8.0 SUMMARY AND CONCLUSIONS FOR THE OUTFITTER ROUTE

8.1 Mitigation Measures

WST is committed to sound environmental management. The project description as described by WST in Chapter 3.0 incorporates both standard and project-specific mitigation measures to eliminate or minimize any environmental effects. These measures will be in place throughout highway construction and operation. The various components of WST's environmental management strategy include the Precautionary Principle, incorporation of environmental protection measures (project-specific mitigation), environmental protection planning, rehabilitation of disturbed areas, and environmental monitoring. VEC-specific mitigation measures, as described in each VEC section (Chapter 7.0), are summarized in Table 81.

Table 8.1 VEC-Specific Mitigation Measures

VEC	Mitigative Measures
Raptors	• Vegetation removal restricted to 30 m within the right-of-way. • WST will confer with Inland Fish and Wildlife Division on appropriate mitigations for all active raptor nests within 800 m of the highway. • WST will conduct an annual pre-construction survey for active raptor nests. • No harassment of raptors by project personnel. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes. • Locations of raptors nests will not be released to the public. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.
Waterfowl	• Vegetation removal restricted to 30 m in the right-of-way. • Reduction or avoidance of in-stream activity. • Use of accepted practices for erosion control and slope stabilization. • Drainage to and through wetlands will be maintained to prevent loss of water supply to downslope areas. • No harassment or feeding of waterfowl by project personnel. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • All construction personnel will be required to follow all applicable legislation for hunting and using and storing firearms. • At locations along the highway where active waterfowl nests are present or suspected, maintenance activities will be restricted until eggs have hatched and broods are mobile. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.

VEC	Mitigative Measures
Caribou	• Areas of vegetation clearing and grubbing will be limited to 30 m within the right-of-way. • Blasting will comply with government laws and regulations, and instantaneous peak noise levels minimized by time-delay blasting cycles. • High disturbance activities, such as blasting, will be scheduled to occur outside of sensitive periods such as calving, when caribou are present in the area of construction. • Blasting areas will be surveyed for caribou and other wildlife species, if any wildlife are observed in the immediate areas, blasting activities will be postponed. • Guidelines for mitigating effects of blasting activities on wildlife will be developed in consultation with Inland Fish and Wildlife Division; • Uncontrolled blasting caused by failed discharges or otherwise will be reported immediately to the appropriate authority. • Where uncontrolled blasting results in degradation to terrestrial habitats, mitigative measures as recommended by the regulatory agency responsible will be implemented. • Walls of decommissioned borrow pits will be graded to slopes less than 2:1. • Slopes of the highway will be graded for ease of passage at potential crossing points for caribou. • Vehicles will be operated at appropriate speeds and yield to wildlife. • Project personnel will not chase, harass, or feed caribou. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.
Furbearers	• Vegetation removal will be limited to 30 m within the right-of-way. • Pre-construction surveys for active beaver ponds and maintenance of a minimum 30-m buffer zone around active beaver ponds, where possible. • Instream activity will be reduced or avoided. • Erosion control measures will be implemented. • Drainage to and through wetlands will be maintained to prevent loss of water supply to downslope areas. • Harassment or feeding of furbearers by project personnel will be prohibited. • All construction personnel will be required to follow all applicable legislation for hunting and trapping and using and storing firearms. • Construction camp garbage and refuse will be properly stored and disposed of to avoid attracting wildlife. • All vehicles will yield to wildlife. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.
Fish and Fish Habitat	• Watercourse crossing installation will be carried out in the dry by diverting or pumping water around the construction area. • Pipe arch culverts will be used on many watercourses. • Culverts will be countersunk, where required, to maintain a water depth in the pipe and reduce any drop at the outlet. • Where the existing stream gradient warrants, baffles will be installed in the corresponding culverts to maintain a water depth to facilitate fish passage and provide shelter from flow for smaller fish. • All instream work will be carried out between June 30 and September 1, unless otherwise approved by DFO, to avoid sensitive periods for fish. • Fish removed from de-watered areas will be returned unharmed to the watercourse. • Fording activities will be minimized or avoided, where possible. • A 20-m buffer will be maintained along watercourses, where possible. • Riparian areas that must be disturbed will be stabilized to control erosion. • During right-of-way clearing, a temporary buffer zone will be left in place at each stream crossing until such time as the crossing is constructed. • ARD potential will be investigated along the highway route to identify areas of potential acid generation and areas of acceptable source materials. Additional measures will be defined based on the results of the initial investigation. • Work will be carried out according to regulations, guidelines, and codes of good practice. • Follow-up inspections will be conducted to verify culvert installation and operation. • Specific details will be provided in the construction EPPs.

VEC	Mitigative Measures
Species at Risk	• Prior to construction each day, the right-of-way will be canvassed for any active migratory bird nests. • Any short-eared owl nests found will be left undisturbed until nesting is complete. • Inland Fish and Wildlife Division will be notified if an active short-eared owl nest is encountered. • Vegetation removal will be limited to a maximum of 30 m within the right-of-way. • Highway right-of-way will be located a minimum of 20 m from the shoreline of waterbodies, where possible. • Drainage to and through wetlands will be maintained to ensure continued wetland function. • Removal of riparian vegetation will be restricted to that required for construction of water crossings. • Construction camps, laydown areas and borrow pits will be located outside of riparian zones. • Blasting activities will be coordinated to avoid sensitive areas, such as active nest sites, and sensitive times, such as incubation, and early brood rearing areas. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland and riparian areas wherever possible. • Harassment of raptors (including short-eared owl) and harlequin duck by project personnel will be prohibited. • Locations of raptors nests (including short-eared owl) will not be released to the public. • Vehicles will adhere to established speed limits and will yield to all wildlife. • Instream activity will be reduced and avoided, where possible. • Erosion control or slope stabilization will use accepted practices. • WST will give consideration to using native species in any re-vegetation activities. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.
Geomorphology	• Highway will be designed according to acceptable standards of practice, reflecting the geotechnical characteristics of the native soils and fill materials. • Source materials for highway construction will be tested for acid-generating potential and only materials with less than 0.3 percent total sulphur would typically be used for construction. • Disturbance to eskers and other landforms will be minimized, where possible. • Material obtained from excavations within the right-of-way will be used, where possible. • Number of borrow pits established will be minimized and borrow pit resources will be depleted, where practical, before establishing new borrow pits. • Geotechincal field investigation will be carried out to determine the best design of highway embankments and slopes (areas of cuts and in-fill). • Field investigation will be conducted to examine areas of potential permafrost.
Water Resources	• Water conveyance structures (culverts and bridges) will be designed and installed to accommodate extreme flow conditions and to reduce the potential effects of ice and other blockages. • Bedrock geology along the proposed route has been examined for ARD potential; confirmatory sampling will be conducted and the risk evaluated to determine final alignment and appropriate mitigation to limit ARD. • Watercourse crossing structures will be installed in the dry by diverting or pumping water around area. • Pipe arch culverts will be used on many streams. • Fording activities will be minimized or avoided, where possible. • Proper buffers will be maintained along watercourses, where possible, and riparian areas that must be disturbed will be stabilized to control erosion. • Measures will be taken to control erosion. • Work will be carried out according to regulations, guidelines, and codes of good practice. • Specific details will be provided in the construction EPPs.

VEC	Mitigative Measures
Wetlands	• Highway route will avoid wetlands where feasible. • Vegetation removal will be restricted to 30 m within the right-of-way. • Natural hydrologic regime of wetlands will be maintained using appropriate construction, specifically: – maintaining the same gradient on both sides of the highway; – sizing cross-drainage structures appropriately to take into consideration knowledge of runoff potential, storm frequencies and intensities; – building up ground surface around culvert inlets and outlets to culvert invert elevation to avoid ponding and sediment build-up in culverts or the occurrence of plunge pools; – ensuring all culverts are at least 60 cm in diameter and placed with their bottom half in the upper 30 cm of the soil to handle the subsurface flow and their top half above the surface to handle above ground flow; and – where terrain conditions allow the use of ditches, the natural drainage flow will not be redirected away from wetland areas. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • WST will conduct a field investigation of potential areas for rare or endangered plant species. • Erosion control or slope stabilization will use accepted practices. • WST will give consideration to using native species in any re-vegetation activities. • If construction machinery from outside Labrador is used, it will be washed prior to arrival in Labrador to avoid spread of invasive, non-native plant species. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.
Riparian Habitat	• Highway right-of-way will be located a minimum of 20 m from the shoreline of waterbodies, where possible. • Natural hydrologic regime of adjacent wetlands will be maintained using acceptable construction techniques, including culverts, to ensure natural flows through riparian zones. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding riparian areas wherever possible. • WST will conduct a field investigation of potential areas for rare or endangered plant species. • Erosion control or slope stabilization will use accepted practices. • Riparian vegetation removal will be restricted to the required construction of water crossings. • Fill areas typical of riparian stream approaches will not be grubbed. • WST will give consideration to using native species in any re-vegetation activities. • A 20 m temporary buffer zone of vegetation will be maintained on each side of a stream crossing until such time as subgrade construction begins. • If construction machinery from outside Labrador is used, it will be washed prior to arrival in Labrador to avoid spread of invasive, non-native species. • Construction camps, laydown areas and borrow pits will be located outside of riparian zones. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.

VEC	Mitigative Measures
Historic Resources	• An archaeological aerial field survey will be conducted, while the centre line is being surveyed and cut, to ensure that the correct area was assessed for historic resources. • If the original highway corridor is altered, affected areas will be assessed for historic resources potential. • More detailed investigation will be conducted, after the highway centre line has been surveyed and cut, in areas where forest cover or other factors limited the original survey. • An archaeological survey of laydown areas, construction camps, borrow pits and maintenance depots locations will be conducted prior to any ground disturbance. • If information on Settler and Québec Innu land use becomes available, it will be considered in any further archaeological study. • The PAO will be consulted regarding necessary mitigative measures for sites discovered within the project area. • EPPs will be designed and implemented in consultation with the PAO, including response procedures for inadvertent encountering of archaeological sites or artifacts during construction. • Personnel will be informed, as part of the environmental awareness training, about procedures for handling and reporting archaeological sites. • The contractors will take all reasonable precautions to prevent personnel from disturbing or destroying archaeological sites or artifacts encountered. • The PAO will be informed of any archaeological findings. • Construction activity will cease until an archaeologist from the PAO authorizes work to continue. • In the event that a important archaeological site is encountered on the 40 m right-of-way during future historic resources field assessment or construction, appropriate measures for excavating the site or possibly re-routing the highway will be developed in consultation with the PAO.
Resources Use and Users (not including Innu land and resource use, see Armitage and Stopp (2003))	• WST will commit to meeting relevant terms and conditions of an Innu land claim settlement. • WST will comply with all relevant provincial and federal legislation and regulations (Refer to Table 3.1). • Environmental protection measures for construction and operation, including contingency and emergency response measures, as identified in Section 3.9.3, will be implemented. • Work will be carried out according to relevant WST Specifications (Appendix D of JW/IELP (2003a)). • Harassment or feeding of wildlife during construction will be prohibited. • Any hunting, fishing or trapping activities by project personnel will be carried out according to applicable legislation. • Buffer zones will be maintained around all waterbodies, where possible. • The area disturbed by the project will be minimized (i.e., limiting vegetation clearing to 30 m). • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • Waste from construction camps and maintenance depots will be properly stored and disposed, as approved by the regulatory agencies. If waste is to be disposed in a municipal waste site, approval will be obtained from the local council. • Innu Nation, commercial operators (e.g., outfitters) and other users of the area will be notified about planned project activities. • Mitigation measures for wildlife, fish, the proposed Mealy Mountains National Park, and tourism and recreation will also be implemented.
Akamiuapishku/Mealy Mountains National Park	• Harassment or feeding of wildlife by project personnel will be prohibited. • Vegetation removal will be limited to 30 m within the right-of-way. • A 20-m buffer zone will be maintained around all waterbodies, where possible. • Drainage to and through wetlands will be maintained to preserve the natural hydrological regime. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.

VEC	Mitigative Measures
Tourism and Recreation	• WST will consult regularly with tourism operators regarding project-related activities and scheduling. • Where possible, the transport of personnel, equipment and materials will be scheduled to take place during non-peak periods. • Local administrators will be consulted regularly regarding transportation plans and requirements. • Any hunting, fishing or trapping activities by project personnel will be carried out according to applicable legislation. • Waste from construction camps and maintenance depots will be properly stored and disposed, as approved by the regulatory agencies. If waste is to be disposed in a municipal waste site, approval will be obtained from the local council.
Employment and Business	• WST support of employment and gender equity in its hiring and contracting practices, and commitment to workplace diversity and to maximizing the use of the local workforce and companies to the extent possible. • Highway construction will be carried out through the public tendering process. • WST consultation with relevant provincial and federal government agencies, Innu Nation, local town councils, educational institutions and other relevant organization prior to the start of construction and regularly throughout the course of the project. • During project operation, business groups and government agencies should also work to identify economic opportunities and provide assistance to local individuals and firms to take advantage of them. • Ensuring that local residents and companies benefit from resource development activities that may be induced by the highway (e.g., forestry and mining), which depend on the policies and practices of the various agencies and organizations included in developing and managing the region's natural resources.
Community Life	• WST will commit to meeting relevant terms and conditions of an Innu land claim settlement. • Environmental protection measures for construction and operation, including contingency and emergency response measures, as identified in Section 3.9.3, will be implemented. • Posted speed limits will be lower than the design standards. • Local administrators and other relevant agencies will be regularly informed about project activities and progress. • Measures will be put in place for fire and spill prevention. • Appropriate health and safety planning, measures and equipment will be put in place for construction and operation. • Fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.

8.2 Monitoring and Follow-up Commitments

WST will conduct ECM throughout project construction to ensure that all provisions of the EPP, permits, approvals and authorizations are followed. ECM will assure WST, regulators and the public that standards and regulations are followed. The monitoring programs proposed will allow early detection of any problems and quick response in the event of any failure of planned protection measures. Specific details for ECM will be determined in consultation with the appropriate regulatory agency when the detailed project design is complete and will be included in project-specific EPPs. VEC-specific monitoring measures are described in Table 8.2.

Table 8.2 VEC-specific Monitoring and Follow-up

VEC	Monitoring
Raptors	• Prior to each construction season, a survey for active raptor nests (specifically osprey and bald eagle) will be completed within 800 m of the proposed construction zone. • Appropriate mitigation for active raptor nests will be determined in consultation with the Inland Fish and Wildlife Division.
Waterfowl	• WST will monitor areas for waterfowl and will restrict construction activities as appropriate. • The contractor and WST will be briefed further on waterfowl monitoring during the environmental awareness session.
Caribou	• Limiting areas of vegetation clearing and grubbing to 30 m within the right-of-way. • Blasting to comply with government laws and regulations, and instantaneous peak noise levels minimized by time delay blasting cycles. • Scheduling of high disturbance activities such as blasting to occur outside of sensitive periods such as calving when caribou are present in the area of construction. • Walls of decommissioned borrow pits graded to slopes less than 2:1. • Slopes of the highway graded for ease of passage at potential crossing points for caribou; • Vehicles operate at appropriate speeds and yield to wildlife. • Project personnel will not chase, harass, or feed wildlife. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.
Furbearers	• Minimization of vegetation removal to 30 m within the right-of-way. • Pre-construction surveys for active beaver ponds and maintenance of a 30-m buffer zone around active beaver ponds, where possible. • Reduction or avoidance of instream activity. • Erosion control measures. • Drainage to and through wetlands will be maintained to prevent loss of water supply to downslope areas. • No harassment or feeding of furbearers by project personnel during construction. • All construction personnel will be required to follow all applicable legislation for hunting and trapping, and using and storing firearms. • Proper storage and disposal of construction camp garbage and refuse to avoid attracting wildlife. • All vehicles yield to wildlife. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.
Fish and Fish Habitat	• Resident engineer or ESO will be onsite during highway construction and watercourse crossings construction. • Regular monitoring along the highway route will be carried out to evaluate flow, erosion, debris and sedimentation at watercourse crossings. • Regular monitoring of public use of the highway, including accidents, spills and waste disposal, will occur throughout operation. • All project personnel will be briefed during environmental awareness sessions on minimizing construction effects to fish and fish habitat.
Species at Risk	• The Inland Fish and Wildlife Division will be notified in the event of encounters with active short-eared owl nests. • CWS will be notified in the event of any harlequin duck observations.
Geomorphology	• A field investigation will be conducted, in areas identified as having acid-generating potential, to further assess the condition of the bedrock. • Source materials for highway construction will be tested for acid-generating potential and only materials with less than 0.3 percent total sulphur would typically be used for construction. • Surveillance monitoring for potential acid-generating rock may be required during construction.

VEC	Monitoring
Water Resources	• Field investigations will be undertaken to characterize the nature and geotechnical parameters of materials to be used for highway construction. • Compliance monitoring for water quality will be considered by WST in consultation with provincial and federal regulatory agencies. • Regular inspection and maintenance of all watercourse crossing structures to ensure that they are performing properly. • The Resident Engineer will undertake water monitoring commitments as outlined in the EPPs.
Wetlands	• Highway route will avoid wetlands where feasible. • Vegetation removal restricted to 30 m within the right-of-way. • The natural hydrologic regime of wetlands will be maintained using appropriate construction technologies. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding wetland areas wherever possible. • WST will conduct a field investigation of potential areas for rare or endangered plant species. • Use of accepted practices for erosion control or slope stabilization. • WST will give consideration to using native species in any re-vegetation activities. • If construction machinery from outside Labrador is used, it will be washed prior to arrival in Labrador to avoid spread of invasive, non-native plant species. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response measure in the event of an accidental or unplanned event.
Riparian Habitat	• The highway right-of-way will be located a minimum of 20 m from the shoreline of waterbodies, where possible. • The natural hydrologic regime of adjacent wetlands will be maintained using acceptable construction techniques, including culverts, to ensure natural flows through riparian zones. • Construction vehicles will remain in the right-of-way and ATVs will use designated routes, avoiding riparian areas wherever possible. • WST will conduct a field investigation of potential areas for rare or endangered plant species. • Use of accepted practices for erosion control or slope stabilization. • Removal of riparian vegetation will be restricted to the required construction of watercourse crossings. • Fill areas typical of riparian stream approaches will not be grubbed. • WST will give consideration to using native species in re-vegetation activities. • A 20-m temporary buffer zone of vegetation will be maintained on each side of stream crossing until such time as subgrade construction begins. • If construction machinery from outside Labrador is used, it will be washed prior to arrival in Labrador to avoid spread of invasive, non-native species. • Construction camps will be located outside of riparian zones. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.
Historic Resources	• A pre-construction historic resources survey of the final cut/marked route will be conducted. • Any historic resources encountered during construction will be reported to the PAO. • Project personnel will be briefed on procedures should historic resources be discovered.
Resources Use and Users (not including Innu land and resource use, see Armitage and Stopp (2003))	• Monitoring for biophysical resources will indirectly benefit resource use and users. • WST will cooperate, by providing project-related information, to government departments and agencies responsible for managing biophysical resources and resource use activity. • Regular monitoring of public use of the highway, including accidents, spills and waste disposal, will occur throughout operation.
Akamiuapishku/Mealy Mountains National Park	• No harassment or feeding of wildlife during construction. • Minimize removal of vegetation to 30 m within the right-of-way. • Maintenance of 20-m buffer zones around all waterbodies, where possible. • Maintenance of drainage to and through wetlands to preserve the natural hydrological regime. • Construction vehicles to remain in the right-of-way and ATVs will use designated routes that avoid wetland areas. • Design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.

VEC	Monitoring
Tourism and Recreation	• WST will consult regularly with tourism operators regarding project-related activities and scheduling. • Where possible, the transportation of personnel, equipment and materials will be scheduled to take place during non-peak periods. • Local administrators will be consulted regularly regarding transportation plans and requirements. • Project personnel will be prohibited from harassing or feeding wildlife. • Any hunting, trapping and fishing by project personnel will be carried out according to applicable legislation. • Contingency plans and response measures will be in place for handling any spills of fuel or other hazardous materials.
Employment and Business	• WST will monitor project-related expenditures and labour during the construction phase of the project, including providing numbers on occupations, gender and period of employment for each year of construction. • Monitoring any changes in employment and business activity and identifying potential opportunities for growth during the operation phase of the highway is the responsibility of provincial and federal government departments, local economic development agencies, and other applicable public and private-sector organizations.
Community Life	• WST will cooperate with the various departments and organizations responsible for aspects of community life by providing project-related information as required.

WST's ESO will be responsible for ensuring that requirements outlined in the EPP are followed throughout construction, and conditions of environmental authorizations are met. The ESO will be responsible for ensuring that all personnel are familiar with any identified monitoring requirements and that the outlined practices are followed. Each site will have a Resident Engineer who will be responsible for carrying out any required monitoring and compliance activities on-site, and reporting to the ESO as appropriate. The ESO will hold environmental awareness training sessions prior to the start of construction, conduct any required sampling, carry out inspections, and liaise with appropriate regulatory agencies.

Regular inspection and maintenance will occur throughout operation (e.g., drainage structures will be inspected regularly to ensure that they are functioning properly). At the end of construction, WST will consult with regulatory agencies to determine appropriate monitoring and reporting procedures for operations. Monitoring activities implemented during operation will be reviewed and adapted, as necessary, on an ongoing basis.

8.3 Rehabilitation Measures

WST's mitigation measures include rehabilitation measures designed to reduce or eliminate the effects of construction activities (Section 3.4.2.7). All infrastructure associated with construction camps, laydown areas, borrow pits and other construction sites will be removed when the sites are no longer required. The sites will be rehabilitated according to WST specifications and any permits or approval requirements for rehabilitation. Rehabilitation may include such activities as seeding, sodding or stabilization to prevent erosion. All rehabilitation efforts will be inspected periodically to ensure the required results are achieved.

8.4 Residual Environmental Effects

The significance (negligible (not significant), minor (not significant), moderate (significant) and major (significant)) of residual environmental effects of the project on the selected VECs (after the application of proposed mitigation) are summarized in Table 8.3 and discussed below.

Table 8.3 Summary of Residual Environmental Effects

VEC	Construction	Operation	Accidental Events
Raptors	Not Significant (Minor)	Not Significant (Minor)	Significant (Moderate)
Waterfowl	Not Significant (Minor)	Not Significant (Minor)	Not Significant (Minor)
Caribou	Not Significant (Minor)	Not Significant (Minor)	Not Significant (Minor)
Furbearers	Not Significant (Minor)	Not Significant (Minor)	Significant (Moderate)
Fish and Fish Habitat	Not Significant (Minor)	Not Significant (Minor)	Significant (Moderate)
Species at Risk	Not Significant (Minor)	Not Significant (Minor)	Not Significant (Minor)
Geomorphology	Not Significant	Not Significant	Not Significant
Water Resources	Not Significant (Minor)	Not Significant (Minor)	Significant (Moderate)
Wetlands	Not Significant	Not Significant	Not Significant
Riparian Habitat	Not Significant	Not Significant	Not Significant
Historic Resources	Not Significant (Minor)	Not Significant (Minor)	Significant (Major)
Resource Use and Users	Not Significant (Minor)	Not Significant (Minor)	Not Significant to Significant (Minor to Major)
Akamiuapishku/Mealy Mountains National Park	Not Significant	Not Significant	Not Significant
Tourism and Recreation	Not Significant (Negligible)	Not Significant (Minor)	Not Significant to Significant (Negligible to Major)
Employment and Business	n/a	Not Significant (Negligible)	Not Significant (Minor)
Community Life	Not Significant (Minor)	Not Significant (Minor)	Not Significant (Minor)

The residual effects during construction and operation on raptors are assessed as minor (not significant), while accidental events are assessed as moderate (significant). The magnitude of effects during construction and operation is predicted to be low, with a specific group of individuals in a population in a localized area being affected. During an accidental event, the magnitude of residual effects is unknown and predicted to affect a portion of the population or species dependant on the raptors over one or more generations; however, the frequency of a accidental event is predicted to be less than 10 events per year. The likelihood of such

events occurring is low. Overall, the project is not likely to result in significant adverse environmental effects on raptors.

For waterfowl, the residual effects during construction, operation and accidental events are assessment as minor (not significant). The magnitude of effects during construction and operation is predicted to be low, with a specific group of individuals in a waterfowl population in a localized area being affected. This is also the case for waterfowl during an accidental event. Overall, the project is not likely to result in significant adverse environmental effects on waterfowl or passerine birds.

The residual effects during construction, operation and accidental events on caribou are assessed as minor (not significant). The magnitude of effects during construction and operation is predicted to be low and unknown for accidental effects. Effects of construction, operation and any accidental events will affect a specific group of individuals in a population in a localized area. Overall, the project is not likely to result in significant adverse environmental effects on caribou.

The residual effects during construction and operation on furbearers are assessed as minor (not significant), while the residual effects of accidental events are assessed as moderate (significant). The magnitude of effects during construction and operation is predicted to be low and affect a specific group of individuals in a population in a localized area. During an accidental event, the magnitude or residual effects is unknown and predicted to affect a portion of furbearer populations or populations or populations of other species dependent on furbearer populations over one or more generations. However, the likelihood of any accidental events occurring is low. Overall, a highway along the outfitter route is not likely to result in significant adverse environmental effects on furbearers.

The implementation of effective mitigation and environmental measures will result in minor (not significant) residual effects on fish and fish habitat during project construction and operation. The magnitude of such effects is rated as low to nil. The residual effects of accidental events are assessed as moderate (significant), but the likelihood of such events occurring is low given the construction and design standards, operating and maintenance procedures, and routine monitoring. Overall, the project is not likely to result in significant adverse environmental effects on fish and fish habitat.

For species at risk, the residual effects during construction, operation and accidental events are assessed as minor (not significant). The magnitude of effects during construction and operation is predicted to be low and unknown for accidental effects. Effects will likely affect a specific group of individuals in a population in a localized area. Overall, the project is not likely to result in significant adverse environmental effects on harlequin duck or short-eared owl (species at risk).

The residual effects during construction, operation and accidental events on geomorphology are assessed as not significant. The magnitude of any effects is assessed as low, and not likely to alter geomorphological features along the highway right-of-way in such a way that there is a measurable, sustained degradation in water quality due to exposed AGR, slumping, erosion and /or permafrost disturbance.

The implementation of effective mitigation and environmental measures will result in minor (not significant) residual effects on water resources during project construction and operation. The magnitude of such an effect, is rated as low. The residual effects of accidental events are assessed as moderate (significant), but the

likelihood of such events occurring is low given the construction and design standards, operating and maintenance procedures, and routine monitoring. Overall, the project is not likely to result in significant adverse environmental effects on water resources.

The residual effects during construction, operation and accidental events on wetlands are assessed as not significant. While effects are expected to be continuous through construction and operation, and irreversible, the magnitude of effects during construction, operation and accidental events is predicted to be low. Overall, the project is not likely to result in significant adverse environmental effects that will impair wetland function.

The residual effects during construction, operation and accidental events on riparian habitat are assessed as not significant. While effects are expected to be continuous through construction and operation, and irreversible, the magnitude of effects during construction, operation and accidental events is predicted to be low. Overall, the project is not likely to result in significant adverse environmental effects that will impair the function of riparian habitat.

The residual effects during construction and operation on historic resources are assessed as minor (not significant), while effects due to accidental events are assessed as major (significant). The magnitude of effects during construction is rated as high, because any historic resources encountered would be permanently destroyed. The magnitude of effects during operation and accidental events is predicted to be low, because any disturbance of historic resources would be similar to natural variation. While the frequency of effects is considered low, any effects that do occur (during either phase of the project) will be irreversible. Overall, the project is not likely to result in significant adverse environmental effects on historic resources.

The residual effects during construction on resource use and users are assessed as minor (not significant) during construction. While the effects are likely to be experienced continuously during construction, the effects will be of low magnitude and reversible. During operation, residual effects are also assessed as minor (not significant), but with a higher magnitude. These effects will be experienced throughout highway operation and will likely be irreversible. The residual effects of an accidental event could range from minor (not significant) to major (significant), but the likelihood of such an event occurring is low. However, the potential for sustainable use of resources is rated as medium in the event that an accidental event should occur as the magnitude, geographic extent and reversibility of any effects associated with an accidental event are unknown. Overall, a highway along the outfitter route is not likely to result in significant adverse environmental effects on resource use and users.

The residual effects during construction, operation and accidental events on Akamiuapishku/Mealy Mountains National Park are assessed as not significant. The magnitude of effects during construction, operation and accidental events is predicted to be low. Effects associated with construction and operation are predicted to be irreversible, while it is unknown for an accidental event whether effects would be reversible. Overall, the project is not likely to result in significant adverse environmental effects that will preclude establishment of the Akamiuapishku/Mealy Mountains National Park.

The residual effects on tourism and recreation are assessed as negligible (not significant) during construction and minor (not significant) during operation (assuming that appropriate enforcement and planning is carried out by relevant agencies). During an accidental event, effects the assessed as negligible to major (not

significant to significant) due to the potential of an major accidental effect to disrupt tourism and recreation activity for several years. The magnitude of any effects is predicted to range from low for construction to medium for operation, and will likely be reversible in both cases. For accidental events, the magnitude and reversibility are unknown. Overall, the project is not likely to result in significant adverse environmental effects on tourism and recreation.

No adverse residual effects on employment and business are predicted for the construction phase of the project. The residual effects on employment and business are assessed as negligible (not significant) during operation, and minor (not significant) during accidental events. Residual effects from operations will be short-term, but have no measurable effect on the economy of the affected area. Residual effects from an accidental event will also be short-term, but would affect employment and business activity for one or more years. Again, there would be no measurable adverse effect on the economy of the affected area. Overall, the project is not likely to result in significant adverse environmental effects on employment and business. In most cases, the positive effects of the project on employment and business will compensate for any potential negative effects.

The residual effects during construction, operation and accidental events on community life are assessed as minor (not significant). The magnitude of effects during construction and operation is predicted to be low, and is unknown for accidental effects. There is not likely to be any measurable adverse affect on aspects of community life or the affected community. Effects associated with construction and operation are considered to be reversible, while it is unknown whether effects associated with an accidental event would be reversible. Overall, the project is not likely to result in significant adverse environmental effects on community life.

8.5 Cumulative Environmental Effects

Cumulative environmental effects were considered for each of the VECs assessed. The existing (baseline) environment description for each VEC reflected the effects of past and ongoing human activities on the region's natural and human environments. An overview of past and/or current actions that are likely to interact with those of the project to cause cumulative effects, as well as the effects of these past and/or current actions, was provided for each VEC. Future projects that are likely to proceed were also included in the cumulative effects assessment. Where appropriate, the current status of the VEC due to natural and/or anthropogenic factors was indicated (e.g., a statement is made as to whether a VEC population is declining, stable or increasing). Relevant technical limitations and assumptions were presented in the cumulative effects assessments for each VEC. Cumulative effects significance was evaluated in the same manner as that described for the project-specific effects.

8.5.1 Assumptions

As details regarding the likelihood, nature, location and timing of induced actions were not available to WST, and control of most potential induced actions and related effects was beyond the responsibility of WST, assumptions were made for assessing cumulative effects of induced actions, including:

- other projects and activities will be subject to appropriate planning and management;
- other projects and activities will be subject to the appropriate government requirements (e.g., legislation, regulations and guidelines) for protecting crown resources;

- relevant government agencies will have adequate resources to effectively carry out their mandate with respect to enforcement and planning;
- adherence to existing regulatory requirements will not measurably change; and
- the TLH - Phase III will be designated a protected road and subject to the *Protected Road Zoning Regulations* administered by MAPA.

8.5.2 Existing and Future Projects and Activities

Existing and future planned projects and activities considered in the assessment include those that are ongoing or likely to proceed, and have been issued permits, licences, leases or other forms of approval as specified by the Canadian Environmental Assessment Agency (1994). The environmental assessment also considered the potential cumulative environmental effects of the proposed TLH - Phase III project that may result from future actions potentially induced by the project.

The following existing, planned or reasonably foreseeable future projects and activities were considered in the cumulative environmental effects assessment:

- existing sections of the TLH (Phases I and II);
- other roads in central and southern Labrador;
- Akamiuapishku/Mealy Mountains National Park;
- hydro development, including transmission lines;
- forestry activities;
- tourism and recreation activities, including outfitting operations;
- land and resource use activities, including consideration of improved access, by Innu and other residents of Labrador;
- Voisey's Bay mine/mill development;
- mineral exploration; and
- low-level military flight training.

8.5.3 Existing Management and Planning Processes

Various mechanisms are already in place for carrying out the planning and management necessary for various projects and activities that are already occurring in the region or may potentially occur in the region in the future.

8.5.3.1 Resource Management

Big game and small game hunting, as well as trapping, in Labrador are regulated under the *Wildlife Act* and associated regulations, including the *Wildlife Regulations* and a series of hunting and trapping orders (JW 2003a). The Inland Fish and Wildlife Division of the Department of Tourism, Culture and Recreation is the provincial government division responsible for managing wildlife in Newfoundland and Labrador. The division manages wildlife resources, sets quotas for hunting and issues trapping licenses. The Forest Resources Division of the Department of Forest Resources and Agrifoods is responsible for enforcing the provincial *Wildlife Regulations*. Conservation officers are based in Happy Valley-Goose Bay and district

offices in North West River, Cartwright, Port Hope Simpson and Red Bay, as well as offices in Churchill Falls and Wabush.

Migratory bird hunting is managed by the Canadian Wildlife Service under the *Migratory Birds Convention Act*. All hunting is prohibited in provincial and national parks.

Fish in inland waters in Newfoundland and Labrador are a provincial resource. The federal government, however, has responsibility for regulation and management of the resource, similar to their responsibility in Canadian coastal waters. Regulation is under the federal *Fisheries Act*, which addresses freshwater and anadromous fish under the *Newfoundland Fisheries Regulations* and the *Coastal Fisheries Protection Act*, which regulates saltwater fish under the *Atlantic Fisheries Regulations*. Aboriginal communal fisheries activities are regulated under the *Aboriginal Communal Licence Fishing Regulations* (under the *Fisheries Act*). The province retains control of who has access to inland fisheries, whereby the province determines licencing, guiding, and related requirements for resident and non-residents. Those regulations are under the provincial *Wildlife Act*, which also regulates big and small game hunting.

Newfoundland and Labrador's forests are the responsibility of the Department of Forest Resources and Agrifoods. The proposed TLH - Phase III route crosses FMD19 and FMD20. A Forest Ecosystem Strategy Plan and Five-Year Operating Plan have been prepared for these two FMDs. District representatives worked with external management teams, comprised of industry representatives, general public, government resource managers and other non-governmental organizations, to complete the strategy and operating plans for each district (JW 2003a). The Department of Forest Resources and Agrifoods issues permits and licenses to control the use of forest resources. Conservation officers have the authority to issue permits and enforce the terms and conditions of the permits or licenses.

The *Forest Process Agreement*, signed by Innu Nation and the Government of Newfoundland and Labrador, facilitates Innu involvement in the forest management process, in the absence of a settled land claim (JW 2003a). Labrador Métis Nation participation in forest management in Labrador is facilitated by a Memorandum of Understanding, between the Labrador Métis Nation and the Government of Newfoundland and Labrador.

The Newfoundland and Labrador Department of Mines and Energy is responsible for managing the province's mineral resources, and plays a regulatory role with respect to mineral exploration, mining and quarrying activities in the province. The province's *Mineral Act* governs and regulates the granting of mineral rights in Newfoundland and Labrador. The *Mineral Regulations* define the procedures and rules for holding and maintaining mineral rights in the province. The *Environmental Guidelines for Construction and Mineral Exploration Companies* also apply to mineral activities in the province.

The TLH - Phase III will also be subject to the terms and conditions of the Innu land claim settlement, currently being negotiated between Innu Nation and the governments of Canada and Newfoundland and Labrador. Under a land claim agreement, it is likely that the Labrador Innu will have more control over land and resource use decisions and regulation (Armitage and Stopp 2003). It will establish a framework for land and resource management in the settlement area.

8.5.3.2 Planning and Development

There are a number of planning processes in place to address various of aspects of resource use. The municipal planning process under the *Urban and Rural Planning Act, 2000* provides the means for incorporated municipalities to prepare municipal plans outlining land use designations and defining the manner in which development may occur within the municipality. The municipal plan and development regulations are legal documents and are binding on the municipality, council and others using or proposing to use land in the municipality. Public consultation in the municipal planning process is required under the act. A development permit is required for any development within the municipality and the development must be carried out according to the municipal plan and associated development regulations. The *Urban and Rural Planning Act, 2000* also has provisions for regional and protected area planning.

Similarly, a development permit is required for any development within the building control lines established for a protected road. Building control lines for protected roads are 400 m on either side of the highway as measured perpendicular from the highway centre line, except for the following:

- within the municipal boundary of an incorporated municipality, the building control line is 100 m from the centre line;
- outside the municipal boundary, but within the municipal planning area, the building control line is 150 m from the centre line; and
- within an unincorporated municipality, the building control line is 400 m from the centre line or as set by an interim or approved protected road zoning plan.

Protected road zoning plans currently being prepared for Routes 500 (Phase I of the TLH) and 510 (Phase II of the TLH) will identify the type of development permitted and locations where it is permitted along the highway corridor (JW 2003a). Public consultation is also required for these plans. In addition, the *Protected Road Zoning Regulations* also outline the type of development that may be considered within the building control lines of a protected road.

Development within the protected road corridor, including any cabin development within the corridor, is subject to permitting and enforcement by the Department of Government Services, specifically the Government Services Centre. Cabin development outside the protected road corridor is the responsibility of the Crown Lands Administration Division of the same department. Any cottage lot development plans that the division may prepare are subject to environmental assessment and a Crown Land Application must be submitted (and permit obtained) for any individual cabin development involving crown land. Both staff with the Land Management Division and Department of Forest Resources and Agrifoods' Conservation Officers are responsible for enforcement. Management and enforcement measures are outlined in the *Lands Act*. Under the act, structures placed on crown land without the proper grant, lease or license can be removed.

Tourism and recreation, including outfitting operations, in the province are within the mandate of the Department of Tourism, Culture and Recreation. The department is involved in various aspects of the province's tourism industry, including: advertising and communications; product development; touring and travel trade; visitor services; regional support; and special celebrations. It is also involved in regulating tourism operations, including outfitting operations, in the province under the *Tourist Establishments Act* and *Tourist Establishment Regulations*. All operators of tourist establishments in the province are required to

be licenced. The regulations also include specific guidelines and requirements for certain types of tourism establishments in the province. There is currently a freeze on the development of new lodges on rivers in Labrador (T. Kent, pers. comm.).

There are also formal processes in place for establishing national parks and heritage rivers, both of which are coordinated by Parks Canada. Recognition of a park under the *National Parks Act* brings with it defined management responsibilities and rules regarding resource use. Similarly, management plans for heritage rivers outline resource protection measures, appropriate resource use activities, strategies to maintain ecological integrity and monitoring. Both of these planning processes provide opportunity for public involvement and consultation.

Provisions for establishing Special Management Areas are outlined in the provincial *Lands Act*. This measure was used to protect lands within the area of the proposed Torngat Mountain National Park, until the park is officially established (Government of Newfoundland and Labrador 2000). The Special Management Area for the Torngat Mountains was established through a MOU between the Government of Newfoundland and Labrador and the Labrador Inuit Association. Under the agreement, commercial and industrial development are prohibited. The Special Management Area is administered by the Department of Tourism, Culture and Recreation.

The forestry management planning process involves various user groups in the planning process, including industry representatives, the general public, government resource managers and non-governmental organizations. In addition, forestry management plans are also required to be registered under the *Environmental Protection Act* and, as a result, are subject to government and public review under this process.

These planning processes (municipal and regional planning, protected road zoning plans, forest management planning, national park planning and heritage river management planning) all require some form of public consultation (JW 2003a). Thus, there is further opportunity for Labrador residents and others to have input into further planning and development.

8.5.4 Experience with TLH - Phases I and II and Others Roads in Labrador

Comments from the public open houses conducted as part of the environmental assessment indicate that many residents are generally pleased with the benefits offered by the TLH - Phase II. Experience with previous highway development in Labrador provides some indication of the type of activities that may occur along the TLH - Phase III.

8.5.4.1 Cabin and Lodge Development

Both the Phase I and Phase II portions of the TLH have been designated as protected roads and protected road zoning plans are being prepared for both sections of highway. As noted above, this designation and associated management plans provide a means for controlling development along the highways. However, there are reports of development having occurred along both the Phase I and II portions of the TLH.

In the section of Churchill River from Gull Island to Churchill Falls (along the Phase I portion of TLH), private cabins are being built and anglers are experiencing good fishing for brook trout and ouananiche (W. Maclean, pers. comm.). Armitage and Stopp (2003) indicate that, of a total 1,248 cottages in Labrador, 462 were located within 1 km of a road.

New lodge development has occurred along the Phase I portion of the TLH between Happy Valley-Goose Bay and Western Labrador. In the Labrador Straits, a number of outfitting operations currently exist in very close proximity to the highway, and the ability to access these camps directly by road has allowed these operations to offer fishing packages at somewhat lower prices than those who rely on air transportation (JW 1998).

8.5.4.2 Resource Harvesting

Increasing trapping activity has been noted along the Phase I portion of the TLH, as well as dust covering vegetation along the route (Innu Nation 2002). Increased incidences of trapping along roadways has occurred around other roads in Labrador, including the Grand Lake Road and Orma Road located along the eastern edge of the Smallwood Reservoir.

Following construction of the highway through the Labrador Straits, there was an influx of anglers from the island of Newfoundland when Atlantic salmon quotas were changed to permit fishers in Labrador to retain one large salmon, resulting in overcrowding along the Pinware, Forteau and other rivers in the region. This eventually resulted in a requirement to implement fish quotas and retention regulations for the Labrador Straits similar to those for the island of Newfoundland (JW 1998).

There has also been an increase in the number of anglers fishing newly accessible areas associated with the construction of the Phase II portion of the TLH. C. Poole (pers. comm.) notes that angling activity has increased (as much as tripled) with the completion of Phase II. Correspondingly, the number of patrols by conservation officers and the number of charges laid have probably doubled. Anglers frequenting the area are mainly from communities in southern Labrador. Others were from the island of Newfoundland, the maritime provinces, Québec and from outside Canada.

Due to the expected influx of anglers as a result of the TLH - Phase II, nine previously unscheduled rivers (including the Paradise River) in Southern Labrador were scheduled and given Class III designations in 2001 for salmon conservation purposes (DFO 2002). In addition, special trout management plans (i.e., reduced daily bag limit and possession limit) were put in place for Gilbert's Lake and Chateau Pond in Southern Labrador to protect brook trout. These plans were put in place in response to the anticipated increase in angling pressure that may result from the completion of the Phase II portion of the TLH (B. Slade, pers. comm.).

8.5.5 Managing the Effects of Induced Development and Activities along the TLH - Phase III

Assuming that the relevant agencies have adequate resources to effectively carry out their mandate with respect to enforcement and the other assumptions (listed in Section 8.5.1) made with respect to induced actions are met, no significant adverse environmental effects, including cumulative effects, are identified for the TLH - Phase III project. While increased use of the area may result due to the improved access provided

by the highway, the planning and control measures in place by various agencies to govern activities and development that may be carried out in the area act to reduce the potential adverse cumulative effects.

While there are appropriate management mechanisms and planning processes in place, these tools are only effective if the relevant agencies have the capacity or means to implement and enforce the various management requirements.

8.5.5.1 Capacity of Resource Management Agencies

The deficiency statement states, *although planning and control measures are available to regulate activities associated with increased access, in the opinion of several agencies current resources are not believed adequate to enforce such regulations, considering the difficulties associated with enforcement across the large, sparsely populated area along the highway corridor* (p. 3). Several agencies were contacted in regard to the proposed TLH - Phase III and asked if they believed they lacked the resources to fulfill their mandate, at least at current levels. Agencies responsible for implementing and enforcing various legislation and regulations with respect to development and resource use activities contacted include:

- Department of Environment, Water Resources Management Division;
- Department of Government Services and Lands;
- Department of Forest Resources and Agrifoods
- Department of Fisheries and Oceans; and
- Environment Canada, Environment Protection Branch.

Based on the results of these contacts, no formal requests were submitted to the regulatory agencies in an attempt to verify the statement from Page 3 of the deficiency statement. The Canadian Wildlife Service was also contacted.

Some agencies recognized their limited capability and the need to reassign or redistribute available resources. In addition, actions by some agencies indicate that they are taking steps to identify and respond to potential concerns that may result in relation to highway development. For example, DFO has commenced program modifications to regulate and mitigate the potential for depletion of the brook trout resource. The deficiency statement (Appendix A of the addendum to the preferred route EIS/CSR) provided to WST in April 2003 states: *Regarding the need for increase management measures to address potential effects on fish resources, DFO recognizes that new management approaches will be required to address the issues arising from Phase III of the Trans Labrador Highway. A regulatory amendment which will allow individual species management (in contrast to the current multi-species approach) is anticipated to be in place this year, and this will be a key component of DFO's management strategy for this area. In the fall of 2003, DFO will begin consultations with user groups, including aboriginal groups, in the development of its new five year management plan. DFO commits to the maintenance of aboriginal access to the resource for food, social and ceremonial purposed. The department has already had preliminary discussions in Goose Bay with the Labrador Salmonid Advisory Committee, which represents all major user groups. Key items discussed included the need for the development of a long-term management plan prior to the completion of the highway, monitoring and enforcement capacity, and the importance of education and public awareness in reducing the potential for detrimental effects on the fishery.*

Likewise, the deficiency statement also notes that the recently completed forest management plan for District 19A outlines objectives for forest management in the district and the *harvesting guidelines specific to District 19 offer significantly more habitat protection than is seen [in] other jurisdictions* (p. 11).

8.5.5.2 Assuming a Lack of or Inadequate Resources for Enforcement

In the event that there is a lack or inadequate level of resources for enforcement, the cumulative environmental effects that may result due to induced development and activities would likely be different from those identified under the set of assumptions presented in Section 8.5.1.

Without proper application of the management and planning processes and related enforcement requirements, it is expected that there would be some level of uncontrolled activities and development occurring along the highway, such as:

- uncontrolled development activity and side roads may occur along the highway;
- ATV and other trails being developed off the highway to provide access to cabins, rivers and/or lakes;
- uncontrolled cabin development along and off the highway;
- uncontrolled hunting, trapping and fishing activity;
- disruption of current land and resource use patterns of Innu and other current users;
- startup of unlicenced outfitting camps along the highway;
- uncontrolled mineral exploration activities; and
- uncontrolled forestry activity, both commercial and domestic.

The concern regarding the inability of the appropriate departments or agencies to fulfill enforcement requirements and the associated potential results is applicable to both the preferred and outfitter routes. However, as noted, the outfitter route is less likely than the preferred route to be included within the final boundary for the national park. Therefore, the area in the immediate vicinity of a highway along the outfitter route would not benefit from the resource protection offered by a national park.

In the absence of a land claim settlement, Innu Nation has been involved in the forestry management planning process that has been established for District 19A (i.e., the area which includes the western portion of both the preferred and outfitter routes). The management plan outlines objectives for forest management in the district and, as noted in the deficiency statement for the EIS/CSR completed for the preferred route, the *harvesting guidelines specific to District 19 offer significantly more habitat protection than is seen [in] other jurisdictions*. Forest management plans are subject to the provincial environmental assessment process, which provides for government and public review and input. The five-year operating plan for District 19A was released from the provincial environmental assessment process on May 23, 2003. As a condition of release, the Department of Forest Resources and Agrifoods was required to prepare a human resource plan and conduct employment monitoring.

The TLH - Phase III will also be subject to the terms and conditions of the Innu land claim settlement, currently being negotiated between Innu Nation and the governments of Canada and Newfoundland and Labrador. When the Innu land claim is settled, it will establish a framework for managing area land and resources within the land claim settlement area.

While mineral exploration is not subject to environmental assessment, permits and/or licences are required and regulations and guidelines are in force. Any resulting mining developments are subject to environmental assessment and monitoring under provincial approvals and the federal *Metal Mining Effluent Regulations*. Likewise, any hydroelectric power development would also be subject to both the provincial and federal environmental assessment processes. Therefore, any mining or hydroelectric power developments are not expected to occur in an uncontrolled manner without proper regulation and enforcement.

For socio-economic aspects, such as tourism and recreation, employment and business, and community life, cumulative effects associated with uncontrolled activities and development may be both positive and adverse, depending on the perspective of the various resource user groups. For example, any employment or business generated due to new activities along the highway would most likely be viewed favourably among local residents, but if any new businesses replace the services offered by existing tourist operations, they could potentially affect the viability of an existing operation.

For those activities or developments that are not subject to the environmental assessment process, permitting, licensing or other regulatory mechanisms could be required. Permits and licences may outline terms and conditions, but in the event permit or licence holders do not adhere to those requirements, it would pose a concern for both the preferred and outfitter routes in the absence of proper enforcement or adaptive management (e.g., adjusting quotas).

In a case where relevant government agencies do not have the resources to adequately carry out their mandate, it is conceivable that inspections and prosecutions will be reduced and accidents and violations increased as a result. If future projects and/or activities are not managed appropriately or, if government agencies do not have sufficient resources to effectively manage or implement and enforce their respective mandates, a major (significant) cumulative environmental effect may result to caribou, and moderate (significant) cumulative environmental effects may result to raptors, waterfowl, furbearers, fish and fish habitat, resource use and users, and tourism and recreation. Minor (not significant) cumulative environmental effects may result to species at risk (specifically short-eared owl and harlequin duck), employment and business, and community life.

Not significant cumulative environmental effects are expected to result to geomorphology, wetlands and riparian habitat. Significant cumulative environmental effects may result to the Akamiuapishku/Mealy Mountains National Park study area.

8.5.6 Recommendations

The Canadian Environmental Assessment Agency (1997) indicates that due to the uncertainty and dispersed nature of induced activities, they are best addressed through a regional land use planning process that involves the relevant regional agencies. The environmental assessment for the TLH - Phase III could provide a resource that may be used by the relevant agencies to develop an appropriate framework for planning for and managing induced development and activities along the TLH - Phase III and in the surrounding area. Agencies may also need to review and adapt existing management policies and programs to ensure that they are appropriate for the region and the type of development and activities that may occur in the region. There may also be a need for agencies to adjust resource levels to meet any changes in development and activity levels.

Tourism Company/Rodger Todhunter & Associates (1997), in their tourism impact assessment of the TLH - Phase II, suggest that the Dempster Highway provides a suitable model for addressing induced development and other activities associated with a highway development in a remote area. Development regulations were put in place to control land use within an 8-km corridor on either side of the Dempster Highway. This was followed by the establishment of a management planning process that involved the Yukon First Nations. The planning process involved: preparing an inventory of land uses and resources (natural, flora, fauna, heritage, mineral, and oil and gas); developing guidelines for managing resources within the corridor; preparing management options; public and First Nations consultation; and developing a management strategy.

Similar strategies are now being used to manage and plan for access into wilderness areas. For example, in southeastern British Columbia, a recreation management strategy is being developed as part of the Southern Rocky Mountain Management Plan. The planning process involved a stakeholder committee, which included commercial and non-commercial interests in the affected area, and public consultation (Matthews and Quinn 2003).

As there is not one sole government agency responsible for managing resources and access, then a cooperative approach would allow all aspects to be considered within the same framework. Interagency coordination and involvement of key stakeholder groups are critical elements for any management and planning process.

8.6 Summary and Conclusions

The environmental assessment of the TLH - Phase III project has considered two route alternatives, a preferred route, as presented in JW/IELP (2003a), and an alternative route, referred to as the outfitter route and the subject of the environmental assessment presented in this report. A comparison of key features of both routes was presented in Section 2.3 and summary of features in Table 2.7. The characteristics listed in Table 2.7 were considered in the environmental effects analysis for both the preferred and outfitter routes.

8.6.1 Environmental Effects Assessment Conclusions

Based on the environmental effects assessment presented for the outfitter route in Chapter 7.0 and the preferred route (Chapter 6.0 of JW/IELP 2003a), both of which take into consideration the mitigation measures identified for the project, overall project construction and operation are not likely to result in significant adverse residual environmental effects on any of the VECs identified for the environmental assessment. The potential residual effects of accidental events that may occur on either the outfitter or preferred route, depending on the nature, timing and duration of the events, may range from negligible (not significant) to major (significant). However, the potential for an accidental occurring at anytime during the project (outfitter or preferred route) is low.

No significant adverse cumulative effects have been identified for either the preferred or outfitter route as proposed for the TLH - Phase III project. While increased use of the area may result due to the improved access provided by the highway, the planning and control measures in place by various agencies, to govern other activities and development that may be carried out in the area, act to reduce the potential adverse cumulative effects.

Subsection 16(2)(d) of CEAA indicates that a comprehensive study must consider the capacity of renewable resources, that are likely to be significantly affected by a project, to meet the needs of the present and those of the future. As the proposed project is not likely to cause significant adverse environmental effects, there are not likely to be adverse effects on renewable resources that will reduce the capacity of any resources so that the needs of future generations are compromised.

Sustainable development seeks to ensure that the needs of the present are met without reducing the ability of future generations to fulfill their needs (World Commission on Environment and Development 1987). The TLH - Phase III project will not change the capability of natural systems to maintain their structure and functions, and support biodiversity. The ability of future generations to use renewable resources will not be compromised. While there area likely to be minor (not significant) effects during project construction and operation, the highway will have positive socio-economic contributions at both the local and regional level. Many of the potential effects on employment and business, and community life are predicted to be positive.

The mitigation measures outlined for the project (Table 8.1) will be in place throughout the project, ensuring that the objectives of sustainable development, as noted in the guidelines, are outlined. The monitoring and follow-up initiatives (Table 8.2) indicate WST's commitment to further action and working with mandated agencies.

8.6.2 Evaluation and Selection of Route Alternative

As noted at the open houses held for the environmental assessment, there is a strong desire to see the TLH - Phase III completed. However, there are also strong positions regarding the possible route alternatives and differing stakeholder interests. The outfitter route was assessed as an alternative to the preferred route after being identified by the Newfoundland and Labrador Outfitters Association.

Based on the environmental assessment of the biological VECs, no constraints have been identified that apply to one route more than the other. The assessment predicts that there will be minor (not significant) effects to the environment resulting from the construction and operation of the road. More severe induced effects of other activities are possible; however, the severity of the effects depends on the assumptions that are made regarding future activities and interactions with the road.

Based on the socio-economic VECs that were examined, no great differences were determined for the effects of the preferred and outfitter routes. There will be positive benefits to employment and business, and minor (not significant) effects to other socio-economic VECs (i.e., resource use and users, and tourism and recreation) for either route. The minor (not significant) effects that have been concluded address the wider socio-economic picture, with individual stakeholder interests being considered in the balance. While the highway will not preclude the establishment of the Akamiuapishku/Mealy Mountains National Park, the park itself would afford protection to many of the VECs.

Given that WST will apply the same best available technology and practice to the construction and operation of the TLH - Phase III (preferred or outfitter route), there are no differences between the two routes that preclude the highway from being constructed along the preferred route. As the purpose of the TLH-Phase III is to complete a reliable and cost-effective all-season, ground transportation system in Labrador that provides a link between communities in western Labrador with those of southern Labrador, the decision then

is logically based on cost-effectiveness. Taking into consideration the lower cost for constructing the preferred route (note that the outfitter route costs $7.5 million more to construct, plus $4.5 million for an additional year of ferry service), and the fact that a highway along the preferred route will be cheaper to maintain and will present a lower cost transportation alternative for users, WST intends to proceed with construction of the TLH - Phase III along the preferred route as outlined in JW/IELP (2003a).

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APPENDIX A

Environmental Impact Statement/Comprehensive Study Report Guidelines

GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR
Department of Environment

Honourable Kevin Aylward
Minister

December 2002

G U I D E L I N E S

for

Environmental Impact Statement

(Pursuant to Part X of the Newfoundland and Labrador *Environmental Protection Act*)

and

Comprehensive Study

(Pursuant to the Canadian Environmental Assessment Act)

Cartwright Junction to Happy Valley-Goose Bay Trans Labrador Highway

Proponent: Department of Works, Services and Transportation

INTRODUCTION

The Department of Works, Services and Transportation has been required through the provincial environmental assessment process to prepare an Environmental Impact Statement (EIS) for the Trans Labrador Highway (TLH) between Cartwright Junction and Happy Valley-Goose Bay, Labrador. The purpose of the EIS is to describe present environmental conditions, identify the potential environmental effects associated with the proposed undertaking, to identify appropriate mitigative measures and the significance of any residual environmental effects. Component Studies shall be carried out to address baseline information gaps for particular Valued Ecosystem Components (VECs). The EIS shall contain a review of all available pertinent information as well as such additional new information or data as provided by the proponent or requested by the Minister of Environment. The contents of the EIS will be used by the Minister of Environment, in consultation with Cabinet, and with the Innu Nation in accordance with a Memorandum of Understanding signed by the Ministers of Environment and Labrador and Aboriginal Affairs, to determine the acceptability of the proposed project based on its anticipated impacts, proposed mitigation, and significance of residual effects. The EIS shall also be used to address the requirements of a Comprehensive Study Report (CSR) pursuant to the Canadian Environmental Assessment Act, and a subsequent decision on the project by the federal Minister of Environment. The EIS shall be as concise as possible while presenting the information necessary for making an informed decision.

The undertaking is subject to a cooperative environmental assessment that will meet the requirements of both the Newfoundland and Labrador *Environmental Protection Act* and the Canadian Environmental Assessment Act (CEAA). The Department of Fisheries and Oceans (DFO) is the Lead Responsible Authority (RA) for the CEAA assessment since there is a requirement for approvals under the Navigable Waters Protection Act (NWPA) and the potential for issuance of Fisheries Act authorizations. Environment Canada, Parks Canada and Health Canada are other Federal Authorities who are providing expert advice to DFO on the environmental assessment.

As more specific information is provided and as additional baseline information is gathered, other concerns and potential effects may be required to be considered by the Minister as recommended by the Environmental Assessment Committee.

The proponent shall hold public information sessions in the communities of Happy Valley-Goose Bay, North West River/Sheshatshiu, Port Hope-Simpson and Cartwright.

The EIS shall also assess the location of the road with reference to the Innu Land Claim currently under negotiation between the federal and provincial governments and the Innu Nation. The EIS must acknowledge that, when a land claim has been settled and lands

selected, the proponent will abide by the terms of whatever arrangements are contained within the settlement.

The proponent shall initially submit 20 paper copies of the EIS and 20 electronic copies on compact disks. Additional copies may be required depending on demand. In addition, an electronic copy suitable for posting on the Department website is required. All electronic copies must comply with the Department's Guidelines for Preparing Computerized Copies of Environmental Assessment Documents.

The contents of the EIS should be organized according to the following format and address the identified information requirements:

1. EXECUTIVE SUMMARY

The executive summary shall contain the following information: identification of the proponent; a detailed project description; a description of the present environmental baseline conditions (including environmental change agents other than the project), a discussion of predicted significant environmental effects; mitigative measures; residual effects; cumulative effects; an outline of the component studies; proposed monitoring programs and a summary of the fundamental conclusions of the EIS. Key public and stakeholder concerns identified during the public information sessions shall also be summarized. The executive summary will allow reviewers to focus immediately on areas of concern.

The summary shall be written in terms understandable to the general public and it shall include a Table of Concordance which will identify where specific Guideline requirements are addressed in the EIS. Sufficient quantities of the Executive Summary and as necessary, key sections of the EIS, shall be made available in Innu-aimun to allow for meaningful review of the EIS by members of the Innu Nation.

2. INTRODUCTION

2.1 Name of Undertaking

The undertaking has been assigned the Name "Cartwright Junction to Happy Valley-Goose Bay Trans Labrador Highway." The proponent should identify the name which it proposes to use for the undertaking.

2.2 Identification of Proponent

Name the corporate body and state the mailing address.

Name the chief executive officer and state the official title, telephone number, fax number and e-mail address.

Name the principal contact person for purposes of environmental assessment and state the official title, telephone number, fax number and e-mail address.

2.3 Purpose of the Environmental Impact Statement

The purpose of the Environmental Impact Statement is to report on the results of the process by which the change in the present or future environment that would result from an undertaking is predicted and evaluated before the undertaking has begun or occurred.

3. THE PROPOSED UNDERTAKING

3.1 The Prospective Site and Study Area

A precise description of the preferred and alternative routes for the highway is to be presented, accompanied by maps of an appropriate scale showing the entire area of each alternative with:

- principle structures and appurtenant works; and,
- kilometers (km) of road and types and quantities of hectares (ha) of habitat to be disturbed.

A description of the study area shall be presented to describe the setting in which the undertaking is proposed to take place. This description shall integrate the natural and human elements of the environment in order to explain the interrelationships between the physical and biological aspects of the environment and the people and their communities. The study area boundaries shall be determined in relation to:

- the physical extent of the highway and any alternatives;
- the extent of aquatic and terrestrial ecosystems potentially affected by the highway;
- the extent of land use for subsistence, commercial, cultural, recreational, spiritual and aesthetic purposes by Aboriginal and non-aboriginal persons and communities which may be affected by the highway; and

- the zones of economic impact, including local and regional effects, of the highway.

The descriptions shall be presented according to the appropriate spatial scale (large landscape to site level) which best illustrates the interactions between the project and the environment being described. Temporal data necessary to establish normal parameters, trends and extremes shall be integrated into the description of the study area where appropriate.

The information on the alternative routes and extent of the project study area is to be considered for a digital form on computer discs in a format suitable for incorporation in a Geographic Information System (GIS). Maps should be at a 1:50,000 scale and possibly in ARC shape format. As a minimum, the information is to consist of sufficient number of geographic coordinates of point locations, line locations and/or spatial extent, as appropriate, of the features at the selected map scale and projection to either re-create the hard-copy versions provided as part of the EIS or to accurately display the features digitally. (Information already available on the National Topographic maps need not be provided.) The information must be organized and labeled such that each unique feature is distinguishable from all others. Appropriate descriptive parameters of each data set such as projection, UTM Zone, datum and data collection method (e.g., GPS, aerial survey, etc.) must also be included. The format should be in ASCII tabular format or in a spreadsheet or database format such as Lotus 1-2-3, Excel, dBase or similar software.

3.2 Rationale/Need/Purpose of the Project

The rationale for the project shall describe its perceived benefits, both local and provincial. If the undertaking is in response to an established need, this should be clearly stated.

3.3 Alternatives

3.3.1 Alternatives to the Project

This section shall describe functionally different ways to meet the project need and achieve the project purpose. The discussion shall address, but not necessarily be limited to, other modes of transportation and the null (do nothing) alternative.

3.3.2 Alternative Methods of Carrying Out the Project

This section shall detail the process the proponent undertook to determine potential corridors, including discussion of all alignments considered. The proponent's

public consultation process shall be described and relate the project alternatives to the results of the consultations.

A detailed discussion of technically and economically feasible alternatives, and the environmental and socio-economic selection criteria (e.g., construction costs, fuel savings, technical factors) for the alternatives shall be provided. The discussion shall include, among other things, routing, location, design, construction standards, maintenance standards, watercourse crossings, etc., which were or could have been considered.

The proponent must specifically include the route identified by Innu members after the proponent's consultations with the Innu community as one of the alternative methods of carrying out the undertaking.

The proponent must specifically include the route identified by the Newfoundland and Labrador Outfitters Association members after the proponent's consultations with the outfitters as one of the alternative methods of carrying out the undertaking.

Alternative routing criteria discussion shall include, but is not limited to:

- avoidance of wetland areas;
- avoidance of adverse effects and enhancement of benefits on existing or potential tourism operations;
- avoidance of environmentally sensitive areas;
- avoidance of additional stress on land and resources through increased access;
- avoidance or reduction of effects on Innu land use;
- avoidance or reduction of effects on the proposed Akamiuapishku/Mealy Mountain National Park; and
- avoidance or reduction of effects on Woodland Caribou (Red Wine and Mealy Mountain herds).

If only one alternative is viable or possible, a statement will be made to this effect with supporting argument. Additional information on any alternatives which may have been considered and rejected, but which may still be regarded as viable should be provided. Reasons for the rejection of those alternatives will be stated.

3.4 Relationship to Legislation, Permitting, Regulatory Agencies and Policies

The EIS shall identify and discuss the project within the context of all existing relevant legislation and policies (municipal, provincial and federal). The proponent shall provide a comprehensive list of permits and regulatory approvals required for the undertaking. The list shall include the following details:

- activity requiring regulatory approval;
- name of permit and/or regulatory approval (eg. authorization).;
- legislation requiring compliance; and
- regulatory agency.

3.5 General Project Description

The EIS shall describe the scope of the undertaking for which an assessment is being conducted.

The EIS shall provide a written and graphic description (e.g. maps and drawings) of the physical features of the undertaking particularly as it is planned to progress through the construction and operation phases of its lifespan. The description should also address other phases of the project as can reasonably be foreseen, including modification, decommissioning and abandonment. Any assumptions which underlie the details of the project design shall be described, including impact avoidance opportunities inclusive of pollution prevention, and adherence to best management practices. Where specific codes of practice, guidelines and policies apply to items to be addressed, those documents shall be cited and included as appendices to the EIS, including mapping at an appropriate scale. Physical features include, but are not limited to:

- highway corridor location: ultimate boundaries of the proposed corridor and highway route in a regional context in relation to existing and proposed land uses and infrastructure such as road networks, trails, power lines, proximity to settled areas, individual and community water supplies, Innu land use areas, proposed or contemplated protected areas, wetlands, ecologically sensitive areas and archaeological sites shall be described;
- roads;
- right-of-way;
- intersections;
- stream crossings;
- temporary stream diversions;
- temporary construction camp(s), laydown areas;
- borrow pits and major excavations; and
- temporary sewage and waste disposal facilities.

3.6 Construction

The details, materials, methods, schedule, and location of all planned construction activities related to the physical features shall be presented including estimates of magnitude or scale where applicable. This is to include but not be limited to, the following:

- specific construction practices incorporating erosion and sedimentation control;
- construction schedule, including proposed time frames for right-of-way clearing, slash disposal, highway construction and construction adjacent to watercourses;
- site preparation (ie., grubbing/clearing of right-of-way, cut and/or fill operations, etc.);
- subgrade construction;
- stream crossing structures: location of watercourse crossings and their proposed infrastructure (e.g., bridge, culvert) as well as any feasible alternatives; their proposed specifications (e.g., clearance from watercourse, height, width, length, diameter); partial causeways and their infill area or footprint together with design criteria and standards; length, width, cross section and estimated types and amount of fill material required; best practices to be employed; and, all applicable regulatory requirements;
- instream activities (i.e., scheduling, duration);
- proposed structures, design features or construction practices intended to mitigate impacts on terrestrial species or habitats (e.g. wildlife corridors, wetland crossings, etc.);
- proposed structures, design features or practices to manage visual and noise impacts of construction activities;
- proposed methods for controlling dust from construction activities;
- excavations;
- blasting operations;
- vehicle types, truck routes, hours of operation of vehicles;
- transport, storage and use of hazardous materials, fuels, lubricants and explosives;
- establishment, operation and removal of construction camp and yard areas;
- sources and estimated volumes of acceptable types of aggregate and pit-run material with identification of any currently known sources likely to be used;
- methods for identifying and managing acid producing rock;
- disposal areas for excess/waste rock and overburden, including locations of any currently known or planned disposal sites, especially those for acid producing slate;
- disposal areas for organic soil, slash, grubbing and wood fibre, including locations of any currently known or planned disposal sites;
- methods of handling waste and refuse at work and camp locations;
- removal of temporary operations; and
- site rehabilitation and monitoring plans for all disturbed areas.

In order to properly assess the socio-economic impacts in the region specific information on the 2,800 seasonal construction jobs shall be detailed. Specific numbers by occupation, gender and period of employment, as well as an indication of whether these positions are normally filled by local area contractors shall be provided. Initiatives to increase opportunities for women and Innu people in occupations in which they are under-represented shall be described using the experience of employment of women and Innu people for the Red Bay to

Cartwright Trans Labrador Highway and construction of site infrastructure at Natuashish and Voisey's Bay to establish targets.

3.7 Operation and Maintenance

All aspects of the operation and maintenance of the proposed development shall be presented in detail, including information on operation and maintenance positions by occupation, gender and period of employment. In addition to the employment information related to operation and maintenance it is important to include environmentally relevant information such as the location of maintenance support areas, types of maintenance proposed (e.g., dust control, use of salt), material storage locations, and the likely sources of aggregates or maintenance and winter surface treatment for a reasonable operational period of the road.

3.8 Abandonment

The predicted lifespan of the highway and temporary facilities shall be indicated. If the highway is not intended to operate in perpetuity, details regarding decommissioning and abandonment shall be presented.

4. ENVIRONMENT

4.1 Existing Environment

The EIS shall identify the study area and shall describe the existing biophysical and socio-economic environment of the study area, and the resources within it, taking an ecosystem approach. **Valued Ecosystem Components (VEC's) (as defined by Beanlands and Duinker, 1983)** shall be identified and described. In addition, the EIS shall describe environmental interrelationships and sensitivity to disturbance.

The description of the existing environment shall be in sufficient detail to permit the identification, assessment and determination of the significance of potentially positive and adverse effects that may be caused by the highway.

This description shall focus on environmental components, processes, and interactions that are either identified to be of public concern or that the proponent considers likely to be affected by the proposed highway. The EIS shall indicate to whom these concerns are important and the reasons why, including social, economic, recreational, cultural, spiritual, and aesthetic considerations. The EIS shall also indicate the specific geographical areas or ecosystems that are of particular concern, and their relation to the broader regional environment and

economy, (e.g., the contribution of the Eagle River Plateau ecoregion to critical habitat and populations of fish and migratory birds, the presence of particular species such as woodland caribou (Red Wine and Mealy Mountain herds), and the contemporary use of the area by Innu and other residents of Labrador).

Aboriginal and other local knowledge of the existing environment shall be an integral part of the EIS, to the extent that it is available to the proponent. In describing the physical and biological environment, the EIS shall consider available Aboriginal and scientific knowledge and perspectives regarding ecosystem health and integrity. The EIS shall identify and justify the indicators and measures of ecosystem and social health and integrity used, and these shall be related to project monitoring and follow-up measures.

Description shall reflect four seasons in the study area where appropriate, through the use of original baseline studies or existing data. If the study results or data has been extrapolated or otherwise manipulated to depict environmental conditions in the study area, modeling methods and equations shall be described and identify calculations of margins of error.

The timing and extent of any surveys for flora, fauna and ecologically sensitive areas must be provided.

A qualitative and quantitative description of the present environment shall include, but is not limited to:

- meteorological conditions are to be described, including weather patterns along the proposed route(s) as they relate to highway operation and maintenance. Include how snow, ice and wind conditions may be expected to change with geographic conditions and seasons, and how these relate to the proposed highway;
- atmospheric conditions are to be described, including wind speeds and directions, precipitation amounts and precipitation chemistry. Identify what Probable Maximum Precipitation levels are used and how they relate to the proposed highway. Particular attention is to be paid to ambient dust levels in areas where construction activities may contribute to increased dust levels;
- background ambient noise levels are to be characterized for various locations along the corridor where traffic noise on the proposed highway could be expected to be heard and felt to be a negative impact (e.g., sensitive wildlife habitat);
- hydrological conditions consisting of hydrologic, hydraulic and design parameters and the methodologies used to determine the dimensions and capacities for all watercourse crossings, including but not limited to: design return period, climate data, watershed characteristics, ice formation, ice breakup and movement, and estuarine features; detailed information (to meet the

requirements of the Water Resources Division of the Department of Environment) concerning number, location, and estimated (identified from 1:50,000 topographic mapping, aerial photography and aerial reconnaissance) site information on each proposed crossing including: water depth, width, flow rate, substrate type, and potential obstructions to navigation;

- hydrological conditions consisting of hydraulic and water quality of representative surface water bodies in the vicinity of the highway, especially downstream. Water quality samples being collected in conjunction with fish habitat surveys may be sufficient but in addition to the parameters being measured a metal scan must be included. Baseline water quality and quantity study will form the basis of a subsequent environmental effects monitoring program. Drainage areas of individual streams both above and below the proposed highway shall be described, including calculations of each watercourse's upstream drainage area as well as water quality prior to construction. Based on seasonal flow estimates, and on prior salt loading data for the area, estimate salt and budget loading to the surface waters and potential change in water quality;
- geography and topography of the study area is to be described;
- geology (both bedrock and surficial), and geomorphology utilizing existing geomorphological data, along proposed corridor(s) including information concerning the location, estimate of the volume, and acid production/consumption data of acid bearing bedrock formations to be encountered and disturbed and the locations and areas of ground instability prone to slumping or landslides. Identification of surficial cover, including overburden depth, soil types, permeability and porosity and areas of high risk erosion, including possible permafrost. The potential for disturbance of contaminated soils is to be identified. Any areas having known or proven economic mineral deposits, areas under advance mineral exploration, and the location and extent of existing and abandoned mines, pits and quarries is to be identified;
- wetland resources including location, size and class of any wetland within a predicted zone of influence and conduct of a wetland evaluation. The true ecosystem value of each wetland is to be examined using comprehensive valuation methodology that assesses component, functional and attribute values. Field surveys and investigations required to supplement available data must be completed in an acceptable manner. The Federal Policy on Conservation of Wetlands shall take into account all wetlands which will potentially be impacted directly or indirectly;
- flora, including typical species, rare plants, species-at-risk, and potential habitat for flora species-at-risk. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS;

- fauna (including migratory species), fauna species-at-risk, and potential habitat for fauna species-at-risk, including, but not limited to Woodland Caribou. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Information on furbearers may utilize surveys conducted as construction proceeds or surveys conducted during component studies. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS; and,
- fish, including, but not limited to, Eastern Brook Trout and Atlantic Salmon.

The identification of known data gaps is imperative.

Discussion of the description of the existing environment shall be developed for each alternative drawing specific reference to the VECs. Detailed discussions shall be developed for the following VECs:

- Raptors;
- Caribou;
- Furbearers;
- Migratory birds, including waterfowl with particular consideration of Harlequin Duck and forest birds, and their habitats, with emphasis on species at risk or species under hunting pressure;
- flora and fauna species at risk, including rare or endangered plant species;
- geomorphology;
- Water resources, including water quality parameters sensitive to erosion and sedimentation, acid rock drainage and road salt;
- Wetlands, including wetland function;
- Riparian habitat and other known sensitive habitats;
- Historic resources, including, but not limited to archaeological, paleontological, burial, cultural, spiritual, and heritage sites;
- Tourism and recreation (emphasis on sport and recreational fishery, adventure tourism and other activities which may be sensitive to increased access);
- the Akamiuapishku/Mealy Mountain National Park Feasibility Study Area and the Feasibility Study of potential establishment of a national park, including its size, geographic area, ecological integrity and wilderness character (including landscape aesthetics, vistas and noise-scapes);
- Resource use and users including:
  - information on historic and contemporary land use by the Innu shall be described. Contemporary land use will include land use within "living memory" of informants, and with reference to the Innu, shall describe both pre-settlement (circa 1960) and post-settlement land use patterns;
  - information on historic and contemporary land use by other residents of Labrador;

- existing uses and users of watercourses;
- a description of patterns of current and planned land use and settlement along the proposed highway corridor(s) including, but not limited to, planning strategies, proposed development, utilities and development boundaries;
- a detailed description of the historical and current utilization (e.g., recreational, commercial, subsistence) of all proposed watercourse crossings for navigational purposes;
- access to and alienation of forest resources relating to the alternative routes;
- information on potential protected areas such as parks, sanctuaries or preserves, including the potential for designation of the Eagle River under the Canadian Heritage Rivers System; and,
- wilderness characteristics, including landscape aesthetics, vistas and noise-scapes;

- Fish and fish habitat; and,
- Community Life, Employment and Business.

4.2 Component Studies

Component studies generally have the following format: (i) Rationale/Objectives, (ii) Study Area, (iii)Methodology, and (iv) Study Outputs.

(i) Rationale/Objectives

In general terms, the rationale for a component study is based on the need to obtain additional data to determine the potential for significant effect on a valued ecosystem component due to the proposed undertaking, and to provide the necessary baseline information for monitoring programs.

(ii) Study Area

The boundaries of the study area shall be proposed by the proponent and will be dependent on the valued ecosystem component being investigated.

(iii) Methodology

Methodology shall be proposed by the proponent, in consultation with resource agencies, as appropriate. The methodologies for each component study shall be summarized in the EIS.

(iv) Study Outputs

Study outputs shall be proposed by the proponent. Information and data generated shall be sufficient to adequately predict the impacts of the highway on the valued ecosystem component.

Component Studies shall be prepared for the following VECs (where new information becomes available as a result of baseline studies, additional component studies may be required):

1) Land and Resource Use

The Component Study shall describe historical and contemporary uses of the study area, including the use of lands and resources by Innu people. In addition it shall describe and analyze changes in land and resource use resulting from previous road developments in Labrador.

2) Migratory birds (with emphasis on waterfowl and including but not limited to Harlequin Duck)

3) Raptors

4) Caribou

5) Fish and Fish Habitat

In consultation with Fisheries and Oceans Canada (DFO), and in compliance with the guidance document "Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams" (1998), field survey information using the Beak Classification System (e.g., qualitative assessment of fish habitat types, approximate stream width and length, area, bank material and backslope, vegetation, presence of potential barriers, etc.) shall be required upstream and downstream (250 m each way depending upon stream morphology) of all proposed watercourse crossings identified from 1:50,000 mapping, aerial photography and aerial reconnaissance. Any additional fish habitat information requirements (e.g., quantitative assessment, ground survey, etc.) for purposes of assessment identified during consultation with DFO shall also be provided. In addition to describing the quality and quantity of fish habitat, the proponent should also discuss existing fish species and fisheries (e.g., recreational, commercial, subsistence, etc.). DFO will require such information in order to fully assess the potential impacts of the proposed undertaking and ensure the protection of fish and fish habitat.

Qualitative descriptions of fish populations, including abundance and life history parameters, in each of the four watersheds that the highway will traverse shall be provided.

Fish population sampling is to be conducted in accordance with the sampling protocol developed by Inland Fish and Wildlife Division. Sampling may occur as construction proceeds.

6) Historic Resources

The Component Study and the EIS shall not contain any data or maps which indicate the exact locations of known historic resources. All data or maps should reference specific historic resource locations in a general context, within a one kilometer block. Exact locations of known historic resources shall be provided only to the proponent, the Innu Nation and the Provincial Archaeology Office, on a confidential basis.

7) Tourism and Recreation

Describe existing sport and recreational fishing and hunting, adventure tourism and other tourism and recreational activities carried out within the study area, including outfitting camps, and identifying the contribution of the tourism and recreation industry to the local economy, including employment, expenditures and revenue generated.

8) Community Life, Employment and Business

Describe the functioning and health of the socio-economic environment, addressing a broad range of matters that affect the people and communities in the study area. Describe the local economies of individual communities and the region as a whole. Describe the production and supply of goods and services within individual communities and the region.

4.3 Data Gaps

Information gaps from a lack of previous research or practice shall be described indicating baseline data/information which is not available or existing data which cannot accurately represent environmental conditions in the study area over four seasons. If background data have been extrapolated or otherwise manipulated to depict environmental conditions in the study area, modeling methods and equations shall be described and shall include calculations of margins of error.

4.4 Future Environment

The predicted future condition of the environment described under 4.1 within the expected life span of the undertaking, if the undertaking were not approved. This information is required when attempting to distinguish highway-related environmental effects from environmental change due to natural processes, such as, surface erosion, cyclical population changes, etc. Specific characteristics of the

future environment to be considered if the undertaking were not approved include degree of forest habitat fragmentation, boundaries of the potential Mealy Mountain National Park, greenhouse gas (GHG) emissions and losses of GHG sinks, negative and positive environmental effects of forest fires, variations in wildlife abundance and distributions, and demographic and socio-economic trends. Boundaries and scale of such descriptions shall be appropriate to those elements of the environment discussed, e.g., site-specific or landscape-level; biological, socio-economic, cultural, etc.

5. ENVIRONMENTAL EFFECTS

The EIS shall describe the scope of the assessment being conducted for the undertaking.

The EIS must also address environmental effects as defined under CEAA. "Environmental effect" refers to any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, and includes any change in the project that may be caused by the environment.

The EIS shall contain a comprehensive analysis of the predicted environmental effects of each project alternative for the VEC's and on any other environmental components, processes, and interactions that are identified to be of public concern or that the proponent considers likely to be affected by the proposed highway. If the effects are attributable to a particular phase of the project (construction, operation or maintenance) then they will be designated as such. As part of the comprehensive analysis the following must receive particular attention:

- land and resource use: predictions of any change in land and resource use resulting from the highway, for each phase (construction, operation, modification, abandonment). Discuss the negative effects and benefits of the project on the use of lands and resources by Innu people and other residents of Labrador with particular attention paid to considerations related to the contemporary use of lands and resources by Innu people;

- proposed Akamiuapishku/Mealy Mountain National Park: potential effects of the highway on the establishment and operation of the proposed Akamiuapishku/Mealy Mountain National Park, with an emphasis on the potential effects of the highway on the establishment, operation and ecological integrity of the proposed park;

- fish and fish habitat: identification and assessment of fish stocks potentially affected by the highway; an assessment of ecosystemic considerations relating to

the health and productivity of aquatic resources potentially affected by the highway, including migratory patterns and sensitive periods; a quantification of any aquatic habitat loss, impairment of ecosystem function, or potential change in productivity or population likely to result from the highway;

- water resources: identify and discuss water resources issues associated with the highway, effects of erosion, sedimentation, diversions, channeling resulting in changes in water quality, quantity or rate of flow. Potential sources of contamination resulting from all phases of the highway (e.g., petroleum products, road chemicals including road salt and dust control agents) shall be assessed;

- tourism and recreation: an assessment of the likely effects of the highway on tourism and recreation within the study area, including any increase or decrease in existing activities or the introduction of new activities; an assessment of likely effects of the project on the establishment or operation of federal and provincial parks, sanctuaries or preserves (other than the Akamiuapishku/Mealy Mountains National Park), including the potential for designation of the Eagle River under the Canadian Heritage Rivers System; and

- community life, employment and business: identification of direct and indirect effects of the highway on local economies of individual communities and the region as a whole; identification of the effects of the highway on the production and supply of goods and services within individual communities and the region; identification of employment and business opportunities during each phase of the highway, including construction and highway maintenance, which would be available to local people, with particular reference to members of the Innu Nation; description of training and education requirements required for local people, with particular reference to members of the Innu Nation, to take advantage of any jobs or business opportunities associated with each stage of the project, and discussion of how such training and education requirements might be met prior to each stage; discussion of the effects of the project on employment and business opportunities for women; discussion of any environmental effects of the highway which may affect women differently than men; description of predicted effects of the project on the availability of goods and services throughout the region; description of predicted effects of the project on transportation and shipping within the region, including any mode shifting that may occur.

The EIS shall also assess the effects of the environment on the highway, and measures to address those effects (e.g., road salt) and the effects on the environment of such measures as well as the potential environmental effects of structural failures that may result from effect of the environment on the highway.

The capacity of renewable resources that are likely to be significantly affected by the highway to meet the needs of the present and those of the future must be addressed.

Predicted environmental effects (positive and negative, direct and indirect, short and long-term) shall be defined quantitatively and qualitatively for each alternative and for each valued ecosystem component. In this regard, the EIS shall offer the study strategy, methodology and boundaries of the assessment which includes the following considerations:

- the VEC within the study boundaries and the methodology used to identify the VEC;
- definition of the spatial and temporal study boundaries for the interactions of the highway, as proposed or subject to subsequent modification, with VECs and the methodology used to identify the study boundaries;
- the temporal boundaries (i.e., duration of specific project activities and potential effects) for construction and operation;
- the strategy for investigating the interactions between the project and each VEC and how that strategy will be used to coordinate individual studies undertaken;
- the strategy for assessing the project's contribution to cumulative effects on each VEC;
- the strategy for predicting and evaluating environmental effects, determining necessary mitigation, remediation and/or compensation, and for evaluating residual effects;
- definition of effect significance criteria against which to evaluate the potential effect of interactions;
- description of potential interactions;
- discussion of issues and concerns which relate to specific interactions;
- discussion of the existing knowledge on information related to the interactions; and
- analysis of potential effects (significance, positive or negative, etc.).

In the latter regard, the proponent shall offer a definition of significance for each category examined (eg. biological, physical, economic, social, cultural, archaeological, etc.) and shall indicate to whom these concerns are important and the reasons why, including social, economic, recreation, cultural, spiritual, and aesthetic considerations.

Environmental effects shall be defined and discussed in the following terms for the phases of the highway (construction, operation, modification and decommissioning): nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance, and level of certainty.

The environmental effects of the project, including the environmental effects of malfunctions or accidental events that may occur in connection with the project shall be discussed with respect to risk, severity and significance. Consequences of low probability, high impact events, including design failure, shall also be described. In particular, the potential for forest fires must be addressed due to the remote nature of the

road. The proponent must demonstrate adequate prevention, control and fire fighting capabilities.

Sustainable Development

The contribution of the project to sustainable development shall be assessed in the EIS, with emphasis on the following objectives:

- the preservation of ecosystem integrity, including the capability of natural systems to maintain their structure and functions and to support biological diversity;
- respect for the right of future generations to the sustainable use of renewable resources; and,
- the attainment of durable and equitable social and economic benefits.

The EIS shall include an evaluation of:

- the extent to which the highway may make a positive overall contribution towards the attainment of ecological and community sustainability, both at the local and regional levels;
- how the planning and design of the highway have addressed the three objectives of sustainable development stated above;
- how the monitoring, management and reporting systems will attempt to ensure continuous progress towards sustainability; and,
- the identification of appropriate indicators to determine whether this progress is being maintained.

Cumulative Environmental Effects

Consideration of any cumulative effects on valued ecosystem components that are likely to result from the project in combination with other projects or activities that have been or will be carried out shall be discussed in the EIS. Particular emphasis shall be placed on the significant increase in human access and the attendant implications for increased development pressure along with induced development (e.g., forest harvesting, fish harvesting, fur harvesting). The assessment of cumulative environmental effects shall specifically address, but shall not be limited to, a consideration of the impact of the highway on:

- future road and related infrastructure development scenarios in central and southern Labrador;
- the Akamiuapishku/Mealy Mountain National Park Feasibility Study and potential establishment of a National Park;
- hydroelectric developments, including transmission infrastructure;
- forestry development;
- tourism and recreation; and

- use of lands and resources by Innu and other residents of Labrador.

Addressing cumulative environmental effects shall involve considering:

- temporal and spatial boundaries;
- interactions among the highway's environmental effects;
- interactions between the highway's environmental effects and those of existing projects and activities;
- interactions between the highway's environmental effects and those of planned projects and activities; and,
- mitigation measures employed toward a no-net-loss or net-gain outcome (e.g., recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).

6. ENVIRONMENTAL PROTECTION

6.1 *Mitigation*

Mitigative measures that are technically and economically feasible, that have or will be taken, to avoid, minimize or eliminate the negative, and enhance the positive environmental effects, shall be described and discussed with emphasis on pollution prevention, avoidance of environmental effect and best management practices. Mitigation includes the elimination, reduction or control of the adverse effects or the significant environmental effects of the highway and may include restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

The policies and any specific commitments on the part of the proponent for environmental protection shall be identified.

In addition to any preferred mitigation measures identified, the EIS shall indicate what other mitigation measures were considered and explain why they were not adopted. Trade-offs between cost savings and effectiveness of the mitigation measures shall be evaluated. The EIS shall identify who is responsible for the implementation of these measures and the system of accountability, including the obligations of all contractors and subcontractors.

Mitigative measures specific to the following must be addressed in particular:

- air quality: through dust control during highway construction, operation and maintenance;

- noise effects: mitigation of increased noise levels during highway construction and operation;
- surface water quality and quantity: outline siltation, erosion and run-off control features, storm drainage management procedures and measures, including specific reference to seasonal variation, that will be used in the following situations: (a) clearing and grubbing of the corridor; (b) installation of watercourse structures; (c) subgrade work; (d) construction of service roads; and, (e) highway maintenance;
- contaminated soils: if they are to be disturbed, discuss methods to minimize adverse effects;
- road salt and dust control chemicals: if proposed to be used, a management strategy must be described;
- flora species: discuss measures to be taken to minimize effects of road construction, operation and maintenance. Include any plans for landscaping and preservation of existing vegetation. Demonstrate how priority will be placed on the use of native species for revegetation efforts. Describe steps to prevent the introduction of invasive species;
- fauna species: describe measures to be taken to minimize effects of road construction and operation on terrestrial and aquatic fauna (including avifauna). Include any plans for preservation of existing habitat and compensation for loss or degradation of aquatic and terrestrial habitat (i.e., habitat rehabilitation or replacement);
- wetland resources: discuss avoidance of wetland de-watering and mitigation measures to maintain ecological and hydrological integrity of wetlands. Identify plans for preservation of existing wetlands and compensation for loss or degradation of the functional values of wetlands affected by the highway. Include plans to monitor the success of mitigative action. Demonstrate how an emphasis will be placed on avoidance of potential losses of wetland function; and,
- use of land and resources by Innu and other resource users in the study area: discuss measures which can be taken to mitigate adverse impacts of the project on Innu land use and to avoid conflict between Aboriginal and non-aboriginal resource users in the study area.

Proposed mitigative strategies integral to the phases of the project (construction, operation, modification and decommissioning) shall be clearly identified and addressed. The effectiveness of the proposed mitigative measures shall be discussed and evaluated. Where possible and appropriate, compensation for losses that cannot be mitigated by any other means shall be examined. Mitigation failure shall be discussed with respect to risk and severity of consequence.

There must be full consideration for the precautionary principle which states, “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” The best available technology and best management practices must be considered. Consideration must be given for impact avoidance through implementation of scheduling and siting constraints and pollution prevention opportunities. The EIS shall assess how the highway conforms to the precautionary principle, including but not limited to consideration of the following in relation to each VEC:

- policies, plans or strategies which avoid creating adverse environmental effects;

- policies, plans or strategies to mitigate adverse environmental effects of the highway;
- contingency plans to address worst-case scenarios, including risk assessments and evaluations of any uncertainty;
- monitoring programs which are designed to ensure rapid response in the event adverse effects are detected; and,
- provisions for liability in the event of adverse effects and associated damage.

Where data is not available, the EIS shall describe the means by which the proponent intends to implement a precautionary approach to avoid or prevent adverse environmental effects, and any proposed follow-up studies to address data gaps and monitor the effectiveness of mitigation.

6.2 *Emergency Response/Contingency Plan*

An emergency response plan shall be outlined that details measures to be taken to effectively respond to any foreseeable mishap that may occur as a result of the undertaking. The following items should be considered when developing such a plan:

- proper first-aid kits,
- numbers of workers trained in first aid, to the appropriate level,
- backboards/stretchers,
- communication devices suitable for the work sites,
- emergency names and numbers,
- arrangements for medivac of injured to Happy Valley-Goose Bay, and
- action plan (roles and responsibilities of work crews).

A contingency plan shall be outlined that details measures to be taken to effectively respond to a spill event in a timely manner. The plan should reflect a consideration of the risk of spills associated with construction, operation and maintenance of the road and the environmental sensitivities to such a spill. The contingency plan must specifically address contamination or drainage to surface water and/or groundwater resources and protection of water quality, contingency and remediation plans for drainage to aquatic and terrestrial habitat as a result of accidental events.

6.3 *Environmental Monitoring and Follow-up Programs*

Environmental compliance and effects monitoring programs for construction, operation, maintenance, modification and decommissioning phases of the highway shall be described. Programs must allow for testing of the accuracy of impact predictions and effectiveness of mitigation measures. Programs must support an adaptive management approach and demonstrate preparedness for a range of potential outcomes to be confirmed through follow-up.

Important ingredients of monitoring programs include:

- elements of the environment (i.e., air emissions, erosion, habitat use, etc.) that are to be monitored;

- where monitoring will occur;
- frequency and duration of monitoring;
- identification of resource agencies that will review program design and results;
- consultation with, and appropriate involvement of, aboriginal groups;
- submission of results; and,
- protocols for the interpretation of results and subsequent actions to be taken based on findings.

Discussion shall be presented on the feasibility of establishing sample plots, established at various points along the alignment and at various distances from the right-of-way across the full range of representative eco-types to determine any long-term changes in plant communities related to effects of increased access.

Monitoring of employment on the construction positions shall be detailed and specific numbers by occupation, gender and period of employment during each year of construction shall be provided at the conclusion of each construction season.

Known or planned follow-up programs specifically related to detecting and monitoring cumulative environmental effects are to be described. Objectives, methodology, duration and reporting covered by the program evaluating effectiveness of avoidance and mitigation measures on long-term effects from the project, and subsequent induced development, are to be described. Programs may be proposed specifically for wildlife (including migratory birds) and their habitats, species-at-risk and their habitat, wetlands, air quality, water quality and increased use of all-terrain vehicle (ATV) traffic along the highway corridor and surrounding area.

The EIS shall include an assessment of the present capacity of resource agencies to mitigate and monitor cumulative environment effects resulting from increased access to the study area.

6.4 Rehabilitation

A plan of proposed rehabilitation measures for the construction activities associated with the highway shall be given with an explanation of how the measures will reduce or eliminate various negative effects during construction, operation and decommissioning**.**

7. RESIDUAL EFFECTS AND SELECTION CRITERIA FOR PREFERRED OPTION

7.1 *Residual Effects*

Residual effects are those adverse effects or significant environmental effects which cannot or will not be avoided or mitigated through the application of environmental control technologies, best management practices or other acceptable means.

The EIS shall list and contain a detailed discussion and evaluation of residual effects, which shall be defined in terms of nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance (including the criteria for determining significance) and level of certainty. Those effects that cannot be mitigated or avoided shall be clearly distinguished from those effects that will not be mitigated or avoided. Positive residual effects shall also be discussed and evaluated.

Particular attention shall be paid to residual effects of increased access on potential for forest fires and unauthorized use of resources such as illegal harvesting of fish, wildlife and forest resources.

The EIS shall contain a concise statement and rationale for the overall conclusion relating to the significance of the residual adverse environmental effects. The EIS shall, for ease of review, include a matrix of the environmental effects, proposed mitigation and residual positive and adverse effects.

7.2 Effects Evaluation and Selection of Preferred Alternative

This section (as compared to Section 3.3 - Alternatives) is intended to provide a detailed discussion and comparison of the residual effects relative to the preferred option and viable alternatives (as applicable).

All selection criteria, including environmental, economic, social, and technical, shall be presented and discussed in sufficient detail to allow a comparative analysis with regard to costs, benefits and environmental risks associated with both the preferred and alternative options.

8. PUBLIC PARTICIPATION

A proposed program of public information shall be outlined. Open House Public Information Sessions shall be held to present the proposal and to record public concerns. The proponent shall hold public information sessions in the communities of Port Hope-Simpson, Cartwright, North West River/Sheshatshiu and Happy Valley-Goose Bay. Public concerns shall be addressed in a separate section of the EIS. Protocol for these sessions will comply with Section 10 of the Newfoundland and Labrador Environmental Assessment Regulations, 2000. Public notification specifications are outlined in Appendix A.

9. ENVIRONMENTAL PROTECTION PLAN

A site specific Environmental Protection Plan (EPP) for the proposed undertaking shall be submitted and approved by the Minister of Environment *before* any construction on the project begins. Consultation with the Innu Nation shall also be required prior to submission of the EPP. For the purposes of the EIS an outline of the EPP shall be

included. The EPP shall be a "stand alone" document with all relevant maps and diagrams. Statements regarding the commitment to and philosophy of environmental protection planning and self-regulatory and compliance monitoring shall be restricted to the EIS. The target audience for the EPP will be the resident engineer, site foreman/supervisor, proponent compliance staff and any environmental surveillance officer. Therefore the EPP shall concentrate on addressing such issues as construction/operation mitigation, permit application and approval planning, monitoring activities, contingency planning for accidental and unplanned events and contact lists. In addition, the EPP shall contain a tabular breakdown of major construction and operational activities into sub-components, followed by permits required, field mitigation and contingency planning where appropriate. The objective is to present concise, comprehensive and easily accessed environmental protection information for field use by the target audience.

The EPP should not include any analysis of impact prediction or mitigation. The EPP is intended to summarize all of the environmental protection commitments outlined in an acceptable EIS, in a concise, formatted document for primary use in the field.

10. REFERENCES CITED

Provide a bibliography of all citations in the EIS. Provide a bibliography of all project-related documents already generated by or for the undertaking.

11. PERSONNEL

Brief descriptions of the expertise and qualifications of personnel involved in the completion of the EIS shall be provided.

12. COPIES OF REPORTS

Copies of reports produced for any studies undertaken specifically in connection with this Environmental Impact Statement shall be submitted.

APPENDIX A

Public Notices

Under the provisions of the Environmental Assessment Regulations 2000, Section 10, and where the approved Guidelines require public information session(s), the following specified public notification requirements must be met by the proponent prior to each meeting:

Minimum information content of public advertisement - (Proponent to substitute appropriate information for italicized items):

PUBLIC NOTICE

Public Information Meeting on the Proposed

NAME OF PROPOSED UNDERTAKING

LOCATION OF PROPOSED UNDERTAKING

Will be held at

DATE AND TIME

LOCATION

This meeting will be conducted by the proponent

PROPONENT NAME AND CONTACT PHONE NUMBER

as part of the required environmental assessment process for this project. The purpose of this meeting is to describe all aspects of the proposed project, the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

Minimum newspaper ad size: 2 column widths.

Minimum posted ad size: 7" x 5"

Minimum newspaper ad coverage: Weekend preceding meeting and 3 consecutive days prior to meeting date; to be run in newspaper locally distributed within meeting area or newspaper with closest local distribution area.

Minimum posted ad coverage: Local Town or City Hall or Office, and local Post Office, within town or city where meeting is held, to be posted continually for 1 full week prior to meeting date.

Any deviation from these requirements for any reason must receive prior written approval of the Minister of Environment.

APPENDIX B

Scientific Names

Table B-1: Common and Scientific Names of Avifauna

Common Name	Scientific Name
American Black Duck	*Anas rubnipes*
Mallard Duck	*Anas platyrhynchos*
Northern Pintai1	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canada Goose	*Branta canadensis*
Ring-necked Duck	*Aythya collaris*
Lesser Scaup	*Aythya affinis*
Common Goldeneye	*Bucephala clangula*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Surf Scoter	*Melanitta perspicillata*
Black Scoter	*Melanitta nigra*
Long-tailed Duck	*Clangula hyemalis*
Harlequin Duck	*Histrionicus histrionicus*
Barrow's Goldeneye	*Bucephala islandica*
Herring Gull	*Laris argentatus*
Great Black-backed Gull	*Larus marinus*
Common Loon	*Gavia immer*
Common Tern	*Sterna hirundo*
Greater Yellowlegs	*Tringa melanoleuca*
Spotted Sandpiper	*Actitus macularia*
Eskimo Curlew	*Numenius borealis*
Belted Kingfisher	*Ceryle alcyon*
Willow Ptarmigan	*Lagopus lagopus*
Spruce Grouse	*Dendragapus canadensis*
Ruffed Grouse	*Bonasa umbellus*
Northern Harrier	*Circus cyaneus*
Osprey	*Pandion haliaetus*
Great Horned Owl	*Bubo virginianus*
Bald Eagle	*Haliaetus leucocephalus*
Red-tailed Hawk	*Buteo jamaicensis*
Merlin	*Falco columbarius*
Short-eared Owl	*Asio flammeus*
Rough-legged Hawk	*Buteo lagopus*
Common Nighthawk	*Chordeiles minor*
Belted Kingfisher	*Ceryle alcyon*

Table B-1: Common and Scientific Names of Avifauna (Continued)

Common Name	Scientific Name
Northern Flicker	*Colaptes auratus*
Hairy Woodpecker	*Picoides villosus*
Three-toed Woodpecker	*Picoides tridactylus*
Black-backed Woodpecker	*Picoides arcticus*
Olive-sided Flycatcher	*Contopus cooperi*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Alder Flycatcher	*Empidonax alnorum*
Philadelphia Vireo	*Vireo philadelphicus*
Blue-headed Vireo	*Vireo solitarius*
Blue Jay	*Cyanocitta cristata*
Gray Jay	*Perisoreus canadensis*
Common Raven	*Corvus corax*
Tree Swallow	*Tachycineta bicolor*
Boreal Chickadee	*Poecile hudsonica*
Red-breasted Nuthatch	*Sitta canadensii*
Winter Wren	*Troglodytes troglodytes*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Bohemian Waxwing	*Bombycilla garrulous*
Cedar Waxwing	*Bombycilla cedrorum*
Tennessee Warbler	*Vermivora peregrina*
Magnolia Warbler	*Dendroica magnolia*
Yellow-rumped Warbler	*Dendroica coronata*
Black-and-White Warbler	*Mniotilta varia*
Blackburnian Warbler	*Dendroica fusca*
Black-throated Green Warbler	*Dendroica virens*
Bay-breasted Warbler	*Dendroica castanea*

Table B-1: Common and Scientific Names of Avifauna (Continued)

Common Name	Scientific Name
Blackpoll Warbler	*Dendroica striata*
Palm Warbler	*Dendroica palmarum*
Yellow Warbler	*Dendroica petechia*
Wilson's Warbler	*Wilsonia pusilla*
Ovenbird	*Turdus migratorius*
Northern Waterthrush	*Seiurus noveboracensis*
American Redstart	*Setophaga ruticilla*
Chipping Sparrow	*Spizella passerina*
Fox Sparrow	*Passerella iliaca*
Lincoln's Sparrow	*Melospiza lincolnii*
White-throated Sparrow	*Zonotrichia albicollis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Slate-colored Junco	*Junco hyemalis*
Rusty Blackbird	*Euphagus carolinus*
Purple Finch	*Carpodacus purpureus*
White-winged Crossbill	*Loxia leucoptera*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Carduelis pinus*

Table B-2: Common and Scientific Name of Mammals

Common Name	Scientific Name
American Marten	*Martes americana*
Beaver	*Castor canadensis*
River Otter	*Lontra canadensis*
Muskrat	*Ondatra zibethicus*
Mink	*Mustela vison*
Least Weasel	*Mustela nivalis*
Ermine	*Mustela erminea*
Red Fox	*Vulpes vulpes*
Lynx	*Lynx lynx*
Wolf	*Canis lupus*
Coyote	*Canis latrans*
Red Squirrel	*Tamiasciurus hudsonicus*
Wolverine	*Gulo gulo*
Black Bear	*Ursus americanus*
American Porcupine	*Erethizon dorsatum*
Snowshoe Hare	*Lepus americanus*
Arctic Hare	*Lepus arcticus*
Moose	*Alces alces*
Caribou	*Rangifer tarandus*

Table B-3: Common and Scientific Name of Fish

Common Name	Scientific Name
Atlantic salmon/Ouananiche	*Salmo salar*
Brook trout	*Salvelinus fontinalis*
Threespine stickleback	*Gasterosteus aculeatus*
Burbot	*Lota lota*
Lake trout	*Salvelinus namaycush*
Arctic charr	*Salvelinus alpinus*
Lake whitefish	*Coregonus clupeaformis*
Round whitefish	*Prosopium cylindraceum*
White sucker	*Catastomus commersoni*
Longnose sucker	*Catostomus catostomus*
Rainbow smelt	*Osmerus mordax*
Atlantic sturgeon	*Acipenser oxyrhynchus*
American eel	*Anguilla rostrata*
Ninespine stickleback	*Pungitius pungitius*
Northern pike	*Esox lucius*
Lake chub	*Couesius plumbeus*
Mottled sculpin	*Cottus bairdi*
Slimy sculpin	*Cottus cognatus*
Pearl dace	*Semotilus margarita*
Longnose dace	*Rhinichthys cataractae*

Table B-4: Common and Scientific Names of Vegetation

Common Name	Scientific Name
Black Spruce	*Picea mariana*
White Spruce	*Picea glauca*
Balsam Fir	*Abies balsamea*
Tamarack	*Larix laricina*
White Birch	*Betula papyrifera*
Trembling Aspen	*Populus tremuloides*
Balsam Poplar	*Populus balsamifera*
Labrador Tea	*Ledum groenlandicum*
Feathermoss	*Broyophyta sp.*

APPENDIX C

Determination of Potential Rare Plant Sites

APPENDIX C

The first step in conducting the rare vascular plant modeling exercise was to obtain a list of rare species for Labrador. A list of 183 uncommon to very rare vascular plant species was provided by the Atlantic Canada Conservation Data Centre (ACCDC) (Table C-1).

Table C-1: Uncommon and Rare Vascular Plants of Labrador

Binomial	Common Name	S-rank
Acer spicatum	Mountain Maple	S1
Actaea rubra ssp. rubra	Red Baneberry	S3S4
Agrostis scabra var. septentrionalis	Rough Bentgrass	S2S3
Agrostis stolonifera	Spreading Bentgrass	S2S4
Ammophila breviligulata	American Beachgrass	S1S2
Anemone parviflora	Small-Flower Anemone	S3S4
Anemone richardsonii	Yellow Anemone	S1
Angelica lucida	Angelica	S1S2
Arabis drummondii	Drummond Rockcress	S1S2
Arctostaphylos uva-ursi	Bearberry	S2S3
Arethusa bulbosa	Swamp-Pink	S1
Armeria maritima ssp. sibirica	Sea Pink	S3S4
Asplenium trichomanes-ramosum	Green Spleenwort	S1
Astragalus eucosmus	Pretty Milk-Vetch	S1S2
Astragalus robbinsii var. fernaldii	Robbins' Milkvetch	S1
Astragalus robbinsii var. minor	Robbins' Milk-Vetch	S1S2
Athyrium americanum	Alpine Lady Fern	S1
Botrychium lanceolatum var. lanceolatum	Lance-Leaved Moonwort	S1
Botrychium matricariifolium	Chamomile Grape-Fern	S1
Botrychium multifidum	Leathery Grape-Fern	S1
Botrychium virginianum	Rattlesnake Fern	S1
Braya glabella	Smooth Rockcress	S2S3
Cakile edentula var. edentula	American Sea-Rocket	S2S3
Caltha palustris	Marsh Marigold	S1
Campanula uniflora	Arctic Harebell	S2S3?
Cardamine pensylvanica	Pennsylvania Bitter-Cress	S2S3
Carex adelostoma	A Sedge	S1S2
Carex aurea	Golden-Fruited Sedge	S1S2
Carex bipartita	Arctic Hare's-Foot Sedge	S3?
Carex buxbaumii	Buxbaum's Sedge	S3?
Carex capitata	Capitate Sedge	S3?
Carex castanea	Chestnut-Colored Sedge	S1S2
Carex chordorrhiza	Creeping Sedge	S3?
Carex concinna	Beautiful Sedge	S1S2
Carex crawfordii	Crawford Sedge	S1S2
Carex diandra	Lesser Panicled Sedge	S1S2
Carex foenea	Dry-Spike Sedge	S2S3
Carex glacialis	Alpine Sedge	S2S3
Carex intumescens	Bladder Sedge	S1S2
Carex leptonervia	Finely-Nerved Sedge	S2S3
Carex mackenziei	Mackenzie Sedge	S2S3
Carex macloviana	Falkland Island Sedge	S3?
Carex maritima	Seaside Sedge	S1S2

Table C-1: Uncommon and Rare Vascular Plants of Labrador		
Binomial	**Common Name**	**S-rank**
Carex membranacea	A Sedge	S1S2
Carex michauxiana	Michaux Sedge	S1S2
Carex microglochin	False Uncinia Sedge	S1S2
Carex misandra	Short-Leaf Sedge	S3?
Carex nardina	Nard Sedge	S1S2
Carex paleacea	Chaffy Sedge	S2S3
Carex praticola	Northern Meadow Sedge	S3?
Carex projecta	Necklace Sedge	S1S2
Carex rupestris	Rock Sedge	S2S3
Carex salina	Salt-Marsh Sedge	S1S2
Carex silicea	Sea-Beach Sedge	S1S2
Carex stipata	Stalk-Grain Sedge	S2S3
Carex umbellata	Hidden Sedge	S1S2
Carex ursina	Bear Sedge	S1S2
Carex viridula ssp. viridula	A Sedge	S1S2
Carex williamsii	A Sedge	S1
Catabrosa aquatica	Brook Grass	S1S2
Chrysosplenium tetrandrum	Northern Golden-Carpet	S1
Circaea alpina ssp. alpina	Small Enchanter's Nightshade	S3S4?
Comandra umbellata ssp. umbellata	Umbellate Bastard Toad-Flax	S1
Corydalis sempervirens	Pale Corydalis	S3S4
Crepis nana	Dwarf Alpine Hawksbeard	S1S2
Cryptogramma stelleri	Fragile Rockbrake	S2S3
Cystopteris montana	Mountain Bladder Fern	S1S2
Descurainia incana	Richardson Tansy-Mustard	S1S2
Draba alpina	Alpine Whitlow-Grass	S1S2
Draba aurea	Golden Draba	S3?
Draba cana	Hoary Draba	S1
Draba crassifolia	Snowbed Whitlow-Grass	S2S3
Draba fladnizensis var. fladnizensis	White Arctic Whitlow-Grass	S2S3
Draba lactea	Milky Whitlow-Grass	S3?
Dryopteris campyloptera	Mountain Wood-Fern	S3?
Dryopteris fragrans	Fragrant Cliff Wood-Fern	S2S4
Equisetum fluviatile	Water Horsetail	S1S3
Equisetum palustre	Marsh Horsetail	S1
Equisetum pratense	Meadow Horsetail	S1
Equisetum scirpoides	Dwarf Scouring Rush	S1
Equisetum variegatum var. variegatum	Variegated Horsetail	S2?
Eriocaulon aquaticum	Seven-Angled Pipewort	S1S2
Eutrema edwardsii	Edward Eutrema	S1S2
Festuca altaica	Northern Rough Fescue	S1S2
Festuca brachyphylla ssp. brachyphylla	Short-Leaved Fescue	S2S4
Festuca saximontana	Rocky Mountain Fescue	S1
Festuca vivipara	Viviparous Fescue	S1S2
Galium triflorum	Sweet-Scent Bedstraw	S2S3
Gentianella amarella ssp. acuta	Northern Gentian	S2?
Gentianella propinqua ssp. propinqua	Four-Part Gentian	S1
Geum rivale	Purple Avens	S1S2
Halenia deflexa	Spurred Gentian	S2S3
Hedysarum alpinum	Apline Sweet-Vetch	S1S2
Hutchinsia procumbens	Prostrate Hymenolobus	S1S2

Table C-1: Uncommon and Rare Vascular Plants of Labrador		
Binomial	**Common Name**	**S-rank**
Iris versicolor	Blueflag	S2S3
Isoetes lacustris	Lake Quillwort	S1
Juncus balticus	Baltic Rush	S3
Juncus tenuis	Slender Rush	S1?
Juncus vaseyi	Vasey Rush	S1
Koenigia islandica	Island Koenigia	S2S3
Lathyrus japonicus	Beach Pea	S2S3
Lathyrus palustris	Vetchling Peavine	S1S2
Lesquerella arctica	Artic Bladderpod	S1S2
Limonium carolinianum	Sea-Lavender	S1
Limosella australis	Mudwort	S1
Lycopodiella inundata	Bog Clubmoss	S2S3
Lysimachia terrestris	Swamp Loosestrife	S1
Mentha canadensis	Canadian Mint	S2S3
Mitella nuda	Naked Bishop's-Cap	S2?
Monotropa uniflora	Indian-Pipe	S1S3?
Myriophyllum sibiricum	Common Water-Milfoil	S2S3
Myriophyllum tenellum	Slender Water-Milfoil	S1?
Nuphar lutea ssp. variegata	Yellow Cowlily	S3S4
Onoclea sensibilis	Sensitive Fern	S2S3?
Oryzopsis pungens	Slender Mountain-Ricegrass	S1S2
Osmunda claytoniana	Interrupted Fern	S2S4
Oxalis montana	White Wood-Sorrel	S1S3
Oxytropis campestris var. johannensis	St. John's Oxytrope	S1
Oxytropis podocarpa	Gray's Point-Vetch	S1S2
Parnassia kotzebuei	Kotzebue's Grass-of-Parnassus	S3S4
Pedicularis hirsuta	Hairy Lousewort	S2S4
Pentaphylloides floribunda	Shrubby Cinquefoil	S2S3
Phippsia algida	Ice Grass	S3?
Pinguicula villosa	Hairy Butterwort	S2S3
Pinus banksiana	Jack Pine	S1?
Platanthera obtusata	Small Northern Bog-Orchid	S3S4
Pleuropogon sabinei	Sabine-Grass	S1
Poa flexuosa	Wavy Bluegrass	S1
Polygonum buxiforme	Small's Knotweed	S1
Polygonum fowleri	Fowler Knotweed	S1
Polypodium virginianum	Rock Polypody	S2S3?
Polystichum braunii	Braun's Holly-Fern	S1
Populus balsamifera ssp. balsamifera	Balsam Poplar	S2S3
Populus tremuloides	Quaking Aspen	S2S3
Potamogeton confervoides	Algae-Like Pondweed	S1?
Potamogeton oakesianus	Oakes Pondweed	S1S3
Potamogeton obtusifolius	Blunt-Leaf Pondweed	S1?
Potamogeton praelongus	White-Stem Pondweed	S1
Potamogeton pusillus var. tenuissimus	Slender Pondweed	S1?
Potamogeton richardsonii	Redhead Grass	S1?
Potentilla nana	Arctic Cinquefoil	S2S3
Potentilla pulchella var. pulchella	Pretty Cinquefoil	S1S2
Primula egaliksensis	Greenland Primrose	S3S4
Primula laurentiana	Bird's-Eye Primrose	S3S4
Primula mistassinica	Bird's-Eye Primrose	S2

Table C-1: Uncommon and Rare Vascular Plants of Labrador		
Binomial	**Common Name**	**S-rank**
Prunus pensylvanica	Fire Cherry	S2S3
Pyrola chlorantha	Greenish-Flowered Wintergreen	S2S3
Ranunculus abortivus	Kidney-Leaved Buttercup	S2
Ranunculus allenii	Allen Buttercup	S2S3
Ranunculus hispidus var. caricetorum	Hispid Buttercup	S1
Ranunculus lapponicus	Lapland Buttercup	S2S3
Ranunculus nivalis	Snowy Buttercup	S2
Ranunculus pedatifidus var. affinis	Northern Buttercup	S2
Ranunculus pensylvanicus	Bristly Crowfoot	S1
Ranunculus pygmaeus	Dwarf Buttercup	S3
Ranunculus sulphureus	Sulphur Butter-Cup	S1S2?
Ribes lacustre	Bristly Black Currant	S2S3
Salix eriocephala	Heart-Leaved Willow	S1
Salix myricoides var. myricoides	Blue-Leaf Willow	S1
Sarracenia purpurea ssp. gibbosa	Northern Pitcher-Plant	S2S3
Saxifraga foliolosa	Leafy Saxifrage	S2S3
Saxifraga nivalis	Snow Saxifrage	S3
Saxifraga paniculata	White Mountain Saxifrage	S3S4
Saxifraga stellaris	Star Saxifrage	S1S2
Saxifraga tenuis	Ottertail Pass Saxifrage	S3
Saxifraga tricuspidata	Prickly Saxifrage	S1
Scheuchzeria palustris	Pod Grass	S3
Schizachne purpurascens	Purple Oat	S2S3
Scirpus microcarpus	Small-Fruit Bulrush	S2S3
Scutellaria galericulata	Hooded Skullcap	S2S3
Sparganium glomeratum	Northern Bur-Reed	S1?
Thalictrum alpinum	Alpine Meadow-Rue	S1
Tofieldia glutinosa	Sticky False-Asphodel	S1?
Urtica dioica ssp. gracilis	Stinging Nettle	S2?
Utricularia cornuta	Horned Bladderwort	S2S3
Valeriana dioica var. sylvatica	Wood Valerian	S1
Veronica scutellata	Marsh-Speedwell	S2S3
Viola blanda	Smooth White Violet	S1S3
Viola selkirkii	Great-Spurred Violet	S2S4
Woodsia alpina	Northern Woodsia	S1
Woodsia glabella	Smooth Woodsia	S3S4
Woodsia ilvensis	Rusty Woodsia	S3S4
Zostera marina	Sea-Wrack	S1S2
***Species Provincial S-Rank Brief Definitions**		
S1 - Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.		
S2 - Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.		
S3 - Uncommon throughout its range in the province, or found only in a restricted range, even if abundant in some locations. (21 to 100 occurrences).		
S4 - Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the species is of long-term concern (e.g. watch list). (100+ occurrences).		
S5 - Demonstrably widespread, abundant, and secure throughout its range in the province, and essentially ineradicable under present conditions.		
S#S# - Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species (e.g., S1S2).		
? - Inexact or uncertain: for numeric ranks, denotes inexactness, e.g., SE? denotes uncertainty of exotic status. (The ? Qualifies the character immediately preceding it in the SRANK).		

A two step process was undertaken to screen out species unlikely to be found in the vicinity of the highway. First, species distribution data for the identified uncommon or rare species were consulted to determine if the study area was outside of the known range. Range data were derived from Meades et al. (2000). Meades et al. (2000) divides Labrador into five regions: western, northern (north of the Churchill River Basin), central (Lake Melville/Churchill River Basin), southern (west and south of the Churchill River Basin, excluding the southeastern coastal area), and southeastern (southeastern corner of Labrador along the Strait of Belle Isle). The proposed highway is located within the central and southern regions, thus species not found in these regions were excluded from the ACCDC list. This process reduced the list of candidate species to 115.

The habitat preferences of the remaining 115 species were reviewed and compared to habitat data collected along the proposed highway route in order to determine if suitable habitat was present. The habitat preferences for these species were derived from a variety of sources, including Meades et al. (2000), Hinds (2000), Bouchard et al. (1991), Britton and Brown (1970), Hulten (1968), and Fernald (1950). Since habitat preferences of plant species can change with latitude, sources of habitat information derived from areas close to Labrador, were used preferentially over sources from more distant locations. Habitat preferences of the 115 uncommon and rare species are provided in Table C-2.

Table C-2: Habitat Preferences of Uncommon and Rare Vascular Plants Found in South and Central Labrador

Species	Habitat	Source
Actaea rubra ssp. rubra	Woods and thickets	Fernald 1950
Agrostis scabra var. septentrionalis	Wet sands, peats and barrens	Fernald 1950
Agrostis stolonifera	Damp thickets, swales, shores, etc. and fields and roadsides	Fernald 1950
Anemone parviflora	In wet or dry calcareous soil (Fernald 1950); Meadows, heaths, stony slopes and snow beds (Hultén 1968)	Fernald 1950; Hultén 1968
Angelica lucida	Rocky and gravelly coast, subalpine meadows	Fernald 1950
Arabis drummondii	Basic or circumneutral ledges, gravels and thickets (Fernald 1950); Dry, rocky slopes (Hultén 1968)	Fernald 1950; Hultén 1968
Arctostaphylos uva-ursi	On exposed rocks and sands (Fernald 1950); Dry, sandy places (Hultén 1968)	Fernald 1950; Hultén 1968
Arethusa bulbosa	Sphagnum bogs and peaty meadows	Fernald 1950
Armeria maritima ssp. sibirica	Common on cliffs along the sea, rare inland	Hultén 1968
Asplenium trichomanes-ramosum	Shaded, often calcareous, rock-crevices	Fernald 1950
Astragalus robbinsii var. fernaldii	Calcareous cliffs and talus, river gravels, sandy beach	Meades et al. 2000
Botrychium lanceolatum var. lanceolatum	Meadows, peaty slopes, clearings (Fernald 1950); Dryish meadow slopes (Bouchard et al. 1991)	Fernald 1950; Bouchard et al. 1991
Botrychium multifidum	Peaty, loamy or gravelly slopes, plains, thickets and clearings (Fernald 1950); Sandy meadows and woods (Hultén 1968)	Fernald 1950; Hultén 1968
Botrychium virginianum	Rich deciduous or mixed woods (Fernald 1950); Woods and meadows with a preference for calcareous soil (Hultén 1968)	Fernald 1950; Hultén 1968
Caltha palustris	Swamps, wet meadows, and wet woods (Fernald 1950); Moist places (Hultén 1968)	Fernald 1950
Campanula uniflora	Arctic region to calcareous alpine areas	Fernald 1950
Cardamine pensylvanica	Springs, rills, wet clearings, etc., "our commonest species"	Fernald 1950

Table C-2: Habitat Preferences of Uncommon and Rare Vascular Plants Found in South and Central Labrador		
Species	**Habitat**	**Source**
Carex adelostoma	Boggy Marshes	Meades et al. 2000
Carex aurea	Meadows, springy banks, and damp shores (chiefly calcareous)	Fernald 1950
Carex bipartita	Slopes of slaty and quatzite hills	Bouchard et al. 1991
Carex buxbaumii	Wet shores, swamps and bogs	Fernald 1950
Carex capitata	Peaty margins of pools in limestone barrens	Bouchard et al. 1991
Carex castanea	Calcareous woods, thickets, shores and meadows	Fernald 1950
Carex chordorrhiza	Sedge marshes along the coast	Bouchard et al. 1991
Carex crawfordii	Damp dry open ground, rarely in woods	Bouchard et al. 1991
Carex diandra	Peaty bogs, swamps, etc., oftenest calcareous (Fernald 1950); Swamps, mires, bogs, borders of ponds (Hultén 1968)	Fernald 1950; Hultén 1968
Carex foenea	Dry open soil (Fernald 1950); Woods, riverbeds, sandy soil (Hultén 1968)	Fernald 1950; Hultén 1968
Carex intumescens	Alluvial woods, meadows, swales	Fernald 1950
Carex leptonervia	Low woods, clearings, and thickets	Fernald 1950
Carex macloviana	Greenland to Labrador to alpine meadows (Fernald 1950) ; meadows, gravelly shores (Hultén 1968)	Fernald 1950; Hultén 1968
Carex membranacea	Wet places	Hultén 1968
Carex michauxiana	Acid peats, wet sands	Fernald 1950
Carex microglochin	Springy fens and turfy limestone barrens	Bouchard et al. 1991
Carex misandra	Sandy and stony places in mountains, marshes	Hultén 1968
Carex praticola	Open woods, meadows, prairies and clearings	Fernald 1950
Carex projecta	Swales, thickets and damp woods	Fernald 1950
Carex stipata	Low grounds (Fernald 1950) ; swamps and meadows (Hultén 1968)	Fernald 1950; Hultén 1968
Carex umbellata	Exposed, barren siliceous summits, gravelly terraces along rivers (Bouchard et al. 1991); Dry sandy, argillaceous or rocky soil (Fernald 1950)	Bouchard et al. 1991; Fernald 1950
Carex viridula ssp. viridula	Damp, often calcareous, gravels, shores, muddy spots, and springy places	Fernald 1950
Circaea alpina ssp. alpina	Cool moist woods and openings	Fernald 1950
Corydalis sempervirens	Rocky places and recent clearings (Fernald 1950); Rocky places, roadsides, occurs sometimes as a weed (Hultén 1968)	Fernald 1950; Hultén 1968
Cystopteris montana	Mossy glades in spruce thickets on limestone	Bouchard et al. 1991
Descurainia incana	On riverbanks	Hinds 2000
Draba cana	Calcareous cliffs and slopes	Fernald 1950
Dryopteris campyloptera	Cool woods and thickets	Fernald 1950
Dryopteris fragrans	Dry cliffs and rocky banks (Fernald 1950); sunny rocky slopes (Hultén 1968)	Fernald 1950; Hultén 1968
Equisetum fluviatile	Shallow water, wet shores, and swales	Fernald 1950
Equisetum palustre	Marshes, wet woods, meadows, wet shores, etc, often in calcareous soil (Fernald 1950); Wet, moist places, ponds, rare along shores, more common inland (Hultén 1968)	Fernald 1950; Hultén 1968
Equisetum pratense	Common in woods of the interior	Hultén 1968

Table C-2: Habitat Preferences of Uncommon and Rare Vascular Plants Found in South and Central Labrador		
Species	**Habitat**	**Source**
Equisetum scirpoides	Woods, thickets, mossy knolls or springy banks, often partly buried in humus (Fernald 1950); Coniferous woods, tundra (Hultén 1968)	Fernald 1950; Hultén 1968
Equisetum variegatum var. variegatum	Damp, often calcareous sands, shores and marly bogs (Fernald 1950); Woods and tundra, scree slopes, in alpine zone (Hultén 1968)	Fernald 1950
Eriocaulon aquaticum	Common in shallow water of ponds and lakes	Hinds 2000
Festuca brachyphylla ssp. brachyphylla	Arctic region to rocky summit and slopes	Fernald 1950
Festuca frederikseniae (F.viviparia excl)	Sandy, rocky places on tundra (Hinds 2000); Limestone crests, ledges and gravelly barrens (Bouchard et al. 1991)	Hinds 2000; Bouchard et al. 1991
Galium triflorum	Woods and thickets	Fernald 1950
Gentianella amarella ssp. acuta	In moist dunes, borders of abandoned dirt roads, hollows, and calcareous ledges	Hinds 2000
Gentianella propinqua ssp. propinqua	Coastal turfy limestone barrens	Bouchard et al. 1991
Geum rivale	Wet meadows, bogs and peaty slopes	Fernald 1950
Halenia deflexa	Damp and cool woods	Fernald 1950
Hedysarum alpinum	Calcareous rocks and gravels (Fernald 1950); Rocky slopes, spruce forests, gravel bars (Hultén 1968)	Fernald 1950; Hultén 1968
Iris versicolor	Marshes, meadows, ditches and turfy shores	Fernald 1950
Isoetes lacustris	In 1o - 5o of water; submerged or rarely above water in dry seasons	Britton and Brown 1970
Juncus balticus	Sandy brackish to fresh shores	Fernald 1950
Juncus tenuis	Roadsides, open ground	Hultén 1968
Juncus vaseyi	Damp thickets, shores, etc.	Fernald 1950
Lathyrus palustris	Shores, damp thickets and meadows	Fernald 1950
Lycopodiella inundata	Bogs and wet shores in lowlands	Hultén 1968
Lysimachia terrestris	Low grounds and wet shores	Fernald 1950
Mentha canadensis	Damp open soils, shores, etc.	Fernald 1950
Mitella nuda	Cool or mossy woods or swamps (Fernald 1950); Along streams, bogs (Hultén 1968)	Fernald 1950; Hultén 1968
Monotropa uniflora	Woodland humus (Fernald 1950); Woods (Hultén 1968)	Fernald 1950; Hultén 1968
Myriophyllum sibiricum	Shallow ponds on limestone	Bourchard et al. 1991
Myriophyllum tenellum	Shallow margins of ponds and pools in sand, granite gravel, mud, and peat	Fernald 1950
Nuphar lutea ssp. variegata	Ponds and low streams	Hultén 1968
Onoclea sensibilis	Low open ground, alluvial thickets and low woods, most often fruiting in the open	Fernald 1950
Oryzopsis pungens=P	Rocky sandy peaty soil (Fernald 1950); Sandy or rocky soil (Hultén 1968)	Fernald 1950; Hultén 1968
Osmunda claytoniana	Moist woods and thickets	Fernald 1950
Oxalis montana	Alder-maple thickets and balsam fir forests in sheltered river (Bouchard et al. 1991); Damp woods (Fernald 1950)	Bourchard et al. 1991; Fernald 1950
Oxytropis campestris var. johannensis	Calcareous cliffs and flats, shorelines and meadows	Meades et al. 2000
Parnassia kotzebuei	Moist cliffs, alpine ravines, and snowbeds	Bouchard et al. 1991
Pentaphylloides floribunda	Both wet and dry ground, forests, heaths, muskeg & skree slopes	Hultén 1968
Phippsia algida	Bogs and wet places, snow beds, mostly on tundra	Hultén 1968

Table C-2: Habitat Preferences of Uncommon and Rare Vascular Plants Found in South and Central Labrador		
Species	**Habitat**	**Source**
Platanthera obtusata	Mossy forests and wet places	Fernald 1950
Poa flexuosa	Rocky ground, cliffs, and alpine slopes.	Meades et al. 2000
Polypodium virginianum	On rocks, crests of ledges, bases of trees, and rocky slopes	Fernald 1950
Populus balsamifera ssp. balsamifera	River banks or gravels	Fernald 1950
Populus tremuloides	Dry open woods and recent burns	Fernald 1950
Potamogeton confervoides	Mountain lakes (Medes et al. 2000); Sandy or peaty ponds and pools on mountains (Fernald 1950)	Meades et al. 2000; Fernald 1950
Potamogeton oakesianus	Acid peaty-, sandy- or rocky bottomed pools	Fernald 1950
Potamogeton obtusifolius	Pools and shallow ponds (Bouchard et al. 1991); Cold streams, springs and lakes (Fernald 1950)	Bouchard et al. 1991; Fernald 1950
Potamogeton pusillus var. tenuissimus	Basic or alkaline waters	Fernald 1950
Potamogeton richardsonii	Lakes and rivers, frequently brackish or alkaline (Fernald 1950); Lakes (Hultén 1968)	Fernald 1950; Hultén 1968
Primula laurentiana	Ledges, cliffs and meadows, chiefly calcareous	Fernald 1950
Primula mistassinica	Calcareous or argillaceous rock, shores and meadows (Fernald 1950); Meadows, along streams (Hultén 1968)	Fernald 1950; Hultén 1968
Prunus pensylvanica	Dry woods, recent burns and openings	Fernald 1950
Pyrola chlorantha	Dry or dryish coniferous woods and thickets (Fernald 1950); Woods (Hultén 1968)	Fernald 1950; Hultén 1968
Ranunculus abortivus	Low woods, thickets, clearings, and damp slopes	Fernald 1950
Ranunculus lapponicus	Boggy plateau	Bouchard et al. 1991
Ranunculus pensylvanicus	Alluvial shores and swales	Bouchard et al. 1991
Ribes lacustre	Cold woods and swamps	Fernald 1950
Salix eriocephala	In swamps and moist hillsides	Britton and Brown 1970
Sarracenia purpurea ssp. gibbosa	Sphagnous bogs and peaty barrens	Fernald 1950
Scheuchzeria palustris	Bogs, quagmires and peaty shores	Fernald 1950
Scirpus microcarpus	Wet places	Hultén 1968
Scutellaria galericulata	Gravelly, sandy or rocky shores, meadows, swampy thickets (Fernald 1950); Wet meadows (Hultén 1968)	Fernald 1950; Hultén 1968
Sparganium glomeratum	Shallow pools	Meades et al. 2000
Tofieldia glutinosa	Calcareous marshes, damp ledges and shores	Fernald 1950
Urtica dioica ssp. gracilis	Waste places, roadsides, etc.	Fernald 1950
Utricularia cornuta	Wet peaty, sandy or muddy shores or bogs	Fernald 1950
Valeriana dioica var. sylvatica	Bogs, mossy woods and brooksides on limestone	Bouchard et al. 1991
Veronica scutellata	Wet places, shores and swamps	Fernald 1950
Viola blanda	Rich, chiefly deciduous woods	Fernald 1950
Viola selkirkii	Rich woods, shaded or cool rocky (often calcareous) slopes	Fernald 1950
Woodsia alpina	Crevices of limestone cliffs (Bouchard et al. 1991, Meades et al. 2000); Artic region south to shaded or exposed, damp to dry calcareous rocky banks of Newfoundland (Fernald 1950)	Bouchard et al. 1991; Meades et al. 2000; Fernald 1950
Woodsia glabella	Crevices of limestone cliffs (Bouchard et al. 1991); In thin moss or humus on calcareous rocks, often at crests of shaded cliffs (Fernald 1950)	Bouchard et al. 1991; Fernald 1950
Woodsia ilvensis	Dry, mostly sterile rocks, cliffs and talus, frequently exposed situations	Fernald 1950

In order to facilitate further analysis, the habitat preferences of the plant species were organized into 16 habitat types, each discernable on available mapping or aerial photography (Table C-3).

Table C-3: Matrix of Uncommon and Rare Vascular Plant Species Found in Central and Southern Labrador and Their Habitat Preferences

Species	S-rank (Labrador)	Mixed Woods and Thickets	Coniferous Forest	Recent Burns/Disturbance/Clearings	Sub-Alpine Meadow/Alpine Meadow	Rocky Meadow Slope	Sandy Substrates/Open Soils	Barrens	Riparian	Lacustrine	Swamps	Marshes	Fens	Bogs	Cliffs/Talus Slopes	Rock outcrop	Calcareous[1]
Actaea rubra ssp. rubra	S3S4	X							X								
Agrostis scabra var. septentrionalis	S2S3						X	X	X								
Agrostis stolonifera	S2S4			X					X	X							
Anemone parviflora	S3S4																X
Angelica lucida	S1S2				X												
Arabis drummondii	S1S2								X								X
Arctostaphylos uva-ursi	S2S3						X	X									
Arethusa bulbosa	S1												X	X			
Armeria maritima ssp. sibirica	S3S4														X		
Asplenium trichomanes-ramosum	S1														X		
Astragalus robbinsii var. fernaldii	S1																X
Botrychium lanceolatum var. lanceolatum	S1					X	X										
Botrychium multifidum	S1	X					X										
Botrychium virginianum	S1	X							X								
Caltha palustris	S1								X	X	X						
Cardamine pensylvanica	S2S3								X		X						
Carex adelostoma	S1S2											X	X				
Carex aurea	S1S2								X	X							X
Carex bipartita	S3?					X											
Carex buxbaumii	S3?									X	X			X			
Carex capitata	S3?							X									X
Carex castanea	S1S2	X							X	X							X
Carex chordorrhiza	S3?										X						
Carex crawfordii	S1S2				X			X									
Carex diandra	S1S2										X			X			X
Carex foenea	S2S3						X		X								
Carex intumescens	S1S2								X								
Carex leptonervia	S2S3			X					X								
Carex macloviana	S3?				X												
Carex membranacea	S1S2								X	X	X	X	X				X
Carex michauxiana	S1S2													X	X		
Carex microglochin	S1S2							X						X			X
Carex misandra	S3?					X	X					X					X

Table C-3: Matrix of Uncommon and Rare Vascular Plant Species Found in Central and Southern Labrador and Their Habitat Preferences

Species	S-rank (Labrador)	Mixed Woods and Thickets	Coniferous Forest	Recent Burns/Disturbance/Clearings	Sub-Alpine Meadow/Alpine Meadow	Rocky Meadow Slope	Sandy Substrates/Open Soils	Barrens	Riparian	Lacustrine	Swamps	Marshes	Fens	Bogs	Cliffs/Talus Slopes	Rock outcrop	Calcareous[1]
Carex praCcola	S3?				X		X										
Carex projecta	S1S2								X			X					
Carex stipata	S2S3										X		X				
Carex umbellata	S1S2								X								
Carex viridula ssp. viridula	S1S2								X	X							X
Circaea alpina ssp. alpina	S3S4?	X	X							X							
Corydalis sempervirens	S3S4			X												X	
Cystopteris montana	S1S2		X														X
Descurainia incana	S1S2								X								X
Draba cana	S1														X		X
Dryopteris campyloptera	S3?	X	X														
Dryopteris fragrans	S2S4					X									X		
Equisetum fluviatile	S1S3									X		X					
Equisetum palustre	S1								X	X		X					X
Equisetum pratense	S1	X	X						X								
Equisetum scirpoides	S1	X	X						X								
Equisetum variegatum var. variegatum	S2?								X	X				X			
Eriocaulon aquaticum	S1S2									X							
Festuca brachyphylla ssp. brachyphylla	S2S4					X											
Festuca frederikseniae (F.viviparia excl)	S1S2						X	X									X
Galium triflorum	S2S3	X						X									
Gentianella amarella ssp. acuta	S2?			X											X		X
Gentianella propinqua ssp. propinqua	S1							X									X
Geum rivale	S1S2								X					X			
Halenia deflexa	S2S3	X															
Hedysarum alpinum	S1S2								X	X							X
Iris versicolor	S2S3								X	X	X	X					
Isoetes lacustris	S1									X							
Juncus balticus	S3								X	X							
Juncus tenuis	S1?						X		X	X							
Juncus vaseyi	S1								X	X							
Lathyrus palustris	S1S2								X	X							
Lycopodiella inundata	S2S3								X	X				X			
Lysimachia terrestris	S1								X	X							
Mentha canadensis	S2S3								X	X	X						

Table C-3: Matrix of Uncommon and Rare Vascular Plant Species Found in Central and Southern Labrador and Their Habitat Preferences

Species	S-rank (Labrador)	Mixed Woods and Thickets	Coniferous Forest	Recent Burns/Disturbance/Clearings	Sub-Alpine Meadow/Alpine Meadow	Rocky Meadow Slope	Sandy Substrates/Open Soils	Barrens	Riparian	Lacustrine	Swamps	Marshes	Fens	Bogs	Cliffs/Talus Slopes	Rock outcrop	Calcareous[1]
Mitella nuda	S2?		X								X			X			
Monotropa uniflora	S1S3?	X	X														
Myriophyllum sibiricum	S2S3									X							X
Myriophyllum tenellum	S1?									X							
Nuphar lutea ssp. variegata	S3S4								X	X							
Onoclea sensibilis	S2S3?								X		X						
Oryzopsis pungens=P	S1S2					X	X										
Osmunda claytoniana	S2S4	X							X								
Oxalis montana	S1S3	X	X						X								
Oxytropis campestris var. johannensis	S1							X	X	X					X		X
Parnassia kotzebuei	S3S4														X		X
Pentaphylloides floribunda	S2S3		X					X									X
Phippsia algida	S3?												X	X			
Platanthera obtusata	S3S4	X	X								X						
Poa flexuosa	S1					X									X		
Polypodium virginianum	S2S3?	X	X													X	
Populus balsamifera ssp. balsamifera	S2S3								X								
Populus tremuloides	S2S3		X	X			X										
Potamogeton confervoides	S1?									X							
Potamogeton oakesianus	S1S3									X							
Potamogeton obtusifolius	S1?								X	X							
Potamogeton pusillus var. tenuissimus	S1?									X							X
Potamogeton richardsonii	S1?								X	X							X
Primula laurentiana	S3S4					X									X		X
Primula mistassinica	S2					X			X	X					X		X
Prunus pensylvanica	S2S3			X			X										
Pyrola chlorantha	S2S3		X														
Ranunculus abortivus	S2	X							X								
Ranunculus lapponicus	S2S3													X			
Ranunculus pensylvanicus	S1								X		X	X					
Ribes lacustre	S2S3										X						
Salix eriocephala	S1										X						
Sarracenia purpurea ssp. gibbosa	S2S3							X						X			
Scheuchzeria palustris	S3									X				X			
Scirpus microcarpus	S2S3								X	X		X					

Table C-3: Matrix of Uncommon and Rare Vascular Plant Species Found in Central and Southern Labrador and Their Habitat Preferences

Species	S-rank (Labrador)	Mixed Woods and Thickets	Coniferous Forest	Recent Burns/Disturbance/Clearings	Sub-Alpine Meadow/Alpine Meadow	Rocky Meadow Slope	Sandy Substrates/Open Soils	Barrens	Riparian	Lacustrine	Swamps	Marshes	Fens	Bogs	Cliffs/Talus Slopes	Rock outcrop	Calcareous[1]
Scutellaria galericulata	S2S3								X	X	X	X					
Sparganium glomeratum	S1?									X	X	X					
Tofieldia glutinosa	S1?									X	X		X				X
Urtica dioica ssp. gracilis	S2?			X													
Utricularia cornuta	S2S3								X	X	X		X	X			
Valeriana dioica var. sylvatica	S1		X						X					X			X
Veronica scutellata	S2S3								X	X	X	X					
Viola blanda	S1S3	X															
Viola selkirkii	S2S4	X				X											X
Woodsia alpina	S1														X		X
Woodsia glabella	S3S4														X		X
Woodsia ilvensis	S3S4														X	X	

[1]Note that the calcareous habitat is used as a descriptor that can be applied to other habitat types.

For example, Drummond rockcress (*Arabis drummondii*) is found in riparian areas on calcareous substrates.

It would not be expected to occur in riparian areas on acidic substrates.

A habitat assessment was conducted along the proposed highway route to determine which of the 16 habitat types were present. Sources used for the assessment included 1:250,000 scale topographic, surficial geology, and geological maps, black-and-white aerial photography (various scales), data from aerial flights along the highway route, and habitat descriptions compiled at 30 wetland sites, found within 100 m of the proposed highway right-of-way.

Habitats found within 100 m of the proposed highway right-of-way included coniferous forest, sandy substrates/open soils, barrens, riparian areas, lacustrine areas, swamps, marshes, fens, bogs, and rock outcrops. Uncommon or rare species associated with these habitat types could be found along the proposed highway route. Habitats not found along the route included mixed woods and thickets, recent burns/disturbance/clearings, sub-alpine meadows/alpine meadow, rocky meadow slope, cliffs/talus slopes, and calcareous substrates. Species associated with these habitat types are unlikely to be present along the proposed highway route and were eliminated from the final list of rare or uncommon species potentially present. The number of species potentially encountered along the proposed highway right-of-way is 72 (Table C-4). Note that species characteristic of calcareous substrates have been eliminated from the list regardless of the other habitat types they may be associated with. For example, mountain

bladder fern (*Cystopteris montana*) is associated with coniferous forest growing on calcareous substrates. Coniferous forest is plentiful along the route, however, no calcareous substrates are present so it is unlikely that this species would occur.

Table C-4: Uncommon and Rare Vascular Plant Species Potentially Present Along the Highway Right-of-way and the Habitats in which they are Typically Found

Species	S-rank (Labrador)	Barrens	Coniferous Forest	Rock Outcrops	Sandy Substrates/Open Soils	Riparian	Lacustrine	Swamps	Marshes	Fens	Bogs
Actaea rubra ssp. Rubra	S3S4					X					
Agrostis scabra var. septentrionalis	S2S3	X			X	X					
Agrostis stolonifera	S2S4					X	X				
Arctostaphylos uva-ursi	S2S3	X			X						
Arethusa bulbosa	S1									X	X
Botrychium lanceolatum var. lanceolatum	S1				X						
Botrychium multifidum	S1				X						
Botrychium virginianum	S1					X					
Caltha palustris	S1					X	X	X			
Cardamine pensylvanica	S2S3					X		X			
Carex adelostoma	S1S2								X	X	
Carex buxbaumii	S3?						X	X			X
Carex chordorrhiza	S3?							X			
Carex crawfordii	S1S2	X									
Carex foenea	S2S3				X	X					
Carex intumescens	S1S2					X					
Carex leptonervia	S2S3					X					
Carex michauxiana	S1S2										X
Carex praticola	S3?				X						
Carex projecta	S1S2					X			X		
Carex stipata	S2S3							X		X	
Carex umbellata	S1S2					X					
Circaea alpina ssp. Alpina	S3S4?		X				X				
Corydalis sempervirens	S3S4			X							
Dryopteris campyloptera	S3?		X								
Equisetum fluviatile	S1S3						X		X		
Equisetum pratense	S1		X			X					
Equisetum scirpoides	S1		X			X					
Equisetum variegatum var. variegatum	S2?					X	X				X
Eriocaulon aquaticum	S1S2						X				
Galium triflorum	S2S3	X									
Geum rivale	S1S2					X					X
Iris versicolor	S2S3					X	X	X	X		
Isoetes lacustris	S1						X				
Juncus balticus	S3					X	X				

Table C-4: Uncommon and Rare Vascular Plant Species Potentially Present Along the Highway Right-of-way and the Habitats in which they are Typically Found

Species	S-rank (Labrador)	Barrens	Coniferous Forest	Rock Outcrops	Sandy Substrates/Open Soils	Riparian	Lacustrine	Swamps	Marshes	Fens	Bogs
Juncus tenuis	S1?				X	X	X				
Juncus vaseyi	S1					X	X				
Lathyrus palustris	S1S2					X	X				
Lycopodiella inundata	S2S3					X	X				X
Lysimachia terrestris	S1					X	X				
Mentha canadensis	S2S3					X	X	X			
Mitella nuda	S2?		X					X			X
Monotropa uniflora	S1S3?		X								
Myriophyllum tenellum	S1?						X				
Nuphar lutea ssp. Variegata	S3S4					X	X				
Onoclea sensibilis	S2S3?					X		X			
Oryzopsis pungens=P	S1S2				X						
Osmunda claytoniana	S2S4					X					
Oxalis montana	S1S3		X			X					
Phippsia algida	S3?									X	X
Platanthera obtusata	S3S4		X					X			
Polypodium virginianum	S2S3?		X	X							
Populus balsamifera ssp. balsamifera	S2S3					X					
Populus tremuloides	S2S3		X		X						
Potamogeton confervoides	S1?						X				
Potamogeton oakesianus	S1S3						X				
Potamogeton obtusifolius	S1?					X	X				
Prunus pensylvanica	S2S3				X						
Pyrola chlorantha	S2S3		X								
Ranunculus abortivus	S2					X					
Ranunculus lapponicus	S2S3										X
Ranunculus pensylvanicus	S1					X		X	X		
Ribes lacustre	S2S3							X			
Salix eriocephala	S1							X			
Sarracenia purpurea ssp. gibbosa	S2S3	X									X
Scheuchzeria palustris	S3						X				X
Scirpus microcarpus	S2S3					X	X		X		
Scutellaria galericulata	S2S3					X	X	X	X		
Sparganium glomeratum	S1?						X	X	X		
Utricularia cornuta	S2S3					X	X	X		X	X
Veronica scutellata	S2S3					X	X	X	X		
Viola blanda	S1S3										
Woodsia ilvensis	S3S4			X							
Total Number of Species		5	11	3	10	35	27	17	9	5	12

The habitat types varied substantially in the number of rare species associated with them. Riparian, lacustrine and swamp habitats support the largest number of species while rock outcrops, barrens, fens, and marshes support the lowest number of species (Table C-4).

Identification of areas having high potential to support rare plants was initially determined by recording the distribution of the habitat types along the highway route that have been associated with rare species. The potential distribution of rare plants along the route is widespread since almost all habitat types present along the route have the potential to harbour rare plant species. Using this criterion for selection, approximately 330 sites with the potential to support rare plants were identified. It is highly unlikely that rare species would be found at all of these locations. Therefore, further analyses were undertaken to select the sites having the highest potential to support rare species. The strategy employed to select the sites having the highest potential varied with habitat type.

Some habitat types such as barrens, rock outcrops, sandy substrates/open soils, and marshes, are relatively uncommon along the proposed highway route. Barrens are found at only two locations along the route. Rock outcrops are present at seven locations. Only one of these sites is exposed bedrock while the remaining six sites are glacial boulder fields. Sandy substrates are found at four locations. Two of these sites are eskers, one is an area of exposed sand and the last site is an area identified as underlain by sand and gravel deposits. Marsh habitats were found at only six locations along the route. Rare plants are generally associated with rare habitat types. Consequently, these areas were selected as sampling sites due to the high potential they have to harbour rare plant species.

The remaining six habitats are relatively common on the landscape. Coniferous forest is the most common habitat type along the route, occupying at least 50 percent of the landscape. Wetlands, particularly bogs, swamps and fens, are also abundant along the route, especially near the eastern end of the route. Riparian habitats are numerous although they do not account for a sizeable portion of the landscape. Only a small subset of these habitats will support rare plant species. In order to identify which of these sites is most likely to support rare plant species, it is necessary to identify habitat that contain features with the potential to provide niches for rare plants.

Some plant species require fertile sites in order to persist, others may be adapted to surviving in extremely infertile sites or in the presence of toxic concentrations of compounds such as metals or salts. Some species are at the northern or southern limits of distribution and may require special conditions in order to persist. For example, species characteristic of more northern areas may survive on mountain summits or north facing slopes while southern species may persist in sheltered areas with southern exposures. Similarly, the flood plains of large rivers often contain fertile fluvial deposits that can provide habitat for species characteristic of rich sites. River valleys are often sheltered from extremes of weather and may support species characteristic of more southern areas.

Wetlands found along the route have been subdivided into various wetland types depending on the structure and location of the wetland. There are four types of bog (string bog, basin bog, shore bog, and

slope bog) and three types of fen (Atlantic ribbed fen, stream fen and slope fen). Only one type of marsh (kettle marsh) and swamp (stream swamp) are present along the route. These wetland types have developed in response to a variety of environmental factors such as the availability of nutrients, basin morphology, topography, and climatic conditions. Rare plant species may be present as a result of various combinations of these environmental factors. The more uncommon wetland types can be expected to have a higher probability of harbouring rare plant species since they may represent an unusual combination of environmental factors. The most uncommon wetland types along the route are kettle marsh, stream fen, and slope fen.

Rare vascular plant surveys conducted along the eastern and western ends of the proposed highway have provided insight regarding the possible distribution of uncommon and rare vascular plant species along the outfitter route. These surveys indicated that riparian areas of large rivers, rich coniferous forest in the Churchill River basin, stream swamps, and rich fens support the greatest concentrations of uncommon and rare species. The surveys also indicated that the western portions of the route supported a greater variety of rare species than the eastern end of the route.

Mapping and aerial photography was reviewed in concert with a consideration of environmental factors such as those outlined above in order to select sites having the highest potential to support rare plant species.

The outfitter route is located outside of the Churchill River basin and this route does not cross any large rivers. The largest rivers along the route have the greatest potential to support rare species, consequently, these watercourses will be specifically targeted for field surveys. A large number (44) of stream swamps are present along the proposed route. It is not feasible to sample all of these wetlands, consequently, a subsample of these habitats will be selected as sample sites. Fens are found throughout the route; however, most fens that were visited during the wetland field survey were infertile rather than rich. Unfortunately, it is not possible to ascertain the trophic status of fens along the route with the available information. Consequently, a random selection of fen types will be selected for study. Uncommon fen types will be preferentially sampled. A total of 32 field sampling sites have been identified along the proposed highway route (Table C-5 and Figure F-1).

Table C-5: Field Sampling Sites Identified along the Outfitter Route		
Site Number	**Location (UTM, NAD 83, Zone 21)**	**Habitat**
1	E298217 N5852187	Medium river, coniferous forest
2	E304916 N5850610	Stream fen
3	E314813 N5844188	Kettle marsh
4	E315905 N5843916	Stream fen
5	E324287 N5832389 to E324463 N5832111	Boulder field, coniferous forest, ribbed fen, lacustrine
6	E324885 N5831303 to E325204 N5830946	Boulder field, stream swamp, basin bog, slope fen, coniferous forest
7	E326485 N5829378	Ribbed fen
8	E332109 N5828181	Black spruce/lichen woodland
9	E335790 N5827252 to E336190 N5827100	Slope bog,slope fen, coniferous forest
10	E341615 N5824976	Slope fen
11	E342205 N5825129 to E342424 N5825166	Stream swamp, slope bog, coniferous forest
12	E343631 N5825115 to E344385 N5825357	Barrens, stream swamp,basin bog, coniferous forest
13	E357489 N5829599 to E357695 N5829306	Kettle marsh, shore bog, slope bog, coniferous forest
14	E360281 N5828084	Lacustrine, stream swamp, coniferous forest
15	E363609 N5826747 to E363687 N5826675	Kettle marsh, basin bog, coniferous forest
16	E365085 N5826476 to E365255 N5826474	Medium river, stream swamp, basin bog, coniferous forest
17	E367698 N5825907 to E368064 N5826073	Ribbed fen (2), string bog, coniferous forest
18	E369693 N5826668	Kettle marsh
19	E372207 N5827912	Medium river
20	E375647 N5827539 to E375956 N5827466	Slope bog, kettle marsh, coniferous forest
21	E377095 N5827441	Medium river
22	E382323 N5829388 to E382483 N5829309	Kettle marsh, string bog, coniferous forest
23	E384337 N5829133 to E384431 N5829169	String bog, medium river, coniferous forest
24	E388201 N5830385	Medium river
25	E390516 N5831019	Esker, coniferous forest
26	E396052 N5836766 to E396373 N5837049	Esker, exposed sand, coniferous forest
27	E401080 N5841472 to E410290 N5841578	Stream swamp, boulder field, coniferous forest
28	E402311 N5842153 to E402365 N5842223	Boulder field, basin bog, coniferous forest
29	E403733 N5844292 to E403979 N5844519	Barrens, shore bog, coniferous forest
30	E406403 N5848856 to E406422 N5849080	Boulder field, string bog, coniferous forest
31	E410187 N5858983 to E410378 N5859302	Lacustrine, string bog, coniferous forest
32	E412576 N5862308	Medium river, stream swamp, basin bog, coniferous forest

APPENDIX D

Plants Characteristic of Various Wetland Types

APPENDIX D Plants Characteristic of Various Wetland Types

			Wetland Form																												
Binomial	**Common Name**	**bb**	**bb**	**bb**	**bb**	**bb**	**bb**	**shb**	**shb**	**shb**	**slb**	**slb**	**slb**	**strb**	**strb**	**strb**	**rf**	**rf**	**rf**	**slf**	**slf**	**slf**	**stf**	**stf**	**stf**	**km**	**km**	**km**	**ss**	**ss**	**ss**	
													Wetland Identification Number																			
		302	8	256	319	313	48	22	71	132	323	68	205	316	70	219	9	28	254	123	192	204	303	46	248	170	213	226	34	94	268	
Trees													Cover (%)																		
Picea mariana	black spruce	5	5	5	0.5	1	5	5	3	2	1	1	10	2	1	5	5	2	0.5	2	5	5	1	1	5	0	0	0	5	10	5	
Larix laricina	tamarack	0	0.5	0	0	1	0	5	4	1	1	0.5	0	0.5	1	1	2	0	0.5	10	5	1	2	3	5	0	0	0	0	0	10	
Shrubs																																
Chamaedaphne calyculata	leatherleaf	20	25	15	10	15	30	20	15	15	20	20	25	10	15	20	15	5	5	0	5	8	10	0	12	5	0	0	0	0	0	
Andromeda glaucophylla	bog-rosemary	0.5	0.5	0	0.5	0.5	1	3	5	1	0	0.5	0.5	1	0	0	2	1	0.5	0	0.5	0	0.5	0	0	0	0	0	0	0	0	
Picea mariana	black spruce	15	5	15	2	2	2	12	2	15	15	15	15	5	8	10	1	2	0	0	8	12	0	0	2	0	0	1	0	0	0	
Larix laricina	tamarack	2	5	0	1	3	2	0	2	1	0.5	2	0	3	4	15	12	12	2	0	15	15	0	0	5	0	0	0	0	0	0	
Kalmia polifolia	bog laurel	1	10	5	5	2	2	0	4	8	1	4	1	5	5	6	8	0.5	0	0	7	5	0	0	2	0	0	0	0	0	0	
Kalmia angustifolia	sheep laurel	0	0	0	3	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rhododendron groenlandicu	Labrador tea	2	0	5	3	0	5	5	0	1	5	0	5	5	1	1	0	0	0	0	2	0	0	0	0	1	0	3	0	0	0	
Empetrum nigrum	black crowberry	0.5	0	7	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	db = Domed Bog
Vaccinium uliginosum	alpine bilberry	0	0.5	10	1	0.5	1	3	2	5	0	0	2	1	2	1	2	0	0	0	5	0	0	0	2	2	0	0	0	0	2	bb = Basin Bog
Myrica gale	sweet gale	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	20	15	8	8	0	0	0	10	0	0	shb = Shore Bog
Alnus incana	speckled alder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	slb = Slope Bog
Viburnum edule	squashberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	strb = String Bog
Betula glandulosa	glandular birch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	rf = Atlantic Ribbed Fen
Abies balsamea	balsam fir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	slf = Slope Fen
Betula pumila	dwarf birch	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	20	12	10	0	5	5	0	8	stf = Stream Fen
Betula michauxii	Newfoundland dwarf birch	0	0	0	1	5	1	0	1	0	0	1	0	15	1	1	2	8	10	0	1	0	0	0	0	0	0	0	0	0	0	km = Kettle Marsh
Salix pedicellaris	bog willow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	50	50	ss = Stream Swamp
Lonicera villosa	mountain flyhoneysuckle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	5	0.5	10	0	0	0	4	0	0	0	0	5	0	0	
Salix bebbiana	beaked willow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	5	0	0	0	0	50	15	0	
Salix pyrifolia	balsam willow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	
Ribes glandulosum	skunk currant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	10	
Salix sp.	willow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	
Alnus viride	downy alder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	
Ground Vegetation																																
Sphagnum spp.	sphagnum moss	80	90	85	90	80	90	90	80	90	90	90	80	80	80	90	40	45	40	70	10	60	20	1	70	0	0	0	80	85	10	
Trichophorum cespitosum	deer grass	1	10	0	8	10	15	6	0	0	0	10	0	10	10	0	15	15	8	0	10	0	0	30	10	0	0	0	0	0	0	
Rubus chamaemorus	bakeapple	2	2	5	7	5	5	5	0	0	2	0	2	2	1	2	1	0	0	0	0	2	0	0	0	0	0	0	0	2	0	
Cladonia alpestris	reindeer moss lichen	0	0	10	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cladonia rangiferina	reindeer moss lichen	8	0	5	2	0	0	0	0	0	1	2	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Carex pauciflora	fewflowered sedge	2	0	2	0	0	0	1	1	2	5	0.5	1	1	5	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Lycopodium annotinum	bristly clubmoss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Carex oligosperma	fewseed sedge	20	15	10	10	20	20	15	30	15	15	25	10	20	15	17	25	5	10	0	35	25	2	0	10	5	0	0	0	0	0	
Scheuchzeria palustris	pod grass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sarracenia purpurea	pitcher plant	0	0	0	0	0.5	0.5	0	0	0	0	0	0.5	1	0	0	0	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0	
Maianthemum trifolia	three-leaved false Solomon'	0	0	0	0	0.5	0	0	0	0	0.5	0	0	0	0.5	2	5	0	0	2	0.5	1	0	0	0	0	0	0	0	2	0	
Vaccinium oxycoccos	small cranberry	0	0	0	0	0.5	0	0	0	1	0	0	0	0.5	0.5	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	
Carex limosa	mud sedge	0	0	0	0	0	0	1	5	2	0	0	0	0.5	0	0	3	4	1	0	0.5	0	0	0	0	0	0	0	0	0	0	
Carex megellanica	bog sedge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
Menyanthes trifoliata	buckbean	0	0	0	0	1	0	0	0	1	0	0	0	3	1	0	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	
Comarum palustre	marsh cinquefoil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.5	2	0	5	0	0	0	0	0	
Eriophorum angustifolium	tall cottongrass	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Aster radula	rough aster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	2	5	0.5	0	0.5	1	0	0	0	0	0	0	0	
Carex exilis	coastal sedge	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	15	20	0	0	10	5	0	0	0	0	0	0	0	0	
Eriophorum tennelum	rough cottongrass	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Calamagrostis canadensis	bluejoint	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0.5	20	0	0	1	0	1	2	0	
bryophyta	moss sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	
Tricophorum alpinum	alpine cottongrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Agrostis scabra	rough hairgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	10	0	0	0	10	0	0	0	0	0	0	0	0	
Carex canescens	silvery sedge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	15	0	0	0	0	0	0	0	
Carex vesicaria	lesser bladder sedge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	60	25	0	0	0	
Juncus filiformis	thread rush	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	5	0	0	0	
Viola sp.	violet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	1	0	
Geum rivale	purple avens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	
Rubus pubescens	dewberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	1	
Mitella nuda	naked miterwort	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	
Drosera rotundifolia	round-leaved sundew	0	0	0	0	0.5	0	0	0	0.5	0	0	0	0.5	0	0	0	0	0.5	0	0.5	0.5	0	0	0	0	0	0	0	0	0	
Nuphar variegata	beaver-root	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

APPENDIX D Plants Characteristic of Various Wetland Types

			Wetland Form																													
Binomial	**Common Name**	**bb**	**bb**	**bb**	**bb**	**bb**	**bb**	**shb**	**shb**	**shb**	**slb**	**slb**	**slb**	**strb**	**strb**	**strb**	**rf**	**rf**	**rf**	**slf**	**slf**	**slf**	**stf**	**stf**	**stf**	**km**	**km**	**km**	**ss**	**ss**	**ss**
													Wetland Identification Number																			
		302	8	256	319	313	48	22	71	132	323	68	205	316	70	219	9	28	254	123	192	204	303	46	248	170	213	226	34	94	268
Aster nemoralis	bog aster	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
Deschampsis flexuosa	wavy hair grass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rubus paracaulis	arctic bramble	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	4	0	15	0	0	0	7	0	0	0	0	0	5	0
Geocaulon lividum	northern commandra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deschampsia atropurprea	tufted hair grass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Aster puniceus	purple-stemmed aster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5	0
Carex lasiocarpa	wooly fruit sedge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0
Solidago uliginosa	bog goldenrod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Sparganium angustifolium	narrowleaf burreed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Equisetum sylvaticum	wood horsetail	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	0	0
Epilobium angustifolium	fireweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Geum macrophyllum	large-leaved avens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Gymnocarpium dryopteris	oak fern	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

APPENDIX E

Archaeological Potential Study Outfitter Route Alternative Cartwright Junction to Happy Valley-Goose

JACQUES WHITFORD PROJECT NO. NFS09308-0008
MINASKUAT PROJECT NO. M6-0008

ARCHAEOLOGICAL POTENTIAL STUDY
OUTFITTER ROUTE ALTERNATIVE
CARTWRIGHT JUNCTION TO
HAPPY VALLEY-GOOSE BAY
TRANS LABRADOR HIGHWAY

SEPTEMBER 2003

JACQUES WHITFORD PROJECT NO. NFS09308-0008
MINASKUAT PROJECT NO. M6-0008

ARCHAEOLOGICAL POTENTIAL STUDY
OUTFITTER ROUTE ALTERNATIVE
CARTWRIGHT JUNCTION TO
HAPPY VALLEY-GOOSE BAY
TRANS LABRADOR HIGHWAY

PREPARED FOR:

DEPARTMENT OF WORK, SERVICES AND TRANSPORTATION
5TH FLOOR, CONFEDERATION BUILDING WEST
P.O. BOX 8700
ST. JOHN'S, NF A1B 4Y6

SUBMITTED BY:

JACQUES WHIFORD ENVIRONMENT LIMITED
607 TORBAY ROAD
ST. JOHN'S, NL
A1A 4Y6

Tel. 709 576-1458
Fax 709 576-2126

MINASKUAT LIMITED PARTNERSHIP
BUILDING 412, LAHR BOULEVARD
HAPPY VALLEY-GOOSE BAY, NL
A0P 1C0

SEPTEMBER 30, 2003

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1.0 INTRODUCTION

The proposed construction of the Trans Labrador Highway (TLH) - Phase III (Cartwright Junction to Happy Valley-Goose Bay) will involve ground disturbance that has the potential to cause damage to historic resources. To avoid such negative effects on historic resources, the Department of Works, Services and Transportation (WST) requested that a historic resources study be conducted along the preferred route (IELP 2002) and that JW/MLP (2003a) undertake pre-construction surveys of the cut and marked route. Results of these studies suggest that there is potential for additional historic resources to be located within both the preferred and alternative routes. Consequently, it was anticipated that additional archaeological assessment would be necessary prior to construction along the alternative route that was not included in previous field programs. Therefore, WST requested Minaskuat (a partnership between Innu Environmental Limited Partnership and Jacques Whitford) to prepare an archaeological potential study focusing on the outfitter alternative route. The study was to depict previous survey efforts and results within these areas, and provide strategic advice to WST and appropriate authorities to reduce scheduling conflicts between construction and further archaeological field assessment, should such assessment be required.

1.1 Work Scope and Objectives

The purpose of the archaeological potential study is to summarize ancient land use, as well as any factual information on historic resources for the assessment of the outfitter alternative route. It was intended that this study would serve several purposes, including:

- to identify the distribution and extent of various areas of archaeological potential;
- to assess the archaeological potential in relation to the proposed routes; and
- to serve as the basis for identifying the further work necessary to complete effective sampling of the study area and for developing a work plan for this work, if required.

In addition, the study would be presented in a format amenable to further comparisons with the results of the assessment of the preferred route.

It was also intended that the study would provide results that can be used by the proponent and appropriate authorities to minimize potential effects on historic resources. Thus, the results would also serve to refine a field strategy, should additional fieldwork be required.

1.2 Study Area

The study area for the assessment included a 10 km-wide corridor along the alternative routing for the highway, within which areas with enhanced archaeological potential were identified for future field investigations, if required. The corridor is approximately 150 km long. It extends east from the Salmon River and Kenamu River junction, south of major bodies of freshwater such as Crooks Lake, and reaches the headwaters of the Eagle and Paradise rivers in the East (Figure 1.1 and NTS topographic map sheets 13 C/16, 13 C/9, 13 B/9 to 13 B/13, and 13 B/16).

1.3 Study Team

The study team included archaeologist Yves Labrèche, M.Sc., Dave Kearsey, a GIS/cartographer, and a secretary. In addition, Ms. Karen Roberts and Ms. Ellen Tracy provided a review of the final report.

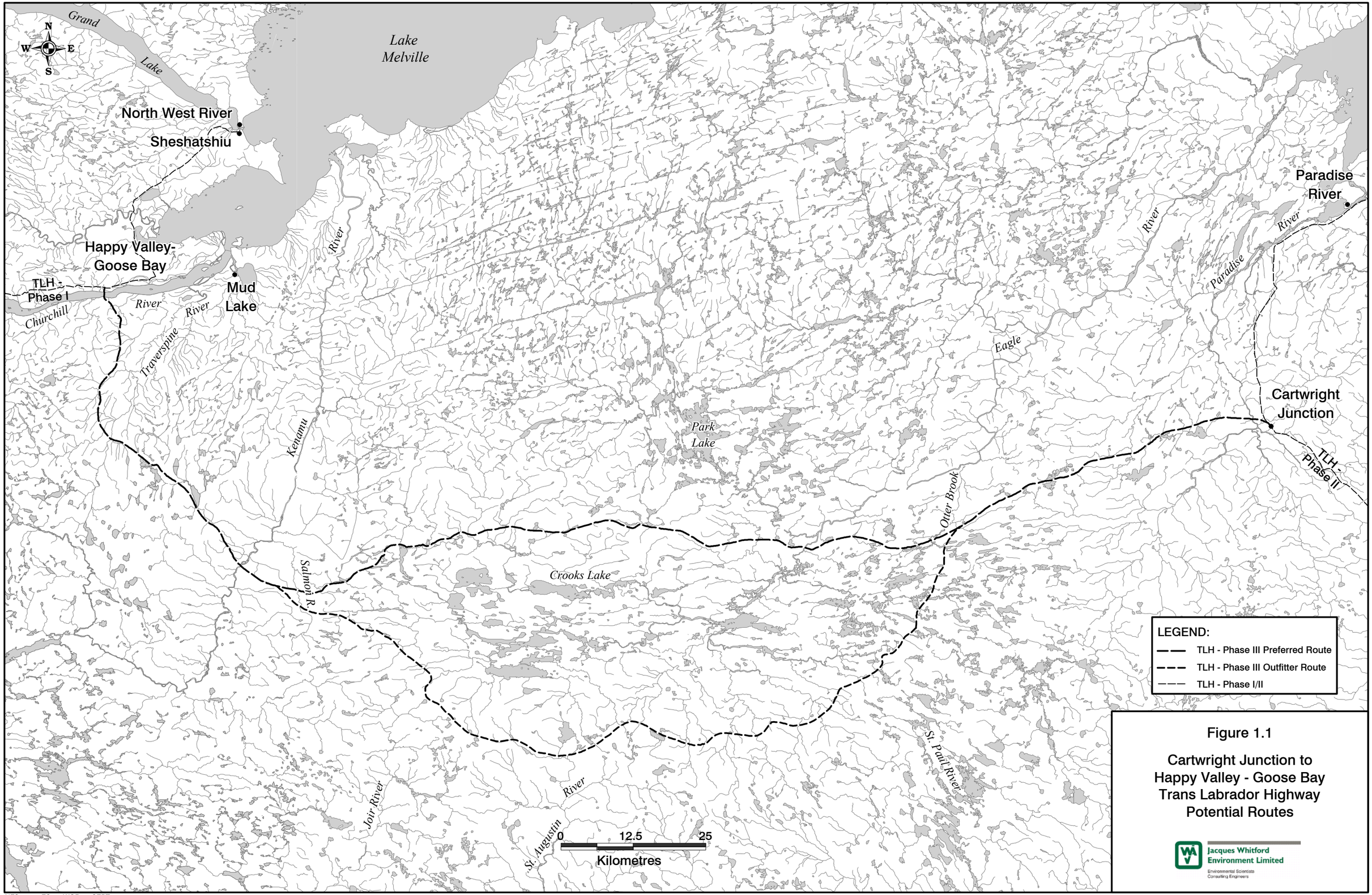


Figure 1.1

Cartwright Junction to
Happy Valley - Goose Bay
Trans Labrador Highway
Potential Routes

Jacques Whitford
Environment Limited
Environmental Scientists
Consulting Engineers

NFS09308-ES-31.WOR 28SEPT03 2:15pm

2.0 METHODOLOGY

The first step consisted in reviewing previous archaeological potential studies of similar scope and scale conducted in project areas with similar environmental (northern) conditions (JWEL/IELP 2001; IELP 2002). Methods employed successfully in previous archaeological potential exercises in Labrador and Northern Québec (e.g., JW/MLP 2003b; JWEL/Innu Environmental 2001; JWEL/MIBC/TCC 1997; Labrèche et al. 1992) were refined and adapted for the analysis of the outfitter route alternative.

The archaeological study included the following steps:

- conduct background research;
- refine methods and topology;
- prepare maps showing registered site plots and delineated areas of enhanced potential in the study area; and
- prepare a document summarizing work completed to date and provide input for a field validation program or further assessment, if required.

Background information used to complete this study included the following documents:

- black and white aerial photography: 1:50,000-scale (estimate);
- colour and black and white NTS topographic maps at 1:50,000 scale;
- digitized maps showing the proposed route;
- surficial geology maps;
- Provincial Archaeology Office (PAO) archaeological data (August-September 2003): sites discovered during previous field investigations;
- archaeological data: testing locations and areas surveyed during previous field investigations (e.g., IELP 2002);
- reports discussing strategic location criteria (e.g., Labrèche et. al. 1992; Schwarz 1997);
- reports discussing past and present environment and resources within the study area (e.g., JW/IELP 2003a); and
- land and resources use information (e.g., Armitage and Stopp 2003; JW/IELP 2003).

3.0 RESULTS

The archaeological potential of an area can be defined as the probability of archaeological discovery based on the analysis of a set of criteria such as topography, type of soil, hydrography, vegetation, wildlife and accessibility. The study of the archaeological potential of a region or a more-precisely targeted assessment area consists of linking different environmental and cultural phenomena that have or had an effect on the land use and occupancy by human groups. Predicting the location of archaeological sites or materials in a region must be based on the existing sample (site distribution) of that region or on fundamental notions concerning human adaptation to the environment. These notions normally include specific local factors that hunters and trappers had to deal with when accessing and using the resources and the land. In areas of low archaeological visibility such as forested areas of the near-coastal hinterland, where field survey must be carefully targeted, the prediction of archaeological potential is an essential stage in both effects assessment and pure research. The interpretation of specific zones of archaeological potential is based on the assumption that sites are located in response to subtle environmental constraints and basic needs. Following this, ease of access, availability of fresh water, presence of an area suitable for habitation, access to food resources, fuel or firewood, and building materials represent key factors for predicting archaeological potential (JWEL/IELP 2001a: 24).

3.1 Cultural History, South Central Labrador

Previous archaeological fieldwork in Labrador has generally focussed on the coast, where it has been demonstrated that archaeological sites are rich and abundant. The basic cultural sequence established for south-central Labrador suggests that there is potential for a 6,000-year sequence of human occupation in the study area (Fitzhugh 1977). Based on previous research, there is potential in the study area for archaeological sites relating to the Intermediate Indian period, Historic and contemporary Innu and Settler/Métis. Maritime Archaic Indian, Recent Indian, Groswater Palaeo-Eskimo, Dorset and Historic Inuit could also be found. However, sites affiliated with these cultures are normally associated with present or ancient marine coastlines and are extremely scarce in the hinterland. In addition, European whalers, explorers, visiting fishermen (from the late 1500s), followed by traders and missionaries (after 1700) and Settlers, also conducted their activities along the Labrador coast and made occasional incursions in the interior. Therefore, evidence of their presence or influence on Aboriginal cultures may also be found at sites located within the study area (Kennedy 1995; Mailhot 1993). Settlers include Labradorians of European descent, whose ancestors have been living in Labrador since the early historic period, and Labradorians of mixed descent (European and Aboriginal). It is anticipated that their material culture would exhibit attributes from both traditions (IEDE/JWEL 2000; JWEL/IELP 2001b).

An Historic Resources Component Study was completed in 1998 as part of the TLH - Phase II environmental assessment (JWEL 1998b). This study was undertaken to identify and confirm the potential for encountering historic resources along the 325.5-km highway route between Red Bay and Cartwright, and access roads into Charlottetown and St. Lewis, and to determine whether there were historic resources along the route that could be affected by highway construction. The 1998 aerial survey targeted a total of 94 locations. Of these, 41 were subjected to ground surveys and testing. As a result of this work, seven ethnographic (recent) sites, including six bird-hunting blinds and one navigational cairn, were recorded. Six were located along the coastal strip and only one site in the hinterland. This study, as well as several subsequent studies conducted in south-central Labrador, suggest that archaeological sites appear to be strongly associated with coastlines, river systems and lakeshores (IELP 2002; JWEL/IELP 2001a; JWEL/MIBC/TCC 1997). Strategic locations preferentially used in the past include present and former points of land and shoreline sections in proximity of confluences, inflow/outflow, rapids or constrictions.

The historic resources component study for the TLH - Phase III Environmental Impact Statement (EIS)/Comprehensive Study Report (CSR) included extensive, pre-field overview research covering a large study region that encompassed most of southern Labrador and Québec Lower North Shore (IELP 2002). The study also focused on a 10 km-wide corridor along the preferred route that was targeted for field investigations. This more focused study involved ethnographic interviews. A total of 128 specific locations within 12 pre-selected areas were investigated by surface inspection and a total of 3,944 test pits were excavated. As a result of this work, 37 archaeological and ethnographic sites were recorded, two of these dating to the precontact period and very likely to the Intermediate Indian period. More than one-third of these (13) were found on Uinikush Lake, nine sites were discovered at the Kenamu, seven sites were recorded on Keupash-nipi, just east of Uinikush, and five at the Eagle River Forks. The remaining components yielded a single site or none at all. In terms of cultural affiliation, most of the sites are definitely or probably Innu, with some definite or probable Métis sites being recorded as well on the Kenamu River and Eagle Forks.

Land and resource use studies (Armitage and Stopp 2003; JWEL/IELP 2003) also provided relevant information that can be applied to the outfitter route alternative, including:

- overall potential rating for the larger study region and the preferred route;
- land and resource use data, including the identification of likely locations for camps, historic resources, and key resource areas used by Innu, Settler or Métis; and
- identification of confirmed sites along the preferred route during field investigations.

3.1.1 Historic Resources Along the Preferred Route

There are 41 archaeological and ethnographic sites within a 10 km-wide corridor along the preferred route, 37 of which were found during the 2002 field survey (IELP 2002). The field assessment yielded evidence of precontact use of the project area at two sites, both dating to the Intermediate Indian period (3,500 to 2,000 Before Present (BP)). In addition, 35 sites dating to the late historic and/or contemporary period were also identified. Several Innu camp locations and Settler tilts used during the early part of the twentieth century were also recorded. However, the cultural affiliation of a number of recent sites and, particularly, cutting locations and trails, remain undetermined and could indicate activities conducted by either group. Most of the sites discovered in 2002 are located in the western portion of the project area. Further investigation will be conducted along the highway route prior to construction.

It was estimated that approximately 15 percent of the sites located to date were situated on or at short distances from the preferred route and would be directly affected by construction. In addition, 85 percent of the sites located within the corridor may be indirectly affected by the project due to improved access to the project area during construction and operation.

The potential for historic resources within the project area appears to be high in six areas (50 percent of the total number of areas investigated during the 2002 field survey (e.g., river junctions and preferred sections of shorelines such as points and constrictions)). Of these, five lie in the western portion of the project area. Elsewhere, the potential varies from low (one area) to moderate or reduced (three areas) or remains indeterminate (two areas).

Other archaeological field assessment in south-central Labrador include a Stage 1 Historic Resources Overview Assessment of a proposed transmission line corridor between Gull Island and L'Anse au Clair (IEDE/JWEL 2000). The assessment involved an aerial survey of the entire route and ground surveys and testing programs of several sectors, including the Kenamu River/Little Drunken River and the headwaters of St. Augustin and St. Paul rivers. No historic resources were discovered and it was concluded that the overall potential of these remote upland sectors of the interior (300 to 500 m above sea level (asl)), was low.

A brief field survey on the shoreline of three lakes including Mistassini, in the Eagle Plateau region, was undertake in 1997 to identify historic resources within the proposed Akamiuapishku/Mealy Mountains National Park (Schwarz 1998). This study led to the discovery of 10 contemporary Innu camp sites, some of which appear to have been in use for many years. One site also contained evidence for earlier historic and precontact components. The presence of quartzite flakes and tool types discovered at this site suggests an occupation during the Intermediate Indian period.

In summary, as opposed to the coastal sub-region, where the presence of numerous precontact sites indicate the presence of a diversity of cultural groups at different time periods, precontact sites are extremely scarce in the deep interior sub-region of south-central Labrador and are generally assigned to the Intermediate Indian period.

3.1.2 Historic Resources in the Vicinity of the Outfitter Route

A total of 41 sites were recorded in the vicinity of the outfitter route between 1997 and 2002 (Table 3.1, Figure 3.1). These confirmed sites include any locations where evidence of ancient (precontact, historic and late historic) or recent (contemporary) land and resources use were observed during archaeological field investigations.

It must be noted that the query covered eight NTS topographic map sheets, but no site were reported for sheets No. 13 B/9, 13 B/10, 13 B/12 and 13 C/9. Thirty sites (73.2 percent) were located on NTS topographic map sheet 13 B/13, nine sites on map sheet 13 C/16, and one site on each map sheet 13 B/11 and 13 B/16 (Figure 3.1). Also, only one site (No. 32) is located within the 10-km study corridor and at the east end of the study area, while the great majority are located at the west end, in the vicinity of both the preferred and alternative routes.

Nine sites, or 22 percent of the total, include more than one component and have been used during two or three different time periods. Three sites, or 7.3 percent of the total, include a precontact component. A historic component has been identified at seven sites, or 17.1 percent, a late historic component at eight sites, or 19.5 percent, and a contemporary component at 33 sites, or 80.5 percent. Twenty-four sites were occupied for the first time during the contemporary period only, while eight sites in use during precontact or historic and late historic period were not in use since the 1960s.

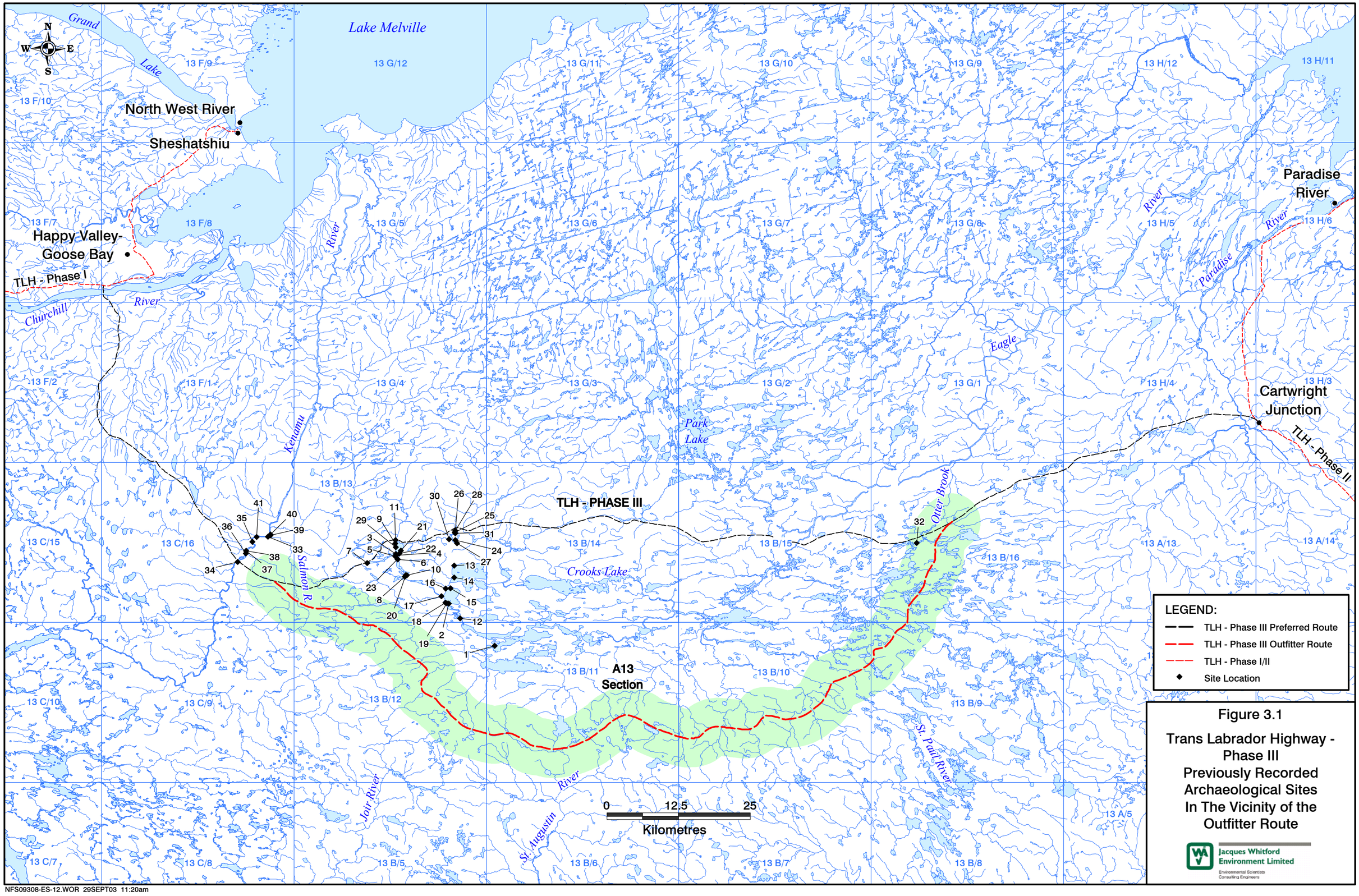
Habitation is the most common type of site, with habitations reported at 29 and perhaps 30 sites (73.2 percent), followed by trails at seven sites (17.1 percent), trapping at five sites (12.2 percent) and subsurface lithicsa at three sites (7.3 percent). Other functions include a cache at one site, a cut stump at another site, and a look-out still at another site.

The cultural affiliation of many sites remains uncertain. Thus, 25 sites (61 percent) and perhaps 34 (82.9 percent) were in use by Innu peoples, seven (17.1 percent) and perhaps 10 sites (24.4 percent) by Settler/Métis, three sites (7.3 percent) by Aboriginal groups during the Intermediate Indian period. A single site (2.4 percent) has been identified as Euro-Canadian.

Table 3.1 Recorded Sites in the Vicinity of the Outfitter Route

Number of sites	Period	Site Type	Cultural Affiliation	Site Number (Figure 3.1)	NTS Topographic Map #
1	Precontact, Historic and Contemporary	Subsurface Lithic and Habitation	Intermediate Indian and Innu	1	13 B/11
1	Precontact	Subsurface Lithic	Intermediate Indian	23	13 B/13
1	Precontact and Contemporary	Subsurface Lithic, Trapping and Habitation	Intermediate Indian and Settler or Innu	40	13 C/16
1	Historic	Habitation and Lookout	Innu	17	13 B/13
1	Historic and Contemporary	Habitation	Euro-Canadian and Innu	2	13 B/13
4	Historic and Contemporary	Habitation	Innu	13, 14, 18,19	13 B/13
4	Late Historic	Habitation	Innu	26, 28, 30, 31	13 B/13
1	Late Historic	Habitation	Settler	33	13 C/16
1	Late Historic	Portage Trail	Innu	34	13 C/16
1	Late Historic and Contemporary	Habitation	Settler	35	13 C/16
1	Late Historic and Contemporary	Habitation	Perhaps Innu	22	13 B/13
11	Contemporary	Habitation	Innu	4, 5, 6, 9, 11, 12, 15, 16, 24, 25, 27	13 B/13
1	Contemporary	Habitation	Perhaps Innu	21	13 B/13
1	Contemporary	Habitation and Trail	Settler and perhaps Innu	20	13 B/13
1	Contemporary	Trapping and Habitation	Settler or Innu	39	13 C/16
1	Contemporary	Trapping and perhaps Habitation	Settler or Innu	37	13 C/16
1	Contemporary	Trapping, and perhaps Habitation	Settler	38	13 C/16
2	Contemporary	Trapping	Settler	36, 41	13 C/16
1	Contemporary	Cache and Trail	Perhaps Settler	8	13 B/13
2	Contemporary	Cut Trail	Innu	3, 29	13 B/13
2	Contemporary	Cut Trail	Perhaps Innu	7, 10	13 B/13
1	Contemporary	Undetermined (Cut Stump)	Perhaps Innu	32	13 B/16

Source: PAO 2003: Topographic Map Sheets 13 B/11, 13 B/13, 13 B/16 and 13 C/16.



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3.2 Land and Resource Use

Before settlement in the 1960s, Innu family groups used to hunt, trap and fish for much of the year in the Eagle Plateau region. They normally lived on the shoreline of the larger lakes such as Iatuekupoau (Park Lake, an important area for ice-fishing), *Uninikush*, and Crooks Lake (*Pepauakamau*). They lived in the interior for most of the year and travelled to Sheshatshiu (North West River), St. Augustin (*Pakuashipi*) and elsewhere in the Lake Melville/Sandwich Bay area (e.g., Cartwright) or along the Gulf of Saint-Lawrence North shore (e.g., Musquaro) to trade and attend Catholic missions. In recent years, several camps were established in the same area (Armitage and Stopp 2003). Other important areas, particularly for camping and salmon fishing, include the junction of Kenamu River (*Tshenuamiu-shipu*) and Salmon River (*Utshashumeku-shipiss*).

Several Innu families from Sheshatshiu have been using the area south of Lake Melville for generations. These families include the Penashues, Pasteens, Pokues, Pones and Pashtishis who have maintained ties with families from Saint-Augustine and nearby communities on the Saint-Lawrence North Shore. Preferred travel routes used to reach the complex of lakes on the Eagle Plateau from Sheshatshiu, normally involved walking and canoeing, following river valleys such as the Traverspine River (*Manatueu-shipiss*) and Kenamu River (*Tshenuamiu-shipu*). In recent years, family groups accessed the large lakes of the hinterland by float planes and small hunting parties by snowmobile (Armitage and Stopp 2003).

Existing land and resource use information on the people that inhabited this region indicates that Settler/Métis lived on the coast and commonly traveled in the hinterland, particularly in the fall and winter for harvesting fur-bearers. However, it appears that the homeland of certain groups such as the Intermediate Indian and the historic Innu was the hinterland. Intermediate Indians and historic Innu were highly mobile and show an adaptation to the use of interior resources, with seasonal exploitation of the inner coastal zone. During the fur-trade period, the Innu also visited trading posts at North West River and elsewhere along the coast (e.g., Cartwright in Labrador and in Saint-Augustin on the Québec North Shore). Both Innu and Métis established their camps along selected habitable shoreline of major rivers and lakes, where they conducted subsistence activities such as hunting, trapping, fishing, harvesting firewood and collecting berries (JWEL 2003). Traditional Innu harvesting activities on the Eagle Plateau generally involved trapping furbearers such as beaver, fishing salmon and other species, and caribou hunting in winter. Porcupine, hare and waterfowl were also caught. In recent years, caribou, black bear, beaver, marten, mink, weasel, lynx, wolf, porcupine, snowshoe hare, spruce grouse, willow ptarmingan, ducks and geese as well as fish have been harvested (Armitage and Stopp 2003).

3.3 Landforms and Surficial Materials

The study area is dominated by morainal deposits of variable thickness but generally less than 5 m thick, and organic deposits. While morainal deposits are found throughout the study area, glaciofluvial deposits (sand and gravel of variable thickness, from 1 to 15 m) are found in few isolated patches, at the east and west ends of the study area, covering less than 2 percent of the area. Organic terrain comprises a large proportion of the surficial ground cover and is estimated to represent approximately 50 percent of the total area. Organic deposits normally occur in wetlands (e.g., bog, fen, marshes and swamp) or areas where the water table is at, near or above the soil surface for all or most of the year (JWEL/IELP 2003). Organic terrain appears to overlay till in the study area and its distribution may reflect topography. Where the surface is relatively level, organic terrains dominate over till, whereas till is likely to dominate in areas of moderate slope.

3.4 Hydrography

The study area lies at the headwaters of several watercourses including, from west to the east: Salmon River, a tributary to the Kenamu River, Joir River, a tributary to the Little Mecatina River, St. Augustin River, Eagle River and Paradise River. Of these, Joir/Little Mecatina and St. Augustin watersheds feed into the Gulf of St. Lawrence (south), whereas, Salmon River/Kenamu River, Eagle and Paradise rivers lead to Hamilton Inlet, Sandwich Bay and the Labrador Sea (north). Of these, the Eagle River has the largest watershed with 10, 828 km^2, Paradise River 5,276 km^2, and Kenamu River 4,403 km^2 (JWEL/IELP 2003). Similar data for rivers of Québec are not available at this time, but it must be noted that the axial length of St. Augustin River (193 km) exceeds that of the Eagle River (139 km). In summary, both the Eagle and St. Augustin rivers and, to a lesser degree, other rivers such as the Kenamu River, Little Mecatina River and Paradise River, can be seen as major routes between the coast and the hinterland.

Major lakes of the Eagle Plateau, such as Crooks and Park lakes are, located several kilometres north of the outfitter route. However, there are large ponds (approximately 5 km long) at the headwaters of St. Augustin River (Map 13 B/11) in the central part of the outer corridor and a series of interconnected ponds at the headwaters of the Eagle River (Maps 13 B/9, B/10 and B/16) in the eastern part of the study area.

3.5 Avifauna, Wildlife and Fish

Five one- to two-day waterfowl surveys were conducted along the outfitter route between May and September 2003 (JWEL/MLP 2003b).

Waterfowl (Canada goose and various ducks), with few exceptions (16 wetlands with densities greater than 0.10 birds/ha), has a relatively low density but is widespread throughout wetland habitats in the study area. Also, the western section of the outfitter route appears to support a larger number of waterfowl than the eastern and central sections.

Other wildlife observations made during these surveys include the following:

- tracks (in snow): river otter, beaver, porcupine, marten, bear, caribou;
- animals: beaver, muskrat, porcupine, river otter, black bear, caribou, moose, bald eagle, osprey, hawk, raven, owl; and
- stationary structures: beaver lodges, and osprey nests.

Caribou numbers are low in Southern Labrador and the total number of animals is estimated to be less than 600 south of Lake Melville, between the headwater of the Kenamu River and east to the Labrador coast. Moose also occur in low densities, normally in forested river valleys. Black bear and wolf, as well as a number of smaller mammals, are also present in the region including porcupine, snowshoe hare, squirrels and a variety of voles and mice. Furbearers species include rex fox, beaver, muskrat, river otter, ermine, weasel, and mink (JWEL/IELP 2003).

Fish species in the watershed of rivers crossed by the outfitter route (Kenamu, Eagle, Paradise and St. Augustin rivers) include Atlantic salmon, brook trout, whitesucker and a number of other species (Dubois 1996; JWEL/IELP 2003). Although the Eagle and St. Augustin rivers are among the largest salmon rivers in North America, it has not been demonstrated that salmon occur at the headwaters of these rivers (in the vicinity of the study area).

3.6 Determination of Archaeological Potential

The archaeological potential of an area is defined as the probability of archaeological discovery based on the results of landscape analysis. The analysis normally involves using a set of physical (landforms) and cultural (assumptions about strategic location criteria used by inhabitants of a region when making settlement-subsistence decisions; such as where to set a camp or a hunting blind) criteria (Table 3.2).

Table 3.2 General Criteria Used to Determine Archaeological Potential

CRITERIA	POTENTIAL RATING		
	High	**Moderate**	**Low**
Morpho-sedimentology	Marine/coastal formations (beaches, terraces, etc.), fluvioglacial formations, glacio-lacustral and fluviatile formations (deltas, estuaries, eskers, etc.). Loose materials: sand, gravel, pebbles and boulders.	Thin deposits of till (sand, gravel, pebbles and boulders) on the bedrock or on silty or clay soils.	Thin deposits of till scattered over rocky ledges or rocky escarpments/scree cones and colluvia at the base; silty and clay formations.
Drainage	Well-drained soils, rapid infiltration.	Fairly well-drained soils with sporadic surface run-off.	Poorly-drained soils, bogs and marshes.
Topography	Flat or slightly-sloping terrain.	Irregular surfaced or rolling terrain (hills, valleys).	Rough terrain, steep slope; depressions.
Hydrography	Close to lakes, rivers or the sea; waterways leading to interior lakes; coves, rocky capes; narrowing of main lakes.	Set back from main lakes (low altitude), rivers and the sea; shoreline and littoral without desired characteristics (neither cove, nor cape); small lakes or ponds; shores of secondary lakes (high altitude).	Completely withdrawn from the hydrographic system; intermittent streams.
Wildlife Resources	Close to zones of concentration in wildlife resources, whether land-, water- or air-based.	Places favorable to wildlife use, the latter not however being present in high concentration.	Places lacking in game.
Land Use	Numerous toponyms; zones traveled through (traditional itineraries); presence of known archaeological sites or campsites.	Named space but few toponyms. Places rarely frequented or traveled through quickly.	Unknown or avoided places.
Source: Labrèche et al. 1992			

3.6.1 Typology of Landscapes

Physical and cultural attributes of landscapes were used in various studies to predict the archaeological potential of project areas of various sizes. In one detailed study that included an extensive field program and a large region, the number of sites and camps located within delineated polygons of different zone types were calculated, as well as the ratio of sites per testing locations for each zone type. The results were used to establish the potential rating for each type and to generate maps showing zones of high, moderate and low potential (JWEL/INEN 2001). Based on the results of the study, zone types such as Steep Slope and Wetland receive a low potential rating and the archaeological potential varies for different categories of shoreline (Table 3.3).

Table 3.3 Archaeological Potential Classification Scheme

Type	Archaeological Potential Rating	Assessment Requirements
Strategic Shoreline	High	Visual inspection and subsurface testing
Generic Shoreline	Moderate	Visual inspection and subsurface testing
Interfluvial Upland	Low	Visual inspection
Wetlands	Low	Visual inspection
Steep Slope	Low	Visual inspection

Strategic shoreline consists of riverbank and other shorelines that presently exhibit one or more of the attributes defined as 'strategic'. It consists of shoreline locations known from previous work in Labrador to be particularly associated with archaeological sites, presumably because they represent strategic locations in travel or harvesting. Such locations include level shorelines situated: (a) within 500 m of rapids and falls; (b) on points of land projecting out into waterways, including sheltered coves on the flanks of these points; (c) within 500 m of river inflows and outflows on lakes; (d) within 500 m of confluences of rivers and streams; and (e) on constrictions in waterways. The junctions of tiny 'single-line' brooks were not deemed to represent confluences. Thus, complex, indented shorelines offer many strategic locations.

Generic shoreline consists of riverbank and other shorelines that presently do not exhibit any of the attributes defined as 'strategic'. It consists of shoreline locations that are habitable, but not known from previous work in Labrador to be particularly associated with archaeological sites. In most instances, generic value is assigned to stretches of level, habitable shoreline which are straight or gently curving and therefore lacking identifiable strategic attributes.

Interfluvial upland consists of areas of moderate slope, neither steeply-sloping nor poorly-drained, between and behind shoreline, plain and terrace zones. It encompasses areas of moderate slope, mountain passes, hilltops and high barrens in between the watercourses.

Wetland areas often represent a broad continuum between open water and closed forest. Even the NTS maps are not always consistent about which wet areas are mapped as wetlands and which are not. For the purposes of this mapping study, wetland included permanently poorly-drained organic deposits, including, but not limited to, areas of bog indicated on 1:50,000 scale maps.

Steep slope: Any operational definition of 'steepness' will be somewhat arbitrary. Mapping purposes required a definition that had value in the context of assessing potential for historic or prehistoric settlement and one that was practical and consistently applicable during this preliminary assessment. To this end, a definition based on contour spacing allowed for more rapid and consistent mapping than one based on degrees of slope.

For the purpose of this study, areas were considered as steep slope on 1:50, 000 maps whenever the spacing of 10-m (or 50-ft) contour lines was less than 1 mm.

3.6.2 Description of Selected Areas of Enhanced Potential, Outfitter Route

The general criteria and classification scheme discussed in Section 3.6 was used to select six areas of enhanced potential. Following this, these areas were ranked, using the finer zones types identified in Section 3.6.1.

3.6.2.1 Area 1 - Salmon River (*Utshashumeku-shipiss*)

The general area has been investigated in 2002 as part of the historic resources component study of the preferred routing. Additional investigations could include strategic as well as generic shoreline sections of the Salmon River, upstream from the Kenamu Junction, where it intersects the outfitter route alternative corridor (Figure 3.2, Sector 13 B/13). Attributes include:

- Morpho-sedimentology: 15 to 50 percent organic terrain; till less than 1 to less than 5 m thick; one esker;
- Drainage: Poor;
- Topography: Level/gentle slope;
- Hydrography: Generic shoreline;
- A Wildlife resources: Waterfowl, fish, furbearers; and
- Land and resource use: Yes (Armitage and Stopp 2003).

3.6.2.2 Area 2 - St. Augustin Lake and River (*Pishiu-Nipi/Pakua-shipu*)

This area includes the shoreline of three lakes, including Lynx Lake (*Pishiu-Nipi*), the upper reaches of St. Augustin River, and three eskers (Figure 3.2, Sector 13 B/11). Attributes include:

- Morpho-sedimentology: till 1 to 5 m thick, 15 to 50 percent organic terrain; eskers;
- Drainage: Poor to fair (on eskers);
- Topography: Level/gentle slope;
- Hydrography: Generic and strategic shorelines;
- Wildlife resources: Waterfowl, fish, furbearers; and
- Land and resource use data: Yes (Armitage and Stopp 2003).

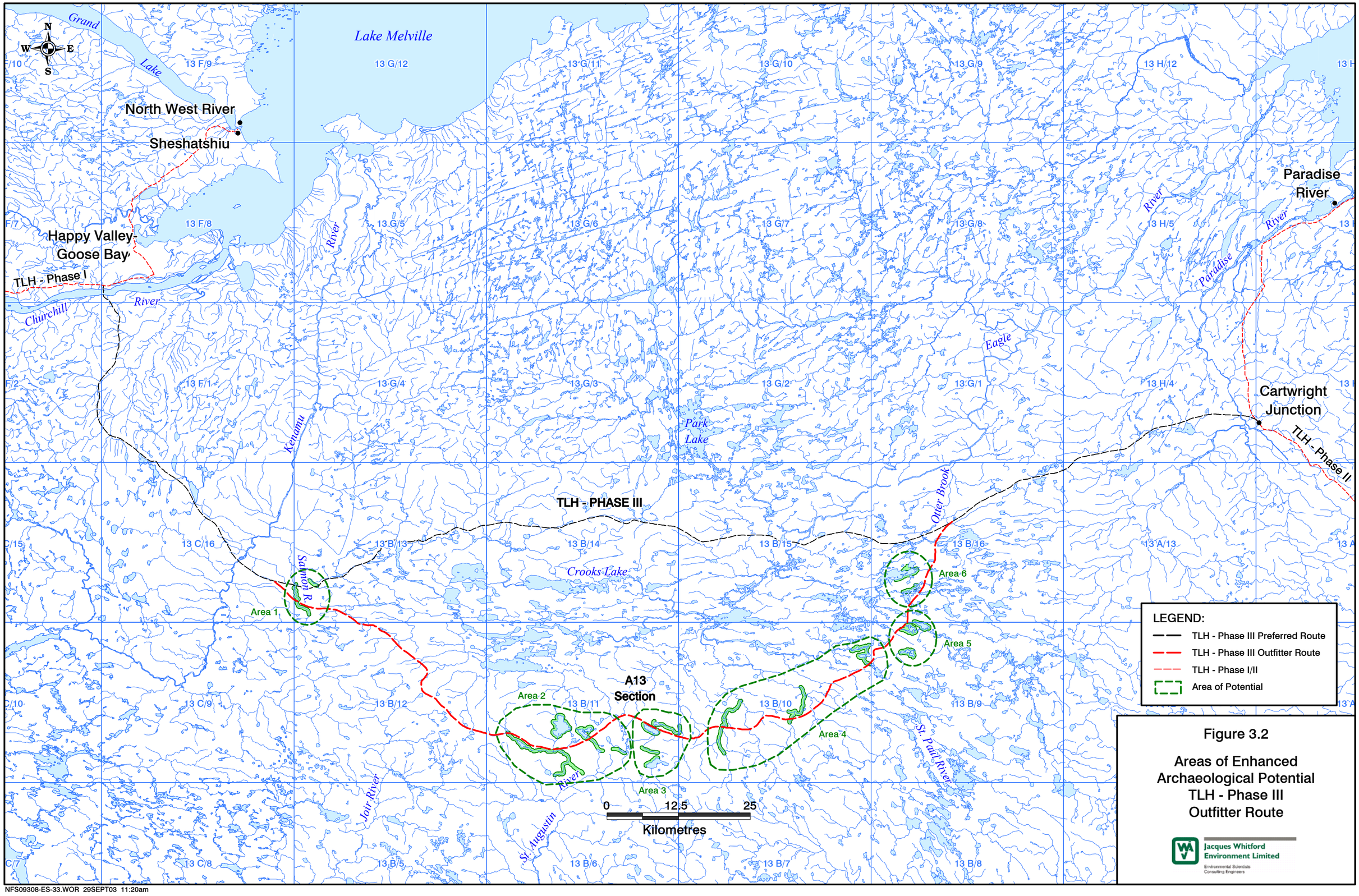

Figure 3.2

Areas of Enhanced Archaeological Potential TLH - Phase III Outfitter Route

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Environmental Scientists Consulting Engineers

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3.6.2.3 Area 3 - Headwaters of Eagle River and St. Augustin River (*Nutapinuant-shipu/Pakua-shipu*)

This area includes the shoreline of two ponds, as short section of shoreline near rapids on Upper Eagle River and one esker (Figure 3.2, Sector 13 B/11). Attributes include:

- Morpho-sedimentology: 15 to 50 percent to dominantly organic terrain; till 1 to 5 m thick; esker;
- Drainage: Poor to fair (on esker);
- Topography: Level/gentle slope;
- Hydrography: Generic shoreline;
- Wildlife Resources: Waterfowl, fish, furbearers; and
- Land and resource use: Yes.

3.6.2.4 Area 4 - Upper Eagle River and Tributaries (*Nutapinuant-shipu*)

This area includes two double-lined stream crossings and one pond (Figure 3.2, Sector 13 B/10). Attributes include:

- Morpho-sedimentology: 15 to 50 percent to dominantly organic terrain; till less than 1 to less than 5 m thick;
- Drainage: Very poor to poor;
- Topography: Level to moderate slope;
- Hydrography: Generic shoreline with small strategic sections, near rapids;
- Wildlife resources: Waterfowl, fish, furbearers; and
- Land and resource use: Yes.

3.6.2.5 Area 5 - Headwaters of Saint-Paul River and Paradise River (*Aissimeu-shipiss/Paradise River*)

This area includes one pond (Figure 3.2, Sector 13 B/9). Attributes include:

- Morpho-sedimentology: 15 to 50 percent to dominantly organic terrain; till less than 1 to 5 m thick;
- Drainage: Poor to fair;
- Topography: Level/gentle slope;
- Hydrography: Generic shoreline with small strategic sections;
- Wildlife resources: Waterfowl, fish, furbearers; and
- Land and resource use: Yes.

3.6.2.6 Area 6 - Headwaters of the Eagle River (*Nutapinuant-shipu*)

This area is located at the east end of the study corridor. It includes a large pond at the headwaters of the Eagle River or its tributaries. Historic resources could be located on the shoreline of this pond where the potential is thought to be moderate (Figure 3.2, Sector 13 B/16). Attributes include:

- Morpho-sedimentology: Dominantly organic terrain; till 1 to 5 m thick;
- Drainage: Poor;
- Topography: Level;
- Hydrography: Generic (rocky) shoreline of a large, shallow pond;
- Wildlife resources: Waterfowl, fish, furbearers; and
- Land and resource use: Yes; also, one reported site (IELP 2002).

3.7 Summary of Archaeological Potential

3.7.1 South-Central Labrador

The results of previous investigations in Labrador between 1990 and 2002 did confirm the presence of important historic resources, with hundreds of sites primarily associated with coastlines (prominent headlands and sheltered coves), river systems and lakeshores. Habitable (dry and relatively level) sites preferentially used in the past include present and former points of land and shoreline sections in proximity of confluences, inflow/outflow, rapids or constrictions (JW/IELP 2001a; 2003).

While the coast has seen detailed investigation, relatively little work has been undertaken in the interior until recently. Therefore, the number of sites located along the coast outnumber by far the number of sites discovered in interior settings. Thus, it has been established that the coastal sequence extends over approximately 8,000 years, with an initial Palaeo-Indian/Maritime Archaic occupation in the Strait of Belle Ilse region. Sites are rich and abundant and the culture-historical sequence complex, particularly after 4,000 BP, when the Labrador coast was also colonized by both Arctic-adapted peoples and Indian. Subsequent work in Labrador including extensive field programs along the Churchill River hydroelectric project (JW/IELP 2001) and the historic resources field program for the TLH Phase III (IELP 2002) led to the discovery of a number of interior sites. The vast majority of the sites discovered in the hinterland are associated with river valleys and the shorelines of major lakes.

Until recent years, the Mealy Mountains/Eagle Plateau region and the headwaters of rivers flowing east to the Atlantic Ocean and south to the Gulf Saint Lawrence was archaeologically unknown (Schwarz 1997). However, a review of Innu land and resource use suggests that this region was an important harvesting area

for caribou, fish and migratory waterfowl. Moreover, it appears to be located at the crossroads of numerous travel routes between Lake Melville, the south coast of Labrador and the north shore of the St. Lawrence. However, historic and precontact sites are extremely scarce and the regional settlement pattern and trading relationships between the three sub-regions remain poorly understood. Based on a review of locational attributes of archaeological sites in the hinterland, it is anticipated that interior sites would be larger and more frequent on lakes. Locations of high potential would include constrictions, prominent points of land, river mouths, river outflows, and sheltered sandy beaches. Along river courses, high potential locations would include river confluences and portage termini, shorelines of salmon pools, rapids and falls. However, it must be noted that riverside sites are more prone to destruction than lakeshore sites and that ancient sites may be located at considerable distance behind and above the present riverbank and are rarely visible on the surface. In summary, although a number of attributes may have attracted ancient settlement, erosion, and other factors such as low-visibility in densely forested settings, have limited opportunities to confirm the importance of early historic and precontact occupation of the hinterland.

In addition, researchers working in the hinterland or near-coastal settings have tended to assume that eskers are high potential locations (IEDE/JWEL 2000; JWEL 1998d), perhaps because sites have been found to be strongly correlated with esker tops elsewhere (e.g., Northwest Territories). However, very few esker-top sites were discovered to date in Labrador, except where such glacial features intersect other high potential locations such as habitable shoreline (Schwarz 1997).

3.7.2 Outfitter Route

The preliminary interpretation of the archaeological potential of the selected areas is presented in Table 3.4. Based on the best information available at this time, it is anticipated that the potential ranges from low-moderate (1.7) to moderate-high (2.2) within the study area.

Table 3.4 Preliminary Archaeological Potential Rating

Criteria	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
Morpho-sedimentology	2	2	2	1	1	1
Drainage	1	2	2	1	2	1
Topography	3	3	3	2	3	3
Hydrography	2	2	2	2	2	2
Wildlife Resources	3	2	2	2	2	2
Land Use	2	2	2	2	2	3
Average	2.2	2.2	2.2	1.7	2	2
Legend: 1=Low 2=Moderate 3=High						

In summary, it appears that the probability of encountering archaeological resources is variable across the outfitter route alternative. The shoreline of major streams and lakes as well as eskers have the highest potential to yield important historic resources. The outfitter route alternative crosses 115 watercourses, in contrast to the preferred route, which crosses 95 watercourses. It is possible that the overall potential of the western portion of the study area would also be the highest. However, the outfitter route alternative extends further away from the coast and traverses extensive bog at the headwaters of rivers and tributaries, particularly in the western portion of the route. It also traverses inter-fluvial upland areas. The overall archaeological potential for such areas is thought to be lower. It is worth noting that several eskers are located near the outfitter route alternative. Eskers are commonly used as sources of granular materials for road construction, but they also serve as passage routes for caribou through the taiga and they were among preferred hunting locations (JWEL 2000). Therefore, it is anticipated that the archaeological potential of the area may be higher due to the presence of these features.

Six areas of positive potential were identified along the alternative route, including three areas (No. 1, 2 and 3) with moderate to high potential. Based on the results of this preliminary exercise and previous field programs in the vicinity of the study area, it is suggested that a great majority of the sites to be discovered along the outfitter route corridor would be located in the central and western portion of the study area

4.0 DISCUSSION AND CONCLUSION

4.1 Data Gaps

Small areas of higher potential for historic resources located within larger zones with lower potential rating were noted during this exercise but could not be depicted in this study. For example, Area No. 4 is traversed by the outfitter route and includes 'islands' of open spruce and lichen forest, reflecting localized drier ground conditions, and perhaps higher potential, within extensive wetlands.

Information derived from traditional knowledge/land use studies were not incorporated in the database, nor was GIS used in this study. These documented locations are normally unverified points (collected during previous ethnographic mapping programs) and would be distinguished from confirmed archaeological sites. In practice, if coordinates for these camps were available, they could be used as starting points during future field surveys, if required.

4.2 Further Research

It must be noted that the prediction of archaeological potential for the proposed alternative route should be based on a more detailed mapping exercise that would include the following additional steps:

- manually delineate and describe zone types identified within the project area;
- apply appropriate potential rating to zone types;
- digitize mapping information with appropriate links to discrete sections of a database; and
- provide an interpretative summary report and maps to depict archaeological potential within the project area.

4.3 Conclusions

It is concluded that the overall potential is extremely variable across the study area. In summary, the study area can be depicted as an extensive area of low potential with localized inclusions of moderate to high potential.

The study also concludes that further research and field assessment may be required. Additional pre-field research would involve a finer selection of zone types and testing locations based on natural and cultural attributes. If required, fieldwork would involve conducting pre-construction surveys, including visual inspection and subsurface testing, in localized areas of high and moderate potential (shorelines), should the final project layout interact with such areas. Thus, strategic and generic habitable (dry and level) shorelines,

as well as selected landforms such as eskers, would be targeted for such field programs, while interfluvial uplands, wetlands and areas of steep slope would receive much less attention. Further refinement of zone types and shoreline classification could be a focus of field validation during pre-construction surveys.

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