6.3 Caribou

The proposed TLH - Phase III lies within the range of the MMCH, a 'resident' herd exhibiting characteristics typical of woodland caribou, such as short seasonal movements and low densities. Woodland caribou in Labrador are listed as threatened by COSEWIC (COSEWIC 2002).

6.3.1 Boundaries

Project boundaries for caribou are defined by the spatial and temporal extent of the anticipated physical, visual, and auditory influences of the project in the area surrounding the proposed highway route.

Ecological boundaries for caribou are primarily seasonal, with the most important periods being calving/post-calving and overwintering. Caribou are a wide-ranging group. The MMCH winter range is extensive and fairly consistent over the years. Winter habitat use is heavily dependent on snow cover, with animals making greater use of forested areas during years of less snowfall. Calving locations are dispersed and, typical of woodland caribou, there is not much consistency in year to year selection of specific sites. In summer, individuals are relatively sedentary and aggregated in small groups. Movement is greatest in the fall and once animals are established on their wintering range, there is relatively little movement unless snow conditions change. Prediction of environmental effects will be made for the MMCH.

The Government of Newfoundland and Labrador, through the Inland Fish and Wildlife Division, Department of Tourism, Culture, and Recreation, is responsible for the management of caribou. The MMCH are protected and there is no legal hunting of the herd.

6.3.2 Methods

The assessment will focus on a 2-km study area centered on the highway but will include the spatial extent (or range) of the herd. Recent population estimates are inconsistent, age structure data are not available for the herd, and recent seasonal range use is not well defined. However, the herd is fairly well understood in terms of its history and historic distribution (seasonal and overall), thus permitting a general understanding of how caribou may use habitat along the TLH - Phase III, and how that use may be affected by the project. Also, ongoing telemetry monitoring of radio-collared animals is providing new information on movement and distribution. Data on spring, distribution, calving and post-calving distribution of the MMCH in 2002 (March 26 to August 31) have been provided as part of an ongoing component study being completed by the Inland Fish and Wildlife Division. Satellite telemetry collars were fixed to six female caribou and the movement patterns of each individual was recorded from March to August 2002. Aerial helicopter surveys for caribou were also completed between March 26 and April 7, 2002. The study area for the assessment encompasses the annual range of the MMCH.

Preliminary results from the Caribou Component Study (Otto 2002a; 2002b) provide the most up to date indication of the size, distribution, habitat use, and movement patterns of the MMCH. This information will be used to discuss the environmental effects of the proposed highway on the MMCH.

6.3.3 Existing Environment

6.3.3.1 Herd Range

The MMCH is the largest and most accessible (to local residents) caribou herd in southern Labrador, and probably the only population in the project region. The MMCH is scientifically the least well known of the three recognized woodland caribou herds in Labrador (Otto 2002a). However, a number of studies have reported on the history and seasonal range of the herd and on the wide population fluctuations the herd has undergone in the past.

Bergerud (1963; 1967) describes the population of caribou south of Lake Melville as consisting primarily of one herd, the MMCH, with several smaller groups (including the Dominion Lake and St-Augustin Herds) occupying an area in the general vicinity of the Labrador/Quebec border. Because of their low densities, the distribution of these latter groups is often described as a low-density continuum rather than in terms of specific 'herd' ranges (DND 1994a). Hearn and Luttich (1990) suggest that the MMCH could be a composite of separate sub-groups of animals. From a survey by Brassard (1972) it was suggested that the St-Augustin caribou may have been mixing with MMCH animals during winter and, around the turn of the century, may have been part of a much larger MMCH. However, by 1979, the St-Augustin animals were considered to be virtually extirpated, and this appears to have been confirmed by a late winter survey carried out in 1988 (RRCS 1989).

The traditional range of the MMCH extends from Lake Melville and Groswater Bay, south toward the Lower North Shore of Québec and the Labrador Straits, and from the Kenamu River headwaters, east to the Labrador coast (Figure 6.11). In normal winters, the main concentration of animals is in the Mealy Mountains (Bergerud 1967; Hearn and Luttich 1987). In winters with little snow, caribou make greater use of the forested areas south of the Mealy Mountains. In years of heavy snowfall, animals are more likely to winter on the south shore of Lake Melville (between Carter Basin and Etagaulet Bay), where they may occasionally cross to the north side of the lake to areas of less snowfall (Bergerud 1967). In most years, some groups may winter along the coastal areas of Groswater (Porcupine Strand area) and Sandwich Bays, and on the Kenamu River marshlands (Bergerud 1967; Hearn and Luttich 1990).

In late spring, females move from wintering areas to dispersed calving locations on the extensive bog/forest stand complexes present in the area, particularly around the headwaters of the Eagle, English, North and White Bear rivers (Hearn and Luttich 1987). Individual females tend to calve somewhere in the same general area each year. However, there is no apparent fidelity of a female cohort to a particular calving location. Hearn and Luttich (1990) found that 61 percent of collared MMCH females were located less than 15 km of their previous calving location, and 32 percent were located less than 5 km away.

To reach the general calving areas, females overwintering near Groswater Bay move southwest and inland. Those wintering on the south shore of Lake Melville and on the Mealy Mountains move south of the mountains. The post-calving period is spent near the calving areas.

The summer range includes the bog/forest complexes in the general calving area, and extends toward the coast, north of Sandwich Bay. The caribou are relatively sedentary and widely dispersed. In fall, movement increases somewhat (probably because of rutting activities) and the animals move to wintering areas in late fall to early winter.

6.3.3.2 Herd Abundance

The MMCH has experienced four or five cycles of abundance and scarcity since the early 1900s. The more recent declines have been attributed to overhunting (Bergerud 1967). Caribou were common in the region around 1900, were reported to be scarce by 1916, and were increasing again by 1945 (Bergerud 1967). Population estimates of the MMCH from censuses are summarized in Table 6.6.

Table 6.7 Population Estimates of MMCH

Years of Census	Population Estimate
1960	2600
1963	800
1972	1200
1975	200
1987	1920
1997	534
Source: Bergerud 1963; Hearn and Luttich 1990; Schaefer 1997.	

During the spring aerial surveys, a total of 276 caribou were observed in a characteristic late winter clumped distribution within the survey area (the survey area generally coincided with the traditional range of the herd indicated in Figure 6.11. The largest number of caribou occurred in five discrete groups within an area of approximately 2,500 km^2 centered around Park Lake (Figure 6.12). Two smaller groups were recorded at the coast; one in the vicinity of Porcupine Strand north of Cartwright, the other south of Cartwright in the general vicinity of Hawke Bay (Figure 6.12).

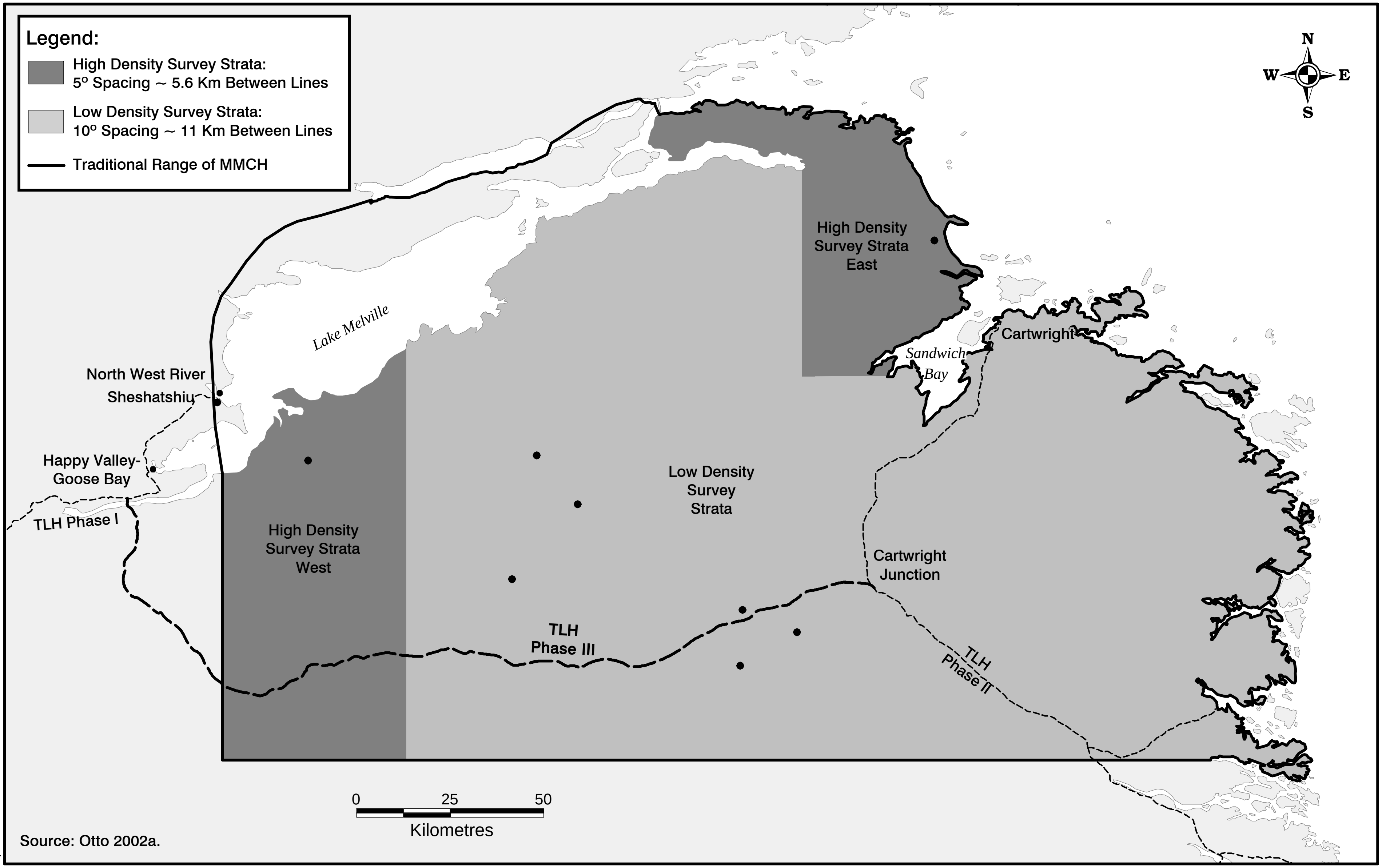

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FIGURE 6.11

Traditional Range of the MMCH and Area Covered During Aerial Surveys

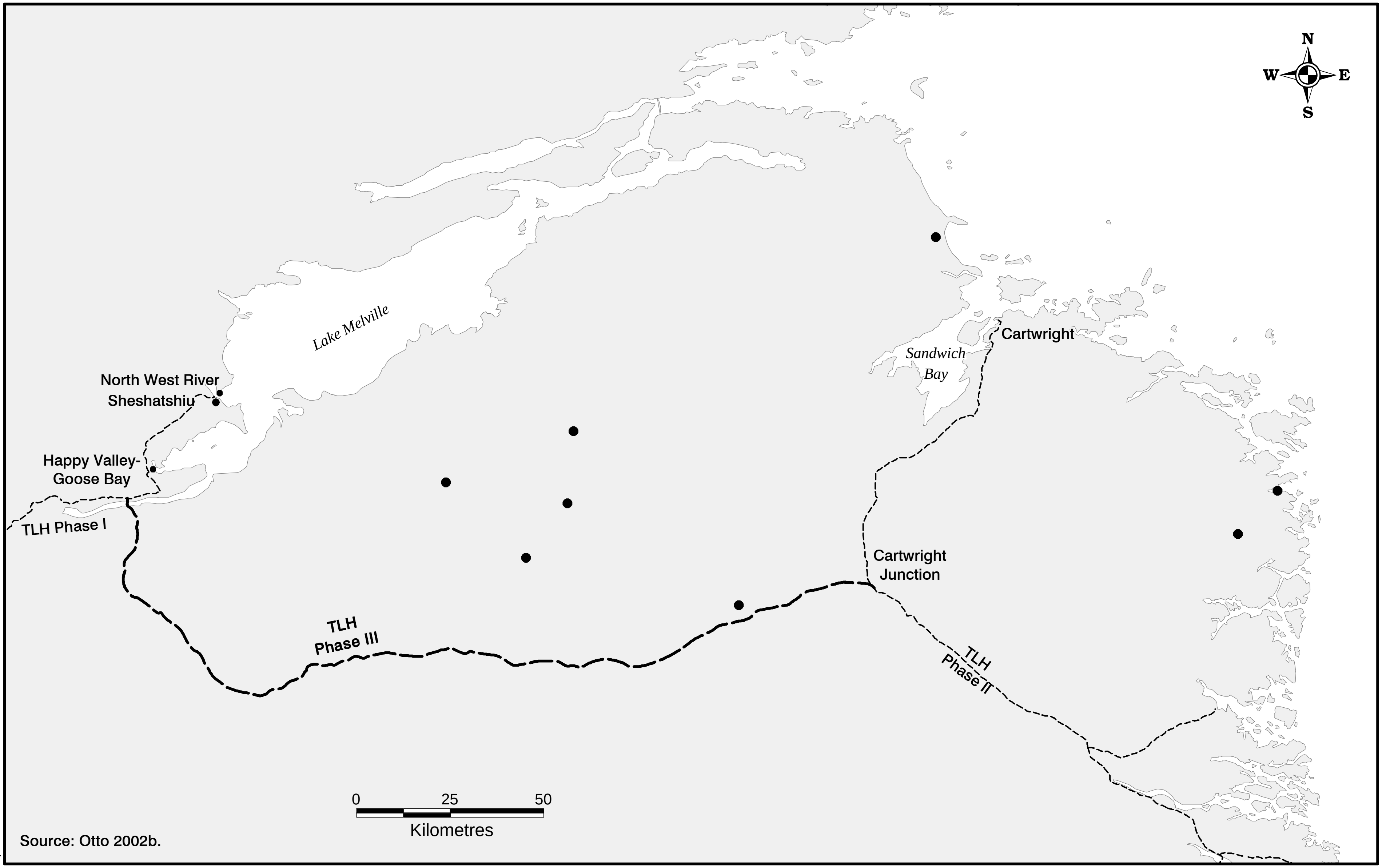

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FIGURE 6.12

Locations of Caribou Groups from Aerial Surveys,
March 29 to April 7, 2002

From surveys conducted in 2002, caribou densities in the survey area were estimated to be 0.048 (Low Density Strata), 0.0 (High Density Strata west), and 0.182 (High Density Strata east) animals/km^2 (Figure 6.11) and the population was estimated to be 2,585 animals[2] (+/- 1,596). Another census is planned for 2004. The results of a classification done in 2002 are presented in Table 6.8. A total of 118 caribou were classified.

Table 6.8 Results of MMCH Classification 2002

Classification	Number of Animals	Percentage of Observations
Females	56	47.5
Stags	28	23.7
Calves	34	28.8
Calves/100F	60.7	60.7
Stags/100F	50	50
Source: Otto 2002a.		

The classification results indicate that recruitment rates are high. The male:female sex ratio of 1:2 suggests that survival rates are also high. If these rates were maintained over a five-year period, there would be a large increase in herd size. However, certain data such as population age structure are missing and must be obtained before conclusions can be made that a large increase in the MMCH population has occurred over the last five years (Otto 2002a). The uncertainty surrounding the latest census results and the lack of data on population age structure make it difficult to determine the current status of the population.

6.3.3.3 Migration Patterns

Telemetry monitoring of movement patterns and seasonal habitat use by six radio-collared caribou was conducted and is available for the spring through post-calving period (May 29 to August 31). A total of 48 relocations (including capture locations) were collected. No consistent pattern of movement or range use emerged. Three of the six collared animals (two males, one female) exhibited the relatively sedentary pattern typical of woodland caribou. Three others (two females, one male) moved up to 100 km during monitoring period (Otto 2002b).

A composite of all collared animal locations (including capture locations) is illustrated in Figure 6.13. These locations lie within the traditional range of the herd, and indicate that members of the herd were present in the area of the proposed highway. Approximately 10 percent of the locations were over a small area 40 km south of the highway, and approximately 20 percent were located to the north, within 40 km of the highway but were more widely dispersed. Of these locations, one or more were within 5 km of the highway. The remaining 70 percent of the locations were more than 40 km north of the highway and spread over a large area (Otto 2002b).

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[2] This estimate is a measurable increase (in fact, a biologically impossible increase) from the last census estimate in 1997 (Schaefer 1997). However, if the upper 90 percent CI from the 1997 census (534 caribou) is compared with the lower 90 percent CI from the 2002 census (989 caribou), the calculated rate of increase is 37 percent; still extremely high, but not impossible (Otto 2002a).

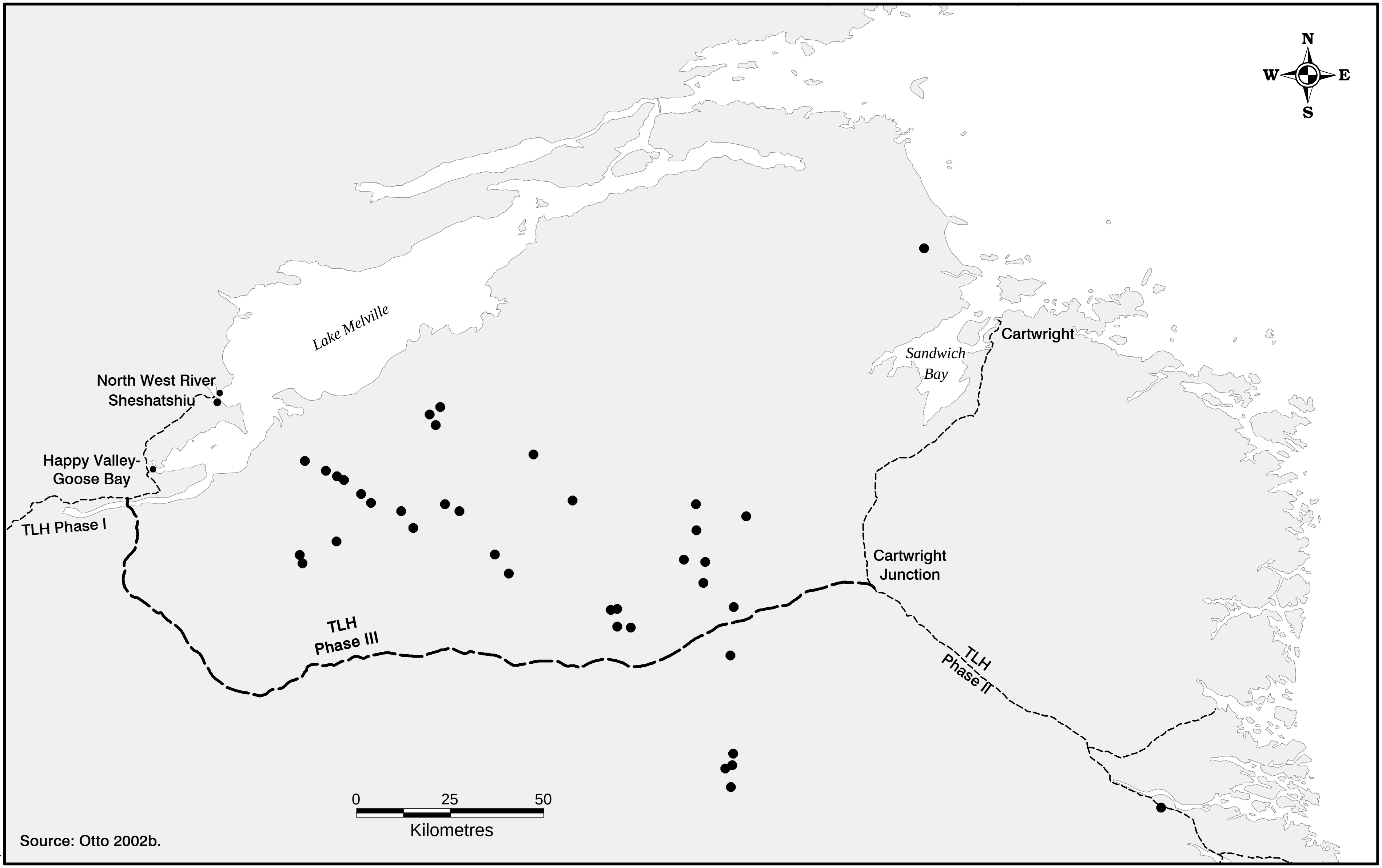

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FIGURE 6.13

Composite of Radio-collared Caribou Locations, (includes capture sites) May 29 to August 31, 2002

Further detail of the home range distribution of the MMCH during the spring, calving, and post-calving periods are provided in Figures 6.14 to 6.16, respectively. The highway route will transect habitat used by the herd during all three periods.

The movement patterns displayed by the collared caribou fit those predicted by models of hierarchical habitat selection processes. This means that caribou choose a location by first selecting a general landscape (e.g., mountains, plateau or coast), and then select suitable patches within that landscape that offer attributes required for survival (e.g., forest cover near bogs). Such movement would be characterized by relatively large displacements in space, along with clusters of relocations in a relatively small area, as is the case in the 2002 monitoring results to date (Otto 2002b).

It appears that individual animals from the MMCH move relatively large distances compared to other woodland caribou herds in Labrador (Otto 2002b). The large aggregations wintering north of Cartwright in 2002 dispersed large distances to summer ranges in the watersheds of the Eagle and Paradise Rivers. This is consistent with what is known about seasonal range use by the herd. The extensive string bog/forest complexes located in the headwaters of both rivers represent typical summer range habitat chosen by woodland caribou in regions where wolves and other large predators are present (Otto 2002b). The distribution of animals during the winter of 2002 suggests it is likely that these animals are choosing different landscapes during different seasons, and will travel long distances to find such landscapes (Otto 2002b).

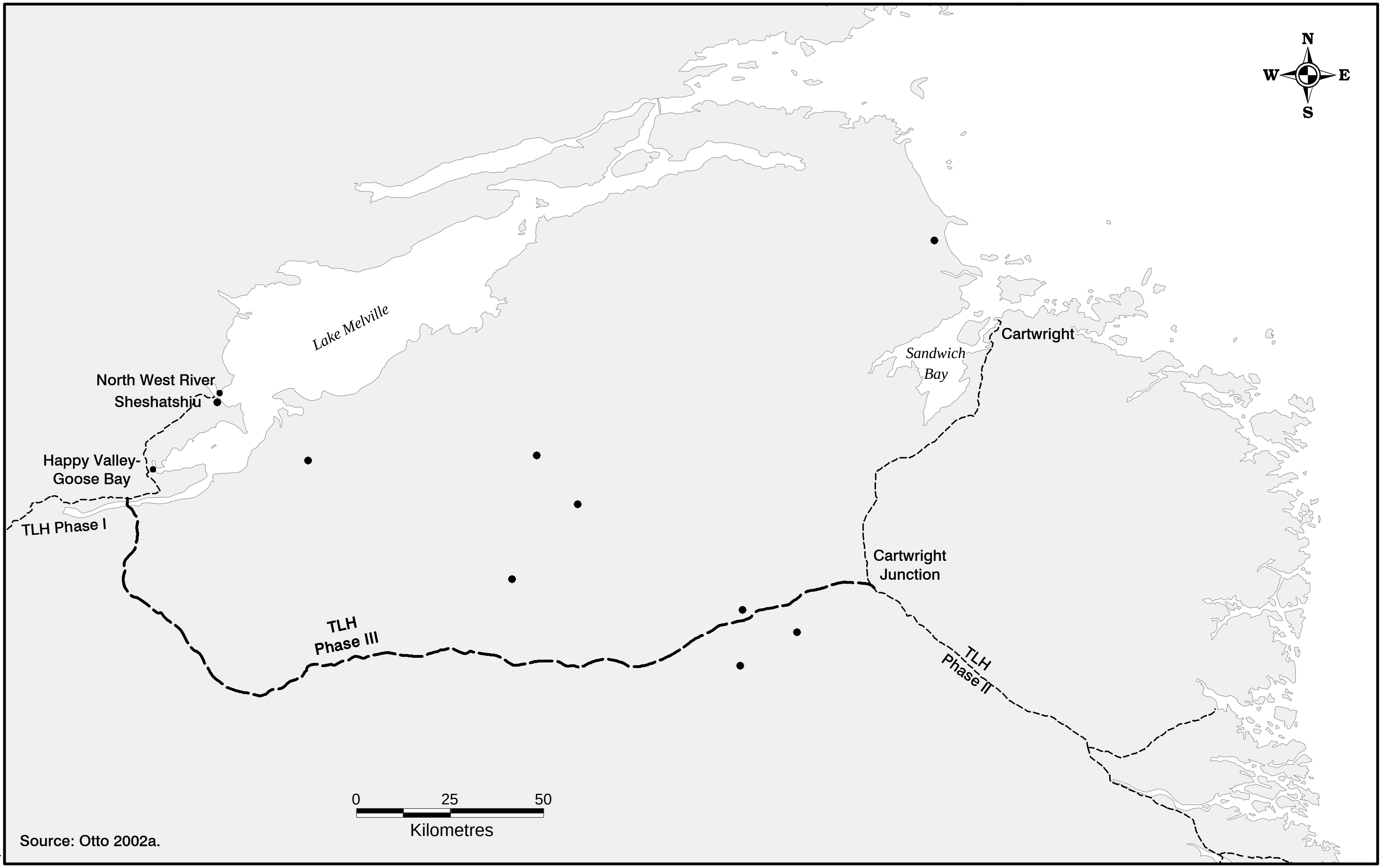

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FIGURE 6.14

Distribution of Collared Caribou, Spring Season 2002

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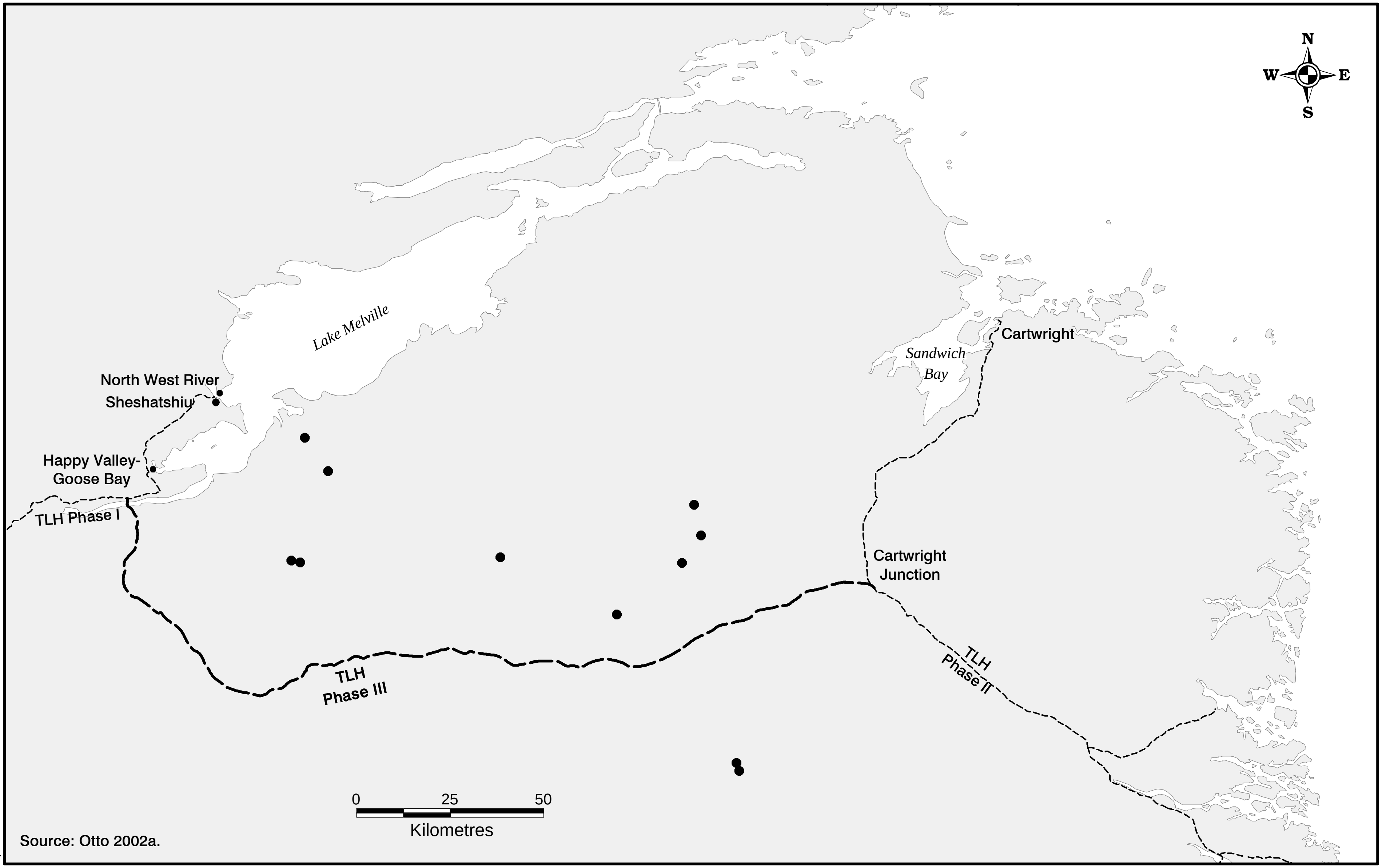

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FIGURE 6.15

Distribution of Collared Caribou, Calving Season 2002

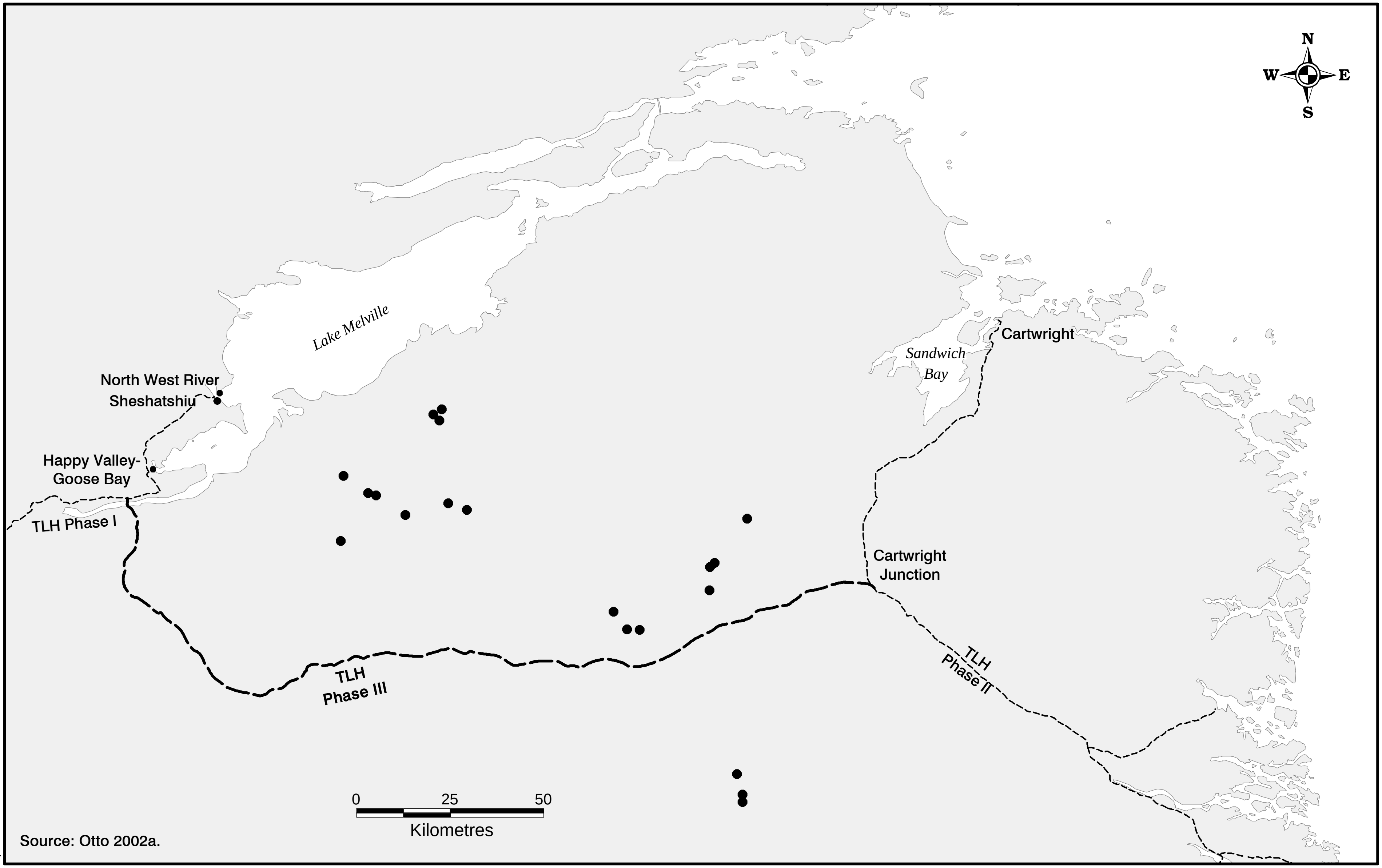

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FIGURE 6.16

Distribution of Collared Caribou, Post Calving Season 2002

6.3.4 Potential Interactions

Activities associated with construction (i.e., use of heavy equipment, blasting, and human presence) may affect caribou, causing animals to temporarily avoid habitat where noise and activity levels are high. The construction camps established along the route during the six-year construction period are shifting centres of human presence, which may be avoided by caribou. Right-of-way clearing and grubbing will result in habitat alteration or loss.

During operation, the physical presence of the highway may interfere with caribou movement through the area. This avoidance is particularly likely to occur when traffic volumes are high . Increased illegal harvesting of caribou could result from improved access.

Caribou/vehicle collisions may also occur. Accidental events such as a forest fire or fuel/hazardous materials spill could also cause habitat alteration or contaminate food sources.

6.3.5 Issues and Concerns

Issues and concerns relating to caribou and the proposed highway include:

- disturbance of caribou, including interference with seasonal movements, during the six-year construction period and during operation;
- displacement of caribou from critical range (i.e., calving or wintering areas) due to habitat alteration or loss during construction, which may lead to lower productivity;
- direct mortality of caribou due to increased hunting made possible by improved access;
- caribou/vehicle accidents; and
- accidental events such as fuel/hazardous materials spills or fires, which could result in habitat alteration or contamination of food sources.

6.3.6 Existing Knowledge

There is extensive literature reporting on the potential effects of linear developments on caribou. These studies identify three major aspects of highway development that may affect caribou: habitat alteration; disturbance caused by the visual presence of the highway, noise and human presence; and increased harvesting as a result of improved access.

Caribou have a number of seasonal habitat requirements, including availability of adequate forage at all seasons, habitats offering insect relief during summer, and calving areas that are relatively predator-free (VBNC 1997). The distribution and seasonal movements of a caribou herd result from an attempt to meet these requirements and to improve reproduction and survival of herd members. Disturbances that alter or destroy habitat, or change the pattern of habitat use, may displace caribou to less suitable habitats or cause the animals to over-graze remaining range. The effects of habitat alteration or loss, or displacement of animals from preferred habitat, are likely to be more important for woodland caribou herds that occupy fairly discrete home ranges than it is for nomadic barren-ground caribou populations that use extensive areas on a seasonal basis (Jakimchuk 1980).

The timing of disturbance, in relation to the animals' daily and/or life cycle activity, influences the magnitude of the effect on caribou. Disturbance during periods when the energy demand is already high (e.g., calving or wintering) may increase the amount of stress on the caribou and adversely affect energy balance.

When exposed to a sudden noise or other disturbing stimuli, caribou commonly exhibit a "startle" reaction that may be slight (i.e., pricking of ears) or more dramatic (i.e., panic running) (Dufour 1980). Horejsi (1981) observed that the visual stimuli associated with the noise may often be more important than the noise itself in eliciting avoidance behaviour. Thompson (1972) noted that the reaction of reindeer to loud noise is intensified by the visual image of the source of the noise. Shideler (1986) determined that heavy equipment will not disturb caribou at distances greater than 1 km if operators remain in the machines. Open habitat offers greater visibility than forested habitat. Therefore, habitat type is likely to play a role in the degree to which caribou react to noise or visual images.

Studies of noise disturbance and wildlife have shown that noise levels under 90 dBA or of a continuous or predictable nature have little affect and usually lead to habituation (Gladwin et al. 1988; Larkin 1994). Louder, unpredictable noises such as from blasting activity can be disturbing, and will not likely lead to habituation over time. Such sudden noises are a stimulus for flight in caribou.

If caribou are alarmed into flight because of construction noise and the detection of motion, the reactions rarely last for very long if the animals are not pursued (DND 1994b). Surrendi and Debock (1976) observed that caribou usually retreated approximately 0.8 km from fast-moving traffic, but would move 12 to 16 km from the disturbance on occasion. Horejsi (1981) studied the trigger distance and flight time of male and female caribou alarmed by a disturbance (fast-moving vehicles) in winter. The study noted that both males and females fled when the noise was between 200 to 300 m away, but the flight time was shorter in males (32 to 44 seconds) than in females (62 to 84 seconds).

Like migratory caribou, woodland caribou appear to be most sensitive to noise disturbance during the calving period and cow-calf groups show the greatest reaction to disturbance (Davis and Valkenburg 1985; Harrington and Veitch 1992). Chubbs et al. (1993) reported that female woodland caribou accompanied by calves during spring and summer demonstrated the greatest avoidance of high-disturbance areas.

Whitten et al. (1992), in a study of migratory caribou, found that even minor changes in habitat use during calving may influence productivity as most calf mortality occurs within 48 hours of birth. However, Bergerud et al. (1984) reported that harassment from prolonged helicopter overflights did not disturb a woodland caribou population in Newfoundland to the point where the calving site was abandoned.

Caribou herds undergo natural shifts in their range that appear to be related to population size or climatic factors (Skoog 1968; Bergerud et al. 1984). Use of traditional calving areas can be altered by snow conditions or flooding. Under such circumstances, females may not form large aggregations and calving can take place in several different locations (Skoog 1968; Davis et al. 1985; Sopuck and Jakimchuk 1986). Calf production and survival appeared to be unaffected.

Caribou avoided, or showed reduced use of the immediate areas where the Upper Salmon hydroelectric project was being constructed (Hill 1985) and the Hope Brook gold project was being developed (Mahoney et al. 1989). After construction, caribou occupation of habitat adjacent to these developments returned to approximately pre-development levels (Upper Salmon) or showed recovery toward pre-development levels (Hope Brook) (Tucker and Mahoney 1990).

Caribou tend to avoid linear structures such as highways, but avoidance is due primarily to the presence of people and/or traffic and not because of the presence of the highway itself (Klein 1980; Shidler 1986; Cameron et al. 1992). Northcott (1985) noted that caribou in the vicinity of the Upper Salmon hydroelectric development in Newfoundland were hindered from crossing main access highways by dust associated with fast-moving vehicles.

There are many examples of caribou habituating to an operating highway. The Avalon herd in Newfoundland has habituated to the presence of fast-moving traffic (Bergerud et al. 1984). Some animals in that herd could be approached to within 100 m, and as the herd increased in size, its range expanded to include the highway. The caribou in that herd had no previous experience with highways, nor previous tradition of crossing the highway. Another Newfoundland herd wintered within 2 km of the operating railway and within 4 km of the Trans Canada Highway (Bergerud 1974a).

Mahoney (1980) suggested that caribou cross highways more readily when the highway is located in wooded terrain because traffic is not visible over long distances. However, Surrendi and DeBock (1976) indicate that caribou show more apprehension approaching a highway in forested areas because the visual change is more sudden and greater than in open terrain. Klein (1980) noted that in forested areas, caribou appeared to prefer to cross where the highway was straight and level and provided the best visibility. Caribou approaching a highway in open terrain usually do so in single file, and often hesitate before crossing if shrubbery is present along the sides of the highway (Surrendi and DeBock 1976). Once they enter the shrubbery, caribou usually move more quickly. Highwayside growth could presumably provide cover for wolves or other predators.

Highway crossing also appears to be influenced by the height of the highway above the surrounding terrain (Klein 1980). In open terrain, caribou showed stronger avoidance to a highway if it was raised appreciably above the surface of the ground. Such a highway presents a greater visual barrier, and the steep, rough embankments may restrict caribou movements.

Caribou generally respond more readily to visual stimuli than to auditory ones (Klein 1980). Although traffic volume and vehicle speed are known to be factors in highway crossing by caribou, little quantitative information is available. Curatolo and Murphy (1986) reported that approximately 50 percent of the cow-calf groups observed adjacent to a highway/pipeline corridor crossed the corridor when highway traffic averaged 15 vehicles per hour. When traffic averaged 30 vehicles per hour, the number of such groups crossing the corridor at another site dropped to 25 percent. Thirty vehicles per hour was defined by Curatolo and Murphy (1986) as ‘heavy traffic’.

Studies of barren ground caribou in the Yukon showed that 86 percent of the animals approaching a highway turned back and did not cross when traffic was moving at 56 km/h or faster (Roby 1978). Slow-moving vehicles were less disturbing. Large trucks caused a stronger avoidance response than automobiles or pickup trucks.

The reaction of caribou to highways and traffic (and to disturbance in general) varies according to the composition (sex and age) and size of the group. The cow-calf segment of woodland caribou in Newfoundland and barren-ground caribou in Alaska demonstrated the greatest avoidance (Chubbs et al. 1993; Whitten and Cameron 1983). Stags appeared to be less sensitive to disturbance. Large post-calving groups of barren-ground caribou were observed to break into smaller and dispersed subgroups as they approached an oilfield development and only individuals and small groups (mostly males) actually entered the area (Whitten and Cameron 1983). This contrasted with the observations of Curatolo and Murphy (1986), who noted that regardless of which avoidance-triggering factor was in play, the reluctance of caribou to cross highways appeared to decrease as the group size increased. This behavior was particularly noticeable in summer when caribou were harassed by insects.

6.3.7 Mitigation

Environmental management planning (Section 2.10) incorporates a number of mitigation measures aimed at reducing the potential effects of the project on caribou and their environment. Specific mitigative measure include the following:

- limiting areas of vegetation clearing and grubbing to 30 m within the right-of-way;
- blasting to comply with government laws and regulations, and instantaneous peak noise levels minimized by time delay blasting cycles;
- scheduling of high disturbance activities such as blasting to occur outside of sensitive periods such as calving, when caribou are present in the area of construction;
- walls of decommissioned borrow pits graded to slopes less than 2:1;
- slopes of the highway graded for ease of passage at potential crossing points for caribou;
- vehicles operate at appropriate speeds and yield to wildlife;
- project personnel will not chase, harass, or feed wildlife.
- construction vehicles will remain in the right-of-way and all-terrain vehicles will use designated routes; and
- design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.

Many of the potential adverse effects of the project 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, 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.

6.3.8 Environmental Effects Assessment

The route of the proposed highway lies within the southern periphery of the range of the MMCH. Although it is difficult to determine the exact southern limit of the herd (Otto 2002b), it is evident that the majority of the range occurs north of the highway. If the "centre of habitation" concept (Skoog 1968) can be applied to woodland caribou herds, as it is to barren-ground herds, habitat at the periphery is considered more marginal and less critical than habitat at the center of the range.

6.3.8.1 Construction

Some habitat used by the MMCH is expected to be altered or lost as a result of right-of-way clearing, grubbing, and other construction activities. As well, it is anticipated that caribou will avoid the immediate area of the highway during construction activities because of noise and human disturbance. The calving and post-calving habitat located on the string bogs in the headwaters of the Eagle and Paradise Rivers is the area most likely for this interaction to occur. Based on traditional range boundaries and on the distribution of collared MMCH animals in 2002, few other portions of the range are close enough to the highway to be affected by construction activity.

Avoidance of habitat because of noise and human activity would probably last one construction season in any particular area. Caribou live in a highly variable environment and tend to habituate quickly to disturbance (Roby 1978; Klein 1980). Caribou prevented by construction activity from using a particular calving area in the headwaters of the Eagle and Paradise Rivers or elsewhere will likely select an alternate undisturbed site. No reduction in herd productivity is anticipated.

In 2002, during the calving and post-calving periods, approximately 20 percent of the range was on the south side of the highway and approximately 10 percent was on the south side of the highway in spring, prior to calving. Although fragmentation caused by the highway is a concern, the major portion of spring and summer habitat for the MMCH remains north of the highway. Displaying the considerable flexibility that caribou appear to have in their habitat requirements (Davis et al. 1985), the MMCH will likely select alternate habitat during construction. That flexibility is perhaps most important in the selection of calving locations and MMCH females have shown limited fidelity to calving sites from one year to the next. Habitat that may be avoided during construction will most likely be used again following construction as experience in other developments has shown (Hill 1985; Mahoney et al. 1989).

This flexibility demonstrated by caribou minimizes the negative effects of habitat avoidance to disturbance. The current range of the MMCH has supported a much larger herd at various times in the past. String bogs and other types of bogs suitable for calving are present throughout the range of the herd, and most will not be disturbed by construction activities.

Although some summer habitat will possibly be lost through construction, caribou are widely dispersed over a summer range that extends from the calving areas to the coast north of Sandwich Bay (Hearn and Luttich 1987).

Little MMCH wintering habitat appears to be threatened by construction activities. Most of the traditional winter range (Mealy Mountains, Porcupine Strand, south shore of Lake Melville) is well removed from the route of the highway. However, in years of light snowfall caribou often move into forested areas south of the mountains. It is here where they may interact with the highway. However, construction will not be occurring during the winter. Therefore, animals will not encounter any disturbance from construction activity. As well, there are numerous examples of caribou habituating to human activity and the relatively small area that will be disturbed in a one construction season should not prohibit caribou from reaching calving grounds south of the highway. In areas where caribou crossings are identified, roadbed slopes will also be graded to allow caribou ease of crossing.

If interactions between the MMCH and construction of the proposed highway do occur, it will most likely be where the highway crosses a portion of the herd's range in the headwaters of the Eagle and Paradise Rivers. In this area, the highway may represent a physical or behavioural barrier to caribou attempting to reach calving areas south of the highway. However, it appears that only a small proportion of calving animals would be using these areas and the failure to reach a particular calving site because of the physical presence of the highway will likely be a single-season effect due to construction activity. As well, there are numerous examples of caribou habituating to human activity, and the relatively small area that will be disturbed in one construction season should not prohibit caribou from reaching calving grounds south of the highway.

No other movements of the MMCH are likely to be greatly influenced by the highway. Although some individual animals may move relatively large distances compared to other woodland herds in Labrador, most of this movement occurs north of the highway and is generally oriented east-west. North-south movement does occur. However, the southward penetration of most animals probably does not extend to the highway. Generally speaking, the MMCH displays only short seasonal movements and mostly as individuals or small groups.

6.3.8.2 Operation

No additional habitat will be altered or removed in the operation phase of the highway. However, the highway may cause some habitat to be avoided due to the presence of traffic. However, as noted above, caribou are know to habituate to vehicular traffic and traffic levels on the TLH - Phase III will be low. Animals would be expected to habituate to the highway, and to cross it when conditions (i.e., low traffic volumes) are acceptable. Caribou are likely to continue using calving sites south of the highway and herd integrity is not likely to be threatened by the presence of the highway.

Because the highway is generally on the periphery of the MMCH range, the highway is not likely to be a physical or behavioural barrier to herd activity as limited migrations appear to be undertaken, and the short to medium-distance movements displayed by the herd in 2002 appear to be mainly north of the highway and in an east-west orientation. However, in the area of Eagle/Paradise River headwaters, calving and post-calving range use does occur and in some years wintering range in the forests south of the Mealy Mountains is also occupied. In each case, animals will probably cross the highway fairly readily because traffic volumes are likely to be low. Caribou have also been documented habituating to operating highways and have expanded ranges across highways.

The highway may also attract caribou (Bergerud 1974b). Although it is peripheral to the herd's range, some animals may use the highway for ease of travel year-round and the general east-west orientation of the highway is consistent with predominant herd movements. If animals are wintering near the highway, they may be attracted to it because plowing or snowcover compression may make movement easier. However, high berms of plowed snow can be a hindrance to caribou moving onto (or across) the highway (Klein 1980). These berms may also trap caribou on the highway and thus contribute to the number of animal/vehicle collisions. Caribou fleeing from vehicles in winter will be incurring increased energy loss at a time when energy demand is already high (Horejsi 1981). Similarly, highways may attract predators for the same reason (i.e., ease of travel) and caribou may be more vulnerable to predation.

In summer, caribou may be attracted to the highway for insect relief (Murphy and Curatolo 1987). This increases the potential for caribou/vehicle accidents to occur. Vehicles traveling at high speeds in winter and summer generate clouds of snow and dust behind them. This adds to the intensity of the general disturbance to caribou adjacent to the highway (Roby 1978; Northcott 1985) and probably increases the likelihood of vehicle/caribou accidents.

Access to areas where previously there was no easy access will likely have some adverse effects on the MMCH. Illegal hunting pressure on the herd will probably increase. Illegal hunting pressure and other human-related disturbance could cause a decrease in the already low number of Mealy Mountains caribou, and could extirpate local pockets of caribou in the vicinity of the highway (Otto 2002b). As noted previously, it is beyond the ability of WST to mitigate the effects of illegal hunting. Appropriate measure can be identified and should be implemented by resource management agencies to control illegal harvesting of the MMCH.

The southern boundary of the MMCH range is not clearly defined. The herd affiliation with pockets of caribou reported closer to the Labrador/Quebec border is not understood and no evidence of these small groups was found during the Caribou Component Study field work to date (R. Otto, pers. comm.). These pockets of caribou were known to be present in the area at one time; however, if they still exist, there is no current evidence linking them to the MMCH. These small groups would also be affected by improved access provided by the highway.

6.3.8.3 Accidental and/or Unplanned Events

The major effect of fire on caribou would be destruction of the food supply. Lichens, a major forage group for caribou throughout the year (and especially critical in winter), are particularly susceptible to wildfires in summer and require many decades to recover (Klein 1982). Summer forage plants are also at risk from fire, but can recover more quickly as they have more advanced root systems or can re-grow from seed sources (Henry and Gunn 1991.)

Some mortality may result from collisions with vehicles; however, with the low traffic volume expected on the highway and the generally low densities of caribou in the region, the number of vehicle collisions is expected to be low.

A summary of the environmental effects associated with each project phase is presented in Section 6.3.9.

6.3.9 Environmental Effects Evaluation

The following definitions are used to rate the significance of the predicted residual environmental effects of the project on caribou:

A **major (significant) environmental effect** is one affecting a caribou population in such a way as to cause a change in abundance and/or distribution beyond which natural recruitment (reproduction and in migration from unaffected areas) would not return that population, or any populations or species dependent upon it, to its former level within several generations. The effect is not reversible.

A **moderate (significant) environmental effect** is one affecting a portion of caribou population in such a way as to cause a change in the abundance and/or distribution of that portion of the population or any populations or species dependent upon it over one or more generations, but does not change the integrity of any population as a whole. The effect may not be reversible.

A **minor (not significant) environmental effect** is one affecting a specific group of individuals of a caribou population in such a way as to cause a change in abundance and/or distribution in a localized area and/or over a short period (one generation or less), but not affecting other tropic levels or the integrity of the population itself. The effect is reversible.

A **negligible (not significant) environmental effect** is one affecting a specific group of individuals of a caribou population in such a way as to cause a change in abundance and/or distribution in a localized area and/or over a short period (one generation or less) in a manner similar to small random changes in the population due to natural irregularities, but having no measurable effect on the population as a whole. The effect is reversible.

The most likely caribou/project interactions are expected to occur during the calving and post-calving periods. Woodland caribou are known to calve singly or in small groups and readily use alternate sites (i.e., do not necessarily have fidelity to any one site). An increase in illegal harvesting is anticipated and caribou-vehicle collisions (a new phenomenon for this herd) can be expected when the highway becomes operational. However, the highway is located on the southern periphery of the herd's range and caribou are known to habituate to highways. Based on the preceding discussion and proposed mitigations, the residual environmental effects of construction, operation, and accidental events on caribou during these periods are predicted to be minor (not significant) (Table 6.9) and will be limited to a specific group of individuals in a localized area.

Destruction of the critical and slow-to-recover lichen food supply as a result of forest fire may affect caribou food supplies. However, like all boreal species, caribou are adapted to a fire-driven ecosystem and the amount of habitat affected within the range of the MMCH as a result of a fire originating near the highway would be relatively small.

Although the MMCH is not well known scientifically, the current Caribou Component Study is providing data on movement patterns and seasonal habitat use that is consistent with the historical record. This, along with the availability of well documented research on caribou/development interactions elsewhere, permits a high level of confidence in evaluating the environmental effects of the project on caribou.

Table 6.9 Environmental Effects Summary - Caribou

	Construction	**Operation**	**Accidental/Unplanned Events**
Mitigation: • limiting areas of vegetation clearing and grubbing to 30 m within the right-of-way; • blasting to comply with government laws and regulations, and instantaneous peak noise levels minimized by time delay blasting cycles; • scheduling of high disturbance activities such as blasting to occur outside of sensitive periods such as calving when caribou are present in the area of construction; • walls of decommissioned borrow pits graded to slopes less than 2:1; • slopes of the highway graded for ease of passage at potential crossing points for caribou; • vehicles operate at appropriate speeds and yield to wildlife; • project personnel will not chase, harass, or feed wildlife. • construction vehicles will remain in the right-of-way and all-terrain vehicles will use designated routes, avoiding wetland areas wherever possible; 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	Unknown
Geographic Extent	<1 km^2	1-10 km^2	100 km^2
Frequency	Continuous	Continuous	<10
Duration	>72	>72	>72
Reversibility	Irreversible	Irreversible	Unknown
Ecological/Socio-economic Context	Low		
Environmental Effects Evaluation			
Significance	Not Significant (Minor)	Not Significant (Minor)	Not Significant (Minor)
Level of Confidence	High	High	High
Likelihood[1]	n/a	n/a	n/a
Sustainable Use of Renewable Resource[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: Collared caribou will continue to be monitored during construction.			

Key:

Magnitude:	High, Medium, Low, Nil or Unknown
Geographic Extent (km^2):	<1, 1-10, 1-100, 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, 36-72, 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 Renewable Resources:	High, Medium, Low or Unknown

6.3.10 Cumulative Environmental Effects

Angling, hunting and trapping have been ongoing in the project area for many years. These activities tend to be localized and of short duration at any given time, with the result that the study area is essentially pristine and undisturbed by human activity. Low-level flying by military aircraft has been occurring in the region since the 1980s; however, except for a small area at its western boundary, the range of the MMCH falls outside the LLTA. Snowmobile trails are found throughout the region and it is possible that caribou will interact with this activity. However, the effects would be localized and of short duration.

Hunting has had an effect on the MMCH in the past and at least some of the herd's large population fluctuations over the years have been attributed to overhunting (both legal and illegal). This hunting pressure will probably increase due to the presence of the highway. The area occupied by the herd is currently closed to caribou hunting. However, poaching is probably still occurring in the area. Moose hunting is also permitted in some areas on the periphery of the range.

Hunting, trapping, fishing, gathering, and camping activities by Innu and other Labrador residents take place in a number of locations along the route of the highway. These activities are particularly concentrated in the region around Park and Crooks Lakes, and are pursued at various levels of intensity throughout the year (Northland Associates Limited et al. 1994).

The most important development activity that is likely to occur following highway construction is commercial forestry. Forestry results in the loss of mature stands of coniferous forest that alters habitat, and the noise and other disturbances associated with these activities may cause caribou to avoid these areas. One of the more serious forms of habitat disturbance for woodland caribou is forest harvesting. The decision by COSEWIC (2002) to designate woodland caribou populations in eight territories and provinces (including Newfoundland and Labrador) as *threatened* is based, in large part, on loss or degradation of habitat resulting from commercial forestry operations within the range of these populations. Other land and resource activities, such as mineral exploration, hunting and angling, are also likely to increase due to enhanced access provided by the highway. Cabin development along the highway may also occur, creating areas of permanent human disturbance that may cause caribou to alter habitat use in an area.

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 their related effects are beyond the jurisdiction of WST. Control depends on interagency planning and cooperation. As a result, assumptions are made for assessing cumulative effects of induced actions, including:

- other projects and activities will be subject to appropriate planning and management;
- other projects and activities will be subject to the appropriate government requirements (e.g., legislation, regulations and guidelines) for protecting crown resources;
- relevant government agencies will have adequate resources to effectively carry out their mandate with respect to enforcement;
- 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.

The creation of the Akamiuapishku/Mealy Mountains National Park, which would encompass approximately half of the highway route, would afford greater protection to caribou from hunting and would protect habitat from activities such as cabin development and forest harvesting.

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

6.3.11 Environmental Monitoring and Follow-up

Collared caribou will be monitored through to Summer 2003.

6.4 Furbearers

Within the context of this assessment, furbearers represent a diverse group of species that occupy a variety of terrestrial and aquatic habitats in the study area. This group represents not only several species with important ecological niches (e.g., as predators or prey) but also those that may dramatically influence habitat for other species (e.g., beaver) Furbearers also have important implications for the Labrador economy. Although waning in recent years, trapping effort for furbearers represents one of the most important and traditional land use activities by residents.

6.4.1 Boundaries

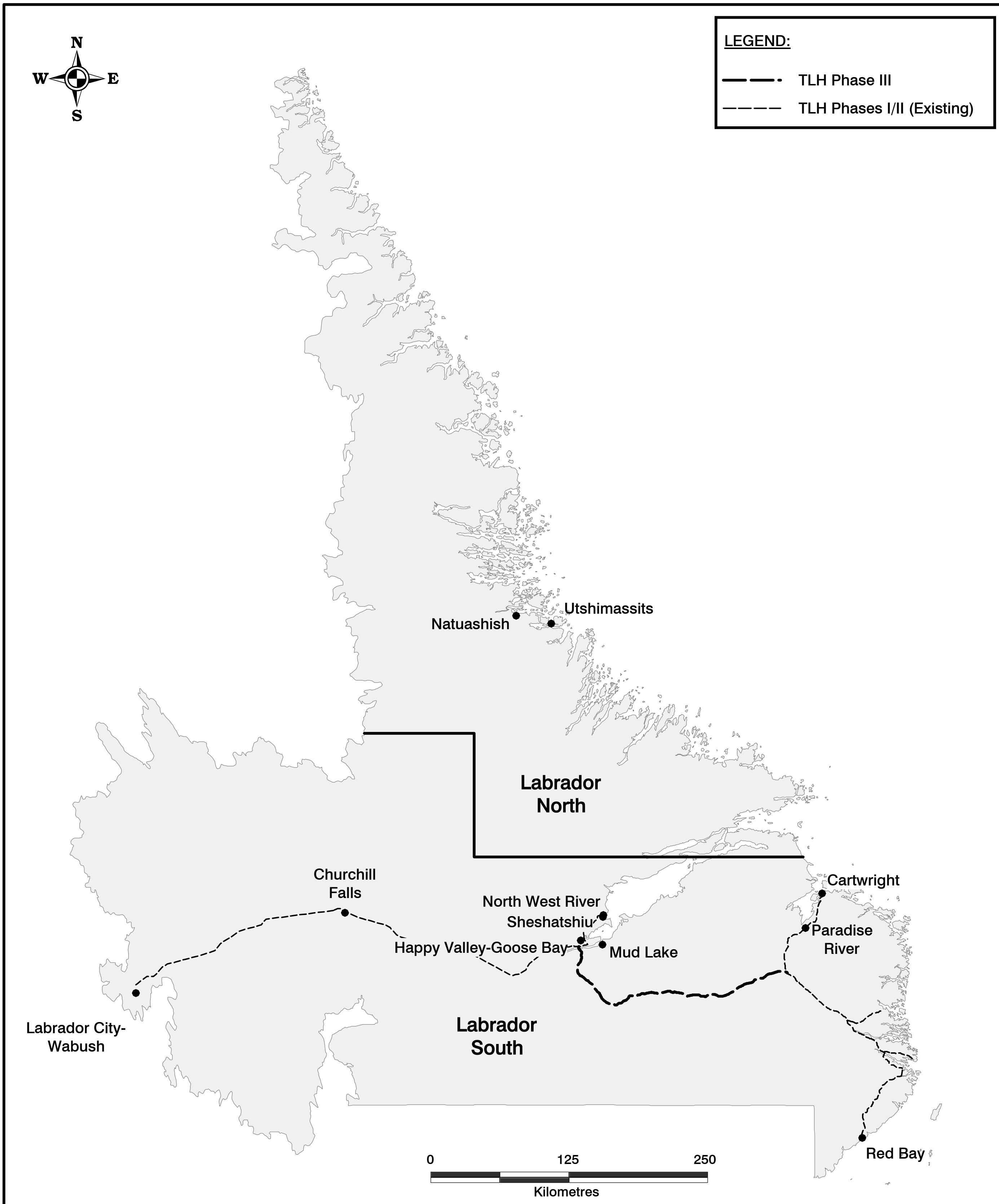
Project boundaries for furbearers are defined by the spatial and temporal extent of project activities and zones of influence in the project area. These project boundaries will extend throughout the project construction and operation phases.

In terms of ecological boundaries, related to this VEC, some species in this group represent those that are wide ranging (home ranges extending several km^2) (e.g., mink, otter, fox, wolf, marten), while other species may be resident in or near a specific waterbody (e.g., beaver, muskrat) or have smaller home ranges (e.g., red squirrel, northern flying squirrel). Black bear and porcupine have been included in the furbearer VEC because of their importance to Aboriginal people and the potential sensitivity of these species to highway development. Ecological boundaries related to this VEC are defined by the distribution of furbearer populations which use the project area.

In terms of administrative boundaries, the proposed highway will pass through the provincially designated Labrador South Fur Zone, encompassing an area from the north shore of Lake Melville, south to the Québec border and west to the Québec border (Figure 6.17). Furbearers are managed under the Newfoundland and Labrador *Wildlife Act*.

6.4.2 Methods

Specific information on furbearer densities, distribution and productivity in the study area or even Labrador in general does not exist. Some harvest information from trapping statistics can infer relative abundance and trends although these data are influenced by effort. Although surveys for this assessment were not designed specifically for furbearers, opportunistic observations of otter and beaver activity were recorded during surveys for raptors and waterfowl in 2002 (JW and LMSS 2003a; 2003b). In combination with available literature from elsewhere in Labrador or the northern boreal forest of Canada, the assessment examined the potential effects of the project based on similar habitats and interactions for each species. Scientific names of furbearers discussed in this chapter are provided in Appendix E.



Source: DTCR 2002a.

Jacques Whitford Environment Limited
Environmental Scientists
Consulting Engineers

Figure 6.17

Furbearer Management Zones in Labrador

6.4.3 Existing Environment

Aquatic furbearers (i.e., otter, mink, muskrat, and beaver) spend most or all of their life-cycle in and around wetland habitat, rivers and ponds (Table 6.10). Other furbearers prefer dryer forested sites (e.g., fox, wolf, lynx, weasel, red squirrel, northern flying squirrel and marten) but may use riparian zones adjacent to wetland habitat. Within both of these groups are carnivorous (feeding on other mammals, birds, fish and insects) and herbivorous species. Some important examples of the former in the study area are marten, least weasel, red fox and ermine that feed primarily on voles and lemmings and other small mammals, while lynx and wolf are more specialized, with lynx feeding primarily on snowshoe hare (Table 6.10). Wolves prey on moose or caribou in Labrador (Trimper et al. 1996) but may feed on a variety of other prey opportunistically (Carbyn 1987). Mink and red fox are more generalized hunters, taking whatever prey is available. Populations of specialists tend to fluctuate in tandem with fluctuations in prey populations, and this relationship is well established between lynx and snowshoe hare. As well as affecting furbearer numbers overall, changes in prey abundance can affect individual fitness, as has been observed in wolves (Messier 1987), or home range size, as has been documented for marten (Thompson and Colgan 1987). Due to the secretive nature and wide-ranging habits of many furbearers, determining the population status of species is difficult. In Labrador the population size of various furbearer species is generally unknown. However, it is likely that furbearer populations are healthy as harvesting pressure is generally localized and relatively low and there is abundant habitat available.

Table 6.10 Characteristics of Furbearers in the Study Area

Species	Probable Habitat in the Study Area	Behaviour	Reproduction	Food Habits
Marten	mature coniferous and mixed forest, >20 percent canopy cover	diurnal/nocturnal, solitary, arboreal and terrestrial	one litter/yr, 1-5 young, average 3	small mammals, hares, birds, carrion, fish, insects, berries
Mink	riparian zones, wetlands	solitary and nocturnal, terrestrial	one litter/yr 2-10 young, average 4-5	small mammals, muskrat, amphibians, fish, birds, hares, invertebrates
River Otter	permanent waterbodies, riparian zones	nocturnal/ crepuscular, family units, aquatic and terrestrial	1 litter/yr 1-6 young, average 2-3	fish, invertebrates, reptiles, amphibians, birds, small mammals
Least Weasel	open areas, mixed forest	nocturnal, solitary, terrestrial	2+ litter/yr 1-10 young	small mammals, insects
Ermine	tundra, forest	nocturnal, solitary, arboreal and terrestrial	1 litter/yr 4-10 young	small mammals, small birds, fish, amphibians, invertebrates
Red Fox	semi-open habitats, forest edges and clearings	diurnall/nocturnal, family units in spring/summer, solitary in fall/winter, terrestrial	1 litter/yr 1-10 young	small mammals, birds, berries, carrion, hares

Species	Probable Habitat in the Study Area	Behaviour	Reproduction	Food Habits
Lynx	mature and successional forest, riparian zones in river valleys	nocturnal/ crepuscular, solitary, populations cycle with snowshoe hare, terrestrial	1 litter/yr 2-5 young	snowshoe hare, small mammals, birds, caribou and moose calves
Wolf	varied, depends on habitat or prey location	nocturnal/ crepuscular, gregarious in family units and packs, terrestrial	1 litter/yr 1-11 young, average 6-7	caribou, moose, beaver, birds, small mammals
Red Squirrel	mature coniferous or mixed forest	diurnal, solitary, arboreal	1-2 litter/yr 1-8 young	conifer cones, berries, fungus, eggs, mice
Northern Flying Squirrel	boreal forest	nocturnal, somewhat gregarious, arboreal	1 litter/yr 2-4 young	lichens, leaves, seeds, carrion, bird eggs
Beaver	slow streams, lakes and ponds in or near forested areas	nocturnal/ crepuscular, gregarious, aquatic and terrestrial	1 litter/yr 3-4 young	aquatic vegetation, bark, leaves, buds and stems of deciduous species
Muskrat	permanent water that does not freeze to bottom, with herbaceous and aquatic vegetation	nocturnal/ crepuscular, solitary or family units, aquatic and terrestrial	2-3 litters/yr 3-9 young	aquatic vegetation, fish, clams, mussels
Black Bear	mosiac of forested and non-forest habitats	diurnal, solitary, terrestrial	1-4 young every 2 years	omnivorous, mainly vegetation, insects, fish, carrion, caribou calves
Porcupine	deciduous/coniferous forest	nocturnal/ crepuscular, solitary, arboreal and terrestrial	1 litter/yr one young	leaves, seedlings, grass, cambium layer and inner bark of trees (aspen, birch, spruce, balsam fir, tamarack)
Wolverine	forest, Arctic and alpine tundra	nocturnal, solitary, terrestrial	1 litter/yr 2-3 young	birds, small mammals, hares, carrion
Source: adapted from DND 1994c.				

Species such as wolf and lynx use a variety of habitats and often have large home ranges. For example, the average home range of wolves in Alaska has been measured at 638 km^2 (Peterson et al. 1984). Medium-sized carnivores may also have fairly large home ranges. In research associated with the TLH - Phase II assessment (JW 1998a), a separate program was initiated for marten. Home range size for radio-collared marten in southeastern Labrador (east of Paradise River) varied, from 10 km^2 to 96.6 km^2 for males and 9.2 km^2 to 79.9 km^2 for females, with male home ranges being considerably larger (Smith and Schaefer 2002). In contrast, species such as weasel and red squirrel have much smaller home ranges and depend on a diversity of habitat types in close proximity to meet their needs for cover and food. For example, red squirrels in spruce forests have been documented with home ranges of 0.2 to 0.5 ha. (Obbard 1987).

Black bear inhabit a variety of habitats in Labrador and are relatively common in the forests of the Quebec-Labrador peninsula (DND 1994c; JW 1997). The species has also colonized tundra regions of the Quebec-Labrador peninsula in the last century (Veitch 1991). In northern Canada, bears den for five to seven months and in Labrador, emerge in April or May (DND 1994). Emergence from denning appears to be influenced by snow melt, photo-period, temperature, gender and pregnancy (Harrington 1994). During black bear research in support of the Voisey's Bay Mine/Mill EIS, monitoring in early April 1997 indicated that all radio-collared bears were inactive and continued to occupy fall dens (JW 1997).

Porcupines are found in coniferous and deciduous forest. Porcupines in Labrador have the largest home ranges recorded, at approximately 10 times larger than anywhere else. This difference is likely the result of the low productivity of the boreal forest in Labrador and it is likely that porcupines exist at lower densities than in more southern regions (I. Schmelzer, pers. comm.). Porcupines typically move little in winter and extensively in summer. These differences are more pronounced in areas where seasonal changes are large, such as in Labrador (I. Schmelzer, pers. comm.). Porcupine numbers appear to be increasing following a sharp decline in the 1950s and 1960s (I. Schmelzer, pers. comm.). Porcupines feed on herbaceous growth outside the winter season when bark is the main source of food. In spring, porcupines switch to emergent vegetations found in riparian zones and along roadsides (I. Schmelzer, pers. comm.).

Wolverine are currently listed as endangered by COSEWIC; however, there have been no confirmed records of wolverine in Labrador since the 1950s. Following interviews and investigation of reports, Northcott (1990) concluded that wolverine may, in fact, be extirpated from Labrador. However, the species is protected and there is no open trapping season. Potential reasons for the decline of the eastern wolverine population include harvesting and reduced ungulate populations after 1900 (Northcott 1990).

Over the course of this assessment, observations of beaver lodges and dams, otter tracks and any incidentally encountered furbearer were recorded during aerial surveys conducted for raptors and waterfowl (May through August 2002) (JW and LMSS 2003a; 2003b) and for caribou in April 2002 (Inland Fish and Wildlife Division unpublished data). During the April and May surveys in particular, snow cover was extensive, and tracks of furbearers were apparent. Beaver activity varied dramatically but was distributed along the entire proposed route, generally associated with smaller waterbodies and streams with hardwood (i.e., aspen or birch) in the vicinity (Figure 6.18). One particular area, northeast of Crooks Lake and approximately 5 km south of the highway route, had seven beaver lodges along a 1-km stretch of ponds and connecting streams (Figure 6.18). The area had numerous patches of hardwood growth. Numerous otter tracks, observed along the Kenamu River and tributaries, likely belonged to the same animal because of the relatively large size of otter home ranges and the generally low density of individuals (Figure 6.19). Otter tracks were generally seen along rivers and larger lakes, where openings in the ice allowed access to the water. Observations of otter were also made during several surveys, most in the area around the Kenamu River, where tracks were numerous. Observations of otter southeast of Park Lake in May and August were likely of the same individual or members of a family unit (Figure 6.19). As the same areas were often overflown during each survey, some individuals observed may have been the same from survey to survey.

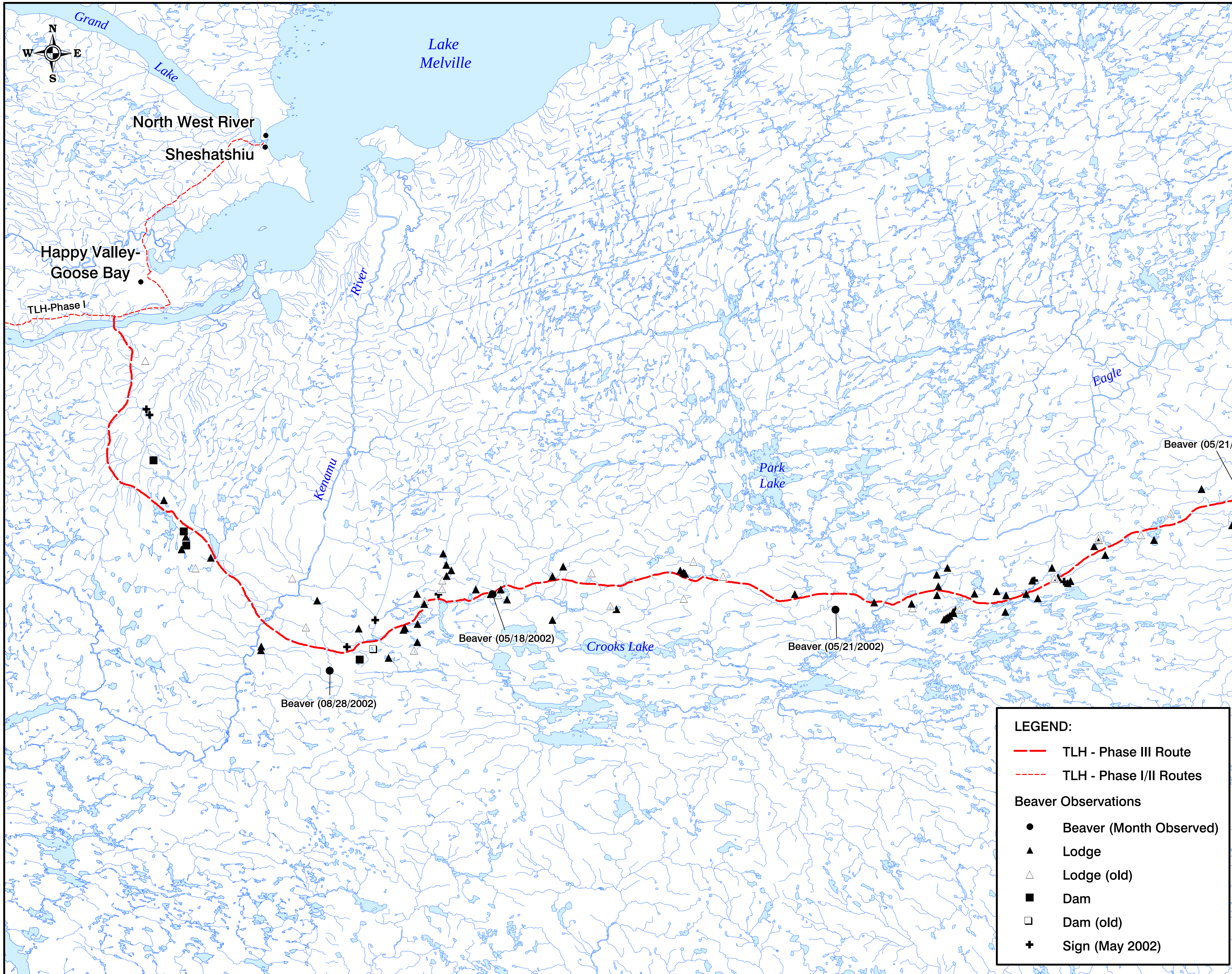


Figure 6.18

Beaver Activity Along the TLH - Phase III

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Figure 6.19

River Otter Activity
TLH - Phase III

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Fox tracks were generally observed along the edges of rivers and brooks. One set of marten tracks was observed on the western end of the highway (Figure 6.20). This single observation would not be representative of marten activity in the region, as tracks of this species are difficult to see in forested areas where marten are generally found. Two observations were made of a muskrat swimming, both north of Crooks Lake (Figure 6.20). As the observations were quite close together and seen on different surveys, it is possible that the two observations were of the same animal. Porcupine were frequently seen on open wetland or bog areas during the spring surveys (Figure 6.20), apparently feeding on new growth in these areas. Porcupine sign, in the form of tree girdling, was also observed at several areas along the highway route (Figure 6.20). A black bear with two cubs was observed south of Park Lake (Figure 6.20) and observations of individual blacks bears were also made, several in the Paradise River area (Figure 6.20).

6.4.4 Potential Interactions

With such a variety of species within the furbearer group, there is a variety of sensitivities and reactions that may potentially occur as a result of the proposed project. In some cases, species within this group may be attracted to, for example, a clearing, whereas others would be displaced.

Construction activities (noise, equipment use and human presence) may cause furbearers to temporarily avoid some areas. In addition to disturbance from noise and human presence, construction may also alter or remove habitat for furbearers, particularly if it occurs in the riparian zone along watercourses and standing waterbodies or in forested areas.

During operation, noise and regular vehicular activity may also cause disturbance, resulting in avoidance of habitat in the vicinity of the highway. Increased harvesting of furbearers may occur as a result of improved access.

An accidental event such as a forest fire could cause furbearers to avoid areas previously inhabited or result in lost foraging opportunities. Spills of fuel or other hazardous materials could result in the contamination of waterbodies, leading to reduced foraging opportunities for species such as otter and mink. Collisions with vehicles may result in mortality for a variety of furbearers.

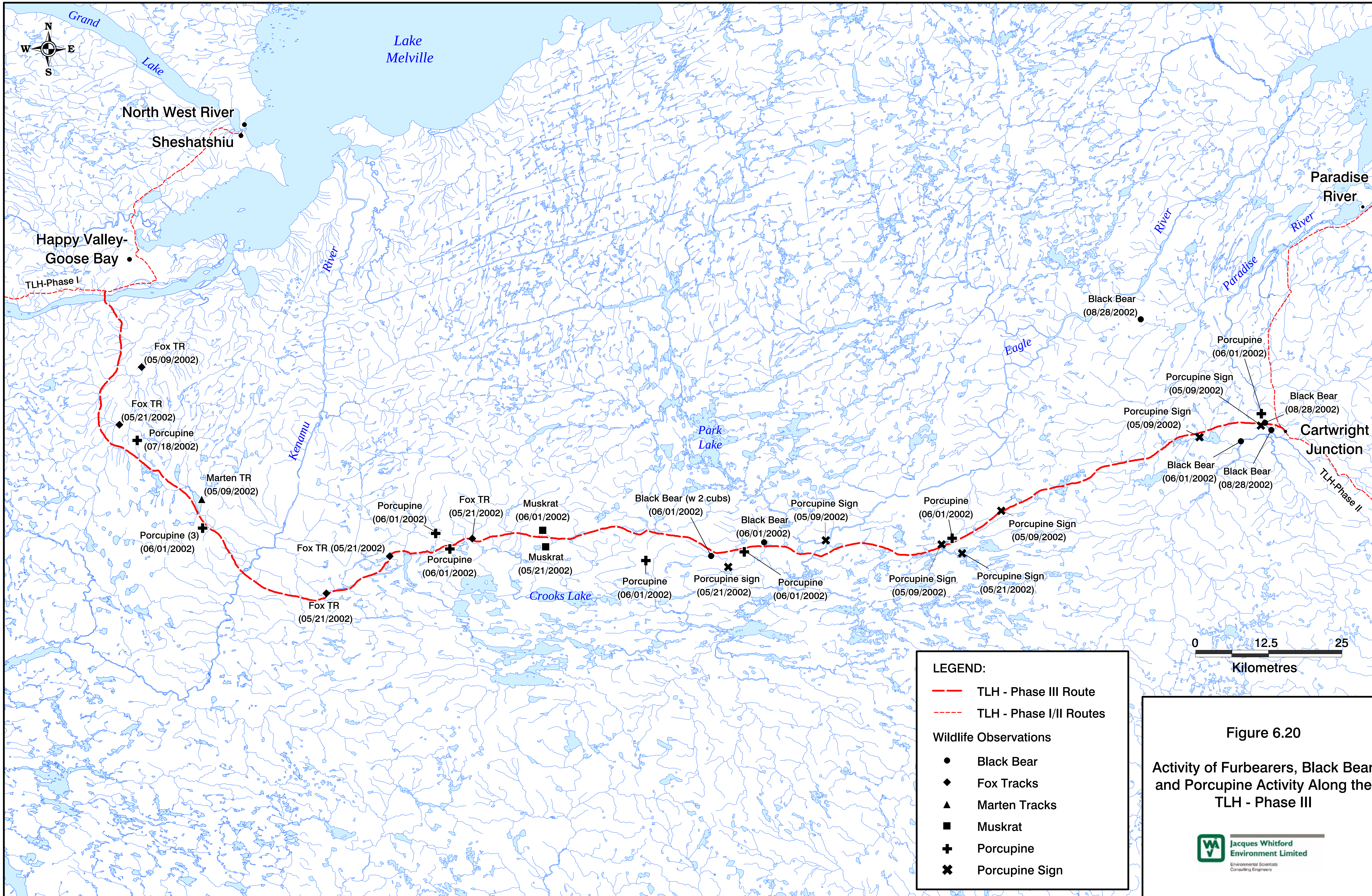

Figure 6.20

Activity of Furbearers, Black Bear and Porcupine Activity Along the TLH - Phase III

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6.4.5 Issues and Concerns

Issues and concerns related to furbearers include:

- habitat loss through removal of vegetation during construction;
- habitat avoidance of human disturbance and noise during construction and operation;
- increased harvesting of furbearers as result of improved access;
- loss of habitat as a result of an accidental event such as a forest fire; and
- mortality as a result of collisions with vehicles or accidental spills of fuel or other hazardous materials.

6.4.6 Existing Knowledge

The effects of development and human disturbance on furbearers are difficult to study due to low or fluctuating population numbers and wide-ranging movements of species in this group (Sopuck et al. 1979). Cyclic population fluctuations are a characteristic of furbearers such as fox, lynx and marten, which are predators of cyclic species snowshoe hare and small mammals. These fluctuations affect the density of both predators and prey and, subsequently, harvesting opportunities. These natural cyclic fluctuations in prey populations appear to be the main factor governing many furbearer populations.

During a study in northeastern Alberta, only 12 of 94 encounters from a continuous snow-tracking sample resulted in otters showing a behavioral disturbance to the presence of a linear corridor (Reid et al. 1984), specifically a change in direction to avoid the corridor. These few disturbance reactions were mostly associated with major construction activities. Unfamiliar noise and visual disruption of vegetation were thought to be the disturbing stimuli. High levels of human use were not measurably associated with avoidance reactions, indicating that otters became accustomed to the presence of disturbance corridors. Otters used culverts to travel under roads if the stream gradient and current were not altered (Reid et al. 1984). Marten have been found in close proximity (within 100 m) of human activity and near locations where heavy equipment was in use (Strickland and Douglas 1987). Marten have been recorded regularly foraging around commercial outfitting camps and private cabins near Red Indian Lake in Newfoundland (JW 1996) and mink have been recorded visiting outbuildings around an exploration camp in central Newfoundland (JW 2001).

Roads with little traffic are frequently used as travel routes for large carnivores, probably because they are beneficial from an energetics standpoint (Paquet et al. 1996; Manville 1983). Similarly, when vegetation recolonizes disturbed areas within the highway right-of-way, herbivores may be attracted the area, followed by carnivores that prey on them. Lynx have been documented preying on snowshoe hares along road corridors (Koehler and Aubry 1994). However, the benefits realized by ease of travel and increased prey may be offset by the increased risk of direct mortality through road kills or indirect mortality through harvesting in areas more easily accessible to humans. Studies conducted in southeastern Ontario found that traffic volume was not necessarily the main inhibitor of mammal movements across a road. Even when traffic volumes were only four vehicles/hr, small and medium sized mammals showed a reluctance to cross the highway. Rather, it appeared that the amount of road clearance was the determining factor for highway crossing, particularly for small mammals (Oxley et al. 1974).

In contrast, some species of furbearers tend to be more sensitive to human disturbance. Wolves are sensitive to disturbance near natal dens and road traffic may cause wolves to move pups to less disturbed areas (Chapman 1977, cited in Jalkotzy et al. 1997). At threshold densities, roads may act as filters or barriers to movement of wolves. The avoidance of open roads by wolves may be inferred from the absence of wolves in landscapes with road densities >0.6 km/km^2 (Paquet et al. 1996). Species that are less disturbed by humans and that do not avoid habitats in the vicinity of roads, probably do not find roads a barrier to movement (Gibeau 1993). However, species that do avoid roads may find them a barrier (Woods and Munro 1996). Width of the road and traffic volume likely have an influence on crossing rates. For example, radio-collared lynx were found to more frequently cross a two-lane paved highway than a four-lane paved highway with higher traffic volumes (Jalkotzy et al. 1997). Similarly, in the Banff National Park area, while no lynx were recorded crossing the four-lane Trans Canada Highway, they did regularly cross an access road to ski hills and parking lots (Stevens et al. 1996), suggesting that it is the level of activity and the size of the open area that influences crossing. In North Carolina, black bears almost never crossed an interstate highway. Of the roads that were crossed, those of low traffic volume were crossed relatively more frequently than roads of higher traffic volume (Brody and Pelton 1989).

Removal of habitat may affect furbearers if the removal occurs in the core area of a home range (Bissonnette et al. 1988), such as for marten, or if the species has a small home range, such as red squirrel. Similarly, removal of riparian habitat along a river or waterbody may affect resident beaver or muskrat that tend to be tied to a specific waterbody or group of connected waterbodies. In northern Alberta, marten track data demonstrated no consistent positive or negative response to habitats adjacent to clearings related to a pipeline, although only 50 percent of tracks actually crossed the pipeline corridor. However, over two years, there was no evidence of reduced marten activity in the immediate vicinity of the right-of-way (Eccles and Duncan 1986).

The total amount of road (defined as two-lane gravel or paved) currently in Labrador is small, being 0.004 km/km^2 of land. The addition of the new highway (250 km) will result in a road density for Labrador of 0.005 km/km^2 of land. In contrast, the density of main roads in the Netherlands is 300 times greater, at 1.5 km/km^2 and 240 times greater in the United States, at 1.2 km/km^2 (Forman and Alexander 1998). In a study in Minnesota, the mean density of roads within an area supporting a resident wolf population was 0.36 km/km^2. The peripheral and disjunct parts of the wolf range had an average road density of 0.54 km/km^2 and the primary range devoid of wolves, an average road density of 0.83 km/km^2 (Mech et al. 1988). In another study in Wisconsin, wolves failed to survive with a road density of 1.5 km/km^2 (Thiel 1985).

Most sources of indirect mortality for furbearers are related to increased human access. Populations subjected to hunting or trapping will likely sustain increased mortalities as a result improved access (Peterson et al. 1984; Melquist and Hornocker 1986; Weaver et al. 1996). Porcupines will be attracted to early seasonal growth of vegetation near roads and it is possible that measurable mortality could occur from both collisions with vehicles and through increased harvesting by residents. This mortality can exceed recruitment; therefore, new roads can have an effect on local porcupine densities (R. Otto, pers. comm). A study recently completed in Labrador found that 44 percent of porcupines with transmitters were harvested along roadsides where they were foraging in daylight for early spring herbaceous growth (I. Smeltzer, pers. comm.).

The effects of fire are generally considered harmful to forest-dwelling furbearers such as marten, particularly if mature forest is destroyed. However, as successional vegetation becomes established, foraging opportunities likely increase for a number of furbearers, including marten.

Numerous data exist on annual road kills for vertebrates, but little research has been directed on how to mitigate the effects on wildlife populations (Gucinski et. al. 2001). Direct mortality related to vehicle collisions has been documented for mink and otter (Flygare 1977; Melquist and Hornocker 1986; Madsen 1990). During a study in Idaho, two of seven marked otters and one unmarked otter were killed on roads (Melquist and Hornocker 1986). Coyotes attracted to high microtine populations along the Trans Canada Highway right-of-way undergo high mortality from collisions with vehicles (Gibeau 1993). However, except for species that are rare, road kill rates are unlikely to be sufficient to affect overall populations of mammals at a regional level (Forman and Alexander 1998).

6.4.7 Mitigation

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

- minimization of vegetation removal to 30 m within the right-of-way;
- maintenance of a minimum 20-m buffer zone around waterbodies, where possible;
- reduction or avoidance of in-stream activity;
- erosion control measures;
- drainage to and through wetlands will be maintained to prevent loss of water supply to downslope areas;
- no harassment or feeding of furbearers by project personnel during construction;
- all construction personnel will be required to follow all applicable legislation for hunting and trapping, and using and storing firearms;
- proper storage and disposal of construction camp garbage and refuse to avoid attracting wildlife;
- all vehicles yield to wildlife; and
- design and implementation of fuel and other hazardous material spill contingency plans and emergency response in the event of an accident.

Many of the potential adverse effects 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, 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.

6.4.8 Environmental Effects Assessment

6.4.8.1 Construction

Furbearers may be disturbed by the noise and human presence associated with construction activities and may temporarily avoid areas where these activities are taking place. Disturbance of resident furbearers during sensitive periods (i.e., breeding) could result in a change in the pattern of habitat use, which could affect reproductive performance. However, the number of individuals likely to be affected by highway construction during each season would be small.

Alteration or loss of furbearer habitat may occur as a result of vegetation clearing, particularly if it occurs in the riparian zone or through forested areas. Construction in riparian zones would have the greatest effect on beaver and muskrat that rely on riparian or nearshore vegetation within a localized area. However, a 20 m riparian buffer zone will be left, where possible, along any waterbodies that are in close proximity to the highway. The amount of forested habitat that is to be removed during construction is approximately 496 ha, a relatively small amount compared to the forested area in the region. Most species of furbearers are wide-ranging and the forest removed during construction would likely represent only a small portion of any individuals, home range. Species such as red squirrel that have relatively small home ranges may be displaced if their home ranges are centered on the highway right-of-way. Road density in Labrador is so low as to likely be of no consequence in relation to threshold effects for use of an area by furbearers.

6.4.8.2 Operation

Similar to construction, noise disturbance from traffic may cause furbearers to avoid habitat adjacent to the highway. However, a number of furbearer species have been shown to readily cross highway rights-of-way, as long as the distance to travel is not too great and the volume of traffic is not too high. The proposed highway will be a gravel road with a maximum right-of-way of 40 m (30 m maximum cleared of vegetation) and will have a relatively low level of daily traffic. Therefore, the disturbance effect on furbearers using habitat in the area of the highway will be minimal and some species may benefit from increased foraging opportunities and ease of travel.

The most likely operational effect on furbearers in the area will be increased trapping as a result of improved access from the highway. While harvesting levels are not likely to reach that seen in past decades, there will probably be more trapping in the area following the opening of the highway, followed by a leveling off of effort. However, the trapping activity will still be greater than if the highway was not present. People in the region are now in a wage economy and constraints on time available for trapping limits the extent that they can travel to relatively accessible areas. The presence of the highway would provide this accessibility. Species most likely to be affected by increased harvesting are beaver, marten and porcupine. As beavers tend to be resident in an area and build dams and lodges that are conspicuous, they are easily targeted by trapping. An increase in trapping effort could result in localized declines in beaver populations (a total of 68 lodges were identified within 5 km of the proposed highway, of which 25 were located within 1 km of the highway). However, subsequent levels of activity will tend to be influenced more by prices and abundance of furbearers, than purely by improved access.

Increased snaring activity could affect marten, as they can be accidentally caught in snares set for snowshoe hare. Snaring activity may also increase, particularly if cabin development occurs along the highway. Similarly, increased human activity along the highway is likely to result in increased mortality for porcupine through increased harvesting.

6.4.8.3 Accidental and/or Unplanned Events

Some mortality may result from collisions with vehicles; however, with the low traffic volume expected on the highway and the generally low densities of furbearers in the area, the number of vehicle collisions is expected to be low and will have no measurable effect on furbearer populations in the area. Species such as otter, muskrat and beaver may travel through culverts and under bridges as they follow waterbodies, thus minimizing the likelihood they will collide with vehicles. Relatively slow-moving porcupine may be susceptible to collisions with vehicles, as they will be attracted to new vegetation growing along the highway. Porcupine densities may decline in a local area; however, the effect on the overall population will likely be small.

Forest fire would destroy forested habitat, initially representing an adverse event for furbearers such as marten, lynx and red squirrel. However, once successional vegetation becomes established, foraging opportunities for marten, lynx, fox and wolf would increase as the area becomes colonized by small mammals. Furbearer species living in the boreal forest ecosystem are adapted to fire and have evolved to live in the mosiac of habitat types created by a fire-driven ecosystem.

An accidental spill of fuel or other hazardous materials into waterbodies or in riparian zones in the project area could cause mortality to aquatic furbearers. Contamination of waterbodies could result in reduced foraging opportunities for species such as mink and river otter. 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. WSTs contingency planning and emergency response plans will ensure that any adverse are minimized.

A summary of the environmental effects associated with each project phase is presented in Section 6.4.9.

6.4.9 Environmental Effects Evaluation

The key potential interactions between project activities and furbearers include direct disturbance, habitat loss and increased trapping. The following definitions are used to rate the significance of the predicted residual environmental effects of the project on furbearers.

A **major (significant) environmental effect** to furbearers is one affecting a population of a species of furbearer in such a way as to cause a change in abundance and/or distribution beyond which natural recruitment (reproduction and in migration from unaffected areas) would not return that population, or any populations or species dependent upon it, to its former level within several generations. The effect is not reversible.

A **moderate (significant) environmental effect** to furbearers is one affecting a portion of a population of a species of furbearer in such a way as to cause a change in the abundance and/or distribution of that portion of the population or any populations of species dependent upon it over one or more generations, but does not change the integrity of any population as a whole. The effect may not be reversible.

A **minor (not significant) environmental effect** to furbearers is one affecting a specific group of individuals of a species of furbearer in such a way as to cause a change in abundance and/or distribution in a localised area and/or over a short period (one generation or less), but not affecting other trophic levels or the integrity of the population itself. The effect is reversible.

A **negligible (not significant) environmental effect** to furbearers is one affecting a specific group of individuals of a species of furbearers in such a way as to cause a change in abundance and/or distribution in a localised area and/or over a short period (one generation or less) in a manner similar to small random changes in the population due to natural irregularities, but having no measurable effect on the population as a whole. The effect is reversible.

The proposed highway is a linear development that will have relatively low volumes of traffic. For furbearers, the environmental effects of greatest consequence will be 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 furbearers are assessed as minor (not significant) for construction and operation (Table 6.11), due to the availability of alternative habitat that will not be disturbed by the highway and the low density of these species. However, an accidental forest fire may remove large areas of habitat for forest-dependent furbearers such as marten and lynx. Therefore, the residual effects of an accidental event on furbearers is considered moderate (significant) (Table 6.11). Overall, the project is not likely to result in significant adverse environmental effects on furbearers.

Table 6.11 Environmental Effects Summary - Furbearers

	Construction	Operation	Accidental/Unplanned Events
Mitigation: • minimization of vegetation removal to 30 m within the right-of-way; • maintenance of a minimum 20-m buffer zone around waterbodies, where possible; • reduction or avoidance of in-stream activity; • erosion control measures; • drainage to and through wetlands will be maintained to prevent loss of water supply to downslope areas; • no harassment or feeding of furbearers by project personnel during construction; • all construction personnel will be required to follow all applicable legislation for hunting and trapping, and using and storing firearms; • proper storage and disposal of construction camp garbage and refuse to avoid attracting wildlife; • all vehicles yield to wildlife; 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	Unknown
Geographic Extent	<1 km^2	1-10 km^2	100 km^2
Frequency	Continuous	Continuous	<10
Duration	72	>72	>72
Reversibility	Irreversible	Irreversible	Unknown
Ecological/Socio-economic Context	Nil/May be affected by resource use and users.		
Environmental Effects Evaluation			
Significance	Not Significant (Minor)	Not Significant (Minor)	Significant (Moderate)
Level of Confidence	High	High	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: No monitoring has been identified for furbearers			
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		

6.4.10 Cumulative Environmental Effects

Angling, hunting and trapping have been ongoing in the project area for many years, although these activities tend to be localized and of short duration at any given time. Low-level flying of military aircraft has been occurring in the region since the 1980s, although only approximately 92 km of the proposed highway route would occur within the existing LLTA. The existing sections of the TLH represent habitat loss to furbearer populations in Labrador. Similarly, the development of the Voisey's Bay Mine/Mill project will also result in habitat loss. However, the furbearers interacting with the proposed highway do not extend to the existing

TLH sections (Phases I and II) or to Voisey's Bay; therefore, cumulative effects from these projects will not occur. Snowmobile trails are also found throughout the region and it is possible the furbearers may interact with these trails. However, the effects will be localized and of short duration.

The most important development activity that is likely to occur following highway construction is commercial forestry. Forestry results in the loss of habitat, particularly for forest-associated furbearers, and the noise and other disturbances associated with these activities may cause furbearers to avoid these areas. However, forestry guidelines stipulate that a minimum 20 m vegetation buffer be maintained along waterbodies following forest harvesting. This would provide a measure of protection to the habitat of a number of furbearer species, particularly those closely associated with water. Other land and resource activities, such as mineral exploration, hunting, trapping and angling, are also likely to increase due to enhanced access provided by the proposed highway. The level of trapping effort is closely tied to the value of pelts in the market place. Cabin development along the highway may also occur, creating areas of permanent human disturbance that may result in increased mortality to furbearers or cause altered habitat use patterns in an area. Legislation and regulations are in place to control these activities and their potential environmental effects.

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 their 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 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.

The proposed Akamiuapishku/Mealy Mountains National Park would encompass approximately half of the highway route, and may afford protection to furbearers from trapping. The creation of this park would protect habitat from activities such as cabin development and forest harvesting.

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

6.4.11 Environmental Monitoring and Follow-up

Monitoring requirements for furbearers have not been identified.