5.2 Vegetation Resources

5.2.1 Study Area

The study area is defined as vegetation cover within 5 miles of the centerline (10 mile total width) of the proposed rail line segments. This study area provides context for the evaluation of potential impacts to vegetation resources from the proposed Port MacKenzie Rail Extension. Within the study area is the 200-foot right-of-way (ROW) of the rail line segments. The Surface Transportation Board's (STB or the Board) Section of Environmental Analysis (SEA) focused the analysis of potential impacts to vegetation cover on the 200-foot ROW and associated facilities.

5.2.2 Analysis Methodology

SEA used Geographic Information System analysis to identify, classify, and quantitatively assess potential impacts to vegetation along the ROW for each of the rail line segments. Descriptions of existing conditions for vegetation are based on data in Nowacki *et al.* (2001), Gallant *et al.* (1995), Viereck *et al.* (1992), and ANHP *et al.* (2008). SEA identified and quantified vegetation types along the 200-foot ROW using the U.S. Geological Survey National Land Cover Database (Homer *et al.*, 2004). SEA also used this database to estimate the prevalence of vegetation types beyond the 200-foot ROW to assess potential impacts to vegetation. SEA further incorporated data on invasive plant populations (ANHP *et al.*, 2008) and fire management (BLM AFS, 2008a, 2008b) to inform this analysis.

5.2.3 Affected Environment

The study area is in the Cook Inlet Basin Ecoregion, a gently sloping lowland basin characterized by a variety of woodland and wetland habitats (Nowacki *et al.*, 2001). Both mature forests and wetland areas serve important ecological functions and provide key wildlife habitat. Forests provide valuable ecosystem services such as photosynthesis and nutrient cycling, and help to prevent erosion and provide riparian buffers. In addition, forests help maintain clean air and water through respiration and their role in the water cycle. When disturbed, mature forests could take up to 100 years to recover (Viereck *et al.*, 1992), and depending on the nature of the disturbance, could be permanently altered.

Wetland plant communities provide habitat and forage for terrestrial and aquatic life, filter surface water flows, and buffer storm waters and floodwaters. In addition, wetland plant communities are remarkably diverse – wetlands are home to 31 percent of all plant species in the United States (USEPA, 2001).

In addition to wetland habits, evergreen, deciduous, and mixed forest stands are the predominant vegetation classes in the study area (Homer *et al.*, 2004; Gallant *et al.*, 1995). Stands of white spruce, black spruce, or a mixture of the two species are common in evergreen forests. Closed stands of white spruce occupy young river terraces where soil drainage is good; closed stands of black spruce occupy poorly drained floodplain soils. Mixed closed stands with both white spruce and black spruce often have tall shrub understories of alder and willow. Colder and

wetter soils support black spruce woodlands, where the tall shrub understory is a much more important component of the ecosystem than in closed forest stands. Mixed forests generally consist of paper birch or quaking aspen with black and/or white spruce, or in some places, are codominated by white spruce and balsam poplar.

Shrub/scrub wetland communities can be found in floodplains and drainageways and are typically dominated by willow or alder. In wet areas, these shrub/scrub communities can include sedges, marsh fivefinger, or other wetland plants. Woody wetlands consist of low-shrub/scrub plant communities in saturated areas with thick organic mats, and can include resin birch, willows, and typical bog plants like Labrador tea, bog blueberry, leatherleaf, sedges, and sphagnum moss. Some woody wetland communities form tussock bogs dominated by cottongrasses. Emergent herbaceous wetlands occupy lake and pond margins, sloughs, oxbows, fens, and poorly drained areas of silty or organic soils. Plants characteristic of emergent herbaceous wetlands include sedges, marsh fivefinger, horsetail, cinquefoil, and aquatic plants like pond lily and water milfoil.

Riparian areas scoured by floodwater in the study area generally follow a successional sequence from bare alluvium, to alluvium with scattered willows and herbs, open willow shrub, closed alder and willow shrub, open balsam poplar forest with a dense alder understory, closed balsam poplar forest with alder understory, mixed balsam poplar-white spruce forest, to closed white spruce forest (Viereck *et al.*, 1992). Development from the closed alder willow shrub to mature balsam poplar forest occurs over a period of 75 to 90 years, and the transition from mixed balsam poplar-white spruce forest to white spruce-dominant forests usually occurs gradually over the span of almost 100 years.

Vegetation cover characteristics in the study area are primarily the result of the generally level topography, mild weather, proximity to the coast, soils created by intense historic glaciations of the region, and the lack of permafrost. Development of vegetation communities is also influenced by slope, aspect, elevation, parent material (the primary material from which soil is formed), and the succession of vegetation communities subsequent to flooding and fire. Forestry, military activity, agriculture, urban and recreational development, transportation development, gravel mining, insect infestations, moose browsing, and the spread of invasive and noxious plants have also affected vegetation in the study area.

Figure 5.2-1 depicts the distribution of vegetation classes around the proposed rail line segments. Table 5.2-1 shows the relative abundance of the different vegetation cover classes present in the study area. Appendix D describes the relevant vegetation classes.

5.2.3.1 Fire Ecology

In the study area, evergreen forests, and in particular black spruce forests, are the most susceptible to fire. As a result, stands of black spruce older than 100 years are rare (Viereck *et al.*, 1992). Recently burned areas typically revegetate with herbaceous communities, which is often dominated by fireweed, and followed by plant communities dominated with bluejoint reedgrass and willow scrub. Broadleaf forests follow willow communities in uplands on south-facing slopes or on well-drained river terraces, while paper birch forests develop on east-, west-,

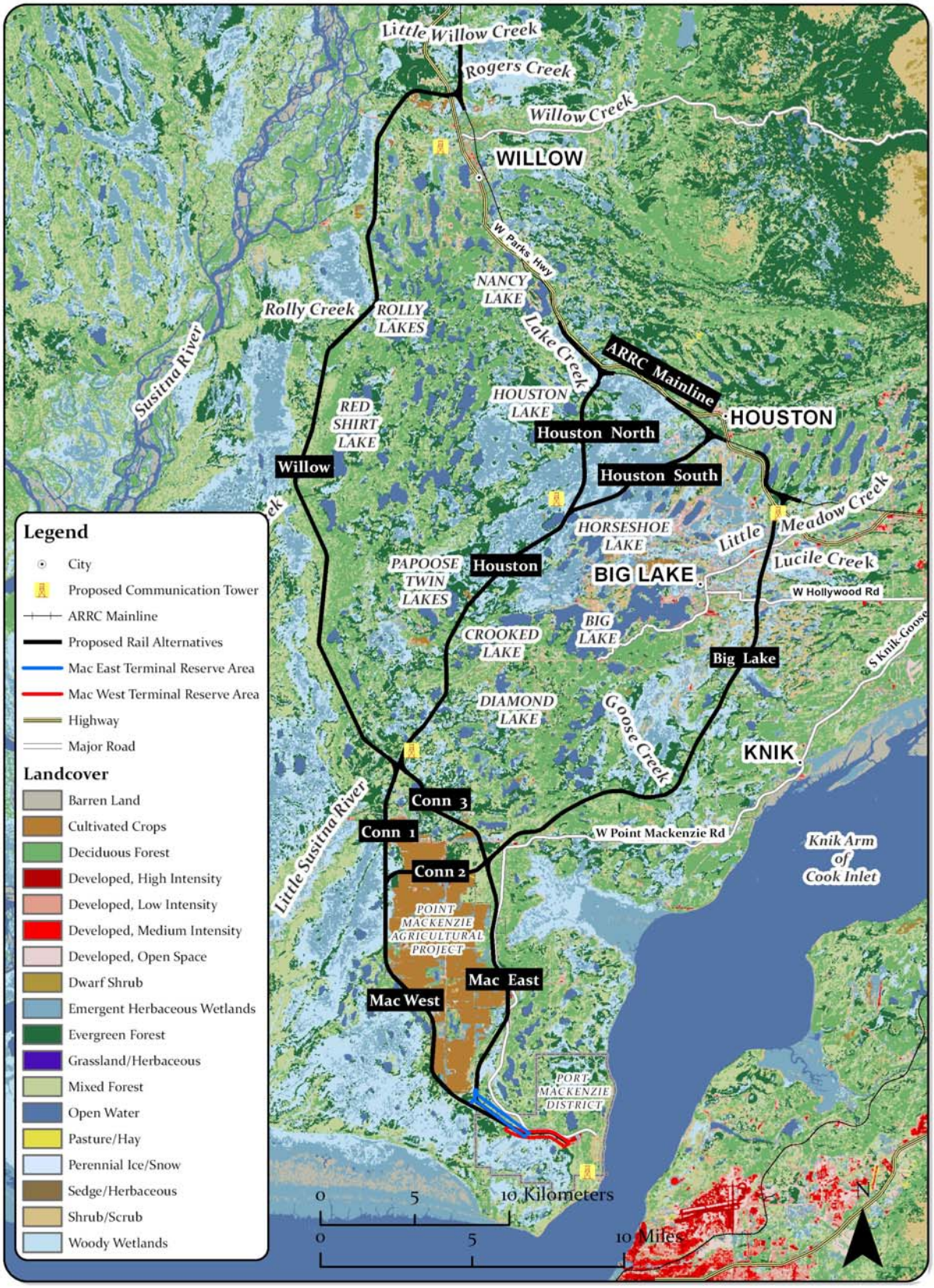

Figure 5.2-1. Overview of Vegetation Classes Around the Rail Line Segments

Table 5.2-1
Vegetation Cover Classes within the Study Area of the Proposed Port MacKenzie Rail Extension Alternatives[a]

Study Area Cover (percent)[b]	Class Name	Study Area Cover (percent)	Class Name
<1	Barren Land	13	Evergreen Forest Closed
2	Cultivated Crops	<1	Evergreen Forest Open
16	Deciduous Forest Closed	<1	Evergreen Forest Woodland
2	Deciduous Forest Open	18	Mixed Forest Closed
<1	Deciduous Forest Woodland	<1	Mixed Forest Open
<1	Developed, High Intensity	<1	Mixed Forest Woodland
1	Developed, Low Intensity	11	Open Water
<1	Developed, Medium Intensity	<1	Pasture/Hay
1	Developed, Open Space	3	Shrub/Scrub
14	Emergent Herbaceous Wetlands	16	Woody Wetlands

[a] Source: Homer e*t al.*, 2004; the study area is defined as vegetation cover within 5 miles of the centerline (10 mile total width) of the proposed rail line segments.
[b] < = less than.

and some north-facing slopes and in flat areas. Mixed forests develop as spruce becomes established within the broadleaf forests, followed by spruce forests in some locations.

5.2.3.2 Invasive and Noxious Plants

Most of Alaska has remained relatively free from large-scale habitat changes resulting from nonnative plant species, primarily because the state has a small human population and relatively few areas of man-made disturbance. However, the Matanuska-Susitna Valley in the study area is one of the most developed regions of the state. As a consequence, 54 species of nonnative plants have been identified in the study area at 179 different sites (ANHP *et al.*, 2008). The most common nonnative plants in the study area are common dandelion, annual bluegrass, and white sweet clover. These plants and some other nonnative plant species common to the area are considered to be highly invasive weed species. Higher concentrations of invasive weed species are found in developed areas, especially along Parks Highway, which passes through the study area between Wasilla and Willow, on Knik-Goose Bay Road between Big Lake and Knik, and the Point MacKenzie Agricultural Project. However, surveys for invasive weed species generally are concentrated within developed areas; therefore, the extent of invasion away from road systems is likely underreported.

The State of Alaska regulates the spread of invasive weed species and has listed 14 species as prohibited noxious weeds and 9 species as restricted noxious weeds under Title 11 of Alaska state statutes (11 ACC 34.020). Prohibited noxious weeds are any species of plants, which when established, are or may become destructive and difficult to control by ordinary means of cultivation or other farm practices. Restricted noxious weeds are species of plants which are very objectionable in fields, lawns, and gardens, but which can be controlled by good cultural practices. Four prohibited noxious weeds and five restricted noxious weeds were identified in the study area (Table 5.2-2). Appendix D provides a complete list of regulated and nonregulated

invasive plants in the study area based on field surveys performed between 2002 and 2007 (ANHP *et al.*, 2008).

Table 5.2-2
Prohibited and Restricted Noxious Weeds in the Proposed Port MacKenzie Rail Extension Study Area[a]

Common Name	Species	Occurrence (sites)	Status[b]
Canada Thistle	*Cirsium arvense*	1	P
Quackgrass	*Elymus repens*	51	P
Brittlestem Hempnettle	*Galeopsis tetrahit*	7	P
Butter and Eggs	*Linaria vulgaris*	14	R
Plantain	*Plantago major*	85	R
Annual Bluegrass	*Poa annua*	96	R
Black Bindweed	*Polygonum convolvulus*	45	R
Perennial Sowthistle	*Sonchus arvensis*	2	P
Tufted Vetch	*Vicia cracca*	44	R

[a] Source: ANHP *et al.*, 2008; the study area is defined as vegetation cover within 5 miles of the centerline (10 mile total width) of the proposed rail line segments.
[b] R = restricted; P = prohibited.

5.2.3.3 Rare Plants

Extensive surveys for rare plant species have not been completed for the entire study area, but available data do not indicate the presence of any known rare plant species, such as Federal- or state-protected threatened, endangered, or candidate species, within the study area (Lipkin, 2008; HDR, 2008; USFWS, 2009).

5.2.4 Environmental Consequences

5.2.4.1 Proposed Action

The primary impacts to vegetation from proposed rail line construction and operations would be the destruction of vegetation cover and the replacement of some cover with gravel fill. The extent of such impacts would vary based on the affected vegetation types, their relative abundance, soil conditions, hydrology, topography, and the extent of topographic modification required for construction. Permanent impacts would include vegetation loss due to placement of gravel fill for the railbed and access road, excavation of gravel, and construction of rail line associated facilities. Other long-term impacts would include the loss or alteration of forested habitat due to the removal of vegetation at temporary workplaces that would be restored after project construction. Operations impacts would include vegetation removal and control within the 200-foot ROW where necessary for safe operations. In addition, impacts to vegetation resources could include altered vegetation communities due to soil compaction and the spread of invasive plant species, and altered vegetation succession caused by the interruption of natural wildland fire ecology.

The primary construction and operations impacts would be similar across all vegetation types; that is, vegetation would be removed and soil structures could be altered.

Common Impacts

Construction Impacts

There would be impacts to vegetation through clearing for construction of the rail line, access road, and other associated facilities; most of these impacts would be within the 200-foot ROW. There could also be impacts to vegetation near the ROW as a result of dust deposition, changes in soil and moisture conditions, fragmentation of vegetation communities, invasion by nonnative plants, and the alteration of natural fire regimes. The extent of these potential impacts to vegetation communities would depend on several factors, including vegetation type, topography, hydrology, proximity to invasive plant populations, and other disturbance patterns. The following paragraphs describe potential construction-related impacts common to all the segments.

Vegetation Clearing and Fill Placement

Clearing of vegetation within the 200-foot ROW would alter plant community composition and structure. There also would be vegetation clearing and disturbance outside the 200-foot ROW for construction of associated facilities, such as the terminal reserve area. Some vegetation regrowth would be expected, although plant communities would be temporarily or permanently altered. Placement of fill to support the rail line and access road would result in the permanent loss of vegetation. Vegetation loss would be short term in the areas that could be restored or allowed to revegetate by natural succession. However, the natural-succession process would be hindered by mechanical vegetation management in some areas, as described under Operations Impacts.

Some areas, such as temporary staging areas that may be needed outside the 200-foot ROW, would be restored after construction. The type of vegetation that would develop as a result of restoration would depend on the type of vegetation cleared, the soil conditions present, and the surrounding vegetation. Most restoration efforts would be initiated with establishment of an initial grassy and herbaceous ground cover to prevent excess erosion and the spread of invasive weeds. Restoration of grass-like plants such as sedges, rushes, and grasses and shrub/scrub habitats could occur within 5 to 20 years, and would be considered a short-term habitat loss. Shrubs would also require 5 to 20 years to return to their original community composition and height (ADF&G, 2001). Forested areas stripped of vegetation during construction would require from 70 to 200 years for regeneration and would be considered a long-term loss of habitat, even with restoration (ADF&G, 2001). Forest communities would likely be replaced, in part, by either native early successional-stage vegetation or invasive plants.

Soil Compaction and Erosion

Soil compaction would result from heavy equipment transiting areas associated with construction of the rail line, access road, and associated facilities and would occur primarily within the 200-foot ROW. Compaction of soils would inhibit germination of some seeds in the upper soil surface, inhibit infiltration of precipitation, inhibit root penetration, and could cause development of bare soil areas or establishment of invasive plants. In addition, removal of vegetation cover would exacerbate erosion; therefore, rail line construction would increase erosion rates. Erosion

and sedimentation effects could extend beyond the 200-foot ROW, especially in areas with steep terrain.

Spread of Invasive Plants

Construction of the rail line, access road, and associated facilities could increase the spread of invasive plants by the following pathways:

- Construction equipment used on the site could carry seeds or propagative plant parts from other construction projects or infested areas.
- Removal of overburden and cut materials to offsite locations could spread invasive species, and placement of fill from borrow sites could introduce invasive plants.
- Seed mixtures used to revegetate slopes and exposed soils could contain invasive plant seeds.

Thus, native vegetation next to the rail line, access road, and other areas cleared for the project could experience competition from invasive plants. Changes in local soil conditions and exposed mineral soils also allow invasive plants to spread, which could contribute to encroachment of invasive plants on vegetation communities adjacent to the ROW. This could contribute to larger-scale vegetation changes that could result in altered vegetation communities and impacts to ecological integrity.

Although comprehensive data for invasive plant infestations is not available for all areas, there are higher concentrations of invasive plant species in developed areas, especially along Parks Highway, which passes through the study area between Wasilla and Willow, on Knik-Goose Bay Road between Big Lake and Knik, and the Point MacKenzie Agricultural Project. Construction of segments near developed areas with existing infestations of noxious and invasive weeds would increase the potential to spread invasive plants. Invasive plants pose risks to wildlife habitat and could be of particular concern in areas adjacent to Susitna Flats State Game Refuge and other wildlife management areas. Table 5.2-3 lists the number of known weed sites near each Port MacKenzie Rail Extension segment and Parks Highway.

Rare Plants

There are no known threatened or endangered plant species in the study area (Lipkin, 2008; HDR, 2008; USFWS, 2009). Rare plant species, if present, would be subject to the same impacts as other vegetation, with the additional concern that clearing or other disturbance could severely impact or even eliminate these species in the local area.

Dust Deposition

Wind-blown dust from the access road and railbed could damage or eliminate plants by direct cover with mineral fines, which inhibit photosynthesis and respiration. More tolerant native and nonnative invasive plants could replace existing vegetation communities in areas exposed to dust. The magnitude and duration of dust exposure would determine vegetation response and the intensity of potential impacts (Auerbach, 1997).

Table 5.2-3
Weed Sites Near Proposed Port MacKenzie Rail Extension Segments and Parks Highway

	Number of Weed Sites within 0.5 Mile of Segment Centerlines
Segment	
Connector 1	0
Connector 2	2
Connector 3	0
Houston	0
Houston North	4
Houston South	7
Mac East	3
Mac West	2
Willow	2
Big Lake	10
Parks Highway	41

Fragmentation

Fragmentation of vegetation communities from rail line construction would alter plant communities along the alignment edges and could facilitate the spread and establishment of invasive nonnative plants (Hansen and Clevenger, 2005). Permanent rail facilities would replace vegetation cover, which would result in linear separation of the landscape (Meffe *et al.*, 1997). Linear construction projects, such as roads and rail lines, divide vegetation communities, converting interior communities into edge communities (Watson, 2005).

Wildland Fires

Clearing of vegetation in the ROW could interrupt the natural fire cycle. Rail line construction would lead to fragmentation of fuel material for wildland fires. This could result in the creation of fire breaks such that a fire starting on one side of the ROW might not cross the cleared alignment to the opposite side of the ROW. This could lead to an increase in fuel accumulation along either side of the ROW and an increased risk of more intense wildland fires, resulting in more damage to vegetation and prolonged vegetation recovery periods. This could change the natural cycle of fire and lead to decreased biodiversity from ecological succession, because the separated vegetation communities might experience different rates of ecological succession. This disruption of natural fire cycles and succession patterns would be of special concern in areas where proposed rail line alternatives would cross through black spruce forests, which are especially vulnerable to fire (Viereck, 1992). For example, in 1996, the Millers Reach 2 fire burned 37,348 forested acres in the Big Lake area between Knik and Houston, including 129 acres in the proposed rail line ROW (BLM AFS, 2008a).

Much of the study area can be considered "wildland-urban interface," where structures and human development intermingle with natural vegetation, increasing the risk for destructive wildland fires. Fires in the wildland-urban interface can pose significant threats to homes, other structures, and forested habitat. Fire management strategies are described in the BLM Alaska Wildland Fire Management Plan (BLM, 2005). Under the current fire management scenario, the Port MacKenzie Rail Extension alternatives would cross three levels of fire protection –

modified, full, and critical (BLM, AFS 2008b). Areas covered by critical and full protection designations are the highest priorities for fire suppression because these designations indicate risk to human life, property, developed areas, and high-value natural resources. While changes in fire management strategies in the study area are not anticipated, the BLM Alaska Fire Service periodically reviews management strategies as ecological conditions change. Appendix D provides a more detailed description of fire management and fire history in the study area.

Floodplains

Construction of the proposed rail line in floodplain areas could impact vegetation communities through the alteration of natural drainage patterns and floodplain storage capacity. These changes could affect vegetation outside the 200-foot ROW. For example, alteration of natural drainage patterns could change the location of the mean high water line and cause riparian vegetation to become submerged. In some cases, this would cause a loss of vegetation or alter plant community composition. Floodplains throughout the study area are home to late-successional mixed and evergreen forest communities, which would be vulnerable to construction impacts because of the long time required for recovery.

Operations Impacts

The following paragraphs describe potential operations-related impacts common to all segments.

Maintenance Clearing

Continued disturbance of vegetation and soil would result from ongoing mechanical clearing and trimming of vegetation within the ROW where necessary to ensure safe operation of the rail line (see Appendix D). Other methods of vegetation maintenance might include thermal removal, steam or hot water removal, fire removal, smothering vegetation with impenetrable plastic layers along the base of the embankment, or manual removal (Torstensson, 2001). These activities would disturb successional vegetation cover, providing an opportunity for growth of invasive species. Any vegetation removed by burning could increase the risk of fire spreading beyond the vegetation management target area and could result in the unintentional destruction of vegetation resources (ARRC, 1984). The alteration of vegetation cover from ROW maintenance would be considered a permanent impact.

Chemical Spills

Vegetation could be affected in the unlikely event of a release of hazardous materials from a train derailment or collision. The level of impact would depend on the type and quantity of material spilled. However, as noted in Section 11.4.1.3, Rail Safety, the Alaska Railroad Corporation (ARRC or the Applicant) has not indicated any plans to carry hazardous materials along the proposed Port MacKenzie Rail Extension. In the unlikely event of a spill of hazardous materials, degradation of vegetation would depend on factors such as the specific material spilled, runoff type, and vegetation community affected.

Dust Deposition and Runoff

Soil disturbance due to rail line operations would produce fugitive dust, which could result in the deposition of dust along the rail line. High quantities of dust deposited on plants such as mosses and lichens can lead to a greater chance of mortality due to a reduction in the plant's ability to photosynthesize. Increased soil erosion can lead to an overall decrease in the number of plant species found in a plant community (Klinger *et al.*, 1983; Walker *et al.*, 1987a, 1987b). Precipitation runoff from road and rail embankments and associated facilities and across dust deposits during rail line operations could result in changes in soil chemistry. The extent of such impacts would depend on the site-specific pH (measure of acidity or alkalinity) of the soil, which would result in reduced nutrient levels, altered organic horizon depth, higher soil bulk density, and lower soil moisture. These changes could cause reduced vegetation biomass and diversity, especially in areas with acidic soils, such as evergreen forest habitats (Auerbach *et al.*, 1997). Potential effects on plant communities from dust deposition and runoff would occur primarily within and adjacent to the 200-foot ROW.

Wildland Fire and Fire Management

While railroads in Alaska are not known to have been a common cause of wildland fires in the past, sparks from rail line operations and maintenance could increase the potential for fires (DeWilde and Chapin, 2006). SEA does not anticipate changes in fire management practices as a result of the proposed rail line. Appendix D provides a more detailed description of fire management and fire history in the study area.

Impacts by Segments and Segment Combinations

Vegetation would be permanently removed during clearing for construction of the rail line and associated facilities. The level of potential impact would depend on the size and type of vegetation in the area to be cleared during rail line construction and operations. The following paragraphs describe the vegetation types and areas of vegetation that would be removed within the 200-foot ROW and for associated facilities by segments and segment combinations. The descriptions include identification and discussion of construction and operations impacts when there would be differences between segments and segment combinations, or when impacts would be notable.

Southern Segments

Construction of any of the southern segments and segment combinations (Mac West-Connector 1, Mac West-Connector 2, Mac East-Connector 3, Mac East) would impact a variety of vegetation. Each of these segments and segment combinations would pass through a combination of undisturbed forest and woodlands, wetlands, and agricultural areas, as shown in Figure 5.2-2. Table 5.2-4 lists vegetation cover within the 200-foot ROW of the southern segments and segment combinations. Construction of southern segments and segment combinations would fragment vegetation communities already affected by existing development. This would reduce the capacity of remaining forests and other plant communities to provide ecological functions like wildlife habitat and nutrient cycling.

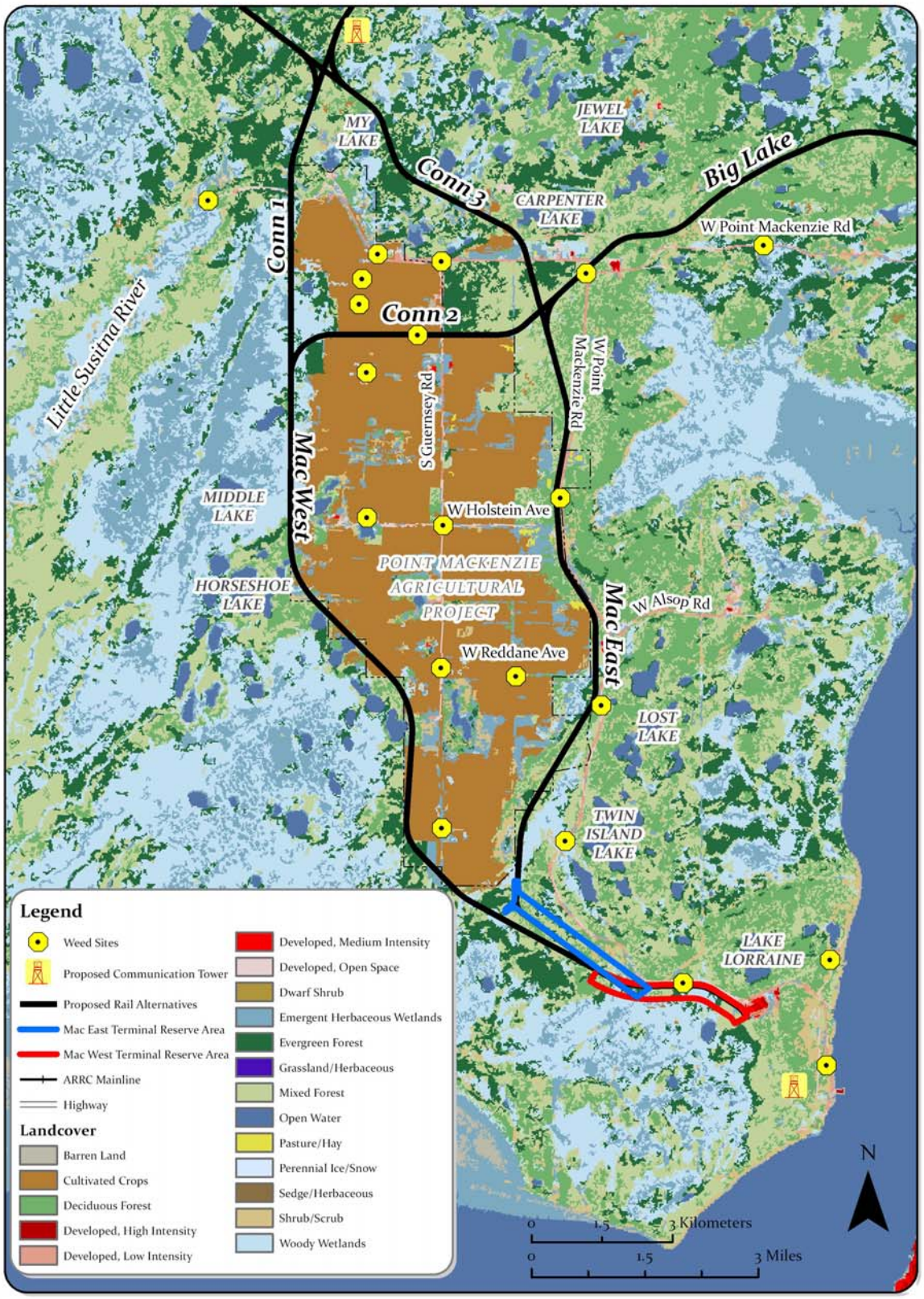

Figure 5.2-2. Vegetation Classes along the Mac West, Mac East, and Connector Segments

Table 5.2-4
Summary of Impacts to Vegetation (acres) by Segments and Segment Combinations for the Southern Segments[a]

Segment	Cultivated Crops/ Pasture/Hay	Deciduous Forest	Evergreen Forest	Mixed Forest	All Forests	Shrub/ Scrub	Woody Wetlands	Emergent Wetlands	Total Area[b]
Mac West-Connector 1	64	50	112	170	**332**	11	158	40	605
Mac West-Connector 2	93	50	91	166	**307**	11	134	37	582
Mac East-Connector 3	5	155	87	249	**491**	33	40	21	590
Mac East	1	143	47	200	**390**	31	34	13	469

[a] Source: Homer *et al*., 2004.
[b] Totals might not equal sums of values due to rounding.

Clearing and cultivation associated with agricultural activities within the Point MacKenzie Agricultural Project area have been the most significant sources of disturbance in the area of the southern segments and segment combinations. Higher concentrations of invasive plant species are found in developed agricultural areas near Port MacKenzie. The potential for the spread of invasive plant species in this area is much lower than for the northern segments as fewer weed sites have been identified in the southern portion of the study area (see Table 5.2-3). The fire protection level in this area is primarily "full," indicating that human life, property, developed areas, or high-value natural resources could be at risk, with small areas designated as "modified" (see Appendix D). Fire activity in this area has been historically low (see Appendix D).

Mac West-Connector 1 Segment Combination

Construction of this segment combination could result in clearing of about 605 acres of vegetation within the 200-foot ROW – 64 acres of cultivated crops/pasture/hay, 50 acres of deciduous forest, 112 acres of evergreen forest, 170 acres of mixed forest, 11 acres of shrub/scrub, 158 acres of woody wetlands, and 40 acres of emergent herbaceous wetlands (Table 5.2-4). There are two known weed sites within the proposed ROW for this segment combination (Table 5.2-3).

Mac West-Connector 2 Segment Combination

Construction of this segment combination could result in clearing of about 582 acres of vegetation within the 200-foot ROW – 93 acres of cultivated crops/pasture/hay, 50 acres of deciduous forest, 91 acres of evergreen forest, 166 acres of mixed forest, 11 acres of shrub/scrub, 134 acres of woody wetlands, and 37 acres of emergent wetlands (Table 5.2-4). There are four known weed sites within the proposed ROW for this segment combination (Table 5.2-3). In 1991, the Stromberg Fire burned 475 acres of mixed agricultural and forested land near the intersection of Mac West and Connector 2, outside the proposed ROW (BLM AFS, 2008a).

Mac East-Connector 3 Segment Combination

Construction of this segment combination would result in the clearing of about 590 acres of vegetation within the 200-foot ROW – 5 acres of cultivated crops/pasture/hay, 155 acres of

deciduous forest, 87 acres of evergreen forest, 249 acres of mixed forest, 33 acres of shrub/scrub, 40 acres of woody wetlands, and 21 acres of emergent wetlands (Table 5.2-4). There are three known weed sites within the proposed ROW for this segment combination (Table 5.2-3).

Mac East Segment

Construction of this segment would involve the clearing of approximately 469 acres of vegetation within the 200-foot ROW – about 1 acre of cultivated crops/pasture/hay, 143 acres of deciduous forest, 47 acres of evergreen forest, 200 acres of mixed forest, 31 acres of shrub/ scrub, 34 acres of woody wetlands, and 13 acres of emergent wetlands (Table 5.2-4). There are three known weed sites within the proposed ROW for this segment (Table 5.2-3). The Mac East Segment is very similar to Mac East-Connector 3 Segment Combination, with proportionally the same approximate vegetation distribution within the 200-foot ROW.

Northern Segments

Construction of any of the northern segments and segment combinations (Willow, Big Lake, Houston-Houston North, or Houston-Houston South) would impact a variety of vegetation. These segments would pass through a combination of relatively undisturbed forests, woodlands, and wetlands, and some developed areas, as shown in Figures 5.2-3 and 5.2-4. Table 5.2-5 lists vegetation cover within the 200-foot ROW of the northern segments and segment combinations.

Residential and commercial development and associated roads and infrastructure have been the most significant sources of disturbance in the area of the northern segments and segment combinations. Higher concentrations of invasive plant species are found in developed areas near Big Lake and along Parks Highway. The potential for the spread of invasive plants in this area is moderate to high. Rail line construction and operations would increase the likelihood that weeds would spread to more remote areas. The fire protection level in this area is primarily "critical," especially in developed areas near Parks Highway; more remote areas along the Willow Segment and in other places are designated as "full." These designations indicate that human life, property, developed areas and/or high-value natural resources are at risk (refer to figures and tables in Appendix D for more detail on fire protection designations). Fire activity in this area has been moderate (see Appendix D). In 1996, the Millers Reach fire burned 37,348 acres in the Big Lake area between Knik and Houston.

Willow Segment

This segment would pass through areas that are primarily undeveloped; vegetation cover is mostly mixed and deciduous forest. Construction of the Willow Segment could alter natural fire ecology and provide a vector for the introduction and spread of nonnative plants. Construction of this segment would result in the clearing of about 684 acres of vegetation within the 200-foot ROW – 2 acres of cultivated crops/pasture/hay, 253 acres of deciduous forest, 90 acres of evergreen forest, 282 acres of mixed forest, 4 acres of shrub/scrub, 27 acres of woody wetlands, and 25 acres of emergent wetlands (Table 5.2-5). There are two known weed sites within the proposed ROW of this segment (Table 5.2-3). Much of this segment would pass through remote areas, and in contrast to the other northern segments, the fire protection level here is mostly "full" (see Appendix D).

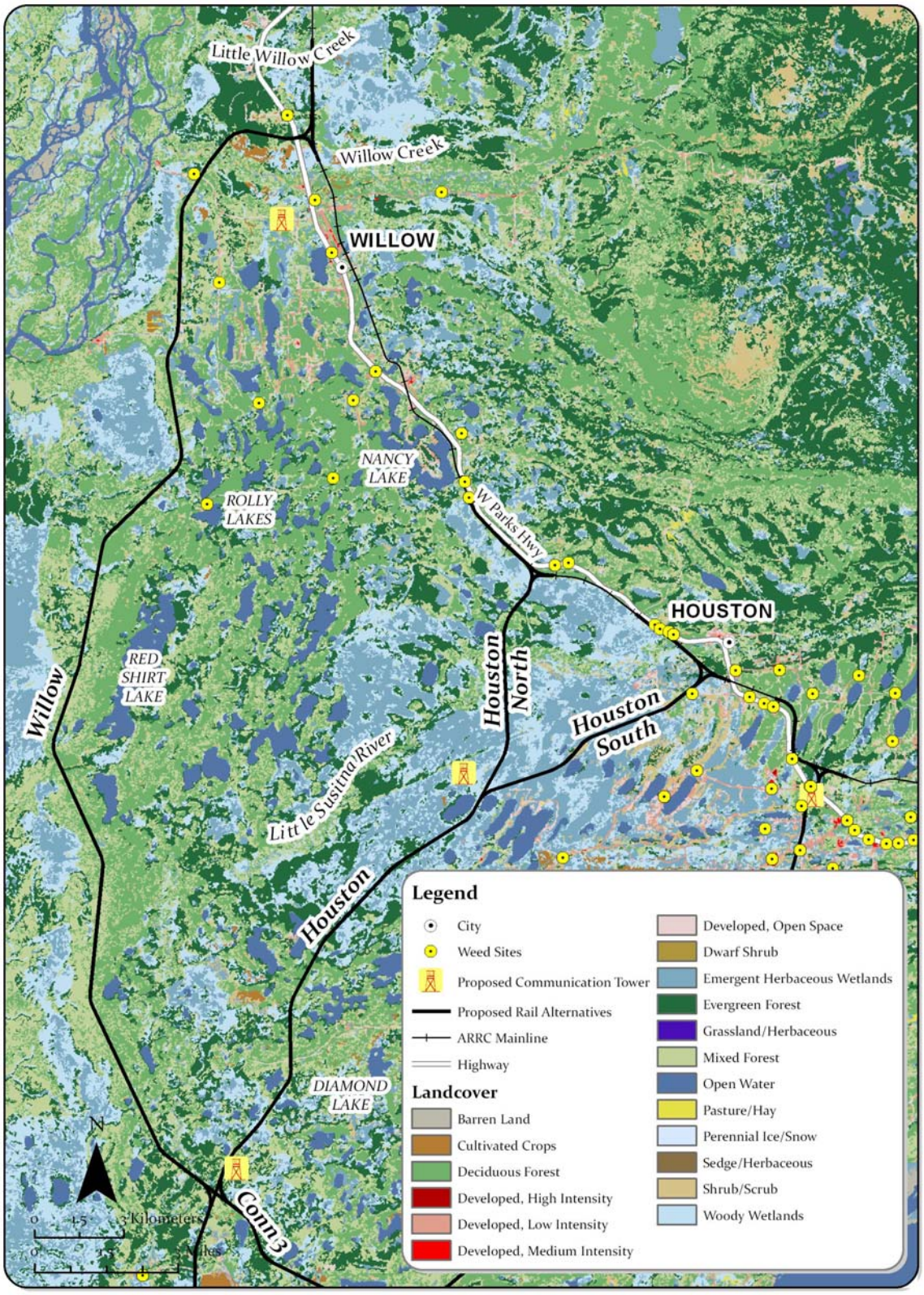

Figure 5.2-3. Vegetation Classes along the Willow, Houston, Houston North, and Houston South Segments

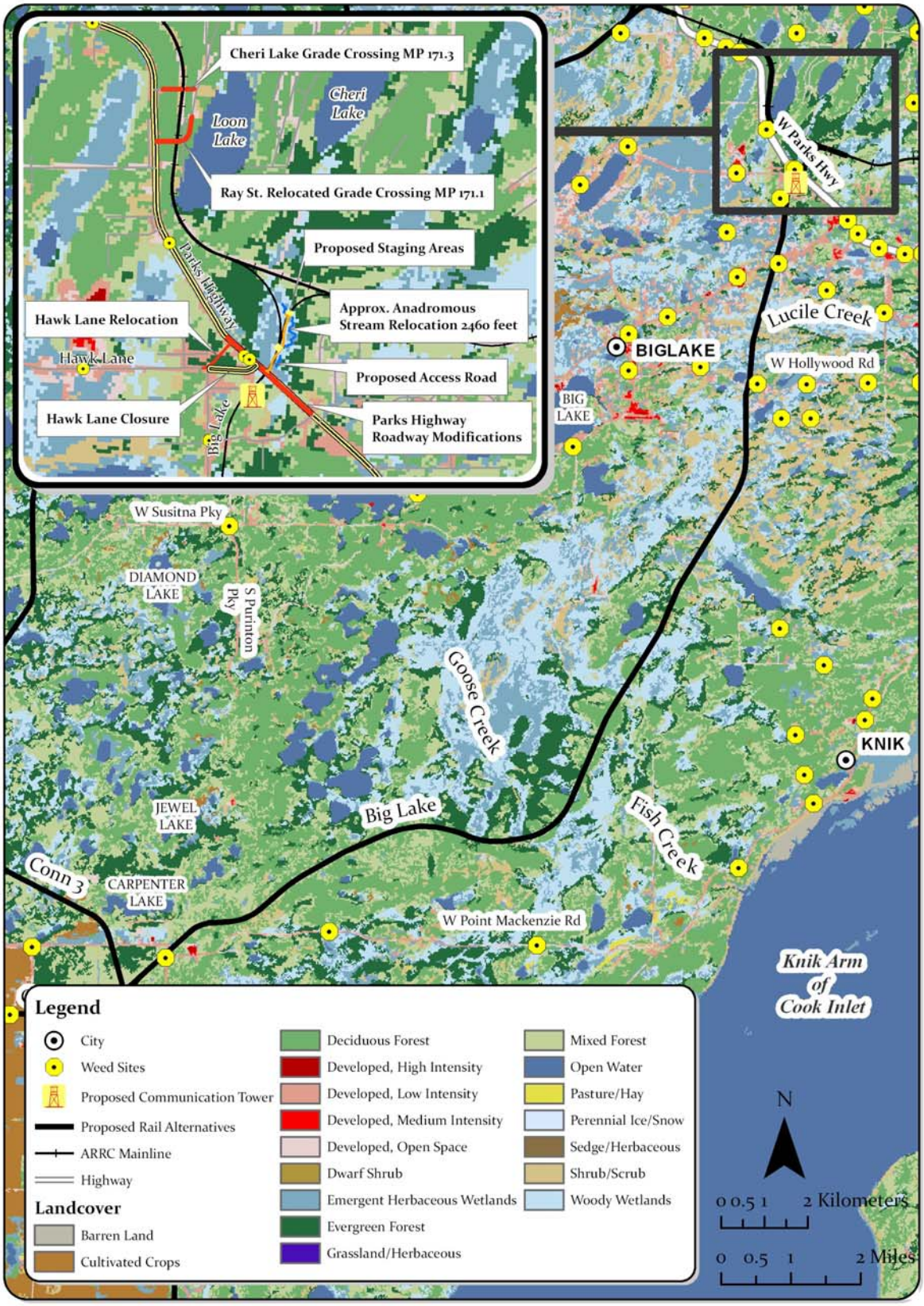

Figure 5.2-4. Vegetation Classes along the Big Lake Segment

Table 5.2-5
Summary of Impacts to Vegetation (acres) by Segments and Segment Combinations for the Northern Segments[a]

Segment	Cultivated Crops/ Pasture/ Hay	Deciduous Forest	Evergreen Forest	Mixed Forest	All Forests	Shrub/ Scrub	Woody Wetlands	Emergent Wetlands	Total Area[b]
Willow	2	253	90	282	**625**	4	27	25	684
Big Lake[c]	<1	131	45	123	**299**	41	77	57	474
Houston-Houston North	0	96	85	75	**256**	1	109	81	447
Houston-Houston South	0	59	68	51	**177**	27	90	146	441

[a] Source: Homer *et al*., 2004.
[b] Totals might not equal sums of values due to rounding. Values less than one were rounded to one acre.
[c] < = less than.

Big Lake Segment

This segment would pass through deciduous and mixed forests and wetlands that have been fragmented by human development. Impacts to natural vegetation remaining in these areas could contribute to additional fragmentation of forested and wetland habitats. Construction of this segment would result in the clearing of about 474 acres of vegetation within the 200-foot ROW – less than 1 acre of cultivated crops/pasture/hay, 131 acres of deciduous forest, 45 acres of evergreen forest, 123 acres of mixed forest, 41 acres of shrub/scrub, 77 acres of woody wetlands, and 57 acres of emergent wetlands (Table 5.2-5). There are 10 known weed sites within the proposed ROW of this segment (Table 5.2-3). In 1996, the Millers Reach 2 fire burned 129 acres within the proposed ROW along 21 miles of the Big Lake Segment (see Appendix D, Table D-7).

Houston-Houston North Segment Combination

There are many lakes and associated wetlands along the Houston-Houston North Segment Combination. Construction of the Houston-Houston North Segment Combination would in places separate forested areas from adjacent wetland plant communities, disrupting continuity and damaging the integrity of lake fringe areas that provide water and nutrient cycling functions and are important for wildlife use. Construction of this segment combination would result in the clearing of about 447 acres of vegetation within the 200-foot ROW – 96 acres of deciduous forest, 85 acres of evergreen forest, 75 acres of mixed forest, 1 acre of shrub/scrub, 109 acres of woody wetlands, and 81 acres of emergent wetlands (Table 5.2-5). There are four known weed sites within the proposed ROW for this segment combination (Table 5.2-3). In 1996, the Millers Reach 2 fire burned 102 acres within the proposed ROW along 19 miles of the Houston-Houston North Segment Combination (see Appendix D, Table D-7).

Houston-Houston South Segment Combination

Construction of this segment combination would result in the clearing of about 441 acres of vegetation within the 200-foot ROW – 59 acres of deciduous forest, 68 acres of evergreen forest, 51 acres of mixed forest, 27 acres of shrub/scrub, 90 acres of woody wetlands, and 146 acres of

emergent wetlands (Table 5.2-5). There are seven known weed sites within the proposed ROW of this segment combination (Table 5.2-3). In 1996, the Millers Reach 2 fire burned 202 acres within the proposed ROW along 20 miles of this segment combination (see Appendix D, Table D-7).

Impacts to Vegetation by Alternative

The primary impact to vegetation from the proposed Port MacKenzie Rail Extension construction and operations would be the loss of the existing vegetation cover. Other impacts would include an increase in the spread of invasive plant species, and interruption of the natural fire cycle as the rail line would restrict the natural pathway of wildland fires. Potential impacts were quantitatively assessed for the areas within the proposed ROW. Table 5.2-6 summarizes the estimated cleared vegetation along the alternatives. Estimates are conservative because they assume clearing of the entire 200-foot ROW.

SEA also compared the percentage of each vegetation class the alternatives would affect to the relative abundance of each vegetation class. Through this analysis, SEA determined that regardless of alternative, all vegetation classes would experience a vegetation loss of 0.5 percent or less as a result of rail line construction. It should be noted that while such a small reduction in relative abundance may seem negligible in the context of the overall study area, this loss could still represent a meaningful loss of habitat at the local level, depending on unique ecological features or landscape position. For example, the Big Lake Segment would result in a comparatively small impact to forests in terms of acres. However, this segment would pass through a patchwork of human development and fragmented forest communities, so the loss of forested habitat could represent a more meaningful loss of forested habitat and associated ecological function and values.

Vegetation clearing would result in a long-term impact for forest communities, even with restoration, especially for late-succession forests and wetlands that would be slow to recover. Some cleared areas would likely be restored after construction; other areas would be covered by fill. Loss of vegetation cover, soil disturbance, and the use of fill materials and seed sources contaminated with the invasive plant seeds would contribute to the spread of weed species. With appropriate restoration efforts, vegetation clearing would result in a short-term impact to grasslands and shrub/scrub communities.

Potential impacts to vegetation from rail line construction and operations vary by alternative. While all rail line alternatives would result in the loss of vegetation across all vegetation classes, the Mac West-Connector 1-Willow and Mac East-Connector 3-Willow alternatives would result infestations. Of these two alternatives, the Mac West-Connector 2-Big Lake Alternative has the highest number of known weed sites within its ROW and is therefore the alternative most likely to contribute to the spread of invasive weeds.

Forested areas at greatest risk for fire are those dominated by evergreen trees, and in particular, black spruce. While all of the alternatives would impact forested areas to some extent, the Mac West-Connector 1-Willow and Mac East-Connector 3-Willow alternatives would impact the

Table 5.2-6
Impacts to Vegetation (acres) by Alternative[a,c]

Alternative	Cultivated Crops/ Pasture/ Hay	Deciduous Forest	Evergreen Forest	Mixed Forest	All Forests	Shrub/ Scrub	Woody Wetlands	Emergent Wetlands	*Total Area*[b]
Mac West-Connector 1-Willow	66	304	195	442	**941**	15	185	65	1,272
Mac West-Connector 1-Houston-Houston North	64	146	190	238	**574**	12	267	121	1,038
Mac West-Connector 1-Houston-Houston South	64	110	173	214	**496**	38	248	186	1,032
Mac West-Connector 2-Big Lake	94	181	136	289	**606**	52	211	94	1,056
Mac East-Connector 3-Willow	7	405	173	515	**1093**	38	66	46	1,249
Mac East-Connector 3-Houston-Houston North	5	247	168	306	**721**	34	148	102	1,010
Mac East-Connector 3-Houston-Houston South	5	211	151	282	**643**	60	129	167	1,003
Mac East-Big Lake	1	272	92	314	**678**	71	109	70	930

[a] Source: Homer *et al*., 2004.
[b] Totals might not equal sums of values due to rounding.
[C] Segment-level data does not sum to alternative-level data as a result of the method used to calculate the rail line routes. Connector segment acreages were calculated by summing both possible "arms" of each connector segment (the arms necessary to connect the segment to either the Willow or Houston segments). Alternative acreages were calculated by generating a smooth path from the respective Mac Terminal to either the Willow or Houston segment, and thus include only the one, necessary connector "arm" (as the extra "arm" connecting to the other segment would not be necessary if that route was built).

greatest amount of evergreen forest, and thus would clear vegetation in those areas most at risk for fire. As a result of the more developed nature of these areas, the Mac West-Connector 2-Big Lake and Mac East-Big Lake alternatives would impact the greatest amount of land at the highest priority of fire protection (see Appendix D, Tables D-4 and D-6).

All rail line alternatives would cross areas of steeper terrain and highly or potentially highly erodible soil, leading to impacts resulting from erosion and sedimentation along the ROW when vegetation is removed. The Mac West-Connector 2-Big Lake and Mac East-Big Lake alternatives cross the highest percentage of highly erodible soils (47 percent of soils crossed, each) though for all rail line alternatives, 31 percent or more of soils crossed would be highly or potentially highly erodible (see Chapter 3, Table 3-8). The Mac West-Connector 2-Big Lake and

Mac East-Big Lake alternatives also cross the greatest length of steeper terrain (6,000 and 6,400 linear feet, respectively) (see Chapter 3, Table 3-2).

Finally, all rail line alternatives would result in impacts to floodplains along the ROW. Of the alternatives, four (Mac West-Connector 1-Willow, Mac West-Connector 1-Houston-Houston North, Mac East-Connector 3-Willow, and Mac East-Connector 3-Houston-Houston North) impact the greatest amount of floodplains (37.0, 30.3, 37.0 and 30.3, respectively) within the ROW (see Chapter 4, Table 4.4-5). Construction of the rail line in these floodplain areas could result in alteration of natural drainage patterns and floodplain storage capacity, creating changes that could affect vegetation outside the 200-foot ROW. The following paragraphs and Table 5.2-6 summarize potential impacts to vegetation by alternative.

Mac West-Connector 1-Willow Alternative

Construction of this alternative would impact 1,272 acres of vegetation within the 200-foot ROW. This alternative would impact the greatest amount of total vegetation (Table 5.2-6). Because a large amount of the potential impact would be to forested area, restoration of vegetation along this alternative could take between 70 and 200 years, representing a long-term loss of habitat. In addition, this alternative would impact a substantial acreage of floodplains, approximately 37 acres which are within the ROW (see Chapter 4, Table 4.4-5). Construction in floodplain areas could impact vegetation through the alteration of natural drainage patterns and floodplain storage capacity, creating changes that could affect vegetation outside the 200-foot ROW. Because the Mac West-Connector 1-Willow Alternative would traverse the flattest terrain with only 700 linear feet of the rail line with a slope greater than 5 percent (see Chapter 3, Table 3-2), removal of vegetation along this alternative would not contribute to a substantial increase in erosion and sedimentation beyond the 200-foot ROW. This alternative only has 35 percent of its soils classified as highly or potentially highly erodible (see Chapter 3, Table 3-8).

Mac West-Connector 1-Houston-Houston North Alternative

Construction of this alternative would impact 1,038 acres of vegetation within the 200-foot ROW. Compared to other alternatives, the Mac West-Connector 1-Houston-Houston North Alternative would impact the greatest number of acres of woody wetlands. After, Mac West-Connector 1-Willow, the Mac West-Connector 1-Houston-Houston North Alternative would impact the largest amount of evergreen forests, which are more susceptible to fire than other vegetation types in the area (Table 5.2-6). This alternative would also impact a substantial acreage of floodplains, approximately 30 acres which are within the rail line ROW (see Chapter 4, Table 4.4-5), which could lead to impacts to vegetation outside the ROW due to alteration of natural drainage patterns and floodplain storage capacity. Because the Mac West-Connector 1-Houston-Houston North Alternative would traverse little highly erodible soil (only 31 percent of soils crossed are highly or potentially highly erodible and only 1,600 linear feet with a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8), removal of vegetation along this alternative would not contribute to a substantial increase in erosion and sedimentation beyond the 200-foot ROW.

Mac West-Connector 1-Houston-Houston South Alternative

Construction of this alternative would impact 1,032 acres of vegetation within the 200-foot ROW. Compared to other alternatives, the Mac West-Connector 1-Houston-Houston South Alternative would impact the least number of acres of deciduous forest. Compared to other alternatives, this alternative would result in the greatest impact to emergent wetland (Table 5.2-6). The Houston South Segment of this alternative would traverse a relatively high concentration of invasive plant populations, which would contribute to a greater risk for the spread of weed species. This alternative would impact 9 acres of floodplain within the ROW (see Chapter 4, Table 4.4-5). Because the Mac West-Connector 1-Houston-Houston South Alternative would traverse little highly erodible soil (only 31 percent of the soils crossed are highly or potentially highly erodible and only 1,600 linear feet of land has a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8), removal of vegetation along this alternative would not contribute to a substantial increase in erosion and sedimentation beyond the 200-foot ROW.

Mac West-Connector 2-Big Lake Alternative

Construction of this alternative would impact 1,056 acres of vegetation within the 200-foot ROW. Compared to the other alternatives, the Mac West-Connector 2-Big Lake Alternative would impact the greatest number of acres of agricultural areas (Table 5.2-6). The Big Lake Segment of this alternative would travel through some developed areas and would traverse a relatively high concentration of invasive plant populations, which would contribute to a greater risk for the spread of weed species. The Big Lake Segment would also travel through areas of steep terrain and highly erodible soil (47 percent of the soils crossed by this alternative are highly or potentially highly erodible and only 6,000 linear feet of land has a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8). Therefore, removal of vegetation along this alternative could contribute to a substantial increase in erosion and sedimentation beyond the 200-foot ROW. Because this alternative would have the least impact on floodplains (2 acres in ROW, see Chapter 4, Table 4.4-5), it would not be expected to lead to substantial impacts to vegetation outside the 200-foot ROW due to alteration of natural drainage patterns and floodplain storage capacity. Because of its proximity to more developed areas, the Mac West-Connector 2-Big Lake Alternative would also result in the greatest impact to land under a critical fire protection classification.

Mac East-Connector 3-Willow Alternative

Construction of this alternative would impact 1,249 acres of vegetation within the 200-foot ROW. After Mac West-Connector 1-Willow, this alternative would have the greatest impact to vegetation (in terms of acreage) of all the alternatives. Compared to other alternatives, the Mac East-Connector 3-Willow Alternative would impact the greatest number of acres of forested land and the least number of acres of woody wetlands (Table 5.2-6). Due to the large acreage of forested land this alternative would impact, restoration of vegetation along this alternative could take between 70 and 200 years, representing a long-term habitat loss. In addition, this alternative would impact a substantial acreage of floodplains (37 acres in ROW, see Chapter 4, Table 4.4-5). Construction in floodplain areas could impact vegetation through the alteration of natural drainage patterns and floodplain storage capacity, creating changes that could affect vegetation outside the 200-foot ROW. This alternative would also travel through areas of steep terrain and

highly erodible soil (41 percent of the soils crossed are highly or potentially highly erodible and 1,100 linear feet of land has a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8).

Mac East-Connector 3-Houston-Houston North Alternative

Construction of this alternative would impact 1,010 acres of vegetation within the 200-foot ROW (Table 5.2-6). The Houston North Segment of this alternative would traverse a relatively high concentration of invasive plant populations, which would contribute to a greater risk for the spread of weed species. This alternative would also impact a substantial acreage of floodplains (30 acres in the ROW, see Chapter 4, Table 4.4-5), which could lead to impacts to vegetation outside the ROW due to alteration of natural drainage patterns and floodplain storage capacity. This alternative would also travel through areas of steep terrain and highly erodible soil (39 percent of the soils crossed are highly or potentially highly erodible and 2,000 linear feet of land has a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8).

Mac East-Connector 3-Houston-Houston South Alternative

Construction of this alternative would impact 1,003 acres of vegetation within the 200-foot ROW. The Houston South Segment of this alternative would traverse a relatively high concentration of invasive plant populations, which would contribute to a greater risk for the spread of weed species. This alternative would also travel through areas of steep terrain and highly erodible soil (38 percent of the soils crossed are highly or potentially highly erodible and 2,000 linear feet of land has a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8). The Mac East-Connector 3-Houston-Houston South Alternative would also impact 9 acres of floodplain in the ROW (see Chapter 4, Table 4.4-5).

Mac East-Big Lake Alternative

Construction of this alternative would impact 930 acres of vegetation within the 200-foot ROW, the least overall impact to vegetation (in terms of acreage) of all the alternatives (Table 5.2-6). Compared to other alternatives, the Mac East-Big Lake Alternative would impact the fewest number of acres of agricultural land. Along with the Mac West-Connector 2-Big Lake Alternative, this alternative would also result in the least impact to floodplains (2 acres in the ROW, see Chapter 4, Table 4.4-5). Therefore, the Mac East-Big Lake Alternative would not be expected to lead to substantial impacts to vegetation outside the 200-foot ROW due to alteration of natural drainage patterns and floodplain storage capacity. The Mac East-Big Lake Alternative would travel through the greatest area of steep terrain and highly erodible soil (47 percent of the soils crossed are highly or potentially highly erodible and 6,400 linear feet of land has a slope greater than 5 percent, see Chapter 3, Tables 3-2 and 3-8, see Chapter 3, Tables 3-2 and 3-8). Therefore, removal of vegetation along the rail line could contribute to a substantial increase in erosion and sedimentation beyond the 200-foot ROW. This alternative, along with the Mac West-Connector 2-Big Lake Alternative, would result in the greatest impact to land under a critical fire protection classification as a result of its proximity to more developed areas. However, this alternative would also impact the least acreage of evergreen forest, which is the most susceptible vegetation in the study area to fire.

5.2.4.2 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 impacts to vegetation.