7.8 Water Resources

Water resources have been discussed to some extent under the heading of fish habitat in Section 7.5. An adequate supply of good quality water is essential to maintenance of fish, other aquatic and terrestrial flora and fauna, as well as the people of the region. For this reason water resources have been designated as a VEC.

Hydrology, the study of water flows or quantities of water, has been incorporated as a planning tool for the design and capacity of the stream crossing structures described in the Chapter 3.0 (Proposed Undertaking).

Water quality is discussed in this section as it pertains to existing conditions and the potential for effects due to the construction and operation of the outfitter route of TLH - Phase III. Many of the mitigations for the maintenance of water quality are also discussed under fish and fish habitat.

7.8.1 Boundaries

The outfitter route will cross through six major watersheds in Southern Labrador. Boundaries for water resources are defined in terms of hydrological boundaries, project boundaries, and administrative boundaries.

The project boundary for water resources consists of the 40-m wide right-of-way that will extend along the route, at each of the stream crossing locations (Figure 7.19). The survey area included an aerial survey of the streams 250 m upstream and downstream of each crossing location.

The hydrological boundaries for water resources include the stream or pond sections at each crossing location extending downstream to the mouth of the six watersheds through which the outfitter route will cross.

As in other areas of Newfoundland and Labrador, freshwater resources are regulated primarily by the provincial government. The Water Resources Management Division of the Department of Environment has jurisdiction over water quality and water quantity in the watersheds pursuant to the *Waters Resources Act*. The *Fisheries Act* is the primary federal legislation governing protection and management of fish and fish habitat. Under the act, Section 36 regulates the release of deleterious substances into fish bearing waters. Environment Canada has responsibility for this aspect of the *Fisheries Act*.

7.8.2 Methods

The scope of the water resources section is based on the EIS/CSR guidelines (Appendix A). On-ground investigations were conducted as required to address the guidelines. Water sampling and flow measurements were obtained at all accessible stream crossing locations during the Fish and Fish Habitat Component Study field surveys. A complete description of the methods is provided in the Fish and Fish Habitat Component Study (JW/MLP 2003).

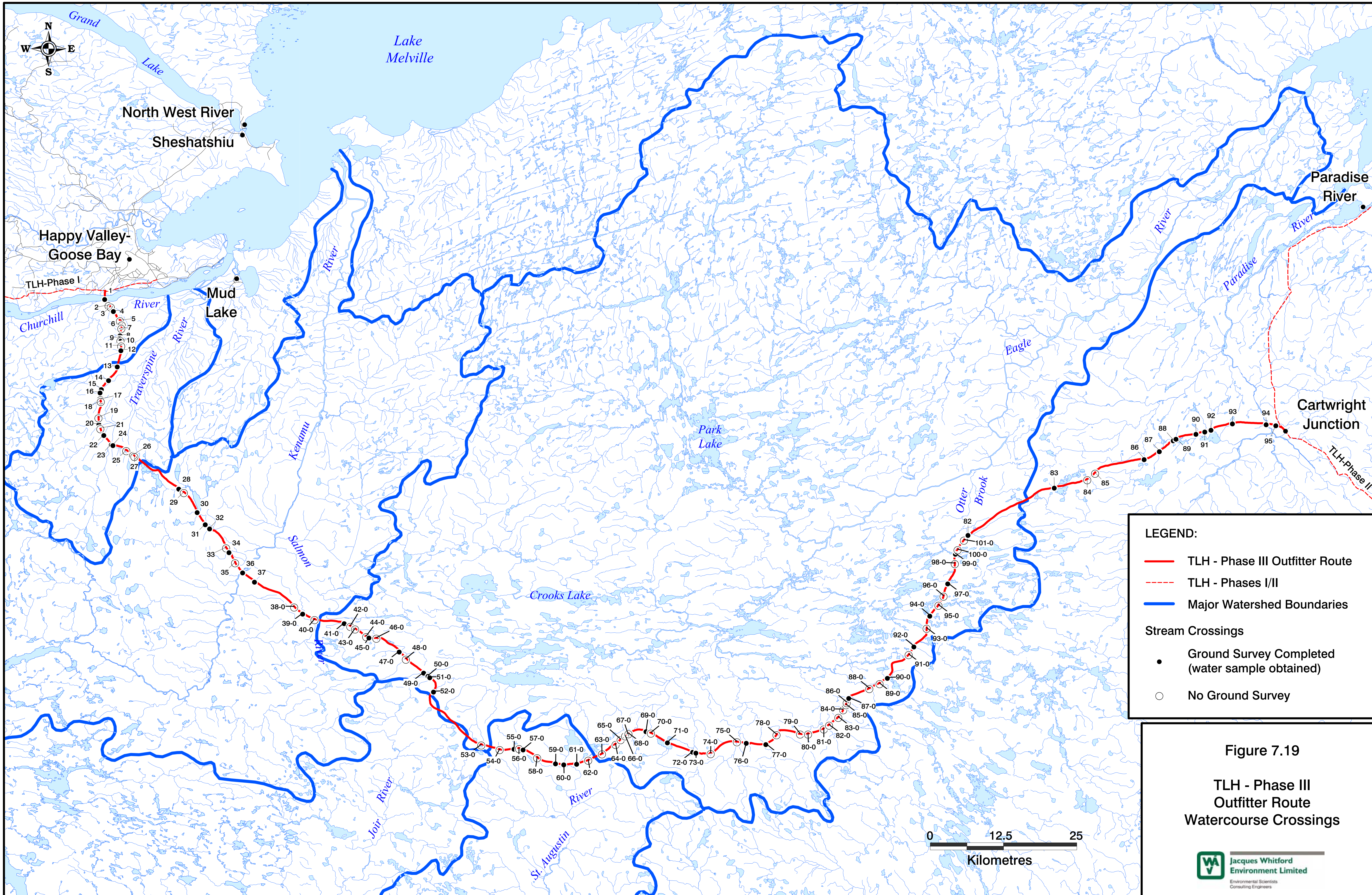

Figure 7.19

TLH - Phase III Outfitter Route Watercourse Crossings

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7.8.3 Existing Environment

Some of the requirements for the characterization of the existing environment outlined in the Guidelines are addressed in other parts of the EIS/CSR, namely:

- the hydraulic and design parameters and the methodologies used to determine the dimensions and capacities for all watercourse crossings are included in Section 3.3.4.1;
- climate data are included in Section 4.1.2;
- watershed characteristics are described in Section 4.3.2; and
- there are no estuarine features of concern with regard to the outfitter route as the watercourse crossings are from 23 to 100 km upstream of salt water.

There is limited historical information available on water quality and streamflow in Southern Labrador.

7.8.3.1 Watershed Areas

The location and upstream watershed areas of each of the proposed crossing locations are summarized in Tables 7.14 to 7.19. The upstream areas will largely determine the flow volumes that must be managed at each crossing. The flow rates are determined by factors such as gradient, run-off coefficient, topography, elevation and the presence of upstream waterbodies and wetlands. Climate will also influence the rate and amount of run-off based on rainfall, formation of ice and snow, and rate of melt of ice and snow. The sizes of the proposed water conveyance at each crossing structure are provided in Chapter 3.0 - Project Description and are minimum sizes based on the calculated flows that must be accommodated. Final design of th watercourse crossings may amend the structure type and size based on site specific factors and consultation with regulatory agencies.

Information was obtained for each crossing from the Fish and Fish Habitat Component Study (JW/MLP 2003). Details of the habitat surveys extending 250 m upstream and downstream of the proposed crossing sites are contained in Tables 7.14 to 7.19, based on the information appended to the component study. Details of the ground survey are contained in Tables 7.20 to 7.22. The crossing location may be modified in the final design stage to conform to highway alignment and other issues.

7.8.3.2 Water Quality

Water quality monitoring was conducted as part of the Fish and Fish Habitat Component Study (JW/MLP 2003). At each crossing location along the outfitter (A13 section) route that was surveyed on the ground, water samples were obtained to determine selected water quality parameters (Tables 7.35 to 7.40). Samples at crossings common to the outfitter route and preferred route were collected in 2002 (JW/IELP 2003a). The samples were obtained as surface grab samples collected in a manner similar to that described by Environment Canada (1995). Samples were collected at the proposed crossing sites and represent the water quality at and immediately downstream of each site.

Summary tables are given for each river basin. The tables list the parameters, estimated quantitation level (EQL), number of stations with quantifiable measurements, summary statistics and CCME guidelines for the Protection of Aquatic Life (CCME 2002 Update) are also shown in Tables 7.35 to 7.40.

Table 7.35 Water Chemistry for Two Samples from Churchill River Tributaries

Parameters	EQL	Units	Count	Max	Min	Mean	Med.	S.D.	CCME*
Temperature		°C	2	7.83	7.79	7.81	7.81	0.03	Note 1
Conductivity		µS/cm	2	9.9	7.1	8.50	8.5	1.98	
Dissolved O_2		mg/L	2	10.14	9.28	9.71	9.71	0.61	5.5 to 9.5
Turbidity	0.1	NTU	2	3.3	0.8	2.05	2.05	1.77	Note 2
pH		units	2	8.76	7.99	8.38	8.38	0.54	6.5 to 9.0
Alkalinity (as $CaCO_3$)	5	mg/L	2	11	< 5		9.5	2.12	
Total Dissolved Solids	10	mg/L	2	50	40	45	45	7.07	
Aluminum	10	µg/L	2	310	240	275	275	49.50	5 to 100
Antimony	2	µg/L	0	< 2					
Arsenic	2	µg/L	0	< 2					5
Barium	5	µg/L	2	22	12	17	17	7.07	
Beryllium	5	µg/L	0	< 5					
Bismuth	2	µg/L	0	< 2					
Boron	5	µg/L	2	11	9	10.00	10	1.41	
Cadmium	0.3	µg/L	0	< 0.3					0.017
Chromium	2	µg/L	0	< 2					8.9
Cobalt	1	µg/L	0	< 1					
Copper	2	µg/L	2	5	2	3.5	3.5	2.12	2 to 4
Iron	20	µg/L	2	890	470	680	680	296.98	300
Lead	0.5	µg/L	1	0.8	< 0.5				1 - 7
Manganese	2	µg/L	2	20	12	16	16	5.66	
Molybdenum	2	µg/L	0	< 2					
Nickel	2	µg/L	0	< 2					25 to 150
Selenium	2	µg/L	0	< 2					1.0
Silver	0.5	µg/L	0	< 0.5					0.1
Strontium	5	µg/L	2	22	14	18	18	5.66	
Thallium	0.1	µg/L	0	< 0.1					0.8
Tin	2	µg/L	0	<2					
Titanium	2	µg/L	2	8	2	5	5	4.24	
Uranium	0.1	µg/L	1	0.1	< 0.1		< 0.1		
Vanadium	2	µg/L	0	< 2					
Zinc	< 5	µg/L	2	6	4	5	5	1.41	30

* CCME Guidelines for Protection of Aquatic Life (CCME 2002 Update) See text for explanation of Notes 1 and 2.
Temperature, conductivity, dissolved oxygen, and turbidity were determined with a Hydrolab.
pH was determined with a Hydrolab, alkalinity by COBAS, and total dissolved solids gravimetrically.
All metal concentrations were determined by ICP-MS.
Count shows number of samples with quantifiable results.
Columns 4-8 show maximum, minimum, mean, and median values along with standard deviation.
All samples were collected in 2002 and reported by JW/IELP (2003a).

Table 7.36 Water Chemistry from Five Samples from Traverspine River and Tributaries

Parameters	EQL	Units	Count	Max	Min	Mean	Med.	S.D.	CCME*
Temperature		°C	5	5.88	5.39	5.60	5.49	0.23	Note 1
Conductivity		µS/cm	5	7	5.4	5.86	5.5	0.67	
Dissolved O_2		mg/L	5	12.67	11.04	11.52	11.23	0.67	5.5 to- 9.5
Turbidity	0.1	NTU	5	4.4	1.4	2.76	2.4	1.42	Note 2
pH		units	5	8.6	7.97	8.35	8.50	0.27	6.5 to 9.0
Alkalinity (as $CaCO_3$)	5	mg/L	5	9	< 5		7	1.10	
Total Dissolved Solids	10	mg/L	5	50	30	38	40	8.37	
Aluminum	10	µg/L	5	220	150	194	200	27.02	5 to 100
Antimony	2	µg/L	0	< 2			< 2		
Arsenic	2	µg/L	0	< 2			< 2		5
Barium	5	µg/L	5	14	10	11	10	1.73	
Beryllium	5	µg/L	0	< 5					
Bismuth	2	µg/L	0	< 2					
Boron	5	µg/L	1	5	< 5		< 5		
Cadmium	0.3	µg/L	0	< 0.3					0.017
Chromium	2	µg/L	0	< 2					8.9
Cobalt	1	µg/L	0	< 1					
Copper	2	µg/L	5	3	2	2.2	2	0.45	2 - 4
Iron	20	µg/L	5	940	150	622	640	294.23	300
Lead	0.5	µg/L	1	0.5	< 0.5		< 0.5		1 to 7
Manganese	2	µg/L	5	20	2	10	8	6.82	
Molybdenum	2	µg/L	0	< 2					
Nickel	2	µg/L	1	2	< 2		< 2		25 to 150
Selenium	2	µg/L	0	< 2					1.0
Silver	0.5	µg/L	0	< 0.5					0.1
Strontium	5	µg/L	5	24	16	18.2	17	3.27	
Thallium	0.1	µg/L	0	0	< 0.1		< 0.1		0.8
Tin	2	µg/L	0	<2					
Titanium	2	µg/L	5	4	2	3	3	0.71	
Uranium	0.1	µg/L	1	0.2	< 0.1		< 0.1		
Vanadium	2	µg/L	0	< 2					
Zinc	< 5	µg/L	5	5	2	3.2	3	1.1	30

* CCME Guidelines for Protection of Aquatic Life (CCME 2002 Update) See text for explanation of Notes 1 and 2.
Temperature, conductivity, dissolved oxygen, and turbidity were determined with a Hydrolab.
pH was determined with a Hydrolab, alkalinity by COBAS, and total dissolved solids gravimetrically.
All metal concentrations were determined by ICP-MS.
Count shows number of samples with quantifiable results.
Columns 4-8 show maximum, minimum, mean, and median values along with standard deviation.
All samples were collected in 2002 and reported by JW/IELP (2003a).

Table 7.37 Water Chemistry from Four Samples from Kenamu River and Tributaries

Parameters	EQL	Units	Count	Max	Min	Mean	Med.	S.D.	CCME*
Temperature		°C	4	20.01	6.33	10.00	6.84	6.68	Note 1
Conductivity		µS/cm	4	8.6	4.6	6.45	6.3	1.74	
Dissolved O_2		mg/L	4	12.72	7.56	10.02	9.90	2.25	5.5 to 9.5
Turbidity	0.1	NTU	4	9.7	0.6	4.78	4.4	3.99	Note 2
pH		units	4	8.6	6.9	7.91	8.06	0.77	6.5 to 9.0
Alkalinity (as $CaCO_3$)	5	mg/L	4	11	< 5		6.5	2.63	
Total Dissolved Solids	10	mg/L	4	50	30	35	30	10.00	
Aluminum	10	µg/L	4	210	110	137.5	115	48.56	5 to 100
Antimony	2	µg/L	0	< 2			< 2		
Arsenic	2	µg/L	0	< 2			< 2		5
Barium	5	µg/L	4	9	7	8	8	0.82	
Beryllium	5	µg/L	0	< 5					
Bismuth	2	µg/L	0	< 2					
Boron	5	µg/L	0	< 5					
Cadmium	0.3	µg/L	0	< 0.3					0.017
Chromium	2	µg/L	0	< 2					8.9
Cobalt	1	µg/L	1	1	< 1		< 1		
Copper	2	µg/L	4	2	2	2	2	0.00	2 to 4
Iron	20	µg/L	4	3200	350	1222.5	670	1332.58	300
Lead	0.5	µg/L	0	< 0.5					1 to 7
Manganese	2	µg/L	4	100	10	37	19	42.85	
Molybdenum	2	µg/L	0	< 2					
Nickel	2	µg/L	0	< 2					25 to 150
Selenium	2	µg/L	0	< 2					1.0
Silver	0.5	µg/L	0	< 0.5					0.1
Strontium	5	µg/L	4	19	11	15.5	16	3.70	
Thallium	0.1	µg/L	0	< 0.1					0.8
Tin	2	µg/L	0	<2					
Titanium	2	µg/L	3	6	< 2		2	2.31	
Uranium	0.1	µg/L	0	< 0.1					
Vanadium	2	µg/L	0	< 2					
Zinc	< 5	µg/L	3	4	< 2		2	1.15	30

* CCME Guidelines for Protection of Aquatic Life (CCME 2002 Update) See text for explanation of Notes 1 and 2.
Temperature, conductivity, dissolved oxygen, and turbidity were determined with a Hydrolab.
pH was determined with a laboratory meter in 2003 and Hydrolab in 2002, alkalinity by COBAS, and total dissolved solids gravimetrically.
All metal concentrations were determined by ICP-MS.
Count shows number of samples with quantifiable results.
Columns 4-8 show maximum, minimum, mean, and median values along with standard deviation.
All but one sample was collected in 2002 and reported by JW/IELP (2003a), one sample in 2003 is reported by JW/MLP (2003).

Table 7.38 Water Chemistry from 20 Samples from Eagle River Tributaries

Parameters	EQL	Units	Count	Max	Min	Mean	Med.	S.D.	CCME*
Temperature		°C	20	22.08	3.07	16.68	18.72	4.76	Note 1
Conductivity		µS/cm	20	9.7	2.5	5.32	4.35	2.42	
Dissolved O_2		mg/L	20	11.16	5.28	7.54	7.72	1.40	5.5 to 9.5
Turbidity	0.1	NTU	20	8.3	0.7	2.02	1.7	1.56	Note 2
pH		units	20	7.1	6	6.56	6.45	0.36	6.5 to 9.0
Alkalinity (as $CaCO_3$)	5	mg/L	6	9	< 5		7.5	1.38	
Total Dissolved Solids	10	mg/L	20	50	10	29.5	30	10.50	
Aluminum	10	µg/L	20	160	70	106	100	23.03	5 to 100
Antimony	2	µg/L	0	< 2					
Arsenic	2	µg/L	0	< 2					5
Barium	5	µg/L	18	17	< 5		8	3.12	
Beryllium	5	µg/L	0	< 5					
Bismuth	2	µg/L	0	< 2					
Boron	5	µg/L	3	6	< 5		< 5	0.58	
Cadmium	0.3	µg/L	0	< 0.3					0.017
Chromium	2	µg/L	0	< 2					8.9
Cobalt	1	µg/L	0	< 1					
Copper	2	µg/L	13	3	< 2		2	0.38	2 to 4
Iron	20	µg/L	20	2300	160	523.5	410	447.57	300
Lead	0.5	µg/L	0	< 0.5					1 to 7
Manganese	2	µg/L	20	44	2	9.5	6	9.41	
Molybdenum	2	µg/L	0	< 2					
Nickel	2	µg/L	0	< 2					25 to 150
Selenium	2	µg/L	0	< 2					1.0
Silver	0.5	µg/L	0	< 0.5					0.1
Strontium	5	µg/L	20	24	7	14.25	13.5	5.55	
Thallium	0.1	µg/L	1	0.1	< 0.1		< 0.1		0.8
Tin	2	µg/L	0	<2					
Titanium	2	µg/L	7	20	< 2		2	6.80	
Uranium	0.1	µg/L	5	0.3	< 0.1		< 0.1	0.08	
Vanadium	2	µg/L	0	< 2					
Zinc	< 5	µg/L	1	2	< 2		< 2		30

* CCME Guidelines for Protection of Aquatic Life (CCME 2002 Update) See text for explanation of Notes 1 and 2.
Temperature, conductivity, dissolved oxygen, and turbidity were determined with a Hydrolab.
pH was determined with a Hydrolab in 2002, alkalinity by COBAS, and total dissolved solids gravimetrically.
All metal concentrations were determined by ICP-MS.
Count shows number of samples with quantifiable results.
Columns 4-8 show maximum, minimum, mean, and median values along with standard deviation.
All but one sample was collected in 2003 and reported by JW/MLP (2003), one sample in 2002 was reported by JW/IELP (2003a).

Table 7.39 Water Chemistry from Five Samples from St. Augustin River and Tributaries

Parameters	EQL	Units	Count	Max	Min	Mean	Med.	S.D.	CCME*
Temperature		°C	5	20.57	9.4	13.66	10.71	5.08	Note 1
Conductivity		µS/cm	5	7.2	3.4	4.86	5	1.58	
Dissolved O_2		mg/L	5	9.15	6.39	7.96	8.34	1.25	5.5 to 9.5
Turbidity	0.1	NTU	5	2.4	0.9	1.78	2.2	0.68	Note 2
pH		units	5	6.9	6.1	6.56	6.60	0.30	6.5 to 9.0
Alkalinity (as $CaCO_3$)	5	mg/L	1	7	< 5		< 5		
Total Dissolved Solids	10	mg/L	5	40	20	32	30	8.37	
Aluminum	10	µg/L	5	130	70	112	120	24.90	5 to 100
Antimony	2	µg/L	0	< 2					
Arsenic	2	µg/L	0	< 2					5
Barium	5	µg/L	5	10	6	8.2	8	1.48	
Beryllium	5	µg/L	0	< 5					
Bismuth	2	µg/L	0	< 2					
Boron	5	µg/L	0	< 5					
Cadmium	0.3	µg/L	0	< 0.3					0.017
Chromium	2	µg/L	0	< 2					8.9
Cobalt	1	µg/L	0	< 1					
Copper	2	µg/L	5	2	2	2	2	0.00	2 to 4
Iron	20	µg/L	5	810	300	440	380	209.64	300
Lead	0.5	µg/L	0	< 0.5					1 to 7
Manganese	2	µg/L	5	19	4	10.4	8	5.77	
Molybdenum	2	µg/L	0	< 2					
Nickel	2	µg/L	0	< 2					25 to 150
Selenium	2	µg/L	0	< 2					1.0
Silver	0.5	µg/L	0	< 0.5					0.1
Strontium	5	µg/L	5	18	11	14	13	2.92	
Thallium	0.1	µg/L	0	< 0.1					0.8
Tin	2	µg/L	0	<2					
Titanium	2	µg/L	3	2	< 2		2	0.00	
Uranium	0.1	µg/L	0	< 0.1					
Vanadium	2	µg/L	0	< 2					
Zinc	< 5	µg/L	1	7	< 2		< 2		30

* CCME Guidelines for Protection of Aquatic Life (CCME 2002 Update) See text for explanation of Notes 1 and 2.
Temperature, conductivity, dissolved oxygen, and turbidity were determined with a Hydrolab.
pH was determined with a laboratory meter in 2003 and Hydrolab in 2002, alkalinity by COBAS, and total dissolved solids gravimetrically.
All metal concentrations were determined by ICP-MS.
Count shows number of samples with quantifiable results.
Columns 4-8 show maximum, minimum, mean, and median values along with standard deviation.
All samples were collected in 2002 and reported by JW/IELP (2003a).

Table 7.40 Water Chemistry from Seven Samples from Paradise River and Tributaries

Parameters	EQL	Units	Count	Max	Min	Mean	Med.	S.D.	CCME*
Temperature		°C	7	11.4	2.82	6.19	5.78	3.44	Note 1
Conductivity		µS/cm	7	8.1	4.1	5.37	4.8	1.33	
Dissolved O_2		mg/L	7	12.9	8.91	11.10	11.51	1.37	5.5 to 9.5
Turbidity	0.1	NTU	7	6.7	0.1	2.81	3.4	2.61	Note 2
pH		units	7	8.09	5.72	6.81	6.41	0.98	6.5 to 9.0
Alkalinity (as $CaCO_3$)	5	mg/L	1	7	< 5		< 5		
Total Dissolved Solids	10	mg/L	7	50	30	38.57	40	9.00	
Aluminum	10	µg/L	7	370	130	261.43	280	90.26	5 to 100
Antimony	2	µg/L	0	< 2					
Arsenic	2	µg/L	0	< 2					5
Barium	5	µg/L	7	11	6	8.86	9	1.77	
Beryllium	5	µg/L	0	< 5					
Bismuth	2	µg/L	0	< 2					
Boron	5	µg/L	0	< 5					
Cadmium	0.3	µg/L	0	< 0.3					0.017
Chromium	2	µg/L	0	< 2					8.9
Cobalt	1	µg/L	0	< 1					
Copper	2	µg/L	3	2	< 2		< 2	0.00	2 to 4
Iron	20	µg/L	7	940	420	640	650	208.09	300
Lead	0.5	µg/L	0	< 0.5					1 to 7
Manganese	2	µg/L	7	15	5	10.14	9	3.63	
Molybdenum	2	µg/L	0	< 2					
Nickel	2	µg/L	0	< 2					25 to 150
Selenium	2	µg/L	0	< 2					1
Silver	0.5	µg/L	0	< 0.5					0.1
Strontium	5	µg/L	7	16	9	12	12	2.31	
Thallium	0.1	µg/L	0	< 0.1					0.8
Tin	2	µg/L	0	<2					
Titanium	2	µg/L	7	5	< 2		3	1.27	
Uranium	0.1	µg/L	1	0.1	< 0.1		< 0.1		
Vanadium	2	µg/L	0	< 2					
Zinc	< 5	µg/L	7	8	3	4.29	4	1.70	30

* CCME Guidelines for Protection of Aquatic Life (CCME 2002 Update) See text for explanation of Notes 1 and 2.
Temperature, conductivity, dissolved oxygen, and turbidity were determined with a Hydrolab.
pH was determined with a laboratory meter, alkalinity by COBAS, and total dissolved solids gravimetrically.
All metal concentrations were determined by ICP-MS.
Count shows number of samples with quantifiable results.
Columns 4-8 show maximum, minimum, mean, and median values along with standard deviation.

The summary statistics provide the maximum, minimum, median values, and the standard deviation. Where all values were below EQL, the maximum level is reported as less than EQL and no other statistics are provided. Where some samples had quantified levels, the maximum level is provided, the minimum level is less than EQL and the median level is shown - no mean can be calculated without ignoring the less than EQL values. If there were measured values for all locations, maximum, minimum, mean and median values are shown. Standard deviations refer only to the measurable values and should be viewed with that in mind. Relevant field measurements are also included for the watersheds.

Overall, water quality is generally dilute, which is typical for waters draining the Canadian Shield. The parameters that were investigated show the region to have near neutral pH, with localized areas prone to acidification, low total dissolved solids, low conductivity and low alkalinity. Dissolved metals are also generally low or non-detectable, except for elevated iron and aluminum, which are presumably higher as a result of local geology. Many of the metals were at concentrations that are below the EQL. The EQL is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The EQL is generally 5 to 10 times the Method Detection Limit.

Recent studies in the Churchill River (1998-99) found much the same water quality in the lower river sections (Newfoundland and Labrador Hydro unpublished data). Investigations on the lower Churchill River found evidence of marine influence in the lower sections of the Traverspine River, where slightly elevated sodium and chloride concentrations were recorded.

In comparing the results with the CCME Guidelines for the Protection of Aquatic Life (CCME 2002), some parameters should be noted as there are apparent accedences of the guidelines:

- Note 1: Although induced changes to natural temperatures and cycle can alter biological systems, interim guidelines are only developed for marine and estuarine conditions. There is no guideline for existing conditions of freshwater environments.

- The guideline range for pH (6.5 to 9.0) was generally met by most sample results and the overall mean value was 7.02. No values exceeded pH 9.0, 10 of 20 samples from the Eagle River basin were below pH 6.5, as was one of five from St. Augustin River Basin and four of seven samples collected in 2002 within Paradise River basin. The lowest value was 5.72.

- Note 2: The guidelines for turbidity relate to additions rather than existing conditions.

- Aluminum concentrations in water often exceed the guideline in Newfoundland and Labrador waters without apparent consequence. The toxicity of aluminum increases as pH falls below the optimal range and within the optimal range under alkaline conditions (CCREM 1987). Also the speciation of aluminum is the key to the actual toxicity and the toxicity may be reduced when aluminum ions are bound to organic or other compounds. The variation in guidelines shown in the table is based on other water quality characteristics (i.e., the guideline is 5 µg/L when pH<6.5; $[Ca^{2+}]$<4.0 mg/L; dissolved organic carbon (DOC)<2.0 mg/L and it is 100 µg/L when pH≥6.5; $[Ca^{2+}]$≥4.0 mg/L; DOC≥2.0 mg/L). Based on the results reported (i.e., levels ranging from 70 to 370 µg/L), aluminum exceeds the guideline of 5 µg/L in all cases and exceeds the 100 µg/L level, in 29 of the 43 samples examined in this study.

- Although the levels of cadmium were less than 0.3 µg/L, the guideline is lower still (0.017 µg/L). No samples had concentrations of measurable cadmium.

- The guideline for copper is dependant on water hardness as expressed as calcium carbonate ($CaCO_3$). The guideline extends over a range of 2 to 4 µg/L. One station had copper at a level of 5 µg/L and three samples had levels of 3 µg/L, which are exceedences due to low alkalinity (i.e., less than 5 mg/L $CaCO_3$).

- The guideline for iron (300 µg/L) is based on effects to fish and invertebrate development, although the most sensitive fish are not species that are present in Labrador (CCREM 1987). A total of 37 of the 43 stations had iron levels that exceeded the freshwater guideline, to levels as high as 1,800 and, 2,300 µg/L (in Eagle River watershed) and 3,200 µg/L (at a station in the Kenamu watershed).

- Selenium and silver each have CCME guideline levels (1.0 mg/L and 0.1 µg/L, respectively) that are below the normal EQL provided by the laboratory (2 µg/L and 0.5 µg/L, respectively). Therefore, as with cadmium, the analytical results cannot be determined to guideline limits. However, all results were below the EQL.

All other parameters that have CCME Guidelines for the Protection of Aquatic Life (CCME 2002 Update) were determined to be below the guideline levels for all samples (i.e., arsenic, chromium, copper, lead, nickel, thallium and zinc). One sample from the Eagle River basin contained titanium at 20 µg/L, which is 3 to 10 times that found at other locations. There is no freshwater guideline for this metal.

7.8.3.3 Salt Loading

Sodium and chloride were not included in the analyses that were conducted on water samples collected at the proposed stream crossing locations. There are no CCME guidelines (for the protection of aquatic life) that apply to sodium or chloride. These parameters both have average values between 1 to 2 mg/L based on historic data obtained from Eagle River (Government of Newfoundland and Labrador 1992a). These ions, in addition to sulphate, are often naturally elevated in waterbodies that are near the coast by virtue of marine aerosols. However, the highway watercourse crossings for the outfitter route are quite removed from marine coastal influences, so this source of salt loading is greatly reduced as a factor in the local water quality.

Conductivity at the 43 sampling stations ranged from 2.5 to 9.9 µS/cm (mean of 5.59 µS/cm). This is quite a low range for conductivity, indicating low dissolved solids (including salt). This is not anticipated to change with the construction and operation of the highway, as road salt will not be used for ice control during winter months. The small amount of salt (less than 5 percent) that will be used to prevent freezing of sand, will be virtually undetectable in run-off and indistinguishable from natural variability in the streams. Salt (approximately 1250 tonnes in 25,000 tonnes of sand) will probably be stockpiled at Cartwright Junction to service both Phase II and Phase III of the road.

7.8.4 Potential Interactions

Nearly all aspects of the outfitter route regarding water resources are fundamentally the same as those of the preferred route that was previously assessed by JW/EILP (2003), although the outfitter route enters two additional river basins, with crossings occurring in one of them. The potential interactions, existing knowledge, and details of mitigation for the outfitter route are largely taken from the assessment of the preferred route submitted earlier this year.

The potential interactions between the project and water resources have been outlined in Section 7.5 - Fish and Fish Habitat. These are reviewed briefly below in point form.

Construction activities in and near waterbodies have the potential to alter water quality and water flows. Potential interactions between the project activities and water resources include:

- fording that may be used to cross some streams at the beginning of construction;
- grubbing and debris disposal will take place in close proximity to watercourses;
- excavation (cuts and fills) will be completed along the route and borrow pits will be operated where necessary;
- rocks with potential for ARD may be encountered along the proposed route;
- blasting may be conducted near waterbodies to construct bridge abutments, to achieve the highway design elevation or to establish the right-of-way;
- culverts and bridges will be placed at watercourse crossings;
- hazardous materials (fuels and lubricants) will be used near waterbodies and used materials will be stored prior to disposal;
- concrete and aggregate production may occur near watercourse crossings;
- temporary construction camps will be established to house work crews;
- solid waste and domestic sewage will need to be handled and disposed of; and
- there will be generally improved access to stream crossing areas.

Many interactions that may occur during construction (sedimentation, contamination) also apply during operation, albeit to different levels of intensity, timing, or spatial distribution. Other potential interactions during operations include:

- runoff will occur along the highway;
- airborne dust from highway operation will be carried to adjacent waterbodies;
- ice control may be applied during winter operations;
- service depots that are planned for the project may store and handle various hazardous materials;
- each depot will have waste handling/holding facilities;
- faulty installations or developing problems with the installations may occur or be evident over time; and
- there will be generally improved access to stream crossing areas.

A summary of water quality issues that are associated with the construction and operation of the outfitter route is provided in Table 7.41.

Table 7.41 Summary of Water Quality Issues Associated with Outfitter Route Operation

Activity/Issue	Concern	Comment
Exposed acidic rock near watercourse crossings could lead to elevated concentrations in water	pH, As, Fe, SO_4, Cu, Al, Total Acidity, Alkalinity, Conductivity	Measures are outlined in Section 7.7.11 for the detection and characterization of acidic rock. Measures will be taken to minimize disturbance to these areas so as to avoid potential leaching to freshwater.
Maintenance	Paints, Preservatives	Guidelines and practices for the proper handling of preservative coating materials will be included with appropriate contract documents.
Ice control	Salt	Salt will not be used on the TLH - Phase III for ice control. A small amount (<5 percent) will be mixed with sand to prevent freezing of stockpiles.
Dust Control	Minor effect to flora and fauna	No action is warranted.

Accidental events that could acutely or chronically affect water quality or water quantity include:

- hazardous material spills may occur during construction, operation or as a result of materials transported;
- fire can occur as a result of construction activities, temporary camp operation and highway maintenance activities, accidents relating to the operation and use of the outfitter route, or accidents unrelated to the highway (i.e., lightening strikes); and
- highway crossing failure such as a collapse, washout or flooding can occur during seasonal high flow periods.

7.8.5 Issues and Concerns

The issues and concerns relating to the potential interactions during construction, operation and from accidental events are, for the most part, the same as for fish and fish habitat.

Fording streams at areas of unstable banks or substrates may lead to increased sedimentation, which will degrade water quality. Erosion and resulting sedimentation will be also be increased from poorly controlled runoff from areas of clearing, grubbing, excavation, quarry/borrow pit operation, and aggregate production. The same can be said for runoff and airborne dust during operation of the highway.

Blasting has the potential to affect water quality by the introduction of toxic blast residues (ammonia). Concrete batch plants and aggregate washing have the potential to introduce silty material into watercourses and liquid concrete products and truck washing residues have a high pH and can degrade water quality (i.e., toxic to plants, invertebrates and fish). During highway construction, blasting and excavation may expose acid generating rock to the elements, resulting in ARD to streams and ponds.

Untreated sewage that is allowed to enter ponds and streams has the potential to introduce pathogens such as *E. coli*, harmful chemicals such as ammonia, and lead to excessive biochemical oxygen demand loading and nitrification. Improper disposal of solid wastes can also introduce harmful chemicals. This reduces the water resource value for recreational and domestic use, and can affect aquatic life.

Ice control on the highway will be limited to the application of sand, with the resulting potential for increased sedimentation if highway drainage is poorly designed or poorly controlled.

All manner of hazardous materials that are improperly handled, store or accidentally spilled will potentially degrade water quality. These materials include fuels, lubricants, cleaners, solvents, deicing fluids, other materials that will be used during construction and operation, and materials that will be transported during operation.

Poorly designed or installed culverts and bridges have the potential to alter stream flow and result in scouring, which could lead to increased bank erosion, turbidity and sedimentation. Insufficient sizing of culverts could cause water back-up, flooding and subsequent erosion and increased turbidity. Another result of poor planning and inadequate sizing could be the formation of ice dams that obstruct water flow during spring breakup. Culvert or highway failure is unlikely to occur, but could result in moderate to massive introductions of sediment.

Forest fires could result in introductions of sediment and ash, which could change water chemistry and increase turbidity. When fire destroys riparian vegetation, the risk of erosion is increased.

7.8.6 Existing Knowledge

Sedimentation (increased sediment load and deposition) is perhaps the most recognized environmental effect on aquatic systems and water quality during highway construction. Sediment deposition can result from a variety of activities, including fording, blasting, vegetation clearing, highway construction, and bridge and culvert installation. Suspended sediment also occurs naturally in watercourses along the route, as witnessed following a heavy rain during the field survey in September to October 2002. The environmental effects of sediment are well studied and understood, mainly dealing with the effects on fish and fish habitat, as discussed in Section 7.5. Effects on water resources include:

- degradation of water quality (i.e., oxygen levels, light penetration, water temperature, water chemistry such as organic content and metals); and
- changes in stream morphology and stream bed porosity.

Sedimentation and siltation can be virtually eliminated during construction and operation, if proper mitigative steps are taken as discussed in Section 3.9.3. Current Canadian guidelines for suspended solids have been set by the CCME (2002). Suspended solids should not increase by a level exceeding 10 mg/L when background suspended solids concentrations are equal to or less than 100 mg/L. Suspended solids should not increase by a level exceeding 10 percent of background concentrations when background concentrations are greater than 100 mg/L.

Experience in the construction of TLH - Phase II showed that during low flow conditions, much of the water was lost in some culvert pipes because it flowed under the pipe rather than through it. The cause of this was the use of oversized ‘clean’ fill in the culvert installation where water could flow through the material in question. Where this may not be a hydrologic problem or result in any problem with the integrity of the pipe installation, the reduction or loss of flow could prevent fish passage during the low flow condition (noting that fish passage may otherwise be impeded in the brook itself). Careful installation can prevent this occurrence, and follow-up monitoring will detect recurring problems that can then be remediated.

Clearing vegetation near riverbanks removes shaded habitat and increases bank erosion. Shaded areas provide cooler temperatures during periods of warm, sunny weather.

Blasting can cause resuspension of sediments (Munday et al. 1986), bank failure and resultant sedimentation. Nitrogen-based explosives can affect aquatic life through direct toxicity, reducing dissolved oxygen during nitrification and providing nutrients for aquatic plants. Nitrite is highly toxic to fish; ammonia can cause gill damage and nitrate promotes algal growth. Pommen (1983) provides detailed information on the potential chemical effects of blasting.

Acid rock drainage can result from the exposure of mineralized rock to water in the presence of oxygen and, bacteria. The resulting lower pH can severely reduce the pH of the runoff from the area and subsequently, affect the water quality in receiving streams and ponds where natural buffering does not occur. Natural buffering (alkalinity) is fairly low in most areas along the highway route.

The crushing and laying of granular rock has the potential to accelerate the ARD processes associated with sulphide-bearing rock, which is exposed through the highway construction process. The most important problem with acid generation is that it may accelerate over time and, once begun, is almost impossible to stop the dissolution of metals. The incorporation of metals into organic compounds may result in increased bioavailability of metals or in bioaccumulation and toxicity, which in turn could lead to adverse effects within the ecosystems.

Hazardous materials spilled into the aquatic environment can degrade water quality, and result in adverse environmental effects on plants, invertebrates and fish.

The introduction of liquid concrete products or wash residues into watercourses can increase sedimentation and change water chemistry (primarily pH).

The main concern with domestic sewage is the potential to increase nutrient loading, suspended sediment or introduce oil and grease or other contaminants into a watercourse. These introductions can lead to eutrophication of waterbodies, adverse sediment effects or water quality contamination.

Several authors have reported that in the years following forest fires, sedimentation, alkalinity and temperature of streams and lakes in the area are increased, thereby altering water quality. The magnitude of change in these factors is dependent on the size of the burned area and the size and flow rate of affected streams. Smaller streams are probably more susceptible to habitat alteration as a result of fire than are large rivers (Kelsall et al. 1977).

Improperly installed culverts can change (throttle) stream morphology, leading to flooding, increased scouring and increased turbidity. Some of these changes may have effects on the upstream and downstream watercourse.

7.8.7 Mitigation

The WST is committed to minimizing adverse environmental effects of the project on water resources. Regulations, guidelines, codes of good practice, mitigation and environmental protection measures specifically related to the protection of fish and fish habitat are integral parts of the project description and environmental protection planning, and are outlined or detailed in Section 3.9.3 and include:

- water conveyance structures (culverts and bridges) will be designed and installed to accommodate extreme flow conditions (high and low flows), and 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 installation carried out in the dry by diverting or pumping water around the construction 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 wherever possible and at riparian areas that must be disturbed will be stabilized to control erosion;
- adherence to regulations, guidelines, codes of good practice;
- follow-up inspections verifying culvert installation and operation; and
- details provided in EPP.

As with the mitigations for the protection of fish and fish habitat, there are no unique or extraordinary mitigation measures that apply to this project with regard to water resources.

During construction, WST is committed to maintaining the existing quality and quantity of water resources. To do this, WST will ensure that their personnel and those of the contractors are aware of the potential effects and appropriate mitigations required to reduce adverse effects, in order to ensure that applicable legislation and regulations are adequately enforced, and that all activities are undertaken in a responsible and sustainable manner.

The same will apply to WST and contractors with regard to repair and maintenance activities during operation. However, many of the potential adverse effects during operation stem from the improved access provided by the highway, and the associated increase in human presence and activities in this previously remote area. Mitigating these potential effects, is for the most part, beyond the ability and responsibility of WST. Managing these actions and their potential effects will require the efforts of regulatory and resource management agencies, in order to ensure that applicable legislation and regulations are adequately enforced. In this regard, the purpose of the environmental assessment is to identify these potential issues well in advance of their occurrence, so that appropriate measures can be identified and implemented by th appropriate agencies in an effective and timely manner.

7.8.8 Environmental Effects Assessment

The following sections discuss environmental effects and their ecological, social, cultural context on water resources for each project phase.

7.8.8.1 Construction

Construction may have localized effects on water quality. Effects will be limited to one construction season of four months at any given location. Both instream and near-stream activities conducted during construction may affect water quality from the point of disturbance to some distance downstream. The main issue is likely increased turbidity and sedimentation and these will only remain elevated until the suspended material settles out, most likely at the first pond or steady downstream. The built-in mitigative measures, as well as adherence to WST's standard mitigative measures to be developed and included in the construction EPP, will prevent or minimize any adverse effects. Also, WST's resident engineer or the ESO will ensure that the contractor complies with the EPP, and all permits, approvals and authorizations. WST also has the benefit of experience with the recently completed TLH - Phase II, which had similar challenges to those projected for the outfitter route.

Any sedimentation and siltation and discharges or spills into watercourses will degrade water quality. While mitigation measures will minimize sediment disturbance, it is likely that temporary sedimentation will result from the limited in stream construction. However, any sedimentation will be within permitted levels or be of very brief duration. Instream work, which may cause elevated suspended solids, will be limited to the "footprint" of the bridge foundations and culvert structures. Where possible, these will be installed in the dry, thus reducing the risk of sedimentation. With the proper mitigative and environmental protection measures, effects of sedimentation and siltation will be further reduced. Environmental effects on water quality will be localized.

The proposed highway has not been surveyed; therefore, specific requirements for blasting have not yet been defined. It is anticipated that there will be requirements for blasting during construction, but it is unlikely that underwater blasting will be required. As well, blasting will not be required at all watercourse crossings. With the proper mitigative procedures, as proposed by WST, it is anticipated that the environmental effects on water quality from blasting will be, at few locations, localized and, for the most part, controlled.

A review of surficial and bedrock geology has been conducted to determine areas along the proposed route where ARD potential exists. The highway design in those areas identified as at risk will be reviewed to determine if excavations and cuts are likely to expose reactive rock. The potential for exposure may be reduced by design modification (i.e., reduce cut and use more fill), local realignment, or other appropriate mitigative measures if the presence of reactive rock is confirmed in the field.

Compliance with the existing provincial water and sewer regulations will ensure that adverse environmental effects from sewage are reduced to acceptable levels. WST is committed to ensuring that sewage and waste disposal for construction camps complies with the Department of Health guidelines and the *Environment Control (Water and Sewage) Regulations.*

One problem that was experienced at a few locations along TLH - Phase II was water flowing under the culvert barrel rather than through it. The cause of the problem was using clean fill (blast rock) to embed the culvert - resulting in seepage through the rock fill. Left unchecked, this could result in chronic or sporadic erosion and elevated suspended solids. This will be rectified at the affected locations by sealing the inflow end with concrete. Measures will be taken to ensure the fill around culverts in along the outfitter route is impermeable, to avoid this problem.

Generally speaking, there will be no requirement for additional regulatory inspection or control to preserve water quality during construction, as the Department of Environment and Environment Canada do not normally dedicate a lot of resources to the inspection of construction projects. WST and the contractor's activities will be self-regulated and other agencies, such as DFO, will be present during construction.

7.8.8.2 Operation

Highway operation may affect water quality and hydrology at the stream crossing locations and downstream. Potential effects will extend over the life of the highway. However, mitigative measures built into bridge and culvert design will avoid or reduce these effects.

Maintenance activities, such as grading and ice control, which will be limited to sand application, may also cause sediment to be deposited in the watercourses. Reasonable care in application of sand and controlling erosion from grading will reduce this risk substantially.

Regular inspection and maintenance will be conducted to avoid debris build-up or beaver workings in culvert inlets. Culverts will be kept free of blockages to avoid flooding and control potential erosion.

Concern has been raised for the potential effects of airborne dust from highway operation on aquatic habitat and fish. Although this is a highly visible and possibly chronic phenomenon, the material that would be deposited in streams and ponds is mainly fine sediment. Accumulations of this material will be easily mobilized and flushed from the streams by high flows. The eventual fate will likely be ponds, lakes and other depositional areas as is the case for other suspended sediments. Dust control that will be applied to the highway will be limited to water spray during construction.

As stated above, the Department of Environment and Environment Canada do not normally dedicate a lot of resources to the inspection of construction projects, and the same applies to the operation of roadways, unless specific issues and sensitive situations are identified. The ability of the resource agencies to fulfill their regulatory mandate with the operation of the new highway is not expected to be diminished.

7.8.8.3 Accidental Events

Fuel or chemical spills entering fish-bearing streams could temporarily degrade water quality. In addition, contaminants can accumulate in sediments and be mobilized slowly over time. If a major spill of a highly toxic and soluble material were to occur at one of the watercourse crossings, the geographic extent would include both the crossing site and areas downstream in the watershed, potentially to the river mouth, depending on the quantity and toxicity of the material spilled. Changes in water quality could also affect biological processes at all trophic levels. The extent of the effect would be dependent on the timing, nature and volume of the material spilled. Subsequent to a spill of hazardous materials, the high spring flows and high bedload transport would effectively flush the system during the spring following the event, thus setting a temporal boundary. Contingency procedures will be developed and included in the construction EPP to ensure that a fast and effective response will occur in the event of a spill.

The potential effects of a forest fire in the project area could be considerable. A forest fire could alter water quality within streams throughout the watershed. Due to the limited number of available personnel during operation and the isolation of some areas, fire fighting capabilities would be limited. Fire within the assessment area of the highway could occur during any phase of the project due to lightning or human activities. Factors influencing the severity and duration of effects include time of year, extent of fire damage and type of fire (chemical, forest). The risk of forest fire is slightly higher than under natural conditions due to the presence of human activity along the highway route, which may be subsistence, recreational or commercial in nature.

A fire that destroys much of the riparian vegetation could have short and long-term effects on water quality. In the short-term, elevated pH and suspended solids (from ash and silt) would immediately follow a major fire. The loss of riparian vegetation could lead to loss of shade and result in seasonally elevated water temperatures. In the medium to longer term, loss of riparian vegetation could lead to increased erosion and sedimentation. Spring flows and high bedload transport would effectively flush the system during the spring following the event; however, erosion within the watershed would continue to contribute sediments to the stream system for a number of years. Changes to groundwater patterns and contribution to baseflow in the stream may be altered during this period due to changes in evaporation and infiltration rates. Restoration of bank stability and cool temperatures would rely on the re-establishment of riparian plant communities through vegetative succession.

A temporary degradation of water quality due to increased sedimentation and culvert or concrete debris would occur in the event of highway failure or washout. This could have a subsequent effects on freshwater fish. Factors influencing the geographic extent, duration and magnitude of effects include time of year, and location in watershed. Roads are most susceptible to washouts during the high flow period during and immediately following the spring snow melt. The highway design will focus on protection of the aquatic environment by incorporating buffer zones, drainage and erosion control features and very conservative culvert design criteria. Culverts will be installed with consideration for highway and stream gradient, ice conditions, bank stability and, where warranted, protection of fish habitat.

7.8.9 Environmental Effects Evaluation

Potential effects on water quality will relate mainly to potential deterioration of water quality due to introduction of sediment, change in pH or the introduction of deleterious substances (such as hydrocarbons and ammonia). The following section provides evaluation criteria based on the potential adverse environmental effects of these changes in water quality.

Regulations and permit conditions will set water quality criteria for the undertaking. Failure to meet a water quality criterion is a serious regulatory issue, but may have reduced environmental implications in the context of a specific site or condition. The environmental significance of adverse water quality conditions will depend on the nature of the resulting adverse environmental effect.

A **major (significant) environmental effect** is rated as high magnitude and would result from a long-term (greater than 37 months), widespread (greater than 100 km^2), very frequent (greater than 51 events/year) and non-reversible adverse effect to water quality that results in adverse effects to freshwater ecology (fish, fish food or fish predators) or water resource use by humans.

A **moderate (significant) environmental effect** would result from a shorter-term (13 to 36 months), less-widespread (11 to 100 km^2) frequent (11 to 50 events/year), and possibly reversible adverse effect to water quality that results in adverse effects to freshwater ecology (fish, fish food or fish predators) or water resource use by humans.

A **minor (not significant) environmental effect** is rated as low magnitude would result from a localized (less than 1 to 10 km^2), infrequent (less than 10 events/year), brief (1 to 12 months) and reversible effect to water quality that may result in adverse effects to freshwater ecology (fish, fish food or fish predators) or water resource use by humans.

A **negligible (not significant) environmental effect** is rated as nil or low magnitude and is one where water quality changes are beyond the range of natural variability, but the resulting ecological or socio-economic effects are not discernible, or are localized and fully reversible.

The above definitions, which are used to rate the significance of the predicted residual environmental effects of the project on water quality are taken from the Duck Pond Copper Zinc Project EIS (JW 2001). A summary of the effects of the project on water resources is provided in Table 7.42.

Construction of the outfitter route will have minor (not significant) environmental effects on water resources. Effective mitigation and environmental measures will minimize effects during highway construction. The duration of any potential adverse effects on water resources is limited to one construction season at any location.

Highway operation will have minor (not significant) environmental effects on water resources. The duration of the effect could be indefinite, based on recurrence throughout the operation phase; the frequency reflects various maintenance schedules and natural perturbations. Again, knowledge and understanding of the potential effects of project operation on water resources is reasonably high.

Accidental events would have a moderate (significant) environmental effect on water resources if these events occur. Due to the uncontrollable and unpredictable nature of events such as forest fires, and hazardous spills, potential exists for these events to occur. WST will implement mitigative measures to minimize the risk of these events occurring. However, accidental events (including hazardous materials spills, fires, and flooding/road washout) cannot be eliminated. Based on the environmental effects analysis, a worst-case accidental event would result in an adverse and moderate effect on water resources. The likelihood of such events occurring is very low given the construction and design standards, and operating and maintenance procedures to be followed and routine monitoring. Reversibility is moderate to high.

Table 7.42 Environmental Effects Summary - Water Resources

	Construction	Operation	Accidental/Unplanned Events
Mitigation: • 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 examined for ARD potential, confirmatory sampling will be conducted; • watercourse crossing installation carried out 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; • buffer areas will be maintained along watercourses and minimum riparian areas will be disturbed; • measures will be taken to control erosion; and • adherence to regulations, guidelines, codes of good practice, details provided in EPP.			
Environmental Effects Criteria Ratings			
Magnitude	Low	Low	Unknown
Geographic Extent	1 to 10 km^2	1 to 10 km^2	11 to 100 km^2
Frequency	< 10	< 10	< 10
Duration	< 1	< 1	< 1
Reversibility	Reversible	Reversible	Unknown
Ecological/Socio-economic Context	Low/Related to fish and fish habitat and resource use and users.		
Environmental Effects Evaluation			
Significance	Not Significant (Minor)	Not Significant (Minor)	Significant (Moderate)
Level of Confidence	High	High	Medium
Likelihood[1]	n/a	n/a	Low
Sustainable Use of Resources[1]	n/a	n/a	n/a
[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994).			
Environmental Monitoring and Follow-up: • Compliance monitoring as required by federal and provincial authorizations and guidelines. • Regular inspection and maintenance at all crossing locations.			

Key:

Magnitude:	High, Medium, Low, Nil or Unknown
Geographic Extent (km^2):	<1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown
Frequency (events/year):	<10, 11-50, 51-100, 101-200, >200, Continuous or Unknown
Duration (months):	<1, 1-12, 13-36, 37-72, >72 or Unknown
Reversibility:	Reversible, Irreversible or Unknown
Context:	Existing Disturbance (High, Medium, Low, Nil or Unknown)
Significance:	Significant, Not Significant, Positive or Unknown
Level of Confidence:	High, Medium, Low
Likelihood:	High, Medium, Low or Unknown
Sustainable Use of Resources	High, Medium, Low or Unknown

7.8.10 Cumulative Environmental Effects

The proposed outfitter route will result in minor and fairly localized (1 to 10 km^2) effects to water quality during construction and operation of the highway. Development activity in the project area has been relatively limited to date, and there are no communities located along this portion of the TLH. Past and ongoing activities in the area such as recreational hunting and angling, hiking/boating and Aboriginal land and resource use activities have had limited effect on water quality in the region.

Although there is some potential for cumulative effects to water quality in combination with Phases I and II of the TLH, this would be limited to watersheds at the ends of the proposed highway (i.e., Paradise River and Churchill River). Other current and potential projects and activities elsewhere in Labrador, such as the Voisey's Bay Mine/Mill, have not or will not have an effect on water quality within the proposed project area. Therefore, there is little potential for interaction between the effects of these actions and those of the proposed project.

By its nature, the new highway will facilitate future economic development in the region, particularly resource development activities such as forestry. Forestry activities have the potential to affect water quality through, for example, the siltation of watercourses due to erosion after vegetative cover has been removed and from forest access roads. The improved access provided by the highway will also likely result in increased mineral exploration throughout the region. Environmental legislation, regulations and guidelines relating to forestry and mineral exploration activities (e.g., maintenance of buffer zones) will ensure that the effects of any such activities on water quality are controlled. There will also be improved access for hunting, fishing and other land and resource use activities. Cabin development will also likely increase which may affect water quality, particularly as proximity to a waterbody is often preferred. All of these activities are regulated under provincial and federal legislation and as such, there are measures available to assess and mitigate adverse environmental effects.

Details such as the likelihood, nature, location and timing of any actions induced by the outfitter route are not known and the control of most potential induced actions and related effects is beyond the ability and responsibility of WST. Control depends on appropriate enforcement, management and planning on the part of relevant regulatory agencies to ensure that any such effects are avoided or reduced. As a result, a number of assumptions have been made in considering induced actions in the cumulative effects assessment, 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;
- the level of 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.

With the implementation of these mitigation measures, particularly appropriate planning and enforcement, the proposed project is not likely to result in significant adverse cumulative effects on water resources in combination with other projects and activities that have been or will be carried out.

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 would be reduced and accidents and violations increased as a result. This is not projected to lead to a substantial change as far as the direct operation of the road is concerned. If activities such as forest harvesting, mining, or cabin development occurs in the future under inadequate regulatory enforcement, a moderate cumulative (significant) environmental effect (13 to 36 months over an area of 11 to 100 km^2, 11 to 50 events/year) could conceivably be the result of these unregulated activities. However, this would only be the case for cumulative effects rather than direct operational effects, and it would only result from negligence or carelessness in the implementation of other projects or activities.

The various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate. There may also be a need for agencies to increase their enforcement staff levels..

7.8.11 Environmental Monitoring and Follow-up

Environmental monitoring of water quality in the form of compliance monitoring will be considered by WST in consultation with provincial and federal regulatory agencies. The Resident Engineer will undertake water monitoring commitments as outlined in the EPP.

WST will review the need for additional water sampling where there is a concern about the effectiveness of the mitigation measures. The water quality of the area has been characterized on a regional basis from existing sources such as the *Water Resources Atlas of Newfoundland* (Department of Environment and Labour 1992) and from water sampling conducted at 35 stream crossing locations.

In addition to any water quality monitoring, there will be a program of follow-up monitoring of all stream crossing installations and structures to ensure that they are performing properly.

7.9 Wetlands

Wetland functions are the natural properties and processes (physical, chemical and biological) of wetland ecosystems. Wetlands serve a number of important functions, such as natural purification and storage of freshwater, natural flood reduction and control, habitat for a wide range of species, and a natural storage base for carbon. In recent years, wetland loss has been connected with increased flooding, poor water quality, desertification, and declines in fish and wildlife populations (Lynch-Stewart et al. 1999).

7.9.1 Boundaries

The project boundary is the cleared right-of-way and areas of associated physical disturbance.
Maintenance of function in wetlands within 100 m of the centre line will be the basis on which the environmental effects analysis will be conducted for this VEC.

Refer to Section 6.9.1 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further discussion on boundaries.

7.9.2 Methods

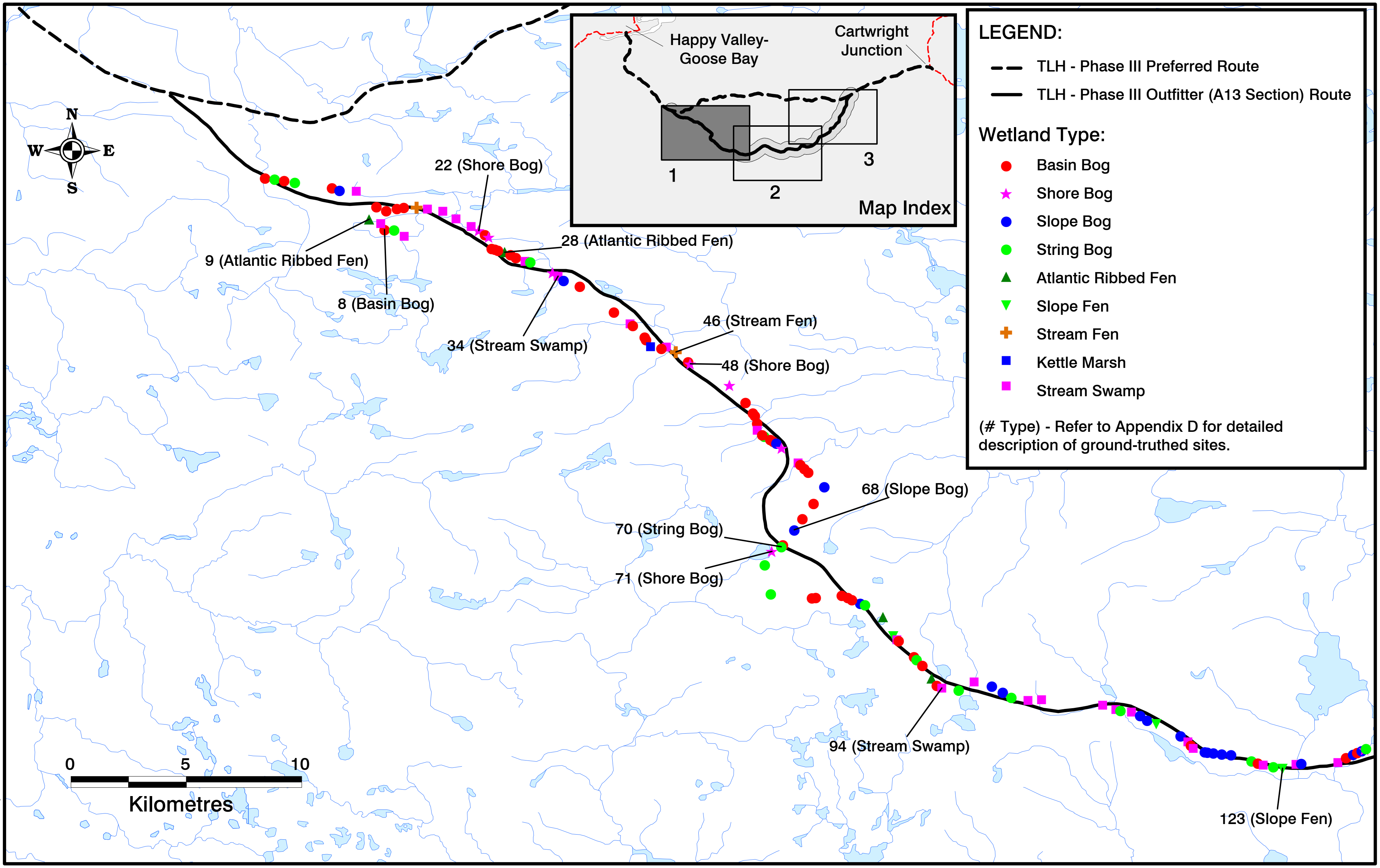
In a methodology similar to that used to assess wetlands along the preferred route, wetlands along the right-of-way of the outfitter (A13 section) route were identified and described using a combination of helicopter and ground-based surveys. Each wetland type within 100 m of the centre line of the outfitter (A13 section) route was identified and recorded using a GPS. Wetlands were classified using the Canadian Wetland Classification System (NWWG 1988). A detailed examination of the wetland types within this survey area was conducted to determine the relative frequency of occurrence of various wetland types and to describe the dominant plant species associated with each.

Following identification of the wetland types, three to six examples of each were randomly selected for floristic description. At each of the selected sites, the dominant plant species were identified and their cover estimated. Wetland vegetation was divided into three structural categories, trees (woody plants greater than 5 cm in diameter at breast height (DBH)), shrubs (woody plants less than 5 cm DBH) and ground vegetation (herbaceous vascular plants, bryophytes and lichens).

7.9.3 Existing Environment

A total of 444 wetlands were recorded during the aerial survey (Figures 7.20 to 7.22). Four general wetland forms were present along the route, including bog (75.4 percent of recorded wetlands), fen (8.4 percent of recorded wetlands), swamp (14.2 percent of recorded wetlands), and marsh (1.9 percent of recorded wetlands) (Table 7.43).

The plants associated with each wetland type and the average percent cover of each plant in each wetland type are provided in Table 7.44. Detailed plant community descriptions for each ground-truthed site are presented in Appendix D. Scientific names of all plant species are provided in Appendix B.



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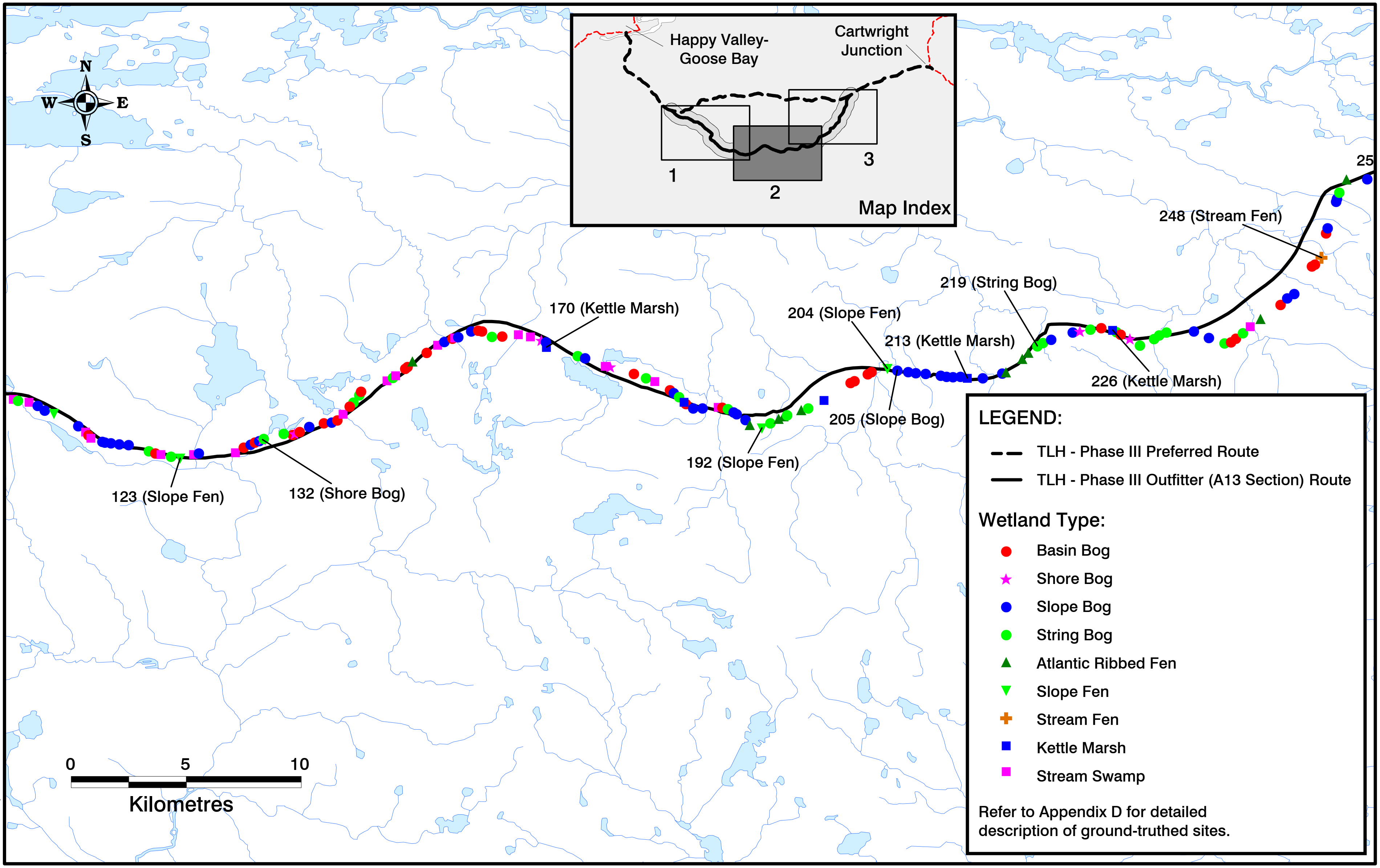
Jacques Whitford Environment Limited
Environmental Scientists
Consulting Engineers

Figure 7.20

Wetland Survey - Block 1
Outfitter (A13 Section) Route, TLH-Phase III



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Consulting Engineers

Figure 7.21

Wetland Survey - Block 2
Outfitter (A13 Section) Route, TLH-Phase III

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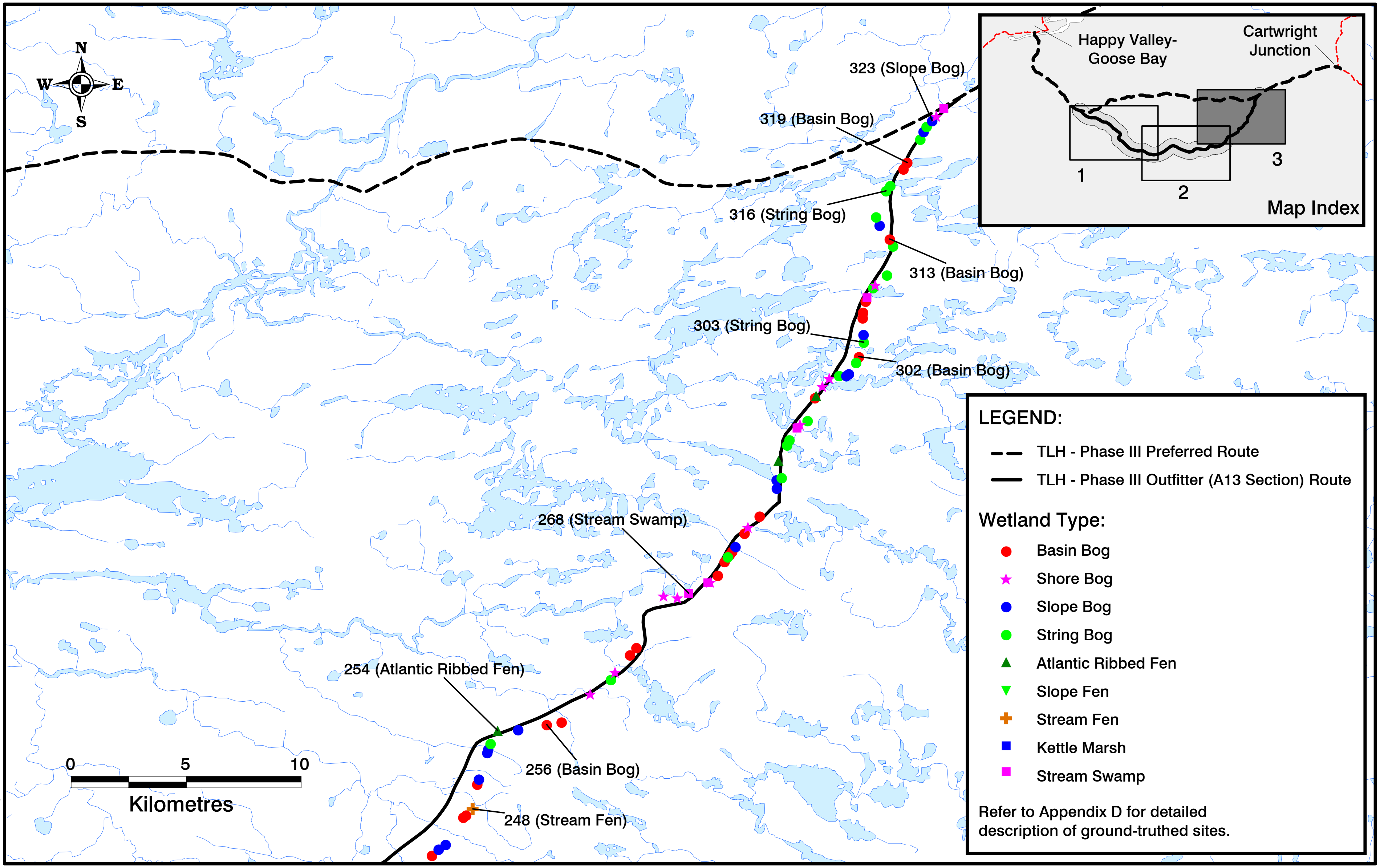

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Consulting Engineers

Figure 7.22

Wetland Survey - Block 3
Outfitter (A13 Section) Route, TLH-Phase III

Table 7.43 Wetland Types Within 100 m of the Highway Right-of-Way-Outfitter (A13 Section) Route

Wetland Type and Form	Number within 100 m of Right-of-way	Proportion of all Wetlands (%)
Bogs		
Basin Bog	93	30.1
Shore Bog	24	7.8
Slope Bog	61	19.7
String Bog	55	17.8
Total	**233**	**75.4**
Fens		
Atlantic Ribbed Fen	16	5.2
Slope Fen	5	1.6
Stream Fen	5	1.6
Total	**26**	**8.4**
Marshes		
Kettle Marsh	**6**	**1.9**
Swamps		
Stream Swamp	**44**	**14.2**

Table 7.44 Dominant Plant Species and Percent Cover at Selected Wetland Sites

Common Name	Wetland Type								
	Basin Bog	Shore Bog	Slope Bog	String Bog	Ribbed Fen	Slope Fen	Stream Fen	Kettle Marsh	Stream Swamp
Trees									
Black Spruce	4.4	3.3	4	2.7	2.5	4	2.3	0	6.7
Tamarack	0.2	3.3	0.5	0.8	0.8	5.3	3.3	0	3.3
Shrubs									
Leatherleaf	19.2	16.7	21.7	15	8.3	4.3	7.3	1.7	0
Black Spruce	6.8	9.7	15	7.7	1	6.7	0.6	0.3	0
Tamarack	2.2	1	0.8	7.3	8.7	10	1.7	0	0
Bog-rosemary	0.5	3	1.3	0.3	1.2	0.2	0.2	0	0
Bog Laurel	4.2	4	2	5.3	2.8	4	0.6	0	0
Sheep Laurel	0.5	0	0	0	0	0	0	0	0
Labrador Tea	2.5	2	3.3	2.3	0	0.6	0	1.3	0
Sweet Gale	0	0	0	0	0	6.7	10.3	0	3.3
Black Crowberry	1.2	0	0.6	0	0	0	0	0	0
Balsam Fir	0	0	0	0	0	0	0	0	1.7
Alpine Bilberry	2.2	3.3	0.6	1.3	0.6	1.7	0.6	0.6	0.6
Squashberry	0	0	0	0	0	0	0	0	0.6
Newfoundland Dwarf Birch	1.2	0.3	0.3	5.7	6.7	0.3	0	0	0
Glandular Birch	0	0	0	0	0	0	0	0	0
Dwarf Birch	0	0	0.1	0	0.7	5.3	1.7	0	0

Common Name	Wetland Type								
	Basin Bog	**Shore Bog**	**Slope Bog**	**String Bog**	**Ribbed Fen**	**Slope Fen**	**Stream Fen**	**Kettle Marsh**	**Stream Swamp**
Bog Willow	0	0	0	0	0	0	0	0	40
Beaked Willow	0	0	0	0	0	5	1.7	0	21.7
Balsam Willow	0	0	0	0	0	0	0	0	3.3
Mountain Fly Honeysuckle	0	0	0	0	2	3.3	1.3	0	1.7
Speckled Alder	0	0	0	0	0	0	0.2	0	
Downy Alder	0	0	0	0	0	0	0	0	8.3
Skunk Currant	0	0	0	0	0	0	0	0	8.3
Willow spp.	0	0	0	0	0	0	0.6	0	0
Ground Vegetation									
Sphagnum moss	85.8	86.7	87	83.3	41.7	46.7	30.3	0	58.3
Moss spp.	0	0	0	0	0	0	0	0	3.3
Bristly Clubmoss	0	0	0	0	0	0	0	0	0.3
Deer Grass	7.3	2	3.3	6.7	12.7	3.3	13.3	0	0
Alpine Cottongrass	0	0	0	0.2	0	0	0	0	0
Podgrass	0	0	0	0.6	0	0	0	0	0
Bakeapple	4.3	1.7	1.3	1.7	0.3	0.6	0	0	0.6
Reindeer Moss Lichen (*C. alpestris*)	1.7	0	2.3	0	0	0	0	0	0
Reindeer Moss Lichen (*C. rangiferina*)	2.5	0	3.7	0.3	0	0	0	0	0
Fewseed Sedge	15.8	20	16.7	17.3	13.3	20	4	1.7	0
Pitcher Plant	0.2	0	0.2	0.3	0.2	0.2	0	0	0
Three-leaved False Solomon's Seal	0.1	0	0.2	0.8	1.7	1.2	0	0	0.6
Rough Hairgrass	0	0	0	0	0.3	3.3	3.3	0	0
Fewflowered Sedge	0.7	1.3	2.2	2.2	0.2	0	0	0	0
Silvery Sedge	0	0	0	0	0	0	0	1	5
Lesser Bladder Sedge	0	0	0	0	0	0	0	35	0
Coastal Sedge	0	0	0	1.7	12.3	3.3	1.7	0	0
Mud Sedge	0	2.7	0	0.2	2.7	0.2	0	0	0
Bog Sedge	0	0	0	0	0	0.3	0	0	0
Purple Avens	0	0	0	0	0	0	0	0	2.7
Round-leaved Sundew	0.1	0.2	0	0.2	0.2	0.3	0	0	0
Beaver-root	0.2	0	0	0.3	0	0	0	0	0
Wooly Fruit Sedge	0	0	0	0	0	0	6.7	0	0
Bog Goldenrod	0	0	0	0	0	0	0.3	0	0
Marsh Cinquefoil	0	0	0	0	0	0.6	0.8	1.7	0
Wavy-hair Grass	0	0	0	0	0.2	0	0	0	0
Tufted Hair Grass	0	0	0	0	0	1.7		0	0
Arctic Bramble	0	0	0	0	1.5	5	2.3	0	1.7
Northern Commandra	0	0	0	0	0.2	0	0	0	0
Wood Horsetail	0	0	0	0	0	0	0	0	2.7
Tall Cottongrass	0	0.6	0	0	0	0	0	0	0
Rough Cottongrass	0	0.3	0	0	0	0	0	0	0
Narrowleaf Burreed	0	0	0	0	0	0	0	0.3	0

Common Name	Wetland Type								
	Basin Bog	Shore Bog	Slope Bog	String Bog	Ribbed Fen	Slope Fen	Stream Fen	Kettle Marsh	Stream Swamp
Fireweed	0	0	0	0	0	0	0	0	1.3
Large-leaved Avens	0	0	0	0	0	0	0	0	0.6
Oak Fern	0	0	0	0	0	0	0	0	0.3
Buckbean	0.2	0.3	0	1.3	3	0	0	0	0
Naked Miterwort	0	0	0	0	0	0	0	0	0.2
Small Cranberry	0.1	0.3	0	0.3	0	0	1.7	0	0
Rough Aster	0	0	0	0	3.3	1.8	0.5	0	0
Bog Aster	0	0	0	0.2	2.3	0	0	0	0
Purple-stemmed Aster	0	0	0	0	0	0.6	0	0	1.7
Thread Rush	0	0	0	0	0	0	0	15	0
Bluejoint	0	0	0	0	0	13.3	6.8	0.3	1
Violet	0	0	0	0	0	0	0.3	0	2
Dewberry	0	0	0	0	0	0	0	0	5.3

7.9.3.1 Bogs

Bog is the most abundant wetland form along the route (Table 7.43). Bogs are peatlands in which the water table is located at or near the surface. The groundwater within the rooting zone of bogs is derived mainly from precipitation and is essentially independent of the mineral-rich groundwater in surrounding mineral soils. Consequently, bogs are typically nutrient-deficient and acidic. The bogs present along the highway route can be divided into five bog forms, including domed bog, basin bog, shore bog, slope bog, and string bog.

Basin bog is the most common bog form, accounting for 30.1 percent of all of the wetlands recorded along the route (Table 7.43). Basin bogs are generally small bogs that develop in essentially closed basins without well defined inflows or outflows.

Shore bogs are non-floating bogs which have formed along the edge of a waterbody. Peat deposits in shore bogs are elevated above the surface of the water such that the surrounding surface waters do not infiltrate into the rooting zone. Twenty-four shore bogs were found along the proposed highway route (Table 7.43). Relatively high cover of alpine bilberry and several sedge species, including fewseed sedge and mud sedge, characterized the vegetation of these bogs. It also typically has low cover of deer grass, and an absence of reindeer moss lichen (Table 7.44).

Slope bogs are small bogs that form on the sides of hills. They typically develop in areas of high rainfall and/or low evapotranspiration. Slope bogs receive water from rainfall or drainage from other nutrient-poor peatlands. Slope bogs are abundant along the proposed highway route, with 61 slope bogs recorded within 100 m of the right-of-way (Table 7.43). The vegetation of slope bogs is generally similar to other bog forms in the area, except that black spruce, Labrador tea and reindeer moss lichen are more abundant. The increased abundance of these species reflects the better drainage present in this bog form (Table 7.44).

Fifty-five string bogs were recorded within 100 m of the road right-of-way (Table 7.43). String bogs are often large and are typically found on gentle slopes. They are characterized by the presence of numerous linear pools, which are oriented perpendicular to the flow of water through the bog. The pools are separated by narrow ridges of vegetated peat that are typically 2 to 3 m wide. Water in the bog is derived from nutrient-poor drainage from other bogs, as well as precipitation which falls on the bog. Peat depths usually exceed 1 m. The vegetation of string bogs along the proposed route is characterized by high abundance of Newfoundland dwarf birch, tamarack, buckbean and coastal sedge (Table 7.44).

Refer to Section 6.9.3.1 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further detail on the characteristics of bogs.

7.9.3.2 Fen

Fens, like bogs, are peatlands that develop as a result of the accumulation of organic matter on poorly drained soils. However, unlike bogs, fens are relatively nutrient-rich due to inputs of groundwater from surrounding upland soils. The vegetation of fens typically consists of grasses, sedges and some sphagnum mosses.

The plant communities present on the fens found along the proposed route are similar in species composition to the plant communities associated with bogs. Most of the dominant species are found in both wetland types (Table 7.44). The main difference between the two wetland types is the relative abundance of various species. The fens typically have substantially less sphagnum moss and erinaceus shrubs and considerably more sedge cover. Generally, the same sedge species are present. A few plant species are associated only with fens in the surveyed area, although they are generally not the dominant species. They include mountain fly honeysuckle, beaked willow, Arctic bramble, coastal sedge, rough aster, rough hairgrass and blue-joint (Table 7.44). Three fen forms were identified along the proposed road route including Atlantic ribbed fen, slope fen and stream fen (Table 7.43).

Atlantic ribbed fens are similar in appearance to string bogs. This type of fen is typically found on gentle slopes and, as in string bogs, the wetland consists of a series of parallel strips of peat separated by elongated pools oriented perpendicular to flow of water. The vegetation in Atlantic ribbed fens in the study area is composed mainly of herbaceous ground vegetation species, the most abundant of which are sphagnum moss, coastal sedge, fewseed sedge, and deer grass (Table 7.44). A high cover of coastal sedge differentiates Atlantic ribbed fens in the study area from slope fen and stream fen as well as bogs.

Stream fens are found along the margins of channels in permanent and semi-permanent streams. The peat deposits in these fens are suffused by water from the stream during both normal and high water periods. Nutrients from the surface water are sufficient to maintain fen plant communities. In the survey area, an abundant cover of sweet gale characterizes the vegetation of stream fens. The vegetation of the ground layer can be distinguished from other fen forms by a relatively high abundance of wooly-fruit sedge and low abundance of fewseed sedge and rough aster (Table 7.44).

Slope fens form on seepage tracks on hillsides. Slope fens are generally small and have peat deposits that are less than 2 m in depth. In the survey area, the plant communities present on slope fens are substantially different from those present on other fen forms. Slope fens typically have a high cover of black spruce, tamarack, dwarf birch, beaked willow, mountain fly honeysuckle, sphagnum moss, fewseed sedge, bluejoint and Arctic bramble (Table 7.44).

Refer to Section 6.9.3.2 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further detail on fens.

7.9.3.3 Marsh

Marshes are mineral wetlands or peatlands that are periodically inundated by standing or slowly moving water. Surface water in marshes generally fluctuate seasonally. Only one marsh form, kettle marsh, is present in the survey area, and only six examples were identified within 100 m of the highway centre line (Table 7.43). Kettle marshes occur in well defined elliptical catch basins located in moraines and glacio-fluvial or glacio-lacustrine landscapes.

The vegetation of these marshes is quite distinctive. There is very little tree or shrub cover. A few small black spruce and tamarack are present around the landward edge of the marsh. The most abundant shrub species are dwarf birch, leather-leaf, Labrador tea and alpine bilberry, which are also restricted to the outer edges of the marsh (Table 7.44). Ground vegetation species composition consists largely of lesser bladder sedge and thread rush. Other species characteristic of marshes in the study area are marsh cinquefoil and fewseed sedge (Table 7.44).

Refer to Section 6.9.3.3 of the of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further detail on marshes .

7.9.3.4 Swamp

Swamps are either mineral wetlands or peatlands that contain standing water or slowly flowing water in pools and channels. The watertable is typically located at or near the surface of the soil and there are often seasonal fluctuations in water level. The rooting zone of plants in swamps is infiltrated by nutrient-enriched surface waters or groundwater. As a result, plant productivity is generally high. Trees and shrubs are typically the dominant species.

Only one swamp form, stream swamp, was present along the proposed highway route (Table 7.43). Stream swamps occur along the banks of permanent or semi-permanent streams. Stream water maintains saturated soil conditions for much of the year. Water levels are highest during spring, following snow melt, and fall to their lowest level during the late summer. During high water periods, silt is often deposited in the stream swamp, which helps to maintain soil fertility. The vegetation of stream swamps in the study area is characterized by the presence of dense tall shrub thickets (Table 7.44). The dominant species are bog willow and beaked willow. Balsam willow, downy alder, sweet gale, and skunk currant are also frequently associated with this habitat type. Trees are uncommon in this plant community and tree cover consists largely of scattered black spruce. The ground vegetation layer is also relatively sparse. The dominant species of the ground vegetation layer are sphagnum moss, dewberry, violet, and wood horsetail.

Refer to Section 6.9.3.4 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further detail on swamps.

7.9.4 Potential Interactions

During construction, some areas of wetland may be altered through removal of wetland material, changes in drainage patterns that alter the natural hydrological regime, or sedimentation. During operation, emissions from vehicles including carbon, nitrogen and sulphur oxides, as well as minute particles of carbon and oil droplets (Bennett 1991), may contaminate wetland areas adjacent to the highway. Dust may inhibit photosynthesis in roadside plants. An accidental release of fuel or other hazardous material may contaminate wetland habitats adjacent to the highway.

7.9.5 Issues and Concerns

The primary issue related to wetlands and highway construction and operation is the potential for degradation of wetland function through removal of wetlands, sedimentation, changes in the hydrological regime, and pollution in the form of oxides, oil and dust.

7.9.6 Existing Knowledge

Wetlands perform a number of physical and ecological functions including:

- flood conveyance - wetlands adjacent to streams and rivers lie within natural floodplains and increase the ability of the landscape to accommodate flood flows without inundating adjacent lands;
- flood storage - wetlands have the capacity to store flood waters and to release them slowly, thus reducing peak flows;
- erosion control - wetland vegetation effectively stabilizes substrate and dissipates the energy of flowing water;
- pollution control - wetlands can filter sediments and organic matter, and use nutrients from the water flowing through them;
- support of small streams - wetlands often support base flows during drier periods and may prevent small streams from disappearing; and
- productivity - wetlands are often very productive, particularly for waterfowl and other birds.

Individual wetlands may exhibit a characteristic that makes them unique, such as their relative rarity in the general area or the presence of uncommon or rare flora or fauna.

Developments that are not directly on a wetland, but affect the local hydrologic regime, may also affect the wetland (Cox and Grose 2000). Highways can restrict the flow of surface water and groundwater to the point where water levels on the upflow side may be raised and those on the downflow side may be lowered. Oligotrophic communities (i.e., those with low nutrient levels) are likely to be particularly sensitive to pollutants, especially those which increase fertility, such as nitrogen (Angold 1997). The primary effect of nutrient enrichment is stimulation of plant growth, which may increase populations of certain species already present in the environment and cause a decrease in other species that are not tolerant of such nutrients.

Refer to Section 6.9.6 of the TLH - Phase III EIS/CSR for further discussion on existing knowledge related to the effects of highways on wetlands.

7.9.7 Mitigation

WST has attempted to reduce the project's potential effects on wetland function through project design and planning. Specific mitigative measures include the following:

- 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 for identified wetlands along the route, 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;
  - 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 all-terrain vehicles will use designated routes, avoiding wetland areas wherever possible;
- no laydown or staging areas will be located on wetland areas;
- 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; and
- design and implementation of fuel and other hazardous material spill contingency plans and emergency response measures in the event of an accidental or unplanned event.

In addition to the above mitigations, WST will consult with the Water Resources Division and apply for the appropriate Certificates of Approval.

7.9.8 Environmental Effects Assessment

7.9.8.1 Construction

The environmental effects of highway construction on wetlands will be the same for both the preferred and the outfitter routes. Some wetland habitat will be removed during highway construction, particularly along the western portion of the outfitter (A13 section) route, where large areas of wetland are present and there are no routing alternatives to avoid these areas. However, only approximately194 ha of wetland or otherwise unforested area (includes lichen/soil barren) will be removed within the highway right-of-way and, where the highway does cross wetlands, the route skirts the edge of these areas wherever possible.

As noted above, the majority of the wetlands found within 100 m of the centre line of the highway are bogs (75.4 percent), with basin bogs being the most common type (30.1 percent). Fens, marshes and swamps make up the remaining wetland types. Kettle marshes were relatively uncommon, with six located along the highway route (Figures 7.20 to 7.22). Slope and stream fens were also relatively uncommon, with only five of each type occurring along the route. Overall, the wetlands that will be physically altered as a result of highway construction are ones that are well-represented within the study region.

The number of wetlands within 100 m of the preferred route and the outfitter route is 345 and 442, respectively. Approximately 29 percent of the vegetation within 5 km of the preferred route is classed as wetland types. Along the outfitter route, approximately 32 percent of the vegetation within 5 km is classed as wetland types. The wetland types and forms found along the preferred and outfitter routes are the same, with some minor variations in the proportion of each type identified.

WST has detailed procedures for prevention of erosion and siltation, maintenance of flows, and protection of vegetation and wetlands during construction (Section 7.9.7). These procedures represent the current best practices for highway construction and will limit construction effects such that ecological and physical functions of the wetlands adjacent to the highway will be maintained.

7.9.8.2 Operation

The environmental effects of highway operation on wetlands will be the same for both the preferred and outfitter routes. With proper placement of subgrade material, culverts and bridges, the natural hydrologic regime of wetlands adjacent to the highway will be maintained through standard WST construction procedures for wetlands. With the low density of roads and other developments, issues that may arise related to threshold levels of development that cause large changes to the hydrologic regime in a region, do not exist in Labrador. Some effects to plants and water quality from vehicle emissions and dust may occur in close proximity to the highway. However, the magnitude of effects from dust and emissions will be low and effects are likely to be restricted to less than 25 m from the highway. As long as the natural hydrologic regime is preserved and traffic levels along the highway remain relatively low, the ecological and physical functions of the wetlands adjacent to the highway will be maintained.

7.9.8.3 Accidental and/or Unplanned Events

The environmental effects of an accidental or unplanned event on wetlands will be the same for both the preferred and outfitter routes. An accidental spill of fuel or other hazardous material during construction or operation has the potential to contaminate wetland habitats adjacent to the highway. If the event occurred in the vicinity of a wetland with areas of open or flowing water, contaminants may affect a larger area than just the adjacent wetland. With the limited number of wetlands that will actually abut the proposed highway, and with implementation of fuel and other hazardous material handling procedures, the likelihood of wetland areas being contaminated during an accidental event is low. Similarly, during operation, the likelihood of accidental releases of fuel or oil as a result of vehicle accidents will be low as the volume of traffic on the highway will be low and few accidents are likely to occur.

7.9.9 Environmental Effects Evaluation

The following definitions are used to rate the significance of the predicted residual environmental effects of the project on wetland function.

A **significant environmental effect** is one affecting the ecological integrity of the wetlands within 100 m of the proposed highway in such a way as to impair wetland function to an extent where increased flooding along the route, occurs over several years, and/or there is a measurable sustained degradation in water quality.

A **not significant environmental effect** is one that does not affect the ecological integrity of the wetlands within 100 m of the proposed highway in such a way as to impair wetland function to an extent where increased flooding along the route, occurs over several years, and/or there is a measurable sustained degradation in water quality.

The proposed highway is a linear development that will have relatively low levels of traffic due to its location and the low human population of Labrador. The environmental effects will be restricted to removal of wetland habitat in the immediate highway corridor, and the effects of dust and vehicle emissions on the vegetation adjacent to the highway. Based on the preceding discussion and proposed mitigations, the residual effects of the project on wetland function are assessed to be not significant for construction, operation, and accidental events (Table 7.45). Overall, the project is not likely to result in significant adverse environmental effects that will impair wetland function.

7.9.10 Cumulative Environmental Effects

The cumulative effects related to the interaction of existing activities and potential future activities with the proposed highway will be similar regardless of whether the highway follows the preferred route or the outfitter route. However, if the highway follows the outfitter (A13 section) routing, it is unlikely that the road will be within the boundaries of the proposed Mealy Mountains National Park. Therefore, resources that may have fallen within the boundary of the national park will not be protected from future development or exploitation.

Uncontrolled access to wetland areas by ATVs may result in rutting, destruction of vegetation and degradation of water quality in localized areas around trails. However, it is unlikely that ATVs crossing wetland areas would actually cause changes to the hydrological regime of such wetlands. While an activity such as forest harvesting does not directly occur on wetland areas, inadequate regulatory enforcement of appropriate harvesting methods could result in disturbance, changes in water quality, and alteration of the hydrological regimes of wetlands adjacent to harvesting operations. However, the area around the proposed highway with the greatest potential for large-scale forestry activity does not coincide with the area that has the greatest amount of wetland. Therefore, it is anticipated that even with inadequate control of ATV access to wetlands and no enforcement of forestry regulations, there would be a not significant cumulative effect resulting from these activities (i.e., one that does not affect the ecological integrity of the wetlands within 100 m of the proposed highway in such a way as to impair wetland function to an extent where increased flooding along the route, occurs over several years, and/or there is a measurable sustained degradation in water quality) on wetlands.

Table 7.45 Environmental Effects Summary - Wetlands

	Construction	Operation	Accidental/Unplanned Events

Mitigation:
- 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, 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;
  - 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 all-terrain vehicles 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; and
- 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.

Environmental Effects Criteria Ratings	Construction	Operation	Accidental/Unplanned Events
Magnitude	Low	Low	Low
Geographic Extent	<1 km^2	<1 km^2	101 - 1,000 km^2
Frequency	Continuous	Continuous	<10
Duration	72	>72	>72
Reversibility	Reversible	Reversible	Unknown
Ecological/Socio-economic Context	Low/Related to waterfowl, water resources and resource use and users.		

Environmental Effects Evaluation	Construction	Operation	Accidental/Unplanned Events
Significance	Not Significant	Not Significant	Not Significant
Level of Confidence	High	High	High
Likelihood[1]	n/a	n/a	n/a
Sustainable Use of Resources[1]	n/a	n/a	n/a

[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994).

Environmental Monitoring and Follow-up:
- All equipment movements will be closely monitored.
- Drainage structures will be maintained as required.
- Project personnel will be briefed on requirements for working in wetland areas.

Key:

Magnitude:	High, Medium, Low, Nil or Unknown
Geographic Extent (km^2):	<1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown
Frequency (events/year):	<10, 11-50, 51-100, 101-200, >200, Continuous or Unknown
Duration (months):	<1, 1-12, 13-36, 37-72, >72 or Unknown
Reversibility:	Reversible, Irreversible or Unknown
Context:	Existing Disturbance (High, Medium, Low, Nil or Unknown)
Significance:	Significant, Not Significant, Positive or Unknown
Level of Confidence:	High, Medium, Low
Likelihood:	High, Medium, Low or Unknown
Sustainable Use of Resources	High, Medium, Low or Unknown

The various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate. There may also be a need for agencies to increase their enforcement staff levels.

For a detailed discussion on cumulative environmental effects, refer to Section 6.9.10 of the TLH - Phase III EIS/CSR (JW/IELP 2003a).

7.9.11 Environmental Monitoring and Follow-up

During construction in wetlands areas, all equipment movements will be monitored and equipment will be restricted to cleared areas. Project personnel will be briefed on requirement for working in wetland areas. Drainage structures will be maintained as required to ensure proper drainage.

7.10 Riparian Habitat

Riparian habitat is defined as vegetation with characteristics that are a result of the influence of an adjacent waterbody. This vegetation can be distinguished from vegetation on the upslope away from the water source.

7.10.1 Boundaries

The project boundary is the cleared right-of-way approaching watercourse crossings. Riparian habitat along waterbodies and rivers adjacent to the highway route or at watercourse crossings will be the basis on which the environmental assessment analysis will be conducted for this VEC.

Refer to Section 6.10.1 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further discussion on boundaries.

7.10.2 Methods

Information used in conducting the assessment for riparian habitat include published literature and information gathered during characterization of watercourse crossings. The environmental effects analysis is based on a review of existing knowledge about riparian habitat and an assessment of the degree to which the various phases and components of the project may affect this VEC.

7.10.3 Existing Environment

Riparian areas provide a critical source of diversity within larger habitats such as forest, lake, and marsh. These habitat attributes attract a great variety of terrestrial wildlife to a riparian zone and a large portion of the vertebrate fauna in a forested region is associated with riparian zones (Hunter 1990). The differences in water levels between the spring flood season and summer low water, particularly along rivers and streams, produce the diversity of vegetation characteristics of riparian zones.

Similar to the preferred route, a general description of shoreline vegetation at each highway stream crossing was completed during fish and fish habitat-related surveys along the outfitter (A13 section) route (JW/MLP 2003c). The general vegetation composition (i.e., bog, grasses, shrubs, trees) at the watercourse crossings on the outfitter (A13 section) route is indicated in Table 7.46. Approximately 59 percent of the crossings had greater than 50 percent tree cover; 30 percent of the crossings had greater than 50 percent shrub cover (Table 7.46). At sites that had bog vegetation adjacent to waterbodies, it generally accounted for 20 percent or less of the cover. The exceptions were Sites 79 and 83, where bog comprised 85 and 70 percent of the cover, respectively (Table 7.46). Grasses were a minor component (generally less than 20 percent) at many of the locations (Table 7.46). In comparison, approximately 66 percent of the riparian zones at stream crossings on the preferred route (the portion not in common with the outfitter route) consisted of trees and 29 percent had greater than 50 percent shrub cover. Refer to Figure 7.18 for locations of watercourse crossings.

Table 7.46 Streamside Vegetation at Highway Watercourse Crossing Locations - Outfitter (A13 Section) Route

Stream Crossing Number	Bank Vegetation (% occurrence at crossing)			
	Bog	Grasses	Shrubs	Trees
Kenamu River				
38	10		15	75
39		5	25	70
40	30	40	25	5
Eagle River				
41			30	70
42	10	10	40	40
43			30	70
44			40	60
45			30	70
46	Data not available			
47			30	70
48		40	40	20
49			60	40
50			60	40
51			30	70
52			30	70
53	20		60	20
63		10	50	40
64			50	50
65			30	70
66			30	70
67		10	45	45
68		10	50	40
69			50	50
70			50	50
71			40	60
72			30	70
73		5	35	60
74	20		30	50
75			20	80
76			50	50
77		10	20	70
78		10	30	60
79	85	5	5	5
80	10	10	30	50
81	20	10	40	30

Stream Crossing Number	Bank Vegetation (% occurrence at crossing)			
	Bog	Grasses	Shrubs	Trees
82	10	10	60	10
83	70	10	10	10
84	50	20	20	10
85	40	10	10	40
86	Data not available			
87			30	70
88	40	10	30	20
89	20	25	25	30
90	10	10	30	50
91	10	15	30	45
92			30	70
93			30	70
94		10	30	60
95		10	40	50
96	50	10	20	20
97	10	10	30	50
98		10	30	50
99		5	25	70
100		10	40	50
101	Data not available			
St. Augustine				
54		10	70	20
55			50	50
56		20	50	30
57			60	40
58		10	50	40
59			50	50
60		5	65	30
61		10	50	40
62	5		25	70

For further discussion on riparian zones, refer to Section 6.10.3 of the TLH - Phase III EIS/CSR (JW/IELP 2003a).

7.10.4 Potential Interactions

Potential interactions are limited to physical disturbance during construction and release of emissions during operations or accidental events.

7.10.5 Issues and Concerns

Construction of the highway will result in the removal of some riparian habitat at watercourse crossings, possibly increasing the potential for siltation of adjacent waterbodies. During operation, emissions from vehicles, including dust, oxides of carbon, nitrogen and sulphur, as well as minute particles of carbon and oil droplets (Bennett 1991), may contaminate vegetation in riparian areas adjacent to the highway. An accidental release of fuel or other hazardous material may contaminate riparian habitats adjacent to the highway. A forest fire may cause destruction of riparian vegetation.

7.10.6 Existing Knowledge

Riparian zones are among the biologically richest, most sensitive and least abundant habitats in any area (Thomas et al. 1979). Although they may show considerable variation in size, structure, and vegetation, all riparian zones have a number of attributes (e.g., successional patterns, edges, vertical layering, special microhabitats) that provide biological diversity and make them extremely important to aquatic and terrestrial populations. Where development occurs in riparian zones, two effects are consistent: the narrower the zone, the more it is affected by development; and development is likely to affect the habitat of the zone far more than indicated by the proportion of the area disturbed (Thomas et al. 1979).

Road construction has a more critical and long-lasting adverse effect on riparian zones than any other development activity (Thomas et al. 1979). Critical functions that can be affected by highways include shade, cycling of nutrients, contribution of large wood, and refugia for fish during floods (Ruediger and Ruediger n.d.). Leaving buffer strips of riparian habitat between waterbodies and highway beds can be effective in reducing disturbance to the zone. Recommendations for width of buffer zones range from 10 to 75 m, depending on the slope (Ohmart and Anderson 1986; Hunter 1990).

Refer to Section 6.10.6 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further discussion of existing knowledge related to the effects of development in riparian zones.

7.10.7 Mitigation

WST has attempted to reduce the project's potential effects on riparian habitat through project design and planning. Specific mitigative measures include the following:

- 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 all-terrain vehicles 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 any 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; and
- design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.

In addition to the above mitigations, WST will consult with the Water Resources Division and apply for the appropriate Certificates of Approval.

7.10.8 Environmental Effects Assessment

7.10.8.1 Construction

The environmental effects of highway construction on riparian zones will be similar for both the preferred route and the outfitter route. During construction, a minimum of 20 m of vegetation will be retained around all waterbodies that are adjacent to the highway route. In most areas, this amount of buffer will encompass the entire riparian zone around lakes and rivers, thereby ensuring that riparian habitat function is maintained. At each highway water crossing, a maximum of 60 linear m of riparian habitat will be removed (30 m on either side of the crossing). Assuming a 20-m riparian zone width, where possible, and a total of 107 watercourse crossings on the outfitter route, this means that a maximum of approximately 12.8 ha of riparian habitat will be removed along the entire highway route. For comparison, 11.4 ha of riparian habitat will be removed on the preferred route (95 crossings). On any one body of water with a highway crossing, a maximum of 0.12 ha will be removed. Due to the large number of rivers, streams and lakes, there is abundant riparian habitat available in the region.

7.10.8.2 Operation

The environmental effects of highway operation on riparian zones will be similar for both the preferred route and the outfitter route. No additional riparian habitat will be removed during operation. The maintenance of a minimum 20 m vegetation buffer between the highway and adjacent waterbodies will limit the effects of dust and airborne emissions on riparian habitat. The maintenance of the vegetation buffer will provide wildlife with a security corridor that allows travel along the shoreline of waterbodies near the highway.

7.10.8.3 Accidental and/or Unplanned Events

The environmental effects of an accidental or unplanned event on riparian zones will be similar for both the preferred route and the outfitter route. As noted above, the maintenance of a minimum 20-m vegetation buffer, where possible, will provide a measure of protection to riparian habitat should there be an accidental event, such as a fuel or other hazardous material spill in the highway right-of-way. A forest fire could destroy riparian habitat for a variety of species. However, boreal species have adapted to a cycle of naturally-occurring fires and the proportion of the population affected during any one fire would be small.

With implementation of environmental protection planning, the potential for such accidental events occurring is extremely low. If such an accident should occur, the significance of its potential effects will be dependent upon the location and timing of the event and its nature and magnitude. WST's contingency planning and emergency response plans will ensure that any adverse are reduced.

7.10.9 Environmental Effects Evaluation

The following definitions are used to rate the significance of the predicted residual environmental effects of the project on maintenance of riparian habitat.

A **significant environmental effect** is one affecting riparian habitat along the corridor of the proposed highway in such as way as to impair its ecological function to the extent that there are measurable effects to water quality and/or dependent populations.

A **not significant environmental effect** is one that does not affect riparian habitat along the corridor of the proposed highway in such as way as to impair its ecological function to the extent that there are measurable effects to water quality and/or dependent populations.

The proposed highway is a linear development that will have relatively low levels of traffic due to its location and the low human population of Labrador. The primary environmental effects will be removal of riparian habitat at watercourse crossings and the effects of vehicles emissions and dust on riparian vegetation adjacent to the highway. As well, if resources agencies do not have adequate resources to plan or manage induced activities such as cabin development or forest harvesting, riparian zones and surrounding waterbodies may be degraded through improper cutting practices, cabin construction and other human activities. However, effects from these activities will be localized and likely minor. Based on the preceding discussion and proposed mitigations, the residual effects of the project on riparian habitat are assessed to be not significant for construction, operation, and accidental events (Table 7.47). Overall, the project is not likely to result in significant adverse environmental effects that will impair the function of riparian habitat.

Table 7.47 Environmental Effects Summary - Riparian Habitat

	Construction	Operation	Accidental/Unplanned Events
Mitigation: • 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 all-terrain vehicles 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 any 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; and • design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.			
Environmental Effects Criteria Ratings			
Magnitude	Low	Low	Low
Geographic Extent	<1 km^2	<1 km^2	101 to 1,000 km^2
Frequency	Continuous	Continuous	<10
Duration	72	>72	>72
Reversibility	Irreversible	Irreversible	Unknown
Ecological/Socio-economic Context	Low/Related to water resources, fish and fish habitat, wildlife and resource use and users.		
Environmental Effects Evaluation			
Significance	Not Significant	Not Significant	Not Significant
Level of Confidence	High	High	High
Likelihood[1]	n/a	n/a	n/a
Sustainable Use of Rescources[1]	n/a	n/a	n/a
[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994).			
Environmental Monitoring and Follow-up: • Ensure minimal disturbance to riparian habitat. • All personnel will be made aware of sensitivities related to disturbance of riparian zones.			

Key:

Magnitude:	High, Medium, Low, Nil or Unknown
Geographic Extent (km^2):	<1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown
Frequency (events/year):	<10, 11-50, 51-100, 101-200, >200, Continuous or Unknown
Duration (months):	<1, 1-12, 13-36, 37-72, >72 or Unknown
Reversibility:	Reversible, Irreversible or Unknown
Context:	Existing Disturbance (High, Medium, Low, Nil or Unknown)
Significance:	Significant, Not Significant
Level of Confidence:	High, Medium, Low
Likelihood:	High, Medium, Low or Unknown
Sustainable Use of Resources	High, Medium, Low or Unknown

7.10.10 Cumulative Environmental Effects

The cumulative effects related to the interaction of existing activities and potential future activities with the proposed highway will be the same regardless of whether the highway follows the preferred route or the outfitter route. However, if the highway follows the outfitter (A13 section) routing, it is unlikely that the road will be within the boundaries of the proposed Akamiuapishku/Mealy Mountains National Park. Therefore, resources that may have fallen within the boundary of the national park will not be protected from future development or exploitation.

Travel through riparian zones is likely to increase in order to access waterbodies from the highway. As well, cabin development and forest harvesting in riparian zones may also occur, creating areas of permanent alteration to riparian habitat. With inadequate planning and enforcement, these activities could cause disturbance and loss of habitat, affecting wildlife species that tend to use riparian habitats disproportionately to other habitat types (i.e., furbearers, waterfowl, raptors). As well, water quality could be degraded, thus affecting forage availability for some of these groups. However, it is predicted that there would be a not significant cumulative effect from these activities (i.e., one that does not affect riparian habitat along the corridor of the proposed highway in such as way as to impair its ecological function to the extent that there are measurable effects to water quality and/or dependent populations) due to the large amount of riparian habitat available in central Labrador and the localized nature of effects to the riparian zone from unregulated cabin development and forest harvesting along the highway corridor.

The various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate. There may also be a need for agencies to increase their enforcement staff levels.

For a detailed discussion on cumulative environmental effects, refer to Section 6.10.10 of the TLH - Phase III EIS/CSR (JW/IELP 2003a).

7.10.11 Environmental Monitoring and Follow-up

The Resident Engineer will ensure that all project personnel have been instructed regarding sensitivities when operating around riparian zones. There will be minimal disturbance to riparian areas during construction. Any disturbance will occur only at stream crossings.

7.11 Historic Resources

Historic resources include archaeological (precontact and historic) sites and artifacts, and contemporary (ethnographic) sites, buildings and features such as traps and snares. Several such sites were discovered within the proposed route corridor in 2002. Although the historic resources field assessment effort in preparation for the EIS was deemed to be adequate, there remains potential for additional resources to be found in the project area. Historic resources are non-renewable and the information they contain cannot be replaced if they are damaged or destroyed. It is important that historic resources in the project area be protected.

7.11.1 Boundaries

The spatial boundaries for historic resources include any areas where ground disturbance will occur. This project is defined by the 40 m right-of-way for the route between Happy Valley-Goose Bay and Cartwright Junction, and includes both the preferred and outfitters routes (Figure 7.23).

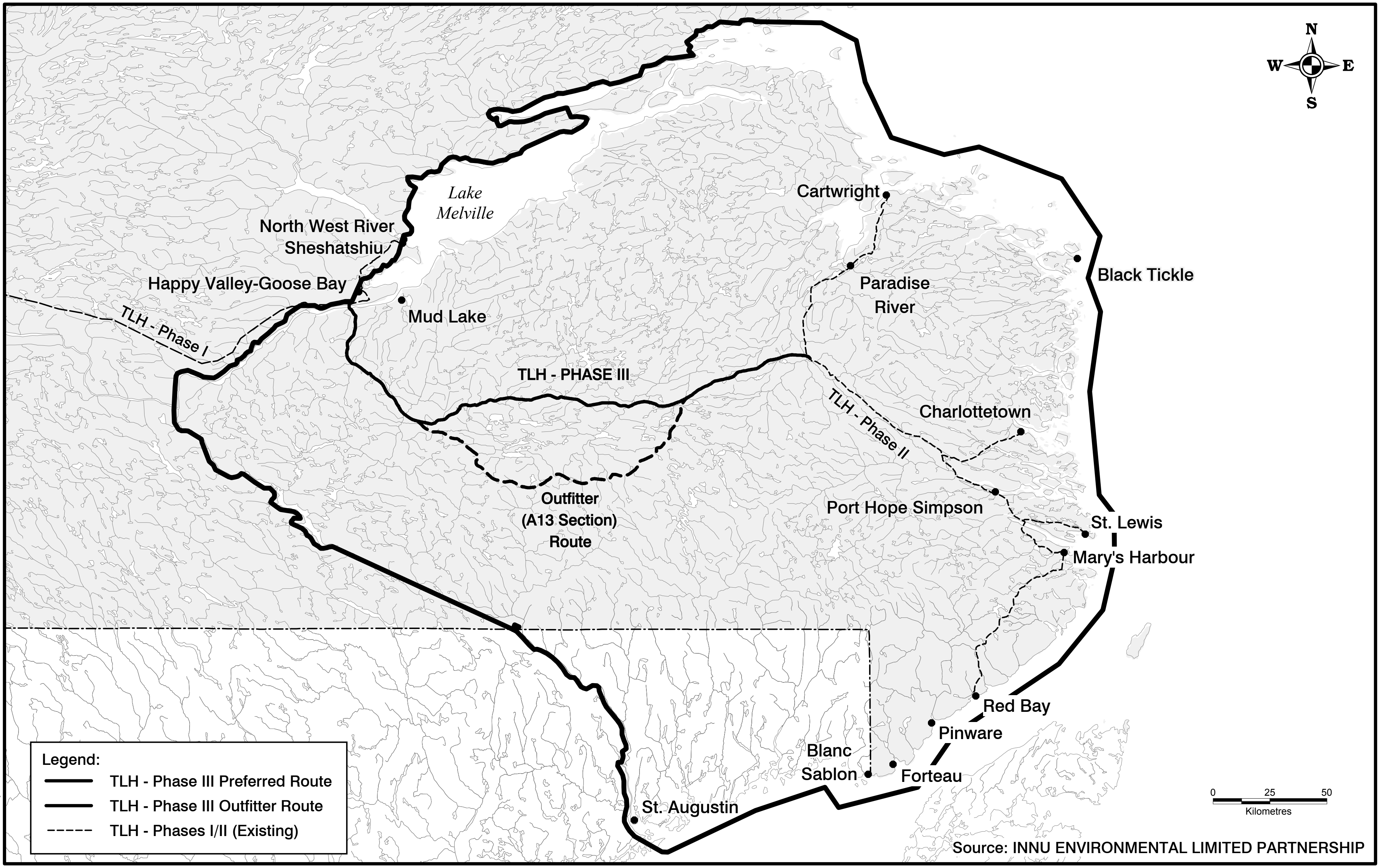
The primary temporal boundary for historic resources is construction, including all phases from surveying and vegetation clearing to site rehabilitation. However, as a result of improved access to previously inaccessible areas, archaeological and ethnographic sites located in certain areas within a 10 km-wide corridor along the route may be subjected to indirect effects during operation.

Protecting and managing archaeological resources in Newfoundland and Labrador is the responsibility of the Provincial Archaeology Office (PAO) of the Department of Tourism, Culture and Recreation. The PAO administers its mandate through the *Historic Resources Act*.

7.11.2 Methods

A Historic Resources Component Study (IELP 2002) was undertaken to assess high-potential locations along a 10 km-wide corridor along the proposed highway route and identify important historic resources which may suffer effects of highway construction and increased vehicle access to this hitherto remote area. The study was designed as a precursor to more detailed Historic Resources Impact Assessment along the actual right-of-way once the precise highway route is finalized. In addition, a Historic Resources Potential Study was completed to assess the archaeological potential of the proposed outfitter (A13 section) route option for the highway that was not included in the 2002 study (Appendix E).

The primary objectives of the Historic Resources Component Study (IELP 2002) and Historic Resources Potential Study (Appendix E) were to complete historic resources requirements for the environmental assessment of the project, predict archaeological potential, identify and understand the regional context of historic resources in the project area, and collect and review any required information for the interpretation of historic resources in the project area. Essential components of the study included:



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Jacques Whitford Environment Limited
Environmental Scientists
Consulting Engineers

Figure 7.23

Historic Resources
Overview Research Study Area

- an overview research of a larger study region (Figure 7.23);
- the identification of areas of enhanced potential along the highway corridor (Figure 7.24);
- an archaeological field survey of selected areas of enhanced potential; and
- preparation of reports on the results of the overview research, the prediction of archaeological potential and the field validation, with identification of data gaps, where appropriate (IELP 2002; Appendix E).

The study area for the overview research encompasses all of southeastern Labrador and the Québec Lower North Shore, lying south of the north shore of Hamilton Inlet and the Churchill River and east of the western banks of the Minipi and St. Augustin rivers (Figure 7.23). This larger study area was researched to allow an understanding the cultural history of the region and to provide the field study team with a number of historic resources potential indicators used in targeting areas for fieldwork and background information from a larger regional context for the interpretation of sites located within the project area. The project area for the field research was defined as a 10 km-wide corridor along the preferred routing for the highway, within which 12 areas or components were identified and investigated during visual inspection and subsurface testing programs. Six additional areas of enhanced potential were identified in 2003 for the outfitter route, for a total of 18 areas. Of these, 13 fall within the outfitter route alternative (Figure 7.24, No. C-1 to C-4, C-9, C-10 and C-12 and A-1 to A-6).

The field validation program targeted a sample of presumably high potential locations within a 10 km-wide corridor along the proposed route. However, the potential rating had to be revised after the completion of the field survey (see Section 7.11.2.2). It must be noted that field work conducted to date does not represent a precise assessment of the 40 m right-of-way and other project features and that of the outfitter route (A13 section) corridor has not been surveyed at all.

7.11.2.1 Overview Research

The pre-fieldwork overview research involved an archaeological and ethnographic literature review, Innu land use and geomorphological data review, informant interviews and aerial photograph interpretation. The information obtained provided the background and context necessary for developing the strategy for the archaeological field assessment of the project area, including the identification of field survey areas.

The literature review included details on previous archaeological work, ethnographic research and traditional land and resource use within the study area and in Labrador and the Québec North Shore. The PAO Site Inventory was also reviewed. This information was researched in an effort to predict the basic chronology and nature of archaeological remains to be anticipated in the project area and list any historic resources already known to exist in the project area. The results provided a framework for the identification of further sites to be discovered during the field survey and for the interpretation of the survey results.

A review of map data on twentieth-century Innu land use data compiled by Innu Nation revealed broad patterns of land use, as well as clusters of known preferred campsites and route junctions that served as indicators of high archaeological potential.

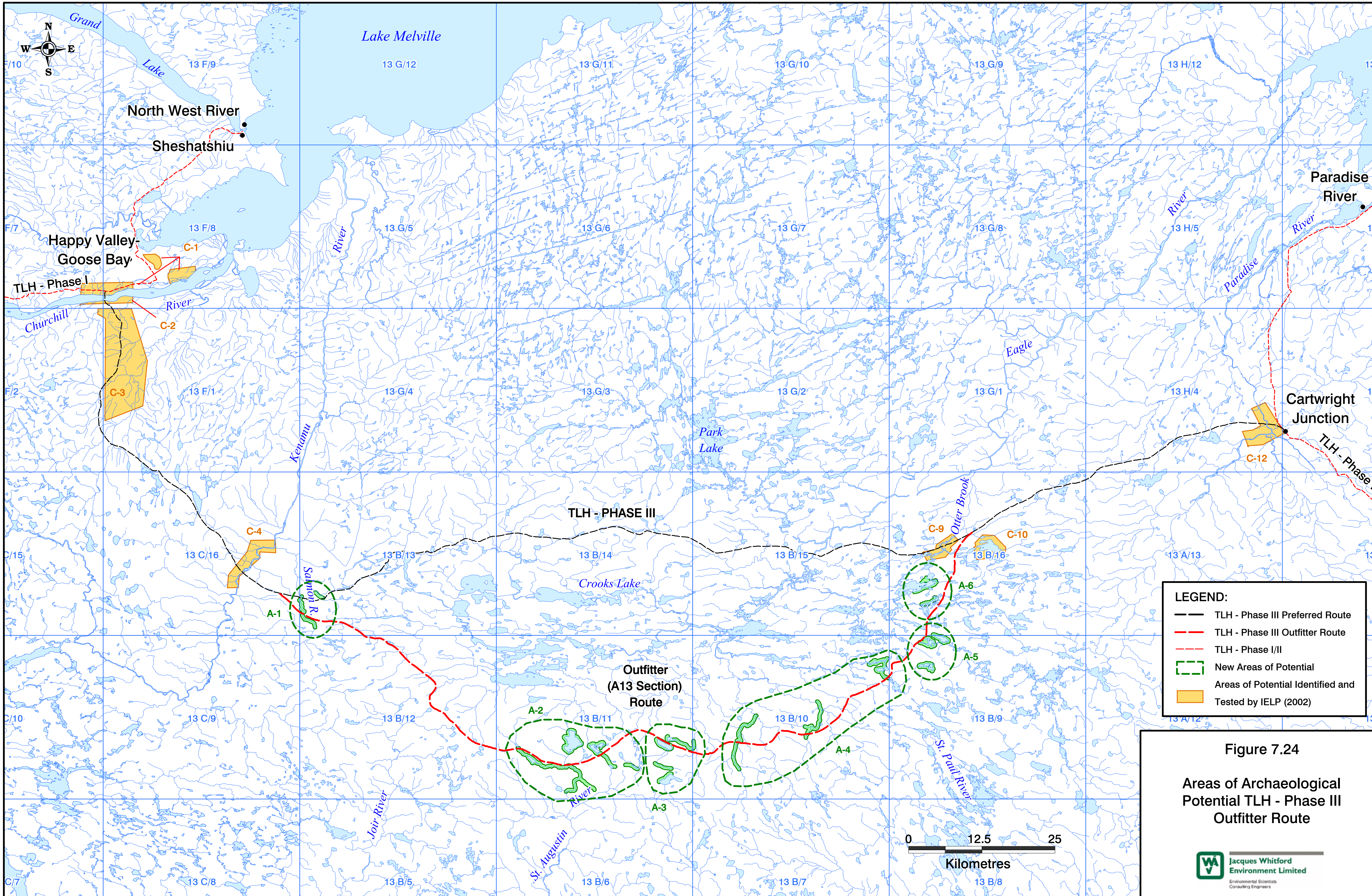

Figure 7.24

Areas of Archaeological Potential TLH - Phase III Outfitter Route

The most relevant geomorphological data on post-glacial events and sea-level change were examined in detail for attributes bearing on the archaeological potential of marine and riverine terrace formation. Additional information obtained related to contemporary ecology and palaeoecology of the project area.

Innu and Settler individuals who are knowledgeable about land and resources use and/or the location of archaeological and ethnographic sites within the study area were interviewed. The objectives for informant interviewing were to:

- acquire information that could be used, in conjunction with information obtained from the literature review and aerial photograph interpretation, to predict areas of historic resources potential;
- establish if any historic resources are known to exist in the region; and
- provide social and cultural context to archaeological finds that are normally restricted to technical interpretations.

Twenty-four informants, five women and nineteen men, provided information on land and resources use in the study area, as well as specific locations of traditional tent sites, tilts and other precontact and historic features. Informant interviews were conducted with eight individuals in Sheshatshiu, six in Happy Valley-Goose Bay, one in Mud Lake and nine in Cartwright, who had lived and harvested resources within the project area. Interviewers used a questionnaire that served as the framework for data collection. Topographic maps and audio-cassettes were also used to collect information. Interview summary forms were completed for each interview and interview consent forms for members of Innu Nation.

Aerial black and white photographs (1:50,000) dating to the late 1960s were examined to identify precise high-potential testing locations within selected larger areas selected from the land use and other data for the field program. Historic resource potential rating was based on criteria employed and tested during previous programs in Labrador (e.g., JW/IELP 2001a; 2001b). High potential zones included shoreline locations of level ground on points of land, at constrictions in waterways, near rapids and falls and at river confluence and relict terraces.

7.11.2.2 Field Survey

The principal objective of the field survey was to verify the predictions made on the basis of the pre-fieldwork overview research and to identify actual sites on the ground in locations that would likely be affected by the project. The field survey was conducted between August 21 and September 15, 2002. Twelve general areas of enhanced archaeological potential were investigated. The field survey included the excavation of 3,944 test pits at 128 distinct testing locations. Testing locations were recorded by means of GPS. Testing programs involved both close surface inspection and subsurface testing. Testing was concentrated in dry, level areas suitable for human settlement. This involved excavation of 20 cm by 20 cm test pits by means of shovel and trowel. Test pits were generally spaced at 5 to 10 m intervals along natural linear features such as shorelines and terrace edges. Areal testing was conducted in the vicinity of contemporary Innu camps or tilt locations identified in the field. At locations where materials of significance were identified during the surface evaluation, only limited testing was conducted to establish the nature and extent of the remains and to avoid any unnecessary site disturbance prior to decisions being made on mitigation. Artifact collection was kept to a minimum. The number and location of test pits were recorded. Photographs were taken of all relevant cultural features (IELP 2002).

7.11.2.3 Potential Mapping of Outfitters Route

The objective of this study was to identify areas of enhanced potential within the outfitter route corridor and report previously recorded historic resources which may be affected by highway construction and increased access, should this alternative route be selected by WST. This study included desktop overview research but no field survey. It was designed as a precursor of further field programs that may include, if required, a field survey focusing on high potential locations identified during this study, and a more detailed field assessment along the actual right-of-way, once the precise highway route is finalized.

Six areas of positive potential were identified along the alternative route, including one particular area of interest at the headwaters of St. Augustin River, approximately 12 km south of Crooks Lake, near the centre of the study area.

7.11.3 Existing Conditions

Archaeological sites and artifacts hold valuable information on past and contemporary cultures, how cultures relate (or related) to one another and how each culture relates (or related) to the environment in which they lived. They are non-renewable resources that sometimes offer the only information for reconstructing the history a particular group. For this reason, historic resources are valued by society and protected by legislation.

7.11.3.1 Precontact Period (8,000 BP to 1,500 AD)

During the precontact period, the inhabitants of south-central Labrador lived by hunting, fishing and gathering the plant, animal and lithic resources of their environment. They normally lived in small groups that moved over the land during the year to exploit resources as they became available. Precontact sites are usually found on the coast, near travel routes that extend from the coast into the interior, and in the hinterland near sources of game and freshwater.

The overview research indicates that the study area has been occupied by various cultures since approximately 8,000 years BP. After 4,000 BP, coastal Labrador was also colonized by Arctic-adapted peoples from the North and thereafter, Labrador prehistory is characterized by a succession of cultures, sometimes overlapping. The origins of the various cultural traditions lie in two regions: south or west of Labrador; or the Arctic. Intermediate Indian and Recent Indian groups migrated into the region from the St. Lawrence region and Palaeo-Eskimo (Pre-Dorset and Dorset) and Neo-Eskimo (Thule) groups from the eastern Arctic (IELP 2002).

The cultural sequence, settlement-subsistence pattern, cultural materials and geographic distribution of sites located to date in Labrador and adjacent regions of Quebec is presented in Table 7.48.

Table 7.48 Selected Cultural Attributes of Aboriginal Groups in Labrador during the Precontact Period

Culture/Period (years BP)	Settlement-Subsistence	Features and Artifacts	Site Distribution
Maritime Archaic 7,500-3,500	Coastal resources in spring/summer; interior in winter.	Single- to multi-family dwellings. Burial sites with red ochre and grave goods. Tools made of quartz and slate, and then Ramah chert.	From Strait of Belle Isle to Hamilton Inlet and northern Labrador. Exclusively along the coast in the study region. No sites discovered to date in the project area.
Palaeo-Eskimo 4,000-800	From inner bays to outer islands. Focus on marine mammals and limited use of terrestrial species.	From tents with mid-passage structures to semi-subterranean dwellings. Mugford and Ramah chert, flaked stone tools, soapstone for pots and lamps, and nephrite for burins.	Northern coast of Labrador to Southern Labrador. Sites are present along the coast in the study region except in the western Lake Melville area. No sites discovered to date in the project area.
Intermediate Indian 3,600-1,400	Use of interior resources such as caribou and fish with seasonal exploitation of the inner coastal zone.	Cobble hearths with fire-cracked rock, charcoal, burnt bone. Mugford chert and quartzite from the Labrador hinterland Lithic scatters.	Central Labrador, Churchill River and adjacent interior regions of Québec. Several are present in the study region. Two sites along the preferred route. Of these one also lies within the outfitter route.
Recent Indian 1,750-350	Inner and outer coastal zone More intensive use of marine resources than during the Intermediate period.	Multi-family and smaller tent structures with associated calcined bone and lithic materials. Ramah chert and occasional ceramic fragments.	Québec North Shore and coast of Southern Labrador; scarce in Central Labrador but present further west, in adjacent regions of Québec. Sites are present in the Study region (approximately 5 percent of all sites). No sites reported to date in the project area.
Thule 700-350	Coastal adaptation, hunting large marine mammals.	Sod house structures, tent rings and boulder features such as burial cairns and caches.	From Northern Labrador Coast to Central Labrador. No reported sites in Southern Labrador. No reported sites to date in the project area.
Source: JWEL/IELP 2001a.			

7.11.3.2 Historic Period (from the Arrival of Europeans to 1960)

When Europeans arrived in Labrador, the Innu and Inuit followed a hunter-gatherer way of life similar to their predecessors. The historic period in southern Labrador is marked by the beginning of European occupation and resource exploitation. While the Norse visited Labrador during their expansion into the New World approximately 1,000 years BP, it was not until the sixteenth century, when the Basque began whaling operations in the Strait of Belle Isle, that a permanent European presence was established in Labrador. Successive European groups, including the Basque, Dutch, French and English, were drawn to the Labrador coast to access the marine resources of the region and trade with Aboriginal groups. European occupation of Labrador altered the traditional subsistence-settlement patterns of the Innu and Inuit. Aboriginal lifestyles and cultures influenced the way Europeans and the early Settlers adapted to the landscape and exploited the region's resources (JW 1998a; Kennedy 1995). Contact with Europeans in Labrador brought about broad-based culture change with the introduction of ceramics and metals and the geographic expansion southward to meet European traders (Table 7.49).

The Inuit settlement and subsistence pattern endured well into the twentieth century. Maintaining their coastal adaptation brought Inuit into constant contact with the European population (Settlers), resulting in a merging of cultures. As a result, it is often difficult to distinguish between Inuit and Settler/Métis sites, and some identified house features could be of either culture (Pastore and Auger 1984; Auger 1991).

The Innu, historically known to Europeans as Montagnais and Naskapi, are thought to have descended from the Recent Indian tradition. It was suggested the Innu spent most of their time in the interior hunting caribou and fishing after withdrawing from the Labrador Coast due to intensification of European and Inuit activities during the seventeenth and eighteenth centuries (Loring 1992). Nevertheless, the Innu continued to visit the coast during the summer for hunting and fishing in the Lake Melville area where they interacted with people from other cultural traditions (Mailhot 1993).

The Innu have continued to use extensive portions of the study region into the twentieth century. Late historic and contemporary Innu use of the study area is extensive and involves harvesting a variety of species year-round. During the period from 1900 to 1930, the Innu of North West River spent much of the year south of the Mealy Mountains, traveling by way of the Kenamu River. Joined by Innu groups from Sandwich Bay, they spent the fall in the Mealy Mountains hunting caribou. Both beaver and otter were trapped around the western headwaters of the Eagle River and its many tributaries and feeder lakes. Other mammals commonly hunted in the Eagle Plateau region included mink, muskrat, fox, lynx, marten, black bear, and snowshoe hare. Summer was spent on the coast of Hamilton Inlet. Frequently, groups traveled south to visit with friends and relatives in St. Augustin (Tanner 1977; JW/IELP 2001a).

The project area traverses traditional Innu territory and contemporary harvesting areas. The Eagle Plateau region was reached following the Kenamu or the Traverspine rivers. Several travel routes including the Salmon and the Little Drunken rivers were also identified, as well as several camp locations established along the way. Winter camps were established on the shoreline of major lakes, such as *Uinikush* and *Keupashnipi*. Further east, important settlement areas included the shoreline of major lakes such as *Nekuanikau* and *Kamishekemat*. Therefore, the potential for historic and contemporary Innu camps to be located in the project area is high (IELP 2002).

Table 7.49 Selected Cultural Attributes of Aboriginal and Other Ethnic Groups in Labrador During the Historic Period

Ethnic Group	Settlement-Subsistence	Features and Artifacts	Site Distribution
Inuit	Heads of bays for hunting sea mammals and seasonal use of the interior for hunting caribou and trapping fur-bearing animals for trade.	Sod houses, tents rings and boulder features such as burial cairns and caches Kayak and sled. Metal, gun flint, glass, and ceramics.	Northern, Central and Southern Labrador. Numerous Inuit sites in southern Labrador, but absent form the forested interior. No reported sites.
Innu	Interior for caribou hunting fishing and trapping; summer presence on the coast for hunting, fishing and trading.	Single and multi-family tent structures. Canoe, toboggan and snowshoes, traps and trails. Metal, gun flint, glass and ceramics.	Québec North shore, Central and Northern Labrador. Numerous Innu sites in Hamilton Inlet, from Sandwich Bay to North West River. Several sites in the study region and project area.
Métis/Settler	Summer fisheries on the coast and late fall through winter trapping in the hinterland.	Tilts, tents and cabins Traps and trails.	Southern and Central Labrador. Several sites in the study region and project area.
European	Coastal whaling, followed by seal and cod fisheries with seasonal incursions in the interior for water, wood and other resources. Fur-trading industry.	Fishing stations, trading posts and mission churches.	Québec North shore and entire Labrador Coast from Strait of Belle Isle to the northern tip of the Labrador Peninsula. Many sites in the study region including trading posts on the Churchill River. No reported sites in the project area.
Source: JWEL/IELP 2001a.			

Several areas of the hinterland were used by Settlers/Métis from Mud Lake, including the Kenamu River and adjoining waterways. Residents of Cartwright also provided land use information for the Eagle and Paradise rivers, which were extensively used by trappers (IELP 2002). Several sites identified within the project area during the field survey are likely attributable to the Settler population of South-central Labrador. However, it must be noted that it is not always possible to distinguish between Innu and Settler trails and/or cutting locations.

Finally, there are numerous archaeological sites of European origin in the study region. However, a great majority of these sites are located in coastal settings. Nevertheless, three outposts of the Hudson's Bay Company were established during the nineteenth century along the Churchill River, two of which were investigated through archaeological subsurface testing programs in recent years (JW/IELP 2001a). However, the 2002 overview research did not identify any sites related to such operation in the project area and no sites of European origin were discovered during subsequent surveys (IELP 2002; JWEL/Minaskuat 2003).

7.11.3.3 Site Distribution

A total of 15 archaeological and ethnographic sites are located within the outfitter route corridor, including 10 sites recorded during the 2002 field survey (Table 7.50). Nine of these sites were found in the vicinity of the Kenamu River crossing in 2002 (Area C-4, Figure 7.24), four sites on the north side of the Churchill River during previous surveys. The remaining areas yielded one 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 (IELP 2002). A single site containing subsurface lithic debitage dates to the precontact period and has been assigned to the Intermediate Indian period.

Table 7.50 Site Distribution along the Outfitter Route Corridor Sorted by Areas Surveyed During Previous Field Investigations

Area	Number of sites	Description
C-1 Churchill River North	4	Dilapidated sawmill Two open hearths Two tent frames Tent place and hearth
C-2 Churchill River South	1	Tent Frame and debris
C-3 Churchill-Traverspine	0	NA
C-4 Kenamu Crossing	9	Axe-cut trees, portage trail Axe-cut stumps and poles Axe-cut stumps and logs Plywood marten trap housing Abandoned fish camp Marten trap housing and cuttings Collapsed tilt and debris Subsurface lithic debitage Clearings, cut stumps, trap
C-9 Eagle Tributary	1	One axe-cut stump
10 Mestekaumau-nipi	0	NA
12 Paradise River Crossing	0	NA

Sources: IELP 2002; JW/IELP 2001b; PAO 2003.
Note: Areas of enhanced potential A-1 to A-6 identified in 2003 were not investigated during previous field surveys. No sites were recorded to date in these areas (see Section 7.11.3.4).

Fourteen of the fifteen sites date to the contemporary or late historic periods, a pattern which almost certainly reflects the greater visibility of recent sites dating to the latter half of the twentieth century. Relatively few sites appear to be in current use, which may relate to the fact that the highway corridor project area is situated to avoid the larger air-accessible lakes favored by Innu families since the introduction of the Outpost Program. The only precontact site is located on the Kenamu River, at the mouth of Salmon River. This area is identified in land use data and informant interviews as an important location of traditional Innu land and resource use during seasonal moves between western Lake Melville and the lakes of the Eagle Plateau. Its role in precontact settlement-subsistence patterns may have been similar. This precontact site dates to the Intermediate period (broadly, 3,500 to 2,000 BP), a period during which "Indian" settlement appears to have been particularly intensive in the interior (JW/IELP 2001a), while the coast was substantially occupied by Palaeo-Eskimo groups.

7.11.3.4 Archaeological Potential

The overview research allowed the identification of 13 areas of enhanced potential distributed along the outfitter route corridor. These areas were each characterized by a variety of indicators suggesting positive potential (IELP 2002; Appendix E). Of these, seven were targeted for field investigations (IELP 2002).

The overview research conducted in 2002 indicated that archaeological potential was particularly high at the major watercourse crossings (Churchill, Kenamu, Eagle and Paradise), and on lakes at the western edge of the Eagle Plateau. Several smaller lakes on the central plateau also appeared to have some potential to yield sites. Highlights of the overview research results include:

- Churchill River/Lake Melville Plain, where higher terraces have potential to yield early precontact sites;
- Kenamu River, where both Innu and Métis land and resource use is well documented;
- the western plateau, where traditional Innu travel routes lead from the Kenamu to the large lakes of the southwestern plateau, with a number of routes converging on *Uinikush* Lake;
- the central and eastern plateau, where there are indications of both Innu settlement and also trapping by Métis from Cartwright, though with the possible exception of Eagle Forks, land use indicators are not abundant (IELP 2002).

The overview research was followed by a field validation program and the results of this survey include:

- Areas 1, 2, and 4 appear to have high archaeological potential. The potential along the Churchill River (Areas 1 and 2) has already been established during previous assessments in the area, though the 2002 work recovered no new sites. The Kenamu River (Areas 4) showed ample evidence for high archaeological potential, with eight sites attesting to contemporary and/or late historic Métis and Innu land use. This area also yielded the only precontact site recorded to date on the outfitter route corridor.
- Areas 9 and 10 appear to have reduced archaeological potential. Land use indicators identified in Area 10 were not confirmed in field surveys.
- Area 12 appear to have indeterminate archaeological potential. This component has only seen limited sampling to date, and its potential cannot be confirmed or denied at this point.
- Areas in the central and eastern plateau appear to have reduced potential, but this does not necessarily hold for other central plateau locations that were identified in 2003 (Areas A-1 to A-6), which were not yet subjected to a field validation program.

In summary, the project area intersects broad areas of high archaeological potential encompassing Area 4, on the Kenamu River and the western plateau. Important travel routes traverse this area linking the Kenamu River to the western plateau and to the lakes of the central plateau. It is likely that the whole project area between the Kenamu River and the western plateau is an area of enhanced potential. Further east, the proposed highway route appears to pass through sections of the central and eastern plateau that have lower archaeological potential. The Churchill River crossing (Area C-1) is known to belong to an area of relatively high potential, while archaeological potential remains indeterminate on the margins of the Lake Melville Plain to the south (Area C-3), as well as the Paradise River crossing (Area C-12) at the eastern end of the project area (IELP 2002).

7.11.3.5 Data Gaps

The overview research, potential mapping study, and field surveys conducted to date identified the following data gaps:

- limited or lack of access to data on land use by Innu from the Québec North Shore and Métis from the south coast of Labrador;
- fine-scale aerial photo coverage was not available during the studies (IELP 2002; Appendix E);
- the field survey does not represent a detailed assessment of the TLH - Phase III route, only of selected high-potential areas distributed in a broad corridor along that route;
- surveyed areas can only be considered sampled in most cases and the 2002 field survey represents only a preliminary investigation of the Project area;
- more than 45 percent (six) of the areas of enhanced potential were not subjected to a field validation program, most of which lie on the central and eastern plateau (A13 section);
- thus, few sites were recorded on the central and eastern plateau;
- limited sampling effort of certain areas at the Kenamu and Paradise rivers watercourse crossings due to difficulties of weather and river currents; and
- sites discovered to date and dating prior to the twentieth century are extremely scarce (IELP 2002; Appendix E).

7.11.4 Potential Interactions

All aspects of highway construction have the potential to interact with historic resources. Surveying, vegetation clearing and grubbing, excavating and borrow pit extraction, constructing the sub-grade and watercourse crossings, establishing camps and lay down areas, rehabilitating work sites and the presence of personnel all involve some level of ground disturbance. Any disturbance of the ground surface can disturb or destroy archaeological sites or artifacts. Increased or more extensive human use of the area, resulting from improved access created by highway operation, may also lead to interactions with archaeological sites or artifacts. An accidental event, such as an on-site fire or forest fire, may also interact with historic resources.

The results of the overview research suggest that, for the most part, the proposed highway route avoids many of the areas of greatest traditional Innu land use, particularly the principal lakes of the Eagle Plateau. However, the proposed route does skirt or intersect several high-potential zones, particularly at the major watercourse crossings. The results of the field survey appear to confirm these suppositions (IELP 2002).

The results of the historic resources assessment indicate that the proposed corridor passes through some broad zones of high archaeological potential, notably the area between the Kenamu River and the western Eagle Plateau. In the central and eastern portions of the plateau, the proposed route appears to pass through areas of lesser potential, with several possible exceptions. Indeed, strategic shoreline section of major rivers (e.g., St. Augustin) and lakes (*Pishiu-nipi*) as well as eskers were identified within areas A-1 to A-6. In addition, the archaeological potential remains indeterminate on the Paradise River and on the margins of the Lake Melville Plain, south of the Churchill River and perhaps on the shoreline of the Churchill River, which was thought to be positive. In general, the study results reflect particularly intensive Innu and Métis land use on the Kenamu River, with Innu settlement extensive as well on the western plateau, on the travel routes leading from the Kenamu River to the large plateau lakes (IELP 2002).

7.11.5 Issues and Concerns

The main concern is that ground disturbance during construction or an accidental event such as a fire may alter or destroy archaeological artifacts or sites. Improved access created by the highway and any subsequent disturbance can also be viewed as concerns with respect to archaeological resources. Interviews conducted to date with Innu and Settler respondents focused on obtaining information about the location of campsites, harvesting areas, and other areas of interest that would be used to facilitate the selection of survey areas (IELP 2002). However, concerns regarding the protection of historic resources were not presented in the Historic Resources Component Study report. Based on previous interviews conducted with residents of southern Labrador (JW 1998a), it is anticipated that knowledge of archaeological resources in the project area is limited. Nevertheless, it is very likely that most interviewees would indicate any sites encountered should be studied and properly documented. Indeed, archaeological sites are valued by Innu and other Aboriginal people. Sites contain the only physical information on how Aboriginal people lived before the arrival of Europeans. They are particularly important for the Innu and other Aboriginal people of Labrador because the information they contain is a record of their past.

7.11.6 Existing Knowledge

It is known that activities involving the disturbance of existing ground cover, such as project construction, may result in the unearthing, alteration and/or destruction of known or unknown archaeological artifacts or sites. It is also known that human activity and improved access increase the likelihood that adverse effects on historic resources occur.

7.11.7 Mitigation

The goal of historic resources management is to protect historic resources and mitigate potentially adverse effects to reduce loss or alteration of archaeological, historic and contemporary sites and objects. WST will have in place a Historic Resources Contingency Plan to address historic resources protection during all project phases. Specific mitigation measures to protect historic resources will include the following:

- while the centerline for the TLH - Phase III is being surveyed and cut, an archaeological aerial and field survey will be conducted to ensure the correct corridor was assessed for historic resources;
- in the event alterations to the original corridor occur, affected areas will be assessed for historic resources potential;

- when the centerline for the TLH - Phase III has been surveyed and cut, areas where thick forest cover or other factors limited the field survey will be reinvestigated;
- when locations for laydown areas, construction camps, borrow pits and maintenance depots are identified, they will be assessed by an archaeologist prior to any ground disturbance;
- should Settler and Québec Innu land use data become available, this information will be considered in any further archaeological assessment;
- design and implement an EPP in consultation with the PAO and appropriate Aboriginal authorities, including procedures on what to do if archaeological sites or artifacts are encountered;
- personnel will be informed of their responsibility to report suspected findings of historic resources during environmental awareness sessions;
- archaeological materials encountered will be reported to the PAO, including the nature of the activity resulting in the find, nature of the material discovered and precise location of the find;
- if archaeological sites or artifacts are encountered, construction activity will halt until an archaeologist from the PAO authorizes the work to resume;
- develop, in consultation with the PAO, appropriate measures for excavating a site or possibly re-routing the highway if an important archaeological site is encountered on the 40-m right-of-way during future historic resources field assessment or construction; and
- contractors will take all reasonable precautions to prevent personnel from disturbing or destroying any archaeological sites or artifacts encountered.

7.11.8 Environmental Effects Analysis

Effects on historic resources may occur during the construction phase, as a result of an accidental event or improved access to the project area.

7.11.8.1 Construction

There are 15 archaeological and ethnographic sites within a 10 km-wide corridor along the outfitter route, 10 of which were found during the 2002 field survey (Figure 7.25). Existing information on the people that inhabited this region indicates that Settler/Métis lived on the coast and commonly traveled in the hinterland, particularly along selected habitable shoreline of major rivers and lakes, where they established camps and conducted subsistence activities such as hunting, fishing, harvesting firewood and collecting berries. However, it appears that the homeland of certain groups such as the Intermediate Indian and the historic Innu was the hinterland.

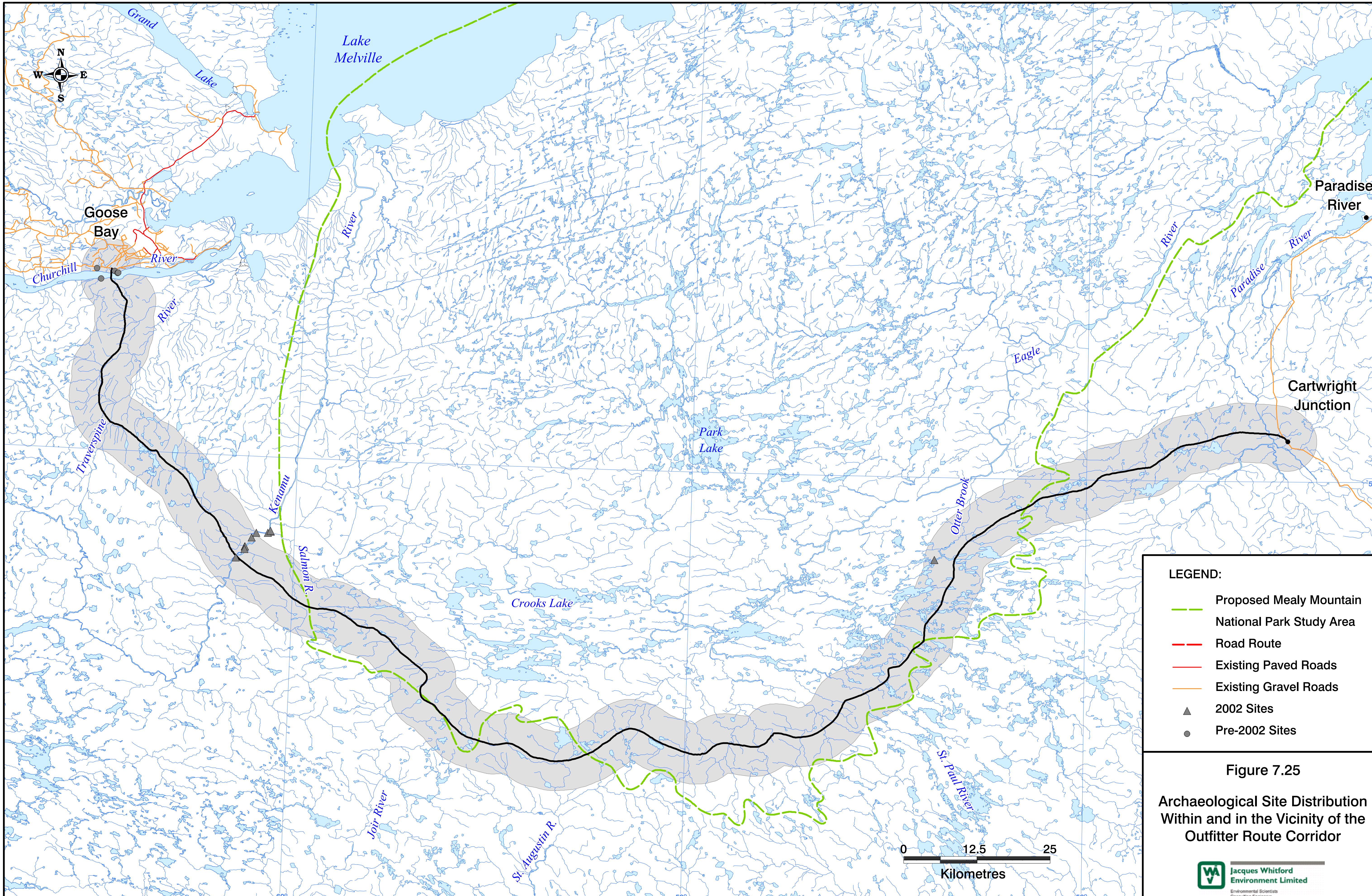

Figure 7.25

Archaeological Site Distribution Within and in the Vicinity of the Outfitter Route Corridor

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Previous field assessments yielded evidence of precontact use of the project area at one site dating to the Intermediate Indian period (3,500 to 2,000 BP). In addition, 14 sites dating to the late historic or contemporary periods were also identified. 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 ethnographic sites and particularly cutting locations and trails remain undetermined and could indicate activities conducted by either group. Most (93 percent) of the sites discovered to date are located in the western portion of the project area. However, the historic resources assessment of the outfitter route cannot be considered to be entirely thorough given the sampling effort to date that targeted approximately 54 percent (eight) of the selected areas of enhanced potential. The field survey conducted to date is distinct from more precise effects assessment along the 40 m-wide construction corridor and project features which may only commence once the route and features are surveyed, marked and delineated (IELP 2002). Therefore, additional historic resources may be present along the precise route. These data gaps can be rectified during subsequent pre-construction surveys. Until such further assessments are completed, there is a possibility that artifacts or other historic resources may be unearthed during construction.

It is estimated that approximately 15 percent of the sites located to date in the 10-km wide corridor are situated on or at short distances from the proposed 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. WST will consult the PAO to obtain the approval of proposed mitigative measures (Section 7.11.6) before proceeding with construction at or in the vicinity of any of these sites.

Based on the existing conditions, the potential for historic resources to be present within the project area is high in three areas investigated during previous field surveys (e.g., river junctions and preferred sections of shorelines such as points and constrictions). These areas lie in the western portion of the project area. Elsewhere, the potential varies from low (one area) to moderate or reduced (two areas) or remains indeterminate (one area). In addition, it is predicted that the potential for historic resources to be present within the A13 section of the route is moderate to high in three areas (A1, A-2 and A-3), low to moderate in area A-4, and moderate in areas A-5 and A-6. Therefore, the probability of encountering archaeological resources during construction or inadvertent discovery is highly variable across the project area. Based on the best information available at this time, it is anticipated that habitable (dry and level) shoreline of major streams and lakes have the highest potential to yield important historic resources and that the overall potential of the western portion of the study area appears to be the highest.

The area of ground disturbance during construction will be localized. Procedures for handling historic resources encountered during project construction will be outlined in the EPP.

7.11.8.2 Operation

There is potential that known and unknown historic resources could be affected as a result of improved access to the study area and project area. There are currently 15 archaeological and ethnographic sites registered for the project area. The anticipated effects associated with operations will affect these sites to various degrees. The indirect effect of increased human presence is one of the most difficult to predict and control. Human access to archaeological remains is not only a function of accessibility, its effects may also depend on how visible and recognizable a site is and how attractive its contents are to potential collectors.

7.11.8.3 Accidental Events

There is potential an accidental event, such as forest fire, could have an adverse effect on historic resources (such as destroying standing structures and contaminating organic materials at a site). A large area of ground could be disturbed during an accidental event, although this is considered unlikely. Such an event could occur during any phase of the proposed project. Accidental events could occur during all phases of the project. Sources of potential effects include discovery of historic resources through operation of heavy equipment and infrastructure failure (e.g., highway washout). The risk of environmental effects on historic resources caused by accidental events is low as a result of the protection measures included as mitigation (Section 7.11.6).

7.11.9 Environmental Effects Assessment

Environmental effects significance criteria for historic resources is largely defined by the *Historic Resources Act*. Historic resources are not assigned a value relative to each other, either within the WST project area or with other historic resources known from elsewhere in the province. The following definitions are used to rate the residual environmental effects on historic resources:

A **major (significant) effect** is the loss of an historic resource without salvage or retrieval of the information it contains.

A **moderate (significant) effect** is partial alteration of an historic resource and loss of some of the information it contains.

A **minor (not significant) effect** is any loss or alteration of an historic resource considered to be acceptable by the Department of Tourism, Culture and Recreation, including loss or alteration of a historic resource resulting from salvage archaeology where information is retrieved.

A **negligible (not significant) effect** is any discovery of a historic resource that does not result in loss or alteration of that historic resource or the information it contains, but increases the risk of future loss or alteration of that historic resource.

The significance of residual environmental effects for construction, operation and accidental events are highlighted in Table 7.51, along with ratings for the established environmental effects significance criteria. The significance ratings in Table 7.51 assume that the PAO will approve the necessary mitigative actions. Mitigation measures for historic resources are also outlined. Application of the mitigative measure discussed in Section 7.11.6 will reduce the probability that historic resources will be lost or altered within the project area. Therefore, the residual effects are negligible to minor.

Table 7.51 Residual Environmental Effects Summary - Historic Resources

<table>
<tr><th></th><th>Construction</th><th>Operation</th><th>Accidental/Unplanned Events</th></tr>
<tr><td colspan="4">Mitigation:
• conduct an archaeological field survey while the centerline is being surveyed and cut to ensure that the correct area was investigated during the archaeological field study;
• conduct more detailed investigation in areas where forest cover or other factors limited the original survey;
• conduct an archaeological survey of laydown areas, construction camps, borrow pits and maintenance depots locations prior to any ground disturbance;
• if information on Settler and Québec Innu land use become available to WST, it will be considered in any further archaeological study;
• consult with the PAO regarding necessary mitigative measures for the sites discovered within the project area;
• design and implement an EPP in consultation with the PAO, including response procedures for inadvertent encountering of archaeological sites or artifacts during construction;
• inform personnel about procedures for handling and reporting archaeological sites and artifacts will be part of environmental awareness sessions delivered to any construction personnel;
• the contractors will take all reasonable precautions to prevent personnel from disturbing or destroying archaeological sites;
• inform the PAO of any archaeological findings;
• halt construction activity until an archaeologist from the PAO authorizes work to continue; and
• if required, develop, in consultation with the PAO, appropriate measures for excavating a site or possibly re-routing the highway if an important archaeological site is encountered on the 40-m right-of-way during future historic resources field assessment or construction.</td></tr>
<tr><td colspan="4">Environmental Effects Criteria Rating</td></tr>
<tr><td>Magnitude</td><td>High</td><td>Low</td><td>Low</td></tr>
<tr><td>Geographic Extent</td><td>11 to 100 km^2</td><td>1,001 to 10,000 km^2</td><td>1,001 to 10,000 km^2</td></tr>
<tr><td>Frequency</td><td><10</td><td><10</td><td><10</td></tr>
<tr><td>Duration</td><td>>72</td><td>>72</td><td>Unknown</td></tr>
<tr><td>Reversibility</td><td>Irreversible</td><td>Irreversible</td><td>Irreversible</td></tr>
<tr><td>Ecological/Socio-economic Context</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td colspan="4">Environmental Effects Evaluation</td></tr>
<tr><td>Significance</td><td>Not significant
(Minor)</td><td>Not significant
(Minor)</td><td>Significant
(Major)</td></tr>
<tr><td>Level of Confidence</td><td>Moderate</td><td>High</td><td>Moderate</td></tr>
<tr><td>Likelihood[1]</td><td>n/a</td><td>n/a</td><td>Low</td></tr>
<tr><td>Sustainable Use of Resources[1]</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td colspan="4">[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994). In the case of historic resources, sustainable use of resources is not applicable.</td></tr>
<tr><td colspan="4">Environmental Monitoring and Follow-up:
• Conduct pre-construction historic resources survey prior to construction.
• Resident Engineer responsible for monitoring construction.
• Any historic resources encountered will be reported to PAO.
• Project personnel will be briefed on procedures should historic resources be discovered.</td></tr>
<tr><td colspan="4">Key:
Magnitude: High, Medium, Low, Nil or Unknown
Geographic Extent (km^2): <1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown
Frequency (events/year): <10, 11-50, 51-100, 101-200, >200, Continuous or Unknown
Duration (months): <1, 1-12, 13-36, 37-72, >72 or Unknown
Reversibility: Reversible, Irreversible or Unknown
Context: Existing Disturbance (High, Medium, Low, Nil or Unknown)
Significance: Significant, Not Significant, Positive or Unknown
Level of Confidence: High, Medium, Low
Likelihood: High, Medium, Low or Unknown
Sustainable Use of Resources: High, Medium, Low or Unknown</td></tr>
</table>

Given the probability of encountering historic resources and the mitigation measures identified, the residual environmental effects during construction are assessed as minor (not significant). Any effect would be limited to the project area (i.e., right-of-way). The specific frequency cannot be predicted at this stage. However, it is anticipated that the frequency may be higher in the western portion of the project area. The magnitude of the effect is rated as high because historic resources would be permanently altered. The residual environmental effects would not be reversible.

Given the probability of encountering historic resources and the mitigation measures identified, the residual environmental effects during operation are assessed as minor (not significant). During operation, activities will be limited to the highway, ditches and back slope. These areas will have been disturbed by construction and then rehabilitated. Any new disturbance will result from human use of the area due to the improved access. The extent of such residual environmental effects will be from 1,001 to 10,000 km^2, and they could occur year-round. However, the frequency is expected to be low. The magnitude of the residual environmental effects is rated as low because any changes in historic resources will be within the range of natural variability. Residual environmental effects will not be reversible.

Residual environmental effects on historic resources due to accidental events could occur during construction or operation. Significant effects (i.e., loss of historic resources) could occur in the event of a fire. The timing and duration of an accidental event is not known and the frequency of such events is expected to be low. However, the likelihood of this occurring is low. The magnitude of the residual environmental effects will vary from low to high, and the effect will not be reversible. Implementation of a Historic Resources Contingency Plan will reduce the probability and magnitude of residual environmental effects on historic resources.

7.11.10 Cumulative Environmental Effects

It is possible that historic resources in the project area may already be disturbed. At present, such activities as all-terrain vehicle travel, commercial ventures (e.g., outfitters) or industrial undertakings (e.g., mineral exploration) may result in some disturbance of the ground cover. Previous development of the TLH - Phase II, as well as the development associated with the creation of the Akamiuapishku/Mealy Mountains National Park, may also affect historic resources in the project area. In addition, any increase in land and resource use activities in the area, such as forestry operations or mineral exploration/mining may also disturb or destroy historic resources. However, all development activities are subject to the *Historic Resources Act*.

Details such as the likelihood, nature, location and timing of any actions induced by the TLH - Phase III are not known and the control of most potential induced actions and related effects are beyond the jurisdiction of WST. Control depends on appropriate enforcement and management and planning on the part of relevant regulatory agencies. As a result, a number of assumptions were made in 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;

- 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.

WST has committed to a Stage 1 Historic Resources Overview Assessment in advance of the onset of construction, once the centre line is cut. In addition, the EPP will require the contractor to report any resources discovered during construction. Improved access to the area may result in the discovery of historic resources by other users, who may or may not report the findings to the PAO. However, given the probability of encountering historic resources is low, the cumulative environmental effect is assessed as minor (not significant).

With the implementation of these mitigation measures, particularly appropriate planning and enforcement, the project and other activities can likely be undertaken without resulting in significant adverse cumulative effects on historic resources.

7.11.11 Monitoring

A pre-construction historic resources survey of the final cut/marked route will be conducted by WST. All project personnel will be briefed on procedures should historic resources be discovered and any historic resources encountered during construction will be reported to PAO.

7.12 Resource Use and Users

Labrador residents make use of land and water resources for subsistence and recreation and, to a limited degree, commercial ventures. A variety of resource use activities are carried out in the area in which the TLH – Phase III, including both the preferred and outfitter routes, will be located. Activities include hunting, trapping, fishing, forestry, mineral exploration, military activities, parks and other special areas, and cabins, trails and recreational use. Resource users include the Innu, Settler/Métis, other residents of Labrador and tourists to the area.

Resource use and users and the potential environmental effects that may be associated with the TLH - Phase III, specifically the preferred route, were discussed in Section 6.12 of JW/IELP (2003a). Much of the discussion presented in that VEC is also applicable to the assessment of the potential effects of the outfitter route on resource use and users in the area, as the socio-economic study area boundary used for the environmental assessment of preferred route also included the outfitter route. Therefore, the discussion presented in this VEC for the boundaries for the environmental assessment, existing environment, potential interactions, issues and concerns, existing knowledge and mitigation draws heavily on the information provided in Section 6.12 of JW/IELP (2003a). Where there is a variation in information for the outfitter route, the information specific to the outfitter route is presented. Otherwise, the reader is directed to Section 6.12 of JW/IELP (2003a), as appropriate.

Note that Section 6.12 of JW/IELP (2003a) did not include Innu land and resource use in the environmental effects analysis. Innu land and resource use were considered in detail in Armitage and Stopp (2003), which also included an analysis of potential environmental effects of the project on Innu land and resource use. Therefore, this report comprised a separate environmental effects analysis for Innu land and resource use. Based, to a certain extent on the findings of this study and analysis, as well as concerns raised by outfitters, direction was given by the Minister of Environment to complete an environmental assessment on an alternative route (i.e., the outfitter route), which is the subject of this environmental assessment. No further work was identified for Innu land and resource use.

7.12.1 Boundaries

The spatial project boundary for resource use and users encompasses the 40-m right-of-way for the outfitter route between Happy Valley-Goose Bay and Cartwright Junction for an approximate distance of 280 km (Figure 1.1), as well as areas of associated physical disturbance, including watercourse crossings, borrow pits, temporary construction camps and laydown areas. Note that the western and eastern portions of this 40-m right-of-way are common to both the preferred and outfitter routes, while the centre portion of the route varies (this is the route segment identified as A13 in Figure 2.1). The boundary also extends beyond the highway right-of-way to include areas of current resource use and areas of potential resource use due to the improved access that the highway will provide. Temporal project boundaries for resource use and users are defined by the timing and duration of construction (i.e., the period from 2004 to 2010), operation (i.e., in perpetuity) and accidental events (which may occur at any time during construction or operation, but the duration will vary depending on the event).

As with the preferred route, the outfitter route passes through Regional Economic Zones 3 (Central Labrador) and 4 (Southern Labrador) (Figure 3.2). These zones comprise the spatial socio-economic boundary for resource use and users. Temporal socio-economic boundaries for resource use and users extend through construction, operation and accidental events. These zones also represented the study area for the component study on land and resource use prepared by JW (2003a).

Administrative boundaries are the same as described for the preferred route. Resource use and users in Central and Southern Labrador are administered by a number of government departments and agencies. Management areas established by these departments set the spatial administrative boundaries for resource use (e.g., wildlife management zones, scheduled salmon rivers or municipal planning areas). The TLH - Phase III will also cross land area that is subject to a land claim by Innu Nation, which is currently being negotiated between Innu Nation and the governments of Canada and Newfoundland and Labrador. Other organizations, include the Labrador Métis Nation, economic development and tourism organizations, and various private-sector organizations and individuals that provide resource use services and infrastructure.

Temporal administrative boundaries are defined by the time periods associated with the various management plans and activities identified for the area. These boundaries will be in effect throughout construction and operation of the outfitter route, and during any accidental events that may occur.

7.12.2 Methods

The environmental assessment of resource use and users draws on the background information provided by the component study on land and resource use completed by for the TLH - Phase III environmental assessment (JW/IELP 2003a). Information for this study was gathered from existing literature and database sources, as well as interviews with individuals from various government departments, municipalities, economic development, tourism and business organizations, and private enterprises. In addition, the study team had access to information from interviews with Settlers carried out by Armitage and Stopp (2003).

As noted, a separate study and analysis of environmental effects on Innu land and resource use was carried out by Armitage and Stopp (2003). This study included gathering information on Innu land and resource use through a series of interviews with Innu informants.

The environmental effects analysis of resource use and users is based on a review of existing resource use activities in the area, and an analysis of the effects that the project may have on resource use and users. Each project phase and activity was considered in relation to the baseline, including potential direct, indirect and induced changes that may result from the project.

7.12.3 Existing Environment

The principle resource users in the study area are the Innu (discussed in Armitage and Stopp 2003), Settler or Métis, other Labrador residents and visitors/tourists to the area (in particular visitors to outfitting operations). While much of the use is for subsistence or recreational purposes, there are also commercial/business interests (e.g., commercial caribou harvest, trappers, outfitting operations, and adventure and nature tourism operators) and industrial and government users (e.g., forestry companies and the military). Resource use activities considered in this analysis of potential environmental effects associated with the outfitter route are Settler or Métis land use, municipal/community land use, waterway use, hunting, trapping, fishing, outfitting operations, parks and special areas, cabins, trails and recreational areas, forestry, mineral exploration and quarries, hydro power development and military activities. The proposed Akamiuapishku/Mealy Mountains National Park and tourism and recreation are also considered in greater detail in Sections 7.13 and 7.14, respectively.

As noted, the existing environment for resource use and users as it pertains to the outfitter route is largely the same as that presented for the outfitter route in Section 6.12.3 of JW/IELP (2003a). With this is mind, the following descriptions of resource use and users as presented for the preferred route are also applicable to the outfitter route:

- Settler and Métis land and resource use (see Section 6.12.3.1 of JW/IELP (2003a));
- settlement and development, municipalities, protected road and municipal water supplies (see Section 6.12.3.2 of JW/IELP (2003a));
- moose, caribou, black bear, small game, waterfowl and seabird management and hunting (see Section 6.12.3.4 of JW/IELP (2003a));
- furbearer management and trapping (see Section 6.12.3.5 of JW/IELP (2003a));
- cabins, trails and recreational areas (see Section 6.12.3.9 of JW/IELP (2003a));
- forestry (see Section 6.12.3.10 of JW/IELP (2003a));
- mineral exploration and quarries (see Section 6.12.3.11 of JW/IELP (2003a)); and
- hydroelectric power development (see Section 6.12.3.12 of JW/IELP (2003a)).

The following sections provide a description of those aspects of resource use and users that are specific to the outfitter route.

7.12.3.1 Waterway Use and Related Resource Use

There are 115 identified watercourse crossings along the proposed outfitter route (Figure 3.5). These crossings are located within six watersheds covering the route: Churchill River; Traverspine River; Kenamu River; Eagle River; St. Augustin River; and Paradise River. The outfitter route also crosses the Joir River watershed, tributary of the Little Mecatina River. However, there are no watercourse crossings within the Joir River watershed. Of the 115 watercourse crossings, only the Churchill River crossing location is considered navigable by traffic larger than canoes or kayaks. For the remaining crossings, it is possible that canoes or kayak are the only vessels that would likely use these watercourses (C. Froude, pers. comm.). All of the watersheds experience a certain level of resource use activity throughout the year, with much of the use possibly being concentrated in the lower reaches of the Kenamu, Traverspine, Eagle, Paradise and St. Augustin rivers (JW 2003c).

7.12.3.2 Fishing

As with the preferred route, of the watersheds crossed by the outfitter route only two have scheduled salmon rivers (i.e., the Eagle River and Paradise River watersheds). While the outfitter route crosses two additional watersheds, there are no watercourse crossings in the Joir River watershed and the St. Augustin River watershed is not a scheduled salmon river in Labrador. As a result, there are no angling return data for salmon available for the St. Augustin River. Therefore, the discussion on scheduled rivers, fishing management practices and fishing activity as presented for the preferred route (see Section 6.12.3.6 in JW/IELP (2003a)) is also applicable for the outfitter route.

7.12.3.3 Outfitting Operations

The information presented on outfitting operations in Central and Southern Labrador in Section 6.12.3.7 of JW/IELP (2003a) also applies to the outfitter route. However, there is a difference between the preferred and outfitter routes, that is the distances of the outfitting camps from the outfitter route. A list of the outfitting operations located in Central Labrador and the approximate distance of these camps from the outfitter route is provided in Table 2.6. The locations of the outfitting camps are shown on Figure 2.2. When compared to the preferred route, the outfitter route is more distant from five of the outfitting camps, maintains the same distance between the highway and eight of the outfitting camps, and is closer to six of the outfitting camps. The closest outfitting operation is approximately 5.3 km from the outfitter route.

7.12.3.4 Parks and Special Areas

The discussion on parks and special areas presented for the preferred route (see Section 6.12.3.8 in JW/IELP 2003a) also applies to the outfitter route. However, with respect to the outfitter route, the routing is located further towards the southern boundary of the Akamiuapishku/Mealy Mountains National Park study area (Figure 7.26). The outfitter route passes to the south of the IBP sites identified in Central Labrador, with the route being adjacent to the southeastern corner of Site 53 - Eagle River Headwaters (which covers an area of 520 km^2).

7.12.3.5 Military Activities

The discussion on military activities in the Central Labrador area is also applicable to the outfitter route. However, approximately 119 km of the proposed outfitter route lies within the LLTA. The practice target area (PTA) within the LLTA has a radius of four nautical miles and is located approximately 84 km southwest of the TLH - Phase III (Figure 7.1).

7.12.4 Potential Interactions

The outfitter route will pass through an area that experiences varied levels of resource use, involving a number of user groups. Both construction and operation activities for the outfitter route have the potential to generate direct, indirect and induced effects on resource use and users. The interactions described for the preferred route (see Section 6.12.4 in JW/IELP 2003a) also apply to the outfitter route.

7.12.5 Issues and Concerns

A summary of the issue scoping process conducted for the environmental assessment and issues and concerns raised is provided in Chapter 5.0. Further detail regarding the scoping process is presented in Chapter 4.0 of JW/IELP (2003a).

The principle issues and concerns raised relate to the potential effects on current resource use activity and users, including Aboriginal people and other Labrador residents, resulting from increased resource use activities due to the improved access provided by the highway. There was concern that the highway would lead to increased use of the areas waterways and subsequent resource depletion, and that induced activities such as forestry would lead to cumulative effects. For the preferred route, the proximity to Eagle River and crossing on the river was noted as a key concern. However, the outfitter route bypasses that watercourse crossing. Otherwise, the issues and concerns relating to the resource use and users as they pertain to the preferred route also apply to the outfitter route.

7.12.6 Existing Knowledge

The planning and management processes outlined in Section 6.12.6 of JW/IELP (2003a) are processes of general application in the province that also apply in the area in which the outfitter route is located. The management and planning processes (municipal planning, protected road zoning plans, forest management planning, national park planning and heritage river designation and management planning) define how planning is to be carried out and measures for determining appropriate development activity. All of the processes 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 that may occur in the area.

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. The Labrador Innu land claim area is shown in Figure 3.3. When the Innu land claim is settled, it will establish a framework for land and resource management in the settlement area, which will offer a protection mechanism for area resources and set rules for users within the claim settlement area.

Experience with previous highway development in Labrador provides some indication of the type of activities that may result from the TLH - Phase III. The experience described in Section 6.12.6.3 of JW/IELP (2003a) is also useful for the environmental assessment of the outfitter route.

While changes in the level of resource use activities have been noted, it is also evident that appropriate actions have also been taken by regulatory agencies with respect to management and planning, and enforcement of regulations. Likewise, the discussion on noise (see Section 6.12.6.4 of JW/IELP 2003a) also applies to the outfitter route. The study area is, for the most part, wilderness, with virtually no human noise, and the proposed highway is anticipated to have a low volume of traffic. The zone of influence for highway noise was determined to be approximately 2 km along flat sections and approximately 4 km at watercourse crossings where the grade will result in the use of compression brakes.

7.12.7 Mitigation

Environmental protection measures incorporated into environmental management planning initiatives for the project will help in mitigating some project effects on resource use and users. In addition, mitigation measures identified for mitigating project effects on the biophysical environment will also indirectly reduce effects on resource use and users. Similarly, mitigation measures for project effects on the proposed Akamiuapishku/Mealy Mountains National Park (Section 7.13.7) and tourism and recreation activities (Section 7.14.7) (as they are elements of resource use) are also applicable to resource use and users.

Principle measures, designed to mitigate project effects of the outfitter route on resource use and users, include implementing the environmental protection measures for construction and operation, and the contingency and emergency response measures, identified in Section 3.9.3, and complying with relevant WST Specifications, and relevant municipal, provincial and federal legislation and regulations (Table 3.1) when carrying out construction and operation activities. WST is also committed to meeting relevant terms and conditions of an Innu land claim settlement. Other mitigation measures listed for the preferred route in Section 6.12.7 of JW/IELP (2003a) also apply to construction and operation of the TLH - Phase III using the outfitter route.

Many of the potential adverse effects on resource use and users are linked to the improved access that will be provided by the TLH - Phase III, and any resulting associated increase in human presence and activities in this relatively isolated area. Mitigating these potential effects is, for the most part, beyond the responsibility of WST. Managing these actions and their potential effects is the responsibility of various regulatory and resource management agencies, which are responsible for ensuring that legislation and regulations are adequately enforced and that future activities are undertaken in a responsible and sustainable manner. This environmental assessment, by identifying environmental aspects, provides opportunity for appropriate measures to be identified and implemented by the relevant agencies in an effective and timely manner, as well as provides the time for decisions to be made regarding any additional staffing requirements that may be necessary.

7.12.8 Environmental Effects Assessment

The area in the vicinity of the outfitter route experiences varying levels of resource use activities, with the greater proportion of resource use activities (and plans for future resource use activities) being concentrated at the western and eastern ends of the highway, in particular around watercourses and waterbodies in these areas. As noted, the western and eastern portions of the outfitter route are common to both the preferred and outfitter routes. The highway will provide an improved means of access to this area and opportunities for increased use and new resource use activities and user groups.

Potential environmental effects that may result due to the TLH - Phase III are associated with both the construction and operations phases of the project. However, it is during the operations phase that potential environmental effects associated with project-VEC interactions may be more evident. The analysis of project-VEC interactions takes into consideration the mitigation described above and existing knowledge.

7.12.8.1 Construction

There are similarities between the potential environmental effects on resource use and users associated with construction of the outfitter route and those predicted for the preferred route construction. While a portion of the route (i.e., the A13 section) varies from that of the preferred route, the construction practices followed will be the same for both the preferred and outfitter routes.

As the western portion of the outfitter is the same as that for the preferred route, the intersection of the TLH - Phase III and TLH (Route 500) is also located within the boundaries of the Town of Happy Valley-Goose Bay. This is the only community located along the route and the only community that will experience direct effects on municipal land use due to the project. The intersection is located approximately 9 km west of the built up area of the community and approximately 2.5 km west of the town’s water supply. Therefore, residents are not likely to be affected by construction activity. No other communities will experience direct effects on municipal land use due to highway construction activities, as none are located on the route.

As with the preferred route, areas of resource use will be subject to disturbance associated with project construction activities, such as vegetation removal along the right-of-way, excavations and laying subgrade material, and temporary construction camps, laydown areas and borrow pits being established. The noise, dust, increased human presence and other disturbances associated with these construction activities may lead to resource users avoiding or reducing their use of resource areas near the construction sites. Some resource users may feel that the overall wilderness experience and aesthetic quality of the area is diminished as a result of the disturbances from construction activity, which may cause resource users to avoid or reduce use of the area. As well, depending on the nature of the activities being carried out, access around the construction area may be restricted for safety reasons. Any hunters, trappers, anglers, cabin owners or others normally engaging in subsistence or recreational activities in the vicinity of the construction sites may be affected by construction activities. However, resulting effects will likely be localized (approximately 20 km of highway will be constructed annually at each end of the highway) and have a short duration (the construction season will extend from around May to November each year between 2004 and 2010). While some resource users may use other areas during construction and others may chose to not participate in resource use activities, no decrease in the overall level of resource use in the area is anticipated during this period. In addition, the fact that the A13 section of the outfitter route is located further south of the larger lakes in the area and the Eagle River plateau will act to reduce effects on any users in these areas.

A number of the waterways used by area residents and other resource users to access hunting and fishing areas, as well as cabins, will be crossed by the TLH - Phase III. Final design of the crossing structures will take into consideration the current type of use and navigability of the waterway; however, construction and placement of these crossing structures may limit or disrupt waterway navigation for a period. This is not expected to be a concern for the larger waterways, where only a portion of the waterway will be under construction at any one time. For smaller crossing locations, potential navigability may be disrupted for a short period; however, this disruption would be restricted to one construction season or less. Any disruption of waterway navigability will also affect resource users that use watercraft to travel to the areas that are used for hunting, fishing or other activities. While there is a different set of watercourse crossing locations along the A13 section of the outfitter route, this effect applies to both the preferred and outfitter route.

Hunters and trappers will be affected if wildlife avoid construction areas due to the noise and habitat disturbance or are displaced due to habitat loss. This applies to black bear, other furbearers, small game and migratory birds. Hunting of Mealy Mountains caribou is not permitted and there are no moose management areas over most of the proposed route. Waterfowl habitat will be altered or removed by right-of-way clearing; however, waterfowl are expected to continue using areas near the highway (Section 7.2.8.1). Therefore, there will be little effect on waterfowl hunting. Similarly with furbearers, habitat will be lost and noise and other disturbance from construction activity may cause furbearers to avoid construction areas for a short period, but the various furbearers will continue to use the area near the highway (Section 7.4.8.1). Also, only the first month of the trapping season overlaps with the annual construction period and trappers have traditionally only accessed this area on snowmobile during the winter months. Therefore, there will also be little effect on trapping activity.

Construction activities around watercourses, whether on the preferred or outfitter routes, that affect fish and fish habitat will indirectly affect angling activity. Standard construction activities have built-in environmental protection procedures that will minimize effects on fish and fish habitat during construction (where effects will be limited to one construction season at any location). Therefore, there will be no discernable effect on fishing activity. In addition, construction workers choosing to hunt or fish while at site will be required to adhere to all laws and regulations pertaining to these activities. Non-compliance will not be tolerated by WST or the contractor.

Potential effects from highway construction on outfitting operations are likely to be similar to those predicted for the preferred route, as only five of the outfitting camps are more distant from the outfitter route than they were from the preferred route. The remainder are either the same distance from the outfitter route as they were from the preferred route or actually closer to the route. As a result, commercial outfitting operations in the immediate vicinity of the project area may have to adjust their operations during project construction in order to minimize the effects of any disturbance from construction activities (e.g., by having their guests fish in alternate areas during the construction of some highway segments). With the closest outfitting operation being approximately 5 km from the outfitter route, outfitting lodges in the area will be outside the zone of influence for noise (estimated to be approximately 4 km) and will not likely experience any noise effects from construction. However, fishing activity undertaken at these lodges is usually within 5 to 10 km from the lodge. Therefore, there is potential that construction noise may be heard at fishing locations. WST will inform tourism operators and other relevant organizations and individuals about the location and timing of construction activities to ensure that any potential conflicts are identified and addressed through appropriate planning.

The outfitter route, like the preferred route, does pass through the study area for the Akamiuapishku/Mealy Mountains National Park, which is considered in detail in Section 7.13. However, the outfitter route lies further to the south closer to the boundary for the park study area. Habitat loss or alteration due to highway construction, and increased human access and development activities, as a result of the highway are the key potential effects on the park area. However, the TLH - Phase III project following the outfitter route is not likely to preclude establishment of the Akamiuapishku/Mealy Mountains National Park (Section 7.13). In fact, if the outfitter route is selected, it is unlikely that the highway will be within the park boundary. Most likely, the park will be established with the highway just outside or acting as the southern boundary for the park.

In contrast to the preferred route, the outfitter route does not pass through IBP Site 53 (Eagle River Headwaters). Instead, the outfitter route lies adjacent to the southeastern edge of Site 53 and passes to the south. Therefore, there is not expected to be any disturbance due to highway construction. In addition, the proposed highway also does not intersect or pass in close proximity to existing snowmobile trails in the area.

The proposed highway route will cross the Churchill, Traverspine, Kenamu, St. Augustin, Eagle and Paradise rivers. All of these rivers, except for the Churchill River, could be considered as potential candidates for Canadian Heritage Rivers. The Churchill River would not likely qualify as a Canadian Heritage River due to the alterations caused as a result of hydroelectric power development. The other rivers and surrounding areas, while they may have been subject to some level of human use, have not been subjected to alteration like that of the Churchill River.

Roads and highways are found near or crossing designated Canadian Heritage Rivers elsewhere in Canada, including the Dempster Highway that passes by the mouth of the Arctic Red River in the Western Arctic (Canadian Heritage River 2003). Therefore, the presence of the highway route through central Labrador is not likely to limit the potential of area rivers for consideration as Canadian Heritage River candidates. It is more likely that attributes, such as geology, landforms, hydrogeology, vegetation, wildlife and landscapes, and the uniqueness of these attributes will be the main deciding factors in river designation.

While the outfitter route passes through two forest management districts, currently there is no forestry activity occurring along the route that would be affected by construction activity. With current forestry operations located north and west of Lake Melville, at the western end of the route (a segment of the route that is also common to the preferred route), construction activity at the Black Rocks area will not interfere with forestry operations in this area. In the east, there will be no interaction between the current limited amount of forestry activity in the Cartwright and Paradise River areas and highway construction activities due to the distance between the two activities. Similarly, there are no mineral exploration claims, mining operations or hydro power developments located along the route and, subsequently, no opportunity for conflicts with construction activity. However, as sections of the highway open, forestry and mineral exploration activities may be initiated in the area. In the case of forestry, operations are most likely to be concentrated along the western portion of the route, as this area contains some of Labrador's most productive forest resources. As the western portion of the route is common to both the preferred and outfitter routes, this forestry activity is likely to occur regardless of which route is selected. To avoid problems or conflicts with these resource user groups, WST and/or the contractor will notify any forestry operators or mineral claim holders that begin operations in the area during construction about planned construction activities.

Approximately 119 km of the outfitter route (compared to 92 km of the preferred route) lies within DND's LLTA and the annual period of highway construction (approximately May to November) will overlap with DND low-level flight training activities (April to October). Construction activities will not affect the flying activities or vice versa. Likewise, the PTA is located approximately 120 km south of Happy Valley-Goose Bay and 84 km southwest of the TLH - Phase III route, so there is no interaction between the PTA and construction activities. As with other user groups, public notices about construction activities, in particular any planned blasting operations, will be made by the contractor.

7.12.8.2 Operation

As with the preferred route, noise, dust, increased human presence and other disturbances can be expected to result from regular maintenance activities and highway use. Any hunters, trappers, anglers, cabin owners or others normally engaging in subsistence or recreational activities in the vicinity of the highway may be affected by maintenance activities and highway use. For some resource users, these disturbances may deter them from participating in resource use activities near the highway. Also, the visual effect of the highway itself may affect the wilderness and aesthetic character of the area and, subsequently, cause resource users to avoid or reduce their use of areas that they previously used and are now near the highway. However, the disturbances associated with highway operation will be limited to a short time period and be concentrated in a localized area. Similarly, disturbances associated with highway use will be of a short duration, as traffic levels for the highway are expected to be low. With an estimated 4-km zone of influence for noise, it is not likely that noise associated with regular highway use will be heard at any of the outfitting lodges. As the locations of area cabins are not known, it is possible that highway operation activity will be audible at some cabins in the area.

While resource users may alter their patterns of use or choose other areas to carry out their activities, no decrease in the overall level of resource use in the area is anticipated during highway operation. This applies to both the preferred and outfitter routes. Given the vastness of the region, resource users will have the opportunity to pursue resource use activities in other areas. Also, it is expected that resource use in the vicinity of the highway will increase over the course of highway operation due to the improved access provided by the highway. Resource users, who would not have used the area if they had to travel by boat or a charter aircraft, will have a cheaper and easier means of access into the area. As portions of the highway are completed, access to areas currently used for resource activities will be improved and other areas will become accessible. As public access will be permitted to each highway section as construction of that section is complete, an increase in resource use activities can be expected to occur immediately following completion of each construction phase. By the time the highway is complete, this increased level of use can be expected along the entire highway route.

The fact that the eastern portion of the A13 section of the outfitter route is located further south and in the upper area of the Eagle River headwaters, with no bridges required, may serve to limit the amount of increased resource use that may occur along the A13 section of the outfitter route. However, as the outfitter route is still within the Eagle River watershed, the outfitter route will create access to the watershed for resource users.

As with the preferred route, while the highway provides improved access for resource users, various aspects of area resources and the resource management regime currently in place for the area act to limit resource use in the area. Hunting of the MMCH is prohibited, because the species is designated as threatened by COSEWIC. The area immediately south of Lake Melville is not zoned for moose hunting. Moose hunting is a regulated activity and zones are limited to the eastern (Paradise River area) and western end (Muskrat Falls area) of the highway. While black bear hunting is permitted throughout Central and Southern Labrador, the harvest of black bears is low and not expected to increase because bears are no longer eaten due to their habitats of foraging in dumps and pelts currently not having a high value. Bear hunting is also restricted to a spring and fall season. Small game (e.g., grouse, ptarmigan and hare) and migratory bird hunting are permitted in Central and Southern Labrador. Small game hunting is restricted to October to April and migratory bird hunting is restricted to September to December, and both are subject to bag and possession limits. There is no legal hunting of harlequin ducks. Trapping is also a fall and winter activity, restricted to the period from October or November (depending on the species) to March.

These factors act to limit the resource use activities along the outfitter route that could potentially be carried out in the vicinity of the TLH - Phase III following the outfitter route. Unless a moose hunting zone is established for the area, furbearers (over the fall and winter), small game (over the fall and winter) and migratory birds (in the fall) will likely be the principle species trapped or hunted in the area. In inland areas, most migratory birds have moved south or to coastal areas by late September. Thus, the actual period for hunting migratory birds in the vicinity of the proposed highway will only be a maximum of six weeks each year. The fact that these hunting and trapping activities are restricted to the fall and winter will mean that they will most likely be carried out by area residents; thus, participation in these activities by non-residents will be limited. Also, the fact that navigability of area waterways is possibly limited to travel by small vessels such as canoes and/or kayaks, will also act to limit access from the highway. However, despite the fact that there are regulations and policies governing resource use in the area, illegal harvesting and other activities may occur.

As noted in the environmental assessment of the preferred route (JW/IELP 2003a), for resource management measures to be effective in protecting area resources and limiting activity, increased enforcement resources or new management initiatives may be necessary. The departments and agencies responsible for managing wildlife resources will need to review existing policies. Should the proposed Akamiuapishku/Mealy Mountains National Park be established, hunting and trapping will not be permitted within the boundaries of the park and Parks Canada would apply enforcement resources to the area. Also, the designation of any of the area rivers as heritage rivers will also bring with it restrictions on resources use activities. The planning processes for both national parks and heritage rivers include opportunities for public input, and both processes would provide further controls on hunting and trapping activity in the area. In the absence of a national park, establishing a Special Management Area under the provincial *Lands Act* would be a means implementing controls on resource use and development in the area.

As the watercourses crossed by the outfitter route, except for the Churchill River, are likely to only be navigable by vessels of the size of canoes or kayaks, the use of many of these waterways to access areas distant from the highway will likely be limited. The Churchill River is already immediately accessible from the Happy Valley-Goose Bay area and its use is expected to continue. An increase in resource use activities may result if there is an increase in nature tourism activities. The Eagle River and its tributaries currently receive a high level of use and this is likely to continue, and possibly increase after the highway is operational. However, the outfitter route crosses the Eagle River watershed far enough upstream to limit access to most of the larger lakes of the area. Similarly, given that the Kenamu, Traverspine and Paradise rivers are currently being used for various resource activities, it is expected that resource use will likely also increase in these watersheds. However, resource users would likely rely on foot or vehicles, such as ATVs or snowmobiles, to gain access from the highway. In addition, there are a number of lakes in the vicinity of the highway that will become accessible to watercraft users and may facilitate access throughout the watershed.

Of the resource use activities occurring in the area, recreational fishing on area rivers and lakes is the most likely activity to be subjected to increased participation following completion of the TLH - Phase III regardless of whether the preferred or outfitter route is selected. Current angling activity is concentrated near Happy Valley-Goose Bay and Cartwright. However, improved access to watercourses and bodies that is provided by the highway will provide increased opportunity for recreational fishing activity throughout Central and Southern Labrador. While this may be viewed as an improvement for the recreational fishing industry, any overfishing (whether legal or illegal) may adversely affect fish resources and, subsequently, the recreational fishing industry. Likewise, any increase in fishing activity that results in overcrowding and congestion on area rivers and lakes, will affect the perceptions that resource users have of the wilderness character of the area and overall quality of the recreational fishing experience. However, the size of the area and potential fishing locations will act to minimize any congestion and help maintain the overall quality of the fishing experience. In addition, the fact that the A13 segment of the outfitter route is located further south into the headwater areas of the region’s major rivers may act to reduce the increase in fishing activity and effects associated effects.

As with hunting and trapping, should the proposed Akamiuapishku/Mealy Mountains National Park be established or heritage rivers designated, restrictions would be put in place on resources use activities (e.g., snowmobile and ATV use are prohibited and special fishing licences are required in national parks) that would aid in protecting area resources. Similarly, the Special Management Area designation under the *Lands*

Act, would see the implementation of measures that may control resource use or development activities. The planning processes for both national parks and heritage rivers include opportunities for public input, including input from resource users in the area. While a park and heritage river designation would offer some protection for fish resources in the area, changes to current fisheries management and enforcement may also be necessary to address issues surrounding increased fishing activity. This may include changes to existing regulations and policies (e.g., changes to bag limits and retention levels or having some lakes and steams designated as hook and release only). There may also be a need for more fisheries officers to patrol the area and enforce these regulations. Outfitters have also noted the importance of ensuring that policies and regulations related to outfitting operations in Labrador (e.g., buffer areas between camps, and outfitter licencing and regulation) are strictly enforced.

Any adverse effect on fish stocks and the overall wilderness experience may also affect operations in the high-value, non-resident outfitting industry. The outfitter route is approximately 5 km from the closest outfitting camp. As noted previously, of the 19 outfitting camps, only five are more distant from the outfitter route than they were from the preferred route. The remaining 14 outfitting camps are at approximately the same distance from the outfitter route or closer than they were to the preferred route. Therefore, the potential effects on outfitting operations will likely be similar to those associated with the preferred route.

All of the outfitting operations are located beyond the 4-km zone of influence identified for noise. As well, the distance from the highway will limit direct effects from highway operation. However, the fishing locations associated with the operations maybe up to 5 to 10 kms away from the lodges. Therefore, there is potential for noise from highway use to be heard at fishing areas depending on the location of these fishing areas in relation to the highway. The improved access to the area provided by the highway, and associated increase in human presence and fishing activity in this previously remote area, will have implications for the outfitting industry. ATV and snowmobile use will mean that any increase in human presence and resource exploitation will likely not be confined to the immediate vicinity of the highway. The highway may detract from the wilderness character that forms the basis of the Labrador angling experience sought by many non-resident anglers. A decrease in fish stocks due to overfishing would adversely affect these operators. However, as discussed with respect to fishing activity, the fact that the outfitter route crosses the upper portion of the watershed rather than the lower portion of the rivers may act to limit effects on salmon populations. Increased human access will also increase the potential for vandalism at these camps.

In addition, the presence of a provincial highway through the area will reduce the need for non-resident anglers to retain the services of a licenced guide, as non-residents are permitted to fish unaccompanied on unscheduled waters within 800 m of any provincial highway. Highway access will also increase the potential for developing new lodges along the TLH - Phase III route, similar to that which has occurred along the Phase I portion of the TLH between Happy Valley-Goose Bay and Western Labrador and in the Labrador Straits. An increase in lodge development may cause further crowding on area rivers, resource depletion and competition. While the current freeze on the development of new lodges on Labrador rivers would act to limit the development of new outfitting operations, it would not preclude unlicenced and unregistered operations being established or carried out in the area after the highway is operational.

While forestry is not currently occurring along the outfitter route, it is considered to be the most likely resource use that could be initiated in the area as a result of the highway. With forest management planning efforts currently in place for the area south of Lake Melville (i.e., Forest Management District (FMD) 19A-S), the access to the area provided by the bridge on the Churchill River and the highway will facilitate the development of forestry operations in the area south of the river. The fact that FMD 19 contains Labrador's most productive forests, from a commercial perspective, also indicates that new forestry development is most likely to occur in this district. Expansion of forestry operations in this area will likely require development of forest access roads, resulting in a network of roads being built in the area. These access roads would also facilitate access to the area by other resource users, creating further opportunity for increased resource use and resulting in further pressure on resources and effects on other resource users. Also, any negative effects of forestry operations on wildlife or fish would also indirectly affect resource users. As well, a growing network of forest access roads will have implications for the aesthetic and wilderness character of the area, with subsequent implications for resource users. These potential effects would be the same for either the preferred or outfitter route as the area of greatest interest for forestry operations is common to both routes.

Similarly, mineral exploration may be facilitated by the highway and any forest access roads built in the area. Again, increasing use of the area and potential interaction with other resource users may result from mineral exploration activities or any subsequent mining developments (pending discovery of any economically viable mineral prospects).

While the Cartwright and Paradise River area has potential for additional forestry development, the potential is not considered to be as great as that in the Lake Melville area. However, overall growth in Labrador's forestry industry will stimulate the development of further forestry activity in other areas. Domestic timber harvesting will likely continue to be focused around communities and cabin areas as resource users will not likely travel long distances to obtain wood for fuel or house/cabin construction. It is also expected that there may be some increase in domestic timber harvesting as people will have access to areas of good timber supply. However, as noted, cutting is not permitted within 100 m of a road.

As noted, the outfitter route does not pass through any existing parks in Central or Southern Labrador. However, it does pass through the study area for the Akamiuapishku/Mealy Mountains National Park, which is considered in detail in Section 7.13, and passes just to the southeast of IBP Site 53 (Eagle River Headwaters). Project operation is not likely to result in significant adverse environmental effects that will preclude establishment of the Akamiuapishku/Mealy Mountains National Park (Section 7.13.8.2). The fact that the outfitter route does not pass through IBP Site 53 indicates that it will not be directly affected by highway operations. Also, the fact that it is located within the proposed national park study area means that the area would be subject to any measures imposed for the national park. The proposed highway also does not intersect or pass in close proximity to existing snowmobile trails in the area. However, as noted, the highway will facilitate access for snowmobile use in the area, resulting in potential increased use of the area during the winter.

With approximately 119 km of the outfitter route lying within DND's LLTA, highway operation will overlap with DND low-level flight training activities (April to October). The PTA is located approximately 120 km south of Happy Valley-Goose Bay, and approximately 84 km southwest of the TLH - Phase III route, so there is no interaction with highway operation.

7.12.8.3 Accidental and/or Unplanned Events

A forest fire could destroy wildlife and habitat, forests, cabins, outfitter operations and other natural or human-made aspects important to resource use and users. In addition, a forest fire would have a negative effect on the aesthetic quality of the affected area, reducing its appeal to some resource users. While the potential for a forest fire occurring as a result of the project is low, the magnitude and extent of any forest fire that might occur is not known.

A spill of fuel or other hazardous material into waterbodies could affect water quality, aquatic life and wildlife resources, causing indirect effects on resource use and users. Resource use and users may be affected by any real or perceived decrease in the availability or quality of these resources. However, any such event that would arise from a highway accident or leak from equipment would be relatively small and localized.

Vehicle accidents or highway failure could also restrict or delay resource use activities. Mortality to wildlife species due to collisions with vehicles could affect resource availability. However, the volume of traffic anticipated to occur on the proposed highway is relatively low; therefore, it is likely that the number of vehicle/wildlife collisions will also be low.

With implementation of environmental protection planning, the potential for such accidental events occurring is extremely low. If such an accident should occur, the significance of its potential effects will depend on the location and timing of the event and its nature and magnitude. WST's contingency planning and emergency response plans will ensure that any adverse effects are reduced during construction.

7.12.9 Environmental Effects Evaluation

Residual environmental effects are those effects remaining after all appropriate mitigation measures have been applied. The following definitions are used to rate the significance of the predicted residual environmental effects of the project on resource use and users:

A **major (significant) environmental effect** to resource use and users is one affecting an entire definable group of people in such a way as to cause disturbance of established activity patterns (related to reduced opportunities for resource use and users) that will not return to pre-project patterns within several generations.

A **moderate (significant) environmental effect** to resource use and users is one affecting a definable group of people in such a way as to cause disturbance of established activity patterns for one or two generations.

A **minor (not significant) environmental effect** to resource use and users is one of short-term duration affecting a specific group of people in a localized area.

A **negligible (not significant) environmental effect** to resource use and users is one occurring in a localized area and in a manner similar to short-term random changes due to natural irregularities.

The environmental effects of the project on resource use and users due to project construction, operation and accidental events associated with the outfitter route are summarized in Table 7.52, as are the mitigative measures designed to minimize effects. Ratings for the established environmental effects evaluation criteria are also presented ion Table 7.52.

Table 7.52 Environmental Effects Summary - Resource Use and Users

	Construction	Operation	Accidental/Unplanned Events
Mitigation: • committing to meeting relevant terms and conditions of an Innu land claim settlement; • implementing the environmental protection measures for construction and operation, including contingency and emergency response measures, identified in Section 3.9.3; • complying with relevant WST Specifications (Appendix D of JW/IELP (2003a)), and relevant provincial and federal legislation and regulations (Table 3.1) when carrying out construction and operation activities; • prohibiting harassment and feeding of wildlife during construction; • requiring that all hunting, fishing or trapping activities by project personnel be carried out according to applicable legislation; • maintaining buffer zones around all watercourses and waterbodies, where possible; • minimizing the area disturbed by the project (i.e., limiting vegetation clearing to 30 m); • requiring construction vehicles to remain in the right-of-way and all-terrain vehicles to use designated routes that avoid wetland areas, where possible; • properly storing and disposing of waste from construction camps and maintenance depots, as approved by regulatory agencies; • notifying Innu Nation, commercial operators (e.g., outfitters) and other resource users about planned project activities; and • implementing mitigation measures for wildlife, fish, the proposed Akamiuapishku/Mealy Mountains National Park, and tourism and recreation.			
Environmental Effects Criteria Ratings			
Magnitude	Low	Medium	Unknown
Geographic Extent	11 to 100 km^2	1,001 to 10,000 km^2	Unknown
Frequency	Continuous	Continuous	<10
Duration	37-72	>72	<1
Reversibility	Reversible	Irreversible	Unknown
Ecological/Socio-economic Context	Low/May be affected by effects on wildlife, fish and fish habitat, water resources, national park, tourism and recreation, employment and business, and community life.		
Environmental Effects Evaluation			
Significance	Not Significant (Minor)	Not Significant (Minor)	Not Significant to Significant (Minor to Major)
Level of Confidence	High	Medium	High
Likelihood[1]	n/a	n/a	Low
Sustainable Use of Resources[1]	n/a	n/a	n/a
[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994).			
Environmental Monitoring and Follow-up: • 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.			
Key:			
Magnitude:	High, Medium, Low, Nil or Unknown		
Geographic Extent (km^2):	<1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown		
Frequency (events/year):	<10, 11-50, 51-100, 101-200, >200, Continuous or Unknown		
Duration (months):	<1, 1-12, 13-36, 37-72, >72 or Unknown		
Reversibility:	Reversible, Irreversible or Unknown		
Context:	Existing Disturbance (High, Medium, Low, Nil or Unknown)		
Significance:	Significant, Not Significant		
Level of Confidence:	High, Medium, Low		
Likelihood:	High, Medium, Low or Unknown		
Sustainable Use of Resources:	High, Medium, Low or Unknown		

The environmental effects associated with construction of the outfitter route primarily relate to physical disturbance (e.g., vegetation removal along the right-of-way, excavations and laying subgrade material, and temporary construction camps, laydown areas and borrow pits being established), noise, dust, increased human presence and other disturbances associated with construction activities. Starting during construction, but most evident during operation, are the induced effects resulting from improved access provided by the highway. While the increased opportunity for resource use activities due to the improved access provided by the highway may be a positive effect for some resource users (i.e., they will now have easier access to a large area in which to carry out various resource use activities), for other users increased use of the area will be an adverse effect (i.e., their activities may be restricted or altered or the overall wilderness experience may be compromised). For example, induced activity during operation may adversely affect existing cabin owners, and commercial (outfitting operations) and recreational fishing activity.

The environmental effects evaluation focuses on the potential adverse effects associated with the project. The potential adverse environmental effects of highway construction are rated as minor (not significant), meaning that any effects on resource use and users will be of short-term duration and affect a specific group of people in a localized area. Potential adverse environmental effects of highway operation are also rated as minor (not significant); however, the magnitude of such effects are likely to be higher, irreversible and extend over a larger area. Effects associated with any accidental or unplanned events are rated from minor (not significant) to major (significant), because the magnitude and geographic extent of an accidental event is unknown and established activities may not return to pre-project patterns within several generations.

7.12.10 Cumulative Environmental Effects

Several ongoing and potential projects and activities may accumulate and/or interact with those of the TLH - Phase III to result in cumulative environmental effects on resource use and users. These existing, planned or potential projects and activities are described in Section 6.5. Consideration of these projects and activities assumes appropriate planning and management are in place and regulatory requirements and mitigation measures are fulfilled.

The existing sections of the TLH (Phases I and II) will influence the nature of the effects of the proposed project on resource use and users. Not only will the TLH - Phase III provide year-round access to a previously remote area, but through connections with the Phase I and II portions of the highway, the area will be open to residents from Western Labrador and Labrador Straits and visitors traveling the highway.

Resource use activities in the area have traditionally been limited due to the remoteness of the area. Improved access to, from and within the region as a result of the TLH - Phase III will likely provide new opportunities for development activities such as forestry, mineral exploration and possibly mining, as well as increased recreational resource harvesting, cabin development and other resource use activities. Each of these activities could, to varying degrees, affect resource use and users in the area and, when carried out in combination with the TLH - Phase III, could result in cumulative environmental effects.

Ongoing low-level military flight training, when combined with construction and operation of the TLH - Phase III, has implications for the wilderness character of the area which may affect some resource users and their activities. Similarly, hydroelectric power development at Gull Island, should it proceed, and associated transmission infrastructure in Labrador, will mean additional disturbance in the area and possible disruption of resource use and users.

The proposed Akamiuapishku/Mealy Mountains National Park may encompass a portion of the outfitter route. While a park may draw more users to the area, the creation of this park would also provide a greater level of protection for resources and bring with it a set of rules regarding resource use. Thus, the cumulative environmental effects of the TLH - Phase III in combination with a park may have both positive and negative effects on resource use and users. However, given the proximity of the outfitter route to the boundary of the park study area, it is likely that the final boundaries for the park will exclude the highway. In this case, the area immediately surrounding the highway would not benefit from the resource protection offered by a national park.

The likelihood, nature, location and timing of these potential induced actions and their potential environmental effects are not known at this stage. The control of most of these potential induced actions and their effects is beyond the responsibility of WST. Managing these actions and their effects will require the efforts of resource management and other relevant regulatory agencies to ensure that applicable legislation and regulations are in place and are adequately enforced, and that future projects and activities are undertaken in a responsible and sustainable manner. Therefore, assumptions have been made in 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;
- the level of 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.

With the implementation of appropriate planning and enforcement, the TLH - Phase III, in combination with other projects and activities that have been or will be carried out, is not likely to result in significant adverse cumulative environmental effects on resource use and users. As noted in Section 7.12.6, there are management and planning processes in place that offer a means for directing and controlling development and other activities along the highway. However, should the relevant government agencies not have adequate resources to fulfill enforcement requirements and should the level of adherence to regulatory requirements by resource users decline, then the resulting cumulative effects resulting from this would likely be adverse and significant.

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

- uncontrolled development activity and side roads being developed 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 the 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 various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate, and adaptive management approach may be appropriate. There may also be a need for agencies to increase their enforcement staff levels.

7.12.11 Environmental Monitoring and Follow-up

Measures designed to monitor project effects on biophysical resources also apply indirectly to resource use and users. Monitoring and addressing any changes in the distribution and intensity of resource use activities is the responsibility of the provincial and federal government departments and agencies that administer and manage these activities. WST will cooperate with such organizations by providing project-related information as required. Monitoring and careful planning on the part of these departments and agencies will ensure that issues can be identified and addressed in an effective and timely manner.

7.13 Akamiuapishku/Mealy Mountains National Park

The proposed Akamiuapishku/Mealy Mountains National Park is located in central Labrador. The study area for the proposed park encompasses approximately 21,500 km^2, extending from Lake Melville and Groswater Bay, south to the Eagle River and east from the Kenamu River to the coast of Labrador. The proposed outfitter route will cross along the southern boundary of the park study area (Figure 7.26).

7.13.1 Boundaries

The project boundary is the cleared right-of-way and areas of associated physical disturbance. Currently, the land under consideration for national park status is crown land under the jurisdiction of the Province of Newfoundland and Labrador. Should the proposed park be acclaimed, the land would fall under federal government jurisdiction and would be under the mandate of the Parks Canada Agency (Parks Canada) and subject to federal laws and regulations.

The study area for the Akamiuapishku/Mealy Mountains National Park is the basis on which the environmental effects analysis will be conducted. The area of the highway that affects the proposed national park is the area that encompasses the direct disturbance corridor of the highway and the areas affected by the increased human access to natural areas that the highway will provide.

7.13.2 Methods

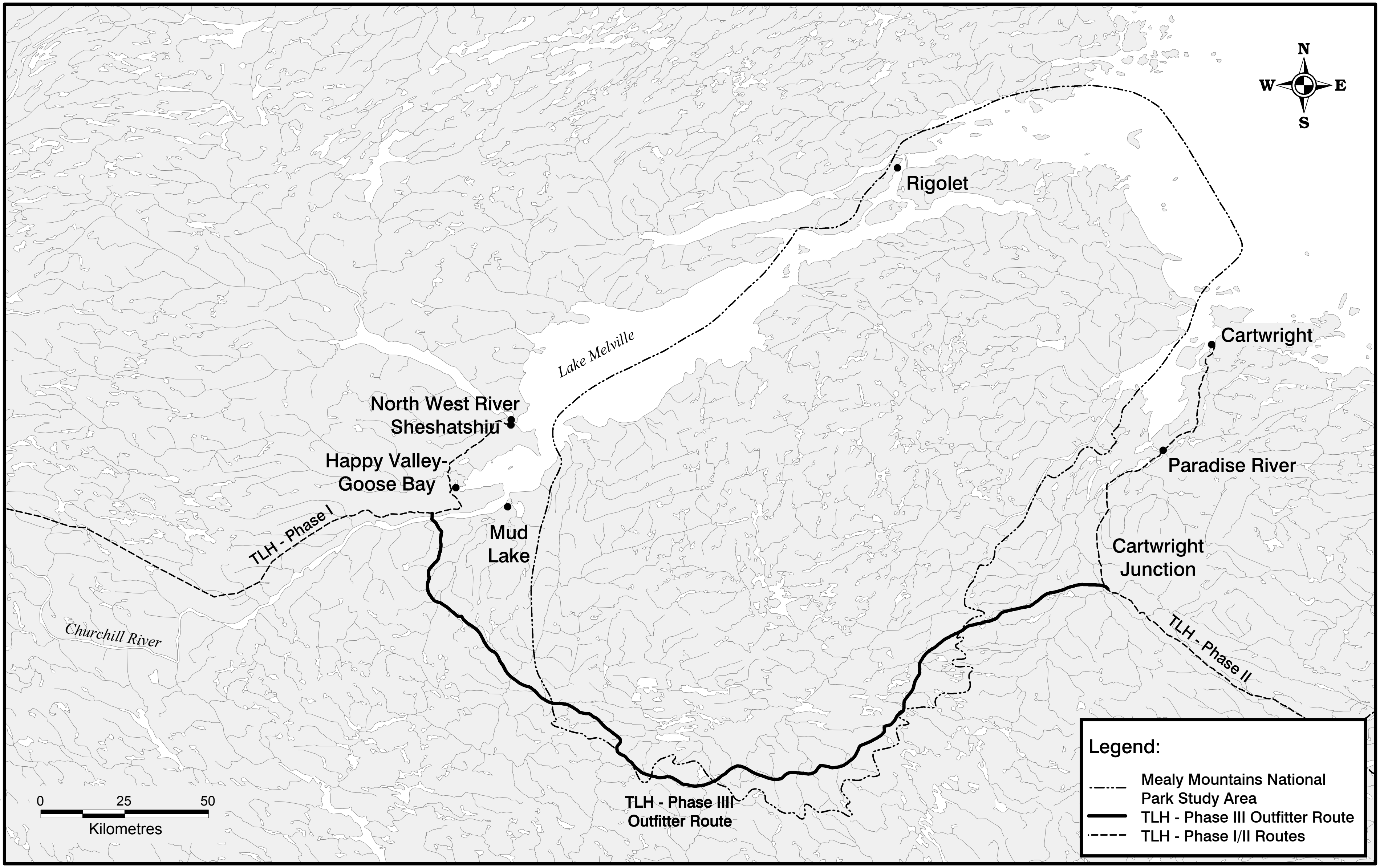
Information used in conducting the assessment of the Akamiuapishku/Mealy Mountains National Park include published reports and unpublished information from various public and private sector organizations. The environmental effects analysis is based on a review of existing information and an assessment of the degree to which the various phases and components of the project may affect the potential for establishment of a national park.

7.13.3 Existing Environment

7.13.3.1 History of the Proposed Akamiuapishku/Mealy Mountains National Park

The creation of a national park in the Mealy Mountains was first suggested in the early 1970s and the site was established as a preferred candidate in 1976. The project was put on hold in 1979 following public concern and opposition from Aboriginal groups. In 2000, the Government of Newfoundland and Labrador announced that federal and provincial governments and representatives of Labrador Aboriginal peoples would embark on a joint feasibility study to examine the potential impacts and benefits of establishing a national park in the Mealy Mountains (Government of Newfoundland and Labrador 2000).

A steering committee was put in place to lead public involvement and a public consultation process to determine whether or not a national park is feasible for the Mealy Mountains area.



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Jacques Whitford Environment Limited
Environmental Scientists
Consulting Engineers

Figure 7.26

Akamiuapishku/Mealy Mountains National Park Study Area

The goal of Parks Canada with respect to the proposed national park is to protect ecosystems and important landscape features while providing opportunities for enjoyment by humans. To accomplish this, it is understood that there will be some level of development within the national park (Blackmore 2001). Park boundary targets have not been defined. However, Parks Canada would like to see protection for river systems, wildlife, unique alpine vegetation and a large area of forest to allow the natural cycle of the forest to evolve without interference (Blackmore 2001).

7.13.3.2 Biophysical Environment of the Akamiuapishku/Mealy Mountains National Park Study Area

The Mealy Mountains represent an area of Arctic tundra surrounded by boreal forests and coastal seascapes and is within the home range of the threatened MMCH. The proposed park boundary would encompass five ecoregions, including Lake Melville, Kingurutik-Fraser River, Mecatina River, Eagle Plateau and Paradise River (ESWG 1996). The park is a candidate to represent Natural Region 21 - East Coast Boreal within the national parks system.

Refer to Section 6.13.3.2 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further discussion on the biophysical environment of the Akamiuapishku/Mealy Mountains National Park Study Area. Further discussion on elements of the biophysical environment of the Akamiuapishku/Mealy Mountains National Park study area is provided in Sections 4.1 to 4.3 and 7.1 to 7.10.

7.13.4 Potential Interactions

The potential interactions of the highway with the proposed Akamiuapishku/Mealy Mountains National Park would be disturbance of vegetation and wildlife in the area surrounding the highway right-of-way and enhanced human access to the southern portion of the proposed park.

7.13.5 Issues and Concerns

Issues and concerns relating to the proposed Akamiuapishku/Mealy Mountains National Park and the proposed highway include:

- potential for degradation of the ecological integrity of various ecosystems through fragmentation or invasion of exotic species or pollution as a result of highway construction and operation; and
- disturbance to wildlife populations and their habitat within the proposed park through increased human access and activity as a result of the highway.

7.13.6 Existing Knowledge

In recent years, Parks Canada's mandate has evolved from primarily providing worthwhile visitor experiences to a position where there is a greater concern for ecological integrity. Subsequently, human use of national parks has become the secondary consideration and ecological integrity has come to the forefront when developing park management plans.

Prior to the 1970s, most national parks established in Canada were located in relatively populated areas in the south. In the last 30 years, numerous parks have been established in the Canadian north, most in areas of little or no development (i.e., Aulavik in 1992, Auyuittuq in 1993). Kluane National Park in the Yukon was established in 1972 and is an example of a National Park that has highways (Alaska Highway and the Haines Road) as boundaries. In contrast, Banff National Park, established in 1885, has towns, highway, railway, trail and other facility developments in the area (Green et al. 1996, cited in Pacas 1997).

Ecological integrity is the capability of an area to maintain ecological processes and species, and to withstand changes and stresses (NRC 1998). Placing boundaries around an area will not ensure ecological integrity if human activities are not controlled. For example, the introduction of exotic species can have a profound effect on the ecological integrity of an area (NRC 1998).

In general, large and mid-size mammals that are otherwise protected within a national park may be at increased risk of mortality through vehicle collisions when roads are situated within park boundaries. A road density of approximately 0.6 km/km^2 appears to be the maximum to maintain a naturally functioning landscape that supports viable populations of large predators such as wolves (Forman and Alexander 1998). Further discussion on the potential for direct mortality of various species groups through vehicle collisions is provided in Sections 7.1 (Raptors), 7.2 (Waterfowl), 7.3 (Caribou) and 7.4 (Furbearers).

Maintenance of ecological integrity in a protected area such as a national park can be achieved through complete protection from all human activity. However, complete protection of a large area is often not practical due to competing land uses or the desire to meet tourism and recreation objectives (NRC 1998). Another way to preserve ecological integrity is to define an area that is divided into zones with varying levels of protection (i.e., a central or core zone of complete protection surrounded by a series of zones with decreasing levels of protection). These zones would be administered through management plans that would also outline controlled (or no) development policies along an existing road corridor.

Refer to Section 6.13.6 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for further discussion on existing knowledge related to national parks.

7.13.7 Mitigation

Mitigation measures that could be applied to limit the effects of a highway on the ecological integrity of the proposed Akamiuapishku/Mealy Mountains National Park include:

- no harassment or feeding of wildlife by project personnel;
- 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 all-terrain vehicles will use designated routes that avoid wetland areas; and
- design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.

7.13.8 Environmental Effects Assessment

7.13.8.1 Construction

Construction of the outfitter route will result in removal or alteration of vegetation in a linear east-west orientation through the southern edge of the Akamiuapishku/Mealy Mountains National Park Study Area. The amount of forest vegetation that will be removed within the Akamiuapishku/Mealy Mountains National Park study area as a result of highway construction along the outfitter route is approximately 227 ha. The amount of unforested area that will be removed is approximately 140 ha. For comparison, approximately 397 ha of forested and approximately 30 ha of wetland or otherwise unforested area will be removed along the preferred route. However, the vegetation types that will be affected by construction along either route are not considered unique within the region, and are well represented in the surrounding area.

Species may avoid habitat in close proximity to construction areas; however, this avoidance will be temporary, lasting for one construction season or less in any one area.

7.13.8.2 Operation

Determining the ecological integrity of an area is difficult as it cannot be measured directly; rather, it must be measured using indicators at various scales. Highway access and road density can provide an indicator of human access to a large area, while the status and population trend of a particular species can be an indicator of the viability of an ecosystem at a regional or site-specific scale (NRC 1998). It is generally accepted that road density is a key predictor that can be used to estimate the effects of disturbance and habitat fragmentation. In the Akamiuapishku/Mealy Mountains National Park study area, the proposed highway will be the only existing road; therefore, the effects of the 30-m wide corridor on fragmentation of forest or wetland habitat will be restricted to the local area. As well, the area is a natural mosiac of forested and non-forested patches and the species living in the area are adapted to this variable pattern of vegetation distribution.

Within a protected area, management of human activities is an important facet of protecting and maintaining ecological integrity. Under *Parks Canada's Guiding Principles and Operational Policies*, ecological integrity is one of the factors considered in the selection of national parks, and management plans for each park must specify the types of resource protection and management needed to maintain that integrity (NRC 1998).

No additional habitat will be removed or altered as a result of highway operation and no chemicals deleterious to vegetation or water quality will be used during highway maintenance. As well, the highway will be a two-lane gravel road with relatively low traffic levels expected. The highway itself is likely to have only a minimal effect on the ecological integrity of the proposed Akamiuapishku/Mealy Mountains National Park. The potential for degradation of the ecological integrity of the park will arise from human access and subsequent use of lands surrounding the highway corridor. Establishment of stringent development restrictions by Parks Canada along the portion of the highway within the Akamiuapishku/Mealy Mountains National Park study area, and development and implementation of park-specific management plans that define the limits of human activity within the national park, will be required to minimize these effects.

7.13.8.3 Accidental and/or Unplanned Events

An accidental spill of fuel or other hazardous materials into waterbodies or in riparian zones in the project area could cause mortality to wildlife or result in reduced foraging opportunities that influence survival and reproductive success. However, any such event that would arise from a highway accident or leak from equipment would be relatively small and localized.

A forest fire could destroy habitat for a variety of species and may actually cause changes in vegetation succession such that forest regeneration may not occur in some areas following fire. A large fire may destroy hundreds of hectares of vegetation, which could result in a decrease in densities of certain species within the region affected. However, boreal flora and fauna have adapted to a cycle of naturally-occurring fires and the proportion of a population affected during any one fire would be small. Wetland habitats are less susceptible to fire due to the moisture regime.

With implementation of environmental protection planning, the potential for such accidental events occurring is extremely low. If such an accident should occur, the significance of its potential effects will be dependent upon the location and timing of the event and its nature and magnitude. WST's contingency planning and emergency response plans will ensure that any adverse are reduced during construction.

Mortality to wildlife species may occur through collisions with vehicles and studies have shown that such mortality is influenced by the number of vehicles that travel the highway daily. The volume of traffic anticipated to occur on the proposed highway is relatively low; therefore, it is likely that the number of vehicle/wildlife collisions will also be low.

7.13.9 Environmental Effects Evaluation

The key potential interactions between project activities and maintenance of the ecological integrity of the Akamiuapishku/Mealy Mountains National Park Study Area include habitat loss or alteration from highway construction and increased human access and development activities as a result of the highway. The following definitions are used to rate the significance of the predicted residual environmental effects of the project on the ecological integrity of the Akamiuapishku/Mealy Mountains National Park study area:

A **significant environmental effect** is one affecting the ecological integrity of the Akamiuapishku/Mealy Mountains National Park Study area in such a way as to preclude selection of the area as a National Park based on *Parks Canada Guiding Principles and Operational Policies*.

A **not significant environmental effect** is one affecting the ecological integrity of the Akamiuapishku/Mealy Mountains National Park Study area in such a way as to not preclude selection of the area as a National Park based on *Parks Canada Guiding Principles and Operational Policies*.

The proposed highway is a linear development that will have relatively low levels of traffic due to its location and the low human population of Labrador. The environmental effects will be restricted to removal of habitat in the immediate highway corridor and the indirect effect of improved access to areas along the highway. Based on the preceding discussion and proposed mitigations, the residual effects of the project on the Proposed Akamiuapishku/Mealy Mountains National Park Study Area are assessed to be not significant for construction, operation, and accidental events (Table 7.53). Overall, the project is not likely to result in significant adverse environmental effects that will preclude establishment of the Akamiuapishku/Mealy Mountains National Park.

Table 7.53 Environmental Effects Summary - Akamiuapishku/Mealy Mountains National Park

	Construction	**Operation**	**Accidental/Unplanned Events**
Mitigation: • 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 all-terrain vehicles will use designated routes that avoid wetland areas; and • design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.			
Environmental Effects Criteria Ratings			
Magnitude	Low	Low	Low
Geographic Extent	<1 km^2	1 to 10 km^2	100 km^2
Frequency	Continuous	Continuous	<10
Duration	37-72	>72	>72
Reversibility	Irreversible	Irreversible	Unknown
Ecological/Socio-economic Context	Low/May be affected by land and resource use.		
Environmental Effects Evaluation			
Significance	Not Significant	Not Significant	Not Significant
Level of Confidence	High	High	High
Likelihood[1]	n/a	n/a	n/a
Sustainable Use of Resources[1]			
[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994).			
Environmental Monitoring and Follow-up: • Monitoring for biophysical resources will indirectly maintain ecological integrity. • WST will cooperate, by providing project-related information to government departments and agencies responsible for managing biophysical resources and resource use activity.			
Key: Magnitude: High, Medium, Low, Nil or Unknown Geographic Extent (km^2): <1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown Frequency (events/year): <10, 11-50, 51-100, 101-200, >200, Continuous or Unknown Duration (months): <1, 1-12, 13-36, 37-72, >72 or Unknown Reversibility: Reversible, Irreversible or Unknown Context: Existing Disturbance (High, Medium, Low, Nil or Unknown) Significance: Significant, Not Significant Level of Confidence: High, Medium, Low Likelihood: High, Medium, Low or Unknown Sustainable Use of Resources: High, Medium, Low or Unknown			

7.13.10 Cumulative Environmental Effects

With the exception of recreational and subsistence resource harvesting activities such as hunting, trapping and angling, human activity within the Akamiuapishku/Mealy Mountains National Park study area has been relatively limited. Snowmobile trails and traffic also cross portions of the park study area, and provide access to parts of the region. Low-level flying of military aircraft has been occurring in the general region since the 1980s. However, the Akamiuapishku/Mealy Mountains National Park study area is located outside of the training area. Therefore, for the most part, the region represents a relatively pristine environment at present. Other past, ongoing and potential future development activities in Labrador, such as the Voisey's Bay Mine/Mill and potential hydroelectric development, have and will affect the natural and socio-economic environment of Labrador, although there is limited potential for direct interaction with the Akamiuapishku/Mealy Mountains National Park study area.

In terms of future projects and activities, the most important development activity that may occur following highway construction is commercial forestry. Other land and resource activities, such as mineral exploration, hunting, angling and cabin development, may also increase due to enhanced access provided by the proposed highway. Therefore, each of these activities can result in effects to the natural and socio-economic environments that may result in cumulative environmental effects in combination with the proposed highway and each other. However, as discussed previously, legislation and regulations are in place to control these projects and activities and their potential environmental effects. Appropriate enforcement, management and planning on the part of relevant regulatory agencies will ensure that any such effects are avoided or reduced.

The significance criteria for this VEC is whether the presence of the highway would affect the ecological integrity of the park study area in such as way as to preclude its designation as a national park. As effects of inadequate management and planning on certain components of the environment that contribute to the ecological integrity of the Akamiuapishku/Mealy Mountains National Park study area have been assessed to be moderate (significant) (i.e., raptors, waterfowl, furbearers, species at risk) or major (significant) (i.e., MMCH), inadequate management and planning following road construction would result in significant cumulative environmental effects resulting from the unregulated activities on the ecological integrity of the Akamiuapishku/Mealy Mountains National Park study area.

The establishment of the Akamiuapishku/Mealy Mountains National Park itself would be an important means of addressing the potential environmental effects of future development activity in the region. Development activities and human access would be controlled through management plans and park regulations that would define the acceptable levels of activity within the park. Following highway construction, and prior to establishment of the park, development controls would be required to ensure that the ecological integrity of the Akamiuapishku/Mealy Mountains National Park study area is not compromised.

The various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate. There may also be a need for agencies to increase their enforcement staff levels.

7.13.11 Environmental Monitoring and Follow-up

Monitoring for biophysical resources such as active osprey nests and beaver ponds and fish resources will assist in maintaining the ecological integrity of the Akamiuapishku/Mealy Mountains National Park. WST will provide monitoring information to government departments and agencies responsible for managing such resources.

7.14 Tourism and Recreation

Tourism and recreation are an integral part of the economy of Labrador, and the lifestyle of its residents. The following sections provide an overview of existing and potential tourism and recreational activities, services and infrastructure, as well as the potential effects of the project on these components. Given the "regional" nature of this VEC, most of the information and findings are essentially unchanged from that provided in the TLH - Phase III EIS/CSR (JW/IELP 2003a) including the existing environment and the potential effects of the project on tourism and recreation.

7.14.1 Boundaries

Project, socio-economic and administrative boundaries related to this VEC are described in Section 6.14.1 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). As in this previous assessment, the environmental effects analysis for tourism and recreation focuses on Central and Southern Labrador (Figure 3.2), as the highway will pass directly through these regions. It also includes consideration of the other regions of Labrador, Labrador as a whole, the island of Newfoundland, and other areas, as applicable.

7.14.2 Methods

Information used in conducting the assessment for tourism and recreation include published reports, unpublished information from various public and private sector organizations, information gathered through interviews with government officials and tourism operators and the Tourism and Recreation Component Study (JW 2003b). The environmental effects analysis is based on a review of existing and potential tourism activity and infrastructure, and an assessment of the degree to which the various phases and components of the project may affect these activities and facilities.

7.14.3 Existing Environment

Information on tourism and recreation in both Southern and Central Labrador and elsewhere in Labrador and the province as a whole is provided in the TLH - Phase III EIS/CSR (JW/IELP 2003a). This includes information on:

- recreational fishing and hunting;
- natural areas and activities;
- cultural attractions and events; and
- tourism-related services (transportation, accommodations, restaurants and craft shops).

This information is equally applicable to the environmental effects analysis for the outfitter route.

Section 6.14.3.4 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) describes a proposed reconfiguration of the Labrador coastal marine service, which was announced in March 2002 as a result of the near completion of the TLH - Phase II. This included the closure of the existing marine terminal at Lewisporte, with Cartwright becoming the southernmost terminal on the shipping route.

On July 22, 2003, WST announced that marine service between the Island of Newfoundland and Northern Labrador would be maintained. The *MV Trans Gulf* will depart Lewisporte approximately every two weeks, and will stop in Cartwright in order to load freight destined for the communities of Black Tickle, Rigolet, Makkovik, Postville, Hopedale, Natuashish and Nain. This was implemented as an interim measure, while alternative transportation modes are evaluated and new supplier links developed in relation to the road transportation network. The *MV Sir Robert Bond* will continue to make three rounds trips weekly between Cartwright and Goose Bay, and the *MV Northern Ranger* will continue to make a weekly round trip between Cartwright, Black Tickle, Goose Bay and ports north to Nain.

As noted in the TLH - Phase III EIS/CSR (JW/IELP 2003a), changes to Southern Labrador's marine and air traffic services and infrastructure and any related socio-economic effects will occur whether or not the TLH - Phase III is constructed. The nature of any such changes and their potential effects will not be influenced by the eventual routing of the TLH - Phase III.

7.14.4 Potential Interactions

Potential interactions between the project and tourism and recreation activity are the same for both the preferred and outfitter routes, and include:

- access to some areas and attractions may be restricted during construction activities. The noise, dust and human presence associated with construction activities may affect the aesthetic quality of an area;
- the use of existing services and infrastructure by construction personnel could also affect their use by tourists, especially as construction will coincide with peak tourism periods;
- once operational, highways increase the mobility of local residents, as well as increasing visitation by non-resident tourists. The highway will provide improved access to existing tourism services and facilities, and may increase the viability of developing additional attractions and facilities;
- improved access may also have adverse effects those aspects of the tourism industry which depend on the remoteness and pristine nature of the Labrador wilderness;
- any effects to fish and wildlife may indirectly affect the outfitters and other establishments that depend upon these resources; and
- tourism and recreation may also be affected in the case of an accidental event, such as a forest fire, or a fuel or chemical spill.

The effects of highway operation can therefore vary considerably between different aspects of the tourism industry.

7.14.5 Issues and Concerns

Issues and raised by local individuals and groups during the environmental assessment are outlined in Section 6.14.5 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). A summary of key points is provided below:

- degradation of the pristine nature of the Labrador wilderness (real and perceived);
- improved access to fish, wildlife and forest resources, which may result in their depletion;
- proximity to existing outfitting camps and the Upper Eagle River Watershed;
- improved access to inland waterways through snowmobile and ATV use;

- the potential for snowmobile and ATV trails extending from the highway;
- increased cabin development;
- influx of anglers from elsewhere once the highway is completed;
- questions regarding the effectiveness of fishing and hunting regulations, and required policies for increased protection;
- overcrowding and congestion in key recreational areas due to improved access;
- increased vandalism of outfitting camps;
- increase in unlicenced outfitting and guiding operations;
- littering along the highway, and the difficulty of controlling it;
- potential opportunities for tourism once the highway is completed;
- adequate maintenance once the highway is operational;
- the identification and development of roadside pull-offs (for safety and scenic purposes);
- a perceived lack of readiness to take advantage of highway-related opportunities; and
- the potential for some communities to be by-passed once the highway is complete.

Again, the public information sessions and interviews conducted as part of the environmental assessment revealed that many people recognize the positive effects which the highway may have on tourism. However, some tourism operators and local residents expressed concern that the highway project would negatively affect some tourism operations, particularly the existing outfitting camps located in close proximity to the highway.

7.14.6 Existing Knowledge

An overview of existing knowledge regarding the potential effects of highway projects on tourism and recreation (particularly those in relatively remote areas) is provided in Section 6.14.6 of the TLH - Phase III EIS/CSR (JW/IELP 2003a), based on a review of the relevant literature, as well as the experience of the TLH (Phase II) and the Labrador Straits Highway. Key points include:

- recreational fishing is currently an integral component of Labrador's tourism industry, and surveys indicate that Labrador's "clean and unspoiled environment" is a key aspect of this;
- many Labrador outfitters reportedly feel that improved access would be an impediment to their business;
- the Labrador Straits region saw an influx of anglers from the island of Newfoundland when fishers in Labrador were allowed to retain one large salmon, resulting in overcrowding. This eventually resulted in a requirement to implement similar fish quotas and retention regulations for both Newfoundland and the Labrador Straits;
- similarly, a number of previously unscheduled rivers in Southern Labrador were scheduled and given Class III designations in 2001, in order to address the expected influx of anglers as a result of the TLH - Phase II; and.
- the Labrador Straits highway has also been a key factor in the development of that region's very successful tourism industry.

7.14.7 Mitigation

Measures designed to mitigate effects on fish and wildlife resources (Sections 7.1 to 7.6) will also help to reduce or eliminate indirect effects on the tourism operations which depend on these resources.

Specific mitigation measures related to tourism and recreation (which are applicable to both the preferred and outfitter routes) include:

- 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; and
- contingency plans and response measures will be in place for handling any spills of fuel or other hazardous materials.

As indicated above, many of the potential adverse effects of the project on tourism and recreation stem from the improved access provided by the highway, and the associated increase in human presence and activities in this previously remote area. Managing these actions and their potential effects will require the efforts of regulatory and resource management agencies, in order to ensure that applicable legislation and regulations are adequately enforced, and that future activities are undertaken in a responsible and sustainable manner. In this regard, the purpose of the environmental assessment is to identify these potential issues well in advance of their occurrence, so that appropriate measures can be identified and implemented by the appropriate agencies in an effective and timely manner.

Recent changes to recreational fishing regulations in Southern Labrador by DFO to reduce the potential effects of increased angling in that region following completion of the TLH - Phase II are an example of such measures. During the course of this environmental assessment, a number of stakeholders commented on the importance of revising existing regulations and policies, and careful planning on the part of resource management agencies. These stakeholders also gave specific examples of potential measures, such as changes to fish retention limits, and designating certain lakes and streams as hook and release only.

Many also indicated that the establishment of the Akamiuapishku/Mealy Mountains National Park would be an important means of protecting and preserving the area's natural environment, and its existing tourism industry. It was noted that development controls within the park, as well as restrictions regarding resource harvesting, ATV and snowmobile use, would serve to alleviate many of these potential effects. Stakeholders also commented that it will be important that the Upper Eagle River be included within the park boundaries, and that the existing outfitters be "grand fathered" into final park planning and permitted to continue their operations. It was also noted that the designation of the Eagle River under the Canadian Heritage Rivers System would be a possible means of protecting the river.

In terms of the potential positive effects of the project on tourism, it is the responsibility of local individuals and businesses to identify and respond to the tourism opportunities generated by the project in an effective and timely manner. The ability of local business groups, development organizations and relevant government agencies to identify these opportunities, and to assist local individuals and firms in responding to them, will also affect the level of success achieved in this area.

7.14.8 Environmental Effects Assessment

7.14.8.1 Construction

The potential effects of the construction of the outfitter route on tourism and recreation are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The following provide a summary of these predicted effects; a more detailed analysis is provided in Section 6.14.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a).

Construction activities will result in disturbance, such as noise and dust, increased human presence and landscape changes. The pristine nature and remoteness of the Labrador forms the basis of much of the existing tourism and recreation industry in Southern and Central Labrador. Although there is potential for some minor interference with tourism and recreation activities, any such effects will likely be localized and of short-term duration. Given the vastness of the region, and the relatively small area which will be under construction at any one time, no measurable decrease in these activities is anticipated.

Road construction will not likely interfere directly with other types of tourism and recreation activity in Central and Southern Labrador. There is relatively limited activity along the proposed highway at present. The highway (either route) does not intersect or pass in close proximity to the existing snowmobile trails.

The use of existing transportation services to move construction personnel, equipment and materials, could disrupt tourist travel to and within the area, particularly since the construction periods will coincide with the main tourism season (i.e., the summer months). The overall use of these transportation services for construction is, however, expected to be low. Scheduling the movement of equipment and materials to non-peak travel periods where possible will further minimize or eliminate any conflict with other users, including tourists.

It is expected that much of the construction labour force will be comprised of local residents, which will minimize project-related demand for local accommodations (and, thus, effects to their use by tourists). Any demands by non-resident personnel will occur primarily in the early stages of construction, and decrease as work progresses (as construction camps are established to house workers). The use of local retail outlets and food establishments by construction workers would also benefit the area's economy (Section 6.15).

7.14.8.2 Operation

The potential effects of the operation of the outfitter route on tourism and recreation are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred route.

Recreational Fishing and Outfitters

Angling activity will likely increase considerably when the highway is operational, due to improved access to previously remote rivers and waterbodies (Section 7.12.7). This will be a positive effect for the recreational fishery in general, at least in the short-term, as it will provide better angling opportunities throughout the region. The highway will result in an increase in human presence and resource exploitation throughout the area, including lakes and streams along and directly adjacent to the highway route, as well as those further inland through snowmobile and ATV use.

Angler overcrowding along some high quality rivers and ponds may also result, although the size of the area and the number of fishing areas available will minimize the potential for such congestion. Of primary concern is that the improved access may lead to the depletion of fish stocks through overfishing (both legal and illegal). Any decrease in the quality of the angling experience will have a detrimental effect on the recreational fishery, including commercial outfitters in the area.

The highway will not come in direct contact with the existing commercial outfitters and their operations. The following provides a comparison of the proximity of both highway routes to the commercial outfitting camps in the area. The preferred route is approximately 8 km from the closest outfitting camp (Crooks Lake), and comes within approximately 10 to 15 km of three others (see Table 6.59 and Figure 6.37 in TLH - Phase III EIS/CSR (JW/IELP 2003a). The outfitter route comes within approximately 5 km of the closest camp (at Osprey Lake), and within approximately 10 to 15 km of three others (Figure 2.2).

The outfitter route differs from the preferred route only along the central portion of the route, and therefore does not affect the proximity to camps along the lower portion of the Eagle River and in the southwestern portion of the region (i.e., in the Minipi River area). Although the outfitter route increases the distance from the highway and four camps (Parke Lake, Igloo Lake, Crooks Lake and Upper Eagle River) it increases the proximity to within 15 km for four others, including coming within approximately 5 km of one camp.

Potential effects from highway construction on outfitting operations are likely to be similar to those predicted for the preferred route, as only five of the outfitting camps are more distant from the outfitter route than they were from the preferred route. The remainder are either the same distance from the highway route or closer to the route. The potential effects of the highway on outfitting operations relate primarily to the access provided by the project, and the associated increase in human presence and angling activity in this previously remote area.

The highway will reduce the perceived aesthetic quality of the area through the presence of the highway itself, as well as any noise, dust and litter associated with its use.

The likely increase in fishing effort will necessitate increased enforcement and management. This may include changes to existing regulations and policies, and more fisheries officers (see Section 6.12.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) for a detailed discussion).

The proposed Akamiuapishku/Mealy Mountains National Park would also help to protect and preserve the area's natural environment and resources, and its existing tourism industry. Other potential measures suggested by stakeholders include the possibility of including the Upper Eagle River within the park boundaries, having existing outfitters be "grand fathered" into final park planning and permitted to continue their operations, and the possible designation of the Eagle River as a Canadian Heritage River. These are equally applicable to either highway route.

Other Tourism Attractions and Services

Once operational, the highway will alter the spatial and temporal patterns of transportation in Labrador, with implications for the tourism industry. Although there are no communities located along the highway route itself, it will provide year-round road access between Southern and Central Labrador and to and from other parts of Labrador, Newfoundland and mainland Canada and beyond.

The completion of the TLH - Phase III will likely bring about an overall increase in visitation to Labrador, as visitors will be able to take travel to these areas and continue on without having to "retrace their steps". An increase in resident and non-resident tourist travel throughout these regions of Labrador will increase the use of existing tourist attractions and related services (such as accommodations, restaurants and craft shops), as well as increasing the feasibility of developing new tourism sites and activities. These positive effects will occur primarily in Southern and Central Labrador, but the tourism industries of the Labrador Straits and Western Labrador will also benefit from tourists "passing through" these regions.

Concern has also been raised that visitation to some communities may decrease once the highway is complete, as visitors will be able to travel directly to larger communities (such as Happy Valley-Goose Bay) or certain areas, thereby bypassing some completely. However, this is not likely to be an issue for either highway route, given the distances and routes involved. A detailed discussion is provided in Section 6.14.8.2 of the TLH - Phase III EIS/CSR (JW/IELP 2003a).

Effects (or more correctly, the lack of such effects) will be the same for both the preferred and outfitter routes, except that the outfitter route would increase these distances even further (which may make it more likely that tourists will likely visit Cartwright). The recently announced continuation of the ferry service between Lewisporte, Newfoundland and Cartwright will also have a positive effect on visitation to the community. However, overall the potential benefits (and predicted lack of negative effects) will be the same for both highway routes.

7.14.8.3 Accidental and/or Unplanned Events

The potential effects of accidental events on tourism and recreation which could conceivably occur as a result of the outfitter route are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The following provide a summary of these predicted effects (a more detailed analysis is provided in Section 6.14.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a):

- a forest fire may destroy natural or cultural resources and areas, and could disrupt tourist travel;
- a fuel or chemical spill could contaminate water, fish and wildlife. Tourism and recreation may be affected by any real or perceived decrease in the availability or quality of these resources;
- vehicle accidents or highway failure could also restrict or delay tourist travel; and

- with the implementation of EPPs and associated plans, the potential for such an accidental event occurring is extremely low. If such an accident were to occur, the significance of its potential effects is obviously dependent upon the nature, magnitude, location and timing of the event. However, the proponent's emergency response and contingency plans will ensure that any such effects are minimized.

7.14.9 Environmental Effects Evaluation

The following definitions are used to rate the significance of the predicted adverse residual environmental effects of the project on tourism and recreation:

A **major (significant) effect** is one which affects established tourism and recreation activity in multiple industry sectors, such that there is a detectable and sustained adverse effect on the industry in Southern Labrador and/or Central Labrador, and to the economy of the affected area(s) as a whole, that would not return to pre-project conditions within several generations. The overall integrity of the industry is compromised.

A **moderate (significant) effect** is one which affects established tourism and recreation activity in multiple industry sectors such that there is a detectable adverse effect on the overall industry in Southern Labrador and/or Central Labrador for several generations. The overall integrity of the industry may be compromised.

A **minor (not significant) effect** is one which affects established tourism and recreation activity in one or more industry sectors, but which does not have a detectable and sustained adverse effect on the overall industry in Southern Labrador and/or Central Labrador. The overall integrity of the industry is not compromised.

A **negligible (not significant) effect** is a localized change in established tourism and recreation activity in a one or more industry sectors, similar to small random changes due to natural variability, but not having a detectable and sustained effect on the overall industry in Southern Labrador and/or Central Labrador. The overall integrity of the industry is not compromised.

The environmental effects evaluation focuses on any potential adverse effects which may be associated with the project. Residual environmental effects on tourism associated with construction, operation and accidental events are outlined in Table 7.54, along with the ratings for the established environmental effects significance criteria.

Table 7.54 Environmental Effects Summary - Tourism and Recreation

	Construction	Operation	Accidental/Unplanned Events
Mitigation: • 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; and • 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.			
Environmental Effects Criteria Ratings			
Magnitude	Low	Medium	Unknown
Geographic Extent	11 to 100 km^2	1,001 to 10,000 km^2	Unknown
Frequency	11-50	Continuous	<10
Duration	37-72	>72	>72
Reversibility	Reversible	Reversible	Unknown
Ecological/Socio-economic Context	Low	Low	Low
Environmental Effects Evaluation			
Significance	Not Significant (Negligible)	Not Significant (Minor)*	Not Significant to Significant (Negligible to Major)
Level of Confidence	High	Medium	Medium
Likelihood[1]	n/a	n/a	Low
Sustainable Use of Resources[1]	n/a	n/a	n/a
[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994).			
* With appropriate enforcement and planning by relevant agencies, effects will not be significant.			
Environmental Monitoring and Follow-up: • 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.			
Key: Magnitude: High, Medium, Low, Nil or Unknown Geographic Extent (km^2): <1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown Frequency (events/year): <10, 11-50, 51-100, 101-200, >200, Continuous or Unknown Duration (months): <1, 1-12, 13-36, 37-72, >72 or Unknown Reversibility: Reversible, Irreversible or Unknown Context: Existing Disturbance (High, Medium, Low, Nil or Unknown) Significance: Significant, Not Significant Level of Confidence: High, Medium, Low Likelihood: High, Medium, Low or Unknown Sustainable Use of Resources: High, Medium, Low or Unknown			

As indicated, the project is not likely to result in significant adverse environmental effects on tourism and recreation.

The potential effects of the outfitter route on tourism and recreation are the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

7.14.10 Cumulative Environmental Effects

The effects of several ongoing and potential projects and activities may accumulate and/or interact with those of the TLH - Phase III to result in cumulative environmental effects on tourism and recreation.

The potential cumulative effects which may occur in the case of the outfitter route are the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The existing sections of the TLH (Phases I and II) will influence the nature of the effects of the project on tourism and recreation. The TLH - Phase III will connect these phases, and will therefore act in combination with these existing highways to alter the spatial and temporal movement of people throughout Labrador. As a result, Phases I and II of the TLH have been considered in the environmental effects analysis described above.

It is unlikely that the Voisey's Bay Mine/Mill development and ongoing low-level military flight training have had or will have an effect on tourism and recreation in the assessment area. Similarly, the proposed Churchill River Power Project hydroelectric facility and associated transmission infrastructure in Labrador will not likely affect tourism and recreation in the area.

Improved access to, from and within the region as a result of the TLH - Phase III will likely provide new opportunities for development activities (e.g., forestry, mineral exploration and possibly mining, increased recreational resource harvesting, cabin development). Each of these could, to varying degrees, affect tourism and recreation in the area, and thus result in cumulative environmental effects in combination with the TLH - Phase III and each other.

With appropriate enforcement and planning, the cumulative environmental effects of induced activities on tourism and recreation would not be significant. However, if regulatory and resource management agencies are unable to ensure the appropriate application and enforcement of applicable legislation and regulations, the potential exists for moderate (significant) cumulative environmental effects. These effects could potentially result from lack of management and enforcement of activities associated with the use of fish and wildlife, cabin development, and ATV use and trail development. In addition, if local tourism associations do not conduct appropriate planning, they may not be in a position to take advantage of the potential tourist-related benefits associated with the road.

The various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate. There may also be a need for agencies to increase their enforcement staff levels.

7.14.11 Environmental Monitoring and Follow-Up

Monitoring and addressing any changes in the distribution and intensity of resource use activities is the responsibility of the provincial and federal government departments and agencies that administer and manage these activities. WST will cooperate with such organizations by providing project-related information as required. Monitoring and careful planning on the part of these departments and agencies will ensure that issues can be identified and addressed in an effective and timely manner. Local development organizations, relevant government departments and local individuals and businesses should work to monitor potential tourism opportunities which may arise as a result of the highway. Measures designed to monitor project effects on fish and wildlife also apply indirectly to tourism and recreation.

7.15 Employment and Business

The following sections provide an overview of existing and potential employment and business activity, as well as the potential economic benefits and effects which may be associated with the outfitter highway route. Given the "regional" nature of this VEC, most of the information and findings are essentially unchanged from that provided in the TLH - Phase III EIS/CSR (JW/IELP 2003a), including the existing environment and the potential effects of the project on employment and business.

7.15.1 Boundaries

Project, socioeconomic and administrative boundaries related to this VEC are described in Section 6.15.1 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). As in this previous assessment, the environmental effects analysis for employment and business focuses primarily upon Central and Southern Labrador (Economic Zones 3 and 4) (Figure 3.2), as the highway (both routes) would pass directly through these regions. It also includes consideration of the other regions of Labrador, Labrador as a whole, the island of Newfoundland and other areas, as applicable.

7.15.2 Methods

Much of the information used to describe the existing environment of these regions is derived from the Census of Canada, which provides socio-economic information by province, census division, and community. Other information sources, such as the published literature and unpublished data from public and private-sector sources, are also used. The environmental effects analysis for employment and business considered each project phase and activity in relation to the baseline, including potential direct, indirect and induced changes which may result from the project.

7.15.3 Existing Environment

7.15.3.1 Employment

Detailed information on employment activity (census data) in both Southern and Central Labrador (by community and for the entire region), as well as for Labrador and the province as a whole is provided in the TLH - Phase III EIS/CSR (JW/IELP 2003a). This includes detailed information on:

- total labour force;
- labour force participation;
- unemployment rates;
- periods of employment;
- education and training levels;
- employment type (industry division);
- individual and household incomes; and
- composition of total income.

This information is equally applicable to the environmental effects analysis for the alternate route.

7.15.3.2 Business

Section 6.15.3.2 of the TLH - Phase III EIS/CSR (JW/IELP 2003a) provides an overview of current business activity in Southern Labrador (e.g., fishing and fish processing; goods and services), Central Labrador (e.g., low-level flying and associated activities; administration and services) and other regions of Labrador (Labrador West, Labrador Straits and Northern Labrador). This information is equally applicable to the environmental effects analysis for the outfitter route. No new or additional information is available or required.

7.15.4 Potential Interactions

Potential interactions between the project and employment and business activity are the same for both the preferred and outfitter routes and include:

- the generation of direct employment activity during design and engineering, construction and operation;
- business opportunities for local companies through project-related expenditures (e.g., equipment and supplies);
- indirect benefits to commercial establishments through any job creation as a result of increased spending;
- improved access to and within Southern and Central Labrador and elsewhere during highway operation, which will expand the market area for local businesses, as well as providing improved access to previously undeveloped natural resources; and
- potential changes to the use of some services and infrastructure, which could indirectly affect employment and business activity, as well as affecting local businesses through increased competition with those in other, now accessible areas.

7.15.5 Issues and Concerns

Issues and raised by local individuals and groups during the environmental assessment are outlined in Section 6.15.5 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). A summary of key points is provided below:

- most area residents appear to view the highway as a positive development, which will result in considerable employment and business benefits;
- there are concerns regarding the potential distribution of the employment and business opportunities which will be created by the project, including project-related jobs and contracts and the benefits of any resulting natural resource development (e.g., forestry);
- the potential for communities such as Cartwright to be by-passed completely once the highway is complete, as people may travel directly to larger centres such as Happy Valley-Goose Bay; and
- other specific questions and comments include highway design considerations (e.g., eventual paving) and maintenance, the need to consult with Labradorians regarding project planning, construction and operation, and on the future development of natural resources in the region, potential business opportunities for Aboriginal people and companies, and a perceived current lack of readiness by communities to take advantage of highway-related opportunities.

These issues are equally applicable to both the preferred and outfitter highway routes.

7.15.6 Existing Knowledge

An overview of existing knowledge regarding the potential effects of highway projects (particularly those in relatively remote areas) is provided in Section 6.15.6 of the TLH - Phase III EIS/CSR (JW/IELP 2003a), based on a review of the relevant literature and previous studies for the TLH, as well as the experience of the TLH (Phase II) and the Labrador Straits Highway. Key points include:

- the economic benefits of highway construction expenditures (which are often immediate and local);
- the provision of long-term infrastructure to facilitate economic growth; and
- the potential negative effects of improved mobility due to increased competition for local businesses.

7.15.7 Mitigation

No mitigation measures specific to employment and business are proposed. In most cases, the positive effects of the project on employment and business activity will compensate for any potential negative effects. General optimization measures which are applicable to both the preferred and outfitter routes include:

- 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; and
- 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.

7.15.8 Environmental Effects Assessment

The effects analysis for employment and business considers potential direct, indirect and induced changes resulting from the project. Potential effects on tourism have been discussed in detail in Section 7.14.

7.15.8.1 Construction

The potential effects of the construction of the outfitter route on employment and business are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The following provide a summary of these predicted effects(a more detailed analysis is provided in Section 6.15.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a).

The project (both the preferred and outfitter routes) will generate direct employment during its design and engineering and construction phases (see Section 3.4.3 for an overview of potential labour requirements and the timing and duration of the construction phase). Workers will be hired for specific construction phases at the discretion of the contractors. It is anticipated that local hiring will be preferred to minimize costs. The construction phase of the project will require skills and trades that are generally available in Labrador. WST supports employment and gender equity in its hiring and contracting practices. Labour force displacement and wage inflation are not likely to occur as a result of the project.

Regular consultation with relevant government agencies, the Innu Nation, local town councils, educational institutions and other applicable organizations will help local residents and firms identify and respond to the employment and business opportunities generated by the project in an effective and timely manner. Local businesses will likely benefit as a result of direct and indirect expenditures made during project construction (e.g., through possible construction contracts, the use of existing transportation services to move construction personnel, equipment and materials to the area; accommodations and food for non-resident construction personnel, etc.).

The outfitter route is approximately 30 km greater in length that the preferred route. Project-related expenditures during construction of the outfitter route would be $107.5 million, compared to $100 million for the preferred routing. This could potentially slightly increase the potential economic benefits associated with the construction phase of the project, although only to a very minor degree. Again, the effects of construction are short-term in nature. The overall duration of the construction phase will be one year longer for the outfitter route (seven versus six years for the preferred route).

7.15.8.2 Operation

The potential effects of the operation of the outfitter route on employment and business are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The following provide a summary of these predicted effects(a more detailed analysis is provided in Section 6.15.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a)).

Highway maintenance and periodic repair will likely create some local employment and business opportunities.

Although there are no communities located along the highway route itself, the project will connect the two existing sections of the TLH. It will provide reliable, cost-effective and year-round road access between Southern and Central Labrador and other regions of Labrador, the Island of Newfoundland and beyond. The ability to travel between these regions year-round by road will benefit existing businesses and provide new development opportunities (e.g., increased visitation; an expansion of the market area for local businesses).

An increase tourist travel will increase the use of existing commercial infrastructure and services (e.g., accommodations, restaurants, tourist attractions) and also create a demand for these and other services (e.g., gas stations and garages) along the highway route itself. Increased visitation will also result in an increase in the use of some existing services and infrastructure in Labrador (e.g., the St. Barbe-Blanc Sablon ferry), although this is not expected to result in interference with other users. However, the use of some transportation infrastructure may be reduced once the highway is operational (e.g., air travel from Happy

Valley-Goose Bay to Southern Labrador communities), although any such reduction will be minor and not have a measurable economic effect.

The highway will provide access to the natural resources of this previously remote area, and allow commercial operators more reliable and cost-effective access to markets. This will likely increase the feasibility of developing or expanding commercial land and resource use activities in the region, such as forestry, mineral exploration, and possibly, mining activity. The degree to which local communities will benefit from the development and/or expansion of these industries will depend on the policies and practices of the various agencies and organizations involved in developing and managing the region's natural resources, and the ability of local individuals and firms to identify and respond to these opportunities.

The road will also give local residents better access to commercial establishments elsewhere, which could result in increased competition for local businesses, which could have a negative effect on local firms. However, this is not unlikely to be an issue, given the distances involved. Although residents may travel to larger centers such as Happy Valley-Goose Bay and beyond to obtain "higher-order" goods and services which are not available locally (e.g., furniture and appliances and automobiles), it is unlikely that they will regularly travel these distances to obtain goods and services which can currently be purchased from local businesses. The outfitter route will result in somewhat longer distances and driving times as compared to the preferred route; however, the nature of any such effects (or more specifically, the lack thereof) will be the same for both routes.

Year-round road access as a result of this project and the recently completed TLH - Phase II (Red Bay to Cartwright) will also likely allow existing businesses in Southern Labrador to obtain and sell their products at lower prices than at present, as well as diversify the goods and services they offer, thereby becoming more competitive. Concern has also been raised that visitation to some communities may decrease once the highway is complete, as visitors will be able to travel directly to larger communities (such as Happy Valley-Goose Bay) or certain areas, thereby bypassing some completely. It is unlikely that this will be the case, given the distances and routes involved. This issue has been discussed in detail in Section 7.14.8.2.

Again, the potential effects of the outfitter route on employment and business would be the same as those for the preferred highway route.

7.15.8.3 Accidental Events

The potential effects of accidental events on employment and business which could conceivably occur as a result of the outfitter route are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The following provide a summary of these predicted effects (a more detailed analysis is provided in Section 6.15.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a)).

An accidental event such as a fire, fuel or chemical spill or a vehicle/equipment accident may have negative effects on employment and business, especially if it results in the destruction and/or closure of any businesses and subsequent loss of employment. If construction work is halted, project workers and firms supplying goods and/or services to the contractors will be negatively affected. A fire, vehicle accident or highway failure during operations could interrupt transportation, indirectly affecting economic activity in the region.

With the implementation of EPPs and associated plans, the potential for such an accidental event occurring is extremely low. If such an accident should occur, the significance of its potential effects is obviously dependent upon the nature, magnitude, location and timing of the event. The proponent's emergency response and contingency plans will ensure that any such effects are minimized.

7.15.9 Environmental Effects Evaluation

The significance of the potential adverse residual environmental effects of the project on employment and business are evaluated on the basis of the following definitions:

A **major (significant) effect** is a detectable and sustained change in established employment and business activity in multiple industries, such that there is a measurable adverse effect on the economy of the affected area(s) that would not return to pre-project conditions within several generations.

A **moderate (significant) effect** is one which affects employment and business activity in multiple industries such that there is a detectable adverse effect on the economy of the affected area(s) for several years.

A **minor (not significant) effect** is one which affects employment and business activity in one or more industries for several years, but which does not have a measurable adverse effect on the economy of the affected area(s).

A **negligible (not significant) effect** is a short-term localized change in employment and business activity in one or more industries, similar to small random changes due to natural variability, but having no measurable adverse effect on the economy of the affected area(s).

As described above, the potential effects of the highway (both routes) on employment and business are largely positive. The environmental effects evaluation focusses on any potential adverse effects, which are summarized in Table 7.55, along with ratings for the established environmental effects significance criteria. In most cases, the positive effects of the project on employment and business will compensate for any potential negative effects.

Table 7.55 Environmental Effects Summary - Employment and Business

<table>
<tr><th></th><th>Construction</th><th>Operation</th><th>Accidental/Unplanned Events</th></tr>
<tr><td colspan="4">Mitigation:
No mitigation measures specific to employment and business are proposed. In most cases, the positive effects of the project on employment and business activity will compensate for any potential negative effects. General optimization measures which are applicable to both the preferred and outfitter routes include:

• 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; and
• 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.</td></tr>
<tr><td colspan="4">Environmental Effects Criteria Ratings</td></tr>
<tr><td>Magnitude</td><td>Nil</td><td>Low</td><td>Unknown</td></tr>
<tr><td>Geographic Extent</td><td>n/a</td><td>1,001 to 10,000 km^2</td><td>Unknown</td></tr>
<tr><td>Frequency</td><td>n/a</td><td>Continuous</td><td><10</td></tr>
<tr><td>Duration</td><td>n/a</td><td>>72</td><td>Unknown</td></tr>
<tr><td>Reversibility</td><td>n/a</td><td>Reversible</td><td>Unknown</td></tr>
<tr><td>Ecological/Socio-economic Context</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td colspan="4">Environmental Effects Evaluation</td></tr>
<tr><td>Significance</td><td>n/a</td><td>Not Significant (Negligible)</td><td>Not Significant (Minor)</td></tr>
<tr><td>Level of Confidence</td><td>High</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Likelihood[1]</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Sustainable Use of Resources[1]</td><td>n/a</td><td>n/a</td><td>n/a</td></tr>
<tr><td colspan="4">[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994). However, Sustainable Use of Resources is not applicable for socio-economic VECs.</td></tr>
<tr><td colspan="4">Environmental Monitoring and Follow-up:
• 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 operations 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.</td></tr>
<tr><td colspan="4">Key:

Magnitude: High, Medium, Low, Nil or Unknown
Geographic Extent (km^2): <1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown
Frequency (events/year): <10, 11-50, 51-100, 101-200, >200, Continuous or Unknown
Duration (months): <1, 1-12, 13-36, 37-72, >72 or Unknown
Reversibility: Reversible, Irreversible or Unknown
Context: Existing Disturbance (High, Medium, Low, Nil or Unknown)
Significance: Significant, Not Significant
Level of Confidence: High, Medium, Low
Likelihood: High, Medium, Low or Unknown
Sustainable Use of Resources: High, Medium, Low or Unknown</td></tr>
</table>

As indicated, the project is not likely to result in significant adverse environmental effects on employment and business. The potential effects of the outfitter route on employment and business are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

7.15.10 Cumulative Environmental Effects

The effects of several existing or imminent projects may accumulate and/or interact with those of the highway to bring about cumulative environmental effects on employment and business. The potential cumulative effects which may occur in the case of the outfitter route on employment and business are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

The existing sections of the TLH - Phases I and II will influence the nature of the effects of the highway on employment and business. The TLH - Phase III will connect these phases, and will therefore act in combination with these existing highways to alter the spatial and temporal movement of people throughout Labrador. As a result, Phases I and II of the TLH have been considered in the environmental effects analysis described above. Improved access to, from and within the region as a result of the TLH - Phase III will likely provide new opportunities for resource development activities in Southern and Central Labrador, such as forestry, mineral exploration and possibly mining, which will have an overall positive effect on the area's economy.

The construction and operation phases of the Voisey's Bay Mine/Mill project will result in considerable employment and business activity throughout Labrador and the province as a whole. Low-level military flight training forms the basis for the economy of the Central Labrador region, generating considerable direct, indirect and induced employment and business activity in Happy Valley-Goose Bay and other parts of Labrador. In addition, existing land and resource use activities in the project area are also an integral part of the local economy. Any increase in these activities as a result of the highway would also increase their contribution to the livelihood of local residents.

Therefore, the overall, cumulative effect of the highway (both the preferred and outfitter routes) in combination with these other projects and activities will be a positive one for the economy of Labrador, as these developments will generate considerable employment and business activity. The highway will also likely serve to expand the labour pool for projects such as the Voisey's Bay Mine/Mill and the Churchill River Power Project hydroelectric development, by giving residents of Southern Labrador and the Labrador Straits more reliable and cost-effective access to Happy Valley-Goose Bay, which will likely serve as a key centre for the employment and business activity associated with these projects.

Cumulative environmental effects could potentially result from lack of management and enforcement of activities associated with the use of fish and wildlife, and cabin development. In addition, if local tourism associations do not conduct appropriate planning, they may not be in a position to take advantage of the potential tourist-related benefits associated with the road. There is potential for minor (not significant) cumulative environmental effects resulting from unregulated activities on employment and business, specifically due to potential effects on the tourism and recreation sector. While there may be a negative effect in one sector of the economy, it is expected that overall the highway would still have a positive effect on the local and regional economy.

The various resource management agencies should consider a cooperative management or regional land use planning approach to managing the land and resources along the highway and surrounding area. In addition, the departments and agencies responsible for managing wildlife resources may need to review existing management policies and programs to ensure that they are appropriate. There may also be a need for agencies to increase their enforcement staff levels.

7.15.11 Environmental Monitoring and Follow-Up

WST will monitor project-related expenditures and labour during the construction phase of the project. Monitoring of construction employment will be detailed and specific numbers by occupation, gender and period of employment during each year of construction will be provided to the Minister of Environment at the conclusion of each construction season. Monitoring any changes in employment and business activity and identifying potential opportunities for growth during the operations 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.

7.16 Community Life

Community life is defined to include the social characteristics of communities and families, health, and infrastructure and services. The construction and operation of the TLH - Phase III may affect the nature, functioning and health of the socio-economic environment. Changes in transportation infrastructure will influence the movement of people and goods to, from and within the region, resulting in effects on the social characteristics of communities and families, health, and local infrastructure and services. Given the "regional" nature of this VEC, most of the information and findings are essentially unchanged from that provided in the TLH - Phase III EIS/CSR (JW/IELP 2003a), including the existing environment and the potential effects of the project on community life.

7.16.1 Boundaries

Project, socio-economic and administrative boundaries related to this VEC are described in Section 6.16.1 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). As in this previous assessment, the environmental effects analysis for community life focuses primarily upon Central and Southern Labrador (Figure 3.2) and the communities within these regions. It also includes consideration of the other regions of Labrador, Labrador as a whole, and the island of Newfoundland, as applicable.

7.16.2 Methods

Information was collected from a number of sources, including Statistics Canada, the Newfoundland Statistics Agency, government agencies, crown corporations, regional economic development corporations, and community service organizations.

7.16.3 Existing Environment

Information on community life in both Southern and Central Labrador and elsewhere in Labrador and the province as a whole is provided in Section 6.16.3 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). This includes information on:

- settlement and demographics (communities, populations, ages, and family characteristics);
- infrastructure and services (municipal administration and planning, transportation, electricity and communications, water supply and sewage, waste disposal, health care, social services, policing and fire fighting); and
- social and health characteristics.

This information is equally applicable to the environmental effects analysis for the outfitter route.

7.16.4 Potential Interactions

Potential interactions between the project and community life are the same for both the preferred and outfitter routes.

Although there are no communities along the highway route, it will provide a lower-cost, easier means of travel to, from and between the communities of Central Labrador and the communities of Southern Labrador. The highway will further reduce the isolation of the communities of Central and Southern Labrador. This may somewhat reduce the level of social cohesion, but it may also increase social interaction between communities. The highway may encourage regional economic diversification and growth, which may stabilize or increase the populations of local communities.

Workers will be hired for specific construction phases at the discretion of the contractors. It is anticipated that local hiring will be preferred to minimize costs, and required skills and trades are generally available in Labrador.

With an increase in employment and income, the health of individuals can be anticipated to improve. Residents will also have better access to social and cultural services elsewhere. Efforts will need to be made to ensure that culturally compatible benefits are enjoyed by Aboriginal peoples.

An influx of construction personnel can affect community infrastructure and services. Temporary construction camps will be established, although local existing facilities may be used at times. During highway operation, maintenance infrastructure (e.g., depots, winter camps) will be established and some local employment created. The use of local transportation services to move equipment, materials and supplies to site can have both positive (increased revenue) and negative (congestion) effects.

The air and marine transportation services provided in southeastern Labrador are currently scheduled to change due to the completion of the TLH – Phase II. Potential accidental events during highway construction or operation (e.g., highway collapse, fires, collisions, etc.) could have effects on community life.

7.16.5 Issues and Concerns

Issues and raised by local individuals and groups during the environmental assessment are outlined in Section 6.16.5 of the TLH - Phase III EIS/CSR (JW/IELP 2003a). A summary of key points is provided below:

- general concern over the readiness of the communities in dealing with the changes associated with the highway;
- conflicts and social problems associated with non-resident construction crews;
- disruption of families if workers are required to be away from home for extended periods;
- increases on the demand for policing services during construction and operation;
- increased incidences of forest fires and a greater need to quickly extinguish them;
- a lack of safety and security on the highway (e.g., communication if there is an accident);
- increased demands on emergency services and their inadequacy to deal with accidents; and
- demand for local infrastructure and services will not be able to be met in the short term.

Individuals contacted also commented on potential positive effects on business, employment and income that may occur as a result of the completion of the highway (see Section 7.15). This would, in turn, have a positive effect on a number of aspects of community life. It is anticipated that local infrastructure and services would expand and develop. There would be a reduced reliance on social assistance programs, and the general health and well being of people would improve.

7.16.6 Existing Knowledge

There have been few large construction projects in the region, especially in Southern Labrador. As the TLH – Phase II has only recently been completed, it is too early to drawn any conclusions on the effects of that highway development on local community life. In Southern Labrador, direct experience with road access to other communities within and outside the region is likewise limited.

Project construction and operation will generate employment and business activity, which will certainly affect communities (FGA 1993). It is possible that the smaller local communities may "feel" the effects of the highway more, but again, direct comparable experience has been limited.

7.16.7 Mitigation

Mitigation measures are identified that will reduce or eliminate the potential adverse effects on community health and infrastructure and services. The potential effects on social characteristics of communities and families are not specifically addressed as the residual negative effects are expected to be minor. Many effects will be positive.

Specific mitigation measures related to community life (which are applicable to both the preferred and outfitter routes) include:

- construction camps that comply with legislation and regulations governing sanitation and food premises, and will have basic first aid equipment and supplies;
- if there is a need to locate a camp near the Town of Happy Valley-Goose Bay, approval by the town will be sought;
- all industrial and domestic wastes generated during the construction of the highway will be collected, properly stored and disposed of as approved by regulatory agencies and local municipalities. Temporary sewage disposal systems will be installed, also in accordance with regulatory requirements and WST Specification 825 requirements;
- accident prevention and response procedures will be established and incorporated into the construction EPP, with which all contractors will be required to comply;
- during operation, the risk of accidental events will be reduced through the proper maintenance of the highway, and enforcement of the posted speed limit and other applicable regulations;
- the highway will be regularly inspected and maintained to guard against failure of any section of the highway; and
- WST will consult with the Inland Fish and Wildlife Division concerning potential vehicle-wildlife collision locations, and erect warning signs and conduct appropriate public awareness activities.

7.16.8 Environmental Effects Assessment

The effects analysis for community life considers potential direct, indirect and multi-order changes resulting from the project after mitigation measures have been implemented. The potential effects of the outfitter route on community life are essentially the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route. The following provide a summary of these predicted effects(a more detailed analysis is provided in Section 6.16.8 of the TLH - Phase III EIS/CSR (JW/IELP 2003a)):

7.16.8.1 Construction

The hiring practices of the construction contractors will be at their discretion. Thus, it is not possible to determine the proportion of the positions that will be filled locally. Skills and trades will be required that are generally available in Labrador, and it is anticipated that preference will be given to local residents (the experience from TLH - Phase II suggests 40 percent local hires). Unemployment rates are relatively high in the region. The construction of the highway is anticipated to improve the economic health of communities, as local individuals are directly hired to fill construction jobs and local businesses are hired to provide goods and services to contractors. This will serve to stabilize population levels within the communities, at least in the short term. The extent to which this will occur is difficult to predict (see Section 7.15).

Existing transportation services and infrastructure will be used to move construction personnel, services and materials to the area. As previously discussed, non-resident personnel will be housed either within the nearest community or in construction camps. Use of local services will have a positive effect on communities. There is some question as to the ability of local infrastructure to accommodate the demands from the construction of the highway (e.g., sewage and garbage disposal). Any such effects will be reduced through the mitigation measures discussed previously.

7.16.8.2 Operation

The highway will substantially alter the existing transportation patterns in Labrador (see Section 7.14). This increased "connectedness" between communities is anticipated to further reduce the isolation of these communities, although it may also somewhat reduce the social cohesion of the communities. There may also be more crime as more people move in and out of the region. However, the likelihood of any such effects is predicted to be low, both in magnitude and extent.

The highway will generate a direct demand for policing because regular patrols will be required to ensure proper highway use and traveler safety. This will be required over the life of the highway.

The highway will provide communities and individuals with improved access to health care, educational opportunities and other social services (particularly for Southern Labrador). With economic growth, an overall reduction in poverty-related health and social problems is predicted.

With the further economic development of the region that is anticipated as a result of the highway, there will be an expanded reliance on the wage economy. The greater involvement in markets will represent an influx of money into communities. This improved access to cash may change the levels of alcohol and substance abuse within the communities, but it is not possible at this point to say what the magnitude or direction of that potential effect may be. With the improved transportation infrastructure between communities, it is possible that these problems will become more prominent. However, the overall effect is predicted to be low.

7.16.8.3 Accidental Events

The likelihood of an accidental event, either a forest fire or vehicle collision, occurring during the construction of the highway is low. During operation, there will be a somewhat greater risk of vehicle-related forest fires, accidents, and fuel or chemical spills in the region. Any such event would increase the demand on forest fire suppression services, policing services, medical services and emergency response. It will be the responsibility of the appropriate agencies to ensure that the levels of service are adequate. Overall, the effect of the highway on emergency services is predicted to be low.

7.16.9 Environmental Effects Evaluation

The significance of the potential adverse residual environmental effects of the project on community life are evaluated on the basis of the following definitions:

A **major (significant) effect** is a detectable and sustained change in community life (including the characteristics of communities and families, health, and infrastructure and services) across many aspects, such that there is a measurable adverse effect on the affected community that would not return to pre-project conditions within several generations.

A **moderate (significant) effect** is one that affects several aspects of community life such that there is a detectable adverse effect on the affected community for one or two generations.

A **minor (not significant)** effect is one which affects an aspect of community life for less than one generation, but which does not have a measurable adverse effect on the affected community.

A **negligible (not significant)** effect is a short-term, localized change in community life in one particular aspect similar to small random changes due to natural variability, but having no measurable effect on the affected community.

As described above, many potential effects of the highway on community life are positive, and any negative effects are predicted to be minor and not significant. The environmental effects evaluation focuses on any potential adverse effects, which are summarized in Table 7.56, along with ratings for the established environmental effects significance criteria.

7.16.10 Cumulative Environmental Effects

The effects of several existing or imminent projects may accumulate and/or interact with those of the highway to bring about cumulative environmental effects on community life. The potential cumulative effects which may occur in the case of the outfitter route are the same as those described in the TLH - Phase III EIS/CSR (JW/IELP 2003a) for the preferred highway route.

Table 7.56 Environmental Effects Summary – Community Life

	Construction	Operation	Accidental/Unplanned Events
Mitigation: • 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; and • fuel and other hazardous material spill contingency plans and emergency response measures will be in place and implemented in the event of an accident.			
Environmental Effects Criteria Ratings			
Magnitude	Low	Low	Unknown
Geographic Extent	1,001 to 10,000 km^2	1,001 to 10,000 km^2	Unknown
Frequency	11-50	Continuous	<10
Duration	32-72	>72	Unknown
Reversibility	Reversible	Reversible	Unknown
Ecological/Socio-economic Context	Low	Low	Low
Environmental Effects Evaluation			
Significance	Not Significant (Minor)	Not Significant (Minor)	Not Significant (Minor)
Level of Confidence	High	Medium	Medium
Likelihood[1]	n/a	n/a	n/a
Sustainable Use of Resources[1]	n/a	n/a	n/a
[1] Likelihood is only defined for effects rated as significant, and Sustainable Use of Resources is only defined for those effects rated as significant and likely (Canadian Environmental Assessment Agency 1994). However, Sustainable Use of Resources is not applicable for socio-economic VECs.			
Environmental Monitoring and Follow-up: • WST will cooperate with the various departments and organizations responsible for aspects of community life by providing project-related information as required.			
Key: Magnitude: High, Medium, Low, Nil or Unknown Geographic Extent (km^2): <1, 1-10, 11-100, 101-1,000, 1,001-10,000, >10,000 or Unknown Frequency (events/year): <10, 11-50, 51-100, 101-200, >200, Continuous or Unknown Duration (months): <1, 1-12, 13-36, 37-72, >72 or Unknown Reversibility: Reversible, Irreversible or Unknown Context: Existing Disturbance (High, Medium, Low, Nil or Unknown) Significance: Significant, Not Significant Level of Confidence: High, Medium, Low Likelihood: High, Medium, Low or Unknown Sustainable use of Resources: High, Medium, Low or Unknown			

The highway will provide year-round road access between Southern and Central Labrador, thereby connecting these two existing sections of the TLH. Therefore, Phase III of the TLH will act in combination with these existing highway sections to alter the spatial and temporal movement of people throughout Labrador, which will have implications for community life in southern and central Labrador and beyond. Improved access to, from and within these regions will likely provide new opportunities for economic development. This will, in turn, have largely positive effects on communities and families and infrastructure and services in the area. Other projects such as the Voisey's Bay development, will contribute further to these potential benefits. Any potential adverse effects of these projects and activities on particular aspects of community life (e.g., increased demands for services and infrastructure) will be minor and typically, localized and of short-term duration.

Community life takes into consideration the social characteristics, and infrastructure and services, of communities within the region. The project is not likely to result in significant adverse cumulative effects in combination with other projects and activities that have been or will be carried out. Note that if there is inadequate monitoring of the use of the highway during operation, the possibility exists that there will be an increase in the numbers of accidental events, and a potential, corresponding increase in the demand for health care services. However, given the low volume of traffic that is anticipated to use the highway, the number of accidental events that could potentially occur are not expected to exceed the capabilities of regional and/or provincial health care services.

7.16.11 Environmental Monitoring and Follow-up

Monitoring changes to the characteristics of communities and families, as well as tracking community health and social issues, is the responsibility of provincial and federal government departments. In addition, there are a number of non-government organizations that are active in the region. WST will cooperate with these departments and organizations by providing project-related information as required.