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4.0 ROUTE SELECTION PROCESS

This Section provides a summary of the steps taken to identify and evaluate alternative alignments/corridors for the Provincial Road 304 to Berens River ASR.

The objectives of this analysis were as follows:

- To summarize the environmental, social and financial aspects of the alternatives considered for PR 304 to Berens River;
- To provide an explanation of the process undertaken to determine the final alignment;
- To summarize the input received on the identification and evaluation of alternative route alignments from the community engagement; and
- To explain the rationale for selection of the preferred route alternative.

In addition to the technical work that was conducted to identify and evaluate routing options, an extensive community engagement program was also undertaken, including community meetings, meetings with WNO Chiefs, meetings with government review agencies and meetings with the general public to receive feedback on the alternatives identified and input into the evaluation. Details of the CEP are provided in Section 5.0. Additional technical details of the alternative route evaluation are provided in Appendix 1.0.

4.1 Alternatives to the Project

The area to the east and north of Lake Winnipeg is one of the last major areas in Manitoba not served by a system of all-season roads. The small size of communities in this area, their remoteness, and the lack of major economic enterprise have resulted in a transportation system that has a modest capital cost, but high operational costs and provides an uncertain service to local residents.

Given the transportation challenges faced by these communities the Manitoba Government is committed to undertake a Large Area Transportation Network Study to confirm basic corridor concepts for all-season road development to service communities on the east side of Lake Winnipeg. The Manitoba Government and the Wabanong Nakaygum Okimawin (WNO) First Nations signed an accord confirming a commitment to develop a shared vision for the east side of Lake Winnipeg.

Other options that have been considered and evaluated prior to this study include:

- Do Nothing (ie. maintain the existing transportation system at status quo);
- Other means of transportation (e.g, boat or air transport);
- Provide an effective transportation system for the movement of goods and services to all the communities on the east side of Lake Winnipeg; and

- Upgrade the Rice River Road and provide an extension from Bloodvein to Berens River.

The "Do Nothing" approach was discounted as it was not considered to be a viable option since the existing transportation network is comprised of a system of airports, unreliable winter roads, and ferry systems. Communities located on Lake Winnipeg have access to air service year round, barge and ferry service in the open water season, and winter roads for most of January, February, and March. All other communities in the study area have access to winter roads for a similar period, but have to rely on air transport for the rest of the year. In either case, there are extensive periods where all of these remote communities have no surface transportation available.

The absence of all-season roads has imposed costs on individuals, communities, and governments in terms of high freight and transportation costs and created other hardships related to a system that is dependent on the weather. The growing size of these communities has also made the long-term future of the current system problematic in terms of its ability to provide adequate service.

Other transport concepts have periodically been advanced as a solution to the reliability and seasonal nature of the current transport system to date; however, concepts such as hovercraft and dirigibles have not been proven reliable given the relatively small-scale and unpredictability of weather and of both freight and passenger movements within this region.

Providing a transportation link to all of the communities on the east side of Lake Winnipeg is currently being considered in the Large Area Transportation Network Study on the ESLW. This study consists of the multi-disciplinary planning and engineering work required identifying the preferred ASR alignments to connect the east side communities to the rest of the road transportation network in Manitoba. This study is in its early planning stage and options developed for future consideration to extend beyond the limits of this Project.

An all-season road system is expensive to build and involves a permanent commitment to maintenance and repair. The significant financial expense means that decisions need to be made in a structured context. The economic justification for extending the all-season road system into these communities involves an assessment of least cost alternatives, net benefits associated with each alternative, and assessment of potential economic activity created by the improved access. Other considerations are public and local community opinion, social objectives, and environment impacts.

In April 2007, the Manitoba Government announced it would move ahead with the first leg of the all-season road development to upgrade the existing Rice River Road and extend it to Bloodvein and construct an all-season road from Bloodvein to Berens River (PR 304 to Berens River). The East Side Road Authority (ESRA) was established, as a provincial Crown agency, to manage the East Side Transportation Initiative (ESTI).

4.2 Route Options

Alternative routing options were examined separately for the portions between Manigotagan and Bloodvein; and Bloodvein to Berens River. Functional design work was conducted on the PR 304 (Manigotagan) to Bloodvein route options in 2005 and 2006 by UMA for the Government of Manitoba. This work was discussed at a preliminary level with government review agencies, affected First Nations communities and the general public at that time. Alternative alignments for the proposed segment between the Bloodvein First Nation and Berens River were examined in the Spring of 2009.

4.2.1 PR 304 to Bloodvein (Rice River Road Upgrade and Extension)

The Rice River Road segment is approximately 78.3 km long and extends from PR 304 near Manigotagan/Hollow Water First Nation to within 20 km of the Bloodvein First Nation. The Rice River Road was constructed by the Pine Falls Paper Company (now Tembec) and has been used as a timber haul road since the 1970's. Parts of the road continue to be used for the hauling of forest products. The road is also used as the first leg of the winter road that extends from PR 304 (north of Pine Falls near Hollow Water) to the Island Lake area, connecting several First Nations and NAC communities on the east side of Lake Winnipeg.

For the purposes of identifying alternative route options in the UMA 2005 Functional Design Report and 2006 EA, the Rice River Road was divided into three segments, as described in Table 4-1.

Table 4 - 1: Rice River Road Segments

Component	Construction Requirement
Existing Rice River Road	Realignment and reconstruction of approximately 65 kilometres of existing road.
Northern Route (connecting to Bloodvein First Nation)	Construction of approximately 13.8 kilometres of new road to the Bloodvein First Nation, including the construction of 2 new bridges.
Southern Route (Hollow Water First Nation)	Relocation and upgrading of existing intersections and bridges, and provision of a new access road for Aghaming and Hollow Water First Nation

Project Alternatives Considered

The following paragraphs described alternative alignments considered for each of the segments between Manigotagan and Bloodvein.

Existing Rice River Road Segment

An objective of this re-design/re-alignment of this 66 km long segment of the alignment was to maximize use of the existing right-of-way for several reasons:

- The existing route was considered suitable (established on good terrain);
- Major realignments would have increased the overall project cost; and
- Major re-alignments would result in increased disturbance to previously undisturbed areas.

As a result, alternative alignments were not considered, and the recommended route alignment for this segment was to stay within the existing right-of-way with only minor modifications in some locations to meet current provincial highway design standards. Modifications included:

- Various vertical and horizontal alignment improvements;
- Upgrade to the Steeprock Creek Bridge crossing;
- Upgrade to the Rice River Bridge crossing; and
- Extension of the existing Loon Creek Culvert crossing.

Upgrading the existing Rice River Road will include both new construction and reconstruction along the improved alignment. New construction will be required in areas where alignment improvements are deemed necessary to meet Government of Manitoba design standards.

Northern Route

The northern route (road extension to Bloodvein) includes construction of approximately 13.8 kilometres of new road. A major constraint in selecting potential alternatives was the need to find a suitable crossing of the Bloodvein River. Potential bridge locations were then used as fixed points from which potential routes were selected. There were three alternatives evaluated including (Figure 4 - 1):

- *Route A* – This westerly alternative turned west at the end of the existing road and followed parallel to the river entering Bloodvein First Nation then crossing the river near Longbody Creek. Part of this route follows an old cut line in the trees that was made many years ago by Bloodvein First Nation.
- *Route B* – This easterly alternative starts at the end of the existing Rice River Road parallel to the boundary of Atikaki Wilderness Park, across the

Bloodvein River and then parallel to the existing distribution line. This route split into Routes B1 and B2 which provide alternative routes for crossing the Longbody Creek.

- *Route C* – This easterly alternative starts at the end of the existing Rice River Road parallel to the boundary of Atikaki Wilderness Park, across the Bloodvein River and then parallel to the existing distribution line. This route then swings further east and splits into routes C1 and C2 which provides alternative routes across Longbody Creek.

Following technical analysis and evaluation, Route A was initially selected technically as the recommended alignment, but was subsequently rejected during the public consultation process.

Respondents attending the first round of Open Houses expressed a clear preference for Alternative Route "B" of the northern routes, crossing the Bloodvein River close to the existing Manitoba Hydro crossing and running east of the Bloodvein River to one of two potential crossing points on Longbody Creek. Those favouring this alternative liked the fact that the route stayed outside the Bloodvein River First Nation, did not affect cultural and recreational areas used by the First Nation and provided a more direct route for a future extension to the north (to Berens River).

After a re-evaluation of the first round of open houses, a slightly modified version of Route B2 was chosen as the preferred alternative. The preferred alternative crosses the Bloodvein River at the Manitoba Hydro existing distribution line crossing; and crosses Long Body Creek at the location initially identified by Tembec for a logging route (Figure 4-2). The route parallels portions of the existing Manitoba Hydro power distribution line right-of-way to minimize additional clearing and grubbing requirements.

During the final round of Public Open Houses in 2006, the Bloodvein River First Nation accepted a modified version of their preferred northern route (Route B), based on a more economical crossing location on Longbody Creek. Outside the First Nation, other stakeholders voiced support for the recommended route.

Planned construction activities for this segment of the route include:

- Clearing 13.8 km of new road right-of-way and construction of new road;
- New bridge crossing at the Bloodvein River; and
- New bridge crossing of the Long Body Creek.

Figure 4 - 1: Northern Route Alternatives

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Figure 4 - 2: Recommended Northern Route

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Southern Route Segment (Hollow Water First Nation)

Alternatives were examined in the area of the Hollow Water First Nation which would improve both the horizontal and vertical alignments of the road segment, and provide a new access point to the communities of Aghaming and Hollow Water First Nation (Figure 4 - 3). Four alternatives were considered:

- *Route A* – This route consisted of upgrading the existing Rice River Road from PR 304 to new Provincial Road standards by improving the horizontal and vertical geometry. The length of this route was approximately 16.4 km and would involve the replacement of two bridges.
- *Route B* – This route was the most westerly route running along the west edge of the Hollow Water First Nation reserve, through Seymourville, near the lake and crossing the Wanipigow River at the location of the single lane bridge. The route would pass through the community of Aghaming and then rejoin the existing Rice River Road. This route was approximately 14.6 km.
- *Route C* – This route ran diagonally through the south part of the Hollow Water First Nation reserve and re-connected to the existing Rice River Road. This route was approximately 12.1 km.
- *Route D* – Route D was the most southerly of the route alternatives running just south of Hollow Water First Nation and connecting to the Rice River Road near the same point as Route C. This route alternative was approximately 11.7 km.

Following technical analysis and evaluation, Route A was chosen as the preferred alternative.

The selection of Option A was recognized to have several advantages in terms of engineering, environmental and cost parameters. A key factor in the decision to remain on the existing Rice River Road alignment that was identified in the Open Houses was to avoid heavy truck traffic through the communities. Additional traffic was identified as increasing noise and dust from vehicle movement and safety risks from traffic accidents in the communities.

During the Final Round of Open House Meetings there was favourable response to a recommended road plan involving upgrading the existing Rice River Road to PR 304.

Planned project activities for this segment of the route include:

- Relocation of the intersection of PR 304 and Rice River Road approximately 420 metres east of the existing location to provide better site lines at the intersection and tie into the existing PR 304 at a 90 degree bend;
- Upgrade to the Wanipigow River Bridge crossing;
- Upgrade to the English Brook Bridge crossing;
- Various vertical and horizontal alignment improvements (approximately 9 km); and

- Construction of an access road for Aghaming and the Hollow Water First Nation.

4.2.2 Bloodvein to Berens River

In selecting the route alignments for the segment between Bloodvein and Berens River, initial broad corridors were identified using a combination of satellite imagery (Land sat and SPOT Satellite Imagery), surficial geology maps, land cover maps, topographic maps and digital elevation models (DEMs). From these data sources the location of major constraints for road construction (i.e. large areas of peatland, wide river crossings, areas of high relief and steep/rugged topography) were identified and avoided where possible.

Once broad corridors were selected, panchromatic 1:56,000 aerial photography were acquired from the National Air Photo Library in Ottawa. Other data sources used included readily available satellite imagery (SPOT and Landsat), Shuttle Radar Topography Mission digital elevation model (SRTM) and 1:50,000 NTS maps.

Figure 4 - 3: Southern Sections Alternatives

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The initial broad corridors were then refined into narrower (100 m) corridors through the examination of stereoscopic air photos (1:56,000 scale). The terrain conditions were identified in the broad corridor including their implications on road construction feasibility and an alignment was selected along the terrain best suited to road construction.

The first route corridor considered as a connection from Bloodvein to Berens River was the shoreline route. This route was selected, as it is a fairly direct route that follows the existing winter road from Bloodvein to Berens River. After examining the terrain of the shoreline route several issues were identified:

- The corridor crossed extensive areas of muskeg and swamp (poor constructability);
- The corridor passed through the Berens River reserve lands at Pigeon River;
- Borrow material is scarce within close proximity of the corridor; and
- Generally, the river crossings were wider near the outlet (closer to Lake Winnipeg), requiring larger and more expensive bridges.

After re-examination of the regional terrain and surficial geology it was decided to identify two alternative routes farther inland in an attempt to resolve some of the issues identified on the shoreline route. Generally, the further inland from Lake Winnipeg one goes in the study area, the terrain exhibits the following general characteristics:

- peatland areas become less extensive and may contain thinner layers of peat;
- the abundance of bedrock outcrops and potential, borrow material becomes more reliable; and
- the crossings of the three major rivers (Bradbury River, Pigeon River and Berens River) are narrower, being further upstream from their outlets.

The inner-shore route and the central route corridors were selected as alternatives to the shoreline route to capitalize on superior terrain conditions, albeit with the possibility of increasing the length of the route slightly. Another consideration in generating the inner-shoreline and central route corridors was that these route options offer shorter connections to Little Grand Rapids and Pauingassi, as well as the Island Lake area (a major population centre).

Using terrain analysis of several broad corridors, three (3) alternative road alignments were identified for the segment between Bloodvein and Berens River and these are detailed on Figure 4-4:

- **Shoreline Route** (Figure 4-5) - is the alignment closest to the Lake Winnipeg shoreline. This route generally follows the shoreline morphology and shape and has a length of approximately 75.4 km. The Shoreline Route is a fairly direct route that follows the existing winter road alignment from Bloodvein to Berens River. This route corridor crosses extensive areas of muskeg and swamp, there are locations where borrow material is scarce and generally,

the river crossings are fairly wide due to the proximity to Lake Winnipeg. These wider watercourse crossings will require long bridge spans.

- **Inner-Shoreline Route** (Figure 4–6), is located to the east of the Shoreline Route alignment. The total length of this alignment is approximately 71.1 km in length. The terrain along this route consists of thin peat and abundant bedrock outcrops. Borrow material is readily available and crossings at the major rivers are relatively narrow resulting in short bridge span lengths.
- **Central Route** (Figure 4-7), is located to the east of the Shoreline Route alignment. The total length of this alignment is approximately 71.1 km in length. The terrain along this route consists of thin peat and abundant bedrock outcrops. Borrow material is readily available and crossings at the major rivers are relatively narrow resulting in short bridge span lengths.

Figure 4 - 4: Route Alternatives

Figure 4 - 5: Shoreline Route

Figure 4 - 6: Inner Shoreline

Figure 4 - 7: Central Route

4.3 Alternatives Analysis Methodology (Bloodvein to Berens River)

The alternative route options from Bloodvein to Berens River were evaluated using a Multiple Criteria Evaluation (MCE) framework developed for this study. The methodology used to perform this study is explained below.

4.3.1 Criteria Identification

At the outset of the study the project team assembled background environmental information to characterize the study area, and to understand the social cultural inter-relationships of the communities within the study area as well as within the broader region associated with the East Side Planning Area. The criteria chosen for the analysis were based on a number of factors including:

- Information provided by provincial and federal government agencies;
- A review of project related activities;
- An appraisal of the environmental setting; temporal and/or spatial conflict, and;
- Personal knowledge and professional judgement.

The following categories of criteria were used to evaluate the route alternatives described above:

- **Technical:** travel distance; terrain conditions; borrow availability (road construction materials) and construction constraints or limitations;
- **Natural Environment:** Habitat fragmentation; effects to environmentally sensitive features; effects to species at risk (SARA); effects to aquatic habitat;
- **Social/Cultural Environment:** Potential effects (positive and negative) of project development on traditional uses of land, culturally sensitive resources, and community infrastructure benefits, etc.;
- **Capital and Maintenance Costs:** Present estimated value of capital cost (bridges, culverts and road), and annual maintenance costs;

To collect data and quantify potential effects, the criteria were divided into indicators or factors as shown in Table 4-2. This table also describes some of the data sources used to collect information for each indicator. Other sources included:

- *Promises to Keep* (2004) document;
- WNO Chiefs land use planning database
- Recent aerial photography;

- Geographic Information System (GIS) data and resource mapping provided by Manitoba Conservation;
- Technical analysis derived from previous studies; and
- Input from First Nations and other stakeholders obtained from the community engagement process.

A number of electronic databases were acquired for the mapping of environmental features within a GIS format at a scale of 1:250,000.

Table 4 - 2: Evaluation Criteria and Indicators

Category	Indicator	Data Source
1.0 Technical Criteria		
1.1 Travel distance	Length northern to southern terminus (km)	Aerial photography; GIS shape files; 1:60,000 topo; Common end point is north of Berens River; southern termination is terminus with Rice River Rd. south of Bloodvein.
1.2 Borrow access	Cumulative length of access road off of the route alignment (km)	Air photo interpretation
1.3 Terrain types	Granular, lacustrine, muskeg, bedrock and swamp (km)	Air photo interpretation
1.4 Construction implementation	Percent of route length within the existing winter road or adjacent to power distribution line (consistent with multi-use corridor concept, avoids additional environmental fragmentation, and minimizes environmental effects)	GIS mapping
1.5 Access to Quarry Materials	M/tonne/km	Air photo interpretation for aerial extent (assume 3 m quarry depth); linear distance for haul road length
2.0 Natural Environment Criteria		
2.1 Terrestrial habitat fragmentation	Size and quality of important habitat traversed (Habitat Suitability Index) (km^2)	Provincial HSI models for caribou; Forest Stand Classification mapping

Category	Indicator	Data Source
2.2 Environmentally significant sites/protected areas	Length and quality of ASI/protected areas traversed (km)	MLI database; DFO studies; Other government data
2.3 Known species at risk	No. of identified SARA species within 1 km each side of the alignment	Conservation Data Centre; Manitoba Museum
2.4 Disturbance to aquatic habitat	No. of large watercourse crossings, no. of bridge piers in water, area of wetland disturbed, and number of watercourses negatively affecting fish habitat	AECOM design engineering and J.D. Mollard
2.5 Disturbance to boreal forest	Area of identified boreal forest cleared (km^2)	J.D. Mollard
3.0 Social / Cultural Environment		
3.1 Traditional Use Areas[1]	Implications to areas of important resource use (subject to confirmation through TEK Studies)	MLI database Conservation Data Centre; Forest Stand Classification mapping TK Surveys
3.2 Culturally sensitive areas / heritage resources[1]	No. of heritage/archaeological sites within 5 km	WNO database
3.3 Community infrastructure and services	Distance to ferry port	DEM mapping
	Crossing locations - Berens River crossing to community centre (km)	AECOM design engineering
4.0 Capital Cost and Maintenance Costs		
4.1 Capital cost (Class D estimates)	Road construction costs in $Million ($2009)	Rock fill depths based on costs/terrain type/soil type
	Bridge construction costs in $Million ($2009)	- Cross sections from DEM; estimate of span length based on slope and crossing distance
	Culvert costs in $Millions ($2009)	Crossing estimates/km
4.2 Maintenance costs	Allowance for annual road maintenance costs in $/year	MIT operating experience on remote gravel roads in

[1] Analysis conducted prior to TEK study results.

Category	Indicator	Data Source
	($2009)	$/km/year
	Allowance for annual bridge maintenance costs in $/year ($2009)	MIT operating experience on remote bridges in $/km/year

CWS – Canadian Wildlife Service
DEM – Digital Elevation Mapping
DFO – Department of Fisheries and Oceans
MIT – Manitoba Infrastructure and Transportation
MLI – Manitoba Land Inventory

4.3.2 Multiple Criteria Evaluation

Multiple Criteria Evaluation (MCE) is a multi-criteria decision matrix tool which provides a framework to compare alternative options with a balanced view to provide decision-makers with an understanding of the trade-offs which are required in evaluating options.

The steps of a Multiple Criteria Evaluation process are the following:

- Identify the attributes of the route options under an individual criterion under broad evaluation categories;
- Tabulate information assembled for individual criterion, by indicator, taking into consideration both quantifiable (i.e. measurable values) and non-quantifiable (i.e. descriptive terms or attributes);
- Assess each category separately so that evaluators may weigh the criterion and categories individually;
- Rank the options in order of preference;
- Document and interpret the results; and identify trade-offs, where appropriate;
- Identify advantages/disadvantages of each route;
- Identify the Preferred Route for more detailed evaluation.

Details of the evaluation are discussed further in Sections 4.3.3 to 4.3.6, 4.4 and 4.6 below.

4.3.3 Assessment Process

The evaluation process was conducted in a series of steps:

- Determine length (km) of each of the three options;
- Apply 1 km buffer to each option (500 m study width each side of the centreline);

- Import data from available sources into GIS format;
- Define evaluation criteria and measurement factors or indicators;
- Record measurement for each route option for each alternative;
- Identify rank preference of each alternative for each category of criteria; and
- Identify overall preference based on results of ranking for all categories of criteria.

A number of electronic databases were acquired for the mapping of environmental features in an ARCVIEW GIS format at a scale of 1:250,000.

4.3.4 Estimated Costs

In developing the planning-level cost estimates for the each of the route alternatives, an independent analysis was conducted by SLI and their sub-consultants AECOM Canada and J.D. Mollard and Associates. The estimate was prepared by AECOM using terrain mapping and water crossing data provided to them by J.D. Mollard and Associates Ltd. as part of their route engineering and terrain analysis to locate feasible alternatives for the all-weather road. This estimate was based on unit costs per kilometre for roads and bridges considering the terrain and ground conditions of the route alternatives. The analysis included costs of bridges and assumed a gravelled road including shoulders of 10 m, an average embankment height in the range of 1 to 1.5 m and 10 m wide bridge structures.

The design criteria for the all-season road were based on Government of Manitoba standards for a Secondary Arterial Highway, modified slightly to suit the local conditions and function of the road. The Rice River Road was designed using these criteria and were carried over for design of PR 304 to Berens River.

Preliminary construction costs for the three route alternatives are shown in Table 4-3, below. The total capital costs include road, bridge construction, mobilization and contingency. The property cost of $ 5 million is a nominal amount allowed for each alternative to cover the cost of assembling Crown Land needed for the project. This number requires re-estimation in later stages of the Project (e.g. during detailed design).

Maintenance costs are based on an annual maintenance cost of $5,000/km for an all-season road and were applied to all route alternatives. This estimated cost if for the road maintenance only and does not include the cost of bridge maintenance.

Additional details, assumptions, etc. are provided in Appendix 1.3.

Table 4 - 3: Construction Cost Estimate for Alternative Routes - Bloodvein to Berens River

Route: Original Shoreline (75.4 km)	**Cost ($M 2009)**
Sub-Total Road:	155,040,000
Sub-Total River Crossings:	35,900,000
Sub-Total Creek Crossings:	9,900,000
Small Culvert Crossings:	2,260,000
Original Shoreline Route Sub-total:	203,100,000
Contingency (20%):	40,620,000
Total Original Shoreline Route Estimated Cost:	**$243,720,000**
Route: Inner Shoreline (71.1 km)	
Sub-Total Road:	153,180,000
Sub-Total River Crossings:	22,500,000
Sub-Total Creek Crossings:	18,200,000
Small Culvert Crossings:	2,130,000
Inner Shoreline Route Sub-total:	196,010,000
Contingency (20%):	39,200,000
Total Inner Shoreline Route Estimated Cost:	**$235,210,000**
Route: Central (73.8 km)	
Sub-Total Road:	157,890,000
Sub-Total River Crossings:	20,930,000
Sub-Total Creek Crossings:	10,800,000
Small Culvert Crossings:	2,210,000
Central Shoreline Route Sub-total:	191,830,000
Contingency (20%):	38,360,000
Total Central Route Estimated Cost:	**$230,190,000**

Road maintenance costs at $5,000/km per year would be as follows:

Shoreline	$377,000 per year
Inner Shoreline	$355,500 per year
Central	$390,000 per year

4.3.5 Overview of Natural Environment Issues

The major concern with any all-season road in this area is the provision of access into areas that were formerly isolated. This could facilitate the hunting of large mammal species in areas that were not previously accessible (e.g., moose and caribou). The sudden increase in hunting pressure can cause an equally sudden drop in large mammal populations. Of key concern is the woodland caribou population between

Bloodvein and Berens River. An environmental concern for the present project in terms of large animals, and especially woodland caribou, is the incursion of the all-season road into critical winter habitat and calving grounds, and through areas that provide high quality food sources.

Access to watercourses and rivers will be increased with the addition of an all-season road, potentially resulting in impacts to the aquatic environment. Any resultant soil erosion, which increases the level of sediments in watercourses, could induce effects on the aquatic flora and fauna and associated habitats.

The risk of wild fire in the forest area could also increase. While wild fire is a significant element in the natural cycle of ecosystems, its frequency is likely greater in wilderness areas frequented by humans, posing risks that are greater than those associated with the natural cycle without an all-season road. This risk is also reflected in ratings for wildlife and watershed values below.

An alignment crossing through areas of disturbed or fragmented land is considered advantageous to one which traverses wilderness areas exhibiting higher quality natural habitat.

Wildlife Populations

There are direct incremental risks to wildlife populations from hunting; all new roads change access and may change hunting patterns and so represent risk whether hunting pressure increases or not.

An alignment in a marginal location avoiding crossing through areas of undisturbed land and wilderness may be advantageous to the protection of wildlife populations.

Water resources

When winter roads are located over water bodies, there is an increased risk for spills (mainly fuel) from tankers. The risk is significantly less where the winter road is located over land. The ASR would provide a more secure option due to more stable and reliable road surfaces for transportation of fuel and other goods throughout all-seasons.

All route options face the same risks in this regard.

Fish Populations

Access to lakes and water courses in both summer and winter may introduce an increased harvesting effort and the all-season road represents an incremental risk to fish populations within reach of whatever corridor is selected.

All route options face the same risks in this regard.

Protected Areas

None of the corridors pass near or through protected areas.

4.4 Input Received From Community Meetings

4.4.1 Input to the Comparative Route Evaluation

The Community Engagement Program is discussed in detail in Section 5.0. Input received from community members in Round 1 of community meetings was utilized in the evaluation of alternative route options and selection of the preferred route alignment.

Round 1 community input included feedback from community member/residents expressed in the form of statements, questions, opinions, ideas, perspectives (both positive and negative) via community meetings, meetings of the WNO Chiefs and other personal communication related to the project. This input was used as a source of information when considering the route alignments in the following ways:

- Provided the project team with information that may not have otherwise been accessed prior to the assessment of route alternatives;
- Assisted in the preliminary identification of environmental and social and economic impacts and benefits stemming from environmental considerations;
- Provided the project team with an indication of community preferences for the various route alternatives; and
- Involved community members directly in the planning process.

A number of concerns were raised during Round 1 of the community visits which helped the Project team understand some community preferences for routing alignment options in the evaluation of the alternatives (e.g. potential effects on moose and woodland caribou; potential for previously undisturbed areas to be opened to access). Other general comments assisted in the evaluation of potential environmental effects as described in Section 8.0 (e.g. potential for noise and dust effects; land use controls, etc).

During the community meeting in Bloodvein, there was a general preference for a shoreline route from Bloodvein to Berens River as it has the least amount of environmental impacts and the least amount of impact on the community's traditional land.

In Poplar River, various members of the Chief and Council also indicated support for a shoreline route alignment between Bloodvein and Berens River. Although the all-season road is not currently planned for extension to Poplar River, the leadership suggested a route north of Berens River along the Poplar River, to capitalize on better drained ground (avoid the muskeg). The leadership indicated that the road should follow closely along the Poplar River as the ground would be better to facilitate construction of a road (this also refers to the connection options for the East Side Transportation Study) due to the deep bogs that surround the community which would be difficult to fill. The community's land use officer stated that, outlined in the land use plan, the community has 2 km wide corridors along the existing winter road set aside for transportation corridors (ie. all-season road). He indicated that the leadership is very flexible when considering placement of the road alignment between Beren's River and Poplar River.

In Berens River, the community leadership stated that an all-season road should focus on the shortest stretch between Bloodvein to Berens River and that the right-of-way should follow the existing winter road and distribution line. A First Nations Councillor indicated that the terrain along the existing winter road is favourable for construction. Similarly, a community member indicated that there is more rock along the shoreline route option than shown on the surficial geology map that the study team had brought as a visual aid. The Berens River Chief indicated potential locations for quarry sites in relation to the existing work camp located at Pigeon River, and together with Project Team members helped to identify refinements to the shoreline route that would facilitate construction and facilitate watercourse crossings, while minimizing length. A rough route was sketched out on an aerial photo in addition to identifying a potential site for a bridge crossing of the Pigeon River.

Little Grand Rapids First Nation community members generally indicated a preference for the Central Route option, being the closest connection point to the all-season road for community members.

Pauingassi First Nation members did not indicate preference for a route option, although there was widespread support for an all-season road.

Based on the feedback obtained from each community with respect to the selection of a preferred alignment, it was concluded that most meeting participants (including the leadership) favoured the shoreline route or a route option located close to the lakeshore of Lake Winnipeg, as close as possible to the previously disturbed existing winter road.

4.4.2 Summary of Social and Community Issues

The social and cultural environment criteria considered in the route evaluation document the potential effects of the proposed all-season road on the communities, their social values and their economy. Evaluation criteria include access to communities, health care and education, land use impacts, and the protection of traditional uses.

Although many of the social/community issues and opportunities might seem to be common to all three of the alternative routes, participants at the various community meetings (described in Section 3.0) indicated a preference for the Shoreline Route as it is considered to present more opportunities from the following aspects:

- The wildlife and the land would be less affected because it minimizes disturbance to lands and forest that have not been previously disturbed, which results in reduced environmental impact and reduced impacts to traditional uses (trapping and hunting).
- Provides better access to Lake Winnipeg, helping to facilitate commercial fishing, boating and tourism activities that was identified through input received from the Community Engagement Program
- Avoids known woodland caribou use areas and high value habitat.
- Easier, more direct access to the Bloodvein and Berens River communities near the lake.

The Central Route provides the opportunity that it would be easiest to construct based on the best soils. It would also minimize connection distance to the Pauingassi and Little Grand Rapids First Nations, as well as connection to any of the wider area network route options that might be developed north to the Island Lake area. However, the Central Route also results in several issues for the communities:

- Longer and likely more expensive route from Bloodvein and Berens River;
- Greatest potential disturbance to wildlife (caribou) and the boreal forest.

The Inner Shoreline Route is similar to the Central Route, with the advantage of less impact to identified caribou habitat, but lower benefits to constructability due to an increase in wetland and muskeg soils.

4.5 Refinements to the Preferred Route

A review of the preferred route was undertaken by the project team considering a review of input and feedback that had been received from discussions in the communities, and further review of soils and constructability. This review resulted in the following refinements or adjustments to improve the preferred route:

- In the northern part of the route, adjust the alignment to avoid the Pigeon River and Berens River Reserve Lands;
- Adjust the route based on the suggestions from Berens River First Nation to take advantage of better terrain conditions, and to match with areas cleared for the existing winter road alignment; and
- Provide a greater set-back from the Lake Winnipeg shoreline in the southern segment of the route to improve on the potential development of lakefront cottage properties or tourism facilities.

Figure 4 - 8 shows the preferred alignment to be assessed in detail in the next stage of the Project, based on refinements that were made to the initial Shoreline Route from suggestions provided by community members during Round 1 of the Community Engagement program.

Figure 4 - 8: Revised Shoreline

4.6 Route Evaluation Analysis

A review of the information presented in Tables 4 – 4 through 4 - 7 indicated that the Shoreline Route ranked as the preferred route with respect to Technical Criteria, Natural Environment Impacts, Social/Cultural Environment Impacts, and Capital Costs & Maintenance Costs. The numerical ranking simply indicates the relative order of preference.

Under the Technical Criteria Category, presented in Table 4 - 4, there were no significant differences with respect to route length, and terrain units crossed. Although the preliminary terrain analysis anticipated a higher percentage of bedrock and wetland on the central minor differences were found to exist between the identified routes. All have approximately the same distance of swampy/muskeg lands to cross. Approximately 65% of the Shoreline Route follows the existing winter road corridor, or could be refined to follow the winter road thereby reducing the establishment of new road right-of-way and fragmenting undisturbed habitat. Other routes utilize less than 10% of the winter road.

The evaluation of the Natural Environment Impacts Category, shown in Table 4-5, indicate that there is not a significant difference in the actual number of water courses crossed by the three routes. Each route crosses three rivers requiring bridge structures more than 30 m in length. The Inner Shoreline requires the largest number of moderate-sized bridge structures ranging between 15 and 30 m in length. The Shoreline Route has the greatest number of bridges with multiple spans that require piers to be placed in the watercourse. The Central Route crosses the most wetland (shrub & herb) habitat and more open coniferous forest that presents habitat conditions favourable to woodland caribou. The Central Route would result in the highest disturbance to caribou habitat and known use areas. The Shoreline Route has the least potential for disturbance and also reduces habitat fragmentation of the boreal forest by using the existing winter road alignment. Overall, despite the potential for more bridge spans the Shoreline Route was favoured from the natural environment perspective as it does not cross critical caribou habitat, and impacts to fish habitat are considered to be mitigable.

The Social/Cultural Environment Impacts Category (summarized in Table 4-6) also favoured the Shoreline Route. Approximately 65% of the Shoreline Route follows the existing winter road corridor which would not significantly modify access to established trapping and traditional use areas

The Capital Cost and Maintenance Cost Estimates (Table 4-7) indicated that the Shoreline Route is more expensive than the other two route options but the difference in costs is less than 10%. At this level of analysis a 10% difference is not considered to be significant resulting in the routes being ranked with equal preference.

The overall conclusion drawn from comparing routes was that the Shoreline Route (as revised following community meetings) is the preferred Route to be assessed in greater detail.

Table 4 - 4: Route Comparison Based on Preliminary Route Evaluation – Technical Criteria

Criteria	Indicator	Shoreline Route	Inner Shoreline Route	Central Route
Technical Criteria				
1.1 Travel distance (route length north to south terminus)	km	75.4	71.1	73.8
1.2 Borrow access (cumulative length of quarry access roads that are off of the proposed route alignment)	km	13.7	16.8	15.4
1.3 Terrain types	Granular (G) Lacustrine (L) Muskeg (M) Bedrock (B)' Swamp (S)	1.7 km 20.4 km 6.3 km 9.8 km 36.9 km	0 km 27.5 km 11.1 km 10.7 km 21.6 km	0 km 24.6 km 9.6 km 12.4 km 27.0 km
1.4 Construction implementation (route length on existing winter road and/or other previously cleared right-of-way)	% of route length within existing winter road	69.5	5.6	0.0
1.5 Quarry overhaul (on access road outside of ROW)	M/tonnes/km	44.4	55.6	52.4

Advantages/Disadvantages

Shoreline		Inner-Shoreline		Centre	
Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
• Route provides better access to Lake Winnipeg than an inner-shoreline route (fishing, boating convenience, tourism potential) this may be a preference for the east side of Lake Winnipeg residents • Route is slightly more direct than an inner-shoreline route (70 km vs. 73 km); thus would reduce travel time slightly between Bloodvein and Berens River Communities •	• Bridge widths on the Bradbury, Pigeon and Berens Rivers are generally wider than at upstream locations on the inner-shoreline route • A single N/S trunk (Shoreline Route) lengthens the system and increases the construction cost of the network. • The severity of fog and snow drifting problems (off Lake Winnipeg) are unknown but are expected to be more severe on this route than on an Inner-Shoreline Route. • Potential for flooding (mainly at outlet area of rivers into Lake Winnipeg and at some low-lying swamp or muskeg areas where these are located near the route.	• The inner-shoreline route lends itself better to joint access to Berens River community and to Island Lake communities, using a 'Y' network configuration and a common N/S segment from Bloodvein north. • Several acceptable alternative Berens River bridge crossing sites exist near the confluence of the Berens River and Island Lake diverging route segments • Several kilometers of better drained terrain along N-S and NW/SE segments of rivers	• More distant connection between the all-season route and a lake-ice or interior WR	• Most bridge crossing river widths (Bradbury, Pigeon) are reduced on the Central route compared to the Shoreline and Inner Shoreline routes with less chance of cost escalation(i.e. due partially to unexpected increased span width at construction time) • The river/stream crossings of the Central Route appear to be favoured from an environmental standpoint, reducing the risk of needing in-water piers.	• Any travel connection between winter ice travel on Lake Winnipeg or the existing land based winter road and the Central Route option, is increased because of this route being farther east.

Rank Preference	Shoreline Route	Inner Shoreline Route	Central Route
	1	2	2

Table 4 - 5: Route Comparison Based on Preliminary Route Evaluation; Natural Environment Criteria

Criteria	Indicator	Shoreline Route	Inner Shoreline Route	Central Route
2.1 Terrestrial habitat fragmentation	Size and quality of important habitat traversed (Habitat Suitability Index (HSI km^2))	82.55	72.44	76.63
	Number of caribou tags returned	111	491	1988
2.2 Environmentally significant sites/protected areas	Length and quality of ASI (Areas of Special Interest) /protected areas traversed	0	0	0
2.3 Known species at risk	Number of identified SARA species within 1 km of each side of route option	3	3	3
2.4 Disturbance to aquatic habitat	Number of large watercourse crossings (>30 m)	3	3	3
	Number of small watercourse crossings (>15 m)	11	14	12
	Number of small watercourse crossings (<15 m)	151	142	147
	Number of bridge piers in water	6	4	3
	Area of Wetland (treed) disturbed (ha)	544,375	434,375	261,875
	Area of Wetland (shrub) disturbed (ha)	757,500	566,250	1,071,250
	Area of Wetland (herb) disturbed (ha)	421,875	456,875	608,125
	Total area of wetland disturbed (ha)	1.723,750	1,457,500	1,941,250
2.5 Disturbance to boreal forest	Area of Coniferous forest (dense) (ha)	1,523,750	1,715,625	1,320,625
	Area of Coniferous forest (open) (ha)	275,000	262,500	337,500
	Area of Coniferous forest (sparse) (ha)	64,375	1,875	86,250
	Area of Broadleaf forest (dense) (ha)	37,500	60,625	161,250
	Area of Mixed woods forest (dense) (ha)	438,125	592,500	672,500
	Total area of forest (ha)	2,338,750	2,633,125	2,578,125

Advantages/Disadvantages

Shoreline		Inner-Shoreline		Centre	
Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
• This corridor traverses a significant length of what appears to be well-drained forest soil segment • Shoreline route has the lowest impact on woodland caribou populations based on known movements and habitat suitablity • Route disturbs the smallest amount of forest habitat and total habitat (forest + wetlands).	• Bridge crossings of the Bradbury, Pigeon, and Berens Rivers tend to be wider than those on crossings of the same rivers on the inland routes leading to more in water piers. • Shoreline route has the highest total number of crossings • Shoreline route has the highest HIS for caribou habitat, but tag data indicates the area is not frequented to the same extent as other options	• Inner shoreline disturbs the smallest amount of wetland habitat • Route does not go through any critical habitat • Bridge crossings are shorter than those needed for the Shoreline Route.	• Inner shoreline has moderate impact on caribou populations based on known movements and habitat suitablity • Route passes through the greatest amount of dense coniferous Forest, as well as total forest habitat.	• Bridge crossings (e.g. Bradbury and Pigeon Rivers) are shorter than routes nearer the shore resulting in fewer in water piers	• Central Route has the greatest impact on woodland caribou populations based on known movements and habitat suitablity. • Disturbs significant areas of boreal forest, and disturbs the greatest amount of all forest types except for dense coniferous. • Disturbs the highest amount of total wetland habitat

Rank Preference	Shoreline Route	Inner Shoreline Route	Central Route
	1	2	3

Table 4 - 6: Route Comparison Based on Preliminary Route Evaluation: Social/Cultural Environment Criteria

	Indicator	Shoreline Route	Inner Shoreline Route	Central Route
3.1 Traditional Use Areas	a. Areas of high mineral potential within 5 km of the route	0	0	0
	Proximity to community based crushed rock operations	1	1	1
3.2 Culturally Sensitive Areas/Heritage Resources	Number of heritage/archaeological sites within 5 km of route (does not include assessment from TEK studies)	1	0	0
3.3 Community Infrastructure and Services	Distance to ferry port	10 km	10 km	10 km
	Distance of Berens River crossing to community (as measured from centre of community)	2 Km	17.2 km	16.7 km

Advantages/Disadvantages

Shoreline		Inner-Shoreline		Centre	
Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
• Route is slightly more direct than an inner-shoreline route (70 km vs. 73 km); thus would reduce travel time slightly between Bloodvein and Berens River communities • Has superior potential for marketable timber during clearing of the ASR ROW. • The route provides shorter distance from Berens River crossing to the community centre and therefore potential for a more convenient relief route if existing community bridge is closed. • The Shoreline Route provides less impact on traditional land by maintaining existing access, and creates less impact on trapping and hunting (minimizes disturbance).	• Lengthens the system and increases the costs of the all-season road network (i.e. lengthens connection to Little Grand Rapids and Pauingassi). • There could be a concern with new access of non-Aboriginals to the land for hunting and fishing. • One (1) heritage/archaeological site located outside the project footprint but within 5km of the route. • Greater potential for fog with traffic visibility issues compared to other routes.	• The Berens River / Island Lake junction mentioned above lends itself better to various take-off options to Poplar River, in the event of a future extension of the all-season road to Poplar River. • Decreases the chances of fog and snow drifting being a problem to all-season road traffic compared to Shoreline Route. • If the network is extended to the north and east routing would serve intercommunity travel between Bloodvein, Pauingassi and Little Grand Rapids,; Norway House, Cross Lake, Oxford House communities and the Island Lake communities marginally more efficiently than Shoreline Route • The route does not cross any heritage/archaeological site within 5 km of the route. • Provides shorter connection to Pauingassi and Little Grand Rapids communities.	• Longer access to the Lake Winnipeg shoreline, less accessible to sustenance fishing areas. • More distant connection between an all-season road route and a lake-ice or interior winter road. • Located away from historic winter road route. • Boreal forest provides higher value habitat for woodland caribou, a concern for traditional land use • Longer distance of Berens River crossing to the community centre. • Concern with providing new access to non-Aboriginals to the land for trapping and hunting.	• Access to Pauingassi and Little Grand Rapids communities from the Central Route is shorter than for the Shoreline and Inner Shoreline Route options. • There are no heritage/archaeological sites within 5 km of the route	• Less marketable timber from ROW clearing than along either the Shoreline or Inner Shoreline Routes due to the existence of more peat land where most timber is black spruce and tamarack (non-marketable species). • Any travel connection between winter ice travel on Lake Winnipeg and the Central Route option, is increased because of this route being farther east of Lake Winnipeg. • Longer distance of Berens River crossing to the community centre. • May have greater impact on traditional lands than Shoreline or Inner Shoreline Routes due to greater disturbance to wildlife habitat (caribou). • Concern with providing new access to non-aboriginals to the land for hunting

Rank Preference	Shoreline Route	Inner Shoreline Route	Central Route
	1	3	3

Table 4 - 7: Route Comparison Based on Preliminary Route Evaluation; Capital and Maintenance Cost Criteria

Criteria	Indicator	Shoreline Route	Inner Shoreline Route	Central Route
4. 1. Capital Cost (Class D estimates)	Road construction costs ($M)	$186.0	$183.8	$189.5
	Bridge costs >30m ($M)	$43.1	$27.0	$25.1
	Bridge / Culvert costs <30m($M)	$11.9	$21.8	$13.0
	Culvert costs (small)($M)	$2.8	$2.5	$2.6
	Total Capital Costs ($M)	$243.7	$235.2	$230.2
4.2 Maintenance Costs	Road maintenance costs ($000/yr)	$377	$355.5	$369
	Bridge maintenance costs ($000/yr)	$22	$28	$24

Advantages/Disadvantages

Shoreline		Inner-Shoreline		Centre	
Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
• Intermediate segment of route relatively good, from a construction viewpoint. This segment may keep the overhaul cost down to about the same level as that for the Inner Shoreline Route (uncertain at this time) • The Shoreline Route as mapped, is some $3 million less than an Inner Shoreline Route but may have a higher risk of construction cost escalation. • Right-of-way has higher amount of marketable timber that may be salvaged during construction. • Routing is fairly direct requiring minimal diversion around peat lands.	• An extensive (10 km wide) swamp area (depth unknown) just to the south of Berens River community. A portion of this swamp must be crossed. Thickness of the peat is unknown but it may be thin (i.e. swamp rather than muskeg) but this is uncertain. Length of this segment is 10 km producing, possibly, an additional average haul on bedrock or drift grade fill of +/- 2.5 km or approximately $1.25/m/km overhaul cost on this 10 km segment. • Bridge widths on the Bradbury, Pigeon and Berens Rivers are wider than at upstream locations on the Inner Shoreline Route, particularly the Pigeon River crossing.	• Has some swamp (S) and muskeg (M) segments but they are somewhat shorter, and may involve less expensive overhaul, than the swamp segment immediately south of Berens on the Shoreline Route • Water course crossings are shorter and can be crossed with less expensive structures on all rivers. • Uses several kilometers of route located on better drained terrain along N-S and NW/SE segments of rivers.	• Additional potential costs to accommodate caribou movements and avoid key habitat areas	• Most bridge crossing river widths (Bradbury, Pigeon) are reduced on the Central Route compared to the Shoreline and Inner Shoreline Routes with less chance of cost escalation (i.e. due partially to unexpected increased span width at construction time). • Access to Pauingassi and Little Grand Rapids communities for the Central Route, would not require a second crossing of the Pigeon River.	• Preliminary terrain mapping suggests the central route may have more length of peat land in its corridor. • Additional potential costs to accommodate caribou movements and avoid key habitat areas

Rank Preference	Shoreline Route	Inner Shoreline Route	Central Route
	1	1	1