Attachment 1

Tulsequah Chief Mine ACB Transportation System

Supplemental Wildlife Information and 2007 Survey Results

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Prepared for
Redfern Resources

Submitted by
Gartner Lee Limited

October 2007

Gartner Lee

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1. Introduction

The Tulsequah Chief Mine project, owned by Redfern Resources Ltd., is located in a remote area of northwestern British Columbia, far from existing transportation infrastructure. The method of shipping ore concentrate off site and re-supplying the mine has been a major consideration for this project. In 1998, Redfern received approval under a Project Approval Certificate issued by British Columbia for the project that included construction of a new 160 km access road from the mine to Atlin, BC. Recently, Redfern requested an amendment to this Certificate to use an air cushion barge (ACB) transportation system that would operate year-round on the Taku River between the minesite and Juneau, Alaska (Gartner Lee 2007). The ACB transportation system would be a mutually exclusive alternative to the 160 km road. Redfern has prepared two volumes for the assessment of the proposed ACB transportation system in both British Columbia and Alaska. This document provides supplemental information on terrestrial wildlife to that provided in *Tulsequah Chief Mine ACB Transportation System Volume 2: Supporting Information for the BC Project Approval Certificate Amendment and the Alaska Coastal Zone Consistency Review*. It includes a more detailed summary of available information on terrestrial mammals for the area as well as a summary of the field assessments conducted in 2007 in support of the proposed ACB transportation system and ongoing permitting requirements.

2. Summary of Available Terrestrial Mammal Information

As outlined in *Volume 2* of the Tulsequah Chief Mine ACB Transportation System application documents, Rescan Environmental Services Ltd. (Rescan) in their Tulsequah Chief Project Report (Rescan 1997) provided much of the terrestrial resources information reviewed in the British Columbia portion of the study area. Information provided by Rescan included the results of moose winter aerial surveys (1996 and 1997), moose browse and pellet surveys (1994 and 1995), moose winter track surveys for relative abundance (1996), mountain goat aerial surveys (1994 and 1995), spring aerial bear surveys (1995 and 1996), furbearer track surveys (1996), and a small mammal surveys (1994). Hatler (2000) provided the results of grizzly bear baseline monitoring from 1996 to 1999, while Francis and Gallagher (1998) completed grizzly bear patch habitat assessments. A grizzly bear habitat suitability model and assessment of habitats used by collared grizzly bears were completed in 2002 and 2003 by Raven Ecological Consulting (Wellwood 2003a, 2003b, 2003c and Wellwood and Murphy 2002). The Ministry of Environment, Lands, and Parks (MOE) inventoried moose in the British Columbia portion of the proposed mine and road corridor in 2000 (Marshall 2000), while winter mountain goat surveys were conducted in March 2000 by Northern Habitat Solutions (Keim 2000). Habitat suitability mapping and verification using available GPS and VHF telemetry data for moose and mountain goats in the study area were conducted by LGL Limited (LGL) in 2002 (Hawkes 2003, Hawkes and MacLean 2003). AXYS Environmental

Consulting Ltd. (AXYS) conducted an analysis of the VHF and GPS telemetry data for moose, caribou and mountain goats in 2004 to outline seasonal home ranges and potential conflicts and risks associated with the proposed mine and road access route to Atlin (AXYS 2004).
Information on terrestrial mammal populations present within the Alaskan portion of the study area was obtained through a review of available literature and discussion with members of the Alaskan governments. Available literature included wildlife management reports completed by Alaska Department of Fish and Game (ADF&G) personnel as well as discussions with biologists from responsible for the Taku area.

Field assessments were conducted in 2007 by Gartner Lee Limited (GLL) biologists to provide additional information on wildlife species distribution and habitat use. The results of the field assessments are summarized in this Section 2, with more details on the methods and results of the field programs presented in Section 3.

Hunter harvest levels of mountain goats, black bear, grizzly bear and moose in BC were obtained from MOE for the years 2000 to 2006, and trapping harvest effort from 1995 to 2005. Alaskan hunter and trapping harvest information was obtained from the ADF&G for the period 1990 to 2003.

The following sections provide the results of the review of existing information available for terrestrial mammals of interest within the study area.

2.1 Ungulates

2.1.1 Dall's Sheep

A review of the available documents related to the Tulsequah Chief EA and other relevant literature found no evidence of Dall's sheep in the areas within or immediately adjacent to the lower Tulsequah and Taku Rivers. This species is normally found north of this area, west of Atlin, BC and based on available information is not expected to be using the habitats found near the proposed barge access route or barge landing site. There was no information available that suggested that Dall's sheep are found in low elevation habitats on the Alaskan side of the Taku River.

2.1.2 Moose

Moose are common, year-round residents in the lower elevation areas of the Taku and Tulsequah river drainages. During the summers of 1994 and 1995, Rescan (1997) found that that the majority of use by moose was within the Flannigan Slough and Shazah Slough areas. Incidental observations during the spring and early summer of 2007 by GLL field crews found that one to two individuals were feeding in Shazah Slough, while at least six individuals were observed in Flannigan Slough. Moose use of the area in the winter is much greater than in other seasons, with much higher densities of moose observed in the Taku River floodplain between Yellow Bluff and

the BC border during aerial surveys conducted by Rescan (1997), MOE (Marshall 2000) and GLL in 2007. A total of 21 moose were observed in the confluence of the Tulsequah and Taku Rivers and in the Tulsequah River and Shazah Creek confluence during the 1996 aerial survey by Rescan (1997). Surveys conducted over a larger area by Marshall (2000) and GLL in 2007 found 94 and 65 moose, respectively, between Yellow Bluff and the BC border. In Alaska, aerial moose surveys have been conducted periodically from 1978 to 2000 and have observed between five and 54 animals with 37 moose observed in 2000 (Barten 2004b). No moose surveys have been conducted on the Alaskan side of the Taku River since 2000 (N. Barten, pers. comm. 2007). GLL conducted one ungulate winter survey on the Alaskan side of the Taku River in March 2007 and observed 22 moose. No survey effort or density information was provided for the ADFG and Rescan inventories, but densities are available for the MOE and GLL surveys. Moose densities from the winter 2000 surveys in the lower Taku and Tulsequah River portions of BC were 0.73 moose/km^2, while in 2007 they were 0.51 moose/km^2 in BC and 0.14 moose/km^2 in the Taku River portion of Alaska.

Habitat suitability mapping and the results of the telemetry studies indicated that much of the Taku and Tulsequah river floodplains were rated as high value summer feeding habitats and moderate to high value winter feeding habitats, with a mixture of moderate to high value calving habitats (Hawkes 2003). No habitat suitability mapping has been completed on the Alaskan side of the Taku River drainage, but aerial assessments conducted by GLL during the spring and early summer of 2007 noted a number of high value feeding areas along the Taku River. These included the floodplain habitats along the Taku River especially at the confluences of Fish Creek, Wright River, Yehring Creek, Moose Creek, Johnson Creek, Sockeye Creek, south of Taku Lodge and at Grizzly Bar.

The number of moose harvested from 1995 to 2005 within BC Management Unit (MU) 6-26 by resident hunters has ranged from ten to 24 moose/year (total = 165, average ~ 17 moose/year); with non-resident hunters harvesting between 18 and 39 moose/year (total = 320, average ~ 32 moose/year). It should be noted that MU 6-26 is a large area (18,982 km^2) with the lower Tulsequah and Taku River floodplain areas only encompassing approximately 0.7% of the MU area. The Taku/Tulsequah Rivers currently have limited access by hunters and this inaccessibility likely limits the harvesting of moose by BC-based hunters. In the Alaskan portion of the Taku River, moose harvesting has ranged from six to 23 animals from 1990 to 2006 (average ~ 16 moose/year) (Barten 2004b and N. Barten, pers. comm. 2007). It is difficult to monitor moose harvesting in the Taku River area and Barten (2004b) suggests that it is likely that some moose attributed to the Alaskan harvest may be obtained from the BC side of the Taku River.

2.1.3 Mountain Goat

Mountain goats are found in the Tulsequah/Taku River watersheds in relatively high densities with summer aerial surveys counting a total of 111 goats in August 1994 and 139 goats in May 1995 in the survey areas (Rescan 1997). Of the areas surveyed, only one is located near the proposed ACB route on the Taku River, approximately 2.5 km from the Taku River on Mt. Strong (west of Flannigan Slough). Eleven goats were observed here in 1994 and 15 in 1995. No mountain goats

or tracks were observed on Mt. Strong during winter surveys conducted in March 1996 (Rescan 1997). Winter surveys conducted by Northern Habitat Solutions in March 2000 (Keim 2000) found mountain goats in a variety of steep habitats within the Tulsequah and Taku River drainages. The information provided in Keim (2000) is not detailed enough to determine the number of goats observed at each sighting location but it was noted that no observed goat locations were within approximately 2 km of the proposed barge access route on the Taku River and no locations were below 400 m elevation. In Alaska, population surveys have concentrated on areas adjacent to roads and areas accessible by boat or float plane, and only two surveys appear to have occurred within the proposed barge access route area since 1986. One survey was conducted in 1998, and one in 2000, with 90 and 66 mountain goats observed, respectively (Barten 2004c). Barten (2004c) recognizes the lack of comprehensive survey data as a limiting factor in addressing management concerns relating to mountain goat harvests and helicopter touring activities near mountain goat habitats, but notes that lack of funding has limited survey efforts.

Habitat suitability mapping conducted by LGL indicated that there was extensive moderate to high value winter and summer feeding and kidding habitats within the higher elevation areas of the Taku and Tulsequah River watersheds. These habitats were not found to be associated with the floodplain habitats at lower elevation. The amount of mountain goat habitat in Alaska appears to be similar to that found in BC, although no habitat suitability mapping has been completed for the Alaskan side of the Taku River. During winter and late spring aerial surveys on the Alaskan portions of the Taku River, some suitable mountain goat habitat was identified by experienced GLL field biologists on Kluchman Mtn., near Johnson Creek, at Goat Ridge along the Taku River; and at Taku Point and Flat Point in Taku Inlet. No mountain goats or tracks were observed during the flights, but it is possible that mountain goats could use these areas for feeding and as escape terrain. The areas identified near Johnson Creek and at Taku and Flat Points are located between 0.5 and 1.5 km from the proposed ACB route, and between 100 m and 600 m above the proposed route.

Mountain goat harvested by resident hunters from 1995 to 2005 within BC MU 6-26 has ranged from one to seven goats/year (total = 38, average ~ four goats/year), with non-resident hunters harvesting between 19 and 36 goats/year (total = 344, average ~ 34 goats/year). As discussed previously, the lower Tulsequah and Taku River areas encompass only a small portion of the MU and there is limited accessibility of the area to hunters for harvesting mountain goats. Discussions with MOE personnel suggest that the majority, if not all, of the mountain goat harvesting is related to guided hunts in areas other than the Taku/Tulsequah area (R. Marshall, pers. comm. 2007). In Alaska, mountain goat harvesting in the Taku area (Wildlife Analysis Units 2517, 2518 and 2519) has ranged from three to twelve animals from 1990 to 2006 (average ~ five goats/year), with the majority of harvesting occurring near an alpine lake in the upland areas of the Taku River watershed (Barten 2004c and N. Barten, pers. comm. 2007).

2.1.4 Sitka Black-Tailed Deer

Sitka black-tailed deer are found west of the coastal mountain ranges and on many coastal islands in Southeast Alaska (Schoen *et al.* 1985). In the northern regions, most of the animals are found

on islands, particularly those without wolves, as predators and deep snows restrict the number of animals present on the mainland (Barten 2005). There has been no evidence of deer use found during aerial and ground-based surveys conducted by Rescan in 1994 and 1996 on the BC side of the border along the Taku or Tulsequah Rivers (Rescan 1997). Discussions with ADFG employees involved in the fisheries project at Canyon Island have indicated that during the summer, deer have been observed in the lower sections of the Taku River (E. Jones pers. comm. 2007). Harvest records and pellet counts for Game Management Unit (GMU) 1C (northern Southeast Alaska) indicate that most of the deer in this unit occur on Douglas, Shelter and Lincoln Islands outside of the Taku Inlet area (Barten 2005). A small number of deer (< five deer/year) are likely harvested near Bishop Point at the mouth of Taku Inlet (N. Barten, pers. comm. 2007).

2.1.5 Stone Sheep

There is no evidence in the Tulsequah EA documents of Stone Sheep presence in the areas within or immediately adjacent to the lower Tulsequah and Taku Rivers (Rescan 1997). This species is normally found to the north of this area near Atlin, BC, and they are not expected to be using the habitats found near the proposed barge access route or barge landing site. Evidence that this species has been observed at lower elevations on the Alaskan side of the Taku River drainage was not found during our investigations of the available information.

2.1.6 Woodland Caribou

Woodland caribou were not found in the areas within or immediately adjacent to the lower Tulsequah and Taku Rivers in previous assessments (Rescan 1997). This species is normally found more to the northeast of this area near Atlin, BC and they are not expected to be using the habitats found within the Taku River near the proposed ACB route or ACB landing site. No collared caribou from previous studies were observed in the areas near the Tulsequah or Taku Rivers. No habitat suitability mapping was developed for the Tulsequah Chief mine area, only for the areas nearer to Atlin (MacLean and Hawkes 2003). Woodland caribou were not identified from available information as a species that would be expected in the low elevation areas on the Alaskan side of the Taku River drainage.

2.2 Carnivores

2.2.1 Grizzly Bear

Grizzly bear are a Blue-listed species in BC (BC CDC 2007) and are listed as a Species of Concern by COSEWIC (2006). Information presented in Rescan (1997) suggested that grizzly bears were common to abundant (39 sightings were made of 60 individuals) in the Tulsequah and Taku River drainages on the BC side of the border during 1995-1996. Grizzlies appeared to use the Tulsequah and Taku floodplains as a travel corridor and there were high levels of use in Flannigan and Shazah Sloughs. Hatler (2000) found that, in the Tulsequah drainage and Shazah Creek area (Sub-area B), the number of grizzly bears using the area was estimated to be 13 in

1997 and five in 1999. The number of different family groups using the area was estimated to have been five in 1996 and zero in 1999. The number of large males detected each year was about two. In the lower Taku from Yellow Bluff to the BC border, Hatler (2000) found that the number of grizzly bears was steady with the estimated total number of bears using the area being ten to 15 from 1997 to 1999. The estimated number of different family groups using the area each year was approximately four and the estimated number of large males detected each year was approximately three to four. In Alaska, within GMU 1, the grizzly bear population is believed to be stable (Porter 2005). Grizzly bears are often seen moving along the Taku River, but there are no major concentration areas, largely because salmon are not spawning in the main river and grizzly bears tend to congregate more along tributary streams higher up, particularly Yehring Creek (E. Jones, pers. comm. 2007). Sockeye Creek, Yehring Creek, Johnson Creek, and possibly Fish Creek and Boundary Creek may have high concentrations of grizzly bears in the fall due to spawning salmon, but this has not been confirmed (N. Barten, pers. comm. 2007).

Suitability mapping by Wellwood (2003b) indicated that the wetland and floodplain habitats adjacent to the Tulsequah and Taku rivers were rated moderate to high value spring, summer and fall feeding habitats. No habitat mapping is available for the Alaskan side of the Taku River, but GLL aerial reconnaissance flights during the spring of 2007 found that the moderate to high habitat values found on the BC side extended into Alaska. Areas noted included wetland and sedge shoreline habitats at the confluences of Fish Creek, Wright River, Yehring Creek, Moose Creek, Johnson Creek, Sockeye Creek, south of Taku Lodge and at Grizzly Bar.

From 1995 to 2005 within BC MU 6-26, the number of grizzly bears harvested by resident hunters has ranged from one to five bears/year (total = 27, average ~ three bears/year). Non-resident hunters have harvested between two and ten bears/year (total = 63, average ~ six bears/year). With the lower Taku River being a small portion of MU 6-26 and relatively inaccessible to BC-based hunters, it is expected that the number of grizzly bears actually being removed from this area is likely limited. In Alaska, grizzly bear harvesting within GMU sub-area 1C has varied from one to seven animals from 1985 to 2003, with an average of four bears being harvested per year (Porter 2005). As in BC, the proportion that the lower Taku River encompasses of the total sub-area is relatively small (~ 0.02%), with limited access to the area, other than by boat, likely limiting the number of harvested bears from this area.

2.2.2 Black Bear

During the studies conducted by Rescan (1997), black bear were assessed to be common to abundant with 63 sightings of 84 individuals in the Tulsequah and Taku River drainages on the BC side of the border during 1995-1996. Black bears were found to be primarily using non-floodplain habitats such as lower and mid-elevation forests and avalanche tracks, with tracks in the Tulsequah and Taku River floodplains being at a much lower density than those of grizzly bears (Rescan 1997). Hatler (2000) found that the estimated number of black bears using the Tulsequah/Shazah and Lower Taku areas fluctuated between years from 1996 to 1999, with 1997 and 1998 being lower (two to three bears) than the 1996 and 1999 (six to 8 bears) values. Within GMU 1C in Alaska, a rough population estimate is 1950 black bears, and is based on density

estimates rather than surveys (Barten 2002). Although no studies have been conducted on habitat use in the Taku area by ADF&G, habitat use is assumed to be similar to that observed in other northern coastal areas and that exhibited by grizzly bears and would include wetland, floodplain and estuarine habitats. During aerial flights in May 2007 by GLL biologists, three black bears were observed feeding on upland vegetation along the lower Taku River. One bear was adjacent to the trees at Grizzly Bar, while two bears were observed at Swede Point.

There has been no specific habitat suitability mapping completed for black bears in this area although diets for both grizzly and black bears have been shown to be similar in some locations (Jacoby *et al.* 1999) and habitat suitability models for both species generally identify similar habitats as high value. The habitat suitability mapping by Wellwood (2003b) therefore provides a reasonable estimate of black bear use. As outlined for grizzly bear, the mapping by Wellwood (2003b) indicated that the wetland and floodplain habitats adjacent to the Tulsequah and Taku Rivers were rated moderate to high value for spring, summer and fall feeding habitats. The habitats identified for grizzly bears in Alaska would also be considered high value black bear habitats.

From 1995 to 2005 within BC MU 6-26 the number of black bears harvested by resident hunters has ranged from zero to three bears/year (total = five, average ~ one bear/two years). Non-resident hunters have harvested between three and nine bears/year (total = 62, average ~ ten bears/year). As discussed in relation to other harvested species, it is likely that the relative inaccessibility of the area and the lower Taku being a small portion of the MU likely result in few bears being harvested from this area. In Alaska, black bear harvesting within the Taku River portion of GMU sub-area 1C has varied from one to nine animals from 1992 to 2006 with an average of three black bears being harvested per year (total = 55).

2.2.3 Grey Wolf

Grey wolves were found to frequently travel along the Tulsequah and Taku River floodplains during the work conducted by Rescan during 1995 and 1996. Observations include: numerous observations of tracks, several visual observations of single wolves during summer/fall, a pack of six wolves observed on the Tulsequah River in Feb 1995, and a pack of six wolves observed on the Taku River in September 1996 (Rescan 1997). During field work conducted in the spring and summer of 2007 by GLL biologist, a single set of wolf tracks was observed along Bacon Creek in Flannigan Slough and a wolf scat was observed near the barge landing in late May. On the Alaskan side of the Taku River, wolves are thought to primarily inhabit the floodplain and adjacent upland forest areas, there are reports of at least one small wolf pack in the lower Taku River drainage (N. Barten, pers. comm. 2007).

No suitability mapping has been completed for wolves in either BC or Alaska as they are not tied to habitat attributes, but are dependent on other species as food sources. Habitat suitability mapping for wolves during the fall, winter and spring would be similar to that of moose or deer, which are their main prey species during those seasons. During the summer a wide variety of prey species are used, so habitat mapping would be more difficult.

From 1985 to 2003, four wolves were trapped by the registered trapline holder (all in 1988), while a total of 23 wolves have been harvested by resident hunters in MU 6-26 (all in 2005) (MOE 2003 and MOE 2007). Non-resident hunters have harvested between one and six wolves/year (total = 36, average ~ four wolves/year). It is unknown where resident and non-resident hunters harvested the wolves, but limited access to the lower Taku River likely limits harvesting of wolves in that area. There is no population estimate for grey wolves in GMU 1C, however incidental observations and anecdotal evidence suggests that the populations are stable or slowly increasing (Barten 2003). A total of six wolves were harvested from 1996 to 2005 within the Alaskan side of the Taku River drainage (N. Barten, pers. comm. 2007)

2.3 Furbearers/Small Mammals

2.3.1 Wolverine (*luscus* subspecies)

Wolverines are wide-ranging carnivores that prefer wilderness areas, away from extensive development (Copeland and Whitman 2003) and wolverine habitat is best defined as providing an adequate year-round food supply from large ungulates and carrion rather than in terms of topography or plant associations (COSEWIC 2003). They are a Blue-listed species in BC (BC CDC 2007) and are listed as a Species of Concern by COSEWIC (2006). Information in Rescan (1997) suggests that low numbers of wolverine are found in the lower Taku River area, with tracks and visual observations at Shazah Creek and Shazah Pass, tracks noted near Whitewater Creek and visual observation near main airstrip on the Tulsequah River. During aerial surveys conducted by GLL in March 2007, one set of wolverine tracks were observed along the Taku River, west of the Tulsequah River. Wolverines are present in low numbers in GMU 1C in Alaska and are most common in remote areas (Barten 2004a). Wolverines have been observed near the Smolt camp at Canyon Island on the Alaskan portion of the Taku River (E. Jones, pers. comm. 2007).

No habitat suitability mapping has been completed for wolverine in the project area. This is primarily due to the difficulty in developing adequate habitat suitability models for this species owing to challenges in identifying important ecosystem features for modeling.

Fur harvest data from 1985 to 2005 in the Taku River area indicated that one wolverine was trapped in 1988 on TR0626T018, which includes the lower Taku and Tulsequah rivers (MOE 2003). Trapping records from MU 6-26 for 2004 and 2005 indicate that five wolverines were trapped, but data from these years are not available to the trapline level (MOE 2007). Within GMU 1C, which encompasses approximately 19,700 km^2, an average of 4.7 wolverine/year were harvested from 2000 to 2003 (total = 14) (Barten 2004a).

2.3.2 Fisher

Fishers are a medium-sized mustelid mid-way in size to wolverine and marten that are Blue-listed in BC (BC CDC 2007). They are closely linked with late-successional forests and require both vertical and horizontal structure in the form of large diameter trees and over head cover (Weir and Harestad 2003). Large-diameter cottonwoods, found on the extensive floodplains of large rivers, are a favoured denning site (Weir and Harestad 2003). Areas of deep, soft snow appear to be avoided by fisher (Raine 1983, Krohn *et al* 1995).

During the studies by Rescan (1997), no observations of fisher were recorded, although they presented information from local residents that suggested that they were in the area in low numbers. Fieldwork conducted in June 2007 resulted in on fisher observation near the airstrip at Flannigan's Slough. Information from ADF&G suggests that fisher are moving into subunit 1C, but currently the population is very small and the only observations/records are from the Taku River drainage (Barten 2004a).

No habitat suitability mapping has been completed for fisher in the project area. The floodplain habitats found in the lower Taku and Tulsequah rivers appear to provide high value denning habitats owing to the extent of large diameter cottonwood. The lack of observations of fisher, however suggest that other factors, perhaps snow conditions or food resources, are not sufficient to support a large population.

No records of fisher are listed in the BC trapping harvest records from 1985 to 2003 for the Taku River area (MOE 2003), and only two are listed as trapped in 2005 for Management Unit 6-26 (MOE 2007). There is only one record of a fisher harvested in GMU 1C from 1986 to 2003 (N. Barten, pers. comm. 2007).

A summary of the information available on a variety of other furbearer and small mammal species is provided in Table 1, which outlines the results of the review of information for these species.

Table 1. Summary of available information for selected furbearer and small mammals.

Common Name	Scientific Name	Summary of Known Habitat Use and Abundance
Coyote	*Canis latrans*	A single set of coyote tracks was found during the work by Rescan in 1996 at the confluence of the Taku and Tulsequah Rivers (Rescan 1997). They were previously scarce in GMU IC but numbers appear to be increasing (Barten 2004a). There have been no observations in the work around Canyon Island but there was an unconfirmed sighting of a coyote just on the Canadian side of the border (E. Jones, pers. comm. 2007). It appears that coyote numbers are low in this area.
Red Fox	*Vulpes vulpes*	Rescan (1997) reported sighting one red fox scavenging a wolf-killed moose, near the confluence of the Taku and Tulsequah Rivers. They have not been observed in the Canyon Island area (E. Jones, pers. comm. 2007) and they were not detected during field assessments in 2007. Red fox do not occur in the trapping returns for either BC or Alaska (MOE 2003, MOE 2007, Barten 2004a). It is likely that red fox numbers are low in this area.
Lynx	*Lynx canadensis*	No lynx were detected during field assessments by Rescan (1997) or during GLL fieldwork in 2007. In Alaska, lynx are uncommon in subunit IC but numbers may be increasing (Barten 2004a). Lynx have been observed sporadically in the area around the Smolt camp on Canyon Island (E. Jones, pers. comm. 2007). Lynx are not present in the trapping records for BC or Alaska to 2003 (MOE 2003, Barten 2004a). Records for MU 6-26 indicate that five and seven lynx were taken for 2004 and 2005 respectively (MOE 2007). Lack of snowshoe hare in the area (see below) may limit lynx populations in the area.
River Otter	*Lontra canadensis*	River otter sign was frequent in 1994-1996 along rivers and creeks, particularly those with fish including Flannigan Slough, Tulsequah River, Shazah Creek, Stuhini Creek, Wilms Creek, Taku River, Shazah Slough, Rogers Creek, and Zohini Creek. (Rescan 1997). They were not observed during fieldwork by GLL biologists in 2007. In Alaska, river otters are believed to be abundant in the bays and inlets and fairly common along the mainland coast (Barten 2004a). There are no records of river otters being trapped in either BC or Alaska to 2003 (MOE 2003, Barten 2004a) and only one record of an otter being trapped in 2005 in MU 6-26. Preferred denning sites for river otters are in banks along rivers and backchannels, as well as in abandoned muskrat and beaver lodges (Eder and Pattie 2001). It is likely that the Taku and Tulsequah Rivers support a healthy river otter population and den sites would be found along the mainstem and backchannel habitats on the Taku River.
Marten	*Martes americana*	Marten were found to be abundant in the area and observed to use forested habitats from floodplain to timberline, with tracks common in forested habitats during studies by Rescan (1997). Some were tracks noted in the Tulsequah River drainage during field assessments in May 2007 and they are common visitors to the Tulsequah and Canarc camps. Trapping records show 258 marten were harvested from 1998 to 1993 (MOE 2003) and 79 in MU 6-26 in 2004 and 2005. In the Alaskan portion of the Taku River, marten are also common observed (E. Jones, pers. comm. 2007) and 112 were harvested between 1996 and 2005 (N. Barten, pers. comm. 2007).
Mink	*Mustela vison*	Mink were observed around the wetlands and backchannels of the Taku River floodplain (Rescan 1997) and have been observed in the area around the Smolt camp on Canyon Island (E. Jones, pers. comm. 2007). Trapping records indicate that three mink have been taken in 2004 and 2005 within MU 6-26 (MOE 2007). Mink are likely abundant in GMU 1C based on anecdotal information (Barten 2004a).

Common Name	Scientific Name	Summary of Known Habitat Use and Abundance
Short-tailed Weasel (Ermine)	*Mustela erminea*	A few tracks were noted at Shazah Creek during field work in 1996 by Rescan (Rescan 1997) and four were reported harvested by the registered trapper in 1998 from the area (MOE 2003). The short-tailed weasel is common in coniferous or mixed woodlands (Eder and Pattie 2001) and likely occurs throughout the Taku and Tulsequah River floodplains.
Beaver	*Castor Canadensis*	In the Taku and Tulsequah river floodplains area they occur in most of the wetlands (Rescan 1997) although there has been no recorded harvesting from 1985 to 2005 (MOE 2003, MOE 2007). During aerial and ground assessments in Flannigan Slough it was noted that the majority of the Slough has evidence of beaver use. In the Alaskan portion of the Taku River, only two beaver have been harvested between 1996 and 2005 (N. Barten, pers. comm. 2007) although they are thought to occur at moderate population levels in the mainland drainages including the Taku (Barten 2004a).
Muskrat	*Ondatra zibethicus*	Muskrat sign was noted in wetlands in the Swede Point area but were considered by local residents to occur only occasionally (Rescan 1997). No evidence of muskrat was observed during fieldwork conducted in 2007 and no information on muskrat was available from ADFG.
Porcupine	*Erithizon dorsatum*	In the assessments conducted by Rescan, porcupine sign was noted to be old and according to local residents, the species was believed to have “died out” in the area (Rescan 1997). Ground assessments conducted in June 2007 found evidence of recent porcupine feeding on a small number of large conifers near the proposed barge access road in the Tulsequah drainage. The only information on porcupine use or habitats in Alaska was from a report of a kill by a fisher in the Sheep Creek drainage (Barten 2004a). Populations of porcupines are not likely to be large in the area, although it appears that they may fluctuate.
Red Squirrel	*Tamiasciurus hudsonicus*	Assessments by Rescan (1997) and in the spring/summer of 2007 found that red squirrel were widespread and common in forested habitats throughout the area, primarily in forested sites associated with large spruce. It is assumed that populations and habitat use would be similar in Alaska.
Northern Flying Squirrel	*Glaucomys sabrinus*	No evidence of flying squirrel use was found in the previous or current work conducted in the project area. It is possible that this species is in the area as they have been known to utilize cottonwood forests and they are sometimes as common as red squirrels, although their nocturnal habits make them difficult to detect (Eder and Pattie 2001).
Hoary Marmot	*Marmota caligata*	Rescan (1997) observed several individuals in the Upper Whitewater Creek valley, and occasional sign in other alpine areas. Hoary marmots are primarily found in alpine and sub-alpine areas, although they will use lower elevation areas if talus and steep habitats are suitable (Eder and Pattie 2001). It is unlikely that Hoary Marmot would be along the majority of the barge transport route.
Snowshoe Hare	*Lepus americanus*	There was no evidence of snowshoe hare found during the previous or current assessments in the project area (Rescan 1997). Forage habitats appear to be sufficient to support hares in the area, although high snow levels may limit use in the winter.

Common Name	Scientific Name	Summary of Known Habitat Use and Abundance
Jumping Mice Deer Mice	*Zapus spp.* *Peromyscus spp.*	A limited small mammal trapping program was conducted by Rescan (1997), with two deer mice trapped. It is likely that the project area supports both jumping and deer mice populations, but population levels are unknown. The Meadow Jumping Mouse (*Zapus hudsonicus alascensis*) is a Blue-listed species that was captured in 1983 in the Chilkat Pass area (Cannings *et al.* 1999). The species has been found in a variety of habitats including moist or marshy fields, and other brushy habitats (Eder and Pattie 2001). During the small mammal trapping program conducted by Rescan (1997), this species was not captured and it is not expected to be found in the project area.
Voles	*Clethrionomys spp.* *Microtus spp.*	During the small mammal trapping program, Rescan (1997) found that capture rates for northern red-backed vole were relatively high although population levels are unknown.
Bats	*Myotis spp.*	No assessments for bats have been conducted to date, although a limited program using a commercial bat-detector will be conducted in the late summer 2007. Common bat species such as little brown bat (*Myotis lucifugus*) are likely to be found in the project area, with species such as long-legged bat (*M. volans*), and silver-haired bat (*Lasionycteris noctivagans*) also possible. All of these species use forested habitats and water bodies such as major rivers and wetlands for foraging and den in structures or large trees (Eder and Pattie 2001). Keen's Myotis (*Myotis keenii*), a Red-listed species, is a medium-sized bat with dark, glossy fur and large ears that appears to be restricted to coastal forests from Washington to south-east Alaska (Nagorsen and Brigham 1993). It likely uses tree cavities and is known to use caves; one colony uses a natural hot spring as a roosting area (Nagorsen and Brigham 1993).
Shrews	*Sorex spp.*	Rescan (1997) outlines that capture rates for common shrew were relatively high, but it is unclear if this refers to the common water shrew (*Sorex palustrus*) or a misnaming of another common shrew species such as masked shrew (*S. cinereus*) or dusky shrew (*S. monticolus*). The Tundra Shrew (*Sorex tundrensis*) is a Red-listed shrew species, with five specimens being captured in the Chilkat Pass area in the late 1970s (Cannings *et al.* 1999). The Chilkat Pass is approximately 190 km west of Atlin, BC and 230 km northwest of the project area. The species is more prevalent in Alaska, Yukon and Russia, but has a very limited distribution in BC with the nearest known population to the project area found approximately 500 km away (Nagorsen and Jones 1981). No Tundra Shrews were captured during the small mammal trapping program conducted by Rescan in 1995-1996 (Rescan 1997) and it is not expected to be found in the project area.

3. Summary of 2007 Terrestrial Field Assessments

During 2007, a number of terrestrial field assessment were undertaken to provide additional information regarding terrestrial wildlife, wildlife habitat and habitat use patterns within the lower Tulsequah River and Taku River areas. Field assessments were directed towards understanding the potential issues and concerns related to the proposed ACB transportation system and providing additional information to supplement the work conducted by Rescan and others since 1995.

Assessments were conducted according to standardized methods, consistent with the Resource Information Standards Committee (RISC) for the species of interest. Where non-target species were observed, they were recorded as incidental sightings with as much information as possible recorded on their habitat use, numbers, sex and age.

For the purposes of the surveys and results presentation the following seasons were identified:

- Winter November 1st to April 30th
- Spring May 1st to June 30th,
- Summer July 1st to August 31st
- Fall September 1st to October 31st

3.1 Winter Moose Assessments

3.1.1 Objectives

The objectives of the winter moose assessments were as follows:

1) to determine a late winter population of moose using the lower Taku River on both the BC and Alaska side of the border using aerial survey techniques comparable to previous surveys conducted in the area; and,
2) to determine habitat use patterns of moose in the vicinity of the proposed ACB transportation route and landing area using ground-based assessments of winter use habitats.

3.1.2 Methods

The aerial surveys conducted in the lower Taku River area were conducted within three of the Sample Units (SUs) that were previously surveyed by Marshall (2000):

SU 226 - lower Shazah Creek and the middle Tulsequah River,
SU 228 - lower Taku River from Yellow Bluff to the Tulsequah River, and
SU 229 - Flannigan Slough and Taku River to the BC-Alaska border.

Surveys were conducted using the methodologies outlined in *Aerial-based Inventory Methods for Selected Ungulates: Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer and Caribou* (RIC 2002). Aerial inventory transects were flown between 500 and 750 m apart at an altitude of 50 to 150 m above the canopy, at airspeeds ranging from 70 to 100 km/hr, using a Bell 206 helicopter. Two observers were used, with one observer keeping track of the flight path on a laptop computer using real time GPS tracking with ArcView GIS and the DNR Garmin Extension from the Minnesota Dept. of Natural Resources (MDNR 2001). When a moose was observed, a waypoint was placed on the digital map adjacent to the flight path line, corresponding to the location of the sighting in relation to the helicopter. This placement was based on visual cues and map information such as the estimated distance from the helicopter, stream location and vegetation information. The waypoint number was recorded and the second observer recorded additional information on a paper survey form, including number of animals, age class and sex, habitat type and percent vegetation cover within 10 m of each animal or group. The habitat type and percent cover were assessed and recorded to aid in determining a moose sightability correction factor as described by Anderson and Lindzey (1996) and Quayle *et al.* (2001). The pilot acted as a third observer helping to locate moose and identify the age and numbers of animals.

During the aerial surveys, a tally was kept of incidental observations of track trails in the snow from moose and other mammals. Waypoints were not taken of track locations, although the general area was noted and the species was identified.

The moose location data obtained during the aerial survey were used to identify potential ground survey transect areas that could be used to obtain more detailed habitat use information. Ground-based transects were conducted using methods similar to those outlined in Johnson (2000) for caribou, but modified to address the feeding habits of moose. Areas of high moose use identified during the aerial surveys that were within areas of potential infrastructure development were selected for ground-based transects. Once a set of fresh moose tracks was identified in an area of investigation, the tracks were followed for a minimum of 100 m. Along the transect, information on the height and quality of security cover, amount and type of browse species, an estimate of proportion browsed and the location of any bedding sites were noted. As well, the snow depth, snow crust layers and moose sinking depth was measured and recorded.

A sightability correction factor (SCF) was applied to the number of moose counted based on the methods outlined in Anderson and Lindzey (1996) and modified by Quayle *et al.* (2001). As described in Marshall (2000), the Sightability Correction Factor (SCF) is based on the % vegetation cover within 10 m of the observed moose and is applied to correct for moose that may be unobserved due to high vegetation covers. Table 2 outlines the SCFs that were applied to the moose counted during the survey.

Table 2. Sightability correction factors applied to different percent vegetation cover during the aerial surveys.

Cover Class	% Cover	Probability of Detection	Sightability Correction Factor
1	0	1	1.0
2	1 - 20	0.8	1.3
3	21 - 40	0.4	1.6
4	41 - 60	0.1	1.9
5	61 - 80	< 0.1	2.2
6	81 - 100	<< 0.1	2.5

3.1.3 Results

All aerial surveys were flown on March 15th, 2007 with a short break between the BC and Alaskan portions of the surveys. Visibility was good for most of the survey, with falling snow a factor along a small portion of the survey along the upland portions of Taku Inlet. Approximately 30 to 40 hours had passed since 30 cm of snow fell and 5 cm of new snow had fallen in the past six hours at the time of the surveys. Daytime temperatures ranged from –8°C to –2°C and night-time temperatures fell to about –12°C.

Figure 1 outlines the survey transect path flown on the BC side of the Take River and indicates the location and group size of moose observed. A total of 64 moose were observed in groups ranging from one to eight animals and included a total of nine adult males, 27 adult females, 14 juveniles and 14 adults of unknown sex. Of these, ten were cow-calf pairs and two had old VHF collars attached (one female and one male). Moose were mainly observed to be using open forests and riparian areas in close proximity to open water on the west side of Tulsequah River in Flannigan Slough, in Big Bull Slough on the north of the Taku River and on the south side of the Taku River adjacent to the BC-Alaska border. In most cases, moose were bedded down on the riverbank, in tree wells and in deep snow near brush. Moose movements appeared to be limited due to the deep snow, with many animals not moving when approached by the helicopter during the survey.

The survey transect path and moose observed on the Alaska side of the Taku River are shown in Figure 2. A total of 22 moose were observed in groups of one to two and included a total of four adult males, ten adult females and eight juveniles. A total of eight cow-calf pairs were observed. Moose were observed to be mainly using open forests and riparian areas in close proximity to open water. Many of the observed moose were bedded down on the riverbank, in tree wells and in deep snow near brush. It was also noted that moose were finding movement difficult due to deep snow.

A comparison of the population parameters and survey results from the surveys conducted in 2000 and 2007 are provided in Table 3. The authors of the surveys did not provide all of the survey parameters to ensure that methods were the same, but it appears that population numbers were

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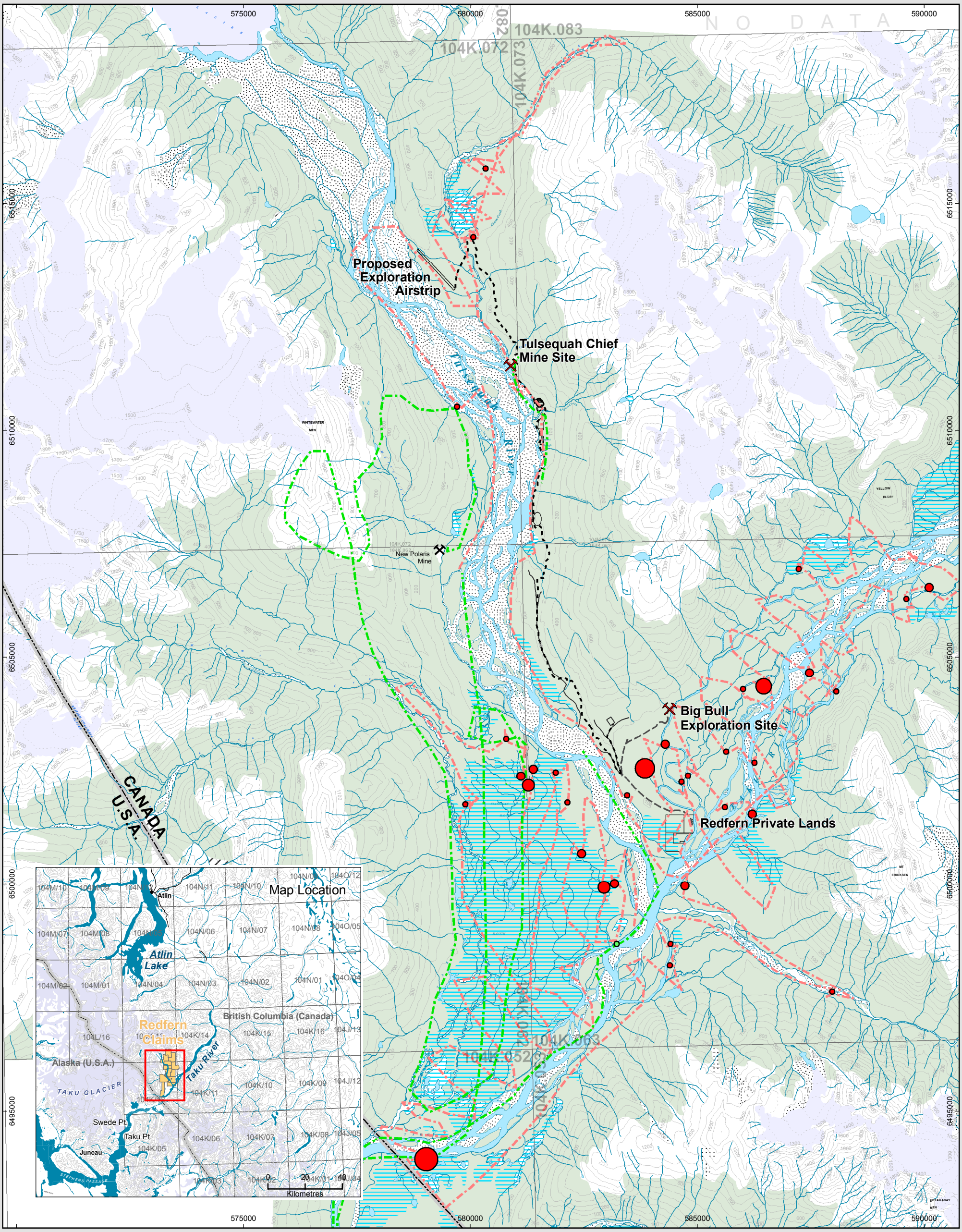

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Exploration road alignment, Wardop Engineering
Mine layout, Wardrop Engineering
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UTM Zone 8N, NAD 83

Legend

Number of Moose Observed (Winter)

1 2 3 5 7 8

Number of Moose Observed (Spring)

1 2

03/15/07 Survey Track
05/23/07 Survey Track
Exploration Road (Existing)
Exploration Road (In Development)
Existing Trail or Road
Swamp / Marsh
Sandbar
Glacier
Contour (Index 100m)
Contour (Index - Indefinite 100m)

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Moose Data Collected During 2007 Field Sessions

Aerial Surveys

24 September, 2007

Gartner Lee

Figure 1
Version 1

File Name: 72615_Figure_1_Aerial_Moose_Survey_Canada.mxd
Reviewed By: LT Prepared By: JW
Date Issued: September 2007 Project Number: 72615

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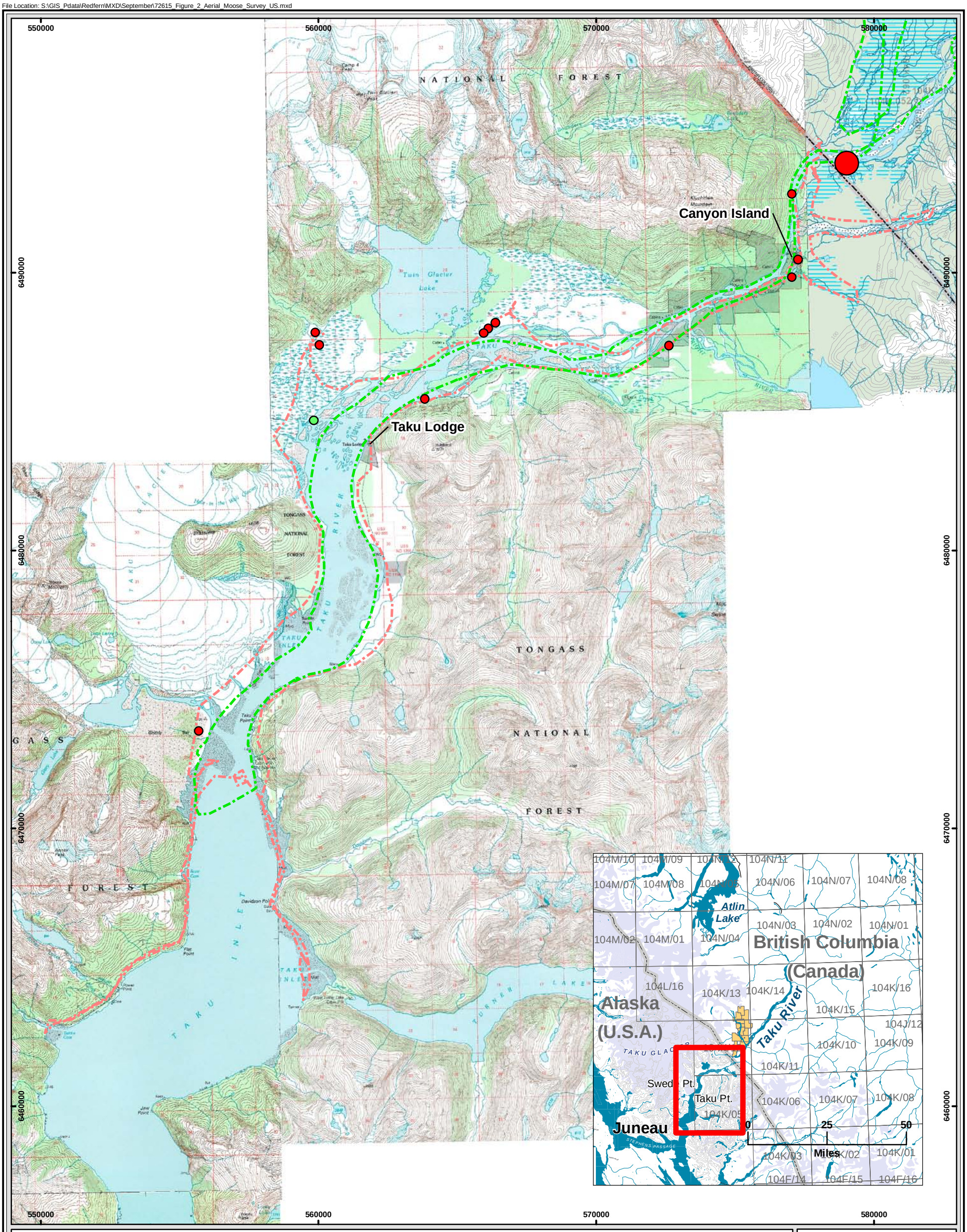

Map Sources/Notes:
- Topographic Images derived from Digital Raster Graphic (DRG) Images produced by the USGS
- Aquatic Resources information digitized from hand-drawn sketches

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File Name: 72615_Figure_2_Aerial_Moose_Survey_US.mxd
Reviewed By: LT
Date Issued: September 2007
Prepared By: JW
Project Number: 72615

Legend

Number of Moose Observed (Winter)

1
2
3
5
7
8

Number of Moose Observed (Spring)

1
2

03/15/07 Survey Track
05/23/07 Survey Track
Swamp / Marsh
Sandbar
Glacier

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Moose Data Collected During the 2007 Field Sessions

Aerial Surveys

24 September 2007

Gartner Lee

Figure 2
Version 1

lower in 2007 than in 2000, although the proportion of calves appears to have increased from 2000 to 2007.

Table 3. Comparison of moose population estimates 2000 and 2007 in the BC and Alaska portions of the lower Taku River.

	BC Portion 2000[1]	BC Portion 2007	Alaska Portion 2000[2]	Alaska Portion 2007
Bulls	26	9	-	4
Cows	57	27	5	10
Calves	9	14	7	8
Unclassified Adult	1	14	36	-
Total	94	64	47	22
Bulls: 100 Cows	46	-	-	40
Calves: 100 Cows	18	-	-	80
% Calves	11%	22%	15%	36%
Density (moose/km^2)	0.73	0.51	-	0.14
Corrected Population[3]	123	82	-	33

Notes: [1] From Marshall (2000), [2] From Barten (2004b)
[3] Sightability Correction Factor applied as per Quayle et al. *(2001) and Marshall (2000)*

Observations of tracks, where an animal was not observed in the immediate area of the tracks, included 28 by marten, 15 by moose, and one set of wolverine tracks. Marten tracks were distributed fairly evenly on either side of the BC-Alaska border, with 16 track trails observed in BC and 12 sets in Alaska. Marten tracks were associated with the denser cottonwood stands and coniferous forest habitats along the Taku River. Moose tracks were generally associated to the areas of the observed moose locations, with some sets of tracks noted crossing the Taku River near Yellow Bluff and within Big Bull Slough. No tracks were noted crossing south of the confluence of the Tulsequah River and Taku River. The wolverine tracks were observed in open habitat near the mouth of Stuhini Creek opposite the Taku River.

Based on the density of animals and sign observed during the aerial surveys, ground surveys were conducted in Flannigan Slough and Big Bull Slough on March 15th and 16th, 2007. Total snow depths were greater than 3 m with a crust at approximately 90 cm from the surface. Snow sinking depth was 30 cm for surveyors wearing snowshoes and 90 cm for moose. Approximately 5.37 km of transects were completed in three transects with moose sign consisting primarily of foraging and bedding. Foraging occurred mostly on Sitka alder (*Alnus crispa* spp. *sinuata*) and to a lesser extent on red-osier dogwood (*Cornus stolonifera*), red elderberry (*Sambucus racemosa* spp. *pubens*) and willows (*Salix spp.*). The deep snow limited foraging opportunities to those species that projected above the snow, with smaller willow and other shrub species not being available for foraging.

A compilation of available incidental observations of moose obtained during other ground-based and aerial-based field assessments during 2007 is provided in Figure 3. These observations provide some information on moose habitat use, but are limited to the small areas where the assessments took place and should not be interpreted as an indication of the overall level of use or for comparison of use between areas.

3.2 Bald Eagle and Trumpeter Swan Nest Assessments

3.2.1 Objectives

The objectives of the bald eagle and trumpeter swan nest assessments were as follows:

1) to use aerial survey techniques during the winter to determine where bald eagle nests are located when lack of foliage would make locating nests easier,
2) to use aerial and ground survey techniques during the spring to determine trumpeter swan nesting locations, and
3) to document the known bald eagle and trumpeter swan nest locations along the lower Taku River from available sources.

3.2.2 Methods

During the aerial survey for moose conducted in March 2007, locations of bald eagle nests were noted when observed. The aerial transects were flown between 500 and 750 m apart at an altitude of 50 to 150 m above the canopy and airspeeds ranging from 70 to 100 km/hr using a Bell 206 helicopter. As outlined in the section describing the aerial winter surveys for moose, a laptop computer with a digital map running ArcView GIS and the DNR Garmin extension (MDNR 2001) were use for real-time tracking of the helicopter location. When a nest was sighted, a waypoint was added to the digital map, based on the location of the nest from the helicopter. The waypoint number and tree species were noted on a paper survey form. Sightings of bald eagles were also noted and a waypoint taken, along with a description the activity of the eagle (e.g. flying, perched).

During the spring and summer of 2007, additional bald eagle and trumpeter swan nest location information was compiled and mapped from the work conducted by Rescan (Rescan 1997) and the US Fish and Wildlife Service (USFWS 2007a and USFWS 2007b). Additional incidental sightings of eagles and eagle nests, as well as trumpeter swans and their nests, obtained during unrelated GLL ground and aerial reconnaissance assessments were also compiled and mapped using ArcView GIS.

An analysis of the number of eagle nests that had been observed in the different surveys was conducted to try to determine if all nests had been identified in the various surveys. The survey areas for each of the surveys was outlined in ArcView GIS to determine which surveys likely

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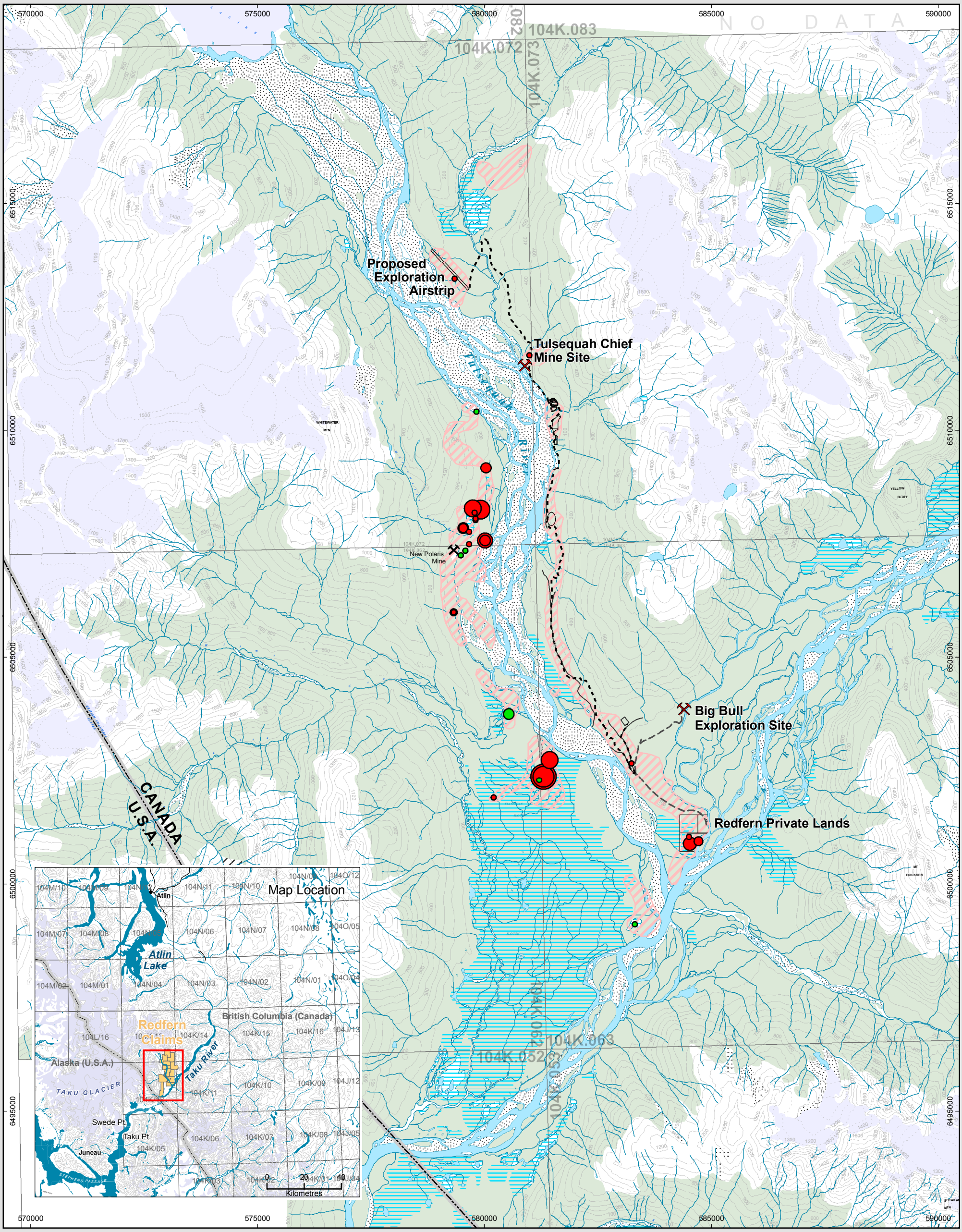

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File Name: 72615_Figure_3_Moose_Incidental_Canada.mxd
Reviewed By: LT Prepared By: JW
Date Issued: September 2007 Project Number: 72615

Legend

Amount of Moose Sign Observed

- 1
- 2
- 3
- 4
- 5
- 6
- 7 - 8
- 9 - 14
- 15 - 20
- 21 - 78

Number of Moose Observed

- 1
- 2 - 4

- Exploration Road (Existing)
- Exploration Road (In Development)
- Ground Based Survey Areas
- Contour (Index 100m)
- Contour (Index - Indefinite 100m)
- Existing Trail or Road
- Swamp / Marsh
- Sandbar
- Glacier

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Moose Data Collected During 2007 Field Sessions

Incidental Sightings

24 September, 2007

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Figure 3
Version 1

overlapped in spatial area. The number of nests detected in each survey within the overlap area were counted, along with the number of nests that had been detected in both. Due to the potential for differences in accuracy of plotting nest locations, a nest was considered to have been detected in both surveys if the locations of the nests were within 50 m of each other. The proportion of nests detected in both surveys was calculated by dividing the number of nests detected in both surveys by the total number of nests in the overlap area.

3.2.3 Results

A total of 12 bald eagle nests were observed on the BC portion of the Taku River, with all of the nests found in large black cottonwood trees (*Populus balsamifera* spp. *trichocarpa*). In Alaska, an additional 12 nests were observed, with all of the nests also located in large black cottonwood trees. During the survey in Alaska, six adult bald eagles were also observed flying while surveying between Taku Point and Sunny Cover in Taku Inlet.

The compilation of all of the available bald eagle nesting data from the Rescan, USFWS and incidental sightings from ground and aerial assessments by GLL in the spring of 2007 can be found in Figure 4 and Figure 5 and are summarized below in Table 4. The initial review of the nest location data suggested that the percent of nests that had been detected in multiple surveys was very low (~ 7%). This was a concern as it indicated that either nests were very difficult to detect; the survey techniques were vastly different; or nest durability in this area is very low. Upon further investigation, however, it was determined that very few of the surveys spatially overlapped. For example, the surveys conducted by the USFWS were conducted in different portions of the lower Taku during different years, so it would be difficult for them to be able to detect the same nests. As well, none of the USFWS and Rescan surveys overlapped spatially, and a portion of the USFWS surveys in Taku Inlet did not spatially overlap the GLL winter aerial survey.

Table 4. Number of Bald Eagle nests detected during field assessments in the lower Taku River area early 1980s to 2007.

Assessment Date and Type	Number of Nests Detected
GLL Winter 2007 Aerial	24
GLL Spring 2007 Aerial Recon	4
GLL Spring 2007 Ground	1
Rescan Summer 1995 Aerial	20
USFWS early 1980's Aerial	20
USFWS 1996 Aerial	16
USFWS 2002 Aerial	10
USFWS 2006 Aerial	6
Total Nests Detected	*101*
# Nests Detected in Multiple Surveys	7
Net Nests Detected	***94***

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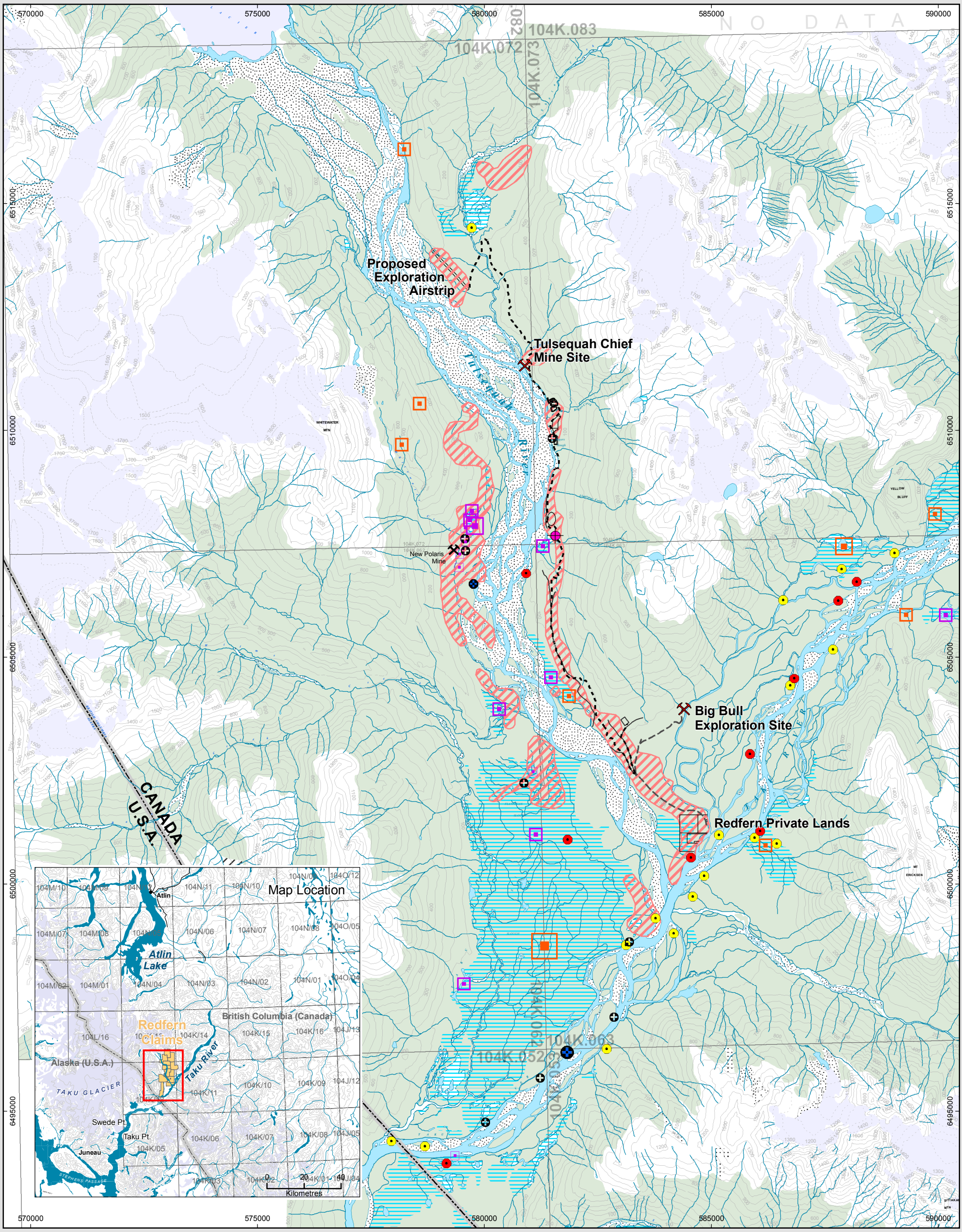

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All other data, Gartner Lee Limited

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Legend

Bald Eagles
- 1 Bald Eagle Observed
- 2 Bald Eagles Observed
- 3 Bald Eagles Observed
- Bald Eagle Nest (Active 1995)
- Bald Eagle Nest (Active 2007)
- Bald Eagle Nest (Unknown)
- Red-Tailed Hawk Nest (Active 2007)

Trumpeter Swans
- 1 Adult Observed
- 2 Adults Observed / Nesting Site
- 2 Adults Observed
- 3 Adults Observed
- 3 Adults Observed / Nesting Site
- 4 Adults Observed / Nesting Site
- 5 Adults Observed / Nesting Site

- Exploration Road (Existing)
- Exploration Road (In Development)
- Contour (Index 100m)
- Contour (Index - Indefinite 100m)
- Existing Trail or Road
- Ground Based Survey Areas
- Swamp / Marsh
- Sandbar
- Glacier

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Raptor and Trumpeter Swan Data Collected During the 2007 Field Sessions

Incidental Sightings

09 October, 2007

Gartner Lee

Figure 4
Version 1

File Name: 72615_Figure_4_Eagles_Swans.mxd
Reviewed By: LT
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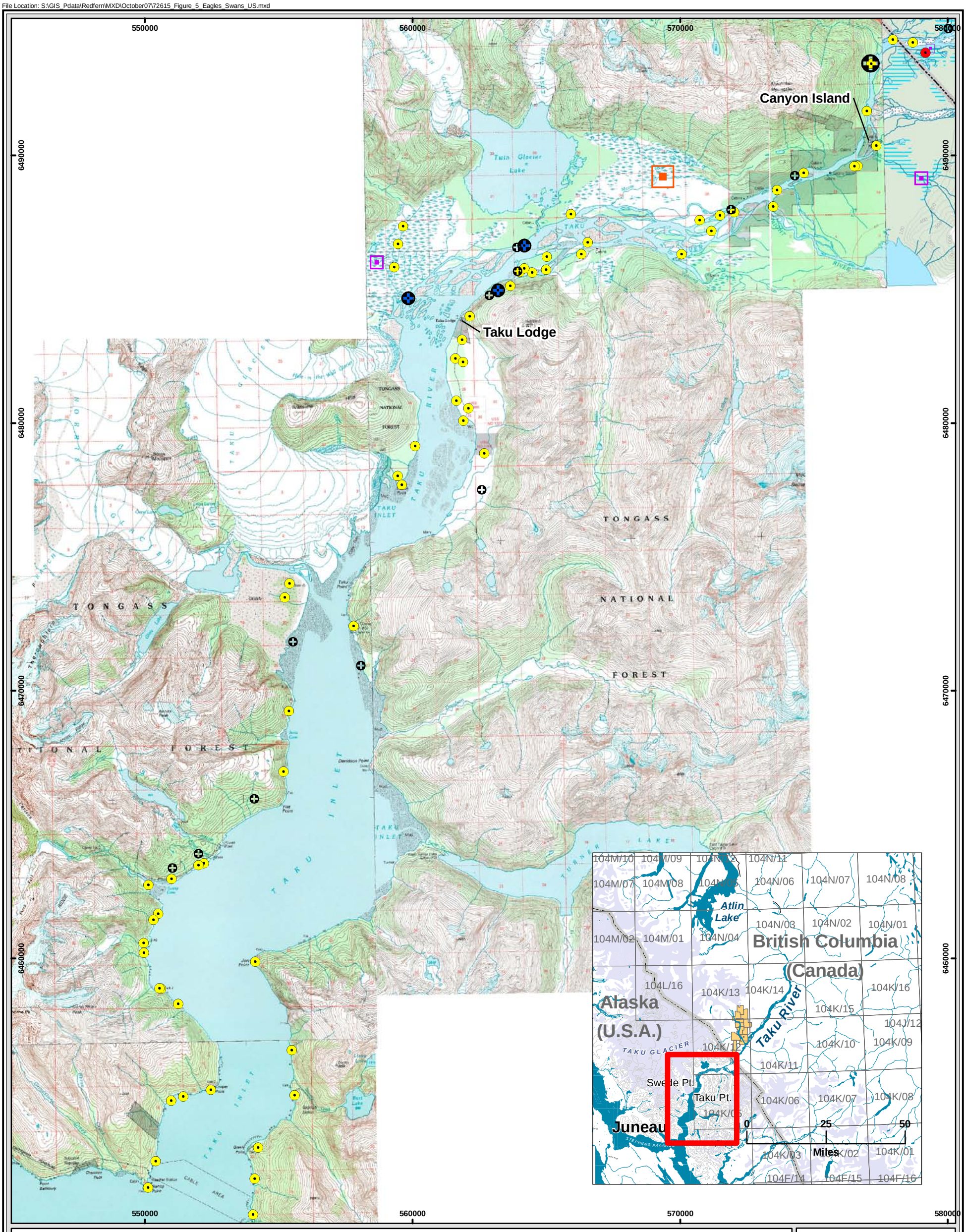
Prepared By: JW
Project Number: 72615

File Location: S:\GIS_Pdata\Redfern\MXD\October07\72615_Figure_5_Eagles_Swans_US.mxd



Map Sources/Notes:
- Topographic Images derived from Digital Raster Graphic (DRG) Images produced by the USGS
- Bird data collected by Gartner Lee Ltd.

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File Name: 72615_Figure_5_Eagles_Swans_US.mxd
Reviewed By: LT
Prepared By: JW
Date Issued: September 2007
Project Number: 72615

Legend

Bald Eagles

- 1 Bald Eagle Observed
- 2 Bald Eagles Observed
- 3 Bald Eagles Observed
- Bald Eagle Nest (Active 1995)
- Bald Eagle Nest (Active 2007)
- Bald Eagle Nest (Unknown)

Trumpeter Swans

- 1 Adult Observed
- 2 Adults Observed / Nesting Site
- 2 Adults Observed
- 3 Adults Observed
- 3 Adults Observed / Nesting Site
- 4 Adults Observed / Nesting Site
- 5 Adults Observed / Nesting Site

- Swamp / Marsh
- Sandbar
- Glacier

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Raptor and Trumpeter Swan Data Collected During the 2007 Field Sessions

Incidental Sightings

09 October 2007

Gartner Lee

Figure 5
Version 1

The analysis of the proportion of nests detected in multiple surveys where there was overlap between the surveys, found that detectability of bald eagle nests between surveys was still quite low. Table 5 below, summarizes the proportion of nests that were detected where surveys overlapped spatially.

Table 5. Proportion of Bald Eagle nests detected in overlapping survey areas in the lower Taku River area.

Survey 1	# Nests in Overlap Area	Survey 2	# Nests in Overlap Area	# Nests Detected in Both	Net # Nests Detected	Proportion Detected in Both
GLL Winter 2007 Aerial	20	GLL Spring 2007 Aerial Recon	3	0	23	0
GLL Winter 2007 Aerial	12	Rescan Summer 1995 Aerial	20	6	26	0.23
USFWS 1996 Aerial	4	GLL Winter 2007 Aerial	0	0	4	0
USFWS 2002 Aerial	10	GLL Winter 2007 Aerial	5	1	14	0.07

The proportions of nests that were detected in spatially overlapping surveys ranged from 0 to 0.23, with the most overlap occurring between the GLL Winter 2007 and Rescan Summer 1995 aerial surveys. The lack of repeat detections in the GLL Winter 2007 and GLL Spring 2007 is likely due to survey effort, and detectability of nests in the spring. Nests were much easier to see during the winter survey than in the spring and the winter survey covered the area more thoroughly. The lack of repeat detections of bald eagle nests suggests that standard methods for detecting bald eagle nests are required and that repeat surveys during the winter will likely be needed to ensure that the majority of nests are found.

Trumpeter swans have been recorded nesting in a number of areas of the Taku and Tulsequah Rivers during aerial surveys conducted in 1998, 2000 and 2005 by the US Fish and Wildlife Service (D. Groves, pers. comm. 2007). Results from the surveys suggest that trumpeter swans may be increasing in the area. In 1998, there were 17 adults observed, with three of these having a total of eight young. In 2000, 22 adults were observed, four of which had a total of 16 young. In 2005, 27 adults were observed, five of these having a total of 15 young. During aerial and ground surveys conducted for bald eagles, waterfowl and breeding birds in May and June 2007, a number of trumpeter swan nests were observed as well as pairs of swans, which likely indicate a nearby nest. Nest locations observed by GLL biologists included locations in Flannigan's Slough, the slough north of the Canarc camp and the wetland located on the east side of the Tulsequah River approximately 4.5 km from the confluence with the Taku River. The locations of known nesting and observed trumpeter swans in BC and Alaska are shown in Figure 4 and Figure 5.

3.3 Waterfowl, Marine Birds and Shorebird Use Assessments

3.3.1 Objectives

The objectives of the waterfowl, marine birds and shorebirds assessments were as follows:

1) to use aerial survey techniques to determine the waterfowl, marine birds and shorebird species and numbers that were using the lower Taku River and Taku Inlet during the late winter and mid-spring, and
2) to use ground-based survey techniques to determine waterfowl, marine birds and shorebird species and numbers using the wetland and river habitats in the Tulsequah and Taku River areas during mid-spring.

3.3.2 Methods

During the aerial survey for moose conducted in March 2007 and in a reconnaissance-level aerial survey conducted in May 2007, open water and mudflat areas along the Taku River and in Taku Inlet were surveyed for any waterfowl, marine birds and shorebird species that were using those habitats. The aerial transects in the lower Taku River and Taku Inlet were flown to follow the shoreline at an altitude of 50 to 150 m above ground-level, at airspeeds ranging from 70 to 100 km/hr, using a Bell 206 helicopter. The aerial survey conducted in May was considered a reconnaissance level survey, as the survey time and area covered was much less than that covered in the March survey. Due to safety issues with low ceiling and distance from shore, the surveys were not flown more than 500 m from shore, although as many bird species as possible were noted in Taku Inlet. Aerial surveys were also conducted for water birds in wetland and river floodplain habitats located near the proposed access route. The main wetland areas were the Big Bull Slough, which was flooded with turbid waters at the time of the survey, and a wetland complex located along the east side of the Tulsequah River about 4.5 km upstream from the confluence with the Taku River.

As outlined in the section describing the aerial winter surveys for moose, a laptop computer with a digital map running ArcView GIS and the DNR Garmin extension (MDNR 2001) were use for real-time tracking of the helicopter location during the March and May surveys. When a bird or bird group was sighted, a waypoint was added to the digital map, based on the location of the bird(s) in relation to the helicopter. The waypoint number, species, number of birds and their activity were noted on a paper survey form.

Ground-based transects were conducted within and adjacent to wetland and river floodplain habitats within the infrastructure development areas for the Tulsequah Chief mine. The infrastructure areas assessed included the proposed tailings area, the waste rock areas, the airstrip, the proposed ACB landing site and roads associated with this infrastructure. All wildlife species observed were noted, although the focus of the assessments was aimed towards spring waterfowl. A hand-held GPS (Garmin 12) was used to record the survey locations and waypoints of any birds seen or heard. Habitat type was also recorded. Surveys were also conducted in

wetland and river floodplain habitats associated with the proposed New Polaris development on the west side of the Tulsequah River and provide additional information on waterfowl and shorebird use in the area.

Point count data for waterfowl, marine birds and shorebirds were also included in this assessment where they were noted during the breeding bird surveys. The methods for the point counts are outlined below in the Spring Breeding Bird Assessment section. Incidental sightings of waterfowl, marine birds or shorebirds seen during any other wildlife related work were also noted.

3.3.3 Results

The winter aerial survey was conducted March 15th, 2007, while winter ground assessments were conducted March 15th and 16th, 2007. The spring reconnaissance aerial survey was conducted May 25th, 2007; with ground assessments conducted May 22nd to 26th, and June 22nd to June 30th, 2007. The breeding bird surveys were conducted from June 12th to 18th, 2007.

During the winter survey in March, the lower Taku River was covered in ice from west of Yellow Bluff until near Taku Point, and ice extended into Taku Inlet on the south side to approximately Grizzly Bar. The Taku River was essentially ice-free by the May surveys.

A summary of the results of the aerial and ground-based surveys conducted during the winter and spring of 2007 are provided in Table 6 below. No water birds were observed on the BC side of the

Table 6. Summary of waterfowl, marine bird and shorebird species observed during winter and spring assessments.

	Species	Winter		Spring				Grand Total
		Aerial	Incidental	Aerial	Ground	Incidental	Point Count	
Tulsequah	American Dipper						1	1
	Arctic Tern						7	7
	Belted Kingfisher				1		2	3
	Canada Goose				1	13	7	21
	Green-winged Teal				4			4
	Hooded Merganser						1	1
	Mallard		2		4	2	3	11
	Ring-necked Duck						2	2
	Semipalmated Plover				2			2
	Spotted Sandpiper				2	3	10	15
	Unspecified Goldeneye				1			1
	Unspecified Gull			4		1		5
	Unspecified Tern				3			3
	Wilson's Snipe				1		9	10
Tulsequah Total			*2*	*4*	*19*	*19*	*42*	*86*

	Species	Winter		Spring				Grand Total
		Aerial	Incidental	Aerial	Ground	Incidental	Point Count	
Lower Taku - BC	Canada Goose			1			4	5
	Greater Scaup				2			2
	Spotted Sandpiper						1	1
	Unspecified Gull			7				7
	Unspecified Tern			2				2
	Wilson's Snipe				1		2	3
Lower Taku - BC Total				*10*	*3*		*7*	*20*
Lower Taku - AK	Canada Goose			6				6
	Common Merganser			27				27
	Mallard			6				6
	Unspecified Duck			9				9
	Unspecified Gull			1				1
	Unspecified Scaup			6				6
	Unspecified Tern			2				2
Lower Taku - AK Total				*57*				*57*
Taku Inlet	Canada Goose	13		37				50
	Common Merganser	1		4				5
	Mallard	39						39
	Mew Gull	16						16
	Unspecified Duck			12				12
	Unspecified Goldeneye	21						21
	Unspecified Gull	523		34				557
	Unspecified Merganser	4						4
	Unspecified Tern			20				20
Taku Inlet Total		*617*		*107*				*724*
Grand Total		***617***	***2***	***178***	***22***	***19***	***49***	***887***

Taku River during the winter aerial surveys due to the ice cover on the river and other water areas. The incidental sightings of mallards recorded during the winter were from the Wildlife Log at Canarc Camp and were for late April, when the water was ice-free (see Figure 6). In Taku Inlet, the majority of the birds observed during the winter aerial survey were unidentified gull species, with a very large group of approximately 500 observed on the mudflats and in the water near Grizzly Bar (see Figure 7). It is likely that this group was glaucous-winged gulls, as they are the most common gull observed during Christmas Bird counts in Juneau (National Audubon Society 2005) but positive identification was not possible. Other common species observed during the aerial survey of Taku Inlet included Canada geese, goldeneye, mew gulls and mallard. No scoters, murrelets or shorebirds were observed to be using the Taku mudflat or Taku Inlet areas during the winter aerial surveys.

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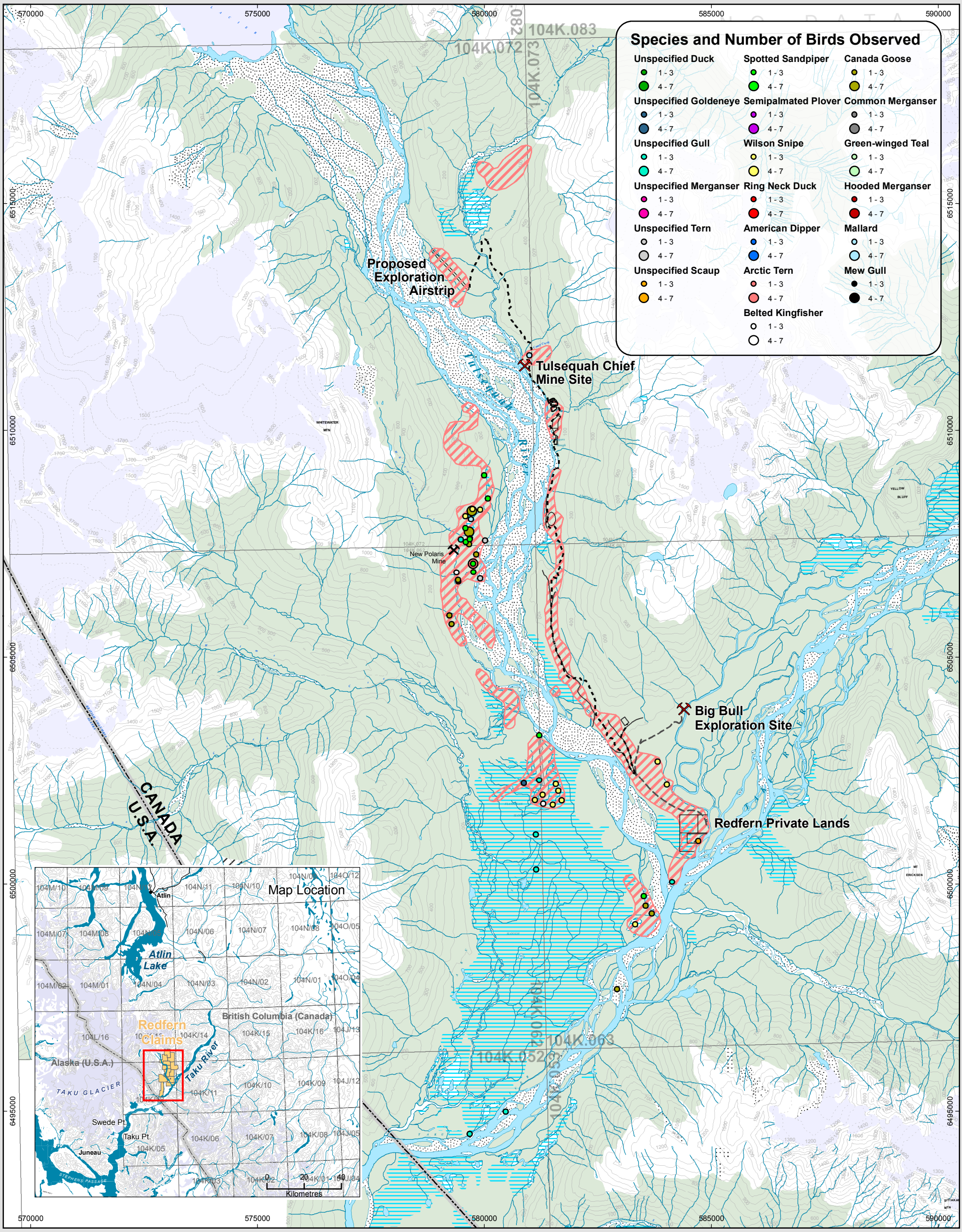

Map Sources/Notes:
Basedata TRIM (1:20,000)
Exploration road alignment, Wardop Engineering
Mine layout, Wardrop Engineering
Quickbird Imagery (2003) Copyright 2007 DigitalGlobe Incorporated
All other data, Gartner Lee Limited

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File Name: 72615_Figure_6_Other_Water_Birds.mxd
Reviewed By: LT
Prepared By: JW
Date Issued: September 2007
Project Number: 72615

Legend

- Exploration Road (Existing)
- Exploration Road (In Development)
- Contour (Index 100m)
- Contour (Index - Indefinite 100m)
- Existing Trail or Road
- Ground Based Survey Areas
- Swamp / Marsh
- Sandbar
- Glacier

Redfern Resources Ltd.

Tulsequah Chief /Big Bull Exploration Project

Water Bird Data Collected During 2007 Field Sessions

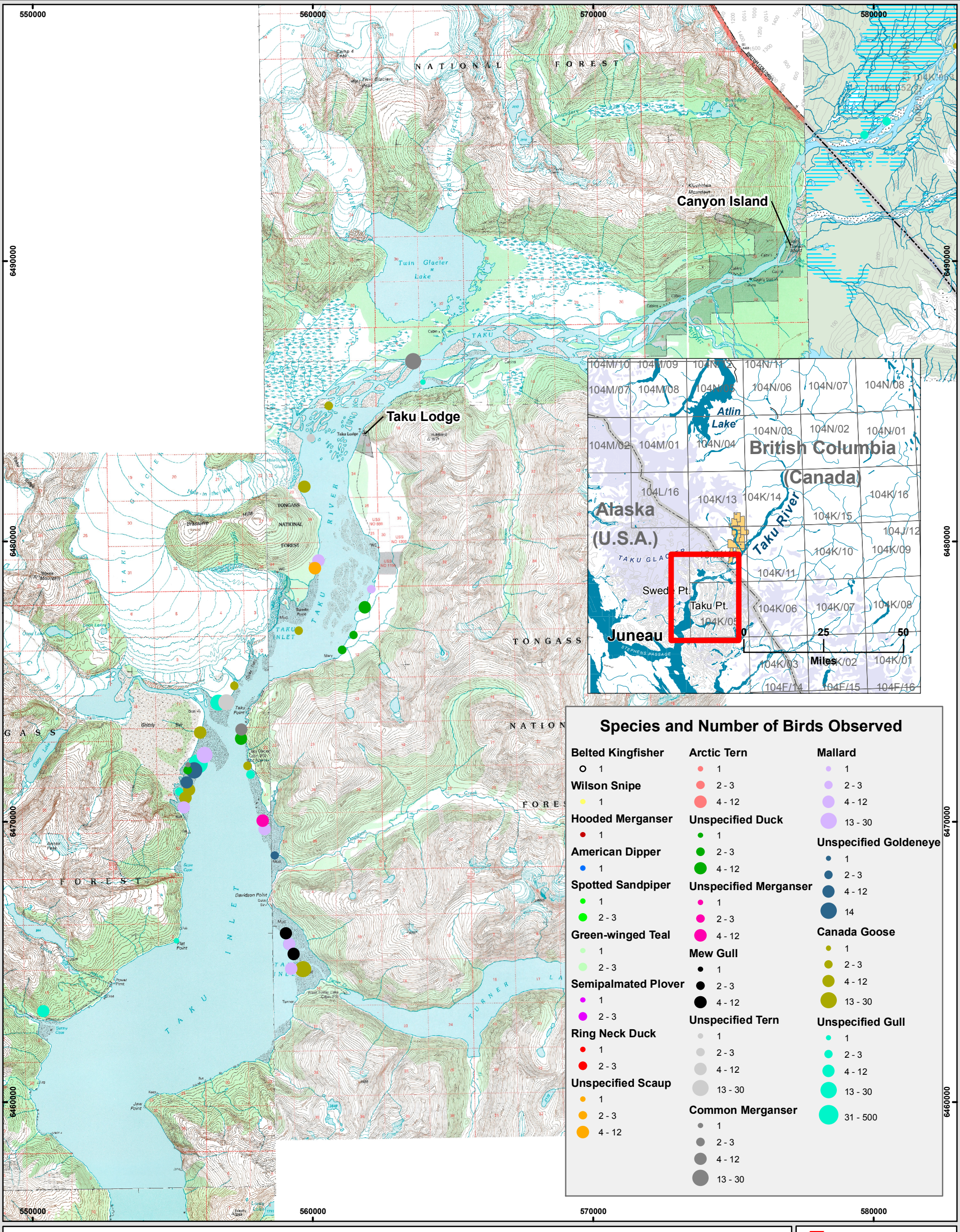
Incidental Sightings

09 October, 2007

Gartner Lee

Figure 6
Version 1

File Location: S:\GIS_Pdata\Redfern\MXD\October07\72615_Figure_7_Other_Water_Birds_US.mxd



Map Sources/Notes:
- Topographic Images derived from Digital Raster Graphic (DRG) Images produced by the USGS
- Aquatic Resources information digitized from hand-drawn sketches

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File Name: 72615_Figure_7_Other_Water_Birds_US.mxd
Reviewed By: LT
Date Issued: September 2007
Prepared By: JW
Project Number: 72615

Legend

Swamp / Marsh
Sandbar
Glacier

Redfern Resources Ltd.

Tulsequah Chief/Big Bull Exploration Project

Water Bird Data Collected During the 2007 Field Sessions
Incidental Sightings

09 October 2007

Gartner Lee

Figure 7
Version 1

A wider variety of species were observed during the spring aerial surveys than in the winter, with the majority of species and numbers found in the lower Taku River and Taku Inlet. Common merganser, Canada goose, mallard and a variety of unidentified ducks, gulls and terns were the most common species observed. Species found during ground-based assessments were more varied in the spring, with the majority of the species observed associated with incidental sightings during ground assessments and from observations during the breeding bird surveys (see Figure 6 and Figure 7).

3.4 Spring Breeding Bird Assessment

3.4.1 Objectives

The objectives of the breeding bird assessments were as follows:

1) to obtain data on breeding birds that are using the area in spring, and
2) to document the birds nesting along the proposed ACB access road and areas of proposed activity.

3.4.2 Methods

Breeding birds were sampled using point count methods adapted from *Inventory Methods for Forest and Grassland Songbirds Vers. 2* (RIC 1999a). Surveys were conducted in mid to late June to coincide with the peak of breeding bird activity in this part of British Columbia. Point counts involved listening for a single five-minute period to record all birds seen or heard within an estimated 75 m radius from the point. Birds observed flying over the plot and obviously not landing were recorded separately. A one-minute quiet period preceded the start of the five-minute point count period. Each point count station was located a minimum of 200 m from the next station to prevent overlap in birds counted. Most of the points followed the proposed ACB access road alignment between the Tulsequah Chief Mine and the barge site on the Taku River. Three of the points were situated near the proposed ACB landing site.

Point count, aerial survey and incidental sighting data for waterfowl, marine birds and shorebirds collected during these surveys were discussed in the Waterfowl, Marine Birds and Shorebird Use Assessments section above.

Nesting Bird surveys were conducted using the methods described in the *Sea to Sky Highway Improvement Songbird Nesting Protocols*, a survey protocol used in The Sea to Sky Highway Project in British Columbia (MOT 2007), and accepted by the Canada Wildlife Service (CWS) (A. Robinson, pers. comm. 2007). Currently, CWS is developing a protocol for ensuring that nesting birds are not disturbed as required under the Migratory Bird Convention Act and the BC Wildlife Act. Surveys were conducted in the morning by walking transects within and adjacent to the area of interest searching for birds and active bird nests of songbirds, raptors and waterfowl. Roads were traversed along the centerline and within approximately 25 m either side. Areas were

searched around potential nest trees and within shrubby areas from a variety of vantage points and over variable distances.

3.4.3 Results

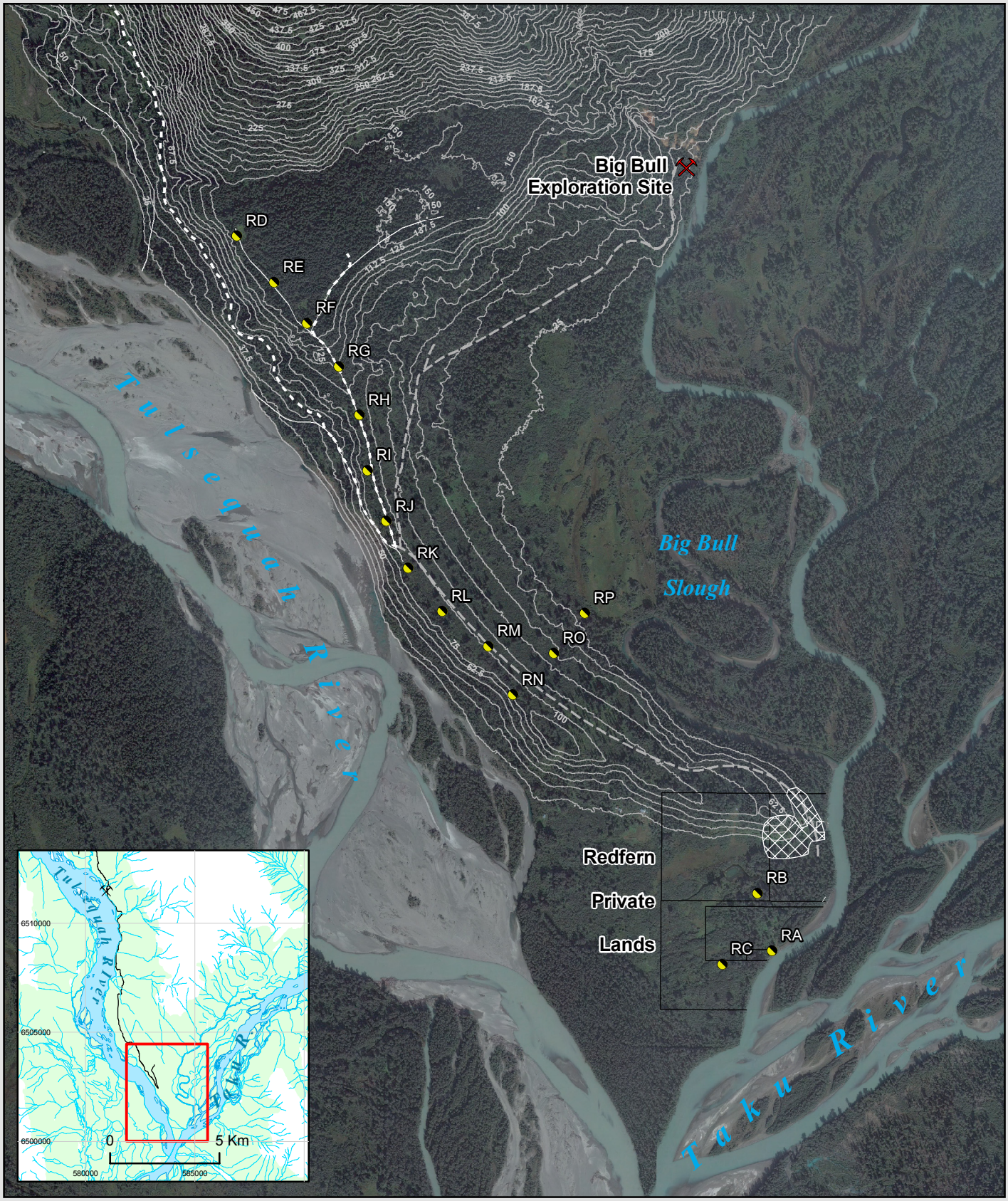
Breeding bird point count surveys were conducted on June 16th and 17th, 2007. A total 26 bird species were recorded, with 105 individual birds counted during the 16 point count station sessions (see Figure 8 and Table 7). Four species were also counted as fly-overs during the point counts, and are considered as incidental sightings. Five of the point count locations occurred in floodplain forests, while the remaining point count locations are in upland forested areas consisting of either coniferous forest dominated by western hemlock and Sitka spruce or dense thickets of Sitka alder, red-osier dogwood and devil's club. A total of 16 bird species occurred in the floodplain point counts, while the upland forest point counts also recorded 16 species (although only some species observed were the same in both areas). No species of concern were recorded in any of the point counts.

Breeding bird surveys conducted on the west side of the Tulsequah River, resulted in observations of additional species to those found on the east side; and it is likely that these species are also breeding in similar habitats on the east side (see Appendix B). Barn swallow, which is a Blue-listed species (BC CDC 2007), was observed at Canarc camp and was the only listed species found in the Tulsequah Valley during the field sessions.

Nesting bird surveys were conducted daily from June 22nd to June 25th, 2007 within and adjacent to the proposed camp and laydown area in DL5687 and DL6302 near the Taku River. Surveys were also conducted daily on July 10th and 11th, 2007 along approximately 250 m of the proposed MX road within the private land parcel DL6302 near the Taku River.

During the surveys conducted in the proposed camp and laydown area, a small number of nests were identified as belonging to thrushes, robins, sapsuckers and likely warblers. None of the nests were found to be active, with no evidence of eggs, brooding or young in the nests. No nests were observed along the proposed MX road. Raptor and waterfowl nests were not observed in the proposed camp and laydown area or along the proposed road. Based on the nesting survey methods and results showing no active nests, the due diligence requirements regarding the Migratory Bird Convention Act and the BC Wildlife Act were met and vegetation clearing occurred at the proposed camp, laydown area and MX road in late June and early July.

During habitat assessments conducted along the proposed access road to the ACB landing site on June 25th, a red-tailed hawk nest was found near the proposed road alignment. A GPS location was taken of the nest site and it was observed to contain one young un-fledged chick, which had started to grow flight feathers on the wings. The nest was located approximately 20 m high in a western hemlock that was approximately 27 m tall and had a diameter at breast height of approximately 1.3 m. The location of this nest is provided in Figure 4.



Map Sources/Notes:
Basedata TRIM (1:20,000)
Exploration road alignment (cartographic representation by Gartner Lee Limited), Wardrop Engineering
Mine layout, Wardrop Engineering
Quickbird Imagery (2003) Copyright 2007 DigitalGlobe Incorporated
All other data, Gartner Lee Limited

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File Name: 72615_Figure_8_Survey_Locations.mxd
Reviewed By: LT
Prepared By: JW
Date Issued: October 2007
Project Number: 72615

Legend

- Point Count Stations
- Nest Survey Areas
- Exploration Road (Existing)
- Exploration Road (In Development)
- Existing Trail or Road
- Contour - (12.5m intervals)

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Tulsequah Chief Mine Project

Breeding and Nesting Bird Survey Locations

09 October 2007

Gartner Lee

Figure 8
Version 1

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Table 7. Summary of bird species identified in the Tulsequah Chief project area.

Species	Point Count Station																
	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	Tot
Alder Flycatcher																1	**1**
American Redstart	1	1															**2**
American Robin	2		2											2	1	2	**9**
Blackpoll Warbler					1			1									**2**
Blue Grouse				1	2				1	1			1				**6**
Canada Goose																2	**2**
Chestnut-backed Chickadee					1							1					**2**
Fox Sparrow		2															**2**
Hairy Woodpecker												1					**1**
Hermit Thrush								1						1			**2**
McGillivray's Warbler				1							1						**2**
Northern Flycatcher												1					**1**
Orange-crowned Warbler	1		1														**2**
Red-breasted Sapsucker	1	1						1								1	**4**
Red-eyed Vireo	1														1		**2**
Ruby-crowned Kinglet	1	1							1	1		1		1	1		**7**
Ruffed Grouse										1							**1**
Swainson's Thrush	1	1	2	1	1	1	1	3	1	1				2	1	1	**17**
Townsend's Warbler							1										**1**
Varied Thrush							1	1	1	1		2					**6**
Warbling Vireo	2		1												1	1	**5**
Western Tanager		1						1									**2**
Western Wood Pewee																1	**1**
Wilson's Snipe																	**1**
Yellow Warbler	1	3	3					1	1	3		1		1		3	**17**
Yellow-rumped Warbler								1	1	2			1	1	1		**7**
Total Individuals	**11**	**10**	**9**	**3**	**5**	**1**	**3**	**10**	**6**	**10**	**1**	**7**	**2**	**8**	**5**	**12**	**105**
Total Species	**9**	**7**	**5**	**3**	**4**	**1**	**3**	**8**	**6**	**7**	**1**	**6**	**2**	**6**	**5**	**7**	**26**
Flyovers during Point Count																	
Bald Eagle											1		1			1	**3**
Canada Goose								1			1						**2**
Mallard																5	**5**
Tree Swallow										1						4	**5**
Total Individuals	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**1**	**0**	**0**	**10**	**15**
Total Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**1**	**0**	**0**	**3**	**4**

3.5 Spring Amphibian Use Assessments

3.5.1 Objectives

The objectives of the amphibian assessments were as follows:

1) to conduct terrestrial and aquatic surveys in order to determine the species of amphibians present and identify any critical habitats needed for amphibians, and
2) to obtain habitat use data on amphibians that are using the area to determine potential breeding areas in the spring.

3.5.2 Methods

Visual encounter surveys (VES) were used to assess amphibian habitat and use along the proposed ACB access road alignment, barge landing and slough area. Field assessments were conducted following those outlined in *Inventory Methods for Plethodontid Salamanders Vers. 2* (RIC 1999b) and *Inventory Methods for Pond Breeding Amphibians and Painted Turtle Ver. 2* (RIC 1998b). In general, surveys involved walking along the edge of the wetted portion of aquatic environments (ponds, backchannels and flooded areas) searching for egg masses, tadpoles, and adult amphibians. Terrestrial searches were conducted along the proposed ACB access road alignment and barge landing area and consisted of searching through forest ground litter and turning over large pieces of coarse woody debris and boulders to search underneath for adults.

A list of potential species occurring in the area was developed from the literature (Corkran and Thoms 1996) and includes western toad (*Bufo boreas*), wood frog (*Rana sylvatica*), Columbia spotted Frog (*Rana luteiventris*) and long-toed salamander (*Ambystoma macrodactylum*). Voucher photographs and descriptions of all observed amphibian species were collected for verification of species identification. A hand-held GPS (Garmin 12 and GPSMAP 76) was used to record the waypoints of any animal seen. Habitat type for each point was assessed and recorded.

3.5.3 Results

Amphibian assessments were completed on the east side of the Tulsequah River at a reconnaissance level on May 24th and 25th, 2007, with detailed assessments conducted on June16th and 17th, 2007. The locations of the detailed amphibian assessments are provided in Figure 9.

During the assessments, an adult western toad was observed southwest of the proposed ACB landing site in May 2007 and another adult was found along Maple Ridge near the proposed ACB access road alignment in June. Several adults were also observed on the western side of the Tulsequah River near Canarc camp and within Flannigan's Slough. No breeding sites for western toad were observed during any of the field assessments, despite an extensive search effort with experienced amphibian surveyors. Many of the lowland floodplain forests on the Taku and

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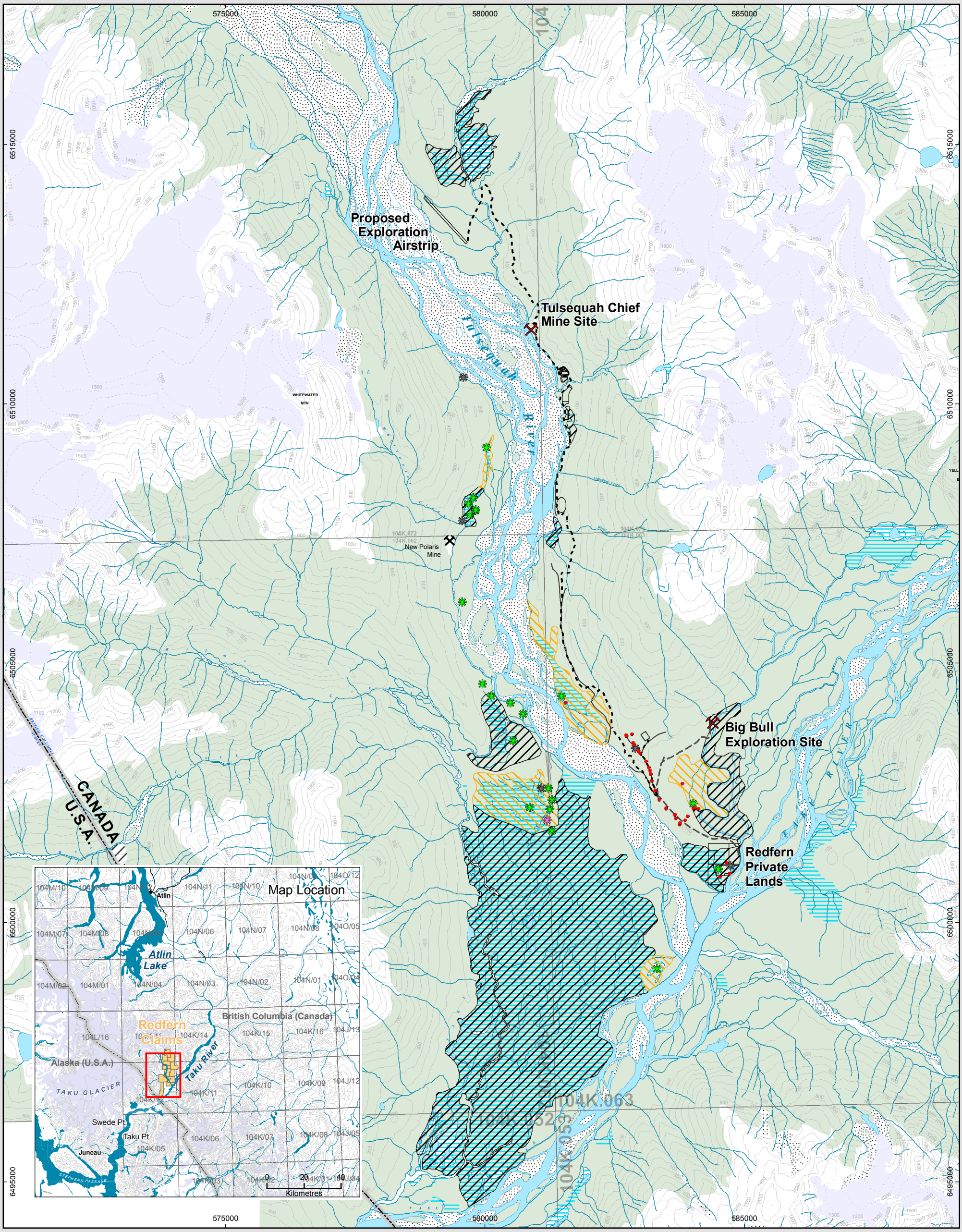

Map Sources/Notes:
Basedata TRIM (1:20,000)
Exploration road alignment, Wardop Engineering
Mine layout, Wardrop Engineering
Quickbird Imagery (2003) Copyright 2007 DigitalGlobe Incorporated
All other data, Gartner Lee Limited

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Legend

- Amphibian Survey Sites
- Western Toad
- Columbia Spotted Frog
- Unknown Frog/Toad
- Assumed Amphibian Breeding Areas
- Known Amphibian Breeding Areas
- Exploration Road (Existing)
- Exploration Road (In Development)
- Contour (Index 100m)
- Contour (Index - Indefinite 100m)
- Existing Trail or Road
- Swamp / Marsh
- Sandbar
- Glacier

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Tulsequah Chief /Big Bull Exploration Project

Amphibian Survey and Observation Locations

09 October, 2007

Gartner Lee

Figure 9
Version 1

File Name:	72615_Figure_9_Amphibians.mxd		
Reviewed By:	LT	Prepared By:	JW
Date Issued:	October 2007	Project Number:	72615

Tulsequah Rivers experienced high water events in early to late June and mid-July, which hampered search efforts and likely limited successful breeding in floodplain areas to periods immediately following high water events. Based on the locations of adult western toads, it is likely that breeding occurs within shallow, backchannel floodplain areas in Big Bull Slough and Flannigan's Slough and along similar backchannel habitats on the Taku and Tulsequah Rivers that do not contain fish. Adult and juvenile Columbia spotted frogs were identified in Big Bull Slough and the wetland complex located along the east side of the Tulsequah River about 4.5 km upstream from the confluence with the Taku River.

Based on the results of the amphibian surveys and incidental sightings a number of wetland areas were designated as 'Known' breeding areas, and a number of other areas were considered 'Assumed' breeding areas. The locations of the amphibian observations and delineated amphibian breeding areas are provided in Figure 9.

3.6 Terrestrial Ecosystem and Soils Mapping

3.6.1 Objectives

The objectives of the Terrestrial Ecosystem Mapping were as follows:

1) to provide 1:10,000 scale detailed mapping of terrain, ecosystems and soils within the proposed infrastructure development areas (tailings pond, waste rock dumps, limestone quarry, airstrip and associated roads) to help in the development of ecosystem and soils reclamation planning and soils handling plans.

3.6.2 Methods

The methods used for the Terrestrial Ecosystem and Soils Mapping followed standardized methods, which included air-photo interpretation and ground assessments of a minimum of 26% of the mapped polygons. The standards for terrain assessment followed (Howes and Kenk 1997), while the ecosystem mapping followed *Standard for Terrestrial Ecosystems Mapping in British Columbia* (RIC 1998a), and the soils mapping followed the *Field Manual for Describing Terrestrial Ecosystems* (MOELP & MOF 1998). Ecosystems were described based on information in Banner *et al.* (1993) and the descriptions outlined in Marcoux (1997) and Fuller (2002) from the previous TEM. Additional details on the ecosystem mapping methods used can be found in the report *Tulsequah Chief Mine - Terrestrial Ecosystem Mapping Expanded Legend Report* located in Appendix A.

3.6.3 Results

The terrestrial ecosystems and soils found in the project study area are quite typical of those found in northern coastal forested areas and in large river floodplains elsewhere in BC and Alaska. Cold air drainage influences the floodplain ecosystems, and the water fluctuations associated with

outburst floods from the Tulsequah Glacier dominate the vegetation of the floodplain, causing vegetation complexes to shift and modify on a regular basis. The ecosystem mapping results can be found in the report *Tulsequah Chief Mine - Terrestrial Ecosystem Mapping Expanded Legend Report* located in Appendix A.

3.7 Bear Habitat and Habitat Use Assessments

3.7.1 Objectives

The objectives of the bear habitat and habitat use assessments were as follows:

1) to identify high value bear habitats within the lower Taku River along the proposed ACB route to aid in routing of the ACB during operations, and
2) to complete a ground-based bear habitat and habitat use assessment (bear patch assessments) along the proposed road from the mine to the proposed ACB landing site to aid in road alignment to avoid those habitats.

3.7.2 Methods

High value grizzly bear habitats were identified through a review of the existing 1:50,000 habitat suitability mapping and models completed by Wellwood (2003b), along with a review of the 1:50,000 TEM completed by Marcoux (1997) and Fuller (2002). High value grizzly habitats for the spring, summer and fall were identified using the GIS query ([High_fdp] <= 2 or [High_fds] <= 2 or [High_fdf] <= 2), which selected all map polygons that had a value of 1 or 2 (High or Moderately-High) for any of the ecosystems in the polygon for any of the seasons of interest. High value grizzly bear habitats were also identified and mapped during aerial surveys conducted in the spring, especially in Alaska where air-photos and satellite imagery were not available early in the assessment process. When the Quickbird satellite imagery became available during the summer of 2007, this imagery was reviewed as well, to identify potential high value sites in Alaska. Areas identified as high value grizzly bear habitats included those ecosystems that had been identified by Wellwood and Murphy (2002) as containing high amounts of high value bear forage in the area, such as wetlands, rich-wet forests and floodplain ecosystems.

During the completion of the 1:10,000 TEM mapping for the Tulsequah infrastructure areas and when reviewing the proposed location of the ACB access road, air-photos and ortho-photos were reviewed to identify and delineate any high value habitats that were smaller than those identified in the 1:50,000 mapping.

The high value habitats identified using the above methods were then delineated using ArcView GIS to provide a comprehensive coverage of high value grizzly bear habitats to use in the field patch habitat assessment conducted in May and June 2007. High value grizzly habitat areas identified within approximately 100 m either side of the proposed ACB access road were investigated to determine if the habitat contained grizzly bear forage values and evidence of bear

use. Habitat assessment plots were completed similar to those conducted for the TEM field assessments, with GIF forms and Wildlife Assessment forms completed to record the vegetation species cover, habitat suitability and habitat use observed. Grizzly bear habitat use and suitability information were also obtained at all of the TEM plot locations completed for the 1:10,000 TEM undertaken for the proposed infrastructure areas and this information was helpful in providing input into the Mines Act Application.

3.7.3 Results

Approximately 9,700 ha of high value grizzly bear habitat were identified from the 1:50,000 mapping within approximately 1 kilometre of the proposed ACB transportation route and the infrastructure associated with the Tulsequah Chief mine in BC. This habitat was primarily located in the floodplain and lower elevation upland forests of the Taku and Tulsequah Rivers and Shazah Creek, and included large polygons containing limited vegetation such as gravel bars and river. The area identified as high value grizzly bear habitat from the 1:50,000 mapping is shown in Figure 10.

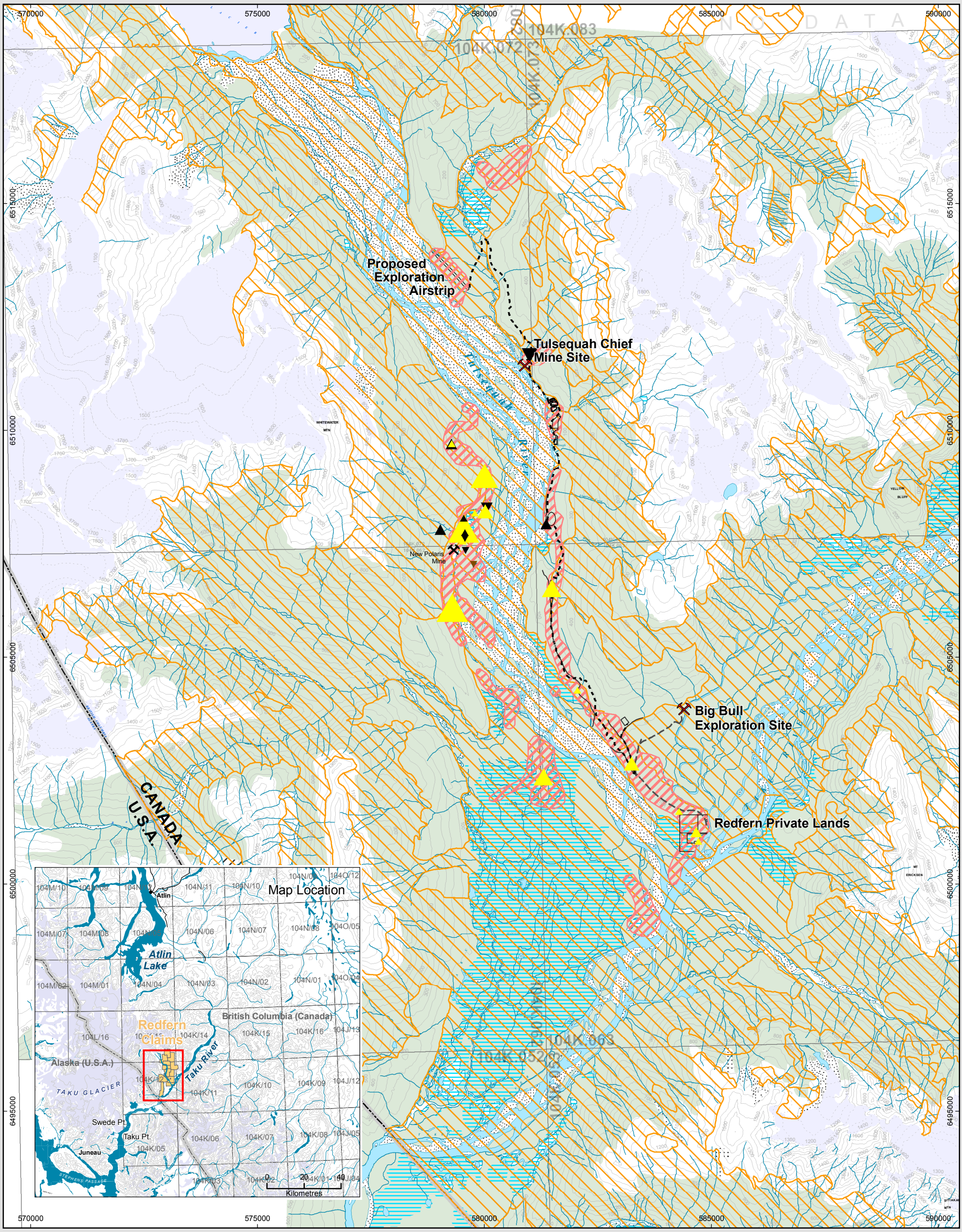
In Alaska, approximately 12,200 ha of high value grizzly bear habitat were identified during the aerial surveys and in a review of the Quickbird satellite imagery (see Figure 11). The majority (approximately 70%) of this habitat was floodplain cottonwood stands and wetland habitats within and adjacent to the Taku River, with the remaining being the upland herbaceous and sedge habitats associated with the tidal mudflats in Taku Inlet.

In the review of the air-photos for the 1:10,000 TEM, and to determine potential high value grizzly habitats along the proposed road to the ACB landing site, a number of polygons were identified as likely high value sites. These included portions of the previously identified 1:50,000 mapped areas; especially wetlands and shrubby habitats associated with the Taku and Tulsequah River floodplains (see Figure 12). Approximately 410 ha of high value grizzly bear habitat was identified near the proposed ACB landing site and associated road from the limestone quarry for review during the field assessments.

Ground transects to assess bear habitat suitability and spring bear use were conducted May 24th to 26th, 2007 on the east side of the Tulsequah River. Approximately 9600 m of transects were completed at the proposed tailings area and air strip at Shazah Creek, the proposed waste rock facility at Roger's Creek and the proposed ACB landing and access road from the landing site to approximately the end of Maple Ridge. Snow levels ranged from bare ground at the ACB landing site to ~ 0.75 m with some bare ground at Shazah Creek. No vegetation plots were completed during this session due to the lack of vegetation and snow although dominant shrub types were noted.

Some evidence of bear use was found during the May assessments, with three black bears noted at the Tulsequah camp and several scat and beds of unidentified bears noted near the proposed barge landing site and along the proposed access road (see Figure 10). Additional sightings of

S:\GIS_Pdata\Redfern\MXD\October07\72615_Figure_10_Bear_Habitat.mxd



Map Sources/Notes:
Basedata TRIM (1:20,000)
Exploration road alignment, Wardop Engineering
Mine layout, Wardrop Engineering
Quickbird Imagery (2003) Copyright 2007 DigitalGlobe Incorporated
All other data, Gartner Lee Limited

N
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S

0 1 2 4
Kilometres

1:80,000
UTM Zone 8N, NAD 83

Legend

- 1 Grizzly Bear (Animal Observed)
- 1 Black Bear (Sign Observed)
- 2 Black Bear (Sign Observed)
- 1 Black Bear (Animal Observed)
- 2 Black Bear (Animal Observed)
- 3 Black Bear (Animal Observed)
- 1 Unknown Bear (Sign Observed)
- 2 Unknown Bear (Sign Observed)
- 3 Unknown Bear (Sign Observed)
- 4 Unknown Bear (Sign Observed)
- 6 Unknown Bear (Sign Observed)
- 8 Unknown Bear (Sign Observed)
- 12 Unknown Bear (Sign Observed)
- Exploration Road (Existing)
- Exploration Road (In Development)
- High Value Grizzly and Black Bear Habitats
- Ground Based Survey Areas
- Contour (Index 100m)
- Contour (Index - Indefinite 100m)
- Existing Trail or Road
- Swamp / Marsh
- Sandbar
- Glacier

File Name: 72615_Figure_10_Bear_Habitat.mxd
Reviewed By: LT
Prepared By: JW
Date Issued: October 2007
Project Number: 72615

Redfern Resources Ltd.

Tulsequah Chief /Big Bull Exploration Project

Bear Data Collected During 2007 Field Sessions

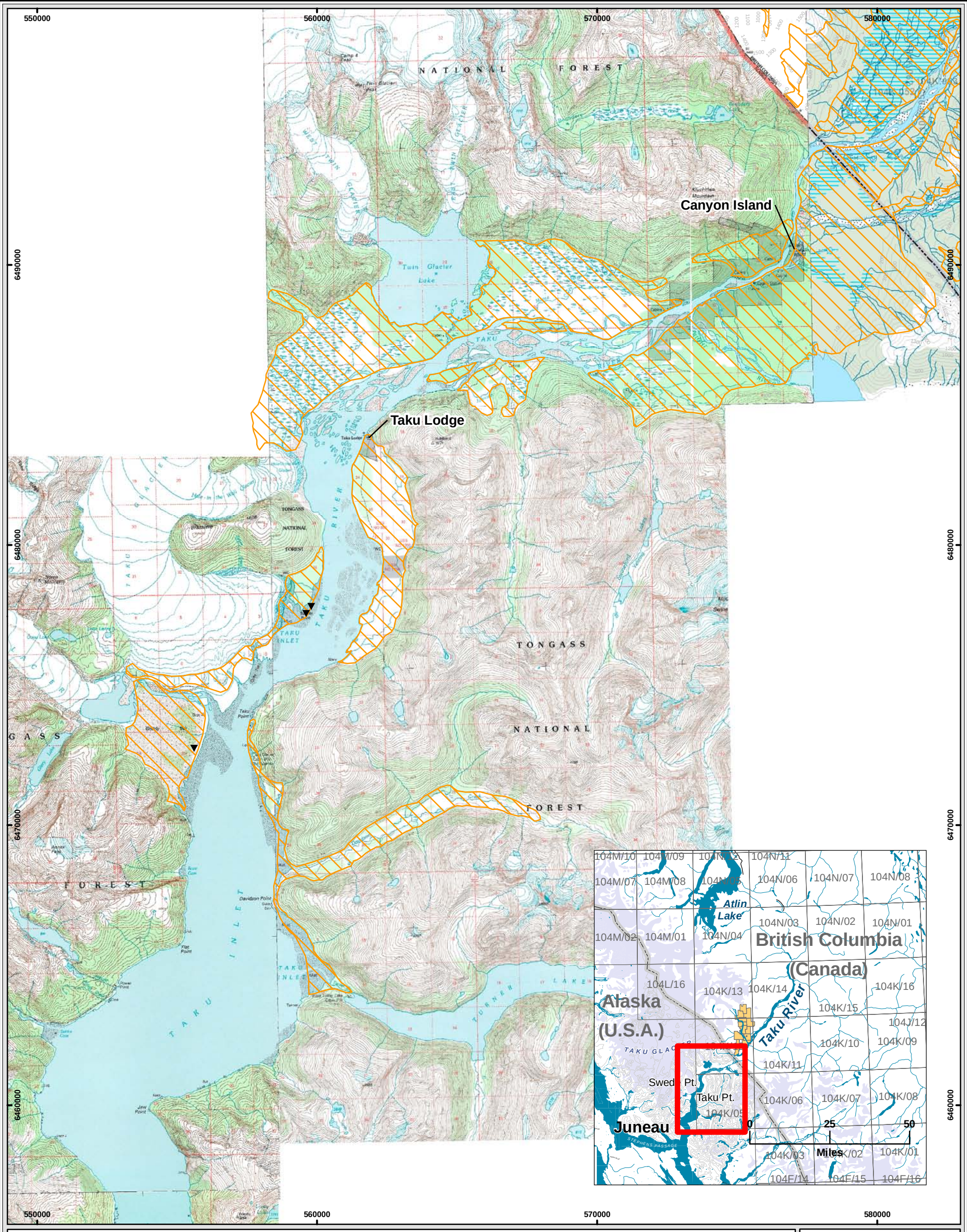
Incidental Sightings

09 October, 2007

Gartner Lee

Figure 10
Version 1

File Location: S:\GIS_Pdata\Redfern\MXD\October07\72615_Figure_11_Bear_Habitat_US.mxd



Map Sources/Notes:
- Topographic Images derived from Digital Raster Graphic (DRG) Images produced by the USGS
- Aquatic Resources information digitized from hand-drawn sketches

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Miles

1:135,000
UTM Zone 8N, NAD 83

File Name: 72615_Figure_11_Bear_Habitat_US.mxd
Reviewed By: LT
Date Issued: September 2007
Prepared By: JW
Project Number: 72615

Legend

- 1 Black Bear (Animal Observed)
- High Value Grizzly and Black Bear Habitats
- Swamp / Marsh
- Sandbar
- Glacier

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Tulsequah Chief/Big Bull Exploration Project

Bear Data Collected During the 2007 Field Sessions

Incidental Sightings

09 October 2007

Gartner Lee

Figure 11
Version 1

S:\GIS_Pdata\Redfern\MXD\October07\72615_Figure_12_Bear_Assesment.mxd

Map Sources/Notes:
Basedata TRIM (1:20,000)
Exploration road alignment, Wardop Engineering
Mine layout, Wardrop Engineering
Quickbird Imagery (2003) Copyright 2007 DigitalGlobe Incorporated
All other data, Gartner Lee Limited

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Kilometres

1:50,000
UTM Zone 8N, NAD 83

Legend

1-1 Plot Number
Habitat Field Notes Taken
Wildlife Habitat Assesment Completed
June Transects
May Transects
High Value Grizzly Bear Habitats (from air-photo interpretation)

Exploration Road (Existing)
Exploration Road (In Development)
Contour (Index 100m)
Contour (Index - Indeficite 100m)
Existing Trail or Road
Swamp / Marsh
Sandbar
Glacier

File Name: 72615_Figure_12_Bear_Assesment.mxd
Reviewed By: LT
Prepared By: JW
Date Issued: October 2007
Project Number: 72615

Redfern Resources Ltd.

Tulsequah Chief /Big Bull Exploration Project

High Value Grizzly Bear Habitats and Assessment Areas

09 October, 2007

Gartner Lee

Figure 12
Version 1

black bear and grizzly bear sign were noted during ground assessment work on the west side of the Tulsequah River on May 22nd and May 23rd, 2007; indicating that bears were active in the valley at this time even though vegetation growth was limited due to deep snow levels. During aerial surveys in the lower Taku River on May 25th three black bears were observed feeding in sedge habitats above the Taku Inlet tideflats but no grizzly bears were observed (see Figure 11).

The ground assessments conducted in June were completed between June 23rd and June 30th, 2007, with approximately 11,700 m of transects completed during this session. Approximately 8,800 m of transects were completed in the vicinity of the 12,650 m of proposed access road from the limestone quarry to the ACB landing site. A total of six ground inspection forms and wildlife habitat assessment (WHA) cards were completed in this area as well as numerous field notes. Additional vegetation plot forms and WHA forms were completed during the TEM field assessments in late June and that information was also used (see Figure 12 and Appendix C). During the ground assessments, sign of both black bear and grizzly bear were noted, with feeding occurring on a variety of herbaceous species such as sedges, lady fern and skunk cabbage. Most of the sign was associated with herbaceous sites rather than shrubby sites, likely due to the spring feeding habits of bears, when they commonly forage on herbaceous plants. Numerous fresh scat and tracks were noted along several portions of the old road right-of-way that was used to access the previously logged areas; it is likely being used as a travel route and feeding area due to the abundance of available forage along it.

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