

**ALBERTA ENERGY AND UTILITIES BOARD**

**Calgary Alberta**

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**CANADIAN 88 ENERGY CORP.  
APPLICATION FOR A WELL LICENCE  
OKOTOKS FIELD**

**Addendum to Decision 2000-33  
Application No. 1037740**

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In *Decision 2000-33*, the Alberta Energy and Utilities Board (the EUB/Board) approved an application by Canadian 88 Energy Corp. (Canadian 88) for a licence to drill a level-2 noncritical sour gas well in LSD 3-2-18-28W4M. Canadian 88 initially proposed to set 244.5 millimetre, 53.57 kilogram/metre, K-55, short-thread and collar surface casing. At the hearing, Canadian 88 upgraded its proposal to L-80 grade material, with appropriate metallurgy and pressure rating. Although the Board recognized Canadian 88's commitment to upgrade, it commented in its decision that it was "very concerned that the plans documented in the application for surface casing would not have met the minimum requirements and that this was detected and modified to meet the requirements only as a result of scrutiny at the public hearing." In addition, the Board required Canadian 88 to satisfy the EUB Operations Group that its casing program meets regulatory requirements.

Having followed up on the matter, the Board now notes that, contrary to its conclusion noted above and notwithstanding that it believes that K-55 casing would not be optimal in this case, the K-55 casing does meet the minimum requirements for burst, collapse, and tension design factors prescribed in EUB *Guide 10: Guide to Minimum Casing Design Requirements*. However, the guide also cautions companies to carefully review the suitability of proposed casing, especially where it will be exposed to hydrogen sulphide (H<sub>2</sub>S). The Board heard evidence that Canadian 88 predicted the potential H<sub>2</sub>S content in the well at about 39 per cent, with a reservoir pressure of 24 800 kilopascals. As before, the Board accepts Canadian 88's commitment to substitute L-80 materials and believes these materials are technically superior.

Dated at Calgary, Alberta, on October 31, 2000.

**ALBERTA ENERGY AND UTILITIES BOARD**

*(Original signed by)*

J. D. Dilay, P.Eng.  
Presiding Board Member

*(Original signed by)*

R. G. Lock, P.Eng.  
Board Member

*(Original signed by)*

C. A. Langlo, P.Geol.  
Acting Board Member

## **1 INTRODUCTION**

### **1.1 Application and Intervention**

Canadian 88 Energy Corp. (Canadian 88) applied to the Alberta Energy and Utilities Board (EUB/Board), pursuant to Section 2.020 of the Oil and Gas Conservation Regulations, for a licence to drill a level-2 noncritical sour gas well from a surface location in Legal Subdivision 3, Section 2, Township 18, Range 28, West of the 4th Meridian (LSD 3-2-18-28W4M; the 3-2 well, surface location). The primary purpose of the proposed well is to produce sour gas from the Crossfield Member (Wabamun Formation) from a projected bottomhole location in LSD 13-2-18-28W4M.

The EUB received an objection to the application from L. Hermann and L. Ronneberg, the owners of a 21.5 acre parcel and home in the southeast quarter of Section 2-18-28W4M. The objection stated that Ms. Ronneberg was the occupant at the existing residence in LSD 1-2-18-28W4M. Subsequently, the Board directed that a public hearing be held pursuant to Section 29 of the Energy Resources Conservation Act. The Board received submissions from various interested parties on March 27, 2000, regarding the application.

The location of the proposed well, the emergency planning zone (EPZ), and the residences in the general area are shown on the attached figure.

### **1.2 Hearing**

The application and interventions were considered at a public hearing in High River, Alberta, on April 4, 2000, before J. D. Dilay, P.Eng. (Presiding Board Member), R. G. Lock, P.Eng. (Board Member), and C. A. Langlo, P.Geol. (Acting Board Member). The Board and staff viewed the proposed surface location and the surrounding area on March 30, 2000.

Those who appeared at the hearing and abbreviations used in this report are listed in the following table.

## **THOSE WHO APPEARED AT THE HEARING**

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### Principals and Representatives (Abbreviations Used in Report)

### Witnesses

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Canadian 88 Energy Corp. (Canadian 88)  
R. Neufeld

G. Thompson, P.Geol.  
G. Dowling  
G. R. Gill, P.Eng.  
B. Sheppard  
F. Ceh, C.E.T.

R. Coote

R. Coote

L. Hermann and L. Ronneberg

L. Hermann

E. and D. Weber (the Webers)

E. Weber

S. Pickering

Alberta Energy and Utilities Board Staff  
G. Bentivegna, Board Counsel  
D. L. Schafer  
H. Nychkalo  
S. Etifier

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Mr. Coote, the landowner at the 3-2 surface location, supported Canadian 88's application.

## **2 ISSUES**

The Board considers the issues respecting the application to be:

- need for the well,
- safety and emergency response planning, and
- environmental impacts.

## **3 NEED FOR THE WELL**

Canadian 88 submitted that it has a valid Crown mineral lease agreement for the proposed well and, therefore, the right to explore for and recover the petroleum and natural gas underlying Section 2. Canadian 88 said that the well was required to evaluate the potential for significant Crossfield pool discoveries south of the existing Okotoks Wabamun pool.

The interveners did not question the need for the well.

The Board accepts that Canadian 88 has the necessary mineral lease agreement for the intended purpose of the well and agrees that it will require a well to evaluate the potential for hydrocarbons underlying Section 2.

## 4 SAFETY AND EMERGENCY RESPONSE PLANNING

### 4.1 Views of the Applicant

Canadian 88 said that it proposed to drill an exploratory horizontal well from a surface location at 3-2 to evaluate the Wabamun Formation at 2784 metres (m) measured depth. Canadian 88 proposed to drill to 480 m, set and cement 244.5 millimetre (mm) diameter, 53.57 kilograms per metre (kg/m), K-55, short thread and collar (ST&C) surface casing back to surface, and install a 21 megapascals (MPa) casing bowl. Canadian 88 then proposed to drill to 2800 m into the Wabamun Formation to evaluate it from logs. Canadian 88 stated that it would then either abandon the well or plug it back to a kickoff point of approximately 2600 m, depending on its evaluation. If the evaluation proved successful, it would drill the “build” section of the well to 90 degrees to a measured depth of approximately 2800 m. At the point where the build section penetrated the Wabamun Formation, Canadian 88 proposed to set and cement full-length 177.8 mm, 34.23 and 38.69 kg/m, L-80, long thread and collar (LT&C) production casing. At the hearing, Canadian 88 made a number of commitments with respect to drilling safety issues regarding the proposed well. The commitments are listed in the Appendix.

Canadian 88 said that it determined that the maximum cumulative drilling hydrogen sulphide (H<sub>2</sub>S) potential release rate for the 3-2 well would be 1.89 cubic metres per second (m<sup>3</sup>/s), with a corresponding calculated EPZ of 3.55 kilometres (km). It said that it estimated the cumulative drilling release rate using an absolute open flow (AOF) potential from the Wabamun Formation of 396.3 thousand cubic metres per day (10<sup>3</sup> m<sup>3</sup>/d) at 39.34 per cent H<sub>2</sub>S (adjusted to consider the maximum release rate potential from the horizontal section of the well by multiplying the original AOF by a factor of 8) and an AOF of 249.9 10<sup>3</sup> m<sup>3</sup>/d at 2.79 per cent H<sub>2</sub>S from the overlying Rundle Group.

Canadian 88 acknowledged that a site-specific emergency response plan (ERP) must be submitted to the EUB for review and approval prior to spudding the proposed well. Canadian 88 said that there would be 17 residences in the EPZ. In developing its ERP, Canadian 88 identified two area residents that would require assistance with evacuation and addressed these issues in its draft plan. Canadian 88 stated that evacuation would be conducted in accordance with the levels of emergency outlined in the ERP and would not be a problem given that residents would be contacted by telephone and given the option to voluntarily evacuate under a level-1 emergency. A level-2 emergency would result in full evacuation.

Canadian 88 stated that it would keep the public informed of all activities during the drilling, completion, and testing of the proposed well due to the close proximity of the residences. Canadian 88 said that it would notify all area residents 48 hours prior to entering the Wabamun Formation. In view of the interveners’ concern regarding public safety, Canadian 88 presented a “List of Current Commitments to Area Residents/Landowners,” which included providing monitors to any resident within the EPZ and a two-way radio to Ms. Ronneberg during the drilling and completion of the well. Canadian 88 believed that its drilling operation could be conducted safely without relocation of residents, as it was confident that evacuation would take place prior to a situation arising that might create any personal danger. However, Canadian 88 further stated that it would be prepared to relocate Ms. Ronneberg or any subsequent

owner/occupant of the property if so desired during drilling and completion of the sour formation. Canadian 88 said that it had fully addressed all safety concerns and had worked cooperatively with area residents to develop its plan. Canadian 88 also explained that it was prepared to ignite a release if the ignition criteria were met. As a result, Canadian 88 was confident that at no time would the public be exposed to a high concentration of sour gas.

Given its commitment to enhance safety equipment for the drilling operation, Canadian 88 also agreed to a remotely activated ignition system. However, it believed that it would be unlikely for drilling operations to escalate from a normal drilling condition to a level-3 emergency situation without prior warning. With respect to an alternative egress route for Ms. Ronneberg, Canadian 88 said that it believed that a north/south route would not be necessary, having considered other residents' views that a new road was not needed and the economics associated with such a road. Canadian 88 further stated that it was prepared to properly maintain the well site access road, the remaining undeveloped road allowance to the Hermann/Ronneberg property, and their driveway to ensure that they remained passable for evacuation purposes. Canadian 88 said that if the well proved to be successful, it would upgrade the undeveloped east/west road allowance to the Hermann/Ronneberg property and residence to acceptable municipal standards, provided that the residence was occupied.

Canadian 88 explained that all emergency response personnel would be fully trained and experienced with respect to their roles and responsibilities, as outlined in its ERP. Once completed, the well would be tied into the Mazeppa gas plant and would be covered under that plant's existing ERP, which addresses emergency response needs for the existing gas gathering system and wells in the area.

Due to the amount of time that had elapsed between when the ERP was developed and when the application proceeded to hearing, Canadian 88 said that it had reviewed its ERP information to ensure that it was current and accurate. It noted that the ERP would need to be updated to incorporate some changes and new construction in the area, as well as the commitments made at the hearing with respect to the ERP. It said that it would revisit all residents in the EPZ to obtain current resident information prior to submission of its revised ERP.

Canadian 88 said that it had Conor Pacific Environmental Technologies Inc. prepare a hazard assessment for the proposed well to evaluate the extent and implications of a blowout of the proposed well. The assessment provided an estimate of the hazard distances associated with a well blowout at prairie level and on the floor of the coulee over a range of meteorological conditions. Based on the analysis conducted, Canadian 88 said that there are benefits in siting the proposed well at prairie level. It said that the analysis indicated a reduced maximum distance to average concentrations of H<sub>2</sub>S from 3.3 to 3.1 km, suggesting that its EPZ of 3.55 km was conservative.

Canadian 88 said that it would commit to installing the following equipment at the well site if the well were successful and production facilities were installed:

- emergency shutdown (ESD) valves on the wellhead and subsurface ESD valves in the well tubing,
- H<sub>2</sub>S gas detection equipment at the facility,

- remote telemetry equipment at the facility to monitor well site operations from the Mazeppa gas plant on a 24-hour basis,
- a concrete barricade around the wellhead and a chain-link fence around the well site.

## 4.2 Views of the Interveners

With regard to safety issues, Ms. Hermann and the Webers expressed concerns over having to evacuate directly towards the proposed well site. They indicated that this was unacceptable because it would endanger their health and safety. Ms. Hermann further stated that she was concerned for the safety of other residents within the general area and therefore strongly opposed the well. Ms. Hermann said that their residence was currently unoccupied and that the Webers were in the process of purchasing the property. Mr. Weber said that they would occupy the residence in the future and that they would have access to vehicles in the event of an emergency. The Webers also said that they were satisfied with the list of commitments made by Canadian 88.

Ms. Pickering expressed concern about how the public can be assured that companies are complying with all of the technical requirements without having to address such issues at a public hearing. She questioned whether there are regulatory processes in place to ensure compliance.

## 4.3 Views of the Board

The Board notes that although the proposed well is not a critical sour well as defined in *Interim Directive (ID) 97-6*,<sup>1</sup> Canadian 88 had made a number of commitments in its application and at the hearing to ensure that the well would be drilled safely and in accordance with the Alberta recommended practices for drilling critical sour wells (ARP, Volume 1).<sup>2</sup> While this ARP was developed specifically for critical sour wells, the Board notes that this and other ARPs contain useful information for the planning, drilling, completion, or servicing of noncritical sour wells.

Notwithstanding that this is an exploratory well, the Board is satisfied that the reservoir characteristics anticipated by Canadian 88, including the H<sub>2</sub>S content and reservoir pressure, are appropriate for a well of this type. The estimates provided have been adjusted to take into account the probability of encountering a new pool that might have higher pressures than similar wells completed in the Okotoks/Crossfield areas.

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<sup>1</sup> EUB *Interim Directive (ID) 97-6: Sour Well Licensing and Drilling Requirements*.

<sup>2</sup> *Alberta Recommended Practices, Volume 1, Drilling* (distributed by Petroleum Industry Training Service [PITS]).

Given that the potential H<sub>2</sub>S content in the well is about 39 per cent, with a reservoir pressure of 24 800 kilopascals (kPa), the Board is concerned that the surface casing originally proposed by Canadian 88 did not meet the requirements of EUB *Guide 10*<sup>3</sup> and ARP, Volume 1.

The Board notes that companies must have procedures in place to ensure that the control of wells is maintained at all times during drilling, completion, and production phases. This includes a sufficient depth and grade of surface casing and the possibility of intermediate casing being set prior to entering the target sour formation. The Board recognizes, however, that a number of options are available to demonstrate equivalence to these requirements. The Board recognizes the commitment made by Canadian 88 to upgrade its surface casing. However, the Board believes that given the high potential H<sub>2</sub>S content and the nearby residences, it is necessary for Canadian 88 to demonstrate to the satisfaction of the Board's Operations Group that its casing program meets regulatory requirements.

The Board accepts Canadian 88's maximum cumulative drilling H<sub>2</sub>S release rate of 1.89 m<sup>3</sup>/s for the 3-2 well. Additionally, the Board agrees with the corresponding calculated EPZ of 3.55 km.

The Board acknowledges the commitments made by Canadian 88 with regard to its ERP, including road maintenance, gas monitors, a two-way radio, and the offer of relocation, in its attempts to minimize the safety concerns of the interveners. The Board notes that although Ms. Hermann remains uncertain that Canadian 88 would be able to effectively evacuate their residence, Ms. Hermann and Ms. Ronneberg are selling their property to the Webers and will no longer have an ownership interest in that land. With regard to egress and evacuation of the Hermann/Ronneberg residence, the Board notes that Canadian 88's ERP addresses early evacuation at a level-1 emergency for those that have egress/access problems. Those parties would have time to evacuate prior to fluid coming to surface and prior to any significant H<sub>2</sub>S readings. In the unlikely event that an immediate level-3 emergency occurs, the ignition criteria would be met and the residents would be requested to shelter until a rover personally assisted them in evacuation. The Board notes the Webers' acceptance of Canadian 88's "List of Current Commitments to Area Residents/Landowners." The Board finds the ERP acceptable and notes that Canadian 88 is aware that it must submit amendments to update its ERP, including the commitments identified at the hearing, and obtain approval prior to spudding the well. The Board notes that Canadian 88 plans to have its personnel revisit the individual residents within the EPZ prior to resubmission of its plan to ensure that the public information is current and accurate in order to adhere to the EUB's ERP notification requirements.

The Board agrees with the findings of Canadian 88's hazard assessment that there would be better plume dispersion if the proposed well were sited at prairie level as opposed to being in the Little Bow River valley.

With respect to Ms. Pickering's concern about scrutiny of energy development plans to ensure that requirements will be met, the Board has documented its requirements in detail and expects oil and gas operators to meet them. The EUB's *Guide 56: Energy Development Application Guide and Schedules* prescribes the information requirements for applications. Other guides and interim directives set out the requirements for casing, cementing, and other features, such as well completion and servicing. The EUB audits all critical sour well licence applications

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<sup>3</sup> EUB *Guide 10: Guide to Minimum Casing Design Requirements*.

completely. The EUB expects applicants for noncritical sour wells to know the requirements and to meet them but audits only a portion of the total number of applications received based on certain triggers. In the case of the subject Canadian 88 application, the Board is very concerned that the plans documented in the application for surface casing would not have met the minimum requirements and that this was detected and modified to meet the requirements only as a result of scrutiny at the public hearing. The Board is presently reviewing its requirements and processes for sour-gas-related applications and intends to include consideration of this kind of problem in the review.

## **5 ENVIRONMENTAL IMPACTS**

### **5.1 Views of the Applicant**

Canadian 88 said that at its initial public meeting regarding a proposed surface location at LSD 7-2-18-28W4M, Ms. Pickering, who was a member of an organization reviewing water quality in the Little Bow River area, provided Canadian 88's consultant with some very good data with respect to water quality issues. Canadian 88 submitted that it used this information and had its consultant, AXYS Environmental Consulting Ltd. (AXYS) test water wells in the area to collect baseline data to help it understand the water quality issues. It said that this information provided it with an understanding of the surficial deposits in the river valley, which are the water source for the area and are highly permeable. On the basis of its consultant's findings and the information provided by the residents, Canadian 88 decided to move the surface location out of the Little Bow River valley to the 3-2 location at prairie level. It believed that this would address the residents' concerns with respect to the environmental impact that the well might have on the river valley and the existing water quality issues in the area.

Canadian 88 said that it had AXYS prepare an environmental assessment for the proposed 3-2 surface location. This included a hydrology assessment that identified a number of mitigative measures that must be implemented to prevent any potential adverse effects on groundwater from the proposed well.

Canadian 88 stated that the base of the deepest groundwater aquifer for this area is 479 m from surface, including a 15 m buffer. Canadian 88's drilling plan indicated that it would set conductor pipe prior to moving the rig in and then drill the surface hole to 480 m using a freshwater gel system. It would then set the surface casing and cement it full length back to surface. This would protect the groundwater aquifer during the drilling of the intermediate hole to a depth of 2800 m. In order to protect groundwater for the longer term, Canadian 88 said that if the well proved to be successful, it would set intermediate casing back to surface and cement it full length in stages. Also, Canadian 88 said that the well site would be adequately bermed to ensure that all fluids are contained on the lease during drilling operations.

Canadian 88 noted that it had offered to test the Hermann/Ronneberg water well but that they had declined the offer. Canadian 88 said that it would commit to testing the Hermann/Ronneberg water well for quality and rate before and after drilling and to conduct post-drilling testing for other residents' water wells for whom pre-drilling testing had been conducted.



Canadian 88 said that the well would not be drilled underbalanced and that there should be no release of any sour gas to atmosphere during normal drilling operations. Canadian 88 said that if the well were successful, it would propose an operational test period of approximately 24 to 48 hours that would involve flaring. It noted four basic reasons to production test a well after completion. It said the test would allow for the cleanup of completion fluids from the zone, permit evaluation of potential production rates, obtain an assessment of fluid composition, and record pressure data with which to interpret reservoir characteristics.

Canadian 88 said that it had completed some scoping analysis for the well test and admitted that flaring the 39 per cent H<sub>2</sub>S gas would be problematic in certain respects. It said that it had not completed its plume dispersion modelling for the test. It noted, however, that the preliminary work it had done suggested that by limiting the flow rate, diluting the well effluent with propane, properly configuring the burner to improve combustion efficiency, and limiting the test to optimum atmospheric conditions, it would be possible to complete a short-duration test and still meet regulatory requirements. Canadian 88 noted that a subsequent application, including a detailed analysis and plan, would have to be submitted to the EUB in order to obtain a flare permit before the test could be conducted. Canadian 88 noted that although incineration technology is advancing and evolving, it would not be feasible to use this technology for well cleanup and testing purposes given the potential H<sub>2</sub>S concentration of this well.

In response to Mr. Weber's suggestion that this well could be tested into a pipeline to the Mazeppa plant rather than with flaring, Canadian 88 said that it had given this concept some preliminary consideration and found that it would not be economically feasible given that the nearest pipeline tie-in point that could accommodate the well would be approximately 5 miles (8.0 km) away at LSD 11-34-18-28W4M. It noted that it also considered the option of using a pipeline approximately 0.5 miles (0.85 km) away but found that that pipeline would require relicensing and considerable upgrades to accommodate the potential H<sub>2</sub>S concentration and volume of sour gas from the 3-2 well. Canadian 88 said that it would prefer to first establish whether or not it has a producible well and its fluid composition in order to properly design any pipeline upgrades that might be required. Canadian 88 said that it would continue to evaluate in-line testing as an option.

## **5.2 Views of the Interveners**

Ms. Hermann did not state specific concerns with Canadian 88's hydrology assessment but she said that there were concerns with the short- and long-term effects of the 3-2 well on their water well at LSD 1-2-18-28W4M and the water quality in the area.

Ms. Hermann and Ms. Ronneberg raised concern for their health and safety and that of the domestic animals and wildlife in the area should the 3-2 well proceed. They said that they were concerned about emissions from flaring at the proposed well site, as their residence is located directly to the east.

The Webers did not express specific concern regarding the impact of the proposed well on the water well. However, they did say that if it were to become their property, they would allow Canadian 88 to conduct testing of the existing water well.

The Webers raised health and environmental concerns with respect to emissions associated with

flaring at the proposed well. They submitted that the well site would be located directly west of the Hermann/Ronneberg residence, directly down wind and in the path of prevailing winds. They feared that the approximate distance of 710 m between the proposed well and the residence would not be sufficient. The Webers suggested that the well be tested in-line to the Mazeppa plant and requested that Canadian 88 consider the feasibility of such in-line testing rather than flaring during testing operations.

### **5.3 Views of the Board**

The Board accepts the mitigative measures that Canadian 88 has committed to in order to protect groundwater in the area. The Board notes the interveners' concerns about water quality and also that Canadian 88 has undertaken to test area water wells before and after drilling at the request of landowners. The Board expects Canadian 88 to work with area residents to ensure that the follow-up water well testing is conducted.

The Board acknowledges the concerns of the interveners regarding health, safety, and the environment with respect to flaring at the 3-2 well. However, the Board does not believe that the Hermann/Ronneberg concerns are relevant in this instance because they are no longer occupying the premises and are in the process of divesting themselves of ownership of the property. The Board believes that Canadian 88 will require a well test to clean up the zone and to obtain important well performance and fluid composition data for planning purposes. The Board notes Canadian 88's comments that any flaring or incineration at 3-2 would be limited to a 48-hour test and that the test would require a detailed application to the Board as well as its written approval. The Board believes that it would likely be necessary for Canadian 88 to limit the flow rate, dilute the sour gas with propane, use specific equipment to improve combustion efficiency, and limit the test to ideal meteorological conditions in order to meet Alberta's ambient air quality guidelines. The Board notes that any emissions from the 3-2 well would have to meet these guidelines and that it is these guidelines that limit the potential health risks and environmental impacts associated with flaring.

The Board does not believe that Canadian 88's flaring operations would pose a health risk to the interveners. However, it notes that Canadian 88 has undertaken to relocate the occupants of the residence in LSD 1-2-18-28W4M during any flaring operations at 3-2.

The Board notes that Canadian 88 said that it had given preliminary consideration to testing the well into a pipeline to the Mazeppa plant rather than flaring and that it would continue to evaluate in-line testing as an option. The Board also notes Canadian 88's comments with respect to further evaluating the use of incineration technology versus using a flare stack for testing purposes. Therefore, the Board expects Canadian 88 to seriously consider these options and, if rejected, submit its findings for the Board's consideration when it applies for its flare permit.

## 6 DECISION

Having carefully considered all of the evidence, the Board approves Application No. 1037740, subject to Canadian 88 meeting all regulatory requirements and all of its commitments at the hearing. The well licence will be issued in due course.

Dated at Calgary, Alberta, on May 26, 2000.

### **ALBERTA ENERGY AND UTILITIES BOARD**

*(Original signed by)*

J. D. Dilay, P.Eng.  
Presiding Board Member

*(Original signed by)*

R. G. Lock, P.Eng.  
Board Member

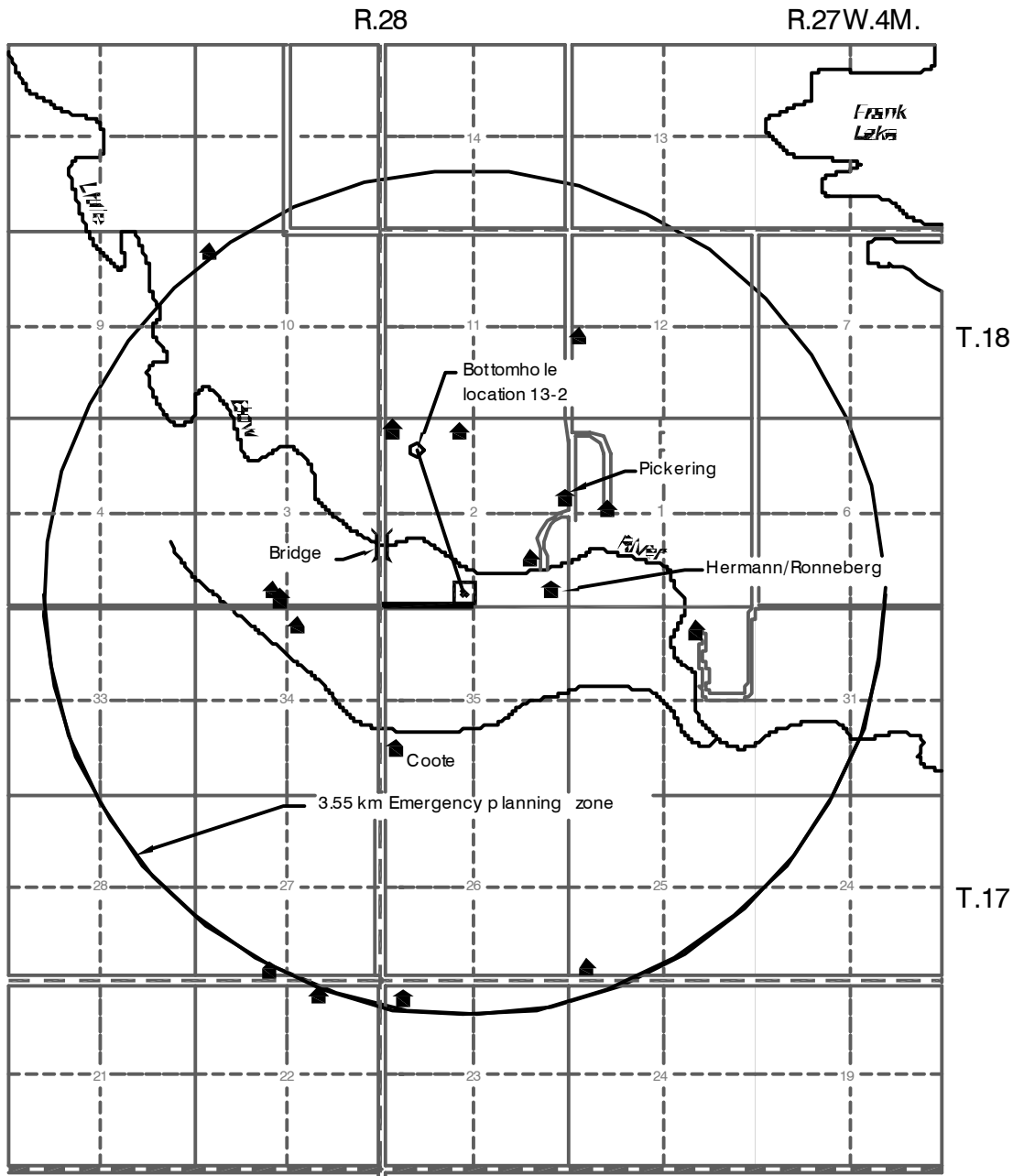
*(Original signed by)*

C. A. Langlo, P.Geol.  
Acting Board Member






## APPENDIX 1 SUMMARY OF DRILLING COMMITMENTS BY CANADIAN 88

- Install surface casing of an L-80 grade material with an appropriate metallurgy and pressure rating, as described in EUB *Guide 10: Guide to Minimum Casing Design Requirements*.
- Install a surface casing bowl with a product specification level (PSL) 3 and a pressure rating of 34.5 MPa.
- X-ray the weld on the surface casing bowl.
- Use a drill string float.
- Conduct and report the leak-off test upon drilling out of the surface casing shoe, as prescribed in EUB *Guide 8: Surface Casing Depth Minimum Requirements*.
- Review and verify that all casing designs meet the requirements of EUB *Guide 10*.
- Use premium grade E drill pipe or possibly SS-95 drill pipe if required to meet overpull requirements.
- Use a filming amine and pretreat the mud system with an H<sub>2</sub>S scavenger. Scavenging capability is to be a minimum of 500 mg/litre of sulphides.
- Design and inspect the drill pipe prior to use to comply with API recommended practice (RP) 7G and API RP 5A5.
- Ensure that the blowout prevention (BOP) stack configuration complies with the alternatives provided in *Alberta Recommended Practices, Volume 1, Drilling*.
- Provide continuous pH and sulphide monitoring during drilling operations in the sour zone.
- Maintain a pH value at or above 10.5 while drilling in the sour Wabamun Formation.
- Maintain the surface usable drilling volume at 100 per cent in excess of the hole volume minus drill pipe displacement.
- Maintain an inventory of weight material sufficient to increase the density of the mud system by a minimum of 100 kg/m<sup>3</sup>.
- Commit not to core any sour formations.
- Ensure that supervisors and rig managers have level-1 and level-2 Petroleum Industry Training Services (PITS) certification.

- Carry \$20 million of blowout insurance and \$30 million of liability insurance during drilling operations. Canadian 88 assumes coverage of 100 per cent of the working interest in the well. Blowout insurance is to cover cost associated with an underground blowout and the cost of drilling a relief well, well pollution and seepage, evacuation expenses and care, custody, and control.



Legend

- |   |                        |   |                   |
|---|------------------------|---|-------------------|
|  | 3-2 Well site location |  | Gravel road       |
|  | Residence              |  | Access road/trail |
|  | Proposed access road   |   |                   |

Okotoks Field  
 Application No. 1037740  
 Canadian 88 Energy Corp.

Decision 2000-33