EnCana Corporation

Applications for Licences for 15 Wells, a Pipeline, and a Compressor Addition

Wimborne and Twining Fields

October 31, 2006

Alberta Energy and Utilities Board

ALBERTA ENERGY AND UTILITIES BOARD
Decision 2006-102: EnCana Corporation, Applications for Licences for 15 Wells, a Pipeline, and a Compressor Addition, Wimborne and Twining Fields

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Calgary Alberta

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APPLICATIONS FOR LICENCES FOR 15 WELLS,
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WIMBORNE AND TWINING FIELDS **Applications No. 1393397 et al.**

1 DECISION

Having considered all of the evidence, the Alberta Energy and Utilities Board (EUB/Board) approves the EnCana Corporation (EnCana) applications subject to the conditions listed in Appendix 1.

2 INTRODUCTION

2.1 Applications

EnCana applied to the EUB for approvals to

- drill 15 vertical wells for the purpose of obtaining natural gas production from coal zones and shallow sands (Appendix 2 lists the surface location and purpose of each well applied for),
- construct and operate 46 pipeline segments to tie the proposed 15 wells and existing and future wells into existing infrastructure, and
- construct and operate a 1000 kilowatt gas compressor and inlet separator at an existing compressor station.

The project area is within Township 32, Ranges 25 and 26, West of the 4th Meridian (W4M) and Township 33, Range 25 W4M. The nearest urban centre is the town of Torrington, about 3.2 kilometres (km) west of the project area. Figure 1 shows the proposed locations for the wells, pipeline segments, and compressor station applied for by EnCana.

2.2 Interventions

A number of landowners and occupants from within the project area (the interveners) objected to the applications (the interveners are listed in Appendix 3). Figure 1 also shows the locations of the interveners' lands.

The interveners' primary concern about the applications was that the drilling and completing of the proposed coalbed methane (CBM) wells may negatively affect local aquifers that provide them with water for domestic and stock use. The interveners also expressed concern about soil conservation and weed control in relation to the well sites and access roads and about the potential for excessive noise associated with an additional compressor.

K. Hoppins, G. Doering, K. Niemi, and L. Howard also registered and participated at the hearing. The primary concern expressed by these individuals also related to the potential risk posed by the applied-for wells to local domestic and stock water supplies.

2.3 Hearing

The EUB encouraged the parties to engage in appropriate dispute resolution (ADR) to continue discussing issues of interest even after the hearing date was established. Due to the scope of the project, EnCana was of the opinion that formal mediation would be the best option. The parties worked with a third-party mediator in December 2005 and January 2006 but were unable to reach an agreement.

The Board scheduled a public hearing to commence on January 11, 2006, in Torrington, Alberta. On November 24, 2005, the Board received a request to reschedule the hearing and granted the request. The Board rescheduled the hearing to commence on March 7, 2006. On February 28, 2006, the Board received a second request to reschedule the hearing and granted the request.

The Board held the public hearing in Torrington, Alberta, on April 3 to 6, 2006, before Board Members M. N. McCrank, Q.C., P.Eng. (Presiding Member), J. D. Dilay, P.Eng., and G. J. Miller. A tour of the project area was conducted on March 6, 2006.

Those who appeared at the hearing are listed in Appendix 3.

Following the close of the oral portion of the hearing, the Board requested that the parties work together to rerun the calculations done on behalf of EnCana using parameters stipulated by the interveners' expert witness. These calculations were made to determine the change in groundwater elevation at the base of the Paskapoo Formation. This information was received from EnCana on August 2, 2006. Therefore, the Board considers the hearing to be closed as of that date.

2.4 Issues

The Board considers that the applications raise the following issues:

- Are the applied-for facilities necessary?
- Does production of coalbed methane represent a risk to water wells and associated aquifers in the area of application?
- Will the proposed compressor station meet the EUB's noise requirements?
- Can the proposed wells be drilled and operated in a manner that ensures appropriate soil conservation and weed control?
- Were EnCana's public consultation efforts adequate?

3 BACKGROUND

3.1 Area Geology

While some geological evidence was presented at the hearing, the exact nature of the geological setting of the proposed wells was not an issue that was contested by the parties. It is not the Board's intention to make specific determinations or findings about the geological setting of the proposed wells in this section. Rather, the Board used the evidence provided at the hearing to prepare a general geological description of the application area.

This description is included in the report simply to help readers understand the subsurface environment in which the proposed wells would be drilled. As this information has been included solely as an aid to understanding the decision, the Board has not attributed the source of the information to a particular party.

Figure 2 (taken from EnCana's evidence), a schematic intended to aid readers with understanding the formations underlying the project area, shows the different subsurface formations that the proposed wells will pass through and also shows

- the depth of aquifers that supply area domestic and stock water wells,
- the depth of local water wells,
- the estimated base of groundwater protection,
- the depth of the surface casing proposed by EnCana, and
- the depth at which the shallowest fracturing operations will take place.

The following are brief descriptions of the formations shown in Figure 2.

Paskapoo Formation

The first bedrock formation encountered when drilling from the surface is the Paskapoo Formation. While other intervals overlie the Paskapoo, they primarily consist of unconsolidated till and gravel. In the area of application, the Paskapoo Formation ranges from 90 to 190 metres (m) in thickness and is primarily sandstones and mudstones.

The Paskapoo Formation can further be divided into the Upper Paskapoo, which ranges in thickness from 60 to 140 m, and the Lower Paskapoo, which ranges in thickness from 30 to 50 m. The majority of water wells in the area of application are completed in aquifers in the Upper Paskapoo. Only a few water wells in the area of application are located in the Lower Paskapoo. No water wells in the area of application have been completed in any interval below the Paskapoo Formation.

Scollard Formation

The Scollard Formation is found immediately below the Paskapoo. In the area of application it ranges in thickness from 80 to 110 m. The Scollard Formation is believed to contain usable groundwater similar to that found in the Paskapoo Formation.

Battle and Whitemud Formations

Underlying the Scollard Formation are the extensive and recognizable Battle and Whitemud Formations, which together are understood to be 2.4 to 10 m thick in the area of application. The Battle Formation is primarily made up of clays and volcanic ash and acts like a seal between the formations above and below it. The Whitemud Formation is impermeable and acts as a barrier to flow.

Horseshoe Canyon Formation

The Horseshoe Canyon Formation lies beneath the Battle and Whitemud Formations and is divided into Upper, Middle, and Lower zones. The Upper ranges in thickness from 40 to 70 m,

the Middle ranges in thickness from 40 to 80 m, and the Lower ranges in thickness from 180 to 220 m. The Horseshoe Canyon contains the coal seams that are the primary target of EnCana's 15 proposed wells. All zones of the formation contain coal seams, but the main CBM resource is in the Lower zone. Sandstones occur within this formation, but they are very infrequent in the area of application and are generally considered to have low permeability. Other areas of the province have better sandstones and thus better aquifers in this formation.

Bearpaw Formation

The Bearpaw Formation lies beneath the Horseshoe Canyon Formation and ranges in thickness from 70 to 200 m. This formation is primarily a series of marine shales that act as a seal in much of the area.

The Belly River Group underlies the Bearpaw Formation and is approximately 350 m thick. The Belly River Group contains the sandstone beds that EnCana believes may yield some natural gas.

Base of Groundwater Protection

The base of groundwater protection (BGWP) is the subsurface elevation below which the groundwater is expected to have more than 4000 milligrams per litre (mg/l) of total dissolved solids. In the area of application, EnCana determined the BGWP to be about 300 m below ground level in Township 33, Range 26 W4M and to be at the base of the Lower Horseshoe Canyon Formation (about 500 m below ground level) throughout the rest of the area of application.

3.2 Casing and EUB Requirements

A significant issue raised at the hearing was how deep the surface casing for the proposed wells should be. In order to help readers have a better understanding of this issue, the Board includes a casing background to explain the different types of casing and the EUB's requirements for surface casing (see Appendix 4).

4 ARE THE APPLIED-FOR FACILITIES NECESSARY?

4.1 Views of EnCana

EnCana requested approval of 15 well applications, one pipeline application for 46 pipeline segments, and one compressor application, all related to the development of natural gas from coal formations (often referred to as CBM or natural gas from coal [NGC]) and shallow sands in the Torrington area. EnCana said that it needed the wells to be able to produce the gas; it needed the pipelines to be able to transport the gas to the compressor and then on to market; and it needed the compressor to increase the pressure of the gas in the pipelines.

EnCana stated that 13 of the 15 well sites would consist of a wellhead surrounded by a fence. It stated that the remaining 2 well sites would also require a metering shack with a separator and tank. EnCana explained that these additional facilities would be necessitated by the potential for wet production from the Basal Belly River sands, which would require separation.

EnCana stated that it used a project-based planning approach for development of the area in order to minimize proliferation of wells, pipelines, and facilities in the Torrington area. It explained that the proposed development in Torrington would overlap an existing shallow gas field that it operates and that it incorporated as much of this existing infrastructure as possible.

EnCana predicted the life expectancy of the wells to be over 30 years. During this time, EnCana estimated that the project would develop about 500 million cubic metres (17.5 billion cubic feet) of gas. EnCana equated this to the amount of natural gas required to heat about 112 000 homes for one year. Furthermore, it stated that the project was expected to generate more than $9 million in royalties, $14 million in federal and provincial taxes, and about $2.5 million in municipal taxes. EnCana also commented on the benefits to the local economy, such as employing local contractors, but was unable to quantify this benefit.

4.2 Views of the Interveners

The interveners did not contest the need for the wells, pipelines, and compressor or EnCana's right to the minerals.

4.3 Views of the Board

The Board agrees that EnCana needs the proposed wells to capture the reserves because there are no existing wells able to do that. Similarly, the Board notes that should the wells be found capable of commercial production, the pipelines and compressor addition would be required for production purposes. The Board notes that the interveners did not contest the need for the wells and facilities. Having satisfied itself that there is a need for the wells, pipelines, and compressor, the Board addresses the other issues raised by the applications and interventions in the following sections of this report.

5 DOES PRODUCTION OF COALBED METHANE REPRESENT A RISK TO WATER WELLS AND ASSOCIATED AQUIFERS IN THE AREA OF APPLICATION?

The interveners raised concerns regarding the potential impact the proposed wells may have on their water wells during three distinct periods in the life of the wells.

5.1 Use of Surface Water for Drilling

5.1.1 Views of EnCana

EnCana stated that it would use untreated surface water obtained from local dugouts to drill the surface holes. EnCana added that it may add bentonite (clay) (see Appendix 5: Glossary for definitions of some technical terms used in this report) to the water to increase its viscosity and deal with lost circulation. However, it noted that adding bentonite may not be necessary because the clays and shales it would be drilling through contained naturally occurring bentonite. For the main hole, EnCana stated that it would use flocculated water (fresh water with a small amount of polymer added to it) to allow the drill cuttings to drop out of the water when returned to the surface.

EnCana testified that while untreated surface water could come into contact with those aquifers encountered during drilling, the surface water posed little risk to the aquifers. EnCana argued that the bacteria or other organisms that live in surface water would not thrive in an underground aquifer. EnCana stated that there would be several obstacles to their survival, including inability to successfully compete with the naturally occurring organisms already living in the aquifers and the lack of an appropriate substrate to allow their continued existence. EnCana further pointed out that there would be little point in using treated water, as that water would encounter bacteria and other organisms in the wellbore.

5.1.2 Views of the Interveners

Mr. Freeman agreed with EnCana that the use of dugout water for drilling the proposed wells would not present a risk. He testified that the bacterial contaminants found in dugouts do not survive in the subsurface. He noted that some organisms, like E. coli, commonly live in the intestines of animals and would thus not be well suited to life 300 m below the ground. However, Mr. Freeman observed that the use of treated dugout water or water from a town water supply was becoming an "industry standard."

The interveners requested in final argument that the Board require EnCana to treat any dugout water it intended to use for drilling the proposed wells.

5.1.3 Views of the Board

With respect to the use of untreated water for drilling surface holes, the Board notes that both EnCana and the interveners' expert witness agreed that the kinds of bacteria and other organisms present in surface water would not be able to survive underground in aquifers. The Board notes that Mr. Freeman did not elaborate on his statement that the use of treated water for drilling was becoming an "industry standard." Accordingly, the Board does not believe it is necessary to require that EnCana use treated water for drilling surface holes.

Notwithstanding that evidence presented at the hearing shows that untreated water does not present a risk, the Board is concerned that the interveners' perception that untreated water does present a risk is not supported by scientific knowledge. Indeed, it appears that the interveners did not accept the advice of their own expert in this regard. The Board is concerned that the interveners did not find the evidence presented at the hearing regarding the use of untreated water for drilling to be convincing. Furthermore, the panel is aware that these views are common to many Albertans. The Board notes that much of the information regarding groundwater and water wells currently in the public realm does not directly address this concern. Unfortunately, the information in the scientific literature does not appear to be accessible or in a format readily available or useful to the general public. As a result, the panel will recommend to the full Board of the EUB that a report specifically written for a public audience be prepared by a third party to address this issue. The panel is also aware that Alberta Environment is working to ensure that all Albertans have access to scientifically based groundwater and water well information on which to base their decisions, and it will continue to support Alberta Environment in this area.

5.2 Surface Casing

5.2.1 Views of EnCana

EnCana argued that its proposed drilling program would adequately protect area groundwater resources. EnCana described its proposed casing and cementing program as follows:

- First, it would drill and condition the surface hole, set surface casing, and cement that casing to surface by pumping cement down the inside of the casing and back up the outside. The depth of the surface casing would vary from 89 to 160 m, depending upon the total depth of each well. This step may be performed for each well using a smaller rig. In that case, the drilling of the production hole by a larger rig would occur later.

- Next, EnCana would drill and condition the production hole and then install steel casing to the total depth of the well. This casing would be cemented along its full length by pumping cement down inside the casing and then back up the annular space between the steel casing and the drill hole.

EnCana said it would meet the EUB's requirements for groundwater protection by having the production casing cemented full length. It also said that the surface casing would extend at least 84 m below the deepest water well within 500 m of any of EnCana's proposed wells, which would provide an additional measure of protection, but it acknowledged that its surface casing would not also be set to the BGWP. EnCana also observed that because the target reservoirs were understood to be under low pressure (underpressured), there was no technical need to set and cement surface casing below the BGWP. Additionally, it noted that some of the coals targeted, though dry, were above the BGWP.

EnCana noted that these wells were eligible for a surface casing waiver pursuant to *Directive 008: Surface Casing Depth Minimum Requirements*, because surface casing was not required for well control reasons. Thus, from a regulatory perspective, EnCana argued that these wells would not require any surface casing. EnCana stated, however, that because its applications included the use of surface casing, it would not request waivers. EnCana filed information supporting Type 1 and Type 2 surface casing setting depth reductions. Such reductions are also based on well control reasons and are explained in Appendix 4, which describes the EUB's casing and cementing requirements.

EnCana acknowledged that it experienced lost circulation in about 10 per cent of the wells it drilled in the area. It stated that these lost circulation events generally occurred during the drilling of the surface hole. EnCana testified that it would add lost circulation material (LCM) to the drilling fluid in the event of lost circulation. EnCana explained that the LCM was essentially fibre that acted to seal or plug off the area of lost circulation. EnCana noted that the drill cuttings coming back up the outside of the hole would also plug areas of lost circulation. Should lost circulation occur, EnCana confirmed that it would not set cement until circulation had been regained, so that a good cement job would be obtained.

EnCana explained that it would run either a cement bond log or a variable density log on all the proposed wells to determine the cement top and integrity following production casing cementing operations. EnCana also indicated that the cement would be monitored during cementing operations to determine if cement returns were obtained at surface, confirming that the casing

had been cemented full length. It stated that these cement evaluation methods would identify any cement integrity concerns prior to completion and stimulation operations.

EnCana submitted that the drilling of the proposed wells would pose little risk to groundwater and asserted that any risk could be managed effectively and responsibly. EnCana emphasized that the risks that would exist would not be exclusive to wells targeting CBM but would apply to any oil or gas well drilled in the province. EnCana stated that because the proposed wells would be relatively shallow, drilling time, and thus the exposure of the open hole, would be very limited. Further, EnCana argued that there was no evidence that drill cuttings from the target formation would be toxic to groundwater. Finally, it added that such cuttings would be unlikely to penetrate more than a very short distance from the wellbore.

In its submission of May 31, 2006, EnCana provided additional information showing the relationship of the proposed depth of surface casing to the base of the Paskapoo Formation. EnCana noted that this information showed that the base of the surface casing would be

- above the base of the Paskapoo Formation for 10 of the applied-for wells,
- roughly at the base for 2 of the wells, and
- below the base for 3 wells.

EnCana maintained that extending surface casing below the base of the Paskapoo Formation in all wells was not necessary to protect groundwater, as the production casing in all wells would be cemented full length, thus meeting the EUB's requirements.

EnCana worked with the interveners' expert to develop the inputs for a simple one-dimensional calculation to estimate the time period for transmission of pressure effects from Horseshoe Canyon gas production to the Paskapoo Formation aquifers. The calculation was run using a gradual decline in gas pressure and also, as requested by the interveners, with a constant gas pressure.

Both gas production scenarios yielded similar results, predicting a maximum decrease in water level of 0.4 m (16"). It was EnCana's position that this magnitude of change over several decades would not be noticeable to a water well user when combined with natural variations in water levels. EnCana also noted that the inputs to the calculation were conservative, meaning that the inputs were chosen so that the maximum impact of gas production on water levels in the overlying Paskapoo aquifers would be assessed. As gas production from the Horseshoe Canyon coals had shown the formation to be underpressured and dry, EnCana maintained that there was no hydraulic connection to the overlying Paskapoo and stressed that caution should be used in evaluating the calculation results, as inputs to it may not reflect actual geological conditions and geological evidence suggested that permeability to water flow between the Paskapoo and Horseshoe Canyon did not exist.

5.2.2 Views of the Interveners

The interveners' expert hydrologist, Mr. Freeman, testified that EnCana's proposal to set surface casing below the deepest water wells in the area was a reasonable approach to protect currently used aquifers. Mr. Freeman commented that surface casing was originally designed to provide an anchor for equipment in the event that a well experienced a kick or a blowout. He noted that only recently had surface casing evolved into protection for groundwater.

Mr. Freeman noted that EnCana's proposal to cement the entire production string would act as a seal between the wellbore and the target zones. Mr. Freeman observed that the BGWP in the area was currently considered to be the base of the Horseshoe Canyon Formation and thus some additional risk may arise as a result of not setting surface casing to the BGWP. He qualified that statement, however, by noting that the risk would not be high and the water at those levels would not be good quality. Mr. Freeman did state, however, that one of the risks associated with not setting surface casing to the base of the Paskapoo Formation would be the potential for contamination of aquifers below the surface casing but above the base of the Paskapoo Formation during the drilling of the main hole.

Mr. Freeman stated that he agreed with EnCana that there was unlikely to be any significant hydraulic connectivity between surface water and the target CBM zones. Mr. Freeman stated that he took some comfort from the evidence presented by EnCana regarding the existence of low conductivity zones between the upper zones and the target Horseshoe Canyon coals. Given these low conductivity zones, Mr. Freeman submitted that it would take a considerably long time for groundwater to flow vertically and thus for communication to occur.

Mr. Freeman participated in the selection of input parameters to the one-dimensional calculation performed by EnCana to estimate the maximum impact on water levels in aquifers at the base of the Paskapoo Formation. He requested the calculation be run using a constant gas production pressure, as well as a gradually declining pressure.

The interveners requested that EnCana be required to set surface casing to the base of the Paskapoo Formation to protect deeper aquifers should they be needed in future. They indicated that while surface casing may not technically be required when the production casing was cemented for its entire length, the addition of surface casing to the base of the Paskapoo Formation would provide additional protection to valuable groundwater resources. The interveners said that if the Board were unwilling to require EnCana to set surface casing to the base of Paskapoo, the Board should at the very least deny EnCana's request for surface casing reductions.

5.2.3 Views of the Board

The Board understands that the interveners' primary concern with the applied-for wells is the potential risk to their water supply. The Board notes that while most area water wells are completed in the Upper Paskapoo, some are completed in the Lower Paskapoo. The Board further notes that no water wells have been completed below the Paskapoo. The Board understands that the interveners' concerns relate not only to existing water supplies but also to supplies that may be used in the future. The Board understands that while non-saline groundwater may be found in the Horseshoe Canyon Formation, the main concern is with aquifers found above the base of the Paskapoo Formation. The Board also notes that if surface casing were required to be set to the BGWP, in this case it would have to be perforated to access the gas-bearing zones.

The Board requested that EnCana run the one-dimensional calculation suggested by Mr. Freeman during the hearing to provide additional information related to the impact of Horseshoe Canyon gas production on water levels in aquifers at the base of the Paskapoo Formation. The Board notes that the current lack of water production and the underpressured state of the Horseshoe Canyon Formation suggest that communication between it and the Paskapoo is

extremely limited in this area. Further, the Board notes that the model provides, at best, an indication of the magnitude of the maximum potential impact, as the inputs used are conservative or worst case. Therefore, the results of the calculation are likely to overstate any potential change to water levels in the Paskapoo. The Board notes that the results of the calculation run using a gradual decline in gas pressure and a constant gas pressure are similar and both results support EnCana's position that the impact on overlying aquifers will not be detectable.

The Board notes that the requirements of *Directive 008*, *Directive 009: Casing Cementing Minimum Requirements*, and *Directive 056: Energy Development Applications and Schedules* provide for the protection of fresh water aquifers in one of two ways, either by setting and cementing surface casing to below the BGWP or, if surface casing is set above the BGWP, by cementing the production casing full length. The Board observes that EnCana proposes to use the approach of cementing the production casing full length, which would meet the requirements. The Board also notes that *Directive 036: Drilling Blowout Prevention Requirements and Procedures* and *Directive 027: Shallow Fracturing Operations—Interim Controls, Restricted Operations, and Technical Review* require the use of non-toxic drilling and fracturing fluids above the BGWP.

Notwithstanding that the Board finds that the production of gas from the Horseshoe Canyon Formation is unlikely to affect the overlying aquifers, the Board notes the interveners' concerns with the potential impacts that drilling the wells may have.

It is the Board's view that approval of the proposed wells is in the public interest. The Board finds that such wells may be drilled and operated in a manner that ensures the protection of the public and the environment. The EUB is committed to ongoing scrutiny of its requirements to ensure that those requirements meet their intended purpose and are consistent with the Board's mandate of ensuring public safety, protection of the environment (including groundwater), and conservation of the province's resources. This scrutiny is currently being applied to an ongoing scheduled review of *Directive 008*. Part of this scrutiny includes soliciting stakeholder feedback, and the public is encouraged to participate in this process. The EUB will take direct and immediate action should any needed improvements be identified.

The Board finds that installing production casing and cementing it full length, as proposed by EnCana, is in accordance with the EUB's regulatory requirements and will ensure the protection of freshwater aquifers. The Board considers that cementing the production casing full length will protect all of the formations encountered and prevent fluid migration from one formation to another.

With respect to the surface casing reductions requested by EnCana, the Board notes that such reductions are available in low-risk, development-type settings such as exist in the present case where well control would not be compromised by such reductions. The Board observes that such reductions will not compromise aquifer protection or well control. Accordingly, the Board finds that the requested surface casing reductions are reasonable and appropriate in the circumstances.

The Board recognizes landowners' concern for their water supplies and believes the public needs to be reassured that water levels are being monitored in the long term. The Board notes that Alberta Environment is enhancing its groundwater monitoring network to provide Albertans with this type of information, specifically with respect to CBM development. The Board confirms that the EUB is supporting and will continue to support Alberta Environment is this area.

Additionally, the Board notes that operators are required to submit monthly water production data and that the EUB is currently developing a system to electronically identify water production from zones above the BGWP, require testing to identify the quality of the water, and take appropriate action in consultation with Alberta Environment. This action is being taken to ensure that water production associated with shallow hydrocarbon production does not impact aquifers.

The Board notes that it is aware of the public's concerns regarding groundwater contamination and the effectiveness of the EUB's current requirements regarding surface casing. The *Coalbed Methane/Natural Gas in Coal, Final Report*[1] prepared by the Multi-Stakeholder Advisory Committee (MAC) includes a recommendation (3.3.7) that drilling and completion practices for energy and water wells be reviewed:

> 3.3.7 AENV and the EUB should review drilling and completion practices for new and recompleted water and energy wells, ensuring regulations are appropriate for the purpose of the well. Topics to be addressed should include: drilling and completion fluids; well bore integrity/aquifer isolation; casing types; ***fracturing;*** and completions, etc. This review should include the drilling and abandonment of temporary water source wells.

The Board notes that as a member of MAC, the EUB is committed to ensuring that its requirements are protective of groundwater and is working with other stakeholders to address recommendation 3.3.7. Part of this effort is the current review of shallow fracturing, as announced by EUB *Directive 027*. Other areas of the recommendation, such as aquifer isolation, will also be addressed as part of the ongoing review.

5.3 Well Completion/Nitrogen Fracturing

5.3.1 Views of EnCana

EnCana testified that it would be necessary to stimulate the formations in order to achieve gas flow from the target coals to the wellbore. EnCana explained that its completion program for the proposed wells would involve the following steps:

- First, it would run geophysical logs in the wellbore to determine the properties and exact location of the coals, shales, and sands.
- Next, it would perforate each of the approximately 20 coal seams targeted by the project using shaped charges that open the coal seams to the wellbore.
- The final step in the stimulation process would be to inject inert nitrogen gas into individual coal seams at a high rate.

EnCana observed that nitrogen is a benign substance that constitutes 80 per cent of the air we breathe. EnCana explained that the stimulation process would perform two functions: first, it would create hydraulic fractures within the coals and provide pathways for the gas to flow from the seam to the wellbore. EnCana explained that using water to fracture coals inhibited gas production. Second, the nitrogen injection would act to flush the drilling water from the coal seams, allowing the gas to flow.

[1] *Coalbed Methane/Natural Gas in Coal, Final Report,* prepared by the CBM/NGC Multi-Stakeholder Advisory Committee, January 2006.

EnCana stated that it generally took about a half day to stimulate each well. It explained that the nitrogen would be injected into the well through coiled tubing inserted into the production casing. The zone to be stimulated would be isolated from the rest of the wellbore to make sure the nitrogen went into the targeted coal seam(s). EnCana stated that it would stimulate the deepest coal seam(s) first and then work its way up the wellbore. It explained that each well in the area would require about 15 stimulations, as EnCana would stimulate only one or two seams at a time.

EnCana stated that the hydraulic fracturing generated by its stimulation process would be primarily horizontal. It stated that it had observed that Horseshoe Canyon coals analogous to those targeted in the current applications tended to fracture along a northwest/southeast axis. EnCana stated that these fractures were generally elliptical in shape, with the long axis extending about 50 m horizontally from the wellbore in either direction and the short axis extending about 30 m.

EnCana stated that in its experience, stimulation of Horseshoe Canyon coals did not result in vertical fractures going beyond the targeted coal seams, especially in the shallower coals. EnCana noted that vertical fractures in adjacent coal seams occurred in less than 1 per cent of operations and that these limited vertical fractures had occurred only in the deeper coals. It emphasized that it had conducted hundreds of such stimulations on Horseshoe Canyon coal seams near the project area. It noted that the targeted coal seams ranged in thickness from less than 0.5 m to about 2 m and that most seams were often less than 5 m apart. EnCana stated that it monitored the pressure in the annulus between the tubing and the casing above the zone being fractured to make sure the fracture stayed in that zone. The applicant maintained that it was apparent that fractures were contained to the coal because the nitrogen did not come back through the open perforations above the stimulated seam.

EnCana testified that where it had observed height growth of vertical fractures in the deeper coals, the average height growth was 5 m, with a maximum height growth of 10 m. EnCana also noted that “T-fractures” were common in formations like the Horseshoe Canyon. It explained that a vertical fracture in coal generally turned horizontal when encountering overlying or underlying shale. It noted that horizontal fractures did not turn vertical. EnCana stated that for all of the above reasons, it was confident that its stimulations remained confined within the targeted coals the vast majority of the time.

EnCana observed that its proposed stimulation program complied with EUB *Directive 027*, as all of its proposed fracturing operations would be below 200 m and none of the proposed wells was within a 200 m radius of water wells. Additionally, EnCana noted that there was a vertical separation of 84 m between its shallowest planned fracture and any water well within 500 m. EnCana stated that it was confident that its proposed stimulation program posed minimum risk to area water wells. EnCana argued that this confidence was based upon the distance of the proposed fracturing operations from area water wells and its observation with respect to vertical fracturing, as explained above.

5.3.2 Views of the Interveners

Mr. Freeman, the interveners’ expert on hydrology matters, testified that he was not an expert on fracturing. However, he did observe that the clays in the rocks that overlie the Horseshoe Canyon

coals include bentonite and are thus somewhat plastic in nature. Mr. Freeman suggested that this property would tend to prevent vertical fracture propagation.

The interveners expressed concerns associated with EnCana's proposed fracturing process. Mr. Kohler provided three examples from the area where he suspected that fracturing had negatively affected local water wells or springs.

The interveners said that EnCana should be required to assess all potential impacts prior to initiating a fracturing program, as provided for in EUB *Directive 027*. Such an assessment under *Directive 027* would include

- the fracture program design, including proposed pumping rates, volumes, pressures, and fluids;
- a determination of the maximum propagation expected for all fracture treatments to be conducted;
- identification and depth of offset oilfield and water wells within 200 m of the proposed shallow fracturing operations;
- verification of cement integrity through available public data of all oilfield wells within a 200 m radius of the well to be fractured; and
- landholder notification of water wells within 200 m.

The interveners acknowledged that under the terms of *Directive 027* EnCana would not be required to perform such an assessment but contended that EnCana should exceed regulatory requirements as a good neighbour. The interveners noted that EnCana had agreed that a *Directive 027* assessment would not be onerous and questioned why EnCana would not agree to perform this task. The interveners also requested that EnCana be required to abide by its commitment to not conduct fracturing operations at a depth shallower than 200 m.

5.3.3 Views of the Board

The Board finds that fracturing, as proposed by EnCana, does not present a material risk to area water wells and their associated aquifers for the following reasons:

- There is a minimum vertical separation of 84 m between the coal seams that EnCana intends to fracture and the deepest water well within 500 m.
- EnCana's evidence, based upon hundreds of stimulations of Horseshoe Canyon coals, demonstrates that vertical fractures do not extend beyond targeted coal seams that range in thickness from 0.5 to 2 m.
- EnCana's evidence demonstrates that vertical propagation of fractures to adjacent coal seams has been observed in less than 1 per cent of operations and only within deeper coals.
- EnCana's evidence demonstrates that where vertical fracturing within adjacent coal seams is observed, the average height growth of such fractures is 5 m, with a maximum height growth of 10 m.
- As noted by the interveners' expert, the formations between the Paskapoo and the Horseshoe Canyon contain clays and bentonitic materials that are plastic in nature and will prevent vertical propagation.

Regarding the interveners' request that EnCana should be subject to the requirements of *Directive 027*, the Board observes that *Directive 027* was recently implemented (January 31, 2006) following an extensive technical review and stakeholder consultation. *Directive 027* requires that licensees must not conduct fracturing operations at depths less than 200 m unless they have fully assessed all potential impacts prior to initiating a fracturing program. Such assessments must address a number of considerations, including the fracture program design and a determination of the maximum propagation expected. In addition, the directive prohibits licensees from conducting fracturing within a 200 m radius of water wells whose depth is within 25 m of proposed well fracturing depth.

The Board notes that EnCana's proposed fracturing program does not trigger the requirements of *Directive 027*, as its fracturing operations will be below the 200 m cutoff. The Board considers that *Directive 027* establishes a conservative but reasonable approach to shallow fracturing operations. The Board recognizes that these new requirements are based upon the most current information regarding fracture propagation and finds no basis to extend these requirements to wells that do not meet the qualifying criteria. In that regard, the Board notes that the interveners provided no evidence to support their request to extend those requirements to wells that do not meet the directive's criteria. The Board will therefore not extend the application of *Directive 027* to the applied-for wells.

However, the Board recognizes the concerns raised by the interveners and notes that EnCana indicated that it monitors the tubing-casing annulus pressure above each zone being fractured for these types of wells, as described in Section 5.3.1. The Board believes that this information is valuable in confirming the evidence EnCana presented. As such, the Board will condition the well approvals such that EnCana will be required to provide these results to the Board within five days of the fracture operation and to the interveners upon request. The Board considers that this monitoring information provides an effective tool to communicate the vertical fracture propagation to the public. EnCana is also required to note and explain all instances where increased pressure was noted.

The Board acknowledges EnCana's evidence regarding the limited vertical propagation of fractures within Horseshoe Canyon coals but notes the public's concern that groundwater resources could be impacted by these operations. In that regard, the Board believes that additional information would be helpful to the interveners and the public at large. Therefore, the Board requires the installation of a groundwater monitoring well within 50 m of the proposed gas well where the surface casing is proposed to be set at the shallowest depth. The monitoring well would have to be completed in the deepest aquifer at that location, immediately above the Battle Formation, as determined from the geophysical logs run on the gas well. The water quality and water level of this aquifer would have to be determined prior to fracturing operations, and the water level would have to be monitored continuously, commencing immediately prior to and continuing during and after fracturing operations, until the level has stabilized. The water quality must be tested in accordance with Alberta Environment's *Standard for Baseline Water-Well Testing for Coalbed Methane/Natural Gas in Coal Operations*, April 2006. EnCana would be required to report on the results of this monitoring to the Board and the interveners within 30 days. Thereafter, the well would be monitored for water quality and water level on a yearly basis and the results reported to the Board and the interveners by December 1 of each year. This requirement would be reviewed after the findings of the Shallow Fracturing Technical Committee are released or a period of no more than five years. The Board considers that the installation of this monitoring well would provide EnCana, area landowners, and the Board with

reliable information as to the state of the groundwater prior to and following fracturing operations.

5.4 Water Well Sampling and Complaint Investigation

5.4.1 Views of EnCana

EnCana stated that it developed its water well testing program following consultation with the interveners and with input from its water experts. EnCana committed to conduct pre- and post-drilling testing on all wells within a 400 m radius of the proposed wells and on 11 additional wells located between 400 m and 880 m from the proposed wells. EnCana further committed to test some springs in the area. EnCana also committed to test high-yield water wells present within a 1000 m radius of any of its proposed wells. EnCana stated that the program would also identify and confirm the occurrence of free gas in landowner wells. It stated that if free gas were identified, it would be sampled and analyzed for methane content. EnCana stated that the proposed testing would provide area landowners with a snapshot of their water quality and conditions at the time of testing.

EnCana stated that it had developed an effective process to investigate water well complaints associated with its activities. EnCana stated that it was informed of such complaints either directly or through Alberta Environment. It stated that its first step was to refer the concern to its internal groundwater specialist. It further explained that the EnCana specialist would next investigate the complaint or hire an external consultant to carry out the investigation. It indicated that the complaint investigator would then interview the complainant to gather information regarding chemistry data, well construction details, well maintenance history, and adjacent hydrocarbon-related infrastructure. EnCana stated that such investigations may also include site visits and well testing where appropriate. EnCana explained that a report would be drafted by EnCana or its consultant following the investigation, which would then be provided to the complainant and Alberta Environment. EnCana stated that the last step in its process was to carry out any further directions that Alberta Environment may develop in response to its report.

EnCana stated that the length of the investigation would vary depending upon the individual circumstances of each complaint. It stated that it would provide drinking water to landowners for the duration of its investigation if the complaint raised health concerns.

EnCana stated that it investigated 36 to 40 water well complaints in the last three to four years in accordance with this process within its Plains Business Unit. EnCana stated that its investigations had determined that it was not responsible for any of the concerns noted in those complaints. EnCana acknowledged that some landowners may be sceptical of their complaint findings and stated that this was the reason that it involved Alberta Environment in its process. EnCana stated that Alberta Environment's review of its report findings assured transparency in its complaint response process.

EnCana emphasized that methane occurred naturally in a number of shallow aquifers in Alberta. EnCana observed that the presence of methane gas in water wells could develop or increase over time due to the ongoing pumping of water wells.

5.4.2 Views of the Interveners

Mr. Freeman stated on behalf of the interveners that he found the water well sampling program proposed by EnCana to be reasonable for the circumstances. However, he noted that the program focused on water quality and would not provide much information with respect to pressure effects. Mr. Freeman stated that it would be beneficial if the predrilling sampling would include information about water levels. In this way, Mr. Freeman explained, landowners would have a baseline from which to judge potential pressure effects.

Mr. Freeman emphasized the need for a more comprehensive understanding of the shallow geological setting from which the targeted coals would produce. He suggested that it would be helpful to link the information generated by the water sampling program with EnCana's reservoir geology information. Mr. Freeman stressed that the goal of such an exercise would be to understand the nature of the intervening units between the Horseshoe Canyon coals and the water wells, most of which were completed in the Upper Paskapoo Formation in the project area.

Mr. Freeman noted that methane gas occurred naturally in aquifers in Alberta. He also noted that the water intake screen of water wells often became encrusted over time, restricting water flow. He noted that this decrease in well efficiency would result in the pump working harder and a lowering of the pumping water level, which may cause methane to be produced or methane production to increase.

The interveners proposed that EnCana expand the radius of the wells it would test from 400 m to 1000 m. Mr. Kohler indicated that he would like to see all water wells within 1600 m of the proposed wells tested. In support of this proposition, the interveners cited a recent newspaper article in which an EnCana spokesperson committed to testing water wells up to 1000 m from proposed wells within EnCana's Chinook business unit. The interveners also proposed that EnCana be required to drill a test well into a sandstone zone in the Horseshoe Canyon Formation to determine whether it was in fact dry.

5.4.3 Views of the Board

The Board notes that since the time of the hearing, Alberta Environment has prescribed requirements for water well testing when CBM wells are proposed. These requirements have been incorporated in the EUB's *Directive 035: Baseline Water Well Testing Requirements for Coalbed Methane Wells Completed above the Base of Groundwater Protection*. The requirement is that all water wells within 600 m of a proposed CBM well must be tested prior to drilling the CBM well, and if there is no water well within 600 m, all water wells within 800 m must be tested.

The Board observes that EnCana had planned to test all water wells within 400 m of its proposed CBM wells and to test 11 additional wells between 400 and 880 m of its proposed wells. The Board also notes that EnCana has committed to test certain high-yield water wells within 1000 m. The Board notes that *Directive 035* was issued after the oral portion of the hearing had closed. The Board acknowledges that EnCana and other oil and gas companies had corporate policies to test water wells prior to this. Accordingly, the Board confirms that EnCana must meet the requirements of *Directive 035*. Notwithstanding, the Board expects EnCana to honour its commitment to test certain other wells beyond the distance required by *Directive 035*.

With respect to the interveners' request to test all water wells within 1000 m and Mr. Kohler's request to test within 1600 m of proposed CBM wells, the Board notes that those distances exceed the new requirement. The Board did not receive any evidence to support testing water wells that are as far away as 1000 or 1600 m. With respect to Mr. Freeman's request to record groundwater levels prior to testing, the Board notes that this is part of the drawdown tests that EnCana has agreed to conduct. The Board finds that reasonable and appropriate baseline information regarding area aquifers and water wells will be generated through the new water well testing requirements prescribed by Alberta Environment in conjunction with the water well testing program that EnCana has committed to implement.

6 WILL THE PROPOSED COMPRESSOR STATION MEET THE EUB'S NOISE REQUIREMENTS?

6.1 Views of EnCana

EnCana commissioned noise impact assessments and two monitoring surveys to measure the noise levels from the existing compressor and to predict the noise levels of the proposed compressor addition. EnCana acknowledged that there were differences between the measured and predicted noise levels for the existing facility; however, EnCana maintained that the noise prediction model used in the January 24, 2006, noise impact assessment by Faszer Farquharson was accurate.

EnCana noted that it had installed some noise attenuation equipment on the existing facility, including a new muffler and building ventilation. EnCana cited an additional five recommended noise control measures that it would implement in order to reduce noise levels. These measures included

1) enclosing the existing compressor building ground void, the cooler ground void, and the building skid with a Noise Solutions Inc. (NSI) compressor building skid enclosure;
2) installing an NSI acoustically treated building ventilation system on the building for the proposed compressor;
3) enclosing the proposed compressor building ground void, the cooler ground void, and the building skid with an NSI compressor building skid enclosure;
4) installing an NSI Box "T" silencer on the cooler inlet of the proposed unit; and
5) installing an NSI "L" style silencer on the cooler outlet of the proposed unit in addition to enclosing the exposed plenum walls of the cooler with an acoustically rated wall panel system.

EnCana indicated that these measures would consist of an additional mitigative measure for the existing compressor and four measures that would be allocated to the proposed compressor. EnCana said that additional noise mitigation could be provided by installing a cooler silencer on the existing compressor at a cost of about $100 000.

EnCana made a firm commitment that it would ensure that the expanded facility, if approved, would operate within the EUB's permissible sound levels (PSLs); in this case, 50 decibels (dBA) during the day and 40 dBA at night. EnCana made a further commitment to meet the predicted

sound level of 25 dBA, as outlined in the January 24, 2006, Faszer Farquarson report, when measured under the summertime conditions outlined in Table 3 of that report.

6.2 Views of the Interveners

Mr. Wright, the noise expert for the interveners, characterized the difference between the measured and modelled noise levels as substantial. He stated that the 14.5 dBA difference of the measured sound levels to the predicted levels of the existing facility cast doubts on the accuracy of the model being used. He believed that the noise prediction model should have been calibrated with the measurement results.

Because of Mr. Wright's uncertainty about the accuracy of the noise prediction model, he was not convinced that the proposed facility would meet the predicted 25 dBA or even the EUB's PSLs. However, Mr. Wright agreed that if EnCana could meet the predicted 25 dBA sound level under the summertime conditions outlined, the facility would be within the EUB's PSL of 40 dBA under worst-case conditions.

The interveners explained that while daytime noise levels were rising due to increased traffic on the neighbouring roads and highway, nighttime was generally still a relatively quiet time in the area. Mr. D. Bauer, who lived along Highway 27 some 955 m north of the existing compressor facility, testified that the existing compressor facility was loud enough to interfere with his family's quiet enjoyment of their property and that an increase to the existing noise level would be unacceptable. Mr. Bauer expressed deep concern about noise levels from an expanded facility since, in his opinion, the mitigative measures implemented on the existing facility had made little or no difference to the existing noise level.

As with the interveners' expert, Mr. Bauer was sceptical about EnCana's ability to meet the predicted sound levels of the expanded facility due to the discrepancy between EnCana's modelling prediction and the measurement results. Mr. Bauer agreed that if noise levels were acceptable during summertime conditions, a time at which he indicated the compressor noise was most noticeable, it should be acceptable during the rest of the year.

6.3 Views of the Board

The Board shares the concerns expressed by the interveners with respect to the uncertainty of EnCana's predictions for the expanded compressor station. The Board is also concerned that the experts for EnCana and the interveners have very different views on this matter. The Board takes noise concerns very seriously, especially in this instance where there is an existing noise complaint that has not been resolved and the applicant wishes to further expand the facility.

Taking into account the substantial evidence submitted on this issue, the Board is inclined to rely heavily on EnCana's commitment to remain within the EUB's PSLs at all times and to meet the 25 dBA sound level under summer conditions, as outlined in the January 24, 2006, Faszer Farquharson report.

The Board notes that 25 dBA is below average ambient sound level in the area. The Board also notes that EnCana made this commitment several times at the hearing. While the Board has some concerns about EnCana's ability to reduce noise levels to 25 dBA under summer conditions, it agrees with the interveners' expert that if EnCana can operate the compressor station at this level, it will very likely be acceptable to the area residents.

As the Board takes this matter seriously, it will accept EnCana's commitment and condition the approval such that EnCana must demonstrate that noise from the expanded compressor be within 25 dBA at the Bauer residence. The 25 dBA noise level must be achieved under conditions outlined in Table 3 of the noted Faszer Farquharson report, which are shown in the table below:

Parameter	Modelled Input
Temperature	Plus 25 degrees Celsius
Wind velocity	5.0 km/hour
Wind direction	From the facility towards each residence
Relative humidity	50 per cent
Topography	Yes
Terrain category	Rural
Ground type	Grass
Temperature gradient (degrees Celsius per 100 m)	0
Receiver height above ground	1.5 m

In addition, EnCana must remain within the EUB's PSLs at all other times.

Alternatively, EnCana could comply by demonstrating that when operating under the above conditions, the facility is not audible above the ambient sound level, or Mr. D. Bauer could agree that the noise from the facility is acceptable under conditions that the resident believes represents a worst-case scenario.

The Board notes that EnCana said that it would continue to operate the facility if it did not meet commitments while the problems were being worked on. To be clear, the Board will not allow the facility to operate if EnCana cannot meet the Board's conditions.

7 CAN THE PROPOSED WELLS BE DRILLED AND OPERATED IN A MANNER THAT ENSURES APPROPRIATE SOIL CONSERVATION AND WEED CONTROL?

7.1 Views of EnCana

EnCana stated that its proposed development would be based on minimal disturbance practices and the implementation of appropriate mitigative measures. EnCana explained that it had completed environmental reviews and communicated with landowners in order to ensure that there would be minimal surface impacts. As a result of this communication, EnCana stated that the well locations as proposed would create as little disturbance and inconvenience to landowners as possible. However, EnCana became aware of two main concerns regarding surface impacts: soil and weeds.

With respect to the issue of soil, EnCana proposed that it would use minimal disturbance techniques, which would include mitigative measures for conserving topsoil. EnCana stated that upon completion of development, the lease would consist of a wellhead surrounded by a 4 m by 4 m fence and a minimal disturbance road. It explained that it would need to use this road weekly or monthly for servicing each site but that the road could be farmed, thereby reducing

inconvenience to the landowner. EnCana indicated that the landowners' ability to farm the majority of the lease would be a benefit to both parties. It explained that the farmer would be able to earn an income for the portion of the lease that was farmed while being compensated for the loss of use; at the same time, EnCana would benefit from the weed control effort as a result of the lease being farmed.

In the event of soil erosion, EnCana stated that if observed, it would be corrected at the time. EnCana explained that for the Torrington area, the soil properties were such that soil erosion would be minimal. It stated, however, that under circumstances where the soil could become susceptible to erosion, such as drought or very wet conditions, it would implement appropriate mitigative measures. In order to do so, EnCana outlined such measures as spraying a site with water in the case of drought or not entering a site in the case of wet conditions. EnCana stated that in the event of an emergency, another option during wet conditions would be to use matting. EnCana clarified that if it were a simple operational issue during wet conditions, it would advise its staff to enter the site with a quad or on foot and, as a last resort, to shut in the well. When the time came for the site to be reclaimed, EnCana stated that it would assess the depth and quality of topsoil in order to ensure that the land met the equivalent land capability.

EnCana stated that the soils in the area were quite fertile. If the soil were to be compacted and the organic matter reduced, EnCana indicated that fertility could be impeded. It stated that it would attempt to minimize and address any concerns while on production, as well as during the reclamation process. EnCana indicated that there were many proven effective remedial methods that could supplement the soil with organic matter and improve the till of the soil after compaction had occurred. It indicated that these methods would also help to increase soil quantity if the soil volume had been reduced due to erosion.

With respect to weed management, EnCana stated that it had developed company-wide policies for vegetation management based on the *Alberta Weed Control Act*. In conjunction with these policies, EnCana stated that in the summer of 2005 it met with the agricultural field-man for Kneehill County in order to discuss its program and ensure that it met the needs of the municipality. EnCana explained that at this meeting it gained an understanding of the key weed issues for Kneehill County and relayed them to both field personnel and weed contractors in the area.

EnCana recognized that weed management continued to be a key issue within its areas of development. It commented on its weed management program, which was implemented by professional agrologists and certified applicators. EnCana stated that its recommended and preferred chemicals had short half-lives, causing less impact on the environment. It stated that it restricted the use of specific herbicides, such as sterilants, that were not permitted to be used. EnCana admitted that despite its best intentions, weed issues did arise on EnCana well sites. It stated, however, that it would work with landowners and the municipality in order to correct such issues. In meeting with area landowners, EnCana stated that it would determine a way to deal with the weed issues while adhering to weed control regulations.

7.2 Views of the Interveners

Brad Bauer, speaking on behalf of the interveners, stated that that he wanted to make the Board aware of their concerns regarding soil fertility and weed control. He stated that oil and gas companies typically dealt with weed control but neglected the issue of soil fertility. He stated

that both weed control and soil fertility had to be dealt with now so that there were not any issues with herbicide-resistant weeds and soil erosion in the future.

With respect to soil fertility, Mr. Bauer stated that it was his experience that when soil was compacted, the organic matter was lost over time due to a lack of growth. He estimated the content of the organic matter in the Torrington area soils to be 5 to 6 per cent prior to any compaction. He indicated that it took about 10 to 12 years to replace 1 per cent of organic matter.

Regarding weed control, Mr. Bauer stated that he was not sure why EnCana would hire a weed expert when there were farmers in the area who had a number of years of experience dealing with weeds. He indicated that he was unclear as to why somebody else would tell them how to manage their weeds. He stated that they were already dealing with the weeds for a living as a result of their farming operations. He expressed concern about one person looking after the weeds at the various well sites and indicated that this would not allow for enough attention to be paid to the interveners' lands.

With respect to EnCana's proposed minimum disturbance access roads, Mr. Bauer stated that black dirt and clay would mix under wet conditions. He acknowledged EnCana's promise that it would not access the site during wet conditions, but stated that this had not been his experience with companies in the past. He explained that use of the access road would spread weeds and introduce foreign material and different crop varieties onto lease sites. He expressed frustration at the fact that companies drove over weed-free, fertile land that an occupant or landowner had been tending to free of charge. He clarified that a high-grade road would not solve these problems and suggested that compensation for crop loss rather than just loss of use would address their concerns. The interveners also suggested that companies be charged with a fine if they accessed minimum disturbance roads under wet conditions.

7.3 Views of the Board

The Board notes that there are generally two options for accessing a well site. The first is a high-grade road and the second is a minimal disturbance road. A high-grade road is constructed and normally topped with gravel. A minimal disturbance road is essentially a path created by driving over the existing soil and through whatever is growing on the land. A high-grade road would permit entry to the site even under adverse weather and soil conditions, while a minimal disturbance road would not. A high-grade road involves land taken out of production until the road is reclaimed; with the exception of the wheel tracks, this is not the case for a minimal disturbance road. Minimal disturbance roads do not generally interfere with the farming of the land, but this may not be the case with high-grade roads.

The Board recognizes that there are soil conservation and weed control benefits and drawbacks to choosing one of these options over the other. In the past the Board has not taken a position on which method should be used to access a well site. However, the Board notes the interveners' concerns regarding minimum disturbance access roads and the negative experiences the interveners have had with such roads in the past. The Board is of the opinion that EnCana, and all operators, need to recognize the surface impacts associated with proposed operations. Furthermore, the Board may be compelled to encourage the construction of high-grade roads in the future. In this case, the Board encourages the parties to establish a standard with respect to accessing the well sites.

In terms of compensation for crop loss, the Board is unable to address this issue, as the matter falls outside the Board's jurisdiction. The Board would strongly recommend that the parties seek the involvement of the Alberta Surface Rights Board if they cannot agree on crop loss compensation.

The Board recognizes the interveners' concerns regarding weed control and also recognizes EnCana's need to adhere to the Alberta *Weed Control Act.* The Board is aware that the enforcement of the *Weed Control Act* is under the jurisdiction of the municipalities. The Board is also aware that oil and gas activities can have a negative impact in this regard. The Board encourages the parties to work together on the issue of weed management. Should weed control problems associated with oil and gas activity become a problem that is not effectively dealt with through existing methods, the Board will look for other methods to minimize these impacts.

8 WERE ENCANA'S PUBLIC CONSULTATION EFFORTS ADEQUATE?

8.1 Views of EnCana

EnCana stated that it made a considerable effort to engage stakeholders and interested parties and address stated concerns in a proactive manner. EnCana pointed out that its consultation took place over a period of two years. It described two open houses that were attended by EnCana geologists, engineers, and surface landmen in order to address questions related to the project. EnCana stated that it engaged in the ADR process by participating in an EUB field facilitation, as well as a series of mediated sessions with the interveners. In addition, EnCana stated that it held numerous meetings with area landowners and occupants within the project area.

EnCana conceded that its negotiations did not go well at the outset. As a result, EnCana said that it replaced its landman in an effort to improve relations with the interveners. EnCana stated that it reached agreements with a large majority of landowners and occupants in the area and suggested that this was proof of the effectiveness of its public consultation process. EnCana also pointed out that it took considerable positive steps to resolve outstanding issues, such as well sampling and noise, and said that it continued to be committed to resolving concerns and working with local stakeholders for the duration of the project.

EnCana acknowledged that it had learned from this hearing and recognized that in the future it would be necessary to provide landowners with more information in order to allay landowner concerns.

8.2 Views of the Interveners

The interveners stated that they were very dissatisfied with EnCana's initial consultation efforts. They referred to a number of incidents regarding EnCana's consultation approach that led to an atmosphere of distrust. They stated that their relationship with EnCana improved when EnCana involved a different person in the process.

The interveners emphasized that they participated extensively in efforts to try to resolve the issues. They noted that they attended all the open houses, the field facilitation, the mediated sessions, and numerous private meetings. Despite these efforts, the interveners stated that they were not satisfied that EnCana truly understood their neighbourhood or their specific concerns.

They stated that other oil companies seemed more willing to listen to their concerns than EnCana.

Mr. Freeman stated that EnCana should have provided additional geological information to the landowners to assist them in understanding the potential risks associated with the project. More specifically, he indicated that more information regarding the Battle and Whitemud Formations as a regional aquitard and its effects would have been useful to the landowners and the Board.

8.3 Views of the Board

The Board notes that the majority of landowners in the project area appear to be fully satisfied with EnCana's consultation efforts to the extent that they entered into agreements with EnCana for the use of their land. The Board also notes that some of the landowners and occupants were very dissatisfied with EnCana's efforts in the initial stages; however, EnCana recognized the dissatisfaction of some parties and addressed it by involving a different person in the process who the interveners said made a significant improvement.

The Board believes that it may have been possible for EnCana to allay some of the concerns brought forward by some of the landowners by integrating expertise such as geology into the information it presented. The Board agrees with Mr. Freeman that better information about the regional geography presented more effectively could have assisted the area landowners in understanding the possible impacts EnCana's proposed development may have.

9 OTHER MATTERS

Mr. Larry Howard, one of the registered participants, stated that he resides about 25 km northeast of Torrington. He explained that his interest in the proceeding related to CBM development in the area. He said that he was also speaking on behalf of a couple who resided in the area and brought a sample of water from their sink. He described the problems the community has been experiencing, including the deterioration of water quality and, in some instances, a sudden lack of water availability.

At the hearing, the Board suggested that Mr. Howard speak with EUB staff and contact Alberta Environment in order to determine whether an investigation would be necessary. Mr. Leo Touchette, of the EUB Red Deer Field Centre, met with Mr. Howard and committed to investigate seven separate water concerns where there was CBM activity in the area, including the water sample provided at the hearing.

Mr. Touchette's investigation involved contacting Alberta Environment and some of the landowners in question. In two cases, the complainants were not contacted, as they had not filed complaints with Alberta Environment. In another case, the complainant chose not to become involved. Additionally, there was one case that was currently under investigation by Alberta Environment. In the remaining three cases, there was no evidence to support the claims that the concerns were caused by oil and gas activity. In one case where there was an apparent deterioration of water quality, it was determined that the problem related to bacteria and Alberta Environment closed the file. In another case where there was an apparent lack of water availability, Alberta Environment determined that the reduced yield was due to well owners overpumping an adjacent water well. With respect to the residents' water sample that Mr. Howard brought to the hearing, Alberta Environment's investigation determined that the

problems were not related to oil and gas activity, but were related to water well maintenance. As such, Alberta Environment closed the file.

Alberta Environment has not advised the EUB that any investigation completed or ongoing is related to oil and gas activity. The Board notes that Alberta Environment is the lead agency that investigates water well complaints and the EUB gets involved if during the Alberta Environment investigation there are indications that oil and gas activity may be related to the complaint.

The Board did not consider this information in making its decision but believes that it is appropriate to comment on this matter, as it was raised at the hearing.

10 CONCLUSIONS

After weighing the evidence and considering the arguments of the parties, the Board has determined that approval of the applied-for facilities is in the public interest subject to the conditions found in Appendix 1.

Dated in Calgary, Alberta, on October 31, 2006.

ALBERTA ENERGY AND UTILITIES BOARD

<original signed by>

M. N. McCrank, Q.C., P.Eng.
Presiding Member

<original signed by>

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

<original signed by>

G. J. Miller
Board Member

APPENDIX 1 SUMMARY OF COMMITMENTS AND CONDITIONS

The Board notes throughout the decision report that EnCana has undertaken to conduct certain activities in connection with its operations that are not strictly required by the EUB's regulations or guidelines. These undertakings are described as commitments and are summarized below. It is the Board's view that when a company makes commitments of this nature, it has satisfied itself that these activities will benefit both the project and the public, and the Board takes these commitments into account when arriving at its decision. The Board expects the applicant, having made the commitments, to fully carry out the undertaking or advise the EUB if, for whatever reasons, it cannot fulfill a commitment. The EUB would then assess whether the circumstances regarding the failed commitment warrant a review of the original approval. The Board also notes that the affected parties also have the right to request a review of the original approval if commitments made by the applicant remain unfulfilled.

Conditions generally are requirements in addition to or otherwise expanding upon existing regulations and guidelines. An applicant must comply with conditions or it is in breach of its approval and subject to enforcement action by the EUB. Enforcement of an approval includes enforcement of the conditions attached to that licence. Sanctions imposed for the breach of such conditions may include the suspension of the approval, resulting in the shut-in of a facility. The conditions imposed on the licence are summarized below.

COMMITMENTS BY ENCANA

- Test all water wells within 400 m, 11 additional wells located between 400 m and 880 m, some springs in the area, and all high-yield water wells present within 1000 m of an EnCana well.

CONDITIONS

- Measure the pressure between the tubing and casing annulus above the zones being fractured, note and explain any increased pressures, and report the findings to the EUB within five days of the fracturing operation.
- Install a groundwater monitoring well in the deepest aquifer immediately above the Battle Formation within 50 m of the EnCana well that has the shallowest surface casing depth. The water quality is to be determined prior to fracturing operations, and the water level is to be monitored continuously, commencing immediately prior to and continuing during and after fracturing operations, until the level has stabilized. The water quality testing is to be conducted in accordance with Alberta Environment's *Standard for Baseline Water-Well Testing for Coalbed Methane/Natural Gas in Coal Operations*, April 2006. The results of this monitoring are to be reported to the Board and interveners within 30 days. Thereafter, monitoring will be done on a yearly basis and reported by December 1 of each year. This condition will be reviewed after the findings of the Shallow Fracturing Technical Committee are released or a period of five years.
- Ensure the noise level at EnCana's facility remains within 25 dBA as measured at the Bauer residence under summertime conditions, as outlined in Table 3 of the Faszer Farquarson report, and within the EUB's PSLs at all other times. Alternatively, EnCana could comply by demonstrating that the facility, when operating under the above conditions, is not audible above the ambient sound level, or Mr. D. Bauer could agree that the noise from the facility is acceptable under conditions that the resident believes represents a worst-case scenario.

APPENDIX 2 SURFACE LOCATION AND PURPOSE FOR EACH OF THE PROPOSED WELL APPLICATIONS (APPLICATION NO. 1393397 ET AL.)

Application No.	Location	Well Purpose
1393397	8-17-33-25 W4M	Coalbed methane (Edmonton Group)
1393399	16-36-32-26 W4M	Coalbed methane (Edmonton Group)
1393401	8-32-32-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Edmonton Group)
		Natural gas (Belly River Group)
1393404	16-6-33-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Belly River Group)
1393405	16-29-32-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Edmonton Group)
		Natural gas (Belly River Group)
1393406	6-19-33-25 W4M	Coalbed methane (Edmonton Group)
1393407	14-32-32-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Edmonton Group)
		Natural gas (Belly River Group)
1393410	8-6-33-25 W4M	Coalbed methane (Edmonton Group)
1393412	14-6-33-25 W4M	Coalbed methane (Edmonton Group)
1393414	14-4-33-25 W4M	Coalbed methane (Edmonton Group)
1393415	16-20-33-25 W4M	Coalbed methane (Edmonton Group)
1393419	16-17-33-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Belly River Group)
1393442	14-19-33-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Belly River Group)
1394241	7-20-33-25 W4M	Coalbed methane (Edmonton Group)
1394246	6-17-33-25 W4M	Coalbed methane (Edmonton Group)
		Natural gas (Black Creek Member)

APPENDIX 3 HEARING PARTICIPANTS

Principals and Representatives (Abbreviations used in report)	Witnesses
EnCana Corporation (EnCana) S. M. Munro M. K. Lozynsky	A. Bullinger S.A. Dole, P.Eng. M. Dubord, P.Geol. R. Hnatuik, P.Eng. W. Ross R. Solinger, P.Eng. K. P. Welsh, P.Eng. T. L. Dabrowski, P.Eng., of WorleyParson Komex C. C. Faszer, P.Eng., of Faszer Farquharson & Associates Ltd.
B. Bauer and G. Bauer B. and G. Bauer Farms Ltd. D. Bauer and D. Bauer J. Bauer E. Buchart G. Ensminger L. Ensminger R. Ensminger T. Kohler K. Kraft and S. Kraft C. Martin D. Martin M. Sanderman A. Weisenburger B. Whatley G. S. Fitch	B. Bauer D. Bauer T. Kohler J. T. Freeman, of Matrix Solutions Inc. R. Wright, P.Eng., of HFP Acoustical Consultants Corp.
Alberta Energy and Utilities Board staff J. P. Mousseau, Board Counsel B. Austin C. Evans D. Howes A. Lewis G. McClenaghan, P.Eng. D. Pana E. Simpson	

APPENDIX 4 CASING BACKGROUND

Installing casing is an important part of the drilling and completion process. Casing consists of a series of metal pipes installed in the freshly drilled hole. The casing is cemented in place by pumping cement into the space between the casing and borehole wall. Casing serves to

- strengthen the borehole and maintain hole integrity to prevent caving,
- provide a conduit through which hydrocarbons can be extracted,
- (hydraulically) isolate fluids from different formations without intermingling,
- prohibit the flow of drilling fluids into the borehole, and
- aid in well control.

Types of casing used depend on the subsurface characteristics of the well, including the diameter of the well and the pressures and temperatures experienced throughout the well. There are five different types of casing:

- conductor casing,
- surface casing,
- intermediate casing,
- liner string, and
- production casing.

Conductor Casing

Conductor casing is typically installed first, before the drilling rig arrives. A small auger drill mounted on the back of a truck is normally used to drill the conductor casing hole. The conductor casing, which varies in length from about 6 to 15 m, is installed in order to prevent the top of the well from caving. The conductor casing also aids in the process of circulating the drilling fluid up from the bottom of the well. The conductor casing is cemented into the hole before drilling commences.

Surface Casing

Surface casing is the next type of casing to be installed. It can vary in length from less than 100 m to as long as about 600 m and is smaller in diameter than the conductor casing. During installation, the surface casing is placed inside the top of the conductor casing and cemented in place. The surface casing serves as a conduit for the drilling mud that is returned to the surface. It also helps to protect the hole from being damaged during drilling. The EUB regards the primary purpose of surface casing to be an aid in well control. While cemented surface casing can also aid in the protection of groundwater, the groundwater resources can be covered by either the cemented surface casing or the next cemented casing string.

Intermediate Casing

Intermediate casing is typically the longest section of casing within a well. Its primary purpose is to minimize such hazards as abnormal underground pressure zones, underground shales, and formations that might otherwise contaminate the well (for example, underground saltwater

deposits). Although there may be no evidence of an unusual subsurface formation, intermediate casing is run in order to prevent any such formations from negatively affecting the well. Intermediate casing may also be cemented into place for added protection.

Liner Strings

In some instances, liner strings are used instead of intermediate casing. Liner strings are typically run from the bottom of another type of casing to the open well area. However, liner strings are usually attached to the previous casing with hangers and can be cemented into place. This type of casing is regarded as less permanent than intermediate casing.

Production Casing

Production casing, otherwise known as the long string, is the final casing to be installed. It is also the deepest section of casing within a well. Production casing provides a conduit from the surface of the well to the producing formation.

Normal Surface Casing Requirements

The minimum surface casing required is influenced by the well depth, the bottomhole pressure, and the pressure gradient. If the calculated surface casing depth is less than 10 per cent TVD (well depth), 10 per cent TVD is used.

Surface Casing Reductions

Surface casing reductions are allowed based on well conditions or formation/area conditions. Operators can apply for a Type 1 or Type 2 reduction for surface casing depth determination as part of the *Directive 008* Surface Casing Check Sheet. There is no separate application required. The following criteria must be met for Type 1 and Type 2 reductions.

Type 1 Reduction

The first reduction (Type 1) is for wells drilled with well control enhancements. These wells have additional equipment or procedures in place to aid in well control.

Reduced Surface Casing Depth = Normal Surface Casing Depth x 0.913

One of the following requirements must be met:

1) a PVT system is used, or
2) a leak-off test will be conducted.

Type 2 Reduction

The second reduction (Type 2) is for wells in a development-type setting. These wells also have well control enhancements and are low risk for a blowout.

Reduced Surface Casing Depth = Normal Surface Casing Depth x 0.707

These requirements must be met:

1) the well is in a development-type setting.
2) The well is low risk for a blowout.
3) A PVT system will be installed with a probe in each active much compartment, sensitive to ±0.5 m^3 and alarming at ±1.0 m^3; or a leak-off test will be conducted.

Surface Casing Waiver Applications

An application to eliminate surface casing can be made to the EUB. In this case, the shallower conductor casing is set and cemented back to surface, followed by the intermediate casing, which is also cemented back to surface. To be eligible for a surface casing waiver, the company must show that the wells are being drilled into an area where there is adequate offset well data showing there is a low risk of blowouts. This evaluation includes assessing the absolute open flow (AOF), field kick rate, and pressure gradient in the offset wells. If all the criteria are met, a surface casing exception may be approved and an intermediate casing string is set and cemented back to surface. The intermediate casing is then used to minimize any well control hazards if the well is drilled to a deeper depth.

The application must include information that well control conditions can be met.

The following criteria must be met for the proposed well for surface casing exemption:

- well terminates at less than 950 m TVD,
- well is located in or adjacent to a development-type setting,
- maximum AOF rate from offset wells does not exceed 190 thousand m^3/day,
- field kick rate is less than 3 per 100 wells, and
- pressure gradient is less than 10 kPa/m.

In addition to the above, applications for surface casing exceptions (*Directive 056*) must include information on geological data, thermal schemes, and severe loss circulation.

Surface casing exception applications can be submitted to EUB Facility Applications as part of a nonroutine well licence application, which is then referred to Well Operations for review. The application is then approved or denied based on submitted information.

APPENDIX 5 GLOSSARY

Annulus – the space between wellbore and casing.

Bentonite – a material composed of clay minerals commonly used in drilling mud.

Coiled tubing – a continuous length of pipe that is wound on a spool and then straightened as it enters the wellbore.

dB (decibel) – A unit of measure of sound pressure that compresses a large range of numbers into a more meaningful scale. Hearing tests indicate that the lowest audible pressure is approximately 0 dB, while the sensation of pain is approximately 140 dB. Generally, an increase of 10 dB is perceived as twice as loud.

dBA – The decibel sound pressure with emphasis on the mid-frequency range to approximate the human hearing response to sound.

Development-type setting – a well location for which there is a minimum of three nearby offset wells.

Drill cuttings – small pieces of rock that break away from the wellbore during the drilling process.

Leak-off test – used to verify that the casing, cement, and formation below the surface casing can withstand the wellbore pressure required to drill safely to the next depth at which casing will be set.

Lost circulation – the reduction or absence of fluid flow up the casing annulus when fluid is pumped through the wellbore.

Low risk – a risk level for which the field kick rate must be less than 3 per cent and determined by evaluating offset wells in the area.

Noise Solutions Inc. (NSI) – a company that manufactures and sells industrial noise abatement systems, including to the oil and gas industry.

PVT system – an automated mud volume sensor that monitors drilling fluid levels and sounds an alarm at ±2.0 m^3.

Surface casing – well casing string set in shallow formations and cemented in place (see Appendix 4).

Surface casing waiver – approval by the EUB for a particular well application to eliminate the installation of surface casing (see Appendix 4).

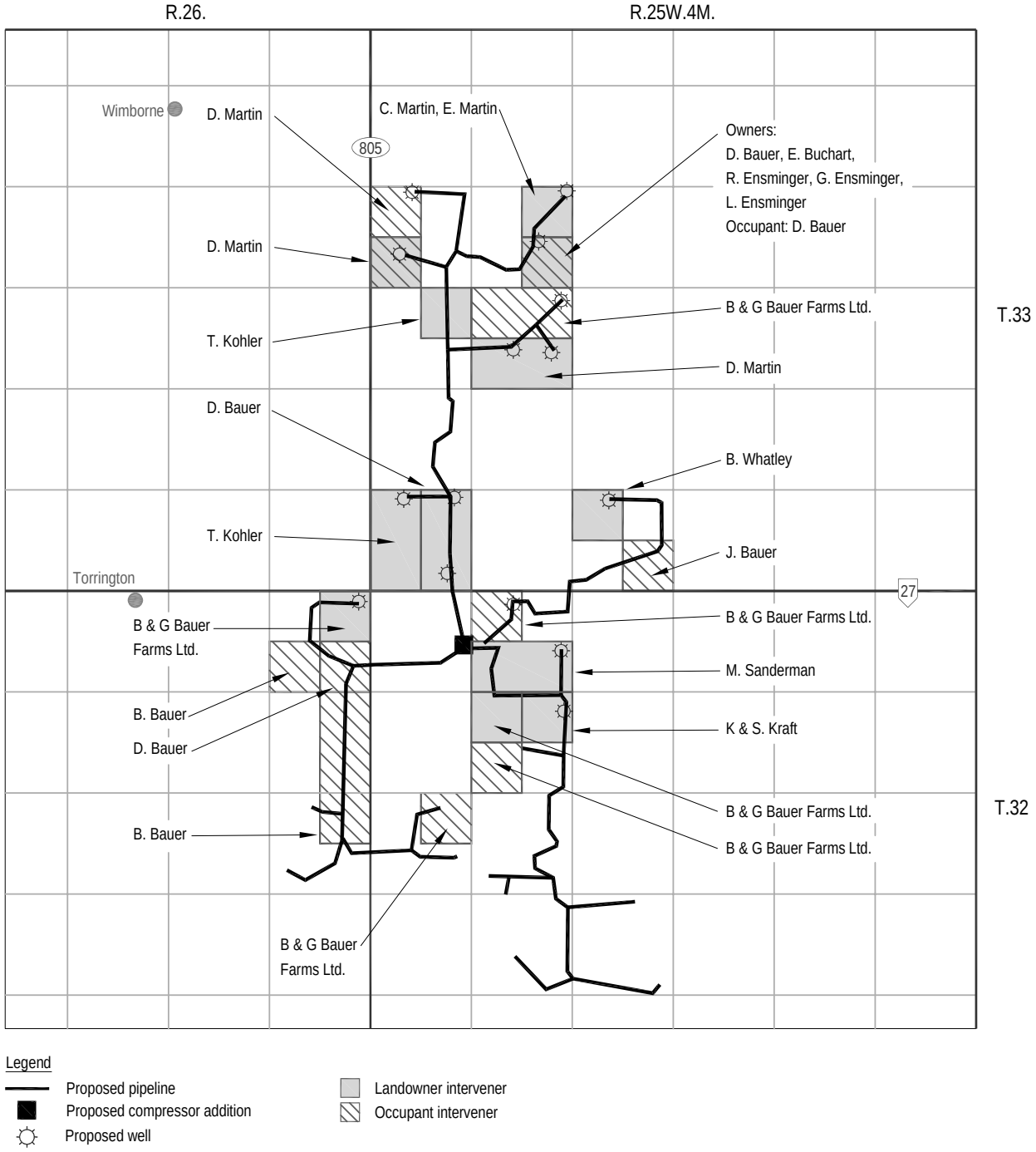

Figure 1. Map of the proposed project and the interveners' lands

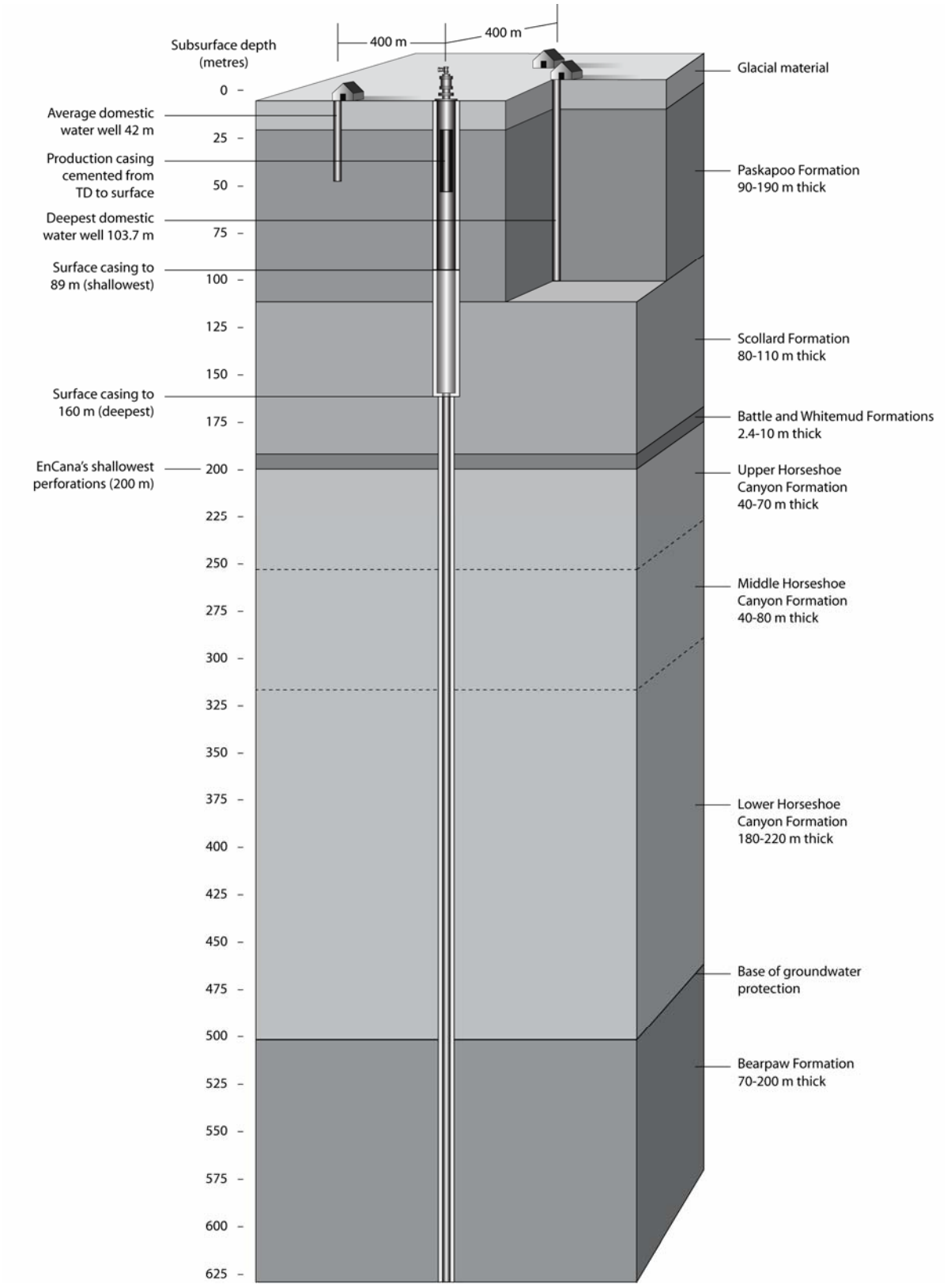

Figure 2. Subsurface schematic diagram