JACQUES WHITFORD PROJECT NO. NFS08243

WATERFOWL COMPONENT STUDY
TRANS LABRADOR HIGHWAY
(HAPPY VALLEY-GOOSE BAY
TO CARTWRIGHT JUNCTION)

JANUARY 2003

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WATERFOWL COMPONENT STUDY
TRANS LABRADOR HIGHWAY
(HAPPY VALLEY-GOOSE BAY
TO CARTWRIGHT JUNCTION)

SUBMITTED TO

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JANUARY 16, 2003

EXECUTIVE SUMMARY

The Department of Works, Services and Transportation (WST) is proposing to construct a 250 km two-lane gravel surface highway from Cartwright Junction to Happy Valley-Goose Bay. In anticipation of seasonally sensitive requirements for environmental assessment, WST contracted Jacques Whitford and the Innu-owned firm, Land Management and Survey Systems Inc., in May 2002 to prepare the following waterfowl component study. The proposed alignment for the Trans Labrador Highway (TLH) will intersect habitat used by waterfowl for breeding, molting or staging, potentially resulting in habitat alteration or loss, temporary or permanent displacement due to disturbance, and increased harvesting pressure.

The objective of this study was to conduct original research and compile available information to describe waterfowl and waterfowl habitat within the proposed route of the TLH. The results of this component study will be used to predict the local and regional impacts of the proposed project on waterfowl and to suggest mitigative measures in the Environmental Impact Statement (WST 2003).

To ensure that the area examined by this Component Study encompassed physical disturbance from the proposed project, a conservative buffer area was also examined. Therefore, the study area comprised areas of wetland and waterbodies within a 5 km either side (i.e. 10 km wide) of the proposed TLH route. Rivers were surveyed for 10 km on either side of proposed highway crossings.

Five aerial surveys were conducted in 2002: 9 May (spring staging), 21 May and 1-2 June (breeding), 18 July (brood/moulting), and 28-29 August (fall staging). Using either a Bell 206 L or Aerospatiale A Star helicopter, survey speed was approximately 50 km\hr at an altitude not greater than 30 m above ground level. Areas of open water and wetland habitat were identified by the navigator/recorder who directed the pilot and two other experienced observers over the course of each survey. Communication through an intercom system on the aircraft used a 12-hour clock for orientation, to locate and identify observations according to species and sex. All sightings were plotted directly onto 1:50,000 NTS map sheets (equipped with the proposed route plotted in advance) and verified using the aircraft's Global Positioning System (GPS).

The number of birds observed during the May 9 survey was relatively low with species congregated in areas of open water such as along the Kenamu River and an area approximately 10 km west of Cartwright Junction. Many observations were of groups of >4 birds.

During the May 21 surveys, ducks were still congregated on the Churchill River and Traverspine River with numerous small groups of mergansers, black ducks and Canada geese. Similarly, ducks continued to congregate along the open water areas of the Kenamu River where green-winged teal and mergansers were commonly observed. During the June 1-2 surveys, no birds were observed along the Churchill River and dispersal to wetlands and small waterbodies from earlier spring concentrations along larger rivers and lakes

was evident. Overall the density of waterfowl in the survey area was low. However, waterfowl were widespread over the region.

The brood/moulting survey on July 18 found ducks, particularly black ducks, Canada geese and ring-necked ducks in groups. The fall staging survey on August 27-28 found that various species were commonly found in groups of four or more individuals. Congregations of black ducks were observed at various locations along the route. Similarly Canada geese were observed in groups ranging from three to 12 individuals, with groupings of less than 10 birds common.

No harlequin ducks were observed during the surveys. While it appears that harlequin ducks do not breed or breed at extremely low densities in the project area, it is known that southern Labrador is a migration route for birds returning from wintering grounds off Newfoundland and further south along the eastern seaboard (Brodeur 1997). Therefore, individuals may use waterbodies in the study area infrequently.

Waterfowl observations during the series of surveys indicate these species occur at relatively low densities throughout wetland habitat in the study area. Few exceptions include nine wetlands with waterfowl densities greater than 0.10 birds/ha, located at various points along the proposed highway route. The wetland with the highest density (0.59 birds/ha) is located approximately 500 m from the proposed highway route. Most of the remaining nine wetlands are greater than 1000 m from the highway.

Additional important areas noted during the surveys include:

- spring staging period: Traverspine and Kenamu Rivers and a tributary of Paradise River approximately 10 km west of Cartwright Junction;

- moulting period: a small unnamed lake 5 km west of Crooks Lake, approximately 10 km south of the highway route and a tributary of the Eagle River approximately 20 km southeast of Park Lake, 4 km south of the highway route; and

- fall staging period: an unnamed lake 25 km east of the Kenamu River, within 100 m of the highway route.

KATAKUAPEKASHT TIPATSHIMUN MASHINEIKAN

Ntshent meshkinanu kanakituatak (Department of Works, Services, and Transportation) nantuenitamuat tshetshi tutakinit ussi meshkinanu tshetshi aitu pampinitshi utapana. Ne meshkinau nete tshika itimu uta Apipani nuash nete Nutapineuant.Ntshent meshkinanu kanakituatak (Department of Works, Services, and Transportation) kuetshimepant nenua kaitusseshitshi kie aueshisha kanantussenimantshi, Jacques Whitford Environment Limited (JW), mak Innuat katipenitak assinu, mak katipeikau assinu kaitusset. Eukuant umue kaitusset tshe nantussenimat shishipa, nishka, mak muakua. Nantussenimakanut aueshishat (shishipit, nishkat, mak muakuat) tan eshiniuit nte miam tshetutakanit meshkinanu kie mamushatinikanu ne tshekuan tsheishimishkakant. Nte tshetutakant meshkinau miam nta tshikapiniaueut shishipit, nishkat, mak muakuat kie tshent kassinu kapiniauet kie katat nipit aueshishat. Tshipa tshi mamashiakanut uapiniauetau nte miam uatutakanit meshkinanu netshent aueshishat.

Nantussenimakanut aueshishat (shishipit, nishkat, mak muakuat) tan eshiniuit nte miam tshetutakanit meshkinanu kie mamushatinikanu ne tshekuan tsheishimishkakant nte meshkinau kuitutakanua. Ne tshekuan tshemishkakant tshika uitshikut kaitushkatak meshkinanu tshetshika nitu itutuat aueshisha.

Nte meshkinau tshetutakant minu nantussenitakanipin tshetshika nitu tutuakanit aueshishat miam mate shishipit, nishkat, kie muakuat. Kassinu nte uashka kie aitu nantussenitakanipin meshkinau (10 km).

Kauauashtetshesht apitshiakinipan niantussenimakanit aueshishat nete miam meshkinau tsheitimut. Nissi Pishum peikushteu mak Nissi Pishum nishunu ashu peik eku ta papinipant shishipit, nishkat mak muakuat. Uapukun Pishum peik mak nish etshishtauakantshi tshipa piniaueut shishipit, nishkat mak muakuat. Shetan Pishum kutunu ashu nishuaush uenitat upuiui shiship, nishkat, kie muakuat. Upau Pishum nishunu ashu peikushteu ekuta kau tshiuepinit shishipit, nishkat kie muakuat. Ne kauauashtetshesht tipatakushipan kie metinu pamipanipan nentussenitakau assinu. Kassinu meshkakant tshekuan mishinatekeikanu nte assiu mashineikant.

Nta Nissi Pishum peikushteu apu shuk uapimakanit shishipit, nishkat, kie muakuat. Ntshent pisse uiapimakanit nete mishkuakinut Tshenuameshipit kie nete pessish Nutapineuant.

Nissi Pishum nishunu ashu peik nentussenimakanit shishipt, nishkat, kie muakuat, nete etitu uapimakanut Mishta Paushtukut kie nete Traverspine shipit. Shishipit etitu nete pessish pampinut Tshenuameshipit. Uapukun Pishum peik kie nish etshishtauakant apu shuk uapimakanit shishipt, nishkat, kie muakuat nete Mishta Paushtukut. Ne kassinu kanantussenimakanit aueshishat shishipit, nishkat, kie muakuat apu shuk thsi mitshetit nete miam kanantussenitakant assi kie shipua. Muk mamen kie katikataku nte tauat shishipit, nishkat, kie muakuat.

Shetan Pishum kutunu ashu nishuaush ekuta nta tshipa uenitat upuiui shishipit kie nishkat. Upau Pishum nishunu ashu nishuass mak nishuash ekuta kau tshiuepinit shishipit kie nishkat mak mishkuakinipant shishipit kie nishkat nantam mamupinut kie neupinut. Pisse shishipit taut nta miam tshetutakant meshkinau. Nishkat iat nta taut muk nantam mamu taut uinuau, nanikutin kutunu ashu nish itatishut.

Apu tat ne shishipit keishinikatakinutshent (harlequin) nete miam nentussenitakant assi. Kie iat apu shuk piniauet tshent (harlequin) shishipit mamu tiatau patush nte tatipan tiatau peniauet.Shishipit nete utshipanut Newfoundland. Nanikutin nipit nte taut muk apu shuk nanukushit ntshent shishipit.

Ne kanatussenitakant assi nanikutin muk uapimakanut shishipit, nishkat kie muakuat nete nipinu tekunit. Peikusteu tatitutshen nipia nte tiat shishipit, nishkat, kie muakuat. Nenua nipia pisse pitshaua nte tshetukakant meshkinau kie pisse pessish takuna.

Kuatak eshpitenitakuak tipatshimun mishineikan

* Shishipit, nishkat, kie muakuat piapintau: ekute nete eshpinit Traverspine shipit mak nete Tshenuameshipit kie nete pessish Nutapineuant.

* Shishipit, nishkat, kie muakuat uentatau upuiui: Shakeikan apu tshissenitakant eshinikatet muk pessish nte Kauauatshikimat shipit, mak shipit pessish Nutapineuant shipu nete ut tapitik Iatuekipau ekuta nta meshkuakinit tshent Shishipit, nishkat, kie muakuat.uentat upuiui.

* Tshiuepintau Shishipit, nishkat, kie muakuat: Eku miam uatshiuepintau tekuatshiki ne shakeikan apu tshissenitakant eshinikatet muk pessish takun ne shakeikan nete Tshenuameshipit. Ne shakeikan ekuan tshetikuak pessish nte ussi meshkinat.

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1.0 INTRODUCTION

1.1 Background

The Department of Works, Services and Transportation (WST) is proposing to construct a 250 km two-lane gravel surface highway from Cartwright Junction to Happy Valley-Goose Bay. This highway represents the final link of an all season ground transportation route between the Labrador Straits, southern Labrador, Upper Lake Melville, western Labrador and Quebec (Figure 1.1). In particular, this proposed highway would connect southern Labrador coastal communities to Upper Lake Melville and western Labrador. Issues such as social isolation, limited access to economic and business development opportunities, limited access to health, education and recreational services and facilities and greater costs of living will be ameliorated by construction of this final link. In the same respect, the construction of this highway will have an equally profound effect on the future of these communities and the development of a natural resource-based economy in this region.

In anticipation of seasonally sensitive requirements for environmental assessment, WST contracted Jacques Whitford in May 2002 to prepare the following Waterfowl Component Study. The proposed alignment for the Trans Labrador Highway (TLH) will intersect habitat used by waterfowl for breeding, molting or staging, potentially resulting in habitat alteration or loss, temporary or permanent displacement due to disturbance, and increased harvesting pressure. In northern boreal areas such as Labrador, breeding waterfowl densities tend to be relatively low. However, the amount of available wetland results in Labrador representing 40% of the breeding population in the northern Atlantic Flyway (Goudie and Whitman 1987). Important species characteristic of this region include: Black duck, Canada goose, Green-winged teal, Common goldeneye, Red-breasted merganser and Common merganser. The common and scientific names and AOU codes of waterfowl and other avifauna recorded during surveys are provided in Appendix A.

Subsequent to initiation of the field program, draft and final Terms of Reference (TOR) were received from the Department of Environment. Additional requirements identified in the TOR were incorporated into the field program.

1.2 Objectives

The objective of this study was to conduct original research and compile available information to describe waterfowl and waterfowl habitat within the proposed route of the Trans Labrador Highway from Happy Valley-Goose Bay to Cartwright Junction. The results of this component study will be used to predict the local and regional impacts of the proposed project on waterfowl and to suggest mitigative measures in the Environmental Impact Statement (WST 2003).

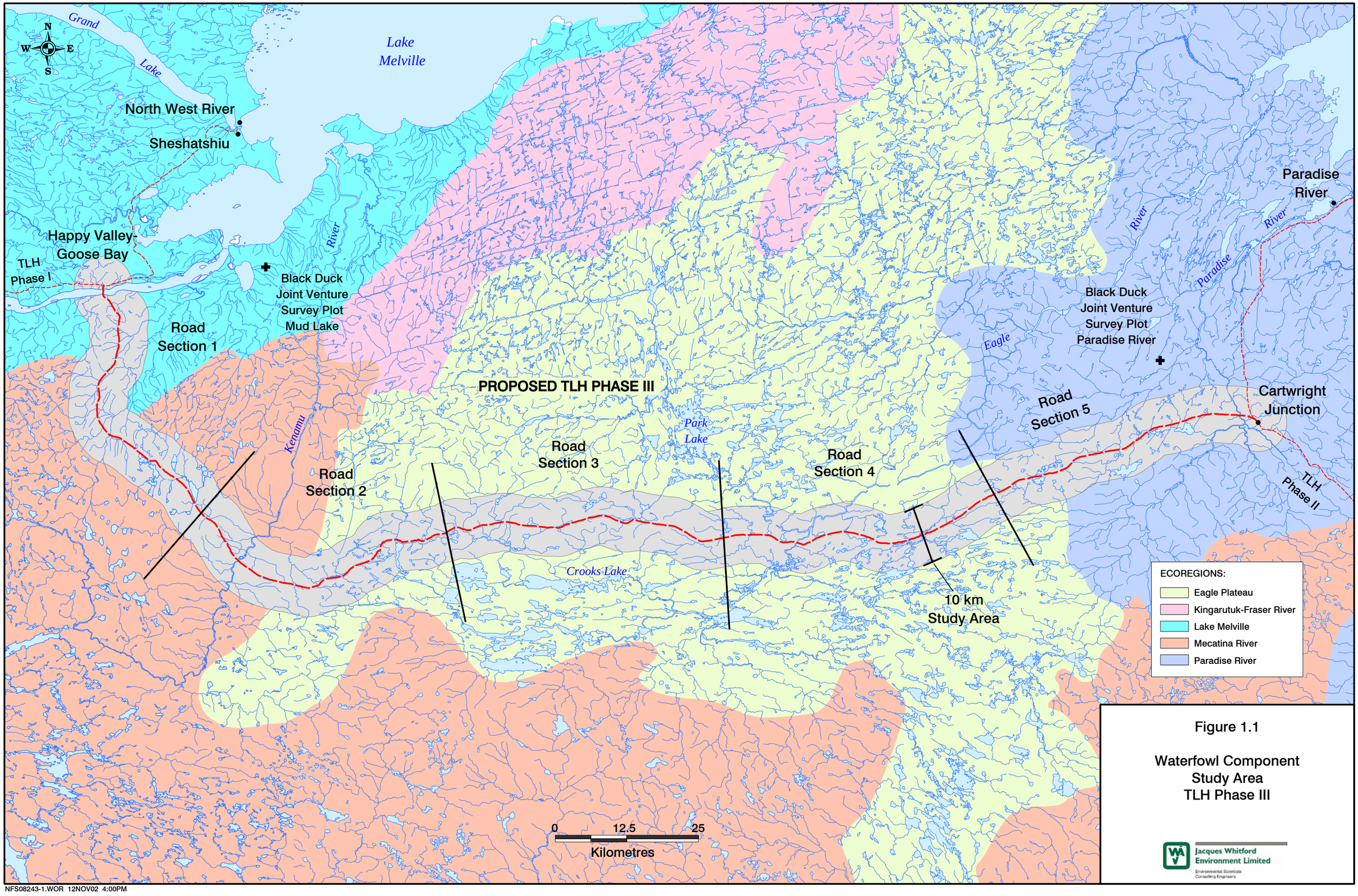

Figure 1.1

Waterfowl Component
Study Area
TLH Phase III

Jacques Whitford
Environment Limited
Environmental Scientists
Consulting Engineers

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Within the proposed study area, this Waterfowl Component Study is to:

- review literature regarding waterfowl in Labrador;
- consult with Innu Nation, CWS and other organizations and individuals knowledgeable about waterfowl in the area;
- describe wetland and riparian habitat potential for waterfowl;
- determine breeding pair, brood and spring/fall staging activity of waterfowl;
- determine waterfowl species abundance, temporal, and spatial distribution; and
- quantify waterfowl habitat that is likely to be physically affected by the project.

With this background on the environment of the study area as relates to waterfowl, potential interactions of the proposed project will be described as effects predictions in the assessment (WST 2003).

1.3 Study Team

Jacques Whitford is an environmental consulting company with offices throughout Canada, and over 15 years of relevant experience in Labrador. Staff from Happy Valley-Goose Bay and St. John's participated in this Component Study.

Perry Trimper was the project manager and was involved in the design and conduct of field surveys and report review. Kathy Knox also participated in field surveys, data compilation and report preparation. Dave Kearsey compiled the MapINFO files for all collected data. The Innu-owned firm Land Management and Survey Systems Inc., worked closely with Jacques Whitford in all data collection exercises such as aerial surveys, literature review, and consultation with knowledgeable persons and translation to Innu-eimun. Max Penashue led this activity with additional observer positions occupied by Greg Penashue or David Hart. Kanani Penashue, an Innu communication expert, assisted with report preparation and translation. Peter Jefford and Lorne Pike of Universal Helicopters Newfoundland Limited were the pilots throughout the surveys and also assisted with observations. Dr. Leonard Lye of Memorial University conducted statistical analyses of wetland size and waterfowl abundance.

1.4 Study Area

The study area lies within the boundaries of four ecoregions in central Labrador: Lake Melville at the western boundary, Mecatina River, Eagle Plateau, and Paradise River at the eastern boundary (ESWG 1996) (Figure 1.1). The Lake Melville ecoregion, at the western portion of the study area, has low-lying (i.e essentially at or near sea-level) undulating upland topography with flat river terraces and generally experiences warmer summers and shorter winters than surrounding regions. A relatively productive closed-crown black spruce forest is the dominant vegetation (Meades 1990). The Mecatina River ecoregion, to the southeast, is dominated by fairly open black spruce forest with ribbed fens and string bogs covering extensive areas. The climate is typically subarctic and continental with warm summers and cold winters (Meades 1990). The Eagle Plateau ecoregion encompasses much of the proposed highway route and is characterized by a flat to rolling upland plateau where extensive string bogs dominate the landscape. Lichen woodland occurs on eskers and areas of course till. The climate is subarctic with cool summers and cold winters (Meades 1990). The Paradise River ecoregion, at the eastern portion of the study area, has a boreal climate with cool summers and short cold winters. It is characterized by undulating topography that supports closed-crown forest and domed bogs (Meades 1990).

To ensure that the area examined by this Component Study encompassed physical disturbance from the proposed project, a conservative buffer area was also examined. Therefore, the study area comprised areas of wetland and waterbodies within a 5 km either side (i.e. 10 km wide) of the proposed TLH route (Figure 1.1). Rivers were surveyed for 10 km on either side of proposed highway crossings.

2.0 METHODOLOGY

2.1 Aerial Surveys

Aerial survey techniques employed for this Component Study have been developed by Jacques Whitford over the last 15 years in consultation with the Newfoundland and Labrador Wildlife Division and the Canadian Wildlife Service. Using either a Bell 206 L or Aerospatiale A Star helicopter, survey speed was approximately 50 km\hr at an altitude not greater than 30 m above ground level. Areas of open water and wetland habitat were identified by the navigator/recorder who directed the pilot and two other experienced observers over the course of each survey. Communication through an intercom system on the aircraft used a 12-hour clock for orientation, to locate and identify observations according to species and sex. All sightings were plotted directly onto 1:50,000 NTS map sheets (equipped with the proposed route plotted in advance) and verified using the aircraft's Global Positioning System (GPS). All wildlife sign and sightings during aerial surveys were recorded.

Each aerial survey was timed (in consultation with knowledgeable persons) to search the study area during different periods of waterfowl activity. Survey dates, target species of waterfowl and waterfowl activity are indicated in Table 2.1.

Table 2.1 Details of Surveys

Survey Date	Activity	Target Species	Comments
9 May 2002	spring staging	harlequin duck	all wetlands and ponds frozen, fast flowing areas on rivers and pond inlets and outlets open
21 May 2002	breeding	harlequin duck Canada geese dabbling ducks	rivers open, lakes mostly ice-free <150 m elevation, ponds and wetlands remained largely ice or snow covered >150 m elevation
1-2 June 2002	breeding	harlequin duck diving ducks	95% waterbodies and wetlands ice or snow free. Waterbodies at higher elevations often >50% ice covered
18 July 2002	brood/moulting	all species	areas likely to provide suitable brood or moulting habitat for various species were targeted - all water open
28-29 August 2002	fall staging	all species	areas likely to provide suitable staging habitat were targeted

Potential habitat for waterfowl was described using ecological land classification maps (ESWG 1996; Meades 1990) and observations during aerial waterfowl surveys and wetland classification surveys.

Spatial survey data (survey lines, species sightings, habitat features) plotted on the 1:50,000 map sheets, were digitized at 1:250,000 scale NTS map sheets using MapInfo (Version 6.0). Data management, analysis and representation was also completed using MapInfo and Vertical Mapper Contour Modeling Software (Version 2.5).

2.2 Consultation with Innu

Based on guidelines "Conducting Research in Innu Territory" provided to Jacques Whitford by Innu Nation, an outline of the proposed study was provided to Innu Nation.

2.3 Other Permits

Prior to conducting aerial surveys, the Canadian Wildlife Service (CWS) was notified of the proposed study and methodology for collecting data on waterfowl.

3.0 LITERATURE REVIEW

Fixed-wing transect surveys for waterfowl were conducted in the general area of the proposed highway in 1970 (Gillespie and Wetmore 1974) and in 1980 (Goudie and Whitman 1987). Additional fixed-wing transect surveys were completed for Canada geese in 1993 and 1994 (Bateman and Hicks 1995) to estimate average waterfowl density by ecoregion. Ecoregions covered included three through which the proposed highway route will pass: Lake Mellville ecoregion, Eagle Plateau ecoregion, and the Paradise River ecoregion.

Beginning in 1994, the Department of National Defence (DND) began avoidance monitoring programs for raptors and harlequin ducks in the low-level training area (LLTA). The LLTA overlaps with only with the most western portion of the proposed highway route. However, surveys within the LLTA, specifically for Harlequin ducks, did include the Traverspine River in 1994 and 1996. Observations of other waterfowl species were also recorded (JW 1995; 1997).

Plot counts have been conducted by CWS as part of the Black Duck Joint Venture Surveys since 1990. Data are available from 1990 to 2000 for two plots within the general area of the proposed highway route, Plot 24 - Mud Lake and Plot 22 - Paradise River (CWS, unpublished data)(Figure 1.1). During 1990 to 1996 the CWS surveyed plots of 100 km^2, but from 1996 onward reduced the size to 25 km^2. It should be noted that after 1995 only a subset of plots were surveyed each year. Hence, there is no data available at Plot 24 for 1995, 1997, and 1999 and no data available at Plot 22 for 1996, 1997, and 2000 (CWS unpublished).

An aerial waterfowl survey conducted on 15 May 1998 as part of the Labrador Hydro Project covered approximately 11 km of the upper Traverspine River and approximately 28 km of the Kenamu River (AGRA 1999). A second survey on 9 June 1998 was conducted along approximately 10 km of the Kenamu River. Finally, in July 1998, a dedicated Harlequin duck survey was completed along the Churchill River, encompassing the area of the proposed highway crossing on the river (AGRA 1999).

Table 3.1 details some general life history characteristics of waterfowl species that were commonly observed in the study area.

Table 3.1 Waterfowl Species, Life Histories and Habitat Preferences

Species	Nesting and Brood Rearing	Diet and Foraging	Preferred Habitat
Canada Goose	**Nest:** ground scrape prefers nesting islands **Clutch Initiation:** early May **Incubation:** 25-30 days **Fledge:** 40-73 days **Young:** Precocial	**Diet:** forbs invertebrates shoots, roots seeds of grasses and sedges **Foraging:** surface dips, dabbles, and ground gleans	slope fen, ribbed fen, marsh, swamp, open water and small island habitats
American Black Duck	**Nest:** ground scrape **Clutch Initiation:** late April to early July **Incubation:** 26-29 days **Fledge:** 58-63 days **Young:** Precocial	**Diet:** aquatic invertebrates, seeds, tubers **Foraging:** dabbles	ribbed fen, marsh, swamp, open water
Green-Winged Teal	**Nest:** ground scrape **Clutch Initiation:** early May to mid June **Incubation:** 21-28 days **Fledge:** 34 days **Young:** Precocial	**Diet:** seeds, aquatic invertebrates, grass, plant shoots **Foraging:** ground gleans, dabbles	ribbed fen, marsh, open water
Ring-necked Duck	**Nest:** ground scrape sometimes use floating nest **Clutch Initiation:** late May to early July **Incubation:** 26-27 days **Fledge:** 49-56 days **Young:** Precocial	**Diet:** seeds, shoots and tubers of aquatic plants, aquatic invertebrates **Foraging:** surface feeding dives	ribbed fen, marsh, swamp, open water often nest in low-productivity wetlands avoided by other ducks
Common Goldeneye	**Nest:** cavity in snag **Clutch Initiation:** early to late May **Incubation:** 28-32 days **Fledge:** 56-60 days **Young:** Precocial	**Diet:** aquatic invertebrates, insects and aquatic vegetation **Foraging:** surface dives	marsh, river bank, riparian alder/willow thicket, open water
Common Merganser	**Nest:** tree cavity sometimes on ground **Clutch Initiation:** mid May to mid June **Incubation:** 28-35 days **Fledge:** 65-85 days **Young:** Precocial	**Diet:** fish, aquatic invertebrates **Foraging:** surface dives	marsh, river bank, riparian alder/willow thicket, open water

Note: Clutch Initiation - time of laying first egg
Incubation - time from egg-laying to hatching
Fledge - time from hatching to first flight
Young - precocial: mobile, downy, follow parents, find their own food

Sources: Ehrlich et al. 1988, Goudie and Whitman 1987, Bellrose 1976

4.0 RESULTS AND DISCUSSION

4.1 Regional Population Status of Ducks

Inland Ducks and Canada Geese

Waterfowl populations in eastern North America tend to be more stable as nesting success is more influenced by spring temperatures than availability of water. Conversely, in western North America, particularly in the important prairie region, annual variations in water availability can create much greater fluctuations in waterfowl breeding success (P. Garrettson pers. comm.).

Waterfowl managers have been concerned regarding the apparent decline of American black duck in North America (CWS 2000). Mid-winter inventories in the Atlantic and Mississippi flyways have shown a decline in the continental population of American black ducks from approximately 750,000 birds in 1955 to approximately 250,000 birds in 1997 (CWS 2000). However, surveys in breeding areas have indicated that the number of breeding pairs of American black ducks has increased significantly over the 1990-2000 period. The Boreal Shield - Eastern region is comprised of survey plots in Newfoundland and Labrador and southeastern Quebec. The estimated number of breeding pairs of American black ducks in this strata has risen through the 1990s from less than 20,000 pairs in 1995 to approximately 40,000 pairs in 1999 (CWS 2000). Trend data for the Boreal Shield - Eastern region indicates that the annual percentage change in observations of American black duck breeding pairs has significantly increased by 9.3 percent for the 1990-2000 period (CWS 2000).

Of the other most abundant inland duck species in the Boreal Shield - Eastern region, observations of breeding pairs of mallard are fairly low with less than 400 pairs observed each year from 1990 to 2000 with the exception of 1995 when 602 pairs were observed. In 1990 and 1994, no breeding pairs of mallards were observed during surveys in the Boreal Shield - Eastern Region (CWS 2000). The number of breeding pairs of green-winged teal observed annually has also increased 0.3 percent over the period 1990 -2000 with just over 6,000 pairs observed in the Boreal Shield - Eastern region in 2000. Ring-necked duck is another species that has enjoyed an apparent increase with annual breeding pair observations increasing 2.9 percent in the period 1990-2000. Approximately 20,000 pairs of ring-necked ducks were counted in the Boreal Shield - Eastern region in 2000, almost double the number of pairs counted in 1999 (CWS 2000). Within the entire survey area for eastern Canada (eastern Ontario, southern Quebec, and Atlantic Canada), the breeding population of mallards is estimated at 127,800 ± 25,000 pairs in 2000, green-winged teal at 68,000 ± 7,900, and ring-necked ducks at 144,700 ± 12,700 (CWS 2000).

Approximately 70 percent of the North Atlantic population of Canada goose breeds in Labrador, insular Newfoundland and eastern Quebec. Breeding ground surveys conducted in Labrador for Canada goose in 1993 and 1994 indicated a stable population compared to surveys in the early 1980s (CWS 2000). The surveys were repeated in 1998 and 1999 and preliminary results suggest an increasing population (M. Bateman pers. comm, cited in CWS 2000). The population was estimated at 175,800 Canada geese in Newfoundland and Labrador in 2000. However it was felt this number may be an underestimate since the survey in Newfoundland and Labrador in 2000 was conducted early, with more geese observed in small flocks rather than in pairs (Bidwell and Drut 2000 cited in CWS 2000).

Sea Ducks

As reproductive rates in sea ducks are low relative to other duck species, it is often difficult to determine the population status of most sea duck species.

The eastern population of harlequin ducks is listed as a species of *special concern* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and considered *vulnerable* under the provincial *Endangered Species Act*. The eastern population appears to winter in two distinct areas, coastal Greenland and Atlantic Canada south to Maine. Approximately 1,500 birds are estimated for the eastern North America "wintering" (Robertson and Goudie 1999) and 6,200 moulting harlequin ducks were counted along the western coast of Greenland during surveys in 1999 (Boertmann and Mosbech cited in CWS 2000). Research by Jacques Whitford for DND has proven that some harlequin ducks that nest in Labrador travel to the coast of Greenland to moult and presumably overwinter (JW unpublished data). However, it is not known how many of these birds originate in Canada.

The breeding and wintering range of Barrow's goldeneye, a species listed as *endangered* by COSEWIC and vulnerable under the provincial *Endangered Species Act*, is not known to fall within Labrador at this time. However, the core breeding area for this species does appear to be the north shore of the St. Lawrence Estuary and Gulf and a few moulting sites are known in northern Labrador (Robert et al. 2000). The population estimate of this species is 4,500 birds (M. Robert pers. comm cited in CWS 2000).

Data on densities of sea ducks (ducks/100 km^2) such as black scoter, surf scoter, white-winged scoter and long-tailed duck along the Atlantic Coast of Canada and the United States have been collected by the U.S. Fish and Wildlife Service (USFWS). Of the scoters, surf and black scoters tend to be the most abundant during surveys. Table 4.1 indicates densities of these species from surveys conducted throughout the 1990s.

Table 4.1 Sea Duck Densities per 100 km^2 of survey area along the Atlantic Coast of Canada and the United States

Species	1991[1]	1992	1994	1995	1997	1998	1999	2000
Black Scoter	88	65	94	131	256	396	171	255
Surf Scoter	55	109	114	249	233	569	101	341
White-winged Scoter	40	17	13	117	85	35	127	13
Total Scoters[2]	1162	358	226	507	576	1000	466	621
Long-tailed Duck	114	114	311	173	108	167	188	170

[1] No surveys conducted in 1993 and 1996.
[2] Total scoters includes unidentified species.

Source: J.R. Goldsberry and J. Wortham (USFWS), cited in CWS 2000.

Scoters as a group appear to have declined in North America over the long term (Savard et al. 1998). In eastern North America, breeding population estimates declined significantly at an approximate average annual rate of one percent between 1955 and 1992 (USFWS 1993). The overall scoter population was estimated to be 940,800 individuals in 2000 (CWS 2000). Long-tailed duck populations appear to be stable (P. Garrettson, pers. comm.).

Breeding pairs of common and hooded merganser in the Boreal Shield - Eastern region during the 1990-2000 period (data from Black Duck Breeding Ground Surveys), have indicated an annual increase of 6.5 percent and 25.8 percent, respectively. Common goldeneye breeding pair observations showed an annual increase of 5.2 percent in this region (CWS 2000).

4.2 2002 Surveys Along the Phase III TLH

Dabbling ducks such as American black ducks and green-winged teal rely on shallow wetlands with emergent vegetation and were generally found associated with peatlands, ribbed fens and fen-marsh complexes during breeding surveys. The bay ducks such as ring-necked ducks and scaup sp. were also associated with peatland or peatland-marsh habitat during breeding. Sea ducks such as common goldeneye and common mergansers are tree cavity nesters and were most often associated with forested rivers and lakes. Surf scoters and black scoters were generally seen on rocky shored lakes and ponds where they are known to breed. Canada geese were recorded throughout the survey area, usually associated with string bogs, ribbed fens, and along the grassy shorelines of small rivers.

Figure 4.1 provides a summary of selected waterfowl species observed by highway segment during each survey along the proposed TLH route. Species diversity and numbers were fairly low during the 9 May survey as much of the survey area was still ice or snow covered. Species diversity and numbers peaked

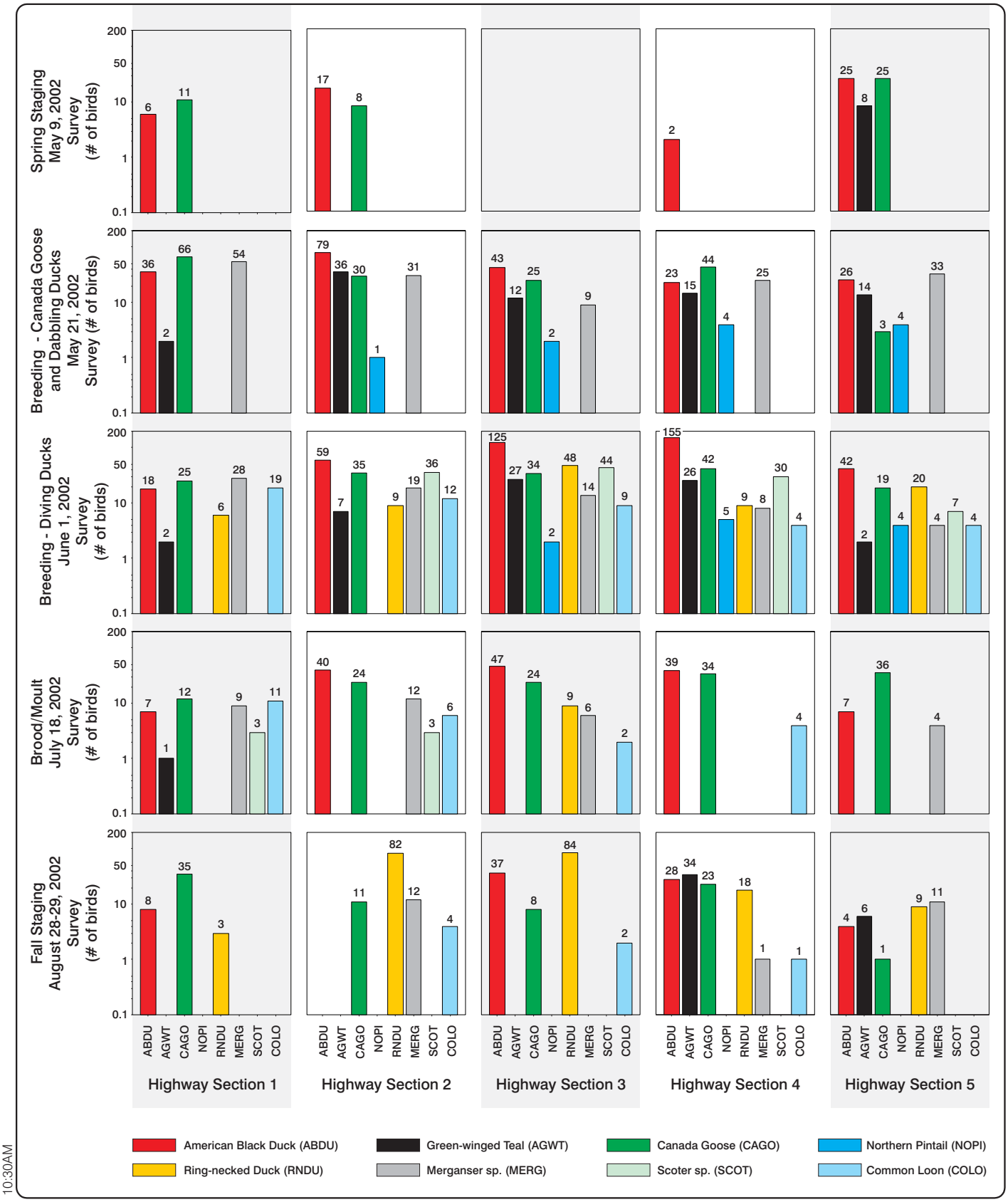
during the June survey with large numbers of ducks being observed, particularly in highway sections 3 and 4 (Figure 4.1). American black ducks were observed in all highway sections during most surveys and were among the most commonly observed species during breeding surveys (Figure 4.1). Similarly, Canada geese were observed in all highway sections during most surveys with the greatest number consistently seen along highway section 4 (Figure 4.1). Ring-necked ducks were, by far, the most abundant ducks during the fall staging survey with concentrations in highway sections 2 and 3 (Figure 4.1). Mergansers were observed on all five surveys in 2002 while observations of other species such as scoters and green-winged teals varied between surveys (Figure 4.1).

The total number of each species observed is provided in tables that are referenced by highway sections indicated on Figure 1.1 These tables are provided in Appendix B. Detailed figures for each survey and a discussion of survey results is provided in the following sections.

4.2.1 Spring Staging

The spring of 2002 was cold and ice out in rivers, lakes and wetlands was delayed by approximately 2 weeks in Labrador (JW unpublished). During the 9 May survey most lakes and wetland areas remained >75% ice or snow covered. However, major rivers with small, fast flowing tributaries (staging habitat appropriate for harlequin ducks) were open with survey effort concentrated in these areas. While no harlequin ducks were observed, other waterfowl species were generally concentrated along open stretches of the large rivers such as the Kenamu and at the inlets and outlets of waterbodies where ice breakup occurred earliest. (Figures 4.2a,- 4.2e) indicate the distribution of the observations during the 9 May survey. The number of birds observed along each of five sections of the proposed highway route during this survey was relatively low with species congregated in areas of open water such as along the Kenamu River (Figure 4.2b) and an area approximately 10 km west of Cartwright Junction (Figure 4.2e). Many observations were of groups of >4 birds. Black ducks were seen in groups of two or four along the route and two groups of four green-winged teal were observed approximately 5 km south of the highway route, 10 km west of Cartwright Junction (Figure 4.2e). A group of 12 Canada geese and the only common goldeneye observed during this survey were observed in the same area (Figure 4.2e).

These numbers of waterfowl are similar to the numbers observed during an aerial waterfowl survey conducted on 15 May 1998 as part of the Labrador Hydro Project (AGRA 1999). The 1998 surveys covered approximately 11 km of the upper Traverspine River and identified five Canada geese and two common mergansers. The survey also covered approximately 28 km of the Kenamu River and identified two pairs + one American black duck, two green-winged teal, three pairs + 19 Canada geese, one pair + 2 common goldeneye, four pair + three common mergansers, and four red-breasted mergansers. No harlequin ducks were observed (AGRA 1999).



8558-14.cdr 2JAN03 10:30AM

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Figure 4.1

Selected Waterfowl Observations by Highway Section and Survey Date

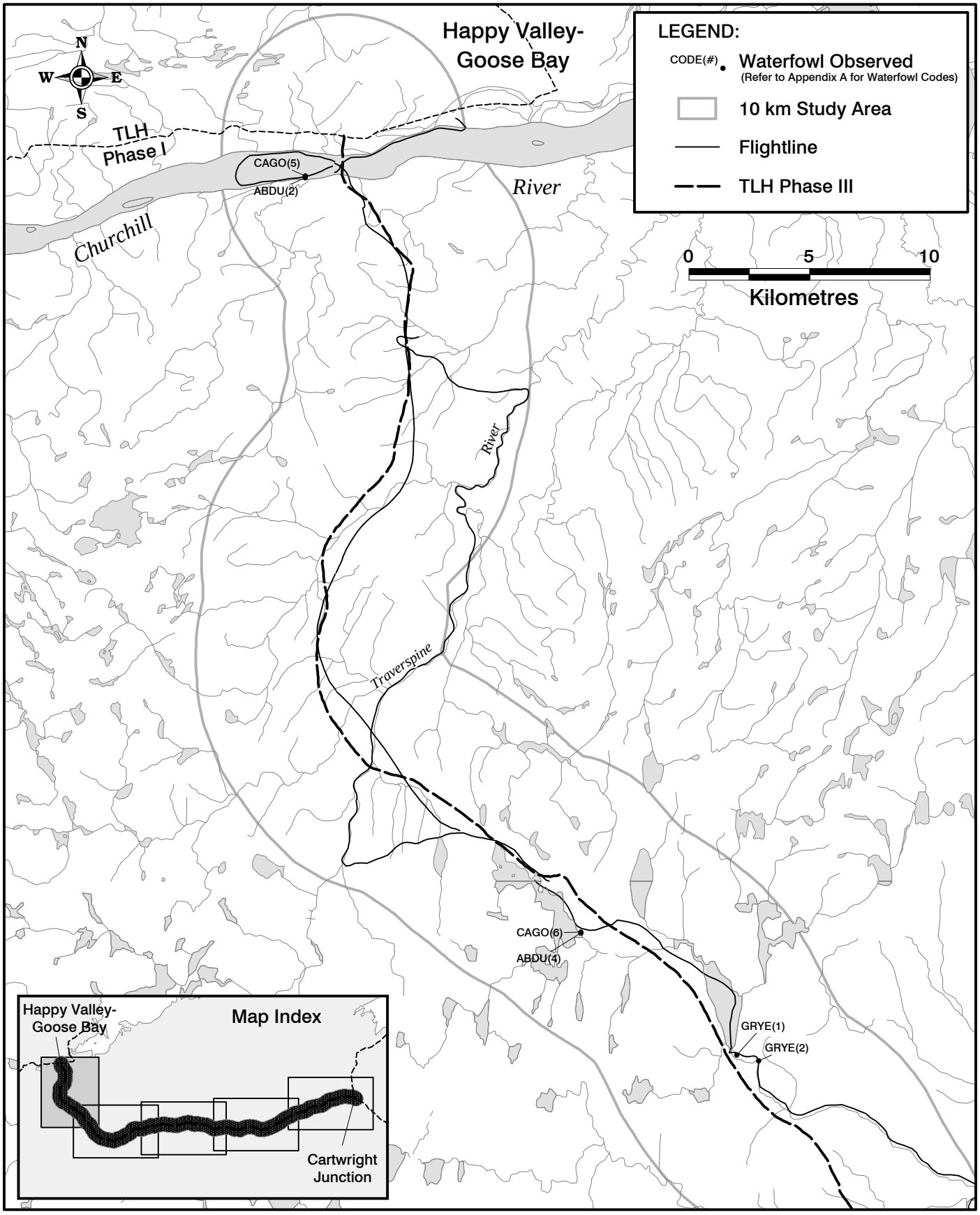

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Figure 4.2a

Waterfowl Observations 9 May 2002
TLH Phase III

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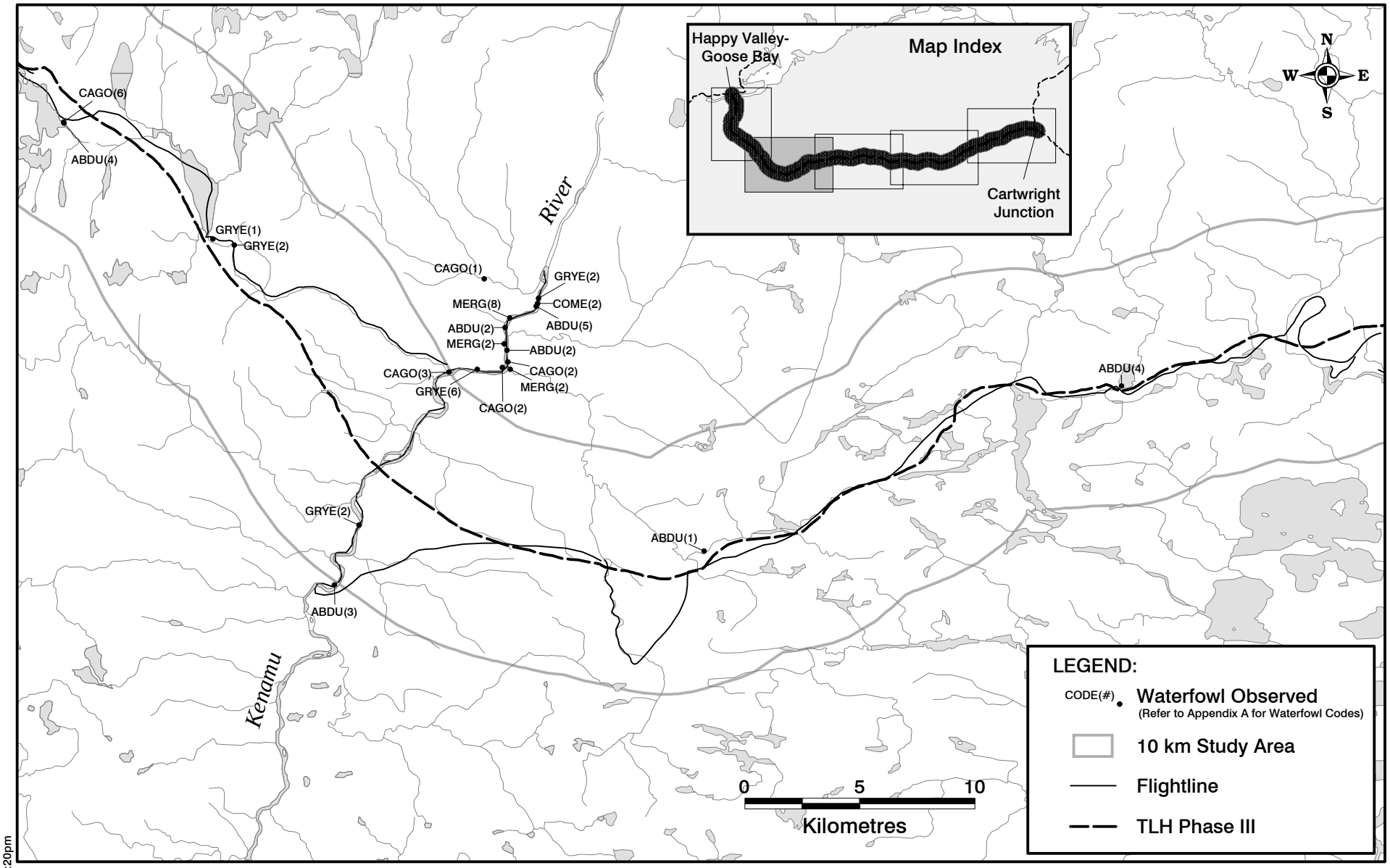

8243-52.WOR 27DEC02 3:20pm

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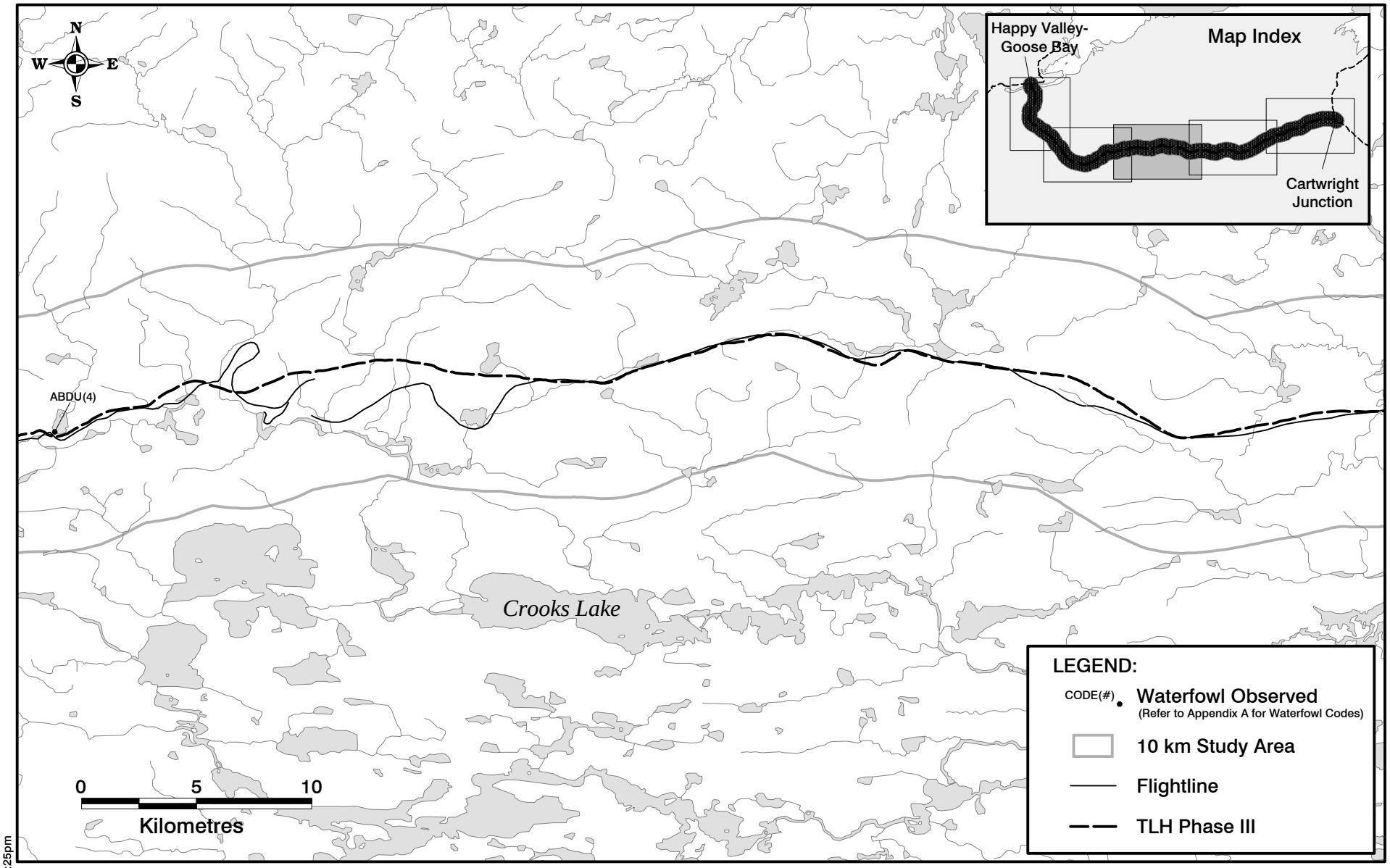
Figure 4.2b

Waterfowl Observations 9 May 2002
TLH Phase III



8243-56.WOR 27DEC02 3:25pm

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Figure 4.2c

Waterfowl Observations 9 May 2002
TLH Phase III

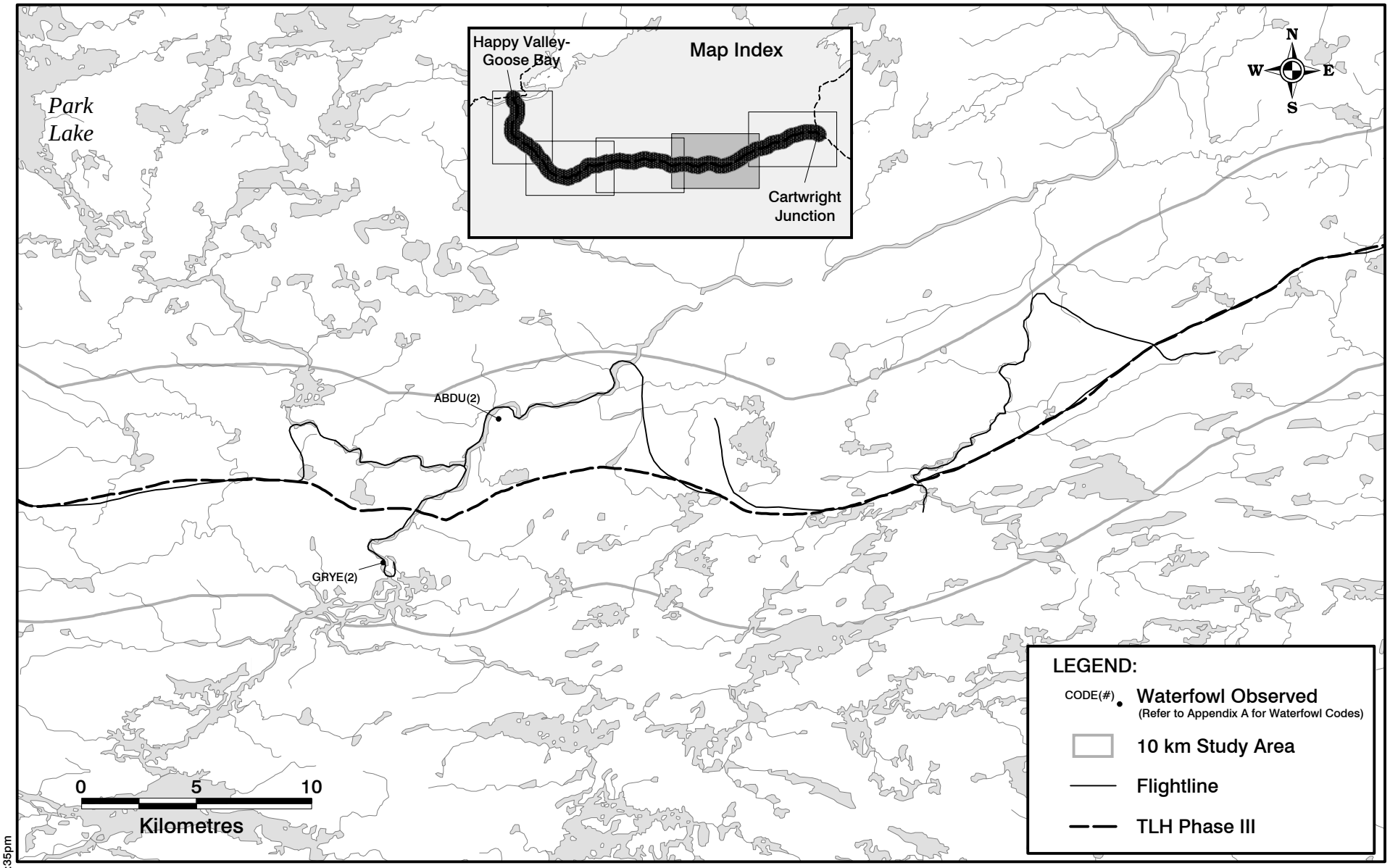

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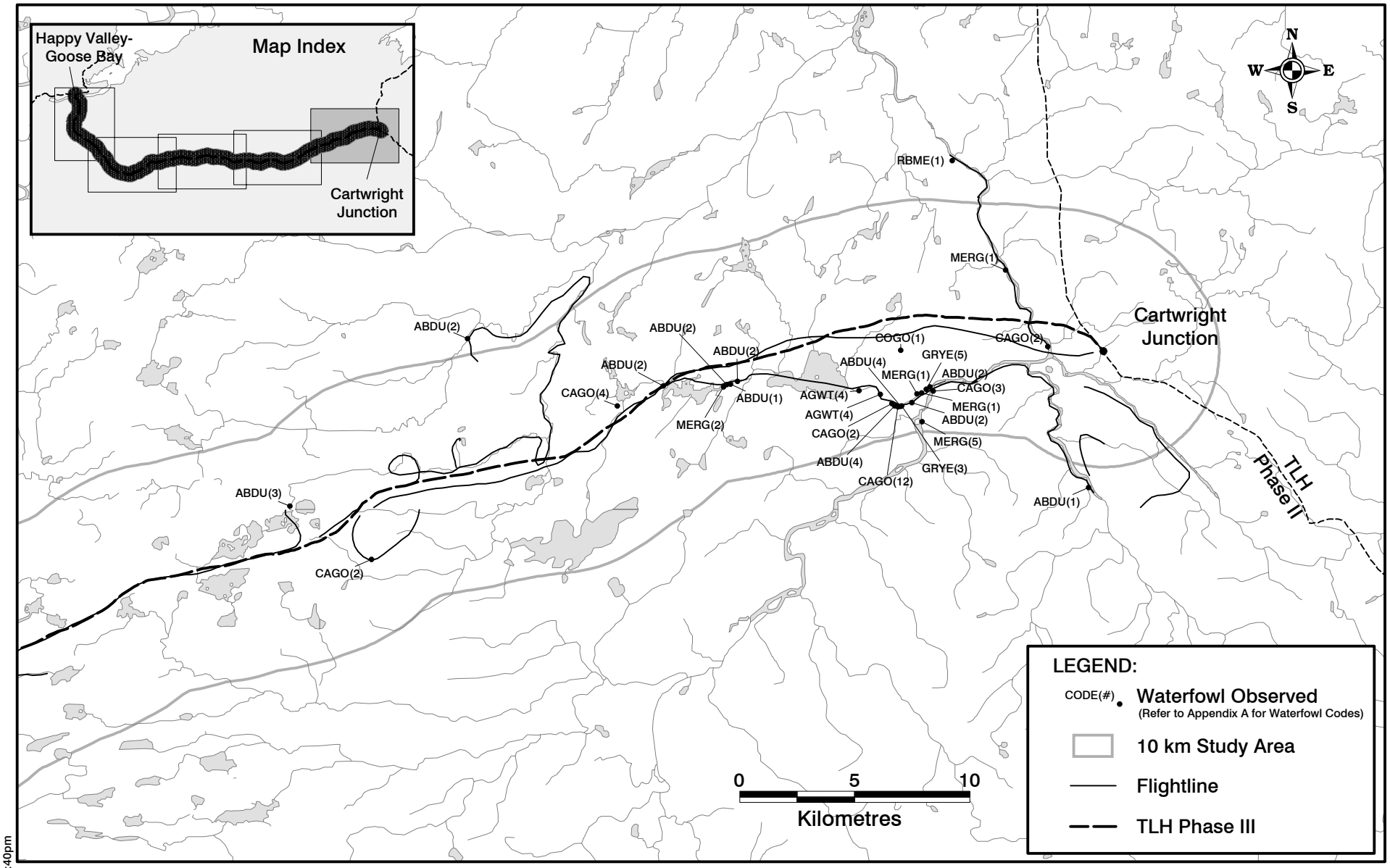
Figure 4.2d

Waterfowl Observations 9 May 2002
TLH Phase III



8243-67.WOR 27DEC02 3:40pm

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Figure 4.2e

Waterfowl Observations 9 May 2002
TLH Phase III

4.2.2 Breeding

Spring was much further advanced during the first survey of the breeding period on 21 May 2002. All rivers and inlet and outlet areas of lakes were mostly ice-free, where ducks tended to congregate. At low to moderate elevations (i.e. along Churchill River and Traverspine River), open water was visible on wetland areas. However, at elevations >150 m ASL (i.e., Eagle Plateau), ponds and wetland complexes continued to remain largely ice or snow covered. Figures 4.3a to 4.3e indicate the distribution of observations along each of five sections of the proposed highway route during the 21 May survey. Waterfowl were still congregated on the Churchill River and Traverspine River with numerous small groups of mergansers, black ducks and Canada geese (Figure 4.3a). Similarly, waterfowl continued to congregate along the open water areas of the Kenamu River where green-winged teal and mergansers were commonly observed and one group of 20 green-winged teal was identified on a small tributary of the Kenamu River (Figure 4.3b). Groups of >5 Canada geese and black ducks were common, however, most species were seen in pairs or groups of <5 individuals (Figures 4.3b - 4.3e).

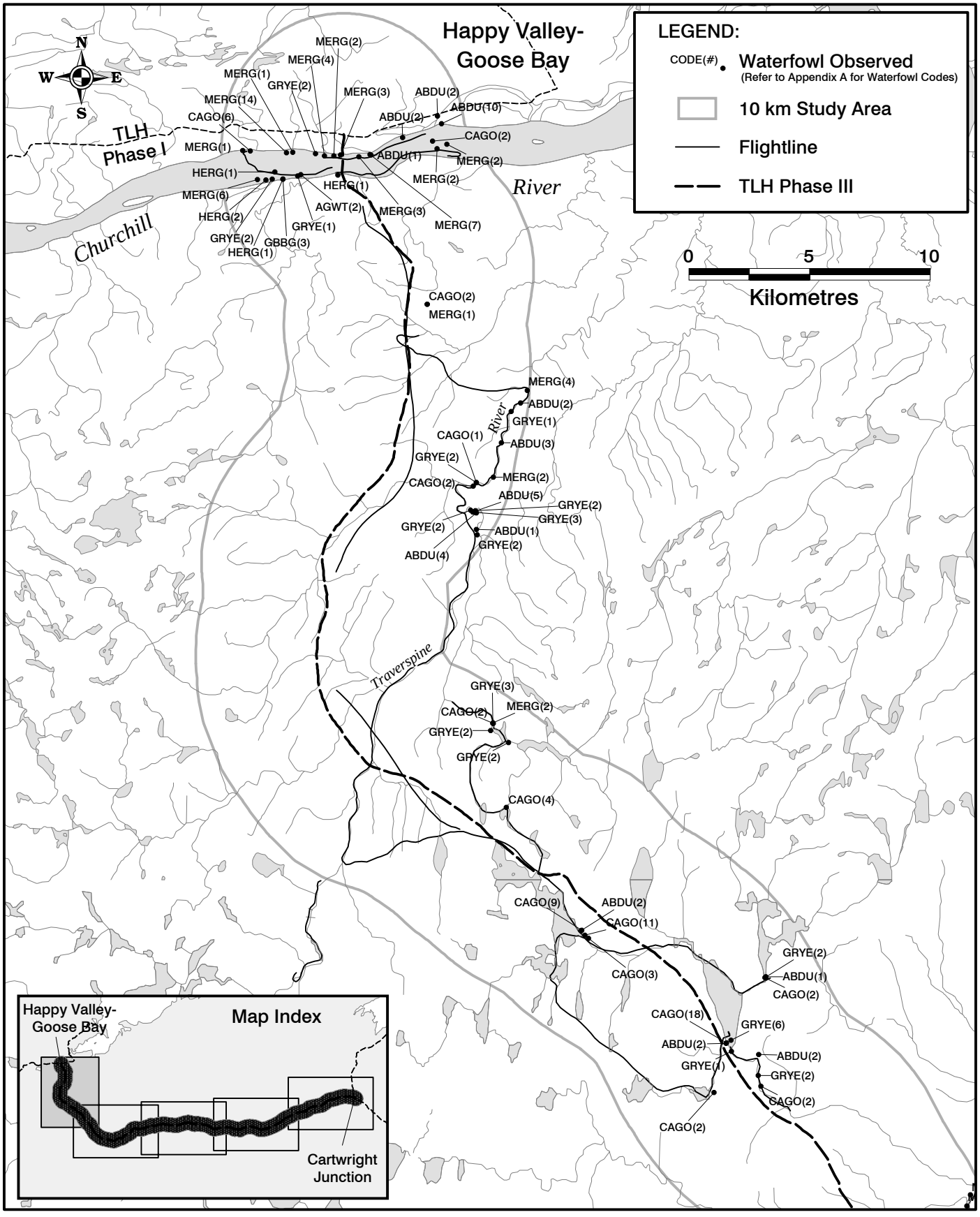

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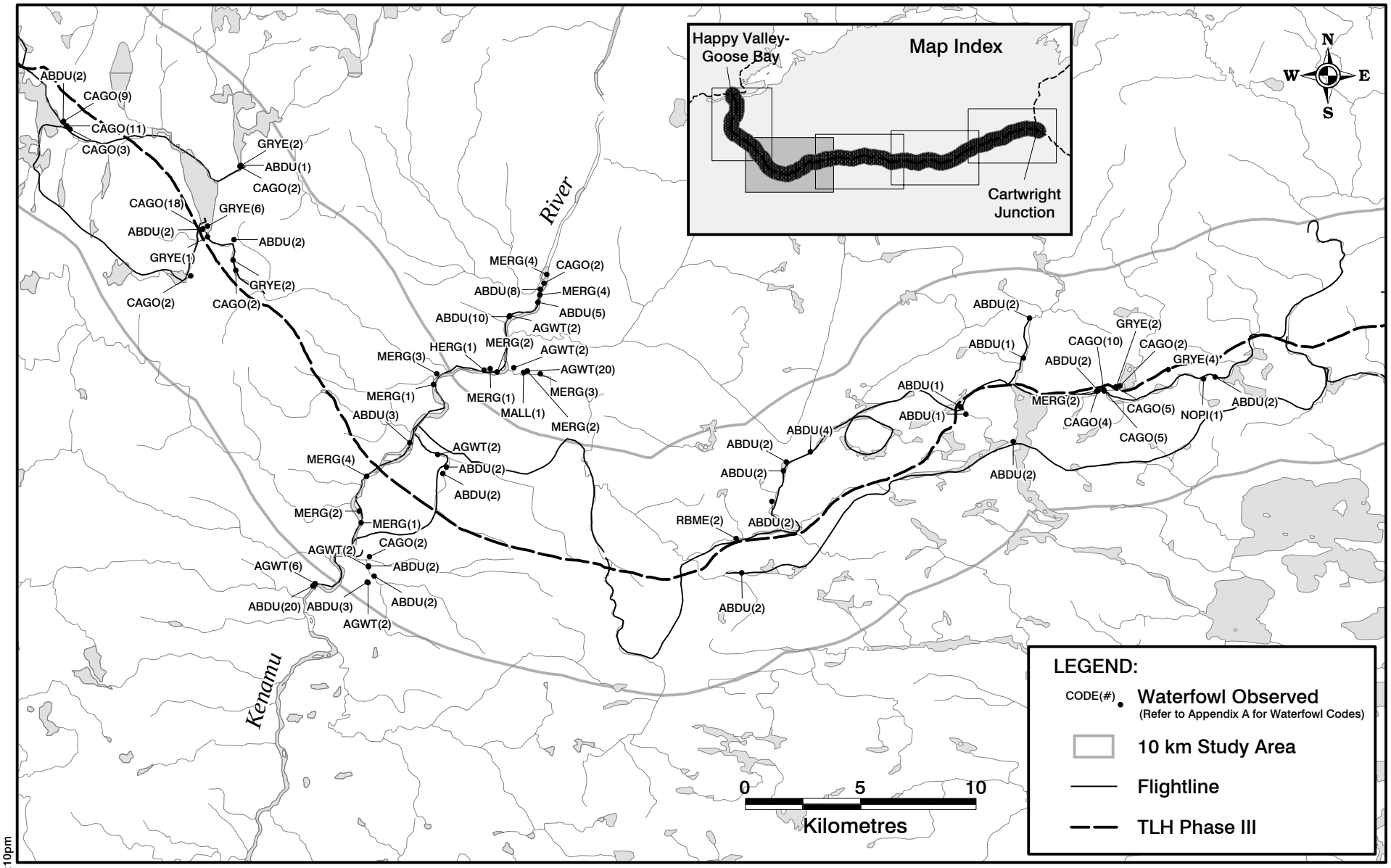
Figure 4.3a

Waterfowl Observations 21 May 2002
TLH Phase III



8243-50.WOR 27DEC02 3:10pm

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Figure 4.3b

Waterfowl Observations 21 May 2002
TLH Phase III

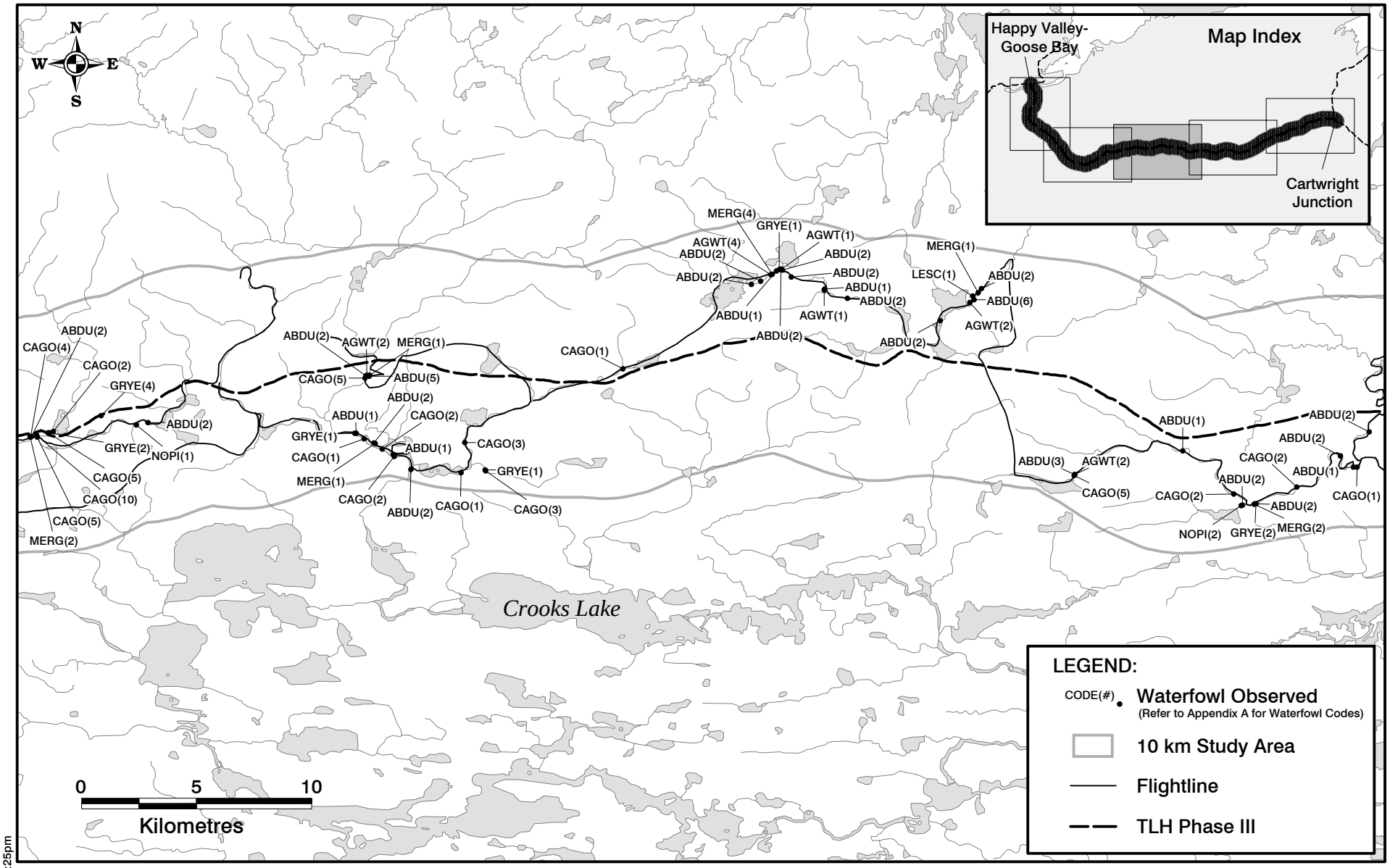

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Figure 4.3c

Waterfowl Observations 21 May 2002
TLH Phase III

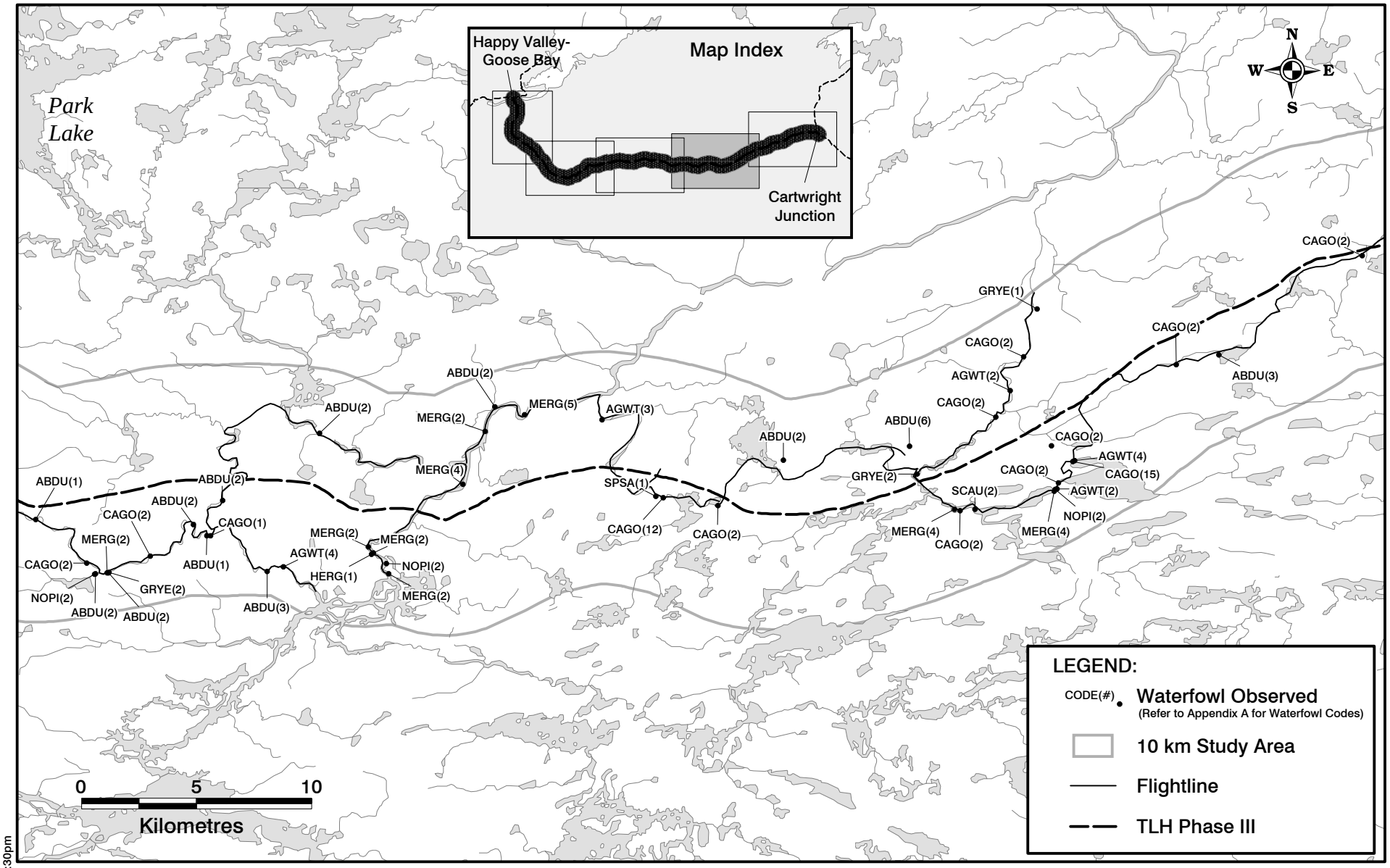

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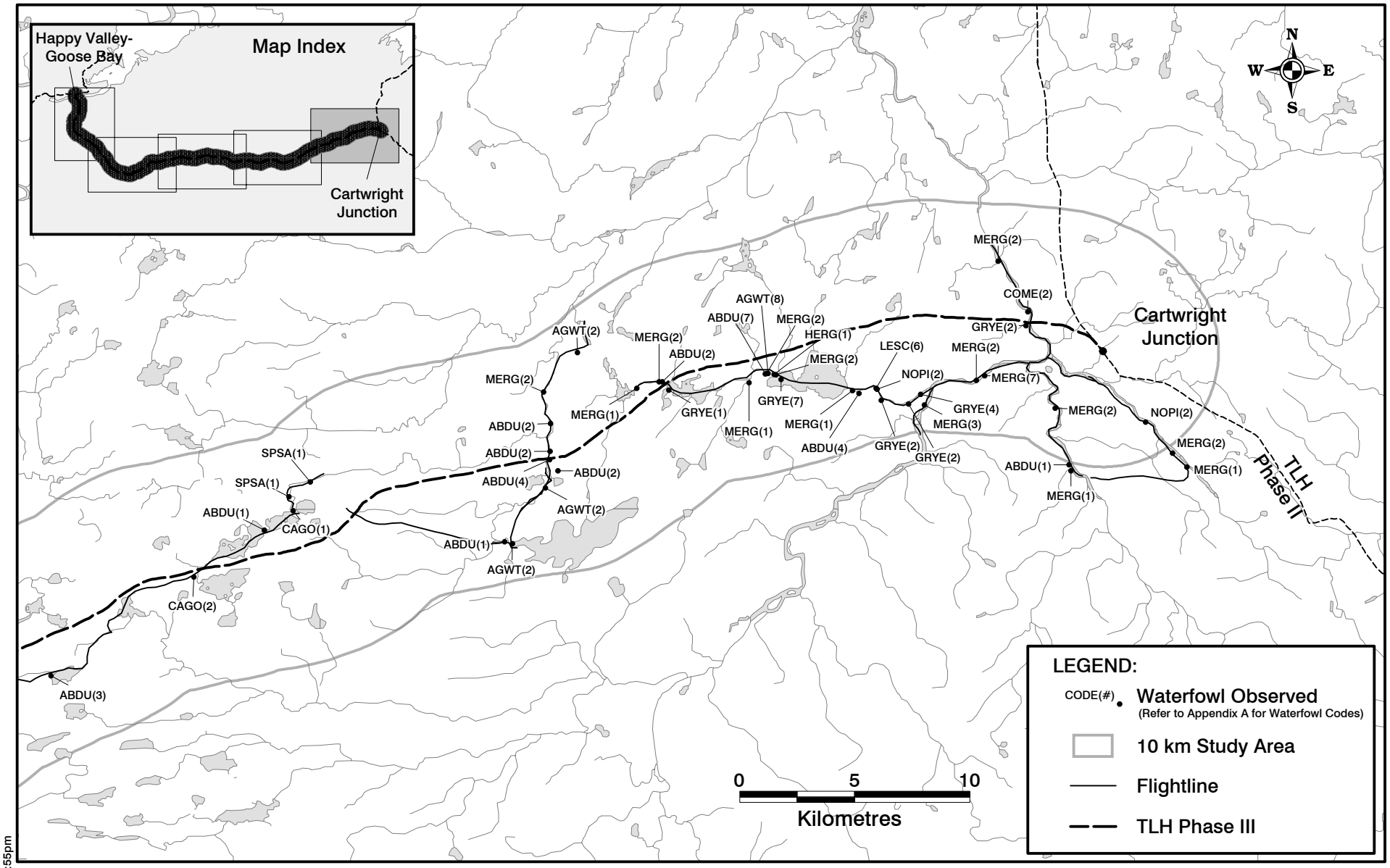
Figure 4.3d

Waterfowl Observations 21 May 2002
TLH Phase III



8243-65.WOR 27DEC02 3:55pm

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Figure 4.3e

Waterfowl Observations 21 May 2002
TLH Phase III

By the time of the second breeding period survey on 1-2 June, 95 percent of waterbodies and wetlands within the study area were ice or snow free. However, some waterbodies at higher altitude still maintained more than 50 percent ice cover. Figures 4.4a to 4.4e indicate the distribution of observations along each of five sections of the proposed highway route during the 1-2 June survey. No birds were observed along the Churchill River and dispersal to wetlands and small waterbodies from earlier spring concentrations along larger rivers and lakes was evident. The only mallards observed in 2002 were 13 during the June survey. Mallards occurred singularly or in groups of two on wetlands to the southeast of Park Lake (Figure 4.4d). Numerous groups of one or two ring-necked ducks were observed during the June survey with one group of 20 observed northwest of Crooks Lake (Figure 4.4c). Canada geese were now observed most frequently in pairs or singularly (Figures 4.4a - 4.4e). Black ducks were also observed in pairs or groups of <5 individuals.

Over 100 scoters (most of them surf scoters) were observed during the June breeding survey, most in groups of four or less. Several aggregations of 10 or more scoters were observed as well. The largest group of 15 individuals was located 2.5 km south of the highway route approximately 50 km west of Cartwright Junction (Figure 4.4d). No white-winged scoters were seen during the 2002 surveys. A total of 48 common goldeneye were observed during the June survey all in pairs or singularly (Figures 4.4a - 4.4d).

Common loons, herring gulls and other gulls were generally associated with medium and large waterbodies and greater yellowlegs were ubiquitous, particularly in wetland areas.

Overall the density of waterfowl in the survey area was low. However, waterfowl were widespread over the region. Black Duck Joint Venture Surveys of nearby plots from 1990 to 2000 show similar results indicative of the relatively low densities of waterfowl found in the region (Tables 4.2 and 4.3). In contrast to the 2002 surveys, relatively few ring-necked ducks were observed on the plots. However, the largest number of ring-necked ducks observed in 2002 were seen in late August, and in all 2002 surveys, the total number of birds observed were calculated over a much larger area than the 25 km^2 Black Duck Joint Venture plots.

Similarly, while dated, breeding surveys conducted in 1980 estimated six Canada geese/100 km^2 in the Eagle Plateau ecoregion, 20 geese/100 km^2 in the Paradise River ecoregion, and 2 geese/100 km^2 in the Lake Melville ecoregion. Estimates of total waterfowl densities were highest in the Eagle Plateau ecoregion (42 ducks/100 km^2) (Goudie and Whitman 1987). In the surveys of the early 1990's, the Eagle Plateau ecoregion was also identified as having the highest average density of Canada geese at 20 to 40 birds/100 km^2. The Paradise ecoregion was estimated to have 10 to 20 geese/100 km^2 and the Lake Melville ecoregion, 0.1 to 10 geese/100 km^2 (Bateman and Hicks 1995). The results of surveys conducted in 2002 confirmed the relative importance of the Eagle Plateau area for waterfowl breeding, with 76 percent of waterfowl observations during the June breeding survey occurring within this ecoregion.

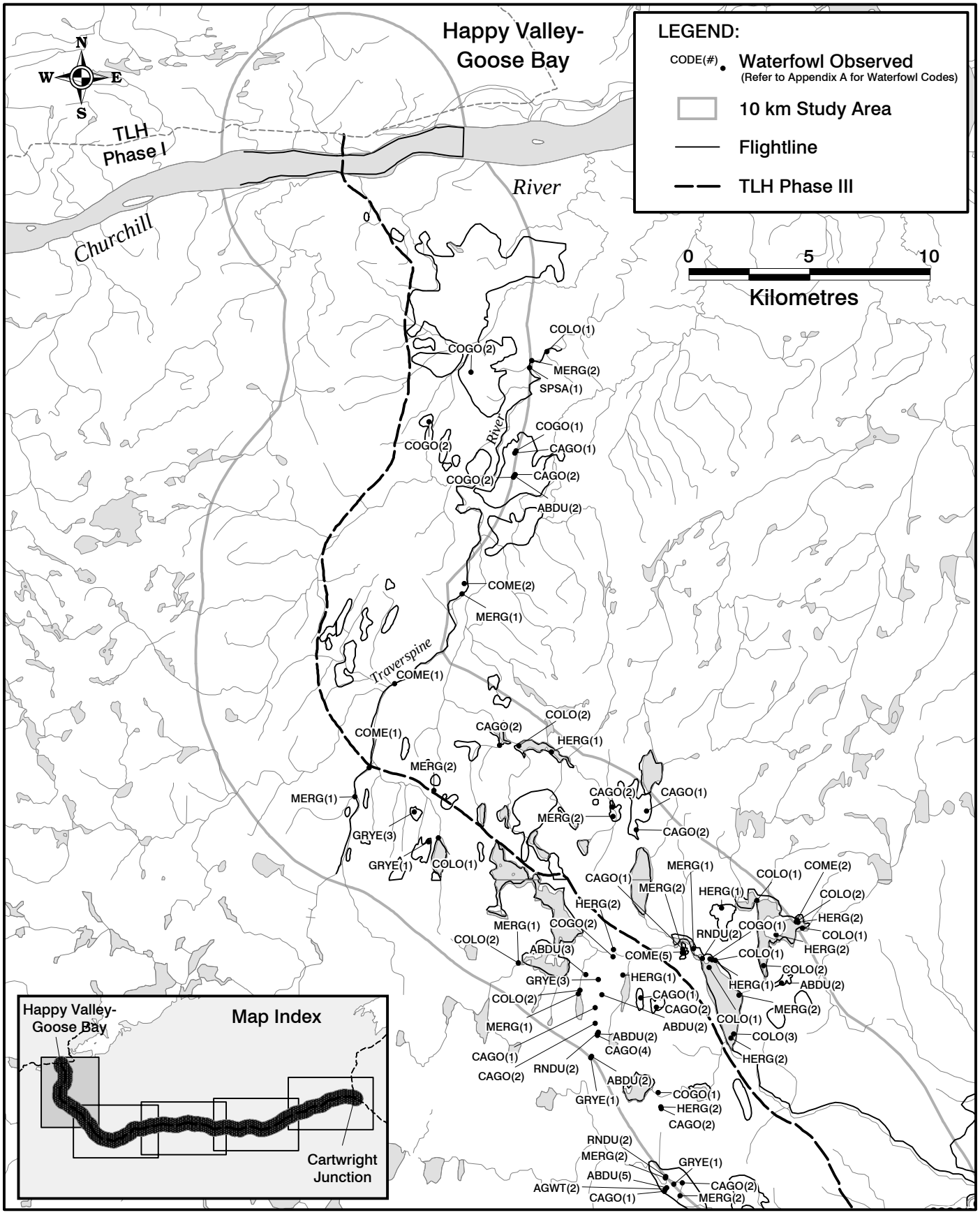

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Figure 4.4a

Waterfowl Observations 1-2 June 2002
TLH Phase III

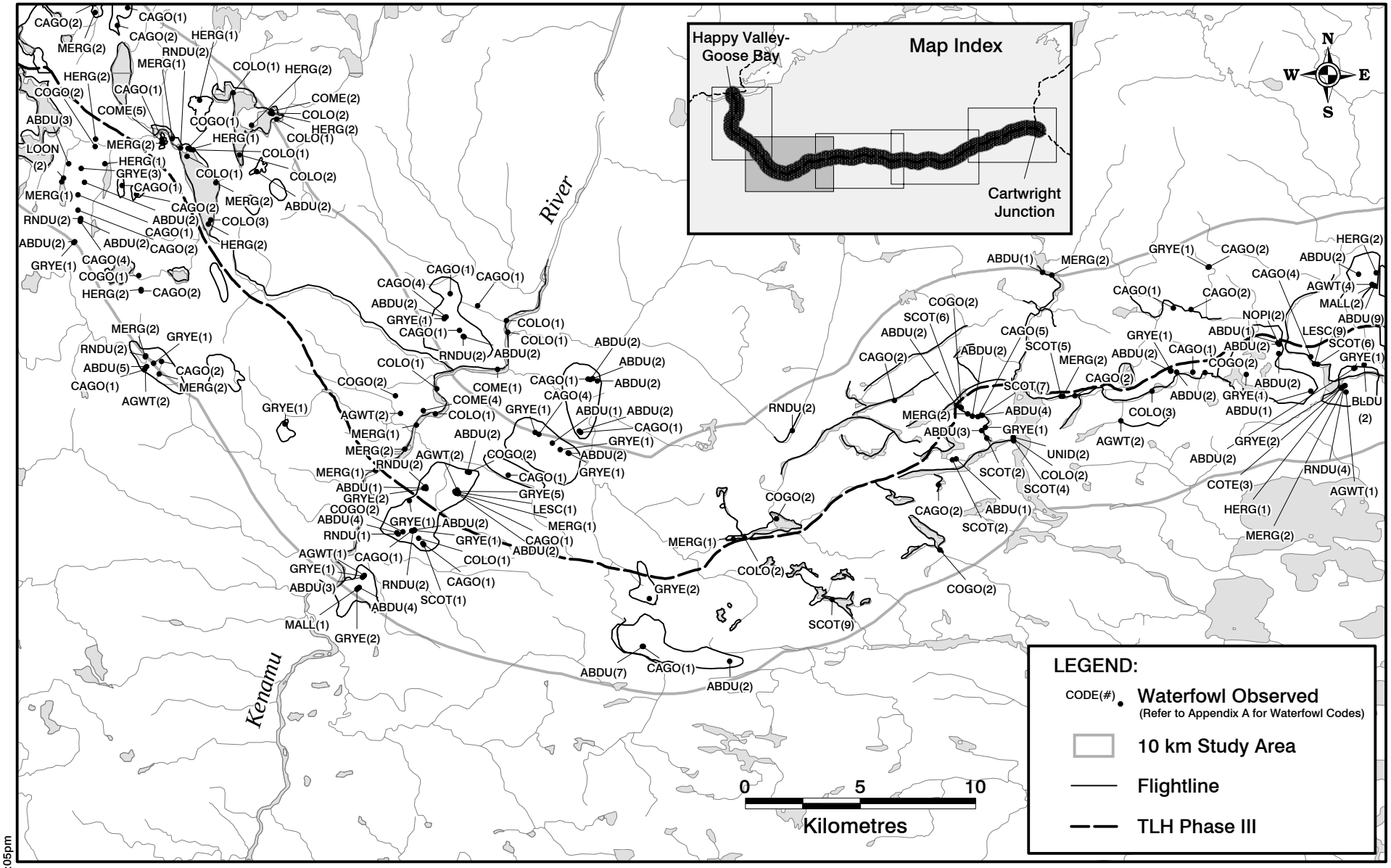

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Figure 4.4b

Waterfowl Observations 1-2 June 2002
TLH Phase III

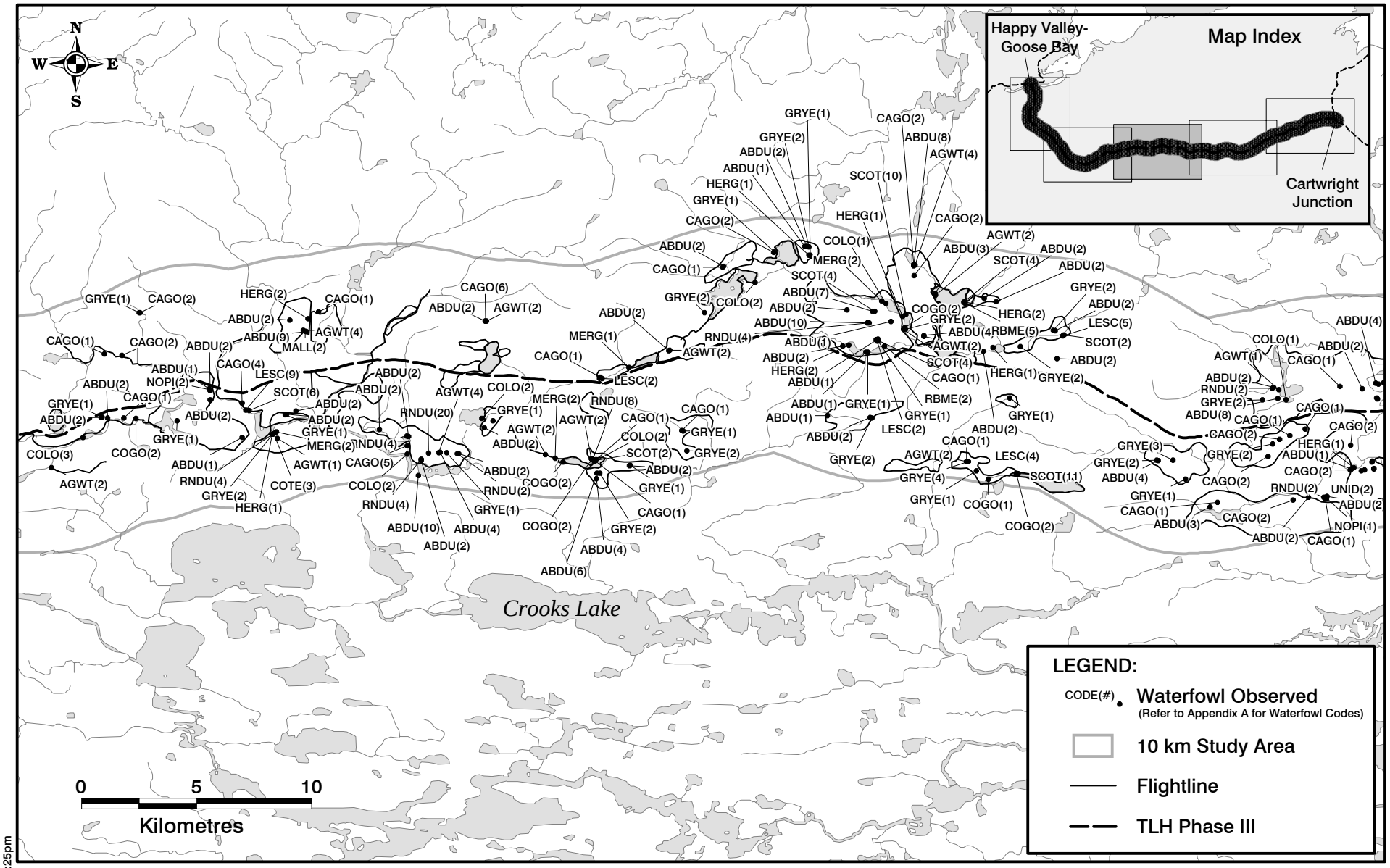

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Figure 4.4c

Waterfowl Observations 1-2 June 2002
TLH Phase III

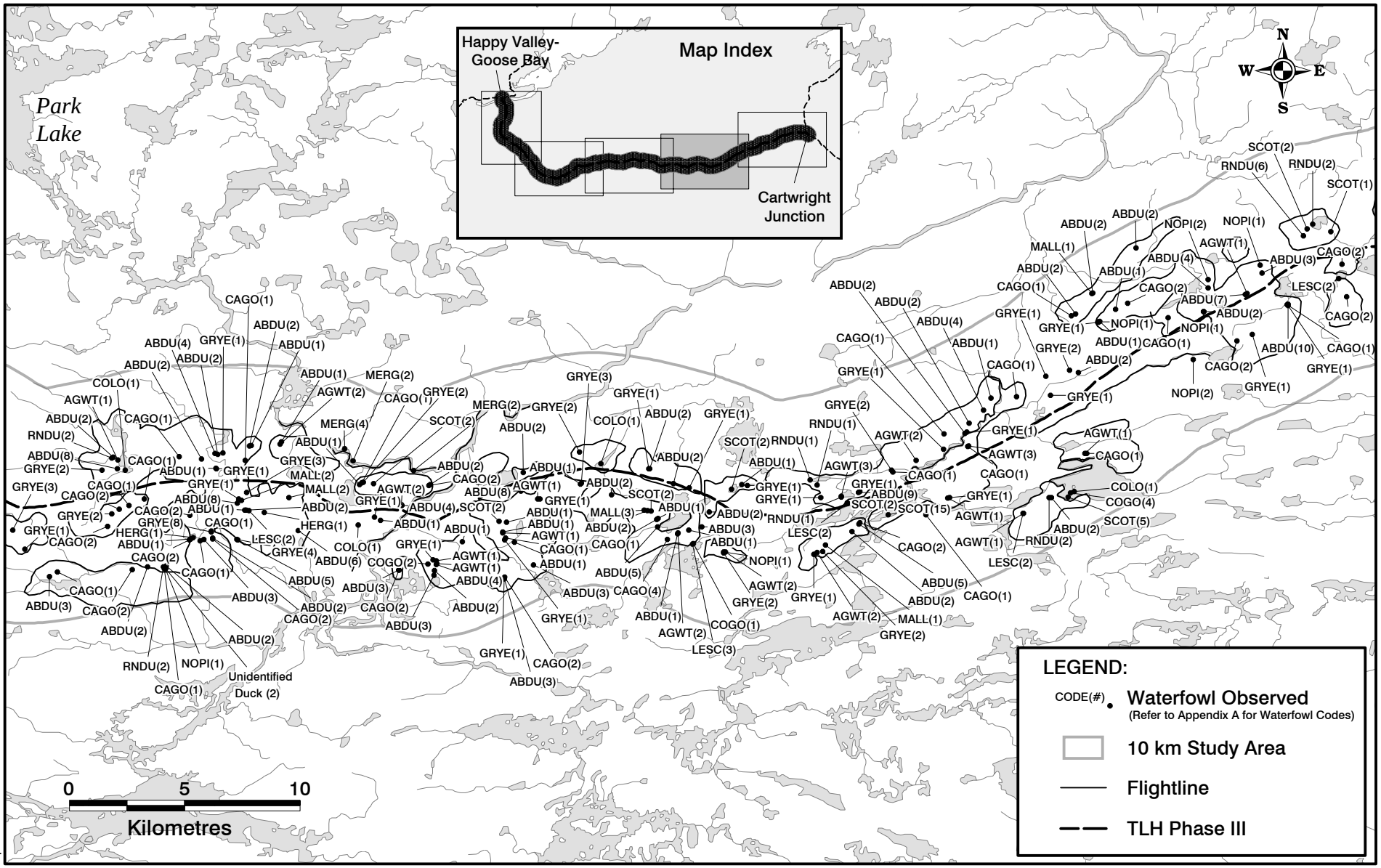

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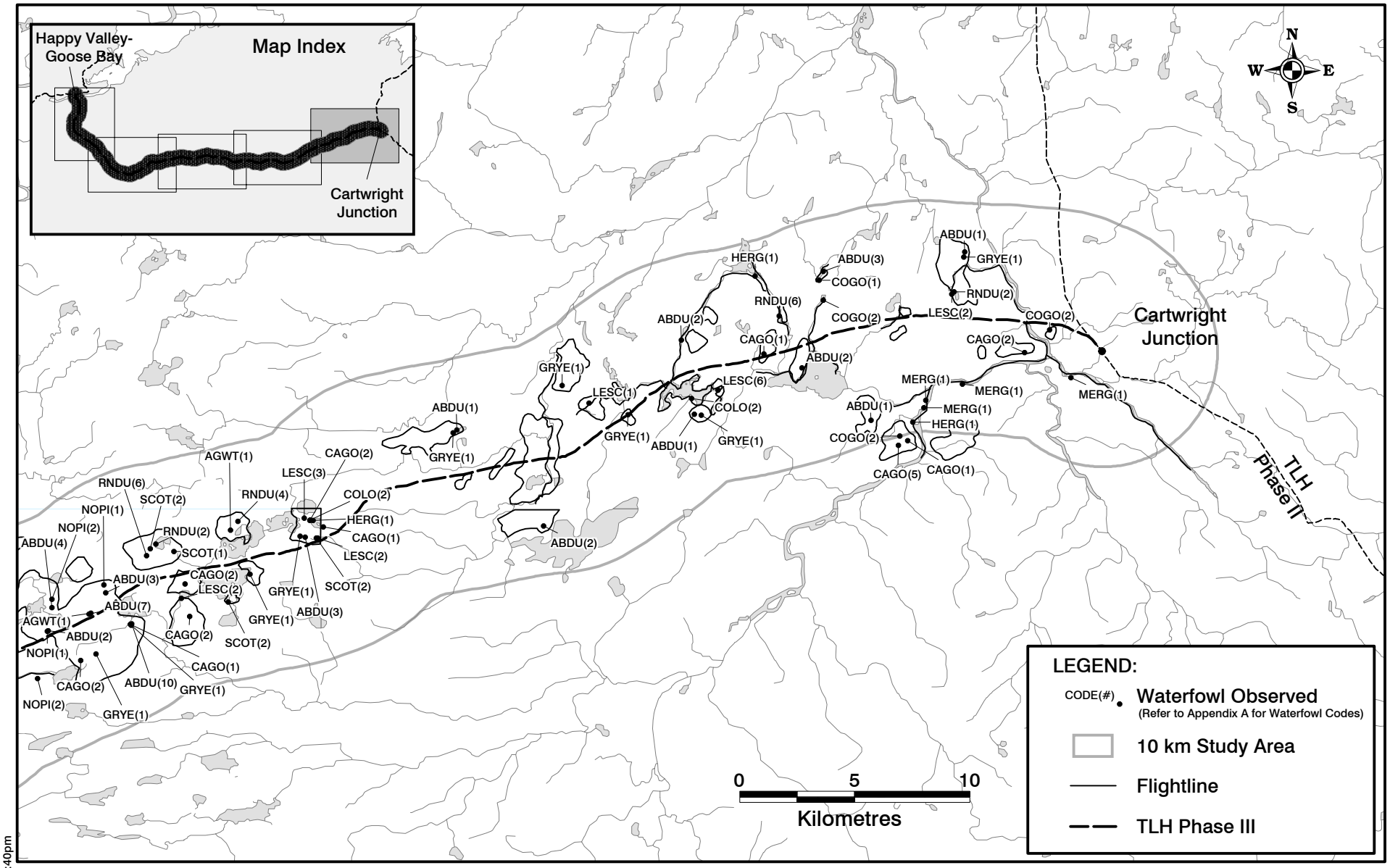
Figure 4.4d

Waterfowl Observations 1-2 June 2002
TLH Phase III



8243-64.WOR 27DEC02 3:40pm

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Figure 4.4e

Waterfowl Observations 1-2 June 2002
TLH Phase III

Table 4.2 Bird Counts at Plot 24 - Mud Lake - Black Duck Joint Venture Surveys 1990-2000

Species	Survey Year/# Birds Observed							
	1990	1991	1992	1993	1994	1996	1998	2000
American Black Duck	8	14	10	15	11	7	1	2
Green-winged Teal	14	5	10	2	2	0	0	1
Canada Geese	7	14	5	11	8	2	8	5
Common Goldeneye	136	100	60	80	77	30	31	23
Common Merganser	7	7	0	0	1	0	0	0
Hooded Merganser	0	0	0	2	0	0	0	0
Red-breasted Merganser	0	1	0	4	2	0	0	0
Ring-necked Duck	2	17	5	3	0	0	10	3
Greater Scaup	5	5	0	0	0	2	0	4
Lesser Scaup	3	0	0	0	0	0	0	0

Source: CWS unpublished data

Table 4.3 Bird Counts at Plot 22 - Paradise River - Black Duck Joint Venture Surveys 1990-2000

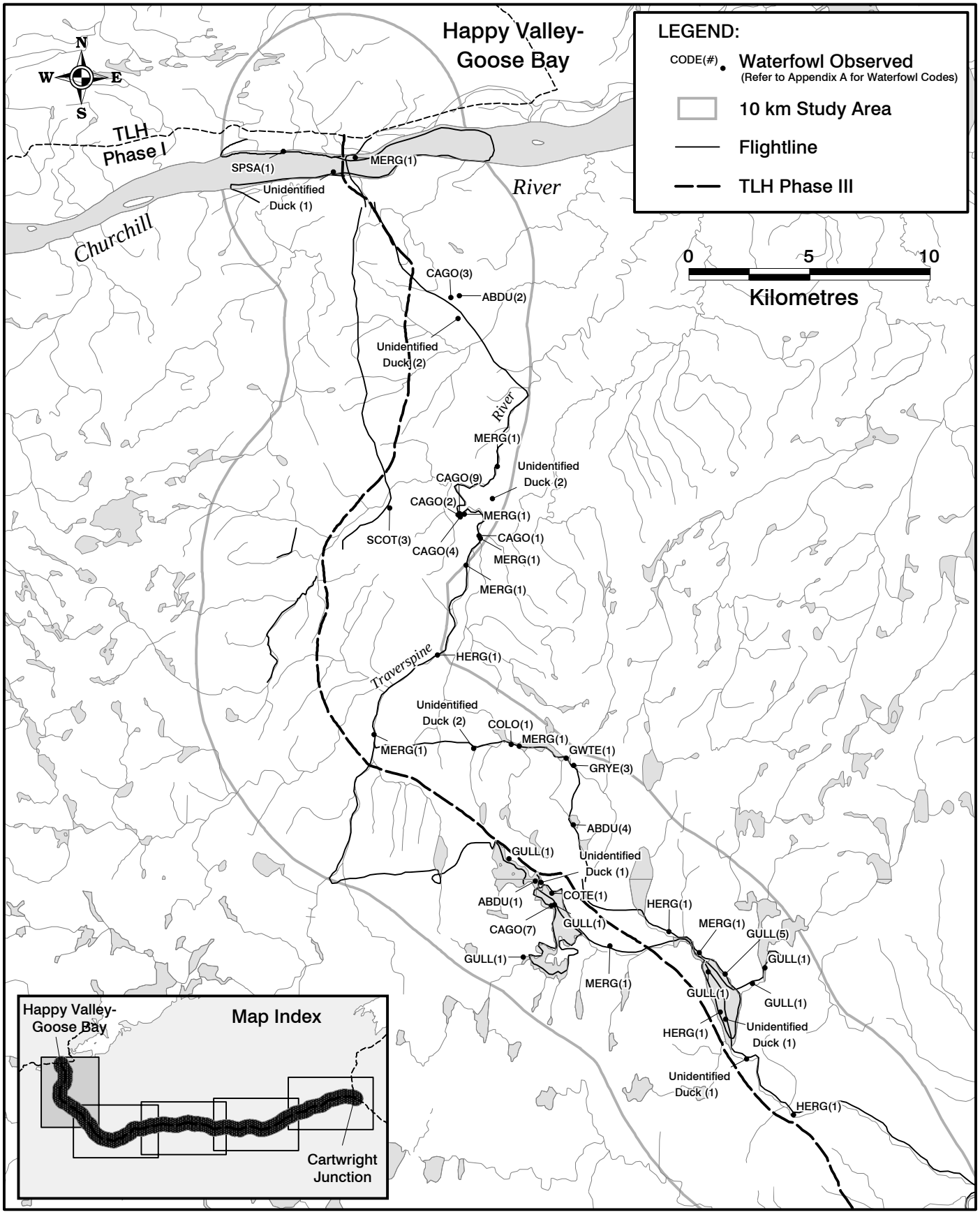
Species	Survey Year/# Birds Observed							
	1990	1991	1992	1993	1994	1995	1998	1999
American Black Duck	8	7	6	4	2	0	0	2
Green-winged Teal	2	9	0	4	5	5	0	0
Canada Goose	7	9	11	8	17	14	6	4
Common Goldeneye	13	8	2	2	2	11	0	0
Common Merganser	5	5	10	2	2	5	2	3
Red-breasted Merganser	1	2	0	3	2	0	0	0
Ring-necked Duck	8	4	6	0	1	1	0	0
Lesser Scaup	0	2	0	0	0	0	0	0
Northern Pintail	0	1	0	0	0	0	0	0
Common Loon	0	0	0	0	3	1	0	0
Yellowlegs sp.	4	11	0	3	10	2	0	0
Herring Gull	3	3	0	5	0	2	1	0

Source: CWS unpublished data

4.2.3 Broods/Moulting

During the 18 July survey, Canada geese and black ducks were observed with broods. A total of 12 young Canada geese were observed in four separate groups. A pair of Canada geese with one young, a pair with five young and a pair with two young, all along the Traverspine River (Figure 4.5a) and a pair with four young on the Kenamu River (Figure 4.5b). Two broods of black ducks were observed. One female black duck with six young was noted approximately 8 km south of the highway route (Figure 4.5d) and one female black duck with seven young was observed approximately 10 km north of the highway route (Figure 4.5e). Although few broods were observed during the July survey, the technique employed was not designed to necessarily maximize opportunities for these sightings. Given the remote nature of the study area and the vast amount of potential habitat, only a limited portion could be surveyed when conditions are most suitable for observing broods (i.e., early morning or evening, calm conditions).

One large group of moulting black ducks (40+) were observed west of Crooks Lake (Figure 4.5c) as well as a group of 14 moulting black ducks southeast of Park Lake (Figure 4.5d). By July, aggregations of Canada geese were again evident with several groups of moulting Canada geese observed including 25 southeast of Park Lake (Figure 4.5d) and 18 north of the highway route, approximately 25 km west of Cartwright Junction (Figure 4.5e). A group of 9 ring-necked ducks was observed north of Crooks Lake during the July survey (Figure 4.5c). While no common goldeneye were seen, mergansers were distributed throughout the survey area, generally in pairs or singularly (Figures 4.5a - 4.5e).



8243-44.WOR 27DEC02 12:15pm

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Figure 4.5a

Waterfowl Observations 18 July 2002
TLH Phase III

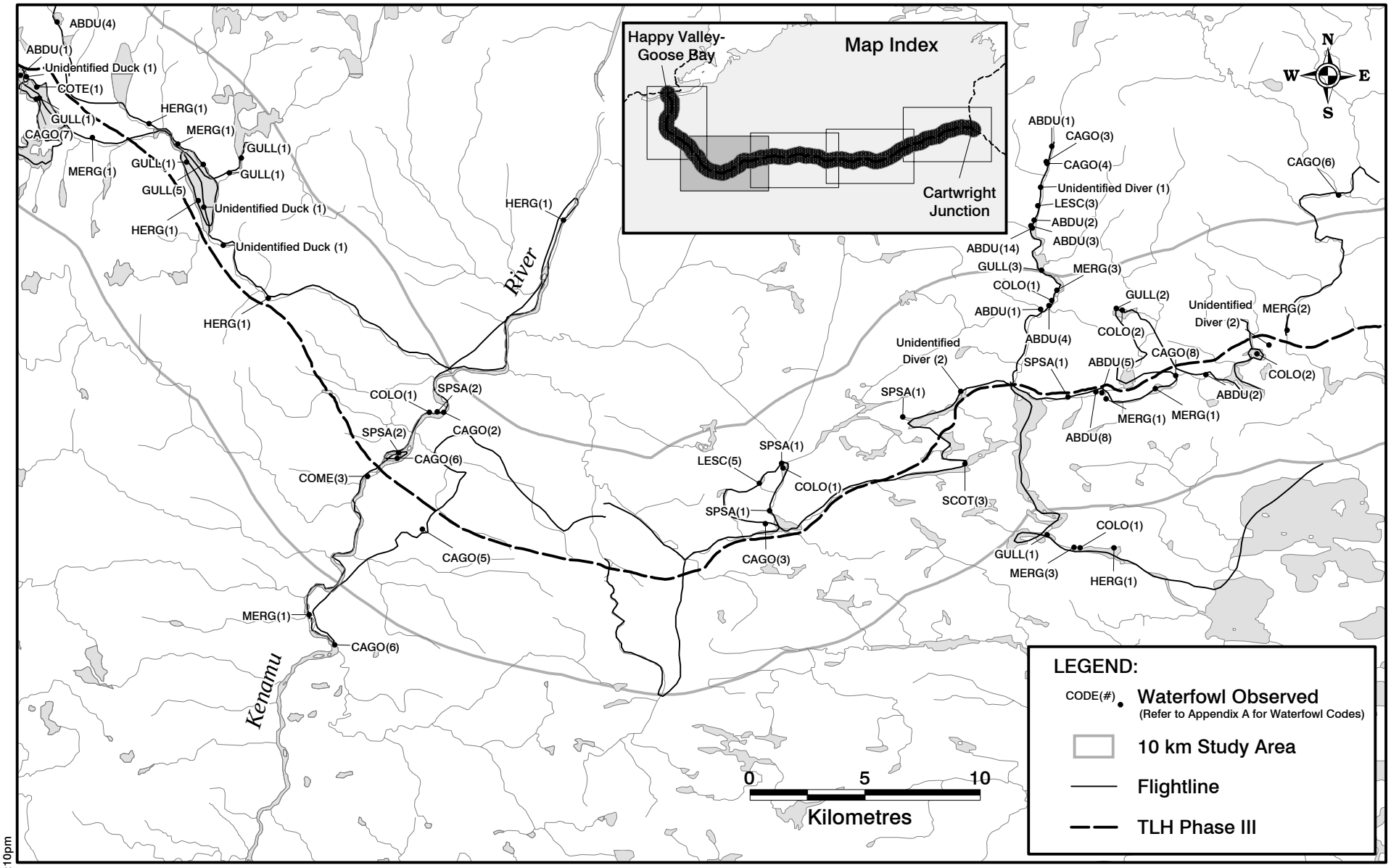

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Figure 4.5b

Waterfowl Observations 18 July 2002
TLH Phase III

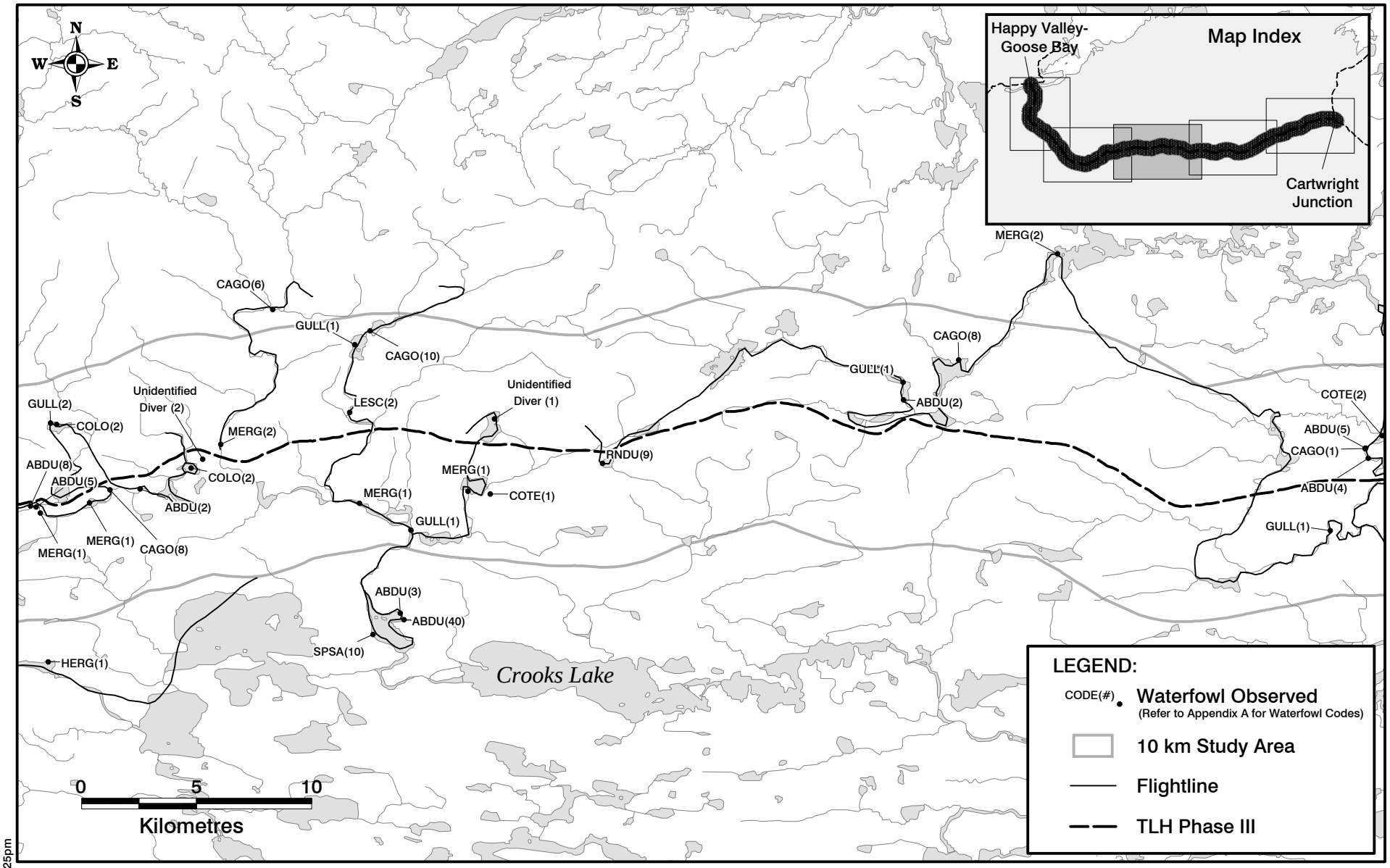

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Figure 4.5c

Waterfowl Observations 18 July 2002
TLH Phase III

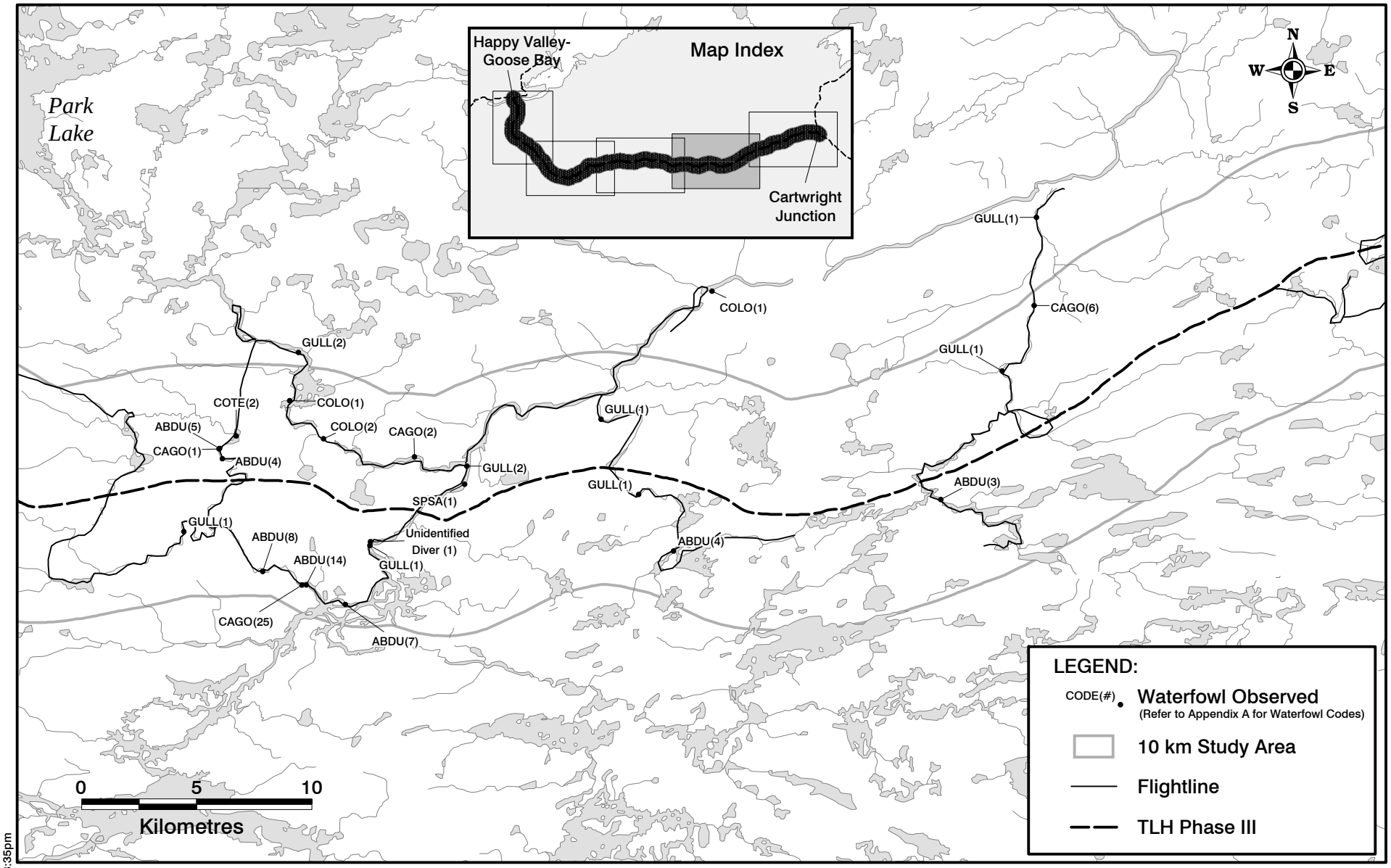

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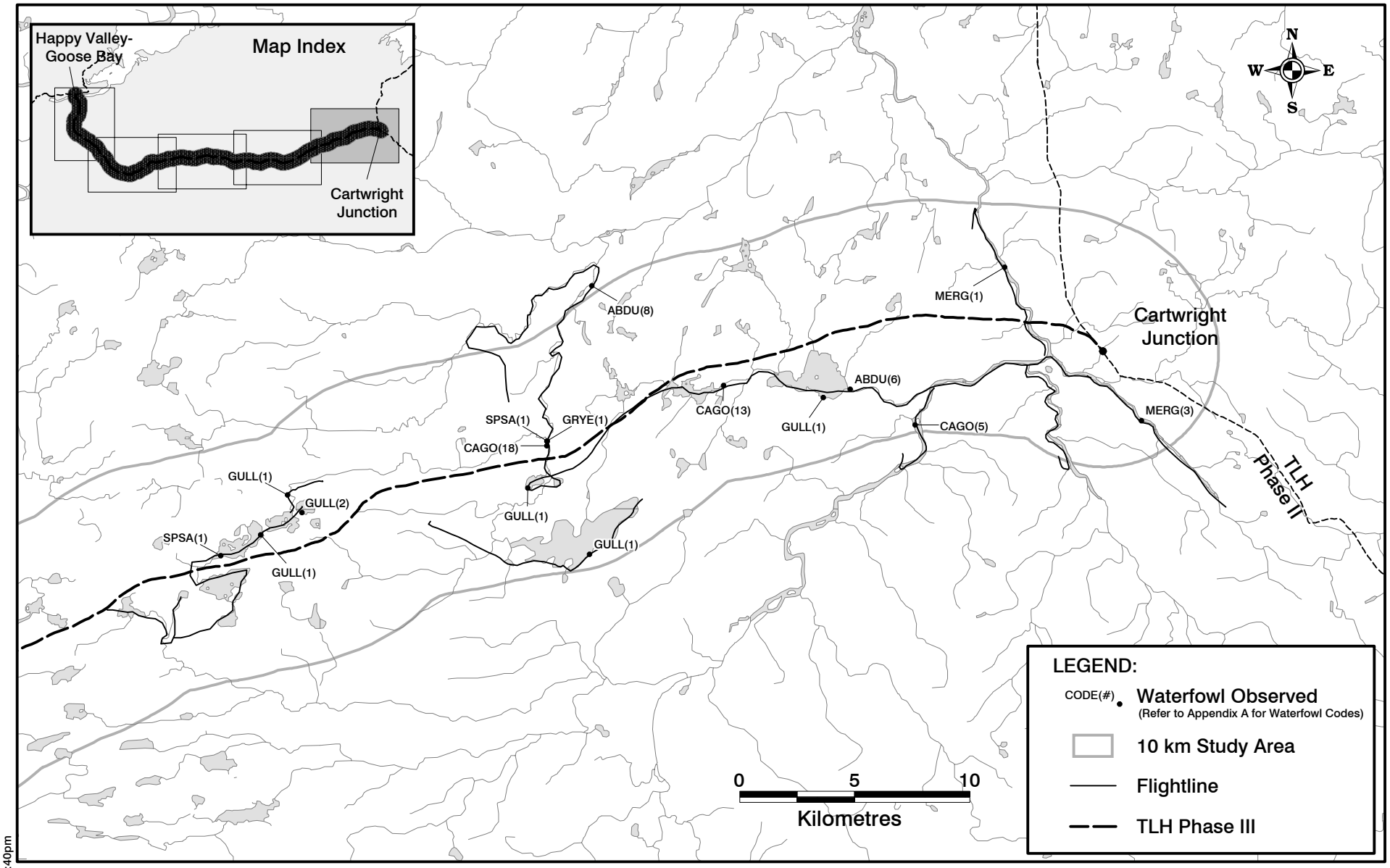
Figure 4.5d

Waterfowl Observations 18 July 2002
TLH Phase III



8243-66.WOR 27DEC02 3:40pm

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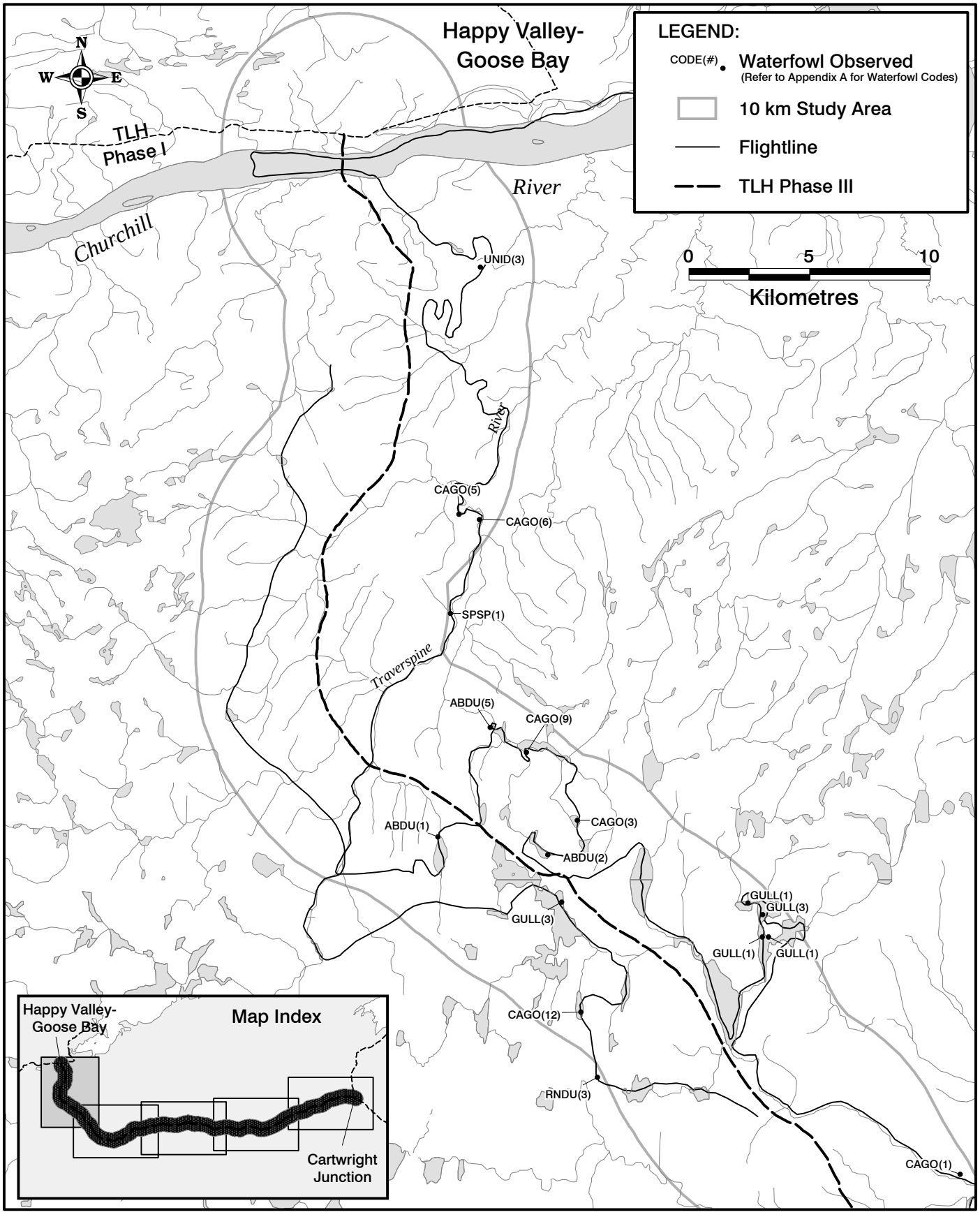
Figure 4.5e

Waterfowl Observations 18 July 2002
TLH Phase III

4.2.4 Fall Staging

Figures 4.6a - 4.6e indicate the distribution of observations along each of five sections of the proposed highway route during the 27-28 August survey. Observations of various species during this survey were commonly of groups of four or more individuals. Congregations of black ducks were observed at various locations along the route (total of 77 individuals) (Figures 4.6a - 4.6e). Similarly Canada geese were observed in groups ranging from three to 12 individuals (4.6a - 4.6e), with groupings of less than 10 birds common (total of 78 individuals). A large number of ring-necked ducks were observed, most in flocks of 10 or more birds and often on lakes (total of 196 individuals)(Figures 4.6b and 4.6c). One group of >50 ring-necked ducks was observed in close proximity to the proposed highway route (Figure 4.6b). Ring-necked ducks with broods were most commonly observed in association with current or past beaver activity. One congregation of 12 mergansers was noted (Figure 4.6b) and green-winged teal were also seen in groups ranging from two to 12 individuals. In particular, two groups of 12 teal were observed along the eastern section of the highway, one group nearly 10 km south of the highway, the second approximately 3 km south of the highway (Figure 4.6d). Two long-tailed ducks were also recorded during the late August survey, the only observation of this species recorded during the 2002 surveys. The birds were observed on a small pond 5 km south of the proposed highway, approximately 30 km northeast of Crooks Lake (Figure 4.6c). No common goldeneye or scoters were observed during the fall survey.



8243-48.WOR 27DEC02 3:15pm

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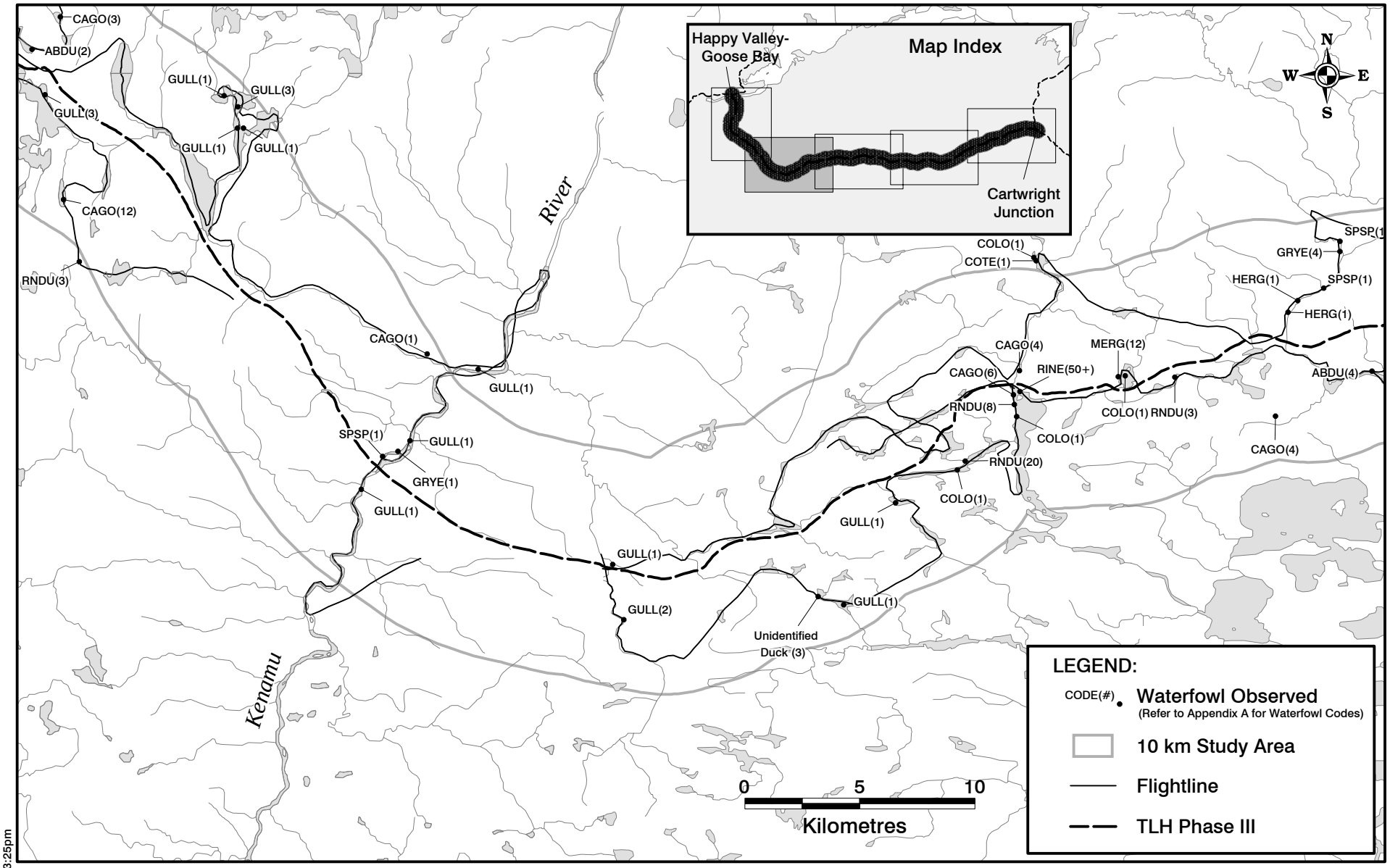
Figure 4.6a

Waterfowl Observations 28-29 August 2002
TLH Phase III



3:25pm

8243-53.WOR 27DEC02

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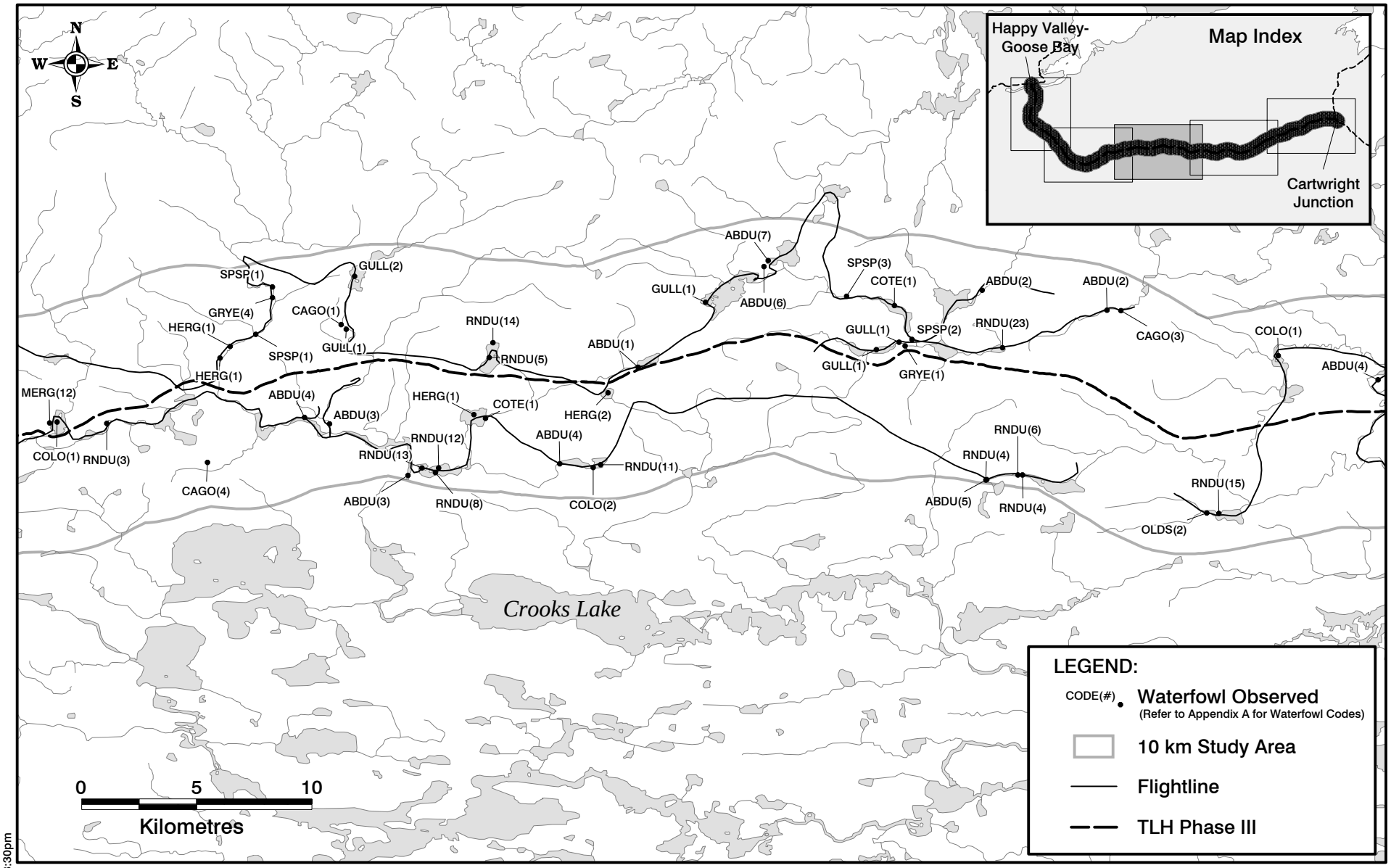
Figure 4.6b

Waterfowl Observations 28-29 August 2002
TLH Phase III



8243-58.WOR 27DEC02 3:30pm

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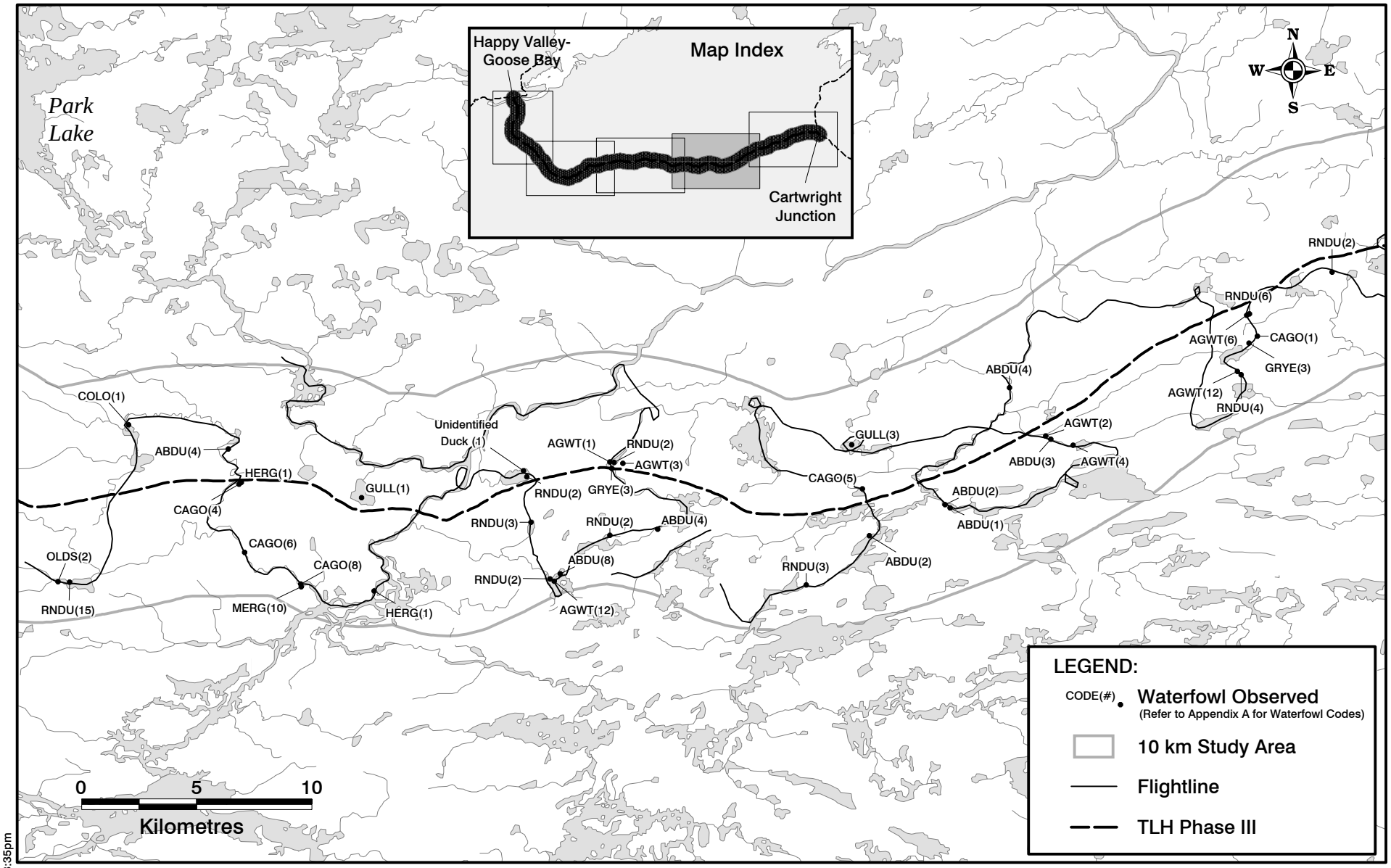
Figure 4.6c

Waterfowl Observations 28-29 August 2002
TLH Phase III



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Jacques Whitford Environment Limited
Environmental Scientists
Consulting Engineers

Figure 4.6d

Waterfowl Observations 28-29 August 2002
TLH Phase III

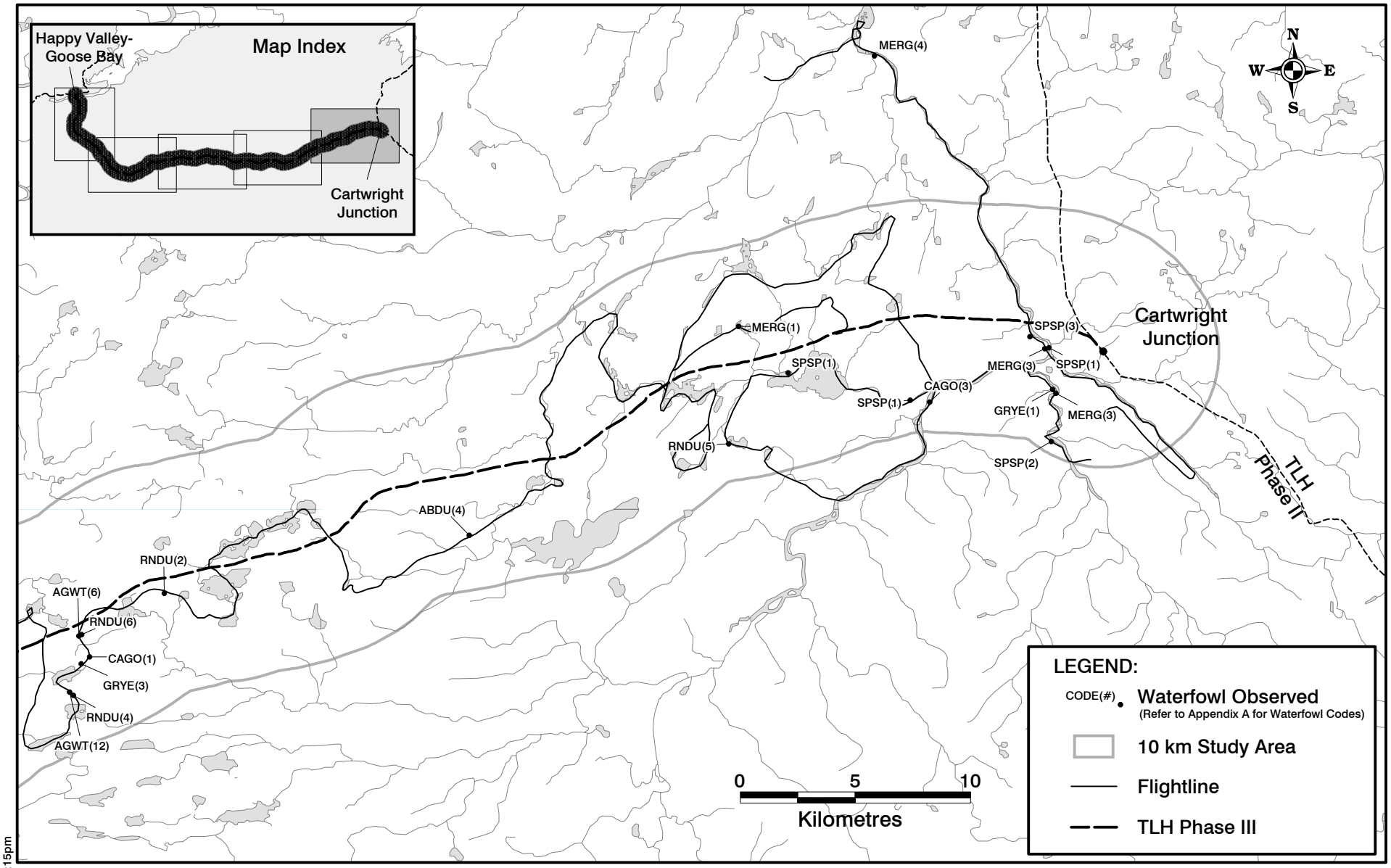

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Figure 4.6e

Waterfowl Observations 28-29 August 2002
TLH Phase III

4.3 Species of Special Concern

Three surveys for harlequin ducks were conducted during May 2002. The first survey on 9 May 2002 was specifically targeted at areas of potential harlequin duck habitat along the proposed highway route. The second and third surveys of potential harlequin duck habitat were completed at the same time as surveys for other waterfowl species on 21 May and 1-2 June 2002. No harlequin ducks were observed during the three surveys.

While harlequin ducks are present on rivers in the Churchill River watershed to the west and apparently suitable habitat exists along several rivers crossing the highway route (i.e., Traverspine River, Eagle River, Paradise River), no harlequin ducks have been observed during surveys for this study or during previous surveys in this region and only one pair has been observed in southern Labrador, on St. Paul's River in May 1998 (JW 1999). Surveys conducted between 1995 and 1998 on the Traverspine River (1995 and 1996), Kenamu River (1995 and 1996), Brennan Lake Brook (1996), St. Augustin River (1997), Petit Mecatina River (1995 and 1996), Paradise River (1998) and Eagle River (1997) found no harlequin ducks (JW 1999). Similarly, no harlequin ducks were observed during another survey of the Traverspine River in 1998 as part of the Labrador Hydro Project (AGRA 1999). Also in July 1998, a dedicated harlequin duck survey was completed along the Churchill River, encompassing the area of the proposed highway crossing. No harlequin ducks were observed on the main stem of the river and all Harlequin duck observations were made along tributaries west of Gull Island (AGRA 1999).

While it appears that harlequin ducks do not breed or breed at extremely low densities in the project area, it is known that southern Labrador is a migration route for birds returning from wintering grounds off Newfoundland and further south along the eastern seaboard (Brodeur 1997). Therefore, individuals may use waterbodies in the study area infrequently.

4.4 Important Habitat Areas

4.4.1 Wetland Size Versus Waterfowl Abundance

An analysis of wetland size versus waterfowl abundance was conducted to identify whether there were any wetlands that, for their size, had an unusual abundance of waterfowl. Two approaches were used to identify wetlands that have an unusual abundance of waterfowl, the first based on the absolute number of waterfowl observed and the second based on waterfowl density.

One hundred and thirty-eight wetlands with areas ranging from 4.5 ha to 3418.7 ha were surveyed for waterfowl during the 1-2 June 2002 breeding pair survey (Figure 4.7). In some instances where several small wetland areas merged into each other, separated by a river or a small line of forest type vegetation, these areas were represented by one polygon (i.e. considered one wetland out of the 138). The observations from this survey (over 1200 waterfowl) were used to explore the relationship between wetland area and abundance of waterfowl. A scatter plot of the number of waterfowl versus wetland area indicates that there are many wetlands, large and small, with no observed waterfowl on them (Figure 4.8). However, from the pattern of the scatter plot, it does appear there is a higher probability of occurrence of at least one waterfowl on a particular wetland as the wetland area increases.

Out of the 138 wetlands surveyed, 79 (57.25 percent) had at least one individual observed. Fifty-six wetlands had between 1 and 9 waterfowl, 14 had between 10 and 20 waterfowl, and nine had more than 20 waterfowl. The nine wetlands with more than 20 waterfowl are indicated in Table 4.4.

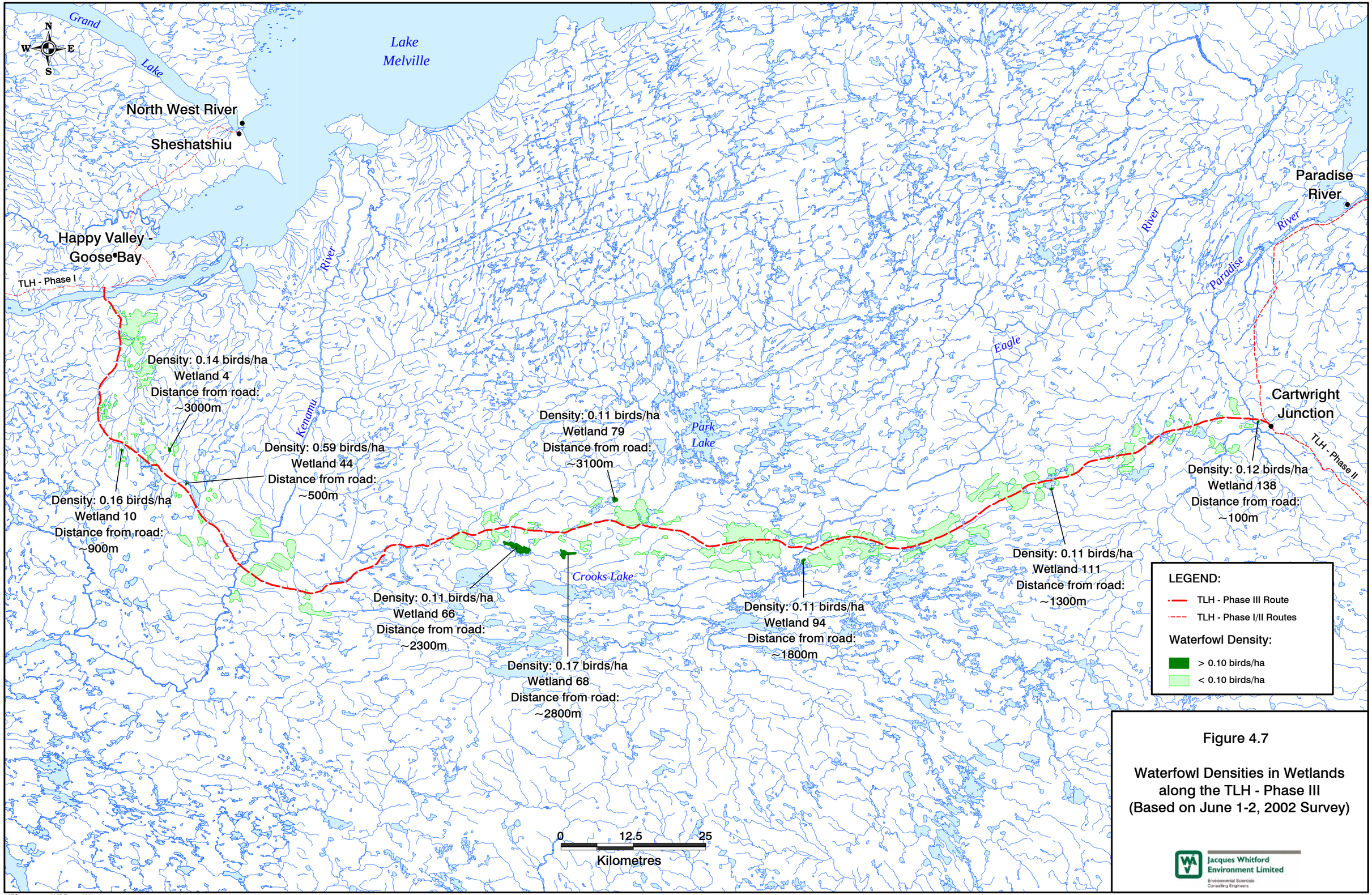

Figure 4.7

Waterfowl Densities in Wetlands along the TLH - Phase III (Based on June 1-2, 2002 Survey)

Jacques Whitford Environment Limited
Environmental Scientists Consulting Engineers

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Figure 4.8 Number of Waterfowl vs. Wetland Area

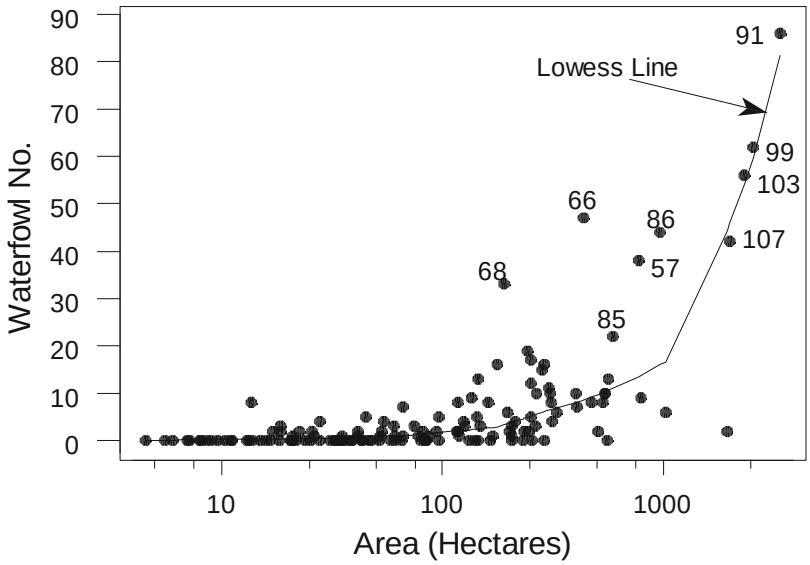


Table 4.4 Wetlands with the More than Twenty Waterfowl

Wetland No.	Area (ha)	No. of Waterfowl
57	774.43	38
66	436.81	47
68	189.85	33
85	594.69	22
86	976.53	44
91	3418.70	86
99	2580.96	62
103	2352.94	56
107	2021.43	42

Similar results were observed when the analysis was based on waterfowl density, defined as the number of waterfowl observed per hectare of wetland. Nine wetlands were identified to have a relatively high density (density > 0.10), 13 with moderate density (density between 0.05 to 0.10), and 57 with low density (density < 0.05). The wetlands with the highest density are indicated in Table 4.5 and their locations are indicated in Figure 4.7.

Table 4.5 Wetlands with Waterfowl Density > 0.10 birds/ha

Wetland No.	Area (ha)	No. of Waterfowl	Density (#birds/ha)
4	27.91	4	0.143
10	18.38	3	0.163
44	13.58	8	0.589
66	436.81	47	0.108
68	189.85	33	0.174
79	66.00	7	0.106
94	44.76	5	0.112
111	18.52	2	0.108
138	16.94	2	0.118

Wetlands 66 and 68 have both large numbers of waterfowl relative to their size as well as a waterfowl density greater than 0.10 birds/ha, the only two wetlands within the highest criteria for both analyses (Tables 4.4 and 4.5). However, Wetland 44 exhibits the highest density of waterfowl even though the absolute number of birds is relatively low (Table 4.5). Since, density is perhaps the most ecologically relevant factor to consider with respect to waterfowl use of an area, Wetland 44 may be of particular importance to waterfowl.

4.4.2 Probability of Occurrence of Waterfowl Versus Wetland Area

The probability of occurrence of at least one waterfowl (WF) as wetland area (A) increased was determined using binary logistic regression analysis (Minitab^{TM}). The approach used was to treat wetland area on a continuous scale using all data.

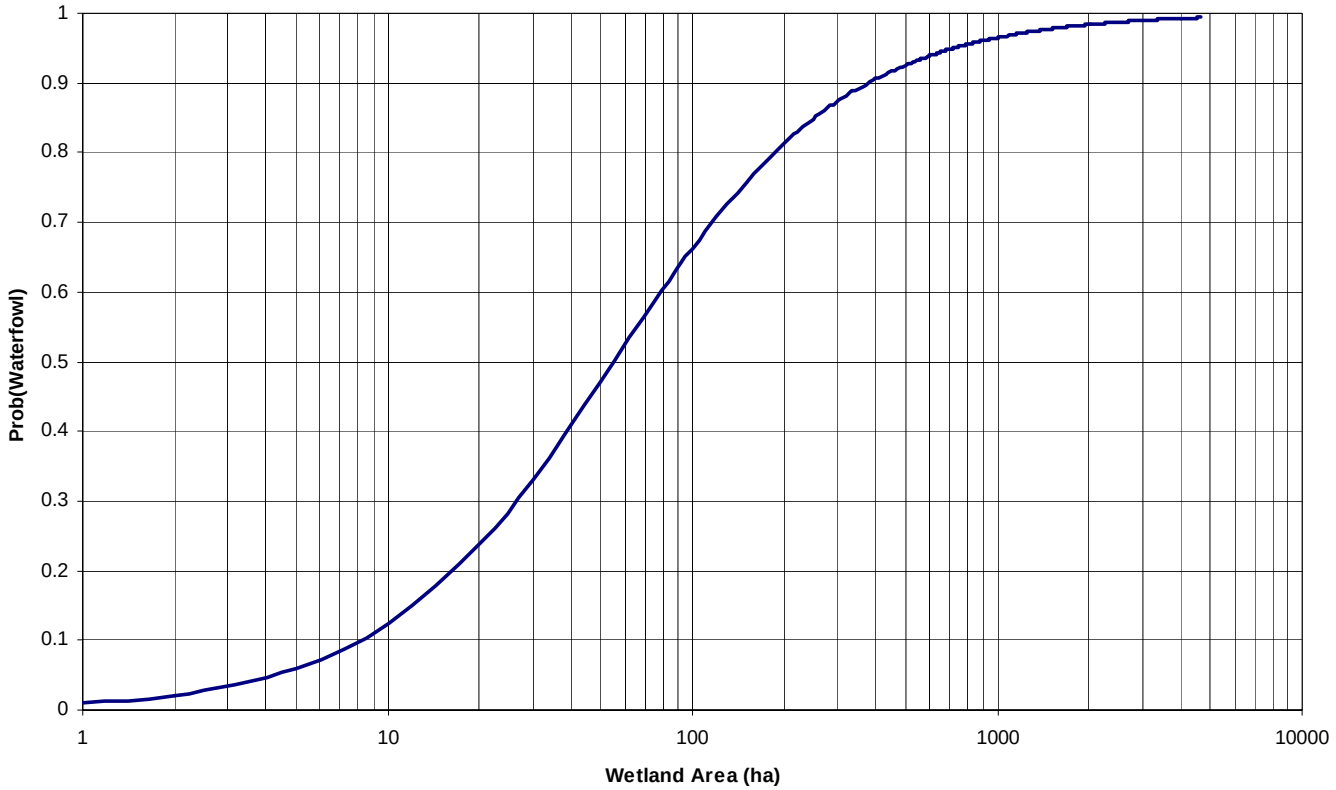
As indicated in Figure 4.8, waterfowl tend to occur on larger wetlands although the actual numbers of waterfowl that occur are not strongly related to the wetland area. Therefore, rather than developing a relationship between numbers of waterfowl and wetland area, the probability of occurrence of waterfowl(any number) with wetland area was determined. Any wetlands on which a waterfowl was observed, (i.e. number of waterfowl > 0), was coded as "1". Wetlands on which no waterfowl occurred were coded as "0". A logistic regression was fit to all the data (n = 138) with the method of maximum likelihood used to estimate the parameters (Myers 1990). The results indicate that the logistic model is appropriate with p-values of both regression coefficients at approximately zero, a highly significant result (Appendix C).

Figure 4.9 indicates that as wetland area increases, the probability of occurrence of waterfowl also increases. For example, a 400 ha wetland would have a 90% probability of a waterfowl occurrence, while a 20 ha wetland would have a probability of a waterfowl occurrence of approximately 12%.

This exercise identified nine wetland areas with waterfowl densities greater than 0.10 birds/ha. Five of the wetlands are > 2 km from the centreline of the proposed highway (Figure 4.7). Three of the wetlands are < 1 km from the centreline, with one on the eastern end of the highway near Cartwright Junction only 100 m away (Figure 4.7). The wetland with the highest density of birds, Wetland 44, is 500 m from the centreline of the proposed highway (Figure 4.7).

The exercise also indicated that the probability of the occurrence of waterfowl increases with wetland area, suggesting support for the hypothesis that, in this region, suitable waterfowl habitat is widespread although not highly productive. Few areas were identified that had duck densities suggestive of more productive habitat.

Figure 4.9 Prob(Waterfowl) vs Wetland Area (Logistic Curve)



4.5 Other Wildlife Observations

Following is a brief summary of wildlife observations made during the various waterfowl surveys. As the same general areas were surveyed repeatedly, stationary structures such as raptor nests and beaver lodges were likely identified several times and duplicate observations occur in the database. However, each survey has been treated as a separate file and geographic location information should be accurate enough to allow for identification of duplicate observations.

9 May 2002 Survey

Extensive snow cover during this survey allowed observers to note evidence of species that otherwise would not be readily identified during an aerial survey. Numerous river otter ( ) tracks were seen along rivers and lakes, with some continuous tracks covering >10 km. One otter was observed on the Kenamu River. Tracks of other species included moose, caribou, black bear, marten and red fox. One black bear was observed south of Park Lake. Two beaver lodges, one in disrepair, were also observed and porcupine sign (stripped bark on trees) was evident in several areas.

21 May 2002 Survey

There was still sufficient snow cover during this survey for identifying tracks of moose, red fox, river otter, willow ptarmigan, marten, snowshoe hare and black bear. Observations of animals included two river otters, one beaver, one yearling moose, one muskrat, 15 willow ptarmigan, one red fox, one grouse, and one black bear. Four beaver lodges and several areas of porcupine sign were also recorded.

1-2 June 2002 Survey

As snow cover had disappeared by the time of the June survey, most observations of other wildlife activity were restricted to identification of beaver lodges. Beaver lodges were distributed across the landscape, usually in small and medium sized waterbodies with riparian zones that provided some type of hardwood forage such as birch, aspen or willow. Several black bears were observed, one with two cubs, all along the portion of the highway route, east of Park Lake. Several porcupine were observed walking on the ground in treed bogs. One caribou was also observed, the only caribou seen during the spring surveys. The caribou was observed on a bog approximately 1 km north of the highway route, approximately 50 km west of Cartwright Junction.

18 July 2002 Survey

Similar to the June survey, there were numerous observations of beaver lodges. One porcupine, one river otter and one beaver were also observed.

28-29 August Survey

As with previous surveys, beaver lodges, dams and signs of activity were recorded. Two moose and two river otters were observed as well as numerous raptors including osprey, bald eagle, red-tailed hawk, and rough-legged hawk.

5.0 SUMMARY

Waterfowl observations during the series of surveys indicate these species occur at relatively low densities throughout wetland habitat in the study area. Few exceptions include nine wetlands with waterfowl densities greater than 0.10 birds/ha, located at various points along the proposed highway route. The wetland with the highest density (0.59 birds/ha) is located approximately 500 m from the proposed highway route. Most of the remaining nine wetlands are greater than 1000 m from the highway.

Additional important areas noted during the surveys include:

- spring staging period: Traverspine and Kenamu Rivers and a tributary of Paradise River approximately 10 km west of Cartwright Junction;

- moulting period: a small unnamed lake 5 km west of Crooks Lake, approximately 10 km south of the highway route and a tributary of the Eagle River approximately 20 km southeast of Park Lake, 4 km south of the highway route; and

- fall staging period: an unnamed lake 25 km east of the Kenamu River, within 100 m of the highway route.

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APPENDIX A

Common Names , AOU Codes and Scientific Names of Avifauna Recorded During Surveys or Included in Text

Appendix A Common Names, AOU Codes and Scientific Name of Avifauna Recorded During Surveys or Included in Text

Common Name	AOU CODE	SCIENTIFIC NAME
American Black Duck	ABDU	*Anas rubnipes*
Mallard Duck	MALL	*Anas platyrhynchos*
Northern Pintai1	NOPI	*Anas acuta*
Green-winged Teal	AGWT	*Anas crecca*
Canada Goose	CAGO	*Branta canadensis*
Ring-necked Duck	RNDU	*Aythya collaris*
Lesser Scaup	LESC	*Aythya affinis*
Common Goldeneye	COGO	*Bucephala clangula*
Common Merganser	COME	*Mergus merganser*
Red-breasted Merganser	RBME	*Mergus serrator*
Scoter sp.	SCOT	--
Surf Scoter	SUSC	*Melanitta perspicillata*
Black Scoter	BLSC	*Melanitta nigra*
Merganser sp.	MERG	---
Long-tailed Duck	OLDS	*Clangula hyemalis*
Harlequin Duck	HARD	*Histrioricus histrionicus*
Barrow's Goldeneye	BAGO	*Bucephala islandica*
Herring Gull	HERG	*Laris argentatus*
Great Black-backed Gull	GBBG	*Larus marinus*
Common Loon	COLO	*Gavia immer*
Common Tern	COTE	*Sterna hirundo*
Greater Yellowlegs	GRYE	*Tringa melanoleuca*
Spotted Sandpiper	SPSA	*Actitus macularia*
Belted Kingfisher	BEKI	*Ceryle alcyon*
Willow Ptarmigan	WIPT	*Lagopus lagopus*
Spruce Grouse	SPGR	*Dendragapus canadensis*
Northern Harrier	NOHA	*Circus cyaneus*
Osprey	OSPR	*Pandion haliaetus*
Great Horned Owl	GHOW	*Bubo virginianus*
Bald Eagle	BAEA	*Haliaetus leucocephalus*
Red-tailed Hawk	RTHA	*Buteo jamaicensis*
Merlin	MERL	*Falco columbarius*
Short-eared Owl	SEOW	*Asio flammeus*
Rough-legged Hawk	RLHA	*Buteo lagopus*

APPENDIX B

Summary of Observations By Road Section and Survey Data

Observations of Waterfowl and other Avifauna - Harlequin Duck Survey - Trans Labrador Highway Cartwright Junction to Happy Valley-Goose Bay, 9 May 2002

Road Section	American Black Duck	Green-winged Teal	Canada Goose	Common Goldeneye	Common Merganser	Greater Yellowlegs	Total Individuals
			Number of Individuals (# of pairs identified)				
1	6(3)	-	11	-	-	5(2)	22
2	17(2)	-	8(2)	-	14(7)	10(5)	49
3	-	-	-	-	-	-	0
4	2(1)	-	-	-	-	2(1)	4
5	25(6)	8(4)	25(5)	1	10(1)	8	77
Total Birds	**50(12)**	**8(4)**	**44(7)**	**1**	**24(8)**	**25(8)**	**152**

Observation of Waterfowl and other Avifauna - Trans Labrador Highway Route, Cartwright Junction to Happy Valley-Goose Bay, 21 May 2002

Road Section	American Black Duck	Green-winged Teal	Mallard Duck	Canada Goose	Common Merganser	Red-breasted Merganser	Scaup sp.	Spotted Sandpiper	Northern Pintail	Great Black- backed Gull	Herring Gull	Greater Yellowlegs	Total Individuals
Number of Individuals (# of pairs identified)													
1	36(6)	2(1)	-	66 (8)	54(11)	-	-	-	-	3	5	34(10)	200
2	79 (12)	36 (6)	1	30 (3)	29 (6)	2(1)	-	-	1	-	1	6(3)	185
3	43 (13)	12(3)	-	25 (3)	9(1)	-	1	-	2(1)	-	-	5(1)	97
4	23(5)	15(1)	-	44(8)	25 (5)	-	2(1)	1	4(2)	-	1	3(1)	118
5	26(6)	14	-	3(1)	33 (8)	-	6	2	4(1)	-	-	18(1)	106
Total Birds	**207(42)**	**79(11)**	**1**	**168 (23)**	**150 (31)**	**2(1)**	**9(1)**	**3**	**11**	**3**	**7**	**66(16)**	**706**

Observations of Waterfowl and Other Avifauna - Trans Labrador Highway, Cartwright Junction to Happy Valley-Goose Bay, 1-2 June 2002

Road Section	American Black Duck	Green-winged Teal	Mallard Duck	Ring-necked Duck	Canada Goose	Common Goldeneye	Common Merganser	Red-breasted Merganser	Surf Scoter	Common Loon	Scaup sp.	Northern Pintail	Black Scoter	Common Tern	Herring Gull	Greater Yellowlege	Total Individuals
Number of Individuals (# of pairs identified)																	
1	18 (5)	2	-	6 (3)	25 (9)	11 (4)	28 (8)	-	-	19 (5)	17 (6)	-	-	-	14	9	149
2	59 (14)	7 (3)	1	9 (4)	35 (9)	14 (7)	19 (5)	-	35 (5)	12 (2)	1	-	1	-	-	21 (2)	214
3	125 (22)	27 (5)	2	48 (4)	34 (7)	9 (3)	7 (3)	7(1)	44 (2)	9 (4)	22 (4)	2 (1)	-	3	10	45 (9)	394
4	155 (27)	26 (6)	9 (1)	9 (3)	42 (5)	7 (1)	8 (2)	-	+25 (5)	4	9 (3)	5 (1)	5	-	2	50 (7)	356
5	42 (4)	2	-	20 (2)	19 (5)	7 (3)	4	-	5 (2)	4 (2)	16 (6)	4 (1)	2	-	3	9	137
Total Birds	**399 (72)**	**64 (14)**	**12 (1)**	**92 (16)**	**155 (35)**	**48 (18)**	**66 (18)**	**7(1)**	**109 (14)**	**48 (13)**	**65 (19)**	**11 (3)**	**8**	**3**	**29**	**134 (18)**	**1250**

Observations of Waterfowl and Other Avifauna - Trans Labrador Highway, Cartwright Junction to Happy Valley-Goose Bay, 18 July 2002

Road Section	American Black Duck	Green-winged Teal	Ring-necked Duck	Canada Goose	Common Merganser	Surf Scoter	Common Loon	Scaup sp.	Spotted Sandpiper	Gull sp.	Common Tern	Herring Gull	Greater Yellowlegs	Unidentified Duck	Total Individuals
Number of Adult Individuals															
1	7	1	-	12	9 (7 f, 2 m)	3	1[1]	-	1	11	1[2]	3	3	10	62
2	40	-	-	33	12 (3 f, 3 m)[1]	3	6 (1 pr)[3]	8	8	7	-	2	-	3	122
3	47	-	9	24	6 (4 f, 2 m)	-	2	2	10	3	1	-	-	3	107
4	39	-	-	34	-	-	4 (1 pr)	-	1	10	2	-	-	1	91
5	7	-	-	36	4 (1 f, 3 m)	-	-	-	2	9	-	-	1	-	59
Total Birds	**140**	**1**	**9**	**139**	**31**	**6**	**13**	**10**	**22**	**40**	**4**	**5**	**4**	**17**	**441**

[1] one individual behaving broody although no brood observed
[2] tern colony
[3] pair and one individual behaving broody although no broods observed

Brood Observations - 18 July 2002

Road Section	Canada Geese	Black Ducks
1	Pair/1 young 2 Pair/5 young Pair/2 young	-
2	Pair/4 young (age 2A)	-
3	-	-
4	-	Female/6 young (age 2A)
5	-	Female/7 young (age C)
Total Young	**12**	**13**

Observations of Waterfowl and Other Avifauna - Trans Labrador Highway, Cartwright Junction to Happy Valley-Goose Bay, 28-29 August 2002

Road Section	American Black Duck	Green-winged Teal	Ring-necked Duck	Canada Goose	Common Merganser	Long-tailed Duck	Common Loon	Kingfisher	Sandpiper sp.	Gull sp.	Common Tern	Herring Gull	Greater Yellowlegs	Unidentified Duck	Total Individuals
Number of Adult Individuals															
1	8	-	3	35	-	-	-	-	1	9	-	-	-	3	59
2	-	-	82[1]	11	12	-	4	-	1	8[2]	1	-	1	3	123
3	37	-	84	8	-	2	2	-	7	6[2]	2	5	5	-	158
4	28	34	18	23	1	-	1	-	-	4[3]	-	3	3	1	116
5	4[4]	6	9	1[5]	11	-	-	3	8	-	-	-	4	-	46
Total Birds	**77**	**40**	**196**	**78**	**24**	**2**	**7**	**3**	**17**	**27**	**3**	**8**	**13**	**7**	**502**

[1] One group of 50+ birds
[2] Two individuals immature
[3] Three individuals immature
[4] Flying high
[5] Numerous tracks in mud

APPENDIX C

Logistic Regression Results
Occurrence of Waterfowl Versus Wetland Area

APPENDIX C

Binary Logistic Regression: S/F versus Log Area

Link Function: Logit

Response Information

Variable	Value	Count	
S/F	1	79	(Event)
	0	59	
	Total	138	

Logistic Regression Table

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	-4.5980	0.8595	-5.35	0.000			
LogArea	1.1450	0.1998	5.73	0.000	3.14	2.12	4.65

Log-Likelihood = -67.693
Test that all slopes are zero: G = 53.014, DF = 1, P-Value = 0.000

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	129.753	136	0.635
Deviance	135.386	136	0.499
Hosmer-Lemeshow	5.967	8	0.651

Table of Observed and Expected Frequencies:
(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

	Group										
Value	1	2	3	4	5	6	7	8	9	10	Total
1											
Obs	0	4	5	4	10	9	10	11	13	13	79
Exp	1.3	2.8	4.3	5.8	7.6	8.7	10.8	11.8	12.5	13.4	
0											
Obs	13	10	9	10	4	4	4	3	1	1	59
Exp	11.7	11.2	9.7	8.2	6.4	4.3	3.2	2.2	1.5	0.6	
Total	13	14	14	14	14	13	14	14	14	14	138

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary Measures	
Concordant	3888	83.4%	Somers' D	0.67
Discordant	761	16.3%	Goodman-Kruskal Gamma	0.67
Ties	12	0.3%	Kendall's Tau-a	0.33
Total	4661	100.0%		