4.4 Floodplains

This section describes the analysis of potential impacts to floodplains from the proposed Port MacKenzie Rail Extension. Section 4.4.1 defines the floodplain study area, Section 4.4.2 describes the methods employed to analyze impacts to floodplains, Section 4.4.3 describes the affected environment (existing conditions), Section 4.4.4 describes potential environmental consequences (impacts), and Section 4.4.5 describes unavoidable environmental consequences of the proposed action to floodplains from the proposed rail line.

4.4.1 Study Area

The study area for the OEA analysis of potential impacts to floodplains is a portion of the Susitna River valley bounded by the Susitna River to the west, the Knik Arm extension of Cook Inlet to the south and east, and Parks Highway and the existing ARRC main line to the north. OEA then focused its analysis on Federal Emergency Management Agency (FEMA)-mapped 100-year floodplains in the study area.

4.4.2 Analysis Methodology

OEA initially identified floodplains in the study area by reviewing FEMA Flood Insurance Rate Maps developed during the Flood Insurance Study of the MSB in 1999. In the study area, the flood study mapped 100-year floodplains (areas that have a 1 percent chance of annual flooding) along Willow Creek, Little Willow Creek, the Little Susitna River, Lake Creek, Deception Creek, and Lucile Creek. FEMA has also designated floodways in the study area along Willow Creek and the Little Susitna River. A floodway is the portion of the channel of a river or other watercourse and the adjacent land area that must remain undeveloped so as to discharge a 100-year flood without cumulatively increasing the water surface elevation more than a designated height (FEMA, 2009a). According to FEMA guidelines, a FEMA-designated floodway must be maintained in an unobstructed condition to prevent an unacceptable increase in flood levels.

FEMA has not mapped much of the study area and it is therefore designated as having possible but undetermined flood hazard risk. For streams in the study area for which FEMA maps were not available, OEA estimated the presence of floodplains from aerial photography and topographic mapping provided by the Applicant, the U.S. Geological Survey, and the MSB. OEA also considered Applicant-proposed water crossings (either bridges or culverts) in its evaluation of potential impacts to floodplains from the proposed action.

4.4.3 Affected Environment

Floodplains are valuable hydrological and ecological resources that serve many functions, including the storage of storm water, erosion and sediment control, and wildlife habitat. For human communities, floodplains can be considered a hazard area for development because properties in floodplains can be inundated during flood events.

In Alaska, flooding can result from rainfall runoff, snowmelt, groundwater, ice jam, flash flooding, fluctuating lake levels, alluvial fan, and glacial dammed lake outbreaks. Although the available data is limited in its period of record, the historical record demonstrates that flooding is

not uncommon in the study area, particularly along the Little Susitna River and Little Willow Creek (see Table 4.4-1). In fall 2006, heavy rainfall led to widespread flooding, particularly along the Little Susitna River near Houston and Willow Creek along Parks Highway, contributing to road closures, property damage, and loss of telephone service (Hollander, 2006).

Table 4.4-1
Floods in the Proposed Port MacKenzie Rail Extension Study Area Since 1980[a]

Little Willow Creek near Kashwitna	Willow Creek near Willow	Little Susitna River near Houston	Nancy Lake Tributary near Willow	Deception Creek near Willow
August 25, 1984	July 28, 1980	September 16, 1980	June 21, 1980	June 21, 1980
August 12, 1985	October 11, 1986	July 11, 1981	October 11, 1986	October 11, 1986
September 20, 1986	August 19, 2006	August 26, 1984		
October 11, 1986		August 13, 1985		
		September 21, 1986		
		October 12, 1986		
		August 19, 2006		

[a] Sources: USGS, 2009a; USGS, 2009b; MSB, 2006.

Within the study area, FEMA has delineated 100-year floodplains along Willow Creek, Little Willow Creek, Lake Creek, Deception Creek, Lucile Creek, and the Little Susitna River. The presence of FEMA-regulated floodplains typically indicates these watercourses present some level of flooding risk to residential and commercial development. FEMA-regulated floodways have also been delineated on Willow Creek and the Little Susitna River. Figure 4.4-1 shows mapped floodplains in the study area and potential rail line crossings of those floodplains.

4.4.4 Environmental Consequences

This section describes potential impacts to floodplains under the build alternatives (Section 4.4.4.1) and the No-Action Alternative (Section 4.4.4.2). Impact determinations for the facilities and structures identified in this section represent best estimates because the location or design characteristics of some temporary construction facilities and rail line structures would be determined only during the final design and permitting process. This section focuses on direct and indirect impacts to floodplains and, in some cases, changes in flood flows that could result from impacts to floodplains. While impacts to floodplains could affect other resource areas such as water quality, wetlands, and fisheries, this section does not address those impacts. For a description of the potential impacts to water quality, see Section 4.2; for a description of potential impacts to wetlands, see Section 4.5; and for a description of potential impacts to fisheries, see Section 5.4.

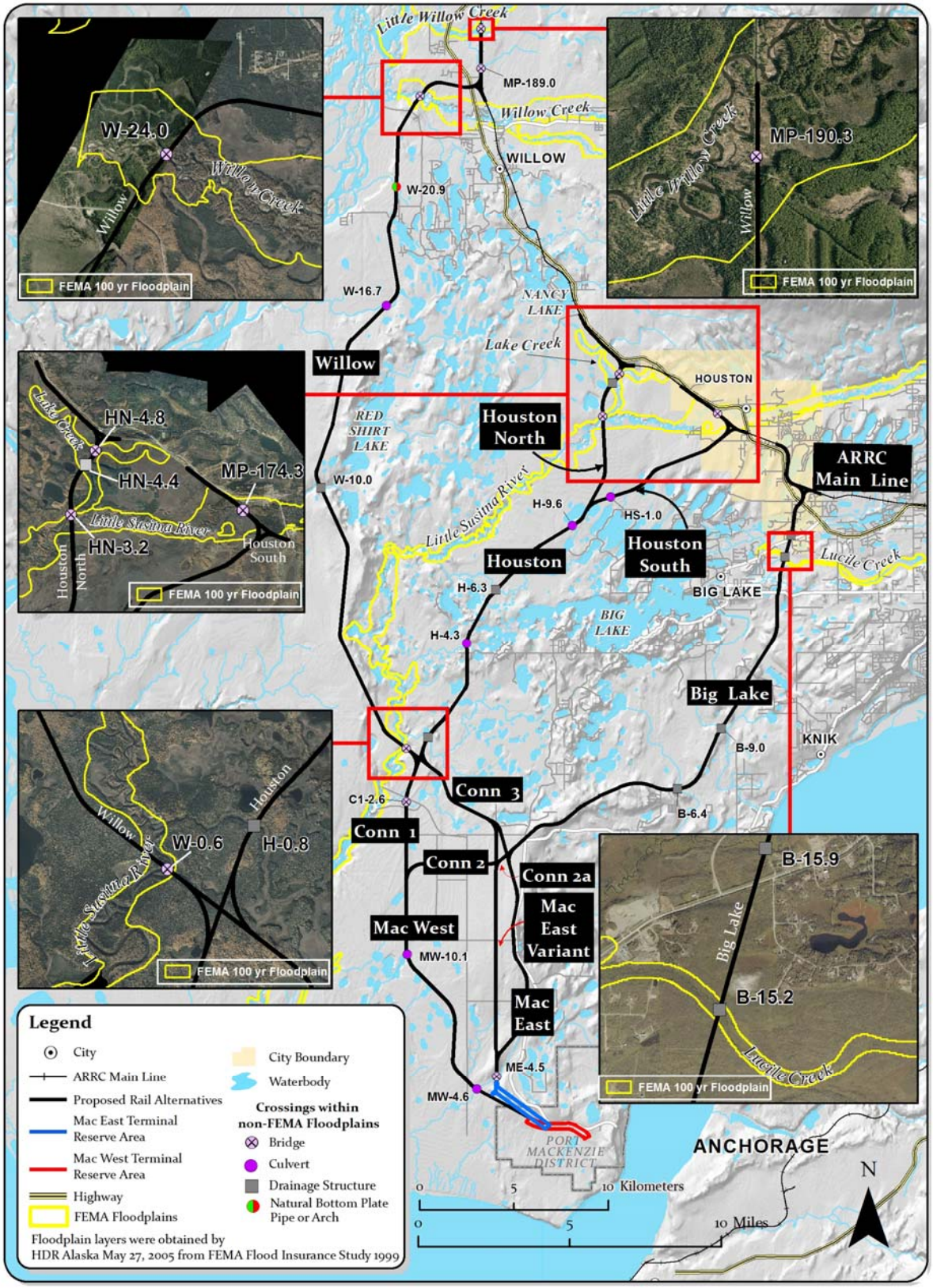

Figure 4.4-1. Floodplains in the Proposed Port MacKenzie Rail Extension Study Area

4.4.4.1 Proposed Action

Common Impacts

Construction Impacts

Rail and Access Road Alignments

The proposed rail line and access roads that would be placed within the 100-year floodplain would require fill placement. Rail and road beds would either parallel the watercourse that defines the floodplain or cross perpendicular to the watercourse. The parallel alignments could reduce floodplain storage volume. Perpendicular alignments could constrict flood flow paths and increase flood water elevation upstream of the constriction; however, the affected areas would be small compared to the total floodplain storage available. As a result, OEA would expect minimal impacts to floodplain storage from the placement of the rail line and access roads. Rail line and access road alignments created by fill within the floodplain could also redirect flood flows to existing channels, leading to channel erosion and the potential alteration of channel alignment.

Excavation of Borrow Areas

The Applicant would use borrow areas to obtain ballast and fill material required for both the rail line and the access road. If ARRC developed borrow areas in a floodplain and in proximity to a watercourse, excavation of ballast and fill material could alter the hydraulics and conveyance of the watercourse during flood stage. This could lead to a short-term increase in flood storage, or alteration of channel alignment through rapid channel avulsion (tearing away of soil) into the borrow areas.

Staging Areas

The Applicant would store construction materials and establish locations for staging areas in the 200-foot ROW on relatively flat, previously disturbed land and would not likely place these facilities in floodplains. In the unlikely event that ARRC developed staging areas in a floodplain, natural drainage patterns could be disrupted if construction activities occurred during flooding episodes of major streams, during high runoff periods, or along shallow overland flow paths. In addition, the presence of staging areas within floodplains could create blockages or diversions, which could impact conveyance capacity and result in increased flooding elevations.

Construction and Installation of Bridges and Culverts

Impacts to floodplains from construction and installation of bridges and culverts would be similar to those described above for access roads. There could be additional impacts associated with the temporary diversion of flow while culverts and bridge sections were being installed. These activities could temporarily reduce channel capacity in the area of construction, leading to higher flood waters in surrounding areas. ARRC would size all water crossings to convey the 100-year flow event associated with local drainages. For larger stream and river crossings, ARRC would construct bridges as single- or multiple-span segments that would either completely or partially span (or clear) the existing active river channel. The proposed locations

for bridges would be associated with crossings of Willow Creek, Rogers Creek, the Little Susitna River, a tributary to Little Willow Creek, and several unnamed streams. For crossings associated with smaller streams, the Applicant would install culverts, natural bottom plate pipes or arch structures, or other drainage structures to convey flows under the rail line.

Operation Impacts

Impacts to floodplains during rail line operation would be common to all proposed rail line alternatives. The continued presence of raised rail beds and bridge crossings could lead to changes in floodplain hydraulics and result in alterations of channel alignment and channel erosion. In addition, channel stabilization designed to protect the rail line from channel migration could create increased channel migration upstream and downstream of the proposed protection measures. Obstruction of drainage structures could result from the deposition of soil and other debris during high flows or from the accumulation of ice during cold weather. Such obstructions would reduce the conveyance capacity of the drainage structure and could lead to increased flooding in the vicinity of the water crossing.

Impacts by Segment and Segment Combination

Southern Segments and Segment Combinations

Table 4.4-2 summarizes floodplains in the area of the southern rail line segments and segment combinations. As mentioned in Section 4.4.2, much of the project area has not yet been mapped by FEMA. For areas without FEMA data, OEA estimated the presence of potential floodplains along identified streams from aerial photography, topographic mapping, and wetland mapping. No additional floodplain mapping sources were available for this analysis.

Table 4.4-2
Floodplain Summary for Proposed Port MacKenzie Rail Extension Southern Segments and Segment Combinations[a]

	Mac West-Connector 1	Mac West-Connector 2	Mac East-Connector 3	Mac East	Mac East Variant-Connector 2a	Mac East Variant-Connector 3 Variant
Within FEMA[b]-designated 100-Year Floodplain	No Data	No Data	No Data	No Data	No Data	No Data
FEMA Floodway	No Data	No Data	No Data	No Data	No Data	No Data
Crossings with the potential for floodplains (non-FEMA)	MW-4.6[c], MW-10.1, C1-2.6	MW-4.6, MW-10.1	ME-4.5	ME-4.5	MEV-4.5	MEV-4.5

[a] Sources: ARRC, 2008; FEMA, 1999; FEMA, 2009b; MSB, 2007; USGS, 2009c.
[b] FEMA = Federal Emergency Management Agency.
[c] The alpha-numeric numbers listed (MW-4.6) indicate segment and mile marker locations where segments cross floodplains.

Mac West-Connector 1 Segment Combination

There are no FEMA floodplain data for the area along the Mac West-Connector 1 Segment Combination. OEA identified 3 potential floodplains at stream crossings MW-4.6, MW-10.1, and C1-2.6 with approximate floodplain widths of 450, 150, and 300 feet, respectively. The Applicant has proposed 2 culverts and 1 bridge at these crossings. This segment combination

would also intersect the flow path of multiple unnamed waterbodies, without clearly defined channels or discernable floodplains that drain adjacent lakes and convey local surface water to the Little Susitna River and Cook Inlet. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, proposed rail line construction and operation along the Mac West-Connector 1 Segment Combination would not be likely to result in adverse impacts to floodplains.

Mac West-Connector 2 Segment Combination

There are no FEMA floodplain data for the area along the Mac West-Connector 2 Segment Combination. OEA identified 2 potential floodplains at proposed stream crossings MW-4.6 and MW-10.1 with approximate floodplain widths of 450 and 150 feet, respectively. The Applicant has proposed culverts at these crossings. Smaller undefined flow paths associated with this segment combination do not have discernable floodplains. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Mac West-Connector 2 Segment Combination would not be likely to result in adverse impacts to floodplains.

Mac East-Connector 3 Segment Combination

There are no FEMA floodplain data for the area along the Mac East-Connector 3 Segment Combination. OEA identified 1 potential floodplain at proposed stream crossing ME-4.5 with an approximate floodplain width of 450 feet. The Applicant has proposed a bridge at this crossing. This segment combination would also intersect the flow path of multiple waterbodies without clearly defined channels or discernable floodplains, which drain to adjacent lakes or Cook Inlet. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Mac East-Connector 3 Segment Combination would not be likely to result in adverse impacts to floodplains.

Mac East Segment

There are no available FEMA floodplain data for the area along the Mac East Segment. OEA identified 1 potential floodplain at proposed stream crossing ME-4.5 with an approximate floodplain width of 450 feet. The Applicant has proposed a bridge at this crossing. This segment would also intersect the flow path of 2 waterbodies without clearly defined channels or discernable floodplains, which drain to adjacent Cook Inlet. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Mac East segment would not be likely to result in adverse impacts to floodplains.

Mac East Variant-Connector 2a Segment Combination

There are no available FEMA floodplain data for the area along the Mac East Variant-Connector 2a Segment Combination. OEA identified 1 potential floodplain at proposed stream crossing MEV-4.5 with an approximate floodplain width of 450 feet. The Applicant has proposed a bridge at this crossing. This segment would also intersect the flow path of 2 waterbodies, without clearly defined channels or discernable floodplains, which drain to adjacent Cook Inlet.

Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Mac East Variant-Connector 2a Segment Combination would not be likely to result in adverse impacts to floodplains.

Mac East Variant-Connector 3 Variant Segment Combination

There are no available FEMA floodplain data for the area along the Mac East Variant-Connector 3 Variant Segment Combination. OEA identified 1 potential floodplain at proposed stream crossing MEV-4.5 with an approximate floodplain width of 450 feet. The Applicant has proposed a bridge at this crossing. This segment would also intersect the flow path of 2 waterbodies without clearly defined channels or discernable floodplains, which drain to adjacent Cook Inlet. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Mac East Variant-Connector 3 Variant Segment Combination would not be likely to result in adverse impacts to floodplains.

Northern Segments and Segment Combinations

Table 4.4-3 summarizes floodplains in the area of the northern rail line segments and segment combinations. As stated previously, there are FEMA data for the Little Susitna River, Willow Creek, Lucile Creek, Lake Creek, and a tributary to Little Willow Creek. For areas without FEMA data, OEA determined the presence of potential floodplains along identified streams from aerial photography, topographic mapping, and wetland mapping. No other floodplain mapping sources were available.

Table 4.4-3
Floodplain Summary for Proposed Port MacKenzie Rail Extension Northern Segments and Segment Combinations[a]

	Willow			Big Lake	Houston-Houston North			Houston-Houston South
Proposed water crossing	W-0.6	W-24.0	MP-190.3	B-15.2	HN-3.2	HN-4.4	HN-4.8	MP-174.3
Stream name	Little Susitna River	Willow Creek	Little Willow Creek Tributary	Lucile Creek	Little Susitna River	Lake Creek	Lake Creek Tributary	Little Susitna River
Would cross FEMA[b]-designated 100-Year Floodplain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Would Cross FEMA Floodway	Yes	Yes	No	No	Yes	No	No	Yes
Crossings with potential floodplains (non-FEMA)	W-10.0[c], W-14.4, W-16.7, W-20.9, MP-189.0			B-6.4, B-9.0, B-15.9	H-0.8, H-4.3, H-6.3, H-9.6			H-0.8, H-4.3, H-6.3, H-9.6, HS-1.0

[a] Sources: ARRC, 2008; FEMA, 1999; FEMA, 2009b; MSB, 2007; USGS, 2009c.
[b] FEMA = Federal Emergency Management Agency.
[c] Alpha-numeric numbers listed (MW-4.6) indicate segment and mile marker locations where segments cross floodplains.

Willow Segment

The Willow Segment would cross multiple streams, including Fish Creek, Rogers Creek, Willow Creek, the Little Susitna River, and multiple unnamed tributaries. Approximately 8,065 feet (about 1.5 miles) of the Willow Segment rail line footprint would cross 26 acres of FEMA-designated 100-year floodplains. This area accounts for less than 1 percent of the total floodplain area along the Little Susitna River, Little Willow Creek, and Willow Creek, the 3 waterbodies with FEMA-designated floodplains the Willow Segment would cross. This segment also would require construction of 3 waterbody crossings within FEMA-designated floodplains (see crossing locations MP-190.3, W-24.0, and W-0.6 on Figure 4.4-1). At the northern extent of the Willow Segment along its connection with the main line, the proposed rail line would be within the FEMA-designated floodplain of Little Willow Creek. ARRC proposed a bridge at crossing MP-190.3 along Little Willow Creek, which ARRC would design to convey 100-year flows. The FEMA-designated floodplain is 2,800 feet (about 0.5 mile) wide in the vicinity of proposed crossing MP-190.3 at a tributary of Little Willow Creek. The Willow Segment would also cross Willow Creek near the connection of the segment with the main line, and the Little Susitna River near the connection of the segment with the Connector 1 Segment. Both waterbodies have FEMA-designated floodplains and floodways. The FEMA-designated floodplain is approximately 4,350 feet (about 0.8 mile) wide in the vicinity of this proposed crossing (W-24.0). ARRC proposes bridges at both crossing locations (W-24.0 for Willow Creek and W-0.6 for the Little Susitna River). Because the Applicant has indicated that bridge spans would be 28 feet long and the floodways at both locations are approximately 300 feet wide, it is likely ARRC would have to construct bridge pilings within Willow Creek and the Little Susitna River. Construction of such pilings within the floodways could alter flood waters and lead to an increase in flood levels in the vicinity of the water crossings. At proposed crossing W-0.6, the FEMA-designated floodplain is approximately 1,750 feet (about 0.3 mile) wide.

The Willow Segment would cross several smaller watercourses not associated with any FEMA-designated floodplains. OEA identified 5 potential floodplains at proposed crossings W-10.0 on Fish Creek, and W-14.4, W-16.7, W-20.9, and MP-189.0 on Rogers Creek with approximate widths of 130, 40, 530, 150, and 320 feet, respectively. Proposed conveyance structures at these crossings include 1 drainage structure, 2 culverts, 1 natural bottom plate pipe or arch structure, and a bridge, respectively. Installation of the culverts could require temporary diversion of water flow. This action could temporarily reduce channel capacity in the area of construction, leading to higher flood waters upstream of the crossing.

Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Willow Segment would not be likely to result in adverse impacts to floodplains at these locations.

Big Lake Segment

The Big Lake Segment would cross Little Meadow Creek, Lucile Creek, Fish Creek, Goose Creek, and multiple unnamed channels. Approximately 460 feet of the Big Lake Segment rail line footprint would cross less than 1 acre of FEMA-designated 100-year floodplains. This area would account for less than 0.1 percent of the floodplain area along Lucile Creek, the only

waterbody with a FEMA-designated floodplain the segment would cross (see crossing location B-15.2 on Figure 4.4-1). ARRC has proposed a drainage structure for crossing B-15.2; final design would determine whether it would be a culvert or a bridge.

This segment would cross several streams not associated with FEMA-designated floodplains. OEA identified potential floodplains at crossings B-6.4 (Goose Creek), B-9.0 (Fish Creek), and B-15.9 (Little Meadow Creek) with approximate widths of 850, 200, and 450 feet, respectively. Conveyance structures at these crossings would include 3 drainage structures; final design would determine whether they would be culverts or bridges. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Big Lake Segment would not likely result in adverse impacts to floodplains.

Houston-Houston North Segment Combination

The Houston-Houston North Segment Combination would cross the Little Susitna River, Lake Creek, and several unnamed tributaries. Approximately 6,600 feet (about 1.25 miles) of the segment combination rail line footprint would cross 27 acres of FEMA-designated 100-year floodplains. This area would account for approximately 2 percent of the floodplain area along the Little Susitna River and Lake Creek, the 2 waterbodies with FEMA-designated floodplains the Houston-Houston North segment combination would cross. This segment combination would also require construction of 3 waterbody crossings within FEMA-designated floodplains (see crossing locations HN-3.2, HN-4.4, and HN-4.8 in Figure 4.4-1). ARRC proposes a bridge at crossing HN-3.2. It is likely that multiple bridge spans and in-water pilings would be required for this bridge crossing because the Applicant has indicated that bridge spans would be 28 feet long and the floodway at this location is approximately 145 feet wide. Construction of such pilings within the floodway could alter flood waters and lead to an increase in flood levels in the vicinity of the water crossing. The Little Susitna River has a FEMA-designated floodplain approximately 2,150 feet (about 0.4 mile) wide at proposed crossing HN-3.2. Lake Creek has a FEMA-designated floodplain 3,760 feet (about 0.7 mile) wide at proposed crossings HN-4.4 and HN-4.8. Although crossing HN-4.8 would be on a tributary of Lake Creek, it would be within the Lake Creek FEMA-designated floodplain. The other streams do not have FEMA-designated floodplains. ARRC proposes a drainage structure for crossing HN-4.4;final design would determine whether it would be a culvert or a bridge. ARRC has proposed a bridge at the Lake Creek tributary crossing (HN-4.8).

There are several smaller streams along this segment not associated with any FEMA-designated floodplains. OEA identified 4 potential floodplains at crossings H-0.8, H-6.3, H-4.3, and H-9.6 with approximate widths of 200, 400, 185, and 170 feet, respectively. Conveyance structures for these crossings would be 2 drainage structures and 2 culverts, respectively. Installation of the culverts could require temporary diversion of water flow. This action could temporarily reduce channel capacity in the area of construction, leading to higher flood waters upstream of the crossing.

Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Houston-Houston North Segment Combination would not likely result in adverse impacts to floodplains.

Houston-Houston South Segment Combination

This segment combination would cross the Little Susitna River and several unnamed tributaries. Approximately 1,945 feet (about 0.4 mile) of the segment combination rail line footprint would cross 4 acres of FEMA-designated 100-year floodplains. This area would account for less than 0.1 percent of the floodplain area along the Little Susitna River, the only waterbody with FEMA-designated floodplains the Houston-Houston South Segment Combination would cross. This segment combination would also require construction of 1 waterbody crossing within a FEMA-designated floodplain (crossing MP-174.3), where ARRC proposes a bridge. This segment combination would cross the Little Susitna River with a bridge adjacent and identical to the existing main line railroad bridge over the Little Susitna River. It is likely that multiple bridge spans and in-water pilings would be required for this bridge because the Applicant has indicated that bridge spans would be 28 feet long and the floodway at this location is approximately 100 feet wide. Construction of such pilings within the floodway could alter flood waters and lead to an increase in flood levels in the vicinity of the water crossing. At proposed crossing MP-174.3, the Little Susitna River has a FEMA-designated floodplain 1,950 feet wide.

There are several smaller streams along this segment combination not associated with any FEMA-designated floodplains. OEA identified 5 potential floodplains at crossings H-0.8, H-6.3, H-4.3, H-9.6, and HS-1.0 with approximate widths of 200, 400, 185, 170, and 200 feet, respectively. Conveyance structures at these crossings would be 2 drainage structures and 3 culverts, respectively. Installation of the culverts could require temporary diversion of water flow. This action could temporarily reduce channel capacity in the area of construction, leading to higher flood waters upstream of the crossing.

Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along the Houston-Houston South Segment Combination would not be likely to result in adverse impacts to floodplains.

Summary of Potential Impacts by Rail Line Alternative

Table 4.4-4 summarizes potential impacts to floodplains for each proposed rail line alternative. In general, the greater the extent of an alternative's footprint within floodplains and floodways, the greater the potential for impacts to floodplain capacity and flood flows.

The alternatives that include either the Houston North or the Willow segments would occupy several times as many FEMA-mapped floodplain acres as the alternatives that include the Houston South or Big Lake segments and would require waterbody crossings within the FEMA designated floodplain and floodway. The alternatives that include the Mac West-Connector 1 Segment Combination have the most crossings within a potential floodplain. The alternatives that include the Big Lake Segment would impact the least acreage of floodplains with approximately 460 feet of rail line crossing less than 1 acre of 100-year floodplain. In addition, alternatives that include the Big Lake Segment would require only 1 waterbody crossing within a FEMA-designated floodplain, and would not impact any FEMA-designated floodways. The Mac West-Connector 2-Big Lake Alternative also would cross an additional 5 streams with

Table 4.4-4
Potential Impacts to Floodplains by Alternative

	Mac West-Conn 1-Willow	Mac West-Conn 1-Houston-Houston North	Mac West-Conn 1-Houston-Houston South	Mac West-Conn 2-Big Lake	Mac East-Conn 3-Willow	Mac East-Conn 3-Houston-Houston North	Mac East-Conn 3-Houston-Houston South	Mac East-Big Lake	Mac East Var-Conn 2a-Big Lake	Mac East Var -Conn 3 Var-Willow	Mac East Var -Conn 3 Var-Houston-Houston North	Mac East Var–Conn 3 Var-Houston-Houston South
Crossings within FEMA[a]-mapped 100-year floodplain	3	3	1	1	3	3	1	1	1	3	3	1
Rail line within FEMA-mapped 100-year floodplain (feet[b])	8,065	6,600	1,945	460	8,065	6,600	1,945	460	460	8,065	6,600	1,945
Rail line footprint within FEMA-mapped 100-year floodplain (acres)	26	27	4	<1	26	27	4	<1	<1	26	27	4
Crosses FEMA floodway	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Crossings with potential floodplain (non-FEMA)	8	7	8	5	6	5	6	4	4	6	5	6

[a] FEMA = Federal Emergency Management Agency.
[b] To convert feet to miles, multiply by 0.0001894.

potential floodplains, 1 more than both the Mac East-Big Lake and Mac East Variant-Connector 2a-Big Lake alternatives.

All rail line alternatives would have the potential to impact smaller, undefined watercourses in the study area not associated with FEMA-designated floodplains. Because ARRC would size all proposed water crossings to convey the 100-year flow event associated with local drainages, rail line construction and operation along any of the alternatives would not be likely to result in adverse impacts to floodplains.

4.4.4.2 No-Action Alternative

Under the No-Action Alternative, ARRC would not construct and operate the proposed Port MacKenzie Rail Extension, and there would be no floodplain impacts from the project.

4.4.5 Unavoidable Environmental Consequences of the Proposed Action

To avoid or minimize the potential environmental impacts to floodplains from the proposed rail line as described above in Section 4.4.4.1, OEA is recommending that the Board impose 4 mitigation measures, including 3 measures volunteered by the Applicant (see Section 19.2). These measures include requiring: acquisition of appropriate Federal and state permits; maintenance of natural water flow and drainage, including maintaining connectivity of floodplains; and the utilization of best management practices imposed by the USACE.

Notwithstanding the recommended mitigation measures, there still would be potential unavoidable impacts to floodplains from the proposed rail line. Potential impacts would include: reduction in floodplain storage within the rail line footprint; constriction of flood flow paths and increases in flood water elevation upstream of crossings; and potential changes in floodplain hydraulics within the rail line footprint, which could lead to alterations in channel alignment and channel erosion. OEA concluded that such mitigated impacts from construction and operation of the proposed rail line would be negligible.