

# *Volume IV*



# **NWT Diamonds Project** *Impacts and Mitigation*

## **Overview - Impacts and Mitigation**

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Volume IV provides a summary of the potential impacts that could result from the development of the NWT Diamonds Project. Impacts are described according to general components (e.g., hydrology, wildlife, employment). Valued ecosystem components are identified and are the focus of most discussion.

This volume begins with a discussion of the approach used to undertake environmental impact assessment and the methods used to evaluate impacts. Impact analysis is based on an ecosystem approach, which means that specific environmental elements are examined with respect to their relationship with other ecosystem elements or processes. The use of traditional knowledge and the consideration of ecosystem linkages are outlined.

The discussion of impacts on each environmental component begins with a summary of the main project activities that could affect the project area. Impacts are explained according to their type (e.g., habitat loss). Spatial, temporal and other attributes of particular impacts are described, along with the mitigation measures that will minimize the potential effects of any project activities. The residual effects of any remaining impacts that could persist after all mitigation measures have been applied are evaluated according to the magnitude of their significance.

**VOLUME IV**  
**ENVIRONMENTAL IMPACTS AND MITIGATION**  
**TABLE OF CONTENTS**

<b>Overview - Environmental Impacts and Mitigation .....</b>	<b>i</b>
<b>Table of Contents.....</b>	<b>ii</b>
<b>List of Tables.....</b>	<b>xiii</b>
<b>List of Figures .....</b>	<b>xxi</b>
<b>Table of Conformity .....</b>	<b>xxiv</b>
<b>Acknowledgments.....</b>	<b>xxxiv</b>
<b>Disclaimer .....</b>	<b>xli</b>
<b>1. Approach to Impact Assessment .....</b>	<b>1.1</b>
1.1 Methods.....	1.1
1.2 Ecological Impacts.....	1.6
1.2.1 Large Animals and Top Carnivores .....	1.7
1.2.2 Clean Water, Soils and Atmosphere .....	1.7
1.2.3 Natural, Self-Organizing Ecosystems .....	1.8
<b>2. Physical Impacts and Mitigation.....</b>	<b>2.1</b>
2.1 Terrain and Permafrost.....	2.4
2.1.1 Terrain .....	2.5
2.1.1.1 Mitigation .....	2.5
2.1.1.2 Residual Effects .....	2.6
2.1.2 Permafrost.....	2.6
2.1.2.1 Mitigation .....	2.6
2.1.2.2 Residual Effects .....	2.7
2.2 Ground Instability .....	2.8
2.2.1 Mitigation.....	2.8
2.2.2 Residual Effects.....	2.8
2.3 Hydrology.....	2.9
2.3.1 Surface Hydrology.....	2.9
2.3.1.1 Drainage Pattern Changes .....	2.10
2.3.1.2 Lake Storage Changes.....	2.12
2.3.1.3 Streamflow Changes .....	2.14

2.3.2 Groundwater Flows .....	2.19
2.3.2.1 Mitigation .....	2.20
2.3.2.2 Residual Effects .....	2.21
2.4 Water Quality .....	2.21
2.4.1 Sedimentation and Suspended Solids .....	2.21
2.4.1.1 Dams, Dikes and Embankments.....	2.22
2.4.1.2 Road Construction .....	2.22
2.4.1.3 Surface Facilities .....	2.22
2.4.1.4 Lake Dewatering.....	2.23
2.4.1.5 Mitigation .....	2.23
2.4.1.6 Residual Impact .....	2.23
2.4.2 Impact on Water Quality of Long Lake Tailings Pond.....	2.24
2.4.2.1 Model Description.....	2.25
2.4.2.2 Model Parameters .....	2.26
2.4.2.3 Model Assumptions.....	2.31
2.4.2.4 Model Results .....	2.35
2.4.3 Waste Dumps .....	2.36
2.4.3.1 Mitigation .....	2.37
2.4.3.2 Residual Impacts .....	2.40
2.4.4 Dust .....	2.40
2.4.4.1 Mitigation .....	2.41
2.4.4.2 Residual Impacts .....	2.41
2.4.5 Exploration Drilling Impacts .....	2.41
2.4.5.1 Mitigation .....	2.41
2.4.5.2 Residual Impacts .....	2.42
2.4.6 Post Closure Tailings Pond Discharges .....	2.42
2.4.6.1 Long Lake .....	2.42
2.4.6.2 Panda Pit.....	2.43
2.4.6.3 Mitigation .....	2.46
2.4.6.4 Residual Effects .....	2.46
2.5 Air Quality Impacts.....	2.46
2.5.1 Air Emissions .....	2.50
2.5.1.1 Mitigation of Air Emissions.....	2.63
2.5.1.2 Residual Effects of Air Emissions .....	2.63
2.5.2 Fugitive Dust.....	2.70
2.5.2.1 Mitigation of Fugitive Dust Emissions .....	2.74
2.5.2.2 Residual Effects of Fugitive Dust .....	2.74
2.5.3 Explosives Detonation .....	2.74
2.5.3.1 Mitigation of Explosives Detonation	
Air Emissions .....	2.75
2.5.3.2 Residual Effects of Explosives Detonation	
Air Emissions .....	2.75
2.5.4 Thermal Inversions and Open Pit Air Quality .....	2.76
2.5.4.1 Mitigation .....	2.87
2.5.4.2 Residual Effects .....	2.87

2.6 Climatology .....	2.87
2.6.1 “Heat Island” Effect.....	2.89
2.6.1.1 Mitigation .....	2.89
2.6.1.2 Residual Effects .....	2.89
2.6.2 Wind Regime Modification .....	2.89
2.6.2.1 Mitigation .....	2.90
2.6.2.2 Residual Effects .....	2.90
2.6.3 Climate Change .....	2.90
2.6.3.1 Mitigation .....	2.91
2.6.3.2 Residual Effects .....	2.91
2.6.4 Acidic Deposition .....	2.91
2.6.4.1 Mitigation .....	2.93
2.6.4.2 Residual Effects .....	2.94
2.7 Noise .....	2.94
2.7.1 Acoustical Concepts and Terminology .....	2.96
2.7.2 Aircraft Noise.....	2.97
2.7.2.1 Mitigation .....	2.105
2.7.2.2 Residual Impact .....	2.106
2.7.3 Noise from Mining Operations.....	2.106
2.7.3.1 Mitigation .....	2.110
2.7.3.2 Residual Effects .....	2.111
2.7.4 Noise from Blasting.....	2.111
2.7.4.1 Mitigation .....	2.114
2.7.4.2 Residual Effects .....	2.114
<b>3. Biological Impacts and Mitigation .....</b>	<b>3.1</b>
3.1 Aquatic Life.....	3.1
3.1.1 Habitat Loss .....	3.2
3.1.1.1 Mitigation .....	3.2
3.1.1.2 Residual Effects .....	3.3
3.1.2 Habitat Modification.....	3.3
3.1.2.1 Turbidity and Sedimentation.....	3.3
3.1.2.2 Mitigation .....	3.4
3.1.2.3 Residual Effects .....	3.5
3.1.3 Shoreline Modification.....	3.5
3.1.3.1 Mitigation .....	3.5
3.1.3.2 Residual Effects .....	3.5
3.1.4 Alteration of the Hydrological Regime.....	3.6
3.1.4.1 Mitigation .....	3.6
3.1.4.2 Residual Effects .....	3.7
3.1.5 Disruption of Migration Routes .....	3.7
3.1.5.1 Mitigation .....	3.7
3.1.5.2 Residual Effects .....	3.8

3.1.6 Exploitation.....	3.8
3.1.6.1 Mitigation .....	3.8
3.1.6.2 Residual Effects .....	3.8
3.1.7 Biological Sampling.....	3.9
3.1.7.1 Mitigation .....	3.9
3.1.7.2 Residual Effects .....	3.9
3.1.8 Habitat Degradation .....	3.9
3.1.8.1 Mitigation .....	3.10
3.1.8.2 Residual Effects .....	3.10
3.2 Vegetation .....	3.10
3.2.1 Loss of Vegetation .....	3.10
3.2.1.1 Mitigation .....	3.11
3.2.1.2 Residual Effects .....	3.11
3.2.2 Degradation of Vegetation.....	3.13
3.2.2.1 Winter Roads .....	3.13
3.2.2.2 Residual Effects .....	3.15
3.2.2.3 Air Quality .....	3.15
3.2.2.4 Mitigation .....	3.15
3.2.2.5 Residual Effects .....	3.16
3.2.2.6 Other Types of Degradation .....	3.16
3.2.2.7 Mitigation .....	3.16
3.2.2.8 Residual Effects .....	3.16
3.3 Wildlife and Habitat .....	3.16
3.3.1 Habitat Loss .....	3.18
3.3.1.1 Loss of Habitat due to Linear Developments ...	3.18
3.3.1.2 Loss of Habitat due to Project Construction ...	3.20
3.3.1.3 Mitigation .....	3.20
3.3.1.4 Residual Effects .....	3.21
3.3.2 Habitat Degradation .....	3.21
3.3.2.1 Mitigation .....	3.22
3.3.2.2 Residual Effects .....	3.22
3.3.3 Disturbance .....	3.22
3.3.3.1 Physical and Physiological Disturbance.....	3.22
3.3.3.2 Displacement.....	3.24
3.3.3.3 Habituation .....	3.24
3.3.3.4 Mitigation .....	3.24
3.3.3.5 Residual Effects .....	3.25
3.3.4 Bathurst Caribou .....	3.25
3.3.4.1 Habitat Loss.....	3.26
3.3.4.2 Habitat Degradation .....	3.27
3.3.4.3 Disturbance.....	3.27
3.3.4.4 Mitigation .....	3.29
3.3.4.5 Residual Effects .....	3.31

3.3.5 Grizzly Bears.....	3.31
3.3.5.1 Habitat Loss.....	3.31
3.3.5.2 Interactions with Humans.....	3.32
3.3.5.3 Mitigation .....	3.32
3.3.5.4 Residual Effects .....	3.33
3.3.6 Furbearers .....	3.33
3.3.6.1 Habitat Loss.....	3.34
3.3.6.2 Interactions with Humans.....	3.34
3.3.6.3 Mitigation .....	3.34
3.3.6.4 Residual Effects .....	3.34
3.3.7 Birds .....	3.35
3.3.7.1 Habitat Loss.....	3.35
3.3.7.2 Disturbance.....	3.36
3.3.7.3 Mitigation .....	3.38
3.3.7.4 Residual Effects .....	3.38
<b>4. Socioeconomic Impacts and Mitigation .....</b>	<b>4.1</b>
4.1 Local and Regional Perceptions of the Project.....	4.13
4.1.1 Land Claims .....	4.14
4.1.2 Employment, Job Training and Business Opportunities .....	4.16
4.1.3 Traditional Knowledge .....	4.23
4.1.4 Caribou/Wildlife .....	4.26
4.1.5 Water Quality, Reclamation and other Environmental Issues .....	4.30
4.1.6 Archaeology .....	4.34
4.1.7 Social Issues.....	4.35
4.1.8 Communications.....	4.39
4.1.9 Northern Content .....	4.42
4.2 Aboriginal Employees’ Perceptions of the Project .....	4.45
4.2.1 Socioeconomic Issues.....	4.46
4.2.2 Environmental Issues.....	4.48
4.3 Employment and Income.....	4.53
4.3.1 Preproduction/Construction Start-up .....	4.58
4.3.2 Direct Employment and Income Levels – Construction .....	4.59
4.3.2.1 Level of Employment and Income with Construction Contractors.....	4.60
4.3.2.2 Level of NWT Diamonds Project Construction Employment and Income .....	4.65
4.3.2.3 Summary of Direct Employment and Income – Construction.....	4.66
4.3.2.4 Future Construction Requirements .....	4.67
4.3.3 Indirect Employment and Income Levels - Construction ...	4.67
4.3.3.1 Background .....	4.68
4.3.3.2 Methodology Used to Assess Potential Northern Purchases .....	4.68

4.3.3.3 Person-years of Indirect Employment .....	4.72
4.3.3.4 Indirect Income .....	4.74
4.3.3.5 In/out Migration.....	4.75
4.3.3.6 Indirect Employment and Income (Level 2) Resulting from Business Responding.....	4.75
4.3.3.7 Summary – Indirect Employment/Income Generated by Project Purchases .....	4.78
4.3.4 Induced Employment and Income Levels - Construction ...	4.78
4.3.4.1 Background .....	4.79
4.3.4.2 Methodology for Assessing Levels of Induced Employment and Income .....	4.79
4.3.4.3 Person-years of Induced Employment.....	4.80
4.3.4.4 Induced Income .....	4.81
4.3.4.5 In-migration Resulting from Induced Employment.....	4.81
4.3.5 Summary Levels of Employment and Income Preproduction/Construction/Start-up .....	4.82
4.3.6 Employment and Income - Operations .....	4.84
4.3.7 Direct Employment and Income Levels – Year 2000.....	4.84
4.3.7.1 Background .....	4.85
4.3.7.2 Methodology to Determine Level of Project Direct Employment and Income - Year 2000 .....	4.86
4.3.7.3 Summary NWT Resident Direct Employment and Income Levels - Operations/Year 2000 .....	4.94
4.3.8 Indirect Employment and Income Levels – Year 2000 .....	4.95
4.3.8.1 Background .....	4.95
4.3.8.2 Methodology.....	4.97
4.3.8.3 Indirect Employment and Income Resulting from Suppliers Responding in the NWT (Level 2).....	4.100
4.3.8.4 Summary of Indirect Employment and Income Levels – Year 2000 (Level 1 and Level 2) .....	4.100
4.3.8.5 In-migration .....	4.100
4.3.9 Induced Employment and Income Levels - Year 2000.....	4.102
4.3.10 Summary Employment and Income Levels Year 2000...	4.104
4.3.11 Mine Expansion and Related Increases in Employment and Income – Year 2007 .....	4.104
4.3.11.1 Direct Employment and Income Levels – Year 2007 .....	4.105
4.3.11.2 Indirect Employment and Income Levels – Year 2007 .....	4.107



4.3.11.3 Induced Employment and Income Levels – Operations Year 2007.....	4.108
4.3.11.4 Summary of All Employment & Income – Year 2007 .....	4.109
4.3.12 Potential Employment and Income Impacts.....	4.109
4.3.12.1 Reduction in Unemployment .....	4.109
4.3.12.2 Increase in Income Levels .....	4.111
4.3.12.3 Increase in Aboriginal Participation in the Wage Economy .....	4.112
4.3.12.4 Increase in Number of Females in Mining Jobs.....	4.112
4.3.12.5 Labour Market Disruption.....	4.115
4.3.12.6 Student Employment/Work Experience. ....	4.116
4.3.13 Mine Closure .....	4.116
4.3.13.1 Closure Plan.....	4.117
4.3.13.2 Residual Effects .....	4.117
4.4 Population Growth/Decline .....	4.118
4.4.1 Causes of Impacts.....	4.118
4.4.2 Potential Level of Impact.....	4.118
4.4.3 In-migration .....	4.119
4.4.3.1 NWT Diamonds Project-generated Employment .....	4.119
4.4.3.2 Labour Force Re-alignment.....	4.119
4.4.3.3 Job Seekers .....	4.119
4.4.3.4 NWT Resident Moves .....	4.120
4.4.3.5 In-migration Summary.....	4.120
4.4.4 Potential Impacts .....	4.121
4.4.4.1 Yellowknife.....	4.121
4.4.4.2 Hay River.....	4.122
4.4.4.3 First Nations and Coppermine .....	4.123
4.4.5 Mitigation/Enhancement.....	4.123
4.4.6 Impact Timing .....	4.123
4.4.7 Residual Effects.....	4.123
4.5 Local Economies.....	4.123
4.5.1 Situation.....	4.123
4.5.2 Causes of Impacts.....	4.124
4.5.3 Level of Impact .....	4.124
4.5.4 Local Economy – Yellowknife.....	4.124
4.5.4.1 Level of Impact.....	4.125
4.5.4.2 Reasons for Economic Impacts in Yellowknife.....	4.126
4.5.4.3 Potential Impacts.....	4.127
4.5.5 Local Economy – Hay River.....	4.130
4.5.5.1 Level of Impact.....	4.130

4.5.5.2	Reasons for Impacts .....	4.130
4.5.5.3	Potential Impacts.....	4.131
4.5.6	Local Economy – First Nations Communities.....	4.132
4.5.6.1	Potential Impacts.....	4.133
4.5.6.2	Expansion of Arts and Crafts Market.....	4.133
4.5.7	Local Economy – Coppermine.....	4.133
4.5.8	Mitigation/Enhancement .....	4.134
4.5.8.1	Out-sourcing .....	4.134
4.5.9	Residual Effects .....	4.135
4.6	Pass-through Traffic - Yellowknife.....	4.135
4.6.1	Causes of Impacts.....	4.136
4.6.2	Potential Level of Impact.....	4.136
4.6.3	Reasons for Impacts .....	4.136
4.6.4	Potential Impacts .....	4.136
4.6.4.1	Spending in the Local Economy .....	4.136
4.6.4.2	Increased Accommodation Usage.....	4.137
4.6.5	Mitigation/Enhancement .....	4.137
4.6.6	Impact Timing .....	4.137
4.7	Use of NWT Infrastructure and Services .....	4.138
4.7.1	Transportation.....	4.138
4.7.1.1	Ground Transport .....	4.138
4.7.1.2	Rail Transport .....	4.143
4.7.1.3	Air Transport .....	4.143
4.7.1.4	Water Transport.....	4.146
4.7.2	Communications.....	4.146
4.7.3	Power.....	4.146
4.7.4	Fuel Supply .....	4.146
4.7.5	Territorial Infrastructure .....	4.146
4.7.6	Municipal Infrastructure .....	4.147
4.8	Traditional Economies and Lifestyles .....	4.147
4.8.1	Potential Causes of Impacts.....	4.147
4.8.1.1	Long Distance Commuting for Labour .....	4.147
4.8.1.2	Increased Income and Accompanying Involvement in a Wage Economy.....	4.149
4.8.1.3	Education and Training Programs.....	4.151
4.8.1.4	Hiring of Aboriginal Women .....	4.151
4.9	Land Users in Vicinity of the Mine .....	4.152
4.9.1	Causes of Impact .....	4.152
4.9.2	Potential Level of Impact.....	4.152
4.9.2.1	Barrenground Caribou Sports Hunting Outfitters.....	4.152
4.9.2.2	Coppermine River Tour Outfitters.....	4.154
4.9.2.3	Trappers .....	4.154
4.9.2.4	Aboriginal Hunters.....	4.154

4.9.3 Potential Impacts .....	4.155
4.9.4 Suggested Mitigation/Enhancement .....	4.156
4.9.5 Timing.....	4.156
4.10 Community Well-being.....	4.156
4.10.1 The Communities.....	4.158
4.10.2 Causes of Impacts.....	4.162
4.10.2.1 Employment and Income .....	4.162
4.10.2.2 Long Distance Labour Commuting (Rotational Employment).....	4.164
4.10.3 Level of Impact .....	4.164
4.10.4 Potential Impacts .....	4.164
4.10.4.1 Increased Purchases of Alcohol and Drugs ..	4.165
4.10.4.2 Higher Incidence of Gambling .....	4.165
4.10.4.3 Higher Incidence of Assaults, Other Crime ..	4.165
4.10.4.4 Strain on Policing Services .....	4.166
4.10.4.5 Strain on Social Service Agencies.....	4.166
4.10.4.6 More Pronounced Community Divisions Between Affluent and Poor.....	4.166
4.10.4.7 Acceleration of Value Changes.....	4.166
4.10.4.8 Marriage Breakdown.....	4.166
4.10.4.9 Family Disruption.....	4.167
4.10.4.10 Increase in Drug Trafficking .....	4.167
4.10.4.11 Staff Turnover.....	4.167
4.10.4.12 Rising Levels of Self-esteem/Pride.....	4.167
4.10.4.13 Transfer of Skills .....	4.167
4.10.4.14 Improved Standard of Living.....	4.168
4.10.4.15 Change in Leadership Structure .....	4.168
4.10.5 Mitigation/Enhancement .....	4.168
4.10.5.1 Community Mobilization Programs .....	4.168
4.10.5.2 Employment Preference.....	4.173
4.10.5.3 The Employment Training Programs .....	4.173
4.10.5.4 Two-week Work Rotation.....	4.173
4.10.5.5 Alcohol and Drug Counselling.....	4.174
4.10.5.6 Employee Assistance Programs .....	4.174
4.10.5.7 Banking Services/Facilities .....	4.175
4.11 Cross-cultural Impacts .....	4.175
4.11.1 Causes of Impacts.....	4.175
4.11.2 Levels of Impacts .....	4.175
4.11.3 Reasons for Impacts .....	4.175
4.11.4 Potential Impacts .....	4.176
4.11.4.1 Staff Turnover Among Aboriginal Employees.....	4.176
4.11.4.2 Reductions in Productivity.....	4.176
4.11.4.3 Development of Factions on Site .....	4.177

4.11.5 Mitigation/Enhancement .....	4.177
4.11.5.1 Cross-cultural Orientation Programs.....	4.177
4.11.5.2 Sensitivity Training.....	4.177
4.11.5.3 Buddy System Approach.....	4.177
4.11.5.4 Career Planning.....	4.177
4.11.5.5 Concern Forums.....	4.177
4.11.5.6 Impact Timing.....	4.178
4.12 Job and Education Aspirations .....	4.178
4.12.1 Causes of Impacts.....	4.178
4.12.2 Potential Level of Impacts .....	4.178
4.12.3 Reasons for Impacts .....	4.179
4.12.4 Potential Impacts .....	4.180
4.12.4.1 Provide Incentive to Improve Educational Levels .....	4.180
4.12.4.2 Expand Career Horizons .....	4.180
4.12.4.3 Improve Skills in Community Labour Pool ..	4.180
4.12.5 Enhancement Mitigation .....	4.181
4.12.5.1 Education Incentive Programs.....	4.181
4.12.5.2 Co-operative Training Approach .....	4.181
4.12.5.3 Student Work Experience Programs.....	4.181
4.12.5.4 Career Counselling .....	4.181
4.12.6 Timing.....	4.181
4.12.7 Residual Effects.....	4.182
4.13 Government Expenses/Income .....	4.182
4.13.1 Potential Expenses to the Government of the Northwest Territories - Year 2000 .....	4.182
4.13.2 Potential Savings to the Government of the Northwest Territories - Year 2000 .....	4.183
4.13.2.1 Social Assistance Payments .....	4.183
4.13.2.2 Housing Subsidy Reductions .....	4.183
4.13.2.3 Grants, Other Assistance .....	4.184
4.13.2.4 Summary of Savings.....	4.184
4.13.3 Potential Expenses to the Federal Government.....	4.184
4.13.4 Government Expense Summary .....	4.186
4.13.5 Potential Revenue to the Government of the Northwest Territories.....	4.186
4.13.6 Potential Effects on Grant Level .....	4.187
4.13.7 Potential Impacts on Federal Revenue.....	4.190
4.13.8 Impact Levels .....	4.192
4.13.9 Residual Effects.....	4.192
4.14 Economic Impacts.....	4.192
4.14.1 Methodology .....	4.192
4.14.2 Magnitude of the Project .....	4.196
4.14.3 Regional Sourcing of Expenditures .....	4.199
4.14.4 Government Revenues and Costs.....	2.204

4.14.5 Downstream Impacts .....	2.209
4.14.5.1 Strategic Role of the Project for the NWT and Canada.....	2.209
4.15 Archaeological Impacts .....	2.214
4.15.1 Mitigation.....	2.215
4.15.2 Residual Effects.....	2.215
<b>5. Cumulative Effects.....</b>	<b>5.1</b>
5.1 Boundary Definition.....	5.3
5.2 Pathways Between Project Environmental Effects .....	5.3
5.3 Past and Present Projects and their Environmental Effects .....	5.5
5.4 Future Projects and their Potential Environmental Effects.....	5.5
5.5 Valued Ecosystem Components within the Zone of Influence of Project Development.....	5.7
5.6 Interactions of Past, Present and Future Activities Through Pathways.....	5.8
5.7 Likelihood and Significance of Cumulative Environmental Effects .....	5.8
5.8 Monitoring Measures .....	5.14
<b>References .....</b>	<b>R.1</b>
<b>Keywords .....</b>	<b>K.1</b>
<b>Glossary.....</b>	<b>G.1</b>

**List of Tables**

Table	Page
1.1-1 Impact Attribute Definitions .....	1.3
1.1-2 Significance Rating for Residual Effects.....	1.5
2-1 Summary of Physical and Biological Residual Effects.....	2.2
2.3-1 Lake Storage Changes .....	2.13
2.3-2 Summary of Lake Dewatering Plan.....	2.15
2.3-3 Watercourses Affected by Lake Dewatering .....	2.16
2.3-4 Summary of Streamflow Impacts for Lake Dewatering .....	2.17
2.3-5 Estimated Annual Reduction in Streamflow During the Operation of the Long Lake Tailings Impoundment.....	2.18
2.4-1 Effects of Kimberlite on Water Quality .....	2.24
2.4-2 Phase I and II Exploration Tailings Pond Water Composition .....	2.25
2.4-3 Modelled Concentration of Total Aluminum in Effluent from Tailings Impoundment.....	2.27
2.4-4 Modelled Concentration of Total Nickel in Effluent from Tailings Compound .....	2.28
2.4-5 Estimated Seepage Rates Through Internal Dikes in Long Lake.....	2.29
2.4-6 Exploration Tailings Pond Water Quality, 1994 .....	2.30
2.4-7 Summary of Water Quality Background for Nero/Nema Lake, 1994.....	2.36
2.4-8 Total Aluminum Concentration in Nema Lake (Receiving Environment) After Dilution.....	2.37
2.4-9 Total Nickel Concentration in Nema Lake (Receiving Environment) After Dilution.....	2.38
2.4-10 Effects of Dust on Lake Water Quality (mg/L).....	2.40

*Table of Contents*

---

2.4-11	Average Composition of Koala Lake Water During and After Rotary Drilling .....	2.41
2.4-12	Summary of Range of Concentrations of Key Water Quality Parameters Observed in Phase I Tailings Pond (1994 to 1995).....	2.43
2.5-1	Equipment/Source Air Emissions.....	2.51
2.5-2	Equipment Operating Hours in Each Pit.....	2.54
2.5-3	Air Emission Sources .....	2.55
2.5-4	Mean Maximum Afternoon Mixing Heights (m).....	2.57
2.5-5	Pasquill-Gifford Stability Categories (after Turner 1969) .....	2.59
2.5-6	Ambient Air Dispersion Modelling Results Maximum Boundary Concentrations - 2000 (Year 4).....	2.62
2.5-7	Ambient Air Dispersion Modelling Results Maximum Boundary Concentrations - 2006 (Year 10).....	2.63
2.5-8	Fugitive Dust (External Haul Road) Emission Rates .....	2.71
2.5-9	Estimated Air Emissions from Explosives Detonation .....	2.75
2.5-10	Frequency and Duration of Extremely Stable Events January 1 to June 30, 1994 .....	2.78
2.5-11	Frequency and Duration of Extremely Stable Events July 1 to December 22, 1994 .....	2.79
2.5-12	Frequency of Stable Atmospheric Events.....	2.82
2.5-13	Plume Rise for Various Stability Conditions.....	2.83
2.5-14	Plume Rise Sensitivity to Wind Speed.....	2.85
2.5-15	Plume Rise Sensitivity to Ambient Temperature.....	2.87
2.6-1	Categories of Water Sensitivity to Acidification.....	2.92
2.7-1	Anticipated Numbers of Aircraft Trips to Site.....	2.99
2.7-2	Sound Exposure Levels at Camps due to Individual Aircraft.....	2.103
2.7-3	Noise Levels of Individual Aircraft at 30 km from Airport .....	2.104

*Table of Contents*

---

2.7-4	Helicopter Noise Levels.....	2.105
2.7-5	Noise Source Frequency Spectra Used for Prediction of Stationary and Mobile Mining Equipment.....	2.107
2.7-6	Maximum Passby Noise Levels for Trucks on Misery Road .....	2.110
2.7-7	Predicted Peak Noise Levels due to Blasting.....	2.113
3.2-1	Vegetation Loss in Project Area .....	3.12
3.2-2	Preliminary Assignments of Overall Habitat Value and Susceptibility to Surface Disturbance Rankings for Tundra Ecosystems of the BHP Claim Block.....	3.14
4-1	Socioeconomic Impacts Directly Related to the NWT Diamonds Project Preproduction/Construction/Start-up 1993 to 1998 - Part A ..	4.4
4-2	Socioeconomic Impacts Directly Related to the NWT Diamonds Project Preproduction/Construction/Start-up 1993 to 1998 - Part B ...	4.5
4-3	Socioeconomic Impacts Directly Related to the NWT Diamonds Project Operations Phase I Year 2000 - Part A .....	4.6
4-4	Socioeconomic Impacts Directly Related to the NWT Diamonds Project Operations Phase I Year 2000 - Part B .....	4.7
4-5	Socioeconomic Impacts Directly Related to the NWT Diamonds Project Operations Phase II (Year 2007).....	4.8
4-6	Socioeconomic Impacts Directly Related to the NWT Diamonds Project Closure.....	4.9
4-7	Socioeconomic Impacts, Mitigation, Enhancement and Residual Effects.....	4.10
4.1-1	The Proponent's Responses to Key Issues .....	4.14
4.3-1	Summary of NWT Diamonds Project Related Employment & Income Preproduction/Construction/Start-up Phase - to 1998.....	4.55
4.3-2	Summary of NWT Diamonds Project Related Employment & Income Operations - Year 2000.....	4.56
4.3-3	Summary of NWT Diamonds Project Related Employment & Income Operations - Year 2007.....	4.57
4.3-4	Demand/Supply Match of Major Contractor Skill Requirements .....	4.61



## *Table of Contents*

---

4.3-5	Distribution of Major Contractor Employment by Person-months .....	4.62
4.3-6	Percentage Distribution of Major Contractor Employment by Person-years per Location.....	4.64
4.3-7	NWT Resident Income from Major Contractor Employment by Location .....	4.64
4.3-8	Potential Number of NWT Diamonds Project Employees by Location End of Construction Phase .....	4.65
4.3-9	NWT Diamonds Project Person-years of Employment and Income Preproduction/Construction/Start-up Phase .....	4.65
4.3-10	Person-years of Direct Employment for NWT Residents During the Preproduction/Construction Phase by Location.....	4.66
4.3-11	Summary of Direct Employment Income for NWT Residents during Preproduction/Construction/Start-up Phase by Location .....	4.66
4.3-12	NWT Resident Employment and Income as Percentage of Total Preproduction/Construction/Start-up Employment and Income.....	4.67
4.3-13	Project Requirements for Goods and Services Preproduction/Construction/Start-up by Location of Purchase .....	4.70
4.3-14	Northern Value of Potential Purchases Preproduction/ Construction/Start-up.....	4.71
4.3-15	Purchases and Northern Value Assessment per NWT Location Preproduction/Construction/Start-up.....	4.73
4.3-16	Person-years of Indirect Employment per NWT Location Preproduction/Construction/Start-up .....	4.73
4.3-17	Indirect Income by Location Preproduction/Construction/Start-up....	4.74
4.3-18	Level 2 Indirect Employment by Number of Jobs Resulting from Business Respending Preproduction/Construction/Start-up.....	4.76
4.3-19	Indirect Income Resulting from Business Re-spending Preproduction/Construction/Start-up .....	4.76
4.3-20	Indirect Person-years of Employment Preproduction/Construction/Start-up Phase .....	4.77
4.3-21	Indirect Employment Income Preproduction/Construction/Start-up Phase .....	4.77

*Table of Contents*

---

4.3-22	In-migration Due to Indirect Employment Preproduction/Construction/Start-up Phase .....	4.78
4.3-23	Person-years of Induced Employment Resulting from Household Responding Preproduction/Construction/Start-up .....	4.80
4.3-24	Induced Employment Income Generated by Proponent Expenditures Preproduction/Construction/Start-up .....	4.81
4.3-25	In-Migration Due to Induced Employment Preproduction/Construction/Start-up .....	4.82
4.3-26	Summary - NWT Resident Construction Employment and Income....	4.83
4.3-27	Summary - Construction/In-migration.....	4.83
4.3-28	NWT Diamonds Project Potential Employment by Community (First Full Year of Operations).....	4.91
4.3-29	Potential NWT Diamonds Project Hires by Location .....	4.92
4.3-30	NWT Diamonds Project Direct NWT Hires by Skill Requirements - Operations (Existing and New Residents) .....	4.94
4.3-31	Summary of NWT Diamonds Project Direct Employment Numbers and Income by Community .....	4.95
4.3-32	Comparison of Existing Mines Expenditures (1992) and NWT Diamonds Project Projected Expenditures in the NWT .....	4.96
4.3-33	Projected NWT Diamonds Project Purchases – Year 2000.....	4.97
4.3-34	NWT Diamonds Project Potential NWT Purchases by Location – Year 2000 .....	4.98
4.3-35	NWT Diamonds Project Indirect Employment Numbers by Location – Year 2000 .....	4.99
4.3-36	NWT Diamonds Project Indirect Employment Income by Location – Year 2000 .....	4.100
4.3-37	Indirect Employment by Number of Jobs Resulting from NWT Diamonds Project Suppliers’ Responding in NWT – Year 2000.....	4.101
4.3-38	Indirect Employment Income Resulting from NWT Diamonds Project Suppliers’ Responding in the NWT – Year 2000 .....	4.101

## *Table of Contents*

---

4.3-39	NWT Diamonds Project Summary of Indirect Employment by Location – Year 2000 .....	4.102
4.3-40	NWT Diamonds Project Summary of Indirect Employment Income by Location – Year 2000.....	4.102
4.3-41	NWT Diamonds Project In-Migration Due to Indirect Employment Year 2000 (Number of Jobs).....	4.103
4.3-42	NWT Diamonds Project Induced Employment – Year 2000.....	4.103
4.3-43	NWT Diamonds Project Induced Income – Year 2000.....	4.104
4.3-44	NWT Diamonds Project - NWT Residents Employment and Income Summary – Year 2000.....	4.105
4.3-45	NWT Diamonds Project NWT Direct Employment – Year 2007.....	4.106
4.3-46	NWT Diamonds Project Direct Employment by Location – Year 2007 .....	4.106
4.3-47	NWT Diamonds Project Direct Income by Location – Year 2007.....	4.107
4.3-48	NWT Diamonds Project Purchase of Goods & Services – Year 2007 .....	4.107
4.3-49	NWT Diamonds Project Additional Indirect Employment by Location – Year 2007 .....	4.108
4.3-50	NWT Diamonds Project Additional Indirect Income by Location – Year 2007 .....	4.108
4.3-51	NWT Diamonds Project Induced Employment.....	4.109
4.3-52	NWT Diamonds Project Additional Induced Income by Location ...	4.109
4.3-53	NWT Diamonds Project Summary of all Employment – Year 2007 .....	4.110
4.3-54	NWT Diamonds Project Summary of Income – Year 2007 .....	4.111
4.3-55	NWT Diamonds Project Reduction in NWT Unemployment, Construction and Operations .....	4.112
4.3-56	NWT Diamonds Project Increases in Earned Income, Construction and Operations .....	4.113
4.3-57	Aboriginal Participation NWT Diamonds Project Generated Employment	4.114

## *Table of Contents*

---

4.4-1	Summary of BHP Generated In-migration .....	4.120
4.4-2	Summary of Total In-migration.....	4.121
4.5-1	Purchases and Income Summary per Location .....	4.126
4.7-1	1991 Traffic on NWT Highways.....	4.142
4.9-1	NWT Economic Impacts from the Outfitted Caribou Hunting Industry in Unit F, 1993 .....	4.155
4.13-1	Federal Government Revenue - Expenses .....	4.185
4.13-2	Potential Direct Territorial Taxes - Year 2000 (1995 tax rates) .....	4.188
4.13-3	Potential Indirect Territorial Taxes - Year 2000 (based on 1995 rates and on NWT wage income of \$48,256 million generated by the Project) .....	4.189
4.13-4	Federal Government Revenue & Expenditures Northwest Territories 1991.....	4.191
4.14-1	Economic Impacts Associated with the NWT Diamonds Project .....	4.194
4.14-2	Impacts on GDP.....	4.196
4.14-3	Expenditures Over the Life of the NWT Diamond Project.....	4.197
4.14-4	Employment and Wages During Mine Construction and Operation.....	4.200
4.14-5	Northern Employment and Wages During Mine Construction Periods .....	4.200
4.14-6	Northern Employment and Wages During Mining Operations .....	4.201
4.14-7	NWT Diamonds Project Potential Reduction in NWT Unemployment Construction & Operations.....	4.203
4.14-8	Distribution of Project Purchases .....	4.204
4.14-9	Mining Operating Costs by Region of Spending (\$000).....	4.205
4.14-10	Direct Economic Impacts of the NWT Diamonds Project.....	4.208
4.14-11	Direct and Total Impacts of the NWT Diamonds Project .....	4.211

*Table of Contents*

---

5.1-1	Definition of Boundaries for Cumulative Effects .....	5.4
5.6-1	Potential Cumulative Effects.....	5.9
5.7-1	Cumulative Effects Assessment Matrix .....	5.11
5.8-1	Summary of Cumulative Effects Monitoring .....	5.15

**List of Figures**

Figure	Page
1.1-1 The Southern Arctic Ecozone.....	1.4
2.3-1 Koala Watershed Map .....	2.11
2.4-1 Changes in Long Lake During Operations Phase.....	2.32
2.4-2 Aluminum Speciation in Long Lake .....	2.34
2.4-3 Predicted Concentration of Total Aluminum in Nema Lake.....	2.39
2.4-4 Aluminum vs. TSS Concentrations in Koala Lake .....	2.44
2.4-5 Al and TSS in Six Consecutive Lakes .....	2.45
2.5-1 Ambient Air Quality Spatial Boundaries.....	2.47
2.5-2 Stationary Air Emission Sources Locations - Koala Camp Area .....	2.52
2.5-3 Weather Station Locations Koala and Misery Sites .....	2.56
2.5-4 ISC2 Air Dispersion Modelling Receptor Locations.....	2.60
2.5-5 Predicted Average Annual Ambient TSP Concentrations (2000) .....	2.64
2.5-6 Predicted Average Annual Ambient TSP Concentrations (2006) .....	2.65
2.5-7 Predicted Average Annual Ambient SO <sub>2</sub> Concentrations (2000).....	2.66
2.5-8 Predicted Average Annual Ambient SO <sub>2</sub> Concentrations (2006).....	2.67
2.5-9 Predicted Average Annual Ambient NO <sub>x</sub> Concentrations (2000) .....	2.68
2.5-10 Predicted Average Annual Ambient NO <sub>x</sub> Concentrations (2006) .....	2.69
2.5-11 Fugitive Dust Model - Annual TSP Contours (2000) .....	2.72
2.5-12 Fugitive Dust Model - Annual TSP Contours (2006) .....	2.73
2.5-13 Stable Atmospheric Events (January 1 to June 30).....	2.80
2.5-14 Stable Atmospheric Events (July 1 to December 22).....	2.81
2.5-15 Plume Rise vs. Atmospheric Stability .....	2.84

*Table of Contents*

---

2.5-16	Plume Rise vs. Wind Speed .....	2.86
2.5-17	Plume Rise vs. Ambient Temperature .....	2.88
2.7-1	Noise/Mineral Claim Boundary .....	2.95
2.7-2	Noise Exposure Forecast Contours.....	2.101
2.7-3	B727 Impact - Equivalent Sound Levels $L_{eq}$ .....	2.102
2.7-4	Mining Operations - Noise Impact Contours - Worst Case Scenario .....	2.109
4.7-1	NWT Highway System.....	4.140
4.7-2	Winter Road to Lupin Mine .....	4.141
4.9-1	Location of Sport Hunting Outfitters .....	4.153
4.10-1	RCMP Statistics for 1994 Intoxicated Persons.....	4.159
4.10-2	RCMP Statistics for 1994 Total Drug Offences .....	4.160
4.10-3	RCMP Statistics for 1994 Total Assault Cases.....	4.161
4.10-4	RCMP Statistics for 1994 Property Damage .....	4.163
4.10-5	Potential Partnerships in the Community Mobilization Process.....	4.170
4.14-1	Distribution of Total Project Expenditures .....	4.195
4.14-2	Ore Values for NWT Mines.....	4.198
4.14-3	Contribution of Project to NWT Mining .....	4.202
4.14-4	Direct Impacts of the Project .....	4.210
4.14-5	Staking Acreage in the NWT .....	4.213
5.4-1	Access Roads and Hypothetical Targets.....	5.6

## **List of Appendices**

The Appendices to this volume are contained in a supplementary report entitled Volume IV - Appendices.

### **Appendix IV-A - Approach to Impact Assessment**

IV-A1 Impact Assessment Matrix

### **Appendix IV-B - Physical Impacts and Mitigation**

IV-B1 ISC2 Input Files: Air Dispersion Modelling

IV-B2 Calculations and Assumptions Used to Prepare Aircraft Noise Contours for BHP Diamonds Project Koala Airport

IV-B3 Methodology and Assumptions for Prediction of Noise from Mobile and Stationary Mining Equipment

### **Appendix IV-C - Socioeconomic Impacts and Mitigation**

IV-C1 Community Mobilization Vision-Setting Workshop

IV-C2 Aboriginal Employee Perceptions of the Project - Individual Responses

IV-C3 North Island Gazette “Focus on Mining” (articles)

IV-C4 Press Releases regarding Island Copper Closure (February 21,1995 and March 22, 1995)

IV-C5 Long Distance Labour Commuting



## **Table of Conformity**

The following table indicates how the design and contents of the EIS conform to the requirements of the “Final Guidelines for the Preparation of an EIS” issued by the BHP Diamond Mine Environmental Assessment Panel in May 1995.

<b>EIS Guideline Requirements</b>	<b>EIS Reference</b>
4.0 EIS Overview	EIS Summary, Volumes I - IV
4.1 Study Strategy and Methods	Vol. II, Sec. 1.1 Methods Vol. IV, Sec. 1.1 Methods
Traditional Knowledge	Vol. I, Sec. 1.2 Indigenous Knowledge Vol. I, Sec. 5.1.1.4 Traditional Knowledge Meetings, Workshops and Studies Vol. II, Sec. 1.2 The Aboriginal Context Vol. II, Sec. 4.1.3 The Traditional Economy Vol. II, Sec. 4.1.4 Emergence of the Mixed Economy Vol. II, Sec. 4.1.5 The Current Economy Vol. II, Sec. 4.1.6 Concerns Vol. III, Sec. 1.2 Role of Indigenous Peoples & Knowledge in Environmental Management Vol. IV, Sec. 4.1 Local and Regional Perceptions of the project Vol. IV, Sec. 4.2 Aboriginal Employee Perceptions of the Project Vol. IV, Sec. 4.8 Traditional Economies/Lifestyles
4.2 EIS Presentation Conformity with Guidelines Keywords References Preparation Glossary	Table of Conformity List of Keywords Reference List Acknowledgments Glossary
4.3 EIS Summary	EIS Summary Volume

*Table of Contents*

5.0 Introduction	Vol. I, Sec. 1	Introduction
5.1 The Project	Vol. I, Sec. 1.1	The Project
5.2 The Setting	Vol. I, Sec. 1.4	Project Setting
5.2.1 Regional Context	Vol. I, Sec. 1.4.1	Regional Context
5.2.2 Land Claims	Vol. I, Sec. 1.4.2	Land Claims
5.2.3 Regulatory Environment	Vol. I, Sec. 1.4.3	Regulatory Environment
5.3 The Proponent	Vol. I, Sec. 1.5 Vol. I, Sec. 1.5.1 Vol. I, Sec. 1.5.2 Vol. I, Sec. 1.5.3 Vol. I, Sec. 1.5.4	The Proponent BHP The Blackwater Group Proponent Obligations Principal Contractors
6.0 Project Description and Overview	Vol. I, Sec. 1.1	The Project
Management Plans	Vol. III, Sec. 2 Vol. III, Sec. 3 Vol. III, Sec. 4 Vol. III, Sec. 5 Vol. III, Sec. 6 Vol. III, Sec. 7 Vol. III, Sec. 8 Vol. III, Sec. 9	Air Quality Management Plan Water Management Plan Materials Management Plan Waste Management Plan Traffic Management Plan Wildlife Management Plan Aquatic Life Management Plan Reclamation, Decommissioning and Closure Management Plan
Commitments and Policies	Vol. I, Sec. 4	Policies, Procedures and Commitments
7.0 Environmental Assessment Boundaries	Vol. II, Sec. 1.1 Vol. II, Sec. 2 Vol. II, Sec. 3 Vol. II, Sec. 4 Vol. IV, Sec. 1.1 Vol. IV Sec. 5.1	Methods Physical Setting Biological Setting Socioeconomic Setting Methods Cumulative Effects - Boundary Definitions

8.0 Description of the Existing Environment	Vol. II, Sec. 2 Vol. II, Sec. 3 Vol. II, Sec. 4	Physical Setting Biological Setting Socioeconomic Setting
8.1 Physical Environment a) geology b) permafrost c) ground instability d) hydrology e) water quality f) sediment quality g) air quality h) climate i) other components	Vol. I, Sec. 2.3 Vol. II, Sec. 2.1 Vol. II, Sec. 2.2 Vol. II, Sec. 2.3 Vol. II, Sec. 2.4 Vol. II, Sec. 2.5 Vol. II, Sec. 2.7 Vol. II, Sec. 2.6 Vol. II, Sec. 2.8	Geology Terrain and Permafrost Ground Instability Hydrology Water Quality Sediments Air Quality Climatology Noise
8.2 Biological Environment a) fish and other aquatic life and habitat b) birds, wildlife and habitat c) vegetation including wetlands	Vol. II, Sec. 3.1 Vol. II, Sec. 3.3 Vol. II, Sec. 3.2	Aquatic Life Wildlife Vegetation
8.3 Socioeconomic Environment a) public health	Vol. I, Sec. 5.1.1.5 Vol. II, Sec. 4.1.11 Vol. II, Sec. 4.2.5 Vol. II, Sec. 4.2.6.3 Vol. II, Sec. 4.4.4 Vol. II, Sec. 4.3.5 Vol. II, Sec. 4.3.3.3 Vol. II, Sec. 4.3.4.2 Vol. II, Sec. 4.4.5.2 Vol. II, Sec. 4.4.6 Vol. II, Sec. 4.5.2.1 Vol. II, Sec. 4.5.4 Vol. II, Sec. 4.5.5	Community Involvement Social Infrastructure Infrastructure - Municipal Government Social/Leadership Resources Infrastructure Outlook Infrastructure Social/Leadership Resources Social/Leadership Resources Outlook Public Administration/ Education/Health Infrastructure Capacity for Growth
	Vol. II, Sec. 4.5.6	Outlook

<p>b) demographics</p>	<p>Vol. II, Sec. 4.1.7 Vol. II, Sec. 4.2.2 Vol. II, Sec. 4.3.1 Vol. II, Sec. 4.4.1 Vol. II, Sec. 4.5.1</p>	<p>People/Demographic Profile People/Demographic Profile People/Demographic Profile People/Demographic Profile People/Demographic Profile</p>
<p>c) social and cultural patterns</p>	<p>Vol. I, Sec. 1.2 Vol. II, Sec. 4.1.3 Vol. II, Sec. 4.1.4 Vol. II, Sec. 4.1.5 Vol. II, Sec. 4.1.6 Vol. II, Sec. 4.1.8 Vol. II, Sec. 4.2 Vol. II, Sec. 4.2.6 Vol. II, Sec. 4.3 Vol. II, Sec. 4.3.5 Vol. II, Sec. 4.4 Vol. II, Sec. 4.4.5 Vol. II, Sec. 4.5 Vol. II, Sec. 4.5.5 Vol. II, Sec. 4.5.6</p>	<p>Traditional Knowledge - The Importance of Knowing The Traditional Economy The Emergence of the Mixed Economy The Current Economy Concerns Economic Activity/Sectors First Nations Communities Capacity for Growth Coppermine Outlook Yellowknife Capacity for Growth Hay River Capacity for Growth Outlook</p>
<p>d) archaeological, paleontological, cultural, heritage, burial sites</p>	<p>Vol. I, Sec. 5.1.1.4 Vol. II, Sec. 4.8</p>	<p>Traditional Knowledge Meetings, Workshops and Studies Archaeology</p>
<p>e) land and resource use</p>	<p>Vol. II, Sec. 4.1.3 Vol. II, Sec. 4.1.4 Vol. II, Sec. 4.1.5 Vol. II, Sec. 4.1.6 Vol. II, Sec. 4.1.8</p>	<p>The Traditional Economy Emergence of the Mixed Economy The Current Economy Concerns Economic Activity/Sectors</p>

<p>e) land and resource use</p>	<p>Vol. II, Sec. 4.2.3 Economic Activity/Sectors  Vol. II, Sec. 4.3.2 Economic Activity/Sectors  Vol. II, Sec. 4.4.2 Economic Activity/Sectors  Vol. II, Sec. 4.5.2 Economic Activity/Sectors</p>
<p>f) local, regional and territorial economy</p>	<p>Vol. II, Sec. 4.1.3 The Traditional Economy  Vol. II, Sec. 4.1.4 Emergence of the Mixed Economy  Vol. II, Sec. 4.1.5 The Current Economy  Vol. II, Sec. 4.1.6 Concerns  Vol. II, Sec. 4.1.8 Economic Activity/Sectors  Vol. II, Sec. 4.1.9 Income and Investment  Vol. II, Sec. 4.1.14 NWT Revenues and Expenditures  Vol. II, Sec. 4.2.3 Economic Activity/Sectors  Vol. II, Sec. 4.2.4 Income  Vol. II, Sec. 4.3.2 Economic Activity/Sectors  Vol. II, Sec. 4.3.3 Income  Vol. II, Sec. 4.4.2 Economic Activity/Sectors  Vol. II, Sec. 4.4.4.12 Financial Resources  Vol. II, Sec. 4.5.2 Economic Activity Sectors  Vol. II, Sec. 4.5.3 Other Income</p>
<p>g) employment, education and training</p>	<p>Vol. I, Sec. 2.10 Human Resources  Vol. II, Sec. 4.1.7 People/Demographic Profile  Vol. II, Sec. 4.1.8 Economic Activity/Sectors  Vol. II, Sec. 4.1.9.1 Wages/Employment  Vol. II, Sec. 4.1.11 Social Infrastructure  Vol. II, Sec. 4.2.2 People/Demographic Profile  Vol. II, Sec. 4.2.6.2 Education/Work Force  Vol. II, Sec. 4.3.1 People/Demographic Profile  Vol. II, Sec. 4.3.4.1 Work Force  Vol. II, Sec. 4.4.1 People/Demographic Profile  Vol. II, Sec. 4.4.3.1 Wages/Employment</p>

<p>g) employment, education and training</p>	<p>Vol. II, Sec. 4.4.4.7 Education Facilities  Vol. II, Sec. 4.5.1 People/Demographic Profile  Vol. II, Sec. 4.5.3.1 Wages/Employment  Vol. II, Sec. 4.5.4.7 Education Facilities  Vol. II, Sec. 4.5.5.1 Work Force</p>
<p>h) services and infrastructure</p>	<p>Vol. I, Sec. 2.7 Infrastructure  Vol. I, Sec. 2.9 Transportation Plan  Vol. II, Sec. 4.1.6 Infrastructure  Vol. II, Sec. 4.1.7 Social Infrastructure  Vol. II, Sec. 4.2.5 Infrastructure - Municipal Government  Vol. II, Sec. 4.3.3.3 Infrastructure  Vol. II, Sec. 4.4.4 Infrastructure  Vol. II, Sec. 4.5.4 Infrastructure</p>
<p>i) government</p>	<p>Vol. I, Sec. 1.4.2 Land Claims  Vol. I, Sec. 1.4.3 Regulatory Environment  Vol. I, Sec. 5.3 Government Entities  Vol. II, Sec. 4 Socioeconomic Setting  Vol. II, Sec. 4.1.1 Political Setting  Vol. II, Sec. 4.2.3.1 Government  Vol. II, Sec. 4.2.5 Infrastructure - Municipal Government  Vol. II, Sec. 4.3.2 Economic Activity/Sectors  Vol. II, Sec. 4.3.2.1 Government  Vol. II, Sec. 4.3.3.3 Infrastructure  Vol. II, Sec. 4.4.4.2 Municipal Government  Vol. II, Sec. 4.5.4.2 Municipal Government</p>
<p>9.0 Impact Assessment</p>	<p>Vol. IV Environmental Impacts and Mitigation</p>
<p>Cumulative Effects  Impact Significance  9.1 Effects on the Physical Environment</p>	<p>Vol. IV, Sec. 5 Cumulative Effects  Vol. IV, Sec. 2 Physical Impacts and Mitigation</p>

<p>9.1 Effects on the Physical Environment (cont.)</p> <p>a) bedrock geology, surficial geology and geomorphology</p> <p>b) permafrost</p> <p>c) ground instability</p> <p>d) hydrological features</p> <p>e) water quality</p> <p>f) sediment quality and quantity</p> <p>g) ambient air quality and noise levels</p> <p>h) climate</p>	<p>Vol. IV, Sec. 2.1 Terrain Impacts</p> <p>Vol. IV, Sec. 2.1 Terrain Impacts</p> <p>Vol. IV, Sec. 2.2 Ground Instability Impacts</p> <p>Vol. IV, Sec. 2.3 Hydrology Impacts</p> <p>Vol. IV, Sec. 2.4 Water Quality Impacts</p> <p>Vol. IV, Sec. 2.4 Water Quality Impacts</p> <p>Vol. IV, Sec. 2.5 Air Quality Impacts</p> <p>Vol. IV, Sec. 2.7 Noise Impacts</p> <p>Vol. IV, Sec. 2.6 Climatology Impacts</p>
<p>9.2 Effects on the Biological Environment</p> <p>a) fish and other aquatic life</p> <p>b) birds and wildlife</p> <p>c) plant and vegetation communities</p>	<p>Vol. IV, Sec. 3 Biological Impacts and Mitigation</p> <p>Vol. IV, Sec. 3.1 Aquatic Life Impacts</p> <p>Vol. IV, Sec. 3.3 Wildlife, Birds and Habitat Impacts</p> <p>Vol. IV, Sec. 3.2 Vegetation Impacts</p>
<p>9.3 Effects on Socioeconomic Environment</p> <p>a) public health</p>	<p>Vol. II, Sec. 4 Socioeconomic Setting</p> <p>Vol. IV, Sec. 4 Socioeconomic Impacts and Mitigation</p> <p>Vol. IV, Sec. 4.1 Local and Regional Perceptions of the Project</p> <p>Vol. IV, Sec. 4.2 Aboriginal Employees' Perceptions of the Project</p> <p>Vol. IV, Sec. 4.10 Community Well-being</p>
<p>b) demographics</p>	<p>Vol. IV, Sec. 4.4 Population Growth/Decline</p>
<p>c) social and cultural patterns</p>	<p>Vol. I, Sec. 3.1 Fly-In/Fly-Out Work Force Versus Permanent Mining Town</p> <p>Vol. I, Sec. 5.4 Methods of Addressing Future Concerns</p> <p>Vol. II, Sec. 4.7 No Development Scenario</p>

c) social and cultural patterns	Vol. IV, Sec. 4.1	Local and Regional Perceptions of the Project
	Vol. IV, Sec. 4.2	Aboriginal Employees Perceptions of the Project
	Vol. IV, Sec. 4.3	Employment and Income Impacts
	Vol. IV, Sec. 4.8	Traditional Economies/Lifestyles
	Vol. IV, Sec. 4.10	Community Well Being
	Vol. IV, Sec. 4.11	Cross-cultural Impacts
	Vol. IV, Sec. 4.12	Job and Education Aspirations
d) cultural sites	Vol. IV, Sec. 4.1	Local and Regional Perceptions of the Project
	Vol. IV, Sec. 4.15	Archaeological Impacts
e) land and resource use	Vol. I, Sec. 1.4.2	Land Claims
	Vol. I, Sec. 1.4.3	Regulatory Environment
	Vol. I, Sec. 5.4	Methods of Addressing Future Concerns
	Vol. IV, Sec. 4.1	Local and Regional Perceptions of the Project
	Vol. IV, Sec. 4.2	Aboriginal Employees Perceptions of the Project
	Vol. IV, Sec. 4.9	Land Users in Vicinity of the Mine
f) local, regional and territorial economy	Vol. I, Sec. 1.3	Project Economic Analysis
	Vol. II, Sec. 4.6	Competing/Complimentary Projects in the NWT
	Vol. II, Sec. 4.7	No Development Scenario
	Vol. IV, Sec. 4.1	Local and Regional Perceptions of the Project
	Vol. IV, Sec. 4.2	Aboriginal Employees Perceptions of the Project
	Vol. IV, Sec. 4.3	Employment and Income Impacts
	Vol. IV, Sec. 4.6	Local Economies
	Vol. IV, Sec. 4.8	Traditional Economies/Lifestyles
	Vol. IV, Sec. 4.13	Government Income and Expenses
	Vol. IV, Sec. 4.14	Economic Impacts



<p>g) employment, education and training</p>	<p>Vol. I, Sec. 1.4.2 Land Claims  Vol. I, Sec. 1.4.3 Regulatory Environment  Vol. I, Sec. 2.10 Human Resources  Vol. I, Sec. 2.11.9.2 Training  Vol. I, Sec. 4.0 Corporate Policies, Procedures and Commitments  Vol. I, Sec. 5.1.1.5 Community Involvement  Vol. I, Sec. 5.4 Methods of Addressing Future Concerns  Vol. IV, Sec. 4.1 Local and Regional Perceptions of the Project  Vol. IV, Sec. 4.2 Aboriginal Employees Perceptions of the Project  Vol. IV, Sec. 4.3 Employment and Income Impacts  Vol. IV, Sec. 4.8 Traditional Economies/Lifestyles  Vol. IV, Sec. 4.12 Job and Education Aspirations</p>
<p>h) services and infrastructure</p>	<p>Vol. IV, Sec. 4.6 Pass-through Traffic - Yellowknife  Vol. IV, Sec. 4.7 Use of NWT Infrastructure and Services  Vol. IV, Sec. 4.13 Government Income/Expenses</p>
<p>i) government</p>	<p>Vol. I, Sec. 1.4.2 Land Claims  Vol. I, Sec. 1.4.3 Regulatory Environment  Vol. I, Sec. 5.4 Methods of Addressing Future Concerns  Vol. II, Sec. 4.7 No Development Scenario  Vol. III, Sec. 10.4 Socioeconomic Impacts Monitoring  Vol. IV, Sec. 4.13 Government Income/Expenses  Vol. IV, Sec. 4.14 Economic Impacts</p>

*Table of Contents*

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10.0 Mitigation Measures and Residual Effects	Vol. I, Sec. 1.3 Vol. IV, Sec. 2 Vol. IV, Sec. 3 Vol. IV, Sec. 4	Project Economic Analysis Physical Impacts and Mitigation Biological Impacts and Mitigation Socioeconomic Impacts and Mitigation
11.0 Monitoring Programs	Vol. III, Sec. 10	Environmental Monitoring Strategy
12.0 Alternatives and Future Development	Vol. I, Sec. 3.1 Vol. I, Sec. 3.2 Vol. I, Sec. 3.3 Vol. I, Sec. 3.4 Vol. I, Sec. 3.5 Vol. I, Sec. 3.6 Vol. I, Sec. 3.7 Vol. I, Sec. 3.8 Vol. I, Sec. 3.9 Vol. I, Sec. 3.10	Fly-In/Fly-Out Work Force Versus Permanent Mining Town Open Pit and Underground Mining Backfilling of Open Pits Plant Site Location Mineral Processing Options Ore Treatment Production Rates Alternative Tailings Disposal Site and Facility Assessment Power Generation Options Transportation Options Future Development
13.0 Information Programs & Public Involvement	Vol. I, Sec. 5	Communications

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<b>Consultants</b>	<b>Contribution</b>
ARA Consulting Group Inc. Vancouver, B.C.	Economic Analysis
Agra Earth and Environmental Calgary, AB	Fish Habitat Evaluation
Applied Technical Services Victoria, B.C.	Benthic Invertebrates and Zooplankton Identification
ASL Laboratory Services Vancouver, B.C.	Water Quality, Sediment and Tissue Analysis
Jerry W. Bair Houston, TX	Communications, Government Affairs, Traditional Knowledge
Barb Brown Community Development Associates Vancouver, B.C.	Community Assessment and Community Mobilization
Barron Kennedy Lyzun and Associates Vancouver, B.C.	Noise Assessment
BC Research Laboratory Vancouver, B.C.	Toxicity Testwork

<b>Consultants</b>	<b>Contribution</b>
Bruce Geotechnical Consultants Inc. Vancouver, B.C.	Groundwater Modelling and Permafrost
Canadian Circumpolar Institute University of Alberta Edmonton, AB	Dene and Inuit Traditional Knowledge Literature Review
Chemex Laboratory North Vancouver, B.C.	Acid Base Accounting Testwork
Chris Hanks Victor, Colorado	Indigenous and Traditional Knowledge
Davis & Co. Vancouver, B.C. Yellowknife, NWT	Legal Services
Dene Cultural Institute Hay River, NWT	Traditional Knowledge
Dene Nation Yellowknife, NWT	Traditional Land Use Maps
EBA Engineering Consultants Ltd. Edmonton, AB	Geotechnical Engineering and Permafrost Assessment
Elemental Research Laboratory North Vancouver, B.C.	ICP/MS Low Level Water Quality Analyses
Fluor Daniel Wright Ltd./ Signet Engineering Pty Ltd. Vancouver, B.C.	Infrastructure and Process Design
Fraser Taxonomic Services Vancouver, B.C.	Periphyton and Phytoplankton Identification
Hamlet of Coppermine Coppermine, NWT	Indigenous and Traditional Knowledge
Inuvik Fisheries Consulting and Age Laboratory Inuvik, NWT	Fish Aging, Scales

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<b>Advisors</b>	<b>Contribution</b>
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Dr. Lionel Johnson Retired Arctic Fisheries Biologist Victoria, B.C.	Fisheries and Aquatics (Lake Trout Specialist)

<b>Advisors</b>	<b>Contribution</b>
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Department of Indian and Northern Affairs

Land Resources Division

Water Resource Division

Environment and Conservation Division

Environment Canada

Environmental Protection Service

Canadian Wildlife Service

Atmospheric Environment Service

Inland Water Directorate

Fisheries and Oceans

Government of Northwest Territories

Department of Renewable Resources

Department of Energy

Mines and Petroleum Resources

Policy and Directive Office

Education, Culture and Employment

Aboriginal Communities

Dogrib Treaty 11 Environment Committee



Yellowknives Dene Treaty 8 Environment Committee

Dene Metis Nation

NWT Chamber of Mines

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## **Disclaimer**

The material contained in this E.I.S. has been prepared in response to guidelines issued by the Panel established by the Government of Canada pursuant to the Environmental Assessment and Review Process Guidelines Order. The contents hereof represent the Proponent's best estimate of its prospects for developing the project on its mineral claim block in the Lac de Gras area, based on information currently available and believed by management to be reliable. Any estimates or forecasts of levels of production, ore grades and reserves have been prepared for purposes of the environmental review process only. They have not been prepared in accordance with securities regulatory requirements pertaining to disclosure of future-oriented financial information and accordingly may not be relied upon for investment purposes.

# **1. Approach to Impact Assessment**

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The environmental impact assessment (EIA) for the NWT Diamonds Project has been undertaken according to standard EIA methods, which are described in this section. The approach consists largely of examining the baseline conditions of the project area (Volume II) and predicting how various project activities, in conjunction with the Environmental Management Plan (Volume III), could affect the existing environment.

The perceptions and concerns of Aboriginal people have contributed to a broader understanding of the effects of project development and their implications. With a history of a land-based lifestyle, Aboriginal people have holistic knowledge on how various types of human activity may affect the land and resources. Impacts on the environmental components have been examined with respect to their ecosystem linkages. The Valued Ecosystem Components (VECs) were identified during the Proponent's consultation program and are discussed fully in Section 4. The viewpoints of other Northerners have also been considered carefully and are addressed in Section 4.

The comprehensive evaluation of potential impacts to the physical, biological and human systems will allow these impacts to be minimized.

## **1.1 Methods**

Volume IV addresses the potential positive and negative impacts of the NWT Diamonds Project. Impacts are described according to general environmental components (e.g., hydrology, wildlife, employment). Valued ecosystem components (VECs) have been identified and are the focus of most of the detailed discussion. Impact analysis is based on an ecosystem approach, which examines specific environmental elements with respect to their relationship with other ecosystem elements or processes.

The assessment of potential impacts for each environmental component begins with an overview of the main project activities that could cause environmental disturbances. The specific development periods (e.g., construction) when these activities are expected to take place are summarized. The interactions between project activities and environmental elements are described, as well as any processes through which an impact is anticipated to result.

The evaluation of impacts for each environmental component is organized by the type or nature of impact (e.g., habitat loss). Potential impacts are explained through the consideration of six impact attributes: geographic extent, duration/frequency, reversibility, ecological context, probability and the capacity of renewable resources to meet the needs of the present and those of the future (sustainable development). These

impact attributes are used to describe the process through which a project activity may cause an effect on the environment. Any impacts already experienced during exploration are outlined. Definitions for impact attributes described by ratings such as high, moderate or low are summarized in [Table 1.1-1](#).

Following each description of a potential impact is a discussion of appropriate mitigation measures that could be applied to minimize the effects of any form of environmental disturbance. Specific operating policies and procedures that could mitigate environmental impacts are explained. In some cases, appropriate mitigation may consist of strict adherence to the timing of a particular project activity in consideration of the sensitivity of certain seasonal activities of a species (e.g., spawning). In other instances, specific sites could be avoided.

Residual effects are outlined as a means of assessing the magnitude of the significance of any remaining impact that could persist after proposed mitigation measures have been applied. The evaluation of impact significance results in the classification of a residual impact as being major, moderate, minor or negligible. These classifications are defined for physical, biological and socioeconomic components as summarized in [Table 1.1-2](#).

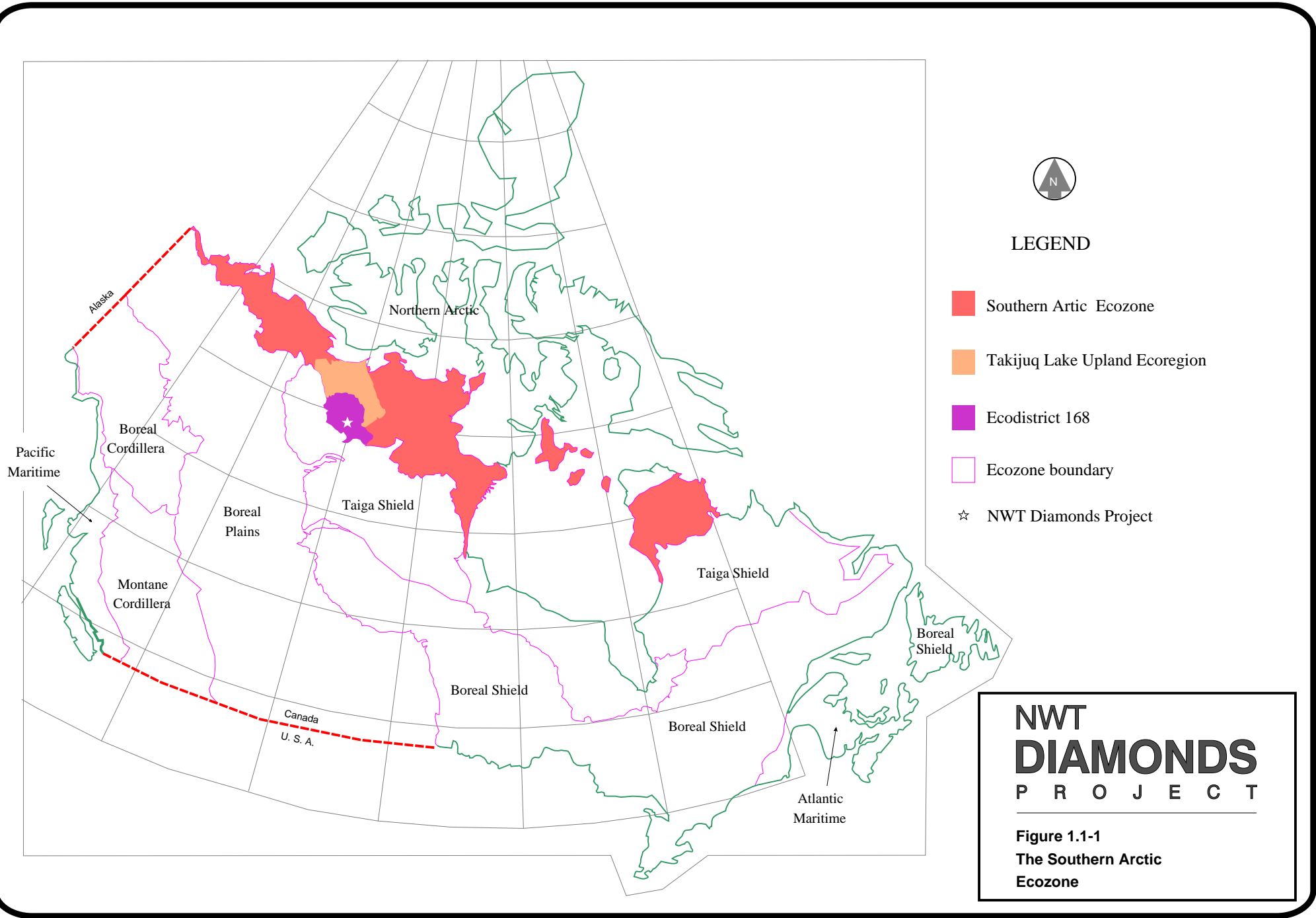
Definitions of impact significance were adapted from previous Environmental Impact Statement (EIS) reports and Environmental Impact Assessment (EIA) literature (e.g., National Defence 1994; Beanlands and Duinker 1983) with consideration for relevant temporal and spatial boundaries. Definitions are based on the appropriate boundaries for the various types (physical, biological or socioeconomic) of parameters. By examining the temporal and spatial characteristics of whole ecosystems, it is possible to classify impacts within a consistent context.

The spatial boundaries incorporated in the impact definitions pertaining to physical and biological components were based on “Terrestrial Ecozones and Ecoregions of Canada,” a map that has been established by Environment Canada and Agriculture Canada (Ecological Stratification Working Group 1995). This federal initiative is an attempt to define and map ecosystems within a national classification system. Since this ecosystem classification has already been endorsed by the federal and NWT governments, it was deemed to be a suitable means of undertaking impact assessment within an ecosystem approach. The significance of a residual effect is assumed to increase as the spatial extent increases from the smaller ecodistrict level to the larger ecozone ([Figure 1.1-1](#)).

The spatial boundaries adopted for the evaluation of impacts on socioeconomic components were based on the assumption that most of these impacts will be realized within the Northwest Territories. The significance of residual effect is

**Table 1.1-1  
Impact Attribute Definitions**

<b>Rating</b>	<b>Reversibility</b>	<b>Probability</b>	<b>Future Capacity of Renewable Resources/Sustainable Development</b>
high	previous research/ experience/ traditional knowledge indicates the impact on the VEC is reversible	an impact is likely to occur to a VEC based on previous research/ experience/traditional knowledge	previous research/experience/ traditional knowledge indicates that the impact on the VEC would not reduce the capacity of resources to meet the needs of the present and those of the future
moderate	previous research/ experience/traditional knowledge indicates that the impact on the VEC may be reversible	an impact may occur to a VEC based on previous research/experience/ traditional knowledge	previous research/experience/ traditional knowledge indicates that the impact on the VEC may, to a certain extent, reduce the capacity of resources to meet the needs of the present and those of the future
low	previous research/ experience/ traditional knowledge indicates that there is a small likelihood that the impact on the VEC is reversible	an impact has a small likelihood of occurring to a VEC based on previous research/experience/ traditional knowledge	previous research/experience/ traditional knowledge indicates that the impact on the VEC would reduce the capacity of resources to meet the needs of the present and those of the future
nil	previous research/ experience/ traditional knowledge indicates that the impact on the VEC is non-reversible	not applicable	not applicable
unknown	there is insufficient research/experience/ traditional knowledge to indicate whether the impact on the VEC is reversible	there is insufficient research/experience/ traditional knowledge to predict the likelihood of an impact occurring to a VEC	there is insufficient research/ experience/traditional knowledge to indicate whether the impact on the VEC would reduce the capacity of resources to meet the needs of the present and those of the future



Source: Adapted from Ecological Stratification Working Group

**Table 1.1-2  
Significance Ratings for Residual Effects**

Impact Significance	Type of Environmental Component		
	Physical	Biological	Socioeconomic
<b>Major</b>	Parameter affected within most of ecozone for several decades	Whole stock or population of ecozone affected over several generations	Whole population of Northwest Territories affected over several generations
<b>Moderate</b>	Parameter affected within most of ecoregion for one or more decades	Portion of population of ecoregion affected over one or more generations	Community affected over one or more generations
<b>Minor</b>	Parameter affected within most of ecosection during less than one decade	A specific group of individuals within an ecosection affected during less than one generation	A specific group of individuals within a community affected during less than one generation
<b>Negligible</b>	Parameter affected within some part of ecosection during a short period	A specific group of individuals within an ecosection affected during a short period	A specific group of individuals within a community affected during a short period

assumed to increase as its spatial extent increases from the community level to the territorial population.

The temporal boundaries incorporated in the impact definitions relate to the lifetime of a particular species or, in the case of physical parameters, the number of decades of an induced effect. Biological and socioeconomic impacts are assessed according to the number of generations that could potentially be affected.

A complete summary of the physical and biological impact assessment undertaken for the VECs identified is provided in matrix form in **Table 2-1**, Section 2, with the detailed assessment included in Appendix IV-A1. The socioeconomic impact assessment matrices are included in Section 4. The matrices outline the main characteristics of the project activities, types of impacts, impact attributes, mitigation and residual effects.

The discussions in the following sections should provide a comprehensive description and analysis of the kinds of impacts that could be anticipated from the development of the proposed NWT Diamonds Project. The summary of mitigation measures and residual effects provides an assessment of the significance of any remaining impacts.

## **1.2 Ecological Impacts**

The development of the NWT Diamonds Project may result in some local ecological impacts. Some of these impacts will be temporary, limited to one season, while some will last beyond the 25 year mine life. The Environmental Management Plan suggests ways of managing any potential impacts by minimizing the interaction or by implementing appropriate mitigation measures. In some cases however, some negligible to minor residual effects may persist after mitigation.

The claim block area is a remote, natural wilderness within a region characterized by severe climatic constraints on ecosystem development. In view of these circumstances, the ecosystems within the claim block is pristine.

The NWT Diamonds Project is designed to avoid any wide-scale degradation of ecological integrity caused by project-related activities related to land use, emissions and other stresses or disturbances. However, there remain specific cases of ecological damages that cannot be avoided or mitigated. These are known as residual effects and are associated, for example, with the local alteration of habitat for the development of roads, open pit mines, the tailings disposal facility, the processing facility and the permanent camp. In all of the cases of unavoidable local damages, management plans are proposed for the eventual restoration, reclamation or compensation for any longer lasting effects to specific resources (such as fish) or to ecological integrity more broadly.

In the majority of cases, the results of the environmental impact assessment for the proposed NWT Diamonds Project suggest that the residual effects on valued ecosystem components (VECs) will be negligible. This judgement is largely based on the fact that the local, unavoidable damages caused to terrestrial and aquatic habitats represent effects on a very small fraction of the affected habitat types within the claim block, and an even smaller impact on the Southern Arctic Ecozone. Since the Environmental Management Plan for the proposed NWT Diamonds Project is designed to prevent substantial damages to the ambient environment and ecosystems beyond directly affected sites, extensive threats to the ecological integrity of the larger ecosystem will be avoided.

Grizzly bear may be exceptions to this generalization. This species is vulnerable to suffering large population reductions from even rather small increases in mortality, as they occupy very large ranges and have low rates of reproduction. Even though the Environmental Management Plan proposes that human conflicts with grizzly bears will be avoided to the greatest extent possible, there may still be some unavoidable conflicts. The Proponent intends to minimize potential encounters through employee education to avoid animal encounters and through appropriate waste management practices.

Although the EIS predicts that occurrences of stress and mortality of grizzlies will be infrequent, it is important that the population status of these two species be closely



monitored at all stages of development of the proposed NWT Diamonds Project, so that if any potential problems do develop, they can be effectively addressed.

The most useful indicators of ecological integrity within the claim block are described in Volume II, Section 1.3, Ecosystem Characteristics and Linkages. These indicators are the presence of populations of large animals and top carnivores; the presence of clean water, soils and atmosphere; and the occurrence of a natural, self-organizing ecosystem at all levels of the spatial and temporal hierarchy. The residual and cumulative effects on these indicators of the proposed NWT Diamonds are described below.

### **1.2.1 Large Animals and Top Carnivores**

The most prominent large animals and carnivores within the claim block are caribou, grizzly bear, wolverine, wolf, lake trout and grayling. The NWT Diamonds Project will ensure that self-sustaining populations of large animals and top predators do not become threatened by the proposed mine development activities. Inevitably some individual animals will be affected by project-related disturbances due to increased human presence and noise, loss of habitat or accidental vehicle collisions.

Although effects on individuals will not be frequent enough to threaten the viability of populations of large animals and top carnivores, it remains possible that populations of certain species will be affected, in particular, the grizzly bear. The residual effect to this vulnerable species will be evaluated through monitoring their populations. If problems are identified as having been caused by project related activities, they will be adaptively dealt with through appropriate management techniques.

The local areas of terrestrial and aquatic habitats that will be directly affected by the project are relatively small, and will not cause any significant disturbances to large mammals or carnivores. Moreover, the Environmental Management Plan is designed to ensure that extensive ecological changes will not be caused by project-related activities, so that ecological integrity will not be threatened.

### **1.2.2 Clean Water, Soils and Atmosphere**

The NWT Diamonds Project has been designed to ensure that the residual effects of project activities will not cause any extensive degradation of the chemical or physical qualities of water, soils or the atmosphere of the ecosystems within the claim block. Therefore, the NWT Diamonds Project will not jeopardize ecological integrity through degradation of water, soil and air.

### **1.2.3 Natural, Self-Organizing Ecosystems**

The ecosystems within the claim block are characterized by native species, natural community types and wilderness values, and can be regarded as being natural and self-

organizing. This means that local ecosystems are in a state of balance without external stresses such as human activities. The local areas of terrestrial and aquatic habitats that will be directly affected by the project are relatively small and will not significantly detract from ecological integrity.