03-005

- via e-mail -

November 19, 2003

Mackenzie Valley Environmental Impact Review Board
Box 938
5102 – 50 Ave
Yellowknife, NT
X1A 2N7

Attention: Martin Haefele

Dear Sir:

Re: Environmental Assessment EA03-005
Cameron Hills Extension
Information Responses

With reference to the subject environmental assessment, the attached document contains Paramount Resources Ltd. responses to Mackenzie Valley Environmental Impact Review Board information requests 1 to 35 with the exception of information request 27 that is directed to INAC, DFO, Environment Canada and GNWT-RWED.

Please contact Shirley Maaskant at (403) 290-3618 should you require additional information.

Yours truly,

PARAMOUNT RESOURCES LTD.

Shirley Maaskant, Regulatory & Community Affairs Coordinator

Encl: IR Responses

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IR Number 1.1.1

Preamble

Paramount notes that 4 m to 6 m wide lines will be required for the Vibroseis seismic program(s). Low-impact seismic utilizing hand cut lines can be employed for programs using explosives as an energy source, thereby reducing both the long-term development footprint and potential for indirect ecological effects.

Request

The MVEIRB asks Paramount to provide the following information:

a) Was low impact seismic considered as a Project Alternative?

b) If so, what factors were explicitly considered?

c) Why was it rejected?

Response

a), b) & c)

In designing the Cameron Hills seismic program Paramount considered many factors. The target depth of the oil and gas producing zones required a 300 m source and receiver line spacing in order to achieve proper imaging. Source point intervals were determined in order to attain sufficient fold to ensure high quality seismic records. Both vibroseis and dynamite were considered as a source on conventionally cut source and receiver lines. (6m to 4m wide) In the area around the Cameron River it was feared that there would be gravel and rock in the near subsurface making shot hole drilling difficult or nearly impossible. As previous seismic programs used a vibroseis source, it would be more advantageous to use a similar source in order to compare data and facilitate interpretation. In areas of sensitive terrain, no source lines will be cut and receiver lines will be hand cut to a maximum of 1.5 m to minimize disturbance. This is standard procedure in river valleys and near water bodies. For example; the 2001/2002 Cameron Hills 3D incorporated hand cut lines. Clearing of source lines was limited to the first breaks of the Cameron River Valley resulting in gaps in subsurface coverage. Handcut receiver lines only were used in the river valley.

In order to conduct a total seismic program with hand cut lines a completely new approach is required. Any program shot in this way would be completely dependant on helicopter support to move equipment and personnel. This approach was not considered for the following reasons.

i) The length of daylight in the Cameron Hills area during the acquisition months is short. A completely heliportable operation would only function during daylight hours extending the acquisition timeframe. The conventionally shot Paramount Vibroseis 3D program in 2001/2002 utilized a daytime and nighttime crew shift to ensure acquisition would be complete.

ii) Narrow hand cut lines would require the use of drill units instead of vibrators. As mentioned above Paramount prefers the vibrator source in order to match previous programs and to avoid drilling shot holes near river systems where gravel may cause interpretive problems.

iii) The cost of a total helicopter supported program of the size and scope of the 3D program Paramount is considering would render the acquisition uneconomic.

IR Number 1.1.2

Preamble

The discussion of ecological thresholds references two documents that are not included in Section 10, References.

Request

The MVEIRB asks that Paramount provide the following information:

a) Please provide references for Suter (1993) and Suter et al. (1995).

Response

a) Suter, G.W. 1993. Ecological Risk Assessment. Lewis Publishers. Chelsea, MI. 538 pp.

Suter, G.W., B.W. Cornaby, C.T. Hadden, R.N. Hull, M. Stack and F.A. Zafran. 1995. An Approach to Balancing Health and Ecological Risks at Hazardous Waste Sites. Risk. Anal. 15(2):221-231.

IR Number 1.1.3

Preamble

"Although the future wellsites are located to the best of Paramount's knowledge, uncertainties with respect to drilling success may affect the final location of subsequent wellsites" DAR p119. Because a spatially-explicit modelling approach was used for the cumulative effects assessment, the assessment conclusions are sensitive to the development footprint included in the Planned Development Case and Far Future Case. The Board acknowledges Paramount's effort to provide this information, but requires better definition of the effect of likely wellsite/right-of-way location changes on assessment conclusions.

Request

The MVEIRB asks that Paramount provide a detailed description of the assumptions used to generate the Planned Development Case, including:

a) *The rationale for assuming that a maximum of 48 wells will be drilled within the Significant Discovery License and an estimate of best case, realistic, and worst-case well numbers.*

b) *The assumptions used to define the footprint (including temporary workspace) for each disturbance feature (i.e., seismic source lines; seismic receiver lines; wellsites; facility sites; access roads; pipeline rights-of-way, camps, airstrips, borrow pits, other).*

c) *The rationale used to locate the 48 wells within the SDL as shown on Figure 7.1-5, and the locations that would be associated with best case, realistic, and worst-case well estimates.*

d) *The rationale used to locate the access roads and pipeline rights-of-way shown on Figure 7.1-5 and the locations that would be associated with best case, realistic, and worst-case well estimates.*

e) *The rationale used to generate the conclusion that 50%* of planned *disturbance will be reused (page 222).*

Response

a) The 48 drilling locations were selected on the basis of Paramount's current geological and geophysical understanding of the Cameron Hills area. All but four wells were selected within the area over which Paramount presently has 3D seismic control; structural elevation and closure being critical factors in defining optimum drilling locations. Another criterion used at Paramount is the current understanding of gas/oil and oil/water contact elevations relative to the structural position of the reservoir at each prospect area, which is based on existing well control and production testing experience. The extension of these contacts to undrilled areas is an interpretive effort. Our experience has shown

that the distribution of oil, gas and water within the reservoir is a very complex relationship and our development program continues to carry significant risk.

Based on the foregoing, Paramount has developed a cursory interpretation of which areas of the SDL are oil bearing versus gas bearing in the Sulphur Point Formation and have applied industry standard well spacing (roughly one per square mile for gas and four per square mile for oil) to those areas in order to arrive at a total possible drilling location count. Our best estimate is that two out of every three wells drilled will be successful and ultimately result in production. Best case then is that all 48 wells will be successful and tied in, realistic case is that 48 wells will be drilled and 32 wells (66%) will be economic successes and tied in, and worst case is that the first 5 wells drilled will be dry and abandoned and that Paramount will not proceed with additional drilling.

b) The assumptions used to define the footprint for each disturbance feature include:

- Utilization to the greatest extent practical of existing corridors (access roads, pipeline RoWs, seismic lines);
- Prior project design information was utilized to estimate pipeline RoW (e.g., 20 m width for one or two pipelines and 30 m for multiple lines, fuel lines and/or power lines), lease size (110m x 110m to incorporate the spacing requirements for a drilling rig), disposal pits (one pit for every 3 wells drilled at 50 m x 50 m), emergency access for each well (required for drilling operation at approximately 1000 m x 10 m), 5 satellites (100 m x 100 m each), road right-of-way widths for drilling operations at 8 m and operational access at 10 m, dimensions of temporary campsites and borrow pits;
- 3-D programs were represented as worst-case by assuming that the receiver and source lines were all 6 m in width, when in fact, the receiver lines were typically 4 m in width; and,
- AutoCad and ArcInfo were used to map, delineate and determine the areas of disturbance related to prior, pre-Paramount cutlines, airstrips and campsites.

Temporary workspaces are typically utilized for pipeline rights-of-ways, in areas where additional space is required to complete construction. This may be on either side of a drainage or road where directional drilling may be needed, or where crossing of another pipeline is required. For the DAR, Paramount assumed that the amount of temporary work spaces required would be minimal, and compensated for by the over-estimation of the disturbance related to the additional 2 m width assigned to each receiver line in the 3-D seismic programs.

c) The technical discussion provided in a) is the detail associated with how the placement of drilling locations within the SDL was developed. However, given

that the actual drilling of many of the wells would be contingent upon success of prior drilling and not knowing at this juncture which of the planned wells will be successful, it is impossible to provide any other drill locations other than the best case as already provided.

d) The rationale for routing the access and pipeline rights-of-way incorporated the strategies outlined in Sections 3.2.2.1 and 3.2.4.1 in the DAR. To summarize, the rationale included designing the shortest, appropriate access/pipeline system on existing disturbance corridors to transport the production from the wells safely to the battery. This rationale included locating a satellite for a batch of approximately 8-10 oil wells. Another important consideration was to utilize the existing system to the extent practical, and avoid a new crossing of the Cameron River.

   As discussed in the response to question c), given that the actual drilling of many of the wells would be contingent upon success of prior drilling and not knowing at this juncture which of the planned wells will be successful, it is impossible to provide the location of other drilling locations other than the best case as already provided. Subsequently, the same argument could be made for the associated access and pipeline system required. Regardless of the case, Paramount would incorporate the design standards and routing strategies developed and used on all project components to-date.

e) The GIS environment enables spatial identification of previously disturbed areas as well as the area of planned disturbance. The areas of the planned disturbance that overlap the area of previous disturbance are calculated for each stage of development. These measures allow us to determine that the actual area of new disturbance is reduced by half. Specifically, the area of the planned development is overlaid onto the area of the existing development. The area of the additional planned disturbance is then queried out by selecting the regions of the planned development that do not contain regions of previous development.

   It was concluded that approximately 50% of the planned disturbance will be reused as planned development. For example, existing pipeline right-of-ways will be widened to accommodate additional pipelines and production access routes to existing well sites.

IR Number 1.1.4

Preamble

Although the future wellsites are located to the best of Paramount's knowledge, uncertainties with respect to drilling success may affect the final location of subsequent wellsites. As noted in various points throughout the DAR, additional temporary work space may be required during construction.

Request

The MVEIRB asks Paramount to provide the following information:

a) Please indicate whether disturbance by temporary workspace was included in the estimates for Baseline, Application, and Planned Development cases.

Response

a) Temporary workspace was not included in the estimates. Temporary workspace requirements on Application and Planned Development cases are expected to be minimal on this project, and the locations and area needed cannot be accurately known at this time. The footprint for 3-D receiver lines was overestimated by 2 meters at 6 m wide. This additional width was considered to compensate for unknowns at this time, including temporary workspace requirements. As discussed in question 1.1.3, temporary workspaces are used primarily during pipeline construction, and only where additional space is required to complete construction activities (e.g., directional drilling related to drainage crossings).

IR Number 1.1.5

Preamble

The rationale for basing the soils, terrain, vegetation, and wildlife Cumulative Effects Study Area (CESA) on an average female woodland caribou home range size is not clear. Use of an individual home range implies that the assessment is focussed on organism-level effects rather than population- or community-level effects. No discussion of the procedure used to define the boundary encompassing this pre-defined area (Figure 7.1-2) was located.

Request

The MVEIRB asks that Paramount provide the following information:

a) The rationale for the use of an average female woodland caribou home range as the terrestrial CESA.

b) Provide an explanation of the procedure used to establish the terrestrial CESA boundary, including the factors explicitly considered.

Response

a) The terrestrial CESA included both the range of a single woodland caribou and the natural features such as drainage, contour lines and lake boundaries. An average female woodland caribou home range is 70,000 ha; (Stuart-Smith et al. 1997). Woodland caribou home range was chosen to help define the terrestrial study area because effects to caribou would be the widest ranging for all terrestrial VECs. In addition, caribou are sensitive to predation and human development (i.e., VEC affected to the maximum extent from project disturbances) and have spatial overlap between home ranges of individuals within a population (i.e, the home range of an individual caribou will include the range of other caribou within the population). The use of the average caribou home range encompasses the home ranges of all the wildlife VEC species and all terrestrial VECs. The rationale used for a CESA must encompass all terrestrial VECs without creating a CESA that is so large that it diminishes the relative effects of the project to an insignificant number.

b) The terrestrial CESA boundary was selected for the following reasons: to encompass the various activities within the SDL; to encompass the potential effects to VECs as a result of the project and future developments; and to avoid dilution of these potential effects through too large of a study area. Woodland caribou home range parameters were selected for establishing the terrestrial CESA boundary based on the MVEIRB ToR (Section 4.1.1) request to identify the most important and wide ranging receptors. One female caribou home range was used as the basis for delineating the boundary, rather than the entire caribou population. This approach will to ensure that the impact assessment is

conservative yet not insignificant due to a large study area. Additionally, natural features in the area which provide unique terrestrial resources were also identified and included within the terrestrial CESA boundary (e.g., drainages and watersheds and terrain breaks and escarpments of the Cameron Hills). See response to 1.1.6.

Reference

Stuart-Smith, A.K., C.J.A. Bradshaw, S. Boutin, D.M. Herbert and A.B. Rippin. 1997. Woodland Caribou Relative to Landscape Patterns in Northeastern Alberta. Journal of Wildlife Management. 61:622-633.

IR Number 1.1.6

Preamble

The terrestrial Cumulative Effects Study Area (CESA) is based on the home range of one female woodland caribou (70,000 ha), however, the area used in the calculations is actually the total Terrestrial Study Area shown as 96,231 ha (Table 7.8-1 Native Vegetation Communities). These areas appear to be contradictory.

Request

The MVEIRB asks that Paramount provide the following information:

a) Why is the CESA being expanded to the vegetation boundaries when the original intent was to use the range of a single female woodland caribou?

Response

a) The CESA was not expanded from the original intent to use only the range of a single female woodland caribou. Rather, the terrestrial CESA was originally based on two criteria (DAR Section 7.1.1.1.2). The first criterion was the home range size of one female woodland caribou (i.e., 70,000 ha). The second criterion was to include natural features including drainages, contour lines and lake boundaries. For example, the north and east boundaries of the CESA followed the escarpment breaks of the Cameron Hills and the west and south boundaries followed natural drainages and lake boundaries. These additional natural feature areas increased the CESA from the caribou home range of 70,000 ha, to a total terrestrial CESA area of 96,231 ha.

IR Number 1.1.7

Preamble

"Medium-term is 1-20 years (proposed life of the project), and long-term is >20 years (e.g., persists beyond the life of the project)" p127. The Terms of Reference note that the assessment should be based on existing and potential future impacts rather than the duration of the development.

Request

The MVEIRB asks that Paramount provide the following information:

a) Rationale for basing duration criteria on project rather than ecological or social considerations.

Response

a) ToR, Section 4.1.2 Temporal Boundaries, 2nd Paragraph – "The temporal boundaries for this assessment should be set according to existing and potential future impacts rather than the duration of the development. In assessing water quality, for instance, the DAR should take into account that certain development components, such as sumps, may be left in place and may pose a threat to ground water quality long after all activities have ceased. The DAR should assume that all proposed components will be developed, regardless of when they may be developed, as the development schedule is likely to change over time."

The duration criteria are designed to group impacts into time interval categories for the purpose of guiding environmental assessment. As the ToR requires (see preamble above), these impacts must consider impacts that may occur after development activities have ceased. Therefore, the criteria for this project included the duration category "long term", which is defined as >20 years.

It is generally accepted that an impact of >20-35 years can be considered to be long-term. This is the accepted criteria by both provincial and federal regulators for several oils sands EIAs in Alberta (for example, Suncor Millennium, Suncor Firebag, Canadian Natural Resources Ltd., etc.) as well as conventional oil and gas projects (Paramount Cameron Hills Gathering System and Facilities Project) and mining projects (De Beers - Snap Lake,). Paramount has taken a more conservative approach than other EIAs in setting a shorter duration greater than 20 years as the criteria for long-term impacts.

From an ecological point of view, Paramount submits that 20 years is a reasonable length of time to be considered long term. Qualitative results have determined that tree density on seismic lines reach similar tree densities to those found after wildfires after 10-20 years (MacFarlane 1999). Caribou were 26%

more likely to occur around seismic lines of older origin (>23 years) than around newer, and presumably less vegetated, seismic lines (Oberg 2001).

The assessment of impacts from an ecological or social perspective takes into consideration all of the criteria (direction, magnitude, geographic extent, duration, frequency and reversibility) in combination as noted in section 7.1.1.5.

References:

MacFarlane, A. 1999. Revegetation of wellsites and seismic lines in the boreal forest. B.Sc. Honour's Thesis, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada.

Oberg, P. R. 2001. Responses of Mountain Caribou to Linear Features Within a West-central Alberta Landscape. M.Sc. Thesis, Department of Renewable Resources, University of Alberta, Edmonton, AB. 123pp.

IR Number 1.1.8

Preamble

"This quantitative assessment system is intended to be used as a guide to facilitate the final assessment step; it is not intended to provide a definitive value" p128. The Terms of Reference note that the developer should present its views on the significance of each impact, but the Paramount Cameron Hills DAR only presents numerical and descriptive values for Environmental Consequence.

Request

The MVEIRB asks that Paramount provide the following information:

a) Are the terms Environmental Significance and Environmental Consequence being used interchangeably by the developer?

b) If not, please provide a rating scheme to relate Environmental Significance to Environmental Consequence.

Response

a) The terms Environmental Significance and Environmental Consequence are not being used interchangeably by Paramount for the purpose of the DAR.

b) Paramount has followed protocols previously used in reports submitted to regulators in the NWT with respect to assessing Environmental Consequence rather than Environmental Significance for each impact. Section 4.1.3, Impact Prediction, of the ToR has been complied with in the summary section of the DAR. In Section 7.13, Environmental Consequence and Significance Rating, Overall Summary, page 343 of the DAR. Paramount has stated the following "*Considering the results presented in Table 7.13-1, and that the assessed Planned Development Case represents a hypothetical worst case scenario, it is predicted that no significant negative environmental effects will result from the cumulative Paramount development in the Cameron Hills.*"

It is Paramount's opinion that there is an indirect relationship between Environmental Consequence and Environmental Significance, in that only impacts with a high Environmental Consequence rating have the potential to have significant adverse effects on the environment. In this case, the highest rating of environmental consequence was attributed to caribou (negligible to moderate, see table 7.13-1) and even in the worst case the overall impact is considered not significant.

IR Number 1.1.9

Preamble

The numerical screening system used in the Paramount Cameron Hills DAR applies a negative factor to reversible impacts. This weighting effectively negates one or more values assigned to the Duration, Frequency, or Geographic Extent criteria (e.g., the Duration of an impact is irrelevant to Environmental Consequence, as long as it is reversible) and effectively emphasizes the Magnitude criteria. By assigning a negative value in the screening system, reversible impacts may be calculated to appear to ameliorate other undesirable aspects of impacts. It is not apparent why an impact that is reversible should be treated as a net beneficial effect (i.e. as a negative weighting in your screening system would imply).

As noted in the CEAA Reference Guide appended to the MVEIRB cumulative effects guidance document (MVEIRB 2000), "In practice, it can be difficult to know whether the adverse effects of a project will be irreversible or not." This should be especially relevant to impacts that are long-term or continuous, those where mitigation / revegetation / reclamation methods are unproven, or those outside the proponent's direct control (e.g., public use of rights-of-way).

Request

a) *The MVEIRB asks that Paramount provide a rationale for applying a negative weighting factor to reversible impacts, instead of using a weighting of zero.*

Response

a) The rationale for applying a negative weighting factor to reversible impacts, instead of using a weighting of zero, is to provide a level of offset for the remainder of the criterion that are only measured with positive or zero values. The reversibility criterion has to have the potential to offset four other criterion, which are all additive (e.g., 0 to +15). Therefore, if an impact is reversible, the criterion must have enough weighting (i.e., more than 0) to compensate, at least partially, for the sum of the positive values for magnitude, duration, frequency and geographic extent. In theory, if an impact is reversible, then in the long-term, once mitigation has been applied and enough time has passed, the effect should be negligible.

IR Number 1.1.10

Preamble

"It is also reasonable to assume that the areas with elevated Potential Acid Input (PAI) levels (i.e., above 0.17 keq/ha/yr) at Cameron Hills would be smaller than at Snap Lake and that they would be restricted to an area that would lie fully within the Cameron Hills Significant Discovery License (SDL)" (p158).
The discussion of potential acid deposition effects is based on comparison with another EIA, rather than a quantitative evaluation of potential effects in the Paramount CESA. While it may be true that the area with elevated PAI levels is smaller than at Snap Lake, what matters is the potential effects of this deposition on sensitive receptors (i.e., soils and waterbodies) in the Paramount Cumulative Effects Study Area (CESA). The basis for the impact description criteria provided in Tables 7.2-19 and 7.2-25 is not clear. There is no evidence shown that supports a direct comparison between Cameron Hills and Snap Lake.

Request

The MVEIRB asks that Paramount provide the following information:

a) *Justification for the comparison of Cameron Hills and Snap Lake PAI.*

b) *Spatially-explicit modeling predictions of cumulative Potential Acid Input levels resulting from Application Case and Planned Development Case emissions at Cameron Hills.*

Response

a) The prediction of Potential Acid Input (PAI) associated with industrial developments is usually restricted to those areas either in the vicinity of, or immediately downwind from large industrial developments that emit significant amounts of potentially acid forming compounds (i.e., 100s of tonnes of SO_2 and NO_X per day). There have been very few situations where PAI levels have been predicted in the vicinity of relatively small developments (i.e., less than 10 tonnes per day of SO_2 and NO_X). One example of such an assessment was the recently completed EIS for the Snap Lake Diamond Project (De Beers 2002). The Snap Lake EIS provides predictions of PAI for an isolated project in the Northwest Territories, with on-site SO_2 and NO_X emissions of less than 6 t/d from mine vehicles, heaters and power generators. Cameron Hills is also an isolated project, located in the Northwest Territories, with less than 3 t/d of SO_2 and NO_X emissions from on-site combustion sources. As such, the predictions completed for Snap Lake were considered an applicable analogue for the PAI values in the vicinity of the Cameron Hills Project, although the PAI levels at Cameron Hills are expected to be much lower. In addition, the predictions and possible environmental consequences associated with the potential acid forming

emissions at Snap Lake are familiar to the members of the Mackenzie Valley Environmental Impact Review Board.

b) As noted in the response to part (a), the PAI predictions for Snap lake are considered an applicable analogue for the predictions at Cameron Hills. As such, spatially explicit predictions of PAI are not warranted for the Cameron Hills Project since no areas are likely to experience PAI values in excess of 0.25 keq/ha/yr, which is protective of the most sensitive ecosystems.

IR Number 1.1.11

Preamble

Vegetation Loss
The duration of direct vegetation loss/alteration is concluded to be of medium-term (i.e,. 1-20 years) and low frequency (i.,e., one time) in the DAR. Vegetation loss/alteration occurs until vegetation is restored to pre-disturbance conditions, which may be >80 years for mature forest and these effects occur continuously. Thus, impacts of direct habitat loss/alteration are likely to be long-term in duration (i.e., >20 years) and High frequency (i.e., continuous).

Habitat Loss
The duration of direct habitat loss is concluded to be of medium-term (i.e,. 1-20 years) and low frequency (i.,e., one time) in the DAR. Habitat loss/alteration occurs until vegetation is restored to pre-disturbance conditions, which may be >80 years for mature forest and these effects occur continuously. Thus, impacts of direct habitat loss/alteration are likely to be long-term in duration (i.e., >20 years) and High frequency (i.e., continuous).

Request

The MVEIRB asks that Paramount provide the following information:

a) Additional information relevant to the study area to support the conclusion that impacts from vegetation loss/alteration are medium-term and one-time.

b) Additional information relevant to the study area to support the conclusion that impacts from habitat loss are medium-term and one-time.

Response

a) The impacts to vegetation loss were determined to be of medium-term in duration to account for progressive reclamation. Clearing of areas will not be continuous throughout the life of the project, once disturbed areas are no longer required for production (i.e., well leases and associated access roads, etc), these areas are expected to revegetate naturally. This revegetation is expected to begin within the medium-term (i.e., within 20 yrs). The average lifespan of a well is predicted to be 5-10 years, thus a medium-term duration. It is anticipated that no cleared areas will be required for more than 20 years, with the exception of the main access road and permanent project fixtures such as battery facilities. Clearing of vegetation in any given area will only be conducted once.

It should be noted that in Section 7.8.3.15 on page 270, the second sentence should state that "impacts to vegetation communities are predicted to be of low

magnitude and medium-term" as opposed to "long-term" as it was stated in the DAR.

b) See response to 1.1.11 a above. This is supported by the assumption that vegetation represents the primary component of habitat, as used in the DAR.

IR Number 1.1.12

Preamble

"Topography, site elevation, and drainage patterns can be altered at the local scale (e.g., within a lease). Implementing progressive reclamation is expected to yield short- to moderate-term disturbances to terrain" p 172. Effects on drainage patterns are generally considered to extend beyond the lease or right-of-way area (i.e., a Regional effect according to the geographic extent criteria provided in Section 7.1.1.5.1). Effects on soil and terrain will extend beyond the proposed 20 year production period (i.e., a Long-term effect according to the geographic extent criteria provided in Section 7.1.1.5.1). Therefore, there is a contradiction as to whether the effects are short/moderate term versus long term.

Request

The MVEIRB asks that Paramount provide the following information:

a) Rationale as to whether the effects on soil and terrain are short/moderate term or long term in nature.

Response

a) On a local scale, the impacts to soil and terrain are considered to be short – to medium-term, depending on the activity, and based on pro-active reclamation. As outlined in Table 7.3-6, the impacts to soil and terrain were rated as having a long-term duration. However, for this assessment the soil and terrain assumed that the entire project occurred at once and lasted for the duration of the project (20 yrs). This resulted in the regional geographic extent and long-term duration (i.e., mitigation not started until after 20 yrs). This worst case scenario assessment resulted in an environmental consequence of negligible to low.

IR Number 1.1.13

Preamble

"All impacts are predicted to be negligible for soil and terrain..." p178. However, the impact summary included in Table 7.3-6 notes that environmental consequence is negligible to low, as opposed to low.

Request

The MVEIRB asks that Paramount provide the following information:

a) Confirm that impacts on soils and terrain are rated as negligible to low.

Response

a) As outlined in Table 7.3-6, the impacts to soil and terrain were rated as having a negligible to low environmental consequence. The statement on Page 178 should have stated negligible to low.

IR Number 1.1.14

Preamble

"Project development will not alter the terrain in the long-term..." p8. However, the Soil and Terrain Residual Impact summary included in Table 7.3-6 notes that effects on soil and terrain will be long-term.

Request

The MVEIRB asks that Paramount provide the following information:

a) Clarify and confirm that impacts on soils and terrain will be long-term.

Response

a) Refer to the response to 1.1.12.

IR Number 1.1.15

Preamble

The aquatics cumulative effects study area (CESA) was established to reflect the maximum extent of potentially affected watersheds that originate within the Cameron Hills Significant Discovery License (SDL) (Section 7.1.1.1.1, page 120). Quantitative analyses of disturbed area and crossings are provided for the Cameron River watershed (1,387 km^2) and combined aquatics CESA (1,987 km^2). Use of too large a study area diminishes effects; for example, the aquatic disturbed area calculations included in Table 7.4-8 (page 201) are less than half the values reported for soils and terrain units in Tables 7.3-3 and 7.3-4 (page 177), and impact magnitude was typically rated to be negligible (i.e., no measurable effect). Cumulative effects on hydrology and sediment yield are most frequently evaluated in sub watersheds smaller than 500 km^2 (e.g., Bosch and Hewlett 1982; BCF 1999), particularly where disturbance is concentrated in one part of a drainage.

Request

The MVEIRB asks that Paramount provide the following information:

a) A quantitative analysis of existing and future disturbed areas for the Cameron River sub watershed, where most Paramount activities are concentrated, as opposed to the entire watershed.

Response

a) The Cameron River sub-watershed area, where most of Paramount activities are concentrated, can be defined as the watershed area where the river crosses the west boundary of the Paramount SDL Area. The watershed area at this location is 774 km^2, which compares to the total watershed area of 1387 km^2.

Table 1.1.15 shows the existing and future disturbed areas relative to other areas.

Table 1.1.15 Disturbed Areas

Area	Environmental Setting Case	Baseline Case		Application Case		Planned Development Case	
	(km^2)	(km^2)	(%)	(km^2)	(%)	(km^2)	(%)
Disturbed Area	0	1.9		1.93		2.02	
Undisturbed Cameron River sub-watershed *	774	772.1	99.755	772.07	99.751	771.98	99.739
Undisturbed Cameron River watershed	1387	1385.1	99.863	1385.07	99.861	1384.98	99.854
Undisturbed Aquatics Study Area	1987	1985.1	99.904	1985.07	99.903	1984.98	99.898

* assumes all disturbances are in the Cameron River sub-watershed

IR Number 1.1.16

Preamble

"The categorization of the impact magnitude (i.e., high, moderate, low, or negligible) is based on a set of criteria, ecological concepts, and professional judgement pertinent to each of the discipline areas analyzed." Geographic extent description criteria page 127: It is recognized that a method of defining impacts ... in terms of a percentage ... must be tempered with an overall qualitative approach that considers the impacts of disturbance ..." p127. The same impact magnitude criteria appear to have been used for each discipline area and effect pathway in the cumulative effects assessment, although the discussion included in Section 7.1.1.5.1 implies that other factors were considered.

Request

The MVEIRB asks that Paramount provide the following information:

a) *Identify the other factors that were considered when assigning magnitude ratings for potential effects on hydrology and sediment yield.*

Response

a) For the hydrology and sediment yield assessment, no other factors apart from those stated in the DAR were considered when assigning magnitude ratings for potential effects on hydrology and sediment yield.

IR Number 1.1.17

Preamble

In Table 7.5-1, the effect of pits and sumps is concluded to be short-term in duration (i.e., <1 year), whereas the text included in Section 7.5.7.1.1 refers to long-term impacts.

Request

The MVEIRB asks that Paramount provide the following information:

a) Does Paramount intend to contain drilling fluids in remote sumps? (Section 3.2.5)

b) Are potential impacts from these pits long-term in duration?

Response

a) Paramount does not intend to contain drilling fluids in remote sumps. Paramount will contain drilling fluids in above ground tanks, reuse the drilling fluid as much as possible, and at the end of the drilling season, transport the fluids out of the area for disposal at an approved facility (see page 87 of the DAR). The drill cuttings will be contained in remote pits following appropriate testing.

b) The potential impacts from the pits containing drill cuttings are not considered to be long-term in duration. The text in 7.5.7.1.1 states that the potential (for) long-term impact to groundwater quality is considered negligible. But the duration is considered to be short-term, because the solids, after appropriate testing do not contain elements that exceed regulatory parameters or guidelines. The drill solids are expected to consolidate on the parent material of the pit, and be stable and non-toxic.

IR Number 1.1.18

Preamble

"During the winter caribou utilize uplands, bogs and south-facing slopes ...these findings are similar to those found in north-eastern Alberta" DAR p213.
"As a result, upland areas considered suitable habitat for ungulates such as moose are not considered suitable habitat for woodland caribou...."Appendix V, Wildlife HSI Model Descriptions, page V-2.
These statements appear to be contradictory.

Request

The MVEIRB asks that Paramount provide the following information:

a) Are uplands, bogs and south-facing slopes suitable habitat for woodland caribou?

b) Resolve inconsistencies in above statements presented in the DAR.

Response

a) Yes, during the winter caribou utilize uplands, bogs and south-facing slopes, where snow conditions allow access to their winter diet, consisting primarily of lichen (RWED 2003).

b) The availability of lichens, as well as predator avoidance strategies, influence habitat use and distribution of woodland caribou. Typically, this habitat use includes lowland areas (e.g., peatland complexes, bogs) where terrestrial lichens constitute the bulk of woodland caribou's winter diet (Morton and Wynes 1997). However, some upland habitats, for example lichen-rich jack pine stands, provide arboreal lichens which are also important in the diet of caribou populations when deep or crusted snow makes accessing (i.e., travel and cratering) terrestrial lichens difficult (Dzus 2001). Other upland stands, including trembling aspen, white spruce, paper birch and balsam fir are seldom used or are avoided (Bradshaw et al. 1995, Fuller and Keith 1981). This reduced use of upland stands is suggested to create a spatial separation between woodland caribou and other prey species (i.e., commonly moose), serving as an anti-predator strategy against wolves (Bergerud et al. 1984).

The reduced use of upland forest stands, relative to peatland areas, was depicted within the HSI modelling for woodland caribou (see DAR, Appendix V). For example, vegetation types within the TSA considered highly suitable (HSI value = 1.0) for woodland caribou included black spruce mature open with sphagnum and lichen and black spruce open uneven sized with lichen. Black spruce closed uneven sized and black spruce mature closed were considered to be moderately (HSI value = 0.66) suitable vegetation types. Upland vegetation types including

pine young closed, pine mature closed, aspen young closed, and aspen mature closed were given a low suitability value for caribou (HSI value = 0.33). Conversely, for moose, the aspen young closed vegetation type was considered to be highly suitable (HSI value = 1.0) and the aspen mature closed vegetation type was given a moderately suitable value (0.66) (Table V-1).

References:

Bergerud, A. T., R. D. Jakimchuk and D. R. Carruthers. 1984. The Buffalo of the North: caribou (*Rangifer tarandus*) and human developments. Arctic 37:7-22.

Bradshaw, C. J. A., D. M. Hebert, A. B. Rippin and S. Boutin. 1995. Winter Peatland Habitat Selection by Woodland Caribou in Northeastern Alberta. Can. J. Zool. 73:1567-1574.

Dzus, E. 2001. Status of Woodland Caribou (*Rangifer tarandus caribou*) in Alberta. Alberta Environment, Fisheries and Wildlife Management Division and Alberta Conservation Association. Wildlife Status Report No. 30, Edmonton, AB. 47pp.

Fuller, T. K., and L. B. Keith. 1981. Woodland Caribou Population Dynamics in Northeastern Alberta. J. Wildl. Manage. 45:197-213.

Morton, K., and B. Wynes. 1997. Progress Report prepared for the North West Region Standing Committee for Caribou (NWRSCC). Unpubl. rep. Peace River, AB. 45pp.

RWED 2003. NWT Woodland Caribou, Species At Risk Fact Sheet. Accessed August 11, 2003 URL: http://www.nwtwildlife.com/publications/speciesatriskweb/woodlandcaribou.htm.

IR Number 1.1.19

Preamble

"Overall, the Cameron Hills is considered to be of poor habitat quality for fur-bearers and in particular marten, due to a lack of forested vegetation with a high structural complexity" p217. This conclusion regarding marten habitat quality is inconsistent with the habitat suitability map included as Figure 7.6-3 which shows large areas of medium and high quality marten habitat.

Request

The MVEIRB asks that Paramount provide the following information:

a) *Resolve inconsistencies in above statements presented in the DAR*

Response

a) The habitat suitability modelling for all wildlife VECs was based primarily on a subjective analysis of habitat potential derived from 30 m satellite imagery. Due to the nature of the vegetation layer, quantification of potential habitat suitability was assessed primarily on overstory tree species. As a large portion of the Cameron Hills is comprised of conifer species, which in general terms provide suitable habitat for marten, the HSI model predicted a high amount of suitable marten habitat (i.e., 60% of possible suitable habitat). However, canopy composition alone cannot account for forest structural complexity associated with mature white spruce and fir stands which is often preferred marten habitat. A large portion of the Cameron Hills is comprised of black spruce (both open and closed) and pine stands, which in general terms, usually have poor structural complexity. Therefore, it is likely that the habitat modelling over-estimated marten habitat due to coarse vegetation information.

IR Number 1.1.20

Preamble

"Approximately 50% of new disturbances will be reused for other components of the project" p222. Information on disturbance features for the Existing, Project Application, and Planned Development cases is presented in several locations in the DAR.

Request

The MVEIRB asks that Paramount provide the following information:

a) *A tabular summary of disturbance by land use feature (i.e., seismic lines, roads, pipelines, wells, facilities, camps, etc.) in the aquatic and terrestrial CESAs for the Existing developments*

b) *A tabular summary of disturbance by land use feature (i.e., seismic lines, roads, pipelines, wells, facilities, camps, etc.) in the aquatic and terrestrial Cumulative Effects Study Areas (CESA) for the Project Application developments*

c) *A tabular summary of disturbance by land use feature (i.e., seismic lines, roads, pipelines, wells, facilities, camps, etc.) in the aquatic and terrestrial CESAs for the Planned developments*

Response

T able 1.1.20-1 provides a breakdown of disturbances by land use feature for the Baseline Case, Application Case and Planned Development Case.

Table 1.1.20-1 Area of Disturbance by Land Use Feature for the Baseline, Application and Planned Development Cases.

Land Use Feature	Development Case		
	Baseline	Application	Planned
Facilities[a]	169 ha	6 ha	64 ha
Roads	97 ha	22 ha	64 ha
Utilities[b]	1,652 ha	-	-
Total (cumulative)	**1,918 ha**	**28 (1,946) ha**	**128 (2,074) ha**

[a] New wellpads and associated infrastructure
[b] Seismic lines, power lines and pipelines

IR Number 1.1.21

Preamble

Pages 228-229 of the DAR suggest that the sensory disturbance assessment is "conservative" or "ultra-conservative", because Section 7.6.3.2.4, page 225: "... displacement is reduced following wildlife habituation to the disturbance; page 7.6.3.4.3, page 228: "It is anticipated that most animals will learn to tolerate noise as long as the disturbance is predictable in both time and space." Table 7.6-16: the frequency of sensory disturbance is concluded to be of Short-term duration (i.e., <1 year), and Low frequency (i.e., once).As noted later in Section 7.6.3.4.3. of the DAR, actual response to disturbance "is expected to vary, depending on the individual and species". Although habituation to consistent, stationary noise sources (e.g., compressors) is likely to occur, thereby reducing (but not necessarily eliminating) the zone of influence, habituation to production-related ATV and vehicle traffic outside protected areas such as National Parks cannot be considered likely. Wildlife monitoring conducted by Paramount has documented reduced wildlife use adjacent to pipeline rights-of-way (Section 9.3). Thus, impacts associated with sensory disturbance are likely to be long-term in duration (i.e., >20 years), and high frequency (i.e., continuous during the project).

Request

The MVEIRB asks that Paramount provide the following information:

a) When referring to the term impact in this case, do you mean stimulus (ie. actual noise)?

b) Are impacts associated with sensory disturbance short-term?

c) Are impacts associated with sensory disturbance one-time?

Response

a) Section 7.6.3.4.3 notes that impacts refers to "wildlife species may avoid or reduce their use of habitat adjacent to areas of human activity", which could lead to the reduction in the effectiveness of the habitat in supporting wildlife needs. Therefore, actual noise is the stimulus that may cause a reaction from the wildlife (e.g., flight reaction, avoidance of an area), which would result in the impact. Other impacts are discussed in the subsequent responses below.

b) The sensory disturbance referred to, and rated in the assessment (worst case) is related to seismic exploration (reflected by the moderate to high magnitude ratings and regional ratings for geographic extent for caribou and moose – Table 7.6-16) within the cumulative effects study area. Further, the disturbance (i.e., habitat alteration, human activity, machinery operation) occurs over a relatively large area within the winter season. As such, the sensory disturbance for the

evaluated worst-case scenario (i.e., completion of 3-D seismic during a single winter) was considered to be short-term. The majority of the 3-D seismic lines are not used again for access or pipeline routing (i.e., no human activity), and are allowed to revegetate.

Sensory disturbance includes all impacts, including noise, as well as habitat avoidance due to increased predation risk (e.g., linear disturbances as demonstrated in Dyer 1999 and James 1999), habitat avoidance due to the presence of humans and increased access (e.g., vehicular activity), and avoidance of facilities, wellsites and associated infrastructure. Recent research results indicate that seismic lines reach similar tree densities to those found after wildfires after 10-20 years post-disturbance (MacFarlane 1999). The impact resulting from sensory disturbance (i.e., noise) from the camp, battery and well operations would be predicted to be negative in direction, low to moderate in magnitude (+5 to +10), local in geographic extent (0), medium-term in duration (+2), reversible (-3), and moderate to high in frequency (+1 to +2). This would be predicted to result in an environmental consequence rating of a maximum of +11 (moderate) for wildlife.

It is expected however that the overall impact will be reduced as wildlife habituate to these predictable (in both space and time) disturbances. Evidence of habituation has been documented in caribou when snow machines were predictable in space and time (Simpson 1987). In addition, the project area on the Cameron Hills has historically supported low numbers of caribou, even before oil and gas exploration began. Further, information from the 2002 and 2003 Wildlife Sighting Cards indicates that caribou continue to use habitats within the terrestrial study area (TSA), particularly the southern portion, and also areas to the south of the TSA.

c) The completion of the 3-D seismic was considered to happen only once, because this level of exploration is not expected to be repeated within a given area. The reference to low frequency (DAR states one time, but should also include infrequent occurrences) also reflects the uncertainty in a given animal's response to a human disturbance corridor. For example, wildlife, including caribou, will still cross roads and cutlines, so these project components were not considered direct barriers. Also, the low frequency criterion attempts to incorporate the low wildlife densities within the project area.

If we consider caribou interactions with seismic cutlines resulting in a visual sensory disturbance, then Paramount suggests the following rating. The visual disturbance (i.e., reluctance to cross) would be predicted to be negative in direction, moderate in magnitude (+10), regional in geographic extent (+1), medium-term in duration (+2), reversible (-3), and moderate in frequency (+1). This would be predicted to result in an environmental consequence rating of a maximum of +11 (moderate) for caribou. Again, this takes into consideration

the fact that the caribou still utilize the cutlines to some extent and that the density of caribou is low on the Cameron Hills.

Wildlife sighting cards indicate observation of caribou crossing the access road and in the vicinity of the manned gate.

References:

Dyer, S. 1999. Movement and distribution of Woodland Caribou (Rangifer tarandus caribou) in response to industrial development in northeastern Alberta. M.Sc. Thesis, University of Alberta, Edmonton, AB. 106pp.

James, A. R. C. 1999. Effects of Industrial Development on the Predator-Prey Relationship Between Wolves and Caribou in Northeastern Alberta. Ph.D. Dissertation, University of Alberta, Edmonton, AB. 77 pp.

MacFarlane, A. 1999. Revegetation of wellsites and seismic lines in the boreal forest. B.Sc. Honour's Thesis, Department of Biological Sciences, University of Alberta, Edmonton, AB.

Simpson, K. 1987. The effects of snowmobiling on winter range use by mountain caribou. British Columbia Ministry of Environment, Parks and Wildlands. Working Report No. WR-25.

IR Number 1.1.22

Preamble

Page 13 of the Terms of Reference requests Paramount to "... address changes in effective or critical habitat for boreal woodland caribou." The wildlife impact assessment focuses on generic 'habitat units' (HU) that provide a single measure of habitat availability and suitability. One of the disadvantages of this approach is that comparative changes in low and high quality units cannot be compared. This can result in a situation where disturbance of a small area of high suitability (critical) habitat can be discounted by large areas of low suitability habitat. As noted in DAR page 233, "... disturbance is relatively localized in the central and southern areas of the SDL..." and Figure 7.6-1 suggests that this area may contain higher suitability habitat than other parts of the SDL.

Request

The MVEIRB asks that Paramount provide the following information:

a) Supplement each HU estimate included in Section 7.6.4 with numerical estimates of HUs classified as High and Moderate Suitability.

Response

a) See Table 1.1.22-1 below.

Table 1.1.22-1 Summary of Direct Habitat Loss and Area Affected by Sensory Disturbance for Wildlife VECs Under Each Development Case.

Species	Environmental Setting	Habitat Affected for each Development Case (HUs)					
		Baseline - Direct Loss	Baseline - Sensory Disturbance	Application - Direct Loss	Application - Sensory Disturbance	Planned Development – Direct Loss	Planned Development- Sensory Disturbance
Caribou							
Low	10413	194	2,006	1	164	14	726
Moderate	22,865	476	4,847	10	747	30	1,469
High	21,996	510	5,069	7	554	32	1,277
Total	**55,274**	**1,180**	**11,922**	**18**	**1,465**	**76**	**3,472**
Moose							
Low	25,471	538	4,978	8	152	29	573
Moderate	5,968	88	837	0	24	2	62
High	3,820	92	696	3	15	36	89
Total	**35,259**	**718**	**6,511**	**11**	**191**	**67**	**724**
Marten							
Low	10,125	214	1,922	2	50	12	197
Moderate	10,291	215	1,999	1	26	4	327
High	37,273	746	7,059	15	288	46	719
Total	**57,689**	**1,175**	**10,980**	**18**	**364**	**62**	**1,243**
Forest songbirds							
Low	14,941	319	1,727	3	13	14	76
Moderate	24,279	506	2,760	12	38	52	102
High	2,629	26	167	0	3	0	2
Total	**41,849**	**851**	**4,654**	**15**	**54**	**66**	**180**

IR Number 1.1.23

Preamble

"The categorization of the impact magnitude (i.e., high, moderate, low, or negligible) is based on a set of criteria, ecological concepts, and professional judgement pertinent to each of the discipline areas analyzed"p127. Geographic extent description criteria page 127: It is recognized that a method of defining impacts ... in terms of a percentage ... must be tempered with an overall qualitative approach that considers the impacts of disturbance on overall viability and diversity..." Table 7.6-16, page 238.
The same impact magnitude criteria appear to have been used for each wildlife species and effect pathway in the cumulative effects assessment, although the discussion included in Section 7.1.1.5.1 implies that other factors were considered.

Request

The MVEIRB asks that Paramount provide the following information:

a) Identify the other factors that were considered for woodland caribou

b) Identify the other factors that were considered for marten

c) Identify the other factors that were considered for forest songbirds.

Response

a), b) & c)

In order to determine the magnitude of impacts from habitat loss/alteration on wildlife species, habitat suitability index models and zones of influence with corresponding disturbance coefficients were applied, as described in Section 7.6.3.4 and Appendix V for all VECs including woodland caribou, marten and forest songbirds. No other factors were considered in determining the magnitude of impacts from habitat loss/alteration.

Factors considered to determine the magnitude of impacts from barriers to movement and increased trapping/hunting/predation as a result of increased access for all wildlife VECs were as follows:

- linear disturbance density;
- VEC species being considered (i.e., these effects generally don't apply to forest birds);
- species home range size and movement ability;
- consumptive recreational use (i.e., hunting and trapping) of the area; and
- presence and density of predator species.

IR Number 1.1.24

Preamble

Page 11 of the Terms of Reference asks Paramount to "... examine ecosystem components and analyze how they will be impacted by all development components combined in space and over time, rather than presenting individual components and their impacts." Residual effects are provided for each VEC and effect pathway, but potential combined effects from multiple pathways are not considered.

Request

The MVEIRB asks that Paramount please provide the following information:

a) *Total impacts of past, present, and reasonably foreseeable activities and developments on Woodland Caribou*

b) *Total impacts of past, present, and reasonably foreseeable activities and developments on Moose*

c) *Total impacts of past, present, and reasonably foreseeable activities and developments on Marten*

d) *Total impacts of past, present, and reasonably foreseeable activities and developments on Forest Songbirds*

Response

a) The MVEIRB ToR, Section G *Effects on the Environment* (Page 13 ToR) outlines that Paramount is required to identify all past, present and reasonably foreseeable human activities and developments that may affect valued components, while predicting the combined impact of the proposed development in combination with the past present and reasonably foreseeable future activities and developments. Based on these terms, total impacts of past, present and reasonably foreseeable activities and developments are described under the results of the Cumulative Effects Assessment (Section 7.6.4) for woodland caribou, moose, marten and forest songbirds. Cumulative (baseline + application + planned development) effects are presented for direct habitat loss (Table 7.6-14), sensory disturbance and indirect habitat loss (Table 7.6-15) and for increased access and barriers to movement. In addition, incremental impacts to habitat and sensory disturbance are presented for each VEC.

b) See above.

c) See above.

d) See above.

IR Number 1.1.25

Preamble

Forest fires are one of the primary sources of natural disturbance in the boreal forest. Because they affect both habitat availability and suitability over the long-term, assumptions used in scenario modelling affect both modelling conclusions and confidence.

Request

The MVEIRB asks that Paramount provide the following information:

a) Provide the assumptions used to generate the Far Future Case burned area estimate of 395 ha, including the pre-disturbance vegetation communities considered to have been burned.

b) Provide information relevant to the study area to support the assumption that historical fire frequencies will continue over the next 70 years, given the dominance of mid to mature seral stage vegetation communities.

Response

a) The environmental setting conditions for the CESA includes 399 ha of burned area (0.4%). As a result of the baseline case 4 ha of burned area were removed (i.e., 395 ha of burn remaining) and were converted to the disturbed category. As there was no means for determining the ecological site conditions of the burned areas, the successive vegetation type could not be determined (i.e., what type of vegetation community the burned area would convert to). In addition, in order to incorporate some level of fire disturbance into the far future conditions, the remaining area of burned areas (i.e., 395 ha) was maintained for all development scenarios including the far future case.

b) As there was no modelling involved to determine future fire disturbance, there were no assumptions with regards to fire frequency or fire return interval. All assumptions regarding fire disturbance are discussed in the above response.

IR Number 1.1.26

Preamble

The DAR illustrates proposed water consumption (Table 3.5-1) for access construction, which accounts for nearly one hundred percent of consumption, over the next ten years. However, the calculations used to predict water consumption are based on years where water consumption has been average. Furthermore, the annual water yields, or water available for consumption, from the proposed source lakes (Table 7.4-5) is based on mean hydrological conditions. Water consumption predictions based solely on mean values do not leave room for contingency planning, where outside of average hydrologic patterns may be encountered.

Request

The MVEIRB asks Paramount to provide information for:

a) *Proposed water consumption (Table 3.5-1), factoring in a twenty percent (20%) increase in water use*

b) *How would available source water be altered in 10-year dry and 100-year dry conditions, with a compounding factor of increased water consumption, as calculated above?*

c) *Plan to monitor changes in water levels and associated impacts*

d) *Strategy to mitigate changes in water levels and associated impacts, in the event detected (adaptive management).*

Response

a) The last column in Table 1.1.26 below shows the factored (by 20%) total annual water consumption with a maximum annual water consumption of 57,376 m^3.

Table 1.1.26 Proposed Annual Water Consumption Forecast for Access Construction

Season Ending in Year	Length of Road for Heavy Access (km)	Water Use for Heavy Access (m^3/km)	Length of Road for Operations Access (km)	Number of Wells	Water Use for Operations Access (m^3/km)	New Wellsites (@ 754 m^3/ wellsite)	Drilling Water (@ 226 m^3/ well)	Total Water Consumption (m^3)	Total Water Consumption Factored by 20% (m^3)
2004	80	23,440	19	10	2,774	7,540	2,260	36,014	43,217
2005	100	29,300	17	8	2,482	6,032	1,808	39,622	47,546
2006	100	29,300	14	5	2,044	3,770	1,130	36,244	43,493
2007	105	30,765	16	5	2,336	3,770	1,130	38,001	45,601
2008	110	32,230	18	5	2,628	3,770	1,130	39,758	47,710
2009	115	33,695	19	5	2,774	3,770	1,130	41,369	49,643
2010	120	35,160	20	5	2,920	3,770	1,130	42,980	51,576
2011	125	36,625	21	5	3,066	3,770	1,130	44,591	53,509
2012	130	38,090	22	5	3,212	3,770	1,130	46,202	55,442
2013	135	39,555	23	5	3,358	3,770	1,130	47,813	57,376
2014+	135	39,555	23	0	3,358	0	0	42,913	51,496

b) An annual water withdrawal of 47,813 m^3 from Lake 1, during year 2013, will result in an additional 5.5 mm drop in lake water level in the event of either the 10-year or the 100-year dry hydrological condition. For an increased annual water withdrawal of 57,376 m^3, during year 2013, the lake water level will drop by an additional 6.6 mm in the event of either the 10-year or the 100-year dry hydrological condition.

c) Paramount feels that with the predicted minimal changes in water levels monitoring is not warranted.

d) The cumulative changes to Lake 1 water levels were estimated to be a few millimeters, which are considered negligible relative to its natural water level range. This led to the conclusion that Lake 1 water balance will not be impacted.

Paramount's strategy is to adhere to the Department of Fisheries and Oceans guidelines for water withdrawal, which is designed to protect fish habitat.

IR Number: **1.1.27**

Source: **Mackenzie Valley Environmental Impact Review Board**

To: **INAC, South Mackenzie District**
DFO
Environment Canada
GNWT-RWED

DAR Section: **Developer Information, Paramount Resources Limited**
Environmental Performance Record

Terms of Reference Section: **B. Developer Information,**
B-4. Performance Record

Preamble

The DAR lists prior commitments made on behalf of Paramount Resources Ltd. to the MVLWB with respect to the operations at Cameron Hills (Table 2.4-2). This Table also describes the current status of the commitments made by Paramount Resources Ltd., according to the developer, during the previous Environmental Assessment. Past performance, with respect to recommendations made throughout the Environmental Assessment process, may be indicative of willingness to comply with future recommendations.

Request

The MVEIRB asks INAC (South Mackenzie District), DFO, Environment Canada and GNWT-RWED to provide the following information, according to your area of jurisdiction:

a) Have all commitments made by the developer been adhered to, as indicated in the summary (Table 2.4-2)?

b) If not, please indicate which commitments raise your concern and why?

IR Number 1.1.28

Preamble

The DAR proposes, as a mitigative measure, a minimum of 4 centimeters of snow cover to protect surface vegetation in low lying areas from winter access road construction. However, the Department of Transportation Handbook (GNWT 1993) clearly indicates that a minimum of 10 centimeters of snow cover is the acceptable standard. The DAR also proposes, as a mitigative measure, to keep the bottom edge of the blade elevated no less than 4 centimeters above the surface to avoid disturbance of vegetation while windrowing timber and slash. Again, the Department of Transportation Handbook (GNWT 1993) suggests the acceptable standard is at least a 1 meter blade height while clearing, and at minimum a 15 centimeter blade height from the surface while windrowing.

Request

The MVEIRB asks Paramount to provide the following information:

a) Rationale for not proposing to follow minimum10 centimeter snow cover standard during construction of winter access roads in low lying areas.

b) Rationale for not proposing to follow minimum 15 centimeter blade height standard when windrowing timber and slash from satellite and well sites.

c) Why is the use of mushroom shoes not included as a mitigation measure?

Response

a) Paramount's primary objective in creating any cleared site is to minimize to the maximum practical extent, and even eliminate if possible, disturbance of the surface duff and insulative layer. (Evidence of this is provided as Paramount emphasizes this objective in its permafrost protection plan.)

The referred to Department of Transportation Handbook is entitled "Environmental Guidelines for the Construction, Maintenance and Closure of Winter Roads in the Northwest Territories" and as such, is taken by Paramount to be an assembly of Guidelines and specifically not a recitation of minimum standards.

It is Paramount's interpretation of the Handbook that it does not advocate a minimum height that the blade of snow clearing equipment will be carried. The Handbook advocates a minimum of 10 cm compacted snow cover over the natural surface, see pages 16, 20, 21, 22 and 24. (Paramount interprets this specification applies to the newly constructed compacted snow winter road as

the Handbook addresses operation of the road as spring approaches with less cover, see page 60 item 3 and 4.)

In clause 2.5, item 4, of the handbook, Paramount understands the clear message as the text advocates, ".....it is more important here not to disturb the surface materials, remove or compress the organic insulating layer and to ensure a minimum cover of compacted snow (normally 10 cm) cover the highest hummocks." Paramount submits that it can achieve that objective and in some circumstances may seek to remove all but the last 4 cm of undisturbed snow cover. The need to remove the insulating snow, to improve and hasten frost penetration, will be served by lower blade heights. Further, some types of snow, sugary granular forms, are not conducive to compaction and work productivity decreases with snow thickness. The Handbook recognizes this problem in clause 3.2 stating, "More of the snow should be compacted on the right of way and this would better protect the terrain and eliminate the mineral soil and organics that are mixed with the snow. It is recognized that this is more easily said than done, because there is a fine line in compacting snow that will strengthen under traffic as compared to being destroyed by traffic.

Paramount agrees that as much of the undisturbed snow should be left in place before compaction begins. (This would serve to provide additional protection against disturbing the surface materials and would eliminate the need to move some snow twice.)

b) Paramount undertakes to minimize disturbance to surface material and in so doing undertakes to adapt the specifications or suggestions of the Handbook.

(In preparing the DAR, Paramount was not aware of, and remains unable to find, the Handbook's suggestion that a minimum blade height of 15 cm be adapted when windrowing slash.)

c) The use of mushroom shoes on dozer and grader blades is not always prudent or most productive. The use of mushroom shoes to prevent disturbance of surface material is prudent in the early stages of road construction. Aside from road opening, during operation and maintenance, when grading equipment is employed, the primary objective is frequently to work the surface. Examples of equipment use which would be hindered by the use of mushroom shoes include, grading to eliminate punch-outs, grading to reduce washboard or other surface roughness, grading to scarify polished ice, etc. The effectiveness of mushroom shoes in certain circumstances is recognized but their use should not be mandated whenever grading equipment is used. The Department of Transportation Government of the Northwest Territories, Environmental Guidelines for the Construction, Maintenance and Closure of Winter Roads in the Northwest Territories, advocates the use of mushroom shoes in the early stages of construction to minimize disturbance of surface material but does not promote their use in every operation. Paramount agrees with that approach.

IR Number 1.1.29

Preamble

The DAR utilizes the terms 'northerner' and 'northern business' in its descriptions of potential benefits, employment, procurement and economic benefits to the Northwest Territories. However, it is unclear what is exactly understood by these terms.

Request

The MVEIRB asks Paramount to provide the following information:

a) *Who does the term 'northerner', used in the DAR's description of Socio-Economics, exactly include?*

b) *What constitutes a 'northern business'?*

Response

a) "Northerner", or alternatively "northern resident" and "northern employee", all refer to individuals whose place of residence is in the Northwest Territories. Where employees of Paramount or its contractors are identified as "northerners", the identification is based on the point of hire (and therefore presumed residency) in combination with the use or not of transport provided to locations outside the Northwest Territories. For example, an individual hired in the NWT, who subsequently is housed at camp and rotated out of NWT is not considered a northerner, whereas an individual hired outside the NWT who subsequently moves to a NWT community and is rotated between a worker camp and an NWT community is considered a northerner.

This definition is consistent with reporting requirements of the National Energy Board. There is no universally sanctioned definition of northerner but rather different definitions are used "for purposes of" a specific document, program, etc. The above definition of northerner is used in the DAR because particularly the economic impacts of employment on NWT are enhanced when employees actually live in NWT communities and therefore spend the greatest part of their wages in NWT on rent, food, utilities, recreation, etc. This is true irrespective of, for example, length of residency, ethnicity, or other parameters that are found in various other definitions.

b) A "northern business" refers either to a business that is formally registered to do business in the NWT or to a business that has formed an alliance with a Northwest Territory community and has been identified as such by community leadership.

As for the above, there is no universally sanctioned definition of northern business. Formal registration is common to many definitions. The restriction to identified alliances with Cameron Hills communities is intended to enhance economic benefits of the project for potentially affected populations in a context where efforts are underway to increase northern economic participation.

IR Number 1.1.30

Preamble

Section 7.6.4.2.2 of the DAR examines habitat loss and alteration due to disturbance associated with development. The linear disturbance density calculated for the Paramount Cameron Hills Significant Discovery License (SDL) is 3.0 km per km^2. One of the disadvantages to relying on a single mean value is that relevant spatially-explicit components cannot be evaluated. As noted in DAR page 233, "disturbance is relatively localized in the central and southern areas of the SDL..." and Figure 7.6-1 suggests that this area may contain higher suitability habitat than other parts of the SDL.

Furthermore, habitat loss due to disturbance can be more accurately measured by not only the total linear disturbance, but by looking at the zone of influence of such disturbances. In the case of Cameron Hills, Woodland Caribou can be used as the indicator species. The literature suggests that any area within 250m of a linear disturbance will be avoided by caribou and up to 1000m from wellsites will also be avoided (2003: Government of Alberta: Status of Alberta Wildlife). Other recent work of the Alberta Boreal Caribou Committee (2003) also suggests that linear corridors and forest age are the best predictors of woodland caribou population effects.

Request

The MVEIRB asks Paramount to provide the following information:

a) *Document the method used to calculate linear disturbance density*

b) *A spatial analysis of the Cameron Hills SDL, employing a 250 meter buffer on either side of any linear disturbance (cutlines, ROWs, pipelines, roads) and a 1000 meter buffer around wellsites. This information should be presented in the form of a paper map, at a scale of 1:50 000.*

c) *Evaluate the suitability of the Alberta Boreal Caribou Committee formula in the Cameron Hills area.*

Response

a) Linear disturbance density was calculated by dividing the total length of linear disturbances within the TSA (i.e., 2,882 km for baseline case) by the total TSA area (i.e., 962.31 km^2). The result was a linear disturbance density of 3.0 km per km^2. Although this method assumes that linear disturbances are evenly distributed throughout the Paramount Cameron Hills SDL area, it is agreed that the seismic disturbance is localized in the central and southern areas of the SDL (DAR, page 233). This localization of disturbance was more accurately measured within the HSI modelling sensory disturbance potential calculations

using zones of influence and disturbance coefficients for reduced habitat effectiveness within these areas (DAR Section 7.6.3.4.3).

b) The wildlife assessment presented in the DAR employed a spatial analysis of the SDL using a 1000 meter buffer on either side of all linear disturbances (i.e., cutlines, ROWs, pipelines, roads) and a 250 meter buffer around wellsites. Within these buffers, zones of influence (ZI) (i.e., the maximum distance that a disturbance will potentially affect a species) with associated disturbance coefficients (DC) (the multiplier used to reduce habitat effectiveness within the ZI) were used to determine effective habitat loss from sensory disturbance (DAR, Table 7.6-8). Since woodland caribou display a high degree of sensitivity to both linear disturbances and wellsites, results reported in Dyer (1999 and Dyer et al. 2001) were used when determining ZI's and DC's (e.g., caribou used buffer within 250 m of new wells significantly less than outer buffer during late winter, calving, rut and early winter; avoidance of roads 250 m; avoidance of seismic lines 100 – 250 m dependent upon season (Dyer et al. 2001)). It is illustrated in Dyer (1999) that as the distance from a linear disturbance and wellsite increases, so too does the occurrence of caribou locations. Therefore, the DC used closer to linear developments and wellsites was smaller (i.e., less effective habitat) than the DC used at ZI's further from the disturbances. This information was used within the HSI spatial models and therefore presented within the DAR as the indirect habitat loss values as a result of sensory disturbance.

   Paramount utilized buffer widths during the HSI modeling to incorporate a reduction in habitat effectiveness. This considers that caribou continue to use the habitat, as suggested by the sightings of caribou within the general project area. Paramount used this approach to evaluate the potential reduction in habitat effectiveness (depending on the season) resulting from the completion of the various phases of their project. Paramount does not feel that employing a restrictive buffer of 250 m on either side of a linear disturbance and 1000 m buffer around wellsites, accurately depicts the situation in the Cameron Hills, therefore, a map will not accurately reflect the buffer on the linear disturbance.

c) In response to declining caribou numbers and the increase in resource extraction developments, caribou committees were formed in Alberta in the early 1990's. The Boreal Caribou Committee (BCC) is a multi-stakeholder group made up of industry (forestry, oil & gas, mining, peat), university and government stakeholders. The BCC's primary objectives are to develop guidelines and best operating practices for industrial activity on woodland caribou range, educate the public and stakeholders on caribou issues, and to plan for caribou habitat supply over time. This committee has also developed extensive research programs and has been assessing the effects of innovative industrial practices on caribou. No such group currently occurs within the Northwest Territories.

Based on the success of the BCC's research and development of operating guidelines, the BCC's findings will be heavily relied upon within both the provincial and federal Recovery Plans for woodland caribou under the federal *Species At Risk Act* (2003) (D. Hervieux pers. comm. 2003). As relatively little research has been conducted on woodland caribou from the Northwest Territories/Alberta border up to the South Slave Region (Olsen et al. 2001), and based on the success and apparent federal role model of the BCC, Paramount feels that the use of the BCC's research findings and best operating practices (BCC 2001) (e.g., use of existing linear disturbances) will provide for conservative estimates of impacts on woodland caribou and will improve innovative mitigation measures to reduce potential impacts to woodland caribou.

Paramount is currently an active member within the BCC and fully supports the implementation of the current industrial guidelines and best operating practices. Knowledge of these best practices and research results have been included within the assessment approach and mitigation strategies development for the Cameron Hills area. Therefore, given that few oil and gas producers and no forestry exists within the Cameron Hills area, Paramount does not feel that a separate committee would need to be formed in an effort to apply the BCC formula.

References:

Boreal Caribou Committee (BCC). 2001. Strategic Plan and Industrial Guidelines for Boreal Caribou Ranges in Northern Alberta.

Dyer, S. 1999. Movement and distribution of Woodland Caribou (Rangifer tarandus caribou) in response to industrial development in north-eastern Alberta. M.Sc. Thesis, University of Alberta, Edmonton, AB. 106pp.

Dyer, S. J., J. P. O'Neill, S. M. Wasel and S. Boutin. 2001. Avoidance of Industrial Development by Woodland Caribou. J. Widl. Manage 65(3):531-542.

Hervieux, Dave (Alberta Sustainable Resource Development, Woodland Caribou Provincial Recovery Plan Coordinator). 2003. Personal Communication with Paula Bentham (Golder Associates Ltd.). Contacted on June 18, 2003.

Olsen, B., M. McDonald, and A. Zimmer. 2001. Co-management of Woodland Caribou in the Sahtu Settlement Area: Workshop on Research, Traditional Knowledge, Conservation and Cumulative Impacts. Special Publication No. 1, Sahtu Renewable Resources Board, Tulita, NT. 22pp.

IR Number 1.1.31

Preamble

As discussed in the DAR, the cumulative amount of linear disturbance under the Planned Development Case is 2,887 km. Linear disturbance includes access roads, pipeline corridors, cutlines etc. A major concern is the increased accessibility of the Cameron Hills to nearby communities and the public at large. Increased traffic to the area results in undue pressures on wildlife populations. As a mitigative measure, Paramount proposes to install a gate along the main winter access road which will be either staffed or locked, with the understanding that no one is to pass unless it is work related.

Request

The MVEIRB asks Paramount to provide the following information:

a) What is the schedule for the personnel at the gate?

b) Alternatively, when will the gate be locked?

c) When work crews are not on site, is it unrestricted access?

d) Is there any signage indicating controlled access?

e) Are there any repercussions for people found accessing Cameron Hills SDL?

f) What measures do you propose in the event that pressures are being felt from unrestricted access?

Response

The manned control point is located in Alberta and as such, Paramount does not have the authority to deny access to any member of the public. It should be made clear that Paramount does not represent that it will make any attempt to stop any traffic at a manned control point. The mere presence of the control point discourages most users that do not have business in the area. The recording of user's names does provide better recovery of fees by industrial users.

a) If the access gate is not locked, the access control point will be manned. Manning of the control point will start at the beginning of the season, 24 hours daily, starting at the completion of work to open the road in late fall and will remain in service, throughout the winter season until the road is closed to all traffic in early spring.

The actual scheduling of the control point attendant(s) is determined by the contractor. In the extreme, Paramount would accept a variety of schedules including the provision of a single attendant to reside at the control site for up to 17 days at a time.

b) The manned control point is located close to the highway while the locked gate is located at the NT/Alberta border. Whenever the attendant is not present at the manned control point, the locked gate will be put in service.

c) Access to the area is not limited to the access used by Paramount in the winter months. Access along other linear disturbances is unrestricted except by natural topographical obstacles. Paramount will lock the gate, just inside the NT border on the winter access, when work crews are not present and when the winter road is closed.

d) When the road is open, the location of the manned control point is signed from both directions.

e) Paramount has no authority to restrict access to the Cameron Hills SDL except on developed sites. Therefore, there are no repercussions for people accessing the Cameron Hills SDL for personal reasons. It is not illegal for the public to access public land.

f) Paramount does not have, nor does it seek to acquire, authority to restrict public access to the Cameron Hills SDL. If public access to wellsites, campsites, or the battery becomes a concern, Paramount would construct fences to deter public entry into potentially unsafe areas. It is Paramount's experience that the public is not interested in oil and gas sites and therefore usually do not enter upon developed sites, other than for the purpose of "passing through" to get access to other areas of interest. It is Paramount's experience that the primary purpose of public access is recreational and very little vandalism or trespass occurs.

IR Number 1.1.32

Preamble

The estimated flow volume of the Cameron River is based on the assumption that the ratio between the flow volumes of the Cameron River and the Steen River is exactly the same as the ratio between the area of the watershed of both rivers. Despite the considerable uncertainty with this estimate the DAR does not include any kind of contingency. Moreover, the calculation of the water flow reduction for the Cameron River uses the average flow of the Steen River (5.4m3/2) rather than the estimated volume for the Cameron River (3.0m3/s).

The DAR concludes that the flow reduction of the Cameron River will be negligible but does not address the flow reduction of the creek that connects lake 1 with the Cameron River.

Request

The MVEIRB asks Paramount to provide the following updated impact predictions taking into account:

a) a 20% reduction of the estimated flow volume of the Cameron River to account for possible errors in estimating the flow volume;

b) flow volumes not only in an average year and average water consumption, but under 10 and 100 year dry conditions at 20% increased water consumption; and

c) impacts on the creek and small lake connecting the water source to Cameron River.

Response

a) Table 1.1.32-1 shows the originally estimated annual water yields for the Cameron River based on the assumption that the ratio between the drainage areas of Steen River and Cameron River is the same as the ratio of their annual water yields.

Table 1.1.32-1 Original Estimate of Cameron River and Steen River Water Yields

Station Name	Drainage Area (km^2)	Estimated Water Yields				
		100 year wet (167 mm)	10 year wet (119 mm)	Average (68 mm)	10 Year dry (26 mm)	100 year dry (7 mm)
Steen River (m^3/s)	2610	13.8	9.8	5.4	2.12	0.57
Cameron River (m^3/s)	1387	7.3	5.2	3.0	1.1	0.3

Note: annual water yields were derived based on the annual runoffs for the Steen River.

Reducing the original estimate of water yield by 20% results in an alternate estimate as summarized in Table 1.1.32-2.

Table 1.1.32-2 Conservative Alternate Cameron River Annual Water Yields

Station Name	Drainage Area (km^2)	Annual Water Yield				
		100 year wet (134 mm)	10 year wet (95 mm)	Average (54 mm)	10 Year dry (21 mm)	100 year dry (5.6 mm)
Cameron River (m^3/s)	1387	5.9	4.2	2.4	0.9	0.2
Cameron River (Million m^3)	1387	185	132	75	29	7.8

Note: assumes 20% reduction in originally estimated water yields.

b) Table 1.1.32-3 shows that the reductions in the maximum annual water yields for the Cameron River are less than 1% including the case where the maximum annual withdrawal rate is increased by 20% and the 100-year dry annual water yield is decreased by 20%.

Table 1.1.32-3 Water Withdrawal Effects on Cameron River Water Yields

Water Yield		Reduction in Annual Water Yield (%)	
Hydrological Condition	M^3/s	With Maximum Annual Withdrawal of 47,800 m^3	With Maximum Annual Withdrawal of 47,800 m^3 increased 20% to 57,360 m^3
Average	3.0	0.05	0.06
10-Year Dry	1.1	0.13	0.16
100-Year Dry	0.3	0.49	0.59
Average (at 20% reduction)	2.4	0.06	0.08
10-Year Dry (at 20% reduction)	0.9	0.17	0.20
100-Year Dry (at 20% reduction)	0.2	0.62	0.74

It should be noted that Paramount does not support the embedded assumption that water withdrawn from a source lake is lost from the water shed. Paramount asserts that the water is temporarily borrowed but remains within the drainage basin.

c) The creek connecting Lake 1 to the Cameron River, referred to here as Creek 1, has a drainage area of 98.5 km^2 and an estimated annual flow of 0.21 m^3/s. Table 1.1.32-4 shows changes in annual water yield of Creek 1, for average and extreme hydrological conditions.

Even with the inflated water withdrawal case, the changes in annual water yields, for the average and the 10-year dry hydrological conditions, is less than 3%. For the condition where the annual water yield is conservatively estimated (reduced by 20%) and the maximum annual withdrawal rate is increased by 20%, the water withdrawal represents only 10% of the annual water yield reduction for the 100-year dry extreme hydrological condition . The degree of conservatism associated with this approach is very high and it represents a situation with a very low probability of occurrence. The conservative results obtained for the average and the 10-year hydrological conditions are considered adequate for this impact assessment.

Table 1.1.32-4 Reductions in Creek 1 Annual Water Yields

Annual Water Yield			Changes in Annual Water Yield (%)	
Hydrological Condition	**Million m^3**	**Average Flow m^3/s**	**With Maximum Annual Withdrawal of 47,800 m^3**	**With Maximum Annual Withdrawal of 47,800 m^3 increased by 20% to 57,360 m^3**
Average	6.70	0.212	0.71	0.86
10-Year Dry	2.56	0.081	1.87	2.24
100-Year Dry	0.69	0.022	6.93	8.32
Average (at 20% reduction)	5.36	0.170	0.89	1.07
10-Year Dry (at 20% reduction)	2.05	0.065	2.33	2.80
100-Year Dry (at 20% reduction)	0.55	0.017	8.67	10.4

IR Number 1.1.33

Preamble

Soil erosion is generally governed by:

- *amount, duration and intensity of precipitation*
- *soil erodibility,*
- *slope length and gradient,*
- *vegetation cover, and*
- *mechanical erosion control measures.*

Of these the DAR addresses vegetation cover and to some extent soil erodibility. Slope is mentioned as a factor but not included in the determination of erosion potential. The DAR equates the potential for soil erosion with the disturbed area of certain soil and terrain units and concludes that the potential is low because less than 1% of the total study area constitutes disturbed areas on susceptible units. The DAR does not address the potential for erosion on steep slopes, which can introduce considerable amounts of sediment into a water body, despite affecting a very small area compared to the entire study area.

The DAR derives soil units by converting Landsat TM satellite images and equating vegetation classes with soil units. It does not explain how soil units were derived from Landsat images, e.g. which soil unit is associated with which vegetation class. The DAR further does not discuss the level of accuracy and the spatial resolution of the Landsat derived soil map.

The DAR states that organic soils have negligible erosion potential.

The DAR states that there is no erosion potential on seismic lines because seismic activity is limited to winter (7.3.2.3.1) The DAR, however, also states that pipeline construction adjacent to seismic lines can result in erosion problems (7.3.2.3).

The DAR states that "with complete restoration of all disturbed lands following final reclamation, there will be no net loss in soil and terrain units. The DAR also states that black spruce bogs will likely revert to black spruce uplands because of disturbance to the peat layer.

Request

The MVEIRB asks Paramount to provide the following information:

a) *Describe if and how slope gradient and length were used to derive the potential for erosion.*

b) *If these factors were not used, explain if and how Paramount intends to predict potential erosion of individual slopes prior to any future RoW development.*

c) *Describe the approach to derive soil units from Landsat images, including:*
   a. *spatial resolution,*
   b. *confidence level (how derived),*
   c. *classification procedure, and*
   d. *basis for equating specific soil units with vegetation classes.*

d) *Explain why organic soils have negligible erosion potential. While a high organic content decreases the erodibility of any soil, factors such as slope may still play a role.*

e) *Please clarify if there is any potential for erosion associated with seismic lines, e.g. where seismic lines cross a pipeline RoW. Justify you conclusions.*

f) *Explain what the term "complete restoration" entails. To what standard will the used land be restored. Particularly, to what standard can soil units be restored where cut and fill is needed on a pipeline RoW or on a lease. If complete restoration of disturbed areas is not possible, revise the impact summary in table 7.3-6 accordingly.*

Response

a) Slope gradient but not length was indirectly used for the erosion risk assessment since organic soils were rated as having a negligible erosion risk as they are found on <2% slopes. Slope length was not considered given the assessment was at a 1:200,000 scale. The relationship between slope gradient and length to effect erosion is embedded in the table detailing the maximum distance between diversion berms as a function of slope gradient, see item 19 on page 73 in section 3.2.4.3 of the Developer's Assessment Report. That is, for a specified slope the maximum length that will be left from the top of a hill to a diversion berm is equal to the specified diversion berm spacing.

Paramount's understanding of the relationship between slope and erosion potential has been learned from experience. The spring following the first year of construction revealed a need to amend the planned erosion control plan. The following year Paramount constructed many diversion ditches and diversion berms. The modified erosion control measures have proven effective noted by Paramount's own inspection team, and/or the regulators.

Terrain stability is considered an issue despite the land being crossed being generally level to gently rolling. We now know that the terrain is quite unstable and sensitive to erosion by spring run-off. Because even gently sloping terrain is susceptible to erosion, and cannot be avoided through route selection criteria, special measures have been developed and implemented effectively to mitigate the erosional force of spring run-off. The special measures include the use of diversion berms, diversion cross and parallel ditches, ditch blocks, and roach

breaks. The tools are described in detail in Golder's November 2002 report entitled "Erosion Survey and Mitigation Plan for the Cameron Hills Gathering System and Pipeline".

b) Slope gradient and length are considered in developing an effective erosion mitigation plan as outlined above.

c) The Landsat soil mapping procedure consisted of the following:
   i. Reviewing existing surficial geology, soils and vegetation patterns for the Study Area (Golder 1999, Golder and Alpine 2001).
   ii. Reviewing the information to derive correlations between vegetation and soil patterns. The following table outlines the process for converting vegetation classified from Landsat to soil great groups. The correlations between vegetation and soil were derived from existing soil and vegetation surveys in the Cameron Hills (Golder and Alpine 2001) and from experience in mapping in northern BC and Alberta.

Table 1. Vegetation to Soil Conversion Used for Landsat Soil Mapping

Vegetation Communities	Community Type	Soil Great Group
White Spruce Mature Closed	Upland	Eutric Brunisol (fine)
Black Spruce Closed Uneven Sized	Upland	Rego Gleysol
Black Spruce Mature Open with sphagnum & lichen	Wetlands	Organic Cryosol
Black Spruce Mature Closed	Upland	Rego Gleysol
Black Spruce Open Uneven Sized with Lichen	Wetlands	Organic Cryosol
Pine Mature Closed	Upland	Eutric Brunisol (coarse)
Pine Young Closed	Upland	Eutric Brunisol (coarse)
Aspen Young Closed	Upland	Eutric Brunisol (fine)
Aspen Mature Closed	Upland	Eutric Brunisol (fine)
Shrubland	Wetlands	Organic
Herbaceous with Shrubs	Wetlands	Organic
Herbaceous Wet	Wetlands	Organic
Herbaceous	Wetlands	Organic

The Landsat data used was a 1998 version with a 30m resolution. No information is available on the confidence level for the Landsat mapping, but given the presentation scale of 1:200,000, it provides adequate representation of dominant tree species vegetation and broad soil patterns in the Study Area. Note that the soil classification used was to the Great Group level, which are broad classifications of soil. This was selected since

the Landsat vegetation classification is limited to selecting dominant tree species.

d) Organic soils were rated as having negligible erosion potential because they occur in level landscapes with less than 2% slopes. Therefore, soil erosion potential was considered negligible.

e) Seismic lines could have short-term erosion risks. The erosion risk would be greatest in areas of steep slopes. The crossing seismic line could introduce increased amounts of runoff water to the pipeline right of way and in those instances, cross diversion ditches on the seismic line near the pipeline right of way, and parallel diversion ditches along the pipeline right of way could be employed to keep the supplemental seismic line runoff away from the pipeline trench.

f) The DAR, page 176, last sentence in section 7.3.3.1.1 states "complete reclamation of all disturbed lands following final reclamation" which describes stabilization followed by natural revegetation. Paramount does not make reference to "complete restoration". In the context of the DAR Section 3, reclamation refers to stabilizing the area and replacing the topsoil where appropriate to promote natural revegetation. Table 7.3-6 was developed incorporating reclamation techniques as outlined in the DAR Section 3. Reclamation is intended to return the land to an equivalent capability (as stated on page 178, section 7.3.3.1.2) in consideration of natural revegetation.

IR Number 1.1.34

Preamble

The DAR outlines a Benefits Plan and an Update to the Benefits Plan. The DAR does not indicate that a Benefits Agreement between Paramount and the affected First Nations

Request

Please indicate whether:

a) there have been any efforts to establish a negotiated agreement between Paramount and any affected First Nations in the past

b) there are any ongoing efforts to negotiate an agreement, or

c) Paramount intends to enter into any Benefits Agreements

Response

a) Paramount is not aware of any regulatory or legislative requirement applicable to the Cameron Hills project area, and specifically within the Mackenzie Valley Resource Management Act that requires a negotiated Benefits Agreement.

Paramount is aware of the regulatory requirement administered by the National Energy Board relative to the provision of benefits as outlined in Section 5.2(1) of the Canada Oil and Gas Operations Act, which through its predecessor act the Oil and Gas Production and Conservation Act section 5(2) states: "In this section, 'benefits plan' means a plan for the employment of Canadians and for providing Canadian manufacturers, consultants, contractors and service companies with a full and fair opportunity to participate on a competitive basis in the supply of goods and services used in any proposed work or activity referred to in the benefits plan."

b) See response to a) above

c) See response to a) above

IR Number 1.1.35

Preamble

The DAR describes that drill cuttings "will be trucked to one of the proposed remote pits". The DAR does not specify how many such pits will be needed or how many already exist.

Request

a) *How many sumps (or pits) are currently within the Cameron Hill SDL area?*

b) *How many additional sumps does Paramount anticipate?*

c) *How many sumps does Paramount anticipate to create in any given year?*

Response

a) Paramount utilized 4 pits near H-04 and one pit hear K-49 during the last few years of drilling activity.

b) Paramount anticipates constructing 16 new pits: 7 pits located in the vicinity of P-04 Grid Area 60°10' 117°30' (adjacent to the previous identified location); 2 pits located near C-16 Grid Area 60°10' 117°30'; 5 pits located in the vicinity of C-19 Grid Area 60°10' 117°30', near the existing airstrip and camp; and the fourth location would contain 2 pits at approximately M-49 Grid Area 60°10' 117°30'.

c) The number of pits required would ultimately depend on the number of wells that are drilled in a given season. Based on Paramount's previous drilling experience in the Cameron Hills, it is anticipated that the solid cuttings from three wells will be placed in each pit, depending on the pit's final configuration. As such, Paramount feels that they will likely require the construction of 2 pits each year, based on the average of 5 wells being drilled each winter.