INTERIM REPORT ON
Tatshenshini/Alsek Land Use
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TATSHENSHINI/ALSEK LAND USE

INTERIM REPORT

OVERVIEW

On July 20, 1992 the British Columbia government referred the land use planning process for the Tatshenshini/Alsek area in northwest British Columbia to the Commission on Resources and Environment. The land use question has been brought into focus by the potential for conflict between a major mine development proposal at Windy Craggy Mountain and the high wilderness values in the region. The Commission has been asked to review and report publicly to Cabinet on the major options for land use in the area and on fair, open and balanced processes related to each.

Commission Mandate

The Commission’s mandate is set out in the Commissioner on Resources and Environment Act, passed by the British Columbia legislature on July 13, 1992. The Act requires:

1. The development, for public and government consideration, of a British Columbia-wide strategy for land use and related resource and environmental management;

2. The facilitation of the development and implementation, and monitoring of
   - regional planning processes to define the uses to which the areas of the province may be put,
   - community-based (local) participatory processes to consider land use and related resource and environmental management issues,
   - a dispute resolution system for land use and related resource and environmental issues;

3. Assurance of effective and integrated management of the resources and environment of the province by
   - facilitating the coordination of initiatives within the government, and
   - encouraging the participation of Aboriginal peoples.
In carrying out this mandate the Commission must give due consideration to economic, environmental, and societal interests; to local, provincial and federal government responsibilities; and to the interests of Aboriginal peoples.

The Commission has published a draft *Land Use Charter* and, during 1993, will complete and publish a comprehensive set of goals and policies to integrate resource and environmental management in the province. It will also make public recommendations to Cabinet on large-scale zoning of three major regions of the province (Vancouver Island, Cariboo-Chilcotin and Kootenay-Boundary regions), following intensive public consultation and multi-party, consensus-based negotiations. These regional land use plans will identify large-scale zones of protected, sensitive management, integrated resource management and intensive management areas. The Commission is also studying models for community-based participatory processes for resource and environmental management at the local level and, following a number of pilot projects, will report during 1993 on the most realistic options.

Considering the options and recommending processes for land use planning in the Tatshenshini/Alsek area fit into the Commission's mandate. The area is a candidate for protection under the province’s Protected Area Strategy, with a decision to have been made by 1995. This land use question must be distinguished from the permitting process under the Mine Development Assessment Process, in which the proponent of the Windy Craggy copper mine, Geddes Resources Ltd. (Geddes), was involved. Because of the uncertainty as to whether the Tatshenshini/Alsek area, in which Windy Craggy Mountain is situated, would be protected under the Protected Areas Strategy or would continue to be available for integrated resource management, including mining, Geddes was not willing to continue with its permit application until the land use question was settled.

In referring the land use question to the Commission on Resources and Environment, with the expectation that a decision would be made by Cabinet within approximately one year, the provincial government is shortening the period of uncertainty. If the land use decision is to protect the area from resource extraction, then the mine development permitting process will be cancelled and the issue of compensation to Geddes will have to be considered. If mining is determined to be an acceptable land use for the area, then the permitting process will continue to determine if the proposal can meet appropriate standards, in Canada and the U.S.

**Nature of Conflict**

The province is faced with a land use decision which is unlikely to be resolved through consensus negotiations. The most directly involved parties hold sharply opposing views as to what is appropriate and possible for the region. These include Geddes and the mining industry and mining employment sectors which believe that mining is a safe, compatible and economically responsible use; and conservation interests, which believe that resource extraction is incompatible with what they see as the extraordinary wilderness values of the area.

There is no permanent human settlement in the Tatshenshini/Alsek area. Apart from limited use of the area by people experiencing and studying the wilderness values, and those who have been involved in resource exploration, there is little human activity of any kind. The major human impact of the land use decision will therefore be felt outside of the area, and it is difficult to bring a purely local perspective to the question. This being said, it remains important that Geddes be treated fairly with respect to its local interest and that local environmental risks and economic benefits be considered carefully.
There is an important international dimension to the land use question in the Tatshenshini/Alsek area. Both the wilderness values and the high mineral potential give the area international significance. Also, the potential downstream, cross-border risks and benefits of the land use decision add a unique international aspect that will require close inter-jurisdictional cooperation among the U.S. and Canadian federal governments, as well as the British Columbia, Alaska and Yukon governments. In effect, U.S. jurisdictions hold a virtual veto on the mining proposal. There is an opportunity for creative, joint management and funding of protected areas as well as joint review processes for proposed development. As well, the international implications are of major significance given the concerted opposition to mine development in the area by a consortium of influential interest groups in the United States, together with broad-based Congressional and now Administration opposition. Given the extraordinary political pressure that this opposition will likely bring upon the Canadian and British Columbia governments, including the links to other projects and issues of common U.S.-Canadian concern and the withholding of cooperation on coordinating or combining regulatory processes reviewing the proposed Windy Craggy mine, the international context cannot be ignored.

Despite the local and international perspectives on this land use question, the options should be considered from a provincial focus. The decision must conform to the overall provincial land use strategy and contribute to the balance required to achieve broad social, economic and environmental sustainability set out in the draft Land Use Charter. This means that any adverse impacts of the decision must be balanced within the overall provincial plan. A decision must also treat significantly affected parties fairly by ensuring that their interests are not put at unreasonable risk or that, if rights are to be taken away in the general public interest, proper compensation is paid. The land use decisions for this area must also be made in a way that secures broad public support, which will be best achieved through public consultation and detailed public reporting on the reasons for the decisions made.

Finally, in view of the high degree of public interest and the high stakes for directly affected interests, it is important that the ultimate land use decision be taken by the provincial Cabinet, which is politically accountable. In this context, the role of the Commission on Resources and Environment is merely advisory.

**Geddes Resources Ltd.**

Geddes Resources Ltd., a Canadian-owned mineral exploration company, has identified a significant, world-class copper ore body at the peak of Windy Craggy Mountain. The company has carried out extensive exploration work since the early 1980’s and since 1988 has been working within the province’s Mine Development Review Process (recently renamed Mine Development Assessment Process). The company states that it has spent approximately $45 million in this exploration and regulatory work, and it now awaits the province’s land use decision as to whether mining is an appropriate activity in the area, before proceeding further.

**Report Preparation**

This report on the land use options and processes of the Tatshenshini/Alsek area is based on a number of studies and an analysis of the local, provincial and inter-jurisdictional issues.

The wilderness values are considered in light of recent studies which describe the natural and cultural
resources that together make up the area's wilderness qualities (Chapter 3). The wilderness setting contains the St. Elias mountain range, steep-walled valleys, alpine glaciers and remote rivers. For such a latitude, the area contains a rich diversity of flora and fauna in several ecoregions. The area is largely untouched by humans; there are no settlements, roads, or resource developments. The area is home to a variety of indigenous wildlife species including two on British Columbia's "Blue List" of endangered species: the grizzly bear and Dall's sheep. The area is bounded to the north by Canada's Kluane National Park, to the south by United States' Glacier Bay National Park and to the west by the Tongass National Forest in Alaska. On December 11, 1992 the United Nations formally designated Glacier Bay National Park as a World Heritage Site and invited Canada to nominate the Tatshenshini/Alsek area for similar consideration. Kluane National Park and Wrangell-St. Elias National Park, to the west of Kluane, are also World Heritage Sites.

As part of this report, a qualitative assessment of environmental risks associated with the proposed development of the Windy Craggy project was conducted (Chapter 5). This study indicated that the greatest potential risk to the environment presented by the proposed mine is a breach of the tailings dam and consequent release of toxic metals and acidity into the Tatshenshini/Alsek watersheds. The results of this exercise are best used to appreciate the nature of risks associated with the proposed development and to gain a relative sense of the potentially most serious occurrences and their possible consequences. They can be used to identify areas where further studies are needed to reduce risk or to eliminate inherently risky design options.

This report also considers the range of issues and interests that have or may be joined in the process of gaining approvals and permits for the proposed Windy Craggy mine. The conflict is defined and reviewed both in terms of the issues related directly to the development of the mine, and on the basis of the broader resource and land use allocations in the area (Chapter 2). The report also considers the various approval and permitting processes that potentially may be applied to the Windy Craggy project (Chapter 6). These include potential processes involving or required by the governments of British Columbia and Alaska, and by the federal governments of Canada and the United States. Different scenarios on the assessment of the mine are considered, including the roles that would be assumed by the regulatory authorities, the proponent and the interest groups; and a consideration of the time required to complete the assessment is included.

Preliminary economic data are also noted and considered (Chapter 4). These include the general economic projections by Geddes; and reports by the B.C. Ministry of Energy, Mines and Petroleum Resources on mineral surveys in the Tatshenshini/Alsek area, projected economic return from the Windy Craggy project based on experience with a composite of other projects with similar attributes, and world copper supply, demand and price projections.

Finally, the above preliminary data and studies have been analyzed to determine the major, realistic options for land use in the Tatshenshini/Alsek area (Chapter 7).

**Options**

This report considers three major options for land use in the Tatshenshini/Alsek area: wilderness protection, integrated use including mining, and delaying a land use decision. The positive and negative aspects of each option are considered, and the processes which would have to be followed before any option could be realized are set out. The principles of fairness, balance and public accountability discussed above are applied.
Wilderness Option

The wilderness option could have the positive effects of enhancing international cooperation in this and other transboundary situations; helping to complete the representativeness of the Protected Area Strategy network throughout the province; protecting habitats of rare and endangered species; creating the world’s largest wilderness preserve in combination with the adjacent preserves in Alaska and the Yukon; avoiding the long and costly, multi-jurisdictional regulatory processes; and, unlike a delay option, perhaps providing a degree of certainty to provincial mining interests through an early, definitive decision that could open the way for greater opportunities for mineral development in land use decisions elsewhere in the province. Negative consequences include the loss of potential economic benefit from mining in the Tatshenshini/Alsek area; the barring of effective access to significant tourism or recreational use of the area due to its remoteness; the raising of a compensation entitlement to Geddes; reducing the selection of protected areas elsewhere in the province; and potentially discouraging mining exploration elsewhere in the province.

If the wilderness option is chosen by the provincial government, then a number of processes should be completed, including: a fair and efficient process to ensure that Geddes is properly compensated for its losses; the timely completion of the provincial land use strategy, allocating protected areas and integrated resource management areas available for mining exploration and development; and the direct financial and regulatory involvement of Canadian and U.S. federal governments in the creation and management of the wilderness area.

Mining Option

The second major option is the division of the Tatshenshini/Alsek region into protected areas, integrated resource management areas and, perhaps, sensitive management areas. The positive elements of such an option include the increased access to the area and the corresponding tourism opportunities that could be accomplished through transportation links into integrated resource management areas; and the more limited protected area designation in this region in favour of protected areas with perhaps greater representative importance elsewhere in the province. Negatively, the major identified mineral values in the area are located in areas with a high wilderness value, and their exploitation appears to be incompatible with the preservation of wilderness.

If mining is determined to be an acceptable land use in the part of the Tatshenshini/Alsek area, positive effects could include potential economic benefits to the province; a feeling of confidence within the mining community that mining will continue to be an important part of the British Columbia economy; no compensation claims from Geddes; the opportunity to test multi-jurisdictional environmental impact assessment processes; and new technology spin-offs from the innovations needed to meet the environmental challenges of mining in these conditions. Negative aspects of the mining option would include the considerable public expense of mine development and environmental impact assessment processes; major U.S. and international opposition to the project and possible negative impact on other cross-border Canadian interests; loss of the wilderness option; and potential massive costs of correcting environmental damage resulting from a tailings impoundment failure or acid rock drainage from other sources, during the operation of the mine or in the decades following its abandonment.

If the mining option is chosen, then before the Windy Craggy mine or any other mine development could
proceed, multiple regulatory processes would have to be completed under British Columbian, Canadian, U.S. federal, Alaska State and Haines Borough laws. Every effort should be made to ensure that these are coordinated and, to the extent possible, combined in a single process to make the most efficient use of time and resources. Prior to these regulatory processes commencing, detailed economic viability studies should be required to indicate with greater certainty the potential private and public benefits and costs involved in this and similar projects in this area. Also, as with the wilderness option, it will be necessary to complete the provincial land use strategy, including the protected areas networks and integrated resource management areas, as soon as possible to ensure that economic benefits are not lost through uncertainty and that environmental options are not lost through development pending designation.

Delay Option

Under the delay option, a decision on land use in the Tatsheshnini/Alsek area would be delayed for a specified number of years, during which there would be a moratorium on development. The studies on which this report is based reveal a broad variety of major uncertainties with regard to the central issues surrounding potential land uses in the Tatsheshnini/Alsek area. Positive features of this option would be that decisions would be taken at a time when significantly more information was available with respect to the relative economic and wilderness values, environmental risks and technological challenges involved in mining in the area. Also, the representative protected areas network throughout the province would be in sharper focus, as would the potential for mine development elsewhere, and the Champagne-Aishihik First Nation land claim to much of the area would be clarified. All of these features could contribute to a wiser and more stable decision for current and future generations. Negative features include continuing uncertainty and potential disincentive to investment within the mining industry in British Columbia.

If the delay option is chosen, the decision should include a number of subsequent processes, including: a process for ensuring that Geddes is fairly compensated for its exploration costs and lost opportunities and possibly granted a right of first refusal or other opportunity to bid for a reactivated proposal if and when a land use decision that includes mining is made in the future; ongoing research into mineral potential, wilderness values, environmental risks and economic importance of different land use options for the region; and the completion of the provincial land use strategy and protected area designations.

As a general comment applying to all options, it must be remembered that the Champagne-Aishihik First Nation has filed a land claim over the Tatsheshnini/Alsek region. As such, any provincial land use decision will be subject to the settlement of that claim.

CONCLUSION

This report provides an initial review and analysis of the major factors to be considered by the Province of British Columbia in making the land use decision for the Tatsheshnini/Alsek area. It also recommends processes which should be completed prior to the full adoption of any particular option in order to ensure that the requirements of fairness, balance and public accountability are applied.

It is recommended that prior to deciding on an option and engaging the recommended processes, the provincial government provide an opportunity over the next six months for consultation and comment on this report, either through the Commission on Resources and Environment, or directly. Such
consultation should include public information forums in such centres as Terrace, Smithers, Prince George, and Vancouver; receiving detailed commentary from the parties identified as directly and significantly affected in this report; and further discussions with relevant government and non-government interests in the United States. There is a major opportunity in this decision-making process for international cooperation and linking with other land use issues, through whichever option is chosen.

Stephen Owen
Commissioner
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1 Introduction

On July 20, 1992, the government of British Columbia directed the Commission on Resources and Environment to develop a process for planning land use and resource allocation for the Tatshenshini/Alsek area in the northwest corner of the province. It is the purpose of this interim report to describe the available options, to organize the information needed to decide on an option, and to identify processes that may be useful to guide that decision.

A. Historical Background

The Tatshenshini/Alsek area is a wilderness of high mountains, massive glaciers, and wild rivers wedged between the Yukon Territory to the north and the Alaska Panhandle to the west and south. Roughly 12,000 square kilometres in size, the area is often referred to as the Haines Triangle, after the Alaskan community of Haines, the closest settlement. (See Map 1)

The area’s major river, the Tatshenshini, rises in British Columbia east of the Haines Highway, loops north through the Yukon Territory, then flows in a roughly southwesterly direction until it empties into the Alsek River about 12 kilometres east of the border with Alaska. The Alsek meanders across the Alaska Panhandle before emptying into Dry Bay on the Pacific Ocean.

The Tatshenshini/Alsek area has been relatively unused by humans in recent times. The only road in the area, apart from an abandoned mine access road, is the Haines Highway, originally built by the U.S. Army during the Second World War to link Haines with the Alaska Highway in the Yukon Territory. There are no settlements along the Haines Highway. The Tatshenshini River was used until the early part of the twentieth century by the Tlingit and Tutchone peoples as a trading route between settlements on the coast and upriver communities. The Champagne-Aishihik First Nation, who now live in the Yukon, are descendants of these peoples. Only in the last few years has there been a significant non-Aboriginal presence in the Tatshenshini/Alsek area, mainly in the form of summertime river-rafting expeditions.

In the 1950s, the area became potentially significant to the mining industry. In the early days of helicopter surveys, it was noticed that some creeks were stained red by iron and copper ores. One of these creeks was Tats Creek, a tributary of the Tatshenshini River which flowed from the vicinity of Windy Craggy Mountain. After drill tests in the 1980s confirmed that the mountain contained an unusually large copper ore deposit, Geddes Resources Limited filed a prospectus in 1988 with the Mine Development Review Process (since renamed the Mine Development Assessment Process) administered by the Ministry of Energy, Mines and Petroleum Resources.
The proposal called for an open-pit mine at the peak of Windy Craggy Mountain, with the ore concentrate being trucked to Haines, where it would be loaded onto freighters to be transported to Japan for processing. Access to the proposed mine would be provided by construction of a road, approximately 100 kilometres long, that would bridge the Tatshenshini River and provide a link to the Haines Highway. The estimated extraction rate of 20,000 tonnes of ore per day would make Windy Craggy one of the largest mining operations in the world.

Once the magnitude of the proposed operation became known, concerns about the proposal began to be raised by groups in Canada and the United States. They expressed concern about the potential impact on the wilderness rivers, on wildlife species such as the grizzly bear and Dall’s sheep, and on the habitat of salmon which spawn in the Tatshenshini/Alsek system and sustain commercial fisheries on the Alaska coast. There were two primary causes of concern. First, construction of the road and mine would have a direct impact on the wilderness character of the area. Second, the high sulphide content of the copper ore deposit in Windy Craggy Mountain raised fears that the proposed mining operation would leach acidity and toxic metals into the river systems. This concern about “acid rock drainage” was increased by the fact that the area is the most seismically active zone in Canada. If an earthquake were to result in a breach of the tailings pond dam, acid-generating waste could be released in large quantities.

The resulting campaign to protect the Tatshenshini/Alsek area from mining development and to preserve it as wilderness led to the formation in 1989 of a coalition of groups calling itself Tatshenshini Wild. The following year, a broader coalition appeared under the name Tatshenshini International.

In January 1990, Geddes Resources submitted to the Mine Development Review Process its Stage I report, including an environmental and socioeconomic impact assessment of all components of the project situated in Canada. The review process steering committee referred the report for comment by interested parties, including government agencies in British Columbia, the Yukon, Canada, Alaska and the United States, as well as Aboriginal and public-interest groups.

A preliminary review by government agencies of the Stage I submission identified the need for Geddes Resources to address concerns about the potential for acid rock drainage and to provide acceptable plans for its prevention. Of particular concern was the company’s plan to store acid-generating waste rock on glaciers and its proposal to manage acid release by blending acid-generating with acid-consuming waste rock.

A revised plan submitted by Geddes Resources in November 1990 contained provisions to minimize the risk of acid-rock drainage by developing part of the mine underground and by constructing a large dam to hold acid-generating waste rock under more than 12 feet of water in a tailings pond. The dam would be designed to withstand the effects of landslides, avalanches and earthquakes. In addition, the impact of truck traffic would be reduced by a revised plan to transport ore concentrate to Haines by a slurry pipeline rather than by road.

On approval, the revised plan would ordinarily have been followed by an application for a mine development certificate.
Meanwhile, opposition to the project remained strong and was being carried into political forums. In April 1992, a joint resolution was introduced to committees of the U.S. Senate and House of Representatives, calling on the Interior Secretary “to enter into agreements with Canada to protect the Alsek and Tatshenshini Rivers [and] to ensure that Glacier Bay National Park and Preserve is not degraded by potential mine developments in Canada, and for other purposes.” As the year progressed, the extent of public interest in the issue was reflected by numerous articles published in, or planned for, magazines such as Equinox, Life, Audubon, Sierra and National Geographic.

The stakes in the conflict continued to rise after the government referred the land use issue to the Commission on Resources and Environment in July 1992. Geological mapping by the Ministry of Energy, Mines and Petroleum Resources, based on field surveys conducted in the summer of 1992, indicated a belt of ore-rich rock about seven kilometres wide, extending south from the vicinity of Windy Craggy Mountain. A preliminary assessment concluded that the belt contained several copper ore deposits of a similar magnitude to that discovered at Windy Craggy. As the yearly production of a mine at Windy Craggy is expected to be in the order of 130,000 metric tonnes of pure copper — more than 1 per cent of worldwide production — the potential value of the recently discovered deposits, if they can be made accessible, is substantial.

In December 1992, the World Heritage Committee of UNESCO named Glacier Bay National Park a World Heritage Site — a designation intended to recognize “outstanding universal value to mankind”. Glacier Bay National Park borders the Tatshenshini/Alsek area to the south and west and contains within its borders the lower Alsek River, into which the Tatshenshini flows a few miles east of the international border. As a signer of the World Heritage Convention, Canada is obliged “not to take any deliberate measures which might damage directly or indirectly the cultural and natural heritage” of the Site. In making its announcement, the World Heritage Committee invited Canada to apply for a similar designation for the Tatshenshini/Alsek area, which now borders three World Heritage Sites: Kluane National Park, Wrangell-St. Elias National Park, and Glacier Bay National Park.

B. Mandate of the Commission on Resources and Environment

The Commission on Resources and Environment was established in January 1992 to advise government regarding the development of a land use planning and management strategy for the province.

The Commission on Resources and Environment Act describes the Commissioner’s duties. The following are some of the provisions of the Act that are relevant to the Commission’s role in advising Cabinet and the public regarding land use in the Tatshenshini/Alsek area:

3(1) The Commissioner shall advise the Executive Council in an independent manner on land use and related resource and environmental issues in British Columbia and on the need for legislation, policies and practices respecting these issues.

1 Reproduced in full on page 109
4(1) The Commissioner shall develop for public and government consideration a British Columbia wide strategy for land use and related resource and environment management.

4(2) The Commissioner shall facilitate the development and implementation, and shall monitor the operation, of

(a) regional planning processes to define the uses to which areas of British Columbia may be put,

(b) community based participatory processes to consider land use and related resource and environmental management issues, and

(c) a dispute resolution system for land use and related resource and environmental issues in British Columbia.

4(3) The commissioner shall work to ensure effective and integrated management of the resource and environment of British Columbia by

(a) facilitating the coordination of initiatives within the government, and

(b) encouraging the participation of Aboriginal people in all processes affecting Aboriginal peoples that relate to the commissioner’s mandate and by maintaining strong links with negotiations on Aboriginal treaties.

During 1992, the Commission drafted and published principles for province-wide land-use planning in the draft Land Use Charter\(^2\) included in its “Report on a Land Use Strategy for British Columbia”. Regional land-use planning processes based on these principles, with participation by all interested parties, were initiated in three regions of the province: Vancouver Island, Cariboo-Chilcotin, and Kootenay-Boundary. The nature of the Commission’s mandate requires that the process recommended by the Commission for deciding land use in the Tatshenshini/Alsek area be consistent with and integrally related to province-wide land use allocation and planning strategies.

C. Report Preparation

Those making the decision on land use in the Tatshenshini/Alsek area will be faced with a significant task. The stakes are high, the facts and issues complex. The decision is of importance to a variety of interest groups with strongly conflicting values. Some of the information needed to make a decision is necessarily speculative because of the uncertainties involved in determining wilderness values, predicting the economic costs and benefits of mining operations, and assessing risk of such operations to the natural environment. If mining activity is prohibited or delayed as a result of the decision, the question

\(^2\) Reproduced in full on page 113
of compensation to Geddes Resources must be addressed; if such activity is approved, the Windy Craggy project must pass through a complex maze of regulatory processes in two countries.

The first step taken by the Commission was to arrange for the gathering and organization of all information that would be needed to provide the groundwork for the decision. Information that was not already available was obtained by commissioning reports by experts. Detailed information on the Windy Craggy project was available in the form of the submissions by Geddes Resources to the Mine Development Review Process. A description of the wilderness values of the area was contained in a recently prepared report by J. S. Peepre and Associates, commissioned by several provincial government agencies. The Commission retained Gerald A. Cormick and Associates to provide a review of regulatory processes applicable to the Windy Craggy project. Rescan Consultants Inc. was retained to assess both the risks created by the project and the measures by which Geddes had proposed to address or might address those risks. Information on mineral values in the Tatshenshini/Alsek area and probable economic impacts of the Windy Craggy project was obtained from the Ministry of Energy, Mines and Petroleum Resources, to supplement the analyses that had been previously prepared by Geddes Resources. In addition to the material contained in these reports, other information was gathered from a variety of sources. Finally, Dr. Tim McDaniels, a specialist in decision analysis, was retained to assist the Commission to structure the decision-making process through a multiple objective analysis.

The Commission has attempted to provide Cabinet with a means of evaluating various decision options by dealing with this information in a structured way. First, it was necessary to identify the nature of the decision and the desirable social, economic and environmental objectives of the decision. This step would enable the Commission to identify a range of options that would satisfy such objectives to the greatest extent possible, while taking into account conflicts among objectives. Finally, the costs and benefits of each option had to be identified to provide a means of evaluating each option against the others.
2 Structuring the Decision

A. Nature of the Conflict

An informed decision on land use in the Tatshenshini/Alsek area will require a familiarity with all relevant issues and interests. A definition of these depends in turn on an understanding of the nature of the conflict that has evolved during the past decade.

Different interest groups naturally tend to define a conflict according to their goals. Depending on perspective, the relevant land use goals in the Tatshenshini/Alsek area range from local (approval of a mine project) to international (creation of the largest protected wilderness area in the world). The nature of the conflict can be framed and defined in at least the following four ways.

1. Windy Craggy project approval

The Tatshenshini/Alsek land-use controversy was precipitated by Geddes Resources' application to develop a copper mine at Windy Craggy Mountain. From the perspective of the company, having already invested millions of dollars on the project and intending to extract over eight billion dollars' worth of copper ore, approval of the project remains the fundamental issue. This perspective is shared by communities and workers which stand to benefit directly from the project, and by other communities which fear an adverse effect on their economies.

2. Land use and resource allocation in the entire Tatshenshini/Alsek area

When the perspective is broadened to include both wilderness values that may be affected by approval of the Windy Craggy project or other enterprises, and mineral values which have been shown to be high in a significant portion of the area, the conflict extends to include the entire area. The land claim by the Champagne-Aishihik First Nation to much of the area also broadens the dimension of the conflict.

3. Land use and resource allocation in British Columbia

The conflict over land use in the Tatshenshini/Alsek area necessarily has province-wide characteristics. The decision is likely to be viewed by parties to the conflict as a signal of governmental attitudes towards wilderness preservation and mining generally. Both the mining industry and advocates of wilderness preservation anticipate that any "imbalance" resulting from the decision would be redressed in the remainder of the province, whether by the confirmation of other opportunities for mining or by the protection of other wilderness areas. The government has announced its intention to prepare a comprehensive land use strategy for the province, and has taken steps to fulfil this strategy through components such
as the Protected Areas Strategy, and through the establishment of the Commission on Resources and Environment. These initiatives demonstrate endorsement of the principle that where an individual use (or absence of use) is emphasized in one area, the weighting of permitted uses elsewhere may be adjusted to ensure a balance of land use and resource allocation in the province as a whole.

4. Land use and resource allocation from an international perspective

The Tatshenshini/Alsek area is almost entirely surrounded by three national parks all of which have been designated World Heritage Sites by UNESCO. To wilderness advocates in Canada and the United States, the central issue in the conflict is whether or not to preserve the Tatshenshini/Alsek area from resource extraction and create the largest contiguous area of protected wilderness in the world. On the other hand, if mining were permitted and other mines in addition to Windy Craggy were eventually developed, the area has the potential to have a significant impact in satisfying an increasing world demand for copper. For both reasons, there is considerable international interest in the outcome of the dispute.

B. Issues

Defining the conflict in its various forms enables the issues surrounding the conflict to be described so that the range of objectives of the decision may be identified. Based on the categories of conflict described above, the issues fall into two broad categories: those related to the Windy Craggy project itself, and those related to broad land use planning and resource allocation throughout the entire area.

1. Project-specific issues

Application for approval of the Windy Craggy project primarily raises issues relating to economic opportunities and benefits and to environmental risks created by the project. Economic issues include the right of Geddes Resources to develop a resource and to receive a return on its investments; opportunities for communities and workers in Canada and Haines, Alaska; and the impact of development on the provincial and federal balance of trade. Risk issues include creation and control of acid rock drainage; impacts on fish and wildlife, including salmon which supply Alaskan fisheries, grizzly bears that den in the vicinity of the mine, Dall’s sheep, blue glacier bears, bald eagles gathering at the Chilkat eagle reserve in the vicinity of the proposed slurry pipeline, and marine life at the Haines terminal; and potential effects of seismic activity and long-term glaciation.

Other project-specific issues relate to competing land and resource uses, for example First Nations land claims, the impact of the mine site and access road on wilderness values of the area, and the impact on surrounding World Heritage Sites, particularly Glacier Bay National Park.
2. Land use planning and resource allocation issues

Issues related to resource allocation and land use planning stem from the incompatibility of mining and wilderness uses in the Tatshenshini/Alsek area. From a regional and provincial perspective, the question becomes: what are the optimal uses of the entire Tatshenshini/Alsek area? The primary issues are the relative importance of wilderness and mineral values of the area compared to other areas of the province, and the degree to which both values might be realized, if at all, through multiple land use. The First Nations land claim to much of the area raises an additional land use issue.

These issues in turn raise broad questions of process and policy. For example, should implementation of a provincial land use and resource allocation policy be considered a prerequisite to further regulatory review of the Windy Craggy project? If such a review takes place, what roles are appropriate for the United States and the International Joint Commission? And what message will a decision on the future of the Windy Craggy project convey about provincial policy regarding the mining industry and wilderness preservation?

C. Interests

In any dispute with numerous parties, it is useful to define groups of interests. This helps to highlight the critical elements of the conflict and to clarify the objectives of the decision to be made. The groupings that follow are not intended to be definitive or to suggest any order of importance among different interests.

1. Windy Craggy project proponent and supporters

The main interest groups supporting approval of the Windy Craggy project would either benefit directly from the project or hold interests which depend on a favourable governmental attitude towards the mining industry. The principal Canadian supporters of the proponent, Geddes Resources Limited, include the B.C. and Yukon Chambers of Mines, the Mining Association of British Columbia, SHARE B.C., organized labour and potential suppliers. American support comes from the U.S. mining industry and from groups that would benefit from the shipping of ore at Haines, Alaska. These include the Haines Chamber of Commerce, Klukwan Inc. (an Alaskan Aboriginal corporation), and AK Industrial Development and Export Authority.

2. Wilderness preservation advocates

Groups which oppose development of the Tatshenshini/Alsek may do so for a variety of reasons. These include the desire to preserve wilderness attributes of the area, and concerns about potential negative impacts of developments on individual wilderness attributes such as wildlife species and scenic values. Over fifty conservation organizations in the U.S. and Canada, united under the umbrella of Tatshenshini
International, share the perspective that the Tatshenshini/Alsek area is vital to the creation of an international wilderness area that already contains parks in Alaska and the Yukon. U.S. conservation groups such as the Sierra Club, American Rivers and the Audubon Society have played a key role in bringing the issue before congressional hearings.

3. Non-mining resource users

The goals of these groups generally overlap with those of preservation advocates in so far as wilderness preservation protects their specific interests, such as river rafting and commercial fishing. They include Wilderness Journeys, Alaskan fishing interests, the Sockeye Society, and an outfitter who guides non-resident hunters in the area.

4. First Nations

The Champagne-Aishihik First Nation, whose members reside primarily the Yukon and whose ancestors lived and traded in the Tatshenshini/Alsek area, regard the area as their traditional territory and have registered a land claim to a large portion of it. They have an interest in employment that might result from the Windy Craggy project, but are also concerned about potential harmful impacts on fisheries and on tourism-related enterprises in which they have an interest. The Tahltan First Nation shares similar interests and concerns and supports the land claim. In the U.S., the Alaska Native Brotherhood and Sisterhood is concerned about potential impacts on their coastal fishery.

5. Provincial authorities

Governmental agencies become parties to land use conflicts through their administrative and planning responsibilities. The Ministry of Energy, Mines and Petroleum Resources will play a lead role if regulatory assessment of the Windy Craggy project continues or if mining activity in the area is either encouraged or prohibited, affecting mineral resource allocation in the remainder of the province. The Ministry of Environment, Lands and Parks also has an interest in the outcome of the decision through its responsibility for wildlife protection and its planning role in wilderness protection strategies. The Ministry of Aboriginal Affairs has a continuing role in protection of Aboriginal interests and land claims negotiations. The Commission on Resources and Environment may continue to play a role in the determination of land use in the Tatshenshini/Alsek area, depending on the decision-making process chosen by cabinet.

6. Federal authorities

In a regulatory role, federal resource agencies such as Environment Canada and the Department of Fisheries and Oceans would focus primarily on environmental protection rather than land use and resource allocation. The Department of External Affairs may become involved as well if the issue is referred to the International Joint Commission under the Boundary Waters Act.
7. **U.S. authorities**

American interest at the governmental level has already been expressed through the introduction of a joint congressional resolution calling for negotiations for wilderness preservation. At the state and local level, the Alaska administration has expressed support for the Windy Craggy project, whereas the Haines Borough Assembly has voted unanimously to support the congressional resolution opposing the project. If regulatory assessment continues, a variety of federal, state and local authorities will become involved under the National Environmental Policy Act (NEPA) review, and the U.S. Department of State would become involved if negotiations for a joint international review took place.

8. **Future generations**

Land use decisions made by one generation inevitably affect the interests of future generations. For example, some of the largest parks enjoyed by urban dwellers today in British Columbia were established by governments over a century ago; and some economic benefits enjoyed by current generations can be traced back to resource management decisions made decades ago. Similarly, land use decisions made today will determine not only current uses but also the uses that may benefit future generations of British Columbians, and their interests are a relevant consideration in the process of deciding the future of the Tatshenshini/Alsek area.

D. **Options**

The interests described above are numerous, and the issues wide-ranging and complicated by provincial and international dimensions. Enumeration of the interests and issues reveals goals ranging from complete wilderness preservation to promotion of potentially lucrative mining enterprises, and the opposing nature of these two goals suggests little room for compromise.

Identification of options for a decision can be facilitated by considering objectives. The issues and interests described above suggest that a decision on land use in the Tatshenshini/Alsek area should endeavour to:

- promote wilderness preservation,
- minimize environmental impacts,
- maximize economic benefits,
- protect the interest of neighbours, including Alaskan communities and the governments of the U.S. and Alaska, which will be affected by the decision,
- enhance the social and political acceptability of the decision both in British Columbia and internationally, and
- ensure integration with provincial land-use planning for wilderness protection and encouragement of a healthy mining industry.
These objectives provide a framework for a decision which, while it may produce a result that is contrary to the goals of some interests on the local level, encourages a balance at the provincial level. In other words, a decision that produces a negative effect for interests favouring either wilderness preservation or mineral extraction may be alleviated by compensating effects outside the Tatshenshini/Alsek area.

No decision is capable of meeting all of the objectives described above. The concluding chapters of this report will describe the range of options that meet one or more of the objectives, and will discuss ways of evaluating options. Among these options, three will be presented as meriting final consideration:

1. **Complete preservation**

   The entire area would be protected as a park or wilderness preserve, forming a part of the largest protected wilderness area in the world. Companies possessing mineral rights in the area would receive compensation according to accepted principles. The decision would be tied into an overall policy regarding land use, including mining and wilderness preservation, in the province. Efforts would be made to involve the U.S. government in financing this option.

2. **Mining and preservation**

   Mining would be declared to be an acceptable activity in the 25 per cent of the area that is considered to have high mineral values, and companies possessing mineral rights would be free to submit proposals for assessment by regulatory processes in Canada and the United States. The remaining 75 per cent of the area would be designated a park or wilderness preserve. As with the first option, the decision would require integration with province-wide land use policies.

3. **Delayed decision**

   The decision would be delayed to allow additional information to be obtained regarding wilderness values, potential risks and benefits associated with mining operations, and the outcome of First Nations land claim negotiations. Determination of the length of delay would depend on the degree of uncertainty and the importance attached to unavailable information.

   The following three chapters detail the information currently available about wilderness values, mineral values and environmental risks of the Windy Craggy project.
3 Wilderness Values

Agency representatives participating in the Stage 1 assessment of the Windy Craggy project under the Mine Development Review Process expressed the view that a decision regarding the overall land use of the area should be reached before development plans for the mine were approved. To address concerns about the shortage of information about the area, the agencies created the Tatshenshini/Alsek Wilderness Study Steering Committee, which commissioned a study on wilderness values. The resulting report, “Tatshenshini-Alsek Region Wilderness Study”, by J. S. Peepre and Associates, was released in July 1992. This report has been the primary source of the assessment of wilderness values contained in this chapter.

Two other studies of note were received shortly before our report went to press: “Tatshenshini-Alsek River Use Study” (November 1992) was prepared for the B.C. Ministry of Tourism by the Centre for Tourism Policy and Research of Simon Fraser University; and “The Conservation Significance of Bears and Their Habitat in the Tatshenshini River Valley” (October 1992 draft report), by Stephen Herrero and other members of the University of Calgary Faculty of Environmental Design, was prepared for the Canadian Wildlife Federation.

Because most wilderness values are inherently non-economic and thus difficult to quantify, their definition and assessment tend to be elusive. How we define and measure wilderness values depends on who we are and what our interests are. For example, duck hunters and bird watchers may each place high values on wilderness, and define those values in very different ways. From a traditional Euro-Canadian point of view, wilderness is usually described as a vast and remote area “untrammeled by man”—a characterization which most Canadians would find well suited to the Tatshenshini/Alsek area. The Champagne-Aishihik First Nation, however, view the Tatshenshini/Alsek area from an altogether different perspective — as a traditional domain and homeland of their ancestors, a land not remote but close to where the Champagne-Aishihik people now live in the Yukon Territory.

The way we define and evaluate wilderness may also alter over time, as society’s needs and perspectives change. In recent decades, the diminishing amount of land that is unchanged by human use has dramatically changed social perspectives of the nature and value of wilderness. The increasing scarcity of wilderness has increased its value, in the eyes of many. In addition, the value of wilderness was historically associated primarily with its ability to provide outstanding recreation experiences, especially appreciation of scenery; today, there is an increasing belief that wilderness should be preserved not just for human use, but also for its own sake and for its capacity to preserve nature, including landforms,
ecosystems, biodiversity, and wildlife habitat and populations. Each of these aspects contributes to wilderness qualities, and the whole is seen as greater than the sum of the parts.

A study cited by Peepre identified 12 wilderness attributes. According to the study, wilderness:

- maintains essential ecological processes and life support systems;
- preserves genetic and biological diversity;
- protects aesthetic values and natural ecosystems;
- conserves watersheds and their production;
- controls erosion, sedimentation and soil depletion;
- maintains air quality;
- protects habitat of representative as well as rare and endangered species;
- provides opportunities for ecotourism and recreation;
- contributes to sustainable use;
- protects natural and cultural heritage; and
- retains future options.

All of these attributes currently exist in the Tatshenshini/Alsek area. The following sections describe the variety of attributes found there.

A. Natural Resources

1. Ecosystems and landscapes

The Coast Mountain range, through which the Alsek and Tatshenshini rivers flow, contains the largest non-polar icecap in the world and some of the biggest valley glaciers in Canada. The combination of the mild Pacific influence and the glacial history of the area has produced an exceptionally diverse range of biophysical conditions ranging from lowlands to alpine tundra, from coastal forest and wet meadows to dry interior spruce forest. Many plant and animal species that are rare or unusual in British Columbia and Canada inhabit the area.

The Tatshenshini/Alsek area comprises three ecossections, including part of the Icefield Ranges, 90 percent of the Tatshenshini Basin, and the Alsek Ranges. (See Map 2) There is currently no representation of any of these ecossections in British Columbia’s protected areas; however, there is some representation of the Icefield Ranges and Tatshenshini Basin ecossections in Kluane National Park, in the Yukon Territory. The Alsek Ranges ecossection includes the lower portions of the Tatshenshini and Alsek rivers in B.C. Several provincially rare species have been recorded in the coastal transition zone where the Tatshenshini flows into the Alsek, but the area is not well understood. Further east, the transition in a short
Map 2
Ecoregions & Wildlife Habitat
Scale 1:1,000,000

LEGEND

Ecoregions

Boundary
ICR - Icefield Ranges
TAB - Tatshenshini Basin
ALR - Alsek Ranges Ecoregion

Biogeoclimatic Zones

- RWRB - Boreal White/Black Spruce
- SWB - Spruce-Willow-Birch
- AT - Alpine Tundra
- CWHb - Coastal Western Hemlock
- MH - Mountain Hemlock

Simplified map based on 1:600,000 B.C. Environment map
distance from coastal to subalpine and alpine vegetation also results in species habitat unusual in B.C. The Alsek Ranges ecosection is similar to some Alaskan coastal ecosystems, but is unique to B.C. and Canada.

The northern part of the Tatshenshini/Alsek area contains two ecosections, roughly divided by the Alsek River, which flows south from the Yukon. In the rugged, heavily glaciated mountains to the west of the Alsek, the Icefield Ranges ecosection contains two biogeoclimatic zones — the forested spruce-willow-birch zone in valley bottoms, and alpine tundra at higher elevations. To the east of the Alsek, the biogeoclimatic conditions of the Tatshenshini Basin ecosection are typical of a cold dry climatic region, with less forest than shrubland, in addition to alpine tundra.

The “St. Elias Mountains regional landscape” — a designation used by B.C. Parks to describe the area containing the Tatshenshini and Alsek river system, Windy Craggy Mountain, and B.C.’s highest mountain, Fairweather — is not currently represented in B.C.’s park system, and is not found anywhere else in Canada, nor is it protected in the United States. No other regional landscape in the province could supply the same balance of vegetation, wildlife and climate.

The Tatshenshini River, Haines Highway corridor, Fairweather Mountain, Tarr Inlet and Turnback Canyon have been ranked as “Outstanding” in the B.C. Parks special features inventory, indicating provincial or international significance.

2. **Rivers and streams**

The northern Coast Mountain range is a watershed divide, with rivers and streams to the west flowing directly into the Pacific Ocean, while those east of the divide flow into interior river systems. Few rivers have eroded through the Coast Range; in Canada, the major ones are the Tatshenshini, Alsek, Stikine, and Taku. Unlike the latter two, the Tatshenshini and Alsek pass through one of the highest parts of the Coast Range and flow through a wide variety of environments.

The abundance of glaciers in the region provides the primary source of flow for the Tatshenshini/Alsek rivers. The lower sections of both rivers and most creeks in the drainage are heavily loaded with glacial silt, especially during the summer. This glacial melt accounts for the chilly summer temperatures of the rivers (between 4.4 and 6.6 degrees centigrade) and dramatic fluctuations in flow that can raise river levels by more than a metre in a day.

3. **Geology and terrain**

The coastal plates that collided to form the upsurge of mountains along the western coast of North America are separated by geological faults. Earthquakes are caused by slippage along these faults. The Tatshenshini/Alsek river system lies in a region containing two major fault systems. Historically, the area has registered some of the largest earthquakes in the history of the planet. Today it remains the most
seismically active zone in Canada, with the chance of a force 4 earthquake within the next 50 years estimated at 40 per cent.

The relatively recent retreat of glaciers, which is still continuing in the northern Coast Range, has created a “young” landscape which contributes to the biodiversity of the region as new habitats are continually created and destroyed. The constant glacial activity has produced geomorphological processes and features on a scale unmatched elsewhere in British Columbia. Some glaciers are several kilometres wide and hundreds of metres deep. Surge-type glaciers (with alternating phases of rapid and slow flow rates) calve into the rivers and have dammed the Alsek in the past, resulting in unusual features such as scoured bedrock and outwash plains with large ripple marks. At the junction of the Alsek and Tatshenshini Rivers, river activity has created a floodplain on a scale unmatched elsewhere in the province, as well as fans, canyons and hoodoos.

4. Vegetation

The variety of biogeoclimatic zones that exists in the region and the constant alteration in habitat caused by glacial activity and events such as landslides, floods, and avalanches has resulted in a rich diversity of species. The few studies of vegetation in the area have identified several rare species as well as unusual plant communities critical to wildlife populations — one example being the provincially rare northern ground cone, an important source of food for grizzly bears on floodplains. No thorough inventory of plant life has been conducted to determine the extent of unique or rare species.

5. Wildlife

Although little is known of most wildlife in the area, wildlife habitat and some species have been assessed as provincially and nationally significant. The diversity of landforms, climate and vegetation have produced a variety of biological niches and an unusual diversity of species. As the region contains habitats not found anywhere else in Canada, further studies are necessary to obtain knowledge about wilderness-dependent species. Species that depend on wilderness for survival are important indicators of the “health” of a wilderness. One example is the grizzly bear, and the Tatshenshini/Alsek area is one of the last strongholds of a thriving grizzly population in North America. Another indicator species is the harlequin duck, which prefers remote settings with fast-running streams. Both species are intolerant of human disturbance. The high density of grizzly bears is due to the abundance of high capability wilderness habitat. One of the best habitats for grizzlies in B.C. and Canada is Tats Creek, with several denning sites in the vicinity.

The Tatshenshini/Alsek area also provides habitat for the blue or glacier bear, a phase of black bear which is found nowhere else in Canada. In addition, the Alaskan brown bear is thought to move into the B.C. portion of the lower Alsek River valley to use floodplain habitat of a type found nowhere else in the province. About half of the estimated 400 Dall’s sheep in B.C. have their summer and winter range in the area. Other large ungulates include an estimated 300 mountain goats, and moose in the river valleys.
One hundred and eighty species of birds have been identified in the region; unusual or rare birds include the Arctic tern, gray-cheeked thrush, lesser gold-plover, Pacific loon, wandering tattler, and king eider. The Alsek River valley is a major flyway for birds migrating to and from the Yukon and perhaps the Mackenzie Delta. In the autumn, eagles follow salmon up the Alsek. The salmon run on the Chilkat River in Alaska, south of the Haines Highway and close to the Canadian border, supports the largest concentration of bald eagles in the world in an area that has been designated as the Chilkat Eagle Preserve.

6. Fish

The Alsek River is one of three major salmon-bearing rivers on the northern Pacific coast, and contains sockeye, chinook, coho, chum and pink salmon, as well as steelhead trout. Spawning grounds in the Tatshenshini River watershed contribute 95 per cent of the chinook salmon, 90 per cent of the sockeye salmon, and 75 per cent of the coho salmon to the commercial fishery in Alaska at the mouth of the Alsek River. The only sizeable lake in the area is Kelsall Lake, east of the Haines Highway; it is reported to contain dolly varden and whitefish.

7. Biodiversity

The protection of biological diversity, including species and habitat richness, representativeness and scarcity, has become a fundamental principle in identifying potential protected areas, and is a key component of wilderness values. Biodiversity is most readily preserved in undisturbed wilderness, and the degree to which it is preserved appears to be related to the size of the wilderness. Large wilderness areas maintain biodiversity more readily because they encompass biological communities at the landscape level of organization, which consists of gradients and mosaics of those community types. They also protect vulnerable species that may be predisposed to extinction.

While each of the natural resource characteristics described above is integral to biodiversity in the Tatshenshini/Alsek area, there are some significant gaps in understanding about:
- links between biodiversity and wilderness in the area in relationship to the adjacent protected areas of Kluane National Park Reserve, Glacier Bay National Park and Preserve, and the Chilkat Eagle Preserve,
- links between critical habitat, wilderness and biodiversity in the area,
- the extent of rare plants and animals in the region,
- habitat needs of wilderness-dependent species such as grizzly bears and wolves, and
- impacts of human development on biodiversity.
B. Cultural Resources

1. Aboriginal history

The Tatshenshini/Alsek area was attractive to Aboriginal peoples because it was rich in resources and because it was strategically located for trade between coastal and interior communities. While almost no archaeological studies have been conducted in the area, archaeological data from Yukon and Alaska studies suggest that people may have been living in the Tatshenshini/Alsek area 8,000 years ago. In the nineteenth century, the area was home to both Tlingit and Tutchone peoples, and there were settlements along the Tatshenshini River at its junctions with the Alsek and O’Connor rivers. The Tatshenshini River was a key trading route between the coastal Tlingit and the Tutchone who lived along the upper reaches of the river. In the eastern part of the region, the Chilkat Tlingit traded with the Tutchone; one of their routes later became known as the Chilkat trail and in the 1940s became the route of the Haines Highway.

In the latter part of the nineteenth century, the Aboriginal population of the Tatshenshini/Alsek river system was greatly reduced, partly as a result of a smallpox epidemic triggered by contact with European traders on the coast. The Klondike Gold Rush of 1898 was followed a year later by a survey of the boundary between the Yukon Territory and British Columbia. The main settlement of Tutchone people at Neskatahin, on the upper Tatshenshini in the Yukon, was effectively cut off from their southern territory after the survey, when government authorities of the day discouraged them from crossing into B.C. to hunt and fish.

Their descendants today are the Champagne-Aishihik First Nation, who primarily live in the Yukon and use the Haines Highway to obtain access for fishing and hunting areas in the eastern part of their traditional territory. Some Champagne-Aishihik people provide guided horse trips and other tourist-oriented activities in the Tatshenshini-Alsek area.

2. Non-Aboriginal history

For most of the nineteenth century, the coastal Tlingit prohibited non-Aboriginal people from using their trading routes through the region, in order to protect their trade monopoly with the Tutchone people. By the 1880s, however, non-Aboriginals began travelling on the Chilkat trail, and in 1890 Edward Glave and Jack Dalton, accompanied by an Aboriginal guide, became the first non-Aboriginals to paddle down the Tatshenshini River, by dugout canoe. On reaching the Alsek, Glave noted in his journal his reaction to the experience. “There is such an incessant display of scenic wild grandeur that it becomes tiresome,” he wrote. “We can no longer appreciate it; its awe-inspiring influence no longer appeals to our hardened senses.”

The first significant movement of non-Aboriginals through the area occurred in 1898, when the Chilkat trail became one of the routes used by tens of thousands of prospectors heading north to the Klondike gold-fields. During the Second World War, the U.S. Army used the trail route to construct a road for military purposes to link Haines with the Alaska Highway in Yukon Territory.
Map 3: Place Names, Land Use and Old Roads
Source: J.S. Pecpe & Associates
Interest in the mineral potential of the Tatshenshini/Alsek area began to occur after the discovery of gold at Squaw Creek in 1927 led to a small influx of miners. In the 1950s, Windy Craggy Mountain was found to contain a potentially rich copper deposit.

Apart from these activities, there was little non-Aboriginal use of the Tatshenshini/Alsek area until commercially guided rafting trips of the Tatshenshini began in the late 1970s.

C. Scenic Resources

Visual landscapes are a key component of wilderness, and are most vulnerable to the first human disturbance because of the value placed on viewing scenery that appears to be unaltered by human activity.

The visual resources of the Tatshenshini/Alsek area are largely intact, spectacular, and diverse. The visual characteristics of the Tatshenshini River valley change several times between the headwaters and the confluence with the Alsek River. Alpine tundra and open subalpine forest views change to confined canyon sections, opening to forested valley views before the mid to lower Tatshenshini reveals a landscape of sawtooth mountain ranges and large alluvial fans. Below the O'Conner River, the viewshed changes again, as the widening river offers expansive views of the St. Elias Mountains. The junction with the Alsek is one of the largest braided river confluences in the province, with views of glaciers and the Noisy Mountain Range; further downstream, the Alsek features lush coastal vegetation and hanging glaciers, some of which calve into the river. Outstanding individual visual features in the area include the Melburn Glacier, Tweedsmuir Glacier, and British Columbia's highest mountain, Fairweather.

The Haines Highway, a major tourist route to the Yukon and Alaska, provides distinctive wilderness views; no other highway route in B.C. provides the same transition from coastal forest through subalpine forest to expansive alpine tundra views.

Using assessment methods designed by the Ministry of Environment, Lands and Parks, the region achieves the highest provincial ratings for scenic quality, based on diversity of landforms, vegetation, water, colour, scarcity, and absence of cultural modifications.

D. Recreation and Tourism

The Tatshenshini/Alsek river corridors and the Haines Highway are identified by B.C. Parks as outstanding backcountry recreation areas. The Haines Highway provides easy access to extensive alpine areas, mountain and glacier viewing, wildlife viewing, and skiing and snowmobile activities. By contrast, the Tatshenshini/Alsek area to the west is virtually inaccessible except by air, boat, foot or horseback; and the difficulty of access increases the value of the wilderness experience for recreationists who are able to take advantage of it.
Travel by raft down the Tatshenshini and lower Alsek Rivers from Dalton Post is considered one of the top wilderness rafting trips in the world, primarily because it is one of the longest trips in "true" wilderness. In 1991, about 1,000 people descended the rivers by raft; as one rafting departure per day has been used as the benchmark for maximum allowable use on the Tatshenshini while still providing a wilderness experience, the river's carrying capacity has already been reached, by that standard.

Recreational use of the Alsek River above the confluence with the Tatshenshini is limited by the fact that Turnback Canyon is unnavigable except by experts at certain water levels. In addition to scenic views, the rivers provide superb wildlife-viewing opportunities.

The wilderness value of the Tatshenshini and Alsek Rivers may be assessed to some degree by considering the following:

- The Tatshenshini and Alsek Rivers are considered to be among the top 14 wilderness rafting routes in the world. They compare favourably with the Grand Canyon section of the Colorado River, which has superior whitewater but does not match the wilderness attributes and wildlife diversity of the Tatshenshini and Alsek.

- No other coastal wild rivers in British Columbia provide an uninterrupted wilderness experience of ten or more days. The other two north coast rivers passing through the Coast Range — the Stikine and Taku — do not match the Tatshenshini and Alsek in terms of combined scenic quality and diversity, biological variety, whitewater challenges, ease of access, and overall wilderness attributes.

- Few navigable rivers with wilderness characteristics, and none comparable in length to the Tatshenshini or Alsek, are protected in British Columbia.

While the mountain ranges in the area have significant potential for climbing and ski mountaineering, such use has been limited to date by their remoteness. Mount Fairweather (4,663 metres or 15,300 feet) is an internationally known climbing destination.

Hunting in the Tatshenshini/Alsek area is limited to 25 hunters a year, mainly non-residents, taken in by guide to hunt for grizzly bear, sheep and goat; along the Haines Highway, moose and ptarmigan hunting is popular, and falcons are collected under permit in the area of Haines summit. There is little fishing except at Kelsall Lake.

Although the Tatshenshini/Alsek area is an international destination for a limited number of tourists seeking a premier wilderness adventure, there are present no communities or tourism facilities, even on the Haines Highway. The highway is an important link in a circle tour from Whitehorse to Haines and Skagway, and draws about 45,000 tourists annually. Tourists are drawn by national parks surrounding the Tatshenshini/Alsek area, including two World Heritage Sites adjacent to the region: Kluane National Park in the Yukon, and Glacier Bay National Park in Alaska. Tourism potential in the Tatshenshini/Alsek
area could possibly increase as a result of the increased profile provided by a protected designation such as national or provincial park, “wilderness area” or “heritage river”, although distance, climate and cost would limit numbers of visitors.

The overall tourism capability class for the Tatshenshini and Alsek river valleys is “very high”, with “high” capability for the Haines Highway corridor, using the rating methodology used for the Northwestern British Columbia Natural Resource Based Tourism Study conducted in 1990.

E. Protected Areas Strategy

One measure of wilderness significance is governmental acknowledgement of that value by formal designation as a protected area. The Tatshenshini/Alsek area is bordered to the north, west and south by national parks (Kluane, Glacier Bay, and Wrangell-St. Elias) that have been designated World Heritage Sites by the United Nations Educational, Scientific and Cultural Organization (UNESCO) — indicating their “outstanding universal value to mankind”. In addition, part of Tongass National Forest, west of the Tatshenshini/Alsek area, has been designated the Russell Fiord Wilderness Area, thereby maintaining it in a roadless state.

The Tatshenshini/Alsek area is a candidate study area (the Tatshenshini/Haines Highway Proposed Study Area) for potential preservation under the B.C. Protected Areas Strategy. This strategy, announced in May 1992, is intended to co-ordinate and integrate the Parks and Wilderness for the '90s, Old-Growth Strategy, and other conservation initiatives. The announced intent of government is to double British Columbia’s protected areas system by the year 2000 from 6 to 12 per cent. This would be in accord with the broad goals set out in the Brundtland report for worldwide protection of representative ecosystems.

The general target of 12 per cent is being employed as a general province-wide guideline, subject to formal cabinet ratification of Protected Areas Strategy recommendations. This target recognizes the significant variation that must occur around the province. Representation in some ecosystems will be difficult to attain for economic or social reasons (for example, incompatible historical uses and human settlement), or due to the absence of suitable candidate areas. As well, some areas may have higher recreational and cultural attributes than others. Representation in excess of 12 per cent may be appropriate for some ecosystems for reasons such as the need to conserve intact areas for wide-ranging, wilderness-dependent wildlife species such as grizzly bears.
For illustrative purposes, application of the 12 per cent guideline to the Tatshenshini-Alsek area produces the following statistics:

<table>
<thead>
<tr>
<th>Ecosystem Area (ha)</th>
<th>Approx. Total Protected Areas</th>
<th>Current B.C.</th>
<th>Approx. Area (ha) needed to fill 12 per cent</th>
<th>Approx. Area (ha) Ecosystem in Haines Triangle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alsek Ranges</td>
<td>450,000</td>
<td>0</td>
<td>54,000</td>
<td>400,000</td>
</tr>
<tr>
<td>Icefield Ranges</td>
<td>200,000</td>
<td>0</td>
<td>24,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Tatshenshini Basin</td>
<td>500,000</td>
<td>0</td>
<td>60,000</td>
<td>450,000</td>
</tr>
<tr>
<td>Totals</td>
<td>1,150,000</td>
<td></td>
<td>138,000</td>
<td>1,050,000</td>
</tr>
</tbody>
</table>

The area required to meet a 12 per cent target would need to proportionally represent all biogeoclimatic subzones within the larger ecosystems. However, this could result in a number of smaller fragmented units because of the geographical distribution of subzones.

The Alsek Ranges ecosystem only occurs in British Columbia, and is considered the most biologically diverse ecosystem in the study area since it is drier than the coastal belt to the west in Glacier National Park, Alaska, and more moist and less continental than the Tatshenshini Basin to the east. Biogeoclimatic zones occur in the Alsek Ranges that are found nowhere else in British Columbia. The mature deciduous forests in the Alsek Ranges ecosystem are unique to British Columbia.

One of the representative characteristics of the study area, particularly the Alsek Ranges, is the presence of a very large number of grizzly bears and of outstanding habitat (food production for bears considered to be among the highest in British Columbia and possibly also Canada). Grizzly bears are a wilderness-dependent or wilderness-associated species, and very large areas are required to adequately maintain viable populations.

The presence of the only population of Dall’s sheep in British Columbia also characterizes the study area. Dall’s sheep are also wilderness-dependent or wilderness-associated.

The quality and nature of these “representative” characteristics suggest that an area much larger than 12 per cent would be needed to protect these values. The 12 per cent guideline, suggesting an area of 138,000 hectares, would be too small to support the area’s large grizzly population and to represent the scale of this rugged wilderness landscape.

Internationally and provincially significant special features of relevance to the Protected Areas Strategy include the following:

- The Tatshenshini River, ranked one of the top 14 wilderness rafting rivers in the world; no other river in British Columbia or Canada provides a similar length of wilderness experience from an interior to coast landscape.
High numbers of grizzly bears, supported by unusually lush habitat believed to produce as much food for grizzlies as anywhere else in British Columbia.

Mount Fairweather, the highest point with greatest topographic relief in British Columbia, and world-class mountaineering area.

Occurrence of the only population of Dall’s sheep in British Columbia (the population also extends east of Haines Highway).

Several rare species to the province, including the tundra shrew and collared pika; several rare bird species; and 45 of British Columbia’s 600 rare plant species.

The Blue Glacier Bear, a rare colour phase of the black bear, which may only occur in the lower Alsek River area.

Large valley icefields and glaciers, several of which “surge”; and Tarr Inlet, the only tidewater glacier in British Columbia.

Haines Highway itself, with outstanding opportunities for landscape and wildlife viewing (bear, moose, sheep, caribou, and raptors).

Examples unmatched elsewhere in B.C. of geomorphological processes, such as the large braided channels at the confluence of the Tatshenshini and Alsek Rivers, large fluvial fans, and scouring caused by the release of an ice-dammed lake.

Cultural resources stemming from early Aboriginal history of trade and travel (much of the area is part of the traditional territory of the Southern Tutshone, with the nearest group now called the Champagne-Aishihik First Nation), and more recent European exploration and development.

Fisheries resources, including salmon populations that support a commercial fishery in Alaska and are a critical food source for the area’s high population of grizzly bears.

The whole study area, if established as a protected area, would comprise approximately one million hectares — an area equivalent to about 1 per cent of British Columbia.
E. Conclusions

Many of the notable wilderness attributes of the Tatshenshini/Alsek area are unique to the area, and the mosaic of wilderness attributes, natural and cultural resources in the Tatshenshini/Alsek area is not protected elsewhere in Canada and the United States, including Kluane and Glacier Bay National Parks.

While wilderness values of the Tatshenshini/Alsek area are clearly high, much remains unknown. To supplement the overview of wilderness values provided by the Peepre report in 1992, a concerted effort has been made by several agencies to obtain further information in a variety of studies. These included geological surveys to provide a foundation for mineral potential mapping (Ministry of Energy, Mines and Petroleum Resources), two biodiversity inventories (one by the Ministries of Forests and Environment, Lands and Parks, the other by the Sierra Club, with sharing of information), and an assessment of the biophysical impacts of recreational river use (Ministry of Tourism).
4 Mineral Values

British Columbia is a major world producer of coal and copper and a significant producer of lead, zinc, molybdenum, and precious metals (gold and silver). The mining industry accounts for 4.9 per cent of the provincial Gross Domestic Product — approximately half the contribution of the forest industry. In 1991, the mining industry created 12,500 direct and an estimated 25,000 indirect jobs,¹ and in recent years contributed in excess of $200 million annually in direct tax payments to the provincial government.

British Columbia’s commercial mineral reserves are declining as mining continues and exploration activity decreases. Ministry of Energy, Mines and Petroleum Resources figures note that the amount spent by companies on exploration in B.C. fell from $226.5 million in 1990 to $137.4 million in 1991, a drop of 39.3 per cent. Factors influencing the continuing decline in exploration activity include fluctuations in markets and metal prices, uncertainties about land use issues, lengthy environmental approval processes, and more attractive tax treatments in other jurisdictions. Mineral exploration has tended to shift to countries which have identified development of their mineral resources as a means of achieving their economic objectives and have reduced barriers and taxes to facilitate that development. The Windy Craggy proposal, with its exceptionally high ore grades and tonnage reserves, is one of only about four large copper mining proposals currently being pursued in B.C.

A. Mineral Potential in the Tatshenshini/Alsek Area

The first prospectors entered the Tatshenshini/Alsek area around the time of the Klondike gold rush in 1898. Their search for placer (streambed) gold led to a discovery of lode silver-gold showings in the Rainy Hollow area, leading to intermittent copper production between 1908 and 1922. In 1927, coarse gold was found along Squaw Creek, near the Yukon border, and placer operations have continued there to the present time, producing at least one nugget over 70 ounces.

Although there has been little active mining in the remainder of the area, exploratory work has revealed important mineral deposits. These include massive sulphide copper-zinc deposits east and southeast of Windy Craggy Mountain, and the O’Connor gypsum deposit, containing more than eight million tonnes.

The Windy Craggy deposit was first identified in 1958, when Frobisher Exploration Ltd. (now Falconbridge) located the massive sulphide deposit, containing copper, silver, cobalt and gold, near the peak of the mountain. In 1981, Geddes Resources signed an option agreement with Falconbridge to acquire an interest in the property by funding further exploration. Geddes Resources later obtained a 100 per cent interest in the property. Surface exploration was followed in 1988 by intensive drilling which enabled Geddes Resources to derive a more precise assessment of the potential for the production of copper ore. These results encouraged the company to file the prospectus by which Windy Craggy entered the Mine Development Review Process.

The possibility that similar deposits might exist elsewhere in the vicinity of Windy Craggy Mountain, together with the controversy surrounding the Windy Craggy proposal, encouraged the Ministry of Energy, Mines and Petroleum Resources to undertake systematic geological mapping of the Tatshenshini/Alsek area in order to assess its mineral potential. This had not been accurately evaluated previously, due to the remoteness of the mountainous area, inclement weather, and barriers of ice created by glaciers forming the largest non-polar ice-cap in the world. In the summer of 1992, helicopter surveys of about 482,000 hectares in the northern portion of the area, where Windy Craggy Mountain is situated, were conducted. Analyzed survey results will be published in the form of a geological map in January 1993 and a mineral potential map in the spring of 1993. Generalized, preliminary mineral potential tracts are shown on Map 4. Mapping of other parts of the Tatshenshini/Alsek area is planned for the summer of 1993.

A preliminary assessment of the survey results revealed significant new copper mineral occurrences, five of which lie in a belt of Late Triassic rock (about two hundred million years old), further demonstrating their very high mineral potential. (See Map 4) The most significant new occurrence is the “Rainy Monday” showing, which is over 600 metres long, over 150 metres wide, and up to 100 metres thick. Assay samples from this zone have yielded up to 20 per cent copper, up to two grams per tonne of gold, 28 grams per tonne of silver, and 0.27 per cent cobalt.

The Late Triassic belt is approximately seven kilometres wide and runs in a southeasterly direction from Windy Craggy Mountain to the southern border of the area that has been mapped. How much further south it extends will not be known until surveying of the southern part of the Tatshenshini/Alsek area takes place in 1993. However, it is believed that the belt continues intermittently to at least the Mount Henry Clay area, southeast of Windy Craggy Mountain, where massive copper-zinc mineralization has been identified in rocks also of Late Triassic age. Some of the copper sulphide deposits located in the belt have significant potential to equal or exceed the Windy Craggy deposit in size and grade.

Metamorphic rocks near the southwestern border of the area surveyed in 1991 may also have significant mineral potential. A sample from one mineral occurrence in the area contains up to 2.6 per cent copper in rock formations similar to those at Windy Craggy Mountain.

Palaeozoic limestone underlies a significant portion of the map area but contains only a few scattered mineral occurrences that appear to be of limited extent. For that reason, areas dominantly underlain by these rocks are assigned low mineral potential. Assay and regional geochemical survey results to confirm these observations are pending.

The third major rock type in the map area, Jura-Cretaceous granite, is associated in some instances with iron-copper skarn mineralization around their margins. These occurrences tend to be small and irregular, and therefore have relatively low mineral potential.

Based on a preliminary assessment, the very high mineral potential of the northern part of the Tatshenshini/Alsek area is mainly restricted to a narrow belt underlain by Triassic volcanic and sedimentary
Map 4: Areas of Mineral Potential
rocks. Roughly speaking, the portion west of the Alsek River and a narrow strip east of the river are considered to have low mineral potential. The area between the Alsek and Tatshenshini Rivers has medium potential except for the zone of very high potential southeast of Windy Craggy Mountain corresponding to the Late Triassic belt of rocks. The area east of the point where the Tatshenshini crosses from the Yukon into British Columbia has high potential. These tentative ranges of mineral values are illustrated in Map 4.

The potentially high mineral values of the area may be offset, at least at the present time, by the difficulty of developing mines economically in a remote northern location with a lack of infrastructure, leading to increased capital and operating costs; and by increased costs of environmental protection requirements. The primary obstacles are the remoteness of the mountain ranges, the abundance and size of the glaciers that cover much of the area, and the technical difficulties of managing potential risks created by the high content of acid-generating sulphide minerals.

B. Windy Craggy Project Production

Geddes Resources estimates that the Windy Craggy deposit would produce 297 million tonnes of ore over 20 years, grading 1.4 per cent copper with a recovery of 90 per cent, thus yielding a predicted annual production of approximately 130,000 tonnes of copper. The grade of copper ore at Windy Craggy is substantially higher than average levels being mined elsewhere in B.C.

Province-wide, the annual production of copper between 1980 and 1990 ranged from 265,000 tonnes to 365,000 tonnes. The Ministry of Energy, Mines and Petroleum Resources estimates that, without Windy Craggy and taking into account declining copper reserves and assuming no new additions to current reserves, copper production in the province could decrease from a high of 330,000 tonnes in 1991 to a low of 240,000 tonnes in 2002.

Based on these figures, annual production from Windy Craggy would, if the project proved feasible and were developed at that scale, be more than 30 per cent of the highest single-year province-wide production since 1980.

In summary, preliminary estimates indicate that Windy Craggy has the highest gross value of reserves of all deposits found in B.C. to date, based on the size of the deposit and the characteristics of the ore it contains. Preliminary geological surveys suggest that the area in which Windy Craggy is situated may contain several other deposits of an equivalent or larger size. Capital costs would probably be significantly higher than elsewhere in the province because of remoteness, climatic conditions, and risk management costs associated with mining sulphide deposits. However, with a mining infrastructure established, production costs for additional mines would be closer to those typical of other parts of the province.
C. Market Potential for Copper

In 1990, world copper consumption was 10,821,000 tonnes; production was slightly lower, at 10,733,000 tonnes. In the longer term, world copper demand is projected to grow between 2 and 2.5 per cent annually over the next ten years, with the greatest growth in demand occurring in China, Japan and other newly industrializing countries of eastern Asia. Demand is expected to be particularly significant for information-related equipment (computers and communications), for complex consumer technology (automobiles, electronic products, refrigeration), and for economic development (infrastructure, etc.).

The price of copper has fluctuated between (U.S.) $1.59 and $0.59 cents a pound since 1985, but is expected to stabilize around the $1.00 level in real terms during the next decade. Approximately 37 to 40 per cent of copper is recycled, and this proportion is not expected to increase. Substitution for copper by other materials is not likely to decrease demand. This is illustrated by the recent history of automobile manufacturing, where the demand for copper for radiators initially decreased because of substitutes, but the overall demand later increased with the introduction of complex electronics in new automobiles; copper use has increased from an average of 32 pounds per car in 1980 to 50 pounds today. Similarly, the growth of microwave and fibre-optics technologies have actually led to increased copper consumption.

Demand growth of 2 per cent per year, combined with current demand of almost 11 million tonnes a year, less an allowance for recycling, suggests an annual demand increase of around 140,000 tonnes. This is roughly equal to the level of production expected at a Windy Craggy mine, if developed. Few mines currently under consideration are capable of production on that scale. Furthermore, a review of the various projects that are currently underway indicates that future mine production may not be sufficient to satisfy the market’s demand. The current outlook for copper is such that there should be a ready market for production from a mine at Windy Craggy Mountain.

D. Economic Impacts of a Windy Craggy Mine

The economic benefits of a mine development include direct employment; stimulation of support industries providing goods and services; an economic base for goods and services whose production is induced by the direct and indirect employment created by a mine; improved infrastructure; export earnings; and revenue to federal, provincial and municipal governments.

1. Gross estimate of revenues

Geddes Resources estimates that the mineral deposit at Windy Craggy Mountain contains 297 million tonnes of ore reserves, with an average grade of 1.4 per cent copper (a total of 4.2 billion kilograms), 3.62 grams of silver per tonne, and 0.18 grams of gold per tonne. Assuming that the full volume of the ore (including gold and silver as well as copper) could be economically extracted and processed, the gross
metal value of the ore at current prices is estimated by the Ministry of Energy, Mines and Petroleum Resources to be $15 billion (Cdn.) minimum. Taking into account recovery factors, Geddes Resources estimates the gross recoverable value at $8.5 billion. For business reasons, Geddes Resources did not wish to detail the method by which they calculated this figure.

The net value may be expected to be influenced by fluctuations in metal prices, capital costs, operating costs, inflation, the cost of managing environmental risks, taxation, and the cost of bonding that would be required by government as part of any mine approval.

2. Impact on economy

With ore production of 20,000 tonnes a day, increasing to 30,000 tonnes after five years, Geddes expects the mine to be in operation for at least 20 years. Construction of mine facilities during a pre-production period of approximately three years is expected to require a workforce of 500, with workers being drawn from communities such as Whitehorse, Prince George, Kamloops, Smithers, Terrace and Fort St. John. The workforce required to operate the mine after start-up is also expected to be about 500 persons, drawn primarily from centres such as Whitehorse, Smithers, Prince George, Kamloops, Fort St. John, Haines, and the lower mainland. The principal home communities of the minesite employees, assuming a fly-in operation, are expected to be Smithers and Terrace.

Every direct job created by a mining operation is the source of additional "indirect" and "induced" jobs. Indirect jobs result from spending by mining companies on goods and services such as fuel purchases, tires, explosives, helicopter charters, drilling, and camp services. Induced jobs are created by the demand for goods and services by the direct and indirect employees of a mine, and include the entire spectrum found in a modern economy, ranging from consumer goods to government services.

Multipliers can be used as rough guidelines to estimate the number of indirect and induced jobs created by a mining operation. Geddes Resources estimates that each direct job would create three additional indirect jobs, based on a multiplier effect used by Price Waterhouse in its 1989 report on the B.C. mining industry for the Mining Association of British Columbia. The Ministry of Energy, Mines and Petroleum Resources estimates every direct job in the mining industry creates an additional 1.4 indirect and induced jobs. (This multiplier does not take into account certain additional employment activity that may flow from mining operations — for example, mine-related construction, financial market activity, and government jobs resulting from tax payments.) Based on this multiplier, 500 mining jobs in B.C., Yukon and Alaska would produce another 700 indirect jobs.

It is important to recognize that these multiplier effects are not benefits to the provincial economy in the same sense as direct employment opportunities. These indirect effects should only be viewed as equivalent to direct employment benefits if the resources (labour and capital) would otherwise be unemployed. The usual assumption is that resources move to sectors where they are more fully employed. In that case, viewing the multiplier effects as benefits equivalent to direct employment benefits would overestimate those benefits.
3. **Tax and royalty revenues**

Until mine design is finalized and capital and operating cost estimates are available, preliminary estimates of tax and royalty revenues from a proposed project such as Windy Craggy are imprecise. They depend on assumptions about the economic and technical feasibility of the project, the degree to which revenues will exceed costs (itself a function of capital and operating costs), the future price of copper, marketing success, and the structure and level of taxes when the mine is in production. Based on a metal recovery value of $8.5 billion, employment of 500 persons, a mine life of 20 years, and other assumptions, Geddes Resources estimated potential tax and royalty revenues. To obtain a reference point for these estimates, the Ministry of Energy, Mines and Petroleum Resources was asked by the Commission to produce, by economic modelling, calculations for a hypothetical project of a similar scale to the Windy Craggy proposal.

Based on its Stage 1 report under the Mine Development Review Process, Geddes Resources made preliminary estimates using the following assumptions: capital investment of $550 million for initial development; annual expenditures averaging $150 million; 1,500 indirect employment opportunities for contractors, suppliers, and other support. These assumptions were used by the company to produce an estimate of gross direct taxes paid during the life of the mine. The taxes estimated to be payable to the government of Canada, including corporate income and personal taxes, totalled $545 million in undiscounted values. Provincial taxes totalled $720 million, including corporate income tax, personal taxes, mining taxes, fuel taxes, and sales taxes.

The Ministry of Energy, Mines and Petroleum Resources modelled a “similar” mine, basing its estimates on the following assumptions: three-year pre-production period; capital costs of $600 million; mine life of 20 years; direct employment of 500 persons; no existing tax pools for corporate income tax purposes; an exchange rate of $0.80; 100 per cent equity; reclamation security at $30 million; and a 15 per cent internal rate of return, which was assumed to be the minimum level of profitability that would attract investors and allow financing. Thus the estimates were structured to represent an economically successful mine, ignoring potential uncertainties about costs and revenues. To achieve this rate of return, the ministry assumed a copper price of approximately 84 cents U.S., which is significantly lower than the current price in the range of $1 U.S. The “base case” assumptions produced the following conclusions regarding taxes to be paid during the life of the mine: $712.6 million in undiscounted values to the federal government (corporate income, personal, and excise taxes), and $877.8 million to the provincial government (corporate income, personal, mining, fuel, sales, property and corporation capital taxes).

The comparability of the two sets of figures is affected somewhat by the fact that Geddes Resources and the ministry used slightly different assumptions in preparing their estimates. Nevertheless, it is

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2 The mineral tax is two-tiered. In the first stage, the net current proceeds are taxed at 2 per cent until the mine has repaid capital costs. In the second stage, cumulative net revenue is taxed at 13 per cent, but net current proceeds paid are creditable against the tax liability. In effect, the mine pays a small minimum tax until capital costs are repaid, after which a larger tax on net revenue comes into effect.

3 Federal and provincial income taxes are both estimated on an incremental basis; federal personal taxes include personal income tax as well as the goods and services tax. Incremental personal taxes measure the incremental change in personal tax payments attributable to the higher income obtained by workers as a result of being employed at the mine. This analysis assumes the employees were working elsewhere before being hired, but at a lower wage.
significant that the gross estimates prepared by the company and ministry are roughly similar in amount and provide a general approximation of revenues that might be expected if the Windy Craggy project is approved. According to the ministry, the fact that Geddes estimates are lower than the ministry's may reflect availability of tax pools (e.g., tax credits for exploration and development that may be deducted from taxable income) or sophisticated tax planning (e.g., taking advantage of tax rules regarding delayed reporting, etc.).

In undiscounted terms, Geddes Resources estimated that the gross direct taxes paid by the company during the life of the mine to both levels of government would total $1,265 million. The ministry's estimate (which included a greater number of variables, such as excise taxes), was somewhat higher, at $1,590.4 million.

These gross-revenue estimates are significantly reduced when translated to present values, which is a more accurate way of viewing the prospective return. The present value of economic returns to the province would be reduced from $877.8 million (in the base case scenario) to approximately $375 million, expressed as a present value at a 6 per cent discount rate in constant 1992 dollars, discounted to 1992. A supplementary analysis estimated that an additional $15 million (present value) would be derived from tax flows stemming from the labour force working on the project, resulting in a total present value of direct tax benefits to the provincial government of $390 million in present value terms. Total flows to the federal government, using the base case analysis, would be $284 million in present value terms.

This base case analysis was an initial attempt to represent the returns of the mine, if the mine were economically successful (i.e., paid a 15 per cent after tax rate of return). However, there are many uncertainties associated with mining investment in general, and Windy Craggy in particular. Three scenarios were considered for the hypothetical mine, taking into account uncertainties that could potentially decrease or increase the level of return. Factors that could increase the level of return include the discovery of more reserves than anticipated or being able to employ a lower cutoff level of grade than originally planned. Factors leading to lower returns could include lower than expected prices, higher than expected capital costs, higher than expected operating costs, or lower recovery rates. The three scenarios that were created, taking into consideration these and other factors, suggested that financial flows to the provincial government might range from a low of $100 million through a median of $275 million to a high of $580 million in present-value terms. A total present-value return to the province of $315 million, being a probability-weighted average (expected value) of these results, is equivalent to an annual annuity payment of about $23 million, calculated at a 6 per cent interest rate and paid over 30 years.

E. Conclusions

There are many uncertainties associated with an assessment of mineral values in the Tatshenshini/Alsek area and of their economic prospects, including those of the Windy Craggy project.
Preliminary indications are that the area in the vicinity of Windy Craggy Mountain contains exceptionally high mineral values. The Windy Craggy deposit itself has an unusually high grade of copper ore, which accounts for its attractiveness. Geological assessment has only recently been undertaken in a comprehensive manner, and the majority of the area has been mapped only at a reconnaissance scale. Preliminary assessments of the results of the 1992 survey suggest that a seven-kilometre belt of rock running southeast from the vicinity of Windy Craggy Mountain is an area of very high mineral potential, with the prospect of locating other deposits equivalent in size and ore grade to Windy Craggy. An area of high mineral potential has also been identified east of the point at which the Tatshenshini River flows into British Columbia. It is unknown to what degree these zones of high and very high mineral potential extend into parts of the area that have yet to be geologically surveyed, creating further uncertainty as to mineral potential in the area.

Development of a mine in the area will be difficult due to the remote northern location, absence of infrastructure, and environmental protection requirements, leading to increased capital and operating costs. If these challenges can be met, overall market prospects for copper sales appear promising.

If regulatory assessment of the Windy Craggy project in Canada and the U.S. were to continue and development were approved, it would be several years before the construction and operational stages of the project could begin. The Windy Craggy project, if economically feasible, would then provide a positive economic stimulus. Estimates of the economic feasibility and economic impact of a project like Windy Craggy are naturally vulnerable to changes in circumstances and information that may occur in subsequent years. Key factors and uncertainties bearing on economic feasibility of the Windy Craggy proposal include:

a. Technical feasibility, including factors related to efficiency of metal extraction techniques, on-site material separation, tailings pond construction and ongoing maintenance, development of a satisfactory closure plan, and construction and maintenance of a slurry pipeline.

b. Capital costs. The cost of constructing the 105 kilometre access road may be particularly vulnerable to increases over current estimated amounts.

c. Operating costs. These may be subject to variations in costs of supplies, to difficulties imposed by severe climatological conditions, etc.

d. Risk management costs. The cost of environmentally related risk management is subject to several factors, including conditions imposed by regulatory agencies, the availability and cost of technology to manage risks, inherent factors such as risk of seismic events, and the cost of bonding required to address risks during the life of the mine and after abandonment.

e. Copper prices and world market demand. Current predictions suggest stable prices and markets, based on current information about future supply and demand; however, prices are subject to fluctuation due to competing supplies and other factors.
f. Employment creation. Evolution of technology during the years before start-up of a mine might affect the numbers of direct jobs created. Estimates of the number of indirect jobs created depend on the multiplier used. Geddes estimates that each direct job would create three indirect jobs; the ministry estimates that each direct job would create 1.4 indirect jobs.

g. Tax revenues. The amounts of revenues currently estimated by Geddes Resources and the Ministry of Energy, Mines and Petroleum Resources do not vary significantly. However, such revenues would be subject to variables such as actual net revenues derived from the operation and alterations in federal and provincial tax policies.

Subject to the significant uncertainties created by these variables, the Windy Craggy project and other potential mining developments in the area appear capable of creating a major economic return to the province.
5 Windy Craggy Project: Environmental Risks

A decision on land use for the Tatshenshini/Alsek area must take into account all potential risks to the environment. The Alsek/Tatshenshini watershed is an important regional spawning destination for several species of Pacific salmon. The area contains one of the densest populations of grizzly bears in the Pacific Northwest and includes significant populations of Dall’s sheep and mountain goat. The area is also a significant flyway for arctic-nesting birds. The decision-making process must consider not only direct risks to fish and wildlife, but also risks to plants and animals throughout the food chain, and to the individual components of the various ecosystems that make up the Tatshenshini/Alsek wilderness.

In order to obtain an overview of environmental risks posed by the Windy Craggy project, the Commission on Resources and Environment commissioned Rescan Consultants Inc. to conduct a qualitative risk assessment. This chapter summarizes the Rescan report, “Windy Craggy Project: Qualitative Risk Assessment” (see Appendix 1) and makes note of concerns that may require further study.

A. Risk Assessment Methodology

While degree of risk is impossible to define absolutely, it can be estimated by attempting to predict (a) risk events and how frequently they might be expected to occur and (b) what the consequences are likely to be if they do occur. These two predictions are linked to produce a qualitative risk assessment, which differs from a quantitative assessment (based on empirical estimates) in so far as it relies on best professional judgement.

A qualitative risk assessment for the Windy Craggy project was achieved by use of a method called an “Occurrence Modes and Effects Analysis”. This involves dividing the mine development proposal into its components, or engineered systems, and then predicting the potential impact of each system on the environment. A harmful impact may occur as a result of a failure of a system to perform as designed because of an accident, a limitation in available technology, a mechanical breakdown, a natural disaster such as an earthquake, or any combination of these factors. It was not within the scope of the risk assessment to attempt project planning and, accordingly, all analyses were completed based on data supplied to the risk assessors at the time of the assignment (September 1992). Wherever practical, however, the risk assessment team identified possible compensation factors the proponent might consider to lessen potential environmental risks.

To predict possible occurrence modes and their consequences, Rescan assembled a team of technical experts representing the following interrelated disciplines: civil engineering, seismic activity, glaciology, hydrogeology, water quality and fisheries, wildlife, process engineering, and transportation. During
an intensive workshop the team used “best professional judgement” in a consensus-based approach to identify, systematically, potential project-related risks. In addition to assessing the likelihood of an undesirable event and its probable consequences, the team assigned confidence factors to both likelihood and confidence judgements to reflect the level of uncertainty associated with a particular assessment. The team also evaluated how the degree of risk might differ during each of the following project stages: construction, operation, closure, and abandonment.

Once undesirable events and their potential effects were identified, the consequences of those effects to the reference species (salmonid fish, grizzly bears, Dall’s sheep, and mountain goats) were placed in one of three categories:

1  Low  - avoidance likely or localized effect
     - population effects short term
     - recovery likely

2  Moderate  - temporary and recoverable or permanent but localized habitat effects
              - lethal or chronic effects on population

3  Severe  - permanent or large-scale habitat destruction
            - lethal to significant proportion of population
            - avoidance not possible

Team members estimated the annual likelihood of an event based on the following categories:

1  Negligible  - less than one in a million

2  Very low  - between one in a million and one in ten thousand

3  Low  - between one in ten thousand and one in a hundred

4  Moderate  - between one in a hundred and one in ten

5  Significant  - greater than one in ten.

Although cumulative likelihood was not assessed, it should be understood that for long-term occurrence, likelihood increases over time, so that an event with an annual likelihood of less than one in a million (“negligible”) will have a cumulative likelihood of up to one in a hundred (“moderate”) over 10,000 years, and an event with a “significant” annual likelihood will be virtually certain to occur within 100 years. As some key components of the Windy Craggy project, such as the tailing dams, must continue to function in perpetuity, it is recognized that some predictions of likelihood must be entirely speculative. For example, the longevity of materials such as concrete is unknown, and biological, climatic, and geological forces may change significantly over long periods of time.
Finally, team members indicated how confident they felt about assigning specific ratings describing consequences and likelihoods, using three confidence factors:

1. Low - confidence less than 20 per cent
2. Medium - confidence between 20 per cent and 80 per cent
3. High - confidence greater than 80 per cent

These three rating systems — consequences, likelihood, and confidence — together were used to attempt to provide a measurement of risk, as reflected in the tables reproduced from the Rescan report in this chapter.

Recognizing the impossibility of rating the consequences for all fish and wildlife species, the team selected the following as representative species or species groups for consideration in the qualitative risk assessment: salmonid fishes, grizzly bears, and Dall’s sheep/mountain goats.

Rescan emphasized that although the process described above is fairly comprehensive, its reliability was limited by dependence on available data that may not be fully developed at this stage of project planning and design.

B. Potential Risks

In this section, the tables reproduced from the Rescan report detail the environmental risks associated with the Windy Craggy proposal as identified by the assembled panel of experts. The text highlights key information in those tables. (For detailed text, see chapters 4 and 5 of the Rescan report.) The components discussed on the following pages include the mine, glacier waste dumps, glacier road and pipelines, the mill, the tailings and waste rock impoundment, the transportation corridor, the deepsea terminal at Haines, and the base camp complex.

1. Mine

a. Description

The primary source of information upon which the following section was based is the Revised Mine Plan submitted by Geddes Resources in January 1990. Plans for the proposed project are illustrated in Map 5.

Two sulphide ore-bodies on Windy Craggy Mountain extend over a 1.6 kilometre northwest/southeast axis and range in elevation from 1,850 to 1,200 metres. The southern ore-body is largely covered by an icefield, and exposed rock is subject to very high annual precipitation, mainly in the form of snow.
Map 5: Proposed Windy Craggy Mine Project
Source: Goddess Resources Limited
The first two years of the project would be spent providing access to the ore-bodies by building three access roads and removing roughly 11 million tonnes of rock and ice. Ore would then be mined at a rate of at least 20,000 tonnes a day, increasing to 30,000 tonnes by the fifth year. The mine would have an expected life of at least 15 years before being closed and abandoned. Roughly 59 per cent of the known ore-body would be mined using open pit methods; 41 per cent, all beneath the south zone below 1,450 metres, would be mined by the "block caving" underground method. Together, the two mines contain a mineable ore reserve of 130.7 million tonnes as well as 250.8 million tonnes of waste rock to be removed, of which 40 per cent is acid generating waste.

At the open pit mine, the rock would be blasted, sorted into acid generating and non-acid generating waste, and loaded by shovel onto trucks, which would dump the non-acid generating waste onto Marie and North Cirque Glaciers and would haul the ore and acid-generating waste to mobile crushers in the pit. After crushing, the ore and waste would be loaded separately onto a conveyor to be transported 1,000 metres to the portal for secondary crushing (ore) or storage (waste). Underground mining would not begin until the tenth year of operation, and all waste rock from this process would be left in the cave blocks.

All runoff and ground water would be contained and pumped to the portal to be used in the grinding process before being piped down to the mill and eventually to the impoundment for treatment, before being released to the environment. When Geddes closes the mine after a minimum of 15 years of operation, the portal would be plugged and the underground mine flooded; Geddes anticipates that the walls of the open-pit mine would freeze, thus preventing release of acidic water.

b. Risks

The potential release of contaminated water into the environment is the main risk presented by the open pit and underground components of the Windy Craggy project. A failure of the water management system to collect and handle sufficient water moving though the mine could lead to a release into the watersheds of acid-rock drainage (ARD) or metal-laden water, spilled hydrocarbons, or nutrients from explosives. Of particular concern is acid-rock drainage, which occurs when sulphides in rock are exposed to the air (for example, by blasting) and oxidize, resulting in the release of low pH drainage, often high in dissolved heavy metals.

The team identified the possibility that the system for collecting water and pumping it to the portal could fail as a result of human error, equipment failures, geologic events such as earthquakes, or contaminated water escaping through fractured rock. The team concluded that there would be a moderate likelihood of such an occurrence, with a low consequence factor due to the company’s commitment to collect and treat contaminated water at the minesite. (See Table 5-1) However, the team concluded that the consequence factor should be increased to moderate upon abandonment of the mine because of (a) decreased monitoring and maintenance, (b) the uncertainty of ARD being prevented by freezing of pit walls after closure, and (c) the uncertainty of success in effectively plugging the portal.
<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence Confidence Factor</th>
<th>Consequence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1.1</td>
<td>water-management system for pit and underground mine failing to contain ARD or leached metals</td>
<td>leading to release of acidity and/or metal-laden water, resulting in toxicity to aquatic life in Tats Creek and Frobisher/Alsek watershed</td>
<td>C, O, CL</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
</tr>
<tr>
<td>5.1.1.2</td>
<td>water-management system for pit and underground mine failing to contain ARD or leached metals</td>
<td>leading to release of acidity and/or metal-laden water, resulting in toxicity to aquatic life in Tats Creek and Frobisher/Alsek watershed</td>
<td>A, moderate</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
<td>flood pit; freeze walls plug in portal</td>
</tr>
<tr>
<td>5.1.1.3</td>
<td>water-management system in pit and underground failing to contain spills of fuel and other hydrocarbons</td>
<td>in sufficient quantity, leading to toxicity to aquatic life in Tats Creek and Frobisher/Alsek watershed</td>
<td>C, O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>medium</td>
</tr>
<tr>
<td>5.1.1.4</td>
<td>water-management system in pit and underground failing to contain nitrate from explosives</td>
<td>leading to excess aquatic vegetation growth and compromise fish habitat</td>
<td>C, O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>medium</td>
</tr>
<tr>
<td>5.1.2</td>
<td>treatment facility/facilities for mine water failing to contain or not fully treating contaminated water</td>
<td>resulting in acute or chronic toxicity to aquatic life</td>
<td>C, moderate</td>
<td>low</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5-1 Windy Craggy Project OMEA: Mine
In light of past experience with water treatment plants in British Columbia and elsewhere in Canada, the team also assigned moderate ratings to the likelihood and consequence of a failure of the water treatment plant during construction, operation, closure, and long-term abandonment.

2. Waste dumps

a. Description

Preliminary tests indicate that 40 per cent of the waste rock produced at the minesite would be acid-generating because of its exceptionally high sulphide content. Geddes Resources plans to separate acid-consuming waste rock from acid-generating waste rock at the minesite. To ensure accurate separation of the two types of waste, blasted material would be marked by Dayglo colour flags according to its content, under the supervision of geologists, with each shovel load of waste being tracked by a computer system.

Acid-consuming waste at the open-pit minesite would be crushed, loaded onto trucks, and dumped onto two glaciers, North Cirque and Marie, draining into the Frobisher/Alsek watershed to the west of Windy Craggy Mountain. Over time, the estimated total of 151 million tonnes of waste dumped onto the two glaciers are expected to break down and disperse into moraines. Acid-generating waste would be crushed, trucked to the tailings impoundment, dumped, and stored in perpetuity under four metres of water to prevent oxidation of sulphide material.

b. Risks

The team concluded it to be most probable that some acid waste could reach the glacier dumps as a result of improper sorting. Any significant quantity of acid waste included in the dumps, which are approximately nine kilometres from the Alsek River, could generate acid and lead to chronic contamination of the Frobisher/Alsek watershed. The team assigned a moderate rating to both the likelihood and the consequence of this occurrence from operation through closure and abandonment, and concluded further evaluation would be required to define the risk and devise suitable containment measures. (See Table 5-2)

The weight of 151 million tonnes of rock on the glaciers could increase the rate of glacial flow. A collapse of unstable dumps resulting from glacier advance could enlarge the moraine at the toe of Frobisher Glacier, and if the moraine were subjected to sudden movement by flood or earthquake, grizzly and salmon habitat could be adversely affected. The team assigned moderate ratings to both the likelihood and consequence of this chain of events, with a low confidence factor indicating uncertainty.

The team assigned a moderate likelihood and low consequence factor to the Alsek River being affected by (a) a glacial surge induced by the dumped rock, or (b) an increase in sedimentation reaching the river because of the existence of the waste dump.
<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Dumps</td>
<td>improper sorting in pit</td>
<td>acid waste on glacier in sufficient quantity could result in chronic contamination of Frobisher/Alsek watershed</td>
<td>O, CL, A</td>
<td>moderate</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
<td>acid consuming rock would be blended in dump on Frobisher Glacier</td>
</tr>
<tr>
<td>5.2.2</td>
<td>dump instability on excavated snow and ice (snow will be dumped prior to rock)</td>
<td>potential rapid runoff to toe of Frobisher Glacier affecting grizzly habitat along Frobisher Creek and salmonoids in Alsek River</td>
<td>O, CL, A</td>
<td>moderate</td>
<td>low</td>
<td>moderate</td>
<td>medium</td>
<td>movement to change direction 90° at Frobisher Glacier</td>
</tr>
<tr>
<td>5.2.3</td>
<td>glacier stability under dump load</td>
<td>increased glacier advance, or increased moraine volume, or potential dump instability, could foul backwaters of lower Alsek critical to spawning and rearing of salmonoids</td>
<td>O, CL, A</td>
<td>low</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
<td>Alsek River will erode small spill</td>
</tr>
<tr>
<td>5.2.4</td>
<td>glacial sedimentation</td>
<td>increased sediment to Alsek watershed could foul backwaters of lower Alsek critical to spawning and rearing of salmonoids</td>
<td>O, CL, A</td>
<td>low</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
<td>as above</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5.2 Windy Craggy Project OMEA: Waste Dump
3. Glacier road and ore pipeline to mill

a. Description

The team’s assessment of the risks associated with the road and pipeline were based on very limited information. An 11-kilometre road and two pipelines (a slurry pipeline and associated water reclaim pipeline) would be constructed on Tats Glacier to connect the mine with a flotation, regrind and dewatering plant in Tats Valley. The road would be used to transport acid-generating waste rock from the underground mine portal to the tailings and waste rock impoundment. This would require roughly 96 trips per day one-way, using 210-tonne capacity bottom dump trailers, to haul approximately 6,700,000 tonnes per year of acid waste rock. The road would also haul fuel, supplies and personnel up to the minesite. The road would rise 700 metres in elevation at an average grade of 6.38 per cent, and would be constructed of compacted aggregate designed to accommodate glacier movement and melting.

The pipeline would carry slurry (ore concentrate mixed with water) to the mill. In addition, two 4,000 metre pipelines would run from the tailings impoundment to the grinding plant at the mill to supply make-up water for grinding and slurry transport, and to carry tailings to the impoundment. The pipelines would be designed to accommodate glacier movement and would have spill-detection, spill collection, and clean-up mechanisms.

Local conditions will impose particular challenges in the construction and operation of the road and pipelines. The road is likely to require annual resurfacing, and steep grades and poor visibility may require stringent safety conditions for truck operation. The pipelines would be subjected to differential melting and would have to be designed to accommodate the points of conjunction between the moving glacier (advancing roughly 40 metres a year) and land at crossing points.

b. Risks

Risks associated with the road and pipelines would be limited to the construction and operations phases, assuming that the pipeline and road traffic control system would be removed on closure of the mine. The potential risks created by heavy truck traffic on the glacier include fuel spills, noise disturbance to grizzly bears, acid waste rock spills, and deterioration of water quality depending on the use of urea/salt for ice control. The team assigned moderate likelihood and low consequence factors to a short-term impact of fuel oil spills resulting in fish mortality in Tats Creek (see Table 5-3); significant occurrence and low consequence factors to a noise impact on bears, due to limited bear use and the tendency of grizzlies to relocate to avoid noise; moderate occurrence and low consequence factors to acid rock spills, assuming effective and timely clean-up; and moderate ratings for both occurrence and consequence of effects of urea/salt use.

The team assigned a low risk to impact of a rupture of the ore pipeline if prompt recovery action were taken, with the caveat that pipeline design features to compensate for glacier movements were unknown. Low likelihood and consequence ratings were assigned, also with low and medium confidence respectively, regarding a rupture of the tailings and water reclaim pipelines between the mill and the tailings impoundment.
Table 5-3
WINDY CRAGGY PROJECT
OMEA

System: GLACIER ROAD AND ORE PIPELINE TO MILL

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine Haul Road 5.3.1.1</td>
<td>fuel spill following transportation accident</td>
<td>recoverable effect on water quality which (depending on quantity and location) could affect fish stocks in Tats Creek watershed</td>
<td>C, O</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
<td>traffic control system</td>
</tr>
<tr>
<td>5.3.1.2 regular vehicular traffic</td>
<td>disturbance of grizzly using slopes beside lower glacier</td>
<td></td>
<td>C, O</td>
<td>low</td>
<td>high</td>
<td>significant</td>
<td>high</td>
<td>animals may adapt</td>
</tr>
<tr>
<td>5.3.1.3 acid rock spill following transportation accident</td>
<td>recoverable effect on water quality which depending on quantity could be prolonged if not cleaned up promptly</td>
<td></td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
<td>clean-up may be easily accomplished</td>
</tr>
<tr>
<td>5.3.1.4 use of urea/salt for ice control</td>
<td>chronic effect on water quality in Tats Creek watershed</td>
<td></td>
<td>C, O</td>
<td>moderate</td>
<td>high</td>
<td>moderate</td>
<td>high</td>
<td>lined spill pond, subject to cost/feasibility re: flow rate of glacier</td>
</tr>
<tr>
<td>Slurry Pipeline 5.3.2</td>
<td>pipeline rupture</td>
<td>short-term toxicity to fish in Tats Creek</td>
<td>O</td>
<td>low</td>
<td>medium</td>
<td>low</td>
<td>low</td>
<td>shutdown controls</td>
</tr>
<tr>
<td>Tailings Pipeline 5.3.3.1 pipeline rupture</td>
<td>short-term toxicity to fish in Tats Creek</td>
<td></td>
<td>O</td>
<td>moderate</td>
<td>medium</td>
<td>low</td>
<td>low</td>
<td>shutdown controls</td>
</tr>
<tr>
<td>5.3.3.2 exposed water reclaim pipeline rupture</td>
<td>short-term water quality degradation, impact on Tats Creek</td>
<td></td>
<td>O</td>
<td>low</td>
<td>medium</td>
<td>low</td>
<td>low</td>
<td>shutdown controls</td>
</tr>
<tr>
<td>5.3.3.3 exposed tailings pipeline leakage over time</td>
<td>chronic water quality degradation in Tats Creek basin</td>
<td></td>
<td>O</td>
<td>low</td>
<td>medium</td>
<td>low</td>
<td>low</td>
<td>detection devices</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5-3 Windy Craggy Project OMEA: Glacier Road and Ore Pipeline to Mill
4. Mill

a. Description

The flotation, regrind, and dewatering plant near Tats Lake would use ammonium chloride and oxalic acid to produce 28 per cent copper concentrate from the slurry piped down to the plant from the mine. Lime from a nearby quarry would be employed for pH modification. Tailings produced by the process would be pumped by pipeline to the tailings impoundment, and tailings water would be reclaimed from the pond and piped back to the plant.

b. Risks

The most significant risk identified regarding the presence of mill was the potential loss of wildlife habitat over an area of 2.5 square kilometres. Denning grizzly bears would be especially affected. (See Table 5-4) The likelihood of disturbance to wildlife as a result of the limestone quarry operation was considered high, with moderate localized and long-term consequences.

Fish habitat in Tats Lake and Tats Creek could be affected by silt and debris produced by excavation, blasting, and levelling; by spills of reagents in storage and during processing; and by a rupture of the water reclaim line.

5. Tailings and waste rock impoundment

a. Description

The tailings and waste rock impoundment would be designed to store 124 million tonnes of tailings and 100 million tonnes of acid waste rock under four metres of water. The impoundment would be created by the construction of two embankments: a major one at the confluence of Tats and Upper Tats Creek, and a smaller one at the saddle marking the watershed divide into Noisy Valley. Constructed of rock fill designed to withstand earthquakes, the impoundment would be approximately five kilometres long and one kilometre wide, and would be raised gradually to a maximum height of 110 metres along the major embankment. A water treatment plant would be installed and operated to treat all discharge water from the impoundment and the mine to meet criteria to be established.

On closure of the mine, steps would be taken to ensure long-term stability of the impoundment by way of annual inspection, rebuilding and maintenance procedures.

b. Risks

Construction of the impoundment would permanently eliminate approximately eight square kilometres of fish and wildlife habitat, particularly grizzly bear habitat. Noise and human activity would further deter grizzlies from remaining in the area.

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1 The assessment of risks to grizzly bears was conducted prior to release in October 1992 of the draft report, "The Conservation Significance of Bears and Their Habitat in the Tatshenshini River Valley", by Stephen Herren, Anne Weenstra, Richard Roth and Linda Wiggins (University of Calgary, Faculty of Environmental Design, January 1993). The study concludes that the area downstream of Tats Lake (the location of the flotation, grinding and dewatering plant) and above Tats Creek is "the most important known grizzly bear denning area" in the Tatshenshini-Alsek area.
Table 5-4
WINDY CRAGGY PROJECT
OMEA

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site</td>
<td>5.4.1.1 excavation/blasting/leveling</td>
<td>impact of increased silt load on Tats Creek aquatic life; increased nitrate content in seepage causing higher algal growth</td>
<td>C</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>5.4.1.2 presence of mill, noise, human activity</td>
<td>impact on nearby wildlife, especially grizzly</td>
<td>O, C</td>
<td>moderate</td>
<td>high</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>5.4.1.3 reagent spills in and out of mill</td>
<td>escape from mill to surface drainage and then to Tats Creek</td>
<td>O</td>
<td>low</td>
<td>medium</td>
<td>moderate</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>5.4.1.3 stored reagent spills (e.g., ammonium chloride)</td>
<td>toxic to aquatic life in Tats Creek</td>
<td>O</td>
<td>moderate</td>
<td>high</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Grinding Facility</td>
<td>5.4.2 surge water tank rupture</td>
<td>short term, localized adverse effect on water quality in Tats Creek basin</td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Tailings Effluent</td>
<td>5.4.3 significant over addition of reagents i.e., NH₄Cl and H₂C₂O₄</td>
<td>contaminate tailings pond leading to impact on wildlife</td>
<td>O</td>
<td>low</td>
<td>medium</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Water Reclam</td>
<td>5.4.4 line rupture</td>
<td>contaminate Tats Creek leading to impact on aquatic habitat</td>
<td>O</td>
<td>low</td>
<td>medium</td>
<td>moderate</td>
<td>high</td>
</tr>
<tr>
<td>Lime Quarry Operation</td>
<td>5.4.5 rock dust, runoff sedimentation, blasting and equipment noise</td>
<td>disturbance impact on wildlife</td>
<td>O</td>
<td>moderate</td>
<td>medium</td>
<td>high</td>
<td>high</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment
** (s) = salmonids; (w) = wildlife

5-4 Windy Craggy Project OMEA: Mill
### Table 5-5

**WINDY Craggy Project**

**OMEA**

**System:** TAILINGS/ACID ROCK IMPOUNDMENT

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence **</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5.1.1</td>
<td>high precipitation/runoff during construction</td>
<td>downstream sedimentation effects on fish</td>
<td>C, O</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
<td>good sediment control practices, small incremental effects</td>
</tr>
<tr>
<td>5.5.1.2</td>
<td>presence of tailings impoundment, noise and activity</td>
<td>bear and fish habitat loss, impact on grizzly movements affects certain individuals but not population</td>
<td>C, O, CL, A</td>
<td>moderate</td>
<td>high</td>
<td>significant</td>
<td>high</td>
<td>reclamation</td>
</tr>
<tr>
<td><strong>Dam Breach from Static Failure Mechanisms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5.2.1</td>
<td>flood overtopping of either or both embankments</td>
<td>dam breach and release of tailings and dissolved metals to Alsek River system habitat</td>
<td>O, CL</td>
<td>severe(s) low (w)</td>
<td>high</td>
<td>medium</td>
<td>very low</td>
<td>medium</td>
</tr>
<tr>
<td>5.5.2.1</td>
<td>flood overtopping of either or both embankments</td>
<td>dam breach and release of tailings and dissolved metals to Alsek River system habitat</td>
<td>A</td>
<td>severe (s) low (w)</td>
<td>high</td>
<td>medium</td>
<td>low</td>
<td>medium</td>
</tr>
<tr>
<td>5.5.2.2</td>
<td>piping/sliding/foundation embankment failures</td>
<td>dam breach and release of tailings and dissolved metals to Alsek River system habitat</td>
<td>O, CL</td>
<td>severe (s) low (w)</td>
<td>high</td>
<td>medium</td>
<td>very low</td>
<td>medium</td>
</tr>
<tr>
<td>5.5.2.2</td>
<td>piping/sliding/foundation embankment failures</td>
<td>dam breach and release of tailings and dissolved metals to Alsek River system habitat</td>
<td>A</td>
<td>severe (s) low (w)</td>
<td>high</td>
<td>medium</td>
<td>low</td>
<td>medium</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment
** (s) = salmonids; (w) = wildlife

5-5 Windy Craggy Project OMEA: Tailings/ Acid Rock Impoundment System
### Table 5-5 (cont'd)

**Windy Craggy Project**

**OMEA**

#### System: TAILINGS/ACID ROCK IMPOUNDMENT

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
</table>
| 5.5.3.1    | Dam Breach from Seismic Failure Mechanisms | Dam breach and release of tailings and dissolved metals to Alsek River system habitat | O, CL, A | severe (s) | high | very low | low | a) thorough and extensive Becker exploration program.  
|            | seismic foundation liquefaction failure | | | low (w) | medium | | | b) excavation of liquefaction susceptible soils in foundation.  
|            | | | | | | | | c) alternative dam site on bedrock.  
|            | | | | | | | | d) removal of water and desaturation of tailings.  |
| 5.5.3.2    | seismic crest deformations, leading to overtopping and breach of dam | Dam breach and release of tailings and dissolved metals to Alsek River system habitat | O, CL | severe (s) | high | low | medium | presumes state-of-the-art design & construction technology, plus maintenance and repair.  
|            | | | | low (w) | medium | | | integrating coarse waste rock into impoundment structure.  |
| 5.5.3.3    | seismicity-induced cracking, piping, internal erosion, leading to breach of dam | Dam breach and release of tailings and dissolved metals to Alsek River system habitat | O, CL | severe (s) | high | low | medium | presumes state-of-the-art design & construction technology.  
|            | | | | low (w) | medium | | | removal of water and desaturation of tailings, integrating coarse waste rock into impoundment structure.  |

* C = Construction; O = Operation; CL = Closure; A = Abandonment  
** (s) = salmonids; (w) = wildlife

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5-5 Windy Craggy Project OMEA: Tailings/Acid Rock Impoundment System (cont'd)
Table 5-5 (cont’d)

WINDY CRAGGY PROJECT
OMEA

System: TAILINGS/ACID ROCK IMPOUNDMENT

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence **</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5.3.3</td>
<td>seismically-induced cracking, piping, internal erosion, leading to breach of dam</td>
<td>dam breach and release of tailings and dissolved metals to Alsek River system habitat</td>
<td>A</td>
<td>severe (s)</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
<td>removal of water and desaturation of tailings</td>
</tr>
<tr>
<td>5.5.3.4</td>
<td>fault offset of dam</td>
<td>dam breach and release of tailings and dissolved metals to Alsek River system habitat</td>
<td>O, CL, A</td>
<td>severe (s), low (w)</td>
<td>high, low</td>
<td>low</td>
<td>low</td>
<td>assumes appropriate mitigation or avoidance through tectonic studies, removal of water or desaturation of tailings after closure</td>
</tr>
</tbody>
</table>

**Dam Breach from Natural Hazards**

| 5.5.4.1    | embankment breach by overtopping due to displacement of tailings or water by landslide, avalanche, debris flow (including earthquake trigger) | dam breach and release of tailings and dissolved metals to Alsek River system habitat | O, CL, A | severe (s), low (w) | high | moderate | low | removal of water, desaturation of tailings after closure, further tailings investigation required of apparent debris flows and rock glaciers above impoundment |
| 5.5.4.2    | dam destruction by landslides, avalanches, debris flow | dam breach and release of tailings and dissolved metals to Alsek River system streambank habitat | O, CL, A | severe (s), low (w) | high | negligible | low | relocate impoundment or dam sites |

* C = Construction; O = Operation; CL = Closure; A = Abandonment
** (s) = salmonids; (w) = wildlife

5-5 Windy Craggy Project OMEA: Tailings/Acid Rock Impoundment System (cont’d)
<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5.5.1 Dam Destruction from Glacial Hazards</td>
<td>dam breach and release of tailings and dissolved metals to Alee River system streambank habitat</td>
<td>A</td>
<td>low</td>
<td>low</td>
<td>very low</td>
<td>low</td>
<td>negligible incremental damage attributable to tailings</td>
<td></td>
</tr>
<tr>
<td>5.5.5.2 Dam destruction by backwater behind down valley glacial or landslide dams</td>
<td>loss of inundated tailings and dams due to breach of landslide or ice dam</td>
<td>A</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>negligible incremental damage attributable to tailings</td>
<td></td>
</tr>
<tr>
<td>5.5.5.3 Glacial ice formation and movement within impoundment area in connection with general glacial advance</td>
<td>dispersion and dissemination of tailings within and by the ice mass</td>
<td>A</td>
<td>low</td>
<td>low</td>
<td>very low</td>
<td>low</td>
<td>general climate change would itself modify all current habitat negligible incremental damage attributable to tailings</td>
<td></td>
</tr>
<tr>
<td>5.5.5.4 Advance of existing rock glaciers or ice fields into impoundment</td>
<td>dispersion and dissemination of tailings within and by the ice mass</td>
<td>A</td>
<td>low</td>
<td>low</td>
<td>very low</td>
<td>low</td>
<td>general climate change would itself modify all current habitat negligible incremental damage attributable to tailings</td>
<td></td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; SL = Closure; A = Abandonment

5-5 Windy Craggy Project OMEA: Tailings/Acid Rock Impoundment System (cont'd)
### Table 5-3 (cont'd)

**WINDY CRAGGY PROJECT**

**OMEA**

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Acid Drainage from Impoundment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5.6.1</td>
<td>loss of water cover due to</td>
<td>oxidation of tailings and acid rock causing low pH and excess dissolved metals in waters draining into Tats Creek watershed, could also affect Aitkin watershed; will result in chronic degradation of aquatic habitat in areas affected</td>
<td>0, 1, 2</td>
<td>moderate</td>
<td>high</td>
<td>very low to low</td>
<td>medium</td>
<td>operational control of water inputs and treatment if necessary</td>
</tr>
<tr>
<td>5.5.6.1</td>
<td>loss of water cover due to</td>
<td>oxidation of tailings and acid rock causing low pH and excess dissolved metals in waters draining into Tats Creek watershed, could also affect Aitkin watershed; will result in chronic degradation of aquatic habitat in areas affected</td>
<td>A</td>
<td>moderate</td>
<td>medium</td>
<td>moderate to significant</td>
<td>low</td>
<td>assess effectiveness of seepage control measures during operation</td>
</tr>
<tr>
<td>5.5.6.2</td>
<td>loss of water cover due to</td>
<td>oxidation of tailings and acid rock causing low pH and excess dissolved metals in waters draining into Tats Creek watershed, could also affect Aitkin watershed; will result in chronic degradation of aquatic habitat in areas affected</td>
<td>0, 1, 2</td>
<td>moderate</td>
<td>high</td>
<td>very low to low</td>
<td>medium</td>
<td>operational control of water inputs and treatment if necessary</td>
</tr>
<tr>
<td>5.5.6.2</td>
<td>loss of water cover due to</td>
<td>oxidation of tailings and acid rock causing low pH and excess dissolved metals in waters draining into Tats Creek watershed, could also affect Aitkin watershed; will result in chronic degradation of aquatic habitat in areas affected</td>
<td>A</td>
<td>moderate</td>
<td>medium</td>
<td>moderate to significant</td>
<td>low</td>
<td>obtain better hydrologic data during operation</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5.5 Windy Craggy Project OMEA: Tailings/Acid Rock Impoundment System (cont'd)

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**Note:** The table continues with more details and additional entries if required, but these are not included in this snippet. The table format allows for a structured presentation of the impacts, stages, consequences, likelihoods, and compensating factors for different scenarios related to acid drainage from impoundment, considering various stages of operation (Construction, Operation, Closure), and abandonment.
Table 5-5 (cont’d)

WINDY CRAGGY PROJECT
OMEA

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5.6.3</td>
<td>metal leaching at neutral pH upwards into tailings supernatant</td>
<td>acute or chronic toxicity to salmonids</td>
<td>O, CL</td>
<td>moderate</td>
<td>medium</td>
<td>negligible</td>
<td>medium</td>
<td>treatment if required</td>
</tr>
<tr>
<td>5.5.6.3</td>
<td>metal leaching at neutral pH into tailings supernatant</td>
<td>acute or chronic toxicity to salmonids</td>
<td>A</td>
<td>moderate</td>
<td>medium</td>
<td>negligible</td>
<td>medium</td>
<td>dilution may be adequate</td>
</tr>
<tr>
<td>5.5.6.4</td>
<td>metal leaching at neutral pH downward to groundwater discharge</td>
<td>acute or chronic toxicity to salmonids</td>
<td>O, CL, A</td>
<td>moderate</td>
<td>medium</td>
<td>negligible</td>
<td>medium</td>
<td>dilution may be adequate</td>
</tr>
<tr>
<td>5.5.6.5</td>
<td>delayed waste rock submergence</td>
<td>ARD and metal leaching which could ultimately affect water quality in Tats Creek and salmonids</td>
<td>O</td>
<td>moderate</td>
<td>medium</td>
<td>low</td>
<td>medium</td>
<td>likelihood depends on placement logistics; treatment if necessary</td>
</tr>
<tr>
<td>5.5.6.6</td>
<td>formation of unsubmerged tailings islands due to rockfall or avalanche into impoundment</td>
<td>ARD and metal leaching which could ultimately affect water quality in Tats Creek and salmonids</td>
<td>O, CL</td>
<td>low</td>
<td>high</td>
<td>very low</td>
<td>medium</td>
<td>water levels can be increased, remedial action i.e. treatment, is possible</td>
</tr>
<tr>
<td>5.5.6.6</td>
<td>formation of unsubmerged tailings islands due to rockfall or avalanche into impoundment</td>
<td>ARD and metal leaching which could ultimately affect water quality in Tats Creek and salmonids</td>
<td>A</td>
<td>moderate</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td></td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5-5 Windy Craggy Project OMEA: Tailings/Acid Rock Impoundment System (cont’d)
Table 5-5a
Summary of Occurrence/Event Types for Tailings/Waste Rock Impoundment System

<table>
<thead>
<tr>
<th>TYPE OF OCCURRENCE MODE</th>
<th>NUMBER OF INDIVIDUAL MODES</th>
<th>CONSEQUENCE RANGE</th>
<th>ANNUAL LIKELIHOOD RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Impoundment Effects</td>
<td>2</td>
<td>low to moderate</td>
<td>moderate to significant</td>
</tr>
<tr>
<td>Dam Failure**</td>
<td>8</td>
<td>severe</td>
<td>negligible to moderate*</td>
</tr>
<tr>
<td>• Static Causes</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seismic Causes</td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Natural Hazards</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impoundment Destruction from Glacial Hazards</td>
<td>4</td>
<td>low</td>
<td>very low to low*</td>
</tr>
<tr>
<td>Acid Generation and Metal Leaching</td>
<td>6</td>
<td>low to moderate</td>
<td>negligible to significant*</td>
</tr>
</tbody>
</table>

* Likelihood is highly dependent on exposure period. Annual likelihoods may increase to significant over time periods associated with abandonment.
** Severe consequences assessed for salmonids only.

5-5a Summary of Occurrence/Event Types for Tailings/Waste Rock Impoundment System

The potential impacts of a failure of the impoundment dams and of acid rock drainage from tailings and waste rock contained in the impoundment pose the most significant risk identified by the team with regard to the Windy Craggy project. A breach of the dams as a result of either earthquakes or other reasons (flooding and erosion) would cause tailings and water to flow into Tats and/or Noisy Creek and from there into the Tatshenshini or Alsek River. Exposed tailings left along stream and river banks after such a breach would continue to generate acidity and metals in solution indefinitely. Destruction of fish habitat would be essentially permanent and virtually complete, at least in the upper reaches of the river systems.

While the likelihood of erosion was considered by the team to be very low during the life of the mine, when monitoring and maintenance would be certain, the risk was considered to increase to low after abandonment. (See Table 5-5) The risk assessment recognized, however, that certain measures could be incorporated to lessen risks of dam failure — for example, integrating coarse waste rock into the impoundment structure.
Windy Craggy Mountain is in the highest seismic hazard zone identified by the National Building Code of Canada. In the event of a major earthquake, dam failure could be caused by foundation liquefaction, embankment deformation, or fault rupture. The team expressed concern that aerial photographs suggest that the main dam may be located either on slide debris or on a terminal moraine deposit, and concluded that the likelihood of occurrence of liquefaction could be reduced by removing liquefaction-susceptible soils in the foundation or relocating the dams on to rock. Based on available data, occurrence of liquefaction failure was rated as very low, with low confidence.

Likelihood of embankment deformation (large movements leading to overtopping and breaching) was rated as low during operation and closure but moderate after abandonment because of an expectation of repeated strong seismic shocks and cumulative damage without an opportunity for repair. Likelihood of fault movement (the impoundment overlies the Tats-Noisy Fault zone) was judged low, with low confidence due to the dearth of knowledge among geologists about seismotectonic relationships among fault systems in the area.

It was concluded that the likelihood of embankment deformation leading to overtopping and breach could be reduced by integrating waste rock into the impoundment structure. However, the use of potentially acid-generating waste rock in this manner could increase the amount of rock susceptible to exposure and thus could subsequently increase the likelihood of acid rock drainage.

Apart from risks created by seismic activity, damage to the impoundments may occur as a result of natural hazards such as landslides, rock slides, debris flows or ice/snow avalanches triggered by heavy precipitation, earthquakes, or natural geologic processes. These in turn could lead to overtopping and dam breach (likelihood moderate) or direct dam destruction (likelihood negligible).

Assessment of the possibility of dam destruction by glacial activity was considered to be speculative, given the difficulty of predicting climatic change. The ratings assigned to the likelihood and consequences of various forms of glacial activity after mine abandonment ranged from low to very low. Tats Glacier is currently receding.

Finally, the team considered the risks posed by the possibility of release of acid and/or soluble metals by tailings and waste rock confined within the impoundment. This could occur if tailings and waste rock are exposed to the air as a result either of excessive seepage of water from the impoundment or of insufficient flow of water into the impoundment because of climatic fluctuations. The consequences of such events in terms of their effect on aquatic habitat were considered to be moderate; the likelihood was very low to low during operation and closure, but increased to moderate to significant after abandonment.

In view of its serious concerns about the potential impacts of dam failure and acid rock drainage, especially after abandonment, the team felt other options should be considered. It suggested draining of the impoundment after abandonment as one possibility. This approach, while creating short-term acid rock drainage risks that would have to be addressed, would significantly reduce the overall risk presented.
by an impoundment subjected to geologic processes over very long periods of time. As availability of data on this subject was severely limited, the team recognized the benefits to be gained by conducting further studies of means of reducing risk.

6. **Transportation corridor**

   a. **Description**

   The project site would be linked to the Haines Highway by a 104-kilometre-long access road, together with a fuel oil pipeline and concentrate slurry pipeline, both of which would cross the same 242 kilometre distance between Windy Craggy and the deep-sea terminal at Haines, Alaska. The all-weather gravel road, with average maximum grades of 14 per cent, would supply the project site with chemicals, explosives, and shop and camp supplies, and would carry three to six trucks a day in each direction. Major bridges and culverts would be removed on closure of the mine.

   The slurry pipeline, six inches in diameter, would carry 1,500 tonnes a day of copper concentrate to Haines, using heated "process effluent" as the carrying medium; the three-inch fuel pipeline would carry 400,000 litres per day of diesel oil from Haines to the project site. Both lines, paralleling the road, would be buried under a minimum three feet of cover and would be suspended alongside bridges when crossing rivers. Safety control features would include remote operation and monitoring, a manned booster station, and leak detection systems.

   b. **Risks**

   The team noted four external conditions that would contribute to the difficulty of building and operating the transportation corridor: (a) rough terrain, with sections of grade and soil slope instability; (b) remote location, hampering a timely clean-up of spills; (c) seismic activity, which would pose a risk to bridges and buried pipes; and (d) heavy precipitation, creating a risk of washouts and accidents on steep grades.

   The team assumed that the road would be decommissioned after closure of the mine, presupposing that the tailings impoundment dams would not require regular long-term maintenance, that the road would not be kept open to provide access to new mining or other developments, and that bridges and culverts would be removed and buried sections of the pipeline would be sealed. Geddes’ intentions in this regard had not been made clear, and the team recommended that clarification be provided. On the assumption that the road would be decommissioned, the team focused on the period of construction and operation.

   The team assigned moderate likelihood and consequence ratings to washouts resulting from plugged culverts and causing silting of fish habitat during heavy runoff. Reduction of wildlife habitat was considered a certainty, with particular concern for the impact on grizzly bear habitat in Tats Creek Valley. The team also expressed concern about the impact on goats, Dall sheep and bears of legal and illegal hunting resulting from road access; while concluding that the impact would be mitigated by control measures such as access closures and law enforcement, the team noted that such measures had not been
### Table 5-6
**WINDY CRAGGY PROJECT**
**OMEA**

**System:** TRANSPORTATION CORRIDOR

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road 5.6.1.1</td>
<td>culvert obstruction</td>
<td>curtailed fish migration</td>
<td>O, CL</td>
<td>moderate</td>
<td>low</td>
<td>moderate</td>
<td>medium</td>
</tr>
<tr>
<td>5.6.1.2</td>
<td>reduced wildlife habitat</td>
<td>reduced grizzly habitat, primarily in Tats Valley; some losses for other species too</td>
<td>O, CL, A</td>
<td>low</td>
<td>high</td>
<td>significant</td>
<td>high</td>
</tr>
<tr>
<td>5.6.1.3</td>
<td>new access for hunting/poaching</td>
<td>excessive wildlife mortality, including grizzly, goat, Dall's sheep, black bear, and moose</td>
<td>C, O, CL, A</td>
<td>moderate</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
</tr>
<tr>
<td>5.6.1.4</td>
<td>washout</td>
<td>sediment loading impacts water quality and fish habitat</td>
<td>C, O, CL, A</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
</tr>
<tr>
<td>5.6.1.5</td>
<td>chemical spill following transportation accident</td>
<td>recoverable effect on water quality, depending on quantity/location</td>
<td>O</td>
<td>moderate</td>
<td>high</td>
<td>moderate</td>
<td>medium</td>
</tr>
<tr>
<td>Concentrate Pipeline 5.6.2</td>
<td>exposed pipeline rupture</td>
<td>acute toxicity and/or chronic toxicity to fish</td>
<td>O</td>
<td>moderate</td>
<td>high</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>5.6.2</td>
<td>buried pipeline rupture</td>
<td>chronic toxicity to fish</td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>medium</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

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5-6 Windy Craggy Project OMEA: Transportation Corridor
### Table 5-6 (cont'd)

**WINDY CRAGGY PROJECT**  
**OMEA**

**System:** TRANSPORTATION CORRIDOR

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6.2</td>
<td>pipeline leak in fish rearing area</td>
<td>chronic toxicity to fish</td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>5.6.2</td>
<td>exposed pipeline rupture</td>
<td>acute toxicity to fish</td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>5.6.2</td>
<td>buried pipeline rupture</td>
<td>chronic toxicity to fish</td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>low, medium</td>
</tr>
<tr>
<td>5.6.2</td>
<td>pipeline leak in rearing area</td>
<td>chronic toxicity to fish</td>
<td>O</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>5.6.3.1</td>
<td>sediment erosion</td>
<td>sediment loading impacts water quality and fish habitat</td>
<td>C, O, CL</td>
<td>low</td>
<td>high</td>
<td>significant</td>
<td>high, significant, proper engineering practice, sediment traps</td>
</tr>
<tr>
<td>5.6.3.1</td>
<td>sediment erosion</td>
<td>sediment loading impacts water quality and fish habitat</td>
<td>A</td>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high, proper remediation</td>
</tr>
<tr>
<td>5.6.3.1</td>
<td>borrow pit siting or active braided channel deposits removal</td>
<td>sediment loading impacts water quality and fish habitat</td>
<td>C</td>
<td>low</td>
<td>high</td>
<td>moderate</td>
<td>low</td>
</tr>
<tr>
<td>5.6.3.2</td>
<td>fuel spill following truck accident</td>
<td>degradation of water quality leading to impacts on fish</td>
<td>C</td>
<td>low</td>
<td>high</td>
<td>significant</td>
<td>medium, tank design</td>
</tr>
<tr>
<td>5.6.3.3</td>
<td>noise from traffic/human presence</td>
<td>disturbance to wildlife, especially grizzlies in Tats Creek Valley</td>
<td>C</td>
<td>moderate</td>
<td>high</td>
<td>significant</td>
<td>high</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5-6 Windy Craggy Project OMEA: Transportation Corridor (cont'd)
completely effective elsewhere in the province. Finally, the team expressed concern about the likelihood of truck accidents, noting that spills of toxic chemicals could adversely affect water quality and have lethal effects of fish.

The team considered that the consequence of a pipeline rupture, which could adversely affect fish habitat, would be low because it would be localized, except in an area of high seismic activity or if it occurred in a pipeline suspended over a watercourse. If the regulatory assessment of the Windy Craggy proposal proceeds, further studies of pipeline feasibility need to be undertaken to assess (a) the likelihood of rupture given the difficult terrain and climate, and (b) the feasibility and effectiveness of measures to terminate leakage of heated slurry in the event of a rupture, as well as associated mitigation measures and other aspects of environmental feasibility, including detailed location and design studies.

7. Deepsea terminal

a. Description

At the Haines terminal of the ore concentrate pipeline and access road system, the concentrate would be dewatered and stored before being loaded onto ships. The facilities for shipping and handling concentrate as well as fuel and supplies for the minesite would be known as Daschuu Terminal.

b. Risks

Aquatic habitat could be affected by such occurrences as a rupture of a pipeline or holding tank near the terminal, a failure of the water treatment plant, or escape of concentrate dust. However, the team concluded that the consequences of such an event would be temporary, as the concentrate is not acutely toxic to marine flora and fauna. The danger of fuel or chemical spills from ships offloading at the terminal could be greater, with some lethality or chronic effects on marine life; the risk of these events would be mitigated by the implementation of the spill, prevention, containment and countermeasure plans that Geddes proposes to develop for the Daschuu Terminal.

8. Base camp complex

a. Description

The base camp complex beside Tats Lake would occupy about 25 hectares, including an airstrip. At any given time, roughly 265 people are expected to be on site, comprising 215 at the base camp and 50 at the mine.

b. Risks

Because the Tats Creek valley is a known denning and seasonal habitat area of grizzly bears, interaction between humans and bears would be highly likely. The facilities would result in permanent reduction of grizzly habitat in the locality. The team noted the need for rigorous standards regarding garbage
## Table 5-7

**WINDY Craggy PROJECT**  
**OMEA**

**System:** DEEPSEA TERMINAL

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deepsea Terminal</td>
<td>5.7.1 blasting, excavation, rock fill, construction</td>
<td>physical alterations of habitat and impact on marine flora and fauna in nearby area</td>
<td>C</td>
<td>moderate</td>
<td>medium</td>
<td>moderate</td>
<td>high</td>
<td>proper construction procedures, time window, air cushions</td>
</tr>
<tr>
<td>Concentrate Pipeline</td>
<td>5.7.2.1 shoreline pipeline breakage near terminal</td>
<td>impact on shoreline marine flora and fauna; concentrate not acutely toxic to aquatic habitat</td>
<td>O</td>
<td>moderate</td>
<td>high</td>
<td>low</td>
<td>high</td>
<td>proper design and maintenance, spill control</td>
</tr>
<tr>
<td>Large Concentrate Holding Tanks</td>
<td>5.7.2.2 tank rupture as result of seismic event</td>
<td>impact on shoreline marine flora and fauna; concentrate not acutely toxic to aquatic habitat</td>
<td>O</td>
<td>moderate</td>
<td>high</td>
<td>very low</td>
<td>high</td>
<td>proper design and maintenance, berm, spill control</td>
</tr>
<tr>
<td>Concentrate Dewatering</td>
<td>5.7.2.3 water treatment plant failure</td>
<td>poor water quality, toxicity to marine life</td>
<td>O</td>
<td>moderate</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
<td>proper design and maintenance, adequate surge capacity</td>
</tr>
<tr>
<td>Concentrate Storage</td>
<td>5.7.2.4 fugitive dust from concentrate storage facility</td>
<td>contaminated vegetation and runoff</td>
<td>O</td>
<td>moderate</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
<td>proper dust control n facility</td>
</tr>
<tr>
<td>Ship Loading</td>
<td>5.7.2.5 fugitive dust during loading</td>
<td>contamination of intertidal flora and fauna</td>
<td>O</td>
<td>moderate</td>
<td>medium</td>
<td>moderate</td>
<td>medium</td>
<td>proper dust control n facility</td>
</tr>
</tbody>
</table>

* C = Construction; O = Operation; CL = Closure; A = Abandonment

5-7 Windy Craggy Project OMEA: Deepsea Terminal
# Windy Craggy Project OMEA: Deepsea Terminal (cont'd)

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>5.7.3.1 Chemical spill curing offloading and handling, including explosives</td>
<td>Impact on terrestrial and marine life, extent of impact depends on quantity lost</td>
<td>O</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>Medium</td>
<td>Proper design and maintenance spill contingency plan</td>
</tr>
<tr>
<td>Fuel</td>
<td>5.7.3.2 Fuel spill offloading ship to shore</td>
<td>Impact to marine life, particularly salmonoids</td>
<td>O</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Proper berm containment and operation spill contingency plan</td>
</tr>
<tr>
<td>Fuel</td>
<td>5.7.3.3 Fuel storage tank failure as a result of seismic event</td>
<td>Impact on terrestrial and marine life, particularly salmonoids</td>
<td>O</td>
<td>Moderate</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Spill berm would contain release</td>
</tr>
<tr>
<td>Fuel</td>
<td>5.7.3.4 Seismic activity causing failure of offloading system</td>
<td>Impact on terrestrial and marine life, particularly salmonoids</td>
<td>O</td>
<td>Moderate</td>
<td>High</td>
<td>Very low</td>
<td>Medium</td>
<td>Tank at least 4 m above HWL</td>
</tr>
<tr>
<td>Fuel</td>
<td>5.7.3.5 Tsunami event causing vessel to breach/sink</td>
<td>Impact on terrestrial and marine life, particularly salmonoids</td>
<td>O</td>
<td>Moderate</td>
<td>High</td>
<td>Very low</td>
<td>Low</td>
<td>Proper procedure</td>
</tr>
<tr>
<td>Dewatering</td>
<td>5.7.4.1 During dismantling of plant reagent, oil, diesel fuel spill</td>
<td>Impact on marine life</td>
<td>CL</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Proper procedure</td>
</tr>
<tr>
<td>Fuel</td>
<td>5.7.4.2 Fuel spill during dismantling of tank farm and pipeline</td>
<td>Impact on marine life</td>
<td>CL</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Alternate user</td>
</tr>
</tbody>
</table>

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## Table 5-8

**WINDY CRAGGY PROJECT**  
**OMEA**

**System:** ANCILLARY FACILITIES

<table>
<thead>
<tr>
<th>Sub-System</th>
<th>Dominant Occurrence Mode(s)</th>
<th>Possible Effects</th>
<th>Stage*</th>
<th>Consequence</th>
<th>Consequence Confidence Factor</th>
<th>Occurrence Likelihood</th>
<th>Occurrence Confidence Factor</th>
<th>Compensating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Camp</td>
<td>5.8.1.1 facilities, human presence and activities</td>
<td>loss of natural wildlife habitat and direct disturbance of grizzly</td>
<td>C O CL</td>
<td>moderate</td>
<td>medium</td>
<td>significant</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>5.8.1.2 improper refuse disposal</td>
<td>attraction for bears; consequent human-bear encounters</td>
<td>C O</td>
<td>low</td>
<td>medium</td>
<td>moderate</td>
<td>high</td>
<td></td>
<td>incinerator</td>
</tr>
<tr>
<td>5.8.1.3 noise</td>
<td>wildlife will avoid habitat in adjacent areas</td>
<td>C O</td>
<td>low</td>
<td>high</td>
<td>significant</td>
<td>high</td>
<td></td>
<td>silencers</td>
</tr>
<tr>
<td>Power Generation</td>
<td>5.8.2 fuel tank rupture</td>
<td>acute toxicity to fish</td>
<td>C O</td>
<td>moderate</td>
<td>high</td>
<td>very low</td>
<td>medium</td>
<td>proper berm design</td>
</tr>
</tbody>
</table>

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5-8 Windy Craggy Project OMEA: Ancillary Facilities
disposal to be applied to minimize the impact on bears. Another risk noted by the team was potential rupture of the 1.5 million litre fuel tanks supplying the power plant, which could be lethal to local fish habitat; the likelihood of this occurring was considered to be very low.

C. Conclusions

The qualitative risk assessment process employed by Rescan identified 86 potential sources of environmental risk, of which 12 were considered to have potentially severe consequences, with annual likelihoods of occurrence ranging from negligible to moderate. All 12 were associated with a potential breach of the tailings dam.

Analysis of the 86 potential events led to the following conclusions by the team regarding key issues. It is important to note that, as stated in the Rescan report, none of these events should in themselves be considered fatal flaws, but rather they are identified as key areas for concentration if the project enters into detailed engineering design.

1. Breach of the tailings dam could have severe potential consequences in the long term.

   Although there may be little annual likelihood of the embankments being breached by earthquakes, floods, landslides or glacial advance, the cumulative probability increases over the period following abandonment of the mine. The effect of a dam breach would be the release of toxic and acid-generating materials causing a widespread and permanent impact on fish habitat. For that reason, design of the tailings embankments must ensure long-term integrity and would require long-term annual inspection and maintenance arrangements.

2. Reliance on perpetual water cover over the impoundment has long-term consequences.

   Although perpetual water cover prevents oxidation of acid-generating material, given the variety of natural forces characterizing the project area, it would remain a perpetual hazard in terms of dam stability and potential for tailings escaping through a breach. Regular inspection and periodic repair of the dam after abandonment would likely mean that neither the impoundment site nor the access road from the Haines Highway could be abandoned as long as heavy equipment was needed for these tasks; and, without abandonment, neither the site nor the transportation corridor would recover their wilderness character. For this reason, an alternative to perpetual water cover, namely desaturation of the tailings by removal of the water when the mine is closed, might be considered. This would increase the short-term risk of acid-rock drainage but reduce associated long-term risks.

3. Control of acid-rock drainage from the mine could become difficult after active treatment ceases.

   During the period of operation of the mine, mine water will be contained, directed to the tailings impoundment, and treated. At closure, Geddes plans to plug the portal and allow the underground
pit to flood. It is expected by Geddes that the open pit pond will eventually become a glacier and the pit walls will become permanently covered in snow and ice, producing a state of equilibrium where water treatment will be unnecessary. The team was uncertain that this would occur; if it were not, continued long-term pumping and treatment might be necessary to avoid acid rock drainage after abandonment, and might be difficult to provide. The team concluded that further evaluation of this issue will be needed. Ongoing monitoring and management, as well as provision for requisite long-term funding, will be necessary.

4. Effects of the proposed project on water quality, fish and fish habitat are potentially significant.

The impact on fish habitat as a result of a potential breach of the tailings dam was the most serious risk identified by the Rescan study team. Failure of either the containment facility or of the water treatment facility could have a chronic and widespread impact on water quality, fish, and fish habitat. The study recognized that measures could be taken to minimize the risk of dam failure, and recommended that this be studied carefully as project planning proceeds. In addition, lethal but probably localized and possibly shorter term effects could occur as a result of fuel or chemical spills.

5. Effects on wildlife are not expected to be severe.

Terrestrial wildlife would be threatened more by the imposition of the project than by system failures. The wildlife species of greatest concern is the grizzly bear, especially in Tats Creek Valley, an area of high grizzly use in which significant elements of the proposed project would be located. Bears would be affected by the physical impact of facilities intruding on their habitat, by noise, and by contact with humans. It is possible that with strict adherence to a bear protection plan, having as its foremost objective that no bears would be destroyed or relocated, that the area would be eventually returned to its original bear use.

Further evaluation of the impact on grizzly bear habitat may be useful as the result of the release in October 1992 of the draft report by Stephen Herrero et al, entitled “The Conservation Significance of Bears and Their Habitat in the Tatshenshini River Valley” (final report to be published in January 1993).

While impacts on other species such as Dall’s sheep and mountain goats may be more easily controlled, permanent public access creates the risk of over-hunting, as well as road collisions between vehicles and animals.

The Rescan report concluded by recommending:

a) that further attention be directed to areas of highest risk and lowest certainty identified in the report;
b) that the results of the team’s qualitative risk assessment be combined with other sources of information on recreation and wilderness values and overall socioeconomic justification to develop a balanced view of the project;

c) that greater attention be given to design and operation of systems for which risk is lower, relative to other systems, but which may have significant impacts — for example, specifications for haul trucks and the deepsea terminal; and

d) that further technical investigation and studies be focused to reduce uncertainty in key areas such as the character of foundation soils under the proposed site of the tailings dam.
6 The Regulatory Framework

If mining is concluded to be an acceptable use of land in the Tatshenshini/Alsek area, the proponent of the Windy Craggy project will be faced with a complex array of regulatory assessments lasting several years.

Regulatory assessment of the project will be particularly complicated by the international scope of the application. An integral part of the proposed project is the use of facilities to the south at Haines, Alaska, for the shipping of copper ore by sea to Japan. To the west, the Alaska Panhandle will be affected by concerns about the impact of the project on water quality in the Tatshenshini/Alsek river system and hence on commercial fisheries that are dependent on the protection of salmon habitat in that system.

In Canada, the project will be subject to assessment at both the federal and the provincial level. In the United States, it will be subject to federal and state assessment under the provisions of the National Environmental Policy Act (NEPA) and state legislation. As well, the project will be susceptible to possible assessment by the International Joint Commission, under the provisions of the Boundary Waters Treaty. At the local level, the city and borough of Haines hold regulatory authority regarding health, safety and siting issues. Figures 6-1 and 6-2 provide an overview of applicable regulatory processes and regulatory steps taken to date.

A. Major Regulatory Components

1. Canada

In Canada, the project has triggered both the B.C. Mine Development Assessment Process (MDAP) and the federal Environmental Assessment and Review Process (EARP). The provincial and federal processes require the full assessment of the project and a review of environmental, economic and social factors prior to approval of the mine. Both processes now allow for joining of the reviews through federal/provincial agreement.

a. British Columbia

Under the MDAP, the project would probably be referred to a review panel for public hearings. The “Stage 1 report” already submitted to the process by Geddes Resources is not sufficient to complete the review under existing requirements; the wide range of fish/wildlife, environmental and First Nations concerns that have been expressed would require additional information to be provided prior to any hearings.

Once these requirements had been technically satisfied, the application would be referred to an assessment panel appointed jointly by the Minister of Energy, Mines and Petroleum Resources and the Minister of Environment, Lands and Parks. After holding public hearings, the panel would make a recommendation to the two ministers, who would either reject the project, approve it, or approve it with conditions. If the project were approved, Geddes Resources would receive a Mine Development Certificate and would apply for regulatory permits and approvals.

b. Federal government

The Canadian Environmental Assessment Act, if proclaimed as expected in 1993, will supersede the federal Environmental Assessment Guidelines Order. Under this Act, the project application would be brought into the Environmental Assessment Review Process. The project would fall within the “comprehensive study” category under the Act and require a detailed assessment.

After a lead agency or department had been designated as the “responsible authority”, the federal Minister of Environment would probably refer the project to an assessment panel for review. The review panel would ensure that all necessary information had been made available, finalize specific guidelines for the proponent to follow in preparation of an Environmental Impact Statement, ensure that the public has been fully involved and informed, and make recommendations to the federal Minister of Environment and the responsible authority, which would then approve or reject the project. If the project were approved, the proponent would proceed to obtain necessary permits and approvals at the federal level.

c. Joint federal/provincial review

When a project raises substantial federal and provincial issues, assessment processes may be combined through a joint federal/provincial assessment. Both the Canadian Environmental Assessment Act and the B.C. Mine Development Assessment Act provide for such a review. This can be done in several ways and would probably be achieved in the case of the Windy Craggy project by appointment of a single review panel, by agreement of federal and provincial ministers, that would simultaneously meet the requirements of both jurisdictions. Federal and provincial authorities have already discussed and reached agreement in principle on a joint review of the project, but there has been no formal agreement on how it would be conducted.

After the Environmental Impact Statement has been submitted, approved, and supplemented by additional information that may be required by the panel, hearings would be conducted, leading to a report by the panel to the responsible federal authority and to the B.C. Minister of Energy, Mines and Petroleum Resources, who would then consider it and advise regulatory and permitting agencies of their conclusions. Should the project be approved, the province would then issue a Mine Development Certificate. The proponent would then apply for the necessary permits and approvals, some of which would require additional work and possibly public review.
The federal-provincial review would only consider those elements of the proposal situated in Alaska to the extent necessary to understand and review the overall project and to ensure that the impacts in Canada are taken into account.

2. United States

The Windy Craggy project has cross boundary effects because of the potential impact on air, water, wildlife and recreational interests in the U.S., and is a cross-border project with a road, slurry pipeline and port facilities in the U.S. As a result, all three levels of government in the U.S. (federal, state and municipal) will have regulatory roles. The federal government ensures compliance with laws designed to protect air and water quality, biodiversity and wildlife habitat; the State of Alaska ensures compliance with state environmental protection requirements; and the city and borough of Haines may impose requirements regarding local health, safety, and siting. The U.S. regulatory process is co-ordinated by federal agencies under the umbrella of the National Environmental Policy Act (NEPA). As a general rule, federal review is substantially completed before state and local agencies begin their permitting processes.

NEPA requires that any project “significantly affecting the quality of the human environment” be analyzed to ensure that “environmental values and amenities be given appropriate consideration in decision making, along with economic and technical considerations”. The purpose of the NEPA review is not to issue a permit but rather to provide decision-making agencies an analysis of environmental, social and economic impacts. A “lead agency” is designated to prepare an Environmental Impact Statement (EIS). In the case of Windy Craggy, the lead agency would probably be either the U.S. Army Corps of Engineers, which regulates tidewater construction activities, or the Environmental Protection Agency, which regulates air and water quality. After completion of the Draft Environmental Impact Statement, the document is submitted to other agencies for comment and is subject to public hearings, after which the lead agency prepares either a Final Environmental Impact Statement or a Supplemental Draft Environmental Impact Statement for further review.

The NEPA review would include assessment of and requirements for detailed information from the developer and the Canadian government about aspects of the project occurring in Canada as well as the U.S., as all projects are assessed comprehensively. Delays through litigation by project opponents are a distinct possibility. After issuance of the Final Environmental Impact Statement, federal, state and local permitting agencies would review the project, consulting with one another to ensure that all potential environmental impacts had been mitigated to the greatest extent possible to meet permit conditions. U.S. agencies participating in the process would have the authority to deny permits for construction of the slurry pipeline and terminal facility until assured that water quality, fisheries and wildlife issues associated with the project in the Tatshenshini/Alsek drainage area had been addressed to their satisfaction.

Timing of the NEPA review would depend on whether the review was limited to consideration of port facilities or broadly scoped by the lead agency to consider all water, fisheries and wilderness impacts to the west of the minesite, as well as those along the transportation corridor to Haines — for example, at the Chilkat Eagle Reserve.
3. International

a. International Joint Commission

Potential impacts of the project on water quality in the Tatshenshini/Alsek river systems may bring into play both the Boundary Waters Treaty of 1909 and the Draft Convention on Environmental Impact Assessment in a Transboundary Context.

The Boundary Waters Treaty obliges Canada and the United States to prevent pollution of transboundary waters. The treaty is administered by the International Joint Commission, with three members appointed by each country. Article X of the treaty provides the two governments with the authority to refer matters to the commission for binding decisions, but this authority has never been invoked.

Article IX of the treaty extends the jurisdiction of the commission beyond questions involving water pollution. It provides that the governments may refer to the commission "any other questions or matters of difference arising between them involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along the common frontier...." In a reference under Article IX, the role of the commission is not to make a binding decision but to "examine and report". References under Article IX may be made by either government or jointly, to be followed by a report to both governments.

In April 1992 a joint resolution of the U.S. Congress called on the Secretary of State to "seek the agreement of the Government of Canada that the International Joint Commission be given a reference, pursuant to Article IX of the Boundary Waters Treaty of 1909, to examine comprehensively the potential adverse environmental and social impacts of the proposed mining activity [Windy Craggy] and that no permits required to develop the proposed project shall be issued prior to completion of the Commission Study". The resolution did not pass, apparently because of time limitations, but is expected to pass in the next Congress.

b. Draft Convention on Environmental Impact Assessment in a Transboundary Context

This draft United Nations convention, signed in February 1991 and expected to be ratified early in 1993, is designed to enhance international co-operation in assessing environmental impacts of activities, policies, plans and programs, particularly where they have transboundary impacts. The convention requires each country to set up an administration capable of ensuring public participation in environmental impact assessments, performance of assessments prior to authorizing activities having transboundary impacts, notification to and participation in review of such activities by affected countries, exchange between countries of information relating to assessments, consideration of alternatives to the proposed activity to minimize or eliminate transboundary impacts, and post-project analysis that may include monitoring of transboundary impacts. The convention provides a mechanism for dispute resolution by a tripartite arbitration tribunal.

The convention underlines the obligations of countries to take into account the concerns of potentially affected jurisdictions and to include them in their assessment processes by sharing information and
inviting participation in environmental reviews. It follows that Canada would be required to involve Alaska and the U.S. in its review of the Windy Craggy project, and vice versa. The recent provisions for joint review would be helpful in this context.

c. **The World Heritage Convention**

The lower Asek River flows through Glacier Bay National Park, which in December 1992 was designated a World Heritage Site by the World Heritage Committee of UNESCO. This designation potentially affects regulatory approval of the Windy Craggy project through obligations placed on the Canadian government. As a signer of the 1972 World Heritage Convention, Canada is subject to Article 6, which provides that “each State Party to this Convention undertakes not to take any deliberate measure which might damage directly or indirectly the cultural and natural heritage referred to in Articles 1 and 2 situated on the territory of other States Parties to this Convention”. This provides an opportunity for arguments to be made that potential environmental risks — for example, risks to fish habitat and migratory bears — associated with the Windy Craggy project may threaten attributes of Glacier Bay National Park, thus creating the possibility of a breach of Article 6.

**B. Three Review Scenarios**

Review of the Windy Craggy project by Canada and the United States might take place in one of three ways: separate, sequential reviews; separate, concurrent, co-operative reviews; or a combined international review. The results and durations of the review process will vary significantly depending on which of these routes is chosen and the many variables that may influence the process.

1. **Separate, sequential reviews**

The U.S. federal and Alaskan agencies would defer consideration of the Alaskan elements of the proposal and the NEPA review until completion of the Canadian assessment of the Windy Craggy project. If U.S. and Alaskan agencies and interest groups had participated in the Canadian process but still had concerns about wilderness, fisheries and wildlife concerns, these issues might still be raised in the U.S. review. If an attempt were made to refer the matter to the International Joint Commission as well, the U.S. permitting process could be delayed until after completion of the IJC report. Under this scenario, the time to complete the review would be very lengthy.

2. **Separate, concurrent, co-operative reviews**

Each country would proceed with its own reviewing process simultaneously, sharing information and participating in each other’s processes. The Environmental Impact Statement prepared for the review in Canada would be acceptable for a similar review in the U.S., with the issues of importance to both jurisdiction being addressed, thus allowing the processes in each country to be completed in a similar
time-frame. It would take an estimated four years to complete the review, assuming that the review process would not become the forum for a protracted discussion of fundamental land and water use issues. Figure 6-3 details the components of such a review.

3. Combined international review

Notwithstanding the differences between the interests and assessment processes of Canada and the United States, a jointly appointed and administered international assessment process could take place, as permitted by the Canadian Environmental Assessment Act and the B.C. Mine Development Assessment Act, and mandated under the Boundary Waters Treaty. The NEPA and Canadian joint review process would be combined into a single, international review panel, with an Environmental Impact Statement and report to both governments leading to completion of the regulatory permitting and licensing of the development on either side of the border.

In consultation with all four governments (Canada, British Columbia, U.S. and Alaska), the International Joint Commission would appoint a panel for the assessment and set out its terms of reference. After proceeding with the scoping, information requirements, draft EIS, final EIS and hearings, the panel would report to the commission and, in effect, to each of the governments.

The duration of a combined international review would likely be similar to that of separate, concurrent, co-operative reviews — approximately four years. Although establishment of the review panel would take longer because of the number of agencies and jurisdictions involved, such a process should proceed with fewer problems as a single review would address all issues.
The development of a mine in British Columbia is governed by the \textit{Mineral Tenure System}, as set out in the \textit{Mineral Tenure Act}. The process, from exploration through to the creation of a lease is set out below.

### Exploration and Development

- **Staking**: Recording and Maintaining Access to a Lease
- **Assessment and Approval/Rejection**: The Mine Development and Assessment Act (BC)
  - **Joint Fed/Provincial Review and Assessment**
    - Both Provincial and Federal Legislation: contemplates the prospect of "joining" federal and provincial assessment processes to avoid duplication.
    - This is done through Joint Review Panels, appointed by both orders of government for their own purposes.

### The Environmental Assessment and Review (Canada)

Most mines will usually require government approvals in a number of areas. These decisions "trigger" the federal environmental assessment process (EARP). Although the "trigger" may be for a specific area, once launched the process looks at all aspects of the project. Approval or rejection of the Project rests with the "Responsible Authority" after the assessment is complete. The Process provides for full public participation, broad scoping and independent public review.

### International Joint Commission

The IJC is a binational organization established by Canada and the United States under the Boundary Waters Treaty. It is an appointed body with those being appointed by each government. It has a number of functions, but primarily, it conducts hearings on specific transboundary issues referred by either government. The practice is for both governments to agree on the matter referred and the terms of reference. The advice of the Commission is advisory and is not binding on the two governments.

### International Boundary Water Treaty Act

### The National Environmental Policy Act (NEPA)

The National Environmental Policy Act requires that any project "significantly affecting the quality of the human environment" must be analyzed. No permit is issued as a result of NEPA review. The process provides agencies with the information necessary to make informed decisions regarding issuing permits. The vehicle for providing this information to decision-makers is the "Environmental Impact Statement," or "EIS." Unlike Canada, where it is prepared by the proponent, the EIS is prepared by the lead agency, usually, the Environmental Protection Agency.

### Proponent applies for Permits

- **Lead Agency Selected**
- **EIS prepared and finalized**
- **Final EIS drafted and issued**

### Permit review

Once the EIS is issued, the federal, state, and local permitting agencies will begin review of the project with respect to the individual permits within their jurisdiction.

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6-1 Proposed Windy Craggy Copper Mine Development — A Regulatory Road Map
6-2 Proposed Windy Craggy Copper Mine Development — Regulatory Steps to Date
6-3 Proposed Windy Craggy Copper Mine Development Separate, Concurrent, Co-operative Review
7 OPTIONS AND EVALUATION

A. Introduction

In referring the Tatshenshini/Alsek area to the Commission for recommendations, the British Columbia Cabinet has asked for an evaluation of how to select the best overall land use for the area from the viewpoint of current and future generations. Previous chapters have indicated that this is not a simple question. While the range of competing uses is comparatively simple, there are substantial complexities. Firstly, there are strongly conflicting value perspectives on the two major land use options — mining and wilderness preservation. Several of these values, such as the value to future generations, are intangible and difficult to assess. Secondly, there are risks and uncertainties — technical and economic. Can the risks be estimated? Can they be designed for and managed? What are the economic prospects and uncertainties? Thirdly, while remote, the Tatshenshini/Alsek area abuts an international border and the Alsek River crosses it; developments therefore have international implications and must meet the requirements of several jurisdictions.

To obtain a better understanding of the complexities, the uncertainties and, particularly, the implied trade-offs between prospective financial returns and environmental preservation objectives for the area, the Commission:

- identified issues and interests,
- clarified objectives and identified reasonable land use alternatives,
- summarized available information regarding the consequences of these alternatives,
- used a multiple objective framework to systematically compare and evaluate alternatives, by considering uncertainties, risks and probabilities, and varying value perspectives, and
- identified appropriate measures to assess the options.

In adapting and applying this approach, the Commission was assisted by Dr. Tim McDaniels, a specialist in decision analysis from the School of Community and Regional Planning at the University of British Columbia. (See Vol. 2, Appendix 3)

1. Objectives

The provincial Cabinet has the responsibility for deciding land use in the region. To satisfy the principles of sustainable development, the decision must factor in the interests and objectives of diverse sectors and citizens of the province including the interests of future generations, as well as the interests of neighbouring Alaska, which also has decision-making authority and will be affected by the decision. Accordingly, a framework was developed to clarify the major objectives of these diverse interests.
Remote, largely unroaded, undeveloped, populated by wilderness-dependent species such as grizzly bears, and unusual for its biodiversity at its latitude, the area clearly has wilderness values. Given prospective development, environmental protection, particularly for wildlife and fisheries with their transborder dimension, is a key objective.

Governments, businesses and communities, employees and residents in both Canada and Alaska, all have economic objectives. Protecting the interests of neighbouring jurisdictions is an international obligation and an important objective in international law, as is social and political acceptability in B.C., Canada and the U.S.A. Compatibility with provincial land use plans and strategies is also necessary. This framework of underlying land use objectives is summarized in Table 7-1.

Given these objectives, the best possible land use of the Tatshenshini-Alsek area would be one that maximized wilderness preservation, minimized adverse environmental impacts, maximized economic benefits, protected interests of neighbours, achieved social and political acceptance and was integrated with broader land use planning initiatives of the province. Since full wilderness preservation would preclude mining economic benefits, and mineral resource development would irreversibly change the wilderness condition, it is clear that not all objectives can be fully achieved at once.

The key question therefore becomes “What are the land use options and their associated trade-offs?”

2. **Land use options**

Two obvious options summarize the essentials of the debate — complete preservation of the area or its complete availability for potential mining development.

Wilderness preservation has several dimensions including conservation for biodiversity, for cultural and spiritual values, and for values like tourism or recreation to which market values can be assigned. Therefore this option is properly characterized as “wilderness preservation and limited ecotourism”. A recent reconnaissance of mineral potential established that roughly 75 per cent of the Tatshenshini/Alsek area has little or no known potential, nor would it be likely needed for access. Therefore the second option might be more accurately characterized as “mining, with wilderness preservation over 75 per cent of the area”.

A third option would be to “defer the decision”. This might be done for several reasons and for various lengths of time. The most compelling reason may be the general uncertainty raised by practically all issues surrounding a land use decision including mineral values, wilderness values, environmental risks, economic and technical feasibility, and Aboriginal land claims. Delay might allow for reduced uncertainty through developing further baseline data, particularly on ecological values. It would allow completion of broader provincial land use objectives like the ‘protected area strategy’ or regional plans clarifying the scope of mineral development areas. Additional time might be used to address technical and economic feasibility issues as well as recreational prospects. These goals might be achieved either by a relatively short delay, or, depending on the degree or significance of uncertainties, a lengthy delay
### TABLE 7-1
Tatshenini/Alsek Land Use Objectives

**Overall Objective**

Select the best possible land use in the Tatshenini/Alsek area for current and future generations in British Columbia.

**Component Objectives**

1. **Promote Wilderness Preservation**
   - 1.1 For Ecological Values
     - build biodiversity
     - provide support for species
     - maintain natural systems
     - provide ecological services
   - 1.2 For Human Market-Related Values
     - genetic information for products
     - scientific information for resource management
     - environmental information for media
     - tourism opportunities
   - 1.3 For Human Non-Market Values
     - outdoor recreation
     - aesthetics and landscapes
     - existence values
     - option values
     - bequest values
   - 1.4 For Human Spiritual Values
     - for traditional cultures
     - rebuild spiritual health and understanding

2. **Minimize Environmental Impacts**
   - 2.1 On Fish and Their Habitat
   - 2.2 On Grizzly Bears and Their Habitat
   - 2.3 On Sheep and Goats and Their Habitat
   - 2.4 On Other Rare or Endangered Species

3. **Maximize Market-Related Economic Benefits**
   - 3.1 To the Government of British Columbia
     - income taxes
     - sales taxes
     - mining taxes
     - licenses
   - 3.2 To Government of Canada
   - 3.3 To Businesses
   - 3.4 To Communities
     - in British Columbia
     - in Yukon

4. **Protect Interest of Neighbours**
   - 4.1 Governments
     - U.S.
     - Alaska
     - Yukon
   - 4.2 Communities
     - Aboriginal
     - non-Aboriginal

5. **Enhance Social and Political Acceptability**
   - 5.1 In British Columbia
     - by affected groups
     - by general public
   - 5.2 Provide Appropriate International Signals
     - regarding commitment to preservation
     - regarding commitment to resource development

6. **Fit With Provincial land Use Planning**
   - 6.1 Regarding Mining
   - 6.2 Regarding Protected Area
that would enable the next generation or future generations to make a well-reasoned decision based on adequate information.

Each of these options is subject to variation, including alternative mineral development scenarios and alternative configurations for allocating and designing wilderness preservation. However, prospective decisions regarding best land use of the area might generally be summarized under three options, namely:

- potential mining with formal wilderness designation of areas lacking high mineral potential, or
- wilderness preservation with associated ecotourism, or
- delaying the decision on either of the above alternatives.

These broad options have important implications not only for the underlying objectives they each uniquely meet, but also for attendant processes, procedures and communication strategies. For example, while not identified as a specific land use objective, fairness in dealing with private development interests is essential, especially under the wilderness preservation and delay options. Also, if British Columbians were to forgo economic benefits to serve broader interests, consideration should be given to negotiating cost-sharing with benefiting jurisdictions. It is evident that additional and more site-specific planning and assessment will be required under any option.

B. Evaluation Framework

Having defined the objectives which could be met under various options, how can the merits of the options be compared? The most straightforward way is to develop measures for each of the objectives. These measures are summarized against the associated objectives in Table 7-2. The specific considerations for each measure based on the detailed discussion contained in Chapters 3 through 6 of this report are briefly described below.

1. Wilderness preservation

Lacking more specific ways to measure impacts, broad descriptions of land use effects that might result from development are used. These are changes associated with the mine, its associated facilities, and the access road.

The access road corridor would change part of the area from a primitive recreation zone to a semi-primitive and roaded area. Using the assumption that primitive zones do not exist within 8 kilometres of a road, the 104-kilometre long access road would shift the recreation capability rating of about 1660 square kilometres of land. This access would change the character of the area for wilderness ecotourism and recreation and represent impact risks to wildlife but would improve opportunities for individual vehicle and recreation access.

Other impacts of the mine facilities, road and aircraft operations would be noise, dust, and visual disturbance, resulting in disruption of intact wilderness and wildlife habitat.
Table 7-2
Measures for Selected Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Promote Wilderness Preservation</strong></td>
<td>Describe effects on biodiversity. Describe effects on recreation and tourism. Describe effects on landscapes, etc. Describe how affected.</td>
</tr>
<tr>
<td>1.1 Ecological Values</td>
<td></td>
</tr>
<tr>
<td>1.2 Human Market Values</td>
<td></td>
</tr>
<tr>
<td>1.3 Human Non-Market Values</td>
<td></td>
</tr>
<tr>
<td>1.4 Human Spiritual Values</td>
<td></td>
</tr>
<tr>
<td><strong>2. Minimize Environmental Impacts</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 Fish (Salmon)</td>
<td>No impact - no change</td>
</tr>
<tr>
<td>2.2 Wildlife</td>
<td>Low - avoidance likely or localized affects - population effects short term - recovery likely</td>
</tr>
<tr>
<td>- Grizzly Bears</td>
<td>Moderate - temporary and recoverable but localized habitat effects</td>
</tr>
<tr>
<td>- Sheep and Goats</td>
<td>Severe - permanent or large scale impacts - lethal to significant proportion of population - avoidance not possible</td>
</tr>
<tr>
<td><strong>3. Maximize Market-Related Benefits</strong></td>
<td></td>
</tr>
<tr>
<td>3.1 Provincial Government</td>
<td>Net revenues to province in present value terms.</td>
</tr>
<tr>
<td>3.2 Federal Government</td>
<td>Net revenues to nation in present value terms.</td>
</tr>
<tr>
<td>3.3 Companies</td>
<td>Net revenues to companies in present value terms.</td>
</tr>
<tr>
<td>3.4 Communities</td>
<td>Number of permanent jobs created.</td>
</tr>
<tr>
<td><strong>4. Protect interests of Neighbours</strong></td>
<td></td>
</tr>
<tr>
<td>4.1 Interests of Governments</td>
<td>Best interest US and Alaska have confidence in BC decision process; BC viewed as cooperative in common property resource management.</td>
</tr>
<tr>
<td></td>
<td>Worst Pollution spillovers across border; long term conflict over lack of cooperation; protests at bilateral and multilateral levels; long term international law conflicts (due to environmental impacts).</td>
</tr>
<tr>
<td>4.2 Interests of Communities</td>
<td>Best BC viewed as attentive to interests of communities to be affected by development</td>
</tr>
<tr>
<td></td>
<td>Worst Adverse effects on community economic activity or community life; adverse environmental impacts; protests to governments.</td>
</tr>
</tbody>
</table>
2. **Environmental impacts**

The central question is "What are the potential impacts of mining developments on the Alsek-Tatshenshini area?" The Rescan Report, (See Chapter 5 and Vol. 2, Appendix 1) selected salmon, grizzly bears, sheep and goats as indicator species, described events that could affect them and estimated the consequence and likelihood of each event.

3. **Market-related benefits**

The intent is to measure market related economic financial flows that would accrue to the provincial and federal governments, and to companies. Community benefits are measured in terms of potential jobs.

The Commission’s consultant worked with officials of the Ministry of Energy, Mines and Petroleum Resources to ‘model’ a mine resembling Windy Craggy with similar volumes and grades of ore and similar capital and operating cost estimates. It is important to note that this modelling assumes that the mine could be operated at a profit while meeting all required technical and environmental standards, which is not certain at this stage. Under the consultant’s direction, three scenarios were developed. Uncertainties associated with each were considered. These included:

- reserves being greater or smaller than expected,
- higher or lower ore grades,
- commodity price variations,
- capital cost savings or increases, and
- the prospects of developing more than one mine.

Employment effects on communities of a mining proposal proved difficult to estimate because of the ‘fly in-fly out’ labour force. Several communities are identified as likely sources of the assumed 500 jobs; it is likely that Whitehorse, Smithers and Terrace could have significant shares.

4. **Interests of neighbours**

Assessing such socio-political factors is made difficult by the variety of perspectives. Certainly Alaska has a substantial interest, especially in trans-boundary aspects including water quality and migratory species. Of those species, salmon is important as an economic and sustenance base for Alaskan communities. On the other hand there is the prospect of positive economic stimulus through job creation to local communities such as Haines.

Having outlined the broad land use alternatives, the underlying objectives and their various measures, it is necessary to evaluate the options.
C. Evaluating the Options

Again, the broad options for the Tatshenshini/Alsek area may be generally described as:

- wilderness preservation and limited ecotourism (Wilderness Option),
- potential mining with formal wilderness preservation in areas lacking high mineral potential (Mining Option), and
- delaying the decision (Delay Option).

These, together with their respective implications for implementation, are assessed below.

1. The Wilderness Option

a. Description

Under this option, the entire area would be designated as a protected area. No extractive resource developments and associated infrastructure or settlements would proceed. The linkage of the area with Kluane, Wrangell-St. Elias and Glacier Bay national parks and wilderness areas in Yukon and Alaska would create what may be the largest protected wilderness area in the world. Presumably appropriate protocols among the governments of B.C., Alaska, Canada and the U.S.A. to ensure consistent and complementary management would be pursued. This would include ongoing control of the level of rafting activity. Investments in park and park-related infrastructure such as trails and lodging may be required, but would likely be minimal.

b. Analysis

Preservation values under this option would be maximized. Ecological processes would continue unaltered and biological diversity and “existence” values would be maximized. Disruption of grizzly bear, sheep and goat habitats would not occur. Mine-related risks to salmon-bearing streams would be avoided. The trans-national river system, which forms the primary tourist access route and attraction, would remain in a wilderness condition with no disruption to its natural scenic integrity.

Designation would contribute complete representation of three ecossections to the evolving provincial “protected area strategy”, thus fully protecting an area of outstanding geomorphological processes, beauty and biological importance as well as one with rafting and other recreational use and potential wilderness.

Strictly speaking, such total representation is not required to meet the “protected areas strategy” goal of preserving representative samples of each ecosystem. Interpreting the strategy rigidly, over-representation in this area might imply reduced representation in other areas to accord with a general conservation target of 12 percent of the province. In a practical sense, however, full representation occurs if no mining proceeds in the area.
Environmental impacts or induced risk due to mineral developments are avoided under this option.

Market related benefits are not maximized. Mineral development opportunities and their potential for economic stimulus throughout the B.C. economy in particular, but also Yukon and Alaska, would be forgone. This would include the prospective 500 direct jobs estimated by Geddes, which would be drawn largely from communities such as Terrace, Smithers and Whitehorse.

Revenue flows to the B.C. and Canadian governments from taxation would also be forgone. Based on analysis of a hypothetical mine similar to Windy Craggy, these tax flows are estimated to range from a low of $100 million to a high of $580 million provincially, and from a low of $25 million to a high of $440 million federally (expressed in discounted present-value terms over a 30-year period). The high range of values reflects the assumption that more than one mine could be constructed. These estimates are based on the assumption that the mine would be economically viable and remain in continuous operation.

Geddes Resources would not proceed with development planning under the wilderness option, and thus this option precludes potential profits to the company that could be derived if the mining proposal were feasible. The company could, under the principles being developed by government following the Schwindt report, be entitled to compensation for exploration expenditures if its proposal is turned down for other than technical reasons. These expenditures would represent a net cost to governments. Both the companies and governments would, however, be spared the costs and uncertainties of regulatory processes.

Wilderness tourism and recreation benefits would be maximized under this option. Presumably the profile and overall attractiveness of the area would be enhanced, leading to greater visitation. This would be constrained, however, by regulatory limitations on rafting as well as by limitations imposed by climate, distance and access cost.

Interests of neighbours would be maximized. Recent statements by senior members of the incoming U.S. administration give a clear indication of emerging U.S. pro-preservation policy towards the area. The U.S. National Park Service nominated Glacier Bay National Park and Preserve for inclusion on the World Heritage List in 1992 in order to extend and enhance coverage of the natural history themes already recognized by world heritage status in Wrangell-St. Elias National Park. Potential upstream mining activity was perceived as a threat to the natural integrity of these areas. These U.S. conservation interests would be maximized. The possibility of inter-jurisdictional conflicts would be eliminated. Costs of joint Canada-U.S. regulatory proceedings and U.S. proceedings on aspects such as the pipeline and port facilities would be minimized.

Community fishery interests in Alaska, both Aboriginal and non-Aboriginal, that operate in Lynn Canal and at the mouth of the Alsek River would be supportive, based on their expressed concerns.

Compatibility with provincial land use strategies is difficult to fully determine. Regarding the Protected Area Strategy, designation of the Tatshenshini/Alsek area substantially represents three
ecosections. The general guideline of 12 per cent representation of ecossections would be exceeded and this could be appropriate for an area where intactness for wilderness dependent species is important. The ecosystem and the prime biodiversity areas in the valley floors would be maintained; much of the remaining area is icefields and peaks. Inclusion of the entire area would contribute approximately 1 million hectares or 1 per cent of the province to protected area status; this could, however, potentially limit flexibility in designating protected areas elsewhere in B.C.

Protected area designation would be seen as adverse to a mineral development strategy because substantial potential would be forgone.

c. **Process Implications**

The main concerns and implications related to selecting this option are
- fair treatment and appropriate compensation to Geddes Resources,
- appropriate signals to the mining industry that much of the province remains open for exploration and development, and
- negotiation of fair and appropriate financial and associated arrangements among B.C., Canada, Alaska and the U.S.A.

Geddes Resources has a reasonable expectation of recovering appropriate exploration and project development costs. This would enable them to redirect their resources and enterprise to other areas. Early agreement on settlement terms would be desirable. A case can be made that because of its international implications, both in terms of issues avoided and conservation benefits achieved, the Canadian federal government should be a co-contributor. A similar contribution by the United States government in cash or through other considerations, such as cooperation in trans-boundary issues where Canadian interests are at risk, would be appropriate in view of the conservation benefits derived by enhancement of the Alaskan wilderness.

It will be fundamentally important that discussions are held with the mining industry to emphasize that selection of this option does not signal unacceptability of mining as an economic activity in B.C. Substantial areas would remain open for exploration. Efforts to settle the scope of the Protected Areas Strategy in particular would give greater certainty to the mining industry. Moreover, this area presents unique regulatory complications because it requires access and associated approvals in Alaska as well as posing potential risks to trans-boundary waters and migratory fish and wildlife, thus necessitating other U.S. regulatory approvals. From a policy perspective, it does not appear that these approvals could readily be obtained. Most areas in B.C. do not have such implications for a mining proposal.

2. **The Mining Option**

a. **Description**

This option provides for mineral exploration and development as well as necessary access to the areas identified as having high mineral potential, through the accelerated but still incomplete field reconnais-
sance and mapping by the Ministry of Energy, Mines and Petroleum Resources. The most highly mineralized belt, trending on a northwesterly axis in the centre of the Tatshenshini/Alsek area, includes Windy Craggy Mountain. The ministry’s 1992 survey also identified high mineral potential in the Squaw Range area near the Yukon border.

Access for mine development and operations at Windy Craggy Mountain would require an air-strip and an access haul road, and a slurry pipeline corridor and associated port and disposal facilities have also been identified as necessary. The access road would have to be located in the Tatshenshini River valley bottom and lower slopes as well as in the Tats Creek Valley. Mineral development would potentially occur, subject to environmental acceptability, throughout the highly mineralized areas shown on Map 4.

The majority of the area, including the entire Icefield Ranges, most of the Alsek Ranges and the Tatshenshini Basin, largely comprises rugged mountains and glaciers where preservation is the most apparent land use because of the high scenic, geological process and other natural values.

b. Analysis

**Preservation values** under this option, while substantial, are not maximized. Biodiversity values in particular may be put at risk by mine and access road development. The Tats Creek Valley and its confluence with the Tatshenshini River has coincidental mineral and wildlife (especially grizzly bear denning and habitat) values. Tats Creek Valley has been described as having some of Canada’s highest quality grizzly bear denning and foraging habitat.

All five species of Pacific salmon, as well as steelhead and other species, spawn in the Tatshenshini/Alsek system and support a regionally important commercial, Aboriginal and sport fishery. Mineral development in the tributary Tatshenshini drainage would present a potential risk of acid rock drainage. The sources and probabilities of this are estimated in Chapter 5 and summarized below. Potential risks may also occur for aquatic and marine life in the vicinity of the proposed Dachau terminal at Haines, and for eagles gathering at the Chilkat Eagle Reserve on the proposed slurry pipeline corridor.

The Tatshenshini River is considered one of the continent’s paramount wilderness tourism trips, although distinct limits exist on its capacity to support this experience. An access road paralleling the river and bridging it is viewed as fundamentally detrimental to its wilderness qualities. This is due to road and right-of-way requirements, traffic noise and visibility and risks of accidental spills due to accidents or seismic activity.

**Environmental impacts** could be substantial under this mine development option. As noted above, potential impacts on bears, goats, sheep and salmon were seen as critical environmental issues. Rescan’s analysis indicated potential for detrimental impacts on grizzly bears, resulting from noise, habitat disruption, poaching and transportation accidents. Impacts on sheep and mountain goat are possible due to excessive illegal harvests, disturbance of movements, traffic mortality and disruption of habitat access roads.
Annual probability estimates of risk to environmental resources were prepared by the Rescan team. McDaniels (Vol. 2, Appendix 3) used the Rescan team’s judgmental probabilities to produce estimates of probabilities of impacts, over time, and across a number of different kinds of events.

For wildlife, McDaniels estimated that events leading to moderate impacts could be expected about once every 2.5 years on average. These moderate impacts could possibly lead to severe cumulative impacts over time.

Rescan’s analysis of the Windy Craggy proposal identified several sources of potential impacts on salmon, with consequences ranging from low to severe. These events could occur through the development and operating stages to closure and abandonment.

The most significant source of environmental risk to salmon identified by Rescan (Chapter 5 of their report) is that of a tailings dam failure. Rescan examined all sources of risk and assigned both probabilities and estimates of impact to each. The underlying concerns are primarily the toxicity of the leached metals released by acid rock drainage and, secondarily, siltation and sedimentation. The risk of tailings dam failure is fundamentally shaped by the frequency and severity of seismic events in the area of the tailings pond and its ability to withstand seismic events. The Rescan report indicates that the area ranks among the most seismically active in the world. Additional work on the size and frequency of seismic events, the design of the dam, and the quality of its foundations would be helpful in refining these estimates.

Rescan’s report provided data that allowed McDaniels to estimate risks of impacts leading to impacts on salmon. The results indicate that events leading to moderate impacts would be expected once every 6 years, and events leading to severe impacts once every 12 years. These severe impacts would be associated with tailings dam failures. It should be stressed that these estimates are preliminary, reflecting available information, and the current preliminary mining plan. Nevertheless, they indicate a high probability of severe impacts in the watershed that could affect both Canadian and U.S. fish resources and indicate areas requiring substantially more assessment before mining could be authorized.

**Market related benefits** would be maximized under the mining option given the mineral potential of the area, assuming the project was economically viable and obtained regulatory approval in both countries. Full opportunities to develop and explore in the mineralized zone would be available. As noted previously, an analysis of a mine with characteristics similar to Windy Craggy was undertaken to estimate economic returns from mining in the area, assuming the mine was constructed and profitable. Many factors influence that determination, as shown in McDaniels’ Figure 3 (Vol. 2, Appendix 3). A “base case” analysis was conducted to estimate the economic flows if a mine in the region was an economic success. These results were then used to make estimates of three scenarios of economic returns reflecting various assumptions regarding scaling development, capital costs, operating costs and recovery factors. These produced the following results.
### Table

<table>
<thead>
<tr>
<th>Case</th>
<th>Return in Millions of $ (Present Value at 6 per cent)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B.C. Government</td>
</tr>
<tr>
<td>High</td>
<td>580</td>
</tr>
<tr>
<td>Medium</td>
<td>275</td>
</tr>
<tr>
<td>Low</td>
<td>100</td>
</tr>
</tbody>
</table>

*McDaniels (1992)*

The analysts considered it reasonable to assume an expected revenue reflecting the ranging scale of $315 million to the province in discounted present value terms. This equates to about $23 million as an equivalent annualized payment over 30 years. The importance of this estimate (and the associated range) is that it indicates the scope of potential provincial revenue, if mining is proven to be technically and economically feasible.

**Interests of neighbours** would be compromised. Recent communications from the U.S. government indicate its policy on this area to be pro-preservation. Recent World Heritage designation implies uncompro-mising protection of natural values and resources in Glacier Bay National Park. The U.S. National Parks Service believes that potential mining activities may adversely affect water quality in the Tatshenshini and thus the Alsek River, the primary waterway and aquatic habitat of the Park. The World Heritage Convention, of which Canada is a signatory, obliges parties “not to take any deliberate measures which might damage directly or indirectly the cultural and natural heritage — situated on the territory of other States party to (the) convention.” It could be argued that any mine approval that fails to address U.S. concerns regarding the risk of acid rock drainage would breach this international legal duty.

More significant, perhaps, is the requirement to secure approvals of facilities situated in the U.S. The pipeline and port facilities would open up the scope of full U.S. environmental review. This requirement effectively gives the U.S. a veto over mine development approval, as an alternative port facility on Canadian waters is not a practical option. It would entail substantial direct regulatory costs in order to ensure full compliance with U.S. requirements. These requirements could be rigorous, if not prohibitive, and potentially involve long delays given the stated objections of U.S. environmental interests, and U.S. Aboriginal and non-Aboriginal fishery interests who are concerned about potential fishery impacts in the east Alsek spawning area and the Dry Bay fishing area. The Borough of Haines, Alaska (site of the proposed port facilities) recently passed a unanimous resolution calling for the U.S. government to enter into agreements with Canada to protect the Alsek and Tatshenshini Rivers and for the Secretary of the Interior to ensure that Glacier Bay National Park and Preserve is not degraded by potential mine developments in Canada. Some other Alaskan interests (see page 21) are supportive of the Windy Craggy proposal.

A major issue associated with interests of neighbours is the potential for environmental impacts on salmon and other fish resources due to tailings dam failure. Rescan’s report suggested events leading to impacts on salmon could be expected to have severe consequences, largely due to the risk of tailings dam failure. If they occurred, they could lead to suits under international law for compensation of impacts on U.S. aquatic resources.
Acceptability factors are difficult to judge but are partially covered in the above discussion of U.S. interests. Domestically, environmental interests would see the mine option as threatening an intact wilderness and its associated recreation and tourism values, and risking biodiversity values.

Internationally, ignoring an opportunity to jointly pursue with the U.S. one of the world’s largest contiguous protected areas could be perceived negatively.

**Compatibility with provincial land use strategies** is not readily determined. A decision to proceed with the mining option would be seen as positive by those favouring a less restrictive approach with opportunities to pursue all mineral development prospects regardless of competing values. Alternatively, a mining decision could be seen as adverse to key conservation and recreation values in this study area under the emerging Protected Areas Strategy for British Columbia, partly because its protected area values and boundary alternatives will not have been fully assessed. However, devoting 75 per cent of the area to protected status would contribute to the goals of that strategy.

c. **Process Implications**

The primary process implications of this option appear to be:

- arranging for an appropriate and effective project review process embracing necessary Canadian and U.S. agencies. This would include consideration of implications for world heritage values.

- providing any necessary additional direction to Geddes Resources respecting the specific requirements of engineering and environmental studies.

- ensuring completion of necessary studies on wildlife, especially grizzly bear and salmon, which appear to be at greatest risk if the mining option is chosen.

- completing the study of protected area values (outside the prime mineral and access areas) and their contribution to larger strategies.

- communicating with ecotourism and conservation interests, to determine the studies necessary to minimize mining related impacts.

Earlier chapters indicated that potential trans-boundary impacts necessitate project review by U.S. as well as Canadian agencies. U.S. policy statements, expressed by the incoming administration, suggests that the most rigorous standards are to be expected and would constitute a virtual veto. It would seem prudent that Geddes Resources first concentrate on focusing and satisfying these standards at the study stage. With this having been done, talks to harmonize the review processes of the various jurisdictions should commence. Particular attention would have to be paid to U.S. concerns related to the World Heritage status of Glacier Bay National Park, and a possible reference to the International Joint Commission (IJC). An IJC reference has particular importance.
In their 1988 report, "Impacts of a Proposed Coal Mine in the Flathead River Basin", the IJC noted that Article IV of the Boundary Waters Treaty establishes "a mutual obligation to protect [a migratory] fishery by a range of management practices in both countries... and ... when any proposed development project has been shown to create an identified risk of a transboundary impact... existence of that risk should be sufficient to prevent the development from proceeding".

It is clear from the work of Rescan and others that particular effort must be made by Geddes with regard to reducing risk to spawning fish. Various aspects of acid rock drainage, particularly seismic risk to the proposed tailings pond, need concentrated work. Risk assessment, risk management, location and other aspects of the slurry pipeline also need special attention. Additional studies on wildlife values — especially grizzly habitats, movements and populations — are essential to further assessment and would need to be initiated.

This option would be seen as presenting risk not only to wildlife but also to wilderness and resultant tourism values. Efforts to determine how best to minimize visual and other impacts of mining access on the tourism and recreation values would be necessary. Improved access by recreationalists would include hunters and particular efforts and expenditures to prevent wildlife poaching and other losses would be required.

3. The Delay Option

a. Description

Deferring the fundamental decision on the best land use for the Tatshenshini/Alsek area is a serious option. Perhaps the most compelling reason for it is the general uncertainty about virtually all aspects of the land use question. These include mineral values, relative wilderness values, environmental risks, technical and economic feasibility and Aboriginal land claims. Better information on mineral values and environmental systems and values can be expected with additional field surveys. Additional scientific and technical information, especially regarding mining and mine impact management in extreme conditions, will emerge. Further opportunities to investigate engineering alternatives will be provided. Current uncertainties about various economic aspects of land use alternatives, such as demand, will be reduced. Because much of the debate relates to the value to future generations, keeping the option open for them — or today’s generation of youth — to decide on the relative weighting of mining and preservation values may be attractive, especially as much important information that is now unknown will likely become available over time. Certainly the additional time would allow the competing uses to be assessed in the context of emerging provincial land use strategies for protected areas and mineral development.

Deferral does, however, preclude any immediate opportunities for Geddes Resources and potentially others to pursue mining development approvals. This option suggests the need to start the process to compensate Geddes fairly for appropriate expenses incurred in advancing the proposal to date. This presumably could include provisions for giving Geddes "right of first refusal", subject to repayment of compensation plus interest, should mining be later judged acceptable in principle.
Deferral may or may not be accompanied by continuing the reserve against mineral claim striking. A reserve would preclude exploration work and limit the amount of new geological data but would minimize potential compensation claims.

This option maintains land use alternatives; it does not however create a climate of certainty for prospective mining investors or provide certainty for conservation interests.

b. Analysis

Preservation values such as wilderness recreation, wilderness habitats and other aspects of biodiversity would remain intact because no development would proceed.

Scientific baseline data and further documentation of biodiversity values could be pursued. Market and non-market tourism and recreational values would be unchanged, although incentive to invest in tourism could be diminished. While the full preservation option remains open, the “bequest” values to future generations would be clouded by uncertainty.

Market related benefits deriving from mineral development would not be obtained, and uncertainty would remain a disincentive to exploration work. Geddes and other companies would be reluctant to undertake further exploration risks, and this in turn would impact exploration-dependent jobs in the area. This could be offset by redirecting the focus of exploration activity to other areas of the province.

While the option of future mineral development remains open, geological reconnaissance might have to be government-sponsored in the interim. Geddes would be reluctant to pursue further work on their proposal and search for approvals. This could be partially mitigated by government indicating those components of the project which are of most concern and hence attempting to focus on the conditions that would have to be met under review and approval processes. This presumes that Alaskan, U.S., Canadian and British Columbian government agencies would be able and willing to conditionally consider the mining option, subject to performance standards being met.

Certainly deferral would delay the stream of prospective job and revenue benefits to governments, companies and the economy that would derive from a feasible mining project.

Interests of neighbours, while not being jeopardized, may be seen as not being served by a lack of certainty about either preservation intentions or prospective mining.

This option keeps open the possibility of costs of regulatory processes to review studies and proposals but would impose no immediate costs unless Geddes decided to proceed in spite of the delay in land use designation. It would weaken any case for pursuing cost sharing with U.S. interests for compensating Geddes Resources, which could be viewed as positive by the U.S.

Social and political acceptability would depend on the perspective adopted towards the opportunity to develop better information as a basis for better decisions. Some may interpret this as the correct strategy
because of the importance of reducing many uncertainties in order to reach a wise and stable decision; others could interpret it as indecisive unless properly reasoned and explained. It does not send strong signals to either mineral development or conservation interests in B.C., Canada, Alaska, the U.S.A. or elsewhere.

**Consistency with land use strategies** is served in the sense of providing greater study time and opportunity to develop broader provincial and regional strategies for protected areas and mineral development and assess the importance of the Tatshenshini/Alsek area to them.

c. **Process Implications**

The main concerns and implications of selecting this option would be:

- a need to explain and communicate the reasons for it,
- ensuring additional studies are undertaken,
- deciding on whether or not to extend the present reserve against mineral claim staking, and
- commencing appropriate compensation and other arrangements with Geddes Resources.

This option does not convey the land use certainty that many parties expect, and may be unpopular with both conservation and mining interests. However, the great uncertainty about wilderness values, mining values and environmental risks presents an argument for an approach based on caution.

This requires focused efforts to obtain the necessary information. Uncertainty about land use intentions may discourage the mining sector from committing to further geological exploration work, and hence government may have to undertake aspects of it. It could also inhibit Geddes Resources from further investing in the studies necessary to establish the economic, technical and environmental feasibility of the Windy Craggy proposal. Given the prospect of future mining proposals, government agencies would have to sponsor and monitor studies on questions such as managing acid rock drainage and fisheries and wildlife impacts. Further understanding of slurry pipelines would also be beneficial.

If Geddes Resources is permitted to continue with project development (additional engineering and drilling, location and environmental studies), compensation may be required should the eventual decision be not to allow mining.

To the extent that uncertainties about biological values are the basis for deferral, necessary studies should be commissioned. Studies of grizzly bear populations, movements and habitat significance, recreation and tourism use, and Aboriginal uses and interests are among the necessary topics.

To the extent that potential economic risk is the issue, the necessary tracking of copper markets as well as mining, milling, transport, and other key aspects of financial and technical feasibility should be studied.
An informal deferral could allow companies such as Geddes to continue their assessment work. A formal moratorium would suspend further mineral staking and assessment work, and this could lead to requests for compensation.

Deferral of the decision might be unpopular with both mining and conservation interests. For this reason, as well as the desirability of ensuring a clear public understanding, it would be most important to articulate clearly the reasons for this decision, the length of the proposed delay, and steps proposed to be taken during the deferral period to reduce uncertainties about the Tats’hemishni/Alsek area.

D. Concluding Observations

The Commission, in addressing the question of the best land use for the Tatshenshini/Alsek area, has examined numerous potentially relevant factors. These have included geological, environmental, engineering, economic, legal and socio-political considerations.

It is clear that there are many land use objectives for the area and that these are held by a diversity of interests. An ideal solution would allow all of these objectives to be satisfied. Wilderness values and economic benefits would be maximized. Both domestic and international interests would be satisfied; acceptance levels would be high, and the solution would fit well within provincial land use strategies. However, in the Tatshenshini/Alsek area, like many others, the objectives are competing; unlike some other areas, there is little room for compromise here because the Tatshenshini/Alsek area has little effective scope for multiple use that does not impinge on environmental values. Mining development would preclude maintaining full values for biodiversity and wilderness tourism because these high values coincide in the Tats Creek and the Tatshenshini Valley. Mining could also present substantial environmental risks that could potentially impinge on interests in neighbouring Alaska.

As a solution that fully meets all interests is not available, difficult land use choices will have to be made. To facilitate the analysis, three general options were identified and measures of the competing objectives were developed and applied to systematically outline the key environmental, economic and socio-political features of each option. In applying these measures, it was evident that substantial uncertainties and information gaps surround virtually all aspects of the land use question.

Preliminary geological reconnaissance confirmed the existence of a significant belt of very high mineral potential. This belt is of unknown extent and includes Windy Craggy Mountain and other mineral deposits. This raw mineral wealth has the potential of generating a flow of economic benefits to mining companies, governments and the economy as a whole. The gross recoverable mineral value of the Windy Craggy deposit has been estimated by Geddes Resources at $8.5 billion, but it is not certain that its extraction is economically or environmentally feasible.

The powerful geological forces that created the extraordinary mineral potential also account for its key risks, namely potential hazards to mining facilities due to seismic events and highly sulphuric rock which creates ongoing risks of acid rock drainage, both during mine operation and after abandonment. Studies
by consultants to the Commission confirm that the greatest risks are potential breach of the mine tailings dam with consequent release or exposure of tailings and acid generating waste. Seismic activity could trigger a breach. While annual likelihood is estimated to be relatively low, the cumulative probability increases over time. A breach could lead to discharge of tailings into Tats Creek, a tributary of the Tatshenshini River, and thence into international waters of the Alsek, thus potentially affecting salmon habitat and affecting U.S. interests. Expert consultants to the Commission concluded that potential for seismic activity and other natural geological hazards will make it necessary to monitor and maintain the tailings impoundment in perpetuity. A less significant area of acid rock drainage risk comes from the pit and mine workings after closure, so that ongoing pumping and treatment may be necessary.

Analysis of the mine proposal identifies areas where additional research and design studies would be required to reduce or eliminate inherent risks. These studies must address issues of long term structural stability in an area with powerful ongoing geological forces which, taken together, can present high cumulative risk probabilities. Active intervention at the project site may be required for a period of two hundred years or more. This raises complex regulatory and economic questions, including how best to provide for such costs through bonding or other mechanisms.

Accessibility is a second key factor bearing on economic feasibility of mining development. Portions of the Tatshenshini/Alsek area are remote and characterized by difficult terrain and a harsh climate. Even for the Windy Craggy site, capital and operating costs for road access and a slurry pipeline will be high, because of these factors. Assuming the project is economically and technically feasible, economic modelling demonstrates major prospective returns to the company and governments. For the province, on a discounted basis, a mine similar to Windy Craggy could, if technically and economically feasible, yield a range of possible annual revenues, with the expected tax flows across all scenarios estimated as equivalent to a steady cash flow of about $23 million yearly for 30 years, at a 6 per cent interest rate.

Wilderness values of the Tatshenshini/Alsek area include world-class wilderness resources and rafting, with high biodiversity values, particularly in the valley corridors. The full extent and potential of these values are unknown, and the impact of mining and access development on them is hard to predict. Greater knowledge of these values would assist in planning for risk avoidance, mitigation and evaluation of options themselves.

More information is needed regarding managing prospective impacts on environmental interests in the U.S. The feasibility of locating the proposed slurry pipeline through the Chilkat Eagle Preserve is uncertain. Another key issue is impact concerns in Glacier Bay National Park and Reserve, particularly since its recent designation as a World Heritage Site. Under the World Heritage Convention, Canada as a signatory country is obliged "not to take deliberate measures which might damage directly or indirectly the cultural and natural heritage situated on the territory of other States...." Mine approval and development could be considered to be such a measure if natural heritage values were seen as being at risk. Mine-related risk to fish and aquatic habitats has been identified as a possibility under the preliminary Windy Craggy mine plan. The consultants indicated that deleterious impacts on water quality, if limited to Tats Creek which flows from the glacier, 30 km to the Tatshenshini confluence,
could be mitigated through some natural buffering. In the Frobisher watershed there is only a 5-10 km buffer before it joins the Alsek some 30 km from the Alaska/B.C. border. While seasonally the dilution factors would be substantial, the risks of lethal or chronic impact on first habitats would be elevated during low flow periods when volumes drop to 5 per cent of their summer peaks. More conclusive information on this topic would be useful. The World Heritage site designation will likely drive the need to satisfy American interests that there is no prospect for damage to habitat of salmon and other marine life along the Alsek River. Given the current mining plan, and potential for dam failure, this assurance is not possible.

Environmental impact assessment will clearly have to respond to such interests as well as to other required facility pipeline and port approvals. Separate, cooperative or combined Canada-U.S. environmental review scenarios are possibilities, with cooperative environmental reviews, based on exchanges of information, thought to be the most likely choice. A combined international review appears possible by Canada-U.S. agreement or by reference to the International Joint Commission under the Boundary Waters Treaty. Both scenarios are legally feasible under Canadian and B.C. environmental legislation. Apparently the U.S. State Department and the lead agencies would have to concur, and in a combined review by Canadian and U.S. agencies, the resulting environmental impact statement would be used to complete regulatory reviews on both sides of the border. Canada would also have to consider whether this approach is in the national interest. Separate reviews by each affected jurisdiction, potentially followed by a reference to the International Joint Commission, would create the longest scenario, requiring several years. However, in a "critical path" sense it may be most effective to first secure approvals in the U.S. as these are likely to be the most difficult.

The wilderness protection option, while creating a possible loss to the B.C. economy, could be supported on the strength of biological, geomorphological, scenic, wilderness tourism and international conservation values. This option could require fair compensation to Geddes Resources and any others who have invested in mineral exploration and development in the area. Given the costs of this plus potential forgone economic benefits, it is not unreasonable to expect the Canadian and U.S. federal governments to consider contributing directly or through other considerations. In return they could be party to formally joining this area to existing parks and reserves to create one of the world's largest conservation areas.

Compensation for suspended mineral development opportunity would be required under a deferral option which would allow time to remedy many of the information uncertainties. The length and purpose of any such deferral should be clearly explained. Informal deferral while additional studies are done is one option and implies a different compensation and communication strategy than a more formal long-term deferral of the decision to a future generation. Mining, conservation, public and international interests could all benefit from the clarification provided by further study.

Whatever option is chosen, well-considered communication of the reasons to all interested parties is critical, as the potential for misunderstanding in a value-based decision is high. If the mining option is chosen, preservation and U.S. interests must understand that environmental safeguards, international accords, and substantial conservation are not abandoned. Should deferral be seen as the best option, the reasons for it must be clearly indicated. If wilderness preservation is preferred, the mining industry must
understand it is because of the unique risks and values of this area and not a general concern with mining activity in British Columbia.

Recognizing that the objectives and interests in the area are diverse, the Commission recommends that government provide further opportunity to receive comments from interested parties on the issues raised in this report over the next six months. The Commission will undertake initial distribution of this report to parties it knows have particular interest and will place copies of this report and its appendices in key deposit libraries. Government may wish to consider, perhaps guided by initial comments, providing for some public meetings in selected centres such as Vancouver, Smithers, Terrace and Prince George to hear and record the views of the public and particularly interested parties. Such meetings could be convened either by the Commission, by a legislative committee, or directly by government.

This report is respectfully submitted for government and public consultation.
COMMISSIONER ON RESOURCES AND ENVIRONMENT ACT

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HER MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows:

Interpretation

1. In this Act "commissioner" means the Commissioner on Resources and Environment appointed under section 2.

Appointment of the commissioner

2. (1) The Commissioner on Resources and Environment shall be appointed by the Lieutenant Governor in Council and is a public officer reporting to the Executive Council.

(2) An appointment under subsection (1) is for a term of 5 years and reappointments may be made.

Commissioner's role

3. (1) The Commissioner shall advise the Executive Council in an independent manner on land use and related resource and environmental issues in British Columbia and on the need for legislation, policies and practices respecting these issues.
(2) If the commissioner considers that the public interest will be best served by making a report to the public on a land use and related resource or environmental issue in British Columbia or on the need for legislation, a policy or a practice respecting such an issue, the commissioner shall make this report to the public in the manner the commissioner considers most appropriate.

Commissioner's mandate

4. (1) The commissioner shall develop for public and government consideration a British Columbia wide strategy for land use and related resource and environment management.

(2) The commissioner shall facilitate the development and implementation, and shall monitor the operation, of

(a) regional planning processes to define the uses to which areas of British Columbia may be put,

(b) community based participatory processes to consider land use and related resource and environmental management issues, and

(c) a dispute resolution system for land use and related resource and environmental issues in British Columbia.

(3) The commissioner shall work to ensure effective and integrated management of the resource and environment of British Columbia by

(a) facilitating the coordination of initiatives within the government, and

(b) encouraging the participation of Aboriginal peoples in all processes affecting Aboriginal peoples that relate to the commissioner’s mandate and by maintaining strong links with negotiations on Aboriginal treaties.

(4) The work of the commissioner and the participation of Aboriginal peoples under this Act shall be without prejudice to their Aboriginal rights and to treaty negotiations.

(5) In carrying out the mandate under this section, the commissioner shall give due consideration to

(a) economic, environmental and societal interests
(b) local, Provincial and federal governmental responsibilities, and
(c) the interests of Aboriginal peoples.

**Representation**

5. If the commissioner believes that a person or group will be significantly and directly affected by a land use issue or related resource or environmental issue under consideration by the commissioner, the commissioner shall inform that person or group and give that person or group an opportunity to make representations to the commissioner on the issue before the development of the recommendation or report.

**Hearings**

6. (1) The commissioner may conduct hearings for the purposes of this Act and determine the procedures to be followed for the purposes of these hearings.

(2) No person is entitled to a hearing by the commissioner under this Act except as provided by this Act.

(3) For the purposes of this section the commissioner has the powers, protection and privileges given under sections 12, 15 and 16 of the *Inquiry Act* to a commissioner appointed under Part 2 of that Act and the commissioner may receive or accept under oath or otherwise, evidence whether or not it would be admissible in a court of law.

(4) At a hearing before the commissioner a person has the same privileges respecting the giving of information, the answering of questions or the production of documents or things as that person would have in a proceeding in a court.

(5) Evidence given by a person in a hearing before the commissioner is inadmissible, insofar as the laws of the Province apply, against that person at a later date in any court or proceeding of a judicial nature except in a prosecution of an offence under this Act or in an application for judicial review.

**Commissioner as a witness**

7. (1) The commissioner or a person appointed, engaged or retained under section 10 shall not, insofar as the laws of the Province apply, give, or be compelled to give, evidence in a court or in
proceedings of a judicial nature concerning knowledge gained in
the exercise of a power or duty under this Act.

(2) Subsection (1) does not apply to an offence under section 13.

Immunity for acts or omissions in good faith

8. (1) No action for damages lies or may be brought against the
commissioner or any person appointed, engaged or retained under
section 10 because of anything done or omitted in good faith
(a) in the performance or intended performance of any duty under
this Act, or
(b) in the exercise or intended exercise of any power under this Act.

(2) Subsection (1) does not absolve the government from vicarious
liability for an act or omission for which it would be vicariously
liable if this section were not in force.

Further terms and conditions of the
commissioner’s appointment

9. (1) Subject to section 2 and this section, the Lieutenant Governor in
Council may establish the remuneration and other terms and
conditions of employment of the commissioner.

(2) The Pension (Public Service) Act applies to the commissioner as an
employee.

(3) The commissioner is declared to have the status of a deputy
minister.

Staff

10. (1) A deputy commissioner and other employees necessary to carry out
the powers and duties of the commissioner may be appointed under
the Public Service Act.

(2) The commissioner may engage or retain specialists or consultants
that the commissioner considers necessary to carry out the powers
and duties of the office and may determine their remuneration, and
the Public Service Act does not apply to the retention, engagement
or remuneration of these specialists or consultants.
Delegation of the commissioner's powers or duties

11. (1) The commissioner may delegate any of the commissioner's powers or duties, except the power to delegate a power or duty under this section or to make a recommendation or report under this Act, to any person or class of person appointed, engaged or retained under section 10.

(2) A person appointed, engaged or retained under section 10 has only those powers of the commissioner that are specified in the delegation under subsection (1) and the commissioner continues to have all the powers and duties that are delegated to others under this section.

(3) A delegation under subsection (1) shall be in writing and is subject to the terms and conditions the commissioner specifies in the delegation.

(4) A delegation under subsection (1) does not cease by reason only that the commissioner who made the delegation ceases to hold office.

(5) A person acting under a power or duty delegated under subsection (1) shall, if so requested, show a copy of the written authority under which the delegation was made.

Yearly report to the Legislative Assembly

12. Each year the commissioner shall give to the Speaker a report to the Legislative Assembly concerning the commissioner's activities under this Act since the last report was made under this section, and the Speaker shall lay the report before the Legislative Assembly as soon as practicable.

Offences

13. (1) A person commits an offence if the person
   (a) impedes the exercise of a power or the performance of a duty under this Act, or
(b) refuses or fails to comply with an order or summons under section 6(3).

(2) If a corporation commits an offence under subsection (1), an employee, officer, director or agent of the corporation who authorizes, permits or acquiesces in the offence commits the same offence whether or not the corporation is convicted of the offence.

Commencement

14. This Act comes into force by regulation of the Lieutenant Governor in Council.
— DRAFT —

A Land Use Charter*

THE PROVINCIAL COMMITMENT

The Government of British Columbia is committed to:
- protecting and restoring the quality and integrity of the environment, and
- securing a sound and prosperous economy
for present and future generations.

This commitment is made to the people of British Columbia and to the global community. A healthy environment and a healthy economy are essential to the social, cultural, material, physical and spiritual well-being of British Columbians. Furthermore, the Province recognizes its obligation to protect, manage and use its resources and environment to fulfil its responsibility to global well-being. Finally, the Province shall ensure that present-day decisions do not compromise the ability of future generations to meet their own environmental and economic needs.

PRINCIPLES

SUSTAINABLE ENVIRONMENT

A healthy environment is the foundation upon which a sound economy and society depend. The essential role that ecosystems play in supporting our society establishes an environmental imperative that must be respected in all land, resource, and economic decisions. Our priority must be to maintain natural systems for present and future generations.

1. The Province shall maintain and enhance the life-supporting capacity of air, water, land and ecosystems. The Province shall respect the integrity of natural systems, and will seek to restore previously degraded environments.

* This draft version, while not officially approved by Cabinet, has been used as a guideline for regional processes.
2. The Province shall conserve biological diversity in genes, species and ecosystems.

3. The Province shall attempt to anticipate and prevent adverse environmental impacts. When making land and resource decisions, the Province shall exercise caution and special concern for natural values, recognizing that human understanding of nature is incomplete.

4. The Province shall ensure that environmental and social costs are accounted for in land, resource use and economic decisions.

5. The Province shall recognize its responsibility to protect the global environment, to reduce consumption to sustainable levels, to avoid importing or exporting ecological stresses, and to help meet the global challenge of sustainably supporting the human population.

6. The Province shall protect the environment for human uses and enjoyment, and will also respect the intrinsic value of nature.

SUSTAINABLE ECONOMY

Our ability to sustain a quality environment depends upon our ability to foster a strong and sustainable economy. Such an economy is more efficient, and derives greater social benefits from the use of fewer environmental assets. In addition, a sustainable economy can provide the means for increased environmental protection and conservation, while offering society alternatives to undue exploitation of natural resources.

1. The Province shall promote a dynamic and competitive economy that maintains options for future land and resource uses.

2. The Province shall encourage diversified economic development that increases the employment and other benefits derived from a given stock of resources.

3. The Province shall encourage development that reduces waste and makes efficient use of resources.

4. The Province shall encourage optimum use of natural systems and resources, consistent with their inherent capability to support our economic, social and environmental needs.

5. The Province shall ensure that renewable resources are used in a manner that is sustainable over the long term.

6. The Province shall ensure that the use of non-renewable resources avoids their exhaustion, and addresses the needs of future generations.
7. The Province shall stimulate environmentally sound economic activity and innovation through a system of economic instruments.

8. The Province shall provide a regulatory framework which promotes stability and predictability for business and investment.

SOCIAL SUSTAINABILITY

Social equity requires that the concerns of individuals and communities are respected as environmental and economic needs are balanced.

1. The Province shall aim for a fair distribution of the costs and benefits of land use decisions.

2. The Province is committed to social stability, and will support economic and social measures to address the economic effects of land use decisions.

3. The Province shall promote a good quality of life by fostering opportunities to:
   - earn a living;
   - obtain education and training;
   - access social, cultural and recreational services; and
   - enjoy a quality environment.

4. In addition, equity requires that land use and related resource and environmental decisions be made in a fair and open manner.

DECISION-MAKING PROCESSES

These environmental, economic and social principles shall be implemented and reconciled in neutrally administered decision-making processes that are open to the participation of all interests. The processes shall promote decision-making through the building of consensus amongst diverse perspectives and stakeholders.

1. The processes used for making decisions regarding land, resource and environment use must be:
   - Comprehensive and Integrated — Land use planning and management shall be cross-sectoral, comprehensive and integrated. The processes will address the full range of environmental, social and economic concerns and values.
• **Fair** — The processes will adhere to the principles of administrative fairness, and shall provide full public access to relevant information.

• **Efficient and Effective** — The processes will strive for efficient use of time and financial resources. Decision-making will be based on adequate information and assessment, so that wise and effective decisions can be made. The processes should effectively implement the principles of a sustainable society.

• **Accountable** — Decision-makers must be accountable to all participants in the processes, as well as to the broader public. Lines of accountability should be established for participants in decision-making who represent others. Overall, the processes must be responsive to community aspirations while maintaining consistency with provincial principles, goals and policies.

• **Enforceable** — The decisions made must be properly monitored and enforced.

• **Adaptive and Flexible** — The processes shall be capable of modifying decisions in response to technological innovations, field experience, shifts in social preferences, and new information. These modifications will be made in a manner that maintains social, environmental, and economic stability.

• **Respectful** — The processes shall encourage respect for the diverse values, traditions, and aspirations of British Columbians and their communities.

**ABORIGINAL PEOPLES**

Aboriginal title and the inherent rights of Aboriginal people to self government are recognized.

Land use decision-making shall incorporate, support and not interfere with negotiations on Aboriginal self government and treaties. Aboriginal peoples shall be encouraged to be active participants in decision-making.

**SHARED RESPONSIBILITY**

Achieving a sustainable society is everyone's responsibility — from individuals, businesses, and non-government organizations, to all levels of government, Aboriginal peoples, and the global community. The Province shall encourage all parties to protect the environment and build a sustainable economy. Our success depends upon the independent and cooperative initiatives of all British Columbians.