2009 ABQB 506
Alberta Court of Queen's Bench

Blatz v. Impact Energy Inc.

2009 CarswellAlta 1369, 2009 ABQB 506, [2009] A.W.L.D. 4053, [2009] A.W.L.D. 4129, [2009] A.W.L.D. 4130, [2009] A.W.L.D. 4131, [2009] A.W.L.D. 4134, [2009] A.W.L.D. 4135, [2009] A.W.L.D. 4143, [2009] A.W.L.D. 4144, 180 A.C.W.S. (3d) 533, 478 A.R. 1, 47 C.E.L.R. (3d) 51, 68 C.C.L.T. (3d) 169

Gwenda C. Blatz, Wayne T. Blatz, Steven T. Blatz, Scott W.A. Blackie, Jennifer J. Blackie, Scott W.A. Blackie as next friend of William J. Blackie and Veronica A. Blackie, infants, Shelagh M. Blatz, Jeffery W. Blatz, Shelagh M. Blatz as next friend of Martie R. Blatz and Finn T. Blatz, infants (Plaintiffs) and Impact Energy Inc. and Pajak Engineering Ltd. (Defendants) and Impact Energy Inc. (Third Party)

R.E. Nation J.

Heard: May 5-29, 2009
Judgment: September 10, 2009
Docket: Calgary 0201-11829

Counsel: Stanley Carscallen, Q.C. Brock Carscallen for Plaintiffs
Timothy S. Meagher for Defendant and Third Party Impact Energy Inc.
James T. Eamon, Q.C., Erin Runnalls for Defendant, Pajak Engineering Ltd.

Subject: Torts; Contracts; Civil Practice and Procedure

Related Abridgment Classifications
For all relevant Canadian Abridgment Classifications refer to highest level of case via History.

Contracts

IX Performance or breach
IX.8 Breach
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Remedies

I Damages
I.5 Damages in tort
I.5.a **Personal injury**
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Remedies

I Damages
I.5 Damages in tort
I.5.d Real property
I.5.d.i Nature of unlawful act

I.5.d.i.E Environmental pollution and **contamination**

Remedies

I Damages
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I.6.c Measure of damages
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Remedies

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Remedies

I Damages
I.7 Exemplary, punitive and aggravated damages
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Torts

XVI Negligence
XVI.6 Strict liability (rule in Rylands v. Fletcher)
XVI.6.b Particular dangers
XVI.6.b.i Chemicals

Torts

XVII Nuisance
XVII.3 Liability
XVII.3.c Miscellaneous

Headnote

Torts --- Nuisance — Liability — Miscellaneous

Causation — **Contamination** of well water — Plaintiffs owned real property which was supplied with water from well which received its water supply from two aquifers — Parties entered into contract whereby defendants could construct sour gas drilling well on plaintiff's property, next to land where plaintiffs intended to have subdivision built — Defendants dug open pits and caused drilling by-products including mud used in drilling in pits, without first acquiring or building holding tanks — Plaintiffs noticed change in quality of well water supply, and after testing disclosed elevated levels of nitrates and nitrites in water supply, defendants began to provide plaintiffs with alternate water supply and plaintiffs brought action, inter alia, in nuisance — Action allowed — Present case basically turned on application of expert hydrogeological evidence — Plaintiffs were required to prove, on balance of probabilities, that "but for" use of pits or related gas drilling, water would not have become **contaminated** — Plaintiffs established on balance of evidence that well water became **contaminated** due to actions of defendants — Plaintiffs were unable to establish either that defendants' actions in, inter alia, digging open pits caused any damage to aquifers themselves or otherwise to water supply of proposed subdivision — Plaintiffs were entitled to their damages causally connected to **contamination** of well water.

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Torts --- Negligence — Strict liability (rule in Rylands v. Fletcher) — Particular dangers — Chemicals

Contamination of well water — Plaintiffs owned real property which was supplied with water from well which received its water supply from two aquifers — Parties entered into contract whereby defendants could construct sour gas drilling well on plaintiff's property, next to land where plaintiffs intended to have subdivision built — Defendants dug open pits and caused drilling by-products including mud used in drilling to be placed in pits, without first acquiring or building holding tanks — Plaintiffs noticed change in quality of well water supply, and after testing disclosed elevated levels of nitrates and nitrites in water supply, defendants began to provide plaintiffs with alternate water supply and plaintiffs brought action, inter alia, under rule in Rylands v. Fletcher — Action allowed — Present case basically turned on application of expert hydrogeological evidence — Plaintiffs were required to prove, on balance of probabilities, that "but for" use of pits or related gas drilling, water would not have become **contaminated** — Plaintiffs established on balance of evidence that well water became **contaminated** due to actions of defendants — Plaintiffs were unable to establish either that defendants' actions in, inter alia, digging open pits caused any damage to aquifers themselves or otherwise to water supply of proposed subdivision — Plaintiffs were entitled to their damages causally connected to **contamination** of well water.

Contracts --- Performance or breach — Breach — General principles

Contract to drill for gas — Failure to protect surrounding water supply — Plaintiffs owned real property which was supplied with water from well which received its water supply from two aquifers — Parties entered into contract whereby defendants could construct sour gas drilling well on plaintiff's property, next to land where plaintiffs intended to have subdivision built — Defendants dug open pits and caused drilling by-products including mud used in drilling to be placed in pits, without first acquiring or building holding tanks — Plaintiffs noticed change in quality of well water supply, and after testing disclosed elevated levels of nitrates and nitrites in water supply, defendants began to provide plaintiffs with alternate water supply and plaintiffs brought action, inter alia, in nuisance — Action allowed — Plaintiffs established claim in tort, both in nuisance and under rule in Rylands v. Fletcher — Failure to adequately protect water supply with use of by-product storage tanks or like devices constituted breach of gas drilling contract — Damages flowing from contract breach were identical to those in tort, and subject to same rules of causation — Plaintiffs established that defendants' conduct which amounted to breach of contract caused **contamination** of well water, but not surrounding aquifers or general supply of water to proposed subdivision — Plaintiffs were entitled to their damages causally connected to **contamination** of well water.

Remedies --- Damages — Damages in tort — Real property — Nature of unlawful act — Environmental pollution and contamination

Contamination of well water — Plaintiffs owned real property which was supplied with water from well which received its water supply from two aquifers — Parties entered into contract whereby defendants could construct sour gas drilling well on plaintiff's property — Defendants dug open pits and caused drilling by-products including mud used in drilling to be placed in pits, without first acquiring or building holding tanks — Drilling by-products caused **contamination** of plaintiffs' well water — Plaintiffs' action for damages allowed — As clear and foreseeable result of defendants' conduct, plaintiffs were required to drill new well — Award of $30,000 was appropriate to cover new well drilling costs.

Remedies --- Damages — Damages in tort — Personal injury — Principles relating to awards of general damages — Miscellaneous

Nuisance and strict liability — Plaintiffs owned real property which was supplied with water from well which received its water supply from two aquifers — Parties entered into contract whereby defendants could construct sour gas drilling well on plaintiff's property, next to land where plaintiffs intended to have subdivision built — Defendants dug open pits and caused drilling by-products including mud used in drilling to be placed in pits,

without first acquiring or building holding tanks — Defendants' conduct caused **contamination** of plaintiffs' well water — Plaintiffs suffered mild symptoms, including diarrhoea, some mouth sores and bladder infections, which generally resolved quickly, within few weeks — One plaintiff had collapse due to chest pains, and was hospitalized and investigated for heart problems — That plaintiff was ultimately diagnosed as having esophageal problem, inflammation of esophagus at entrance to stomach — Plaintiffs' action allowed — Plaintiffs were each entitled to general damage award of $1,000 for **personal injuries** sustained from **contamination** of well — With respect to esophageal problem, plaintiff did not prove that defendants' actions were responsible for its emergence as medical data indicated that it may have been preexisting condition.

Remedies --- Damages — Valuation of damages — Measure of damages — Miscellaneous

Defendants drilled gas well on plaintiffs' real property — Defendants used open pits to store drilling by-products — By-products caused **contamination** of plaintiffs' well — Plaintiff B was required to lose time from work dealing with well-water problems — It was fair on evidence to compensate B at rate he was paid, $20 per hour, for time spent dealing with problems to well caused by defendants — Damages for lost wages were assessed at $4,000 calculated at $20 per hour for 200 hours.

Remedies --- Damages — Valuation of damages — Where ascertainment difficult

Defendants drilled gas well on plaintiffs' real property — Defendants used open pits to store drilling by-products — By-products caused **contamination** of plaintiffs' well — Plaintiffs sold their cattle herd, allegedly at discount price — Plaintiffs were not entitled to award of damages related to sale of cattle — Plaintiffs were required to prove that sale of herd was causally related to defendants' actions in **contaminating** well water — Plaintiffs did not meet burden of proof of causation and damages could not be awarded.

Remedies --- Damages — Exemplary, punitive and aggravated damages — Grounds for awarding exemplary, punitive and aggravated damages — Miscellaneous

Nuisance — Defendants drilled gas well on plaintiffs' real property — Defendants used open pits to store drilling by-products — By-products caused **contamination** of plaintiffs' well, causing them **personal injuries** and requiring drilling of new well — Few days passed between initial testing of well found elevated levels of **contaminants** and time at which defendants began to supply plaintiffs with alternate source of drinking water — Plaintiffs' action in nuisance, under rule in Rylands v. Fletcher and for breach of contract allowed — Plaintiffs were not entitled to award of punitive damages — Plaintiffs were required to show outrageous or high-handed conduct on part of defendants before punitive damage award could follow — In present case, neither defendants' drilling conduct itself nor delay in providing alternate water supply was sufficiently outrageous as to justify punitive damages.

Table of Authorities

Cases considered by *R.E. Nation J.*:

Ball v. Imperial Oil Resources Ltd. (2008), 64 C.C.L.T. (3d) 275, 2008 ABQB 765, 2008 CarswellAlta 2064 (Alta. Q.B.) — distinguished

Boucher v. Miramichi (City) (2007), 2007 NBQB 341, 2007 CarswellNB 501, 2007 CarswellNB 502, 827 A.P.R. 324, 321 N.B.R. (2d) 324, 39 M.P.L.R. (4th) 211 (N.B. Q.B.) — referred to

Browne v. Willis (January 18, 1983), Doc. 370/82 (Ont. H.C.) — referred to

Cambridge Water Co. v. Eastern Counties Leather Plc (1993), [1994] 1 All E.R. 53, [1994] 2 A.C. 264 (U.K. H.L.) — considered

Hanke v. Resurfice Corp. (2007), 69 Alta. L.R. (4th) 1, 404 A.R. 333, 394 W.A.C. 333, 2007 CarswellAlta 130, 2007 CarswellAlta 131, 2007 SCC 7, [2007] 4 W.W.R. 1, 45 C.C.L.T. (3d) 1, 278 D.L.R. (4th) 643, [2007] R.R.A. 1, 357 N.R. 175, [2007] 1 S.C.R. 333 (S.C.C.) — considered

Jones v. Mobil Oil Canada Ltd. (1999), [2000] 1 W.W.R. 479, 72 Alta. L.R. (3d) 369, 1999 CarswellAlta 654, 248 A.R. 1 (Alta. Q.B.) — referred to

Keays v. Honda Canada Inc. (2008), 2008 SCC 39, (sub nom. *Honda Canada Inc. v. Keays*) 2008 C.L.L.C. 230-025, 376 N.R. 196, 294 D.L.R. (4th) 577, (sub nom. *Honda Canada Inc. v. Keays*) [2008] 2 S.C.R. 362, 92 O.R. (3d) 479 (note), (sub nom. *Honda Canada Inc. v. Keays*) 63 C.H.R.R. D/247, 66 C.C.E.L. (3d) 159, 2008 CarswellOnt 3743, 2008 CarswellOnt 3744, 239 O.A.C. 299 (S.C.C.) — referred to

Mobil Oil Canada Ltd. v. Beta Well Service Ltd. (1974), [1974] 3 W.W.R. 273, 1974 CarswellAlta 35, 2 A.R. 186, 43 D.L.R. (3d) 745 (Alta. C.A.) — followed

Royal Anne Hotel Co. v. Ashcroft (Village) (1979), 8 C.C.L.T. 179, 1979 CarswellBC 657, [1979] 2 W.W.R. 462, 9 M.P.L.R. 176, 95 D.L.R. (3d) 756 (B.C. C.A.) — referred to

Rylands v. Fletcher (1868), [1861-73] All E.R. Rep. 1 at 12, 37 L.J. Exch. 161, 19 L.T. 220, 33 J.P. 70, L.R. 3 H.L. 330 (U.K. H.L.) — followed

TransCanada Pipelines Ltd. v. Potter Station Power Ltd. Partnership (2003), 2003 CarswellOnt 1758, 35 B.L.R. (3d) 61, 172 O.A.C. 379, 226 D.L.R. (4th) 262 (Ont. C.A.) — followed

Vorvis v. Insurance Corp. of British Columbia (1989), 25 C.C.E.L. 81, [1989] 1 S.C.R. 1085, [1989] 4 W.W.R. 218, 58 D.L.R. (4th) 193, 94 N.R. 321, 36 B.C.L.R. (2d) 273, 42 B.L.R. 111, 90 C.L.L.C. 14,035, 1989 CarswellBC 76, 1989 CarswellBC 704 (S.C.C.) — referred to

Statutes considered:

Environmental Protection and Enhancement Act, R.S.A. 2000, c. E-12

Generally — referred to

s. 109(2) — considered

Water Act, R.S.A. 2000, c. W-3

Generally — referred to

Regulations considered:

Oil and Gas Conservation Act, R.S.A. 2000, c. O-6

Oil and Gas Conservation Amendment Regulation, Alta. Reg. 36/2002

Generally — referred to

Oil and Gas Conservation Regulations, Alta. Reg. 151/71

s. 8.151 — referred to

s. 8.151(2) — considered

ACTION for damages in nuisance, strict liability negligence, negligence and breach of contract.

***R.E. Nation J.*:**

Introduction

1 Impact Energy Inc. (Impact) drilled a sour gas well immediately adjacent to property owned, used and lived on by members of the Blatz family. Pajak Engineering Ltd. (Pajak) authorized the use of open pits to store drilling mud and drill cuttings on the Impact lease site. The plaintiffs allege material seeping from those pits **contaminated** their water well and related aquifers, and caused physical ailments and financial losses to various family members.

2 The legal principles applicable to this action are not in dispute, they are the well established principles of *Rylands v. Fletcher* (1868), L.R. 3 H.L. 330 (U.K. H.L.), nuisance, negligence and contractual interpretation. The essence of this lawsuit is whether the plaintiffs can prove that the defendants' activities on the lease site caused the alleged **contamination**. The determination of the cause of the problem in the Blatz water well and the extent of any **contamination** was the subject of expert evidence. The findings resulting from the analysis of the expert evidence is the focus of this lawsuit.

3 As a result, this judgment will start with a brief discussion of the applicable law, followed by an examination of pertinent facts, and then a detailed analysis of the expert evidence. This leads to a determination of whether the plaintiffs have met the onus of proof in relation to the causation question, and then to the quantification of any damages.

The Law

1. Rylands v. Fletcher

4 The rule in *Rylands v. Fletcher* is an old, but still available basis for a tort action in Canada. It is a strict liability concept standing for the proposition that a person who brings onto land or keeps something there that is likely to do mischief if it escapes, keeps it at his peril, and if the material escapes, he is *prima facie* answerable for all the damages which are the natural consequence of its escape.

5 Although generally it is not difficult to show that the injury is the direct and natural consequence of the escape of the dangerous thing, causation must be proven for liability to follow: G.H.L. Fridman, *The Law of Torts in Canada*, 2nd ed., at 239. Foreseeability of harm is also a prerequisite of the recovery of damages under this rule: *Cambridge Water Co. v. Eastern Counties Leather Plc* (1993), [1994] 2 A.C. 264 (U.K. H.L.), at 306.

2. Nuisance

6 The concept of nuisance is interference with an occupier's use of his land. It protects against unreasonable invasion of interests in land, even where negligent conduct is not found. To establish nuisance, a plaintiff must establish that a noxious substance was allowed to escape by the defendants onto land that was owned or occupied by him: *Jones v. Mobil Oil Canada Ltd.* (1999), 248 A.R. 1 (Alta Q.B.) at para. 142.

7 Nuisance will result in liability, even if there is no negligence, but as with the *Rylands v. Fletcher* analysis, causation and damages must be proven by the plaintiff: *Royal Anne Hotel Co. v. Ashcroft (Village)*, [1979] B.C.J. No. 2068 (B.C. C.A.), at paras. 10-14, *Browne v. Willis*, [1983] O.J. No. 995 (Ont. H.C.) at para. 16, and *Boucher v. Miramichi (City)*, 2007 N.B.Q.B. 341 (N.B. Q.B.) at para. 36. The *Cambridge Water* case also establishes that foreseeability of harm is applicable to a claim in nuisance.

3. Negligence

8 The essential elements of a negligence claim require the plaintiff to prove that the defendant had a duty of care, there has been a breach of that duty of care and damages resulted from that breach. There is no question that Impact and Pajak owed a duty of care to the plaintiffs who were occupants of the lands adjacent to the drilling operation. If **contaminants** improperly stored on the lease site entered into the ground water, they breached that duty of care. The question that is front and center in this lawsuit is whether any breach of duty that is proven caused the damages alleged.

9 The issue of legal causation has been the subject of comment in a number of cases from the Supreme Court of Canada, the latest being *Hanke v. Resurfice Corp.*, 2007 SCC 7, [2007] 1 S.C.R. 333 (S.C.C.). This case reaffirmed that the "but for" test is the basic test for determining causation. The plaintiff bears the burden of showing that "but for" the negligent act or omission of each defendant, the injury would not have occurred. It is designed to ensure that there is a substantial connection between the injury and the defendant's conduct.

10 Plaintiffs' counsel argued that the facts in this case comprise special circumstances, so that if the "but for" test cannot be met, a material contribution test should be applied. In *Hanke*, the Court clarified that the material contribution test should be applied only where it is impossible for the plaintiff to prove that the defendant's negligence caused the injury using the "but for" test. The impossibility must be outside factors that are in the plaintiff's control, for instance, limits on scientific knowledge. It must also be clear that the defendant breached a duty of care to the plaintiff, thereby exposing the plaintiff to an unreasonable risk of injury, and that form of injury was suffered by the plaintiff. In essence, this extension to the "but for" rule is established where it would offend basic notions of fairness and justice to deny liability by applying the "but for" approach.

Facts

1. Undisputed Background Facts

11 The following background facts are relevant to this decision and were not in issue between the parties:

1. Impact hired Pajak to design, execute and oversee the preparation of the location, drilling and completion on the 3-8 well in question. Pajak and Impact have reached an agreement in terms of the division of any damages the plaintiffs may receive from this lawsuit. As a result, delineation between the activities and responsibilities of the two defendants is not relevant to the outcome of this case, and the third party proceedings were moot by the time of the trial.

2. The plaintiffs are all related by birth or marriage, Gwenda Blatz (Mrs. Blatz) and Wayne Blatz (Mr. Blatz) moved onto an acreage near Priddis, Alberta (the Blatz lands) in 1986. At the material times to this lawsuit, they lived there in their home with their son Steven. Adjacent to them, in a separate home, their daughter Jennifer Blackie lived with her husband Scott Blackie (Mr. Blackie) and their two young children. Jeff Blatz (another son of Mrs. and Mrs. Blatz) and his wife Shelagh lived with their two young children on the Blatz lands, across a road from the other two residences.

3. The water supply for the homes of the three families living on the Blatz lands was a well which was drilled and completed on May 1, 1985 (the Blatz 85 well). It was perforated from 25 to 180 feet covering four potential water-bearing sandstone zones, so the possibility was there for water to flow from more than one aquifer.

4. Details of any water testing entered as evidence at trial on the Blatz 85 well prior to the issues that arose in the spring of 2002 was limited to four test results. They showed the water was safe for human consumption, as it met the Canadian Drinking Water Standards (CDWS). December 2001 was the last well chemistry analysis done on the Blatz 85 well prior to the drilling of the 3-8 well in February 2002.

5. Mr. and Mrs. Blatz signed a surface lease (the lease agreement) giving Impact the right to utilize an area of 4.45 acres (the lease site) to drill the 3-8 well. Preparation for the well required the defendants to break away rock and soil from a steep ridge of fractured bedrock, and flatten a drilling pad. The pad was excavated one third into the rock and two thirds was comprised of fill. The 3-8 well bore was uphill and about 117 meters away from the Blatz 85 well.

6. The defendants excavated several pits on the lease site, intended to store drill cuttings and waste cement. Two pits, referred to as pits 1 and 4 were excavated out of the bedrock. It was initially intended that pit 1 would hold drill cuttings and the smaller pit 4 would hold waste cement. Three additional pits were constructed on April 15, 2002 as pit 1 became too full. Pit 3 was added by building a berm uphill to pit 1, while pits 2 and 5 were dug out of the fill area of the lease site. The numbers assigned to the pits in this judgment are as illustrated in diagram on Appendix G, p. G-38 of exhibit 44.

7. On February 2, 2002, 153 cubic meters of drilling mud was hauled from another well to be reused at the lease site. There were no holding tanks on the lease site when the mud arrived, so a decision was made to store the mud in pit 1, where it remained until February 8, 2002. By this time, a holding tank had been moved and the mud was transferred to a mud tank and used in the drilling process.

8. In the process of drilling the 3-8 well, a 24 inch hole was drilled with air to 30.5 meters, and a conductor pipe was placed. The drilling rig arrived on site on February 8, 2002 and the 3-8 well was spudded on February 9, 2002. The well was drilled directionally (at an angle).

9. The drill cuttings from the surface hole generated in early February were placed in pit 4. Excess cement was placed in pit 1. After February 9, drill cuttings were placed in pit 1 until it became full. Later drill cuttings were placed in pit 3 and in April they were placed in pit 2.

10. Various members of the Blatz family started to notice a change in their water supply. In February, there were observations of some cloudiness in the bath water, and a bit of odour. The problems became more obvious in March and ultimately in April, Mr. Blackie took a sample to be analyzed by the government lab, the results of which he gave to Impact.

11 On April 24, 2002, as a result of the plaintiffs' complaints, representatives of the Alberta Energy and Utilities Board (the AEUB) came to the lease site and an order was made that tanks be put in place to hold the contents of the pits. As a result, by April 26, the practice of putting drill cuttings in the pits stopped.

12. On April 25, 2002 Murray Fitzimmons of Impact advised the Blatz family that they should not drink the water, and from that date Impact provided water to the plaintiffs living on the Blatz lands, initially by bottles and ultimately by trucked potable water held in cisterns, which was still being provided at Impact's expense at trial.

13. On May 13, 2002 the AEUB orally directed Impact to remove all the drilling waste from the sumps, dispose of all drilling waste at an approved waste management facility and provide a water supply to the affected landowner

for agricultural and domestic use. Approximately 399 tonnes of drill cuttings were removed from the open pits, and trucked to a BFI landfill site.

14. The AEUB by letter dated June 7, 2002 found a "major 2 Non-compliance event" had occurred at the lease site due to inappropriate well construction. The letter referenced the oral directives that had been made, and found that Impact had addressed the directions and therefore the suspension of activities on the lease site was lifted. All future drilling waste was to be stored in above ground tanks, the pits were to remain open and empty and the domestic and agricultural water supply was directed to continue until such time as the water supply was deemed suitable for use.

15. At trial, there was no evidence of any further action being taken by the AEUB. Alberta Environment was involved in a review of the situation, but there was no evidence that Alberta Environment commenced any enforcement action against the defendants.

16. The plaintiffs reported a variety of medical ailments in the spring of 2002, which they attribute to **contamination** to the water in the Blatz 85 well. These range from diarrhea, mouth sores, bladder infections, and skin rashes for various members to esophageal problems suffered by Mr. Blatz. His illness, ultimately diagnosed as an esophageal irritation, lead to his hospitalization. His recovery was not complete until August 2002.

17. Mr. and Mrs. Blatz ran a backhoe business called Blatzie's Backhoe Services (Blatzies) from the Blatz lands. They also had plans to subdivide out some residential lots for sale from the Blatz lands. They took steps to submit an Area Structure Plan (ASP) to the Municipal District of Foothills No. 31 (the M.D.) in the spring of 2002, which was ultimately adopted by the M.D. in March 2004. Their next step would be to prove a sufficient quantity of water, before any actual subdivision of titles could occur.

18. Mr. and Mrs. Blatz had a well drilled in 2001 (the 2001 well), which was drilled for the purpose of proving water for the subdivision. It did not have a pump installed and was not in use as a well in 2002, and has not been used subsequently.

19. The Canadian Government publishes the CDWS, which sets standards for the chemical and physical parameters for water to be considered safe for human consumption in Canada.

2. Disputed Facts

2.1. The quality of the water from the Blatz 85 well prior to 2002

12 The Blatz 85 well was drilled in 1985 to a depth of 71.6 meters, with a casing down to 13.4 meters. The liner is slotted or perforated from 25 to 180 feet which left it open in a number of potential aquifers or zones where water could be produced. This was an acceptable practice at the time it was drilled, but not currently. Both experts who testified agreed that this leaves the well more susceptible to fouling, as there are more zones that may carry bacteria or pollutants going into the well.

13 Expert evidence made it clear that it is a prudent practice to have wells serviced regularly: once a year. There was no evidence of any servicing of the Blatz 85 well from the time it was drilled in 1985 until the events of 2002.

14 There was an issue raised at trial, about the truth of the evidence of the adult plaintiffs that the water in the Blatz 85 well was clear and pure, with no previous problems. All the adult plaintiffs testified that the water from the well was clear, good tasting drinking water, and they noted no problems with colour, taste or odour before February 2002.

15 The challenge to the plaintiffs' evidence was brought on two bases. Firstly, there was a suggestion that had the quality of the water been tested as often as Mrs. Blatz suggested, records of that testing should exist. Secondly, there

was some evidence of deposits in a toilet tank that would suggest iron and manganese in the water had been deposited as a result of some previous water problem.

16 Mrs. Blatz testified that the water from the well was tested often. She ran a catering business for some years from her residence, so there was annual spot testing of the water. The only test results produced at trial of any testing prior to April 2002, were two chemistry tests and two bacteria tests. The two water chemistry analyses were dated July 7, 1997 and December 17, 2001, summarized in enclosure 3 of exhibit 23. Although there is some variation in the recorded quantity of certain elements, the expert evidence was that the magnitude of variation was insignificant. The analyses showed the water was acceptable under the CDWS. The tests relating to bacteria levels in the water from the well, tested on July 7, 1997 and July 16, 1999, indicated no total or fecal coliforms. A heterotrophic plate count of less than 10 CFU per ml was recorded in the latter test.

17 Regrettable as it may be that records of any other previous tests were not available as evidence at trial, the court has to rely on the evidence before it. Without any evidence of steps taken to subpoena or find previous tests and inconclusive evidence about why they were not available, I do not make any adverse finding from the lack of data available to the court, in comparison to the amount of testing to which Mrs. Blatz alluded in her evidence. The testing from the well before 2002 is the only historical data available of the chemical and bacteriologic quality of the water.

18 The second issue raised by the defendants related to the photograph that shows a toilet tank of the Blackie household on May 13, 2002. Dr. Nowak testified that this shows iron and manganese which are generally stable in well water. He indicated that when something happens to water quality in the well, manganese and iron tend to come out of solution. He opined in cross-examination that the tank looks like it would have to been in contact with water with increased iron and manganese for a prolonged period of time, something that would be in "terms of years".

19 From this, I accept that there had been some events in the past that affected water quality from the well, so there was some iron and manganese coming out of solution to stain the toilet tank. According to the evidence before me, this could have been an event or events that were not particularly detectable to the residents. Further, this staining does not mean the water was not safe to drink by CDWS. Based on the evidence, I do not infer that the water was not pure, or the residents were not honestly reporting their knowledge and observations about the water from the Blatz 85 well.

20 As a result, I find as a fact that the Blatz 85 well had been used by the families and livestock for over fifteen years without any material problems. It had rarely or never been serviced. I accept that to the residents' eyes, they had no concern about the water from the well, and used it without concern from 1985 until the events of 2002.

2.2. Slough or ditch water as a source of contamination

21 Several of the adult plaintiffs testified that once or twice while driving the roads near their residence, they had observed a purple KTL water truck parked by the ditch, with the water hose in the ditch or creek. The significance of this was that KTL had the water contract to supply all water to the lease site, including the water used in the drilling process and to make mud.

22 The plaintiffs' expert, Dr. Nowak, testified that the use of ditch water by drillers to mix drilling mud may have been a source of introduction of bacteria into underground aquifers. He commented that the use of ditch or slough water in drilling mud could have been one source of **contamination** of an underground aquifer in this case.

23 The defendants called as a witness, Mr. Joseph Kramer, the owner of KTL, who explained the details of obtaining water for Impact, which was to be at the municipal treated level. He went through the procedures for obtaining water and the invoicing. There had been a number of drivers, and the invoicing did not clearly indicate the source of the water for each load.

24 Although Mr. Kramer insisted that the proper procedures were followed, I do not accept that he was able to assure the court that ditch or stream water had never been used to fill the KTL trucks. The reliability of his evidence was effectively brought into question when he was cross-examined about the issue of his drivers leaving the water hoses open, without screening, at the Blatz residence.

25 However, from the limited anecdotal information of the family members, I do not find that KTL drivers, in breach of their instruction, were on some occasions delivering ditch water, rather than municipal water to the lease site, and that water was used to make the drilling mud. There is no evidence to support the use of that water to make drilling mud.

26 Further, the issue is not material, as I accept Mr. Clissold's expert evidence that bacteria introduced by the use of slough or ditch water does not move more than two centimeters into an aquifer. His evidence is backed up by history, as the evidence was clear that in the past in Alberta, before regulations were passed to prohibit the practice, non-treated water sources were often used in the drilling muds for drilling water wells. There was no evidence of widespread, or even significant or concerning bacterial **contamination** in aquifers as a result.

27 As a result, I do not find the evidence proves that bacterially polluted ditch water was used to mix the mud that was at the lease site.

2.3. Overflowing sewage tanks as a source of contamination

28 Mr. Blackie, working through Blatzie's, was contracted by Impact to help place and install septic tanks, to hold sewage from the outhouses placed on the lease site. He testified that the tanks were placed on rocks and wood chips were placed underneath and around to protect the tanks. He was asked to install an alarm on the tank, so it was known when it was full. Both he and Mr. Blatz testified that at least once they were aware the tanks were full or suspected they were overflowing due to the smell, and their observations of soiled wood chips. Mr. Blatz's evidence was that on the one occasion when he noticed this, he advised the Impact representative on site, and shortly after he saw the vacuum truck heading up to the lease site which he assumed was to deal with the issue.

29 The two outhouses could be a source for fecal **contamination** of the Blatz 85 well, if sewage was introduced to the groundwater and that water travelled to the well.

30 I do not accept that there was **contamination** of the Blatz 85 well or any aquifer from the very limited instances of overflow of sewage that were observed. I accept Dr. Nowak's evidence that if sewage had leaked, he would expect to see fecal coliform in the bacteria assessment from the well, and that was not seen.

2.4. Whether large amounts of drilling mud were lost into the ground in February 2002

31 Trucking records recorded that 153 cubic meters of drilling mud was placed in pit 1. It was removed by vacuum trucks a few days later, put into a tank and used in the drilling of the 3-8 well. The vacuum truck invoices produced at trial (exhibit 36) show that 40 cubic meters were placed into tanks on February 9 and 45 cubic meters were transferred on February 11. This would indicate that only 85 cubic meters were removed.

32 These records, taken at face value, would suggest that almost 70 cubic meters of drilling mud was unaccounted for or "lost". Plaintiffs' counsel suggested that the court should find that it was lost into the ground, through seepage.

33 I do not find that the paper work establishes that 70 cubic meters of drilling mud was lost into the ground. I am not willing to make that inference as the accuracy of the paperwork was questionable and such an inference does not fit with the surrounding circumstances. Firstly, had almost half of the drilling fluid been lost, it is hard to believe that would not have been noticed visually. Even if it was not noticeable, for instance, if water seepage or snow increased the volume

as fast as it seeped, I do not accept that the workers when they went to use the mud in the operations on February 9 would not have noticed either a loss of half the expected quantity, or a change in viscosity from any added water from precipitation. Secondly, if 70 cubic meters went into the ground, and affected the Blatz 85 well, I accept the evidence of Mr. Clissold that one should have seen a much more dramatic effect on the chloride level in the water from the Blatz 85 well. I take it from that portion of his cross-examination, that had 70 cubic meters been lost, and a hydraulic connection existed, there should have been a much more obvious and profound chemical effect on the water in the Blatz 85 well.

34 The unreliability of using the vacuum truck invoicing to establish facts is further illustrated when one realizes that the records report that 45 cubic meters was transferred on February 11, yet the well was spudded February 9, so it seems unlikely that the vacuum truck would still be vacuuming up the mud on February 11.

35 This finding does not mean that smaller amounts of drilling mud did not leak from pit 1. Nor does it mean that water in association with the mud in that pit did not pick up some of the mud's chemical or bacteriological qualities and **contaminate** the groundwater.

3. The Causation Question

36 The major issue in this lawsuit is whether any **contaminated** water or product escaped from the lease site and caused the changes noted in the Blatz 85 well. Further, the plaintiffs allege that the aquifer feeding the Blatz 85 well has been damaged, as well as the ability to find potable water under the subdivision lands.

37 One of the primary questions that has to be answered is whether there is a hydraulic connection between the drainage of the lease site, and the source of water for the Blatz 85 well. This question was the subject of expert evidence from two hydrologists. As their opinions are so central to the findings on this issue, considerable time and effort at trial was spent on their evidence. I will summarize the salient evidence of each expert, and then consider the matters upon which they agreed and disagreed. I will then look at the three questions that underpin much of the causation aspects of the allegations of the plaintiffs, by deciding whether any **contaminants** were released from the lease site, and if so, whether they caused **contamination** to: (1) the Blatz 85 well; (2) the aquifer feeding that well; and/or (3) the water source for the proposed subdivision lands.

3.1. Background

38 Concerns around the conduct of the defendants at the lease site arose in early spring 2002, when members of the Blatz family noticed changes to the water in their homes. In April, Mr. Blackie decided to have the water tested, and he notified Impact's representative on the site of that test. Impact hired Hydrogeological Consultants Ltd. (HCL) to become involved in assessing the water quality, and advising whether the problem was related to the lease site activity. Attention turned to the source of the problem with the well, and whether any **contamination** was caused by the lease site practices.

39 A decision was made to set up a system of sampling, which was to drill 29 bore holes to a depth of 18 meters, completing 13 as piezometers. These were completed with a plastic casing, which had a certain part slotted to allow access to a specific depth or interval. Seven of these piezometer wells (piez) on the Blatz lands were of particular importance to the evidence. Each was numbered. Piez 1, 2 and 3 were on top of the lease site, (1 and 2 were by the cuttings pit), piez 5, 6 and 7 were in close proximity to the Blatz 85 well, and piez 4 was placed close to the subdivision lands, at an elevation higher than that of the lease site. Data was collected on the groundwater in each piez, in an attempt to look for evidence of **contamination** from the site. Water levels as well as chemical and microbiological samples were taken in each piez over a period of years to monitor the situation.

40 Two hydrologists, Dr. Nowak and Mr. Clissold (from HCL), studied the data and ultimately opined on the cause of and extent of the problem, and what should be done. They hold different opinions in some areas of critical importance.

Both admit that the analysis of the situation here is not clear-cut or simple. Both have the same constraint, that no one can say exactly what is happening to water underground with certainty, it cannot be actually seen or observed, and therefore, opinions must be developed, based on the data available.

3.2. Dr. Nowak's evidence

41 Dr. Nowak testified for the plaintiffs. He was qualified as an expert in matters relating to ground water geology, and able to express opinions relating to groundwater and its **contamination** by oil and gas operations. He was also qualified to give opinion evidence about the water requirements for subdivisions in the M.D. His education includes a BSc in geology, a MSc in Petroleum Geology and a PhD in Engineering Geology. He was involved in installing monitoring wells for ground water **contamination** around various gas plants in Alberta and writing reports for the AEUB in the 1970's and 1980's. Since that time the predominance of his work has been writing Q-20 reports, related to water production of wells, and specifically water reports necessary to prove water production capacity, as part of the subdivision process.

42 When Dr. Nowak became involved in May 2002 with the issue of the source of the **contamination** of the Blatz 85 well, he inspected the well, the Blatz lands, the lease site and reviewed information available about the drilling activity. He looked to see the relationship between the drilling and the Blatz 85 well. He was aware that for some days in February drilling mud had been stored in open pits. He also considered that the actual bore hole went down 30.5 meters, so there was 7.5 meters of open hole that could have transmitted any liquid found in or introduced to the bore hole on a horizontal basis if there was a liquid carrying aquifer. The hole was "open" with no casing for a matter of days, during which time it was drilling mud that kept the bore open. He felt that any drilling mud or a product envirofloc (which was circulated down the hole at this time) could have transmitted chemicals, if in contact with water that travelled through any horizontal connection that may have existed between the open hole and the Blatz 85 well. He considered that it would be possible if the drilling mud was mixed using creek or slough water, that bacteria **contamination** could be introduced underground through the drilling mud.

43 Dr. Nowak then looked at the water chemistry, both the historic chemistry on the Blatz 85 well, and the testing data summarized in enclosure 4 of his report which indicated dramatic increases of dissolved solids, calcium, magnesium, nitrates, sulfates and chlorides all peaking around May 9, 2002 and then dropping off. He considered the possibility that as well livestock, which is a known source of bio fouling which generally provides high nitrate and chloride readings, the drilling activities provided sources for other items that were elevated, being ammonium nitrate in envirofloc, chloride in the drilling mud, and sulfate from potassium sulfate in the drilling fluid.

44 Dr. Nowak looked to some of the neighbor's wells, notable the Thomas Adam's family well which showed a significant increase in chloride in February 2002 and an increase in sodium, which later dropped. The Tim Adams well also showed an increase in chloride, although that well historically had a high chloride content. He concentrated on the aspect of hardness of water in the Burton, Carson and Robbins wells. In his opinion, the hardness of water does not usually register large swings, unless other components, particularly calcium and magnesium are changing. He looked at the data collected from the 2001 well as outlined in exhibit 20, and found it "unstable" due to various changes in chemical composition from August 2001 to April 2003.

45 From a geologic point of view, Dr. Nowak identified that the lease site and the Blatz 85 well are on the northeast side of an anticline, and that the bedrock thrust zone involved is often attributed enhanced permeability due to fracturing. He found that the Blatz 85 well was down gradient of the pits, and as a result it was reasonable to assume groundwater flow from the drill pad to the Blatz 85 well, especially as the bedrock is fractured and was exposed when the first pits were constructed. His opinion in 2005 was that the sandstone unit at a depth of 7.6 to 9.8 meters just below the casing was water bearing, and this was a horizontal hydraulic connection. This water bearing aquifer could have transmitted **contaminated** water from the pits on the lease site to the Blatz 85 well. At trial, he indicated he was no longer sure of that,

and the connection could be vertical (down through the ground, and then into the well at a lower aquifer). He indicated that how water was getting from piez 1 and 2 into piez 7, or if it was, or whether it passed below, he did not believe he could tell "with any certain degree of comfort".

46 Dr. Nowak in enclosure 1 to his report provided a groundwater map, which calculated the groundwater elevation. It illustrated how water, once it hit groundwater level, would flow with the downhill gradient, which in the map is northeast. This meant that the flow would be from the lease site towards the Blatz 85 well. He stated that from a geologic point of view if someone complains of pollution of their water, the complaining person's well must be down gradient from the alleged polluter. There is no chance of activity affecting anyone whose well is up-slope of the ground water table in relation to the alleged polluter's activity. He felt the down gradient concept was important in that with fractured rock, as there is the potential for fractures to affect where water may travel, if the Blatz 85 well was down gradient, and fractures were at work, that might also explain how **contaminated** water or material could get from the pits to the Blatz 85 well.

47 Dr. Nowak looked at ground water temperatures and graphs of major changes in water level and found that several of the piez wells and the Blatz 85 well acted in similar fashions. As both he and Mr. Clissold wanted to understand whether there was a hydraulic connection, they devised a test to pump the Blatz 85 well for 15 continuous days, which was done in November and December 2002, to see how piez 7, nearest to the Blatz 85 well, responded, and also how piez 1 and 2 responded. The concept was simple, if once the pumping started, the piez well responded by drawing down water, and then once the pumping ended, the piez wells bounced back, they were likely connected hydraulicly. The test proved that piez 7 was connected to the Blatz 85 well, as it drained dry during the test. Piez 1 and 2 whose water levels were dropping in any event, continued to drop during the test, but after the test they did not bounce back. Dr. Nowak attributed this to "afterflow", a sign that there was slow drainage from the area of the pits to the Blatz 85 well. In his evidence he acknowledged that any connection may not be a direct connection.

48 Dr. Nowak identified that the changing hardness and softness of the water found in the Blatz 85 well was strange. It indicated to him that the water quality system was out of whack, even though quite soon after the spring of 2002, the levels of chemical found in the Blatz 85 well had all fallen below the CDWS levels for chemical concerns. His opinion was that this changing hardness and softness was due to pulses coming through the system. As he felt sodium bentonite could act as a water softener, he opined that a plug of drilling mud may be stuck somewhere underground, and subject to pulses of water. The fact that the hardness and softness still varied several years after 2002, indicated to Dr. Nowak that drilling fluids and other additives have changed the whole aquifer system from a water quality point of view.

49 Dr. Nowak testified that the well testing demonstrated a bacteria problem, which could be a well problem or an aquifer problem. He referred to the shock chlorination of the well which was done July 10, 2002, after which bacteria was still found. Also, after two hours of pumping the Blatz 85 well, bacteria was still found in the water. This indicated to him an aquifer problem. As a result he indicated that a permanent treatment system would be needed on this well, as there is a lack of consistency, so the water from the well was not reliable.

50 The issue of **contamination** below the subdivision lands was addressed by Dr. Nowak in his report and in evidence. Enclosure 1 indicates that the gradient flow would not be towards the subdivision lands. Dr. Nowak testified he was not so sure of the details of the map he made as it relates to piez 4, as it may be on the other side of the anticline. Piez 4 lies about the lease site, so it is not deep enough to encounter anything that may have come from the pits. Notably, it shows a significant change of water quality over the two year test period of July 2002 to 2004.

51 Dr. Nowak gave the opinion that the change in the Blatz 85 well had compromised Mr. and Mrs. Blatz's position as to whether or not they would be able to construct the subdivision. Although standing by his evidence that the most usual and preferable way to do the subdivision would be to have one well per lot, he testified that the second option

would be through a communal well. As that originally might have encompassed the Blatz 85 well, he felt the subdivision proposed was compromised.

52 In relation to the process of Mrs. Blatz applying for subdivision approval and proving water production capacity, Dr. Nowak had been contacted by Mrs. Blatz in the early spring of 2002 in relation to her application for subdivision approval and the necessity that she prove water capacity. She provided him with the pump test data on the Blatz 85 and 2001 wells. His opinion, given in writing on April 9, 2002 was that the wells were not completed to a standard necessary for licensing under the *Water Act* R.S.A. 2000, c. W-3, deficiencies in the completion of the Blatz 85 well were pointed out, and he opined that neither well as it was completed could supply sufficient water for the 29 lots then proposed. Dr. Nowak's opinion was that at minimum recompletion of the wells was necessary, but it was likely further wells would have to be drilled.

53 Dr. Nowak testified that individual wells on each of the subdivided lots is the most usual method of proving water for subdivision in the M.D., and frankly, that favoured by him, so that no one aquifer is stressed. He also confirmed that the fracture permeability in the area introduces great variability into the equation, it is possible to have a dry well and move over a few feet and find a producing water well.

3.3. Mr. Clissold's evidence

54 Mr. Clissold testified for the defendants. He was qualified as an expert in the area of hydrogeology (the study of the distribution and movement of groundwater in the soil and rock of the earth's crust). He was also qualified to give opinion evidence about water well design, the source, cause and extent and treatment of **contaminated** groundwater, the management of the quality and quantity of groundwater resources and the mediation of **contaminated** groundwater. He has a BSc in geology and mathematics, and a MSc in geology. In the past, he worked for the Research Council of Alberta, and the Ontario Water Resources Commission. He has been the president and principal hydrogeologist of HCL since 1969.

55 HCL was originally retained by Impact in the Fall of 2001 prior to drilling the 3-8 well, to test the water wells that were within 1,600 meters of the surface location of the drilling. HCL became involved with the Blatz 85 well when the testing from the April sample taken by Mr. Blackie was provided to Impact, who passed it on to HCL. HCL sent a technician to obtain a sample and test the well, and then recommended to Impact that it take measures to make sure the residents did not drink the water, as it did not meet the CDWS for nitrate content.

56 Mr. Clissold authored a preliminary report dated May 2, 2002 which indicated that the drilling could be the source of the increased nitrogen, and that if the concentration of nitrates in the water declined once the source was removed, that would be consistent with **contamination** from the lease site.

57 During May and June of 2002, HCL was denied access to the Blatz property for some weeks at the instruction of the Blatz legal counsel. Eventually access was allowed and more data collected. Mr. Clissold was suspicious that the cause of the problem was the lease site, due to the elevated chlorides and some nitrates. Elevated nitrates could also be due to fertilizer. He wanted to do a survey to try and identify the plume or area of **contaminated** material. If there was a plume, this would assist to identify the **contaminant**. Efforts could be made to treat the plume and a decision made whether to put in a capture well to collect the **contaminant**. However, no plume was detected by his testing.

58 Mr. Clissold analysed the sample that Dr. Nowak took from the cutting pit in May 9, 2002. He noted particularly the very elevated content of dissolved solids, potassium and sulphate, and compared it to the analysis of the Blatz 85 well up to that time. He felt the sample was not the source of the water showing up in the Blatz 85 well. The order of magnitude of the potassium concentrations were larger than any potassium concentration associated with the groundwater samples. Molybdenum, nickel and aluminum concentrations were not elevated in the Blatz 85 well, but these were elevated in

samples taken from the water that gathered in the pits during the study period. In the Blatz 85 well, the potassium was not elevated, and the nitrate levels were decreasing, after peaking in May. Thus, in the May to July 2002 time frame, Mr. Clissold began to think about other sources of **contamination**.

59 In June 2002, HCL conducted an informal field test in pit 1, which indicated that the volume of water that accumulated from environmental sources (run off or rain) increased 5.2 cubic meters for two days, and then decreased 5.9 cubic meters. This, Mr. Clissold felt, established that the pit did leak water, when the ground was not frozen. He pointed out the ground would be frozen in February 2002 and that potassium sulfate mud has a higher viscosity than water, intentionally so it inhibits liquid flow in permeable rocks.

60 He reviewed the microbiological data, looking for total coliforms which include environmental bacteria. Testing for them is a way to determine if the groundwater may be a risk for human consumption, as they are an indicator of disease causing agents in the water. Total coliforms were not present in piez 1 and 2, but they were evident in the Blatz 85 and 2001 wells. Piez 1 and 2 are far closer to the 3-8 well site. Thus, Mr. Clissold found no reason to attribute the presence of coliforms in the Blatz 85 and 2001 wells to activities on the lease site. In fact, ultimately, he attributed the presence of coliforms in the Blatz 85 well as introduced from the groundwater, not evidence that the deeper bedrock aquifer had been **contaminated**.

61 Mr. Clissold looked at the pump tests and determined that after 11 minutes of flow, the softness/hardness of the water was changing. Because of this, he opined that there was more than one aquifer feeding the well. Exact isolation of the aquifers would require the Blatz 85 well to be refinished, which was not done. Mr. Clissold was of the opinion that in the Blatz 85 well, there is an aquifer that ends below the casing (shallow aquifer) and then a deeper aquifer or aquifers which provide softer water, not influenced by ground water. His theory was that when the well is pumped, the water level goes down, and once the water level in the well is below the level of the shallow aquifer, it allows the shallow groundwater that is chemically hard to enter the well, thus changing the hardness of the water. When the well is high, or flowing, its water pressure affects the shallow aquifer, so it cannot contribute to the well water, and thus the softer water flows from the deeper aquifer, which is less impacted by and thus less subject to **contamination** from ground water.

62 Mr. Clissold relied on the electrical conductivity of the groundwater as a method to try to separate different sources of water, and in his opinion, that indicated that the groundwater from the shallow aquifer could be to a depth above 30 meters in the well and the deeper aquifer was below a depth of 36 meters.

63 Mr. Clissold's analysis lead him to use a Piper tri-linear diagram to try to determine the mix of groundwater from the deeper aquifer, groundwater from the surface aquifer, and any introduced **contaminated** water from the lease site. Mr. Clissold used the composition of water from piez 5, as it was completed to the shallowest depth, and was adjacent to the Blatz 85 well as the groundwater sample. Based on the mixing results which he detailed in his report, he found it difficult to see any impact on the chemical quality of the water in the Blatz 85 well related to the sample taken from cutting pit 1. His conclusion was that the plotting indicated that the water in the Blatz 85 well had the same source, just different relationships between the percentages of composition from the upper and lower aquifers. When he attempted to search for a mix which used some components of the tested chemical constituents from the sample taken from the pits, using chloride as a marker, he could not match the constituents. Thus he felt there was no component of the water in the Blatz 85 well that was coming from the pit.

64 Mr. Clissold discussed the pumping test that was an attempt to see whether a hydraulic connection can be shown between piez 1 and 2 (which are in hydraulic connection with the 3-8 well site) and piez 7 (which is in hydraulic connection with the Blatz 85 well). He pointed out that the test was done at the time when the water level was decreasing in the fall. Piez 7 results (as demonstrated in document 5 of exhibit 14) showed that when the pumping started, there was a notable increase in the rate of decrease, so that the draw down was clearly due to the pumping, and thus there was a

direct hydraulic relationship between piez 7 and the Blatz 85 well. He pointed out that for piez 1, there was no change in the rate of the draw down of the water level when pumping started, and when pumping ended, there was not a rise in the water level. He found this did not support a hydraulic connection. He acknowledged the "after flow" theory outlined by Dr. Nowak, but indicated that phenamena relates to large bore wells, as there is significant storage. Also, Mr. Clissold was of the opinion that as the graphs did not establish draw down at the start of the test, the concept of after flow did not come into play.

65 Mr. Clissold 's ultimate opinion on the cause of the **contamination** of the Blatz 85 well took into account information which was provided by Mr. Blackie that the well had not flowed for five years prior to 2002. Mr. Clissold felt the **contamination** was a result of recharge to the shallow aquifer that fed into the Blatz 85 well. Once the well started to flow, the elevated constituents in the well started to decrease. His opinion was that the problem with the Blatz 85 well at the same time as the drilling activity was a coincidence. He believed infiltrating water dissolved salts and incorporated micro-organisms and then transported them to the shallow aquifer. Recharge had not occurred for five years, so the solids had not been flushed for sometime, and there was an accumulation of organic materials. It was only the combination of a number of factors that lead to the problem with the Blatz well: (1) that the well was completed through more than one aquifer; (2) one aquifer was shallow, and under normal operative conditions, the deeper aquifer would keep water from the shallow aquifer out of the well; (3) at that time, there had been a limited recharge, so the water in the well was low, and did not act as a barrier for water from the shallow aquifer; and (4) that there had not been a good flush of the system for some years, meaning a build up of materials in the soil. This was first manifested by the cloudy look to the water and later the smell that lead the Blatzs to have a test done and be aware of the increased chemical compositions in the water.

66 Mr. Clissold acknowledged in cross-examination that water that comes into contact with drilling mud, or some type of residue can be affected chemically, just as water that rained or came into the pits after the material was removed was tested to have picked up chemical components.

67 He recommended that the Blatz 85 well be refinished to isolate the shallow aquifer, and prevent water coming into the well from that level. This would involve pulling and changing out the liner, and making only the lower, deeper aquifer available. In his opinion, shock chlorination of the well would likely be necessary a number of times, since the bacteria have become well established as the well has not been used for over seven years. Mr. Clissold testified that the 2001 and the Blatz 85 wells are not hydraulically connected, so in his opinion there was no **contamination** in the 2001 well from lease site activities, and thus no remedial steps are necessary for the 2001 well.

68 In relation to water issues around and under the subdivision lands, Mr. Clissold felt that piez 4 could be an indicator of groundwater unaffected by the drilling activity, as it was higher in elevation than the drill site, and water would not travel uphill to **contaminate** the site. This piez indicated seasonal variations in nitrates, which increase when groundwater recharge is significant (in the spring) and decreasing throughout the rest of the year.

69 Mr. Clissold testified that it is probable that there is water under the proposed subdivision, however, he confirmed Dr. Nowak's statement that no one can guarantee water in any location, the only option is to drill and see what is there.

70 Mr. Clissold agreed with Dr. Nowak that the gradient flow is to the northeast, so that if the ground water was **contaminated** from the lease site, it would move to the northeast, and would not move from the lease site in the direction of the subdivision lands.

3.4. Areas of agreement between the two experts

71 The experts agree on the following pertinent matters:

1. There was a rapid change in the chemical composition of the water produced from the Blatz 85 well in the spring of 2002, with a peak chemical concentration around May 9, 2002. This dramatic and rapid spike of change in ground water composition is unusual.

2. Both experts initially identified two potential and most likely sources for the problem with the Blatz 85 well: (1) the drilling operations and activities on the lease site; and (2) mammal wastes, here largely livestock manure.

3. Nitrates are nitrogen oxygen chemical units that combine with various organic and inorganic compounds. They are essential nutrients for plants, which absorb them from the soil. Nitrates not absorbed by plants can be carried through the soil to ground water in a process called "leaching". Fertilizers are one source of nitrates, as are human and mammal waste and decomposing plant and animal materials. Nitrates are tasteless and odorless, not alerting a water user of their presence, unless they were found in water in association with something else (cloudiness, odour) that would lead someone to test for and find them. The concern around their presence in drinking water is generally related to young children, as children under six years of age do not have the enzyme necessary for the digestion of this element.

4. Shallow aquifers are notorious for producing well **contamination**, as they are more susceptible to influence from groundwater, and surface product.

5. Water table conditions are the first occurrence of underground water. If no strata or barrier of rock is containing it, it is an unconfined aquifer, and has access from the atmosphere directly down to the top of the water table. This would be the case for piez 1, 2 and 7.

6. The water in the Blatz 85 well according to the chemical CDWS standards has been fit for human consumption since July 2002. However, there are bacteria concerns with the Blatz 85 well since July 2002, as testing has shown the presence of coliforms and pseudomonads. Testing as early as May 8, 2002 showed the presence of iron related bacteria, sulphate reducing bacteria and suspected pseudomonad bacteria. These are all what are termed "nuisance bacteria", affecting smell and taste and colour. One shock chlorination did not got rid of the problem. Both experts agree that at a minimum the liner on the Blatz 85 well should be pulled, the well properly completed in only one zone, and a series of chlorination treatments may be necessary, as the well has not been used for a substantial period of time.

7. There is no guarantee of the life of a water well. The life span of any particular well is subject to many factors. Water wells need maintenance, bacteria are a major concern, and the fact that a well has worked for many years with no problems gives no guarantee of its future. Both experts acknowledged that a well such as the Blatz 85 well, finished in more than one zone, is susceptible to a higher risk of problems, than one finished in a deeper zone.

8. Neither expert saw any barrier to drilling a new well to replace the Blatz 85 well. In the area where the Blatz lands are located, no one can say exactly where water will be found underground, nor can one predict the quantity or quality of the water that may be found. The presence of water in one place, or one well, does not mean water will be found by drilling an adjacent well.

9. It is hard to know where water actually travels underground, especially in the formations found under the area of the Blatz lands, as this is a fractured area, and water can travel into fractures and become diverted. Fractures do occur in the rocks in this area, and the path of travel of water and fluid does get affected.

10. Water goes into the ground, encountering solids, and travels until it finds saturated soil, and at that time will move by fluid potential. Dr. Nowak mapped this to be to the northeast, and Mr. Clissold took no issue with this. Even when water hits a fracture, it's path or travel may be diverted, but it has to travel down gradient.

11. There has to be hydraulic connection between the Blatz 85 well and the drainage from the pits or from the lease site, in order to say drainage from the pits or pollutants from the lease site entered the water which then caused **contamination** of the Blatz 85 well.

3.5. Consideration of the differences in the opinions of the experts

3.5.1. Qualifications

72 It was argued by the plaintiffs' counsel that more emphasis should be placed on Dr. Nowak's opinion as he had superior qualifications. These were outlined as Dr. Nowak's PhD as opposed to Mr. Clissold's MSc and the fact that Dr. Nowak had more experience monitoring water for gas wells, and assessing water quantity in the Priddis area.

73 Dr. Nowak does have higher formal education. He also has more experience in water studies dealing with whether the water source is sufficient to support the subdivision requirements of the M.D. Mr. Clissold has a more varied, broader experience in the evaluation of groundwater, but he does not have the specific involvement and narrow practice of evaluation of water sources for subdivision requests in the M.D., which has been a primary focus of Dr. Nowak's work in the recent years. Neither expert has any notable or extensive experience dealing with **contamination** from storage of drilling muds, such that their experience to opine on this situation would be somehow superior to that of the other.

74 From my observation of their evidence, Mr. Clissold had a more comprehensive, academic approach. In fairness to Dr. Nowak, he prepared his report in December 2005 and as Mr. Clissold's final report was dated April 3, 2009, Dr. Nowak did not had the luxury of preparing a written rebuttal. In their cross-examinations, I found Dr. Nowak more open minded, able to acknowledge weaknesses or problems with his ideas and theories, and open to other ideas. Mr. Clissold was more defensive in his cross-examination, he had problems even acknowledging a fact as a hypothetical if it did not support his conclusions. Especially, he did not want to acknowledge any weakness around the dependence of his theory on the truth of the fact that the Blatz 85 well had not flowed for five years before 2002, and was flowing by May 8, 2002.

3.5.2. The pumping test

75 The experts were not in agreement in their interpretation of the results of the pumping test. They both agreed that piez 1 and 2 were in hydraulic connection with the well site, and piez 7 was in hydraulic connection with the Blatz 85 well. They both agreed to run the continuous pumping test, to see if there was draw down, and thus evidence of a hydraulic connection between piez 1 and 2 and piez 7, and thus between the well site and the Blatz 85 well.

76 Dr. Nowak looked to the decline in piez 1 and 2 after pumping started as an indication they were affected by the pumping and suggested that the "after flow" effect may be the reason the water level did not recharge when pumping ended. He confirmed that if this was true, piez 1 and 2 would likely be in aquifers that display low transmissivity and are heterogenous, which were draining slowly to fill the Blatz 85 well aquifer. He also confirmed that the after flow effect generally relates to large diameter wells.

77 Mr. Clissold pointed to the fact that there was no initial indication of change in the rate of decline of the water level in piez 1 or 2 when the pumping started, and thus he questioned hydrological connection. Nor was there a bounce back when the test ended, rather a general decline continued. This, in Mr. Clissold's opinion was evidence that there was not likely a hydraulic connection. He acknowledged the "after flow" effect, but discounted it as this was not a large diameter well.

78 I prefer the interpretation of Mr. Clissold on this issue. A review of the graphs at exhibit 14, document 4 of 8 (enclosures 29-31) confirms his observations that at the time of the test in November, all three piez's had been in general decline, as the water table was generally declining, and not under spring recharge conditions. There was no noticeable change in the rate of decline in piez 1 or 2, unlike the graph for piez 7 which shows a notable change in the rate of decline, hence direct hydraulic connection.

79 I note that the Blatz 85 well was not a wide diameter well. Also, Mr. Blatz started to notice the cloudiness in February, which would be shortly after the mud was placed in the pit, which would suggest a higher, rather than a lower transmissivity aquifer. Likewise, to the extent other wells were reviewed, the high chloride in the Tom Adams well was detected February 18, 2002 so if related to the mud storage, it would have to be a higher transmissivity aquifer as it was detected that soon after the February storage of the drilling mud.

80 When I review this analysis, I find that the pumping test does not offer support for a finding of a direct hydraulic connection between the 3-8 well site and the Blatz 85 well.

3.5.3. The hardness/softness issue

81 It was clear at trial that the swing between hardness and softness that was being observed was a challenge to both experts when they started to review and analyze the data that was generated from the Blatz 85 well. It was clearly something that would not be generally expected or observed in an established well.

82 Dr. Nowak's only explanation, which he raised in his initial analysis, was that the sodium bentonite in the drilling mud could be providing the element that softens the water. It is impermeable, so does not allow water to flow through it, but if a plug of it was trapped somewhere, he opined that may explain the pulsing events that seem to take place, with swings in hardness and softness as the Blatz 85 well is pumped. Dr. Nowak testified that drilling mud will not move away from a site without a steep gradient, so there has to be another event, such as ground water flow diluting it to allow this to be the explanation for the softness/hardness swing.

83 Mr. Clissold was critical of that theory, testifying that he had never heard of sodium bentonite softening water. He pointed out that it is used in drilling water wells, and there is no indication that water that is in contact with it through or after drilling tests soft as a result of that contact. He conceded that sodium is used to soften water.

84 Mr. Clissold came to the conclusion that the only way to explain the fluctuating hard and soft water was that the Blatz 85 well was being supplied by more than one aquifer. One of them was subject to the influence of surface groundwater which is generally harder, and the other aquifer was close to the pump, which was lower, and thus softer water. He explained the swing while pumping as dependant on where the column of water was in the well. If it was high, it would block water from the upper aquifer, if lower, the upper aquifer water would be introduced. He also pointed to his electrical conductivity tests to isolate the difference in level between the waters being introduced into the well from different sources (aquifers).

85 Dr. Nowak was critical of this explanation, as he found it hard to attribute some of the swings while pumping to the upper aquifer, because in his opinion to achieve some of the results noted, more significant amounts of water would have to be introduced from the upper aquifer than he believed likely.

86 Both experts agreed that to determine definitively which of the potential layers are water bearing, the lining would have to be pulled on the Blatz 85 well and testing done. This was not done for the trial, and so the court does not have the benefit of that evidence.

87 I find the reasoning of Mr. Clissold on this question more convincing, as the idea of a plug of drilling mud moving from the pits and then subject to pulse water events is less likely, when viewed in the context of all the evidence. None of the evidence supported any finding that there had been a loss of circulation while drilling the 3-8 well, which would be one explanation consistent with drilling which would mean significant amounts of drilling mud could escape into a rock formation. Dr. Nowak's theory appears more of an educated guess when compared to the theory of Mr. Clissold. The explanation by Mr. Clissold is more supported by the evidence, and it is a more logical explanation of how the hard and soft water could be producing the results seen. The electric conductivity tests provides support to the theory of more than one aquifer being water producing, and thus supplying two sources of water with potentially different characteristics.

*3.5.4. Bacteria and possible **contamination** of the aquifer*

88 There was an extensive discussion by the experts in their examination and cross-examination about bacteria in groundwater. Their evidence was consistent about certain background facts relating to bacteria and wells. They agreed on the following background information:

> 1. Generally speaking, bacteria is present in soil and water. Bacteria, virus, parasites and other microorganisms are sometimes found in water. Shallow wells, with water close to ground level are most at risk. Run off or water flowing over the land surface can also pick up pollutants from wildlife and soils. Many types of bacteria are native and are present in water supply aquifers, even in deep formations.
>
> 2. Most coliform bacteria are not harmful, they serve as indicators of possible harmful bacteria. Total coliform counts are looked to generally as an indicator that there could be other items of concern in water, (for example, fecal coliforms) and specific testing for those should be performed. Total coliforms come in from the soil surface, as do fecal coliforms, however, the latter do not generally migrate through it.
>
> 3. Pseudomonads, a particular bacteria which showed up in some testing in this case, are bacteria often associated with hot tubs, warmer swimming pools, and are a nuisance bacteria. They cause slime formation, turbidity and, taste and odour problems. They also like a nitrate source as food to grow. Any testing showing over 500 CFU (colony forming units) per milliliter is a reason for concern and further investigation.
>
> 4. There is no way to test to determine the source of many micro-organisms in any one well. Long periods of non-use or occasional use will allow fouling growth to build up.

89 There was a difference of opinion between the experts as to whether the data in relation to bacteria testing in the Blatz 85 well indicated that there was a **contamination** of any aquifer that supplies the Blatz 85 well. Both acknowledged that the presence of bacteria in a well may indicate either a well problem, an aquifer problem, or both.

90 After the shock chlorination of the well on July 10, 2002, bacteria was still found in the water from the Blatz 85 well. This, with the continued presence of bacteria after long term pumping, lead Dr. Nowak to opine that the bacteria was an aquifer problem, as opposed to a well problem. An aquifer problem is harder to solve. He recommended a permanent treatment system to put the Blatz 85 well back into regular use, as the water derived from that the aquifer could not be relied upon to be consistent, or bacteria free.

91 Mr. Clissold opined that the bacteria presence was a well problem, not an aquifer problem. He attributed the presence of coliforms in the Blatz 85 well to be introduced from the groundwater, not evidence that the deeper bedrock aquifer has been **contaminated**. He also pointed out that total coliforms were not present in piez 1 and 2, but they were evident in the Blatz 85 and 2001 wells. As piez 1 and 2 are far closer to the 3-8 well, Mr. Clissold found no reason to attribute the presence of coliforms in the Blatz 85 and 2001 wells to activities on the lease site.

92 It was clear from Dr. Nowak's cross-examination, that he had made a mistake in the conversion of the bacterial count, so some readings in his report were treated as higher than they would have been if given in colony forming units per milliliter. The result would be, for example, that the reading in December 2002 reported in the appendix to his report are below, not above, the standard court. His report has to be read with that understanding.

93 The testing on the Blatz 85 well shows bacteria, and most concerning continued bacteria after pumping. The long period of lack of use of the well since 2002, means that the bacteria in the well, screen and elsewhere will be well entrenched. The bacteria that is in the well will likely be aggressive and very difficult to eradicate. Bacteria is certainly a problem related to the well and its lack of use at the current time.

94 When I consider the two opinions, I accept the opinion of Mr. Clissold, that the bacteria problem is a well problem, and explained by the introduction of groundwater and compounded at the current time by the lack of use of the well.

3.5.5. Other wells in the district

95 Dr. Nowak looked to some of the neighbors' wells close to the lease site, to see if there had been influences that could be attributed to the drilling. He referenced certain chemical changes seen in the Thomas Adam's family well in terms of the large chloride spike, and increase of sodium, and the further increase to the already high chloride content of the Tim Adams well at the material times, as evidence that there had been chemical compromise to the groundwater supplying the wells in the area of the lease site.

96 Dr. Nowak noted the swing of hardness to softness that is seen in the Burton, Carson and Robbins well data. He opined that this was an indication that something unusual was being experienced at wells down gradient from the lease site at the material times.

97 Mr. Clissold dismissed the hardness/softness swings as proof of lease site activity, pointing out that both the Tim and Thomas Adams wells are finished in multiple aquifers, and the Burton well may also be, as all three wells were drilled by the same driller. He explained this as the reason for a fluctuation in the hardness of the water, not a dramatic influence on the water quality or aquifer from the drilling.

98 The defendants pointed out that the testing of the Burton and the Carson wells showed no concern of elevated nitrates for the periods tested from December 2001 to May of 2003. They point to this as an indication that not all the nearby wells were showing elevated nitrate numbers.

99 There is always a concern about comparing wells, as some matters are very well dependent. For example, Mrs. Blatz testified that historically the Tim Adams well produced water with gas in it, that it was possible to light it with a match, and as a result equipment had been installed to remove the gas. If one looks at the 2001 well, the only background profile prior to drilling is a sample of December 17, 2001, (exhibit 1-tab 9) which involved no bacteria analysis.

100 I accept Mr. Clissold's opinion that fluctuations in the hardness or softness of the water in the three wells referenced by Dr. Nowak may well be related to the way they are completed in multiple zones.

101 I recognize that information of testing from other wells must be treated with caution. However, this information does raise a concern that pollutants may have been introduced into the water by the defendants and temporarily influenced these wells, at the materially significant times. The Thomas Adams well, the only well that was tested in February, specifically February 18, 2002, showed a dramatic increase in its chloride content (220 times the usual). This was not explained at trial as due to other causes. This was a well that was northeast of the anticline structure and down gradient from the lease site.

3.5.6. Mr. Clissold's build up theory

102 Mr. Clissold's explanation of the source of the initial problem with the Blatz 85 well was that of the build up of salts and micro-organisms over a number of years, which were then transported by spring infiltrating water to the shallow aquifer. It is essential to his theory that the solids had not been flushed for sometime, as a much greater than usual accumulation of organic materials had to be present, to cause such a high spike of the certain chemicals in the Blatz 85 well as was found in the April and May 2002 data.

103 Both Mr. Clissold and Dr. Nowak struggled with explaining that level of spike from animal waste alone. Mr. Clissold relied on advice from Mr. Blackie volunteered to Jason Sanders of HCL at the Blatz property on April 19, 2002, that the well had not flowed for the five years before 2002, but it had flowed for three years in a row before that. It was also essential to his theory that the well was flowing around May 8 or 9, 2002 to explain the sudden decrease of some chemical components in the water immediately around and after that date.

104 The defendants have the onus to prove these two assumptions, for this theory of Mr. Clissold, to be accepted as proven.

105 In relation to the assumption that the well flowed from May 8 onwards, there was no direct evidence to indicate the flow happened May 8 or 9, which was essential to Mr. Clissold's explanation of the sudden reduction in the chemicals at that time. Two witnesses were on the lands, and looked at the well on May 8. The first was Dr. Nowak, who testified that the whole site was very wet and muddy after a snow on May 6. He was not asked, nor did he say, whether the well was flowing that day. Mr. John Chan from the AEUB was at the lease site on May 8, but he was not questioned as to his observations as to whether the well was flowing. Intensive daily monitoring of the Blatz 85 well did not start until later in the summer, and then continued until 2004.

106 The second assumption that is essential to the proof of Mr. Clissold's theory was that the well had not flowed for the five years (or a number of years) prior to 2002. The only evidence in relation to this was anecdotal evidence given by Mr. Blackie to Mr. Sanders, and evidence given by Mr. Blatz as rebuttal evidence. Mr. Blackie when he testified was not asked by any counsel what he had observed about the Blatz 85 well flowing before 2002, or even if he was resident on the lands to observe it. He was only asked if he made the statement to Mr. Sanders, which was documented in Mr. Sander's notes on April 19. Mr. Blackie did not deny making the statement, he indicated he could not remember, and may have said that to Mr. Sanders. My assessment of Mr. Blackie, from the manner of giving his evidence, and the whole issue around the details of his loss of wage claim, is that the reliability of his evidence in general is suspect. This leads me to have concerns to rely on the truth of the statement he gave to Mr. Sanders, without more evidence to support the truth of the statement.

107 The only other witness who gave direct evidence about the Blatz 85 well flowing was Mr. Blatz, who was called to give rebuttal evidence on this point. He testified that he could not remember a year that the well had not flowed, his recollection was that it generally flowed from June to mid-July. The reliability of his evidence was squarely put in issue, as in his cross-examination on that evidence, he testified very specifically that he recalled that the well flowed in 2002, 2003 and 2004. However, the Blatz 85 well was monitored for those years, and the data shows the Blatz 85 well did not flow in 2004. Thus Mr. Blatz's memory as to exactly what years the well flowed is suspect.

108 As a result, I do not find it proven that the Blatz 85 well did not flow for five years before 2002, or that it was flowing on May 8 or 9, 2002.

109 Mr. Clissold also testified that the lease site as the source of the **contamination** of the well was only a possibility not a probability based on his Piper tri-linear diagram analysis. In his opinion the results indicated that the water in the

well was not a mixture that included water from the lease site. In this analysis, he used a sample taken by Dr. Nowak from the residue in a pit on May 8, 2002, as representative of the chemical composition of **contaminant** from the lease site. He used a sample from piez 5 as being representative of water from the upper aquifer in the well. However, it cannot be said that the May 8 sample is necessarily indicative of what was there in the pits when the mud was there, or that it is representative of the composition of the drilling fluid that may have been mixed with the cuttings. The sample is the residue of water that fell in the pits and remained there, after contact with whatever residue was left after pit 1 had been pumped. In addition, it is cannot be said with any degree of certainty that the sample from piez 5 actually represents the water coming in from the upper aquifer. Thus, the Piper tri-linear diagram analysis has to be regarded with the awareness that certain assumptions about the composition of two of the sources of water may be questionable, as their chemical composition was not known with any degree of certainty.

110 As a result, I do not find that Mr. Clissold's theory of the **contamination** of the Blatz 85 well from chemical build up in the soil and subsequent discharge has been proven on the balance of probabilities.

3.5.7. Is the water nonetheless under the influence of drilling fluids

111 There was a difference between the experts in how they viewed the fact that chemically the water from the Blatz 85 well since July 2002 has tested within acceptable limits for all chemical content designated by the CDWS. Clearly the chemical composition of the water currently, and after 2002, has not returned to the exact composition that was seen in the two previous tests that are in evidence before the court. Those two tests taken a few years apart were fairly consistent.

112 Dr. Nowak opined that the water from the Blatz 85 well is still "under the influence of drilling fluid", so subject to concern about unknown **contaminants**. He felt that as the chemistry has not returned to the exact way it was before the spring of 2002, there is still a reason to be concerned. A number of times he alluded to, or used words to the effect that to drink the water from the well, one would be drinking "drilling fluid", or water "under the influence of drilling fluid".

113 Mr. Clissold took the approach that if a water sample does not show levels of chemicals elevated above that designated by the CDWS, one cannot say it is chemically **contaminated**. It is safe to drink. Mr. Clissold testified that the CDWS standards are designed to test for anything harmful. He pointed out that the most recent analysis performed on water from the Blatz 85 well before trial tested all 230 elements for which Health Canada has standards. None of the maximum allowable concentrations were exceeded.

114 This issue lead to substantial examination at trial, both in direct and cross-examination about the use of sawdust, easy slide, foam buster, and other items that were identified by trade name as having been used in the drilling mud. Details of all the ingredients of these products were not in evidence.

115 The submissions of the plaintiffs' counsel were along the lines that the fact that these type of products had been used during drilling or in making the mud, (including bleach and chloride), suggested chemicals might be in the drinking water, and the CDWS was not sufficient to detect these. Thus, by inference, if the water came under the influence of drilling fluids, it was **contaminated** and should never be used for drinking, whether that was out of the Blatz 85 well, or water lying under the subdivision.

116 The submissions by the defendants' counsel were that it has to be accepted that the CDWS sets out scientific testing for elements known to be dangerous to health. If water passes that test, one cannot be facing an elusive "bogeyman" of other possible chemicals that may have been used in the drilling operation. They took the position that just because drilling mud and drilling fluids were once stored upgradient and some chemical composition of them may have leached into the groundwater, does not mean all water down gradient should not be used without an extensive water purification system.

117 I accept that the CDWS sets maximum allowable standards for 230 elements which the Canadian government has isolated as important to test for when considering human health and drinking water. If none of the set levels are exceeded, then by current Canadian standards, the water is chemically acceptable to drink. The fact that various items of unproven chemical composition were used in material stored in an open pit that leached into some groundwater, does not automatically mean that unknown items that are detrimental to health are present in the Blatz 85 well. There is no evidence before me in this trial to suggest that any of the products used in the mud or the drilling fluid contained toxicants or have chemical compositions that are not tested for by the CDWS, or have characteristics that are harmful to health that would not show up in some chemical manner in the analyses performed.

3.6. Causal conclusions

3.6.1. Did the pits leak in early 2002?

118 In addition to the mud that was put into pit 1 for a specified period of time in February, 2002, drill cuttings were placed in pit 1 and later in April in pit 3. These would have some viscous drilling fluid around them, that would pool at the bottom of those pits. Most of the workers who were on the site confirmed that although there was a shaker to separate the drilling fluid from the cuttings, it was not one hundred percent successful. Drilling fluid would leak when the screen became plugged, as well, it would pool in the trap that caught the drill cuttings, and then leak from the buckets of the front end loaders picking up the cuttings and moving them to the pits.

119 There was no direct evidence to establish one way or another whether the pits would allow fluid to leak from them in the winter, and specifically in February when the mud was there, and from February to May when the drilling fluid was in the pits, mixed with cuttings, or spilt on the lease site area, while the cuttings were being moved

120 Dennis Baudais, the Pajak engineer responsible for the project had no opinion on the impermeability of the pits. He visited the site only occasionally and did not see pit 1 when it was finished. He relied on George Peterson, the construction consultant for the lease site, to speak to the suitability of the pit. The evidence disclosed that Bob Brooks, the drilling consultant, made an operational decision on the site, in discussion with the mudman, tool push and other workers, to put the mud in pit 1 when it arrived before the tanks. Mr. Brooks testified that he relied on a comment from George Peterson that it was "a good pit". George Peterson in giving his evidence was very defensive. He clearly felt the pits were suitable to hold the material for which they were meant to be used, which at the time they were constructed was drill cuttings and cement left overs, not drilling mud.

121 The decision to put the mud in the pit was made by default. The mud arrived before the tank and the Pajak representative on site decided to put it in pit. It was clear from the evidence of the Pajak employees that no one spent much time and thought as to the possible implications, and no one bothered to take the time to think about logistics such as holding the mud in vacuum trucks while waiting for a holding tank, or testing the pits carefully before placing the mud in them. It was never contemplated when pit 1 was constructed that it would be used to hold a viscous fluid such as drilling mud. Nor were the pits ever filled with water prior to their use, to see if they would hold water. Clearly, pits 2 and 5 that were dug in the fill would not hold fluid, due to their nature, as they were dug in loose fill.

122 It was acknowledged by Mr. Baudais and Mr. Brooks that once the mud was removed by the vacuum trucks there would still be mud left as a residue in the cracks and crevasses of the pit. The action of putting the cement leftovers in pit 1 had the result of sealing over much of the bottom of the pit. Thus, once the issues in this lawsuit arose, no one could actually examine the bottom of the whole pit to see how fragmented or not it was when the mud was held there. The decision to put the cement leftovers in pit 1, was made in the same casual manner as the mud placement, it just happened, without a lot of investigation or thought. The evidence of Mr. Wilf Swann supports this finding. This ultimately meant pit 1 was not large enough for all the drill cuttings and pit 3 was constructed above pit 1.

123 Photographs marked as exhibit 33 indicated quite dramatically that rain and snow melt did accumulate on the lease site and in the pits during the late spring of 2002. It was also the evidence of several witnesses that there was a risk of runoff coming down the steep hill into pits 1 and 5. I find that those two pits were subject to run-off. In May, after a late spring snow fall, substantial amounts of water were vacuumed out of the pits.

124 Mr. Clissold's informal field test illustrated that pit 1 did not hold water in June 2002, and that a fluid with the viscosity of water, rain or run off that collected in the pits, was seeping into the ground. Further, I accept the evidence of Mr. Clissold, who testified that after he drilled the piezometers in June, there was no question that piez 1 and 2 had high nitrates from the site, which had leached out of the pits into the groundwater at the site. The evidence establishes that in April and May, samples of water pooling in pit 1 at the lease site showed influence from the residue left, and picked up chemical constituents from the pit.

125 How does that evidence relate to the mud being held in pit 1 in February? Drilling mud has a higher viscosity than water, intentionally so it inhibits liquid flow into permeable rocks. Also, in the winter there is ground frost in Alberta, the experts were clear that the ground is impermeable when frozen. There was evidence that there were chinook temperatures in February, the temperature information in evidence was a daily entry on the daily drilling report, which indicated one temperature for each day. Around the time the mud was in pit 1, the recorded information showed February 3-plus two degrees, February 4-plus five degrees, February 5-plus twelve degrees, February 6-plus twelve degrees and February 7-plus five degrees. There was no evidence to indicate the influence of those temperatures on the ground around the pits, in terms of permeability, nor is there anything in evidence that allows a finding to be made of exactly when, between February and June, the frost would have come out of the ground around the pits.

126 Mr. John Chan and Ms. Susan Halla, employees of the AEUB testified about the investigation started by the AEUB in April of 2002. As a result of their investigation, the AEUB in communication with Impact, made a statement that: "The sump construction activities have created a situation that *would* (my emphasis) allow **contaminants** to migrate beyond the walls and bottom of the sumps into the surrounding native soil/surficial and geological materials." The AEUB required sumps to be constructed in impermeable soils and in a fashion to prevent collection of surface run off waters. A properly constructed sump will not allow **contaminants** from the drilling waste to migrate beyond the pit walls and bottom.

127 The AEUB investigation was not a hearing, nor a detailed observation by scientists. It was started by a concern that the sumps were not properly constructed for their use, and a reaction to the Blatzs' complaint. Ms. Halla was very precise and careful in her evidence to make it clear that the level 2 infraction referenced in exhibit 1-tab 37 meant there was a potential or immediate risk to the environment. She was also careful to be clear that the wording must be read as it is, that it "would" allow **contamination** to migrate, not that there "has been" such a migration.

128 The AEUB report is not proof that **contaminants** had migrated into faults or geological features. It was based on a field trip by John Chan, who at that time was a compliance inspector. He did a site inspection on May 1 and May 8, 2002. He generally expected a thick layer of clay, or another type of liner to be used in the pits. He saw highly fractured bed rock, and he was concerned that the fluids in the pits could easily percolate down. He was not qualified as an expert, nor did he do anything to establish that percolation had occurred, his observations were that the risk and possibility was there. He acted in the face of obvious concerns, and the AEUB required remedial steps to be taken.

129 One of the fundamental limitations in this case is that there was never any exact chemical analysis of the drilling mud stored in pit 1 in early February. During the time it was there, no one was aware it may have leaked or suspected the investigation that would later result. Compounding this limitation, is the fact that drilling mud does not come in a container with a defined analysis. It is a mixture of different things, which can vary daily, depending on the drilling situation. All that was in evidence about the composition of the mud that was held in pit 1 is a drilling mud report,

reproduced at p. G-30 of Appendix G to the HCL report, which indicated chlorides of 1700 mg/L. This report is not a detailed chemical analysis, rather a notation in a report related to the mud used at another site and later delivered for use in the 3-8 well. Likewise, in terms of the drilling fluid that may have been on the drilling cuttings, there was no specific chemical analysis. Thus, the determination of whether the Blatz 85 well or any other well has been directly or indirectly influenced by the drilling mud or drilling fluid is not a simple question of taking the composition of those fluids and seeing if exact chemical elements or a defined percentage of chemical elements can be traced to the water in a recipient well.

130 Likewise, there is no way to know whether or not there was bacteria, and if so, the type, in the mud or the drilling fluid, or water that accumulated in the pits in the spring. There was evidence by various employees of Pajak, identifying certain items that are put in drilling mud, such as bleach, and chlorine, and their understanding that they are used to kill bacteria. The evidence of Mr. Clissold was that he did not think bleach in drilling mud would kill bacteria, in fact chlorine may just adhere to the clay. From the evidence, all I can conclude is that there appears to be a concern that bacteria may be present in drilling mud, but it was not established that bacteria deleterious to drinking water would automatically be in the mud that was stored in pit 1, or in the drilling fluid mixed with the cuttings.

131 There is direct evidence that the pits did allow water to leak into the ground water after the frost was out of the ground, in the late spring of 2002. There is no direct evidence that this occurred with drilling mud, a more viscous fluid in February of 2002. There is evidence that potential for a leak was there. Thus the importance of the evidence of the experts, Dr. Nowak and Mr. Clissold, is accentuated as they attempted to look at the whole situation to see if they can establish a direct or indirect hydraulic connection between the pits on the drilling site and the Blatz 85 water well. Their evidence is essential, as the other evidence does not establish whether in February, or before May 8, **contamination** did travel from the lease site to the Blatz 85 well.

*3.6.2. Did drainage from the lease site cause **contamination** to the Blatz 85 well?*

132 The first time anyone noticed a problem with water from the Blatz 85 well was in late February when Mrs. Blatz knew her son, Stephen, was commenting about stinky hot water. By mid-March, she noticed that the water had a funny taste. Jennifer Blackie noticed a change of colour in bath water, but could not remember the exact time frame. By early April, there was sufficient family concern that a water analysis was done.

133 As soon as that analysis caused awareness of the increased nitrate levels in the water from the Blatz 85 well, attention turned to the nearby drilling activity. Both hydrologists recognized that the drilling and the livestock were the two most likely sources of the increased nitrates. Initially, both experts suspected the involvement of the lease site activities. In a report to Impact on May 2, 2002, Mr. Clissold advised Impact that if the nitrate readings were as a result of drilling activities, the concentration should decline once the source was removed. The pits were no longer used to hold drill cuttings after the AEUB's involvement, when all drill cuttings were dealt with in a closed system.

134 The area where the pits had been created was fractured bedrock and no clay or other type of liner was used. Pit 1 held drilling mud for a period of days in February, and subsequently held drilling cuttings, which would be mixed with chemical drilling fluids. This clearly could be a source of **contamination** for water.

135 The Blatz 85 well was in close proximity to the lease site, and was down gradient, in terms of water table flow. Initial attempts to locate a plume of **contaminant** were unsuccessful. Monitoring indicated that the spike of dramatic changes in chemical composition in the water from the Blatz 85 well dropped off after May 9. However, the continued testing of the water in that well showed pseudomonads and that the water did not meet the bacteriological standards set for drinking water. Thus, the bacteria issues affecting the Blatz 85 well became a concern.

136 By the fall of 2002, both hydrologists turned their attention to whether they could establish a hydraulic connection between piez 1 and 2 on the lease site, where the water was clearly impacted by the drilling operations, and

the Blatz 85 well. A pumping test was performed, it was subject to different interpretation by them. A dye test which was proposed, never got the approval needed from Environment Canada. The experts were looking for a horizontal or vertical connection.

137 A possible horizontal connection was identified as the sandstone unit at a depth of 7.6 to 9.8 meters just below the casing of the well which both experts suspected was water bearing. This was found by Dr. Nowak in his initial report to likely be a horizontal connection. He felt this water bearing aquifer could be transmitting **contaminated** water from the pits to the Blatz 85 well. At trial, he indicated he was no longer sure of that, and the connection could be vertical (down through the ground, and then into the well at a lower aquifer). He questioned how water was getting from piez 1 and 2 into piez 7, or if it was, or whether it passed below, he did not believe he could tell "with any certain degree of comfort". He indicated that when he wrote his report he felt the problem was top down in the well. However, at trial he was thinking it was a bottom up problem, and so was searching for a vertical connection.

138 In looking for a vertical connection, Dr. Nowak wondered if the cone of depression that is formed from pumping would pull any **contaminants** that water took into solution from the lease site into the water table, that it would then enter the well through the bottom aquifer. He acknowledged that there is not generally a cone of depression as household wells do not operate on a continuous basis. However, Dr. Nowak concluded that there may be some connection that had not been discovered, which meant the water could be pulled into the well in some form.

139 Mr. Clissold, when he reviewed Dr. Nowak's findings, was not certain of a vertical or horizontal connection, and so sought another explanation for the high spike in certain chemical composition in the water in the well in the spring of 2002. He came up with the theory that it was caused by groundwater recharge. His theory and explanation depended on two crucial assumptions that have not been proven in evidence at trial.

140 There were dramatic changes to the water quality in the Blatz 85 well that were present when it was first monitored in 2002, and peaked around May 9, with a significant drop off in the amount of several chemical components after that date. All indications are that the source of these chemical changes is either the drilling, or livestock. The experts agree that livestock **contamination** would not normally result in this dramatic spike.

141 Although the experts could not find a definitive, direct hydraulic connection between piez 1 and 2 and the Blatz 85 well on the testing they undertook, they did not dismiss an indirect connection, and in fact suspected it may be there.

142 I have found no direct connection is shown by the evidence. That said, there were constraints on the ability of the experts to establish their theories, as no chemical analysis of the mud existed, no exact chemical content of the drilling fluid was available and no measurements of the frost in the ground was done. It was clear the pits were transmitting water into the groundwater at the lease site in the spring, and that the pits were not impervious to water at the time. In addition, the geologic formation underneath the lands in question is known to include many fractures, that make the prediction of exactly where water travels more difficult than in other geological areas.

143 When I look at all the evidence, the expert opinions, and the analysis of the evidence set out in this judgment, I find that it was not coincidence that the Blatz 85 well produced a deteriorating water supply from February 2002, and ultimately increased levels of chemicals were detected from the time it was tested in April until early May, at exactly the same time that the defendants were storing firstly drilling mud and then drill cuttings with drilling fluids in the pit uphill, and in close proximity to the Blatz 85 well, and upgradient in terms of ground water flow. I find the plaintiffs have proven on the balance of probabilities that there was seepage from the pits and lease site of water that had been in association with the mud and drilling fluids, and that the water through an indirect connection **contaminated** the water in the Blatz 85 well, affecting the chemical composition of the water and making it unsafe for human consumption by the CDWS until July, 2002.

144 There is ample evidence to show a source for **contaminants** to the water: (1) water leaching through the mud placed in pit 1, (which the evidence established had the viscosity of butter milk); (2) the collection of rain, melting snow or run off that was flowing into and collecting in pit 1 and picking up chemical qualities from the drill cuttings placed there with some drilling fluid; and (3) drilling fluid spilt on the lease site as the front end loaders carried the drill cuttings. The evidence discloses that both experts suspected either drilling or livestock **contaminants**, but the amount and volume of the spike was not consistent with the general pattern expected from livestock fouling. No explanation but the lease site activities was proven as a reason for the dramatic chemical change in the water from the Blatz 85 well. The only data available close in time to when mud was stored in pit 1, specifically February 18, 2002 at the Tom Adams well (down gradient from the lease site) showed a dramatic increase in its chloride content, being an increase of 220 times.

145 The chemical **contamination** did not last a long time, and in fact, from July 2002, both experts agree that the chemical content of the water would allow its consumption under the CDWS. Unfortunately, bacteria problems were identified in the well in the early summer of 2002. Non-use of the well as a result of the initial **contamination**, coupled with the reality that the well is completed in multiple levels, including one that is susceptible to groundwater bacteria **contamination**, allowed nuisance bacteria to become well established in the well. In conclusion, I find the defendants liable for the chemical changes and bacteria problems that resulted in the Blatz 85 well.

*3.6.3. Did drainage from the lease site cause **contamination** to any aquifer supplying the Blatz 85 well?*

146 When I consider the evidence, and the analysis of the evidence of the experts set out in paragraphs 81 to 94 above, I do not find that activity on the lease site caused bacterial or chemical **contamination** to any aquifer that is supplying the Blatz 85 well or otherwise underlying the Blatz lands. I accept the evidence of Mr. Clissold and find it more convincing on this point than that of Dr. Nowak.

147 To the extent there is undesirable bacteria in the Blatz 85 well, and I find that there is, I find on the evidence before me that its cause is related to the **contamination** and resulting non use of the well, and not aquifer **contamination**.

*3.6.4. Did drainage from the lease site cause **contamination** to or under the subdivision lands?*

148 A substantial dollar amount of the damages claimed relates to the allegation that the activities of Impact on the lease site **contaminated** the water supply to the subdivision lands, and has impacted the ability of Mr. and Mrs. Blatz to continue forward with their plan of a subdivision. The onus is on the plaintiffs to show that the activities of Impact **contaminated** the water supply to the subdivision lands.

149 The geology underlying the subdivision lands is a fractured area, so it is subject to many uncertainties of exactly where water will be found. Both experts testified about this generally in relation to the Priddis area. This factor means dry holes may be drilled very close to good water wells, and there is unpredictability about what underground water may be doing. However, even in a fragmented region water does not run uphill, it will be driven by the fluid potential, and can only go one way. All ground water, once it hits the water table, flows with the water gradient, which the evidence establishes is to the northeast from the lease site. This would then suggest that any **contamination** that may have entered the groundwater from the lease site activities would ultimately move with the gradient flow to the northeast towards the Blatz 85 well but away from the subdivision lands.

150 Piez 4 was located near to the subdivision lands. Piez 4 was drilled at an elevation that is above that of the lease site, so it is not deep enough to encounter anything that may have come from the pits as it is uphill from the lease site. Piez 4, during the period of years it was monitored, had an instability in its water chemistry. Dr. Nowak could not account for the significant change in water quality in that piez during the years it was monitored. Dr. Nowak's only explanation as to how piez 4 could be impacted from the lease site activities, if at all, was that there was some construction activity

in proximity to piez 4 in terms of material being moved for the road construction. Interestingly, any construction done for the road would have been needed for the subdivision in any event, as the road was specifically built by Impact to the subdivision standards at the Blatzs' request, as outlined in the lease entered into between Impact and Mr. and Mrs. Blatz.

151 On the subject of the instability at piez 4, Dr. Nowak testified: "Whether I can associate that instability with the lease site, I'm not prepared to say at this time."..."I am not able to say whether that swing in water chemistry from the highs and lows can be attributed to any activity that would have occurred at the lease site itself, the Impact lease site."

152 Dr. Nowak gave the only evidence that suggested **contamination** could have occurred at the subdivision lands. His direct examination as to whether the water that he says is likely to exist underneath the lots in the proposed subdivision would be **contaminated** as a result of the activity on the lease site, was the following:

> The only evidence I can provide in that matter is the fact that the anti-cline has two slopes to it, so that water drains off each of the slopes. The subdivision happens to be on the southwest side of the anti-clines. So there's the potential for that to happen, but there's no site specific data to confirm that.

153 Mr. Clissold gave no opinion that suggested the lands under the subdivision were **contaminated** as a result of activities on the lease site.

154 No steps had been taken by the plaintiffs after the spring of 2002 to drill any type of well on the subdivision lands, and have the water tested, or take any steps to prove water for the M.D., which would be the next step in the subdivision. Mrs. Blatz testified she did not want to drill a well or take steps to prove water on the subdivision as she did not want it to become public knowledge that there was polluted water or **contamination** on the subdivision lands, if that was found. She testified that she understood the results of all water testing had to be in the public domain. In contrast, Dr. Nowak was clear in his evidence that although the fact of drilling a water well is a matter of public record, there is no requirement to provide any information about quality of water, and in fact, that has not been required since 1986. He testified that there was no reason he saw to stop the Blatzs' from drilling individual wells to attempt to prove water on each lot.

155 When I consider this above analysis, I do not find that the plaintiffs have proven on the balance of probabilities that the water at or under the subdivision lands has been affected or **contaminated** in any way by the activities of the defendants on the lease site.

4. The Application of the Law to the Findings

156 Under the *Rylands v. Fletcher* principles, the plaintiffs have proven that the defendants, in the course of storing drilling mud and drilling the well, kept on the lease site substances that could cause damage if they escaped. They were stored in a way that they were in association with water that escaped into the water source. The defendants are responsible for the damages which are the natural consequence of this escape, being the damage caused to the Blatz 85 well. In terms of allegations that **contamination** has occurred to aquifers feeding the Blatz 85 well, or to aquifers or water under the subdivision lands, those allegations have not been proven by the plaintiffs.

157 In relation to the claims advanced by the plaintiffs in nuisance, the application of the law to the facts results in a similar finding, to the application of the *Rylands v. Fletcher* principles.

158 In relation to the claim framed in negligence, the duty of care owed by the defendants was never in issue. The facts support a finding that the defendants breached the duty of care they had by allowing **contaminants** to leak from the pits and lease site, and **contaminate** the water chemistry of the Blatz 85 well in the early spring of 2002. The lack of use of this well caused by the **contamination** lead to bacteria problems in the well. On the facts, the plaintiffs have not

proven that the breach of care resulted in **contamination** to the aquifer supplying that well, nor did it **contaminate** the aquifers or water under the subdivision lands.

159 The plaintiffs appeared to argue that as it was impossible for experts to say exactly what water does underground, and since there are only two obvious sources for the problem in the well, either animal waste or oil drilling activity, the court should look to the material contribution test, rather than the "but for" test set out in *Hanke*. They argue that the breach of the duty by the defendants exposed the plaintiffs to an unreasonable risk of injury, and that the injury that was sustained should be found to be to the Blatz 85 well and to the aquifer and the subdivision lands.

160 I do not agree. The test is and should be the "but for" test. Here, experts can testify about the hydraulic connection between the lease site and the Blatz 85 well. They expressed opinions as to whether, with all the information they had, they would say the storage of the mud and the drilling waste caused the problems in the Blatz 85 well and whether that involved aquifer **contamination**, and whether the water under the subdivision lands has been negatively affected. Science can address these issues. The fact that there are conflicting opinions is not a reason to look to the material contribution test. This is not the type of situation as found by McDonald J. in *Ball v. Imperial Oil Resources Ltd.*, 2008 ABQB 765 (Alta. Q.B.), where he applied the material contribution test to find a causal connection between the hydrocarbons on the land and the problem in the livestock. Rather, this case is largely decided on the analysis of the expert evidence and the finding of facts to determine what damages were actually proven to be suffered by the plaintiff. I find in all the evidence that the plaintiffs have established on the balance of probabilities that the drainage from the lease site caused **contamination** to the Blatz 85 well.

4.1 The contract claim

161 Mr. and Mrs. Blatz advanced a cause of action based on a breach of contract, arguing that Impact had broken the terms of the lease agreement. They point to the following three specific clauses in the lease agreement:

> Clause 3 provides an indemnity:
>
> The Lessee shall indemnify and save harmless the Lessor from and against any and all claims or demands that may result from the Lessee's use and occupation of the leased premises, other than through willful damage or gross negligence by the Lessor.
>
> Clause 9 provides for compensation for damages:
>
> The Lessee shall pay compensation for damage done by its servants and agents which, without restricting the generality thereof, shall include crops, machinery, livestock, fences, buildings, or other improvements of the Lessor upon the said lands other than the leased premises.
>
> Clause 13 provides for compliance with laws and regulations:
>
> The Lessor and the Lessee shall comply with all applicable laws and regulations as may be in force from time to time, and any other *Act* pertaining to the activities herein, and the regulations passed thereunder.

162 The argument relating to clause 3 of lease is that the contract creates an obligation for Impact to indemnify Mr. and Mrs. Blatz for any claims or demands arising from Impact's use and possession of the lands. It is argued this does not only relate to third party claims, but in addition claims that the plaintiffs may have from Impact's conduct on the lease site.

163 Two cases which provide guidance on the question of whether an indemnification clause can give the right of indemnity to a party to the contract are *Mobil Oil Canada Ltd. v. Beta Well Service Ltd.* (1974), 2 A.R. 186 (Alta. C.A.) and *TransCanada Pipelines Ltd. v. Potter Station Power Ltd. Partnership* (2003), 172 O.A.C. 379 (Ont. C.A.). The

decisions very much turn on the wording of the clauses and the intention of the parties. The *Mobil* case looked at wording that indemnified for claims against Mobil, or which it may sustain as a result of performance or non-performance. The court found that the clause was an undertaking to indemnify against claims of third parties not direct claims of Mobile. The *TransCanada* case found that there was liability for the direct losses of *TransCanada*, mainly as a result of wording that stated that the indemnity was against all actions brought against but also "suffered by" TransCanada.

164 Here the clause is more general, as it is to indemnify and save harmless the Blatzs from claims "that may result from the Lessee's use and occupation of the leased premises", and then goes on to exclude those "through willful damage or gross negligence by the Lessor". When I consider this wording, in the situation of the parties, I find this clause is meant to address third party claims against Mr. and Mrs. Blatz, it does not contemplate damage caused to the Blatz family as a result of Impact's use and occupation of the leased premises. There is no specific language such as in the *TransCanada* case that talks about damages suffered by the lessors.

165 In addition, reading the lease document in totality, clause 9 appears to address damages caused by Impact's agents and servants, and specifically mentions property of the Lessor on lands other than the leased premises. This clause would appear to be more applicable to damage caused by Impact to Mr. and Mrs. Blatz.

166 Clause 13 requires that Impact comply with the applicable law and regulations. The plaintiff argued that breaches had occurred of section 8.151 of the *Oil and Gas Conservation Amendment Regulation* (OGCA), Alta Regulation 36/2002, section 109(2) of the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. E-12 (*EPEA*) and AEUB Directive 050: Drilling Waste Management.

167 Section 8.151(2) of the OGCA specifies the duty of the licencee of a well to ensure that earthen excavation at the well site does not collect natural run-off water and is located and constructed that it will not allow **contaminants** from the drilling wastes to migrate beyond the pit wall and bottom.

168 Section 109(2) of the *EPEA* restricts a person from releasing into the environment a substance that causes or may cause a significant adverse effect, which is defined as an impairment of or damage to the environment, human health or safety or property.

169 AEUB Directive 050 is a detailed document of over 100 pages dealing with Drilling Waste Management.

170 This action is not the forum to deal with whether there have been statutory breaches, as that is the domain of the regulatory groups designated by the legislature with this power. Here, there was no finding by those boards although the AEUB did step in and make directives when it appeared there was a problem with the water well, and it insisted on remedial steps to install a closed system, to forestall the potential of any further environmental damage. Breach of a statutory directive is a factor to consider in establishing negligence, but here the duty of care is clear and the issue of breach is a factual causation issue.

171 Any breach of a statutory directive may give rise to remedies under the *Act*. It does not change the fact that for the plaintiffs to receive damages for breach of a contractual term, they must prove what damages result from the breach of contract. On the facts, this is the **contamination** to the Blatz 85 well. Thus the damages allowable under any breach of contract are the same as those for the nuisance and negligence found in this case.

5. Damages

5.1. Damages for the contamination of the Blatz 85 well

172 The **contamination** to the Blatz 85 well started with a murkiness. The April test showed water that was unsafe to be used for drinking. Both experts acknowledged that by July 2002, the water was safe for human consumption by the

CDWS. However, both experts acknowledged that the bacteria fouling that existed in the well in July and subsequently means that the well cannot be used as it currently stands. The disuse of this well for a number of years as a result of the **contamination** and litigation means that the plaintiffs will be obligated to at a minimum have the liner pulled and the well recompleted and then shock chlorinated, (possibly a number of times) or at maximum, to drill a new well.

173 Neither party offered evidence on the exact cost of recompleting the well. Kirk Morrison, a professional engineer who gave opinion evidence about costs, estimated the cost of drilling and completing an individual well at $10,000 to $11,000. The exact amount, of course, would depend on the depth of drilling that is required to hit water. Also, with all the challenges of finding water in the Priddis fractured area, it is conceivable that the first try may be a dry hole. All the evidence suggested that finding water should not be a large problem, multiple dry holes are unlikely.

174 In the circumstances, I award Mr. and Mrs. Blatz, the owners of the land and well, damages of $30,000, so they can explore refinishing the well and have the option to drill a new well. I recognize that if they drill a new well, there is a risk it could be a dry hole, and thus I have assessed the damages on the high end to cover this eventuality.

175 I recognize that recompleting the well, or drilling a new well, does not guarantee exactly the quality or quantity of water which the Blatz 85 well produced before 2002. However, the evidence at trial was clear that the fact someone has an operating well is no guarantee that it will always operate to that quantity and quality in the future. Both experts were critical of the finishing of the Blatz 85 well, and suggested it may be more subject to biofouling in the way it is currently finished. The assessment of $30,000 covers a number of options for the plaintiffs and is fair in all the circumstances of this case.

5.2. Personal Injuries

176 Most of the plaintiffs testified about various medical ailments they had suffered sometime in March or April of 2002. In summary form, they were as follows:

1. Mrs. Blatz-suffered a bladder infection in May, for which she was treated for five days with antibiotics. She felt better two days after the start of treatment. She also had diarrhea for a little over a week in April.

2. Finn Blatz-the baby of Jeff and Shelagh Blatz, who was born March 23, 2002 had a skin rash during April, and some diarrhea.

3. Martie Blatz-who was just over two years old, complained in May that her vagina hurt, and she had stomach cramps.

4. Shelagh Blatz-suffered a bladder infection in early May. She was treated with a course of antibiotics.

5. Mr. Blackie-reported sudden onset diarrhea at the end of March, into the beginning of April.

6. Jennifer Blackie-complained of mouth sores in early April for two weeks, and a bladder infection in May. She was not treated for the sores, she took a course of antibiotics for the bladder infection.

7. William Blackie-who was three years old, had mouth sores for two weeks and diarrhea for one week, which interfered with his potty training.

8. Veronica Blackie-who was one year old, had mouth sores.

9. Mr. Blatz-had a collapse on March 17, 2002, due to chest pains. He was hospitalized March 17 to 29, and investigated for heart problems. He was ultimately diagnosed as having an esophageal problem, which he described

as an inflammation of his esophagus at the entrance to his stomach. He reported a weakness through the summer of 2002 that affected his performance and ability to work.

177 In terms of all of the medical issues reported, other than those of Mr. Blatz, they were minor ailments that lasted at most a few weeks. Veronica was the plaintiff who had sought medical treatment, and records indicated that she had a past history of sores, that may be herpetic. No medical witnesses were called to link any of the ailments which the plaintiffs suffered to the water problem.

178 It is a matter of common sense and wide knowledge that diarrhea can be caused by drinking **contaminated** water. I consider that I can take judicial notice of this fact. Also, as the outbreak was so prevalent amongst the plaintiffs drinking the water, the link between that ailment and the water is proven. However, without some medical evidence, there is no evidence to link mouth sores, or bladder infections to impure drinking water. That is not something of which I can take judicial notice, as I do not consider it to be accepted or well accepted in public knowledge.

179 The quantification of damages for bouts of diarrhea lasting one or two weeks is at a minimal level. Health is an important personal issue, and the law should guard carefully the health of citizens from careless interference. However, an assessment of damages is done by the application of established set legal principles which look to the permanence of any injury, the interference with usual life activities, the treatment taken, and the diagnosis and prognosis for recovery. Damage awards are not significant for transient conditions that lasted a few days to a week, required no medical attendance and left no permanent consequence.

180 I assess damages at $1,000 for Mrs. Blatz, Finn Blatz, Mr. Blackie and William Blackie who suffered from diarrhea, as well as for Martie Blatz who complained of stomach cramps, another ailment frequently associated with drinking **contaminated** water. In addition, I assess $1,000 in damages for Shelagh Blatz and Jennifer Blackie, the two mothers of the young children who were affected, who clearly from the evidence, did the lion's share of the work and worry associated with caring for their young children, getting information about the water, and for the stress of the event, as it related to the health of their young families.

181 In relation to the medical problems of Mr. Blatz, he referenced an operative diagnosis sheet after a gastroscopy, which discussed an ulcerative diathesis. No medical evidence was called to explain the investigations, the diagnosis, or provide any evidence in terms of causation of this type of medical ailment. Plaintiffs' counsel argued that the fact this disease was inflammatory and near the stomach should be sufficient to find it was caused by the water problem. I disagree. Expert evidence is required to link a medical condition that is not a common or usual ailment in every day life to a cause such as **contaminated** water. This is not something of which a Court could take judicial notice. It is a league away from the type of common knowledge that a virus causes influenza, or that **contaminated** water may cause diarrhea or stomach cramps. I cannot say on a "but for" test, or even the "material contribution" test, if it applied, that the plaintiff has produced evidence to satisfy the causation test, in relation to the medical ailments suffered by Mr. Blatz starting in March 2002.

5.3. The loss of income claim of Mr. Blackie

182 Mr. Blackie advanced a loss of income claim to compensate him for the time that he spent away from work dealing with the concern about the water. This involved: getting the water tested; communicating with individuals from Impact and the AEUB; meeting the experts who came to the Blatz lands; and obtaining adequate service for replacement water.

183 Mr. Blackie was working as an equipment operator for Blatzies in the spring of 2002, and was paid just under $20 an hour for actual equipment operation hours. At trial he relied on exhibit 1, tab 21 that outlined 341 hours to represent the time for which he should be compensated. He originally advanced a claim based on $140 an hour, a rate he claimed

was allowed by the AEUB for administrative services. He testified he was willing to reduce that rate to $70, and claimed $25,000 (roughly 341 hours at $70=$23,870).

184 It was clear from his evidence that the 341 hours was only a rough attempt to recapture the hours he noted in his day timer. The times set out were not exact, nor did he spend all the time himself. This list included substantial portions of time that his wife, Jennifer, spent taking children to the doctor, or talking to the health unit.

185 There was also testimony from Mrs. Blatz that Blatzies had paid Mr. Blackie his annual wage, but he was paid a minimum of one day a week when he was dealing with water issues. There is a conflicting claim here, as Mrs. and Mr. Blatz in their loss of income claim are claiming reimbursement for $14,605, which they say represents money paid to Mr. Blackie for this time when he was actually not working on Blatzie's business, but rather interacting with Impact, its engineer and consultants. As any claim of this type would properly be by the company, Blatzie's, which was not a plaintiff in this action, it is more appropriate to deal with any claim that arises for loss of wages as a result of time spent by Mr. Blackie dealing with **contamination** issues as a claim personal to him.

186 It is fair on the evidence to compensate Mr. Blackie at the rate he was paid, $20 an hour, for time he had to spend dealing with problems to the water well caused by the defendants, which he otherwise could have spent driving equipment, and earning an income. I set this amount at $4,000 calculated at $20 an hour for 200 hours.

5.4. Mr. and Mrs. Blatz's loss of business income claim

187 Mrs. Blatz prepared a summary of a loss of income claim alleged to be sustained by herself and Mr. Blatz. This was based on the fact that they together owned and operated Blatzies through the company Blatzie's Backhoe Services Ltd. The claim is based on the fact that Mr. Blatz's health after March 2002 made it impossible for him to participate in the management, sales and operation of the business. Mrs. Blatz testified that her duties as office manager were disrupted as she took an active part in the treatment of Mr. Blatz. She outlined the claim in exhibit 1-tab 19. She broke it down as $223,000 for loss of income and extra expenses in the backhoe operations, $100,000 loss of income due to loss of goodwill and $87,000 loss of loader oilfield operations for a total claim of $410,000. Mrs. Blatz in her testimony indicated she was willing to accept $200,000 in the spirit of compromise.

188 This claim is not allowable, as the medical problems experienced by Mr. Blatz in the spring and summer of 2002 have not been causally linked to the conduct of the defendants. I would also comment that the calculation of this claim was very rough and ready, it was based on a general suggestion that there was a decrease in work, as it became widely known that Mr. Blatz was ill and thus people did not request his services. No evidence of any customer was called, nor was an accountant involved in formulating or testifying about the claim. Many issues arise, including who would be entitled to bring the claim legally, the company or Mr. and Mrs. Blatz, as well as issues raised on cross-examination about how dependant Blatzies was on certain oil and gas customers for their revenue. However, those issues need not be dealt with, in light of the fact that no damages are payable by the defendants in relation to this part of the plaintiffs' claim.

5.5. The loss of livestock claim

189 Mr. and Mrs. Blatz advanced a claim for $243,000 for loss of future income that they alleged they would have gained from their livestock. They sold their cattle herd in the summer of 2002, for fair market value, when it became evident that Mr. Blatz's medical condition made care for the cattle too difficult. A calculation of the number of offspring that could be anticipated in the future for each of the cows sold was made, and a value attributed to that. Mrs. Blatz at trial, testified that in the spirit of reasonableness, she would reduce this claim to $50,000.

190 There is no basis for this claim in law, as the sale of the herd cannot be causally linked to the conduct of the defendants. Further, as the cattle were sold for fair market value in August 2002, and money was received for the sale,

and could be invested, any legal basis for the claim is hard to understand, and could not be justified on the evidence called at trial.

5.6. The claim for the cost of a water purification system for the subdivision lands

191 The plaintiffs argued that the government agencies that regulate the matter of subdivision in the M.D. and the provision of water to the subdivided units, would not allow any parcel to be subdivided without a full water treatment facility and distribution system. This claim was advanced on the basis that if there has been a breach of a duty of care, the obligation of the tortfeasor should be to put the plaintiff in the situation he or she would have been, had the injury not occurred. Here the plaintiffs argue that they were about to prove water on the subdivision lands and then get subdivision approval and market the separate lots. Now, they argue that they are unable to do so due to the **contamination**. It was argued the obligation then is to provide the cost of a water purification system and the cost of its operation in perpetuity for the subdivision lots, so they can be subdivided once quantity of water is proven.

192 Mr. Kirk Morrison was qualified as an engineer able to give opinion evidence in that field. He testified that on the assumption that the water aquifer that would serve each individual well to be drilled on each lot was **contaminated**, the cost of building a water purification plant that would deal with **contaminated** groundwater, as described in Dr. Nowak's report, was $2,819,000 and the annual cost of operating it would be $62,800 a year. Economic expert evidence suggested that if a discount rate of 2.98% were used, the present value to operate the water treatment plant in perpetuity would be $2,974,024. Thus, the total claim advanced by Mr. and Mrs. Blatz for a central water purification plant to service in perpetuity the whole subdivision lands was $5,793,024.

193 The process for Mr. and Mrs. Blatz to apply to subdivide their land involved them first proposing an ASP, which is essentially a conceptual plan of what the developer wants to develop. This is presented to the municipal council. There is a public hearing, and then a vote. If it is approved, the next step is the predesignation of the land from agricultural to country residential, which requires a paper study to show water availability. The actual physical subdivision of the title requires proof of water for each title. The proof relates to quantity, not quality, of the water, as many of the acreage wells are the subject of water treatment. Once water for the lot is proven, at that point, the separate title is created and can be sold.

194 Mr. Riva, an employee of the M.D. confirmed that at the ASP stage, some evidence is necessary that there is a possibility to produce water. Then it is necessary to prove water, and the usual way is to drill individual wells on each lot, which are generally not licenced. It is possible to come forward with a proposal for communal water distribution, the owner has to prove there is a system that provides sufficient water to meet the needs of the subdivided lots.

195 Dr. Nowak testified that it is generally a term and condition of the actual subdivision phase to drill and install a well on each individual lot and to conduct a Q-20 test, which involves a twelve hour pump and a twelve hour recovery period and a hydrologist's report confirming sufficient water production. The sole test in terms of water is whether there is a well on each lot that could sustain 1,250 cubic meters of water per annum over an extended period of twenty years, without adversely affecting the other subdivision lots or the other surrounding users.

196 There was a substantial issue at trial as to whether the subdivision proposed by Mr. and Mrs. Blatz was intending to use individual wells, as indicated by Mrs. Blatz in her evidence, but with the option left open to use communal wells, if necessary; or whether the intention all along was to use a communal well system. The defendants spent substantial time concentrating on the wording of the ASP which referred to communal wells to provide potable water service. There was also reference to the Whiskey Springs Ridge being serviced by individual wells licenced for communal system use.

197 Geoffrey Blatz, who had worked on mapping the subdivision, testified that his parents wished to keep their options open as to how to provide water, but intended to do it in the most economical manner. He indicated that it was

recognized that there may not be water to allow a well on each lot, there may have been a need for some commonality of water sources. Christie Beunder, the planner assisting Mrs. Blatz with her ASP, testified that the intention was to service the lots with water in the most economical fashion. Her evidence was that this would be individual wells on each lot, if it was possible to drill a suitable well for each. She recognized that it may have been necessary to use communal wells to service one or more lots, but that would not be known until steps were taken to drill an individual well for each lot.

198 Dr. Nowak confirmed in his evidence and his 2005 report, that when he was contacted by Mrs. Blatz in the spring of 2002, after the December 2001 well test, the intention as he understood it was to use either the Blatz 85 well, the 2001 well or both as a communal well source at least as proof of water for the proposed subdivision. He was specific that he was to give an opinion as to whether or not the wells would be suitable for a communal well, not whether there was enough water in the wells to supply the proposed subdivision. He advised at that time, that neither the Blatz 85 well or the 2001 well were completed to a standard acceptable for licencing purposes under the *Water Act*. Both wells failed to achieve the recovery necessary. There was not enough water to fulfill the requirements for a communal well. His advice at that time was that Mr. and Mrs. Blatz should re-complete the wells and test, or drill a new well or wells and conduct appropriate pump tests.

199 From this evidence, I find that Mr. and Mrs. Blatz clearly had the intention to subdivide their land and attempt to sell lots as a source of revenue. They had taken steps to provide an ASP, and took advantage of Impact's interest in drilling on their lands, to negotiate a road built to subdivision standards and to receive financial assistance towards the twelve hour pump test necessary to get Dr. Nowak's opinion as to water capacity. Despite comments recorded at the public hearings, and the strict wording of the ASP, which could be read to suggest that communal wells were being contemplated for the subdivision, when I consider the evidence, especially that of the experts, and take into consideration that this was a development being done privately on a shoestring budget, the economics would dictate ultimately requesting subdivision approval with individual wells on each lot, with any communality of wells considered only if water could not be found on any particular lot.

200 As the plaintiffs have not proven that the water aquifers or water beneath the subdivision lands were **contaminated** as a result of the activities of the defendants, they cannot prove that a water purification plant or a communal supply of water is necessary or caused by an inability to rely on individual wells to do their subdivision. Their claim would only be provable if it was proven that the Blatz 85 well was going to be providing water to the subdivision lots and that water source cannot now be used without purification.

201 The evidence is clear that just before any **contamination** to the Blatz 85 well, Dr. Nowak did not believe the Blatz 85 well and the 2001 well were sufficient to prove water for the subdivision lands. He suggested at a minimum that the Blatz 85 well would have to be refinished and retested. It is thus difficult to say that the Blatz 85 well would have been used to provide water to the subdivision, if some type of communal water was required. The evidence before me is clear that a central, communal water system using the Blatz 85 well, due to its location, would require piping through bedrock and would likely be uneconomical. Further, Mr. Liyanage, an engineer, detailed in his evidence and his report (exhibit 51) that there may be concerns about the Blatz 85 well being under the influence of groundwater, which would lead to issues licencing it with Alberta Environment to supply a communal well without some form of water treatment. When I consider all of this, I do not find that the Blatz 85 well was an integral part of the water service for the subdivision plan, so that the **contamination** that I have found was caused by the defendants entitles Mr. and Mrs. Blatz to any higher damages than the cost of relining and cleaning the well or drilling a new well to replace it.

202 Further, and in the alternative, Kirk Morrison a professional engineer who gave opinion evidence about water treatment, did testify that the economies of a central water system would mean the development is "economically challenged" to say the least. He was clear that the cost of providing a central water purification service would be extremely expensive. He estimated the cost of drilling an individual well at ten to eleven thousand dollars a lot plus maintenance

of about $200 a year. The capital cost of building a water purification plant would be $156,000 per lot, with operating costs estimated at around $5,000 a lot per year. From this I doubt that the subdivision would go ahead with a water purification plant system. Also, the Blatz's would never have been under any obligation to provide a permanent pure water source in perpetuity to perspective buyers. Thus, if damages were legally owing by the defendants to the plaintiffs for **contamination** of a water source under the subdivision lands, the most realistic way of determining them would be the loss of profit to the Mr. and Mrs. Blatz for a failure to be able to subdivide the lands, as their aim in doing so was profit.

5.7. Punitive damages

203 The plaintiffs requested that punitive damages be assessed against the defendants. The factual background on which these damages were claimed were as follows: (1) that Impact intentionally decided not to test the Blatz 85 well prior to or during drilling, (2) that Impact did not immediately tell the plaintiffs not to drink the water, and they neglected to tell them not to boil it to drink and not to bathe in it, and (3) that the act of putting the cement left overs in pit 1 was a deliberate cover up, so people could not inspect the bottom of the pit which had been used to hold the drilling mud, which the defendants knew had been problematic.

204 Punitive damages are an extraordinary remedy, used when egregious conduct has been exhibited by one party to another. They are restricted to advertent wrongful conduct that is malicious and outrageous and deserving of punishment. The conduct must be harsh and vindictive, as well as extreme, so that by any reasonable standard it is deserving of punishment: *Vorvis v. Insurance Corp. of British Columbia*, [1989] 1 S.C.R. 1085 (S.C.C.) and *Keays v. Honda Canada Inc.*, 2008 SCC 39, [2008] 2 S.C.R. 362 (S.C.C.).

205 The only evidence about the lack of testing done to the Blatz 85 well arose in evidence from Mr. Clissold that HCL was directed by Impact not to perform the background or baseline testing that was routinely done on the other water wells in the area. Neither Mrs. nor Mr. Blatz, nor Impact dealt directly with this issue in their evidence. The written Agreement in Principal, exhibit 8, was signed July 3, 2001 between the parties. It indicates that Impact agreed to pay for one half of a 48 hour test of the Blatz 85 well. The agreement also outlined a number of other agreements, including the use of Blatzies to do work on the lease site and to rent equipment for use on the property. The 48 hour test was needed by Mr. and Mrs. Blatz for their subdivision application, and obviously there must have been some discussion about the testing, and a reason to choose this type of testing to be funded by Impact. There was no evidence, direct or indirect, that suggested that Impact or Pajak tried to suppress testing or not provide it to the Blatz family because they knew or feared there would be some problem with the well. I do not find from the evidence any indication of an intentional motive to avoid testing the well in order to hide or hinder detection of any damage that may occur. Neither am I willing to infer that intention from the facts that have been proved.

206 In relation to the second ground for punitive damages, the evidence suggests Mr. Blackie received the water analysis report on the sample on April 8. This was not a new procedure to the Blatz family, Mrs. Blatz's evidence was that water from the well was tested and reported on yearly. Mr. Blackie had the ability to ask and get information about the test results, and he indicted he could tell the nitrates were high. He gave the test to Mr. Fitzsimmons, the communications person on the site for Impact who sent it to the Calgary office of Impact, a corporate entity that had no in-house expertise on water quality. Impact immediately sent it to Mr. Clissold who did his own testing. On April 26, Impact, on Mr. Clissold's advice, advised the Blatz family that the water from the well should not be used for drinking, and provided an alternate water source. The Blatz family started boiling the water to use until April 30, when discussion with the public health nurse disclosed that this did nothing to mediate any nitrate/nitrite concerns with the water.

207 I do not find that a punitive damage award is appropriate because approximately fourteen days went by from receipt of the test results by Mr. Blackie until notification by Impact not to drink the water. In the circumstances presented here, the Blatz family had done the testing, had access to the information, and the health consequences to the families

were not severe. In making this decision, it is an important factor that the elevation of nitrates in the sample of April 8 was small, a reading of 10.7, whereas the limit prescribed by the CDWS was 10. Mr. Clissold testified that if the elevation had been significantly more, he might have taken a different approach, but at the time he wanted to do independent testing to verify the result. He indicated that one would notify immediately if there were components such as fecal coliform present, or if the elevation was a larger amount. I do not find that Impact acted irresponsibly or maliciously in failing to inform the Blatz's not to drink the water, or to provide an alternate water source until April 25, 2002.

208 In relation to the suggestion that the placement of the cement returns in pit 1 was a deliberate cover up, there was no evidence to support that allegation. It was established that the smaller pit 4 was designed to hold waste cement. The decision making to place the cement in pit 1 appeared as lackadaisical as the decision to put the mud in pit 1. There is no suggestion that anyone had any inkling that the mud might be leaking, or there was any problem to the water well until April, long after this decision had been made.

209 As a result, the claim for punitive damages is dismissed, as the facts in this case do not support a remedy of this type.

Conclusion

210 The defendants are liable to the following plaintiffs for damages:

1. for the damage to the Blatz 85 well, total damages of $30,000 to Mr. and Mrs. Blatz as the joint owners of the well;

2. for **personal injuries**: $1,000 to each of the seven plaintiffs: Mrs. Blatz, Finn Blatz, Martie Blatz, Mr. Blackie, William Blackie, Shelagh Blatz and Jennifer Blackie;

3. for loss of wages, $4,000 to Scott Blackie.

211 If the parties cannot come to an agreement in relation to the costs of this action, either party is at liberty to bring an application in that regard.

Action allowed.