construction effort. The use of best management practices as described in the CMR Plan (Appendix B) would minimize any ancillary impacts associated with the overall construction effort in the vicinity of HDD water crossings.

3.7.3.5 Hydrostatic Testing

Withdrawal and discharge of water for hydrostatic testing also can affect fisheries (Manny 1984). Keystone lists 32 water bodies on the Mainline Project route and nine water bodies on the Cushing Extension route as primary or potential sources for hydrostatic testing (Table 3.7.3-1). Among the list of proposed water sources are six locations that are known to contain sensitive species (the James River, the Platte River, the Elkhorn River, the Big Blue River, and two sections of the Missouri River).

Impacts

Removal of water from water bodies can decrease water volume and flow, resulting in a decrease in habitat (wetted area in a stream or lake); degradation of water quality (increased temperature and decreased dissolved oxygen [DO]); and entrainment of small fish, eggs, and macroinvertebrates during water extraction. Keystone anticipates performing hydrostatic testing during spring, summer, and fall. Almost all of the fish species located along the Keystone Project route spawn from April to July, with some continuing into August. If Keystone performs the testing as planned, there would be a high coincidence with sensitive reproductive periods for multiple fish species. There is potential to affect spawning fish through decreases in water levels (displacing spawning habitat) and water quality degradation. Fish eggs could be affected through desiccation if water levels drop, eggs can be entrained, and development can be affected by impaired water quality. Larval and juvenile fish could be susceptible to entrainment during water withdrawal, survivability can be decreased through poor water quality, and reduced habitat and food sources affected through entrainment of macroinvertebrates and decreased suitability of production areas with lower flows.

The discharge of large volumes of hydrostatic test waters into surface waters could temporarily cause a change in the water temperature and DO levels, could increase downstream flows, and could increase streambank and substrate scour. As stated in Keystone's CMR Plan (Appendix B), discharge locations would not include state-designated exceptional value waters, water bodies that provide habitat for federally listed threatened or endangered species, or water bodies designated as public water supplies unless the appropriate federal, state, and local agencies grant written permission. However, this same policy is not extended to the intake sources for hydrostatic testing. The impacts caused by the hydrostatic testing could be further reduced by avoiding using water bodies as intake sources that contain commercially and/or recreationally important species.

If interbasin transfers of water occur, there is also the potential to introduce and spread aquatic nuisance species. The proposed source water bodies include some locations that have been identified as containing non-native or exotic fish species (USGS 2007). These largely consist of the major recreational and commercial species including carp, crappie, bass, and walleye.

**TABLE 3.7.3-1
Hydrostatic Testing Water Source Locations for the Keystone Project**

Water Source	Legal Description	County	Estimated Volume (gallons)
MAINLINE PROJECT			
Primary Water Source			
North Dakota			
Pembina River	S/W 1/4 T163N R56W Sec 31	Pembina	12,561,669
South branch Park River	N/E 1/4 T157N R57W Sec 24	Walsh	160,000
North branch Turtle River	N/W 1/4 T153N R57W Sec 25	Nelson	3,982,422
Unnamed lake	S/W 1/4 T145N R57W Sec 9	Steele	7,629,929
Sheyenne River	N/W 1/4 T136N R58W Sec 12	Ransom	16,427,319
South Dakota			
Unnamed creek	N/E 1/4 T123N R59W Sec 20	Day	8,325,553
Foster Creek	N/W 1/4 T115N R59W Sec 17	Clark	6,801,790
Redstone Creek	N/W 1/4 T108N R58W Sec 23	Miner	8,102,798
Wolf Creek	N/W 1/4 T103N R57W Sec 25	Hanson	10,968,244
James River	N/E 1/4 T95N R56W Sec 13	Yankton	6,165,037
Marne Creek (Missouri River)	Not available	Yankton	12,708,894
Nebraska			
Elkhorn River	S/E 1/4 T23N R1E Sec 36	Stanton	8,679,834
Platte River	S/W 1/4 T16N R2E Sec 3	Colfax	350,000
Big Blue River	S/W 1/4 T11N R3E Sec 6	Seward	12,633,723
Cub Creek	N/E 1/4 T3N R4E Sec 7	Jefferson	4,094,688
Kansas			
Big Blue River	S/E 1/4 T1S R7E Sec 11	Marshall	9,159,234
Delaware River	N/W 1/4 T3S R15E Sec 4	Brown	9,529,108
Missouri River	N/E 1/4 T4S R22E Sec 20	Doniphan	9,824,818
Missouri			
Long Creek	N/W 1/4 T55N R28W Sec 16	Caldwell	9,109,531
Grand River	S/E 1/4 T54N R21W Sec 17	Carroll	6,606,710
Chariton River	S/W 1/4 T53N R18W Sec 1	Chariton	7,745,268
Cuivre River	N/W 1/4 T49N R1E Sec 29	Lincoln	17,305,675
Cuivre River	ML-MO-LI-4801 (Tract)	Lincoln	200,000
Dardene Creek	S/E 1/4 T47N R4E Sec 3	St. Charles	4,665,184
Mississippi River	N/E 1/4 T47N R8E Sec 9	St. Charles	300,000
Illinois			
East fork Silver Creek	S/W 1/4 T4N R5W Sec 4	Madison	10,563,376
Mississippi River Levee	N/W 1/4 T4N R9W Sec 4	Madison	150,000
Indian Creek (for Highway 255)	N/E 1/4 T4N R8W Sec 7	Madison	150,000
East fork Silver Creek	S/W 1/4 T4N R5W Sec 4	Madison	150,000
Hurricane Creek	S/W 1/4 T4N R1W Sec 8	Fayette	150,000
Kaskaskia River	S/W 1/4 T4N R1W Sec 10	Fayette	150,000

TABLE 3.7.3-1 (continued)			
Water Source	Legal Description	County	Estimated Volume (gallons)
MAINLINE PROJECT (CONTINUED)			
Alternative Water Source			
North Dakota			
North Branch Forest River	S/E 1/4 T156N R57W Sec 11	Walsh	15,421,700
CUSHING EXTENSION			
Primary Water Source			
Kansas			
Carter Creek	N/E 1/4 T6S R4E Sec 18	Clay	18,285,731
Republican River	N/W 1/4 T9S R3E Sec 1	Clay	200,000
Carry Creek	S/E 1/4 T14S R3E Sec 36	Dickinson	10,229,359
Whitewater River	N/E 1/4 T26S R4E Sec 8	Butler	27,639,705
Arkansas River	S/E 1/4 T34S R3E sec 16	Cowley	250,000
Oklahoma			
Bois d Arc Creek	S/W 1/4 T26N R2E Sec 32	Kay	6,015,740
Salt Fork Arkansas River	S/W 1/4 T25N R2E Sec 30	Kay	250,000
Black Bear Creek	S/E 1/4 T21N R2E Sec 2	Noble	16,059,641
Cimarron River	Not available	Payne	300,000

Source: Keystone's Hydrostatic Test Plan (Appendix B).

Mitigation

To minimize the potential for entrainment or impingement of fish during the withdrawal, Keystone's CMR Plan (Appendix B) states that it would install intakes with filtering and screening devices and suspend the intakes above the stream bottom. Withdrawals would be made at controlled rates to protect aquatic life, provide for all water body uses, and avoid effects on downstream withdrawals of water by existing users. Mitigative measures concerning the location and screening of intake manifolds are provided in Section 3.3.2.2.

To minimize potential adverse effects on sensitive breeding periods, Keystone would generally avoid withdrawal of hydrostatic test water from sources where sensitive species are located until after August 1. Where this is not possible, Keystone would obtain specific approval in advance from the appropriate regulatory or resource agencies. There is the potential for small withdrawals to be made in association with HDD crossings before August 1. In this situation, the withdrawal rates would be minor and the pump intakes would be screened with fine mesh to avoid entrainment or impingement of fish or debris.

Discharge controls to reduce water quality affects listed in the CMR Plan (Appendix B) include restrictions on pipeline dewatering rates, energy dissipaters to prevent erosion, and/or temporary synthetic channel linings. The pipeline is constructed of materials that do not require protective additives in the test water. To ensure compliance with Project and permit requirements, Keystone would obtain water

samples for analysis from each source before filling the pipeline and prior to the beginning of the discharge after the testing is completed. Any water containing oil or other substances in sufficient amounts to create a visible color film on the surface of the receiving water would not be discharged prior to treatment.

To minimize the risk associated with introduced species, Keystone has stated that the hydrostatic test water would be returned to the same source—or to the same general vicinity—from where it was withdrawn at the completion of the testing. In areas where zebra mussels are known to occur, Keystone has committed to thoroughly cleaning all equipment used during the withdrawal and discharge prior to use at subsequent test locations in order to prevent the transfer of zebra mussels or veligers to new locations. Further mitigation measures to prevent the spread of invasive species are discussed in Section 3.7.3.3.

3.7.3.6 Connected Actions

Power Lines and Substations. A total of 0.2 mile of water bodies would be affected during construction and operation of Western's 192.4 miles of transmission lines (Table 3.4.3.1-1 in Section 3.4). The primary impacts on water bodies would be related to clearing or removing the existing riparian vegetation in the construction work area. In general, transmission line construction impacts to water bodies would be minor, as most lines would run alongside existing roadways.

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