

Mining, Minerals and Sustainable Development North America

# Towards Change

## The Work and Results of MMSD–North America



**Final Report**  
**September 2002**

**iisd** International  
Institute for  
Sustainable  
Development Institut  
international du  
développement  
durable

**MMSD**  
NORTH AMERICA



World Business Council for  
Sustainable Development

**Mining, Minerals and Sustainable Development North America**

# **Towards Change**

## **The Work and Results of MMSD–North America**

**Mining, Minerals and Sustainable Development North America**

The International Institute for Sustainable Development contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change, measurement and indicators, and natural resource management. By using Internet communications, we report on international negotiations and broker knowledge gained through collaborative projects with global partners, resulting in more rigorous research, capacity building in developing countries and better dialogue between North and South.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD receives operating grant support from the Government of Canada, provided through the Canadian International Development Agency (CIDA) and Environment Canada, and from the Province of Manitoba. The institute receives project funding from the Government of Canada, the Province of Manitoba, other national governments, United Nations agencies, foundations and the private sector. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States.

Copyright © 2002 International Institute for Sustainable Development

Published by the International Institute for Sustainable Development

All rights reserved

Copies are available for purchase from IISD.

National Library of Canada Cataloguing in Publication

Mining, Minerals and Sustainable Development (Project). North America

Towards change: the work and results of MMSD North America/Mining, Minerals and Sustainable Development North America.

Includes bibliographical references.

ISBN 1-895536-64-2

1. Mineral industries--Environmental aspects. 2. Sustainable development.  
I. International Institute for Sustainable Development. II. Title.

TD195.M5M56 2002                    338.2                    C2002-911142-0

International Institute for Sustainable Development

161 Portage Avenue East, 6th Floor

Winnipeg, Manitoba

Canada R3B 0Y4

Tel: +1 (204) 958-7700

Fax: +1 (204) 985-7710

E-mail: [info@iisd.ca](mailto:info@iisd.ca)

Web site: <http://www.iisd.org>

*Towards Change* was designed by Donald Berg.

Printed by ePRINTit (<http://www.eprintit.com>), Winnipeg, Manitoba.

Cover photography: Left and centre photos by Tamra Rezanoff. Right side photo courtesy of IAMGOLD Corporation.



*The future will be dominated by the competition for public trust. People are increasingly turning to “trustmarks” to sort through the cluttered market-place of an information economy... Today, people are seeking a higher order... We aren’t seeking a signal about the quality of the product so much as the trustworthiness of the producer—whether it be a corporation, charity or political leader. The default position of the new mindset tends to be set on skepticism rather than trust. Therefore trustmark holders possess an asset as rare as platinum. Trustmark stewardship will become one of the top tasks of modern CEOs. Leaders must excel beyond traditional management skills of finance, strategy, and marketing to master the political skills necessary to forge trusting relationships with the new knowledge consumers.*

*From “Searching for Certainty” – D. Bricker and E. Greenspon, 2001*

## **Dedication**

*During the life of MMSD–North America, two greatly respected participants passed away.*

*In September 2001, while hiking in the foothills of the Rocky Mountains, Jim Leslie died suddenly. Just two days earlier, Jim’s quiet voice and wise counsel had played a key role in the first workshop of the MMSD–North America Scenarios team. Jim had risen to a senior executive position in Canada’s energy industry and from there had contributed greatly to the implementation of sustainable development concepts within Canada and abroad.*

*In June 2002, while giving a lecture in Toronto, and only a few weeks after retiring from Stanford University where he was Gildred Professor in Latin American Studies, John Wirth also passed away. John was the heart and soul of the North American Institute, an organization he created with others to explore creative approaches to North American trans-boundary issues. He played a key role in negotiating the Environmental Side Agreement to the North American Free Trade Agreement (NAFTA) and served as the initial U.S. Chair of the Joint Public Advisory Committee to the North American Commission for Environmental Cooperation.*

*Each of these men brought to MMSD–North America a lifetime of precious experience and a deep commitment to change, collaborative decision-making and the ideas of sustainable development. They are deeply missed.*

*This work is dedicated to them and to the ideals that they championed.*

## Acknowledgements

### Resources

The following companies have contributed to MMSD–North America through their sponsorship of MMSD Global. Those with North American interests are bolded and italicized; those who are members of the Mining Task force of the World Business Council for Sustainable Development are marked with an asterisk. MMSD Global has also received support from governments, international agencies and universities.

<i>Anglo American plc*</i>	Mitsui Mining & Smelting Co. Ltd.
<i>Alcan Inc.</i>	<i>Newmont Mining Corporation*</i>
<i>Alcoa Inc.</i>	Nippon Mining & Metals Co. Ltd.
Anglovaal Mining Ltd.	<i>Noranda Inc*</i>
<i>Barrick Gold Corporation</i>	Normandy Mining Limited
<i>BHP – Billiton*</i>	Norsk Hydro ASA
<i>Codelco*</i>	Pasminco Ltd.
De Beers Group	<i>Phelps Dodge Corporation*</i>
EDM/Somincor	<i>Placer Dome Inc.*</i>
<i>Freeport-McMoRan Copper and Gold Inc.</i>	<i>Rio Tinto Group*</i>
Gold Fields Ltd.	Sibirsky Aluminium Group
Lonmin plc	Sumitomo Metal Mining Co. Ltd.
MIM Holdings Ltd.	<i>Teck Cominco Metals Ltd.</i>
Mitsubishi Materials/Mitsubishi Corporation	WMC Limited*

In addition to the above, the following have provided support specifically earmarked for MMSD–North America:

### **Greater than US\$25,000**

Natural Resources Canada (Ottawa)  
Knight Piésold Ltd. (Vancouver)

### **US\$10,000**

AMEC Simons Mining and Metals (Vancouver)  
Bechtel Corporation (San Francisco)  
Coudert Frères (Montreal)  
ESG International (Waterloo)  
Gallagher & Kennedy (Phoenix)  
Geomega (Boulder)  
Golder Associates (Toronto)  
McCarthy Tetreault (Toronto)  
Newmont Mining Corporation (Denver)  
North American Palladium Ltd. (Toronto)  
SENES Consultants Ltd. (Toronto)  
URS Corporation (Phoenix)

### **US\$2,000 – \$10,000**

Beak Consultants Inc. (Toronto)  
CAMECO Mining Corporation (Saskatoon)  
KPMG (Vancouver)

## MMSD–North America Participants

The following individuals participated in one or more of the MMSD–North America activities including the Canadian and U.S. initiating workshops, the workgroups and the North American Mining Dialogue. Inclusion in this list does not imply endorsement of the MMSD–North America process, results or reports.

Saleem Ali, Brown University, Providence, Rhode Island

Emmanuel Ato Aubynn, University of Alberta, Edmonton, Alberta

Kathleen Anderson, Wallingford, Connecticut

Deborah Archibald, Government of the Northwest Territories

Jerry Asp, Canadian Aboriginal Minerals Association, Dease Lake, British Columbia

Greg Baiden, Professor, Mineral Engineering, Laurentian University, Sudbury, Ontario

Dave Baker, Newmont Mining Corporation, Denver, Colorado

Dennis Ballard, Flin Flon, Manitoba

Tony Berger, Geologist, Bonne Bay, Newfoundland

Ken Bocking, Golder Associates Ltd., Vancouver, British Columbia

Pat Bolger, Bolger Associates, Richmond Hill, Ontario

David Brooks (retired), International Development Research Centre, Ottawa, Ontario

Bruce Brown, Knight Piésold, Vancouver, British Columbia

William F. (Bill) Brown, U.S. Geological Survey, Reston, Virginia

Arden Brummell, Global Business Network Canada, Calgary, Alberta (Facilitator, Scenarios Workgroup)

Peter Butler, Animas Stakeholder Group, Durango, Colorado

Ann Carpenter, Geologist, Women's Mining Coalition, Reno, Nevada

Ann Cowan, Centre for Dialogue, Simon Fraser University, Vancouver, British Columbia

Dave Crouch, Cleveland-Cliffs Inc., Cleveland, Ohio

Dave Chambers, Center for Science in Public Participation, Bozeman, Montana

Colin Chambers, PhD Candidate, Faculty of Environmental Studies, York University

Madelaine Chocolat, Rae Edzo, Northwest Territories

Berni Claus, Royal Roads University and Environment Canada

Jim Collord, Placer Dome Inc., Elko, Nevada

Leta Collord, Elko, Nevada

Gerald Cormick, CSE Group, Mill Creek, Washington

Ross Conner (observer), Business Development Coordinator, Hudson Bay Mining and Smelting Co. Ltd., and Secretariat, Mining Association of Canada, Sustainable Mining Initiative, Flin Flon, Manitoba

Verna Cuthbert, Coudert Frères, Montreal, Quebec

Luke Danielson, MMSD Global, London, England

Joe Danni, Placer Dome, Denver, Colorado

Michel de Spot, Association of Professional Engineers and Geoscientists of British Columbia, Vancouver, British Columbia

Laura Dear, Canadian Environmental Assessment Agency, Vancouver, British Columbia

Robert Desjarlais, United Steelworkers of America, Thompson, Manitoba

Rob Dies, Association of Professional Engineers and Geoscientists of British Columbia, Vancouver, British Columbia

Catherine Dunlop, Evaluation Unit, Simon Fraser University, Vancouver, British Columbia  
Rod Eggert, Colorado School of Mines, Golden, Colorado  
Peter Eggleston, Rio Tinto Zinc, London, England  
Dave Evans, CSD Project Management Services, Calgary, Alberta  
Glenn Eurick, Barrick Management Corporation, Salt Lake City, Utah  
Elizabeth Everhardus, Pollution Probe, Toronto  
Glenda Ferris, Houston, British Columbia  
Doug Fraser, DJF Consultants, Kelowna, British Columbia  
Leigh Freeman, Downing Teal Inc., Denver, Colorado  
Jim Frehs, Natural Resources Canada, Ottawa, Ontario  
John Gammon, Ontario Ministry of Northern Development and Mines, Sudbury, Ontario  
Bob Gibson, University of Waterloo, Waterloo, Ontario  
Cindy Gilday, Diavik Diamond Mines, Yellowknife, Northwest Territories  
Ginger Gibson, Co-Development Canada, Vancouver, British Columbia  
Bill Glanville, International Institute for Sustainable Development, Winnipeg, Manitoba  
Pat Gochnour, Northwest Mining Association, Spokane, Washington  
Jim Gowans, Placer Dome Inc. (formerly), Consultant, Toronto, Ontario  
Tom Green, Consulting Ecological Economist, Nelson/Vancouver, British Columbia  
Annaliese Grieve, Ryerson Polytechnic University, Toronto  
Terry Harbottle, Global Business Network Canada, Calgary (Facilitator, Scenarios Workgroup)  
Rich Heig, Rio Tinto Technical Services, Murray, Utah  
Jennifer Hinton, Centre for Responsible Mining, Vancouver, British Columbia  
Michael Hitch, AngloGold Ltd., Englewood, Colorado  
Tony Hodge, Anthony Hodge Consultants Inc., Victoria, British Columbia, International Institute for Sustainable Development, Winnipeg, Manitoba, Facilitator, MMSD–North America  
Connie Holmes, National Mining Association, Washington, D.C.  
Susan Holtz, Consultant, Toronto, Ontario  
Dale Hull, Natural Resources Canada, Ottawa, Ontario  
Ed Huebert, Manitoba Mining Association, Winnipeg, Manitoba  
Paul Jones, Royal Victoria Minerals Ltd., Golden, Colorado  
Susan Joyce, Golder Associates, Calgary, Alberta  
Alistair Kent, AMEC Engineering and Construction Services, Vancouver, British Columbia  
Valerie Keyes, Natural Resources Canada, Ottawa, Ontario  
Andy King, United Steelworkers of America, Toronto, Ontario  
Jim Kuipers, Center for Science in Public Participation, Bozeman, Montana  
Brenda Kuzyk, Diavik, Rio Tinto, Yellowknife, Northwest Territories  
Denis Lagacé, Natural Resources Canada, Ottawa, Ontario  
Kathleen LeClair, Natural Resources Canada, Ottawa, Ontario  
Jim Leslie, International Institute for Sustainable Development, Winnipeg, Manitoba



Michael Long, Division of Minerals and Geology, Colorado  
Ann Maest, BUKA Environmental, Boulder Colorado  
Gislaine MacLeod, CAMECO Corporation, Saskatoon, Saskatchewan  
Jim McDivitt, Honolulu, Hawaii  
Alistair MacDonald, Consultant, Vancouver, British Columbia  
John McDonough, Barrick Gold Corporation, Salt Lake City, Utah  
Michael Mckernan, Tetres Consultants Inc., Winnipeg, Manitoba  
Graeme McLaren, British Columbia Ministry of Sustainable Resource Development, Victoria, British Columbia  
Michael R. McPhie, Knight Piésold Ltd., Vancouver, British Columbia and MMSD–North America  
Frank McShane, MMSD Global, London, England  
George Mercredi, Stony Rapids, Saskatchewan  
George Miller, former President and CEO, Mining Association of Canada, and former Co-Chair Whitehorse Mining Initiative Leadership Council, Ottawa, Ontario  
Robert W. Micsak, AngloGold Ltd., Englewood, Colorado  
Rick Mohr, Phelps Dodge, Tempe, Arizona  
Allan Moss, Rio Tinto Technical Services, Vancouver British Columbia  
John Mudge, Newmont Mining Corporation, Reno, Nevada  
Kathryn M. Mutz, Natural Resources Law Center, University of Colorado, Golden, Colorado  
Susan Nesbitt, University of British Columbia, Vancouver, British Columbia  
Ron Nicholson, Beak International Incorporated, Toronto, Ontario  
Ron Nielsen, Alcan Inc., Toronto, Ontario, Montreal, Quebec  
Albert Nitisza, Yellowknife, Northwest Territories  
Donna Marie Noel, Pyramid Lake Paiute Tribe, Nixon, Nevada  
Peter O’Connor, AngloGold North America Inc., Denver, Colorado  
Jim Otto, Institute for Global Resources Policy and Management, Colorado School of Mines, Golden, Colorado  
David Parker, Cominco Inc., Vancouver, British Columbia  
Dale Peniuk, KPMG, Vancouver, British Columbia  
Gordon Peeling, Mining Association of Canada, Ottawa, Ontario  
Gerry Pepper, Rio Tinto Borax, Valencia, California  
Merrell-Ann Phare, Centre for Indigenous Environmental Resources, Winnipeg, Manitoba  
Calvin Price, Placer Dome Inc., Vancouver, British Columbia  
Polly Quick, Bechtel Corporation, San Francisco, California  
Jim Rader, Business for Social Responsibility, San Francisco, California  
Jeremy Richards, University of Alberta, Edmonton, Alberta  
Norm Ringstad, British Columbia Environmental Assessment Office, Victoria, British Columbia  
Joe Ringwald, Canadian Institute of Mining and Metallurgy (CIM) and CREW Development Corporation, Vancouver, British Columbia  
Wendy Ripmeester, Natural Resources Canada, Ottawa, Ontario  
Andy Robertson, The Robertson Group of Companies, Vancouver, British Columbia

Jim Robertson, Placer Development Inc., Vancouver British Columbia  
Eric Rodenburg, United States Geological Survey, U.S. Department of the Interior, Reston, Virginia  
David Rodier, Noranda Inc., Toronto, Ontario  
David Runnalls, International Institute for Sustainable Development, Winnipeg, Manitoba  
Carol Cox Russell, Mining Team, United States Environmental Protection Agency, Denver, Colorado  
Roy Sage, Natural Resources Canada, Ottawa, Ontario  
Bernard Salome, World Bank Extractive Industries Review, Washington, D.C.  
Richard Sandbrook, MMSD Project Coordinator for the World Business Council for Sustainable Development and the International Institute for Environment and Development, London, England  
Paul Scheidig, Society for Mining Metallurgy and Exploration (SME), Littleton, Colorado  
Malcolm Scoble, Department of Mining Engineering, University of British Columbia, Vancouver, British Columbia  
Nola-Kate Seymour, International Centre for Sustainable Cities, Vancouver, British Columbia  
Shannon Shaw, Robertson Geo Consultants Inc., Vancouver, British Columbia  
Stephen Sheehen, Environment Canada, North Vancouver, British Columbia  
Deborah Shields, United States Forest Service, Department of Agriculture, Fort Collins, Colorado  
Glenn Sigurdson, CSE Group, Vancouver, British Columbia  
Jim Skinner, United Steelworkers of America, Newfoundland and Labrador  
Colin F. Smith, Consultant, Highlands Ranch, Colorado  
Walter Smith, CAMECO Corporation, Saskatoon, Saskatchewan  
Suzanne Stewart, URS Corporation, San Francisco, California  
Paul Sullivan, Sullivan Media, Vancouver, British Columbia  
Malcolm Taggart, Consultant, Whitehorse, Yukon  
John Tilton, Colorado School of Mines, Golden, Colorado  
Ian Thomson, Consultant, Social Dimensions of Mining, Hornby Island, British Columbia  
Shirley Tsetta, Yellowknife, Northwest Territories  
Dirk van Zyl, Mackay School of Mines, University of Nevada, Reno, Nevada, Facilitator, MMSD–North America  
Marcello Veiga, Department of Mining Engineering, University of British Columbia  
Gerd Wiatzke, Senes Consultants Inc., Richmond Hill, Ontario  
Maxine Wiber, BHP-Billiton, Toronto, Ontario  
Gregg Wilkerson, U.S. Bureau of Land Management, Bakersfield, California  
John Wirth, North American Institute and Stanford University, Stanford, California  
Milton Wong, HSBC Asset Management, Vancouver, British Columbia  
Chris Wren, ESG International, Guelph, Ontario  
Special thanks are due to Mike McPhie of Knight Piésold Ltd. who was seconded, fully supported, for the duration of the implementation phase. Our work could not have been completed without his effort, insight and good humour.

### **IISD Staff Support**

Don Berg (Graphic design, contracted by IISD)  
Dennis Cunningham (Fundraising)  
Shawna Curtis (Initial coordination)  
Kyle Fargey (*Mining Alert* newsletter)  
Bill Glanville (Project Committee)  
Karen Goulding (Administration)  
Art Hanson (Project Committee)  
Kristen Hildebrand (Overall administration and coordination)  
Jennifer Hirschfeld (Accounting)  
Darryl Kutzan (Accounting)  
Deborah Lehmann (Administration)  
Jason Manaire (Web development)  
Catherine Muir (Accounting)  
Marlene Roy (*Mining Alert* newsletter)  
David Runnalls (Chair, Project Committee)  
Jennifer Senenko (Accounting)  
Ian Seymour (Finance, Project Committee)  
Stuart Slayen (Publications management)  
Terri Willard (Information architecture)

### **Mackay School of Mines Staff Support**

Gary Righettini (Project Manager, Mining Life-Cycle Center, Workshops)

---

## **Disclaimer**

To as great extent as possible, participants in the activities of MMSD–North America were drawn from a range of interests including companies (small, intermediate, large, technical service and supply, financial services, industry associations); mining-affected communities; First Nations/Native Americans; non-government organizations; government; organized labour; and universities (teachers, researchers and students).

While participants were asked to share their knowledge and expertise, they were not asked to “represent” any organization. Further, while a great effort was made to incorporate everyone’s perspective and reach consensus on issues, neither participants nor their affiliated organizations (where they existed) were asked to endorse the results.

Ultimately, however, responsibility for the final outcome must be clearly assigned. In this case, while credit for the richness of this work lies with all participants, limitations that remain rest with us.

R. Anthony Hodge  
Dirk van Zyl  
Co-facilitators, MMSD–North America

## Contents

Dedication	iv
Acknowledgments	v
MMSD–North America Participants	vi
Executive Summary	1
1. Introduction	7
2. The Players	13
3. Lessons from the Past	29
4. Learning from the Future	37
5. Sustainability on the Ground	45
6. Change	51
7. Strategy for Change	55
Epilogue	69
Appendices	
1. MMSD–North America Project Design and Budget	71
2. MMSD–North America Recommendations and the Link to MMSD Global Recommendations and the ICMM Toronto Declaration Implementation Process	79
3. Summary of Recommendations from <i>Breaking New Ground</i> , The Final Report of MMSD Global	83
4. MMSD–North America Publications and Reports	87

## Figures

Figure 1	Communities of interest.	13
Figure 2	Size distribution of firms in the Canadian mineral production system.	14
Figure 3	Size distribution of firms in the U.S. metals production system.	14
Figure 4	Major forces driving change.	38
Figure 5	Scenario framework.	39
Figure 6	The mine life-cycle.	46
Figure 7	The Seven Questions at a glance.	47
Figure 8	Example from the full Seven Questions matrix.	48
Figure A1-1	The mine life-cycle.	75
Figure A1-2	The mine/minerals life-cycle.	76
Figure A1-3	Direct and indirect implications of mine/mineral activity.	77

## Tables

Table 1	U.S. and Canadian figures for gross revenues, contribution to GDP and employment.	15
Table 2.	Major groupings of the International Classification of Non-profit Organizations (ICNPO).	23
Table 3	Scenario signposts.	40
Table 4	Summary: scenario comparison.	42
Table 5	Change agent roles.	53
Table 6	MMSD–North America final recommendations in summary.	55
Table 7	Recommended action and follow-up process.	57
Table A1-1	MMSD–North America work plan tasks and objectives.	71
Table A1-2	MMSD–North America revenues (by source) and expenses (by task).	73
Table A1-3	Minerals and mineral products.	74
Table A1-4	Principles of participation in MMSD–North America meetings.	78



## Executive Summary

This report describes the work and results of Mining, Minerals and Sustainable Development North America (MMSD–NA). The project began with a scoping study in late fall of 2000 and was completed in late spring 2002 following a period of fundraising and a nine-month implementation period. The project was driven by four goals:

1. to assess global mining and minerals production and use in terms of the transition to sustainable development including the industry's track record and its current contribution to—and detraction from—economic prosperity, human well-being, ecosystem health and accountable decision-making;
2. to identify if and how the services provided by the minerals system can be delivered in accordance with sustainable development in the future;
3. to propose key elements of an action plan for improvement in the minerals system; and
4. to build a platform of analysis and engagement for ongoing cooperation and networking among all communities of interest.

MMSD–North America discharged its mandate through a facilitated, multi-interest process organized around the following tasks:

1. profiling of key interests and their concerns and a review of the past and current contribution of mining and minerals activities to people and ecosystems;
2. design and analysis of a range of likely future scenarios;
3. development of a practical way to assess the compatibility of mining/mineral activities with the concept of sustainability; and
4. development of a strategy for change.

### The Players and the Story of Mining and Minerals

Interests important to the mining/minerals industry include:

- the industry itself, including some 1,875 publicly-listed junior, intermediate and senior companies with head offices in North America;
- government including local, state/provincial and federal components;
- about three million indigenous people, many living in rural and remote areas where mining/mineral activities are most common;
- organized labour, which comprises about 30 per cent of the mining/minerals workforce;
- mining-affected communities encompassing several million people in several hundred towns and cities across North America;
- non-government organizations, a diverse set of hundreds of entities with diverse local, regional and international interests; and
- the academic support system with interest in mining including the hundreds of teachers, researchers, students, scientists and engineers who work in universities, technical institutions and research centres.

Special attention was paid to profiling the North American industry itself, a complex, interdependent, vertically and horizontally integrated production system. There are significant differences between the U.S. and Canada. A particular concern is that mining and minerals are far down the public policy agenda in the United States even though the industry's value ranks second in the world (after China).

Several centuries of mining/minerals activity in North America have contributed enormously to the development of the U.S. and Canada. However, many aspects of early mining/mineral activity (consistent with other industrial activities and the values of the time) were nothing short of vicious. As time has evolved, industry practices and the values of society diverged. Industry resisted change and eventually found itself on the defensive. The legacy of environmental and social damage is great and the mining industry is only now beginning to surface above the long shadow of history.

### **Learning from Scenarios of the Future**

Scenarios are stories of different futures, each of which is possible. They force a lengthening and broadening of perspective and, in so doing, bring insights that can improve today's decisions and actions. In this exercise, four scenarios were developed and explored in terms of:

- key insights each had to offer;
- major challenges facing the mining/minerals industry;
- actions needed to address these challenges; and
- implications if these actions were not taken.

In addition, signposts were developed that could help distinguish today which scenario might be emerging.

---

### **The Scenarios**

---

#### ***New Horizons***

In New Horizons, there is a coincidence of strong economic conditions and a high level of trust and respect characterizing overall societal values. For the most part, this same trust and respect is found among mining- and minerals-related communities of interest. Vision and change are guided through collaborative activity involving many communities of interest interacting in a constructive way. Confidence in the future is high.

#### ***Phoenix Rising***

In Phoenix Rising, difficult economic conditions serve to drive innovation. At the same time, respectful social values further facilitate positive change. The overall result is that difficult times give way to more encouraging conditions like a phoenix rising.

#### ***Perfect Storm***

In Perfect Storm, depressed economic conditions coincide with fractious social conditions. Here the spiral is downwards. The possibility of reversing the trend seems remote. A perfect storm emerges.

#### ***Money Divides***

The dominant force in Money Divides is an excess of money. However, rather than serving as a positive force, industry arrogance and societal divisions increase. Government stands back and watches money divide.

---

## **Sustainability on the Ground: The Seven Questions to Sustainability**

If ideas of sustainability cannot be brought to bear in a way that is meaningful for the explorer, mine manager or mill superintendent, they will be of little use. To address this challenge, MMSD–NA developed a robust, dynamic assessment framework that came to be called the *Seven Questions to Sustainability*.

Work on this front began with a review of 10 recent initiatives from government, the mining industry, non-government organizations, indigenous people and the financial services sector. The interrogative approach that emerged is based on the experience of auditors and evaluators. It has the capacity to provide clear, practical guidelines on applying sustainability at the project or operational level, and in the process:

- establish consistency across applications, reduce confusion and achieve efficiencies; and
- clarify the case for sustainability.

From the Seven Questions falls a hierarchy of objectives, indicators and specific metrics. Simultaneously, the starting point for assessing the degree of progress is provided by an “ideal answer” to the initial question. In this way a single, initial motivating question— is the net contribution to sustainability positive or negative over the long term?—cascades into progressively more detailed elements which can be tailored to the project or operation being assessed. In practice, the details of indicators and specific metrics will be dependent on the phase of the life-cycle under consideration as well as the specific site conditions.

In application, the Seven Questions approach is highly versatile and has the potential to aid in a range of practical decision-making applications.

---

### **Potential Applications of the Seven Questions Approach**

---

- *Early appraisal:* can/should a project or operation be acquired or implemented?
  - *Planning:* what do we do and who do we involve?
  - *Financing and insuring:* does the overall risk reflected in the project or operation lie within an acceptable range?
  - *Licensing and approvals:* does the project pass or fail?
  - *Internal corporate reviews:* how are we doing, what’s missing and how do we do things better?
  - *Corporate reporting:* how and what do we communicate?
  - *External review:* from the perspective of an external interest, how is the project or operation doing?
- 

## **Change and Mining/Minerals as a Learning Industry**

The deep heritage of the mining/minerals industry underlies the huge contribution it has made to today’s world. However, this same heritage brings with it an innate resistance to change that has impeded the profound cultural adjustment that the industry is now facing.

In facilitating progress, change agents play different roles and must employ different strategies depending on: the change being sought; the particular point in the change

process; and the degree and nature of the resistance. Four of these roles are: catalyst, solution giver, process helper and resource linker. Clearly, if the whistle-blowing strategy of a catalyst is used at a moment when the problem has been fully recognized and effort is needed to design a solution, the results will be something less than satisfactory.

Long-lasting organizations—those that achieve a kind of internal sustainable development—are those with a capacity to have memory, adjust to change and to reach out and actively participate in the development of the operating and social environment in which they exist. This improves their own situation and the situations of others. These are learning organizations and they achieve change through relatively smooth and gradual processes, a type of transition that is more efficient than alternating abruptly between crisis and stability like the boom-bust pattern that has been a traditional part of the mining/minerals industry.

The work of MMSD–NA is a small step in helping the mining and minerals industry to become a “learning” industry.

### **Strategy for Change**

Participants of MMSD–NA eventually zeroed in on 10 priority recommendations.

---

## **MMSD–North America Final Recommendations**

---

### **The Legacy Issue**

#### *Immediate Priority*

1. Enhance effort to address the legacy of past mining and mineral activities.

#### *Longer Term*

2. Strengthen the basket of legislated rules, market incentives and voluntary programs to prevent the same from happening in the future.

### **Improving Practices**

#### *Immediate Priorities*

3. Initiate a series of pilot tests as the next step in the collaborative development of the Seven Questions to Sustainability framework.
4. Design and implement effective approaches for rewarding good and discouraging poor performance within the context of sustainability as indicated by the Seven Questions framework.
5. Design and implement a set of effective dispute resolution mechanisms tailored for application across the full life-cycle of mining and mineral projects.
6. Review and optimize the rules and systems for designating and controlling recyclable material and hazardous waste to encourage recycling while maintaining safety.
7. Develop and implement a practical approach to addressing the equity issue at the project/operational level.

#### *Longer Term*

8. Initiate a review of the current financial/business/economic decision support model and the processes used in its application in the mining and minerals industry to identify how ecological and social costs, benefits and risks can be more effectively incorporated.

### **Enhancing Capacity**

9. Strengthen the learning and research/development system in support of the North American mining and minerals industry to avoid serious human resource problems within the next decade.

### **Monitoring and Reporting on Follow-up**

10. Create a mechanism to facilitate follow-up activities and report on MMSD–North America outcomes, 2002–2007.
- 

In the full report, the issues underlying each of these recommendations are described. In addition, organizations are identified who have signalled a willingness to convene the multi-interest groups needed to design the detailed work plans and resource strategies for implementation. In all cases, the proposed follow-up is based first on encouraging existing relevant initiatives where they are already underway and, secondly, on facilitating partnerships between interests. In so doing, the recommendations attempt to maximize efficiencies and the possibility of achieving concrete results while continuing the “platform for engagement” as called for in the goals of MMSD.

### **Limitations in the Work of MMSD–North America**

Four important limitations in the work of MMSD–NA require mention. Firstly, available resources did not allow the inclusion of Mexico. In today’s context of the North American Free Trade Agreement and growing international linkages, undertaking a “North American” review without Mexico is cause for significant concern.

Secondly, resources also precluded direct examination of the implications of offshore activities of North American-based companies as well as the North American activities of offshore-based companies.

Thirdly, while we tried to involve as many individuals and organizations as possible in an effort to engage a full and balanced spectrum of interests, ultimately we fell short. We are pleased with the significant reach we had, but we recognize the importance in any follow-up work of nourishing and expanding the networks established through MMSD–NA.

Lastly, the nine-month time frame for implementation within which MMSD–North America worked served as a significant constraint even though it added a degree of pressure that led to tremendous productivity within a very short period of time—thanks to the high energy and quality of everyone’s contribution.

### **Towards Change**

Ultimately, the motivation for applying the concept of sustainability comes from a quest for security for:

- our communities and their families;
- the local and regional economy that serves the well-being of people and ecosystems;
- mining companies seeking greater confidence in land tenure, strong prices and the opportunity to continue doing what has brought them together in the first place; and
- the environment in the hopes that the foundations of all life will be maintained over time and that the quality of life for generations to come will be even better than the quality of life we have enjoyed.



Together, these elements form the foundation for a social licence to operate and it is the pursuit of security that lies behind the Strategy for Change. If the Strategy's recommendations are not effectively pursued, mistrust will continue and the credibility of government and industry will decline.

There is now a window of opportunity to continue:

- the relationship-building that lies at the core of MMSD–North America activities;
- collaborative development of a practical and meaningful language of sustainability;
- collaborative exploration of the benefits, costs and risks associated with supplying mineral-based materials to society;
- enhancing non-industry understanding of mining/minerals issues; and
- enhancing industry's understanding of the values of society.

The initiation of MMSD–North America has provided an opportunity for the mining and minerals industry to step forward in a new, creative and collaborative way to deal with the tough issues that it faces. In response, many individuals and organizations from inside and outside the industry have enriched the outcome and helped set the stage for future interaction.

By initiating this process, the mining and minerals industry has demonstrated a kind of leadership that has not been characteristic in the past. It is a leadership that has greatly enhanced the chance that the legacy this generation leaves for the future will be a cause for pride.

# I. Introduction

## Origin and Goals

The mining industry has entered a time of major transition. It is being driven by a rapidly shifting global marketplace and increased public concern related to the environmental and social implications of mining activities. The breadth and pace of this change are without precedent.

A broad array of interrelated technical, environmental and social issues face the mining/minerals community. Legal and financial implications have multiplied as investors, indigenous people, communities, non-governmental organizations and other interests apply increasing scrutiny to mining operations. With the immediacy of worldwide communications, local incidents become global news overnight. Not surprisingly, across the world, regulatory systems—financial, environmental and social—are also in a state of flux.

In 1999, nine chief executive officers of some of the world's largest mining companies came together in Davos, Switzerland. Driven by a sense that an uncomfortable gap had emerged between mining/minerals-related practices and the values of today's society, they voiced a concern that their "social licence to operate" was in jeopardy.

Working through the World Business Council for Sustainable Development (WBCSD), they initiated the Global Mining Initiative (GMI). As part of GMI, they then commissioned the International Institute for Environment and Development (IIED, London) to undertake a review that would lead to the identification of how mining and minerals can best contribute to the global transition to sustainable development. The resulting project, Mining, Minerals and Sustainable Development (MMSD), has been driven by the following four goals:

1. to assess global mining and minerals use in terms of the transition to sustainable development—its track record in the past and its current contribution to and detraction from economic prosperity, human well-being, ecosystem health and accountable decision-making;
2. to identify if and how the services provided by the mineral system can be delivered in accordance with sustainable development in the future;
3. to propose key elements of an action plan for improvement in the minerals system; and
4. to build a platform of analysis and engagement for ongoing cooperation and networking among all communities of interest.

As part of its delivery mechanism, MMSD Global created a suite of independent regional activities with partners operating in Southern Africa, South America, Australia and North America. In North America, the International Institute for Sustainable Development (Winnipeg) has served as the regional partner working in concert with the Mining Life-Cycle Center, Mackay School of Mines, University of Nevada (Reno).

This report provides a synthesis of the activities and results of MMSD–North America as they emerged through two phases of activities. Initial analysis and project design took place during late fall of 2000 and early spring of 2001. Following a period of fundraising, implementation occurred in the nine-month period from July 31, 2001, to May 2002.

## The North American Context

In North America, a rich and complex web of activities forms the backdrop for MMSD (Project Mining Team, 2002). Some of the elements are:

- significant parts of North America's land tenure and management system are in a state of adjustment reflecting a recognition of the rights of aboriginal peoples. In British Columbia alone, dozens of treaty negotiations are slowly proceeding with the mining/minerals industry, often expressing a sense that they are caught in the middle of a continuing jurisdictional tug-of-war, unable to be sure of land tenure and management conditions;
- the diverse non-government community is increasingly active on many fronts. What was, 20 years ago, a fairly unconnected community of people and organizations is now highly linked and often operating cooperatively;
- examples are arising of companies actively reaching out directly to indigenous people and non-government organizations seeking input on internal policy and procedures that until now have been closely guarded internal matters;
- similarly, there are a growing number of cases in which indigenous and non-government organizations are reaching to companies to partner on projects of mutual concern;
- national and provincial/state mining associations are taking an active interest in sustainable development-related issues. The Mining Association of Canada has a Task Force on Sustainable Development that will move into its third year of activity in 2003. The Prospectors and Developers Association of Canada is actively exploring sustainability ideas as is the Northwest Mining Association in the U.S. The Manitoba Mining Association has been actively working with the World Wildlife Fund in developing an innovative approach to screening land areas simultaneously from ecological sensitivity and mineral potential perspectives;
- academic institutions that focus on mining are integrating concepts of sustainable development in their curriculum; funding is being sought in the U.S. and Canada for centres of excellence that focus on mining and sustainability;
- federal and provincial/state/territorial governments are pursuing sustainable development-related policies and actions. For the Government of Canada, sustainable development is a central policy thrust and Natural Resources Canada has been pursuing application of this policy to mining and minerals for a number of years. An active and ongoing, multi-stakeholder project is focusing on developing indicators of sustainability for mining and minerals. In the U.S., a similarly broad, collaborative, multi-party initiative aimed at indicators of sustainability for mining is being led by the U.S. Forest Service and the U.S. Geological Survey;
- much of the current Canadian activity builds from earlier work that came to a head through the Whitehorse Mining Initiative (WMI) which reported out in November 1994. WMI was a multi-stakeholder process that linked five sectors of society: the mining industry, senior governments, labour unions, aboriginal peoples and the environmental community. For some, particularly those associated with the mining industry, follow-up to WMI occurred at an expected rate and fashion. For others, WMI set in place expectations that were not met: adequate follow-up mechanisms were not established and activity lapsed. Regardless of today's alternative perspectives on past events, a broad base of relationships was established through WMI upon which MMSD–North America was able to build.
- in the U.S., major programs now exist to support development and application of the principles of alternative/environmental dispute resolution reflecting a shift

away from the adversarial character that is ascribed by some to the U.S. regulatory system; and

- in Canada, major court decisions in the last 10 years, particularly related to aboriginal rights, seem to be introducing an adversarial character to a regulatory system that in the past has often been described as more collaborative than that found in the U.S.

## **The Five Tasks of MMSD–North America**

MMSD–North America development, design and budget are summarized in Appendix 1. The following five tasks were ultimately designed and implemented:

### **1. *Story/Profile (Profile of Interests and Lessons from the Past)***

*Objective A:* to develop a profile of the North American mining Industry (U.S. and Canada) from the perspective of the nature of the companies that comprise the industry.

*Objective B:* to articulate the contribution and implications of mining (to people and their communities, to ecosystems and to economies) through the eyes of various communities of interest and as it has changed over time.

### **2. *Scenarios (Lessons from the Future)***

*Objective A:* to develop a set of scenarios that bracket the likely futures to be faced by the North American mining and minerals industry and the related communities of interest;

*Objective B:* to use the scenario-building exercise as a means to identify and discuss:

- risks and opportunities;
- issues, challenges and areas of consensus and disagreement on their resolution; and
- potential prescriptions (aimed at any or all of the communities of interest) for adjusting mining- and minerals-related policy, practices, behaviour and infrastructure.

### **3. *Test/Guideline for Sustainability (Practical Application for the Project or Operation)***

*Objective A:* to develop a set of practical principles, criteria and/or indicators that could be used to guide or test the exploration for design, operation and performance monitoring of individual, existing or proposed, operations in terms of their compatibility with concepts of sustainability;

*Objective B:* to suggest approaches or strategies for effectively implementing such a test/guideline.

### **4. *Strategy for Change***

*Objective:* to collaboratively develop a “Strategy for Change” comprising specific actions and timelines for the North American mining industry and related communities of interest to meet in moving towards sustainable development.

### **5. *Final Report***

*Objective:* to synthesize and communicate the results of MMSD–North America.

## Report Organization

The organization of this report is a reflection of the above tasks.

Immediately following this introduction, Section 2 summarizes the current players and their concerns. Section 3 describes a number of insights that arose from the review of the past contribution of mining and minerals to people and ecosystems of North America. Section 4 matches this retrospective with a prospective stance. It reports on the results of a scenarios analysis that looks forward to test the preparedness of the current players to meet the range of possible futures that they may face. In so doing, an innovative approach is taken to identifying risks and opportunities to enhance effectiveness.

The two work elements captured in Sections 3 and 4 offer a broad perspective. In contrast, Section 5 turns the focus to activities on the ground. It provides a summary of “Seven Questions to Sustainability,” an assessment framework that leads to a determination of whether a mine or mineral operation results in a net positive contribution to people and ecosystems over the long term. The approach serves to clarify the practical application of sustainability concepts across the complete life-cycle of mine and mineral activities from early exploration through to post-closure.

In its work, MMSD–North America attempted to involve the complete range of implicated communities of interest wherever possible. In the process of doing so, much was learned about nourishing change when many such interests are focused on a complex industry like mining and minerals. Section 6 provides an overview of change, the different roles that are possible in nourishing change and the relevant insights that were learned through the MMSD–North America experience.

Through each of the MMSD–North America work elements, recommendations arose regarding how mining and minerals can best contribute to the global transition to sustainable development. An initial set of these recommendations was vetted at the first North American Mining Dialogue held in Vancouver at the Morris J. Wosk Centre for Dialogue (Simon Fraser University). A second iteration was subsequently circulated for comment.

Through this process, 10 of the many recommendations arose to be the top priorities in terms of:

- urgency and usefulness for the industry and others;
- opportunity to continue the relationship-building that MMSD–North America facilitated; and
- opportunity to continue the collaborative exploration of sustainability concepts and their practical application to mining and minerals and beyond.

These 10 recommendations are brought together in the Strategy for Change described in Section 7.

## Limitations

From the beginning, MMSD–North America followed an ambitious plan. However, some significant limitations need mention. First and foremost, available resources did not allow the opportunity to link with Mexico. In today’s context of the North American Free Trade Agreement and growing international linkages, undertaking a “North American” review without Mexico is cause for significant concern. In follow-up to MMSD–North America, this gap is a top priority for rectification.

Secondly, the reach of many North American-based mining and mineral companies is international in scope and many offshore-based companies are active here in North America. In addition, many non-industry North American communities of interest including regulators, environmental organizations, social justice organizations, indige-



nous peoples and mining communities have also established similar global links. The implications of this international interconnectedness are only now emerging and MMSD–North America did not have the resources to examine this topic.

Thirdly, the results of the various MMSD–North America workgroups obviously reflect the values and preferences of participants. In turn, this is a function of who participates. Here, two issues arise. First, although great effort was made to involve as many individuals and organizations reflecting as broad a spectrum of implicated interests as possible, many potential participants who could have greatly enriched the process were left out. Second, as a result, while much effort went to ensuring that a fair “balance” was achieved between communities of interest—Americans and Canadians; men and women; indigenous and non-indigenous; major companies and juniors; geographic representation; and so on—success was not always achieved. This challenge is likely never-ending. However, the networks created through MMSD–North America should not be left to wither on the vine. They have taken great effort to develop and in the follow-up that is ahead, they should be used as a foundation for future expansion.

Fourthly, the nine-month time frame for implementation that MMSD–North America was working within served as a significant constraint even though it added a degree of pressure that led to tremendous productivity within a very short period of time.

In hindsight it is easy to look back and recognize the above kinds of limitations. All of these hint at issues that need further attention in the future. Regardless, MMSD–North America accomplished an extraordinary amount and the quality of participation was high without exception.

### **Security and the Social Licence to Operate**

Ultimately, the motivation for applying the concept of sustainability comes from a quest for security for:

- our communities and their families;
- the local and regional economy that serves the well-being of people and ecosystems;
- mining companies seeking greater confidence in land tenure, strong prices and the opportunity to continue doing what has brought them together in the first place; and
- the environment in the hopes that the foundations of all life will be maintained over time and that the quality of life for generations to come will be even better than the quality of life we have enjoyed.

Together, these elements form the foundation for a social licence to operate. In the discussion that now follows, MMSD–North America’s contribution towards strengthening this foundation is described.

### **Reference, Section I**

Mining Project Team, 2000. “MMSD–North America Working Draft Action Plan, December 11, 2000.” Winnipeg: International Institute for Sustainable Development. Also available on the web: <http://www.iisd.org/mmsd/>



## 2. The Players

### The Mining/Minerals Industry

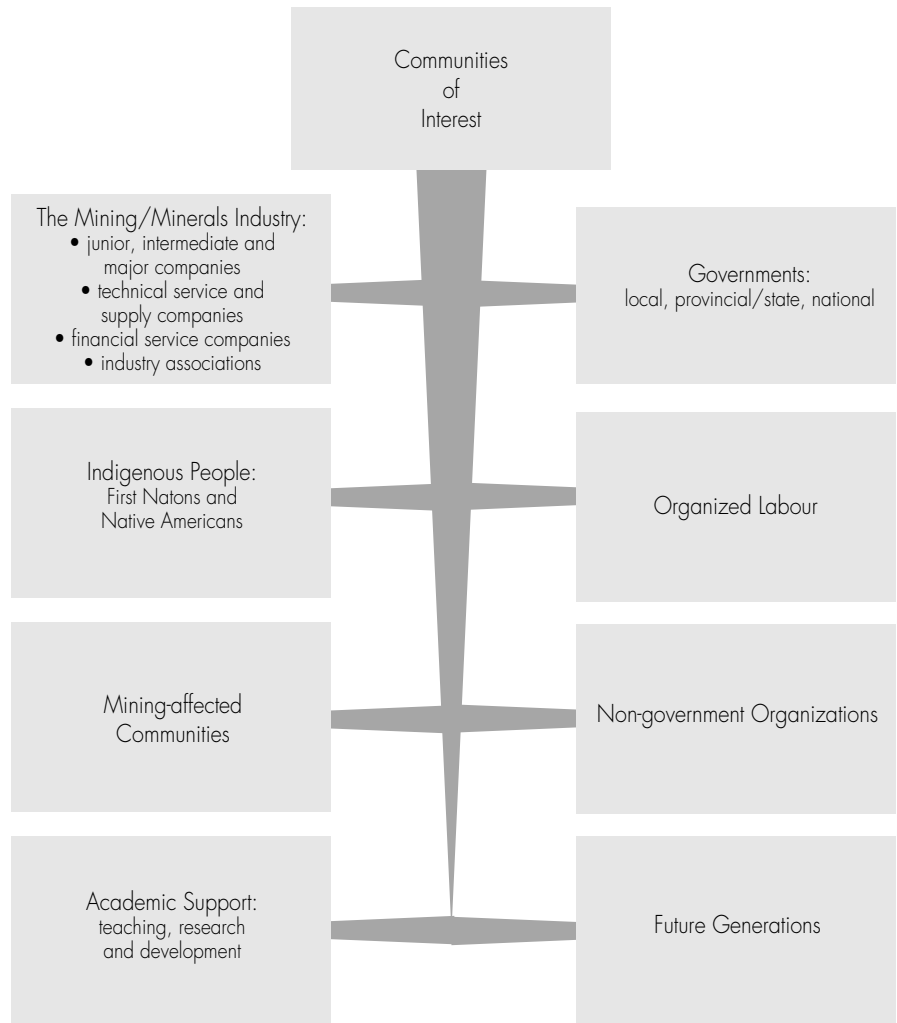
#### The Mining Companies and Their Concerns

Nine senior mining companies initiated the Global Mining Initiative. Of these, seven maintain significant North American interests. Ultimately, the circle of participating companies to GMI expanded to 29 of which 12 are major players in North America. However, a focus on these companies alone would give a seriously incomplete picture of the mining/minerals activities. The following material is summarized from MacDonald (2002) who was commissioned by MMSD–North America to provide a comprehensive overview of this complex sector.

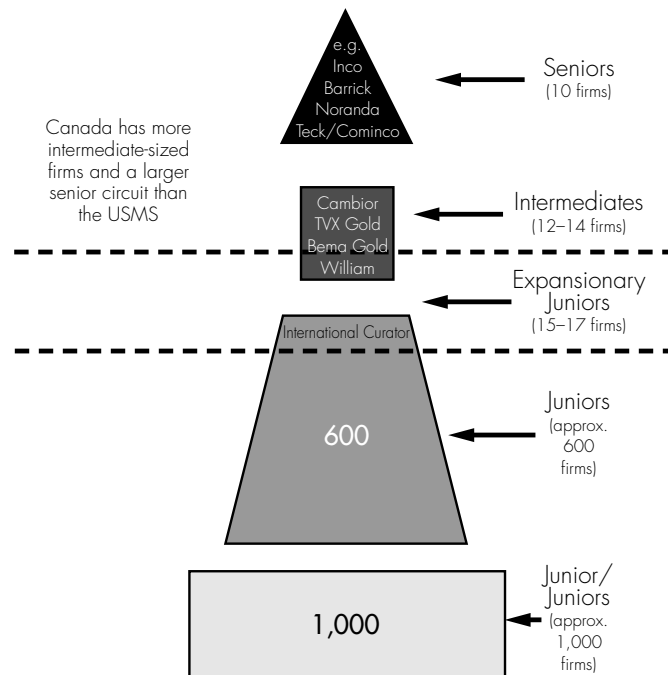
In Canada, and limiting the discussion to metals and non-metals (see Appendix 1; this focus does not include structural and energy minerals), there are about 1,650 discernable mining companies (publicly traded with head office in Canada) consisting of 39 “large firms” (assets over CDN\$100 million) and over 1,600 “small firms” (PDAC, 2001). In the U.S., this profile is very different. It includes about 225 firms of which 11 would be “large” and the remainder “small.” Figures 2 and 3 provide a more detailed picture of the size distribution of firms in both countries. Note that because of definitional differences in statistical categories, only general conclusions should be drawn from comparing these two figures.

The industry is an integrated production system, with companies occupying identifiable niches and using various business strategies to reduce risk and create opportunities for growth and upward mobility in the system. The production system is highly interdependent and vertically and horizontally integrated, among and between companies and along the product chain.

**Figure 1.**  
**Communities of interest.**

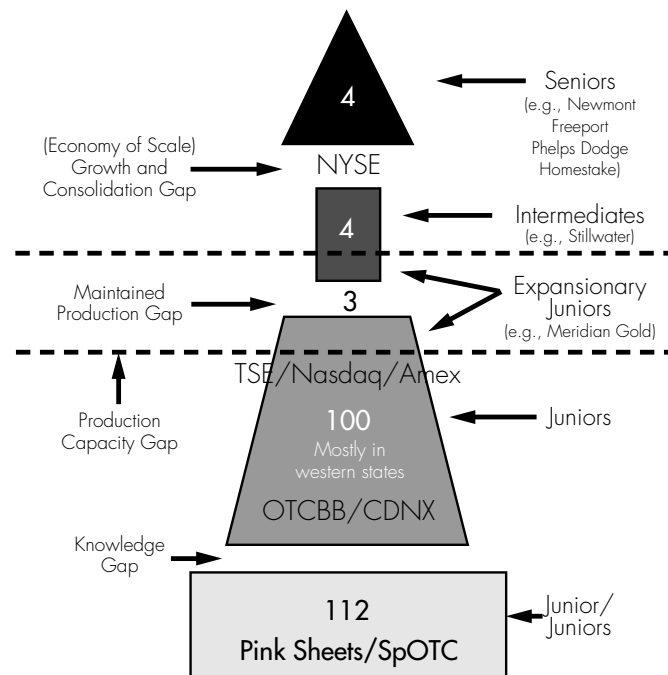


**Figure 2. Size distribution of firms in the Canadian mineral production system.**



Source: MacDonald, 2002

**Figure 3. Size distribution of firms in the U.S. metals production system.**



Source: MacDonald, 2002

The difference in the number of small companies reflects the vibrant universe of exploration companies based in Canada whose reach includes about 100 countries around the world (NRCan, 2001) of which the U.S. is first and foremost.

With few of the small companies involved in production, it is not surprising that from a “value of production” perspective, the picture is quite different. Table 1 provides a comparison on this basis along with employment numbers for each country.

**Table 1. U.S. and Canadian figures for gross revenues, contribution to GDP and employment. (Note that an exact U.S. – Canada comparison cannot be made because of definitional differences in the statistical categories.)**

Indicator	Canada, year 2000	U.S., year 2000
1. Revenues from all mining including metals, non-metals, structural and energy minerals (reported by the World Bank as quoted in Macdonald, 2002): total and world rank	CDN\$24 billion, world rank number six behind China, the United States, Australia, South Africa and Russia	US\$40 billion, world rank number two after China
2. GDP from metal and non-metal mining (excluding coal), total and percentage of GDP	CDN\$7.6 billion, 0.8 per cent of \$930 billion, all industries	US\$9 billion .09 per cent of \$9.8 trillion National GDP
3. Direct employment, all mining, total and as percentage of national workforce	388,911 (NRCan, 2002. Includes extraction and concentrating, smelting and refining, non-metals and metal-based semi-fabricating industries, and metals fabricating industries, also uranium and coal) 2.6 per cent of national workforce of 15 million	267,207 (NMA, 2002. Includes metals, non-metals, coal, sand and gravel, and stone) 0.2 per cent of national workforce of 146 million
4. Direct employment, metal and non-metal mining, excluding coal (extraction and concentrating), total	45,595 (Drop from 83,097 in 1980, a change of 45 per cent, NRCan, 2002)	40,500 (Drop from 98,200 in 1980, a change of 59 per cent, U.S. Bureau of Labour Statistics, 2002)

These figures point to a remarkable story. The U.S. mining industry is the second largest in the world after China, but leads the world in the sale of mining goods and services. Despite this, mining is a very small part of the enormous U.S. economy.

In absolute terms, the Canadian industry is economically smaller, but plays a larger role in the national economy in terms of GDP and employment. The Canadian industry currently enjoys greater access to venture capital and mine financing and its long mining tradition is marked by a culture of innovation, sharing and risk-taking in Canada as well as overseas. There are roughly eight times more publicly listed mining companies in Canada and many of the companies active in the U.S. are Canadian based.

Since the mid-1980s, the combined effects of low metal prices, increased costs (part of which is related to environmental and land use regulations), social and political pressures, and revised mining claim laws in the U.S., has resulted in reduced investment in mining in both countries. In addition, employment has dropped in both countries (in metal mining, by 45 per cent in Canada and by 59 per cent in the U.S.) although, in terms of the value of mineral production, this has been more than offset by dramatic technology-driven productivity increases that outpace all other industries.

What this leads to in the U.S., in spite of the fact the U.S. mining industry is the largest in the world, is a weak and weakening political position for the industry. As a result, it is difficult to get policy concerns addressed at the highest decision-making levels in the country. Unfortunately, because of the significance of the industry at the global scale, the effects of this situation are felt far beyond the U.S.

In fact, in both countries the industry is in transition. During the last five years, consolidation among the larger companies has been matched by attrition among the juniors, resulting in an overall reduction in the number of active firms. Furthermore, the move to invest offshore that began in the early 1990s, mostly in Latin America where the opportunities are seen as both richer and more accessible, shows little sign of reversal.

### *Concerns*

Within North America, the concerns of the industry are dominated by the perennial questions of access to land and access to financing, together with sustainability-related issues, including:

1. *The public perception of mining* (generally benign or positive in Canada and overwhelmingly negative in the U.S.) and the image projected in the popular media (generally negative/sensationalized regardless of constituency) and the need for the industry to address this proactively. In a very real sense, the industry is hostage to the image created by its own legacy of rape and run. This negative image affects political decisions and, particularly in the U.S., has led to the opinion that mining is a pariah, sunset industry.
2. *Survival*, of which two aspects are of note:
  - Over-regulation of the industry in the areas of corporate governance (most affecting the junior sector and applied following the Bre-X scandal) and financial reporting, and also environmental regulations and permitting process for new mines (particularly in the U.S.). Both add costs and time, and are seen as stifling the creative capacity of the industry.
  - The challenge of sustainable development. Many in the industry are intrigued with this concept but believe that the “three legged stool” (environment, economy and social) has been built on two strong legs and one withered leg. The weakest leg is economic viability; the need to generate profits and value for shareholders has been forgotten.
3. *Declining political influence* in Canada and (except for the all important energy minerals) effective loss of political power in the U.S. The industry is being forced to find other ways to advance its case, including direct interaction with the public. This is new, untried and uncomfortable territory for miners.
4. *Trade barriers that limit recycling*. The North American Free Trade Agreement has generally favoured mining and metals, opening markets across the continent. It has not helped the recycling of metals, however. Because of international conventions, recycling remains, for the most part, tied within borders because of the fact that much scrap metal becomes classified as toxic waste when it crosses the border between the U.S. and Canada.



5. *The relationship among and between junior, intermediate and senior companies.* These companies have different time frames, needs and cultures but are nevertheless intimately related through the production system. In terms of sustainable development, large companies tend to see embracing sustainability as a value added process, while many juniors see it as an added cost. This leads to a simplistic assertion that the juniors lack the ability to adopt sustainable development practices, while practical experience has shown that, when they want to, these small organizations can change much more quickly than the larger, more formally structured operating companies.
6. *The challenge of going international.* By going international and being successful, Canada, in particular, may become victim of this very success. By transferring expertise offshore and further developing it overseas, a concomitant loss of expertise may occur at home, weakening the capacity of the home country to sustain its own industry.
7. *The “greying” of the industry.* For some time, particularly in the U.S., the industry has had problems attracting new, young professionals and skilled tradespeople, leading to a steady rise in the median age of the workforce. In the U.S. the median age of membership in the Society of Mining Engineers (SME) rose from 47.5 to 49.5 between 1995 and 1998, while the number of under 25 year-old members fell from 198 to 104 (SME, 1999). Nowhere is this greying more evident than in the exploration sector—the very future of the industry—where new mines are discovered and evaluated. Data from Canada (CGC, 2001), where the industry is much stronger than in the U.S., indicate that fewer than one in six geoscience professionals (geologists, etc.) are under 40.

### **Technical Service and Supply Companies**

The North American mining industry is supported by an extensive network of consultants, contractors and service and supply companies, based principally in Toronto, Vancouver and Denver. These range in character from small, often highly specialized firms to large, integrated accounting, law, engineering, construction and environmental organizations such as KPMG, Hatch, Bechtel Corporation, McCarthy Tetreault, AMEC and Golder Associates. Many aspects of the work of the mining industry are routinely assigned to the service sector, including drilling, the design and construction of new mines and, most notably, the environmental, social and legal studies required for regulatory approvals. In some cases, mining is carried out under contract, leaving the marketing of mine products to the company owning the resource. Contract mining may well significantly increase in the future. Consultants and service companies are particularly numerous and prominent in the exploration phase of the mine cycle.

A significant issue is ensuring the consistency of policy and the maintenance of standards between owners and contractors. In addition, contractors are well-placed, if encouraged, to play the role of change agent in introducing improved practices.

### **Concerns**

The service sector shares the greater industry concern for its survival in North America, and also how to successfully participate in the new international arena. In terms of sustainable development, the service sector is realigning to provide a reservoir of expertise in management, engineering, environmental and social aspects of the mining industry, which is available to all corporate interests. On the other hand, it is not clear that all actors properly understand the full dimension of sustainable development. Furthermore, it will be important that those involved in activities with direct social and environmental impacts, such as drilling and construction companies, are themselves held to the highest standards of social, environmental and corporate responsibility.

## **Financial Service Companies**

The North American capital markets are of enormous importance to the mining industry, both in the form of equity raised on the Toronto, CDNX, New York, NASDAQ and over-the-counter markets, and debt financing of new mining projects through banks and other financial institutions. Interestingly, the increase in scrutiny felt by the mining companies is also being felt by the financial service industry. However, in this case, the lead is not so much by non-government organizations but rather by regulatory agencies acting on behalf of investors who are increasingly vocal about the values reflected in their investments. The rise of the corporate social responsibility and ethical investment movements reflects this phenomenon and the recent train of large corporate bankruptcies in the U.S. will reinforce this trend.

### **Concerns**

The priorities of this sector are risk management and rate of return. In the current context this creates two important scenarios:

1. A growing number of shareholders and financial institutions, including banks and insurance companies, have come to see a proven corporate commitment to sustainable development by mining companies as a proxy for good management, lower risk and potentially better returns.
2. On the other hand, corporate ethics have no role in the majority of equity decisions—those made seeking short-term capital gains from swings in commodity prices or the highly speculative junior exploration sector.

### **Industry Associations**

There are a significant number of mining/minerals industry associations in North America. Some are national in scope; many operate at a provincial/state level where much of the regulatory responsibility lies.

These organizations serve to coordinate, support and provide advocacy and educational services for their memberships. Sustainable development has now become part of their vocabulary, with nascent initiatives such as the Task Force on Sustainable Development of the Mining Association of Canada and the Sustainable Development Policy Workgroup of the Northwest Mining Association.

A cultural distinction can be observed between the U.S. and Canada, with industry associations in the latter more willing to engage with non-governmental organizations and other critics of the industry, a process that began in 1994 with the Whitehorse Mining Initiative. The inherently litigious nature of U.S. society has tended to foster an atmosphere of confrontation around the industry. In turn, this stance has been reflected in the posture of many of the industry associations although there are signs that this situation is changing.

### **Government**

Governments (on behalf of society) provide the overall framework of rules in which markets function and social processes take place. They create the macroeconomic and political conditions for economic development. In North America, the differences in approach taken by governments in the United States and Canada are significant.

In Canada, the constitution assigns management of natural resources to the provinces, which take a lead role in establishing the regulatory regime governing mining except on federal lands which include the Yukon, Northwest Territories and Nunavut. The federal government has special responsibilities related to fisheries and oceans, environment, and health and safety that complicate the picture and can lead to overlap in jurisdiction. However, for the most part, the federal government assumes a coordinating role.

Furthermore, mining is an important part of the economy and receives significant support and attention from government. Its social and political significance is shown by the fact that the sector is strongly represented at the ministerial level, either directly or in shared portfolios. Despite this consensus that mining is important, differences in the details of priority and action exist between the federal and provincial governments and between the industry and all levels of government, leading to tensions. There is, however, a tradition of negotiation and shared responsibility in Canada that encourages identification of common objectives and resolution of differences (even if for some, this leads to much talk and not so much action).

In the U.S., the situation is very different. At the base of the regulatory system lie three aspects of law:

1. the Mining Law of 1872 under which tenure over a mineral discovery on public lands was assured by staking a claim, undertaking minimal annual assessment work and paying \$5/acre to affect a transfer of ownership to individuals or companies;
2. a series of leasing acts starting in the World War I era in which coal and industrial mineral extraction necessitated a payment of royalties for the use of public lands; and
3. a series of laws governing the relationship between private landholders and mining companies, providing for fair compensation.

The 1872 Mining Law remains, having survived many attempts at amendment. Over time, underlying regulatory controls have evolved, resulting in what has been described as “an intricate web of federal, state, and local laws and restrictions dealing with mining... complicated by inconsistencies in policy goals, uneven enforcement and overlapping jurisdictions in enforcement agencies” (as described by Dempsey, 1973 and quoted in Cameron, 1981).

Few are happy with the current state of affairs. However, with the low priority that mining enjoys with political decision-makers, there appears to be little chance that change will occur. Interestingly, the recent catapulting of security concerns to the highest priority of government as a result of the September 11, 2001, tragedy may re-kindle interest in security of supply of minerals and metals which in turn may finally provide the impetus to re-craft the regulatory and policy regime governing mining and minerals.

### *Concerns*

Current priorities for governments in Canada are generally supportive of mining (although the industry is not necessarily comfortable or satisfied with the current situation) and include:

- dealing with abandoned and orphaned mines;
- securing access to land through resolution of outstanding aboriginal land claims and long-term land use planning;
- a regulatory regime that balances development with the protection of people and the environment;
- fiscal policies that encourage mining; and
- incorporating sustainable development principles into policies and regulations.

In the U.S., a priority for the Bush administration is to encourage the energy sector, including coal. Yet, in metal mining, the emphasis appears to remain one of enforcing environmental controls and responding to public outrage towards the legacy of abandoned and orphaned mines. This partly explains the embattled sentiments felt by many

mining people who see environmental activists and distant economic and social interests taking precedence over mining in the western states.

On a more positive note, the link between sustainable development and mining has been the consistent focus of an intergovernmental team led by the U.S. Forest Service (upon whose lands many mining activities take place).

### **First Nations/Native Americans**

Indian Nations had always been considered as distinct, independent political communities, retaining their original natural rights, as the undisputed possessors of the soil... The very term "nation," so generally applied to them, means "a people distinct from others." – *John Marshall, 1832, Worcester v. Georgia, 31 U.S. (6 Pet.) 515, 561.*

In the U.S., "Indian America" is made up of more than 550 tribes, with a total population of just less than two million. It is the youngest, fastest growing population in the nation. Nearly 40 per cent of all American Indians and Alaskan Natives are under the age of 20. About 20 per cent of the total American Indian and Alaskan Native population reside on 314 reservations, Indian lands and in Alaskan Villages that make up Indian Country. American Indians and Alaskan Natives have a land base of approximately 3.6 million square miles. It is made up of American Indian and Alaskan Native trust lands totalling approximately 56 million acres and Alaskan Native lands totalling approximately 44 million acres.

While economic conditions in Indian Country have improved in recent years, American Indian and Alaskan Native communities continue to lag behind the rest of the United States with respect to social, economic and educational attainment levels. Income levels between American Indians and Alaskan Natives are substantially below those of all other Americans, and some 31 per cent continue to live below the poverty level. In comparison, the national poverty level in 1990 was 13 per cent. Complicating factors such as geographical isolation, underdeveloped physical infrastructures and demographics, add to the challenges confronting tribes as they work toward a better standard of living and quality of life for tribal peoples (Department of the Interior, 2002).

The aboriginals of Canada include (from the Department of Indian Affairs and Northern Development, 1995):

- Status Indians (as defined by the Indian Act);
- Non-status Indians (descendants who have lost their right to claim Status under the Indian Act);
- the Inuit of Northern Canada;
- the Innu of Quebec and Labrador; and
- the Métis of Manitoba (described by the Métis National Council as "an aboriginal person who self identifies as Métis, is distinct from Indian and Inuit and is descendent from those Métis who received land grants under the provisions of the Manitoba Act, 1870, or the Dominion Lands Acts, as enacted from time to time).

There are about one million aboriginal people in Canada (Statistics Canada, 1995). The population is young (in 1991, nearly 38 per cent of all aboriginal people were under the age of 15 compared with 21 per cent of Canada's total population) and growing at a rate that is twice that of the general population.

Echoing the description above of Native Americans, The Royal Commission on Aboriginal People (Canada, 1996) points out that among Canada's aboriginal people:

- life expectancy is lower;
- illness is more common;
- social problems, from family violence to alcohol abuse, are more common;
- fewer children graduate from high school;
- far fewer go to colleges and universities;
- the homes of aboriginal people are more often flimsy, leaky and overcrowded;
- water and sanitation systems in aboriginal communities are more often inadequate;
- fewer aboriginal people have jobs; and
- more spend time in jails and prisons.

About half of Canada's aboriginal people live in rural communities of 1,000 people or less. Mining and mineral-related activity most often occurs in remote areas where aboriginal people make their home.

### *Concerns*

Many First Nations/Native Americans see mining as a challenge as well as an opportunity. It has the ability to create wealth in otherwise remote and marginalized areas, but it has a long history of bringing social and environmental problems. The question for North America's first peoples is to find a way of gaining the benefits without taking unnecessary risks or suffering harm.

The concerns of aboriginal people are slightly different in the U.S. and Canada. In the U.S., the issues of mineral title and revenue entitlements are largely resolved in the treaty and reservation system, although there are some important exceptions in the western states.

In Canada, the situation is more fluid, particularly in British Columbia where treaties have yet to be signed. Issues for Canadian First Nations are well articulated by the National Round Table on the Environment and the Economy (2002) and include:

- land claims settlement and self-government;
- capacity building;
- consultation;
- benefit from resource development (including mining) on traditional lands;
- building sustainable communities;
- social and cultural well-being; and
- environmental security.

At the heart of the issue in Canada are the questions of severed title and treaty entitlements—normally the Crown owns the mineral title on traditional lands while surface rights may lie substantially (but not entirely) with the relevant First Nation.

Canadian First Nations have been successful in the courts in asserting the position that they should participate in resource development on traditional lands. As a result, impact and benefit agreements negotiated directly with mining companies have quickly become the norm. Recent developments include a shift towards co-management of land and environmental monitoring, revenue sharing at the mining stage and agreements to cover the exploration phase.

## **Organized Labour**

Organized labour may have become less visible in recent years but remains an important part of the mining industry. Union membership and participation in the mining sector are poorly quantified, although both geographical and commodity concentrations are recognized. For example, there is a dominance of the United Mine Workers in U.S. coal mining. Overall, it is estimated that some 30 per cent of mine workers are members of unions with the United Steelworkers of America, the United Mine Workers of America and the Canadian Auto Workers accounting for the majority.

The union movement is justifiably proud of the strong influence it continues to have on the industry. The high wages and culture of safety that pervades the North American mining industry are directly attributable to the efforts of organized labour. Similarly, they have been major players in the drive to raise environmental performance and develop environmental consciousness.

### *Concerns*

Organized labour continues to articulate three priority concerns:

1. protection of the workers' right to organize;
2. safety, security and well-being of its members and the communities in which they live; and
3. as a minimum, adherence to international conventions and agreements on human rights, occupational health and safety, public health and the environment.

## **Mining-affected Communities**

About 138 Canadian communities with a combined population of 700,000 are currently considered economically dependent on mining (White and Watson, 2001).

In the U.S., data are less easily accessible, but it is known that some 70 counties in 23 states are considered to be dependent on mining (i.e., mining contributes 15 per cent or more of labour and proprietor income, data from U.S. Forest Service IMPLAN). Geographical and commodity concentrations are evident in the U.S. where the majority of dependent counties rely on coal mining; with 17 counties dependent on metal mining of which seven are located in Nevada where gold mining dominates.

Some patterns are worthy of note. In Canada, fly-in/fly-out arrangements and the growth of impact and benefits agreements with First Nations that provide assurances of employment, have both increased the number of communities dependent on mining and created a more dispersed dependent population; significantly, many of these are very small communities. Also, the recent growth of a diamond mining industry in the Northwest Territories of Canada has increased the number of remote, northern communities dependent on mining.

### *Concerns*

Communities everywhere hope for a secure future. Ideally, there would be continuing opportunities for young people to offer a chance that families might stay close as generations evolve.

Over time, more and more communities are becoming sensitized to the risks of dependence—that social, cultural and environmental aspects are also involved—and are looking at different ways of maintaining their vitality beyond the life of a mine or mineral project. Creating alternatives to mining and avoiding a post-mining economic and social collapse is a particularly significant challenge for the small, remote, aboriginal communities in northern Canada and Alaska.



The mining/minerals industry provides high paying employment. For example, the average wage for all U.S. miners in 2002 is US\$58,112 while the average for all private industries is US\$35,296 (data from Bureau of Economic Analysis). It is difficult to replace these well-paid jobs when mines close and a major question for mine-affected communities is what happens when the mine is gone. This has become a real issue in the western U.S. where the metals mining sector has experienced steady contraction over the last 20 years creating a number of near ghost towns and relatively impoverished communities.

The fly-in/fly-out approach referred to earlier is proving advantageous from an economic perspective from company and government points of view. However, the typical working rhythm of a week or two on followed by a week or two off is disruptive to family life and the increased load carried by spouses of miners is now only just beginning to be recognized and assessed.

### **Non-government Organizations**

The nature and role of civil society has received much attention since the break-up of the communist block countries and the end of the cold war. A major driver of this has been the realization that the rich diversity and high activity of non-government organizations found in western democracies are sources of significant “social capital.”

The John Hopkins University Comparative Non-profit Sector Project created the International Classification of Non-profit Organizations (ICNPO), now broadly used as an organizing template to describe civil society. Table 2 below lists the 12 major groupings of non-government organizations.

**Table 2. Major groupings of the International Classification of Non-profit Organizations (ICNPO).**

Major Grouping	Description
1. Culture and Recreation	organizations and activities in general and specialized fields of culture and recreation.
2. Education and Research	organizations and activities administering, providing, promoting, conducting, supporting and servicing education and research.
3. Health	organizations that engage in health-related activities, providing health care, both general and specialized services, administration of health care services and health support services.
4. Social Services	organizations and institutions providing human and social services to a community or target population.
5. Environment	organizations promoting and providing services in environmental conservation, pollution control and prevention, environmental education and health, and animal protection.
6. Development and Housing	organizations promoting programs and providing services to help improve communities and promote economic and social well-being of society.
7. Law, Advocacy and Politics	organizations and groups that work to protect and promote civil and other rights, advocate the social and political interests of general or specific constituencies, offer legal services and promote public safety.

Major Grouping	Description
8. Philanthropic Intermediaries and Voluntarism	philanthropic organizations and organizations promoting charity and charitable activities including grant-making foundations, voluntarism promotion and support, and fundraising organizations.
9. International	organizations promoting cultural understanding between peoples of various countries and historical backgrounds and also those providing relief during emergencies and promoting development and welfare abroad.
10. Religion	organizations promoting religious beliefs and administering religious services and rituals; includes churches, mosques, synagogues, temples, shrines, seminaries, monasteries and similar religious institutions, in addition to related organizations and auxiliaries of such organizations.
11. Business and Professional Associations, Unions	organizations promoting, regulating and safeguarding business, professional and labour interests.
12. Groups not elsewhere classified	

Table 2 serves to demonstrate the richness and diversity of non-governmental organizations. Over the past 30 years it has been environmental issues and environmental non-government organizations (ENGOs) that have tended to dominate where mining is concerned. ENGOs bring an environmental ethic to the table and their objective is to see environmental concerns play as significant a role in decision-making and operational practice as more traditional economic concerns.

The ENGO community ranges from local, single-issue focused organizations to multi-country organizations with thousands of members. ENGOs across North America number into the thousands. They are extremely diverse and include extreme activist organizations as well as very low-key conservation and education groups. Advocacy, research and education are all practised in varying amounts by ENGOs.

### *Concerns*

ENGOs believe that mining should and could perform at a much higher level. The industry is often seen as self-serving, arrogant, aggressive, inflexible, irresponsible and even dangerous. There is real concern that the industry is inconsistent in the application of best practice, both within and between companies, and on too many occasions simply not performing as claimed. Thus, they seek changes to industry practices and government policy and regulation that would reflect environmental values and entrench a much higher degree of public accountability. Importantly, ENGOs raise the question of “need” and the fundamental role of metals and minerals in society. These questions sometimes reach to the fundamental decision-making structures of our democratic society and for some this is threatening.

More recently, issues of human rights, community and rural development, social-justice, health and security, and corporate social responsibility have risen to prominence. Non-government organizations championing these issues are increasingly found participating in review of mining activities.

In fact, all elements of civil society listed in Table 2 are important to the mining industry. The issue is not simply one of understanding an adversary, but rather one of understanding and interacting with the society in which mining activities take place.

## **Academic Support: Teaching, Research and Development**

Many years of declining enrollment in undergraduate and graduate programs that feed into the mining industry have led to pressure for change, consolidation and closures in the academic sector in both Canada and the U.S. Mining engineering and economic geology faculties have been particularly impacted. Poignantly, in 2000, only several hundred of 2.5 million graduating high school students in the U.S. indicated an interest in mining in their Standard Aptitude Test (SAT).

In 1908 there were 38 universities and seven schools of mining engineering with a combined enrollment of 2,370 students in the U.S. (Anderson, 1908). By 2001, this had declined to 16 programs with an enrollment of about 578 undergraduates (SME, 2001). In the same year, Canada, with approximately one tenth of the population, had an undergraduate enrollment of 521, indicative of a stronger minerals sector in this country (Scoble, *et al.* 2001).

Not only are enrollments at historical lows, but there has also been a change in employment patterns for graduates. This is particularly noticeable in the U.S. where, in recent years, the majority of mining engineering graduates have found work in the industrial minerals sector, as opposed to the historical norm of employment in hard rock and coal mining. Similarly, among geology graduates the majority now finds work in environmental and geotechnical sectors with no more than a handful joining the mining industry.

### **Concerns**

The universities are faced with a number of issues, which include availability of employment for graduates, recruitment of students, employers' needs, curriculum development, the impacts of globalization and, most significantly, popular perceptions of mining (Archibald, 2000, and Van Zyl, personal communication). For many young people, mining is seen as a dead-end industry, dirty and unsophisticated.

In response, universities have innovated with distance learning, joint programs and the formation of specialized centres of excellence (both stand-alone and networked between institutions) which emphasize the technology, environmental expertise and sophistication needed by the modern industry (Archibald, *et al.* 2002; see also McDivitt, 2002). Economic geology, in particular, has increasingly become a specialty subject with skills gained at the MSc and PhD levels in dedicated research environments such as the Mineral Deposits Research Unit of the University of British Columbia.

When taken in context with the rapidly aging population of professionals currently employed in mining, a crisis situation can be seen looming in the next 10 years: the mining industry can not sustain itself with domestic graduates. Unless enrollments increase, there will be insufficient young, appropriately skilled graduates available to replace the existing workforce as it retires.

Some in the industry argue that if the mines and jobs were there, the support for universities, technical schools and research organizations would follow. However, this approach is short-sighted and dangerous. With the time lag involved not only in developing mines but also in building the education support system, taking such a reactive approach will lead to a serious shortfall in the human resource and technical support requirements of industry, government and the other implicated communities of interest.

### **References, Section 2**

Alderson, V.C. (1908) "Mining Engineering Education in the United States," Quarterly of the Colorado School of Mines, Vol. 2, No. 4, April (reprinted in the Quarterly of the Colorado School of Mines, Vol. 100, No. 1, 2000, pp 39–45).

- Archibald, J.F. 2000. The Status of Canadian University Programs in Mining Engineering, *Bulletin Canadian Institute of Mining and Metallurgy (CIM)*: 93, 1043, pp. 56–59.
- Archibald, J., Scoble, M., Hassani, F., Haggigeorgiou, Corthesy, R., Singh, S., Bawden, W.F., Frimpong, S., Stevens, R. and S. Butt, 2002. “Networking Tertiary Education and Industry.” Paper accepted for presentation at 104th Annual General Meeting, Can. Inst. Min. Metall., Vancouver.
- Cameron, E.N., 1981. “Changes in the political and social framework of United States mineral resource development,” 1905–1980. *Economic Geology*, 75th Anniversary Volume, pp. 955–964.
- Canada 1996. *Highlights from the report of the Royal Commission on Aboriginal Peoples, People to People, Nation to Nation*. Ottawa: Minister of Supply and Services Canada.
- Centre for Collaborative Action and Senes Consultants Limited, 2002. “Sustainability Profile: The Story of North American Mining and Minerals.” Draft Working Paper, Mining, Minerals and Sustainable Development North America. Winnipeg: International Institute for Sustainable Development.
- CGC, 2001. Demographic Survey of Canadian Geoscience Professionals. Canadian Geoscience Council, Waterloo University.
- Department of the Interior, 2002. Native Americans Overview. Washington: Department of the Interior, Office of American Indian Trust. Web site: <https://128.174.5.51/denix/Public/Native/Outreach/American/indian.html>
- DIAND, 1995. *Highlights of Aboriginal Conditions, 1991, 1986: Demographic, Social and Economic Characteristics*. Department of Indian Affairs and Northern Development. Ottawa: Public Works and Government Services Canada.
- MacDonald, Alistair, 2002. *Industry in Transition: A Profile of the North American Mining Sector*. Report to Mining, Minerals and Sustainable Development North America. Winnipeg: International Institute for Sustainable Development.
- McDivitt, J. (2002) Status of Education of Mining Industry Professionals, Mining, Minerals and Sustainable Development, IIED (<http://www.iied.org/mmsd>)
- National Mining Association, 2002. Employment Statistics. Web site: <http://www.nma.org>
- National Round Table on the Environment and the Economy, 2002. Special Report 1: Using non-renewable resources to foster sustainable Aboriginal communities in the North. *Aboriginal Times* 6:4, February 2002.
- NRCan, 2001. *Canada's Minerals and Metals Industry: An Economic Overview*, August, 2001. Ottawa: Economic Analysis Division, Minerals and Metals Sector, Natural Resources Canada.
- NRCan, 2002. *Employment Information Bulletin*. Ottawa: Natural Resources Canada.
- PDAC, 2001 (draft). *Canadian Junior Mining Sector Exploration Trends, 1999–2000*. Toronto: Prospectors and Developers Association of Canada.
- Scoble, M., Archibald, J., R. Corthesy, F.P. Hassani, R. Stevens, J. Haggigeorgiou, W. Bawden, S.P. Sinng, F. Frimpong and S.D. Butt, 2001. The Canadian Mining Education Council: an initiative to network Canada's Mining Schools. *Bulletin Canadian Institute of Mining, Metallurgy and Petroleum*, Montreal, 94, pp. 43–48. Also presented and published in Proc. 12th Canadian Conference on Engineering Education, University of Victoria, August 2001, pp. 56–52.

SME, 1999. Executive Directors Report. Denver: Society for Mining, Metallurgy and Exploration (SME).

SME, 2001. Guide to Mining Schools. Denver: Society for Mining, Metallurgy and Exploration (SME).

Statistics Canada, 1995. *Highlights of Aboriginal Conditions, 1991, 1986*. IQR Fall, 1995. Catalogue R32-154/11-1986.

U.S. Bureau of Labor Statistics, 2002. Metal Mining Employment, 1980–2000. <http://data.bls.gov>

U.S. Forest Service/IMPLAN, Minnesota IMPLAN Group, Inc., IMPLAN data in Microsoft Access database files, various years.

White, W. and D. Watson, 2001. Natural Resource Based Communities in Canada: An Analysis based on the 1996 Canada Census. Ottawa: Natural Resources Canada. Northern Forestry Centre, Canadian Forest Service.





### 3. Lessons from the Past

#### The Long Shadow of History

Metal mining in the Americas began long before European contact and likely some form of metal gathering and processing existed as early as the second millennium before Christ (Waszkis, 1993). John Udd (2000, p. vii) points out:

As long as 6,000 years ago, there was trading in North America in native copper that had been mined from excavations in the Lake Superior area... about 4,000 years ago, Maritime Archaic Indians mined the chert beds at Ramah Bay Labrador for material from which to fashion implements... there was native trading in silver from the Cobalt area during the period 200 B.C. to 200 A.D.

However, pre-contact activities were small-scale and superficial in comparison to today's mining and minerals activities in terms of their implications for people and ecosystems.

It was the hope of finding the fabulous gold fields of Asia that motivated Christopher Columbus to set out from Spain in 1492.<sup>1</sup> This quest for gold and precious metals was to dominate the spirit of mining through to the early 20th century. Unfortunately, the intensity of the pursuit during this period, the viciousness of the actions taken along the way and the social and environmental destruction created a legacy with which the industry is only now coming to terms and beginning to move beyond. However, in the process of this quest, the influence on the social, economic and political development of the Americas was profound. In fact, the U.S. and Canada would not be the nations that they are today were it not for the mining industry and its fundamental contribution to the economy.

On his first voyage, Columbus did find evidence of gold on the northwest coast of Hispaniola in an area now part of Haiti. However, it was not until 16 years later when Cortéz made contact with the Aztecs at Veracruz, Mexico, that the plunder of Aztec treasure by the Spanish was on—the first great bonanza in the history of metal mining in the Americas.

Mines in New Spain (Mexico) were opened up at an astonishing pace by the Spanish colonists following the conquest. And just as Spain had formerly been the source of mineral treasure for the Phoenicians and others, now Mexico was to become the great treasury of Spain (Gregory, 1980).

Meanwhile, on the heels of Cortéz's conquest of the Aztecs, Francisco Pizarro moved south across the Isthmus of Panama to smash and plunder the Inca civilization of Peru. By the end of the 16th century, mines were in production in Mexico, Peru, Chile, Bolivia and Columbia. In 1692, gold was discovered in the Portuguese colony of Brazil and, within a few years, thousands were gravitating to the first major gold rush in the Americas. Thus, the wealth of the New World flowed to Europe, paying for the Renaissance, the wars and the industrial revolution of the 18th and 19th centuries.

Through the 16th and 17th centuries, the same quest for a route to the Orient (this time a "northwest passage,") also sparked European exploration of what are now Canada and the United States. However, the great surge in mining activity was to come much later.

The first mineral discovery in Canada is credited to M. Prévert, a colleague of Samuel de Champlain who in 1604 discovered copper ore in the Bay de Chaleur of Québec's Gaspé region. But it was several centuries before the site saw mining. Also in 1604, iron and silver ore were discovered at St. Mary's Bay in Nova Scotia. In 1672, coal was found on Cape Breton Island although production and export to Boston did not occur until 1724 (Waszkis, 1993). In the U.S., copper was mined near Lynn, Massachusetts, as early as

---

<sup>1</sup> Columbus was sponsored by Queen Isabella of Spain under the terms that he was to receive 10 per cent of all the precious metals and gems discovered and was to be appointed governor-general over the lands annexed (Gregory, 1980).

1664 and in 1687, the lead mines of Missouri were discovered. In 1733, iron ore was smelted for the first time in Trois Rivières, Quebec. However, none of these early activities matched the fervour and extent of the gold rushes that swept North America (along with Australia and South Africa) in the 19th century.

The French and English founders of the North American colonies had hoped to find mineral wealth, especially gold, as Spain and Portugal did in their territories. But time passed, wars were fought, and it would be the young nations of United States and Canada that would feel the benefit of their mineral endowment, not the former colonial masters.

Two minor gold rushes, one in North Carolina (1802 to about 1825) and one in Georgia (1829 to about 1840) marked the beginning of this era. Sadly, the real legacy of the Georgia gold rush was the eviction of the Cherokee Nation who in 1838 was escorted by U.S. Army troops to new lands west of the Mississippi River. In a five-month trek that came to be known as “The Trail of Tears,” 4,000 of 14,000 Cherokee died (Martinez, 1990).

The landmark event known as the California Gold Rush began in 1848, practically as the ink was drying on the Treaty of Gualdalupe Hidalgo marking the end of the Mexican War and ceding California to the U.S. By 1852, the peak years of the California Gold Rush were ending. It was not the richest strike in North America, but its influence was extraordinary. As a direct consequence of the gold find at Sutters Mill, the slow movement of westward development in the U.S. shifted to a frenetic pace; California became a state as a result of it and in order to link the state with the rest of the nation, the transcontinental railroad was finished in 1869.

Hard on the heels of the California Gold Rush and partly as a result of “forty-niners” spreading out to explore for new opportunities, a series of other gold rushes occurred, including:

- British Columbia: 1858 on the Fraser and Thomson Rivers; 1861 in the Cariboo starting on the Horsefly River;
- Nevada: discovery of the Comstock Lode (gold and silver) in 1860;
- Colorado: 1858–1867;
- Idaho and Montana: 1860–1880;
- Black Hills, South Dakota: 1874 (as a result of a “scientific expedition” by George Custer, later killed in 1876 by the Sioux at the Battle of Little Bighorn); and
- Yukon: 1886 on the Forty Mile River, 1898 in the Klondike.

Gold, however, was not the sole focus of mining in North America through the 19th century. In the U.S., three mineral discoveries (along with gold, coal and petroleum) provided a critical materials base for the industrialization that occurred: high-grade iron ore in the Marquette Range, Michigan in 1844; high-grade copper ores in northern Michigan in 1841; and major lead deposits in the Mississippi Valley in 1864. In Canada, it was also iron ore and iron making—not gold—that provided the start to the industry.

From these beginnings, the mining/minerals industry in both countries has diversified remarkably. North America is now either a world leader or near-leader in the production of potash, uranium, nickel, asbestos, cadmium, zinc, aluminum, salt, cobalt, gypsum, gold, silver, lead, copper, molybdenum, platinum, palladium, rare earth minerals and a host of industrial minerals.

### **Changing Technology**

The years of activity that the above discussion spans are characterized by a remarkable evolution of technology touching every aspect of mining and mineral processing, including:

- explosives;
- drilling;

- earth moving;
- hoist systems;
- lighting and ventilation;
- crushing;
- processing;
- metallurgy;
- power sources;
- transportation systems;
- communications and information technology;
- computer technology;
- remote sensing and mapping;
- global positioning and mapping systems;
- many aspects of worker health and safety;
- effluent treatment and management;
- environmental management systems;
- robotics (earth moving, hauling, drilling, underground mapping); and
- laser technology for branding diamonds.

Changes in mining technology in the 1950s and 1960s, together with new geological understanding on the controls to ore deposits, led to the development of very large, low-grade bulk tonnage mining operations, particularly in the United States. The economies of scale created by this approach immediately made open-pit mining the preferred method of extraction in North America. Beginning in the 1960s, the large excavations created by these mines, together with the enormous volumes of waste rock and tailings, changed the appearance and the scale of impact of mining.

Continuous innovation in mining has kept productivity high and costs low, supporting the long industrial expansion of North America. A modern mine operation would not be recognized if a miner from even 20 years ago were catapulted into today's world. In a review of the U.S. mining industry, Peterson *et al.* (2001) summarize priority technologies currently receiving attention for resolving mine productivity bottlenecks. Included are:

- advanced information and communication technologies being used in a range of functions such as: (a) planning and visual simulation techniques for optimizing mine design, operations and equipment choices; (b) dispatch systems using Global Positioning Systems (GPS) for monitoring equipment positions, directing material flows and optimizing capacity utilization in real time; (c) GPS-based surveying approaches linked to high-precision drilling and earth moving so mine maps and plans are updated in real time as material is moved; and (d) site-wide information-sharing systems to facilitate integration of previously separate operations, such as surveying, mining, processing and reclamation;
- remote control and automation of a wide range of major equipment categories including earth moving, hauling and drilling; and
- improved operations and maintenance technologies.

The above technological changes and many others are having a large impact on mining personnel. Peterson *et al.* (2001, p. xvii) point out that:

- as mining equipment increases in scale, staffing levels will decline but individual operators will play a greater role in determining mine output;
- as mining equipment becomes more advanced through IT and communications innovations, line workers are gaining unprecedented access to information and control over the equipment they are operating; and
- achieving the productivity gains sought by both management and investors requires that miners develop new, multidisciplinary skills to fully utilize emerging technologies.

The role of robotics in future mining and mineral operations is only now beginning to be recognized. Field tests have already demonstrated the benefits to be achieved by a single operator controlling multiple drilling installations in multiple mines from a single on-surface location. The implications for improving mine economics and safety conditions while simultaneously, dramatically reducing environmental impacts are profound (Baiden, 2001, personal communication).

Mineral production in Canada and the U.S. has been sustained by aggressive exploration for new ore deposits. This too has been facilitated by innovation, technological change and improved geological knowledge. The 1950s and 1960s were particularly productive, taking advantage of new geophysical and geochemical techniques. By the 1970s, North America had been thoroughly investigated and had become, particularly for base metals, a mature exploration environment with the search increasingly for blind and deeply buried mineralization. Geological methodology continues to evolve, however, along with technology resulting in further discoveries and recognition of previously unknown ore deposit types, such as the “Carlin” type gold in Nevada through the 1970s and diamonds in Northern Canada in the 1990s.

In addition to the above, information technologies are facilitating an unprecedented level of access to information about mine operations on the part of external communities of interest including regulators and a range of non-government organizations.

### **A Turning Point in Values**

The world of mining and minerals described above exists within a broader society. That larger world too, is evolving and if the evolutionary tracks of the two diverge, tensions emerge to motivate a re-alignment. In a nutshell, that appears to be what has been happening over the past century.

In his insightful work, *Mining America*, Duane Smith (1987) describes the changing values related to mining and the environment from 1800 to 1980.

With legislative and judicial blessings, and with tradition, economic significance, technological advances, public acceptance, self image and the general profit-motivated business operation of the day weighing in its favor, mining plunged ahead in the nineteenth century... The challenge, when it finally came, was a shock and could not be viewed as anything but a temporary aberration... During the late 19th century, industry rode a crest of popularity and success that defied previous experience... Although Marysville was not literally buried by the tailings that washed down the Feather and Yuba rivers, the implication was clear: nothing would stand in the way of mining.

If mining had stood alone in its cavalier disregard for the bounties of nature that allowed it to flourish or its failure to comprehend its impact on the environment, then it would have faced public censure, even in the nineteenth century. Mining did not stand alone... The steel industry, the oil fields and manufacturing also produced waste and pollution. Lumbering attacked the forests with a ferocity that matched mining’s onslaught on mineral deposits. American railroads rib-

boned the country with the same disregard for the environment as mining, except where profits could be made by selling land grants. Refuse was scattered everywhere, and lives were wasted, victims of industrial ignorance and arrogance, in Pittsburgh and Chicago as well as Leadville and Butte. – *Smith 1987 p. 51*

But the challenges did come, slow at first, then with gaining momentum. The first came in California when farmers challenged the right of placer miners to continue using techniques that muddied water supplies and flooded downstream agriculture land covering it with debris. Out of this growing dispute pitting agriculture interests against mining, materialized the classic 1884 case of *Woodruff v. North Bloomfield, et al.*

The industry defence was very much a harbinger of industry arguments to be repeated many times in the century to come. They argued that finding in favour of the farmers would paralyze mining, deprive California of millions of dollars, drive much needed capital away, make valueless the property of thousands leaving them and their families without employment or means of subsistence, depopulate villages, towns and cities, cause schoolhouses and churches to go to ruin and decay, cause the disorganization of county government, and in time bring ruin and disaster over the entire state. They even produced affidavits to show that the sediment in the water actually enriched the soil and made it more productive. (Smith 1987, p. 71). In 1884, the United States Circuit Court ruled in favour of the farmers and hydraulic placer mining, as it was then being practised, was banned in California.

The late 1800s also brought growing concern in the U.S. about the use, abuse and state of the nation's forests. This rise in public voice reflected the first wave of the environmental movement in North America. Two "camps" emerged, traces of which can be seen today. On one hand, "preservationists" called for setting aside of lands in their undeveloped state in perpetuity. Others championed a "wise use" or utilitarian approach—the management of timberland for the benefit of various interests. Regardless of objective, pressure from forest conservationists, scientific groups and ordinary citizens rose and in response, 1891 saw the creation of six forest reservations and in 1897, 13 more were created.

For its part, the mining industry (and other industrialists) would have nothing to do with either "preservationists" or "wise use" proponents. They watched this change in government policy "with amazement and disgust... wishing to continue its business as usual with no interference, light or heavy" (Smith 1987, p. 56). Western mining men would lead the fight against the national forest concept in the decades to come incited by fear of economic setbacks and the loss of the "right" to use the public domain. In addition, small miners saw open public land as their last defence against the growing dominance of large mining corporations.

Over the past century, similar debates and arguments have been repeated time and time again although the details and proponents have varied.

For example, the debate over smelter smoke raged for decades starting in the late 19th century (examples include Oakland California; Butte, Montana; Trail, British Columbia; Ducktown, Tennessee; Denver, Colorado; San Francisco, California; Sudbury, Ontario) and in an early example of a kind of win-win result, eventually led to technological advances that not only greatly ameliorated the health and environmental impacts but also led to great economic benefit for smelting operations. However, early in the debate with battle lines clearly drawn and guns blazing, the Butte Miner boasted: "The thicker the fumes the greater our financial vitality, and Butteites feed best when the fumes are the thickest." A prominent smelter superintendent argued that burning sulfur supplied a "partial disinfectant" for the filth found "in our valleys." The people in the lowlands, where the smoke hovered at its thickest, were actually healthier, in his estimation, than those who suffered the misfortune of living up on the hill, were the "sun shone all the



time.” (*Weekly Missourian*, Nov. 11, 1891, quoted in MacMillan, 1973). Local doctors supported this position proclaiming that the smoke acted as a disinfectant destroying “microbes that constitute the germs of disease” (Smith 1987, p. 77).

In the 1920s, disputes over stream pollution hit mining in a broad set of locations in Colorado, Pennsylvania, Oregon and South Dakota. In Pennsylvania, figures from 1920–21 show some 1,200 operating coal mines which drained an estimated 450 million tons of water per year containing 1.6 million tons of sulfuric acid into the Ohio River Basin. In addition, considerable additional drainage came from the large number of abandoned mines (estimates ran as high as 6,000) (Smith 1987, p. 14). The defence from the mining industry evolved in a predictable manner: they weren’t solely to blame; costs of neutralizing acid water were prohibitive; it should not be blamed for drainage that simply emerged as an unexpected outgrowth of industrial development; it was being asked to shoulder the entire responsibility for a problem that resulted from actions to benefit the public, the state and the nation (Crichton, 1923, 1924 as quoted in Smith 1987, p. 114); and in any case, who was responsible for the abandoned mines whose owners were dead or whose companies no longer existed?

The 1930s depression, World War II and its demand for strategic metals, and the post-war boom all brought variations in conditions for the industry. With a few small exceptions, the industry held its defensive posture. Smith (1987, p. 133–134) describes a 1958 incident in upper Michigan that exemplified the onrushing dilemma.

Copper miners there were seeking permission to mine in part of the Porcupine Mountains State Park (near White Pine). Comprising some seventy-five square miles of virgin hardwood forests, this wilderness park maintained an area along Lake Superior in virtually the same condition as when the first French *coureurs de bois* had seen it centuries before.

A section of the park harbored low-grade copper... copper-mining interests requested permission to mine the park and under part of the adjoining lake... By late 1958, over 90 per cent of the letters to the State Conservation Department protested this action.

Copper miners fought back. They talked of only 900 acres out of 58,000 being affected, a \$6 million annual payroll, of increased local tax revenue and a royalty to the state of three-quarters of a million dollars. All of these would bestow a windfall to unemployment-beleaguered Upper Michigan. Not overlooked was the fact that the tax revenues and royalties could be used to improve other state parks.

The mining faction rallied supporters—business folk, chambers of commerce, city councils, Rotary Clubs—all from the Upper Peninsula. The support that the industry rallied came to little. The damage to public relations had already been done, and the opposition had been marshaled. Mining seemed to be unable to shake its nineteenth-century indifference. An editorial in *Nature Magazine* summarized the position of the opposition: “We have always questioned any attempt to place a price tag on the values inherent in a park or comparable area ... wilderness and wilderness values are irreplaceable.” Another writer called mining’s rationale for development “the siren song.” Where were the discussions of the impact on workers, access roads, power lines, and waste? This last item the company planned to dump in Lake Superior, thereby creating another environmental horror. The same writer went on to say: “I thought it would be a sacrilege to build a mine on the doorstep of such a cathedral.”

The social and cultural changes of the 1960s exploded on the mining industry like everyone else. Rachel Carson’s *Silent Spring* (1962) became a touchstone for the environmental movement. The environment rose to the top of the public policy agenda. In short



order the United States proclaimed the 1963 Clean Air Act, the 1965 Water Quality Act, the 1967 Air Quality Act and the 1969 National Environmental Policy Act (NEPA) (signed into law, January 1, 1970). NEPA created the United States Environmental Protection Agency six months after Japan had been the first country in the world to establish a federal environmental agency. Environment Canada, Canada's equivalent, came into being less than a year later. State and provincial counterparts quickly followed.

The year 1970 stands as a poignant turning point in the public policy expression of environmental values in North America. The rules of the game for mining were forever changed and there was no going back.

### **Lessons from the Past**

In the 32 years since, the mining/minerals industry has slowly adjusted although remnants of 19th century attitudes still prevail in some quarters. Now in retrospect, it is clear that the mining industry has paid dearly for its intransigence. Until the mid-1980s (and in some cases much more recently), tradition, assumed rights, availability of minerals where they are found, the legal responsibility to generate dividends and protect the shareholders' investment, need, and the economy were the constant arguments used to justify the industry's right to continue without regard for long-range implications.

Voluntary change would not be accepted without demonstration of economic viability first and certainly responsibility for closure and post-closure have not been assumed voluntarily. More likely it would only succumb to reform under overwhelming public pressure. With rare exceptions and until about a decade ago, this resistance has been an industry hallmark. It has meant that mining would pay the price of eventual public condemnation. And that was exactly the situation facing the chief executive officers of the nine senior mining companies meeting in 1999 in Davos, on the shoulders of the World Economic Summit. Their decision to create the Global Mining Initiative reflects an innovative and unprecedented attempt to start down a new path.

This same period has seen some additional changes of an unprecedented nature including:

- the recognition of the key importance of a strong and diverse civil society to a healthy country and the enhanced role of non-government organizations of many types in decision-making processes that were previously limited to government and business;
- the advent of a worldwide communications system that would make widely available instant linkages possible; and the globalization of the economy;
- increasingly sophisticated technology;
- a smaller, more highly educated and trained labour force, with large gains in per capita productivity and individual worker responsibility;
- major changes in the economics of ore deposits with some previously non-economic properties now becoming economic; and
- major reductions in environmental and social stress generated throughout the entire mine project life-cycle from exploration through to post-closure.

There are many signals that the 19th century-based attitudes that prevailed through the first six decades of the 20th century have finally been set aside. However, much mistrust remains, mistrust that will not go away quickly. It will take time and demonstration of new practices with new results.

In addition, evaluation of the appropriateness of past practices needs to allow for the social values prevailing at the time. It is easy, in hindsight and with today's knowledge, to look back and condemn past practices. But for the most part, these practices were wide-

ly supported by a public caught up in the idea of gold from the New World, or anxious to see 19th and 20th century industrial “progress.”

What is important now is to learn from this past and work to further reduce the disconnect in values that came to a peak in 1970. No one part of society can do this alone. As a result, it requires a commitment from all quarters to pursue greater sharing in decision-making so that differences in values can have a chance to be expressed and addressed. This cannot be a theoretical/academic exercise but rather one that involves real people and their communities, real projects/operations and real ecosystems.

### References, Section 3

Baiden, Greg, 2001. Personal Communication. Professor and Director of Engineering, Laurentian University, Sudbury, Ontario.

Centre for Collaborative Action and Senes Consultants Limited, 2002. “Sustainability Profile: The Story of North American Mining and Minerals.” Draft Working Paper, Mining, Minerals and Sustainable Development North America. Winnipeg: International Institute for Sustainable Development.

Crichton, Andrew, 1923. “What Shall be Done about the Growing Evil of the Pollution of Streams by Mine Drainage?” *Coal Age*, March 15, 1923, pp. 447–451.

Crichton, Andrew, 1924. “Mine Drainage Stream Pollution.” *Transactions of the American Institute of Mining Engineers*, 1924, pp. 434–446.

Gregory, C.E., 1980. *A Concise History of Mining*. New York: Pergamom Press.

Hodge, R. Anthony, 2001. Mining: A Study in Sustainability and Change in the Knowledge Economy. Paper presented at the Conference Building Capacity – Sustainable Production and the Knowledge Economy. Chateau Laurier Hotel, Ottawa, April 4–5, 2001. Carleton Research Unit in Innovation, Science and Environment (CRUISE). Carleton University.

MacMillan, 1973. “A History of the Struggle to Abate Air Pollution from Copper Smelters of the Far West, 1885–1933.” Ph.D. diss. University of Montana.

Martinez, Lionel, 1990. *Gold Rushes of North America: An Illustrated History*. Secaucus, New Jersey: The Wellfleet Press.

Peterson, D.J., Tom LaTourrette, James T. Bartis, 2001. *New Forces at Work in Mining – Industry Views of Critical Technology*. Santa Monica and Arlington: RAND Science and Technology Policy Institute.

Smith, Duane E., 1987. *Mining America: the Industry and the Environment, 1800–1980*. Niwot Colorado, University Press of Colorado (Initially published by the University Press of Kansas).

Udd, John E., 2000. *A Century of Achievement – The Development of Canada’s Minerals Industries*. Montreal: Canadian Institute of Mining and Metallurgy.

Wazkis, Helmut, 1993. *Mining in the Americas*. Cambridge, England: Woodhead Publishing Limited.

## 4. Learning from the Future

In the early 1970s, the Royal Dutch Shell group demonstrated the usefulness of taking a long view in planning. When the Arab oil embargo occurred in 1973, they were ready—not because events were predicted, but rather because events lay within the range of futures for which they had been preparing. By the time the dust had settled, Shell was a significantly stronger company.

Since that time, scenarios techniques have evolved significantly. They are now widely used not only by companies but also by governments and non-government organizations. Motivated by a desire to bring this perspective to the work of MMSD–North America, Workgroup 4 was mandated to:

1. develop a set of scenarios that bracket the likely futures to be faced by the North American mining and minerals industry and the related communities of interest; and
2. use the scenario-building exercise as a means to identify and discuss:
  - risks and opportunities;
  - issues, challenges and areas of consensus and disagreement on their resolution; and
  - potential prescriptions (aimed at any or all of the communities of interest) for adjusting mining- and minerals-related policy, practices, behaviour and infrastructure.

The full results are reported in *Learning from the Future – Alternative Scenarios for the North American Mining and Minerals Industry*. Reflecting the concepts of sustainability and sustainable development, they:

- include consideration of mining/minerals' contribution (positive and negative) to people (individuals, communities and organizations, overall society) and the enveloping ecosystem; and
- integrate the varying perspectives, roles and responsibilities of the different communities of interest including: companies (small through large and service), First Nations/Native Americans, mining-affected communities, organized labour, non-government organizations, regulators and teachers/researchers/students.

Scenarios are alternative descriptions of the future. They focus on the forces driving change and the critical uncertainties leading to different possible future outcomes. They are not predictions. Rather, they are stories of different futures, each of which is possible. Stories are a traditional and powerful way of communicating complex and often subtle ideas.

The process of developing the stories and the stories themselves serve to deepen understanding and insight related to the evolving conditions in which we may find ourselves. In this sense, they are “thought” experiments and by broadening thinking on the future, they can contribute to improving today's decisions and actions.

Within the mining industry, a number of major companies such as Noranda Inc., Placer Dome Inc., CAMECO Corporation and BHP-Billiton have employed the scenarios technique as part of their internal corporate strategy development. However, the exercise initiated by MMSD–North America in a small way breaks new ground. While many companies, governments and other organizations have used these techniques, this appears to be the first time a broad range of interests has been brought together to consider a whole industry in a multi-country setting through the eyes of a scenarios exercise.

## Scenario Development

Scenario development involves sequential consideration of the following four steps:

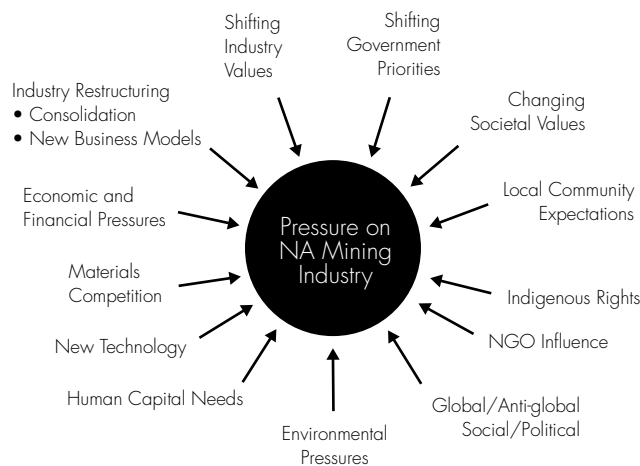
1. identifying the forces driving change in North American mining- and minerals-related activity;
2. identifying the major uncertainties facing North American mining and minerals;
3. choosing the two most dominant uncertainties and development of a framework for developing a distinctly different logic for each of four scenarios in a two-by-two matrix; and
4. crafting the characteristics and logic of each scenario as they are developed over a time horizon of approximately 15 years.

Steps 1 through 3 are described below and the fourth is dealt with in the next section.

## Forces Driving Change

Major forces driving change are summarized in Figure 4.

**Figure 4. Major forces driving change.**



## Major Uncertainties

Uncertainties facing the industry provide the key to defining the range of possible futures. In the scenario-building analysis, two critical uncertainties dominated all others: societal values and changes in economic performance.

### *Societal Values*

How will societal values change in the future? At one extreme, values could become more open, holistic and inclusive with increased trust and respect for differences. At the other extreme, values could become more divided and rigid leading to conflict and distrust.

### *Economic Performance*

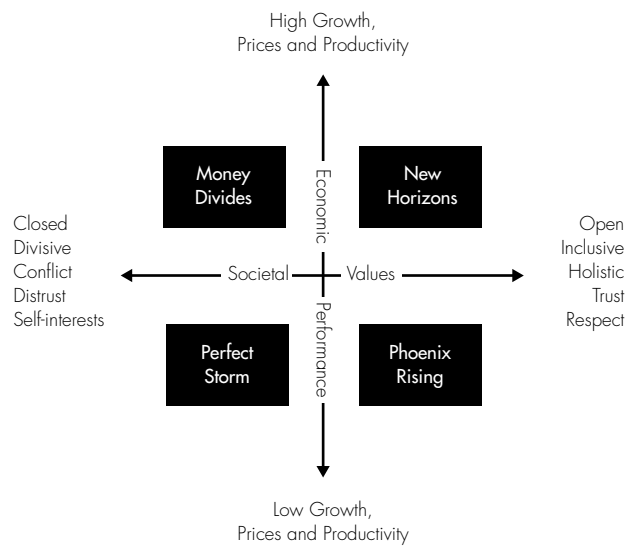
How will the global economy evolve in the future and how will the industry perform economically in response? What will be the economic conditions within which the industry will operate in the future? On one hand, the industry could experience extended periods of strong prices, growth and productivity improvement supporting the economic viabil-

ity of new mines in North America and enhanced access to capital. On the other hand, the industry could experience extended periods of downturn with weak prices, low growth and limited productivity improvements. The economic viability of new mines would be limited and access to capital curtailed.

### Framework for Scenario Development

The above uncertainties provide a logical framework for developing distinctly different scenarios and may be represented as continuums or dimensions shown as orthogonal axes in Figure 5.

**Figure 5. Scenario framework.**



In Figure 5, each quadrant represents a unique combination of outcomes of the two critical uncertainties. For example, the upper right quadrant defines a future in which societal values become more holistic and inclusive, fostering an environment of respect and mutual trust. Simultaneously, a healthy economic environment is envisioned, reflected by strong commodity prices, robust growth and productivity improvement in the mining and minerals industry. It is an optimistic future. In spirit, this scenario reflects a move towards “New Horizons.” In stark contrast, “Perfect Storm” brings together a societal value set that is divisive and less trusting along with a weak economic environment.

A different mix of these two key variables characterizes each scenario. Stories were then developed in response to the following questions: (1) How does this future come about? (2) What developments need to occur for this future state to emerge? (3) What are the major characteristics that would describe this scenario?

### Scenario Descriptions

#### New Horizons

In New Horizons, there is a coincidence of strong economic conditions and a high level of trust and respect characterizing overall societal values. For the most part, this same trust and respect is found among mining- and minerals-related communities of interest. Vision and change are guided through collaborative activity involving many communities of interest interacting in a constructive way. Confidence in the future is high.

### **Phoenix Rising**

In Phoenix Rising, difficult economic conditions serve to drive innovation. At the same time, respectful social values further facilitate positive change. The overall result is that difficult times give way to more encouraging conditions like a phoenix rising.

### **Perfect Storm**

In Perfect Storm, depressed economic conditions coincide with fractious social conditions. Here the spiral is downwards. The possibility of reversing the trend seems remote. A perfect storm emerges.

### **Money Divides**

The dominant force in Money Divides is an excess of money. However, rather than serving as a positive force, industry arrogance and societal divisions increase. Government stands back and watches money divide.

### **Scenario Signposts**

Following development of the four scenarios, a set of “signposts” was identified that could be monitored to determine which scenario was emerging over time. These signposts are listed in Table 3. No signpost will unambiguously confirm the emergence of a single scenario, but collectively the signposts should indicate which scenarios seem to be emerging, and which are not.

**Table 3. Scenario signposts. (NH = New Horizons; PR = Phoenix Rising; PS = Perfect Storm; MD = Money Divides.)**

Signpost	Significance
• Commodities/metal prices index	Rising → MD or NH Falling → PS or PR
• Investment in new mining technology	Increasing → MD or NH Decreasing → PS or PR
• Global economic growth rates	High → MD or NH Low → PS or PR
• 1872 General Mining Law	Revisions debated, progress achieved → NH, PR Little or no progress achieved → PS or MD
• Bankruptcies	Sharp increases → PS
• Actions of mining leaders (e.g., participation in dialogue; efforts to relax regulations)	Open/supportive of dialogue → NH, PR Closed to dialogue → PS or MD
• Growth of ethical/green investment funds	Increased visibility → NH or PR Little investor interest → PS or MD
• First Nation participation in or owning of mining companies	Increased participation → NH or MD No participation → PS Limited participation → PR
• Movement to certification and adoption of best practices by mining companies	Increasing → NH or PR Indifferent → MD or PS

Signpost	Significance
• Triple bottom line reporting	More companies → NH or PR Few companies → MD or PS
• Peer pressure on “bad actors” by mining companies and other communities of interest	Increased peer pressure → NH or PR Unwilling to criticize → MD or PS
• Public attitudes to mining	Increasingly positive → NH or PR Indifferent/irrelevant → MD or PS
• Divisions and conflict within local mining communities	Local conflicts → MD

## Scenario Comparison

Scenario development did not limit its focus to mining companies. Effort was also put into considering implications for government, indigenous people and various elements of civil society. Some of the results are provided in Table 4.

## Reflections

Perhaps the greatest benefit of a scenarios exercise is to stretch the boundaries of participants’ mindsets. Some of the key reflections from participants are summarized below.

*What are the key insights from this scenarios exercise?*

1. There is a need for a far more holistic approach to designing, operating and closing a mine than has been typical practice in the past. The need for such a holistic approach extends not only to companies but also to government, mining industry service providers and other communities of interest.
2. The sophisticated nature and ease of worldwide communication has dramatically changed the “influencing” environment for mining/minerals projects and operations.
3. There is a need for transparency by all, particularly mining companies and government. Coupled with transparency is engagement that will facilitate greater involvement on the part of individuals and communities in mining/mineral related decision-making that affects their current and future lives.

*What are the major challenges to be faced in ensuring that North American mining and minerals contribute to the transition to sustainable development?*

1. Gaining recognition that the drive toward sustainable development is not only the responsibility of the mining/minerals industry (though they shoulder a particular responsibility in terms of their practices) but also government and broader society.
2. Overcoming the immense gap between the short-term perspective of the market and the long-term time horizon of sustainability.
3. Finding ways to bring price in line with full costs.
4. Raising standards related to environmental and social implications in a way that is fair and practical while ensuring that adequate movement towards sustainability is achieved.



**Table 4. Summary: scenario comparison.**

	<b>New Horizons</b>	<b>Phoenix Rising</b>	<b>Perfect Storm</b>	<b>Money Divides</b>
<b>Major Themes</b>	<ul style="list-style-type: none"> <li>• Strong financial performance—prices and efficiency gains</li> <li>• New leadership, new mindset, new culture</li> <li>• Trust develops through joint actions</li> <li>• Sustainable Development embraced by unified industry</li> </ul>	<ul style="list-style-type: none"> <li>• Severe financial pressures</li> <li>• Desperation leads to new mindset</li> <li>• Openness leads to problem solving</li> <li>• New coalitions</li> <li>• Major divergence U.S. and Canada</li> </ul>	<ul style="list-style-type: none"> <li>• Severe financial pressures</li> <li>• Hunker-down, cost-cutting mentality</li> <li>• Closed to change</li> <li>• Growing safety and environmental risks</li> <li>• Sunset industry</li> </ul>	<ul style="list-style-type: none"> <li>• Buoyant financially</li> <li>• Existing industry values entrenched</li> <li>• Distrust of large corporations</li> <li>• Acrimonious conflict and legal battles</li> <li>• “They don’t get it”</li> <li>• Path unsustainable</li> </ul>
<b>Economic Performance</b>	<ul style="list-style-type: none"> <li>• Strong margins</li> <li>• Increased productivity</li> </ul>	<ul style="list-style-type: none"> <li>• Eroding margins</li> <li>• Bankruptcies</li> </ul>	<ul style="list-style-type: none"> <li>• Eroding margins</li> <li>• Bankruptcies</li> </ul>	<ul style="list-style-type: none"> <li>• Rising margins</li> <li>• Increased capital for investment</li> </ul>
<b>Industry Structure</b>	<ul style="list-style-type: none"> <li>• Expansion</li> <li>• New mines</li> <li>• Recycling increases as economically viable</li> </ul>	<ul style="list-style-type: none"> <li>• Consolidation</li> <li>• Rationalization</li> <li>• Mine closings and selected new mines</li> </ul>	<ul style="list-style-type: none"> <li>• Consolidation</li> <li>• Mine closures, layoffs and rationalization</li> </ul>	<ul style="list-style-type: none"> <li>• Opportunistic M&amp;As</li> <li>• Selective entrepreneurial initiatives</li> </ul>
<b>Industry Values</b>	<ul style="list-style-type: none"> <li>• Openness and dialogue</li> <li>• Sustainable Development performance practices adopted</li> <li>• Association builds consensus</li> </ul>	<ul style="list-style-type: none"> <li>• Openness and dialogue (Canada &gt; U.S.)</li> <li>• Commitment to social and environmental performance</li> <li>• Peer pressures to conform</li> </ul>	<ul style="list-style-type: none"> <li>• Old-line culture persists</li> <li>• Focus entirely on costs</li> <li>• Deteriorating maintenance threatens infrastructure integrity</li> </ul>	<ul style="list-style-type: none"> <li>• Closed</li> <li>• “Money solves everything”</li> <li>• Defensive “Laager” mentality</li> <li>• Money = power</li> </ul>
<b>Societal Values</b>	<ul style="list-style-type: none"> <li>• Commitment to environmental and social sustainability</li> <li>• Interdependence</li> </ul>	<ul style="list-style-type: none"> <li>• Commitment to environmental and social sustainability</li> <li>• Interdependence</li> </ul>	<ul style="list-style-type: none"> <li>• Strong commitment to environmental and social sustainability</li> <li>• Mining perceived as dirty and irrelevant</li> </ul>	<ul style="list-style-type: none"> <li>• Uncertainty/insecurity</li> <li>• High environmental concerns</li> <li>• Cynicism toward corporations</li> </ul>

	<b>New Horizons</b>	<b>Phoenix Rising</b>	<b>Perfect Storm</b>	<b>Money Divides</b>
<b>Local Mining Communities</b>	<ul style="list-style-type: none"> <li>• More prosperous</li> <li>• More equitable sharing of benefits</li> <li>• Supportive of expansions and new mines</li> </ul>	<ul style="list-style-type: none"> <li>• Severe economic impacts</li> <li>• Increasingly part of dialogue and joint problem solving</li> </ul>	<ul style="list-style-type: none"> <li>• Severe economic impacts</li> <li>• Declining support for companies or mining industry—no economic benefits</li> </ul>	<ul style="list-style-type: none"> <li>• More prosperous</li> <li>• Supportive of expansions</li> <li>• Protesting voices vilified</li> </ul>
<b>First Nations/ Native Americans</b>	<ul style="list-style-type: none"> <li>• Open to development as full partners</li> <li>• First Nation mining companies</li> <li>• Goal = sustainable communities</li> </ul>	<ul style="list-style-type: none"> <li>• Open to development with long-term mutual benefits</li> <li>• Support of industry with governments</li> </ul>	<ul style="list-style-type: none"> <li>• Little interest in mining development—no benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Open to development as full partners</li> <li>• First Nation mining companies</li> </ul>
<b>Role of Governments</b>	<ul style="list-style-type: none"> <li>• Supportive of joint initiatives such as R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>• Ineffective shifting to support</li> <li>• Regulations maintained</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal involvement</li> <li>• Reluctant participants in managing sunset industry</li> </ul>	<ul style="list-style-type: none"> <li>• Paralyzed—unable to act effectively</li> </ul>
<b>Role of National and International NGOs</b>	<ul style="list-style-type: none"> <li>• Strong credibility and influence</li> <li>• Support external audits</li> <li>• Participate in joint task forces</li> </ul>	<ul style="list-style-type: none"> <li>• Skeptical, but take risks to work collaboratively</li> </ul>	<ul style="list-style-type: none"> <li>• Opposed to mining and negative social and environmental impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Rising credibility</li> <li>• Active and uncompromising</li> </ul>
<b>Technology</b>	<ul style="list-style-type: none"> <li>• Major advances in tele-mining and other technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Innovations adopted through necessity</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal innovation</li> </ul>	<ul style="list-style-type: none"> <li>• Investment in new technology</li> <li>• Increased automation</li> </ul>
<b>Human Capital</b>	<ul style="list-style-type: none"> <li>• Renewed interest in mining programs</li> </ul>	<ul style="list-style-type: none"> <li>• Decline in mining schools and enrollments</li> </ul>	<ul style="list-style-type: none"> <li>• Most mining schools close</li> </ul>	<ul style="list-style-type: none"> <li>• Decline in mining schools and enrollments</li> </ul>

*What actions are needed to address these challenges and/or to assist in achieving a more desirable future?*

1. Education of mining companies with regard to the benefits of a more holistic approach (New Horizons) versus the pitfalls of the status quo (somewhere between Perfect Storm and Phoenix Rising) and the risks that come with an isolated focus on profitability (Money Divides).
2. Continuing dialogue involving the breadth of communities of interest that have been involved in this exercise.
3. Actions on the part of companies and government that demonstrate the successful steps taken.
4. Development of business models that incorporate “real” costs and overcome the limitations of discounted cash flow techniques when applied to closure 20, 30 or 50 years in the future.
5. Grooming of new managers on a more holistic approach; shifting the corporate culture and awards system in support of this change.
6. Broader recognition of the many “players of influence” in the industry including mining suppliers, engineering firms, construction contractors, environmental and social consultants; development of ways that their role and responsibility is more visible.

*What are the implications if these actions are not taken?*

1. An increasingly marginalized industry in North America.
2. Greater disconnect between government, industry and other communities of interest.
3. A greater tendency towards Perfect Storm than towards New Horizons.

During its short life, the scenarios exercise achieved a great deal. Most of the MMSD–NA final recommendations began as output from the final brainstorm of the workgroup. However, at the same time, it suffered from some significant limitations that need mention. Firstly, time and financial resources precluded a link with Mexico. This is a significant topic that was not explored during this exercise. With the North American Free Trade Agreement in place, it is inevitable that corporate interconnections, regulations, standards and practices across Canada, the U.S. and Mexico will continue to converge.

Secondly, except for maintaining a general overall sense, this exercise did not specifically consider implications of foreign companies operating in Canada and the U.S. nor the implications of U.S. and Canadian companies working elsewhere. With industry consolidation, processes of globalization, the split between developed and developing economies, and in the Americas, the efforts of the Mines Ministries of the Americas (CAMMA) all continuing, implications for scenarios work are profound.

Lastly, opinion, culture, values and history vary between Canada and the U.S. Sometimes these differences are poignant and obvious, often they are subtle or even hidden. Nevertheless, they are always important to recognize and understand when possible. While these differences surfaced in discussion from time to time and every attempt was made to capture such insights, the limited resources of this exercise did not allow an in-depth consideration of this topic.

Taken together, the above kinds of limitations lead to a need to recognize the current work as a first step in what should be a longer, more profound exercise in reflection regarding alternative futures for the mining/minerals industry. In the meantime, the work that has been completed here can be used by mining companies large and small, industry associations, First Nations/Native Americans, labour organizations, government agencies, non-government organizations, communities, teachers, researchers and students as a starting point for preparing for the future.

## 5. Sustainability on the Ground

The effort underlying all of the discussion in the previous sections provides a rich overall context, past, present and future. However, how does this help the explorer, mine manager or mill superintendent? In practice, if the ideas of sustainability cannot be brought to bear on the ground of real practice they will be of little use. For this reason, Workgroup 2 was asked to collaboratively develop a set of practical principles, criteria and indicators that can be used to guide or test the design, operation and monitoring of performance of individual, existing or proposed operations in terms of their compatibility with concepts of sustainability.

The motivation stemmed from the idea that building such an assessment tool would not only be immediately useful but also would force articulation of sustainability concepts in terms that were meaningful to mining/mineral practitioners as well as others.

The starting point for this effort was 10 pieces of recent and relevant work drawn from government, industry, non-government organizations, indigenous peoples and the financial services sector. Authors of seven of these were at the table.

The result of this effort is a robust, dynamic framework for assessment in which questions are asked about direction and the answers obtained compared to ideal or desired outcomes. A full description of the framework can be found in the report *Seven Questions to Sustainability – How to Assess the Contribution of Mining and Minerals Activities*.

### Conceptual Base

At the heart of the concept of sustainable development there is a fundamental, immutable value set that is best stated as “parallel care and respect for the ecosystem and for the people within.” From this value set emerges the goal of sustainability: to achieve human and ecosystem well-being together. It follows that the “result” against which the success of a mine (or any human activity) should be judged is the extent to which development meets the challenge of achieving, or making a positive contribution to, human and ecosystem well-being together.

Seen in this way, the concept of sustainability is much more than environmental protection in another guise. It is a positive concept that has as much to do with achieving well-being for people and ecosystems as it has to do with reducing stress or impacts. Furthermore, sustainability is more confidently identified as a process towards desirable outcomes rather than a final product with fixed end points.

Given these perspectives, the practical approach to sustainable development becomes one of:

- setting directions towards the ideal objective; and
- measuring progress along these trajectories.

The *Seven Questions* approach is based on the experience of auditors and evaluators. It has the capacity to provide clear, practical guidelines on applying sustainability at the project or operational level, and in the process:

- establish consistency across applications, reduce confusion and achieve efficiencies; and
- clarify the case for sustainability.

### Important Issues

#### *Focus on people and ecosystems*

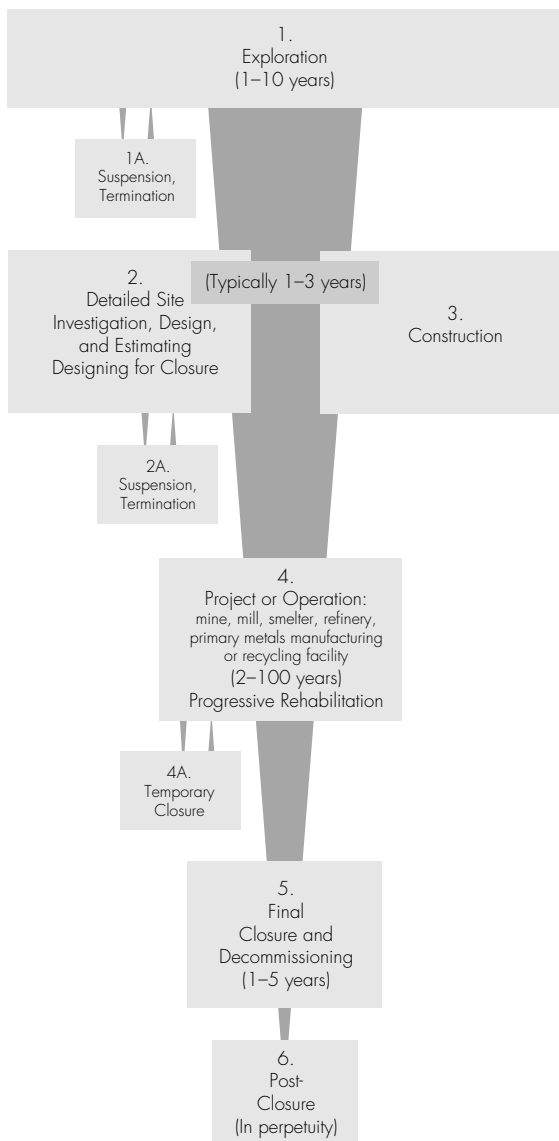
Remarkably, the fact that minerals are nonrenewable (or stock) resources and in some sense fixed in absolute quantity turns out to be relatively unimportant from a sustainability perspective, at least at the macro scale and at this point in time. The history of min-

eral production and future geological resource potential show depletion to be a lesser issue. Rather, the focus is on mining as an activity and its implications for people, their communities and ecosystems within which minerals are embedded and mining activities take place.

*Need to achieve a positive contribution to people and ecosystems over the long term*

At any one site, mining and mineral activity has a finite life-span, while the implications of that activity (not only as a direct result of the activity but also through the products that are produced) go on indefinitely. In that sense, mining/mineral activities serve as a bridge to the future. The sustainability challenge is to ensure that the implications of mining are net positive for people and ecosystems over the long term: these are the aspects that need sustaining. Sustainability objectives can be served if mining/minerals projects and operations are designed and implemented in ways that build viable long-term capacities, strengthen communities and rehabilitate damaged ecosystems.

**Figure 6. The mine life-cycle.**



*Culture is a determining variable*

Public perceptions and practical application of the sustainable development duality—human plus ecosystem well-being—are culturally constrained. For example, in the developed world, the environmental values serve as a strong influence on development decision-making. As part of this, the mindset of decision-makers is expanding to include consideration of the implications of today’s action for future generations. In contrast, hunger, poverty and health concerns are often the driving forces and ethical imperatives in much of the developing world where the urgency of providing for the needs of people alive today is simply too great to allow much time to reflect on the needs of those not yet born. These perspectives are not mutually exclusive. However, simultaneous expression of both without care and sensitivity can and does lead to tension.

*Process and substance are both critical*

By extension, in making an assessment for sustainability, values (social and cultural) will come into play and there is not necessarily a unique or right answer to every question. Similarly, the questions asked are themselves based on today’s values and perspectives and may change, be refined or replaced based on an evolution of values, as well as improvements in knowledge and experience. Because of this value dependency, the question of who participates in making the assessment is important. Therefore, in bringing ideas of sustainability from theory to practice, the process of application (the how) is as critical as the substance of the application (the what).

*Issues vary over time; ongoing periodic assessment is essential*

The specific issues to be addressed in meeting the sustainability challenge will be different during the various phases of a mining project (exploration, production and post-closure) and may also change over time as knowledge, understanding and also cultural and social values change. As a result, any given project should be re-assessed periodically to address changing circumstances, and the questions themselves revised or augmented to reflect intellectual and value shifts. It is only through such continuous learning that the needed improvements can be identified and implemented.

## The Seven Questions Framework

### Scope

The focus of the Seven Questions framework is an individual (existing or proposed) project or operation and is applicable throughout the entire life-cycle of projects that range in scale from very small to very large. To be effective across such a wide spectrum, the framework requires careful review and adaptation to site- or sector-specific conditions.

Although the Seven Questions approach is drawn from North American experience, it is hoped that it is sensitive to cultures and conditions found elsewhere. In this way it can be of value to the North American industry at large, which is highly active around the world, and also to offshore based companies operating in North America.

Finally, the spatial scale of the Seven Questions is determined by the “reach” or “footprint” of a site as implications ripple out from a project/operation into human society and the natural ecosystem. Such implications may be past, present or future; actual or potential; and direct or indirect and induced in character.

### The Seven Questions

Developing an inclusive, holistic framework led to the articulation of seven questions to be posed in assessing a mine/mineral project or operation’s net contribution (positive or negative) to sustainable development. They are shown in short form in Figure 7.

**Figure 7. The Seven Questions at a glance.**



The seven-part numbering does not imply a particular sequence of steps or prioritizing of topics. In practice, application as a whole is essential, although relative weight and significance may vary considerably from site to site.

**Figure 8. Example from the full Seven Questions matrix.**

**Table 3. Environment: Is the integrity of the environment assured over the long term?**

Question (goal)	Ideal Answer (objectives)	Example Indicators	Example Metrics
<p>3. <i>Environment.</i> Will the project or operation lead directly or indirectly, to the maintenance or strengthening of the integrity of biophysical systems so that they can continue in post closure to provide the needed support for the well-being of people and other life forms?</p>	<p>The project or operation will lead directly or indirectly to the maintenance or strengthening of the integrity of biophysical systems as indicated by:</p> <p><i>3.1 Ecosystem Function, Resilience and Self-organizing Capacity.</i> A reasonable degree of confidence on the part of all communities of interest that ecosystem function, resilience and self-organizing capacity will be maintained or improved over the long term.</p>	<p>Input – Output – Result</p> <ul style="list-style-type: none"> <li>• Baseline studies completed.</li> <li>• Monitoring systems in place.</li> <li>• Projected effects of project on indicator species of aquatic and terrestrial flora and fauna (identified through scientific assessment as well as traditional ecological knowledge studies).</li> <li>• Projected long-term well-being of water systems and renewable resources in the area of the mining/mineral project.</li> <li>• Tracking rapid geological change.</li> </ul>	<p>NOTE: In the metrics below the term “grade” is used as a placeholder to suggest that some kind of assessment of the quality and adequacy of the work referred to should be undertaken.</p> <ul style="list-style-type: none"> <li>• Yes/no/grade.</li> <li>• Yes/no/grade.</li> <li>• Population effects of project on indicator species. (e.g., Bathurst Caribou herd, northern Canada).</li> <li>• Various interests confident in projections as indicated by survey.</li> <li>• Fish, ungulate, small mammal and bird population health.</li> <li>• Health and abundance of medicinal plants used for traditional purposes.</li> </ul>



## **Ideal Answers, Indicators and Metrics**

The seven questions are in fact simply the interrogative form of a goal statement. Once these have been crafted (a tough process when many interests are involved), a hierarchy of objectives, indicators and specific measurements or metrics fall out quite easily. In this way a single, initial motivating question—is the net contribution to sustainability positive or negative over the long term?—cascades into progressively more detailed elements which can be tailored to the subject under evaluation. Simultaneously, the starting point for assessing the degree of progress that has been achieved is provided by an “ideal answer” to the initial question.

The resulting comprehensive matrix serves as a master template for assessing the overall contribution of the project or facility. In this work, a full matrix was developed to serve as a starting point for application and an example from Question 3, The Environment, is shown in Figure 8. In practice, the details of indicators and specific metrics will be dependent on both the phase of the life-cycle under consideration and the specific site conditions.

## **Application**

In application, the Seven Questions approach is highly versatile and has the potential to aid decision-making in such areas as:

- a. *Early appraisal:* can/should a project or operation be acquired or implemented?
- b. *Planning:* what do we do and who do we involve?
- c. *Financing and insuring:* does the overall risk reflected in the project or operation lie within an acceptable range?
- d. *Licensing and approvals:* does the project pass or fail?
- e. *Internal corporate reviews:* how are we doing, what’s missing and how do we do things better?
- f. *Corporate reporting:* how and what do we communicate?
- g. *External review:* from the perspective of an external interest, how is the project or operation doing?

## **Bringing Theory to Practice**

During the deliberations of the workgroup, the process of implementing the Seven Questions framework was debated but not developed in detail. A number of issues were generally agreed upon in principle, but the specifics of practical application were left unresolved. The list includes:

*The equity issue:* effectively addressing the distribution of costs, benefits and risks amongst parties implicated by a mining/mineral project or operation.

*Trade-offs:* how to best design and implement decision-making systems and approaches that effectively and fairly address trade-offs in any given site application.

*Need and alternatives:* how to most effectively and fairly assess the need for a given project and/or commodity in light of considerations and alternatives that span local and global implications.

*Achieving a whole system perspective:* seeing, understanding and factoring in a sense of the whole system, not just the small component parts.

*Uncertainty, precaution and adaptive management:* dealing with uncertainty, using an appropriate level of precaution and an adaptive management approach.

*The attribution problem and dealing with cumulative effects:* how to best address the common situation where a project is one of a number of contributors to social, cultural, economic and environmental change or stress. This includes how to best establish the cumulative implications, how best to proportion responsibility and who should take responsibility for the analysis.

*Integration, synthesis and language:* how to engender respect for the contribution of many disciplines and build a synthesis that draws on their many insights; how to address the challenge of finding a common language to facilitate such an approach.

These issues are not new—many have grappled with them and others will continue to do so into the future as different approaches to their resolution are recognized and applied. Together they are testament to the complexities that must be faced in bringing the idea of sustainability from theory to practice.

### **Further Implementation**

Many of the concepts at the heart of the Seven Questions approach are new and evolving. The work should, therefore, be considered a step in a continuing process. As such, the workgroup recommended the following actions for further implementation:

1. Pilot test the Seven Questions framework at a number of existing projects, which provide examples of different types of operations (e.g., mine, smelter, refinery, recycling plant)
  - at different phases of the mine/project life-cycle;
  - in both developed and developing countries; and
  - that are led by different interest groups (company, community, first nation, government, non-governmental organization, etc.).
2. Reconvene the workgroup following completion of five of these pilot tests to:
  - review the lessons learned and appropriately modify the approach; and
  - undertake a comprehensive review of the implementation issue.

## 6. Change

MMSD was initiated to provide insight into how mining and minerals can best contribute to the global transition to sustainable development. The need for change was recognized by the industry. For MMSD–North America the task has been to build a strategy for achieving the needed change.

This cursory discussion stands back and looks at the nature of change and the related implications for the transition now facing the mining/minerals industry.

### Resistance to Change

The role of metals and minerals in providing for both human and ecosystem well-being is critical and it is with good reason that the mining industry has roots in antiquity. The depth and richness of its heritage brings a strength that is undeniable. However, this same heritage brings with it an innate resistance to change that has impeded the profound cultural adjustment that the industry is now facing.

There are many contributing factors to this resistance including:

- tradition – “we’ve always done it this way and it has worked, why change now?” or “if it’s not broke, why fix it?”;
- a number of economic factors that tend to favour risk-averse behaviors including: the volatility and uncertainty inherent in commodities markets, the scale and complexity of operations, the highly competitive nature of the business, and the resulting thin margins (Peterson *et al.*, 2001, p. 11); and
- a range of personal factors that apply not only in mining but in other industries, including: surprise, inertia, uncertainty, fear of the unknown, fear of failure, resentment of criticism, lack of training, lack of understanding about how change might affect a given job or activity, loss of job status, loss of security, peer pressure, loss of known workgroup, personality conflicts and timing (summarized from Stanislaw and Stanislaw, 1983).

Understanding and addressing this resistance effectively is critical. Faced proactively, the needed change can be achieved through smooth, incremental and efficient adaptation. Addressed from a reactive and defensive stance, the change will come in a disjointed and unexpected way with significant costs not only to industry but also to the broader community.

### Drivers of Change

Over the past two decades, a number of factors have emerged to provide a climate conducive to change in the mining industry. These factors include:

- changing societal values regarding the environment and fairness in the distribution of costs, benefits and risk related to various human activities such as those involved in mining and minerals;
- the increasing role of civil society in decision-making and a parallel opening of decision-making processes in government and business to include greater participation by all interests;
- increased public scrutiny of mining activities brought about by the improved communication system and the rise in the activity level, sophistication and significance of non-government organizations focused on the mining industry;

- public recognition of the significance of environmental and social risks and liabilities associated with mining/mineral activities and a change in the practices of both the financial services sector and regulatory agencies which clearly assigns those liabilities to project owners and proponents;
- a growing recognition on the part of mining-affected communities that preparations for post-closure must begin years before closure and similarly, allowance must be made for managing the effects of an operation years after closure;
- changing practices in the financial services industry that are increasingly linking access to capital to a demonstration of corporate social and environmental responsibility;
- consolidation among both operating firms and technology suppliers;
- globalization of mining activities as a result of economic liberalization and falling trade barriers (Peterson *et al.*, 2001); and
- recognition in business that competitive advantage lies with those who embrace change in their operating environment and establish ways of addressing it proactively.

The above drivers of change are not going to disappear. If anything, their significance will increase. The result is that the mining industry is facing unprecedented adjustment and the concepts that have emerged to guide that change are those of sustainability and sustainable development.

### **Different Change Agent Roles and Implications for MMSD–North America**

Change is facilitated by “change agents” who, for success, must play different roles and employ different strategies depending on the change being sought, the particular point in the change process, and the degree and nature of resistance. Table 5 lists a four-part taxonomy of change agent roles that includes catalyst, solution giver, process helper and resource linker. This taxonomy was originally applied to individual organizations. However, its application to broader society is equally useful.

MMSD was created as a change agent and varyingly served as a solution giver, process helper and resource linker.

All of the listed roles are important to the change process and none likely exists in a “chemically pure” state. However, different strategies are needed at different times in pursuing any one of these roles. Clearly, if the whistle-blowing strategy of a catalyst is used at a moment when the problem has been fully recognized and effort is needed to design a solution, the results will be something less than satisfactory.

One of the issues facing MMSD–North America was the decision of many mining-focused environmental organizations to boycott MMSD activities. They questioned the integrity of the internal MMSD decision-making process, cited the limitation of their own resources and their desire to focus on action that would lead to concrete results on certain specific priority issues and raised a concern that their participation would undermine their integrity in subsequent public debate regarding mining/mineral industry practices. This last point was particularly important given the World Summit on Sustainable Development held August–September 2002, marking 10 years since the Earth Summit in Rio de Janeiro, Brazil, in 1992, a few months after release of the MMSD Global report.

Organizers and participants in MMSD–North America were disappointed with this position particularly because MMSD was created to provide the opportunity for engagement. However, from another perspective, the positioning of the ENGO community is completely consistent with a choice to emphasize, in this case, their change agent role as a “catalyst.”

**Table 5. Change agent roles.**

Role	Description and comment
1. Catalyst	needed to overcome inertia; primary functions are to make dissatisfaction known, upset the status quo and to energize the problem-solving process. Vocal advocacy organizations such as Greenpeace primarily assume this role. The original catalysts were likely poets, satirists and artists.
2. Solution Giver	needed to offer creative ideas about the change to be taken; for success, must know how and when to communicate ideas so that they will be heard; requires sensitivity to others' capacity and how change can accommodate their needs. Consultants are solution givers by profession. Some non-government organizations are embracing this role as well.
3. Process Helper	needed to show how to: (1) recognize and define needs; (2) diagnose a problem and set objectives; (3) acquire relevant resources; (4) select or create a solution; (5) adapt and carry out solutions; and (6) evaluate solutions and feed the lessons back into the decision-making processes. This is the role of the facilitator whether an individual or an organization.
4. Resource Linker	needed to bring people and other resources together to be applied to a problem.

Source: modified from Hunsaker, 1982.

Others (including those within and outside the environmental movement) did not agree with their stance, arguing instead that ENGOs are more effective if they also participate in solution building, something for which MMSD provided an unprecedented opportunity. However, the debate then is over strategy and the diversity of opinion on strategy is as great within the environmental community as it is within the mining/minerals industry. In any case, the strategic choice of not participating in solution building through MMSD does not preclude doing so in the future through other mechanisms and opportunities. Regardless of agreement or not with this particular strategy at this particular time, its consistency with their role as a “catalyst” is undeniable.

### **The Mining/Minerals Industry as a “Learning Industry”**

Burgoyne (1992) describes learning as “what any individual, institution, or entity does to change and adapt and survive and fit in with changing circumstances.” He goes on to offer three characteristics for identifying the level or degree of learning that is exhibited by any given organization:

1. capacity for memory – processes are developed, implemented and maintained over time;
2. capacity for adaptation – adaptation occurs to ensure survival in the face of changing demands of markets, economics, social interests or political systems; and
3. capacity to reach out and develop the operating context (operating and social environment) making their own world better for them to live in and contribute to.

He then points out (p. 223):

Second level learning organizations will tend to exploit their customers, clients, employees, suppliers, neighbours, raw materials, and even owners. They will erect their own needs as they exhaust the old ones and move on to new territory. Third level organizations will act in a way that assists the development and enrichment of the organization's stakeholders, resources, trading partners, and then erects less need for dramatic internal changes.

It is the attainment of this “third level” that he links to the stability of longstanding organizations or from their perspective—their own internal sustainable development. The following discussion draws from Burgoyne’s thesis and applies it to the mining/minerals industry as a whole.

The mining/minerals industry as a “learning industry” would continuously transform itself in a reciprocal relationship with all of its members. Four notions are important:

1. The learning industry would see itself as a “whole” and be concerned with how the industry as a whole changes its methods, practices and procedures. This approach is consistent with seeing the mining/minerals industry as a complex, vertically and horizontally integrated production system (as described by Alistair MacDonald in *Industry in Transition*) knitted together with all of the players described in Section 2. Obviously, there is a sense that individuals, companies and other interests will integrate the learning but, nonetheless, the whole is going to be more than the sum of its parts.
2. The learning industry would achieve its own sustainable development through enriching rather than exploiting its operating and broader social environment. In that way it would ensure a contribution to the broad societal transition to sustainable development. This links to the third level characteristic described above. This notion lies at the heart of the call for corporate social responsibility and, specifically in the case of mining and minerals, to come to grips in a more holistic way with its own contribution on the ground as described in Section 5 through the Seven Questions framework.
3. The learning industry would maintain excellence in changing circumstances and over time. The excellence movement is now over 20 years old (stems from Peters and Waterman’s book, *In Search of Excellence*) and is a fundamental building block of the sustainability management systems that are now emerging.
4. The learning industry would tend to be able to achieve change through relatively smooth and gradual processes rather than through periodic major crises. The learning industry in a stronger form would veer away from walls as it approaches them and smoothly adapt. This kind of transition is more efficient than alternating abruptly between crisis and stability which has been the traditional pattern in the mining/minerals industry.

MMSD–North America is a small step in having the mining and minerals industry become a “learning industry.” Section 7 offers a series of concrete steps to seeing this evolution continue.

## References, Section 6

Burgoyne, John, 1992. “Creating a Learning Organization.” *RSA Journal*, April 1992, pp. 321–332. London: Royal Society for the Encouragement of Arts, Manufactures, and Commerce. Originally delivered to the Society as an Address on Wednesday, 8 January 1992.

Hunsaker, Phillip L., 1982. “Strategies for Organizational Change: The Role of the Inside Change Agent.” AMACOM, Periodicals Divisions, American Management Association. Portions of this article were originally presented at the twenty-third annual Western Academy of Management Meeting, Colorado Springs, Colorado, April 1982.

Peters, T.J. and R. H. Waterman, 1982. *In Search of Excellence*. New York: Harper & Row.

Peterson, D.J., Tom LaTourrette, James T. Bartis, 2001. *New Forces at Work in Mining – Industry Views of Critical Technology*. Santa Monica and Arlington: RAND Science and Technology Policy Institute.

Stanislao, J. and B.C. Stanislao, 1983. Dealing with Resistance to Change. *Business Horizons*. July–August, 1983.

## 7. Strategy for Change

At the heart of this initiative is the task of designing and initiating a strategy for change. It amounts to identifying specific steps that will lead to further aligning mining-/minerals-related activities with the broad societal adjustment to sustainable development. The challenge is to lay out a series of actions that will effectively nourish the positive change that is already occurring. It doesn't mean addressing all the issues that face today's mining and minerals industry.

In discharging its mandate, MMSD–North America has used the lens of sustainability to look at the past (Section 3), the future (Section 4) and to think in concrete terms about what it means today for an operation or project (Section 5). Throughout all of this work, significant effort has been put to recognizing all implicated communities of interest (Section 2). The lens we have used is one that calls for consideration of implications to people and ecosystems, positive and negative, over the short and long terms. It is a lens that forces consideration of not only what is done (the substance), but also how it is done (the process). And in synthesis, the overall goal that guides this approach is to enhance the well-being of both people and ecosystems.

Each task of the MMSD–North America work plan led to suggestions for follow-up action. A synthesis of these recommendations was vetted at the North American Mining Dialogue held in Vancouver, November 7–9, 2001. A revised set was subsequently circulated for comment.

Recommendations and priorities from two other sources provide an important context: (1) those contained in the MMSD Global final report; and (2) those suggested in the International Council on Mining and Metal's (ICMM's) May 24, 2002 "Toronto Declaration Implementation Process." A comparison identifying elements of these other two documents relevant to the recommendations of MMSD–North America is provided in Appendix 2. The recommendations from MMSD Global are summarized in Appendix 3.

By the end of the MMSD–North America activities, 10 priority actions emerged. The substance of these is summarized in Table 6.

The recommendations have been crafted to encourage positive change while enhancing the capacity of all communities of interest. Together, they are aimed at helping mining and mineral activities achieve a net positive contribution to people and ecosystems over the long term thereby helping to synchronize mining and mineral activities with the overall societal transition to sustainable development.

The recommendations remain at a "high level." This is deliberate. Each of the topics they address is important and worthy of a depth of consideration that was not possible within the short life-span of MMSD–North America.

**Table 6. MMSD–North America final recommendations in summary.**

---

### **The Legacy Issue**

#### *Immediate Priority*

1. Enhance effort to address the legacy of past mining and mineral activities.

#### *Longer Term*

2. Strengthen the basket of legislated rules, market incentives and voluntary programs to prevent the same from happening in the future.

### **Improving Practices**

#### *Immediate Priorities*

3. Initiate a series of pilot tests as the next step in the collaborative development of the Seven Questions to Sustainability framework.



4. Design and implement effective approaches for rewarding good and discouraging poor performance within the context of sustainability as indicated by the Seven Questions framework.
5. Design and implement a set of effective dispute resolution mechanisms tailored for application across the full life-cycle of mining and mineral projects.
6. Review and optimize the rules and systems for designating and controlling recyclable material and hazardous waste to encourage recycling while maintaining safety.
7. Develop and implement a practical approach to addressing the equity issue at the project/operational level.

#### *Longer Term*

8. Initiate a review of the current financial/business/economic decision support model and the processes used in its application in the mining and minerals industry to identify how ecological and social costs, benefits and risks can be more effectively incorporated.

#### **Enhancing Capacity**

9. Strengthen the learning and research/development system in support of the North American mining and minerals industry to avoid serious human resource problems within the next decade.

#### **Monitoring and Reporting on Follow-up**

10. Create a mechanism to facilitate follow-up activities and report on MMSD–North America outcomes, 2002–2007.

### **Recommendations in Detail**

In detail, each recommendation includes two components: (1) the specifics of the recommended action; and (2) the follow-up process. Table 7 lists both.

The substance of these recommendations (Table 6 and column 1 in Table 7) has been subject to significant discussion amongst participants. The specifics of a follow-up process for each recommendation is also addressed here (column 2 in Table 7) to do as much as possible to ensure that timely action is taken. This is important. A broad range of participants gave their time, energy and ideas to be part of the process. They contributed in good faith, believing the initiative was important and in the expectation that there would be follow-up. The issue is particularly sensitive in Canada where in 1994, the Whitehorse Mining Initiative reported out after two years of deliberation, raising expectations for action which were not met in the eyes of some.

There is significant delicacy attached to wording suggestions for the follow-up process. Each element of the follow-up requires a collaborative effort. Thus, participants must be part of designing how to proceed. The intent of the wording that follows is to ensure that someone assumes responsibility for initiating the required follow-up (and for which there is a good chance that there will be support forthcoming) but always in a way that respects the role of participants.

In all cases, the proposed follow-up is based first on encouraging existing relevant initiatives where they are already underway and second on facilitating partnerships between interests. In so doing, the recommendations attempt to maximize efficiencies and the possibility of achieving concrete results while continuing the “platform for engagement” as envisioned in the original concept of MMSD and GMI.

**Table 7. Recommended action and follow-up process.**

Recommended Action	Recommended Follow-up Process
<i>The Legacy Issue</i>	
<b>Immediate Priority</b>	
1. Enhance effort to address the legacy of past mining and mineral activities.	<p>In Canada the Mines Ministers have created the Orphaned/Abandoned Mines Advisory Committee to address this issue under the chair of Dr. Christine Kaszycki, Assistant Deputy Ministry of Mines, Manitoba. The Advisory Committee is a national multi-interest mechanism involving all key interests including industry associations, regulatory agencies and communities, First Nations and non-government organizations. In addition, the Inter-governmental Working Group on Mining has also been mandated by the Mines Ministers to address this issue. Most of the implicated interests also have their own dedicated task forces or committee. For Canada, the Advisory Committee is the logical mechanism to coordinate continued work on this topic.</p> <p>In the U.S., there is significant activity related to this topic involving state, federal, and tribal governments and non-government organizations. The main focus to date has been related to coal mining as a result of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The relationship between coal mining related activities and other forms of mining is a topic of significant discussion. The Office of Surface Mining Reclamation and Enforcement of the U.S. Department of the Interior plays a central role. Initiatives are also underway involving The U.S. Forests Service (Department of Agriculture), Bureau of Land Management (Department of the Interior), National Parks Service, and the U.S. Army Corps of Engineers. Work on this issue has also led to creation of the National Association of Abandoned Mine Land Programs, a non-profit organization involving states and tribal governments. In spite of the high level of activity, no overall coordinating mechanism currently exists and will not emerge without the support of all the implicated parties.</p> <p>The issue is important to address on a North American basis, particularly because of the North American Free Trade Agreement. The Mines Ministers of the Americas, the North American Commission for Environmental Cooperation and the North American Institute (NAMI) are three important collaborators for taking up this issue.</p>

Recommended Action	Recommended Follow-up Process
<b>Longer Term</b>	
2. Strengthen the basket of legislated rules, market incentives and voluntary programs to prevent the same from happening in the future.	<p>The University of British Columbia Department of Mining has offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy. They are particularly well-placed to undertake this first step because of their key networking role in seeking the creation of Centres of Excellence for mining and sustainability in the U.S. and Canada. Important collaborators include:</p> <ul style="list-style-type: none"> <li>• industry associations including: the Mining Association of Canada (MAC), the National Mining Association (NMA), Prospectors and Developers Association of Canada (PDAC), Northwest Mining Association (NWMA) and their state, provincial and territorial counterparts;</li> <li>• organized labour including, but not limited to, the International Federation of Chemical, Energy, Mine and General Workers' Union and affiliates;</li> <li>• various state, provincial, territorial and federal government agencies;</li> <li>• non-government organizations;</li> <li>• academic centres such as, but not limited to: the Mackay School of Mines, University of Nevada, Reno; Department of Mining Engineering, University of Arizona, Mining Engineering Department, University of Kentucky, the Colorado School of Mines; and</li> <li>• The International Institute for Sustainable Development (Winnipeg).</li> </ul>

### *Improving Practices*

#### **Immediate Priorities**

3. Initiate a series of pilot tests as the next step in the collaborative development of the Seven Questions to Sustainability framework.	<p>As part of its role as facilitator of MMSD–North America, the International Institute for Sustainable Development is now pursuing opportunities for pilot testing the Seven Questions framework. Potential partner organizations include companies, communities, indigenous peoples, non-government organizations and government agencies. In each case, the partner organization would assume responsibility for undertaking the pilot. IISD is helping initiate the pilots and is serving as a mechanism to ensure links are maintained with the original MMSD–North America workgroup, International Council on Mining and Metals (ICMM), Global Reporting Initiative (GRI), International Standards Organization (ISO), World Bank, UN agencies and the World Business Council for Sustainable Development (WBCSD). This work is now ongoing.</p>
---	--

Recommended Action	Recommended Follow-up Process
<p>4. Design and implement effective approaches for rewarding good and discouraging bad performance within the context of sustainability as indicated by the Seven Questions framework.</p>	<p>The Prospectors and Developers Association of Canada (PDAC) with the Northwest Mining Association (NWMA) in the U.S. has offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy. PDAC and NWMA are particularly well-suited to undertake this first step because of their reach to the many junior and intermediate elements of the mining industry. Important collaborators include:</p> <ul style="list-style-type: none"> <li>• industry associations including: the Mining Association of Canada (MAC), the National Mining Association (NMA) and their state, provincial, and territorial counterparts;</li> <li>• organized labour including, but not limited to, the International Federation of Chemical, Energy, Mine and General Workers' Union and affiliates;</li> <li>• professional associations including the Society for Mining, Metallurgy and Exploration (SME) and The Canadian Institute of Mining and Metallurgy (CIM);</li> <li>• First Nations and Native American organizations;</li> <li>• various state, provincial, territorial and federal government agencies;</li> <li>• non-government organizations;</li> <li>• the governing bodies of the stock markets; and</li> <li>• representatives of the financial services industry including investors, lenders and insurers.</li> </ul>
<p>5. Design and implement a set of effective dispute resolution mechanisms tailored for application across the full life-cycle of mining and mineral projects.</p>	<p>The Morris J. Wosk Centre for Dialogue, Simon Fraser University, through its Dialogue Forum Project, has offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy. The Centre, through its Dialogue Forum Project, is currently engaged in a broad-ranging initiative that is drawing together key North American experts in dispute resolution with participants who bring insights and experience from a broad range of communities of interest including indigenous people, non-government organizations, corporations and government. In this particular exercise, links to the International Council on Mining and Metals (ICMM), World Bank, UN agencies and the World Business Council for Sustainable Development (WBCSD) are all important.</p>

Recommended Action	Recommended Follow-up Process
6. Review and optimize the rules and systems for designating and controlling recyclable material and hazardous waste to encourage recycling while maintaining safety.	This issue would be best taken on by an industry–NGO collaborative. In Canada, the New Directions Group may be a useful starting point (an industry-NGO collaborative established in the late 1980s). No equivalent exists either in the U.S. or Mexico. Close collaborators should be the North American Commission for Environmental Cooperation, the Mines Ministers of the Americas (CAMA) and national and state/provincial governments.
7. Develop and implement a practical approach to addressing the equity issue at the project/operational level.	The International Institute for Sustainable Development (IISD) has offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy. IISD is particularly well-suited to this task not only because of its role as facilitator of MMSD–North America but also because of its own mandate and the important role that the equity issue plays within that mandate.

---

### Longer Term

---

8. Initiate a review of the current financial/business/economic decision support model and the processes used in its application in the mining and minerals industry to identify how ecological and social costs, benefits, and risks can be more effectively incorporated than they are at present.	The Director of Engineering, Laurentian University, has offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy.
--	--

### *Enhancing Capacity*

9. Strengthen the learning and research/development system in support of the North American mining and minerals industry to avoid serious human resource problems within the next decade.	<p>The Society for Mining, Metallurgy and Exploration (SME) with the Canadian Institute for Mining and Metallurgy have offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy. This issue is a priority issue for both of these organizations.</p> <p>Important collaborators include:</p> <ul style="list-style-type: none"> <li>• the academic centres that focus on mining and minerals activities;</li> <li>• the informal North American Working Group on Academic Support for the Mining Industry;</li> </ul>
---	--

Recommended Action	Recommended Follow-up Process
	<ul style="list-style-type: none"> <li>• organized labour including, but not limited to, the International Federation of Chemical, Energy, Mine and General Workers' Union and affiliates;</li> <li>• industry associations including: the Mining Association of Canada (MAC), the National Mining Association (NMA), Prospectors and Developers Association of Canada (PDAC), Northwest Mining Association (NWMA) and their state, provincial and territorial counterparts;</li> <li>• representatives of state, provincial, territorial and federal government agencies;</li> <li>• non-government organizations;</li> <li>• First Nations and Native American organizations; and</li> <li>• representatives of federal and state/provincial governments.</li> </ul>

*Monitoring and Reporting on Follow-up*

<p>10. Create a mechanism to facilitate follow-up activities and report on MMSD–North America outcomes, 2002–2007.</p>	<p>The International Institute for Sustainable Development (IISD) has offered to convene an initial discussion that would scope out this topic and develop a work plan and funding strategy. IISD is well placed to undertake this step because of its role as facilitator of MMSD–North America.</p>
--	---

**Underlying Issues**

*Recommendation 1. Enhance effort to address the legacy of past mining and mineral activities.*

Throughout all of the activities of MMSD–North America, designing and implementing a solution to the current problems presented by past mining activities arose as the number one priority.

Mining and mineral practices are central to the development of human society. However, some past practices have left a legacy of abandoned and orphaned sites and related environmental, social and economic problems that for some communities of interest serves to foster continuing mistrust and antagonism directed not only at the mining and minerals industry, but also at government.

This legacy involves significant liabilities and the distribution of responsibility for these liabilities across:

- government including federal, state/provincial and local elements (representing current, past and future generations);
- the mining industry (representing current, past and future mining companies);
- local communities (in the form of degraded quality of life); and
- the environment.

Different jurisdictions have different approaches for apportioning the responsibility. The mosaic of approaches in the U.S. and Canada is complicated by the fact that local, state/provincial and federal legislation and policies all play significant roles.

In addressing this topic, there are at least two distinct aspects: (1) public recognition that some past practices are no longer acceptable; and (2) design and implementation of an effective and timely set of mechanisms to address lingering problems associated with abandoned and orphaned sites: sites where legal responsibility has reverted to the government for a variety of reasons.

Key challenges include: (1) developing a comprehensive inventory of abandoned and orphaned sites; (2) assessing the nature and significance of concerns in each case; (3) developing an effective way for prioritizing sites so that the worst get addressed first; and (4) developing a formula for coming up with the resources for the required action.

***Recommendation 2. Strengthen the basket of legislated rules, market incentives and voluntary programs to prevent the same from happening in the future.***

While recommendation 1 is a response to an existing problem, recommendation 2 is looking forward and assuming a preventative stance.

A significant portion of mining- and mineral-implicated interests continue to question the adequacy of the current legislated rules, financial incentives, voluntary programs and policies aimed at ensuring that the kinds of problems being faced today from past mining/mineral activity are not created now for those in the future. These interests carry significant doubt that the current system will ensure that acceptable post-closure outcomes will be achieved and that commitments made can and will be fulfilled whether they be by companies, governments, First Nations/Native Americans or the local community.

To develop the needed degree of confidence, an approach to closure is required that:

- minimizes the long-term problems by good design and operating procedures in the present; and
- ensures that adequate surety (financial and otherwise) is in place to fully cover social and environmental implications over the long term.

At the outset, such an approach is partly captured in legislated rules governing approvals, operation and closure; partly in the market incentives that exist; partly in the spirit and voluntary programs of companies and the industry as whole; and partly in the regulatory and enforcement capacity of government. However, in addition, part of this issue relates to the transparency of decision-making processes, the capacity of industry to communicate what it is doing; and the capacity of other interests to address the technical issues under consideration.

***Recommendation 3. Initiate a series of pilot tests as the next step in the collaborative development of the Seven Questions to Sustainability framework.***

The Seven Questions framework was developed by a 35-person, multi-interest workgroup. Through application on real projects it will receive the kind of testing that is required to prove or adjust such an instrument.

Testing must be by various interests to ensure that a complete range of values is brought into play and the needed insight is brought to bear.

***Recommendation 4. Design and implement effective approaches for rewarding good/discouraging poor performance within the context of sustainability as indicated by the Seven Questions framework.***

The mining/minerals industry and the various implicated communities of interest do not have in place an effective set of mechanisms for rewarding good and discouraging bad



performance within the context of sustainability as reflected in the Seven Questions framework. As a result, when success occurs it is not always recognized and when bad practices are implemented, effective action is not always taken to prevent the same from occurring again. In both cases, all communities of interest ultimately suffer.

The industry itself is a complex, interconnected production system comprised of company units with widely varying financial/technical focus and capacity. As a result, what might work for one part might be totally ineffective for another. In addition, a wide range of interests are implicated including small, medium and large companies, communities, labour, First Nations/Native Americans, non-government organizations and academics. Each community of interest has special considerations to address in terms of encouraging good and discouraging bad practices. Importantly, there needs to be consistency across all interests—if one element of this mosaic makes a commitment to certain performance levels, others must also if the entire community is to move ahead.

Options to consider include:

- the effectiveness of developing principles for behaviour and conduct that can be used by all the communities of interest;
- various program options for implementing the principles;
- options for ensuring that such processes are open to scrutiny by all communities of interest; and
- the effectiveness of a certification process and how such a process might be implemented for the mining industry.

*Recommendation 5. Design and implement a set of effective dispute resolution mechanisms, starting with approaches to preventing disputes in the first place, and tailored for application across the full life-cycle of mining and mineral projects.*

Once disputes are in the courts, the ensuing process is expensive, time consuming and often leads to bad feelings between parties. Most importantly, the participants themselves lose control of both the process and the solution. In contrast, voluntary, transparent and issue-focused approaches to avoid disputes in the first place and creatively resolve disputes if they do occur, do not lead to animosity, leave control with parties involved and provide for opportunities to work together towards solutions.

Currently there is no industry norm for dispute resolution except in extreme situations where courts or quasi-judicial processes are invoked.

*Recommendation 6. Review and optimize the rules and systems for designating and controlling recyclable material and hazardous waste to encourage recycling while maintaining safety.*

There is concern that current policies and regulations that control the designation and movement of hazardous waste and recyclable materials are less than optimum for maximizing levels of recycling while ensuring the safe handling of hazardous waste. A key issue is the Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal and its domestic interpretation in Canada and the U.S.

More and more companies are pursuing recycling options as the business case builds for pursuing such secondary sources in lieu of creating new operations. Simultaneously, many other interests are supportive of recycling materials to the greatest extent possible.

Interestingly, effective recycling is a key element of “industrial ecology,” an approach that is broadly supported by a growing number of environmentalists, ecologists and engineers dedicated to achieving a wide range of efficiencies and environmental stress reduction by bringing principles of ecology to industrial design.

***Recommendation 7. Develop and implement a practical approach to addressing the equity issue at the project/operational level.***

Many interests believe that the current distribution of costs, benefits and risks arising from mining/mineral activity is unfair. These costs, benefits and risks are not only economic in nature but also social, cultural, environmental and political. Throughout the sustainability literature, a call for greater equity is a central theme. This theme is strongly reinforced by current discussion regarding poverty alleviation in remote areas, particularly in developing countries and regions.

However, in spite of such calls, there is a dearth of documented experience that demonstrates how greater equity in the distribution of costs, benefits and risks associated with mining and mineral activities, can actually be achieved. Doing so requires approaches that are both practical and sensitive to the cultural context at any given site. Doing so also requires a high degree of maturity amongst all parties including government, industry (companies and their associations), non-government organizations, indigenous people and communities.

While some capacity currently exists for identifying and describing the costs, benefits and risks that arise, that capacity on its own is not adequate to ensure that a fair distribution results. Thus, not only is the nature of the distribution at issue but also the means of distribution.

Broadly understood and respected approaches are needed for:

- identifying and monitoring the mining-/minerals-related distribution of costs, benefits and risks accruing to various communities of interest; and
- design of practical processes for ensuring that the distribution is fair and equitable.

Factors to consider include:

- the roles and responsibilities of key players including government, company and community;
- clarification on how existing institutions are succeeding or failing;
- how to identify and monitor costs, benefits and risks and their distribution to various interests;
- how processes might be designed to assess the fairness and equity of that distribution;
- alternative mechanisms (could be legislated rules, voluntary programs, market incentives) for ensuring a fair and equitable distribution;
- applications and implications across the full project life-cycle from exploration through to post-closure and in both developed and developing country settings; and
- options for funding the required follow-up.

***Recommendation 8. Initiate a review of the current financial/business/economic decision support model and the processes used in its application in the mining and minerals industry to identify how ecological and social costs, benefits and risks can be more effectively incorporated.***

Current practice in the mining industry (as used by companies, governments and the financial services industry) uses a financial/business/economic model that effectively addresses traditional economic costs, benefits and risks from the perspective of the company. However, although significant improvements have been made over the past 20 years, the model and/or its process of application does not adequately deal with more

recently emphasized factors that emerge through application of the concept of sustainability. These factors may be one or any combination of economic, environmental, social, cultural or political in nature.

In addition, a number of other important factors may be under-emphasized including:

- achieving effective engagement with implicated communities of interest;
- recognizing and working with competing values and implementing fair decision-making processes where sensitive trade-offs must be weighed; and
- factoring in a sensitivity to local circumstances and preferences.

It is the combination of all of these factors that provides the foundation for a social licence to operate. Future mining (or material supply) operations will require a social licence that will be granted either formally or informally. Anticipating this, industry needs a decision-support package that extends current approaches by better capturing the combination of traditional and non-traditional concerns within a process that also reflects the concept of sustainability.

Given the long lead times of mining operations and the speed with which social values are changing, the model must be robust. If effective development is to occur, any new approaches should be built on the foundation provided by current approaches.

This is a long-term challenge that requires careful thought and the involvement of a broad range of interests. However, until this step is taken, clear and full articulation of the business case for sustainability will remain elusive.

*Recommendation 9. Strengthen the learning and research/development system in support of the North American mining and minerals industry to avoid serious human resource problems within the next decade.*

Many participants in MMSD–NA voice a concern that a significant crisis in human resource capacity is looming for the mining/minerals industry.

In the U.S., the median age of membership in the Society of Mining Engineers (SME) rose from 47.5 to 49.5 between 1995 and 1998, while the number of under 25-year-old members fell from 198 to 104 (SME, 1999). Nowhere is this more evident than in the exploration sector, the very future of the industry, where new mines are discovered and evaluated. In Canada, where the industry is much stronger than in the U.S., fewer than one in six geoscience professionals (geologists, etc.) are under 40. In 2000, only several hundred of 2.5 million graduating high school students in the U.S. indicated an interest in mining in their Standard Aptitude Test (SAT).

Present curricula in mining-related courses of study are rarely effective in addressing many of the major social, cultural, environmental and political challenges that the industry faces. In addition, mining- and mineral-focused schools and faculties are not providing the kind of appeal necessary to attract new students.

Some educators believe that the overall quality of mining-interested students has decreased over time. Thus, there is concern that the source of new leadership for the industry is diminishing.

Many mining engineering faculty are near retirement age and few PhD graduates are available to fill future mining engineering academic vacancies.

Programs of continuing education for mining professionals are also not adequate for upgrading skills to meet the technical and social changes that are appearing at an increasing rate.

*Recommendation 10. Create a mechanism to facilitate follow-up activities and report on MMSD–North America outcomes, 2002–2007.*

Implementation of the actions that are listed here is partly the responsibility of industry, partly the responsibility of government and partly the responsibility of other communities of interest. Where possible, leadership for follow-up has naturally fallen to an existing initiative or to an organization that is well-placed to facilitate progress.

However, currently there is no mechanism or coordinated group of mechanisms to facilitate, oversee and report on progress. To ensure lasting benefit from the momentum created by MMSD–North America, such a mechanism is essential.

### **Time Frame for Action**

Action is underway on Recommendations 1 (addressing the legacy) and 3 (pilot tests of the Seven Questions). All of the remaining eight require the convening of a multi-interest initiating meeting to develop a work plan and funding strategy. The timing of these follow-up meetings will depend on how quickly the needed human and financial resources can be put in place.

To maintain the momentum that has been generated through MMSD–North America, these meetings should be scheduled for the fall of 2002 and spring of 2003 with implementation to follow as quickly as possible.

To ensure coordination and the maintenance of an overview of progress, Recommendation 10, which addresses the creation of a multi-interest mechanism to facilitate and track follow-up activities, should be implemented prior to the end of 2002.

### **Towards Change**

Unless all the implicated communities of interest effectively address the recommendations listed in this section, chances are that:

- the current climate of mistrust that exists between some elements of industry, government and other communities of interest will continue;
- there will be continued questioning on the part of many non-industry groups and individuals of the seriousness with which industry is taking the concepts of environmental, social and cultural responsibility;
- there will be continued questioning on the part of many industry elements of the motivation and integrity of non-government organizations;
- there will be continuing erosion of industry and government credibility and society's willingness to grant a social licence to operate;
- interest on the part of the financial services industry for providing support to mining and minerals projects will continue to decline;
- government, industry and other communities of interest will continue to operate with unclear and divergent senses of what it means to contribute to sustainability;
- communities of interest will continue to exhibit significant variations in their capacity to effectively interact with each other; and
- North American human resources needed in the transition to sustainable development, not only by industry and government but also by other communities of interest, will become progressively more difficult to find.

There is now a window of opportunity to continue:

- the relationship-building that lies at the core of MMSD–North America activities;
- collaborative development of a practical and meaningful language of sustainability;
- collaborative exploration of the benefits, costs and risks associated with supplying mineral-based materials to society;
- enhancing non-industry understanding of mining/minerals issues; and
- enhancing industry’s understanding of the values of society.

The initiation of MMSD–North America has provided an opportunity for the mining and minerals industry to step forward in a new, creative and collaborative way to deal with the tough issues that it faces. In response, many individuals and organizations from inside and outside the industry have enriched the outcome and helped set the stage for future interaction.

By initiating this process, the mining and minerals industry has demonstrated a kind of leadership that has not been characteristic in the past. It is a leadership that has greatly enhanced the chance that the legacy this generation leaves for the future will be cause for pride.



## Epilogue

### A Word From the Miner

I have always wished that my children could see me at my work. That they might journey down with me in the dripping cage to the shaft's bottom or walk the eerie tunnels of the drifts that end in the walls of staring stone. And that they might see how articulate we are in the accomplishment of what we do. That they might appreciate the perfection of our drilling and the calculation of our angles and the measuring of our powder, and that they might understand that what we know through eye, ear and touch is of a finer quality than any information garnered by the most sophisticated of mining engineers with all their elaborate equipment.

I would like to show them how professional we are and how, in spite of the chill and the water and the dark and the danger, there is perhaps a certain eloquent beauty to be found in what we do. Not the beauty of stillness to be found in gleaming crystals or in the polished hardwood floors to which my wife devotes such care but rather the beauty of motion on the edge of violence, which by its very nature can never long endure. It is perhaps akin to the violent motion of the huge professional athletes on the given days or nights of their many games. Men as huge and physical as are we; polished and eloquent in the propelling of their bodies toward their desired goals and in their relationships and dependencies on one another, but often numb and silent before the microphones of their sedentary interviewers. Few of us get to show our children what we do on national television; we offer only the numbness and silence by itself. Unable to either show or tell.

Alistair MacLeod, 1976. "The Closing Down of Summer" in MacLeod, Alistair, 2000. *Island: The Collected Short Stories*. Toronto: McClelland and Stewart. Pp. 199–200.





## Appendix I

### MMSD–North America Project Design and Budget

MMSD–North America followed a simple work plan.

An initial pre-implementation scan was undertaken to develop an inventory of issues and players (Mining Project Team, 2000). Results were fed to two workshops, one of Canadian participants (Winnipeg, December 18–19, 2000) and one of American participants (Golden, January 8–9, 2001).

Notes of these meetings are found on the web at <http://www.iisd.org/mmsd/>. A total of 42 individuals participated (15 in Winnipeg; 27 in Golden) drawn from a wide range of interests including companies (small, intermediate, large, service), government regulators, mining affected communities, First Nations/Native Americans, non-government organizations government, organized labour and universities (teachers, researchers, students). The discussions led to the tasks listed in Table A1-1 and described in more general terms subsequently.

With the work plan of MMSD–North America set, fundraising was undertaken to facilitate implementation. Adequate funds to initiate work were in place as of July 31, 2001. The final listing of revenues by source and expenditures by task is provided in Table A1-2.

**Table A1-1. MMSD–North America work plan tasks and objectives.**

---

#### Task 1: Story/Profile

- Objective 1A: to develop a profile of the North American mining industry (U.S. and Canada) from the perspective of the nature of the companies that comprise the industry.
- Objective 1B: to articulate the contribution and implications of mining (to people and their communities, to ecosystems, to economies) through the eyes of various communities of interest and as it has changed over time.

#### Task 2: Test/Guideline for Sustainability

- Objective 2A: to develop a set of practical principles, criteria and/or indicators that could be used to guide or test the exploration for, design, operation and performance monitoring of individual, existing or proposed operations in terms of their compatibility with concepts of sustainability.
- Objective 2B: to suggest approaches or strategies for effectively implementing such a test/guideline.

#### Task 3: Agenda for Change

- Objective 3: to collaboratively develop an “Agenda for Change” comprising specific actions and timelines for the North American mining industry and related communities of interest to meet in moving towards sustainable development.

#### Task 4: Scenarios

- Objective 4A: to develop a set of scenarios that bracket the likely futures to be faced by the North American mining and minerals industry and the related communities of interest.
- Objective 4B: to use the scenario-building exercise as a means to identify and discuss:
- risks and opportunities;

- issues, challenges and areas of both consensus and disagreement on their resolution; and
- potential prescriptions (aimed potentially at any or all of the communities of interest) for adjusting mining- and minerals-related policy, practices, behaviour and infrastructure.

### Task 5: Final Report

Objective 5: to synthesize and communicate the results of MMSD–North America.

---

First, an attempt was made to capture a sense of the past contribution of mining and mineral activity to the people and ecosystems of North America (Grieve, 2002). Interpreting this contribution varies across communities of interest so a major part of this task was to develop an understanding of who those interests were/are. Because of its central importance, special attention was paid to developing a profile of the North American Mining/Minerals sector (Macdonald, 2002).

The above retrospective was matched by a prospective stance achieved through a formal scenarios analysis. Here, a range of possible futures was developed and analyzed in an innovative approach to identifying risks, opportunities and priorities for action (Scenarios Workgroup, 2002).

The above two tasks provided a broad overview of the industry and the conditions in which it operates. In contrast, the third task focused on the practicalities of activities on the ground. Here, an approach was developed to:

- assess a project's or operation's contribution to sustainability; and
- determine whether the net contribution is positive or negative over the long term.

The resulting framework, *Seven Questions to Sustainability*:

- clarifies what the concepts of sustainable development and sustainability mean in practice for the mining/minerals industry;
- offers a way to bring consistency across applications and phases of a project/operation life-cycle that will reduce confusion and achieve efficiencies; and
- helps to identify the benefits, costs and risks of bringing the ideas of sustainability from theory to practice and, in so doing, sheds light on the overall case for sustainability in general and the business case in particular.

In addition to the tasks listed in Table A1-1, two additional actions were taken to assist in the communications of MMSD–North America and mining/minerals-related activities. First, an MMSD–North America web site was designed and mounted by IISD staff (<http://www.iisd.org/mmsd/>). The web site will be maintained at least until the end of 2003.

Secondly, IISD staff initiated a review of all international, web-based news media outlets on a bi-weekly basis and culled from this review any article related to the environmental and social implications of mining and mineral-related activities. For each article, a brief summary was prepared. The compiled results were then distributed free of charge to all interests in a synthesis called *Mining Alert*. This service was made possible through parallel work being undertaken by IISD staff focused on climate change. Funding is now being sought to continue this service indefinitely.

Through each of the MMSD–North America work elements, recommendations arose regarding how mining and minerals can best contribute to the global transition to sus-

tainable development. An initial set of these recommendations was vetted at the first North American Mining Dialogue held in Vancouver at the Morris J. Wosk Centre for Dialogue (Simon Fraser University) in November, 2002. The Dialogue brought together 105 people from all communities of interest. A second iteration was subsequently circulated for comment prior to finalization as reported here.

**Table A1-2. MMSD–North America revenues (by source) and expenses (by task).**

**Revenues:**

Item	\$US	%
1. Original allocation from MMSD Global	350	56
2. Additional form MMSD Global (specific tasks)	102	16
3. Natural Resources Canada	65	11
4. Additional corporate fundraising (16 contributors)	107	17
Total revenue	624	100

**Expenditures**

Pre-project planning and workshops	77	12
Coordination, outreach, fundraising, communication, administration, taxes	165	26
Task 1, profile/story	41	7
Task 2, test/guideline	67	11
Task 3, Agenda for Change, Vancouver Dialogue	82	13
Task 4, Scenarios	90	14
Task 5, Final Report	50	8
Task 6, Global Report Review	23	4
Contingency used for follow-up (5 per cent)	29	5
Total	624	100

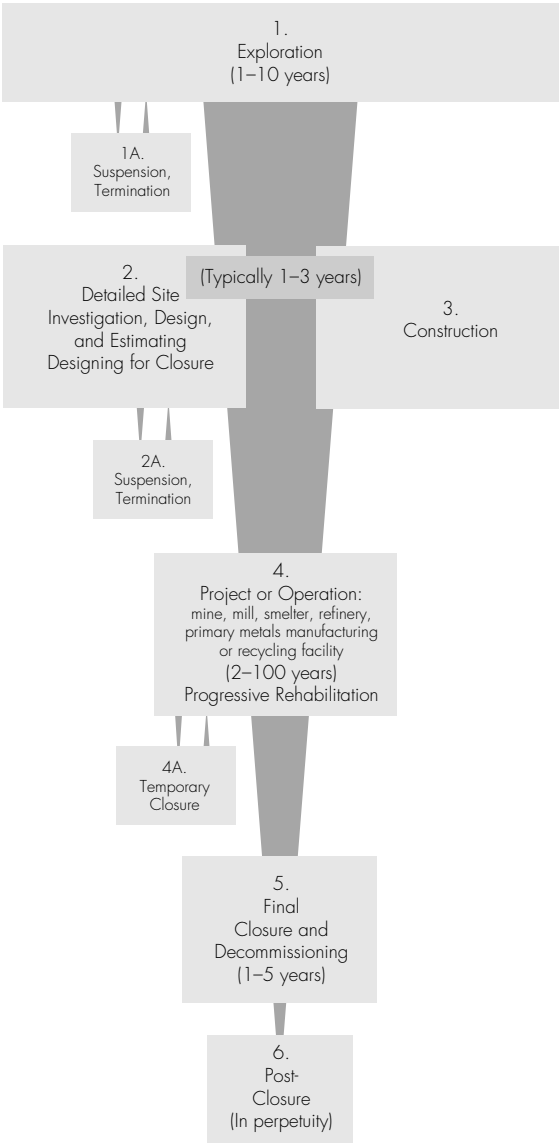
Early in the MMSD–North America process, the “boundaries” of the overall task required clarification. As a result, the project was framed by a commitment to include consideration of: (1) the full mine project life or operation life-cycle (Figure A1-1); the full mine/mineral life-cycle (Figure A1-2); and both direct and indirect implications of mining and mineral activity (Figure A1-3).

Two additional guidelines served to complete the definition of the boundaries of project analysis. First, an emphasis was set on the extractive end of the minerals cycle and second, an emphasis was set on metals and non-metals (see Table A1-3). Activities and implications related to structural materials (e.g., sand and gravel, construction material) and energy minerals (coal and coke, oil and tar sands, uranium and thorium) were set aside except in consideration of aspects that were common to all mining.

**Table A1-3. Minerals and mineral products.**

Category	Minerals and Mineral Products
1. Metals	Aluminum (bauxite), antimony, barium, beryllium, bismuth, cadmium, calcium metals, chromium, cobalt, copper, germanium, gold, indium, iron and steel, iron ore, lead, lithium, magnesium and magnesium compounds, manganese, mercury, mineral pigments, molybdenum, nickel, niobium, platinum group metals, rare earth metals, selenium, silicon, silver, strontium, tantalum, tin, titanium metals, tungsten, vanadium, zinc, zirconium, (plus others)
2. Non-metals	Abrasives, arsenic, asbestos, barite and witherite, boron, bromine, calcium, chlorine and chlorine compounds, diamonds, feldspar, fluorspar, glass and glassware products, graphite, gypsum, iodine, mica, nitrogen, pearls, peat, perlite, phosphate and phosphate compounds, potash and potassium compounds, salt and sodium compounds, silica and silica compounds, sulphur and sulphur compounds, talc, soapstone and pyrophyllite, titanium oxides, vermiculite, (plus others)
3. Structural Materials	Cement, clay and clay products, dolomite, granite, lime, limestone flux and other limestone, marble, travertine and other calcareous stones, olivine, sand and gravel, sandstone, slate, (plus others)
4. Energy	Coal and coke, oil and tar sands, uranium and thorium (note that uranium and thorium are metals)

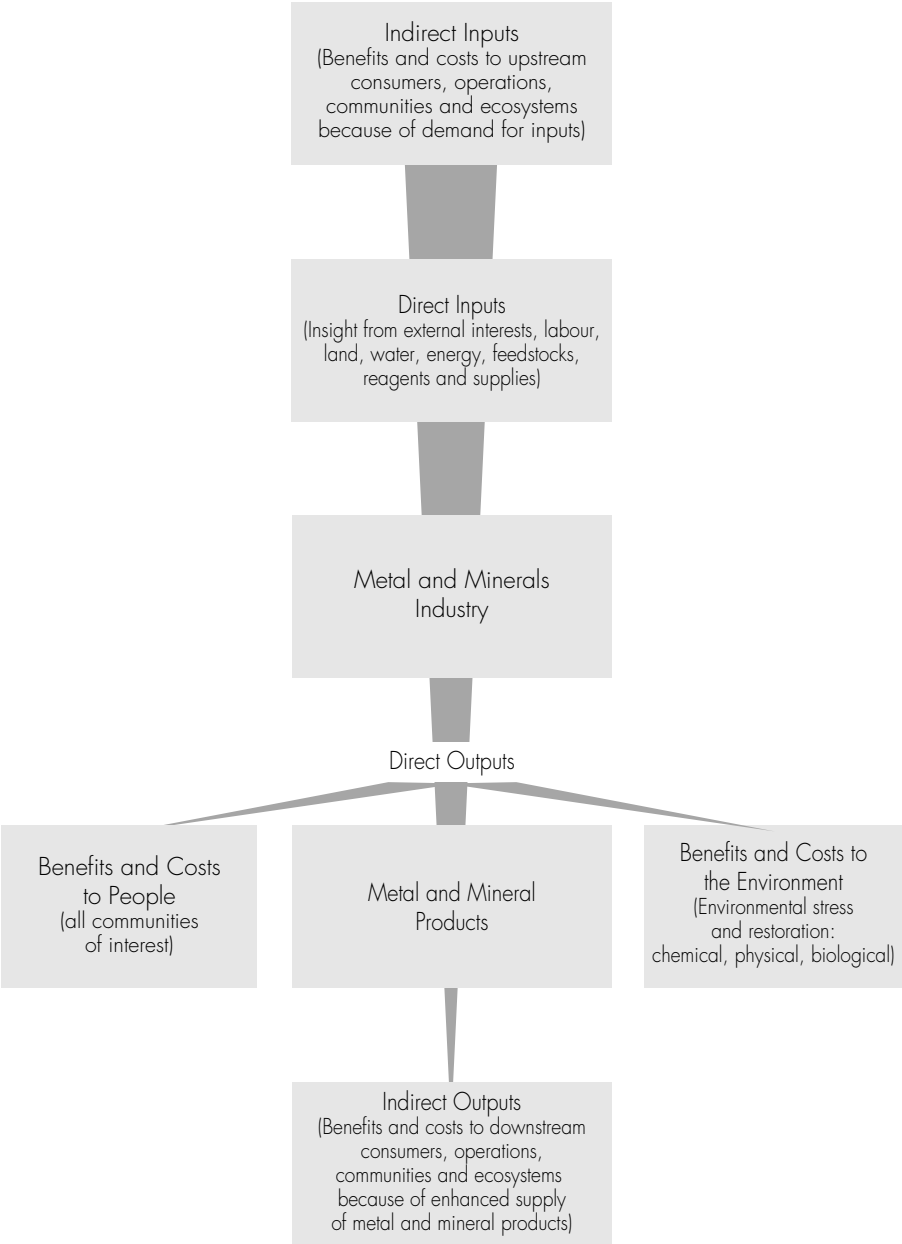
Figure A1-1. The mine life-cycle.







**Figure AI-3. Direct and indirect implications of mine/mineral activity.**



Throughout the planning and implementation of MMSD–North America, significant attention was paid to the process of engaging the various interests. At the initiating workshops, a set of principles governing the meeting process was agreed upon and subsequently reviewed at the beginning of all MMSD–North America meetings and workshops. These principles are listed in Table A1-4.

One key aspect of the MMSD–North America approach is worthy of emphasis. While participants were explicitly drawn from a range of interests, they were not asked to formally “represent” any constituency, nor were they asked to return to their roots to obtain any endorsement or approval of MMSD–North America outputs. Further, while much effort was made to incorporate everyone’s perspective and reach consensus on each issue, success in doing so was not always possible. As a result, while MMSD outputs generally reflect the overall agreement of participants, they should not be considered formal “consensus” documents.

**Table A1-4. Principles of participation in MMSD–North America meetings.**

---

Below are listed 10 assertions that provide a draft basis for participation in MMSD–North America activities (meetings, workshops, studies, etc.). Depending on the purpose of and the participants in any activity, not all of these provisions may be appropriate. Similarly, additional provisions may be necessary. These principles will be discussed at the beginning of each activity and modified accordingly.

*Our intent is:*

1. to explore, not to negotiate;
2. to share, not to decide;
3. to inform and, when requested, to advise;
4. to understand the diversity of perspectives and build relationships;
5. to consider how to widen the network of connections with which MMSD will need to build complementarity and linkages;
6. to help guide the flow of the discussions in such a way that areas of common ground and areas of difference are identified along with the underlying reasons; and
7. to respect that participation and contributions are not to be seen as an endorsement by any participant of the MMSD project (or any specific outcome of it).

*Attribution of comments:*

8. No specific attribution of any comment made by any participant(s) will be referenced in any notes unless specifically requested by the participant(s).

*Notes*

9. Notes will be prepared from the activity (meeting, workshop) and shared, either with a representative group, if identified at the activity, or with the full group prior to finalization. Notes shall typically be of a summary nature and will include a list of participants.
10. Any notes prepared should include at the beginning this “Basis for Participation” which shall have been discussed with participants at the beginning of the activity.

---

Source: Glenn Sigurdson, CSE Group

## Appendix 2

### MMSD–North America Recommendations and the Link to MMSD Global Recommendations and the ICMM Toronto Declaration Implementation Process

MMSD–North America Recommendation	Relevant Chapters and Recommendations in the MMSD Global Final Report (see Appendix 3 for a summary of Recommendations by Category)	Relevant References in ICMM’s Toronto Declaration Implementation Process (May 24, 2002) (available at <a href="http://www.icmm.com">www.icmm.com</a> )	Comment
1. Enhance effort to address the legacy of past mining and mineral activities.	<ul style="list-style-type: none"> <li>• Chapter 10, “Mining, Minerals and the Environment” (mining legacies)</li> <li>• Recommendation under the “Global Level” of Category 4, (legacy)</li> </ul>	The Toronto Declaration indicates that the legacy issue is beyond the capacity of industry to resolve on its own.	Identified as the highest priority for action by participants in MMSD North America.
2. Strengthen the basket of legislated rules, market incentives, and voluntary programs to prevent the same from happening in the future.	<ul style="list-style-type: none"> <li>• Chapter 7, “The Control, Use and Management of Land”</li> <li>• Chapter 9, “Local Communities and Mines” (mine closure)</li> <li>• Chapter 10, “Mining, Minerals and the Environment” (closure planning)</li> <li>• Chapter 14, “Governance: Roles, Responsibilities and Instruments for Change”</li> </ul>	<ul style="list-style-type: none"> <li>• Governance issues, p. 8</li> </ul>	A broadly accepted approach to current projects should be designed and implemented that will give confidence that (a) acceptable post closure outcomes will be achieved; and (b) commitments made will be fulfilled.
3. Initiate a series of pilot tests as the next step in the collaborative development of the Seven Questions to Sustainability framework.	<ul style="list-style-type: none"> <li>• Chapter 6, “Viability of the Mining Industry”</li> <li>• Chapter 7, “The Control, Use and Management of Land”</li> <li>• Chapter 9, “Local Communities and Mines” (improved social impact assessment)</li> <li>• Chapter 10, “Mining, Minerals and the Environment”</li> </ul>	<ul style="list-style-type: none"> <li>• Reporting guidelines, p. 2</li> <li>• Criteria for evaluating progress, p. 4</li> <li>• Global sustainable development framework, p. 5</li> <li>• Sustainable development performance reporting, metrics and/or indicators, p. 5</li> <li>• Capacity building, p. 7</li> </ul>	The Seven Questions to Sustainability framework provides a practical foundation for assessing the compatibility of mining and mineral activities with sustainability concepts. It is closely aligned to a major priority of follow-up for both ICMM and MMSD Global.

MMSD North America Recommendation	Relevant Chapters and Recommendations in the MMSD Global Final Report (see Appendix 3 for a summary of Recommendations by Category)	Relevant References in ICMM's Toronto Declaration Implementation Process (May 24, 2002) (available at www.icmm.com)	Comment
	<ul style="list-style-type: none"> <li>Recommendations on practical tools (Category 1); organizational policies and management systems (Category 2); integrated impact assessment (Category 4), harmonized reporting guidelines (Category 4), audits and third party verification (Category 4)</li> </ul>	<ul style="list-style-type: none"> <li>In-service training programs, p. 7</li> <li>Reporting guidelines, p. 11</li> </ul>	
4. Design and implement effective approaches for rewarding good and discouraging bad performance within the context of sustainability as indicated by the Seven Questions to Sustainability framework.	<ul style="list-style-type: none"> <li>The overall thrust of the global report is aimed at this topic.</li> </ul>	<ul style="list-style-type: none"> <li>Not explicitly mentioned but this topic underlies the rationale for initiating GMI and creating ICMM in the first place.</li> </ul>	A delicate topic and one which MMSD North America is approaching through a collaborative effort led by industry Juniors through PDAC and the NW Mining Association.
5. Design and implement a set of effective dispute resolution mechanisms tailored for application across the full life-cycle of mining and mineral projects.	<ul style="list-style-type: none"> <li>Chapter 8, "Minerals and Economic Development" (preventing conflict)</li> <li>Chapter 9, "Local Communities and Mines" (conflict and dispute resolution)</li> <li>Chapter 12, "Access to Information" (building trust and balance)</li> <li>Recommendations under Category 4, (dispute resolution, local and global)</li> </ul>	<ul style="list-style-type: none"> <li>Dispute resolution, p. 8</li> <li>Industry has signaled that this is not a topic they will lead on.</li> </ul>	A topic of considerable interest to international agencies as signaled through discussions with the World Bank and UN personnel.

MMSD North America Recommendation	Relevant Chapters and Recommendations in the MMSD Global Final Report (see Appendix 3 for a summary of Recommendations by Category)	Relevant References in ICMM's Toronto Declaration Implementation Process (May 24, 2002) (available at <a href="http://www.icmm.com">www.icmm.com</a> )	Comment
6. Review and optimize the rules and systems for designating and controlling recyclable material and hazardous waste to encourage recycling while maintaining safety.	<ul style="list-style-type: none"> <li>• Recommendation under Category 1, research priority)</li> </ul>	<ul style="list-style-type: none"> <li>• Science-based decision-making (reference to recycling), p. 9</li> </ul>	This is a small step forward in encouraging an integrated materials management perspective (Toronto Declaration Implementation Process, p. 9). Recommendation aimed at causing industry and NGOs to work together to build solutions as part of the ongoing platform of engagement.
7. Develop and implement a practical approach to addressing the equity issue at the project/operational level.	<ul style="list-style-type: none"> <li>• Chapter 8, “Minerals and Economic Development” (managing mineral wealth)</li> <li>• Chapter 9, “Local Communities and Mines” (distribution of costs and benefits)</li> <li>• Chapter 10, “Access to Information” (equity in information access)</li> </ul>		“Equity” is a central thread in the sustainability literature but there is little available in terms of practical approaches either for (1) identifying the costs, benefits, and risks as they accrue to different communities of interest or (2) ensuring that their distribution is fair and equitable. This is another topic that can be used effectively as a means to continue collaborative follow-up effort.
8. Initiate a review of the current financial/business/economic decision support model and the processes used in its application in the mining and minerals industry to identify how ecological and social costs, benefits, and risks can be more effectively incorporated than at present.	<ul style="list-style-type: none"> <li>• Chapter 8, “Minerals and Economic Development”</li> </ul>		This is a long-term topic that will require careful and thoughtful effort. It is best approached through a broadly collaborative approach.

MMSD North America Recommendation	Relevant Chapters and Recommendations in the MMSD Global Final Report (see Appendix 3 for a summary of Recommendations by Category)	Relevant References in ICMM's Toronto Declaration Implementation Process (May 24, 2002) (available at <a href="http://www.icmm.com">www.icmm.com</a> )	Comment
9. Strengthen the learning and research/ development system in support of the North American mining and minerals industry to avoid serious human resource problems within the next decade.	<ul style="list-style-type: none"> <li>Chapter 6, "Viability of the Minerals Industry"</li> <li>Recommendation under Category 1 (education)</li> </ul>		This is a serious issue in the U.S. and Canada.
10. Create a mechanism to facilitate follow-up activities and report on MMSD–North America outcomes, 2002–2007.	<ul style="list-style-type: none"> <li>Recommendation under Category 4 (periodic forum)</li> </ul>		To ensure lasting benefit of momentum created through MMSD–North America, an effective mechanism to facilitate and report on follow-up, particularly on action items requiring collaborative multi-interest effort, is essential.

## Appendix 3

### Summary of Recommendations from *Breaking New Ground, The Final Report of MMSD Global*

(the full report is available online at <http://www.iied.org/mmsd/>)

#### *Major Category 1. Increase understanding of sustainable development*

- *Education.* Sustainable development concepts should be integrated into the curricula for mineral professionals—at formal institutions and through professional development short courses; donors should insist on this emphasis.
- *Research on priority areas.* Policies for transparency and rigour of research should be established for all research projects; multi-interest mechanisms to set research priorities should be used more often; the business case for recycling of metals and minerals and the implications of mineral development on community health should be given priority attention; integrative, cross-disciplinary research should be encouraged; international links should be cultivated.
- *Development of practical tools.* An emphasis should be put on practical tools; industry needs should be surveyed; tools for enhancing government decision-making should be surveyed.
- *Improving professional practice and knowledge.* A series of meetings to examine priority issues facing labour and different disciplines working to apply principles of sustainable development should be convened at international, national and local levels.

#### *Major Category 2. Create organizational-level policies and management systems for implementing the principles of sustainable development*

- *Organizational level sustainable development policies and appropriate management systems* should be established for all organizations: companies, labour organizations, governments, NGOs and international organizations.

#### *Major Category 3. Collaborate with others with common interest to take joint steps towards sustainable development*

- Collaborative mechanisms bringing together groups of actors should be used to:
  - Review and formulate sustainable development policies.
  - Share information and capacity building.
  - Establish stronger networks for artisanal and small scale miners.
  - Establish stronger networks for communities.
  - Consider the establishment of an international indigenous peoples organization focused on mining.
  - Develop and agree on norms and principles that could include non-binding statements, conditions of membership, codes or protocols that verify performance through third-party audits.
- Industry should adopt a Global Declaration on Sustainable Development and establish a Sustainable Development Protocol to support its commitment. A three-phase development process is suggested.
- National and regional Industry Codes of Conduct related to sustainable development should be established.
- Regional (e.g., southern Africa, the Americas) Statements of Sustainable Development Principles by governments should be considered.



- Non-government organizations should consider adopting minerals-related Statements of Principles.
- A collaboratively supported international Emergency Response Facility should be established.

*Major Category 4. Increase the ability to work towards sustainable development at the local, national and global levels*

- *Local level.* Where a local community is affected by mineral development, the following should be established:
  - A shared Community Development Vision including how the costs and benefits of any mineral activity are apportioned, how decisions are taken and who comprises the “community.”
  - Programs for continuous engagement.
  - Integrated Impact Assessment (IIA) that considers all of the economic, environmental and social implications.
  - Community Sustainable Development Plan (CSDP).
  - Integrated Planning for Closure.
  - Supportive labour-management agreements.
  - Dispute Resolution Mechanisms.
  - In relevant situations, mechanisms for cooperation between large companies and artisanal/small-scale miners.
- *National level.* The following should be addressed at the national level:
  - Legislation that gives interested parties the legal right to access to information as well as the support infrastructure that makes information accessible.
  - Continued regulatory reform to support public participation and access to information.
  - Clear rules for access to and use of land and clear and fair processes for their application.
  - Resolution of indigenous land claims; clear definition of the extent of indigenous territories; maintenance by companies and government of the principle of prior informed consent.
  - A framework that can be used to maximize and sustain the benefits of mineral development through a distribution of costs, benefits and risks that is fair and acceptable; international organizations should continue to promote dialogue on the wealth distribution issue.
  - An appropriate, transparent, consistent policy and regulatory framework that focuses on both the facilitation and management of artisanal and small-scale mining.
  - A collaboratively-built framework for community development that includes a coordinated legal and institutional framework to incorporate integrated impact assessment (including clear quality standards), Community Sustainable Development Plans, integrated closure planning (including the complete range of environmental and social issues) and a clear assignment of responsibilities among agencies.

- Legislation addressing mining-induced displacement and re-settlement.
- Concerted effort to combat corruption including legislation that enshrines the anti-corruption convention of the Organization for Economic Co-operation and Development.
- Adoption of the practice of more open publication of basic information about how much wealth is generated from projects, the amount of revenue received by government departments, and how that money has been spent; industry should consider establishing an international and public register of all payments by mining companies to governments at all levels.
- Requirements for regular independent audits of tailings storage facilities; guidelines for evaluating different disposal methods on a case-by-case basis with a clear value in the short term of the need to avoid riverine disposal; standards for baseline data and analysis addressing such specific issues as acid drainage assessment, closure planning and water quality; effective communication of the results, and integrating into decision-making processes from exploration through closure.
- An international review of national government capacity to address sustainable development issues.
- Promotion by national governments of labour-management agreements in support of sustainable development.
- Active involvement of national governments as facilitator of multi-interest discussions on policy and change.
- *Global level.* The following should be addressed at the global level:
  - An effective and broadly accepted complaints and dispute resolution mechanism.
  - Further development of the stewardship concept through a Product Stewardship Initiative that promotes greater exchange of information and integration of views with the industry's principle customers, intermediary processors, recyclers and others.
  - A Sustainable Development Support Facility to serve in a number of roles that might include a central clearinghouse on mining and sustainable development-related initiatives and information, an independent source of capacity building and advice to national governments; a supplement to governments on certain technical tasks such as inspections, a convener in the development of technical standards, provision of technical advice to companies and communities.
  - Development of a harmonized system of reporting guidelines covering the sustainable development performance of companies and projects.
  - A collaborative, multi-interest Protected Areas and Mining Initiative that works towards resolution of issues related to protected areas and mining.
  - A collaborative, multi-interest Minerals Legacy Initiative that addresses the issue of abandoned and orphaned sites starting with a full-scale feasibility study.
  - The convening by the World Bank and world's mines ministers of an international dialogue, starting with a high-level conference on how best to achieve financial surety of mining/mineral projects.

- Development of a global-level agreement between labour federations representing workers in the minerals sector and international organizations representing companies aimed at achieving broad cooperation in support of sustainable development.
- A periodic Forum on Mining, Minerals and Sustainable Development that would assist in establishing priorities for action by all players, suggesting process guidelines for governing issue-specific initiatives, and endorsing the processes and results of work on priority issues.

## Appendix 4

### **MMSD–North America Publications and Reports**

The following are the published outputs of Mining, Minerals and Sustainable Development North America.

#### ***In print:***

Industry in Transition: A Profile of the North American Mining Sector (By Alistair MacDonald, Talmac Consulting).

Sustainability Profile: The Story of North American Mining/Minerals (Draft Working Paper by A. Grieve, Centre for Collaborative Action with SENES Consultants Ltd.).

Learning from the Future: Alternative Scenarios for the North American Mining and Minerals Industry.

Seven Questions to Sustainability (brochure).

Seven Questions to Sustainability: How to Assess the Contribution of Mining and Minerals Activities.

Towards Change: The Work and Results of MMSD–North America (brochure).

Towards Change: The Work and Results of MMSD–North America (final report).

#### ***Electronic:***

Web site (<http://www.iisd.org/mmsd/>)

Mining Alert (electronic newsletter: [http://www.iisd.org/mmsd/mining\\_alert.asp](http://www.iisd.org/mmsd/mining_alert.asp))

## Publications Order/Information Request Form

### Publications and Reports from Mining, Minerals and Sustainable Development North America

All prices are in Canadian funds.

**Publications Available Now**

- \_\_\_\_\_ MacDonal, A. *Industry in Transition: A Profile of the North American Mining Sector* (\$20 including taxes; add \$5 for shipping and handling).
- \_\_\_\_\_ MMSD Work Group 4. *Learning from the Future: Alternative Scenarios for the North American Mining and Minerals Industry* (\$15 including taxes; add \$5 for shipping and handling).
- \_\_\_\_\_ MMSD Work Group 2. *Seven Questions to Sustainability brochure*. (Free!)
- \_\_\_\_\_ MMSD Work Group 2. *Seven Questions to Sustainability: How to Assess the Contribution of Mining and Minerals Activities*. (\$15 including taxes; add \$5 for shipping and handling).
- \_\_\_\_\_ MMSD–North America Final Report: *Towards Change*. (\$15 including taxes; add \$5 for shipping and handling)

Name \_\_\_\_\_ Title \_\_\_\_\_

Company/Organization \_\_\_\_\_

Address \_\_\_\_\_ City/Town \_\_\_\_\_

Province/State \_\_\_\_\_ Postal Code/Zip Code \_\_\_\_\_

Phone Number \_\_\_\_\_ Fax Number \_\_\_\_\_

E-mail Address \_\_\_\_\_ Web Site \_\_\_\_\_

Total current purchase \$ \_\_\_\_\_

Cheque enclosed (payable to the International Institute for Sustainable Development)

Please charge the amount above to my  Visa  Mastercard

Credit Card Number \_\_\_\_\_

Expiry Date \_\_\_\_\_ Name on the Card \_\_\_\_\_

Send your completed form to:  
 The International Institute for Sustainable Development  
 161 Portage Avenue East, 6th floor  
 Winnipeg, Manitoba R3B 0Y4  
 Attention: MMSD Publications  
 Phone: 204-958-7700  
 Fax: 204-958-7710  
 E-mail: info@iisd.ca

For office use:

***Towards Change*—the final report of Mining, Minerals and Sustainable Development North America—captures the work and results of the largest-ever review of mining and minerals. Positive and negative implications to people and to ecosystems are considered. As part of the MMSD Global initiative, MMSD–North America also offers a strategy for how the industry and others can ensure that mining and minerals contribute positively to society's overall transition to sustainable development.**

International Institute for Sustainable Development  
161 Portage Avenue East, 6th Floor  
Winnipeg, Manitoba  
Canada R3B 0Y4  
Tel: +1 (204) 958-7700  
Fax: +1 (204) 958-7710  
E-mail: [info@iisd.ca](mailto:info@iisd.ca)  
Web site: <http://www.iisd.org>