

MCCLEAN LAKE SURFACE LEASE AGREEMENT

Between

The Government of Saskatchewan

And

Cogema Resources Inc.

Denison Mines Limited

OURD (Canada) Co. Ltd.

*App. drawn to Midway
Sask. (not attached here)*

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Appendices

"A"	PLAN OF SURVEY for Surface Lease, approved by the Controller of Surveys on January 21, 1997 as MG 964
"B"	Guidelines for Environmental Protection During Road Construction, Saskatchewan Environment and Resource Management, December 1993
"C"	Guidelines for Environmental Protection During Development and Restoration of Sand and Gravel Pits, Saskatchewan Environment and Resource Management, September 1983, reprinted November 1987
"D"	Occupational Health and Safety
"E"	Social and Economic Benefits Commitments
"F"	Reporting Requirements
"G"	Glossary of Terms

LEASE AGREEMENT

THIS AGREEMENT EFFECTIVE April 10, 2002.

BETWEEN:

THE GOVERNMENT OF SASKATCHEWAN, as represented by the Minister of Saskatchewan Northern Affairs and the Minister of Saskatchewan Environment (hereinafter collectively called the "**Minister**")

- and -

Cogema Resources Inc., a corporation incorporated under the laws of Canada and registered to carry on business in the Province of Saskatchewan; **Denison Mines Limited**, a corporation incorporated under the laws of Ontario and registered to carry on business in the Province of Saskatchewan; **OURD (Canada) Co., Ltd.**, a corporation incorporated under the laws of British Columbia and registered to carry on business in the Province of Saskatchewan (hereinafter collectively called the "**Lessee**")

WHEREAS:

Cogema Resources Inc. on behalf of the Lessee is the holder of Mineral Dispositions ML5513, ML5514, S106520, S106522, S106523, S106525, S106526, S106528, S106531, S106532, CBS 7650, CBS 7653, S-105342, S-106519, S-106527, S-106529, S-106530, S-106536 and S106535; and

Minatco Ltd. and Her Majesty the Queen, in right of the Province of Saskatchewan, entered into the McClean Lake Surface Lease Agreement dated February 26, 1991 involving land in the Province of Saskatchewan constituting the area as described on Plan of Survey MG 964 dated May 3, 1996 containing 4660 hectares more or less (which area is hereinafter called the "1991 Lease Lands"); and

On January 21, 1992 Minatco Ltd. changed its name to Total Minatco Ltd.; and

Total Minatco Ltd. entered into the McClean Joint Venture Agreement with Denison Mines Limited and OURD (Canada) Co., Ltd. on March 17, 1993; and

On July 19, 1993, Cogema acquired certain assets of TOTAL including its subsidiary Total Minatco Ltd. which was the holder of uranium interests in Saskatchewan; and

Total Minatco Ltd. was renamed Minatco Limited on September 13, 1993; and

Minatco Limited amalgamated with Cogema Resources Inc. on January 17, 1996 and continued as Cogema Resources Inc.; and

By virtue of the above acquisition and subsequent amalgamation, Cogema Resources Inc. assumed the assets and liabilities of Minatco Limited, including its interest in the McClean Joint Venture Agreement dated March 17, 1993 and the McClean Lake Surface Lease Agreement dated February 26, 1991; and

Pursuant to the McClean Joint Venture Agreement, Cogema Resources Inc. was appointed Manager of the McClean Joint Venture and the Manager holds all McClean Joint Venture property in trust for the other participants in the McClean Joint Venture in accordance with their respective participating interests; and

The current composition of the McClean Joint Venture is Cogema Resources Inc. 70%, Denison Mines Limited 22.5% and OURD (Canada) Co. Ltd. 7.5%; and

It is the intention of the Minister and the present Lessee to replace the existing McClean Lake Surface Lease Agreement dated February 26, 1991 between Her Majesty the Queen, in right of the Province of Saskatchewan as the Lessor and Minatco Ltd. as the Lessee; and

The Province of Saskatchewan is the owner of the Lease Lands and has agreed to enter into this lease agreement under joint authority of The Forest Resources Management Act and The Provincial Lands Act and the Regulations made thereunder; and

The Lessee and the Minister acknowledge that the Aboriginal peoples of northern Saskatchewan have existing Aboriginal and Treaty rights which are recognized and affirmed by section 35(1) of the Constitution Act, 1982 and which, to date, have not been completely defined.

NOW THEREFORE the Parties agree as follows:

PART I

LAND TENURE

Article 1.0 LEASE OF LAND

- 1.1 The Minister hereby leases to the Lessee the Lease Lands, located in the Province of Saskatchewan at approximate UTM Grid 6467300mN / 568200mE, Zone 13, constituting the surface area, containing approximately 4660 hectares, described on the map titled Plan of Survey for Surface Lease 1994, dated May 3, 1996, approved by the Controller of Surveys as MG 964 and attached as Appendix "A".
- 1.2 Annually on or before the first day of April, the Lessee shall provide a Land Development Report (see Appendix "F") to the Minister of Saskatchewan Environment, specifying the portion of the Lease Lands that has been developed as at the date of such report.
- 1.3 If the Lessee fails to comply with the requirements set out in Article 1.2, the Minister of Saskatchewan Environment may determine the portion of the Lease Lands, which has been developed, for purposes of calculating rent or other charges in accordance with *The Resource Lands Regulations, 1989*.

Article 2.0 RENTAL CHARGES

- 2.1 The Lessee shall pay to the Minister at the Sustainable Land Management Branch of Saskatchewan Environment at Prince Albert, the rent and any additional charges as are prescribed by *The Resource Lands Regulations, 1989*.
- 2.2 Payments required by Article 2.1 are due annually in advance on the first day of June. The Parties acknowledge that this Agreement replaces an existing Surface Lease and the Minister will consider, in calculating lease fees due and payable upon the new Surface Lease, the amount of monies, if any, already submitted by the Lessee for lease fees due and payable upon the existing Surface Lease.

Article 3.0 USE OF LANDS

- 3.1 Subject to the terms of this Agreement, the Lessee shall be entitled to the use, occupation and, insofar as the Minister is legally able to convey, quiet possession of the Lease Lands for the term of this Agreement.

The Lessee shall:

- (a) obtain and comply with the terms of any permit, license, approval, permission or consent required by and issued pursuant to any and all laws in force in the Province of Saskatchewan; and

- (b) comply with the terms of and maintain in good standing for the duration of this Agreement the existing mineral dispositions underlying the Lease Lands and registered to the Lessee pursuant to *The Mineral Disposition Regulations, 1986*.
- 3.2 The Lessee shall not use the Lease Lands for any purpose other than those necessary for:
- (a) the exploration for, mining, milling and transporting on the Lease Lands of uranium-bearing ore or other mineral-bearing material including dewatering activities related thereto;
 - (b) the construction and operation of one or more mills for processing mineral ore or other substances approved by the Minister of Saskatchewan Environment, including the production of by-products related thereto;
 - (c) the construction and use of waste management facilities;
 - (d) the construction and use of camp facilities and ancillary facilities for employee accommodation and recreation;
 - (e) the construction and use of all buildings, structures, facilities, machinery, equipment, supplies, air strips, power, fuel and water supplies, roads and all other support and service facilities relating to the construction and operation of the mine and mill or other permitted site activities;
 - (f) the reclamation, decommissioning and post-decommissioning monitoring of the Lease Lands and the buildings, structures and facilities located thereon; and
 - (g) such other purposes relating to uranium and other mineral mining, processing and transportation, including the construction and use of facilities related thereto, as may be approved by the Minister of Saskatchewan Environment.
- 3.3 The Lessee may construct buildings or structures not authorized under Article 3.2 only with the prior written consent of the Minister of Saskatchewan Environment.
- 3.4 The Lessee shall have the right to remove timber from the Lease Lands where such removal is necessary for the McClean Lake project subject to first obtaining and complying with any necessary permits.
- 3.5 Subject to completing and submitting a Sand and Gravel Royalty Return Report (see Appendix "F") and paying the applicable royalties, as may be required under *The Resource Lands Regulations, 1989*, the Lessee shall have the right to remove and/or use sand and gravel from the Lease Lands where such removal and/or use as necessary for the McClean Lake project. However, the Lessee shall not be required to submit a Sand and Gravel Royalty Return Report or pay any royalties in respect to

any sand or gravel which is waste rock, mine waste or other byproduct of the McClean Lake project.

- 3.6 The Lessee shall obtain written approvals for the right to use or divert surface or ground water from any water body or aquifer located in whole or in part on the Lease Lands, and for the construction and operation of water-works for that purpose, as required under the provisions of The Water Corporation Act and any other Applicable Laws.

Article 4.0 PAYMENT OF TAXES

- 4.1 The Lessee shall pay all royalties, charges, taxes, rates and assessments, whatsoever, whether municipal, provincial or otherwise, charged by or payable pursuant to provincial or federal legislation, which may at any time during the term of this Agreement be charged upon or become payable in respect of the occupation of the Lease Lands, or of any business or operations conducted by the Lessee on the Lease Lands.

Article 5.0 IMPROVEMENTS AND ROADWAYS

- 5.1 The Lessee shall comply with the terms, conditions and requirements of the Guidelines for Environmental Protection During Road Construction (Appendix "B") and the Guidelines for Environmental Protection During Development and Restoration of Sand and Gravel Pits (Appendix "C"). The Lessee shall avoid unnecessary road construction.

Article 6.0 ACCESS TO LEASE LANDS

- 6.1 In this Article, "authorized employees" means:
- (a) employees of Saskatchewan Labour who are authorized by the Minister of Saskatchewan Labour;
 - (b) employees of Saskatchewan Environment who are authorized by the Minister of Saskatchewan Environment;
 - (c) employees of Saskatchewan Northern Affairs who are authorized by the Minister of Saskatchewan Northern Affairs;
 - (d) employees of Saskatchewan Learning who are authorized by the Minister of Saskatchewan Learning;
 - (e) employees of Saskatchewan Industry and Resources who are authorized by the Minister of Saskatchewan Industry and Resources;

- (f) employees of Saskatchewan Water Corporation, who are authorized by the President of Saskatchewan Water Corporation; and
 - (g) any other person authorized by the applicable Minister to monitor compliance by the Lessee with the provisions of this Agreement.
- 6.2 The Lessee shall provide the Minister and the authorized employees specified in Articles 6.1(a), (b), (e), (f) and (g) with access to the Lease Lands, with or without prior notice to the Lessee, together with the right to take necessary equipment onto the Lease Lands for the purpose of monitoring compliance by the Lessee with the provisions of Parts I, II, III and V of this Agreement. Upon request, the Lessee shall furnish the applicable Minister and such authorized employees with such information as may be required in order to monitor compliance by the Lessee with the provisions of this Agreement.
- 6.3 The authorized employees specified in Articles 6.1(c) and (d) shall, upon reasonable prior notice to the Lessee, have access to the Lease Lands at any reasonable time for monitoring the Lessee's compliance with the provisions of Part IV of this Agreement. Upon request, the Lessee shall furnish the applicable Minister and such authorized employees with such information as may be required in order to monitor compliance by the Lessee with the provisions of Part IV of this Agreement.
- 6.4 Authorized employees of Saskatchewan Environment shall have access to the Lease Lands at any time with or without prior notice for environment and resource management purposes.
- 6.5 In furtherance of the obligations of the Lessee contained in Articles 6.2 and 6.3, the Lessee, on reasonable notice, agrees to provide the applicable Ministers and authorized employees site transportation, meals and accommodation as is necessary and available. The Lessee shall be entitled to charge for such transportation, meals and accommodation at rates established by the Lessee each year.
- 6.6 The Lessee shall, subject to the requirements of the Nuclear Safety and Control Act, 1997, c.9:
- (a) provide reasonable public access to the Lease Lands required for the purpose of acquiring underlying mineral rights; and
 - (b) provide reasonable access, when the Minister of Saskatchewan Environment so authorizes, to valid mineral disposition holders for the purpose of exploring and commercially developing their dispositions underlying the Lease Lands

provided however that the Lessee shall not be responsible or liable for the acts or omissions of such person, or their employees, agents or contractors while on the Lease Lands pursuant to such authorization of the Minister of Saskatchewan Environment.

PART II**OCCUPATIONAL HEALTH AND SAFETY OF WORKERS****Article 7.0 OCCUPATIONAL HEALTH AND SAFETY OF WORKERS**

- 7.1 Without restricting the generality of Article 16.0, the Lessee shall comply with:
- (a) The Occupational Health and Safety Act, 1993 and the Regulations and codes of practice made pursuant to that Act;
 - (b) The Radiation Health and Safety Act, 1985 and the Regulations made pursuant to that Act; and
 - (c) The requirements of Appendix "D" titled "Occupational Health and Safety".
- 7.2 Subject always to the provisions of Article 7.1, the Lessee shall, in the design, construction, operation and decommissioning of the mine, mill and associated facilities located on the Lease Lands, meet the procedures and standards regarding the health and safety of workers which it undertook to meet in any report, including amendments and additions thereto, which the Lessee submitted to the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan; provided that the Lessee may, subject to approval from Saskatchewan Labour, meet procedures and standards other than those referred to above.
- 7.3 The Lessee and the Minister, after consultation with the Lessee's Occupational Health Committee, may make changes to Appendix "D" consistent with the health and safety of the workers.
- 7.4
- (a) Where, in the opinion of an authorized employee of Saskatchewan Labour, the Lessee is contravening or has contravened any provision of this Article 7.0, Appendix "D", The Occupational Health and Safety Act, 1993 and associated Regulations or The Radiation Health and Safety Act, 1985 and associated Regulations in circumstances which make it likely that the contravention will continue or will be repeated, such authorized employee may serve on the Lessee a notice of contravention stating the provision which is being or has been contravened and the reasons which make the authorized employee of the above opinion, and requiring the Lessee to remedy the contravention within the period specified in the notice.
 - (b) The appeal provisions of The Occupational Health and Safety Act, 1993 (currently found in Part VIII of such Act) apply to any notice of contravention served under Article 7.4(a).

- 7.5 For greater clarity, but without restricting the generality of the foregoing, the Lessee shall establish an Occupational Health Committee with such structure, powers, duties and responsibilities accorded to Occupational Health Committees under Part III of The Occupational Health and Safety Act, 1993 and Part IV of *The Occupational Health and Safety Regulations* for all occupational health and safety matters relating to the requirements of this Agreement, including Appendix "D".

PART III

ENVIRONMENTAL PROTECTION

Article 8.0 ENVIRONMENTAL PROTECTION

- 8.1 The Lessee shall comply with the terms and conditions of any Ministerial Approval obtained from the Minister of Saskatchewan Environment (hereinafter in this Part referred to as the "Department") under The Environmental Assessment Act, The Environmental Management and Protection Act and The Clean Air Act and associated Regulations thereunder.
- 8.2 Subject to Article 8.3, the Lessee shall, in the design, construction, operation and decommissioning of its facilities located on the Lease Lands, meet the procedures and standards which it undertook to meet in any report, including amendments and additions made thereto, approved by the Department.
- 8.3 The Lessee may use new or different standards, procedures or designs other than those referred to in Article 8.2, if the prior written approval of the Department is first obtained, which approval shall not be unreasonably withheld.
- 8.4 As may be required under any permit, license, approval, permission or consent required by and issued pursuant to any and all laws in force in the Province of Saskatchewan, the Lessee shall submit for the approval of the Department, prior to their implementation, all design plans for the management of waste rock and any other solid or liquid effluent or air emission, including those for dewatering processes, wastewater handling and treatment, domestic wastewater treatment, air pollution abatement or other operations with potential environmental impacts.
- 8.5 The Lessee shall ensure that in all its activities the quantities and concentrations of contaminants released into receiving waters, lands and the atmosphere are as low as is reasonably achievable, taking into account social and economic factors, and that, in any case, they shall not exceed the discharge limits established in legislation and/or Regulations for which the Department is responsible.
- 8.6 The Lessee shall prepare, in consultation with the Department and the Athabasca Environmental Quality Committee, or such other replacement body as may be designated from time to time by the Minister of Saskatchewan Northern Affairs to discuss such matters, a program to monitor discharges and to measure the environmental effects of the McClean Lake project, and shall implement the program as approved by the Department. The Lessee shall implement any changes to the monitoring program as may from time to time be reasonably required by the Department and shall take any mitigative or remedial measures as may be required by the Department following review of the program data.

- 8.7 Prior to the storage upon the Lease Lands or transit to or from the Lease Lands of any hazardous substances or waste dangerous goods, the Lessee shall prepare and adhere to an Environmental Contingency Plan that complies with *The Hazardous Substances and Waste Dangerous Goods Regulations*, as further specified in Appendix "F". Thereafter, the Lessee shall modify the Environmental Contingency Plan periodically as may be required by the Department based on inspections.
- 8.8 As required under Regulations for which the Department is responsible, as referenced in Article 8.1 hereof and exemplified in Articles 8.9 to 8.13 below, the Lessee shall develop and submit all Decommissioning and Reclamation Plans, including specific plans for post-decommissioning monitoring, for approval by the Department.
- 8.9 Without limiting the generality of the foregoing, the Parties agree that:
- (a) the Lessee shall obtain any approvals and establish any assurance funds required by *The Mineral Industry Environmental Protection Regulations, 1996*, as amended from time to time, hereinafter referred to as the "*MIEP Regulations*";
 - (b) the Minister of Saskatchewan Environment, where he considers it necessary, may:
 - (i) enforce any security, call in, cash or redeem any security or other instrument, or take any other action that the Minister of Saskatchewan Environment considers necessary to realize on the assurance fund; or
 - (ii) require that all or part of the assurance fund be used to decommission and reclaim all or part of the mining site as defined in the *MIEP Regulations*, for which the assurance fund was approved in accordance with the decommissioning and reclamation plan approved for that mining site or in any other manner the Minister of Saskatchewan Environment considers appropriate.
- 8.10 The Lessee shall prepare Decommissioning and Reclamation Plans, as required by the Department and shall discuss such plans with the appropriate Environmental Quality Committee or such other replacement body as may be designated from time to time by the Minister of Saskatchewan Northern Affairs. The Lessee shall decommission and reclaim the Lease Lands on an ongoing basis throughout the term of this Agreement including, once they are no longer needed and without limitation, the mining site and individual pollutant control facilities as defined in the *MIEP Regulations*.

- 8.11 The Lessee shall implement final Decommissioning and Reclamation plans, as approved by the Department for the entire mining site, according to the time frame set out in the Decommissioning and Reclamation plans, upon:
- (a) a decision by the Lessee to permanently cease operations at the McClean Lake project;
 - (b) the inability of the Lessee to obtain necessary regulatory approvals to introduce or to continue with the mining, crushing, processing or transporting of uranium-ore or other mineral-bearing material; or
 - (c) the reasonable direction of the Department.
- 8.12 In the event the Lessee permanently ceases operations or this Agreement is terminated without a replacement agreement being entered into, and no final Decommissioning and Reclamation Plans for the entire mining site have been approved by the Department, the Lessee shall carry out any decommissioning and reclamation procedures as may be required by the Department.
- 8.13 For the purposes of Articles 8.10 to 8.12 inclusive, the Lessee shall, if required by the Department, enter into a new Surface Lease Agreement for such length of time as may be necessary to complete decommissioning and reclamation of the Lease Lands and facilities located thereon to the satisfaction of the Department.
- 8.14 The Lessee shall prepare and submit a State of the Environment Report (see Appendix "F") to the Department every five years or as the Department may otherwise reasonably require.

PART IV**DIRECT EMPLOYMENT AND ECONOMIC BENEFITS
FOR RESIDENTS OF SASKATCHEWAN'S NORTH****Article 9.0 INTENT**

- 9.1 The Parties recognize that the operations of the Lessee on and in respect of the Lease Lands represent a major development with the potential to provide significant employment and business benefits to Residents of Saskatchewan's North.
- 9.2 It is the intent of the Parties to provide a cooperative atmosphere for the Lessee to maximize project-related employment and economic opportunities for Residents of Saskatchewan's North.
- 9.3 The Parties agree that the provisions of this Part establish a mutually agreed upon framework of reasonable expectations and measurable objectives in sufficient detail to allow effective monitoring and evaluation of the Parties' performance in achieving employment and business benefits for Residents of Saskatchewan's North. The Parties further agree that the commitments contained in this Part IV are subject to social and economic factors and good Canadian mining practice.
- 9.4 The Lessee shall establish employment, contracting and local purchasing policies and practices, and development programs consistent with the intent of this Article.
- 9.5 The Parties expressly acknowledge and agree that nothing in this Part IV is intended to or does require the Parties to undertake any practice or policy which contravenes any provision of the Canadian Human Rights Act (Canada) or The Saskatchewan Human Rights Code, any Regulations enacted pursuant thereto or any policy or guideline of the Canadian Human Rights Commission or the Saskatchewan Human Rights Commission.

Article 10.0 EMPLOYMENT POLICIES AND PRACTICES

- 10.1 The Lessee shall, in consultation with Saskatchewan Learning and Saskatchewan Northern Affairs, establish and implement employment policies and practices affording preferential consideration to Residents of Saskatchewan's North, as exemplified below:
- (a) the Lessee and Saskatchewan Learning agree to review and update the existing Human Resource Development Agreement, to be completed no later than three (3) months following the signing of this Agreement;
 - (b) development of annual Human Resource Development Plans (see Appendix "F"); and

- (c) special recruiting efforts in northern communities undertaken in cooperation with local governments, First Nations, Metis and federal and provincial agencies.
- 10.2 The Lessee shall, where practicable, use its best efforts to cause all contractors working on site to adopt similar policies of employment, recruitment and reporting that will contribute to the achievement of the intent stated in Article 9.0.

Article 11.0 TRAINING AND DEVELOPMENT PROGRAM

- 11.1 The Parties agree that the Lessee has the ultimate responsibility for the establishment of internal training programs necessary to meet its needs on the Lease Lands.
- 11.2 The Lessee shall, to the extent practicable, upgrade and train its employees in relation to the Lessee's needs and obligations and ensure a positive work environment which is conducive to employees, in particular Residents of Saskatchewan's North, achieving increased knowledge and accepting greater responsibility in their employment opportunities with the Lessee.
- 11.3 The Parties agree that ongoing and progressive on-the-job training is an effective approach to meeting the intent of this Part IV and that such training will be offered to the Lessee's employees, in particular Residents of Saskatchewan's North, to the extent practicable. The Lessee further agrees that to the extent practicable, it will use its best efforts to ensure its contractors' employees are provided the same on-the-job training by the contractors.
- 11.4 The Government of Saskatchewan shall use its best efforts to provide basic education and literacy training which will make the transfer of skills on-the-job more effective, and the Lessee will cooperate with the Government of Saskatchewan in this regard, where practicable. It is agreed that provision of opportunities for professional and technical education in the Northern Saskatchewan Administration District would assist Residents of Saskatchewan's North to compete for a wider range of jobs associated with the McClean Lake project.
- 11.5 With the support and cooperation of Saskatchewan training institutions and such other accreditation-granting bodies as may be involved from time to time, the Lessee shall use its best efforts to organize and implement its training programs so that employees, in particular Residents of Saskatchewan's North, completing the training will be able to use the skills acquired and time spent as credit towards certification or status recognized in Saskatchewan.
- 11.6 Where it is mutually advantageous and agreeable to the Lessee and an employee, the Lessee will take the steps necessary to record the details of employment with the

Northern Office of Saskatchewan Learning according to The Apprenticeship and Trade Certification Act.

Article 12.0 COMMERCIAL OPPORTUNITIES

12.1 The Lessee shall encourage Northern Businesses to supply goods and services to the McClean Lake project through:

- (a) adoption of the following practices:
 - (i) preparing and submitting, on an annual basis, a five year rolling Business Opportunities Forecast (see Appendix "F") to the Economic and Community Development Division, Saskatchewan Northern Affairs;
 - (ii) maintenance of ongoing contact and liaison with the business community in northern Saskatchewan and the Economic and Community Development Division, Saskatchewan Northern Affairs; and
 - (iii) provision of public tender documents at one or more locations in northern Saskatchewan when contracts for work at the McClean Lake project are to be awarded by public tender.
- (b) adherence to the following practices, where consistent with the economics of the McClean Lake project and good Canadian mining practice:
 - (i) fragmentation of contracts, requests for proposals or invitations to quote on the supply of goods and services; and
 - (ii) the establishment of bids or quotes on invitational bases.

12.2 The Lessee agrees it is desirable and it will, where practicable, use its best efforts to require all contractors working on site to procure goods and services from Northern Businesses.

Article 13.0 MONITORING

13.1 The Parties agree that the Government of Saskatchewan has primary responsibility for monitoring the success of activities undertaken to address the objectives of this Part IV and that in conducting this monitoring the Government of Saskatchewan shall consult with the appropriate Environmental Quality Committee(s), or such other replacement body(ies) as may be designated from time to time by the Minister of Saskatchewan Northern Affairs to discuss such matters.

- 13.2 Pursuant to Article 13.1, and in a spirit of cooperation, the Parties agree:
- (a) to establish and maintain an open dialogue and certain formal reporting mechanisms for the timely exchange of relevant information, as set forth in Appendix "F"; and
 - (b) that, to the extent possible without breaching confidentiality and/or proprietary interests, such information will be shared in public forums.
- 13.3 The Lessee will file Employment Status Reports (see Appendix "F").
- 13.4 The Lessee shall prepare and submit annually on or before March 31st a Northern Business Participation Report (see Appendix "F") to the Resource and Industry Development Division, Saskatchewan Northern Affairs.

Article 14.0 COMPENSATION

- 14.1 The Lessee shall satisfy the Minister of Saskatchewan Northern Affairs that any individuals, who immediately prior to the establishment of the original Surface Lease Agreement used or occupied the Lease Lands, by way of a lease, license or permit granted by the Government of Saskatchewan, have been compensated for their actual monetary losses arising out of the disposition, and shall disclose to such Minister the names of such individuals.
- 14.2 The Lessee shall prepare and submit annually on or before March 31st a Compensation Report (see Appendix "F") to the Resource and Industry Development Division, Saskatchewan Northern Affairs. Notwithstanding the foregoing, the Lessee's obligation to submit a Compensation Report is conditional upon the Lessee receiving, and the Lessee shall request, the consent of affected individuals to the release of the information contained in the Compensation Report to the Resource and Industry Development Division. The absence of any one individual's consent shall not prevent the preparation and submission of this Report with respect to other affected, consenting individuals.

Article 15.0 OTHER COMMITMENTS

- 15.1 The Government of Saskatchewan shall use its best efforts to consult and cooperate with the Lessee to coordinate and consolidate reporting requests by the Government to the Lessee to avoid, as much as practicable, duplication in reporting requests by the Government and reporting by the Lessee in response to such requests under this Agreement.

- 15.2 The Lessee shall use its best efforts to comply with the Social and Economic Benefits Commitments made to Residents of Saskatchewan's North, and shall report on its progress in complying with these commitments in the manner contemplated in Appendices "E" and "F".
- 15.3 The Lessee shall prepare and submit Public Involvement Program Reports (see Appendix "F") to the Resource and Industry Development Division, Saskatchewan Northern Affairs.
- 15.4 The Lessee shall, upon the written request made by the Minister from time to time, but not more often than annually, issue public reports on its record of achievements against the Social and Economic Benefits Commitments and hold subsequent public meetings with impact communities to discuss the reports.

PART V**MISCELLANEOUS PROVISIONS****Article 16.0 COMPLIANCE WITH RELEVANT STATUTES**

- 16.1 The Lessee shall perform, observe and comply with all laws in force from time to time in the Province of Saskatchewan including, without limiting the generality of the foregoing, provisions of the following Saskatchewan statutes: The Provincial Lands Act, The Forest Resources Management Act, The Wildlife Act, 1997, The Occupational Health and Safety Act, 1993, The Mineral Resources Act, 1985, The Groundwater Conservation Act, The Government Organization Act, The Litter Control Act, The Clean Air Act, The Environmental Assessment Act, The Boiler Pressure and Vessel Act, The Electrical Inspection Act, 1993, The Fire Prevention Act, 1992, The Gas Inspection Act, 1993, The Passenger and Freight Elevator Act, The Radiation Health and Safety Act, 1985, The Public Health Act, 1994, The Environmental Management and Protection Act, The Dangerous Goods Transportation Act, The Ozone-depleting Substances Control Act, 1993, The Pest Control Products (Saskatchewan) Act, The Water Corporation Act and The Crown Minerals Act.

Article 17.0 TERMINATION OF AGREEMENT

- 17.1 In the event the Lessee fails to pay the rent required under Article 2.0 or any part thereof when due, whether formally demanded or not, or fails to observe or perform the other covenants, conditions, provisos and stipulations herein agreed to be observed and performed in Articles 2.0, 3.0, 4.0, 6.0, 7.0, 8.0, 16.0, 19.0, 20.0 and 24.0, the Minister may give written notice (the "Default Notice") to the Lessee specifying the failure. The Lessee shall thereupon:
- (a) remedy such failure within thirty (30) days after receiving the Default Notice; or
 - (b) if the failure is such that it cannot be remedied within the thirty (30) day period, promptly and in any event within the thirty (30) day period, commence and diligently continue thereafter to remedy such failure and take any steps required to reasonably ensure that the failure will not occur again.
- 17.2 If a Default Notice is given relating to a material breach of any of the provisions listed in Article 17.1 and if the Lessee does not proceed in one of the manners contemplated in Articles 17.1 or 17.3, the Minister may terminate this Agreement by giving written notice to the Lessee that this Agreement is terminated on such date as may be specified in the written notice and, thereupon, this Agreement shall be terminated.

- 17.3 The Lessee may, prior to the expiration of the thirty (30) days referred to in Article 17.1, apply to the Minister for relief from the breach of the requirements which have given rise to the failures set out in a Default Notice. The Minister may grant relief from any of the said requirements and in granting such relief the Minister may establish alternative procedures and requirements that the Lessee shall fulfill. If the Lessee fails to comply with the decision of the Minister within a further thirty (30) days the Minister may, by notice to the Lessee, terminate this Agreement.
- 17.4 The Minister shall be entitled to waive all rights of termination arising under this Agreement by reason of any default and thereupon this Agreement and the Lessee's rights hereunder shall be construed to continue as though no such default had occurred. All such waivers must be in writing and signed by the Minister and shall not prejudice any right of the Minister in the case of any other default.
- 17.5 This Agreement does not restrict the Lessee from commencing legal action in a court of law should the Minister terminate this Agreement.

Article 18.0 ARBITRATION

- 18.1 (a) Subject to Article 18.1(b), disputes arising out of the interpretation, performance or breach of any of the Articles of this Agreement, other than the Articles set out in Parts II and III and Article 23.1, may be submitted by either Party to arbitration. This provision shall not limit the requirements, provisions or powers conferred on any minister or official as contained in any statute of the Province of Saskatchewan or Regulations thereunder.
- (b) The Lessee may submit a decision of an adjudicator, made pursuant to the appeal provisions referred to in Article 7.4(b), to arbitration, provided however that:
- (i) such reference may only be made if the decision of the adjudicator is relied upon such that it results in a written notice (a "Termination Notice") being given by the Minister to the Lessee that this Agreement is being terminated, as provided for in Articles 17.2 and 17.3, and
 - (ii) such reference is to be filed within thirty (30) days of the Lessee receiving a Termination Notice.

The submission of the dispute to arbitration does not stay the operation of the adjudicator's decision.

- 18.2 The Arbitration Act, 1992 shall apply to any arbitration hereunder.

- 18.3 The Parties shall agree on the arbitrator. If the arbitrator is not selected within ten (10) days after notice of arbitration is given, a three-person arbitration board shall conduct the arbitration. Each Party shall, within seven (7) days from the expiration of the ten (10) day period, appoint one person to the arbitration board and thereafter immediately inform the other Party of the name of its nominee. The two nominees shall, within seven (7) days, agree on a third arbitrator who shall be the chairperson of the arbitration board. In the event either Party fails within the time specified to select its nominee or the nominees of the two Parties fail to agree upon a third arbitrator, then the third arbitrator or the arbitrator to represent the Party which has not appointed its nominee, as the case may be, shall be appointed by the Chief Justice of the Court of Queen's Bench for the Province of Saskatchewan. Each arbitrator shall be a person who, by education and experience, is qualified to adjudicate the matter.
- 18.4 The arbitration shall be conducted in La Ronge, Saskatchewan or such other place as the Parties may agree or the arbitrator or chairperson of the arbitration board, as the case may be, may determine, and the arbitrator or arbitration board shall hear and dispose of the dispute, difference or question submitted in such manner as he in his discretion shall determine, but in doing so he shall be required to receive the submissions of the Parties in respect of the said question, dispute or difference. The arbitrator or arbitration board in the conduct of the proceedings shall not be bound by the Rules of Court of the Province of Saskatchewan or by the traditional rules of evidence.
- 18.5 The decision of the single arbitrator or a simple majority of the arbitration board shall be binding upon the Parties. In the event the arbitration board is unable to arrive at a simple majority decision, the decision of the chairperson shall be binding.
- 18.6 The arbitrator or the arbitration board shall have the authority to include in an award any of the following:
- (a) a finding that there has been a breach of the Agreement;
 - (b) a finding that there has been no breach of the Agreement;
 - (c) a finding that although there has been a breach of the Agreement, the breach should be excused;
 - (d) an order of specific performance as could be awarded by a Judge of the Court of Queen's Bench;
 - (e) an order to pay a penalty for a breach of the Agreement;
 - (f) an order to pay a fixed sum daily by way of penalty until the Party to pay discontinues or remedies the breach of this Agreement;

- (g) a direction to pay damages;
 - (h) an order overturning or confirming a decision to terminate this Agreement; and/or
 - (i) such other direction or order as is deemed necessary and equitable to ensure compliance with the spirit, intent and provisions of this Agreement.
- 18.7 Where a dispute has been submitted to arbitration, in addition to all of the powers contained in Article 18.6, the arbitrator or arbitration board may make such interim orders as it considers appropriate pending resolution of the dispute.
- 18.8 The decision of the arbitrator or the arbitration board may be appealed by either Party to the Court of Queen's Bench. The Notice of Appeal shall be served on the respondent by the applicant within fifteen (15) days of receipt of the decision of the arbitrator or the arbitration board.
- 18.9 Where any matter is referred to an arbitrator or arbitration board, the provisions of this Agreement shall continue in full force until a final determination has been made by the arbitrator or arbitration board and the period for commencing an appeal under Article 18.8 has expired, or if an appeal is made, until a final court decision is issued.
- 18.10 Where the Lessee fails to comply with an order of an arbitrator or arbitration board or, where an appeal is taken and the Lessee fails to comply with the final decision of a court, this Agreement shall terminate forthwith and the provisions regarding decommissioning in Part III and the provisions of Articles 20.0 and 23.4 shall apply.

Article 19.0 ASSIGNMENTS

- 19.1 The Lessee shall not assign, transfer or sublet this Agreement or any part hereof or any of the rights or privileges contained herein without the written consent of the Minister, which consent shall not be unreasonably withheld, and in the event an assignment is made, the assignee shall become a Party to this Agreement.

Article 20.0 INDEMNITY

- 20.1 The Lessee shall indemnify and keep the Minister harmless from and against all actions, suits, claims and demands arising out of or in connection with the operations carried on by the Lessee, its servants, employees, agents, licensees and contractors, in, under or upon the Lease Lands except for actions, suits, claims and demands against the Minister arising from the negligence or fault of the Minister or the Minister's servants, representatives, employees or agents. If any claim comes to the attention of the Minister which could give rise to a right of indemnity hereunder, the Minister shall promptly give written notice to the Lessee and the Lessee may, at

its option, defend such claim, in which event the Minister shall, at the Lessee's expense, cooperate with the Lessee in any reasonable way including providing such information as the Lessee may reasonably request and allowing the Lessee to act for, on behalf and in the name of the Minister for such purposes. In defending such claim, the Lessee shall not make any admission of liability or fault on behalf of the Minister without the written consent of the Minister. If the Minister elects to defend such claim and the Lessee does not exercise its option to do so on behalf of the Minister, the Lessee shall only be liable in respect of the costs and expenses of such defence for those costs and expenses which, reasonably viewed, would have been incurred in such defence by a Lessor other than the Government of Saskatchewan.

Article 21.0 FORCE MAJEURE

- 21.1 If either Party is delayed, hindered or prevented from the performance of any of its obligations under this Agreement (hereinafter referred to as the "Delay"), by reason of fire, flood, explosion, acts of God, war, revolution, civil disturbance, embargoes, authorized and lawful acts of the federal government or any board, agency or other instrument of the federal government, strikes or other cause similarly beyond the reasonable control of the Party affected (except by reason of lack of funds or the financial condition of that Party) (collectively an "Event of Force Majeure"), such performance shall be excused for the period of the Delay, and any period within which such performance is to be effected shall be extended by the period of such Delay, subject to the limitations set out in Article 23.1. No Party shall be entitled to relief under this Article 21.1 unless, within fourteen (14) days after the commencement of the Delay, the Party claiming such relief shall have given notice of the Delay in writing to the other Party.

Article 22.0 NOTICES

- 22.1 Any notices or communications required or permitted to be given pursuant to this Agreement shall be in writing and shall be delivered to, or sent by prepaid registered or certified mail, or confirmed facsimile addressed as follows:

- (a) in the case of a notice or communication to the Minister:

Legislative Building
Regina, Saskatchewan, Canada S4S 0B3
Attention: Minister of Saskatchewan Northern Affairs
Facsimile: (306) 798-2042

with copies forwarded to:

Resource and Industry Development Division
Saskatchewan Northern Affairs
P.O. Box 5000
La Ronge, Saskatchewan, Canada SOJ 1LO
Attention: Executive Director
Facsimile: (306) 425-4349

and to

Legislative Building
Regina, Saskatchewan, Canada S4S 0B3
Attention: Minister of
Saskatchewan Environment
Facsimile: (306) 787-0395

(b) in the case of a notice or communication to the Lessee:

Cogema Resources Inc.
P.O. Box 9204
817 – 45th Street West
Saskatoon, Saskatchewan S7K 3X5
Attention: Corporate Secretary
Facsimile: (306) 653-3883

and to:

Denison Mines Limited
Atrium On Bay, Suite 320
40 Dundas Street West
Toronto, Ontario M5G 2C2
Attention: Secretary
Facsimile: (416) 979-5893

and to:

OURD (Canada) Co., Ltd.
 c/o Mitsui & Co. (Canada) Ltd.
 Suite 1500, 20 Adelaide Street East
 Toronto, Ontario M5C 2T6
 Attention: Corporate Secretary
 Facsimile: (416) 865-9756

or to such other address as either Party may notify the other in accordance with this Article, and if so delivered shall be deemed to have been given when delivered, or at the time of confirmation of electronic transmission if sent by facsimile if such day is a business day, otherwise the next business day following, and if so mailed shall be deemed to have been given on the third business day after the date of mailing except in the case of a mail strike or other disruption of postal service in which case it shall be deemed to have been given on the third business day after such strike or disruption ceases.

Article 23.0 TERM OF AGREEMENT

- 23.1 Except as otherwise provided herein, the term of this Agreement shall be for thirty-three (33) years, commencing on the effective date.
- 23.2 At any time during the term of this Agreement the Lessee shall be entitled on twelve (12) months written notice to apply to the Minister to terminate this Agreement, or to surrender any portion of the Lease Lands, which application shall be granted subject to terms and conditions established by the Minister.
- 23.3 The Parties agree that this Agreement shall terminate when there has been successful completion of the final Decommissioning and Reclamation Plans and SERM has issued to the Lessee a release from further decommissioning and reclamation.
- 23.4 The Lessee shall on the termination of this Agreement for whatever cause (including expiration of the term) or within six (6) months thereafter, if all claims for rent and charges, if any, have been duly satisfied, remove from the Lease Lands all of its property; provided however that if:
 - (a) the Lessee does not conform to the provisions regarding decommissioning in Part III of this Agreement; or
 - (b) the Lessee has not removed the property within six (6) months of the termination of this Agreement;

the property remaining on the Lease Lands shall be forfeited to the Government of Saskatchewan and shall become and be the property of the Government of Saskatchewan. The Minister may recover from the Lessee any reasonable costs incurred for the cleanup or removal of such property. The Minister may grant an extension to allow the Lessee sufficient time to remove its property, subject to the Lessee showing due cause, and subject to the limitations set out in Article 23.1.

Article 24.0 PLACE OF BUSINESS

- 24.1 The Lessee shall maintain an office of the operator of the McClean Lake project in the Province of Saskatchewan, and at such office shall make available on reasonable notice to the Lessee any and all books and records or copies thereof, which the Government of Saskatchewan or its authorized representatives may require pursuant to the provisions of this Agreement.

Article 25.0 CONFIDENTIALITY

- 25.1 All information exchanged between the Parties hereto which either Party declares in writing to be confidential shall be kept confidential, except insofar as may be necessary to enforce the terms of this Agreement or as may be required by law.

Article 26.0 BINDING EFFECT

- 26.1 This Agreement and everything herein contained shall enure to the benefit of and be binding upon the respective successors and permitted assignees of the Parties hereto, and the expression "Minister" shall be construed as including the successors in office of the Minister of Saskatchewan Northern Affairs and the Minister of Saskatchewan Environment, and shall include such other members of the Executive Council for the Province of Saskatchewan that are designated by the Lieutenant Governor in Council as being the Minister responsible for this Agreement, and includes the successors in office of such other members of the Executive Council.

Article 27.0 OTHER LEASES

- 27.1 Without limiting the requirements, provisions and powers conferred on any Minister or official as contained in any statute of the Province of Saskatchewan or Regulations thereunder, the Minister shall not grant or permit other surface leases or other agreements granting easement, tenement or other rights of whatever nature or kind upon any of the Lease Lands (collectively the "Other Interest") during the term of this Agreement, or any extensions thereof, without:
- (a) first consulting with the Lessee; and

- (b) if the Other Interest will interfere with the Lessee's operation of the McClean Lake project, first obtaining the consent of the Lessee to the granting or permitting of the Other Interest, which consent will not be unreasonably withheld.

Article 28.0 SCOPE OF COVENANTS

- 28.1 Except as provided in Articles 8.7 and 24.0, the covenants of the Lessee have reference only to the operations of the Lessee to be conducted on the Lease Lands.

Article 29.0 CONTINUING OBLIGATIONS

- 29.1 Notwithstanding that this Agreement has been terminated or has expired, the Lessee shall fulfill requirements for decommissioning and reclamation as are set out in Part III, shall remove its property from the Lease Lands as set out in Article 23.4 and in connection with such operations shall indemnify the Minister as set out in Article 20.1.

PART VI

CONSTRUCTION OF AGREEMENT

Article 30.0 DEFINITIONS

- 30.1 In this Agreement and in the Appendices, unless there is something in the subject matter or the context inconsistent therewith, the terms and expressions defined in Appendix "G" (Glossary of Terms) shall have the meanings given to them therein.

Article 31.0 INTERPRETATION

- 31.1 In this Agreement, unless there is something in the subject matter or context inconsistent therewith:
- (a) the singular shall include the plural and the plural shall include the singular; and
 - (b) the masculine shall include the feminine or neuter where the context so requires.
- 31.2 The Appendices attached hereto and forming part of this Agreement as of the effective date of this Agreement are as follows:

Appendix "A"	PLAN OF SURVEY for Surface Lease, approved by the Controller of Surveys on January 21, 1997 as MG 964
Appendix "B"	Guidelines for Environmental Protection During Road Construction, Saskatchewan Environment and Resource Management, December 1993
Appendix "C"	Guidelines for Environmental Protection During Development and Restoration of Sand and Gravel Pits, Saskatchewan Environment and Resource Management, September 1983, reprinted November 1987
Appendix "D"	Occupational Health and Safety
Appendix "E"	Social and Economic Benefits Commitments
Appendix "F"	Reporting Requirements

Appendix "G" Glossary of Terms

To the extent that any provision of Appendix "A", "B", "C" or "D" is inconsistent with the body of this Agreement and/or Appendices "E", "F" or "G", the body of this Agreement and/or Appendices "E", "F" and "G" shall prevail.

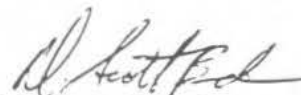
- 31.3 The division of this Agreement into Parts and Articles and the insertion of headings are for convenience of reference only and shall not affect the construction or interpretation hereof.
- 31.4 In the event that any other legal entity owned, directed or controlled by the Lessee or any of the corporations referred to herein collectively as the Lessee becomes the operator of the McClean Lake project, then the said entity shall become a Party to this Agreement and all references applicable to the Lessee hereunder as operator shall be interpreted as referring to the said entity. The Lessee shall ensure that the said entity assumes and performs all the obligations and responsibilities of the Lessee hereunder as operator.
- 31.5 It is agreed that all covenants, undertakings, and agreements of the Lessee under this Agreement shall be joint and several as among the Parties hereto that comprise the Lessee and their permitted successors and assigns.
- 31.6 The Lessee shall ensure that any third party undertaking any of the obligations of the Lessee under this Agreement shall comply with the spirit and intent of this Agreement and all requirements imposed on the Lessee as may be applicable to the third party.
- 31.7 Any reference herein:
 - (a) to any Act or to any Regulation made under any Act is a reference to Saskatchewan laws unless otherwise specifically indicated;
 - (b) to any Act or to any Regulation made under any Act includes a reference to all orders and statutory instruments made pursuant to that Act or Regulation; and
 - (c) to any Act or to any Regulation made under any Act includes a reference thereto as may from time to time be re-enacted, amended, revised or consolidated, or to any Act or Regulation from time to time passed in substitution therefore or in relation to like matters.
- 31.8 To the extent that any provision of this Agreement is inconsistent with the provisions of any provincial operating permit issued to the Lessee in connection with the McClean Lake project, the provisions of such operating permit(s) shall prevail.

Article 32.0 ENTIRE AGREEMENT

- 32.1 This Agreement together with all documents and agreements incorporated by reference herein constitutes and contains the entire and only Surface Lease Agreement between the Minister and the Lessee concerning the use of the Lease Lands and supersedes and cancels any and all pre-existing Surface Lease Agreements and understandings relevant thereto.

The Parties have executed this Agreement on the date set opposite their signature, to have effect as of the effective date indicated at the beginning of this Agreement.

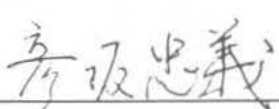
COGEMA RESOURCES INC.

Per:  Date: April 10/02 Witness:/Seal: 

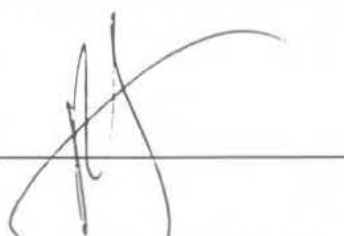
DENISON MINES LIMITED

Per:  Date: April 10/02 Witness/Seal: _____

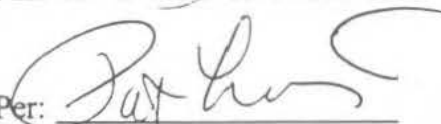
OURD (CANADA) CO., LTD.

Per:  Date: April 10th Witness:/Seal: 

MINISTER OF SASKATCHEWAN NORTHERN AFFAIRS

Per:  Date: April 10/02

MINISTER OF SASKATCHEWAN ENVIRONMENT

Per:  Date: April 10/02

Map - Not copied

GUIDELINES FOR
ENVIRONMENTAL PROTECTION
DURING ROAD CONSTRUCTION

Environmental Assessment Branch
Saskatchewan Environment and Resource
Management
December, 1993

INTRODUCTION

This document presents a series of guidelines to be followed during all stages of road construction and operation in Saskatchewan. The guidelines have been extracted from a variety of publications and have been adapted for Saskatchewan conditions through liaison with a variety of agencies in this province. There are a wide variety of situations facing road builders in Saskatchewan, and it is not possible to address every situation in a document such as this. While some of these guidelines may not be appropriate to the entire province, an attempt has been made to cover the most common and most widely occurring situations in both northern and southern Saskatchewan. These guidelines emphasize protection of the biological and physical environments, and do not attempt to address most social and economic factors.

In preparing these guidelines, it is our intention to make road proponents and designers, contractors and managers more aware of environmental concerns associated with roads and of how these problems can be minimized. Their objective is to strike a balance between road construction and the measures necessary for the long-term protection of the environment. While intended to provide guidance during construction of all roads, the most common application of these guidelines will be to roads which do not require the close scrutiny of the environmental assessment process.

Many environmental problems associated with roads occur where watercourses are crossed or where streams and waterbodies are closely paralleled. An earlier code of good practice, the "Guidelines for the Protection of Aquatic Habitat During Road Construction," was established in August, 1978, under the aegis of the Saskatchewan Departments of Environment, Highways and Transportation, Northern Saskatchewan, Tourism and Renewable Resources and Municipal Affairs. The present set of guidelines is much broader in scope than the stream crossing guidelines, all of which have been incorporated into this document.

These guidelines are organized into sections corresponding to the stages of a road construction project: route selection, survey, design, construction, reclamation, maintenance and abandonment. Road development is most flexible in the route selection and design stages, and many potential problems can be avoided if full use is made of all available information and essential new information is collected during these phases. Careful attention during construction to all plans, specifications and special

provisions is necessary for the preliminary work to be effective. Although few design decisions should be left to the contractor and equipment operators, their familiarity with and concern for environmental safeguards and skill in implementing them are critical. Operation, maintenance, and abandonment also require careful implementation of plans developed in the design stage.

Although the primary focus of these guidelines are on new road development, many of these guidelines can be applied to upgrading and re-working of existing routes. It may be less convenient and more costly to implement these guidelines on existing roads, but applying these guidelines can mitigate past negative environmental effects. An environmentally conscious approach should be taken during all aspects of road construction and maintenance.

In applying these guidelines, it should be recognized that no one set of recommendations can be "correct" and sufficiently inclusive to be applicable to construction and maintenance of every new and existing road in Saskatchewan. Similarly, all the guidelines presented here are not intended to apply to every situation. Where several guidelines present contradictory advice for dealing with a particular problem, an assessment of the implications of each course of action is necessary to identify the trade-offs required and to select the best option from amongst those presented.

While a document such as this can provide guidance, it cannot do the job alone. In the final analysis, good site-specific judgement and co-operation amongst affected individuals and agencies continue to be critical. These guidelines, however, attempt to standardize techniques and are an informal codification of good procedures for most situations. Their implementation while facing the constraints of time, money, equipment, materials, and nature itself is the challenge facing all road builders.

Finally, for the user's assistance, a summary table of the guidelines has been included on the next ten pages. These summary guidelines present the essence of the more detailed guidelines presented in the body of this document. Readers should therefore refer to the detailed guidelines for a complete understanding of issues and requirements.

GUIDELINE SUMMARY

Activity	General Guidelines	Wildlife Guidelines
Route Selection	2.1.1 Use multidisciplinary approach 2.1.2 Use maps/aerial photos w ground survey 2.1.3 Check seasonal restrictions for route alternative 2.1.4 Consider effects on land use, regional dev., fish, wildlife, recreation, tourism & aesthetics 2.1.5 Multiple uses should be considered 2.1.6 Potential upgrades should be anticipated 2.1.7 Consult the public 2.1.8 Consider feasible alternate routes 2.1.9 Use existing linear developments 2.1.10 Impact of alternate routes should be compared 2.1.11 Contact local municipality for dev't permit 2.1.12 Avoid tourist destination unless access is req'd 2.1.13 Avoid land claims	2.2.1 Avoid the following: i) good wildlife habitat ii) areas within 3km of colonial bird nesting sites (500m in north) iii) highly productive or unique forest areas 2.2.2 Avoid the following unless access req'd by Prov. - prov. parks, ecological reserves, IBI ¹ candidates, game preserves, wildl. refuges, wildlife mgmt units, Fish and Wildlife Dev't Fund, Wildlife Ha 2.2.3 Avoid the following unless access req'd by Fed gov't - national parks, migratory bird sanctuaries, Prairie National Wildlife Areas.
Survey	Not Applicable	Not Applicable
Design	4.1 Scheduling of construction should be considered 4.2.1 R.O.W. widths should be minimized but should not cause road shading, dust or drying problems, or fire hazard 4.2.2 In wooded terrain roads should be curved at approaches to main roads 4.2.3 Where sight distance is needed consider shifting centreline 4.2.4 Selective cutting may screen roads and facilities 4.2.5 Formulate reclamation plans 4.7.5 Minimize number of access roads to route 4.7.8 Setback maintenance areas from road; prevent water quality damage from leaching salt & gravel piles	4.7.2 Warning devices & safety features may be req'd for wildlife 4.7.3 Determine potential for creating a barrier for wildlife 4.7.4 Design for safe movement of wildlife & livestock

Activity	General Guidelines	Wildlife Guidelines
Construction	5.1.1 Construction contracts should be explicit in describing environmental protection measures to be fulfilled by contractor. 5.1.2 A qualified environmental monitor should be assigned to direct & monitor implementation of protection measures. 5.1.3 Modifications required by Approving Agency should be implemented immediately. 5.1.4 Approving agency may conduct post-construction inspections. 5.1.5 Construction employees should receive training on prevention of environmental damage. 5.1.6 Obtain all permits & authorizations prior to commencing construction. 5.3.16 For more detail on the development of borrow & gravel pits, please refer to the "Guidelines for Environmental Protection During Development and Restoration of Sand & Gravel Pits." 5.7.1 Equipment should be confined to R.O.W. except in unusual circumstances. 5.7.4 Locate and operate construction camps in accordance with Approving Agency requirements. 5.7.5 Dispose of camp wastes as per requirements of Approving Agency. 5.7.6 Most R.M.'s require a development permit for a camp. 5.7.9 Contingency plans for fire suppression and clean up of spills should be developed prior to construction. Equipment & trained staff should be in place. 5.7.10 Comply with Environmental Spill Control Regulations. (See Appendix 111). 5.7.13 Firearms should be discouraged in construction camps.	5.2.3 Construction schedules should avoid disturbance within 3 km of important wildlife habitat during sensitive wildlife periods. A 500m reservation is required in forested areas. Sensitive periods are: i) for most birds of prey - northern regions: May 1 to July 30; southern regions: March 15 to June 30; ii) for colonial birds - breakup to July 15; iii) for big game & upland game birds - January 1 to April 30, very high sensitivity from late February to late March for big game. 5.4.5 Leave a 6m break in windrows every 100 m for lateral drainage & animal access. 5.7.11 Harassment of wildlife is prohibited. 5.7.12 Wildlife should not be fed. Edible garbage should be buried at least 1.5 km from camps to avoid conflicts with wildlife.
Reclamation	6.1.1 Detailed reclamation plans should be developed in co-operation with Approving Agency	Not Applicable
Maintenance	7.1.1 New R.O.W.s & problem areas should be inspected annually to detect soil erosion & unsuccessful revegetation. 7.1.12 Access roads should be maintained in usable condition or removed.	7.1.2 Structures intended to reduce traffic hazards to wildlife should be inspected and repaired soon after snowmelt. 7.1.3 Locations where vehicle-animal collisions occur frequently should be examined with wildlife authorities. Measures should be put in place to minimize risks. 7.1.9 Mowing & spraying should be scheduled for after August to avoid critical periods. 7.1.16 Lengthy snow windrows should have pushed out openings every 100m where ungulates use road in winter.

Activity	General Guidelines	Wildlife Guidelines
Decommissioning	8.1.1 Consider decommissioning roads which will not be used for a reasonable period of time. 8.1.2 Abandoned roads should be reclaimed so that original forest, wildlife, agricultural or other productivity is restored or allowed to grow back. 8.1.3 Recontouring and revegetation should be done as necessary to restore the visual quality of the site. Planting should be checked in subsequent years to ensure satisfactory results.	Not Applicable
Activity	Fisheries/Stream Crossings Guidelines	Soils & Borrow Pit Guidelines
Route Selection	2.3.1 Reservations set by Fisheries, SERM. They may be altered in specific circumstances. The following reservations are required: i) non-fish bearing streams: 0 m ii) Class I streams: 15 m iii) Class II streams & waterbodies: 30 m iv) Class II streams & waterbodies w angling or commercial potential: 90 m v) potentially entire floodplain 2.3.2 Cross as few Class II watercourses as possible 2.3.3 For winter roads cross streams where banks low, stable, gentle approach, & slow flow. Avoid inlets/outlets. 2.3.4 Cross where channel is straight; crossing already exist; minimum cut & fill req'd; no spawning habitat; approach is at right angle; channel gradient is low; avoid construction of new channels.	2.3.5 Avoid unstable, steep and sensitive terrain 2.3.6 All-season roads avoid local lowlands and valleys 2.3.7 In permafrost, avoid slopes >7%; watercourses; burned-over areas > 50cm deep; wetlands 2.3.8 Try to avoid Muskeg on permanent roads 2.3.9 If sand hills <u>must</u> be crossed, use stable terrain
Survey	Not Applicable	3.1.3 For wetlands & permafrost areas, clear in winter and avoid use of heavy equipment until soil is frozen & snow is adequate 3.1.4 Survey vehicles should avoid erosion-prone terrain in summer; in sensitive areas use helicopters

Activity	Fisheries/Stream Crossing Guidelines	Soils & Borrow Pit Guidelines
Design	4.4.2 Erosion-control measures may be necessary in watercourses (see detailed guideline) 4.4.6 Follow guidelines for design of stream crossing (4.5 & 4.6) 4.4.7 Ditches/road shoulders within stream/river valleys or draining directly to valley should be revegetated ASAP 4.5.1 Erosion-control measures are required for approaches, bridges & culverts 4.5.2 Stream diversions require permission from Approving Agency 4.5.3 Do not constrict stream more than 2/3s during stream modification 4.5.4 At crossing, R.O.W clearing shall be, in fill sections-within 6m of the fill slope; in cut sections-within 5m of top of backslope 4.5.5 Make approach perpendicular to the channel 4.5.6 Accompany asphalt and concrete curbs with off-take structures in sensitive areas 4.6.1 All watercourse crossings (w 3 exceptions) must include either bridges or culverts 4.6.2 Submit info on location, timing & type of crossing to Approving Agency prior to construction 4.6.3 Obtain info on stream flow and aquatic resources before designing bridges and culverts or use safety factor designated by approving agency 4.6.4 Bridges are generally the preferred crossing for Class II streams or erosion prone banks 4.6.5 Design bridges high & wide enough to permit passage of floods plus debris over life of road 4.6.6 Use culverts where bridges cannot be used 4.6.7 Lay culverts minimum 20 cm below normal streambed elevation 4.6.8 For multiple culverts, culvert walls should be 1.8 m apart 4.6.9 Design & install culverts to ensure: i) discharge not directed at unstable bank; ii) culvert installation follows stream gradient; iii) hydrostatic uplift does not develop iv) minimum design flood can be handled without upstream ponding	4.3.1 Control erosion by minimizing exposure of soil 4.3.2 Minimize or eliminate cut ditches where they are not needed 4.3.3 Provide full backsloping on each graded section: cut & fill slopes not to exceed 2:1; Cut & fill sideslope of 3:1 with rounded crests & toes is preferable. Some areas will require special case-by-case treatment. 4.3.4 Include adequate drainage structures when designing fills; specify early stabilization on both cut and fill designs. 4.3.5 Use of borrow pits is preferred to widening R.O.W. to obtain extra fill. Where R.O.W. must be widened for this purpose care should be taken to minimize disturbance and disruption (See specific guideline). 4.3.6 When designing borrow pits area of disturbance should be minimized. Future reclamation should be considered including salvaging topsoil for future reclamation of the operation. 4.3.7 In Prov. Forests, borrow pits require permit under Resource Land Regulations; they should be planned as part of the entire proposal for road development. 4.4.1 Assess degree of potential erosion & effective erosion control mechanisms. Preferred approach is revegetation. Other control measures are geotextiles; spreading rock; excavating perpendicular to flow; erecting dykes perpendicular to flow; straw bales; compacting soil surface; constructing terraces or reverse benches. 4.4.2 Parabolic & trapezoidal ditches are preferable to V-shaped ditches. 4.4.3 Parabolic & trapezoidal ditches are preferable to V-shaped ditches. 4.4.4 Dips, water bars, and cross drains should be specified on temporary roads to prevent water from accumulating & eroding the trails (see detailed guideline)

Activity Design Cont'd	Fisheries/Stream Crossings Guidelines v) ice accumulation is minimized 4.6.10 All culverts must be sufficient size & number to ensure average water velocities do not exceed 1.2m/s in culverts under 25m and 2m/s in culverts over 25m unless design ensures fish passage. 4.6.11 Culverts may be impassable for not more than 3 days during median annual flood and not more than 7 days during 1:50 flood 4.6.12 The above 2 guidelines (4.6.10 & 4.6.11) do not apply if fish do not use the watercourse at peak flows 4.6.13 Culvert design for fish passage are: i) arch & box culverts with natural substrate bottom; ii) arch culverts of unit construction; iii) horizontal ellipse culverts; iv) conventional circular culverts. 4.6.14 Guidelines on erosion control & design of approaches should also be followed (4.4 & 4.5)	Soils & Borrow Pit Guidelines 4.4.5 Wherever natural drainage crosses a road, cross drainage should be specified and run-out should lead run-off to non-erodible areas. See design guideline for formula to determine optimum spacing of runouts and distances from watercourses. 4.7.1 For roads located in any major wetland, permafrost, sand hills, or special interest area, the location, timing of construction and type of crossing should be submitted to the Approving Agency
Activity Construction	Fisheries/Stream Crossings Guidelines 5.2.4 Stream crossing activity would avoid fish spawning & migrating periods 5.3.9 Gravel pits should be worked to extract maximum amount of material from the deposit. 5.3.10 No clearing, grubbing, or other disturbance within watercourse 5.3.11 Obtain borrow & gravel from outside watercourse reservations except at road cross-sections. No borrow may be removed from a fish-bearing stream or contributing stream unless a permit from Fisheries Branch has been obtained. 5.3.12 Machine clearing should be discontinued at watercourse reservation 5.3.14 For summer construction, in erosion-prone & sensitive areas or where erosion could degrade streams, erosion control measures should be implemented within 10 days of grading if section is not built upon or further graded in that period. 5.4.10 Debris must be removed from watercourse or waterbody reservations 5.5.1 Stream crossing should be constructed as per guidelines for design. 5.5.2 Equipment should enter watercourse only at previously identified crossing; only essential in-stream activity should take place. 5.5.3 No waste construction material should enter stream; if they do they should be removed with as little disturbance as possible. 5.5.4 Where construction of a coffer dam is required, it should be constructed prior to excavation of piers abutments and footings. 5.5.5 Where stream diversion is approved, a plug should separate the old & new channels during excavation. When filling the diversion, remove plug on downstream end first, then fill the old channel or provide a suitable means of drainage.	Soils & Borrow Pit Guidelines 5.2.1 If possible, undertake construction in muskeg, permafrost & other sensitive terrain in fall & winter. 5.2.2 Construction should not occur at spring run-off & during heavy rain except to prevent flooding & serious erosion 5.3.5 Do not disturb permafrost areas outside roadbed. Clearing should be done by hand & bulldozers should be equipped with proper shoes to avoid ditching & scalping the surface. 5.3.6 Unless later cutting or filling will be required, slopes of greater than 1:1 should be cleared by hand. 5.3.7 Topsoil required for revegetation should be stockpiled prior to excavating along R.O.W's & at borrow pits, gravel pits & other facilities 5.3.8 Topsoil to be stockpiled for more than 6 months should be stabilized with plant cover. 5.3.15 Long-term exposure of soil should be minimized in order to reduce erosion.

Activity	Fisheries/Stream Crossings Guidelines	Soil & Borrow Pit Guidelines
Construction	5.6.1 Temporary stream crossing have same environmental constraints as permanent crossings. 5.6.1 Temporary crossings must be completely removed prior to spring breakup unless designed to handle peak flows 5.6.3 Following crossing removal, the area should be restored to near its original condition. 5.6.4 Temporary stream crossings may use metal or log skid bridges. 5.6.5 Temporary summer crossings of gullies or streams should use only metal or wooden culverts. Filling of stream with soil or material should be avoided. 5.6.6 Winter crossings may use ice and snow bridges. These must not obstruct flows, fish movement or overwintering areas. 5.6.7 Other temporary crossings may be allowed with agreement from Fisheries Branch. 5.6.8 Locate approaches to ice bridges where banks cuts will not be required. A sufficient snow pack is required to protect banks & vegetation. 5.6.9 Watercourses may be forded where essential & with approval from approving agency. 5.7.14 Washing of any type of equipment in streams, lakes or on sites which drain immediately to these, is prohibited	5.4.3 In ice-rich terrain, waste material may be stacked & burned only where subsidence due to thawing will not occur. 5.7.15 Summer construction should be avoided in permafrost areas. If such construction is necessary use wide-tracked bulldozers in high land areas & balloon-tired vehicles in wetlands. 5.7.16 When constructing across permafrost, fill material should be placed directly on undisturbed vegetation using end-haul techniques. 5.7.17 Vehicles should not use winter roads until at least 10 cm of snow has been packed & frost has penetrated soil to sufficient depth to support equipment.

Activity	Fisheries/Stream Crossing Guidelines	Soils & Borrow Pit Guidelines
Reclamation	Not Applicable	6.1.2 Revegetation should commence as soon as possible after construction as to minimize potential for erosion. 6.1.3 Stockpiled topsoil should be spread over area prior to reclamation. 6.1.4 If fall seeding, complete at least 21 days before mean temp is below 5°C. 6.1.5 Select plant species for their known ability to establish a self-sustaining cover; bromegrass should generally not be used. 6.1.6 Special seeding techniques should be used on slopes which are susceptible to erosion (see detailed guideline). 6.1.7 Where erosion has occurred the affected area should be recontoured and revegetated. 6.1.8 Where salt may be used to control snow and ice, the following should guide revegetation: i) place salt-sensitive plants 15 m from edge of road surface; ii) place moderately salt-tolerant plants 10 m from road surface; iii) place salt-tolerant plants within 10 m of road surface. 6.1.9 Gravel pits & spoil piles should be restored prior to abandonment. <u>Guidelines for Environmental Protection during Development & Restoration of Sand & Gravel Pits</u> should be followed when sand & gravel pits are used to obtain material. 6.1.10 Reclamation of gravel pits should include: i) recontouring with final slopes not more than 1:3; ii) spreading topsoil; & iii) revegetating.
Maintenance	7.1.4 Ensure that oil, asphalt and tar not enter surface waters. 7.1.8 Provide for a reservation of 25m between areas where herbicides are applied & the edge of watercourses or waterbodies. 7.1.14. Place material cleared from ditches where it cannot be blown into watercourses or waterbodies. 7.2.1 Newly installed culverts & bridges & those with history of blocks should be inspected prior to freeze-up & during break-up; debris & in-culvert icing should be cleared. 7.2.2 Remedial action should be taken where culvert design is proven inadequate. 7.2.3 Newly constructed approaches to watercourses or those with history of erosion should be inspected each summer. 7.2.4 Materials for road repair should not be taken from stream beds or waterbody/course reservations. 7.2.5 Maintenance of R.O.W. as per section 7.1 should be implemented at watercourse crossings.	7.1.11 Gravel & dirt windrows near stream crossings should be broken up at regular intervals & in erosion-resistant areas to allow sheet runoff from road surface to enter the roadside ditch. 7.1.13 Where chronically unstable soils are encountered in R.O.W., appropriate investigations, redesign & remedial action should be undertaken without delay. 7.1.15 Where off-road melting occurs in permafrost areas, melt water should be drained away unless accumulations are more than 20 cm deep or cause a hazard, and such melt pools should be allowed to refreeze.

Activity	Fisheries/Stream Crossings Guidelines	
Decommissioning	8.2.1 Abandoned water diversion structure should be removed or plugged and stabilized. 8.2.2 Stream crossing installations except bridges must be removed. Culverts should be salvaged, the channel restored, and all unstabilized fill material removed from the site. 8.2.3 Where erosion has occurred, the slopes should be stabilized and recontoured as required to repair damage and to prevent further erosion. If the slopes are very steep, they should be mulched or seeded to enable natural vegetation to establish itself. 8.2.4 All temporary facilities, equipment and waste construction materials should be removed and the sites reclaimed in a manner acceptable to the Approving Agency. 8.2.5 Temporary stream crossings must be removed prior to spring breakup.	Not Applicable
Activity	Vegetation & Land Use	Recreation and Aesthetics
Route Selection.	2.5.1 Highly productive agricultural land should be avoided where possible 2.5.2 Routes should minimize fragmentation of land into parcels which are uneconomical to farm	2.6.1 High recreational capability lands & private/public recreational areas should be avoided unless approving agency requires new access 2.6.2 Unnecessary contact with recreation routes should be avoided 2.6.3 Industrial haul roads should emphasize shortest distance, limited access & should avoid recreational & scenic areas. Where plan is for both public & industrial use road, a scenic route should be considered. The effects of new access should be assessed. 2.6.4 Visually sensitive areas should be identified and avoided by at least 1 km 2.6.5 Sites of outstanding religious, historic, aesthetic, natural or cultural significance or intensive "traditional" resource use should be identified. Route selection in these areas should be done with consultation with appropriate groups.
Survey	3.1.1 Temporary access trails & preliminary survey lines should be hand cut & limited to a 1.5 m swath. 3.1.2 Temporary access trails cut for survey should be blocked by brush piles or fences after survey is complete unless otherwise specified by landowner. 3.1.5 Survey crews should use offsets to avoid cutting lines through shelterbelts.	Not Applicable

Activity	Vegetation & Land Use Guidelines	Recreation & Aesthetics Guidelines
Design	Not Applicable	4.7.6 Road design should consider effects of alignment, profile and cross-section on scenic landscape. Scenic & public roads should be designed to advantage of areas of existing visual interest through means such as i) highlighting views; ii) achieving good relationship between open space and dense forest in woodlands. Clearings to allow views should be opened up after construction. 4.7.7 Where roads intersect a R.O.W. or cross visually sensitive areas, the visual impact may be reduced by using vegetation for screening (as long as adequate sight distance is maintained).
Construction	5.3.1 Carry out clearing, grubbing and earthwork in accordance with guidelines for design (4.2 & 4.3). 5.3.2 Where erosion could be a problem, clearing should not be undertaken far in advance of construction. 5.3.3 Stumps should not be grubbed within 2 m of standing timber. 5.3.4 Vegetation outside the R.O.W. clearing boundary must not be cut or damaged, but selective removal of tall trees may be specified for the purposes of safety and road integrity (see detailed guideline). 5.3.13 Clearing in heavily forested areas should be assisted by flagging each edge of the R.O.W.; All merchantable timber is to be salvaged. 5.4.1 Vegetation, overburden and other debris should be disposed of when construction in an area is complete. (See detailed guideline) 5.4.2 Salvage of merchantable timber must be carried out according to the requirements of the Approving Agency. 5.4.6 Debris may be buried within the designated R.O.W. or in approved borrow pits. 5.4.7 Cleared brush and woody material may be chipped & used for mulch in areas where it cannot wash away or be submerged by standing water. 5.4.8 In erosion-prone areas woody debris may be compacted and placed on the R.O.W. across the direction of run-off. 5.4.9 Debris should not be piled on property outside the R.O.W. unless arranged with the owner.	Not Applicable

Activity	Vegetation and Land Use Guidelines	Recreation and Aesthetics Guidelines
Maintenance	7.1.5 R.O.W maintenance should preserve integrity of the road & ensure safe operation. Regrowth of understorey woody and herbaceous vegetation should be permitted subject to consideration of safety & proper road function. 7.1.6 Where brush control is required, cutting (by hand in sensitive areas) is preferable to spraying 7.1.7 Herbicides may be used for brush control subject to guideline 7.1.8 (re: watercourses) & to applicable standards of the Approving Agency. In selecting herbicides use criteria such as lack of toxicity to man and animals, non-corrosiveness & non-volatility. 7.1.10 Drainage & erosion control installations including sediment traps and vegetation buffers should receive regular maintenance.	Not Applicable

Activity	Heritage Resources	
Route Selection	2.4.1 Heritage resource impact assessment (HRIA) may be warranted for road projects. Such projects must be reviewed by the Heritage Branch, Municipal Gov't to determine need for and level of HRIA. 2.4.2 In northern regions an HRIA may be required for sites located in proximity to: i) previously recorded heritage sites; ii) lakes greater than 5 km in width/length iii) navigable streams & seasonal streams in well-formed valleys, near falls, rapids, confluences, terraces, or portage routes; iv) prominent landforms, prominent uplands with well drained soil, and features such as kames, eskers & moraines. 2.4.3 In southern Saskatchewan, an HRIA may be required for sites in proximity to: i) previously recorded sites; ii) permanent lakes > 2 km; iii) seasonal lakes > 2 km if located in well defined basin; iv) permanent rivers/streams; v) seasonal streams in well-formed channels or valleys; vi) sand dune complexes; vii) uplands, escarpments, or prominent features such as kames, eskers & moraines; viii) hummocky moraine near sloughs; ix) glacial lake strand lines. 2.4.4 An HRIA may be required in areas having high probability for vertebrate & invertebrate fossils: i) plateaus & badlands; ii) walls of valleys; iii) areas with exposed Palaeozoic or later strata. 2.4.5 Impacts to heritage resources from heavy vehicles, mechanical tree & shrub removal, temporary work facilities should be assessed & mitigated.	
Construction	5.2.5 The construction schedule should allow for any archaeological reconnaissance & salvage deemed necessary by Saskatchewan Municipal Government 5.7.2 All archaeological reconnaissance & salvage deemed necessary by Saskatchewan Municipal Government 5.7.2 All archaeological, historical or vertebrate paleontological remains, fortuitously discovered during construction must be reported to Saskatchewan Municipal Government, Heritage Branch. All land-altering activities within 30 m of the discovery site must cease. Work may proceed only after receiving direction from Heritage Branch.	
Design	Not Applicable	

GUIDELINES FOR ENVIRONMENTAL PROTECTION DURING ROAD DEVELOPMENT

1. GENERAL

1.1 Purpose

- 1.1.1 These guidelines have been developed in order to avoid and to mitigate adverse impacts on Saskatchewan's environment from development and maintenance of roads.

1.2 Application

- 1.2.1 These guidelines apply to all types of rural roads and are addressed to all who are engaged in locating, constructing and maintaining any type of road in northern or southern Saskatchewan.
- 1.2.2 These guidelines are administered by the Approving Agency. Changes in their application are to be made through consultation with and agreement by the Approving Agency. Other agencies will provide technical and regulatory advice as required. The appropriate Approving Agency for various developers is specified in Appendix II.
- 1.2.3 Adherence to these guidelines does not obviate the need to comply with other guidelines, regulations, legislation, or terms and conditions of environmental approval, as may be required on a case-by-case basis.

1.3 Definitions

- 1.3.1 A Glossary of definitions is included as Appendix I.

2. ROUTE SELECTION

2.1 General

- 2.1.1 Subject to section 2.2, a multi-disciplinary, interagency approach should be adopted in the preliminary route selection phase, incorporating information and analyses from diverse bio-physical, socio-economic and engineering specialists. Traffic Safety considerations must be considered when selecting a route.
- 2.1.2 Maps and aerial photographs should be used along with ground reconnaissance. Ground reconnaissance should be minimized as much as possible in environmentally sensitive areas.
- 2.1.3 The construction schedule should be considered during route selection, since seasonal restrictions on construction may render certain alternatives unattractive. Planning should be done well in advance of proposed construction in order to ensure adequate time for review of proposals and approval.
- 2.1.4 Both beneficial and adverse effects of creating easier access to previously inaccessible areas should be considered during route

selection, including effects of such access on land use, regional development, fish and wildlife harvest, fish and wildlife habitat, recreation, tourism and aesthetics.

- 2.1.5 Long-term use of the road, including possible multiple-use options of various potential routes (e.g. recreation, logging, hunting), should be considered during route location studies and included in a master plan for the road.
- 2.1.6 Winter or temporary roads that may be upgraded to all-weather roads should be routed so as to minimize the number and extent of changes that would be required in the conversion.
- 2.1.7 The public in any area potentially affected by a road alternative should be consulted during route selection studies.
- 2.1.8 Feasible alternative routes should be considered during route selection.
- 2.1.9 Corridors occupied by existing linear developments, such as old roads, winter roads, and seismic lines, are to be utilized wherever possible as potential routes, as impacts may be reduced by using existing corridors.
- 2.1.10 Route selection studies should indicate and compare potential alternatives and the advantages and concerns of each. In arriving at a decision, the relative significance of potential impacts associated with each option should be assessed, incorporating both technical appraisals and public evaluations.
- 2.1.11 A development permit may be required from the local municipality for road construction. Early contact with the local municipality is encouraged for early mitigation.
- 2.1.12 Routes should be selected that avoid tourist destinations, other than those routes required for access. Early contact with outfitters or the agency in charge of tourist locations will assist in mitigation.
- 2.1.13 New road development should avoid crossing land under selection for treaty land entitlement or subject to specific claims by Saskatchewan bands where possible. If a road must cross a treaty land entitlement selection or land under specific claim, then the Indian and Native Affairs Secretariat should be contacted in advance of the final decision being taken on road construction.

2.2 Considerations Relating to Wildlife and Forestry

- 2.2.1 When selecting a route, the following areas should be avoided:
 - (i) important wildlife habitat, including:
 - areas of important wildlife habitat in southern Saskatchewan, as identified by the Terrestrial Wildlife Habitat Inventory and wetlands habitat specialists of the Wildlife Branch - Saskatchewan Environment and Resource Management;
 - areas identified as such by the Canada Land Inventory (CLI Class 2 to 3 for waterfowl and ungulates) in southern Saskatchewan;
 - areas of important wildlife habitat in northern Saskatchewan as identified by the Wildlife Branch;

- south-facing slopes and deciduous woodlands, especially in the north;
 - wooded areas in extensive agricultural lands;
 - valley floors and open meadows.
 - in woodland caribou ranges, areas at right angles to a series of string bogs (placement in these areas can cause substantial increased harvest of herds);
 - in woodland caribou ranges, eskers and beach ridges supporting important woodland caribou habitat.
- (ii) areas within 3 km of major nesting sites of colonial birds (e.g. terns, gulls, herons, cormorants, pelicans, and similar species). In forested areas, 500m should be kept between road development and such nesting sites.
- (iii) highly productive and/or unique forested areas, including:
- areas identified as such by the Canada Land Inventory (CLI Class 2 to 3 for forestry), except for forest haul roads;
 - isolated areas of climax woodland;
 - reforested and nursery areas.
 - areas of unique or unusual vegetation or geology.
- 2.2.2 The following designated areas should be avoided except where the Approving Agency indicates new access to or near the area is desirable:
- provincial parks;
 - ecological reserves;
 - International Biological Programme (IBP) "Candidate Natural Areas";
 - game preserves;
 - wildlife refuges;
 - wildlife management units;
 - Fish and Wildlife Development Fund lands.
 - Crown-owned important wildlife as designated in The Wildlife Habitat Protection Act. The Wildlife Habitat Lands Disposition and Alteration Regulations specifically prohibit new roads other than on legal road allowances on the habitat designated in the Act.
- 2.2.3 The following designated areas should be avoided except where the appropriate federal agency indicates new access to or near the site is desirable:
- national parks;
 - federal migratory bird sanctuaries;
 - Prairie National Wildlife Areas.

2.3 Considerations Relating to Watercourses, Wetlands, and Other Sensitive Terrain

- 2.3.1 Reservation limits are set by the Fisheries Branch; they may be altered in special circumstances. The following reservations of undisturbed vegetation are to remain between the right-of-way and the edge of a

watercourse or waterbody, except where watercourse crossings have been identified:

- (i) waterbodies and watercourses not capable of supporting fish and not connected to a recognizable stream system can have no reservation; however, wherever possible, a minimum of 45 metres reservation should be established in order to protect nesting migratory waterfowl and shorebirds as well as aquatic animals.
 - (ii) Class I streams generally require a reservation of 15 m; however, wherever possible, a reservation of 90 metres should be established to protect fish habitat, nesting birds and aquatic animals.
 - (iii) waterbodies and Class II streams, other than those outlined in (iv), generally require a reservation of 30 m; however, wherever possible a reservation of 90 metres should be established as in (ii) above.
 - (iv) waterbodies and Class II streams possessing fish populations suitable for angling or commercial exploitation, including fish farming, or capable of supporting such fish populations introduced by stocking, require a reservation of 90 m.
 - (v) the above reservations should be extended to 200 metres where the region provides good moose habitat. In such cases the Wildlife Branch of Saskatchewan Environment and Resource Management should be contacted for their input.
 - (vi) where the width of an active flood plain exceeds these specific reservation widths, the Approving Agency may designate the entire width of the active flood plain as a reservation. In such instances, the flood plain should be avoided by all construction activities except those required at watercourse crossings;
 - (vii) where there is a steep slope leading to a water body, the reservation should begin at the top of the slope.
 - (viii) construction activity within these reservations may require a Fish Habitat Alteration Permit from Fisheries Branch of Saskatchewan Environment and Resource Management.
- 2.3.2 Routes should cross as few watercourses as possible, especially Class II streams.
- 2.3.3 Winter roads should cross watercourses where banks are low and stable, approaches are gentle, and water flow is slow. Inlets and outlets of waterbodies should be avoided.
- 2.3.4 Routes should be selected so that watercourses may be crossed where:
- (i) the channel is straight, unobstructed, and well-defined;
 - (ii) use can be made of existing crossings;
 - (iii) contours of the crossing can conform closely to the natural topography at the site and avoid extensive cuts or additions of fill;
 - (iv) there are no known important fish spawning areas within a

- minimum of 500 m downstream;
 - (v) the approach to the watercourse is near a right angle;
 - (vi) the channel gradient is near zero;
 - (vii) construction of new channels can be avoided.
- 2.3.5 Land stability should be investigated, and unstable areas, steep gradients and sensitive terrain (e.g. wetlands, palsas, permafrost, sand hills) avoided.
- 2.3.6 All-season roads should avoid local lowlands and valleys wherever possible, although the possibility of other significant environmental effects (e.g. on forestry, wildlife, aesthetics, heritage resources) should be considered when routing through areas of greater elevation.
- 2.3.7 In permafrost zones, the route should avoid the following:
 - (i) permafrost slopes over 7 per cent;
 - (ii) watercourses;
 - (iii) burned-over areas;
 - (iv) areas where peat is more than 50 cm deep;
 - (v) wetlands.
- 2.3.8 Muskegs should, as a rule, only be crossed with winter roads, and permanent construction should be avoided. Where impossible to avoid, roads crossing muskegs must preserve flow patterns within the areas by having good and frequent cross-drainage.
- 2.3.9 When sand hills must be crossed, the route should be located in the most stable terrain available (e.g. flat areas, in the trough of dunes).

2.4 Considerations Relating to Archaeological, Historical and Vertebrate Paleontological Sites

- 2.4.1) Heritage Resources, including archaeological and paleontological sites are fragile, inconspicuous components of the landscape, and frequently buried below surface. Archaeological sites are locations containing the material evidence or remains of past human activity. Paleontological sites are locations containing the fossils of extinct vertebrate animals, including their mineralized skeletal remains and traces of activity, or the macroscopic fossils of invertebrate animals and plants.

Heritage Resource Impact Assessment (Hria), pursuant to section 63 of The Heritage Property Act, may be warranted for road development projects in a number of environmental contexts and in proximity to previously recorded sites. Road development projects should be reviewed by Archaeological Resource Management, Heritage Branch- Saskatchewan Municipal Government to determine the need for, and level of, Hria. The Hria serves to:

- i) Determine if heritage sites are present within construction rights-of-way;
- ii) Facilitate or assist site avoidance vis-a-vis minor right of way changes or project relocation/redesign.

- iii) Evaluate sites found in unavoidable conflict with development;
 - iv) and formulate recommendations for managing adverse impacts. Hria studies must be carried out and completed prior to construction. If necessary, mitigation may involve site avoidance, physical protection (e.g., fencing) salvage excavation, monitoring, or a combination of these measures. Hria's must be conducted by qualified personnel under an investigation permit from Saskatchewan Municipal Government (pursuant to section 67 of the Heritage Property Act).
- 2.4.2) Sites of a Special Nature (SSN's), including burials, pictographs, petroglyphs, boulder effigies and medicine wheels and other ceremonial sites may be encountered during the course of development. No person shall remove, excavate or alter SSN's in any manner whatsoever except as authorized by the Minister responsible for Municipal Government.
- 2.4.3) In the northern (forested) region of Saskatchewan, significant archaeological and historic sites have high to moderate probability of being located in proximity or adjacent to:
- i) previously recorded heritage sites.
 - ii) lakes greater than 5 km in length/width, particularly near inlets, islands, narrows or other shoreline constrictions, peninsulas and other prominent points on land, and sandy beaches;
 - iii) in proximity to and along navigable streams and seasonal streams in well-formed valleys, particularly on or near falls and rapids, confluences with other streams, relict terraces, and portage routes; and
 - iv) in association with prominent landforms, prominent uplands with well drained soils, and the upland margins of low lying areas, such as kames, eskers and moraines.
- 2.4.4) In southern Saskatchewan, including parkland habitats, significant archaeological and historic sites have high to moderate probability of being located in proximity or adjacent to;
- i) previously recorded archaeological sites;
 - ii) permanent lakes greater than 2 km in length/width;
 - iii) seasonal lakes greater than 2 km in length/width, if located in well-defined basins;
 - iv) permanent rivers/streams;
 - v) Seasonal streams in well-formed channels or valleys;
 - vi) sand-dune complexes, particularly if associated with any of the above noted terrain types;
 - vii) uplands, escarpments or other prominent features such as kames, eskers and moraines; and
 - viii) Hummocky moraines associated with sloughs;
 - ix) glacial lake strand lines.
- 2.4.5) An Hria may be required in areas potentially supporting vertebrate and invertebrate fossils. These areas may be found in a number of localities

in Saskatchewan, including northern regions. In particular, fossil-bearing deposits may be encountered in:

- i) plateaus and badlands;
- ii) in walls of valleys that have erosional cuts below surficial deposits; and
- iii) other contexts containing exposed Palaeozoic or later strata.

2.4.6) Adverse impacts to heritage resources, if situated in development areas, may occur as a consequence of:

- i) heavy vehicular traffic (particularly during warm weather);
- ii) tree and brush removal, if not done by hand; and
- iii) temporary facilities associated with construction such as work camps, staging areas and barge-off loading sites.

2.5 Considerations Relating to Agricultural Land

2.5.1 Highly productive agricultural land (Canada Land Inventory Classes 2 to 3 for Agriculture) should be avoided where possible.

2.5.2 Routes should minimize fragmentation of land into parcels which are uneconomical to farm.

2.6 Considerations Relating to Recreational, Scenic, and Special-Use Areas

2.6.1 When selecting a route, areas with a high recreational capability (Canada Land Inventory Classes 2 to 3 for Recreation) and private or public recreational areas (e.g. resorts, parks, historic sites, campgrounds, recreational watercourses, beaches) should be avoided unless the Approving Agency indicates new access to the recreational area is desirable.

2.6.2 Unnecessary contact with recreation routes (e.g. canoe routes, ski trails) should be avoided.

2.6.3 The route should reflect the planned use for the road. Industrial haul roads should emphasize the shortest distance and limited access and should avoid recreational and scenic areas. Where a road is for both public and industrial transport use, a scenic route should be considered. The possibility that scenic routes may create undesirable new access to lakes or other sensitive areas for which adequate development plans are not in place should also be considered.

2.6.4 Visually sensitive areas should be identified during preliminary route selection and avoided by at least 1 km or otherwise adequately screened.

2.6.5 Sites of outstanding religious, historic, aesthetic, natural or cultural significance and local areas where intensive "traditional" resource uses (e.g. subsistence hunting, trapping, and fishing) occur should be identified. This process of identification and subsequent route selection in such areas should be done in close consultation with the individuals or interest groups involved.

3. SURVEY

3.1 Preliminary Surveys

- 3.1.1 Temporary access trails and preliminary survey lines should be hand cut and limited to a 1.5 metre swath in commercial timber. (This does not apply to centre-line clearing.)
- 3.1.2 Temporary access trails cut for purposes of preliminary survey should be blocked by brush piles or fences after survey and construction are complete. This requirement may be waived if the trails may be useful for permanent access and/or if the landowner/occupant wishes the trails to be left open. Wherever possible, trails should use existing routes.
- 3.1.3 In wetlands and permafrost areas, preliminary survey lines and access trails should be cleared during winter. Heavy equipment should not enter such areas until the soil is frozen to a sufficient depth and snow cover is adequate to protect the vegetative mat.
- 3.1.4 In summer, survey vehicles should be restricted to terrain that is not susceptible to erosion or other damage. Where summer access to sensitive areas is required, only helicopters or other transportation equipment authorized by the Approving Agency should be used.
- 3.1.5 Field survey crews should use offsets to avoid cutting lines through shelterbelts.

4. DESIGN

4.1 Scheduling

- 4.1.1 Scheduling of construction (Section 5.2) should be considered in the design phase.

4.2 Right-of-Way Clearing

- 4.2.1 Removal of timber due to R.O.W. clearing is governed by Environment and Resource Management, Forestry Branch. The widths of clearing for a right-of-way should always be the minimum determined by safety, construction requirements and environmental considerations. Clearing widths should not be so restrictive that trees will shade the road surface and hinder drying or contribute to a serious fire hazard.
- 4.2.2 Access roads should be curved (while retaining adequate sight distance for traffic safety) as they approach a main road in wooded or rolling terrain in order to minimize long sight distances down the access roads. This does not apply to municipal or other roads constructed on a "grid" in southern Saskatchewan.
- 4.2.3 Where extra sight distance is necessary, such as at a curve, it may be possible to accommodate this requirement, particularly on roads with low design speeds, by shifting the roadbed from the centerline rather

than achieving it through an increased clearing width.

- 4.2.4 In visually sensitive areas, the design may specify use of selective cutting to create transition zones and use of natural features to screen roads and other facilities.
- 4.2.5 Reclamation operations should be formulated in the design phase of the development (see Section 6).
- 4.2.6 Removal of timber in the right of way is regulated by the Forestry Branch of Saskatchewan Environment and Resource Management.

4.3 Design of Earthworks

- 4.3.1 Erosion should be controlled by minimizing exposure of soil.
- 4.3.2 Cut ditches should be minimized or eliminated where they are not needed (e.g. along crests or high points and in certain wetlands).
- 4.3.3 The design of each graded section should provide for full backsloping. Cut and fill slopes shall not exceed 2:1, and high clay fill should always be greater than 2:1 at the upper slopes. A minimum cut or fill side slope of 3:1 with rounded crests and toes is preferable. The above recommendations may be inappropriate for certain situations (e.g. rock cuts, unstable soils), which should receive special treatment as indicated on a case-by-case basis.
- 4.3.4 The design of fills should specify inclusion of adequate drainage structures, and both cut and fill designs should specify early stabilization and revegetation.
- 4.3.5 When extra fill material is required, the landowner adjacent to the right of way should be consulted before removal. Care should be taken when widening R.O.W.'s to provide extra fill. In cases where this is necessary, disruption to existing land uses and damage to adjacent lands should be minimized. (Generally, a right-of-way should be widened to provide extra fill material only when the use of borrow pits would cause excessive damage to the land or disrupt existing land uses (e.g. agriculture)). Use of borrow pits (existing pits if possible) is preferred in all other cases. Where feasible, and where requested by the landowner, borrow pits may be converted into dugouts.
- 4.3.6 When designing borrow pits and other excavations, the area to be disturbed should be minimized. Excavations should be designed to facilitate future reclamation, including stripping of the topsoil prior to excavation. The topsoil is then replaced as part of the reclamation operation.
- 4.3.7 In Provincial Forests, borrow pits require separate authorization and permits under The Resource Land Regulations. They should also be planned as part of the entire proposal for road development so as to avoid adding borrow pits during construction.

4.4 Design of Drainage and Erosion-Control Structures

- 4.4.1 The degree of erosion likely to occur in erosion-hazard zones should be assessed by the developer and effective erosion-control measures appropriate to the site designed. The preferred approach is

revegetation, using special techniques (e.g. erosion control blankets, fertilizing, mulching, hydroseeding) as required. Other general control measures which may be used in addition to or instead of revegetation are listed below in order of diminishing effectiveness:

- (i) use of geotextiles where appropriate;
- (ii) spreading crushed rock, gravel, or mats of non-erodible material (e.g. cellulose) on the surface. Steep slopes may require armouring of the surface with rigid structures;
- (iii) excavating cuts, serrations, or ditches perpendicular to the direction of flow (except in highly erodible soils);
- (iv) erecting soil or stone dykes perpendicular to the direction of flow;
- (v) straw bales (for temporary usage);
- (vi) compacting the soil surface;
- (vii) constructing terraces or reverse benches.

4.4.2 Erosion-control measures may be necessary in watercourses, especially when stream flows are constricted or changes are made in channel geometry. The flow may be deflected from potential erosion sites in waterways with slopes of less than 5 per cent. Energy dissipating structures (e.g. gabions, check dams, weirs) may be necessary for waterways with steeper slopes.

4.4.3 Parabolic and trapezoidal ditches are preferable to those that are V-shaped.

4.4.4 Dips, water bars, and cross drains should be specified on temporary roads (e.g. roads for skidding out timber) to prevent water from accumulating and eroding the trail. These control structures should be installed sufficiently close together to keep runoff water from attaining the velocity necessary to cause serious erosion and to limit the volume of runoff to that which can be diverted easily into areas where it can spread out and dissipate. These spreading areas should also be included in the design.

4.4.5 To prevent build-up of excessive runoff in ditches, cross-drainage should be specified wherever natural drainage crosses a road, and runouts should be provided to lead this runoff into non-erodible areas. The following formula may be used to determine optimum spacing of runouts:

$$\text{Spacing (metres)} = \frac{300}{\text{road centerline gradient (\%)}}$$

To prevent this silty water from entering surface waters directly, these runouts should discharge their water at least 8 m from any watercourse or waterbody plus 0.6 m for every per cent of slope. Evaporation pits should be constructed for saline runoff from saline areas.

4.4.6 Guidelines pertaining to design at stream crossings (Sections 4.5 and 4.6) should also be followed.

4.4.7 Ditches and road shoulders within stream or river valleys, or draining directly into stream or river valleys, should be revegetated to suitable

and acceptable grass species as soon as possible following road construction, as defined by Saskatchewan Environment and Resource Management.

4.5 Design of Approaches to Watercourses

- 4.5.1 To prevent excessive erosion and sediment deposition in watercourses, appropriate erosion-control measures must be designed for approaches and for toes and fills around bridges and culverts. Rip-rapping, mulching, seeding, or other stabilization measures shall be specified (Guideline 4.4.1).
- 4.5.2 Stream diversions and channelization will require a permit from the Approving Agency.
- 4.5.3 Where watercourse modification is required (e.g. channelization, construction of bridge abutments), the width of the stream should not be constricted by more than two-thirds. Culverts should be designed according to Section 4.6 of this document.
- 4.5.4 Reductions in width of right-of-way clearing at watercourse crossings shall be in accordance with the following (assuming safety can be maintained):
 - (i) in fill sections, to within 6 m of the fill slope;
 - (ii) in cut sections, to within 5 m of the top of the backslope.
- 4.5.5 The approach to watercourse crossings should be as nearly perpendicular to the channel as possible to minimize bank disturbance.
- 4.5.6 Asphalt and concrete curbs which concentrate road top runoff should be accompanied by off-take structures to prevent soil erosion in sensitive areas and in the vicinity of watercourses or waterbodies.
- 4.5.7 Guidelines pertaining to erosion control and design of stream crossings should also be followed (Sections 4.4 and 4.6).

4.6 Design of Stream Crossing Installations

- 4.6.1 All watercourse crossings, except temporary crossings (Section 5.6), low-level crossings and those where ferries are acceptable must include either bridge(s) or culvert(s).
- 4.6.2 Specifications regarding location, timing of construction, and type of crossing of roads encountering any watercourse must be submitted to the Approving Agency prior to construction.
- 4.6.3 Knowledge of stream flow characteristics and the aquatic resources of a stream is essential for adequate bridge or culvert design. Where such data are inadequate, a safety factor designated by the Approving Agency should be incorporated into the design.
- 4.6.4 Unless otherwise indicated by the Approving Agency, bridges are the preferred crossing structure for Class II streams and for streams that are actively eroding their banks. The Approving Agency may also specify use of bridges for other crossings.
- 4.6.5 Bridges should be designed wide and high enough to permit unrestricted passage of anticipated flood volumes plus debris for the

expected service life of the road.

- 4.6.6 Culverts must be used for all watercourse crossings where bridges are not physically or economically desirable, except low-level, ferry and certain temporary crossings.
- 4.6.7 Culverts should be laid a minimum of 20 cm below normal streambed elevation to enable a substrate of natural materials to establish.
- 4.6.8 If multiple culverts are required, adjacent culvert walls should be at least 1.8 m apart unless precluded by channel width.
- 4.6.9 Culverts should be designed and installed to ensure:
- (i) that the discharge is not directed at a potentially unstable stream bank;
 - (ii) that the culvert installation follows the existing stream gradient. Where an existing stream gradient is steep at the point of culvert installation, culvert design must compensate for the effects on fish passage of removing the natural substrate and of increasing water velocity through the culvert. The requirements of Guidelines 4.6.10 and 4.6.11 must also be met;
 - iii) that hydrostatic uplift does not develop at either end;
 - (iv) that they can handle the minimum design flood without upstream ponding as specified by the agency responsible for the particular type of road being constructed or that they can handle the design flood for the intended life span of the road in the case of non-permanent crossings.
 - (v) that potential for accumulation of ice inside the culvert is minimized.
- 4.6.10 All culvert installations on fish-bearing streams must be installed in sufficient size and/or numbers to ensure that average cross-sectional water velocities do not exceed 1.2 m/s in culverts under 25 m long and 2 m/s in culverts over 25 m long during the period when fish are migrating in that stream. This requirement may be waived if it can be satisfactorily demonstrated that the culvert design includes a selected region wherein velocities are low enough to permit fish passage. This selected region should be continuous throughout the culvert length and of sufficient size to permit the fish to locate it and to swim through it without encountering obstructions (e.g. heads of bolts).
- These velocity criteria for the migration period are waived for the duration of the delay period in which culverts are permitted to be impassable to fish (Guideline 4.6.11).
- 4.6.11 Culverts may be impassable to fish for not more than three consecutive days during a median annual flood event (a flood with a recurrence interval of two years) or for not more than seven consecutive days in a 1:50 year flood.
- 4.6.12 The specifications in 4.6.10 and 4.6.11 are not required if it can be satisfactorily demonstrated that fish do not utilize a specific watercourse or that peak flows do not coincide with fish movement at a particular culvert. Several years' data on a stream are generally

necessary to satisfactorily define the sequence of fish movements versus that of flood peaks. Provisions to maintain water quality must still be incorporated into the design.

4.6.13 Culvert designs in order of preference for fish passage are:

- (i) arch or box culverts with a natural substrate bottom;
- (ii) arch culverts of unit construction;
- iii) horizontal ellipse culverts;
- (iv) conventional circular culverts.

4.6.14 Guidelines pertaining to erosion control and design of approaches to watercourses should also be followed (Sections 4.4 and 4.5).

4.7 Special Design Considerations

4.7.1 Specifications regarding location, timing of construction and type of crossing of roads encountering any major wetland, area of permafrost, extensive sand hills, or other unstable or special interest area should be submitted to the Approving Agency prior to construction.

4.7.2 The Approving Agency may specify that warning devices (e.g. signs, deer flashers) and other safety features such as deer fencing should be incorporated into the design of roads crossing habitat important to large mammals.

4.7.3 When elevation of the roadbed to facilitate road maintenance is considered, the increased potential for the road to become a barrier to wildlife movements should also be considered. This is particularly important where a road must intersect major big game or furbearer migration routes.

4.7.4 Roadway design should allow for the safe movement of wildlife and livestock under or across the roadway. Where wildlife are expected to attempt to cross the road frequently, road design should be developed in consultation with the Approving Agency and the authorities with responsibility for wildlife within Saskatchewan Environment and Resource Management.

4.7.5 The number of access roads leading to the route should be minimized.

4.7.6 Road design should consider effects of alignment, profile and cross-section on scenic landscape. Scenic and public roads should be designed to take advantage of areas of existing visual interest, through means such as:

- (i) highlighting views of interesting, unique, or typical features such as lakes, streams, rock formations, valleys, woodlands, and farm land;
- (ii) attempting to achieve a good relationship between open space and dense forest in woodlands (e.g. use of selective plantings and clearings). Clearings to allow scenic views should be opened only after construction is complete so that the finished road can be observed and improvements made in conjunction with other roadside developments.

- 4.7.7 Where access and haul roads intersect a right-of-way or cross visually sensitive areas, their visual impact may be reduced through screening with vegetation so long as adequate sight distance is maintained.
- 4.7.8 Maintenance areas should be set back an adequate distance from the highway, and existing vegetation and ground forms around such areas should be preserved. Special drainage may be required to prevent water quality damage from the leaching of salt and gravel stockpiles.

5. CONSTRUCTION

5.1 Contracts and Surveillance

- 5.1.1 Construction contracts should be explicit in describing the environmental protection measures to be fulfilled by the contractor. Road developers must ensure that these requirements have been executed to the satisfaction of the Approving Agency.
- 5.1.2 The proponent is encouraged to assign a qualified individual as an environmental monitor to each road project to direct and monitor implementation of environmental protection measures.
- 5.1.3 Construction activities may be inspected by the Approving Agency. Modifications and corrective measures requested by the Approving Agency should be considered immediately by the proponent and/or contractor and implemented within a reasonable time so as to avoid potential impacts.
- 5.1.4 The Approving Agency may conduct post-construction inspections.
- 5.1.5 Prior to commencing right-of-way preparation, the proponent should ensure that all construction employees receive training which emphasizes prevention of environmental damage as a primary goal, with restoration as an acceptable alternative only when damage is unavoidable.
- 5.1.6 All permits and authorization must be in place prior to construction commencing.

5.2 Scheduling

- 5.2.1 Construction in muskeg, permafrost and other sensitive terrain is generally least disruptive in fall and winter subject to the limitations of Guidelines 5.2.3.
- 5.2.2 Construction should not be carried out during spring runoff and during heavy rains except where remedial action is required to prevent flooding or serious erosion and at the sites of major structures or excavations.
- 5.2.3 Construction should be scheduled to avoid disturbance within 3 km of critical wildlife habitat as designated by Saskatchewan Environment and Resource Management [see Guidelines 2.2.1 (i) and (ii)], during periods when the wildlife are particularly sensitive. A 500m reservation is required in forested areas. In general, these critically sensitive periods are:

- (i) for most birds of prey (raptors):
 - northern regions (May 1 to July 30);
 - southern regions (March 15 to June 30);
- (ii) for colonial birds (terns, gulls, herons, cormorants and similar species) - the breeding season (breakup to July 15);
- iii) for big game and upland game birds:
 - January 1 to April 30;
 - very high sensitivity from late February to late March for big game.
 - for Barren ground caribou, both early winter and late winter during migration as identified by Wildlife Branch.

5.2.4 Stream crossing construction activities which could affect fish activity or sedimentation should not be constructed when spawning or migrating fish occur in the stream. Critical dates for spring spawning species are between April 15 and June 1 and for fall spawning species, between September 15 and November 1. Information on specific streams may be obtained from Fisheries Branch, Saskatchewan Environment and Resource Management. Exceptions to these dates must be obtained from the Approving Agency.

5.2.5 The construction schedule should allow for any archaeological reconnaissance and salvage deemed necessary by Saskatchewan Municipal Government.

5.3 Clearing, Grubbing and Earthwork

5.3.1 Clearing, grubbing and earthwork should be carried out in accordance with the guidelines for design of these operations (Sections 4.2 and 4.3). On Crown land, these activities are controlled by Environment and Resource Management, Forestry Branch.

5.3.2 Clearing should not be undertaken far in advance of construction where erosion could be a problem.

5.3.3 Stumps should not be grubbed within 2 m of standing timber in order to minimize damage to the roots of the standing trees.

5.3.4 Vegetation outside the right-of-way clearing boundary must not be cut or otherwise damaged, although selective removal of tall trees may be specified for the purposes of safety and road integrity. In such instances, disturbance of the ground cover shall be minimized. Trees may be felled by hand towards the road, and any necessary skidding done from the roadbed, or felled away from the road and either left there or lopped and scattered in the brush.

5.3.5 In permafrost areas, there should be no disturbance of the ground surface off the roadbed. Clearing should be done by hand and bulldozers should be equipped with "mushroom" shoes when working off the roadbed to avoid ditching and scalping of the surface.

5.3.6 When excavating slopes, use of "U" blades on bulldozers provides better control over excavated material. Unless later cutting or filling will be required, slopes of greater than 3:1 should be cleared by hand

- and not bulldozed.
- 5.3.7 Topsoil required for revegetation should be stockpiled prior to excavating along rights-of-way and at borrow pits, gravel pits and other facilities.
 - 5.3.8 Topsoil which is to be stockpiled for more than six months should be stabilized with plant cover until the material is to be used in reclamation operations.
 - 5.3.9 Gravel pits should be worked so as to extract the maximum amount of material from the deposit. Reclamation can be aided by working from one side to the other and by keeping the actively exposed face as compact as possible. "The Guidelines for Environmental Protection During Development and Restoration of Sand and Gravel Pits", published by Saskatchewan Environment and Resource Management should be followed.
 - 5.3.10 There should be no clearing, grubbing or other disturbance of the ground surface within watercourse or waterbody reservations, except at specified crossings.
 - 5.3.11 Borrow material and gravel must be obtained outside watercourse and waterbody reservations except where this material is available within the reservation in the designated road cross-section. In general, borrow may not be removed from the channel of any stream which is fish bearing or contributes to a fish bearing stream. Removal of gravel from any stream requires a permit from Saskatchewan Environment and Resource Management and a quarrying lease.
 - 5.3.12 Machine clearing of the right-of-way should not continue into a watercourse reservation. An uncut vegetative buffer equal to the width of the reservation (Guideline 2.3.1) should be left on the right-of-way for as long as it is practicable. When both clearing and construction are to take place during the same winter, these requirements are waived.
 - 5.3.13 Clearing in heavily forested areas should be assisted by flagging each edge of the right-of-way. All merchantable material is to be salvaged.
 - 5.3.14 Where construction takes place in summer, erosion control measures should be started in some situations within 10 days of grading if the section is not built upon or further graded within that period. These situations include erosion prone or otherwise sensitive areas, situations where erosion could degrade adjacent streams or lakes, or where future restoration could be prejudiced by erosion in the interim. Stabilization should be initiated while grading is ongoing wherever feasible, and in all cases should be completed before freeze-up. Roads should not be rough graded beyond what can be completed in the current season.
 - 5.3.15 Long-term exposure of soil should be minimized in order to reduce erosion.
 - 5.3.16 For more detail on the development of borrow and gravel pits, please refer to the Guidelines for Environmental Protection During

5.4 Disposal of Debris

- 5.4.1 Vegetation, overburden, and other debris should be disposed of when construction in an area is complete. This may be accomplished by burning, burying, windrowing, or chipping. Existing conditions and/or imposed restrictions may preclude certain of these options in particular areas. (Brush disposal on Crown Land is controlled by Saskatchewan Environment and Resource Management's Forestry Branch and The Prairie and Forest Fire Act.)
- 5.4.2 Salvage of merchantable timber occupying a right-of-way must be carried out according to the requirements of the Approving Agency.
- 5.4.3 In ice-rich terrain, waste material may be stacked and burned only where subsidence due to thawing will not occur (e.g. where embankments or foundations will be located on rock surfaces).
- 5.4.4 Where debris is pushed into windrows, these windrows must be at least 4.5 m from standing timber. Windrows should be compacted and should not exceed 1.3 m in height.
- 5.4.5 A 6 m break should be left in each windrow at least once every 100 m to allow for lateral drainage and animal access. Windrows may also be placed on alternating sides of the right-of-way at 100 m intervals.
- 5.4.6 Debris may be buried within the designated right-of-way or in approved borrow pits.
- 5.4.7 Cleared brush and woody material may be chipped and used for mulch, but only in areas where it cannot wash away or be submerged in standing water.
- 5.4.8 In erosion sensitive terrain, woody debris may be compacted and placed on the right-of-way across the direction of runoff.
- 5.4.9 Debris should not be piled on or left overhanging property outside the right-of-way. Disposal outside the right-of-way or in borrow pits must be arranged with the landowner/occupant and the Approving Agency.
- 5.4.10 Debris must be removed from watercourse or waterbody reservations and other places where there is a reasonable possibility that it could be transported into any watercourse or waterbody.

5.5 Construction of Permanent Stream Crossing Facilities

- 5.5.1 Stream crossing facilities should be constructed in accordance with the guidelines for design of these facilities (Sections 4.5 and 4.6).
- 5.5.2 Construction equipment should enter watercourse reservations only at previously identified stream crossings. No instream activity should be undertaken unless essential to installation of stream crossing structures.
- 5.5.3 No waste construction material (e.g. concrete, lime, creosote or fill) or debris shall be allowed to enter a stream. When such materials are inadvertently added to a stream, they must be removed with as little disturbance as possible, by hand if necessary and if safe. Appendix III

lists environmental spill control regulations that must be followed when a spill occurs.

5.5.4 In most cases, construction of a coffer dam should be done prior to excavation for piers, abutments, and footings within a flowing stream. This is especially significant where important downstream fish habitat exists.

5.5.5 Where a stream diversion is approved (Guideline 4.5.2), a plug should separate the old and new channels during excavation. When filling the diversion, erosion can be reduced by removing the plug on the downstream end first and allowing the water to reach its natural level before removing the upstream plug. Once diversion into the new channel is complete, the old channel should be filled with excavated material or provided with a suitable means of drainage, such as an outlet or culvert.

5.6 Stream Crossings on Temporary and Winter Roads

5.6.1 Temporary stream crossings should abide by the same environmental constraints as permanent crossings. They should be located and designed so as to minimize interference with natural river conditions. Major temporary crossings, such as Bailey bridges and culverts, should be designed and constructed according to the same criteria as for permanent crossings. Serious consideration should be given to native timber bridges as a substitute for culverts, particularly on development roads.

5.6.2 In general, temporary crossings must be completely removed prior to spring breakup unless they are designed and constructed to handle peak runoff.

5.6.3 Following removal of temporary crossings, the area should be restored to as near its original condition as possible. If terrain damage has occurred, the area should be recontoured and revegetated to prevent excessive erosion.

5.6.4 Temporary summer crossings may be facilitated with metal or log skid bridges. Their use should be avoided in winter, if possible (Guideline 5.6.6).

5.6.5 Temporary summer crossings of gullies or intermittent streams should use only metal or wooden culverts. Filling the stream channel with soil or other materials should be avoided.

5.6.6 Winter crossings of ice covered streams may be facilitated by ice and snow bridges. Bridges of this type must be channelized before spring breakup and must in no way obstruct the natural flow of water or movement of fish in the stream or adversely affect fish overwintering areas. Debris may not be used, and logs should be avoided since they may freeze in, becoming impossible to remove and causing ice jams in spring.

5.6.7 Temporary crossings, other than those described above, may be allowed after consultation and agreement with the Fisheries Branch,

Saskatchewan Environment and Resource Management.

- 5.6.8 Approaches to ice bridges should be located where bank cuts will not be necessary. A snow pack of sufficient thickness to completely protect stream banks and the vegetative cover should be in place before the ice bridge is used.
- 5.6.9 Watercourses may be forded only where it is essential and with authority of the Approving Agency. Any such crossings should be made along the centerline of the proposed right-of-way, and any damage to the site should be repaired immediately.

5.7 General Road Construction Guidelines

- 5.7.1 Equipment should be confined to the right-of-way except in unusual circumstances.
- 5.7.2 All archaeological historical or vertebrate paleontological remains, fortuitously discovered during road construction, must be reported to Archaeological Resource Management, Heritage Branch- Saskatchewan Municipal Government. Upon locating such remains, all land altering activities within 30 m of the discovery site should cease. Work may resume in this area only after receiving an appropriate directive from that department.
- 5.7.3 Camps associated with any development activity must not be located within stream or lake reservations (Guideline 2.3.1).
- 5.7.4 Construction camps should be located and operated in accordance with the requirements of the Approving Agency.
- 5.7.5 Disposal of camp wastes must meet the requirements of the Approving Agency.
- 5.7.6 Most rural municipalities with zoning bylaws permit temporary construction camps at the discretion of Council and require a development permit.
- 5.7.7 Fuel caches must not be located within stream or waterbody reservations or where there is a potential for any spills to enter streams or lakes. They should be on flat or gently sloping ground and should be dyked to at least 125 per cent of the total capacity of the storage containers. Dykes should be construction of impermeable material or lined to ensure that petroleum products cannot escape from the dyked area. Spill control regulation should be observed at all times.
(Appendix III)
- 5.7.8 For developments which depend on the use of lakes for access by aircraft and include trail or road construction only as an incidental activity, stream and waterbody reservations (Guideline 2.3.1) may be altered in so far as they apply to locations of temporary camps and fuel caches as long as the camps and fuel caches are located above the normal high water mark of the lake or stream.
- 5.7.9 Contingency plans for the suppression of fires that are related to or may affect construction and for the clean-up of spills should be prepared prior to construction. The necessary equipment should be in place and

appropriate staff trained and fully familiar with this equipment and relevant procedures prior to starting construction. This is particularly important when construction schedules coincide with periods and localities of high fire risk.

- 5.7.10 Compliance with The Environmental Spill Control Regulations is essential. Significant spills of fuels, lubricating oils, asphalt, or other petroleum products (see Appendix III) must be reported immediately to Saskatchewan Environment and Resource Management (24 hour number: 1-800-667-7525) and to the Approving Agency.
- 5.7.11 Harassment of wildlife is prohibited. Wildlife encountered on the right-of-way must be allowed to leave at a leisurely pace.
- 5.7.12 Wildlife should not be fed. All garbage/refuse must be removed to an approved landfill site.
- 5.7.13 Firearm(s) should be discouraged in any construction camp. Control and destruction of nuisance and problem wildlife is governed by Saskatchewan Environment and Resource Management -Wildlife Branch.
- 5.7.14 Washing of any type of equipment or machinery in streams or lakes or on sites where wash water may enter a stream or lake is prohibited.
- 5.7.15 Summer construction should be avoided in permafrost areas. If summer activity is essential, wide-tracked bulldozers should be used in high land areas and only balloon-tired vehicles should enter wetlands.
- 5.7.16 When constructing across permafrost, fill material should be placed directly on undisturbed vegetation using end-haul techniques.
- 5.7.17 Winter roads should not be used for vehicular traffic until at least 10 cm of snow have been packed and frost has penetrated the ground to a sufficient depth to support the equipment without damaging the ground surface. To achieve this, passage of at least 310 degree days ($^{\circ}\text{C}$) or 550 degree-days ($^{\circ}\text{F}$) of frost is recommended.

6. RECLAMATION

6.1 Right-of-Way Reclamation

- 6.1.1 Detailed reclamation plans should be developed in co-operation with the Approving Agency.
- 6.1.2 Reclamation should commence as soon as possible after construction so that erosion will not have a chance to start. Erosion-prone and visually sensitive areas should have highest priority. Where plantings are undertaken, an attempt should be made to achieve as natural a transition as possible between the right-of-way and the surrounding vegetation.
- 6.1.3 Where topsoil has been stockpiled, it should be spread over the area to be reclaimed prior to revegetation.
- 6.1.4 If fall seeding is planned, it should be done at least 21 days before the mean daily temperature is below 5°C in order that ground cover can develop before winter.

- 6.1.5 Plant species and varieties should be selected for their known ability to establish a self-sustaining, soil stabilizing cover under the climatic, topographic, and soil conditions at the site. Species native to the area are preferable. Brome grass should generally not be used as it is considered to be an invader and not necessarily wildlife-friendly.
- 6.1.6 Special seeding techniques, such as hydroseeding, sodding or seed-impregnated jute, are recommended for slopes which may be subject to serious erosion. Other drainage and erosion control measures may also be indicated (Section 4.4).
- 6.1.7 Where erosion has occurred, the affected area should be recontoured and revegetation promoted.
- 6.1.8 Where salt may be used to control snow and ice, the following should guide revegetation:
 - (i) salt-sensitive plants should be at least 15 m from the nearest edge of the road surface;
 - (ii) moderately salt tolerant plants should be at least 10 m from the nearest edge of the road surface;
 - (iii) salt tolerant plants should be used within 10 m away from the nearest edge of the road surface.
- 6.1.9 Gravel pits and spoil piles should be restored prior to abandonment, and disposal of debris should be in accordance with Section 5.4. Reclamation of depleted areas should commence while the pit is in operation. The open face of an operating gravel pit may remain unreclaimed pending extraction of the remainder of the gravel. The Guidelines for Environmental Protection During Development and Restoration of Sand and Gravel Pits should be followed when sand and gravel pits are used to obtain material.
- 6.1.10 Reclamation of gravel pits and borrow pits (except dugout-type borrow pits) should include:
 - (i) recontouring so that the pit will blend into the surrounding landscape or will function as a pond. In general, final slopes should not be in excess of approximately 1:3;
 - (ii) spreading topsoil (saved upon opening the pit) evenly over the surface;
 - (iii) revegetating, subject, where applicable, to the landowner's wishes.

7. MAINTENANCE

7.1 Right-of-Way Maintenance

- 7.1.1 New rights-of-way and previously identified problem areas should be inspected annually to detect soil erosion and unsuccessful revegetation. Remedial measures should be taken promptly, in accordance with the guidelines for design, construction and reclamation (Sections 4, 5 and 6).
- 7.1.2 Structures intended to reduce traffic hazards to wildlife, such as informational signs, deer flashers and fencing, should be inspected and

- repaired soon after snowmelt.
- 7.1.3 Locations where vehicle-animal collisions frequently occur should be examined carefully in co-operation with the authorities responsible for wildlife management. To the extent that it is feasible, measures to minimize the risk of collisions should be put into place at problem sites. Experience relating to situations and designs likely to cause problems with wildlife should be incorporated when routing/designing new roads.
 - 7.1.4 Care should be taken that oil, asphalt and tar are restricted to the road surface during application. It is particularly important that these materials not enter surface waters.
 - 7.1.5 Right-of-way maintenance should be no more intensive than is required to preserve integrity of the road and ensure safe operation. Regrowth of understory woody and herbaceous vegetation should be permitted subject to considerations of safety and proper road function.
 - 7.1.6 Where brush control is required after initial clearing, cutting (by hand in sensitive areas) is preferable to spraying.
 - 7.1.7 Herbicides may be used for brush control, subject to Guideline 7.1.8 and to the application standards of the Approving Agency. Criteria to be used in selecting herbicides should include lack of toxicity to man and animals, non-corrosiveness and non-volatility.
 - 7.1.8 A minimum reservation of 25 m should be provided between areas where herbicides are applied and the edge of watercourses or waterbodies. The remaining portion should be cleared by hand. (Note that ground spraying within 25 m and aerial spraying within 50 m of waterbodies or watercourses requires a permit from the Water Quality Branch, Saskatchewan Environment and Resource Management.) Regulations governing spraying around recreational and inhabited areas must also be followed.
 - 7.1.9 Mowing and spraying should be scheduled wherever possible for after August 1, to avoid birds' critical nesting/rearing period. Mowing before this date should be restricted to a narrow strip adjacent to the edge of the road surface.
 - 7.1.10 Drainage and erosion control installations, including sediment traps and vegetation buffers, should receive regular maintenance.
 - 7.1.11 Gravel or dirt windrows near stream crossings shall be broken at frequent intervals and in erosion resistant areas to permit sheet runoff from the road surface to enter the roadside ditch where it can be led away by runouts.
 - 7.1.12 Access roads should be maintained in a usable condition or removed.
 - 7.1.13 Where unexpected chronically unstable soils (slides, slumping, severe erosion) are encountered within the right-of-way, appropriate investigations, redesign and remedial action should be undertaken without delay.
 - 7.1.14 Material cleared from ditches should be placed where it cannot be washed or blown into waterbodies or watercourses.

- 7.1.15 Where off-road melting occurs in permafrost areas, melt water should not be drained away unless accumulations are more than 20 cm deep or cause a hazard; such melt pools should be allowed to refreeze. Remedial action is required if these melt ponds do not freeze to the bottom.
- 7.1.16 Lengthy snow windrows should have pushed out openings at least once every 100 m wherever the road crosses areas utilized by ungulates during winter. These openings should be in similar locations to breaks left in debris windrows and openings on either side of the road should be opposite each other. The windrow height for which this is necessary depends upon the wildlife species present in an area.

7.2 Maintenance at Stream Crossings

- 7.2.1 Newly installed culverts and bridges and those with a history of being blocked by debris or in-culvert icings must be inspected prior to freeze-up and during break-up, and debris and in-culvert icings cleared. This is particularly important on streams known or suspected to have spring fish migration.
- 7.2.2 Remedial measures should be taken where culvert design (Section 4.6) is proven inadequate for unimpeded drainage and/or fish migration.
- 7.2.3 Newly constructed approaches to watercourses or those with a history of erosion should be inspected each summer to evaluate bank stability and to recommend necessary remedial action.
- 7.2.4 Materials for road repair must not be taken from stream beds or from waterbody or watercourse reservations.
- 7.2.5 Appropriate guidelines for maintenance of the right-of-way (Section 7.1) should be implemented at watercourse crossings.

8. DECOMMISSIONING AND ABANDONMENT

8.1 Roads

- 8.1.1 Consideration should be given to decommissioning roads which will not be used for a reasonable period of time (in general, 5 years). Decommissioning should be done in a manner determined by the Approving Agency. Special attention should be paid to controlling access along abandoned roads.
- 8.1.2 Abandoned roads should be reclaimed so that as much as possible of the original forest, wildlife, agricultural or other productivity is restored or allowed to grow back.
- 8.1.3 Recontouring and revegetation should be done as necessary to restore the visual quality of the site. Plantings should be checked in subsequent years to ensure satisfactory results.

8.2 Stream Crossing Structures

- 8.2.1 Abandoned water diversion structures should be removed or plugged and stabilized.

- 8.2.2 Stream crossing installations except bridges must be removed. Culverts should be salvaged, the channel restored, and all unstabilized fill material removed from the site.
- 8.2.3 Where erosion has occurred, the slopes should be stabilized and recontoured as required to repair damage and to prevent further erosion. If the slopes are very steep, they should be mulched or seeded to enable natural vegetation to establish itself.
- 8.2.4 All temporary facilities, equipment and waste construction materials should be removed and the sites reclaimed in a manner acceptable to the Approving Agency.
- 8.2.5 Temporary stream crossings must be removed prior to spring breakup.

APPENDIX I

DEFINITIONS

Access Road - A road, often designed, constructed and maintained to relatively low standards, which facilitates entry to a previously remote area.

Approving Agency - The Agency responsible for approving the construction activity, as outlined in Appendix II.

Buffer - An area or strip of land which acts as a zone of transition or protection between two types of land uses (see also Reservation).

Canada Land Inventory (CLI) - A comprehensive survey of land capability and use for various purposes (agriculture, forestry, wildlife and recreation). Inherent productivity of each land area is expressed in terms of classes, Class 1 having the best and Class 7 the lowest productive capability.

Class 1 Stream - A stream of 1st, 2nd or 3rd order with a gross drainage of less than 50 km² and lacking commercial or game fish species (see also Stream, Stream Order, Watercourse).

Class II Stream - A stream of order 4 or larger, or a stream with a gross drainage of more than 50 km² or having commercial or game fish species at least on a seasonable basis (see also Stream, Stream Order, Watercourse).

Contingency Planning - A planning strategy directed towards meeting crises which may occur but which are not necessarily highly likely.

Corridor - A linear area through which a facility such as a highway, railway, pipeline or electrical transmission line is routed. Selection of a corridor, which may be several kilometres wide, is normally the first step in locating a new linear facility.

Critical Habitat - A part of the natural environment of a species of plant or animal which is essential for survival of a significant number of individuals of that species during at least part of the year (e.g. waterfowl staging area, deer winter range, fish spawning area).

Degree Days of Frost - Unit that represents one degree of declination from the freezing point in the mean daily outdoor temperature.

Environment - The aggregate of conditions which influences the life of an organism or society; the surroundings of a plant or animal, including man.

Environmental Monitor - A qualified individual whose responsibility is to ensure that protection measures are being carried out adequately in the field, and who can

provide direction to field personnel on ways to minimize potential or unforeseen environmental impacts.

Fish - Means fish as defined in The Fisheries Act, R.S.C. 1970 c. F-10.

Guideline - A recommended or acceptable course of action.

Habitat - The environment, usually the natural environment, in which a plant or animal lives.

Hydroseeding - Spraying of seed in water, possibly mixed with mulch and fertilizer.

Impact - The effect or consequence of a given action. Impacts may be beneficial or adverse (see also Mitigation).

Master Plan - A comprehensive, long-range, general plan for development and future management of a new undertaking, such as a road. The plan should incorporate objectives for the new facility.

Mitigation - An action taken to lessen the effect of another action, generally said of adverse effects or impacts (see also Impact).

Muskeg - A northern swampy forest, with a moss cover, tussocky sedges, and a more or less open growth of scrubby timber.

Palsa - A dry "island" usually raised above the level of the surrounding large area of saturated peat and commonly providing important habitat for small mammals.

Reclamation - The process of returning disturbed land to a condition and productivity as close as possible to that which existed prior to the disturbance (see also Revegetation).

Reservation - A strip of undisturbed vegetation along a watercourse or waterbody left to protect the water from the effects of disturbance on adjacent land. Reservation width is measured on each side of a stream from the top of the stream bank, and on lakes from the lakeward edge of terrestrial vegetation (see also Buffer).

Revegetation - Re-establishment and redevelopment of a vegetative cover on a disturbed area. This may be effected through natural colonization by plants from other areas or through the direct action of man, for example by reseeding or reforestation (see also Reclamation).

Right-of-Way - That specific strip of land on which a road, including ditches, is constructed (see also Road, Route).

Road - A prepared way for travelling by truck or car in non-urban areas, and

including highways, trails, logging roads, winter roads and temporary roads (see also Right-of-Way, Route).

Route - A generally narrow strip of land somewhere within which the actual right-of-way will be selected and the linear facility (e.g. a road) constructed (see also Right-of-Way, Corridor).

Rural - All parts of Saskatchewan which are outside organized urban areas.

Sand Hills - Any large, more or less continuous area of which the surface deposits consist primarily of unconsolidated sands.

Sensitive Terrain or Area - An area characterized by one or more special features, such as: unique or impeded drainage, steep slopes, unstable soils, unstable geologic structure, permafrost, or an adverse climate restricting plant growth (e.g. tundra).

Stream - A natural watercourse; a general term for a body of water flowing continuously or intermittently within a defined channel and banks (see also Class 1 Stream, Class II Stream, Stream Order, Watercourse).

Stream Order - A system of classifying streams, as follows: Tributaries at the head of a stream system are designated as 1st order streams. Two 1st order streams join to form a 2nd order stream, two 2nd order streams join to form a 3rd order stream, and so on. Stream designations are derived from 1:50,000 topographic maps (see also Class 1 Stream, Class II Stream, Stream, Watercourse).

Visual Sensitivity - The degree to which man-made changes may be seen in the landscape and the potential of these changes to degrade scenic quality.

Waterbody - A natural or man-made body of standing water, including lakes and ponds (see also Stream, Watercourse).

Watercourse - A natural or man-made channel through which water flows, as for example a river or creek (see also Class I Stream, Class II Stream, Stream, Stream Order).

Wetland - Permanently wet or intermittently water covered areas, such as swamps, marshes, bogs, muskegs, slough and potholes (see also Muskeg).

Wildlife - Means wildlife as defined in The Wildlife Act, R.S.S. 1979, cw-13.1 and Regulations.

Winter Road - Any type of road or trail built of snow, ice or a mixture of mineral soil, snow and ice, that remains functional only during the winter season.

APPENDIX II

LIST OF APPROVING AGENCIES

- A. The Approving Agency, as referred to in Section 1.2.2 of the Guidelines for Environmental Protection During Road Development, is specified below for various developers. Any changes in the application of these guidelines are to be made only through consultation with and agreement by the Approving Agency.
1. Saskatchewan Environment and Resource Management, Forestry Branch, is the Approving Agency for any road requiring a Timber Permit within the Provincial Forest. This includes roads constructed by:
 - (a) forest harvesting companies;
 - (b) mining companies;
 - (c) Saskatchewan Power Corporation;
 - (d) Saskatchewan Telecommunications;
 - (e) Saskatchewan Highways and Transportation (on behalf of rural municipalities);
 - (f) Saskatchewan Environment and Resource Management, Operations Section;
 - (g) Resource users such as outfitters and wild rice operators
 2. The Department of Highways and Transportation is its own Approving Agency for roads it builds outside the Provincial Forest.
 3. Saskatchewan Highways and Transportation is the Approving Agency for all roads (e.g. primary grid roads, main farm access roads, resort roads, oil and industrial access roads and access roads to regional parks outside the Provincial Forest) that are constructed by Municipal Government.
 5. Saskatchewan Environment and Resource Management, Parks and Protected Areas Branch, is the Approving Agency for any road construction on lands set aside under The Provincial Parks, Protected Areas, Recreation Sites and Antiquities Act.
- B. Where technical aspects of a particular situation are not within the expertise of the indicated Approving Agency, then the Agency will normally consult with and/or refer a proponent to the department or agency possessing the relevant technical capabilities. These include:
- on issues relating to fish - SERM, Fisheries Branch
 - on issues relating to wildlife - SERM, Wildlife Branch

- on issues relating to the removal and harvest of forest vegetation - SERM, Forestry Branch
- provincial and regional parks, recreation sites, historic sites, protected areas and proposed park land or protected areas - SERM, Parks and Protected Area Branch.
- special areas - SERM
- reclamation - Saskatchewan Agriculture and Food
- heritage resources- Saskatchewan Municipal Government, Heritage Branch
- access to highways - Saskatchewan Highways & Transportation

C. Section 8 of The Environmental Spill Control Regulations requires that:

Immediately after a spill, and subject to any order made by the minister pursuant to section 12.21 of the Act, the person having control of a pollutant which is spilled and the owner of a pollutant which is spilled shall take all reasonable action, having due regard for the safety of the public and themselves, to:

- (a) prevent further discharge of the pollutant;
- (b) contain the spilled pollutant;
- (c) minimize the effects of the spill; and
- (d) restore the area affected and the environment as nearly as possible to its condition immediately prior to the spill.

* SERM- Saskatchewan Environment and Resource Management

APPENDIX III EXCERPTS FROM THE ENVIRONMENTAL SPILL CONTROL REGULATIONS

A. Petroleum product spills to be reported under the Environmental Spill Control Regulations

Column I	Column II	Column III	Column IV	Column V
Pollutant	Form, Character or Concentration	Spills to be Reported if amounts Equal or Exceed		Time Period
Petroleum and Petroleum Products		Onsite	Not Onsite	
1. Gasoline	liquid	200 L	100 L	24 hr
	liquid from above ground container	500 L		any period
	liquid from below ground container	any sub-surface loss		any period
2. Diesel Fuel	liquid	200 L	100 L	24 hr
	liquid from above ground container	500 L		any period
	liquid from below ground container	any sub-surface loss		any period
3. Bunker Oils	liquid	200 L	100 L	24 hr
Aviation Fuel, Jet Fuel	liquid from above ground container	500 L		any period
Kerosene, Stove Oil	liquid from below ground container	any sub-surface loss		any period
4. Lubricating Oils	liquid	100 L	50 L	24 hr
5. Asphalt	liquid	500 L	100 L	24 hr
6. Other Petroleum Products	liquid	100 L	50 L	24 hr

NOTES:

- "Onsite" means on and completely contained within the boundaries of property owner or occupied by the owner of a pollutant or the person having control of a pollutant.
- Extracted from The Environmental Spill Control Regulations. Full reporting requirements are found only in the Regulations.

APPENDIX "C"

GUIDELINES FOR
ENVIRONMENTAL PROTECTION DURING
DEVELOPMENT AND RESTORATION OF
SAND AND GRAVEL PITS

Environmental Assessment Branch
Saskatchewan Environment and
Resource Management

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INTRODUCTION

These guidelines are a selection of environmentally desirable procedures recommended by Saskatchewan Environment and Resource Management to public and private developers and operators of sand and gravel pits. Applying relevant points as is appropriate at each active pit site will assist operators in preventing unnecessary environmental disruption, while at the same time promoting a productive afteruse of the area, providing for public safety, and reducing adverse effect on adjoining property. The guidelines address these three principal phases of pit operation: planning, operation, and restoration.

Although these guidelines apply to sand and gravel pits throughout the province, the diversity of situations in Saskatchewan means that A PARTICULAR GUIDELINE'S RELEVANCE TO A SPECIFIC PIT WILL DEPEND ON SUCH FACTORS AS PIT LOCATION AND CHARACTERISTICS AND THE FEASIBILITY OF SPECIFIC AFTERUSES AT THE SITE. For instance, a pit in an isolated northern area may be developed and the area restored in a markedly different manner than would a pit adjacent to a southern, urban centre. NOT EVERY RECOMMENDATION CAN OR SHOULD BE APPLIED TO EVERY PIT. Rather, on-site evaluation and cooperation amongst the operator, the public, and government agencies is recommended so that the most appropriate environmental measures may be selected and implemented in each case.

1. REGULATION OF SAND AND GRAVEL OPERATIONS IN SASKATCHEWAN

These guidelines neither substitute for, nor preclude compliance with, regulations governing sand and gravel operations in Saskatchewan. This section reports the most common controls, but may not be all-inclusive. It is the operator's responsibility to identify and fulfil applicable requirements for each project and to contact appropriate approving agencies for additional information. THE ENVIRONMENTAL ASSESSMENT BRANCH OF SASKATCHEWAN ENVIRONMENT AND RESOURCE MANAGEMENT WILL ASSIST PIT DEVELOPERS AND OPERATORS IN IDENTIFYING THESE REQUIREMENTS IF CONTACTED BY THE PROPONENT.

- 1.1 Saskatchewan Energy & Mines - issues quarrying leases and licenses for removal of sand and gravel from Crown lands.
- 1.2 Saskatchewan Environment and Resource Management, Sustainable Land Management Branch - regulates extraction and related activities (eg., work camps, gravel washing, clearing, disposal of timber/debris) on Crown lands administered by the department. Fisheries Branch regulates developments within or adjacent to fishbearing lakes or streams.
- 1.3 Saskatchewan Municipal Government, Heritage Branch - protects archaeological, historical, architectural and paleontological resources.
- 1.4 Saskatchewan Agriculture - regulates extraction and related activities on Crown lands administered by this department.
- 1.5 Saskatchewan Environment and Resource Management - environmental protection legislation and regulations, including:
 - i) co-ordinating environmental screening and assessments;
 - ii) regulating spill control and clean-up;
 - iii) regulating air quality;
 - iv) regulating water quality, including disposal of wash water from certain gravel resources.
- 1.6 Saskatchewan Municipal Government - regulate subdivision of land.
- 1.7 Saskatchewan Highways and Transportation - regulates pits adjacent to highway rights-of-way.
- 1.8 Local Authorities - rural municipalities administer zoning bylaws.
- 1.9 Saskatchewan Water Corporation - regulates water-use related legislation and regulations including:
 - i) licensing use of surface and ground waters and pit dewatering;
 - ii) regulating surface drainage and diversion;
 - iii) regulating pits in reservoir development areas.

2. PLANNING AND SITING SAND AND GRAVEL PITS

2.1 The operator should prepare a sketch plan for his own use in planning preparation, extraction, and later restoration of the pit area prior to initiating work at the site. The plan should include the following types of information, as appropriate to the specific situation:

- site location in relation to nearby surface features, such as existing roads, railroads, buildings and utilities, and proposed access and haul roads;
- surficial outline of deposit(s) to be developed by the operator on that property in future;
- areas to be cleared;
- sites for stockpiles, debris, and overburden storage;
- depth and type of overburden (eg. topsoil, subsoil);
- drainage features to be affected or created;
- depth to water table at the pit site;
- location and depth to water in currently utilized farm water wells less than 10 m deep within 1 km of the pit;
- a general plan for site restoration (see Section 4), wherever possible. Designation of an appropriate afteruse for the depleted pit (Guideline 4.2) will guide later restoration.

2.2 Owner(s) or administrator(s) of adjoining property should be advised where possible prior to initiating excavation or activities such as crushing, and their concerns taken into consideration by the pit operator.

2.3 Set-back distances may be recommended or required by the landowner, the approving agency, or the local authority having jurisdiction, depending on the nature of the activity, zoning or similar land-use restrictions, adjacent land use, and the operator's

land purchase or leasing arrangements. Set-backs may be advised or required from land uses such as:

- seasonal or permanent residences;
- recreational developments or parks;
- areas zoned for urban residential use;
- public roads;
- ecological reserves, International Biological Programme "Candidate Natural Areas", and historically, archaeologically, or environmentally significant or sensitive areas.

2.4 Adverse aesthetic impacts of pits in visually sensitive areas may be reduced by advance planning and by steps such as the following, as appropriate and feasible:

- screening, including retention of existing trees around a pit, use of spoil berms, or in special cases, advance planting of trees or shrubs;
- early initiation of progressive restoration (Guidelines 4.3, 4.4);
- maintenance of adequate set-back distances.

3. OPERATING SAND AND GRAVEL PITS

- 3.1 Vegetation removal and exposure of bare soil should be minimized. Overburden removal should be restricted to the area that will be excavated in one year if substantial erosion of the cleared area is likely.
- 3.2 Slash and similar debris should be placed where it will not obstruct drainage patterns or enter any lake or stream. These materials may be windrowed, burned, buried, crushed, or shredded and stockpiled with the topsoil, or distributed over pit slopes following recontouring. The method of disposal should be selected in consultation with the landowner, approving agency, or local authority. It should reflect what is appropriate at the site and be in accordance with any designated afteruse.
- 3.3 The initial step in excavation should be the selective removal of available topsoil at those pit sites where this is feasible and where topsoil will be necessary to

carry out restoration plans. If the topsoil layer is very thin, or if stripping is to be done in winter, it may be preferable to remove the topsoil with the subsoil, rather than attempting to separate the layers.

This topsoil and/or subsoil should be stockpiled or used to restore depleted areas of the same pit (Section 4).

- 3.4 Erosion of topsoil and other spoil piles should be controlled, particularly if the piles will be stored for longer than two years. Seeding of spoil piles, preferably with alfalfa or clover, will limit erosion, maintain soil health, and control weeds.
- 3.5 Non-commercial materials should be stockpiled so as not to interfere with natural drainage and surface water flow pending their return to the pit during restoration.
- 3.6 The open face(s) should be no larger than necessary for efficient pit operation. Individual operators should exhaust material at one location in a pit, prior to opening a new face to remove a similar type and grade of material.
- 3.7 Water from pit dewatering should be recycled through any wash plant associated with the pit. Wash water should be directed to settling ponds and the clarified water reused in the wash plant. These ponds should not be in contact with the groundwater.
- 3.8 Active pits which may pose a threat to public safety (eg., those with steep backslopes or deep water) should be fenced, with warning signs erected and maintained by the pit operators.
- 3.9 Pit slopes generally should be left at not steeper than 4:1 when a pit is to be inactive for greater than two years. Pits inactive for a shorter period (eg., over winter) should have slopes less than 4:1 if they would otherwise threaten public safety.
- 3.10 Pit access or haul roads should be planned, designed, located, constructed, used, maintained and abandoned to promote public safety and minimize environmental disturbance.
- 3.11 Refuse and toxic or polluting materials should not be dumped onto an area designated for pit development or into an excavated pit, but should be removed to an approved landfill or similar facility.

- 3.12 All refuse, temporary structures, and unnecessary equipment should be removed from the site when excavation is complete. Non-commercial materials should be included in the rehabilitative earthwork. Open faces an unused sand, gravel, or other merchantable materials in or around should be stabilised pending future use, and the remainder of the pit restored.

4. RESTORING SAND AND GRAVEL PITS

- 4.1 The objective of pit restoration is to achieve an appropriate and productive afteruse of the disturbed site. Depending on the area involved, this normally consists of some combination of the following: smoothing and contouring slopes, replacing subsoil and topsoil, and revegetating.
- 4.2 Restoration should be recognized as an integral part of extraction, and should be included in pre-excitation planning. As part of this process, a practical afteruse should be selected as early as is possible. Factors to consider include: pit location and characteristics, availability of topsoil and water, the surrounding area, zoning and similar restrictions, and practicality and cost-effectiveness. The operator, landowner or other individual to whom title to the depleted pit will be transferred (if known), and the approving agency/local authority should undertake this planning jointly (see Guideline 4.4).
- 4.3 Progressive restoration, in which depleted sections of a pit are restored while extraction is ongoing in other sections of the same pit, is encouraged, particularly for large pits (see Guideline 4.4).
- 4.4 Post-excitation ownership of a pit or the restorative procedures and designated afteruse which will be preferred or required by the landowner/approving agency/local authority may be in substantial doubt prior to and during excavation. Where this is the case, it may not be advisable for the operator to delay intensive restoration or designation of any unusual or highly specialised afteruse until final agreements are reached. This does not reduce the necessity for basic environmental protection and restoration during excavation to ensure public safety, slope stability, overburden management, drainage, and erosion and weed control (reference should be made to the relevant guidelines in this document). Similarly, progressive restoration should not require intensive restoration (e.g. an "unimproved" wildlife area).

- 4.5 The landowner or approving agency/local authority may wish to negotiate a performance bond or other guarantee of acceptable performance and restoration with the operator before excavation commences.
- 4.6 Rehabilitative earthwork normally should include the covering of bare rock and subsoil. Nonuseable or nonsalable materials including overburden, screenings, and rocks should be placed in the pit bottom. Recontoured slopes generally should be no steeper than 4:1, where reasonably attainable and consistent with surrounding terrain and planned afteruse.
- 4.7 Any previously stripped topsoil (Guideline 3.3) should be applied to newly contoured slopes. Where amounts are inadequate to cover the entire area (a depth of 5cm to 10cm is commonly recommended), side slopes should receive priority treatment.
- 4.8 Revegetation as soon as possible after recontouring is the best way to stabilize slopes, control weeds, minimize erosion, and promote an aesthetic and productive afteruse.
- 4.9 The most essential aspect of revegetation is rapid establishment of a ground cover. Grasses are usually the best species for doing this. Fertilizers, including manure, will enhance growth. Spreading of slash on recontoured slopes will speed natural revegetation.
- 4.10 Underwater slopes should have a gentle grade where wildlife is to be encouraged.
- 4.11 The operator should restore, in a mutually agreeable manner, access and haul roads constructed by the operator and considered unnecessary by the final landowner.
- 4.12 Restoration should normally be finished within three years of completing excavation.

OCCUPATIONAL HEALTH AND SAFETY

1.0 Interpretation

1.1 In this appendix:

- (a) "absorbed dose", with respect to any medium, means the ionizing radiation energy absorbed per unit mass, expressed in grays;
- (b) "committed effective dose" means the sum of the weighted equivalent doses in all the organs or tissues of the body of a person from the intake of any radioactive substance, other than short-lived radon progeny or thoron progeny, during the period of 50 years immediately following the intake;
- (c) "competent person" means a person qualified by knowledge, training and experience to give advice on monitoring, protective measures and operating procedures to the Lessee, which will enable the Lessee to fulfil the requirements of this appendix relating to the protection of workers from exposure to radiation;
- (d) "department" means Department of Labour;
- (e) "director" means executive director of the Occupational Health and Safety Division of the Department of Labour;
- (f) "effective dose" means effective dose determined in accordance with section 5;
- (g) "employer" means a person, firm, association or body that has, in connection with the operation of a place of employment, one or more workers in the service of the person, firm, association or body;
- (h) "equivalent dose" means the product of absorbed dose and the appropriate radiation weighting factor set out in Table 1, expressed in sieverts;
- (i) "fractional effective dose" is defined by the formulae in subsections 5.2(1)(a) and 5.2(1)(b);

- (j) "mine", when used as a noun, includes an opening or excavation in, or working of the ground for the purpose of winning, opening up or proving a mineral, or of gaining a mineral, and also includes a quarry, excavation or opening in the ground made for the purpose of searching for or removing mineral, soil, earth, rock, quartz, stone or clay, and all ways, works, engines, machinery, plant, buildings, furnaces, roast yards and premises under or above ground used in connection with crushing, reducing, melting, refining or treating any mineral, soil, earth, rock, quartz, stone or clay;
- (k) "National Dose Registry" means the centralized record-keeping system containing the dose information for radiation workers in Canada that is maintained by the Radiation Protection Bureau of the Department of Health of the Government of Canada;
- (l) "radiation" for the purpose of this appendix means ionizing radiation and includes any atomic or subatomic particle or electromagnetic wave emitted or produced directly or indirectly by a machine or radioactive isotope and having sufficient kinetic or quantum energy to produce ionization;
- (m) "radiation worker" means a worker who, by his/her employment at a uranium mine, is likely to be exposed to an effective dose greater than five millisieverts in one year;
- (n) "worker" means, when used in the context of this appendix, any person employed by the Lessee or by any other employer commissioned by or contracted by or otherwise performing services for, the Lessee;
- (o) "radon progeny" means the following short-lived radioactive decay products of radon-222:
 - (i) polonium-218 (radium A);
 - (ii) lead-214 (radium B);
 - (iii) bismuth-214 (radium C);
 - (iv) polonium-214 (radium C');
- (p) "thoron progeny" means the following short-lived radioactive decay products of radon-220:
 - (i) polonium-216 (thorium A);
 - (ii) lead-212 (thorium B);
 - (iii) bismuth-212 (thorium C);
 - (iv) polonium-212 (thorium C');

- (q) "uranium" means the mixture of uranium-234, uranium-235, and uranium-238, as they occur in nature;
- (r) "weighted equivalent dose" is the absorbed dose, averaged over a tissue or organ, from a particular type of ionizing radiation, multiplied by the appropriate radiation weighting factor (Table 1) and multiplied by the appropriate tissue weighting factor (Table 2).
- (s) "working level" means:
 - (i) with respect to radon, the unit of concentration of radon progeny in air and is equal to the concentration of any combination of those radon progeny in one cubic metre (1 m^3) of air that has the potential to ultimately result in the emission of 2.08×10^{-5} joules of energy in the form of alpha particulate radiation; and
 - (ii) with respect to thoron, the unit of concentration of thoron progeny in air and is equal to the concentration of any combination of those thoron progeny in one cubic metre (1 m^3) of air that has the potential to ultimately result in the emission of 2.08×10^{-5} joules of energy in the form of alpha particulate radiation;
- (t) "working level month" means the unit of exposure to radon or thoron progeny that is equal to 1/170th of the summation for all periods of exposure in hours multiplied by the respective radon or thoron progeny concentrations expressed in working levels;
- (u) "year" means a calendar year;
- (v) "5 year dosimetry period" means a dosimetry period of five consecutive calendar years commencing on January 1, 1998, and every five years thereafter.

2.0 Duties of Lessee

- 2.1 The Lessee agrees to require any other employer at the mine to comply with *The Occupational Health and Safety Act, 1993*, *The Occupational Health and Safety Regulations, 1996*, *The Mines Regulations* and sections 2.6, 2.7, 2.8, 5.3, and 9.1 of this appendix, with any necessary modification.

- 2.2 The Lessee agrees to retain a competent person to advise the Lessee on all matters pertaining to this appendix.
- 2.3 The Lessee agrees to consult with the competent person on all relevant aspects of radiation health and safety.
- 2.4 The Lessee agrees to provide the competent person with adequate means to carry out his/her duties.
- 2.5 The Lessee agrees:
- (a) in consultation with the occupational health committee, to design and establish an occupational health and safety program that meets the requirements of section 13 of *The Occupational Health and Safety Act, 1993*, and section 22 of *The Occupational Health and Safety Regulations, 1996*.
 - (b) the occupational health and safety program will be in writing and readily available to the occupational health committee; and
 - (c) to require any other employers at the mine to participate in an occupational health and safety program that meets the requirements of section 13 of *The Occupational Health and Safety Act, 1993*, and section 22 of *The Occupational Health and Safety Regulations, 1996*.
- 2.6 The Lessee agrees to ensure that where an incident reportable to the director under section 3.5 or section 5.2 of this Appendix occurs at the minesite, the employer, in consultation with the occupational health committee, shall investigate the incident as soon as reasonably possible and prepare a written report describing the causes of the incident and any corrective actions taken to prevent a reoccurrence.
- 2.7 The Lessee agrees to ensure that:
- (a) the occupational health committee inspects working areas of the mine every month; and
 - (b) the occupational health committee keeps written records of the investigations required by section 2.6 and the inspections required by clause (a) and makes such records available to the director or designate on request.

- 2.8 The Lessee undertakes that the mine will be designed, developed and operated so that the exposure to radiation of any worker in that mine is as low as reasonably achievable, social and economic factors being taken into account.
- 2.9 In any building or on any equipment not associated directly with the mining, transport, beneficiation or storage of ore, mineral, uranium concentrate or tailings, the Lessee agrees to take all necessary steps to limit any removable surface contamination to levels below 37,000 becquerels per square metre averaged over any 0.01 square metre area.
- 2.10 The Lessee agrees to provide and implement a code of practice, acceptable to the director, which will specify the action to be taken when radiation levels specified in the code of practice occur including,
- (a) the monitoring of radiation levels and workers' radiation exposures;
 - (b) the posting of radiation levels;
 - (c) the prohibition or restriction of access to places or equipment;
 - (d) the control and correction of spills; and
 - (e) the procedure to be adopted during equipment failures and unusual operating conditions.

3.0 Monitoring

- 3.1 (a) The Lessee agrees that as soon as practicable before the commencement of operations at a mine, the Lessee will submit to the director, a program, acceptable to the director, for the monitoring of radiation levels and the determination of the effective dose received by workers.
- (b) The Lessee agrees that all workers:
- (i) who may receive an occupational external gamma dose greater than two millisieverts per year wear personal gamma dosimeters; and
 - (ii) who may receive a radon progeny exposure greater than one working level month per year shall be monitored using a personal radon progeny dosimetry system.

- (c) The program may, after consultation with the affected occupational health committee(s), be amended from time to time by agreement between the director and the Lessee.

3.2 The Lessee agrees to ensure that the monitoring of radiation and the determination of effective doses for workers is conducted under the direction of the competent person in accordance with the program mentioned in clause 3.1(a), except that this shall not apply to any part of the determination conducted by an external agency acceptable to the director.

3.3 The Lessee agrees;

- (a) to determine the effective doses received by all radiation workers at the mine by a method acceptable to the director; and
- (b) to ensure that the effective doses received by all workers, other than radiation workers, engaged in activities directly associated with any radioactive material or anything contaminated by radioactive material are, and are likely to continue to be, less than five millisieverts per year.

3.4 For the purpose of this appendix, any dose pertaining to a worker, which is currently entered into the National Dose Registry shall be deemed to be that worker's true dose unless the Lessee can provide to the director evidence to the contrary.

3.5 (a) The Lessee agrees to inform the director and the occupational health committee, as soon as reasonably possible, when

- (i) any worker is assessed to have received a fractional effective dose determined in accordance with subsection 5.2(1)(a), which has exceeded 0.4 in a year.
- (ii) the Lessee or the worker believes the fractional effective dose assigned to that worker to be inaccurate.

(b) The Lessee agrees to facilitate any investigation by the director or occupational health committee into a high or inaccurate reading reported in subsection 3.5 (a);

(c) Where the Lessee or a worker requests a review of the action taken, or required to be taken, by the Lessee based on the fractional effective dose assessed for a worker, the Lessee agrees that the director in consultation with the Lessee, the worker and

the occupational health committee may review the circumstances and the director may accept such alternative action provided that the standard of health and safety to the worker is not thereby materially affected.

4.0 Radiation Workers

- 4.1 The Lessee agrees not to require a worker to be a radiation worker unless that worker has been informed and advised of the significance of that designation.
- 4.2 The Lessee agrees to inform the director of any worker and the activities of that worker who is required to be a radiation worker.
- 4.3 The Lessee shall not designate any worker as a radiation worker if advised by the director that in the director's opinion such designation is not necessary.

5.0 Exposure Limits

5.1 The effective dose of a worker shall comprise:

- (a) the equivalent dose from all external gamma emitting sources of radiation received from work at the mine;
- (b) the committed effective dose from the inhalation or ingestion of radioactive substances other than radon and thoron progeny from work at the mine; and
- (c) the exposure from the inhalation of radon and thoron progeny from work at the mine.

5.2 (1) The fractional effective dose received by a worker shall be determined as follows:

- (a) during a year the fractional effective dose is calculated in accordance with the formula:

$$F_{E1} = \frac{D_E + D_I}{50} + \frac{D_r}{10} + \frac{D_t}{35}$$

and

- (b) during any five year dosimetry period the fractional effective dose is calculated in accordance with the formula:

$$F_{E5} = \frac{D_E + D_I}{100} + \frac{D_r}{20} + \frac{D_t}{70}$$

where:

F_{E1} is the fractional effective dose over a 1 year dosimetry period;

F_{E5} is the fractional effective dose over a 5 year dosimetry period;

D_E is the total of contributions to the effective dose in millisieverts from all external sources determined in accordance with subsection 5.1(a);

D_I is the committed effective dose in millisieverts from all inhaled or ingested radioisotopes other than radon progeny or thoron progeny determined in accordance with subsection 5.1(b);

D_r is the exposure to radon progeny measured in working level months determined in accordance with subsection 5.1(c);

D_t is the exposure to thoron progeny measured in working level months determined in accordance with subsection 5.1(c);

- (2) Subject to the remedial actions listed in subsection 5.2(3), the Lessee shall ensure that the fractional effective dose received by a radiation worker is:
- (a) less than one for any one year as determined by the formula subsection 5.2(1)(a); and
 - (b) less than one for any 5 year dosimetry period as determined by the formula in subsection 5.2(1)(b).
- (3) Where the fractional effective dose received by a radiation worker is in excess of that specified in subsection 5.2(2) the Lessee agrees to:

- (a) inform the worker, the director and the occupational health committee as soon as reasonably possible;
- (b) investigate the cause and circumstances leading to this level of radiation exposure; and
- (c) in consultation with the affected occupational health committee(s), develop a program to minimize the possibility of similar future radiation exposure to such worker, and submit the same to the director.

5.3 The Lessee agrees:

- (a) that the importance of reporting a pregnancy to the Lessee as soon as possible will be explained to all female workers at the time at which they enter into employment;
- (b) where the pregnancy of a worker is reported to the Lessee, the Lessee shall make arrangements to ensure that the dose to the abdomen of the pregnant worker does not exceed four millisieverts during the remainder of the pregnancy, where the dose to the abdomen shall be deemed to be equal to the effective dose, other than from radon and thoron progeny, unless the Lessee provides to the director, evidence to the contrary; and
- (c) if a pregnant worker desires to continue in employment or training, the Lessee shall reassess and, if necessary, revise the employment duties or educational activities of the worker so that the limit set by clause (b) is not exceeded.

5.4 The Lessee agrees that where a worker exceeds the maximum permitted exposure for any period:

- (a) where the worker is employed by the Lessee, the Lessee will make every reasonable effort to provide the Lessee's worker with suitable alternative employment; and
- (b) where the worker is employed by any other employer, commissioned by or contracted by or otherwise performing services for the Lessee, the Lessee will require the employer to make every reasonable effort to provide that worker with suitable alternative employment.

6.0 Personal Monitoring

- 6.1 The Lessee agrees to maintain a record of the total dose received by each radiation worker which shall:
- (a) include a record of the total effective dose for any quarter, year or five year dosimetry period; and
 - (b) be given to that worker, the director and the National Dose Registry not less frequently than every quarter.
- 6.2 The Lessee agrees to provide this information in a form mutually acceptable to the Lessee, the director and the National Dose Registry.
- 6.3 The Lessee shall, to the extent of its knowledge, provide each worker who leaves the employ of the Lessee a record of the worker's total effective dose.
- 6.4 The Lessee shall ensure that a summary of the information sent to the director is made available to the occupational health committee but this summary shall not identify the personal records of any worker.

7.0 Records

- 7.1 The Lessee agrees to preserve dosimetry records required by this appendix during the operating life of the mine and shall forward such records to the director as the director may reasonably require when the mine is closed.
- 7.2 The Lessee shall make any record required by this appendix available to the director or designate on request.

8.0 Training

- 8.1 The Lessee agrees to provide and implement an effective training program to educate every radiation worker in:
- (a) the health hazards associated with radiation work, in particular the health effects of radiation exposure including the need for good hygiene practices and the added risk to a radiation worker of smoking;

- (b) the safe working methods and techniques to be used;
- (c) the precautions to be taken and the reasons therefore; and
- (d) the requirements for medical surveillance contained in this appendix and the importance of complying with these requirements.

8.2(1) The Lessee agrees that the training program will be:

- (a) fully documented;
 - (b) developed in consultation with the occupational health committee; and
 - (c) subject to review by and acceptable to the director.
- (2) The Lessee agrees that a record will be kept of the training given to each radiation worker.

9.0 Protection of Workers

9.1 The Lessee agrees to:

- (a) ensure that all protective equipment is suitable for the efficient performance of its intended purpose and is adequately maintained;
- (b) require that workers do not smoke, eat or drink except in suitable designated areas;
- (c) ensure that appropriate standards of hygiene are maintained in working, rest and eating areas; and
- (d) ensure that all workers are encouraged to adopt good hygiene standards.

10.0 Medical Surveillance

10.1 The Lessee agrees, with respect to its operations on the leased lands:

- (a) to engage the services of a physician for the purpose of providing occupational medical service to workers unless otherwise exempted by the director; and
 - (b) to ensure that the appointed physician has sufficient opportunity to familiarize himself/herself with the operation to an extent necessary to fulfill his/her purpose effectively.
- 10.2 The Lessee agrees that the physician shall have reasonable opportunity, resources and facilities to implement appropriate medical services for the health and safety of any worker.
- 10.3 The Lessee agrees to facilitate the availability of medical services to the worker except that, if the worker refuses, a record of his refusal shall be kept.
- 10.4 The Lessee agrees to make information regarding the occupational medical service program available to the Chief Occupational Medical Officer of the Department of Labour and agrees to make reasonable changes as requested by the Chief Occupational Medical Officer.

TABLE 1

Radiation Weighting Factors

<u>Type and energy range</u>	<u>Radiation weighting factor, w_R</u>
Photons, all energies (x-rays, gamma rays)	1
Electron and muons, all energies (beta rays)	1
Neutrons, energy < 10 keV	5
> 10 keV to 100 keV	10
> 100 keV to 2 MeV	20
> 2 MeV to 20 MeV	10
> 20 MeV	5
Protons, other than recoil protons, energy > 2 MeV	5
Alpha particles, fission fragments, heavy nuclei	20

TABLE 2

Tissue Weighting Factors

<u>Tissue</u>	<u>Tissue weighting factor</u>
Gonads	0.20
Bone marrow (red).....	0.12
Colon	0.12
Lung ¹	0.12
Stomach	0.12
Bladder.....	0.05
Breast.....	0.05
Liver	0.05
Oesophagus.....	0.05
Thyroid.....	0.05
Skin	0.01
Bone surface	0.01
Remainder ²	0.05 ³

¹The lung is subdivided into the following regions with their respective fractions of the lung weighting factor: bronchial 0.333, bronchiolar 0.333, alveolar-interstitial 0.333, lymphatics 0.001.

²For purposes of calculation, the remainder is composed of the following additional tissues and organs: adrenals, brain, small intestine, kidney, muscle, pancreas, spleen, thymus, uterus and extrathoracic airways⁴.

³In those exceptional cases in which a single one of the remainder tissues or organs receives an equivalent dose in excess of the highest dose in any of the 12 organs for which a weighting factor is specified, a weighting factor of 0.025 should be applied to that tissue or organ and a weighting factor of 0.025 should be applied to the average dose in the rest of the remainder as defined above.

⁴The extrathoracic airways are subdivided into the following regions with their respective fractions of the extrathoracic weighting factor: anterior nose 0.001; posterior nasal passages, larynx, pharynx and mouth 0.998; lymphatics 0.001.

For guidance in the necessary calculations, refer to the following publications of the International Commission on Radiological Protection: Publication 66 "Human Respiratory Tract Model for Radiological Protection" and Publication 68 "Dose Coefficients for Intakes of Radionuclides by Workers".

APPENDIX "E"

SOCIAL AND ECONOMIC BENEFITS COMMITMENTS

1. Employment Commitment

Cogema Resources Inc. commits to use its best efforts to maximize employment participation by Residents of Saskatchewan's North in the Midwest Joint Venture project in striving toward a goal of 67% northern employment as recommended by the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan in its 1997 report.

Progress and achievements regarding this Commitment will be reported annually in the Human Resource Development Plans (see Appendix "F").

2. "Stay in School Program" Commitment

Cogema Resources Inc. commits to work in cooperation with its industry counterparts, government and northern educational institutions to plan and implement programs that will encourage students who are Residents of Saskatchewan's North to pursue higher levels of education and consider professional careers related to the mining industry.

Progress and achievements regarding this Commitment will be reported annually in the Human Resource Development Plans (see Appendix "F").

3. Northern Business Participation Commitment

Cogema Resources Inc. commits to use its best efforts, in cooperation with government, to achieve the goal of Northern Businesses annually supplying 35% of the overall value of the goods and services purchased in support of its mining operations in the Northern Saskatchewan Administration District.

Progress and achievements regarding this Commitment will be reported annually in the Northern Business Participation Reports (see Appendix "F").

4. **Community Vitality Study Commitment**

Cogema Resources Inc. commits to work with appropriate government agencies and industry counterparts, to develop and fund a means by which to study the impacts of uranium mining operations on the vitality of communities in the Northern Saskatchewan Administration District, through the study of selected representative communities.

Progress and achievements regarding this Commitment will be reported annually in the Public Involvement Program Reports (see Appendix "F").

5. **Employee Education and Training Commitment**

Cogema Resources Inc. commits to develop and implement employee education and training plans necessary to meet its needs for the Midwest Joint Venture project.

Progress and achievements regarding this Commitment will be reported annually in the Human Resource Development Plans (see Appendix "F").

6. **Employee Services Commitment**

Cogema Resources Inc. commits to provide suitable services to its employees of the Midwest Joint Venture project and to consider employee suggestions for enhancement of such services. Further, Cogema Resources Inc. commits to provide its employees with counseling through a joint company/employee sponsored assistance program.

Progress and achievements regarding this Commitment will be reported annually in the Human Resource Development Plans (see Appendix "F").

7. **Public Involvement Commitment**

Cogema Resources Inc. commits to work with governments, regulatory agencies and community leaders to consult and inform Residents of Saskatchewan's North with respect to its mining operations in the Northern Saskatchewan Administration District.

Progress and achievements regarding this Commitment will be reported annually in the Public Involvement Program Reports (see Appendix "F").

APPENDIX "F"

REPORTING REQUIREMENTS

List of Lessee's reporting requirements under the terms of the Agreement:

- (a) **Land Development Reports:** Pursuant to Article 1.2, annually on or before April 1st, the Lessee shall provide the Minister of Saskatchewan Environment at the Sustainable Land Management Branch at Prince Albert with information as to the portion of the Lease Lands that has been developed, in such detail as is necessary to calculate rent or other charges payable in accordance with the Applicable Laws.
- (b) **Sand and Gravel Royalty Return Reports:** When required by Article 3.5, the Lessee shall complete and submit Sand and Gravel Royalty Return Reports to the Sustainable Land Management Branch at Prince Albert on a quarterly basis, with such reports being due within 30 days after March 31, June 30, September 30 and December 31, unless otherwise specified in *The Resource Lands Regulations, 1989*.
- (c) **Environmental Contingency Plan:** Pursuant to Article 8.7, the Lessee shall prepare and submit a plan to the Minister of Saskatchewan Environment (the "Department") dealing with the storage and handling of spills in transit of hazardous substances and waste dangerous goods, which plan will comply with the provisions of *The Hazardous Substances and Waste Dangerous Goods Regulations*. The Lessee will review and revise the Environmental Contingency Plan on a regular basis and advise the Department of any material revisions thereto.
- (d) **State of the Environment Reports:** Pursuant to Article 8.14, the Lessee shall prepare and submit to the Minister of Saskatchewan Environment reports regarding the environmental condition of the Lease Lands and surrounding lands in a form acceptable to the Department.
- (c) **Human Resource Development Plans:** Pursuant to Article 10.1(b), the Lessee shall prepare and submit Human Resource Development Plans to Saskatchewan Learning in accordance with the Human Resource Development Agreement referred to in Article 10.1 (a).
- (h) **Business Opportunities Forecasts:** Pursuant to Article 12.1(a), the Lessee shall annually prepare a five year rolling Business Opportunities Forecast, the first two years of which shall be complete with such information, benchmarks and processes as will enable performance monitoring for the Midwest Joint Venture project and the last three years of which shall contain general business trend information. The initial Business Opportunities Forecast shall be completed and submitted to the Economic and Community Development Division, Saskatchewan Northern Affairs within 3 months following the execution of the Agreement. Thereafter, an updated Business

Opportunities Forecast will be prepared and submitted annually on or before November 1.

- (g) **Employment Status Reports:** Pursuant to Article 13.3, the Lessee shall prepare and file with Saskatchewan Learning employment statistics for the Midwest Joint Venture project and on behalf of its on-site contractors which reflect the degree of achievement of the objectives of Part IV. These statistics shall be prepared and submitted in accordance with the terms of the applicable Human Resource Development Agreement or as otherwise reasonably requested by Saskatchewan Learning.
- (h) **Northern Business Participation Reports:** Pursuant to Article 13.4, the Lessee shall prepare and submit a Northern Business Participation Report to the Resource and Industry Development Division, Saskatchewan Northern Affairs annually on or before March 31st, in a form acceptable to such Division, detailing:
 - i. the nature (character), by suitable categories, and value of goods and services purchased during the year under report, in the construction, operation and reclamation and decommissioning phases of the Midwest Joint Venture project;
 - ii. separate more detailed information regarding the nature (character) and value of goods and services purchased during the year under report, in the phases referred to in (i) above, from Northern Businesses; and
 - iii. the activities undertaken by the operator of the Midwest Joint Venture project and its on-site contractors to achieve the intent of Part IV of the Agreement and any objectives as may have been set forth in the Business Opportunities Forecast for the year under report.
- (i) **Compensation Reports:** Pursuant to Article 14.2, the Lessee shall prepare and submit reports to the Resource and Industry Development Division, Saskatchewan Northern Affairs annually on or before March 31st, in a format prescribed by such Division detailing any compensation paid during the course of the year under report, for actual monetary losses arising as a result of this Agreement, to individuals who had used or occupied the Lease Lands prior to the effective date of this Agreement.
- (j) **Reports on Social and Economic Benefits Commitments:** Pursuant to Article 15.2, the Lessee will report on its progress in complying with the Social and Economic Benefits Commitments, which are listed in Appendix "E". This reporting shall be accomplished through the reports listed in this Appendix "F".

(k) **Public Involvement Program Reports:** Pursuant to Article 15.3, the Lessee shall prepare and submit reports to the Resource and Industry Development Division, Saskatchewan Northern Affairs annually on March 31st, on the Lessee's public involvement programs in accordance with the recommendation made by the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan in its February 1997 report to the Saskatchewan Minister of Environment and agreed to by the Government of Saskatchewan.

APPENDIX "G"

GLOSSARY OF TERMS

In the Agreement and in the Appendices attached thereto, unless there is something in the subject matter or the context inconsistent therewith, the following terms and expressions will have the following meanings:

- (a) **"Agreement"** means this document as a whole and the attached Appendices as amended from time to time, and the expressions "herein", "hereto", "hereunder", "hereof" and similar expressions refer to this Agreement as so defined and not to any particular Article, section, subsection or other subdivision hereof;
- (b) **"Applicable Laws"** means The Forest Resources Management Act, The Provincial Lands Act and all other Saskatchewan legislation, including Regulations made thereunder, regarding the disposition of surface rights and the activities carried out as part of the Midwest Joint Venture project;
- (c) **"Decommissioning and Reclamation Plans"** means the decommissioning and reclamation plans for the Lease Lands, including the mining site and individual pollutant control facilities, as required by the Minister pursuant to *The Mineral Industry Environmental Protection Regulations, 1996*;
- (d) **"Human Resource Development Agreement"** means the co-operative training agreement between the Lessee and Saskatchewan Learning referred to in Article 10.1(a) of the Agreement;
- (e) **"Lease Lands"** means the lands described in Article 1.0;
- (f) **"Midwest Joint Venture project"** means mining and other permitted site activities including decommissioning, reclamation and monitoring carried out on and from the Lease Lands;
- (g) **"Mineral Disposition"** means Mineral Leases 5115 and 5264 between the Government of Saskatchewan and Cogema, Redstone, Tenwest and OURD granted under *The Mineral Disposition Regulations, 1986* made pursuant to The Crown Minerals Act, or such other mineral dispositions as may be substituted therefor;
- (h) **"Northern Saskatchewan Administration District"** has the meaning attributed to that term in the Regulations made pursuant to The Northern Municipalities Act, 1983;
- (i) **"Northern Business"** means those businesses located in the Northern Saskatchewan Administration District;

- (j) **"Occupational Health Committee"** means the occupational health committee established by the Lessee for the Midwest Joint Venture project pursuant to the provisions of The Occupational Health and Safety Act, 1993, and the Regulations made pursuant to that Act;
- (k) **"Parties"** means the parties to this Agreement;
- (l) **"Residents of Saskatchewan's North"** means the residents defined in the Human Resource Development Agreement; and
- (m) **"Social and Economic Benefits Commitments"** means the commitments listed in Appendix "E", which commitments were made by the Lessee:
 - (i) in its Environmental Impact Statement for the Midwest Joint Venture project including the Main Volume, Appendices or Addendum, and in written presentations during the 1996 hearings of the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan; and
 - (ii) which were recommended by the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan and agreed to by the Government of Saskatchewan.