

Tulsequah Chief Mine Wildlife Monitoring Program (DRAFT)



Prepared for
Redfern Resources

Submitted by
Gartner Lee Limited

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1. Introduction

The Tulsequah Chief Mine Project is located on the Tulsequah River in northwestern British Columbia (BC), approximately 10 km north of the confluence of the Tulsequah and Taku Rivers. Currently the Mine has a valid Project Approval Certificate, issued under the British Columbia Environmental Assessment Act, from 1998 and subsequently re-issued in 2002. It has also received a positive screening pursuant to the Canadian Environmental Assessment Act, and a Special Use Permit from the Province of British Columbia for the construction and operation of a limited access, all-season road from Atlin BC to the Tulsequah Chief Minesite. Recently, Redfern Resources Limited (Redfern) identified that year-round use of Air Cushion Barges (ACBs) on the Taku River represents a technically, financially and environmentally preferable option for shipment of mine supplies and mineral concentrate to and from the Tulsequah Chief Mine.

In August 2007, an assessment of the potential environmental effects associated with the ACB transportation option was presented in the document *Tulsequah Chief Mine ACB Transportation System Volume 2: Supporting Information for the BC Project Approval Certificate Amendment and The Alaska Coastal Zone Consistency Review* (GLL, 2007). In February 2008, an additional document was produced outlining additional detailed assessments of the potential effects of the proposed ACB transportation system on wildlife and wildlife habitat (GLL, 2008). These assessments reviewed the potential environmental effects related to year-round use of the ACB transportation system, which includes the ACB as well as the associated tug and amphitrac towing vessels; the ACB access road, which extends from the end of the previously reviewed road (the limestone quarry south of the Tulsequah Chief Mine) to the ACB landing site; and the ACB landing site.

As part of the permitting process for the new transportation option, a new Wildlife Management Plan for the protection of wildlife and wildlife habitat values is being developed for the Tulsequah Chief Mine. Previously, in 2004, an Adaptive Management Plan for the protection of wildlife and wildlife habitats was developed for the Tulsequah Chief Mine by AXYS Environmental Consulting Ltd. (AXYS, 2004); at this time Redfern was proposing to build the access road to Atlin, requiring the Plan to focus on the access road and its effects. The new Plan builds upon the AXYS document, with the addition of the effects from the ACB transportation option rather than the access road to Atlin. It will also provide more detailed prescriptions, guidelines and strategies to deal with the construction and operations of the Tulsequah Chief Mine and the associated infrastructure.

The determination of project effects and the impact that those effects will have on the surrounding environment is a difficult and imperfect process (BC EAO, 2003). As a result, it is important to set up effective monitoring programs and incorporate monitoring results into wildlife management in order to ensure project effects do not exceed predicted impacts. The Wildlife Management Plan will be based on adaptive management principles and will consist of two major components: Wildlife Mitigation Policies and Procedures that guide construction and operations activities and a Wildlife Monitoring Program that ensures the effectiveness of the Mitigation Policies and Procedures.

This document outlines the various components of the Wildlife Monitoring Program, as well as the process by which the results of the Wildlife Monitoring Program will be incorporated into the overarching Wildlife Management Plan and used to guide the Wildlife Mitigation Policies and Procedures.

1.1 Objectives

The purpose of the Wildlife Monitoring Program is to ensure the Wildlife Mitigation Policies and Procedures are effectively minimizing effects of the Tulsequah Chief Mine, the ACB transportation systems and all associated infrastructure on wildlife and wildlife habitats within the Project Area. This document outlines each of the components of the Wildlife Monitoring Program.

1.2 Scope

The scope of the Wildlife Monitoring Program is based on the scope of the overarching Wildlife Management Plan and is detailed in the following sections.

1.2.1 Study Area

The study area for the Wildlife Management Plan is based on the study area used for the Tulsequah Chief Mine ACB Transportation System, which includes the lower Tulsequah and Taku Rivers and the Taku Inlet (see Figure 1). It includes the Tulsequah Chief mine, the ACB route, and associated project roads and infrastructure. The resulting area encompasses approximately 40,000 ha in BC and approximately 56,000 ha in Alaska.

In BC the study area is located in the Coast Mountains Ecoprovince and the Boundary Ranges Ecoregion (Demarchi, 1995). Based on information obtained through various terrestrial ecosystem mapping projects conducted in the area, three BEC subzones occur in the study area: Coastal Western Hemlock wet maritime (CWHwm), Mountain Hemlock moist maritime leeward variant (MHmm2) and Alpine Tundra (AT) (Banner *et al.*, 1993). Property terrain can generally be described as large floodplain within steep, rugged mountains. Based on TRIM data, elevation ranges from approximately 0 to 1500 meters above sea level. In Alaska, the study area extends from the US/Canada border downstream on the Taku River to Duke Point and across to Scow Cove in Taku Inlet. This area includes the lower mainstem of the Taku River and the mudflats found where the Taku River enters Taku Inlet.

1.2.2 Species and Habitats

The Wildlife Management Plan, while covering the broad range of species occurring within the study area, focuses on species of interest that were identified during the environmental assessment process. Species of interest, for which specific mitigation measures and monitoring programs were developed, include: black and grizzly bear, wolf, moose, fisher, harbour seal and other marine mammals, bald eagle, trumpeter swan and western toad.

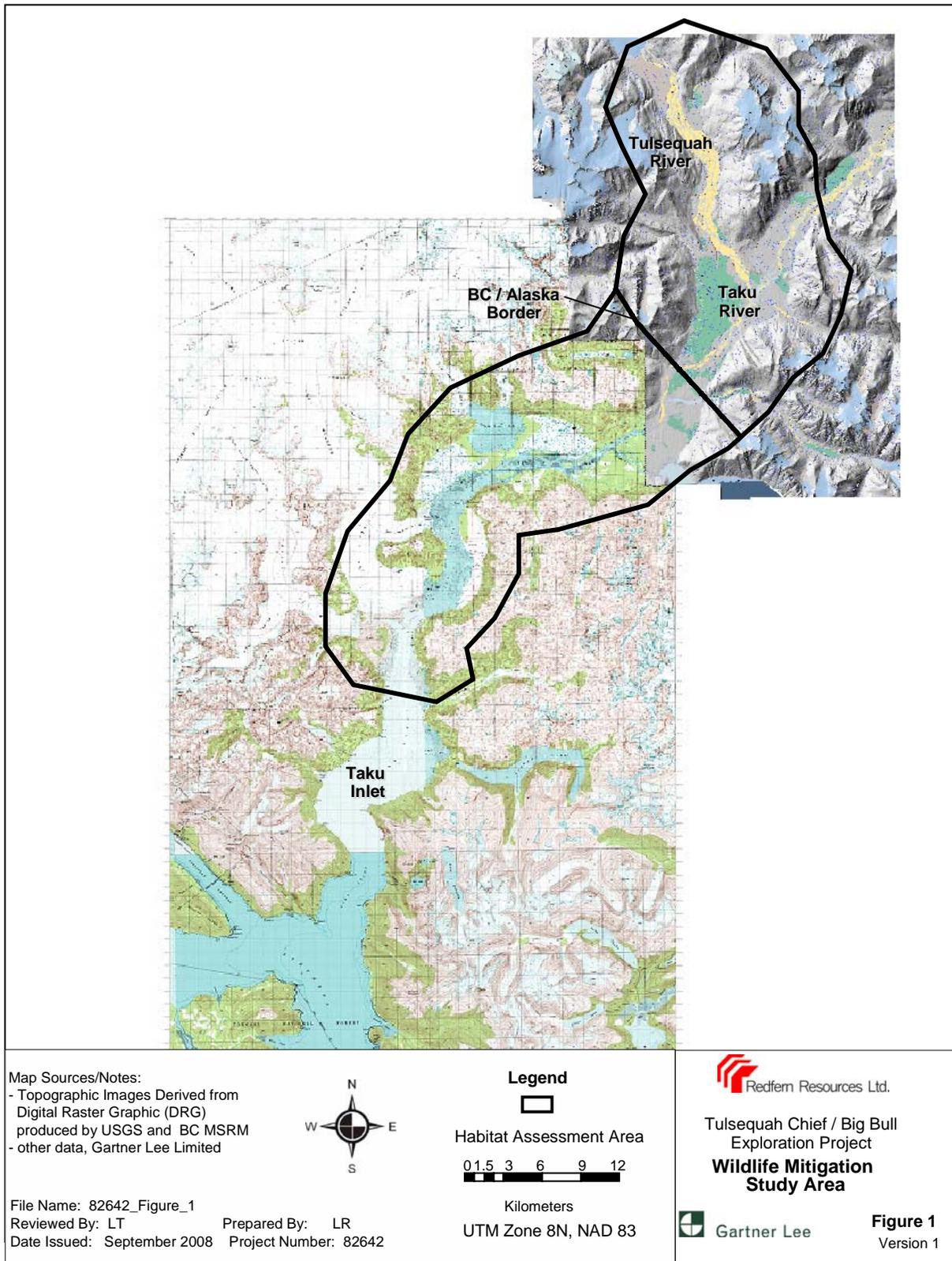


Figure 1. Tulsequah Chief Mine Wildlife Management Plan Area

2. Implementation of the Wildlife Management Plan

As previously outlined in Section 1, the Wildlife Management Plan will be based on adaptive management principles, consisting of two major components: Wildlife Mitigation Policies and Procedures, and a Wildlife Monitoring Program. The term adaptive management refers to a dynamic process by which management strategies are continually modified as additional information becomes available (Dunster and Dunster, 1996). Within the Tulsequah Chief Wildlife Management Plan, the Wildlife Monitoring Program studies will attempt to identify project effects on wildlife throughout the projects' life, particularly, any areas in which the Wildlife Mitigation Policies and Procedures are proving less effective than predicted, or where unexpected project effects are occurring. Additionally, monitoring studies will attempt to reduce current uncertainties surrounding local wildlife populations. The information obtained through these studies will then be used to review and, if necessary, modify the Wildlife Mitigation Policies and Procedures in order to better protect wildlife and wildlife habitats in the vicinity of the project. The Wildlife Management Plan is therefore not a static document but will continually evolve based on the results of future data collection as well as input from government, First Nations and members of the public. Figure 2 provides a schematic of the general structure of the Wildlife Management Plan and the role of the Wildlife Monitoring Program within this plan.

In order to facilitate the adaptive management process, regular reporting on the results of the Wildlife Monitoring Program and review of those results will be required. The following sections outline considerations for each of these processes.

2.1 Reporting

Regular reporting and analysis of the results of wildlife monitoring is a necessary component of the adaptive management process. The reporting process will include:

- Periodic reporting on the results of the Wildlife Monitoring Program by the monitors – may be annual, semi-annual, etc;
- The reporting should involve a detailed report of all of monitoring surveys which occurred during the monitoring period, the results of these surveys and an analysis of these results, including, a comparison to project thresholds and indicators, and where applicable, a comparison of the monitoring results to pre-mine conditions.

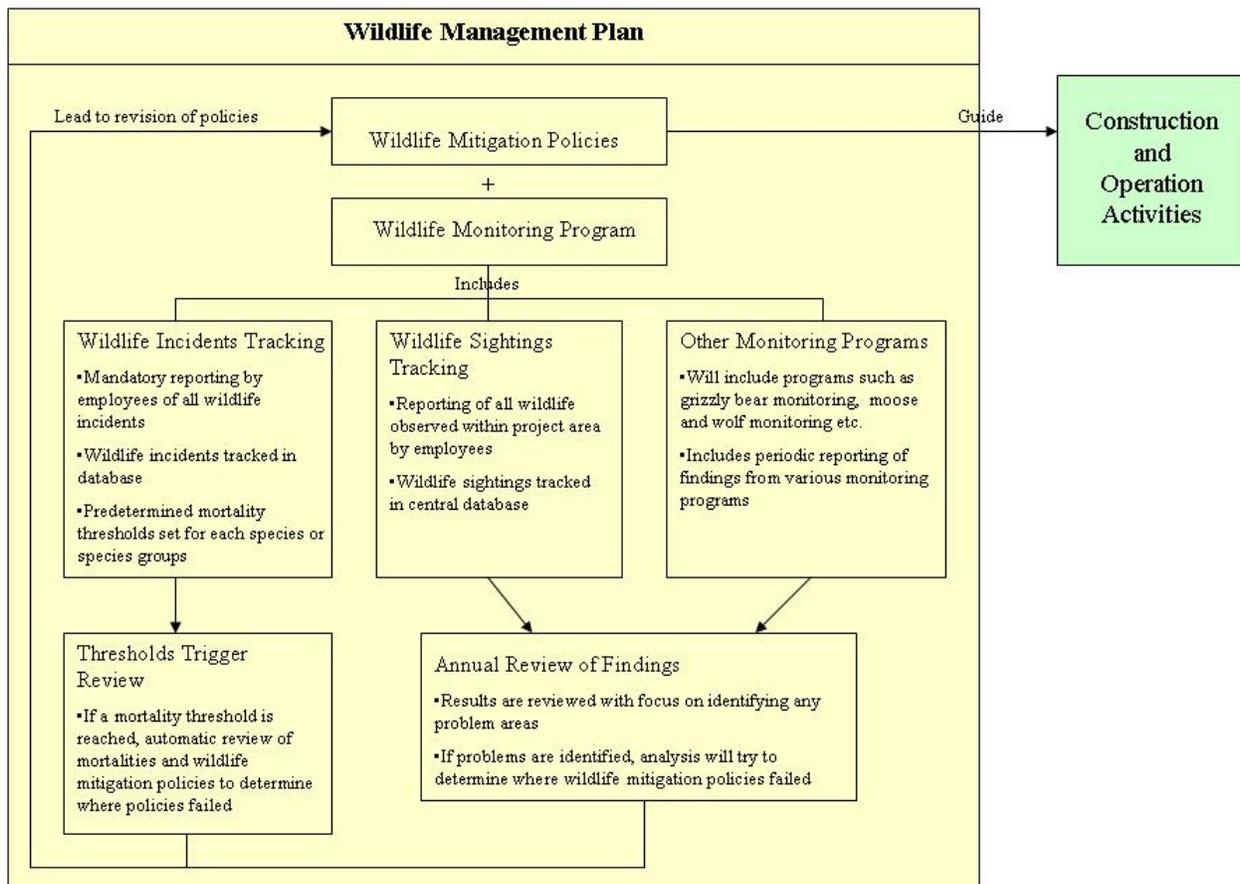


Figure 2. Adaptive Management Structure of the Wildlife Management Plan

2.2 Review and Revision

As a final step in the adaptive management process, monitoring results will need to be periodically reviewed and assessed to determine whether mitigation policies are having the expected results and are minimizing project effects. If review determines that project effects are exceeding expected impacts, revision of mitigation processes may be required. Revision of monitoring programs may also be required if mitigation processes are changed or if the review process finds the current monitoring activities are insufficient in determining project effects. This review and revision process will include:

- Establishment of thresholds within the various monitoring programs;
- Periodic review of monitoring reports by biologists, government regulators and Redfern representatives which will look at individual and collective results of monitoring programs to determine whether any thresholds have been crossed or whether monitoring results indicate a problem;
- If thresholds are crossed or if monitoring programs detect a significant impact to a particular species or group of species, mitigation measures relating to the species and

project activities involved will be reviewed and revised to correct the problem and minimize project effect;

- Additionally, if at any time, those involved in the monitoring process notice that a project threshold has been crossed, they should immediately bring it to the attention of the appropriate persons. This should trigger a review of the threshold and revision in mitigation measures.

2.2.1 Environmental Advisory Committee

To facilitate the evaluation of the monitoring results and the revision of Wildlife Mitigation Policies and Procedures it is recommended that an Environmental Advisory Committee be established. Under the previous *Adaptive Management Plan for the Tulsequah Chief Main Project*, Redfern, the BC EAO and BC WLAP collectively agreed on the formation of such a committee (AXYS, 2004). The following description is adapted from this document.

The Environmental Advisory Committee, at a minimum, should consist of representatives from Redfern, the BC Government, the Alaskan Government and the TRTFN. The Committee may play an advisory role in a wide range of environmental issues related to the Tulsequah Chief Project, however, the primary objective of the Committee would be the ongoing evaluation of the Wildlife Management Plan. Some preliminary tasks of the Committee may include:

- The development of a terms of reference that clearly defines general roles and responsibilities of the Committee as related to the Wildlife Management Plan and the Tulsequah Chief Project;
- The establishment of project thresholds and/or indicators for monitoring the effectiveness of the Wildlife Management Plan;
- The establishment of a reporting schedule and protocol for Redfern that would involve periodic summaries of monitoring findings and reporting on unforeseen issues related to project construction and operations; and
- The development of a decision-making process for agreeing on, and implementing, modifications to the Wildlife Management Plan, possibly including the development of an appeal or mediation process, in the event of an impasse within the Committee.

3. Components of the Tulsequah Chief Wildlife Monitoring Program Tulsequah Chief Project by Area

The Wildlife Monitoring Program is made up of several studies aimed at reducing current uncertainties surrounding local wildlife populations and the effect of the Tulsequah Chief Project on those species, and identifying any areas in which the Wildlife Mitigation Policies and Procedures are proving less effective than predicted, or where unexpected project effects are occurring. These studies have been developed based on the results of the detailed effects assessment presented in the document *Tulsequah Chief Mine*

ACB Transportation System, Effects Assessment for Wildlife and Ecosystems (Gartner Lee Limited, 2008), a review of the previous permitting requirements and on discussions with regulators during the permitting process for the ACB transportation option.

3.1 British Columbia

3.1.1 Wildlife Incidents and Observations

Redfern will implement a reporting and tracking process for wildlife observations and wildlife incidents; where a wildlife incident is defined as an interaction between an animal and human or human property where either (1) the animal is harmed, (2) the person is harmed, (3) the person is threatened, or (4) significant property damage occurs. These records should be reviewed periodically and, if necessary, additional measures should be taken to prevent further incidents. The monitoring program should appear similar to the following:

Purpose

- To assist in monitoring local wildlife populations and aid in identifying potential problems or areas of conflict between wildlife and project components (e.g., vehicles, humans etc).

Focal Species

- Wildlife Observations – species tracked should include grizzly bear, black bear, grey wolf, fisher, moose, mountain goat, trumpeter swan, western toad, and bird species at risk.
- Wildlife Incidents – all wildlife incidents should be tracked.

Measurable Indicators

- Number of wildlife observations – analyzed by species, area, time of year, etc.
- Number of wildlife incidents – analyzed by species, location, time of year etc.

Proposed Study Design

Survey Methods

- Incident forms and a wildlife log will be made available to staff; examples of each are provided in Appendix A.
- Documentation of wildlife observations and incidents will be conducted year-round by project staff.
- Reporting and documentation of all wildlife incidents will be mandatory for all project employees.
- As a component of the wildlife observation reporting, the ACB or pilot vessel will have a designated individual watching for and recording wildlife as well as their response to the barge traffic.

Data Analysis and Reporting

- One or more employees will be designated to collect incident forms and enter data from incident forms and the wildlife log into a tracking system (e.g., database, spreadsheet etc).
- In the case of wildlife incidents, the designated employee/employees will ensure that the appropriate government agencies are contacted when required (e.g., when wildlife or person is injured).
- An annual review of the wildlife incident and wildlife observation records will be conducted; as a component of this review, the data will be analyzed for issues or potential problems such as seasonal concentration areas or sections of road along which there is a high incidence of collisions or near miss occurrences. A summary report of the review findings will be produced following this analysis.

Adaptive Management Process

- Maximum thresholds for the number of wildlife incidents have been set based on species and in some cases based on project areas or project components. These thresholds are provided in Appendix B.
- At any time a wildlife incident threshold is crossed, an immediate review of the incident(s) will occur to determine the cause of the incident(s) and if appropriate, to implement measures to prevent further incidents.
- Additionally, during the annual review of wildlife incident and wildlife observation records, mitigation strategies will be reassessed to identify any potential problems and if necessary, changes will be made to the wildlife mitigation strategies to combat potential problems (e.g., increase signage and/or post lower speed limits along potentially problematic sections of road; provide site-specific warnings etc).

3.1.2 Project Effects to Moose

During the detailed project effects assessment for the ACB transportation option, several potential effects to local moose populations were identified as requiring monitoring to ensure that effects were minimized. These project effects include: 1) potential habitat loss as a result of the ACB development, 2) possible habitat fragmentation, particularly the effect of snow banks along the ACB route and project roads on moose movements in the winter, but also impacts to moose movements in other seasons 3) potential impacts to moose/wolf interactions with the potential for increased moose mortalities in relation to project roads and the ACB route, particularly in the winter. Monitoring programs designed to meet each of these objectives will likely overlap significantly, thus all monitoring relating to moose will be addressed in a single section.

Purpose

- To assist in monitoring local moose populations and ensure that project effects do not lead to a significant increase in habitat loss, habitat fragmentation or predator effectiveness.

Focal Species

- Moose
- Grey Wolves

Measurable Indicators

- Seasonal habitat use by moose within the study area.
- Movement patterns of moose within the study area.
- Movement patterns of wolves within the study area.
- Number and location of moose kill sites.

Proposed Study Design

Survey Methods

- Moose and wolf monitoring will be conducted through a combination of survey methods:
 1. Aerial-based counts at the regional scale to look at population levels and seasonal habitat use. These surveys will be conducted every two years in early March and will consist of an aerial survey of the project area, the Tulsequah River floodplain and the Taku River/Inlet from the US/Canada border to Yellow Bluff. The survey will focus on documenting observations of moose and wolves or their sign within the survey area.
 2. Ground-based habitat use studies to monitor winter habitat use, and movements by moose and wolves along the ACB route and project roads. The ground-based surveys will include sign transects conducted via snowmobile approximately every six weeks throughout the winter. Whenever possible, surveys should be timed to occur when tracking conditions are most suitable, ideally with two to three days of a significant (at least 5-10 cm) snowfall. In addition to recording the species, number and location of wildlife sign encountered along the transects, the surveys should also document snow depths and crusts encountered along the transects. Alternately, this monitoring may be conducted via an aerial survey every six weeks.
 3. Reporting and tracking of moose kills by wolves; this may be done as a component of the Wildlife Incidents and Observations monitoring program.
- Both aerial and ground-based surveys should be conducted as per Resource Inventory Committee (RIC) standards.

Data Analysis and Reporting

- Analysis of survey results will be conducted every spring with the focus on determining whether there has been a significant change in seasonal habitat use or movements by either moose or wolves and whether the number of moose mortalities resulting from wolf predation has significantly increased. A summary report documenting the findings will be produced following analysis.

Adaptive Management Process

- Review of the surveys results will occur annually. Should the monitoring results indicate that a significant increase in habitat loss, habitat fragmentation or predator effectiveness is occurring, review and revision of applicable mitigation measures will occur to ensure that project effects are minimized.

3.1.3 Grizzly Bear Habitat Use

To ensure that project effects on grizzly bear are minimized and to monitor the long-term project effect on grizzly bears, a grizzly bear monitoring program has been developed. This program is based on work previously conducted in the area and focuses on monitoring project-related changes in bear movements and seasonal habitat use throughout the project area.

Purpose

- To ensure that project effects on grizzly bear habitat use and movement, particularly through indirect habitat loss and habitat fragmentation, are minimized.

Focal Species

- Grizzly Bears

Measurable Indicators

- Seasonal habitat use by grizzly bears within a designated study area.
- Movement patterns by grizzly bears within a designated study area.

Proposed Study Design

Survey Methods

- Grizzly bear monitoring will be conducted through the use of tracking surveys and will be based on the baseline studies conducted in the area by Hatler (2000). The tracking surveys will consist of Time-constrained Searches and Transects carried out at the previously established surveys sites within three of the sub-areas designated by Hatler – sub-areas B (Tulsequah), C (Lower Taku) and D (Middle Taku). Additional sites will also be established along the Alaskan section of the Taku River.
- Survey methodology will follow Hatler, 2000 – surveys will collect information including the species of bear, track size, any indication of other bears travelling with the individual (eg. family groups), the relative age of the track, and direction of travel.
- Surveys will be carried out every two years during the month of September.

Data Analysis and Reporting

- Analysis of survey results will be conducted following completion of the surveys and a summary report documenting the findings will be produced. The focus of the analysis will

be on determining whether there has been a significant change in seasonal habitat use or movements patterns of grizzly bears in the area.

Adaptive Management Process

- Following completion of the summary report, a review of the surveys results will be conducted to determine whether any revision of applicable mitigation measures is necessary to ensure that project effects on grizzly bears are minimized.

3.1.4 Trumpeter Swan Nesting

During the EA review period, concerns were expressed by the US Fish and Wildlife Service and the TRTFN on the effect of the ACB transportation system on nesting trumpeter swans in the area. The detailed effects assessment conducted by Gartner Lee Ltd determined that the area with the potential for the most significant project impact to nesting swans was along the ACB road. To ensure that project activities do not have a detrimental effect on swan reproduction, Redfern will monitor swan nesting along the ACB road.

Purpose

- To assist in monitoring trumpeter swan use of habitats adjacent to the ACB road and ensure project effects to these areas area minimized.

Focal Species

- Trumpeter swans

Measurable Indicators

- Number of breeding pairs nesting along the road corridor.
- Habitats used by breeding pairs.

Proposed Study Design

Survey Methods

- Breeding surveys will be conducted annually within suitable habitats along the road corridor. These should be conducted as per RIC standards and will likely involve ground-based surveys of potential habitats. If habitats allow, surveys can be conducted via observation stations (i.e. observations made from a viewpoint overlooking the area); alternatively ground transects or aerial surveys of the habitats may be conducted.
- Two surveys should be conducted every year, one early in the breeding season to document the presence of any breeding pairs within the area and a second later in the summer to document the presence of any young and determine whether nesting was successful.

Data Analysis and Reporting

- Analysis of survey results and creation of a summary report will be conducted every fall. This report will outline whether nesting occurred in habitats along the road corridor and will attempt to determine whether there is any significant change in the number of breeding pairs or in habitat use by breeding pairs nesting in habitats along the road corridor.

Adaptive Management Process

- Following completion of the summary report, a review of the surveys results will be conducted to determine whether any revision of applicable mitigation measures is necessary to ensure that project effects on nesting trumpeter swans are minimized.

3.1.5 Amphibians

An amphibian monitoring program is recommended that would monitor the project effects on breeding amphibians, particularly western toad, which is a species of Special Concern under COSEWIC (BC CDC 2008). This program may focus on specific areas where project components are expected to have the most effect on breeding amphibians. These areas include (but are not limited to) the ACB landing and laydown area, the south causeway, and along the ACB access road. Due to the limited information available on amphibian breeding sites during the approval phase of the project, the monitoring project would need to confirm the location of suspected breeding areas prior to commencement.

Purpose

- To assist in monitoring western toad use of habitats adjacent to the ACB road and ensure project effects to these areas area minimized.

Focal Species

- Western toad

Measurable Indicators

- Species using the study area.
- Number, location and extent of breeding areas.
- Relative abundance of breeding individuals.
- Movement of amphibians to and from breeding ponds.

Proposed Study Design

Survey Methods

- Breeding surveys will be conducted annually within suitable habitats along the road corridor. These should be conducted as per RIC standards and will involve ground-based surveys of potential habitats.
- Two surveys should be conducted every year, one early in the breeding season to document breeding habitats and migration corridors within the area and a second later in

the summer to document the presence of dispersing toadlets and determine breeding success.

Data Analysis and Reporting

- Analysis of survey results and creation of a summary report will be conducted every fall. This report will outline whether breeding migration occurred in habitats along the road corridor and will attempt to determine whether there is any significant change in habitat use by western toads along the road corridor.

Adaptive Management Process

- Following completion of the summary report, a review of the surveys results will be conducted to determine whether any revision of applicable mitigation measures is necessary to ensure that project effects on amphibians are minimized.

3.2 Alaska

3.2.1 Wildlife Incidents and Observations

Similar to the 2004 Adaptive Management Plan (AXYS, 2004), it is recommended Redfern develop a reporting and tracking process for wildlife observations and wildlife incidents; where a wildlife incident is defined as an interaction between an animal and human or human property where either (1) the animal is harmed, (2) the person is harmed, (3) the person is threatened, or (4) significant property damage occurs. These records should be reviewed periodically and, if necessary, additional measures should be taken to prevent further incidents. The monitoring program should appear similar to the following:

Purpose

- To assist in monitoring local wildlife populations and aid in identifying potential problems or areas of conflict between wildlife and project components (e.g., vehicles, humans etc).

Focal Species

- Wildlife Observations – species tracked should include grizzly bear, black bear, grey wolf, fisher, moose, mountain goat, trumpeter swan, western toad, bird species at risk, and marine mammals.
- Wildlife Incidents – all wildlife incidents should be tracked.

Number Measurable Indicators

- Number of wildlife observations – analyzed by species, area, time of year, etc.
- Number of wildlife incidents – analyzed by species, location, time of year etc.

Proposed Study Design

Survey Methods

- Incident forms and a wildlife log will be made available to staff; examples of each are provided in Appendix A.
- Documentation of wildlife observations and incidents will be conducted year-round by project staff.
- Reporting and documentation of all wildlife incidents will be mandatory for all project employees.
- As a component of the wildlife observation reporting, the ACB or pilot vessel will have a designated individual watching for and recording wildlife as well as their response to the barge traffic.

Data Analysis and Reporting

- One or more employees will be designated to collect incident forms and enter data from incident forms and the wildlife log into a tracking system (e.g., database, spreadsheet etc).
- In the case of wildlife incidents, the designated employee/employees will ensure that the appropriate government agencies are contacted when required (e.g., when wildlife or person is injured).
- An annual review of the wildlife incident and wildlife observation records will be conducted; as a component of this review, the data will be analyzed for issues or potential problems such as seasonal concentration areas. A summary report of the review findings will be produced following this analysis.

Adaptive Management Process

- Maximum thresholds for the number of wildlife incidents have been set based on species and in some cases based on project areas or project components. These thresholds are provided in Appendix B.
- At any time a wildlife incident threshold is crossed, an immediate review of the incident(s) will occur to determine the cause of the incident(s) and if appropriate, to implement measures to prevent further incidents.
- Additionally, during the annual review of wildlife incident and wildlife observation records, mitigation strategies will be reassessed to identify any potential problems and if necessary, changes will be made to the wildlife mitigation strategies to combat potential problems.

3.2.2 Project Effects to Moose

During the detailed project effects assessment for the ACB transportation option, several potential effects to local moose populations were identified as requiring monitoring to ensure that effects were minimized. These project effects include: 1) habitat loss as a result of the ACB development, 2) habitat fragmentation, particularly the effect of snow banks along the ACB route on moose movements in the winter, but also impacts to moose movements in other seasons 3) impacts to moose/wolf interactions and resulting moose mortalities in relation to the ACB route, particularly in the winter. Monitoring programs

designed to meet each of these objectives will likely overlap significantly, thus all monitoring relating to moose will be addressed in a single section.

Purpose

- To assist in monitoring local moose populations and ensure that project effects do not lead to a significant increase in habitat loss, habitat fragmentation or predator effectiveness.

Focal Species

- Moose
- Grey Wolves

Measurable Indicators

- Seasonal habitat use by moose within the study area.
- Movement patterns of moose within the study area.
- Movement patterns of wolves within the study area.
- Number and location of moose kill sites.

Proposed Study Design

Survey Methods

- Moose and wolf monitoring will be conducted through a combination of survey methods:
 1. Aerial-based counts at the regional scale to look at population levels and seasonal habitat use. These surveys will be conducted every two years in early March and will consist of an aerial survey of the project area, the Tulsequah River floodplain and the Taku River/Inlet from Swede Point to the US/Canada border. The survey will focus on documenting observations of moose and wolves or their sign within the survey area.
 2. Ground-based habitat use studies to monitor winter habitat use, and movements by moose and wolves along the ACB route. The ground-based surveys will include sign transects conducted via snowmobile approximately every six weeks throughout the winter. Whenever possible, surveys should be timed to occur when tracking conditions are most suitable, ideally with two to three days of a significant (at least 5-10 cm) snowfall. In addition to recording the species, number and location of wildlife sign encountered along the transects, the surveys should also document snow depths and crusts encountered along the transects. Alternately, this monitoring may be conducted via an aerial survey every six weeks.
 3. Reporting and tracking of moose kills by wolves; this may be done as a component of the Wildlife Incidents and Observations monitoring program.
- Both aerial and ground-based surveys should be conducted as using standards approved by the Alaska Department of Fish and Wildlife.

Data Analysis and Reporting

- Analysis of survey results will be conducted every spring with the focus on determining whether there has been a significant change in seasonal habitat use or movements by either moose or wolves and whether the number of moose mortalities resulting from wolf predation has significantly increased. A summary report documenting the findings will be produced following analysis.

Adaptive Management Process

- Review of the surveys results will occur annually. Should the monitoring results indicate that a significant increase in habitat loss, habitat fragmentation or predator effectiveness is occurring, review and revision of applicable mitigation measures will occur to ensure that project effects are minimized.

3.2.3 Grizzly Bear Habitat Use

To ensure that project effects on grizzly bear are minimized and to monitor the long-term project effect on grizzly bears, a grizzly bear monitoring program has been developed. This program is based on work previously conducted in the area and focuses on monitoring project-related changes in bear movements and seasonal habitat use throughout the project area.

Purpose

- To ensure that project effects on grizzly bear habitat use and movement, particularly through indirect habitat loss and habitat fragmentation, are minimized.

Focal Species

- Grizzly Bears

Measurable Indicators

- Seasonal habitat use by grizzly bears within a designated study area.
- Movement patterns by grizzly bears within a designated study area.

Proposed Study Design

Survey Methods

- Grizzly bear monitoring will be conducted through the use of tracking surveys and will be based on the baseline studies conducted in the area by Hatler (2000). The tracking surveys will consist of Time-constrained Searches and Transects carried out at the previously established surveys sites within BC and at additional sites which will be established along the Alaskan section of the Taku River from the BC/Alaska border to the mudflats. Additional sites will be selected based on the availability of suitable tracking

substrates with the objective of thorough and uniform coverage throughout the study area.

- Survey methodology will follow Hatler, 2000 – surveys will collect information including the species of bear, track size, any indication of other bears travelling with the individual (eg. family groups), the relative age of the track, and direction of travel.
- Surveys will be carried out every two years during the month of September.

Data Analysis and Reporting

- Analysis of survey results will be conducted following completion of the surveys and a summary report documenting the findings will be produced. The focus of the analysis will be on determining whether there has been a significant change in seasonal habitat use or movements patterns of grizzly bears in the area.

Adaptive Management Process

- Following completion of the summary report, a review of the surveys results will be conducted to determine whether any revision of applicable mitigation measures is necessary to ensure that project effects on grizzly bears are minimized.

3.2.4 Harbour Seal Habitat Use

To ensure that project effects on harbour seals are minimized and to monitor the long-term project effect on harbour seals, a harbour seal monitoring program has been developed. This program is based on initial baseline work conducted in the area and focuses on monitoring project-related changes in harbour seal use of the barge route and known seasonal haul-out areas in the lower Taku River area.

Purpose

- To ensure that project effects on harbour seal habitat use and haul-out areas are minimized.

Focal Species

- Harbour seals

Measurable Indicators

- Harbour seal use of haul-out areas within the lower Taku River.

Proposed Study Design

Survey Methods

- Harbour seal seasonal use of haul-out areas will be conducted through the use of aerial surveys that document the numbers of harbour seals using haul-out areas in the lower Taku River.

- Aerial surveys be conducted every three weeks during the first two years of operations, by counting and photographing for verification, the numbers of seals hauled out on ice or gravel bar areas.
- After the initial two survey years, additional surveys will be conducted every three years to monitor for any long-term changes in habitat use or populations. The information from these surveys will be compared to the regional population information to determine if any trends observed in Taku Inlet are different than those identified within the stock as a whole. For example, if declines are detected in Taku Inlet, they may reflect overall population declines rather than an effect due to barging.

Data Analysis and Reporting

- Analysis of survey results will be conducted following completion of the surveys and a summary report documenting the findings will be produced. The focus of the analysis will be on determining whether there has been a significant change in seasonal use of haul-out areas over time.

Adaptive Management Process

- Following completion of the summary report, a review of the surveys results will be conducted to determine whether any revision of applicable mitigation measures is necessary to ensure that project effects on harbour seals are minimized.

3.3 Required Permits and Opportunities for Cooperation

Several of the monitoring programs described above may require scientific research permits from the appropriate government agencies prior to the commencement of any fieldwork. The types of work requiring permits and the requirements for these permits will vary between BC and Alaska. Therefore, surveyors will need to contact the appropriate agencies prior to conducting any fieldwork and determine what permits will be required for the type of work they are doing and the area in which they will be working.

It should be noted that several of the monitoring programs provide opportunities for involvement by other interested parties such as the TRTFN or government agencies (e.g. grizzly bear tracking surveys or aerial surveys for moose). Such cooperation would minimize the costs to Redfern and allow for regulators and TRTFN to be involved with the project and ensure that the data collected will meet their requirements for monitoring.

4. Literature Cited

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Appendix A

Wildlife Log Form

Wildlife Risk/Incident Report Form

Wildlife Incident/Risk Report

If a staff member has an incident with wildlife (wildlife incident = an interaction between an animal and a human or human property where either (1) the animal is harmed, (2) the person is harmed, (3) the person is threatened, or (4) significant property damage occurs), they must complete this report immediately and bring it to the attention of the Supervisor, Project Manager.

Observer(s): _____
Supervisor / Manager: _____
Date / Time: _____

Incident Type (circle one): vehicle collision, near collision, physical encounter
other: _____
If vehicle was involved, circle vehicle type: barge, boat, truck, helicopter, all terrain

Incident Results (circle one): death, injury, defensive behaviour, no injury, other: _____

Describe Results: _____

Exact Location: _____

Habitat Description: _____

Species: _____ **Number:** _____

Sex: _____ **Age Class:** _____

Wildlife Activity: _____

Description of Incident: _____

Could the Incident Have Been Prevented? yes, no

If yes, how? _____

For office use only.

Incident Report Reviewed By: _____

Date Reviewed: _____

Does the Incident (In Isolation of Other Project Effects) Represent the Crossing of a Wildlife Incident or Mortality Threshold? yes, no

Note: if yes, incident should be immediately reported to the Environmental Advisory Committee.

Corrective Action Suggested: _____

Corrective Action Completed By: _____

Signature: _____

Date: _____

Copies of this report to: Resource Agency Supervisor/Manager Employee

Appendix B

Wildlife Mortality Thresholds

Wildlife Mortality Thresholds

As a component of the Wildlife Incident Tracking, wildlife mortality thresholds for the project were developed based on the findings of the *Effects Assessment for Wildlife and Ecosystems* (Gartner Lee Limited, 2008). As outlined in sections 2.2, 3.1.1 and 3.2.1 of this document, should any of the wildlife mortality thresholds be crossed, an immediate review of the incident(s) will be triggered. The review will look at the cause of the mortality and will re-evaluate the applicable mitigation measures to determine why and how they failed to prevent the mortality. Based on the results of the review, changes may be made to existing mitigation measures or new mitigation measures may be created to prevent further mortalities.

The species-specific mortality thresholds that will be used for the Tulsequah Chief Project include the following:

- Bear (both grizzly and black bears) – mortality threshold is zero. This means that any mortality of black or grizzly bears that is caused directly through the construction or operation of the Tulsequah Chief Project would trigger a review.
- Moose – mortality threshold is zero. As with the bears, any moose mortality directly relating to the Tulsequah Chief Project would trigger a review.
- Grey Wolf – mortality threshold is zero. Any mortality of grey wolves directly relating to the Tulsequah Chief Project would trigger a review.
- Fisher – mortality threshold is zero. Any fisher mortality directly relating to the Tulsequah Chief Project would trigger a review.
- Marine Mammals - mortality threshold is zero. Any mortality of marine mammals – including, but not limited to, harbour seals, sea lions and whales - directly relating to the Tulsequah Chief Project would trigger a review.
- Trumpeter Swan - mortality threshold is zero. Any mortality of trumpeter swans that is caused directly through the construction or operation of the Tulsequah Chief Project would trigger a review.
- Raptors - mortality threshold is zero. Any raptor mortality directly relating to the Tulsequah Chief Project would trigger a review.

In addition to the species-specific mortality thresholds, mortality threshold may also be set for certain areas or project components.

- Waterfowl and Shorebird Mortality relating to ACB Operation – mortality threshold is five per year. Should more than five individuals be killed through ACB operations in a year, a review would be triggered.