

5.0 Alternatives Study

One purpose of Port MacKenzie Rail Extension Preliminary Environmental and Alternatives Report is to use quantitative measures to compare the strengths and weaknesses of the Port MacKenzie Rail Extension project alternatives. For planning and policy analyses, a *Goeller scorecard*, called a matrix in this report, is useful as it utilizes a disaggregate method to display and compare the strengths and weaknesses of the alternatives (Patton and Sawicki 1993). This method describes the impacts for each alternative in “natural” units, such as physical units, monetary terms, or other quantifiable terms, and then allows decision-makers to assign a score by which to compare the alternative alignments. Each column of the matrix represents one impact and each row represents an alternative alignment. The result is a final analysis summary matrix used to present the various impacts.

5.1 Criteria Identification

The matrix evaluation criteria used in this analysis were derived from STB criteria (49 CFR 1105.7) and environmental and engineering criteria specific to the project area. Criteria were selected based on (1) availability of a quantifiable measure and (2) differences in measurements for alternatives that allowed for comparison. Quantifiable criteria that resulted in similar results for all alternatives were removed from the analysis as they would not be useful in differentiating the alternatives. The criteria used in the matrix to compare alternatives are described in Table 5-1. A weighting of the various criteria was avoided to ensure that each criterion was considered equally.

The ARRC is seeking to acquire a 200-foot ROW along the entire length of the proposed alignment. The ARRC would build the rail and all other associated infrastructure within this ROW. Based on this specification, a 200-foot wide buffer along the proposed alignments was used to calculate the aerial impacts to the various evaluation criterions using the GIS.

Each criterion was evaluated separately. Alternatives were assigned a plus (+), neutral (0), or minus (-) for each criterion. This was determined by assigning the least impacting alternative(s) a plus and the most impacting alternative(s) were assigned a minus. Alternatives falling in the middle were then assigned a neutral value. The numbers of pluses, neutrals and minuses were totaled for each alternative, and the number of minuses was subtracted from the number of pluses to compare the overall strengths and weaknesses of the alternatives. The number of neutral criteria was not calculated into the final comparison number. Matrix measurements and evaluations are presented in Table 5-2.

The environmental and engineering opportunities and constraints were compiled by alternative into the final matrix (Table 5-2). The cells of each criterion column contain two results; the actual unit value of each category as well as the overall scoring result. The final score of each alternative is represented in the ‘total’ column. Construction costs of each alternative were not a part of the final score, although they are included in the matrix as a separate column.

Table 5-1: Description of criteria used in the matrix

Matrix Criterion	Description
Poorly or highly compressible soils (cubic yards)	Poor soils are often located in wetlands, may include hydrology considerations, and can complicate constructability. Geotechnical fieldwork, including subsurface probing that evaluated all soil types, including peat which is highly compressible, was conducted for the proposed routes. Based on an assumed 80-foot construction width, the approximate amounts (cubic yards) of poor or highly compressible soils to be excavated were calculated by alternative and compared.
Number of new road crossings	Crossing roads, with either a grade separated bridge crossing or an at-grade crossing add cost to the project. At-grade crossings also may impact traffic patterns on existing roads, increase noise levels at development near road intersections, and affect local socio-economics. Additionally, grade crossings require driver attentiveness and ongoing maintenance. As a measure of each of these potential impacts, the number of new road crossings was tallied for each alternative and compared.
Land availability (acres/mile)	The project area is comprised of privately owned parcels; local and state owned designated parcels (parks, refuges, and other public uses); and large tracts of undeveloped or undesignated parcels owned by government (State of Alaska and MSB), Native Corporations, The Trust (Alaska Mental Health Trust Authority), and University of Alaska. This category includes only these large tracts of undeveloped and undesignated land as they represent this category and are land types that are the most compatible for locating a rail line and minimize impacts to more developed areas and people. Because the lengths of each alternative varies, the acreages of undeveloped lands within a 200-foot-wide ROW were calculated for each alternative and divided by the length of that alternative. More acres per mile in this category were considered positive.
Number of developed parcels	Among the privately owned parcels in the project area, many are currently undeveloped. To evaluate the greater impact to human development, the MSB GIS parcel database was queried for parcels containing an appraised building value. The number of parcels crossed by each alternative that contained structures was counted. A higher number of developed parcels along a route represent impacts to more densely populated areas, individual property owners, and community cohesion.
Designated land use (acres)	Designated lands include state and MSB lands that are designated as refuges, recreation areas, and parks; state or private lands established for agricultural uses; and private lands designated as residential areas. MSB and state GIS land use databases were examined and the acres of designated lands within each 200-foot-wide ROW were estimated and compared.

Train energy (horsepower-hours) The movement of trains is resisted by forces related to distance, grades, and curvature. The amount of energy needed for a standardized train to overcome these forces was calculated for each alternative and compared.

Matrix Criterion	Description
Wetlands (acres)	The NWI dataset was examined. Wetland types within the project area are highly diverse and have varying levels of functionality and overall value. For this analysis, all wetland types were combined. Wetland impacts were avoided and minimized to the greatest extent possible. The total wetland impacts were calculated for each alternative and compared.
Number of mapped anadromous fish stream crossings	Crossing anadromous streams could impact salmon populations, habitat, and/or sportfishing. State regulations require that culverts and bridges with in-water support structures be designed to allow for fish passage. The ADF&G catalog of anadromous fish streams was used to tally and compare the number of stream crossings by each alternative
High potential for archaeological sites (acres)	Areas of cultural and historic significance were avoided where practicable. An archaeological probability map provided by MSB cultural resource specialists was used to calculate the acres of potential impact to areas with highest probability of having cultural resources along each alternative.
Fragmentation of designated refuge and recreation areas (Yes/No)	State lands designated as recreation areas and refuges represent areas of high quality wildlife habitat and areas of significant recreational opportunity for fishing, boating, hunting and other outdoor activities. Crossing or encroaching on the boundary of these areas is seen as fragmentation. An alternative that encroached on the boundary of one or more recreation area or refuge was given a 'yes' for fragmentation, while alternatives that had no impact on these areas were given a 'no'. In the scoring, alternatives with no encroachment were assigned a plus (+), alternatives that bisected one or more of these areas were assigned a minus (-), and alternatives that encroached a border but did not bisect the property were assigned as neutral (0).
Construction costs	Preliminary total construction cost estimates, including ROW acquisition, were compiled and used to compare each of the alternatives. Construction costs were not included as part of the overall comparison of strengths and weaknesses.

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Table 5-2: Final matrix evaluation

Proposed Routes	Criterion										+ / 0 / -	Total	Cost Estimate (millions)	
	1 Poor or highly compressible soils (cubic yards in 10 ⁶ yds ³)	2 New road crossings (#)	3 Land availability (acres/mile)	4 Developed parcels (#)	5 Designated land use (acres)	6 Train energy (horsepower-hours)	7 Wetlands (acres)	8 Mapped anadromous fish streams (#)	9 High potential for archaeological sites (acres)	10 Fragmentation of designated refuges and recreation areas (yes/no)				
Mac West - Willow	1.15 0	5 +	15.8 0	15 0	440 -	8,100 +	200 0	5 0	585 -	YES -	2/5/3	-1	\$285	-
Mac West - Houston North	1.73 -	4 +	14.6 0	13 +	440 -	8,600 0	350 -	7 -	225 +	YES -	3/2/5	-2	\$220	0
Mac West - Houston South	1.19 0	5 +	16.3 0	13 +	415 -	9,500 0	280 -	6 0	280 +	NO 0	3/5/2	+1	\$200	+
Mac West - Big Lake	0.66 +	11 -	11.3 -	35 -	320 -	11,600 -	220 0	7 -	530 -	NO 0	1/2/7	-6	\$240	0
Mac East - Willow	1.05 0	7 0	18.9 0	7 +	150 +	8,700 0	90 +	4 +	580 -	YES -	4/4/2	+2	\$280	-
Mac East - Houston North	1.62 -	6 0	18.7 0	5 +	145 +	9,100 0	240 0	6 0	225 +	YES -	3/5/2	+1	\$220	0
Mac East - Houston South	1.08 0	7 0	20.4 +	5 +	130 +	10,100 0	175 +	5 0	280 +	NO +	6/4/0	+6	\$200	+
Mac East - Big Lake	0.56 +	11 -	15.4 0	26 -	120 +	10,900 -	160 +	7 -	540 -	NO +	4/1/5	-1	\$220	0

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5.2 Topics Not Covered or Removed from Matrix

Several topics were either not covered or removed from the evaluation matrix. As previously mentioned, some topics were not applicable to the project, some were difficult to quantify, and others were so similar once quantified that they did not contribute to the comparison. The criteria not included in the matrix are described in Table 5-3.

Table 5-3: Criteria not included in the evaluation matrix

Criterion removed	Description
Air Quality	There are no non-attainment areas in the MSB and therefore in the project area (USEPA 2007). Air quality is generally reported to be good. Each of the alternatives is a similar length and would result in similar air emissions from train traffic. None of the alternatives are likely to increase air emissions to a level of non-attainment.
Noise	Because most train noise is generated at crossings, alternatives that require more new at-grade crossings may have a greater noise impact. Noise was not included as a stand-alone criterion in the matrix as it seems to duplicate the “number of new road crossings” criterion.
Safety	Safety is an issue for all alternatives, and is generally incorporated in the “number of new road crossings” criterion.. While some alternatives would have more at-grade road crossings than others, all alternatives cross recreational trails that may pose a safety concern. All alternatives would have equal potential impacts from the frequency or probability of a release to the areas from hazardous materials. Hazardous spills contingency plans would be modified by ARRC to include the new alignment. Because safety concerns are essentially equal among each of the alternatives, this issue was not a discriminating factor for comparing the alternatives.
Endangered Species	There are no threatened or endangered species present within the project area.
Coastal Zone	All alternatives would include construction in Alaska’s coastal zone and would be subject to consistency review under the ACMP and the MSB CMP including the Point MacKenzie AMSA Plan (as amended in 2006). Therefore, coastal zone impacts were not a discriminating factor for comparing the alternatives.
Operations and Maintenance	Operations and maintenance requirements would be similar for all alternatives and are not a discriminating factor for comparing the alternatives.
Public Comment	Public comment was not included in the matrix evaluation because it is difficult to measure public comment in quantifiable terms. However, public comment was important for developing the alternatives and for understanding issues specific to the project area. Public comments were considered and helped to refine the proposed corridors and influenced preliminary design elements.

Criterion removed	Description
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Socio-economics	The potential socio-economic impacts of the project are an important consideration. This criterion, however, is complex and is difficult to quantify and compare the impacts between the alternatives in a matrix format. U.S. Bureau of the Census data from 2000 were analyzed to evaluate project area demographics, housing, and the economy.
Habitat Fragmentation	Most of the project area provides quality habitat for a wide range of wildlife species because of the undeveloped to moderately developed nature of the project area. For this reason it was difficult to quantify wildlife habitat fragmentation and impact. This criterion was included in the fragmentation of a park or refuge category.
Trail Crossings	The project area has a multitude of trails, both officially recognized through easements and unofficial 'social' trails. Extra effort was taken to identify trail locations and to maintain trail connectivity. The number of trail crossings for each alternative was originally included in the analysis, but was dropped because the numbers of officially recognized trails were similar for all alternatives and the numbers of social trails are not easily quantifiable.

5.3 Strengths and Weaknesses

Based on the results of the matrix, the various alternatives were described by their strengths and weaknesses. This was done to provide an easy to comprehend list, without numbers, of the pros and cons of each alternative. Table 5-4.

Table 5-4: Alternatives strengths and weaknesses

Route	Strengths	Weaknesses
Mac West/ Willow	<ul style="list-style-type: none"> • Requires fewer number of new road crossings • Requires smaller expenditure of train energy 	<ul style="list-style-type: none"> • Crosses more incompatible land uses • Has higher probability of impacting archaeological and/or historical sites • Has greatest impacts to designated state refuges and recreation areas
Mac West/ Houston North	<ul style="list-style-type: none"> • Requires fewest number of new road crossings • Impacts fewer developed parcels • Has less probability of impacting archaeological and/or historical sites 	<ul style="list-style-type: none"> • Crosses more incompatible land uses • Has less suitable soil conditions • Impacts more wetlands • Impacts a designated refuge and fragments a state recreation area • Crosses greater number of mapped anadromous streams
Mac West/ Houston South	<ul style="list-style-type: none"> • Requires fewer number of new road crossings • Impacts fewer developed parcels • Has less probability of impacting archaeological and/or historical sites 	<ul style="list-style-type: none"> • Crosses more incompatible land uses • Impacts more wetlands • Requires moderate expenditure of train energy, but less than the two Big Lake alternatives
Mac West/ Big Lake	<ul style="list-style-type: none"> • Has more suitable soil conditions 	<ul style="list-style-type: none"> • Involves greater number of new road crossings • Impacts more developed parcels • Crosses more incompatible land uses • Requires greater expenditure of train energy • Crosses greater number of mapped anadromous streams • Has higher probability of impacting archaeological and/or historical sites
Mac East/ Willow	<ul style="list-style-type: none"> • Impacts fewer developed parcels • Crosses more compatible land uses • Impact less wetlands • Crosses fewest mapped anadromous streams 	<ul style="list-style-type: none"> • Has higher probability of impacting archaeological and/or historical sites • Fragments designated state recreation areas

Route	Strengths	Weaknesses
Mac East/ Houston North	<ul style="list-style-type: none"> • Crosses more compatible land uses • Impacts fewer developed parcels • Less probability of impacting archaeological and/or historical sites 	<ul style="list-style-type: none"> • Has less suitable soil conditions • Fragments a designated state recreation area • Requires moderate expenditure of train energy, but less than the two Big Lake alternatives
Mac East/ Houston South	<ul style="list-style-type: none"> • Impacts fewer developed parcels • Crosses more compatible land uses • Impacts less wetlands • Has less probability of impacting archaeological and/or historical sites • Avoids designated state refuges and recreation areas 	<ul style="list-style-type: none"> • Requires moderate expenditure of train energy, but less than the two Big Lake alternatives • Involves moderate number of new road crossings, but less than the two Big Lake alternatives • Has less suitable soil conditions than the Big Lake alternatives, but better than the Houston North alternatives
Mac East/Big Lake	<ul style="list-style-type: none"> • Avoids designated state refuges and state recreation areas • Crosses more compatible land uses • Has more suitable soils • Impacts less wetlands 	<ul style="list-style-type: none"> • Impacts more developed parcels • Involves greater number of new road crossings • Requires greater expenditure of train energy • Crosses greater number of mapped anadromous streams • Has higher probability of impacting archaeological and/or historical sites.