

Scoping of Ecological Impacts of Mining on Canada's National Parks

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Executive Summary

This scoping exercise was performed for the Canadian Nature Federation and the Mining Association of Canada. The project was carried out to investigate the extent and nature of mining activities and impacts on Canada's National Parks. Using the 1997 *State of the Parks Report* as a basis for identifying relevant national parks, 16 national parks were interviewed using a preset questionnaire. Results from the interviews have been summarized in the report and discussed in more detail under three subsections: mining activities, impacts associated with mining, and mitigation and management.

Almost half of Canada's national parks indicated that mining has occurred in the past or is currently occurring in or around their park boundaries. Approximately 90% of the mines identified during the interview process are located outside park boundaries, however many of these (~39%) are located within 10 km of the park boundaries. A variety of types of mining were reported including; rock and gravel quarrying, and mining for coal, gypsum, gold, lead, tungsten, peat, limestone and sand. Mining activities were identified as occurring both within and outside of park boundaries, with a variety of associated footprints, levels of impact and status (exploration, active, abandoned).

Parks were asked to report on trends in mining impacts, which varied depending on the park in question, and well as regionally within the parks. Interviewees were asked to rate the degree of impacts that mining activities were having on their park, with the majority of respondents indicating a medium to low level impact, with several exceptions. Eighty eight percent of the respondent parks identified impacts on wildlife associated with mining activities, including; habitat fragmentation and loss, habitat effectiveness, direct and indirect mortalities, and blockage of seasonal dispersal movements. Other identified ecological impacts included: issues with human use, impacts on vegetation and water quality and quantity, air pollution and terrain issues.

During interviews parks staff also identified strategies to manage and mitigate impacts related to mining, and communication initiatives with the mining industry. Identified mitigation and management techniques included remediation and reclamation, monitoring, research, access control and land management planning. Communication initiatives included regional advisory groups, management committees, and other more informal communication initiatives between parks and the mining companies. Follow up with the mining industry would provide more information on mitigation and management techniques, but was beyond the scope of this study. It has been identified as a next step to this work.

Relevant scientific literature and research initiatives were identified by parks staff during the interview process. Several parks identified studies and research initiatives related to ecological impacts and mining including regulatory applications, university research and governmental research. A preliminary review of some of the identified literature is included in this report, and more detailed review has been presented as a potential next step to this work. Parks were also asked to identify future research needs related to mining impacts and mitigation, almost all of the respondent parks indicated some form of future research needed.

As part of the scoping exercise a preliminary risk assessment of potential and future risk to ecological integrity was conducted and included in this report. Further information is required to conduct a more detailed assessment. Several points included in the preliminary assessment included:

- Impacts identified in the interviews: habitat loss/alteration, habitat fragmentation, the introduction of exotic species, human use, pollution etc., all can negatively influence biodiversity at all levels (landscape, community, species, genetic) and in turn could pose a potential risk to ecological integrity in Canada's National Parks.
- Ecological integrity is also linked to ecosystem processes, such as fire, flood, predation, pollination and grazing. Mining and its associated activities have the potential to indirectly

affect ecosystem processes by altering natural processes however adequate information was not collected to fully assess the contribution of mining to these processes.

- Mining is not the only human use activity occurring within and around national parks and their impacts can not be assessed individually, but must be assessed in combination with other stressors to determine cumulative effects.
- The maintenance and improvement of ecological integrity is dependant on people making informed choices and decisions and working together to implement appropriate management strategies to reduce all stressors to Canada's parks. Ongoing communication between parks the mining industry is important in reducing threats to regional biodiversity and ecological integrity of Canada's National Parks.

Recommendations for next steps were included in this report and included; a more detailed literature review using identified studies and reports, a case study of one or several parks, and follow up on the perspectives and knowledge of the mining industry.

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Abbreviations

AXYS	AXYS Environmental Consulting Ltd.
CEA	Cumulative Effects Assessment
CNF	Canadian Nature Federation
CWS	Canadian Wildlife Service
DIAND	Department of Indian Affairs and Northern Development
DFO	Department of Fisheries and Oceans
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MAC	Mining Association of Canada
MOU	Memorandum of Understanding
MT	Mountain
NGO	Non Government Organization
NNPR	Nahanni National Park and Reserve
QC	Quebec

1 Introduction

In the 1997 *State of the Parks Report* (Parks Canada), 15 out of 36 national parks surveyed identified 'mining' as a stressor causing significant environmental impacts. However, it was unclear on what basis the assessments were made, and what types of mining activities (e.g. exploration, mine construction and operation, abandoned mines, peat or gravel extraction, etc.) were implicated. In order to address threats to national park integrity from mining activities, the nature and extent of mining impacts needed to be further investigated.

The Canadian Nature Federation (CNF) and Mining Association of Canada (MAC) awarded AXYS Environmental Consulting Ltd. (AXYS) a contract in April 2002 to investigate in greater detail the impacts of mining and exploration activities on national parks and existing mitigation measures.

The objectives of the project were to survey the scientific literature and interview the identified parks to further define the nature and scope of mining impacts in Canadian national parks. The interviewing of national parks representatives was a key component of this study. The interviewees identified types and extent of mining activities, the nature and extent of ecological impacts, any current or known mitigation and management initiatives and potential future research. The interviews were also used to identify research and literature sources for mining impacts in Canada's national parks.

In addition to the surveys, a preliminary assessment of potential current and future risk to ecological integrity was completed. It was a broad level assessment considering mining activities and impacts identified during our research, and assessing these at the broader ecosystem level. This assessment considered the type of mine and mining activity, and classified information from interviews and the literature review according to the following criteria:

- Determining the spatial extent of mining as a stressor; regional stressor (located outside park boundaries but still impacting the ecological integrity of the park) vs. within the park boundaries
- Determining what element of ecological integrity is being affected:
 - Biodiversity; at the species, community, landscape scale
 - Ecosystem processes
- Identifying if there are indirect stressors from mining activities, such as increased access
- Identifying other stressors in the park and assessing possible synergies with mining activities
- Identifying the jurisdictions involved in land management decisions (federal, provincial) to assess implications on resolution of mining stressors

1.1 State of the Parks Report

In the *State of the Parks Report* (Parks Canada, 1997), park representatives responded to a question on the impact of mining on the parks. Although the question included information on the nature, temporal and spatial scale of impacts, trend of mining activities and mitigation activities, it did not clarify the nature of mining activities or basis on which the assessments were made. *The State of the Parks Report* provided a reference point from which to begin this more in depth investigation into mining impacts on the parks.

As indicated in the introduction, 15 out of 36 national parks identified mining as a stressor causing significant environmental impacts. When asked what ecological impacts mining was having on their parks the responses were diverse, however habitat and physical environmental issues were a primary concern. The ecological impacts and percentage of parks that identified them as concern is presented in the Figure 1.1.

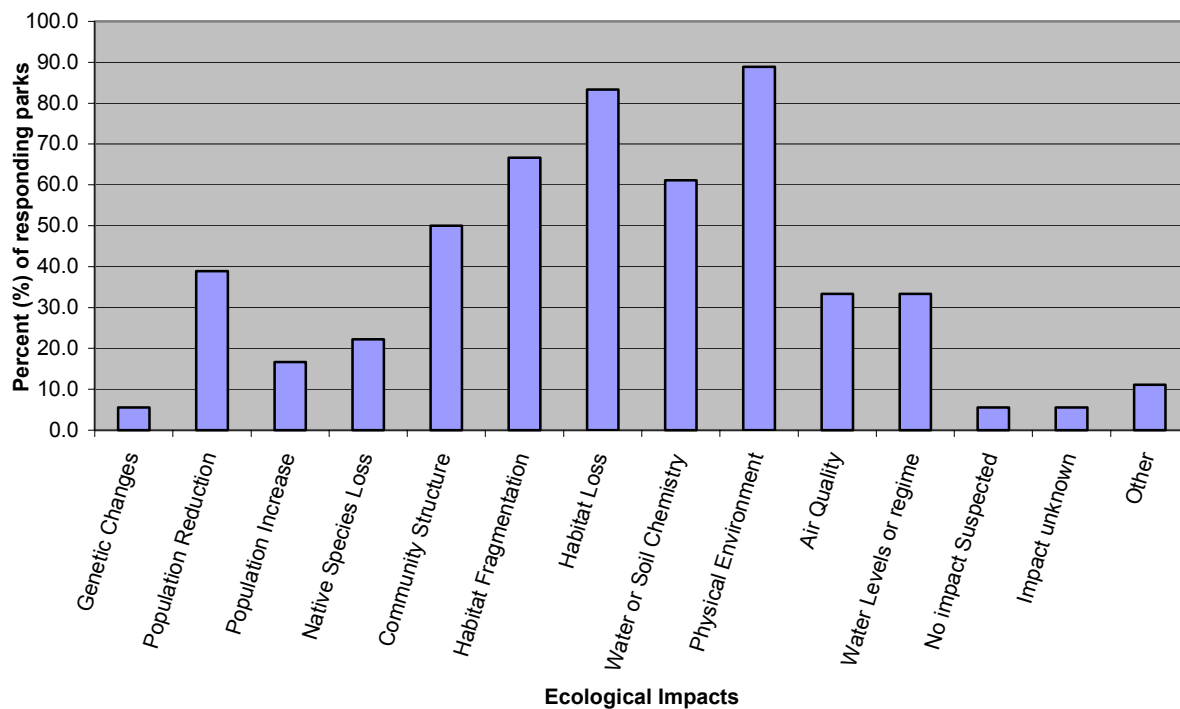


Figure 1.1 Impacts Indicated in the 1996 State of the Parks Questionnaire

1.2 Methodology

This section is intended to be a brief overview of how information was collected, and summarized to produce this report. The reasoning behind the selection of particular methods will be discussed. Methods were directly related to the project terms of reference and selected based on communication and feedback from MAC and CNF. Limitations to methodology based on scope and resources for the project will also be discussed.

1.2.1 General Project Methodology

As presented in the project proposal, the general methodology for this scoping exercise was intended to include:

- Working closely with Parks Canada, CNF and MAC to identify relevant scientific literature and sources of information
- Conducting a systematic review of the literature, using a focused methodology and template (by mine type, mining activity, region, nature of effect)
- Establishing an interview protocol, and response template to compile interview materials
- Performing a preliminary assessment of the effects of mining on park lands
- Compiling all relevant information into a report for delivery to the CNF and MAC
- Developing a CD to capture and report findings

As the project progressed, and direction was provided by CNF and MAC, the proposed methodology changed slightly to focus on information collected in the interview. The priority of the project became the collection of information from parks staff during interviews with the literature review becoming secondary. The interviews became the key source of information on existing literature and research. Selected literature was reviewed as follow up to the interviews, and is described in section 2.4.

AXYS Environmental Consulting Ltd., worked closely with CNF, MAC and Parks Canada to develop a questionnaire for use in interviewing representatives from the 17 relevant parks. The results of the interview and follow-up scoping exercises are presented in Section 2.0 and include the identification of mining activities, mining impacts, existing research and reports and mitigation, management and communication initiatives.

1.2.2 Interviews with Park Personnel

The 15 national parks that identified mining as a stressor in the *State of Parks Report* formed the basis of the contact list for the interviews. With the cooperation of Parks Canada, the original questionnaires for the State of the Parks Report (Questionnaire on Ecosystem Stresses in Canada's National Parks) were provided by CNF, and reviewed by AXYS staff. This review identified two other national parks: Bruce Peninsula and Pukaskwa that mentioned mining in their responses. These two additional parks were also contacted for this project, bringing the total number of parks interviewed to 17. The final list of national parks and park representatives interviewed is included below in Table 1.1.

Table 1.1 National Parks Contacted and Representatives Interviewed

National Park	Province	Park Representative
Banff	Alberta	Cliff White
Bruce Peninsula	Ontario	Frank Burrows
Cape Breton Highlands	Nova Scotia	James Bridgland
Elk Island	Alberta	Ross Chapman
Forillon	Quebec	Jean-Guy Chavarie
Georgian Bay Islands (Reserve)	Ontario	Darlene Upton
Grasslands	Saskatchewan	Pat Fargey
Gros Morne	Newfoundland	Bruce Bradbury
Jasper	Alberta	George Mercer
Kluane (Reserve)	Yukon	Ray Breneman
Kootenay/Yoho	British Columbia	Paul Galbraith
Kouchibouguac	New Brunswick	Eric Tremblay
Nahanni (Reserve)	NWT	Doug Tate and Chuck Blyth
Point Pelee	Ontario	Dan Reive
Pukaskwa	Ontario	Keith Wade
Terra Nova	Newfoundland	Randy Powers
Waterton Lakes	Alberta	Cyndi Smith

An interview template was designed to gather information in the most efficient and effective way possible. Questions and format were reviewed by CNF and MAC and approved prior to initiation. The questionnaire included questions on environmental impacts, ecological integrity, mining activities, available research, and mitigation/management. A copy of the questionnaire is included in Appendix A.

Prior to contacting the national parks, Stephen Woodley of Parks Canada sent out an email to park representatives introducing the study to them, and informing them that AXYS Environmental Consulting Ltd. staff would be contacting them. Questions were then sent to all relevant parties prior to the interview to provide them with the opportunity to consider the questions and collect any needed information. This preparatory work by Parks Canada was a key contributor to the 100% response rate received during the interview process.

The identified representative from each of the relevant parks was then contacted by AXYS staff to complete the questionnaires. In recognition that it has been several years since the State of the Parks Report was produced, part of the interview methodology was to initially ask if mining continued to be a stressor for the parks. If a park indicated that mining was no longer a stressor to the park ecosystem, then it was anticipated that a complete response would not be obtained.

Elk Island and Point Pelee National Parks responded that mining was not a significant issue for their parks, and had not been a stressor for quite some time. Elk Island did not complete the questionnaire, however Point Pelee did respond to some of the questions and thus their responses have been included in this report. They had both indicated mining as a stressor in the *State of the Parks Report*. This change in perspective may indicate how the perspective of the interviewee can influence the information collected. It is recognized that the results from this scoping exercise, can be influenced by perspectives, knowledge and availability of the park staff interviewed. This influence was actually raised by some of the park staff themselves during the interview process.

Detailed interview responses from each park are available in Appendix A. Responses from the interviews and information gathered from additional sources were then used to

summarize information on impacts, mining activities and mitigation. These results are presented in section 2.0.

1.2.3 Follow Up/Literature Review

The literature review in this report is limited in scope due to the resource limitations for this project, and represents an initial scoping of information and issues. AXYS Environmental Consulting Ltd. recognizes the limitation of literature reviewed, and has presented a more thorough review of identified literature as a potential next step from this work. Internet resources, reports and management plans were consulted to supplement information presented in the information and mitigation/management sections. Please refer to Section 5.0 for references used.

Questions 9 and 10 of the study questionnaire asked park staff to identify research and any literature on the impacts of mining in Canada's national parks. A list of identified studies and reports is presented in Table 2.5. AXYS Environmental Consulting Ltd. staff completed an initial review of available reports and conducted some follow up work on other identified sources of information (websites and contacts). See Section 2.6 for results of this review.

2 Results

This section outlines the information collected from parks through interview questions and results of a preliminary literature review. Results from the interviews have been summarized in the following section (2.1) and discussed in more detail under three subsections: mining activities, impacts associated with mining, and mitigation and management. Future research needs identified in interviews are presented in Section 3.0.

Mining activities ranged from rock quarrying to coal mining and represented both activities within and outside park boundaries. Identified impacts included wildlife impacts, habitat fragmentation and loss, issues with human use, impacts on vegetation, water and air pollution and terrain/erosion issues.

Parks staff also identified strategies to manage and mitigate impacts related to mining, and communication initiatives with the mining industry. Current mitigation and management techniques included remediation and reclamation, monitoring, research, access control and land management planning. Communication initiatives included regional advisory groups, management committees, and other communication initiatives between parks and the mining companies such as field visits and training on sampling programs.

Relevant scientific literature and research initiatives were identified by parks staff during the interview process. These are identified in section 2.6. Many of these considered a variety of ecological stressors to parks, not just mining. Exceptions to this include Jasper National Park, where research was carried out in direct response to mining activities or the potential for mining activity.

2.1 Summary of National Parks Responses

2.1.1 Banff National Park

Mining continues to be a stressor for Banff National Park, with medium level rated impacts. Identified mining activities included existing plants and operations close to park boundaries, and several abandoned mine sites within park boundaries. Impacts related to mining included; impacts to carnivores from human use of mining and access roads, a perceived air quality issue, and redevelopment of abandoned mine sites. The park interviewee identified several research studies related to impacts from mining and other stressors, and that communications with industry were ongoing through a variety of regional committees, including the Bow Corridor Ecosystem Advisory Group. Mining was indicated as posing potential future risk to the ecological integrity of the Park, due to redevelopment of old mine sites, the poor rehabilitation of mine sites, the expansion of existing operations, air pollution and increased human access.

2.1.2 Bruce Peninsula National Park

Mining continues to be a stressor for the park, but with low level rated impacts. Identified mining activities included limestone quarrying close to park boundaries. Associated impacts were identified as habitat fragmentation, alteration and loss. Mining was indicated as posing potential future risk to the ecological integrity of the park, if the

quarrying activity expanded. Permitting was identified as a source of mitigation and management measures for impacts, and no formal communication was identified with the mining industry.

2.1.3 Cape Breton Highlands National Park

Mining continues to be a stressor to the park, with medium to low rated impacts. Identified mining activities included mineral exploration outside of park boundaries. Associated impacts were identified as habitat fragmentation and loss, impacts on water quality and quantity, and impacts related to human access. Mining was indicated as posing potential future risk to the ecological integrity of the park, if exploration becomes active again. Impacts related to ecological risk are the identical to those listed above.

2.1.4 Elk Island National Park

Mining was not rated as a park stressor by park staff, the interview was not applicable.

2.1.5 Forillon National Park

Mining was identified as a park stressor, although the oil and gas industry was identified as being the most significant industry related stressor to the park. Mining activities and infrastructures included an abandoned lead mine and gravel pit, and distant smelting at Murdochville, QC. Impacts included disturbance of marine habitat, habitat pollution and stress, but more closely associated with oil and gas exploration activities in the region. Remediation of the abandoned mine and gravel quarry had been completed and some communication had occurred with the mining industry in regards to smelting. Mining was not indicated as posing future risk to ecological integrity, although oil and gas exploration was.

2.1.6 Georgian Bay Islands National Park

Mining was identified as a park stressor, with medium to low rated impacts. Mining activities were identified as rock and gravel quarrying, occurring outside of park boundaries. Associated impacts included habitat fragmentation and loss, impacts to reptile species and impacts to groundwater. Mining was indicated as posing a future risk to ecological integrity of the park, in relation to habitat fragmentation and subsequent impacts on wildlife.

2.1.7 Grasslands National Park

Mining was identified as a park stressor, with low level localized impacts. Mining impacts were related to gravel extraction within park boundaries. Impacts included habitat fragmentation and the introduction of exotic species. Mining was not indicated as posing a future risk to ecological integrity of the park. Discussions have occurred with industry in regards to access to the gravel pits.

2.1.8 Gros Morne National Park

Gros Morne indicated that although mining can still be identified as a stressor to the park, the associated impacts were low. Some gravel mining was occurring within park boundaries, with localized impacts. No concerns related to mining were expressed in regards to future risk to the ecological integrity of the park.

2.1.9 Jasper National Park

Mining was identified as park stressor, with a medium rated impact. Impacts are related to open pit coal mining activities adjacent to park boundaries. There is one closed coal mine, undergoing remediation, another currently operating, but with potential closure, and one impending approval (Cheviot Mine). Identified impacts included habitat fragmentation, for grizzly bears in particular, and other impacts on wildlife including population distribution and mortality, related to human use. There is a significant amount of research being undertaken to investigate impacts on wildlife in the park, most notably the five-year Model Forest Grizzly Bear Study. Research on sheep, harlequin ducks, fish and water quality are also being undertaken by various governmental bodies. Mining was indicated as posing potential future risk to the ecological integrity of the park due to increasing access in some of the highest quality bear habitat in the region, exploration causing continued fragmentation of habitat, and an increase in wildlife mortality from human poaching and contact. Extensive communication has occurred between the mining industry and the park related to the Cheviot mine proposal, and continues through the North East Slope Management Committee and Regional Carnivore Management Group.

2.1.10 Kluane National Park and Reserve

Mining continues to be a park stressor, with moderate to low level rated impacts. There is currently one abandoned mine in the park, and placer mining and exploration outside of park boundaries. Identified impacts related to mining activities included habitat fragmentation. Mining was indicated as posing a future risk to the ecological integrity of the park when considered with other park stressors. Future risks were associated with road development and access issues, and fragmentation of wildlife corridors. A site assessment of the abandoned mine in the park had been completed, communication with mining industry was not reported to be very active, but several regional management boards and committees were identified for dealing with local land management issues.

2.1.11 Kootenay and Yoho National Parks

Mining continues to be a stressor to the park, and was reported as having a major influence on the regional landscape. There are several open pit coals mine, gypsum and magnetite mines, mineral exploration and gravel and slate quarries in the region. The park interviewee for Yoho/Kootenay discussed mining as an integral part of the culture and economy in the region and commented that the park works closely with the mining industry on regional land management issues, including the reduction of threats to biodiversity and ecological integrity. Identified impacts included impacts on habitat effectiveness, and connectivity and impacts related to human access and use. Mining was indicated as having the potential to pose future ecological risk to the park, supporting the need for ongoing communication with the mining industry. Yoho/Kootenay reported having excellent communications with the mining industry, and the importance for parks and mining to understand each other's concerns and objectives.

2.1.12 Kouchibouguac National Park

Mining continues to be a park stressor, with moderate to low level rated impacts. There are peat mining activities adjacent to the park boundary, with facilities including open pit, roads, waste disposal, processing plants, and mining equipment. As the major watersheds flowing into the park originate in the peat lands, identified impacts included, impacts on aquatic habitat, water flows and cycles of local water-bodies, and impacts on water

quality. Several universities have undertaken research in the park, investigating impacts from peat mining on the Portage watershed, St. Charles peat bog, and on amphibian populations. There are 19 bogs surrounding the park are now under provincial protection, and the Southern Gulf of St. Lawrence Coalition on Sustainability was identified as a communication forum for local industry government and parks.

2.1.13 Nahanni National Park and Reserve (NNPR)

Mining continues to be a stressor to Nahanni National Park and Reserve. The regulatory process associated with mining was reported as having serious impacts on parks resources and staff. The potential for serious ecological impacts was also identified, but not confirmed with evidence due to a lack of information from monitoring and research. There was a variety of mining activities identified adjacent to Nahanni National Park and Reserve, including; advanced mineral exploration, operating tungsten mine, active mining exploration and abandoned mine sites. Mining facilities included milling and housing infrastructures, camps, tailings ponds, fuel storage, airstrips, and toxic chemical storage. Impacts were identified as including; impacts to water quality in tributaries of the South Nahanni River, impacts to terrain, wildlife impacts including habituation and food conditioning, sensory disturbance, blockage of movement patterns, and mortality and other impacts related to access roads. Nahanni also identified several indirect impacts related to local economics of the region, including an increased pressure on wildlife from hunting and an increase in visitor use. Mining was indicated as posing a current and future risk to the ecological integrity of the park, due to all the potential impacts previously listed. There is concern that increased access and economics will encourage more exploration and mining of metals in the region. NNPR reported a concern that mining activity may impede a proposal for the expansion of the park boundaries. The park has communicated with the mining industry mostly through regulatory activities. There was no regional management committee identified.

2.1.14 Point Pelee National Park

Point Pelee National Park indicated that mining was no longer a stressor to their park. Past mining activities included sand mining in Lake Erie which impacted the Lake shoreline. Mining activities ceased in the 1960s, it is believed there are no longer any current impacts from mining, but may be some residual impacts such as the erosion of beaches.

2.1.15 Pukaskwa National Park

Mining continues to be a stressor to the park, and impacts were rated at a medium to low level of significance. Identified mining activities included; three active gold mines north of the park, one active gold mine south of the park, and gravel extraction. Impacts related to mining were associated with water quality in park watersheds, as they are located downstream from mining activities. Mining was indicated as posing a future risk to the ecological integrity of the park, due to impacts associated with access roads, habitat fragmentation and pollution of watersheds. The park indicated active management and communication by one mining company in particular, where water quality monitoring was being conducted in collaboration with the park. The Greater Park Area Regional Communications Group was identified as a forum for communication.

2.1.16 Terra Nova National Park

Mining continues to be a stressor to the park, with impacts being rated at a medium level of significance. Gravel mining is occurring adjacent to park boundaries and old gravel pits still exist within park boundaries. Associated facilities included roads, grinders, trucks and storage areas. Identified impacts included habitat fragmentation and non-native plant introduction. Mining activities outside of park boundaries were identified as posing a potential future risk for the park's ecological integrity due to surface removal of habitat for white pine. Identified mitigation measures or issues included reclamation activities within the park and communication/discussions on regional land use.

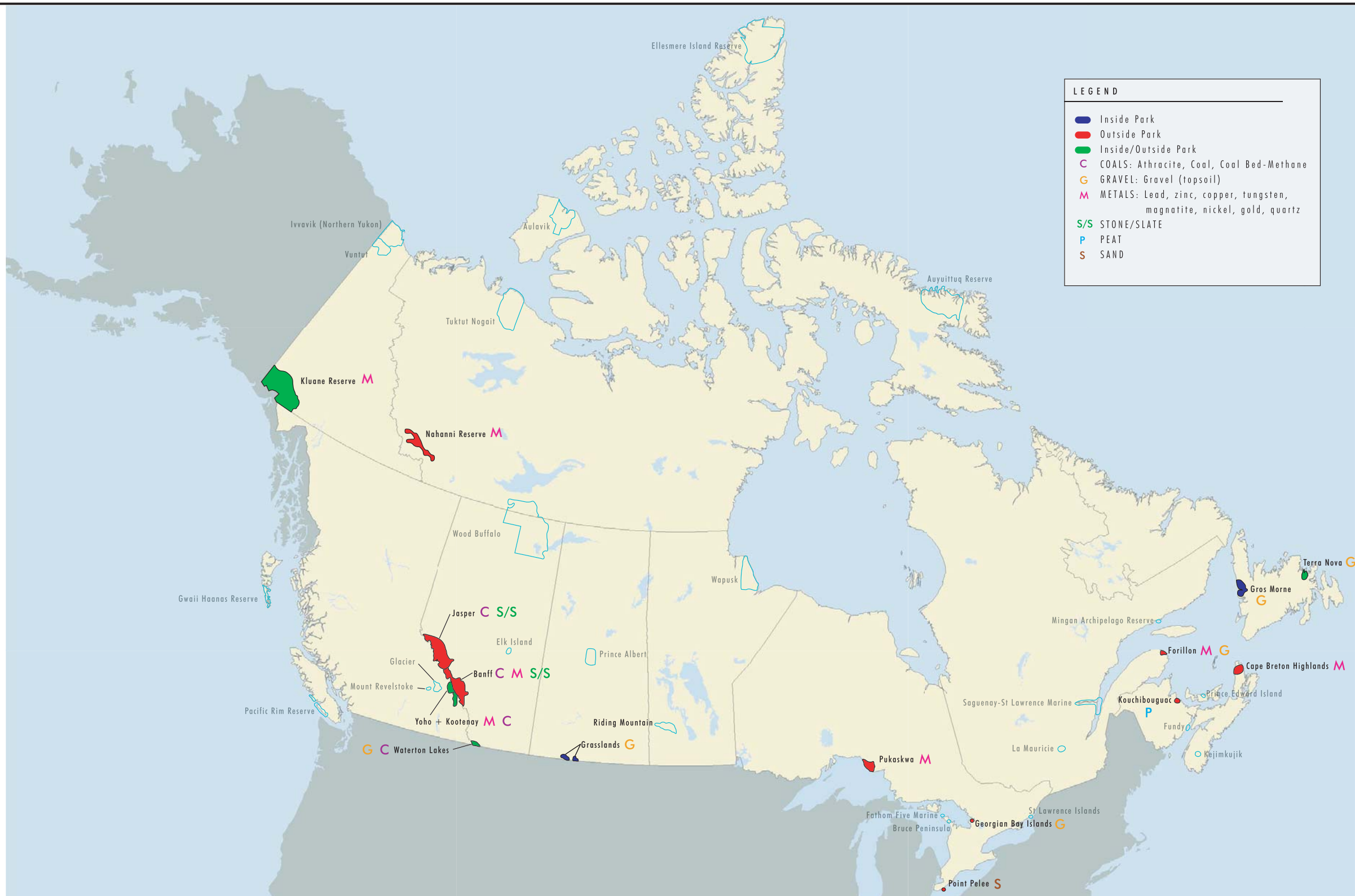
2.1.17 Waterton Lakes National Park

Mining continues to be a stressor to the park, although the impacts were believed to be of low significance. Within park boundaries there continues to be gravel extraction. Impacts related to these activities were identified as habitat fragmentation and the introduction of non-native species. External to park boundaries, there are coal mine operations and mineral exploration (including coal bed methane) with related potential impacts on habitat fragmentation and wildlife mortality (human access). Impacts related to mining were reported as being stable due to economics, but the park indicated mining as a potential future risk to ecological integrity to the park due to the potential for more exploration and extraction, associated air pollution, and habitat fragmentation. Some reclamation of internal gravel pits was identified.

2.2 Mining Activities

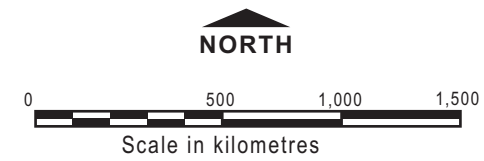
For this scoping exercise, mining included all activities associated with the exploration, physical extraction and processing of solid minerals and metals. All phases of mining were considered when identifying impacts, from the exploration phase to site remediation and reclamation. This broad definition included the extraction of surface aggregates, such as gravel and rock, but excluded the extraction of petroleum resources. Any concerns related to oil and gas were recorded in the questionnaire responses, in Appendix A, but not included in the following sections on mining activities and impacts.

There was a wide array of mining activities reported by the parks that were interviewed. This is primarily due to the fact that the parks are situated across Canada in vastly different geological regions. There were more than 20 different types of mines identified by the 16 respondent parks, these included but were not limited to mines for coal, gypsum, slate, gravel/stone, peat, anthracite, gold, magnetite, limestone, and sand. Figure 2.1 provides a geographic reference for the relevant national parks, types of mining associated with those parks, and location of mining activities.



ECOLOGICAL IMPACTS OF MINING ON CANADA'S NATIONAL PARKS

Mining Activities and Canada's National Parks



Acknowledgements:
Prepared by AXYS Environmental Consulting Ltd.



DATE	August 2002	SCALE	1:20,000,000
DRAWN	L.A.T.	CHECKED	E.M.
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2.1		FIGURE NO.	REV
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Various mining techniques were also identified during the interview process, including open pit mining, quarries, topsoil extraction, smelting plants, and sand mining. Exploration activities included the construction of roads, drilling and borehole sampling. Some mining activities are located within park boundaries, although a majority occurs outside of park boundaries, with impacts extending into the park. A summary of the types of mines, location in relative to the park boundary, facilities, footprint and status is provided in Table 2.1. The name of the mining companies and impacts are also provided for reference. Note that all information in Table 2.1 was based on information collected in the interviews with parks staff. Some follow up was conducted to collect additional information on mining companies and footprints, but a more thorough review and follow up with the mining companies themselves would be needed to accurately complete the information presented in Table 2.1. Where information was not obtained (beyond scope of project) it is marked with N/O.

2.2.1 Associated Facilities

There is more to most mine operations than just the extraction area itself. The operation of a mine, and even exploration activities, requires a number of associated facilities depending on the type of mine and processing needs. These facilities include, but are not limited to; access roads, exploration trails, camps, waste disposal areas, water processing facilities, sumps, tailing ponds and staging and storage areas that can also contribute to environmental impacts. Parks staff identified a variety of facilities, with the most common infrastructure being access roads. See Table 2.1 for a description of facilities associated with mines surrounding the parks.

Access roads are required for all phases of mining: exploration, extraction and processing. During mine operations, roads are required to gain access to the mine site itself and to carry the mined materials to a processing facility. Additional roads may be required to link the site with any worker camps, equipment maintenance buildings, storage areas or water sources. Exploration activities also require roads for access to the exploration sites. Mining roads are generally wide, full service roads necessary to accommodate large, heavy, mining vehicles. See Section 2.3 for impacts associated with increased access roads in parks, which include habitat fragmentation, human use and wildlife mortality.

Work camps were also identified as a facility associated with some of the larger mining developments. Work camps are required to accommodate mine workers if the location of the mine is in a remote area. These camps can range from small temporary portable shelters with rudimentary facilities to large permanent camps with accommodation for hundreds of workers. Of the parks identified in the study, seven included camps in their discussion of associated facilities.

Other facilities identified by parks staff included: staging areas, tailings ponds, and processing facilities. These areas are all part of the processing of the raw materials, which can occur at the mine site itself or at an off-site location depending on the size of the mining operations. These facilities can include large tailings settling ponds, water processing facilities, fuel storage, and electrical generators or power lines. For these associated mining facilities, potential impacts of concern identified by parks staff included: habitat fragmentation, water and air pollution, human development and impacts on terrain stability. See Section 2.2 for a more detailed description of impacts and Table 2.1 for a summary of the types of ecological impacts associated with the mine type and facility.

Table 2.1 Mines Activities Identified by National Parks

Park	Mine/Mineral	Location	Associated Facility	Footprint ¹	Status	Company	Degree of Impact ² (Impacts)
Waterton	Gravel	Inside park	Access roads Exploration roads/trails	<10km ²	Abandoned	N/O*	3 <i>Wildlife</i> <i>Vegetation</i> <i>Human Use/Access</i>
	Coal	Regional – 15-40 km away on BC side (Coal Mountain mine, outside park)	Access roads	10-25 km ²	Excavation	Fording Coal Limited	
	Coal bed methane	Elk Valley	Exploration roads/trails	N/O	Exploration	Devon/Encana	
Banff	Magnetite	Assiniboine Brusillof/Cross River mine 15km from West boundary	Roads Camps Waste disposal Water processing	> 25 km ²	Active	Baymag Mines Co. Ltd.	3 <i>Air quality</i> <i>Human Use</i> <i>Wildlife</i>
	Limestone Cement	Exshaw 15 km from East boundary	Roads Camps Waste disposal Water processing	10-25 km ² (including townsite)	Active	Lafarge Continental Lime	
	Coal	Elk Valley, open pit coal mines, closer to Waterton	Roads Camps Waste disposal Water process	>25 km ²	Active	Fording Coal Limited Luscar Limited	3 <i>Air quality</i> <i>Human Use</i> <i>Wildlife</i>
	Coal Anthracite	Near Banff, 3 km from Banff townsite	No mining Current: hiking trails and day use area	1-10 km ²	Abandoned, partially reclaimed	Bankhead Mine CP Rail	

¹ See Appendix A for more details of mine footprints

² Impacts are rated from 1 to 5, with 1 being little or no impact and 5 being serious impact

Table 2.1 Mines Activities Identified by National Parks

Park	Mine/Mineral	Location	Associated Facility	Footprint ³	Status	Company	Degree of Impact ⁴ (Impacts)
Jasper	Limestone Quarry	N/O	N/O	N/O	Active	N/O	3 <i>Wildlife</i> <i>Human Use/Access</i>
	Coal (3)	East boundary of park	Processing plants Roads Camps Garages Fuel storage Railway lines	> 25km ²	See company	Cheviot Mine-Luscar-Sterco (applied for) Cardinal River Coal-Luscar-Sterco (active) Greg River Mine-Manalta – (closed)	
Yoho/Kootenay	Coal (5)	Elk Valley	Roads Staging areas Processing	> 25km ²	Active	Fording Coal Limited Teck Corporation Luscar-Sterco	2 - 4 <i>Wildlife</i> <i>Human Use</i>
	Gypsum	Canal Flats (1)	Roads	<1 km ²	Active	Georgia Pacific Canada Ltd.	2 - 4 <i>Wildlife</i> <i>Human Use</i>
	Gypsum	Elkhorn quarries (2)	Roads	<1 km ²	Active	Westroc Inc.	2 - 4 <i>Wildlife</i> <i>Human Use</i>
	Magnetite	Mount Brusillof Mine near Radium	Roads Staging areas	<1 km ²	Active	Baymag Mines Co. Ltd.	
	Slate/stone Barite quarries	Rocky Mountain Hanging Valley	Roads	<1 km ²	Active	Provincial Government	
	Metals: Lead Zinc, Gold	Kimberly	Roads Staging areas Processing	N/O	Recent Closure	Teck Corporation	
	Gold – placer mining	Numerous locations	Roads	<1 km ²	Active	Various small claims	

³ See Appendix A for more details of mine footprints⁴ Impacts are rated from 1 to 5, with 1 being little or no impact and 5 being serious impact

Table 2.1 Mines Activities Identified by National Parks

Park	Mine/Mineral	Location	Associated Facility	Footprint⁵	Status	Company	Degree of Impact⁶ (Impacts)
Terra Nova	Gravel	Inside and outside boundary	Roads Pits Storage areas	<1 km ²	Some active. Some abandoned	Crown/ government	3 <i>Wildlife</i> <i>Vegetation</i>
Pukaskwa	Gold (Hemlo)	East and north of boundary 14-15 km	Roads Tailings areas Water processing Sewage	<1 km ²	Active	Williams Operating Corporation	2.5 <i>Water Quality</i>
	Gold (Eagle River Mine)	Southeast 18-20 km from park boundary	Roads Tailings areas Water processing Sewage	Linear 1 – 10 km ²	Active	River Gold Mines Ltd.	
	Gravel/borrow pits	4.5 km from boundary	Roads	N/O	N/O	Provincial government, transportation	2.5 Water quality
	Molybdenum	SE right up to park boundary	Roads	<1km ²	Exploration	N/O	
Point Pelee	Sand	Lake Erie	N/O	N/O	Discontinued	N/O	Unknown <i>Terrain</i>

⁵ See Appendix A for more details of mine footprints

⁶ Impacts are rated from 1 to 5, with 1 being little or no impact and 5 being serious impact

Table 2.1 Mines Activities Identified by National Parks

Park	Mine/Mineral	Location	Associated Facility	Footprint ⁷	Status	Company	Degree of Impact ⁸ (Impacts)
Nahanni	Lead-zinc	Prairie Creek, 15 km north of boundaries (drainage into park)	Housing Mining/milling Fuel tanks Tailings ponds Chemical storage Airstrip Roads	> 25km ²	Advanced Exploration	Canadian Zinc	5 <i>Water quality</i> <i>Terrain</i> <i>Wildlife</i> <i>Human Use</i>
	Tungsten	45 km west of boundaries	Mining Infrastructure Tailings ponds Townsite Airstrip Roads	N/O	Active	CanTung	
	Claims	North park border	Camp approved	N/O (Claims are >25 km ²)	Application pending	Clearwater Resources	
	Claim	65 km northwest of park boundary	Camp approved	N/O(claims >400 km)	Exploration Permit	Nordac Resources	
	Mineral Survey	Within 5 km of southeast boundary	N/A	N/O	Surveys	Fugro-Sial	5 <i>Water quality</i> <i>Terrain</i> <i>Wildlife</i> <i>Human Use</i>
	Old mines	Lened Creek and Howard's Pass	Roads	N/O	Abandoned	N/O	
Kouchibouguac	Peat mines (6)	Outside park boundaries 1-30 km	Roads Waste disposal Processing plants Drain bog Equipment	1- 10 km ²	Active	Small companies	2 <i>Wildlife</i> <i>Water</i>

⁷ See Appendix A for more details of mine footprints⁸ Impacts are rated from 1 to 5, with 1 being little or no impact and 5 being serious impact

Table 2.1 Mines Activities Identified by National Parks

Park	Mine/Mineral	Location	Associated Facility	Footprint ⁹	Status	Company	Degree of Impact ¹⁰ (Impacts)
Kluane	Quartz and placer mining	5-10 km out of park	Camps Roads Waste disposal Water processing Placer mining	1- 10 km ²	Exploration, some abandoned	N/O	2.5 <i>Wildlife</i>
	Gold Mine	Inside park	Roads	1 km ²	Abandoned	Johobo Mines Lmt.	
Grasslands	Gravel	West side of west block	Roads	<1 km ²	Active	Sand Lake Hutterite Colony	2 <i>Wildlife</i> <i>Vegetation</i>
Georgian Bay Islands	Gravel/rocks	Outside east park boundary	Roads Equipment Pits	<1 km ²	Active and abandoned	Private companies	2 <i>Wildlife</i>
Forillon	Lead	Beside western park boundary	Mine	1 km ²	Abandoned	Hyman and Son Corporation	2 <i>Wildlife</i>
	Gravel	Beside western park boundary	Pits	<1 km ²	Abandoned/ remediated	Government or small private	
Cape Breton Highlands	Gold	Within 2 km of park boundary	Roads	<1 km ²	Past exploration	Regal Gold Fields	2 <i>Wildlife</i> <i>Water</i> <i>Vegetation</i>
	Nickel	Within 2 km of park boundary	Roads	<1 km ²	Past exploration	Regal Gold Field	
	Copper	Within 2 km of park boundary	Roads	<1 km ²	Past exploration	Regal Gold Field	

⁹ See Appendix A for more details of mine footprints

¹⁰ Impacts are rated from 1 to 5, with 1 being little or no impact and 5 being serious impact

Figures 2.2 through 2.5 show examples of some of the different mine types and techniques.



Figure 2.2 Coal Mountain Mine near Waterton National Park



Figure 2.3 Hemlo Gold Mine near Pukaskwa Park



Figure 2.4 Gravel Mine in British Columbia



Figure 2.5 Cantung Mine near Nahanni

2.2.2 Mining Impact Trends

Reported mining development and impact trends vary depending on the park in question, as well as regionally within the parks. Some parks felt that there was a direct link between an increase in mining activity, or potential for mining activity, and ecological impacts, while others felt that, due to an increase in awareness of ecological integrity issues, impacts from mining are in fact decreasing. Six of the parks studied believed that impacts from mining and exploration activities in and around their parks were increasing

while six reported activities to be stable and three reported a decrease in activity. See Table 2.2 and Figure 2.2 for a summary of these results.

Table 2.2 Mining Impact Trends in National Parks

Stable	Increasing	Decreasing	Varied
Jasper ¹	Georgian Bay ²	Cape Breton Highlands	Banff
Forillon	Grasslands	Kluane	Terra Nova
Kouchibouguac	Nahanni	Yoho/Kootenay/Lake Louise ³	
Waterton	Pukaskwa		

- NOTES:**
- 1 Currently stable to decreasing, due to closure of mines, but if Cheviot proceeds it will increase
 - 2 Impacts are believed to be increasing – as development is increasing, but no data to prove impacts are increasing.
 - 3 Although there has been an increase in exploration, there has also been an increase in sensitivity to environmental issues, and a better understanding of key issues associated with ecological integrity.

2.3 Impacts Associated with Mining

The *State of the Parks* report collected some initial information on the impacts associated with mining. The intent of this study was to further investigate the nature and extent of ecological impacts due to mining in national parks and determine the basis on which these were being identified. Several questions were similar to those asked in the 1996 questionnaire for the *State of the Parks* report, to provide a current assessment of impacts, and several were specific to identifying research and literature that exists on this topic. Section 2.4 describes the degree and nature of identified impacts, while research studies and reports related to this topic are presented in section 2.6.

The questionnaire used for this scoping exercise, initially asked park interviewees, “What degree of ecological impact is mining/exploration having on your park?” Impact was determined on a scale from 1 to 5, with 1 being “little or no impact” and 5 meaning “serious impact”. Even though this was a subjective question and difficult to quantify, the majority of respondents said that mining was having a mid to lower degree of impact on the park (level 2-3). Several parks indicated that there were other ecological stressors that were more significant than mining.

Nahanni responded that mining activities were having significant impacts on their park staff, due to resource limitation, and time spent reviewing regulatory applications, and that there was high potential for ecological impacts due to mining activities, but that necessary research was not available to make this assessment. Banff, Jasper, Terra Nova, and Kootenay/Yoho also identified mining impacts as being more significant. Kootenay/Yoho identified differences depending on the region: with Elk Valley as a level 2, and the intermountain north/south corridor as a level 4. See Figure 2.6 below for individual responses.

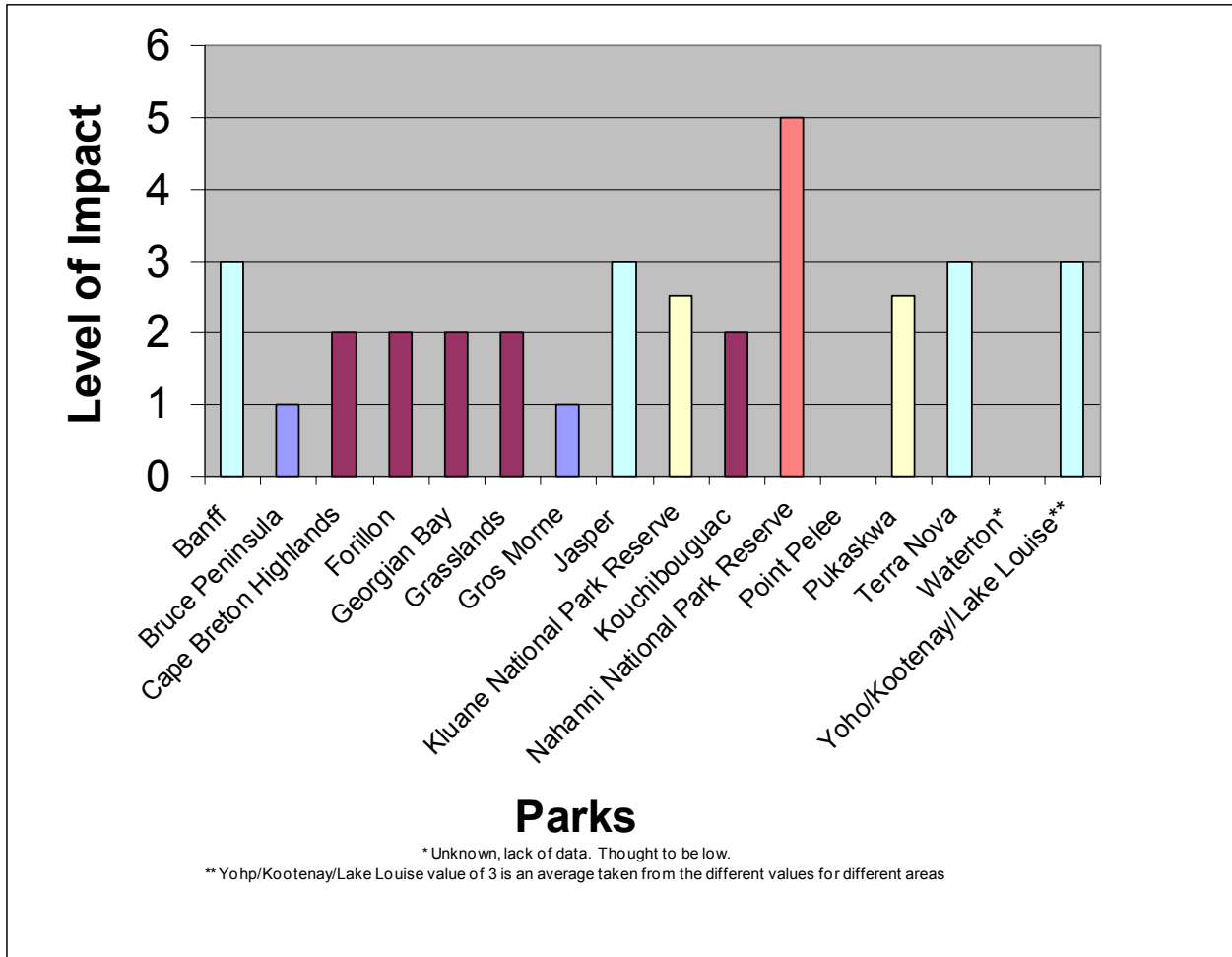


Figure 2.6 Degree of Ecological Impact of Mining Activities on Parks

Respondents were asked to identify the reasons behind the determination that mining is impacting their parks, or the nature of the impacts. A variety of ecological impacts were identified by parks representatives. The primary concern for most parks is potential impact on wildlife, namely the habitat fragmentation, loss of habitat, decrease in habitat effectiveness, and direct and indirect mortality risk. Other concerns that were expressed from numerous parks were non-native plant species introduction, changes to ground and surface water quality, impacts on terrain and concerns related to increased human use. These reported impacts have been summarized into six different categories for reporting purposes, and include:

- Wildlife;
- Water;
- Human Use;
- Vegetation;
- Terrain, and
- Air Quality.

Figure 2.7 shows the frequency of response for each category of impact and Figure 2.8 provides a geographic representation of the nature and scale of impacts associated with each national park.

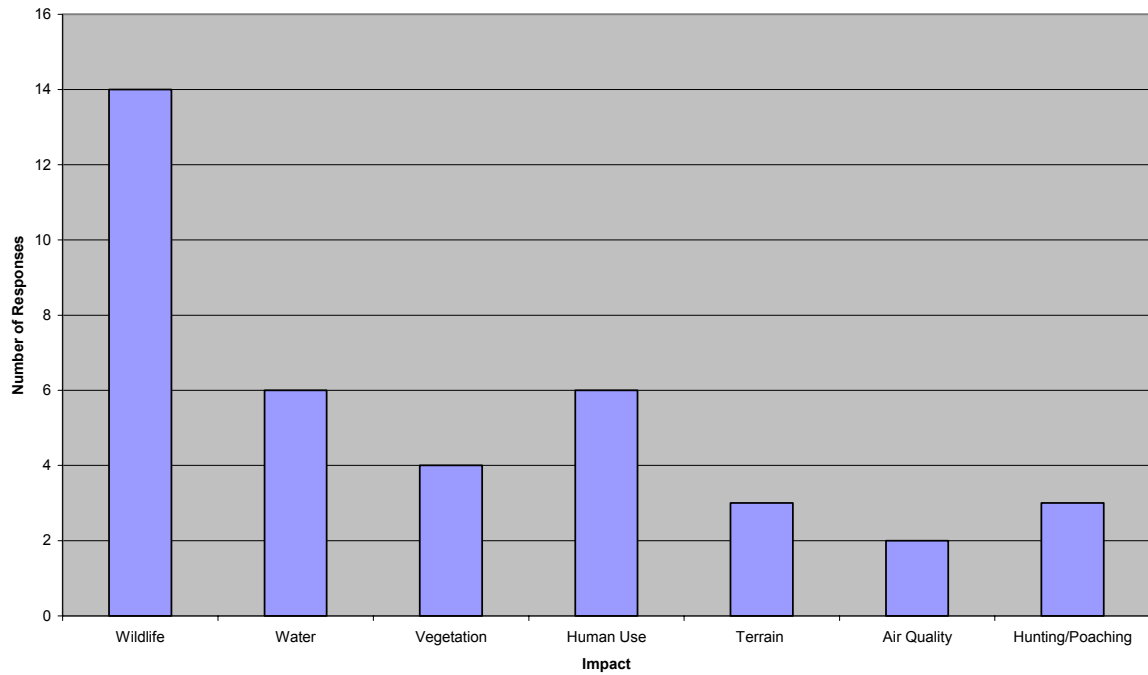
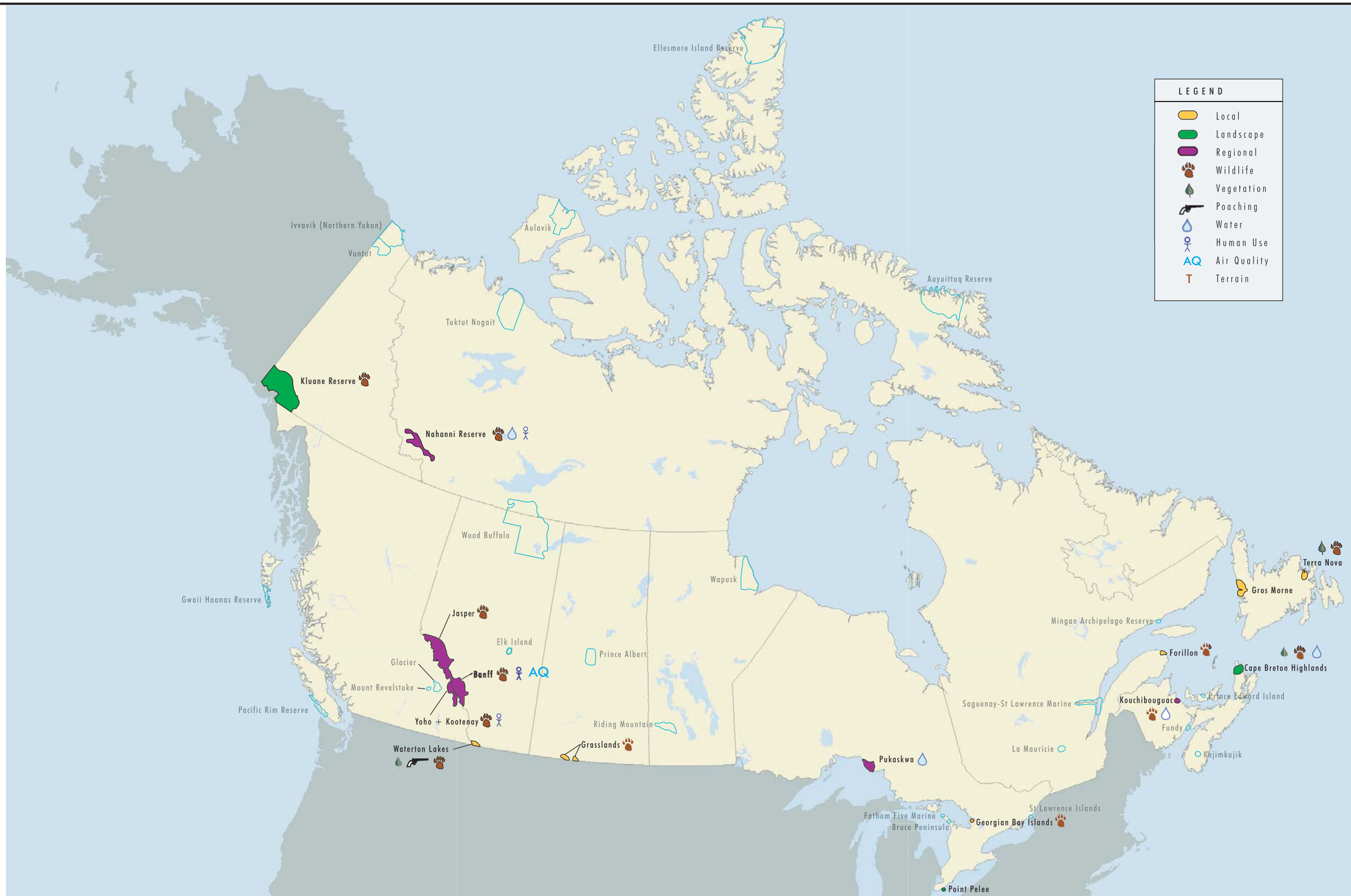


Figure 2.7 **Frequency of Response for Impacts**



LEGEND	
	Local
	Landscape
	Regional
	Wildlife
	Vegetation
	Poaching
	Water
	Human Use
	Air Quality
	Terrain

ECOLOGICAL IMPACTS OF MINING ON CANADA'S NATIONAL PARKS

Ecological Impacts and Canada's National Parks



Scale in kilometres



DATE	August 2002	SCALE	1:20,000,000
DRAWN	L.A.T.	CHECKED	E.M.
REVIEWED	E.M.	PROJECT	CP1007
		FIGURE NO.	2.8
		REV	01
		VOL	01

Acknowledgements:
Prepared by AXYS Environmental Consulting Ltd.

2.3.1 Wildlife Impacts

Wildlife and wildlife habitats are highly valued attributes and measures of the ecological integrity of Canada's national parks (Parks Canada, 2000). Wildlife populations are, in general, vulnerable to impacts from human activity and development. Large species, such as the grizzly bear, are considered an indicator of ecosystem diversity and integrity. They are a landscape species that is sensitive to human activities and, as a result, some parks, such as Banff National Park and Jasper National Park, have developed specific management goals and standards for grizzly bear management.

Many of the parks interviewed in the study mentioned specific wildlife populations that were being potentially impacted by mining activities and cited impacts on wildlife habitat as their primary concern associated with mining. Wildlife habitat impacts are related to both the linear and non-linear nature of mining facilities. Wildlife populations are in general vulnerable to impacts from human activity and facility development (including mining) through four general types of processes: habitat loss, reduced habitat effectiveness, direct and indirect mortalities and blockage of movement patterns (loss of connectivity). These are described in the following sections.

Many of the parks interviewed are not experiencing mining pressures directly within the park, however their boundaries are slowly being surrounded by development, including mines, which has implications for the ecosystems within the park. Many species, in particular the larger carnivores, have habitats and home ranges which extend beyond the park boundaries into surrounding areas. Development within these surrounding areas then becomes a significant stressor for some park species which use habitat beyond the boundaries of the national park. Please refer to figure 3.1, for identification of national parks where mining impacts are occurring within park boundaries.

2.3.1.1 Habitat Fragmentation

The footprint of human activities on the land base can influence wildlife populations by affecting the capability or utility of habitats. The collection of multiple footprints results in fragmentation, defined as the process whereby a large, continuous area of habitat is both reduced in area and divided into two or more fragments or habitat "isolates" (Wilcove et al. 1986; Primack 1993). Fragmentation, in turn, can initiate population extinction processes through three main effects that can act independently or in cumulative fashion. These effects are as follows (Strom, K.B., D. Walker and R. Eccles, 2000):

1. The creation of habitat patches of insufficient size and/or quality to meet a species' requirements (individuals and/or populations);
2. Reduction of species mobility within and between supportive habitats, (loss of connectivity); and
3. Effects that are associated with increased amounts of edge habitats (direct and indirect mortality effects, parasitism, etc.).

Landscape fragmentation poses a major challenge to the management of Canada's national parks, and has been recognized as one of the greatest threats to biodiversity (Parks Canada, 1997). With fragmentation habitat is not only lost, but the remaining habitat is broken into increasing smaller fragments, causing species populations to become increasingly isolated. Habitat fragmentation is a concern because of its potential

to isolate populations and reduce biodiversity. Many species are particularly wary of human activity and will not cross a cleared area, such as roads, to gain access to habitat on the other side. This reduces the amount of suitable habitat for that species and may potentially isolate animals from their prey or others their population.

Sixty-five percent of the study respondents specifically identified habitat fragmentation as their reasoning for deeming mining as a stressor on their parks. Many parks referred to the road networks as being the facility of most concern for habitat fragmentation. Nahanni National Park and Reserve referred to road networks impacting spawn areas of bull trout populations, and increased disturbance of caribou calving and rutting grounds. Other parks that identified impacts on wildlife due to fragmentation included: Jasper, Cape Breton Highlands, Bruce Peninsula, Waterton Lakes, Yoho/Kootenay, Georgian Bay Islands and Grasslands. On a more regional scale, parks like Kluane National Park and Reserve commented on the parks themselves becoming “ecological islands” of habitat that are no longer effective on their own.

2.3.1.2 Habitat Loss/Alteration

Habitat loss refers to physical disturbance of habitats through clearing, grading and the development of permanent structures. Certain types of mines, such as open pit mines, can disturb large surface areas, potentially altering or destroying important habitat areas. Even for mines where the lease area may be quite small, the associated facilities such as access roads and survey lines can involve a considerable area. These seemingly small linear disturbances accumulate creating a cumulative impact on the whole area.

Several parks commented on the potential for mining activities to alter important habitat areas. Cape Breton Highlands referred to the potential for large habitat loss for barrens (Jim Campbell Barrens) that were unique for the region. Other parks such as Kouchibouguac and Jasper indicated the potential for large habitat loss due to mining. Kouchibouguac National Park also referred to the impacts of peat mining on aquatic habitat through erosion and siltation of the regional watershed.

2.3.1.3 Habitat Effectiveness and Sensory Disturbance

Habitat effectiveness refers to the potential for wildlife to use habitats following disturbance effects of human activity and presence. Impacts on habitat can extend beyond the physical impacts associated with clearing and development. The potential for wildlife to use the habitat areas surrounding the land disturbances associated with roads and other facilities can also be reduced. Parks that specifically identified habitat effectiveness as an impact of concern included Yoho/Kootenay National Park.

Sensory disturbances contribute to a reduction in habitat effectiveness. The constant activity of mining machinery and transport equipment creates considerable noise disturbance affecting the local wildlife. Many species are particularly wary of human presence and will relocate away from the source of disturbance. In avoiding human presence and sensory disturbance, animals may be forced into potentially less suitable habitat areas, further reducing habitat effectiveness. Nahanni National Park Reserve referred to sensory disturbance of wildlife due to overflights and machinery.

2.3.1.4 Direct and Indirect Mortalities

Mining activities and the presence of more people surrounding the mine area can contribute to an increase in direct and indirect mortalities of wildlife species. Primary

sources of direct wildlife mortalities include kills along roads, creation of winter predator highways, and from management removal of habituated and aggressive animals, such as grizzly or black bears.

Increases in traffic along mining roads and other access roads associated with mining activities has the potential to increase the number of animals killed in an area. Many parks indicated impacts associated with mining roads. In addition to traffic kills, indirect mortality from hunting and trapping is also a significant concern associated with road networks and increased access. The impacts of increased human use on wildlife mortality are discussed in more detail in the following section.

Activities associated with mining activities may also create "predator highways." Predator highways result from the compaction of snow due to operation of snow machines, which in turn improve winter access by predators into areas they could not easily access. If this occurs, it can pose the risk of increased predation on wintering ungulates and, in turn, diminish potential opportunities for the predators who normally hunt in the area.

Parks which responded with concerns about direct and indirect mortalities related to access roads and other mining facilities included: Nahanni National Park and Reserve, Jasper, Banff, and Waterton National Parks.

Wildlife Habituation

As human activities and development around parks intensifies, wildlife habitat is modified and predators are displaced. Some animals adapt to changes in the environment in ways that generate conflict. Conflicts between wildlife and humans, and the associated management actions, often result in wildlife mortalities. In Jasper National Park, research through the Foothills Grizzly Bear Research Project, and conducted by Alberta Environment, indicates that grizzly bears and sheep were attracted to mine sites. Grizzly bears were found to choose their dens close to mine sites and feed around mine reclamation areas, putting themselves at a higher risk for mortality due to poaching. Sheep surveys conducted by Alberta Environment are indicating that sheep populations are re-distributing to the mine sites, with no preference shown for reclaimed and non-reclaimed sites. The sheep are also growing larger around the mine sites and seem to be investing more energy into horn growth (personal communication Jeff Kneteman, 2002).

Nahanni National Park and Reserve also expressed concerns regarding the habituation and food conditioning of Dall's sheep and grizzly bears living in and around the park. Other wildlife species avoid areas where there are many people, limiting the amount of habitat available to them.

2.3.1.5 Blockage of Seasonal and Dispersal Movements

Connectivity refers to the ability of wildlife to move through the landscape. It is a critical element with respect to the maintenance of ecological integrity. Movements of wildlife are impacted from the cumulative effects of habitat loss, fragmentation, reduced habitat effectiveness and physical blockage of movements (e.g., fences, buildings, heavily used roads). Most obvious blockages in movement typically occur in areas with both high human activity in conjunction with physical impediments such as fenced highways and towns or hamlets. Even if there are no defined, highly utilized wildlife movement corridors through the development areas, the construction and operation of facility sites, roads, above-ground pipelines and other linear facilities can create zones of disturbance

and high risk for some wildlife, and can impede the natural ability of wildlife to move through the area during day-to-day foraging activities or seasonal movements.

Parks that specifically identified the loss of connectivity as a potential impact from mining included: Nahanni National Park and Reserve and Yoho/Kootenay. Nahanni National Park and Reserve referred to access roads acting as impediments to caribou migration.

2.3.2 Human Use

Several of the parks identified concerns that mining infrastructure provides the opportunity for an increase of human use in the park. The physical disturbances associated with mining such as access roads and cleared mine sites can provide increased opportunity for human recreational use, development and hunting and poaching activities within the parks. Economics related to mining can have indirect ecological impacts as they provide local populations will an increased opportunity to use the parks for recreational and poaching activities.

2.3.2.1 Increased Access

The roads and trails created for the mining projects can provide access to the prime habitat areas. Hikers, cyclists, ATV riders, and snowmobilers use the roads and trails for recreational purposes increasing the potential disturbance to wildlife. Many parks referred to impacts associated with increased human access into park species habitat areas, including; Waterton, Yoho/Kootenay, Cape Breton Islands, Jasper, Kluane Park Reserve and Banff National Parks. Specific examples identified by Nahanni National Park and Reserve included; roads associated with CanTung Mine providing easy access to calving and rutting areas of woodland caribou, and potential roads associated with Prairie Creek Mine would penetrate prime habitat areas for Dall's Sheep.

2.3.2.2 Redevelopment of abandoned mine sites

Another potential concern related to human use, raised by Banff National Park, was the redevelopment of abandoned mine sites. Once a site has already been cleared and access has been established, it can become a prime development site for other human activities. The redevelopment of abandoned mine sites can prolong habitat disturbance and potentially introduce other impacts associated with the new development. Banff National Park cited Canmore as an example, where an abandoned mine site is currently under development as the Three Sisters Resort. Instead of reclaiming the site to a natural state it is further developed prolonging the habitat disturbance issues.

2.3.2.3 Hunting/Poaching

Another impact related to human use and access was the increased predation of wildlife from poaching and hunting. Access roads and trails created during mining exploration and development can become access points for hunters and poachers. This increases the opportunities for poaching and encourages hunting in areas that were previously inaccessible. As a compounding factor, many of the animals near a mining site become habituated to human presence, or change behaviour patterns to favour habitat near the mining infrastructure, thus becoming easier targets for hunters. The increased harvesting of the animals puts pressure on the populations, which could eventually weaken the population. Parks which specifically indicated concern about increased poaching and

hunting activities included; Nahanni National Park Reserve, Waterton, and Jasper National Parks.

2.3.3 Water

Impacts on water quality and quantity were identified by several parks. Identified impacts included; pollution of aquatic habitat, impacts on water quality, quantity and impacts on groundwater. Mining sites can impact local watersheds and groundwater quality in a number of ways. Water withdrawal, treatment of tailings, and the use of chemicals and local water sources for processing activities are all mining activities that may have potential impacts on water.

Cape Breton Highlands, Pukaskwa, Kouchibouguac National Parks, and Nahanni National Park and Reserve all expressed concern about potential impacts on water and aquatic habitat due to mining activities. Specific concerns included:

- Kouchibouguac National Park: peat mining may be impacting the integrity of the entire watershed and water cycle, and may also affect both riverine and marine aquatic habitat through erosion, siltation/deposition of particles.
- Nahanni is downstream of two mines along the tributaries of the South Nahanni River. There is past history of diesel spills from both sites and more recent leaks and spills in 2000. There are also numerous questions about the quality and integrity of the tailings ponds, sewage disposal facilities and fuel storage areas. At one site there is known toxic chemical storage. Both mines have mining and milling infrastructures on site, tailings ponds and camp facilities or townsites.
- Cape Breton Highlands has concern about waste products and siltation of major salmon rivers in the region, including the Cheticamp River, located in the park. Impacts are associated with exploration activities of local metal deposits.

The impacts from mining on water can also include effects on both riverine and marine environments, depending on the location of the mine in question. Pollutants directly from the mining operation, chemical spills and sedimentation effects can effect nearby aquatic habitats. Forillon expressed concerns about the potential pollution of marine habitat, and subsequent effects on birds and seal colonies, due to mining and oil and gas exploration activities.

Impacts on water quality can be managed through effective environmental monitoring and contingency planning. Pukaskwa reported pro-active water monitoring and spill reporting activities by Williams Operating at the Hemlo Goldfields.

2.3.4 Vegetation

Several parks indicated concerns related to vegetation and the introduction of non-native species, from mining activities, during exploration, operation, and reclamation or abandonment. Waterton and Terra Nova both expressed concerns about non-native species introduction. Terra Nova also identified impacts on white pine habitat due to gravel pit mining activities in the region.

Non-native species can be introduced from mining transport vehicles carrying seeds or plant segments, during reclamation in the seed mixes used to re-vegetate, or from recreation vehicles using the roads as access to wilderness areas. The introduction of non-native species can have a detrimental effect on the ecosystem within the park by decreasing the biodiversity of plant life and impacting the dynamics of the ecosystem.

2.3.5 Terrain

Nahanni National Park and Reserve and Point Pelee National Park both referred to impacts on terrain and landscape due to mining activities, although the reference to road networks by many parks may indicate the potential for these impacts in other parks as well. Nahanni reported the impacts of bulldozer roads on property leases impacting mountainous terrain, and causing increased erosion and siltation. The proposed access road for Prairie Creek also crosses sensitive karst landscapes.

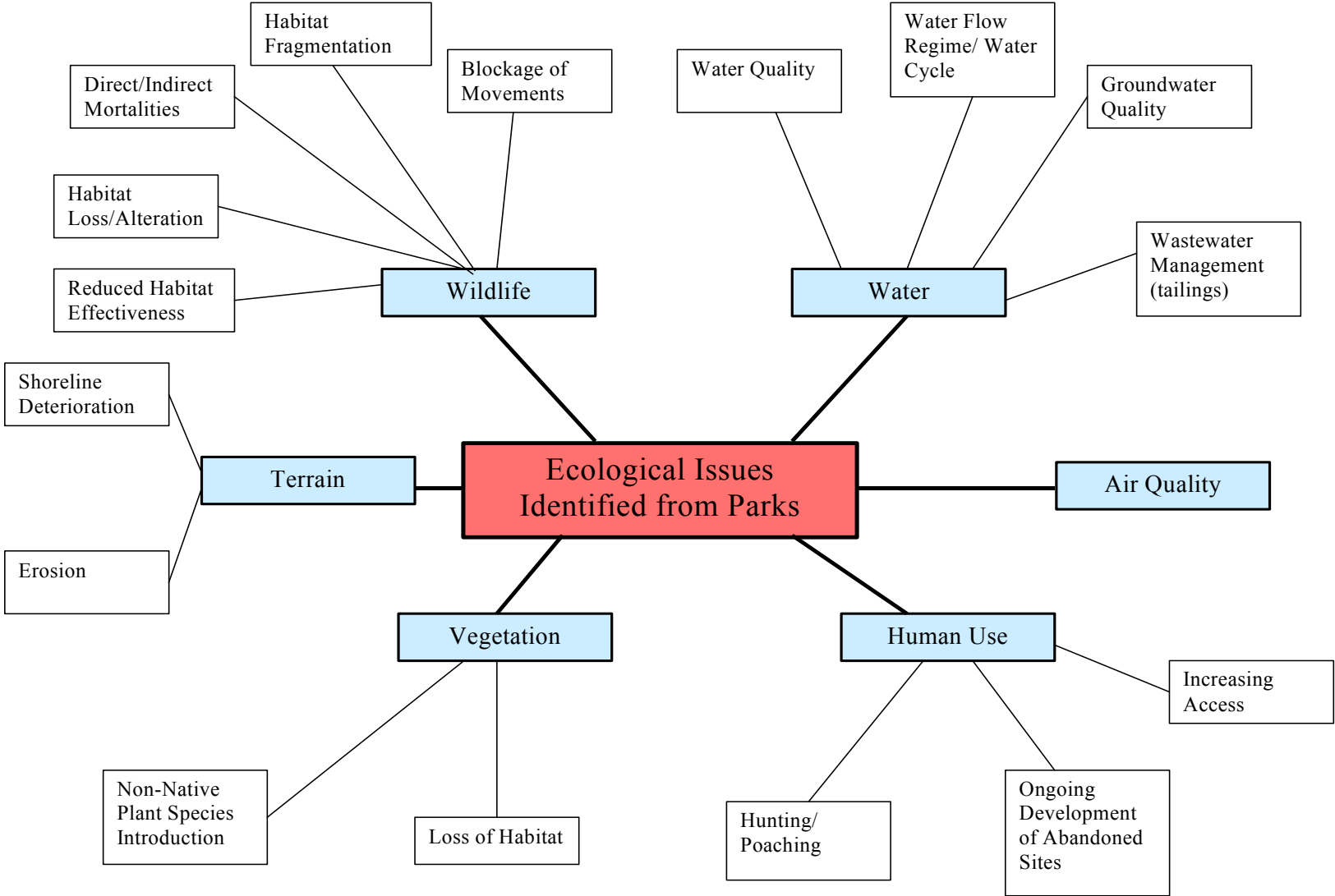
Although the practice of sand sucking has been abandoned, the previous damage from this procedure has altered many lakeside shorelines. This impact was mentioned specifically by Point Pelee National Park in Ontario where sand sucking had previously been conducted on Lake Erie.

2.3.6 Air Quality

Banff and Waterton National Parks were the only parks that specifically indicated air quality as a concern related to mining activities in the region. Banff National Park indicated that there was a perceived air quality problem stemming from the nearby Exshaw processing plant and mine. Waterton National Park indicated concerns about particulate emissions (associated with dust and coal) and the need for more regional research/monitoring.

Air quality impacts near mines can be related to the exhaust produced from the heavy machinery and processing equipment. Hydrocarbons are burned to power large mining trucks, drills, backhoes, crushers, and generators and these hydrocarbons are released into the air around the mines. Processing plants can also release chemical and hydrocarbon by-products into the local air-shed, potentially posing risks to local ecological and human communities and raising fears and concerns of local residents. Other air quality impacts associated with mining activities are an increase in air-borne dust particulates that can impair vision and breathing.

Figure 2.9 Mining Impacts on Parks



2.4 Mitigation and Management

The mining industry has played an important role in Canada's history and continues to do so today. The impacts that have resulted from mining are now better understood and can be more effectively managed. There has been strong public pressure to reduce these impacts and governments have responded by imposing more stringent regulations.

This section presents mitigation, management and communication strategies related to mining impacts, as identified by parks staff. Mitigation and management activities included; remediation, monitoring, and a variety of communication initiatives between parks staff and the mining industry, including regional advisory committees. These are described in sections 2.4.1 and 2.4.2 below. No formal evaluation of the success of mitigation or management techniques has been undertaken, but views and perspectives of parks staff on this subject have been included.

AXYS Environmental Consulting Ltd. would like to recognize that the information presented here represents the perspectives and knowledge of parks staff on mitigation and management activities for mining impacts. More information on these activities would likely be available from the mining companies themselves. Contacting mining companies was beyond the scope of this project, but has been identified as a logical next step.

2.4.1 Mitigation and Management Techniques

As part of the interview process, park representatives were asked about existing mitigation or management practices for impacts associated with mining. Eighty one percent stated that direct action had been taken to mitigate impacts of mining and other stressors. Many of the identified regional management techniques were developed in response to a variety of stressors to the parks, including mining. Identified activities included but were not limited to remediation/reclamation, monitoring, land management and research. Table 2.3 summarizes the mitigation and management techniques, identified by interviewed park staff.

Table 2.3 Identified Mitigation and Management Techniques

National Park	Mitigation/Management Techniques	Local/Regional
Banff National Park	Hunting Regulations for Road/Access to Cross Mine	Local
	Establishment of Wildlife Corridors (multi-agency)	Regional
	Establishment of Bow Valley Wildland Park – secondary corridors (multi-agency)	Regional
	Bankhead Mine Mitigation Plan	Local
Bruce Peninsula	Regulatory permitting by province	Local
Cape Breton Highlands	Water quality monitoring (Multi-agency committee)	Regional
Forillon	Reclamation/remediation of abandoned mine and quarry	Local
Gros Morne	Restricted development in park	Regional
	Landscaping and rehabilitation activities/planning	Local
Jasper National Park	Restricted Access on Mine sites	Local/regional
	Foothills Grizzly Bear Research Project	Regional
Kluane	Surveillance of sediment and streams (DFO)	Regional
	Assessment of abandoned mine site and remediation	Local
Kouchibouguac	Provincial protection of peat lands adjacent to park	Regional
Nahanni National Park Reserve (NNPR)	Participation in the Environmental Assessment Process	Regional
	Baseline Study by Nahanni and Environmental Canada on the Nahanni and Flat River Drainages	Regional
	Identification of areas of high conservation value for withdrawal for national parks (expanding park)	Regional
Pukaskwa	Hemlo goldfields (Williams Operating) conducting water sampling, open exchange of this information with Park	Local
	Notification system for downstream users (part of Williams Operating environment management planning)	Regional
Terra Nova	Reclamation/re-vegetation of gravel pits within park	Local
Waterton	Some reclamation of gravel pits within park	Local
Yoho/Kootenay	Mining company required to monitor grizzly bear habitat connectivity and human use	Regional
	Industrial access restrictions adjacent to Banff	Regional

2.4.1.1 Remediation/Reclamation

Remediation of a site includes treating and removing any contaminated soil and materials, while reclamation involves returning the mine site back to a vegetated state. Several parks, including Waterton, Kluane, Terra Nova, and Gros Morne, referred to mining companies undertaking active remediation and reclamation activities to minimize impacts when mines are decommissioned or abandoned.

Many current reclamation practices include monitoring programs, and proceed according to approved post mining land use objectives. The East Pit Lake Wildlife Habitat and recreation area (Whitewood Mine, Alberta) and Henretta Creek Reclamation (Fording River Mine, Elk Valley, BC) are two examples of active reclamation activities undertaken by Fording Inc. to help protect the environment and minimize impacts.

It is important to note that past reclamation and remediation practices do not necessarily reflect the current regulations and knowledge of today. Many of the abandoned mines identified by parks representatives were abandoned years ago and therefore may not have been reclaimed or remediated to today's standards. Parks, including Nahanni and Banff and Kluane, referred to historical abandoned mine sites with potential contamination either within or close to park boundaries. Others referred to abandoned mine sites within

park boundaries, in particular quarries, where reclamation activities were being undertaken by the park.

2.4.1.2 Monitoring

Monitoring programs can be effective tools in informing and developing management and mitigation strategies due to mining and other human developments. Monitoring can be an effective tool in measuring compliance to regulatory or contingency measures, and can identify impacts for adaptive management planning. Monitoring can act as the link between the identification of impacts and development of mitigation and management strategies. Several parks indicated ongoing monitoring activities while others identified the need for monitoring programs. Nahanni National Park and Reserve specifically mentioned the lack of monitoring activities, and their need for measuring impacts related to mining. Parks that identified ongoing monitoring activities included:

- Pukaskwa
 - Water quality monitoring by Williams Operating
- Yoho/Kootenay
 - Monitoring for wildlife connectivity and human activity (mining company regulated by permit)
- Cape Breton Highlands
 - Water quality testing for (multi agency committee)
- Kluane
 - Surveillance of sediments and streams.(DFO)

2.4.1.3 Research

Sound management decisions for park species and ecosystems, must be based on sound scientific research. Jasper National Park identified the Foothills Grizzly Bear Research Project, as a tool that will assist in forming management and mitigation strategies to minimize impacts from mining and other human developments in Jasper National Park. The project began in response to concerns over the Cheviot Mine proposal. A summary of all research activity identified by the parks is available in section 2.4. Many of identified studies provide information on which to base management and mitigation strategies, though many are intended to investigate impacts from a variety of stressors on the parks. Banff National Park wildlife corridor studies, the East Slopes Grizzly Bear Study and air quality studies are examples of research undertaken to investigate impacts and inform management strategies from a variety of park stressors. Section 3.0 summarizes the research needs identified by parks when asked if any research needed to be carried out to fully determine and address the effects from mining activities.

2.4.1.4 Access Control

Access restrictions can be used to reduce the impacts related to an increase in human use. The construction of roads, and clearing of land for mines sites, can provide access into areas previously un-accessible to humans. Mining activities and increased human presence surrounding the mine area can contribute to an increase in direct and indirect mortalities of wildlife species. Primary sources of direct wildlife mortalities include kills

along roads, creation of winter predator highways, increased hunting and poaching of wildlife, and from management removal of habituated and aggressive animals, such as grizzly or black bears. Parks that included restrictions for access or other human activity included:

- Banff National Park
 - Hunting regulations at Cross Mine
 - Industrial access restrictions adjacent to Banff
- Jasper National Park
 - Restricted access on mine sites

2.4.1.5 Land Management

Regional Land Management planning has become an important tool in maintaining ecological integrity of national parks and other regions. All national parks are required by law to develop a park management plan, to be submitted to Parliament for tabling. Park management plans identify threats or stressors to ecological integrity and propose strategic goals, objectives and key actions to maintain ecological integrity.

Some examples of regional land management planning identified by parks in the interview include:

- Banff National Park
 - Establishment of wildlife corridors, Municipality of Bighorn
 - Establishment of Bow Valley Wildland Park with secondary corridors
- Kouchibouguac
 - Provincial protection of peat lands adjacent to park
- Nahanni
 - Selecting land to be withdrawn for protection

2.4.2 Communication Initiatives

As part of the scoping exercise, parks staff were also asked to describe any communication initiatives where they had an opportunity to express their concerns to mining companies. Identified communication initiatives included both formal and informal activities. Informal communications included:

- Open communication and exchange about water monitoring programs
- Exchange visits between parks staff and environmental staff from the mining companies.
- Parks staff touring underground and above ground mining facilities.
- Discussions around access and other issues
- Communications on remediation activities within the park

Several parks identified more formal communication initiatives either through Regional Advisory Committees, or regulatory reviews. The regional advisory committees

identified by parks staff are described below in section 2.4.2.1. Other formal communications included;

- Permitting – either face to face or written comments
- Mine site visits for regulators
- Reviewing comments through EIA and licensing – regulatory agencies
- Agreements with government to have all applications for exploration works or mine development sent to Parks Canada for their consideration (Yoho/Kootenay). Reviews can involve meeting with Parks Canada and the proponent, or in a multi-agency forum

In general parks staff expressed positive outcomes from communication initiatives with the mining industry. Interviewed parks that had close relationships with the mining companies in the region, reported only positive outcomes from these communication efforts. In fact, the park representative for Yoho/Kootenay commented on the questionnaire being too “park centered”, without consideration of the mining industry and their perspective. “Understanding the role that mining has and continues to have on the regional landscape is important to reducing threats to regional biodiversity and to the ecological integrity of Canada’s National Parks” (Paul Galbraith, 2002, pers. comm.). This close relationship between the mining industry and parks in Yoho/Kootenay may be a reflection of the long history of mining in the region, but may also be a reflection of individual companies and their commitment to reducing impacts to the surrounding ecosystems, and to working with other stakeholders to maintain ecological integrity in the region. Pukaskwa was another park that reported positive outcomes from a mining company (Williams Operating), with progressive environmental management plans, and open communications with Parks Canada.

Informal communications between parks and the mining industry, potentially an indicator of a strong relationship, were mostly reported to have positive outcomes for ecosystem management. Formal communications were reported as having both positive and negative outcomes depending on the park in question. Regional Advisory Committees were all reported as being an effective tool for the communication and management of concerns about impacts and ecosystem planning. These committees are explained in more detail in section 2.4.2.1.

Where communication occurred within a regulatory forum, outcomes were reported to be both positive and negative. Several comments made by parks staff supported the need for parks to have the opportunity to be involved in permitting and licensing of mining exploration and development activities. Several parks reported concerns about a lack of knowledge/involvement in permitting activities, whereas others such as Yoho/Kootenay reported an efficient process where they have the opportunity to comment on all proposals, including exploration.

Although concerns may be clearly communicated through regulatory reviews and appropriate management strategies can be implemented, they may not provide the opportunity for parks and the mining industry to develop open communication channels and begin building relationships that seem significant for regional ecosystem management. The difference in outcomes of formal communications may be related to the nature/form of communication, i.e., written vs. verbal/face to face. The response from Nahanni National Park Reserve indicated that informal verbal and in person communications with one company, were more successful than regulatory

correspondence with another in regards to water quality sampling. A formal evaluation of communication initiatives was beyond the scope of this project.

2.4.2.1 Regional Advisory Committees

There were several regional advisory committees identified by parks staff during the interviews. These committees are a means of bringing together representatives from relevant industry, the parks, and government to discuss ways to reduce ecological impacts in the region, including those specifically from mining. They provide the opportunity for all stakeholders to discuss concerns about ecological impacts, and mitigation and management initiatives. These committees are generally considered to have positive outcomes for regional land use planning and ecosystem management. Table 2.4 presents and describes the regional management/advisory committees that were identified by respondent parks. Other regional management committees may exist that are not listed in Table 2.4, as these only include those identified during the interview process.

Table 2.4 Identified Regional Plans and Advisory Groups

Park	Plan/Advisory Group	Description
Banff	Bow Corridor Ecosystem Advisory Group:	Studies and discusses wildlife corridor issues.
Kluane	Greater Kluane Land Use Plan/Kluane Management Board	Board makes recommendations to Minister regarding development and management of Kluane National Park.
	Alsek Renewable Resource Council	Advises Minister on issues related to fish and wildlife management in traditional territory of Champagne and Aishihik First Nations
Jasper	Regional Carnivore Management Group	Aim to ensure that grizzly bears, continue to prosper in the Alberta Yellowhead ecosystem. Representatives include forestry, oil and gas, mining, government, parks.
	Northern East Slopes Environmental Resources Committee	Regional resource use planning
Kouchibouguac	Southern Gulf of St. Lawrence Coalition on Sustainability	Collaboration between NGOs, government, and companies to protect the long term sustainability of the region.
Pukaskwa	Greater Park Area Regional Communication Group	Communication clearing house between government and parks to update each other of activities in the park.
Yoho/Kootenay	Interagency Management Committees	Develop regional strategic land use planning

2.5 Studies and Reports

There have been many studies and reports produced about the ecological conditions in and around the national parks. Some are specific to mining impacts while others are studies on particular species or project assessments. Most new or proposed mine sites require environmental impact assessments to be conducted. These assessments serve as a useful source for information on environmental conditions, impacts and mitigation methods. Other sources of information include university graduate studies and studies conducted by the government and private industries. A list of studies related to mining and reports on ecological conditions in and around national parks is provided in Table 2.5. Where possible the author/manager of the study has been identified, although some

follow up is required to complete this exercise. A detailed review of all of the listed reports was not possible under the scope of this project, although a summary of several of the key reports is provided below.

Table 2.5 Studies and Reports Identified

Park	Study/Report Source	Description
Nahanni	DFO/Parks Canada	Study of Bull Trout habitat and populations in Nahanni and Prairie Creek watersheds. Available from NNPR office
	NNPR	Woodland Caribou seasonal ranges study
	MVEIRB	Environmental assessment decisions
	NNPR	Consultant reports from Tungsten and Prairie Creek mining areas.
	CWS	Fort Liard songbird studies
	NNPR & Environment Canada	Water quality and fish tissue research
Banff	BowCORD Bow Valley Naturalists Canadians for Corridors Canadian Parks and Wilderness Society	Assessing the Design and Functionality of Wildlife Movement Corridors in the Southern Canmore Region
	ESGBP, CRWP	Eastern Slopes Grizzly Bear Project, Central Rockies Wolf Project
		Air quality studies in Canmore area
	The Banff Bow Valley Task Force	Banff Bow Valley Study
		Water quality studies near old Canmore mine site
		Bankhead mine mitigation plan
Kluane		Windy Craggy mine assessment (BC)
		Greater Kluane Land use plan
	Yukon Territorial Government	Dall sheep studies
	Independent consultants	Moose Creek evaluation
Jasper	Parks Canada and Alberta Government	Model forest grizzly bear study
	Alberta government	Waterfowl and sheep studies
	Independent consultants	Cheviot mine assessment
Forillon	Noranda	Investigation into effects of oil spills on Panouille salt marsh
Kouchibouguac	University of Sherbrook	Assessment of potential impacts on Portage watershed from adjacent peat mining (undergraduate study)
	University of Moncton	Study on St Charles peat bog, estuarine river
	Laval	Impacts of peat mining on amphibian communities
	University of Sherbrook	Reports on protected area management

Table 2.5 Studies and Reports Identified

Park	Study/Report Source	Description
Pukaskwa	University of Waterloo	Ecological landscape specification, mapping areas around the park, water sampling to determine baseline water quality
		4 year aquatic resources inventory, biology of lakes
	Hemlo Gold mine Williams	Hemlo gold field contingency planning Water testing study results
Cape Breton Highlands	ADI, Noland Davis Engineering and Geological company	Watershed runoff initiative, hydrological assessments.
	Regal Goldfields	Jim Campbell Barrens
Terra Nova		Thesis on non-native species in the park
		General in-park infrastructure report

2.5.1.1 Review of Selected Reports

FOOTHILLS MODEL FOREST GRIZZLY BEAR RESEARCH PROGRAM 2001 ANNUAL REPORT – Jasper National Park Area

An annual report of the grizzly bear research program whose study area includes a portion of Jasper National Park. This research program focuses on management issues and questions by assessing grizzly bear populations, bear response to human activities, and habitat conditions to provide land managers with tools to integrate grizzly bear “needs” into the land management decision making framework. The prime directive of the study is a five-year tag and release program to track and monitor grizzly bear movement in the study area. Various hypotheses are presented with regard to grizzly bear habitat selection, population viability, resource selection and effects of seismic outline activity on habitat connectivity. Within this report are the findings from the third year of research for studies done within the Foothills Model Forest. Conclusions were not officially presented as research is ongoing.

A Cumulative Effects Assessment of Proposed Projects in Kluane National Park reserve, Yukon Territory (1995). By George Hegmann for the Department of Canadian Heritage, Kluane National Park Reserve

A detailed cumulative effects assessment for the Kluane Park reserve focusing on five wildlife species (grizzly bear, Dall sheep, mountain goat, moose, and golden eagle). Eleven general conclusions were made with regards to cumulative effects on the parks. It was determined that mining was ranked second out of the regional projects and activities outside the park with the greatest contribution to cumulative effects. Mining was identified as an active industry with the potential for growth in the area.

Impacts due to mining cited in the report include degradation of riparian and bottomland habitat and increased hunting pressures due to road access, as well as significant habitat loss in the Burwash Uplands was noted.

Greater Ecosystem Planning: ABC Resource Survey of the Pukaskwa National Park to Lake Superior Provincial Park Area (1995). By Andrew Skibicki

This survey was conducted to identify the components of the park ecosystem, delineate areas of ecological significance and possible stresses, and to identify stakeholder and land use interests in the area. Mines in the Pukaskwa area are clearly delineated and identified, additionally a comprehensive history of the mining in area is included. A co-ordinated regional approach to ecosystem management was proposed with suggestions for MOUs between mining companies and the park to set standards for park management.

Eastern Slopes Grizzly Bear Project. Banff National Park.

Ongoing research investigating the demographic and habitat parameters for grizzly bears, with the intent to link these in a habitat and population viability model. The research is focused on cumulative effects of regional land use and mortality factors on grizzly bears.

Historical Review for Environmental Assessment Purposes, Former Johobo Mine Site, Kluane National Park and Reserve, Yukon.

A review of historical literature; land titles, air photos, spill reports, contaminated sites catalogues and files, claims reports and papers to identify potential site contamination. It concluded that there was potential for contamination at the mine site. An historical dumpsite was identified, as were strewn fuel barrels, the less stringent regulatory requirement of the time were recognized, and two interviews told of a one truck that sank into Kathleen Lake. A site visit was recommended to the mine site, to look for hydrocarbon fuel spills and historical dumpsites.

2.6 Preliminary Risk Assessment Overview

Mining is an important industry in Canada that provides vital materials for both use within Canada and export to other nations. Mining activities have been undertaken all across Canada, including within and adjacent to national parks. The very nature of mining, however, causes both direct and indirect environment impacts and with Parks Canada's mandate to maintain or improve ecological integrity within the parks, mining has been identified as a stressor and one of the potential threats to maintaining ecosystem health in park system.

Almost half of Canada's national parks indicated that mining has occurred in the past or is currently occurring in or around their park boundaries. Approximately 90% of the mines identified during the interview process are located outside park boundaries, however many of these (~39%) are located within 10 km of the park boundaries. The impacts attributed to mining and its associated activities can extend beyond the extraction site itself and into the parks, which can influence the ecological integrity of the park. A majority of the mining activities can be classified as a regional stressor to Canada's parks.

The key impacts that were identified by parks representatives during the interview process include: wildlife, water, human use, vegetation, terrain, and air quality. Wildlife and habitats issues were of primary concern to a majority of the parks interviewed. Biodiversity, and in turn ecological integrity, are negatively influenced by environmental impacts on wildlife and habitat. There are four types of biodiversity (landscape, community, species and genetic), all of which can be affected by mining activities.

Habitat loss/alteration, habitat fragmentation and the introduction exotic species can influence biodiversity at the landscape, community and species level. These impacts can influence ecosystem health and the ability of plant and animal communities to resist and adapt to stresses and change and the ability of species sustain healthy populations. Water quality and air quality effects have the potential to affect biodiversity at the genetic level, although more information is required to fully assess these effects. Biodiversity is also linked to ecosystem processes, such as fire, flood, predation, pollination and grazing. Mining and its associated activities has the potential to indirectly affect ecosystem processes by altering natural processes, however, adequate information was not collected to fully assess the contribution of mining to these processes.

Increased access was identified as one of the main indirect stressors associated with mining activities. An increase in access through the development of roads, trails and other linear disturbances contributes to habitat loss, habitat fragmentation, direct and indirect wildlife mortality and human encroachment. The implementation of access restrictions and regional access management plans can assist in reducing these effects.

Mining is not the only human use activity occurring within and around national parks and their impacts can not be assessed individually, but must be assessed in combination with other stressors to determine cumulative effects. Insufficient information was gathered on other park stressors that may contribute to cumulative impacts. Further research may identify other potential stressors that could act cumulatively with the impacts experienced by mining.

The maintenance and improvement of ecological integrity is dependant on people making informed choices and decisions and working together to implement appropriate management strategies to reduce all stressors to Canada's parks (Parks Canada, 2000). Two of the main methods identified by parks representatives for reducing environmental impacts are through mitigation and management strategies and communication initiatives. Over 80% of the parks representatives interviewed indicated that direct action had been taken to mitigate mining impact. Some of the methods had been employed by the mining company, while others were government, or multi-stakeholder initiatives. Open communication and information exchange programs have been on-going between Parks Canada and the mining companies at both the formal and informal level. Some parks representatives had a very positive response regarding the communication efforts and the working relationship that is developing with the mining industry. These types of integrated management strategies can serve to mitigate environmental impacts and reduce the risk to ecological integrity. Other parks expressed a lack of communication and research necessary to inform management initiatives and maintain ecological integrity.

3 Future Research

Parks were asked to identify what, if any, future research should be done in and around their parks to help assess the impacts of mining. Responses were received from many parks, and included both research and mitigation related needs. They ranged from highly specific research needs related to mining impacts, to more broad based ecosystem level research. Identified research needs included habitat disturbance models, human use studies, regional air quality research, and a variety of impact related research on vegetation, aquatics and wildlife. The need for more cumulative assessments of impacts was identified by several parks, as was the need to evaluate mitigation and management measures, specifically related to access. Many of the respondent parks identified a clear need for further research, not only to investigate impacts from stressors such as mining, but to evaluate and inform mitigation and management strategies. The following table summarizes the research needs identified by each respondent park.

Table 3.1 Future Research Needs

National Park	Identified Research Need
Yoho/Kootenay	To develop more refined habitat disturbance models.
	Human Use studies related to wildlife displacement.
	Cumulative Effects Modeling.
Waterton	Vegetation studies on impact of invasive non-native plants in the park.
	Regional air quality studies, specifically regarding particulates.
	Habitat effectiveness studies on carnivores and ungulates in the Flathead Valley, to determine what habitats they use and how fragmentation may affect them.
Terra Nova	Research impacts of gravel mining (surface removal) on White Pine habitat.
	Research related to mitigation and management for access on the western boundary.
	Research on impacts related to human use including access.
	Monitoring and remediation efforts, investigate effect of fences on moose movements and habitat use.
Pukaskwa	Predator/prey studies, to assess impacts from all park stressors
Nahanni (Reserve)	Wildlife movement studies, specifically Grizzly and black bears and Dall's sheep.
	Additional information on fish habitat and population sensitivity in areas of mining activity or interest.
	Operational water quality monitoring program, including information on benthic aquatic life.
	Research on air quality.
Kouchibouguac	Research on impacts of mining and other activities on amphibians.
	More research on the water budget in peat lands and the contribution of peat bogs to the water cycle and budget of rivers.
	Develop mitigation measures to minimize impacts from mining.
Jasper	Wildlife studies: continue monitoring on large carnivores, but include more research on other species including song birds and smaller carnivores.
	Human use studies including an investigation of when and where people are using access roads, and assess the success of mitigation measures.
	Study relationship between Grizzly bear population and human use.
Georgian Bay Islands	Mapping of gravel pit sites, identifying footprints and locations.
	Investigate and refine permitting procedure to ensure correct permitting is being done.

Table 3.1 Future Research Needs

National Park	Identified Research Need
Banff	Continue large landscape research programs for wide ranging carnivores.
	Evaluation of aesthetics in Bow Valley.
	Work with mine owners and operators to develop reclamation plans for the mines.
	Evaluation of rehabilitation techniques for abandoned mines.
	More fine scale research on wildlife corridor use in Bow Valley.
	More regional air quality studies
	Studies on locations of remaining coal beds and methane zones.
Kluane (Reserve)	More Cumulative Effects assessments which considered: <ul style="list-style-type: none"> • Wildlife corridors • Terrain features • Roads • All stressors • Future disturbance and potential of park landscape to respond
Forillon	Identified need for a Committee or Framework to discuss issues
Point Pelee	Nothing identified
Cape Breton Highlands	Nothing identified
Grasslands	Nothing identified
Gros Morne	Nothing identified
Bruce Peninsula	If there is an increase in development, more CEA is needed considering impacts at a landscape level.

4 Recommendations for Next Steps

This report is intended to summarize the results of an initial scoping of ecological impacts related to mining in national parks. During this scoping exercise AXYS Environmental Consulting Ltd. staff had the opportunity to identify other tasks and actions related to the project, but uncompleted due to project scope. The information presented in this report can be used to form the basis of more detailed investigations into impacts associated with mining, mitigation and management strategies and risks posed to ecological integrity. Specific suggestions for potential next steps to this scoping exercise are provided below.

4.1 Literature Review

The studies and reports identified in Table 2.5 provide an excellent starting point to conduct a more detailed literature review, as would the literature listed in the references section of this report. A more detailed review of literature could support and investigate the identified impacts presented in this study, and potentially identify others. It could also provide more information for an assessment or evaluation of mitigation and management techniques related to mining. The literature review could also be used to inform a more detailed assessment of the potential current and future risk that mining activities pose to the ecological integrity of Canada's national parks.

4.2 Case Study Analysis

From interview responses there were several parks that had significant information on potential impacts, mitigation strategies and research related to mining impacts in national parks. These parks could serve as excellent potentials to assess as case studies. A case study analysis would allow a more thorough analysis and comparison of the nature and extent of mining activities and how they impact parks. Implications and success of mitigation and management strategies can be assessed and comparisons made between parks and regions.

4.3 Mining Industry

This scoping exercise relied on the knowledge and perspectives of parks staff. Mining companies could provide information to complement this report. This could include additional studies and reports related to impacts, and additional information on mitigation and management strategies. Follow up with the mining companies would provide the opportunity to present the mining industry's views on land management, and environmental conservation and how they impact the industry's goals and objectives. This follow up would not only supplement the information presented in this report, but could also provide another perspective on mining and national parks in Canada, on their relationship, and interactions, both positive and negative.

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5.2 Personal Communications

Please refer to table 2.1 for a list of park representatives who participated in interviews for this report. Personal communications also occurred with Gordon Stenhouse from the Foothills Model Forest Grizzly Bear Research Program, and Jeff Kneteman a Biologist, with Alberta Environment, in Hinton, AB. A record of these conversations is included in Appendix A with the questionnaire responses.

5.3 Internet Sites

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