

Terms of Reference

for the

Environmental Assessment

of the

Paramount Resources Ltd.

Cameron Hills Drilling Project

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Mackenzie Valley Environmental Impact Review Board

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1 INTRODUCTION

The purpose of these terms of reference is to provide the framework for the environmental assessment that will be undertaken for the Paramount Resources Ltd. Cameron Hills Drilling Project. The Mackenzie Valley Environmental Impact Review Board (Review Board) is required by s.126 of the Mackenzie Valley Resource Management Act (MVRMA) to conduct an EA of the development. This project was referred to the Review Board by the South Mackenzie Panel (SMP) of the MVLWB which concluded that the development activities “might have a significant environmental impact” mostly with respect to flaring (see chronology below).

In preparing these terms of reference the Review Board took into account its mandate as stated in sections 114, 115, 117 and 128 of the MVRMA. The Review Board also considered previous assessment reports (s.127) as they may relate to the development proposal before them. The Review Board was also mindful of the scale and size of the development being proposed.

Chronology of events:

On August 29, 2000, the Mackenzie Valley Land and Water Board (MVLWB) received Paramount Resources Ltd.’s applications for a Type ‘A’ Land Use Permit (Application #MV2000A0041) and a Type ‘B’ Water License (Application #MV2000L1-0009) to undertake the Cameron Hills Drilling Project.

The applications and supporting documentation were circulated to federal and territorial government departments, First Nations organizations and municipal governments. The comments received were taken into consideration by the MVLWB staff when they completed the preliminary screening on the development.

On November 20, 2000, the MVLWB referred the development proposal to the Review Board, in accordance with ss.126(1) of the MVRMA, citing the following reasons for the referral:

- Exact quantities of H₂S (hydrogen sulfide) and SO₂ (sulfur dioxide) that would be released into the atmosphere as a result of incomplete combustion or venting of gases from this development proposal are unknown.
- The potential for deposition of waste from noncombusted gases released from flaring/venting operations in relation to the project area and proposed operations were not documented.
- The scope of the proposed development did not document when flaring or venting would be required and with what frequency.
- The application did not outline what the maximum allowable limits of H₂S and SO₂ emissions would be as a result of flaring activities.
- Levels of all other contaminants that can be released into and potentially contaminate the environment from project flaring or venting operations are unknown.

2 SCOPE OF THE DEVELOPMENT

The Review Board is required to provide a scope of development determination according to ss.117(1) of the MVRMA. This section describes what the Review Board considers the scope of the drilling program.

2.1 *Principal Development*

The development is located on the plateau of the Cameron Hills in the Northwest Territories, about 75 km southwest of Enterprise, NWT and immediately north of the Alberta/NWT border.

The principal development activities are:

- Drill, complete and test 9 new wells. Each well location will be cleared and graded as required to a maximum size of 110 m by 110 m. Access to the well sites will be through existing cut-lines where possible although some new access routes will have to be constructed. The testing will involve the flaring of natural gas.

The drilling, completing and testing of wells involves the tasks listed in Table 1.

Table 1 – Well Drilling, Completing and Testing Activities

Move in and set up drilling equipment
Drill well
Move out drilling equipment
Wait for service rig to be available
Move in service rig
Conduct wellbore operations to prepare it for perforation
Perforate the zone of interest
Run a static gradient to acquire initial parameters
Stimulate the zone
Move out service rig
Initial flow back of gas and stimulation fluids to clean up the zone to allow for accurate evaluation of the zone.
Run electronic recorders into the well to conduct an evaluation of the reservoir through production testing of the well.

Flow test the well to determine economics of project development by evaluating reservoir parameters including:

- Permeability
- Effectiveness of wellbore stimulation
- Well deliverability
- Potential reservoir size

The length of the production test is determined by:

- Threshold reserves required for the project development; and
- Any declining performance seen during production testing.

Shut in the well to acquire pressure build-up information

Pull recorders and install suspension plug

Wait for pipeline to be built to enable well to go on production.

Source: Paramount Resources Ltd.

The list of activities in Table 1 was compiled with the assistance of, and with information provided by, Paramount Resources Ltd.

The land use permit and water license applications submitted by the developer to the MVLWB also indicated that up to 10 additional wells would be drilled in the area over the next seven years conditional on prior drilling success. The locations of these possible future wells are unknown at this time and so they were not being included in this environmental assessment. On January 16th, 2001, Paramount requested that the final Work Plan and final Terms of Reference (both issued on January 15th, 2001) for the Cameron Hills EA be amended to include these possible 10 future wells. On January 25th, 2001, the Review Board rejected this amendment request and issued Reasons for Decisions on January 26th, 2001.

On January 16th, 2001, Paramount also requested that the final Work Plan and final Terms of Reference be amended to remove references to work to be completed at 7 existing wells. This work will be done under existing authorizations. On January 25th, 2001, the amendment was approved by the Review Board so the work at these 7 existing wells is not covered by this environmental assessment. However, the work at these 7 existing wells will still need to be included in the cumulative impacts analysis for the Cameron Hills EA. This amended final Work Plan is being issued to replace the final Work Plan that was previously issued on January 15th, 2001.

2.2 Accessory Developments and Activities

The completion of the principal activities requires additional developments and activities to be undertaken. These include the following:

- Re-use a temporary winter access road, approximately 33 km in length, from Indian Brook, Alberta on Highway 35, to a point approximately 10 km into the NWT. This winter road access will follow the same alignment as the winter road previously permitted and used in the 1999-2000 winter season.
- Air access will be via a temporary winter airstrip equipped with lights and a radio beacon.

-
- Construct three ice bridges: two on the Cameron River and one on a tributary of the Cameron River. Other water crossings will be over streams that are expected to freeze to the bottom.
 - Construct up to six temporary 20 man camps. The camp locations will take advantage of previous camp or airstrip locations. Water for the camps may come from an existing well or new wells will be drilled at each camp location.
 - Obtain drilling water from a specific unnamed lake near the well sites and, if required, from the water wells.
 - Dispose of drill wastes in two remote sumps. Some clearing and leveling will be required around the sumps.
 - Use an existing borrow pit. Soil excavated from the borrow pit will be used during the closure of the drilling fluid and sewage sumps using the mix, bury and cover method.

The well drilling, well completions, well testing and camp operations will occur within an area delineated as follows: on the north by latitude 60° 20', on the south by latitude 60° 00', on the east by longitude 117° 15', and on the west by longitude 117° 50'.

3 SCOPE OF THE ASSESSMENT

As a minimum, an EA report should include the following:

- Title (of the development proposal);
- Executive summary (translated into appropriate aboriginal languages, if requested);
- Description of the development (e.g., phases, timetables, location, maps, photos, technology used, alternatives to the development, development design details taking into account the environment);
- Description of the existing environment, including environmental interactions (e.g., natural and human setting);
- Impact of the development on the environment, including those caused by malfunctions or accidents, and any cumulative impact(s);
- List of potential impacts and the proposed mitigation or remedial measures;
- Identification and description of the residual impacts following mitigation or remedial measures;
- Results and summary of issues from public and community consultation, including any concerns;
- Plans for any environmental management plan, follow-up and monitoring;
- List of supporting evidence and information sources, including previous environmental assessments; and
- List of the required licences, permits and other authorizations, if relevant.

Additional items that the Review Board added to the list for this EA include:

- the name of company representatives managing the proposed development;
- company incorporation and structure information;
- the company's corporate history in Canada and the Northwest Territories, and that of its partners, if any;
- the proposed development ownership
- an organizational structure identifying corporate and individual responsibilities for the development and operations, and
- an environmental performance record at the current site.

All of the items listed above constitute the scope of the assessment for the environmental assessment of the Cameron Hills Drilling Project.

The Review Board undertook a Preliminary Conformity Check (Appendix A) against para. 117(2)(a) requirements to determine what areas of the scope had already been covered off in the developer's *Environmental Screening Report for the Cameron Hills Drilling Project*. Based on the Preliminary Conformity Check, the Review Board decided that the developer's environmental screening report would be accepted as the environmental assessment report, with the understanding that the report has been determined to be insufficient for the areas listed in Section 4.1. The information required to address the deficiencies will be accepted by the Review Board as an addendum to the developer's EA report.

4 REQUIRED ENVIRONMENTAL ASSESSMENT INFORMATION

This section provides direction to Paramount about the additional information still required by the Review Board and its advisors in order to make an EA decision. In responding to these additional information requirements, Paramount will be advised to provide the information consistent with the direction provided under Scope of Development and Scope of Assessment. The Review Board may also request that Paramount and/or others respond to Information Requests from the Review Board and other parties in the EA process.

4.1 Direction to Paramount

The Review Board requests that Paramount submit the following information regarding the proposed development as an addendum to its *Environmental Screening Report for the Cameron Hills Drilling Project*. Paramount shall provide a clear rationale for statements made, conclusions reached and intended courses of actions to be followed in carrying out the development.

4.1.1 Executive Summary

Paramount shall provide an executive summary that encompasses the contents of the Environmental Screening Report for the Cameron Hills Drilling Project as well as the information submitted in response to this Terms of Reference.

4.1.2 Developer Identification and Performance Record

Paramount shall provide the following;

- the name of company representatives managing the proposed development;
- company incorporation and structure information;
- the company's corporate history in Canada and the Northwest Territories, and that of its partners, if any;
- the proposed development ownership
- an organizational structure identifying corporate and individual responsibilities for the development and operations, and
- an environmental performance record at the current site.

4.1.3 Tenure

Paramount shall clearly delineate, using appropriate mapping, proposed and existing leases, land use permits and/or other tenure arrangements for the proposed development.

4.1.4 Regulatory Regime

Paramount shall provide a table summarizing relevant licenses, permits and other authorizations that are required, or require amendment to allow the proposed development to occur. This should include, for reference purposes, existing permits and other authorizations that remain in force, and do not require amendment to allow the proposed development to occur, and their respective durations.

4.1.5 Socio-Economic Effects

Paramount shall provide details on the socio-economic effects of the project on the local communities. This should include information such as identifying the local businesses that will be involved in the project, the likely increase in local employment, implications for community quality of life effects as well as the documentation and details behind any other predicted socio-economic effects and mitigation measures.

4.1.6 Accidents and Malfunctions

Paramount shall identify the probability of accidents and/or malfunctions occurring related to the proposed development including, but not limited to, fuel and other hazardous material spills. The potential magnitudes of, and contingencies to deal with, these accidents and/or malfunctions should also be discussed.

4.1.7 Consultation

Paramount shall summarize consultations undertaken with the affected municipalities, First Nations organizations, government etc. indicating what concerns were raised and how they have been addressed.

4.1.8 Alternatives

Paramount shall provide an explanation of the alternatives to the principal and accessory parts of the development. Specific questions that the Review Board will expect to have answered include:

- What are the alternatives to and justifications for requiring well clearings to have a maximum size of 110 m x 110 m? Can these clearing sizes be reduced?
- What are the alternatives to and justifications for using up to 6 camp sites? Can or should the number of camps be reduced?

4.1.9 Air Quality and Climate

An analysis should be undertaken to determine the possible impacts of the proposed development on air quality. All well test flaring must comply with the NWT one-hour air quality standard for sulphur dioxide (450 µg/m³). The analysis shall include:

1. Provide reports from preliminary sampling that estimates gas composition. What is the hydrogen sulphide and the carbon dioxide content of the gas? Provide an estimate of the emission rates of hydrogen sulphide, sulphur dioxide, carbon dioxide and volatile organics.
2. Provide details about the equipment that will be used for the test burn including the flare stack size, stack combustion efficiency and the anticipated gas flow rates during tests including the maximum rates. Describe the efficiency of flare combustion under various stable and unstable meteorological conditions.
3. Discuss the potential accidental releases or venting of unburned gases and describe steps that will be used to prevent these releases.
4. Discuss the meteorology and climatology of the area including parameters that would affect the dispersal of pollutants such as wind speed, wind direction and atmospheric stability. Describe efforts to obtain the

representative meteorological data that would be needed for dispersion modelling of air emissions in a complex terrain.

5. Conduct dispersion modelling in compliance with recognized guidelines such as the Alberta Energy and Utilities Board Guide 60.
6. Discuss baseline air quality conditions including a discussion of emissions from other existing and proposed sources within the region.
7. Discuss ambient ground-level concentrations of sulphur dioxide and hydrogen sulphide that could result during the well tests.
8. Assess the impacts of flaring activities on wildlife including vegetation and migratory birds as well as any impacts on human health and surrounding surface water quality. This impact assessment should:
 - identify the development activity;
 - identify the potential impacts of this activity (along with any supporting evidence);
 - propose mitigative measures (along with evidence that the mitigative measures will work); and
 - predict the significance of residual impacts that cannot be mitigated.
9. A discussion of efforts taken to minimize the release of any air contaminants and to mitigate the impacts of any emissions.

4.1.10 Cumulative Impacts

Paramount shall review their cumulative effects assessment and up-date it (Ch. 8, *Environmental Screening Report for the Cameron Hills Drilling Project*), as required, to include Paramount's proposed seismic program in the Cameron Hills.

Paramount shall analyze and report on the cumulative impacts where impacts on biological receptors such as vegetation and wildlife are identified as a result of production testing (flaring) and/or venting. This assessment should cover the same criteria listed in Section 4.1.9 (8).

When addressing cumulative impacts, Paramount should consult the document *Addressing Cumulative Environmental Effects in Environmental Assessment under the Mackenzie Valley Resource Management Act* (Interim Guide, September 2000) which was prepared by the Review Board.

4.2 Direction to Others

The Review Board may also request information from government bodies, expert advisors or others through the issuance of Information Requests (IR's). Information requested and received through the IR process would assist the Review Board in completing the EA and reaching an EA decision.

Parties receiving an IR should provide responses that meet the criteria listed in Section 4.1.9 (8). With an anticipated EA decision date Sept. 15th, all responses to IR's and any other information parties wish to provide to the Review Board should be submitted as soon as possible, and certainly before the closure of the

public registry.

5 EA DECISION PROCESS

When the public registry has closed for this EA, the Review Board will consider all of the evidence received and reach an EA decision in accordance with ss.128(1) of the MVRMA. Once the Review Board has made a decision and provided its written reasons, the Review Board's Report of EA, made in accordance with ss.128(2), will be forwarded to the federal Minister of DIAND for his decision in accordance with s.130. As this development also involves a DRA (i.e., the NEB), the Review Board's Report of EA will also be forwarded to the NEB for its decision in accordance with s.131.

Appendix A

Preliminary Conformity Check Checklist for the Cameron Hills Drilling Project

PHYSICAL - CHEMICAL EFFECTS

DISCUSSION

1. Ground Water

☒ water table alteration

Withdrawal from water wells will be at a rate to protect well integrity.

☐ water quality changes

☐ infiltration changes

☐ other: _____

☐ N/A

2. Surface Water

☒ flow or level changes

Water usage from the source lake will be staggered and, if required, supplemented by water wells.

☒ water quality changes

Possible impacts due to deposition of ash from flaring and venting operations has not been examined.

☐ water quantity changes

☒ drainage pattern changes

Potential impacts identified

☐ temperature

☐ wetland changes / loss

☐ other: _____

☐ N/A

3. Noise

X noise increase

Possible short-term temporary impacts on wildlife due to noise increase in the immediate area of the development.

☐ noise in/near water

☐ other: _____

☐ N/A

4. Land

☐ geologic structure changes

X soil contamination

Potential impacts identified

☐ buffer zone loss

X soil compaction & settling

Potential impacts identified

X destabilization / erosion

Potential impacts identified

**X permafrost regime
alteration**

Potential impacts identified

☐ other: _____

☐ N/A

5. Non Renewable Natural Resources

X resource depletion

Minimal loss of petroleum resources through flaring and venting operations.

☐ other: _____

☐ N/A

6. Air / Climate / Atmosphere

X Vehicle and equipment emissions

Potential impacts identified

X Flaring and venting emissions

Additional research required to determine potential impacts due to flaring and venting operations.

○ N/A

BIOLOGICAL ENVIRONMENT

1. Vegetation

○ species composition

X species introduction

Seed mixes with foreign species will only be used during reclamation where required to avoid erosion problems.

○ toxin / heavy accumulation

X other: Flaring and venting emissions

Additional research required to determine potential impacts due to flaring and venting operations.

○ N/A

2. Wildlife & Fish

○ effects on rare, threatened or endangered species

○ fish population changes

○ waterfowl population changes

○ breeding disturbance

X population reduction

X habitat changes / effects

○ species diversity change

○ health changes (Identify)

X behavioural changes (Identify)

Potential impacts identified.

Possible displacement from habitat.

Possible habitat reduction for some species.

☒ **game species effects**

Potential impacts identified.

☐ **toxins / heavy metals**

☐ **forestry changes**

☐ **agricultural changes**

☒ **other: Flaring and venting emissions.**

Additional research required to determine potential impacts due to flaring and venting operations.

☐ **N/A**

INTERACTING ENVIRONMENT

1. Habitat and Communities

☒ **predator-prey**

Possible increased predation on new access corridors and clearings.

☐ **wildlife habitat / ecosystem composition changes**

☐ **reduction / removal of keystone or endangered species**

☐ **removal of wildlife corridor or buffer zone**

☐ **other: _____**

☐ N/A

2. Social and Economic

☐ planning / zoning changes
or conflicts

☐ increase in urban facilities
or services use
☐ rental house

☐ human health hazard

☐ impair the recreational use
of water or aesthetic quality

☐ affect water use for other
purposes

☐ affect other land use
operations

☒ quality of life changes

Short term increase in employment in the local communities.

☐ public concern

☐ other: _____

☐ N/A

3. Cultural and Heritage

☐ affects to historic property

☐ increased economic
pressure

on historic properties

☐ change to or loss of historic
resources

☐ change to or loss of archaeological resources

☐ increased pressure on archaeological sites

☐ change to or loss of aesthetically important site

☒ affects to aboriginal lifestyle

Possible short term impacts on
traditional land use.

☐ other: _____

☐ N/A

Review Board staff reviewed the following documentation to prepare this checklist.

- The Water License and Land Use permit applications, including the accompanying environmental screening report, *Environmental Screening Report for the Cameron Hills Drilling Project*, submitted by the developer;
- The comments received from the developer, government and First Nations organizations during the application review period; and
- The MVLWB preliminary screening report and the reasons for the EA referral.
- Two 1999 CEAA screening forms for work (Land Use Permits N1998A0942 and N1998A0943) by the same developer in the Cameron Hills along with other documentation related to these screenings;
- A December 18, 1998 report by ARC Inc. prepared for the developer in support of their 1999 work and titled *Environmental Assessment Cameron Hills Wells I-74 and C-75*; and
- An October 1991 report by Hardy BBT Limited prepared for the developer and titled *Cameron Hills Oil Development Plan Environmental Components*.