From: ernstj
Sent: 5 octobre 2008 14:27
To: <JRP>

Cc: <removed CEAR>
Subject: EnCana fined again for violating legislation

<address of recipient removed, CEAR>

To the CEAA, ERCB, Joint Review Panel, and Alberta Justice,

Re: EnCana fined again for violating legislation, for posting.

EnCana's recent gas well blow out at Suffield and the articles below provide more reasons to refuse EnCana's application to speed up profits and risk listed species in the National Wildlife area.

I find it suspicious and protest that the CEAA did not send out an information release to interested parties about EnCana's blow out, notably given that the hearing begins on Monday and this EnCana statement (highlighted in green below) in Submission *Vol. 1, Section 2: Project Description, 2.2.5.3 Blowouts and Surface Casing Vent Flow*:
"In over 30 years of operations at CFB Suffield, there has never been a gas well blowout."
Why did the CEAA not notify interested parties *before* the hearing that EnCana's no blow out boast is busted? Or did EnCana and the ERCB not tell the CEAA about the blow out? If not, why the hush hush?

The articles copied below report that our Prime Minister protests drilling in Alaska's Arctic National Wildlife Reserve to protect listed species in Canada. Even our Prime Minister recognizes that drilling in national wildlife areas puts listed species at risk. One of the articles below reports EnCana violating - yet again - regulations that are in place to protect the environment. And again, EnCana is reported denying responsibility.

Does EnCana ever admit to the company's many regulation violations? Does denial make EnCana's violations acceptable to Alberta Justice, the CEAA, ERCB, and Joint Review Panel? Do the CEAA, Joint Review Panel, ERCB and Alberta Justice think it acceptable for EnCana to secretly invade the fresh water aquifers in my community, violate the *Water Act* and *Water (MInisterial) Regulation* and when water well problems began, lie and deny, and walk away from responsibility while drilling and fracturing more and more and more wells? Do the CEAA, Alberta Justice and Joint Review Panel think it is acceptable for the ERCB to cover up EnCana's non compliance using a Directive created more

than two years after the fact? I respectfully request accountable, transparent, complete and non deflective answers to my questions.

The CEAA and or ERCB deflecting my valid and reasonable questions in past submissions aptly fits the reported bias and unfairness of the ERCB. EnCana's own data proves that the company was dishonest when it wrote: "EnCana complies with all regulatory requirements" in Vol 1, Section 2.2.5.4, entitled *Water Contamination* (highlited below in red for your convenience). The CEAA, ERCB and Joint Review Panel appear keen to overlook this and EnCana's regulation violations.

Never mind our biased ERCB intermingled with corporate dishonesty. Given the Prime Minister's protests about drilling in a national wildlife area to protect listed species in Canada, and EnCana's recent blow out at Suffield, growing list of violations against the environment and refusal to accept responsibility for the company's violations, EnCana's application must be denied.

Refer below to The New York Times article about lap dancers striking it rich on the natural gas industry. Imagine the biased and provincial ERCB sitting on a *federal* Review Panel assessing EnCana's application to jeopardize listed species in a National Wildlife Area and an ERCB legal council - who advised on the ERCB's unlawful 500 KV transmission line fiasco - advising this Panel. Then imagine this Panel granting approval for EnCana to risk listed species and a National Wildlife Area so that more money can be blown in strip clubs.

Sincerely,

Jessica Ernst
Ernst Environmental Services
<>**Published October 4, 2008 in The New York Times**
http://www.nytimes.com/2008/10/05/us/politics/05wyoming.html?_r=1&oref=slogin

ROAD TO NOVEMBER

In a Red State Rolling in Green, a Relaxed Attitude

By JENNIFER STEINHAUER

ROCK SPRINGS, Wyo. — There are any number of ways to gauge an economic boom, and here lap dances may be a pretty good measure.

“I make over $100,000 a year,” bragged Eric Palmer, who works as a gas field operator in a town that has enriched many of them. Mr. Palmer was surrounded by a bevy of strippers at the Astro Lounge, all of them eager to take advantage of his generosity. “I spend $3,000 a weekend here,” he said. “I just love the company of beautiful women.”

The women in Rock Springs, off Interstate 80 in southern Wyoming, seem to like Mr. Palmer and his ilk, which is why they travel from cities across America — often places where the economy has tanked — to make thousands of dollars a week at places like the Astro Lounge. Most of their customers are men who work in natural gas exploration and production and who have few other ways or places to spend money on their rare days off.

The gas industry has almost single-handedly set Wyoming in stark contrast to the rest of the nation, where industries have fallen on hard times, homes are in foreclosures and many Americans have lost their jobs. While other states are laying off workers and cutting programs, Wyoming has enjoyed billions of dollars in surpluses in recent years.

There is a sort of relaxed composure here that other towns in America are not enjoying as the race for president enters its final chapter. Many voters here seem to agree: whoever wins is not likely to stand in the way of Wyoming and its natural gas fortunes.

“We have the opposite economy of the rest of the United States,” said Steve Aaron, who was eating dinner at the Coyote Creek steak house across the street from the Astro Lounge. Mr. Aaron works in the court system and is a part-time minister. “But we still wonder and worry about what’s going on around the rest of the country,” he said, “even though people in the oil fields are making more money than they ever have in their lives.”

The fortunes here stem from the state’s enormous supply of natural gas — its reserves are second only to Texas — and its role in supplying not only a demanding domestic market but other nations as well. Wyoming, the home state of Vice President Dick Cheney, has benefited from the

Bush administration's energy policies, which opened up land for natural gas drilling.

Men making $15 an hour five years ago now take in as much as $26, and it all makes for very deep pockets for the workforce, much of it drawn from out of state. There is not very much to do in this town but work, and that is enough for most people.

"I was drawn here for economic reasons," said Colt Felmlee, 24, who was interviewed at the steak house. Mr. Felmlee, a foreman for an oil fields service company, moved here from Montana, where the wages are not as high. "I don't find it hard to relate to the rest of the country's problems because I've been there," he said.

Mr. Felmlee said he believed Senator John McCain, the Republican presidential nominee, was the candidate who most supported his industry. "I think with him in office I would continue to do well," he said. "I think in general the oil industry supports McCain. Not many people would take a strong opposition to him."

Some other oil workers said they supported Mr. McCain as well, but others said they were for Senator Barack Obama, the Democratic nominee.

"I think he'll be a stronger leader," said Cory Rock, as he sucked on a cigar at the strip club. But while the state's governor, Dave Freudenthal, is a Democrat, this mostly Republican state is almost certainly in Mr. McCain's column.

All the industries that serve oil workers — steak houses, title brokers and bars — have done well in the boom.

"I find it odd that we are so for finding alternative sources of energy when this is where the money is," said Meesa, a stripper in the club who came from Idaho and asked to be identified by only her stage name. She makes about $500 a night. "The guys here are paid hand over fist for extremely hard labor," she said, "and there is no where to spend it here but on us."

EnCana's Dickensian Court Case

EnCana's multiple appearances in Medicine Hat Court, on charges of violating Canada's *Wildlife Act* within the Suffield National Wildlife Area, are beginning to resemble *Bleak House*, the story of a legal battle over an inheritance that eventually drained the legacy fund dry. **In this case, though, it's Canadian taxpayers picking up the tab for the Crown's legal costs.**

The company has appeared in court six times, with their seventh appearance scheduled for August 12. Each time, the case has been adjourned because of EnCana's claim that they need more time to review the evidence against them. They have not yet entered a plea.

"This is the third counsel in a row who has come on with respect to these matters," said Judge Legrandeur during EnCana's June 26 appearance, when EnCana changed lawyers once again. "They'll certainly require more time to review the disclosure."

The repeated adjournments are certainly in the company's best interests. With the Joint Review Panel hearing into EnCana's proposal for an extensive shallow gas infill project in the Suffield National Wildlife Area scheduled to begin on October 6, the bad press that would inevitably accompany a guilty verdict would be undesireable for the company.

AWA will be an intervener at the hearing as part of a six-group coalition opposing the project. For more information, see our website at www.AlbertaWilderness.ca.

– Joyce Hildebrand

from: http://fanweb.ca/issues/suffield/news-releases/encana2019s-dickensian-court-case

FOR IMMEDIATE RELEASE

ERCB ON SCENE AT SWEET GAS WELL BLOWOUT ON CFB SUFFIELD

Calgary, Alberta (October 3, 2008) The Energy Resources Conservation Board (ERCB) is working closely with EnCana at a sweet gas well blowout on CFB Suffield.

The incident occurred at approximately 3:30 p.m., Thursday, October 2 and is located approximately 14 kilometres southeast of Jenner.

Currently, the well is venting sweet natural gas. There are no residents in the area, there is no danger to the public and no injuries have been reported. The well is located in a remote area and no public complaints have been registered.

Air monitoring and well control specialists are on scene and a plan to stop the flow from the well has been submitted to ERCB Operations.

All appropriate authorities have been notified including Environment Canada, as the incident is on federal land.

As is the normal practice, the ERCB will conduct an investigation into the incident.

- 30

Sweet gas well leak in southern Alberta capped

Fri, October 3, 2008

By THE CANADIAN PRESS, in the Edmonton Sun and Medicine Hat News

JENNER, Alta. — Encana crews have capped a sweet gas well that blew out in a remote area on land belonging to Canadian Forces Base Suffield.

Darin Barter of the Energy Resources Conservation Board says no one was injured.

He said the blowout happened Wednesday about 13 kilometres southeast of Jenner.

He says it posed no threat to the public because the gas doesn't contain hydrogen sulphide, which is deadly.

Alan Boras, spokesman for Encana (TSX:ECA), says crews were working on the well when the leak occurred and they were aware of the potential concerns and took precautions.

Barter said the exact cause of the incident is under investigation by the ERCB and they will be looking into whether there were any non-compliance issues.

"There were no injuries, no fire and because this is sweet gas, there is no danger to the public as a result of the emission of gas. But clearly, this is a situation we take seriously."

Barter added it's the company's responsibility to be in control of their wells at all times and if that doesn't occur, ERCB needs to know why.

This is the second oil and gas related leak at the base in less than a month.

On Sept. 8, an abandoned sweet crude well operated by Harvest Energy and located on the base five kilometres east of Ralston leaked up to 90 barrels oil, **killing more than 300 birds.**

CFB Suffield has allowed oil and gas exploration and drilling on their base for decades but those activities have come under scrutiny and criticism in recent years by environmental groups and members of the public.

EnCana is currently facing charges under the Wildlife Act for installing a pipeline without a permit in 2005 within the Suffield National Wildlife Area located on the base.

Also, hearings into allowing EnCana to drill up to 1,275 additional shallow gas wells within the Suffield National Wildlife Area begin on Monday in Calgary.

CFB Suffield is home to a number of rare native grasses and threatened animals including the endangered burrowing owl as well as containing elk, deer and antelope herds.

(Medicine Hat News, CJCY)

Crews plug southern Alberta gas leak

Last Updated: Friday, October 3, 2008, from CBC website

A leak from a natural gas well in southern Alberta is being investigated, less than a month after an oil leak in the same area.

Workers managed to plug a sweet gas well blowout on Canadian Forces Base Suffield on Friday.

The leak began on Thursday afternoon, about 14 kilometres southeast of Jenner, said the Energy Resources Conservation Board.

The well belongs to Calgary-based EnCana, which has proposed drilling 1,200 more wells in the Suffield area.

The well was not producing so the company does not yet know how much gas is leaking, said EnCana spokesman Alan Boras.

The well is venting non-sulphureous sweet natural gas, and not sour gas which can contain deadly hydrogen sulphide.

There are no residents in the area, no threat to the public and no injuries reported, said the provincial agency.

Air monitoring and well-control specialists were on scene Friday.

The ERCB is investigating, as is normal practice in any leak. Environment Canada has also been notified because the leak is on federal land.

In September, between 60 and 90 barrels of liquid leaked from a sweet oil well at CFB Suffield, killing hundreds of ducks and swallows. The well, which was abandoned in December 2005, was licensed to Harvest Energy Trust.

With files from Reuters

EnCana agrees to pay $36K fine
But company does not admit fault in storm-water violation

GLENWOOD SPRINGS, Colorado — EnCana Oil and Gas (USA) reached an agreement with the Colorado Department of Public Health and Environment (CDPHE) earlier this month to pay a $36,326 fine for an alleged 2006 storm-water violation in Garfield County.

That is the largest storm-water violation fine connected to oil and gas development on the Western Slope, according to the CDPHE.

EnCana has also agreed to pay $113,417 for an "environmentally beneficial project" in the state, according to the agreement an EnCana representative signed on Sept. 11. The company, however, did not admit to any of the allegations the CDPHE cited in the agreement, which staved off any potential litigation between the agency and EnCana.

The alleged storm-water violation against EnCana, the second largest natural gas operator in Garfield County, stems from a July 18, 2006, visit a CDPHE inspector conducted at EnCana's South Parachute Field. That field is a 10,880-acre area southwest of Parachute.

The inspector found that EnCana reportedly failed to prepare and maintain a complete and accurate storm-water management plan for the area, which was required by a permit that EnCana obtained, according to the agreement. Storm-water management plans are required to describe and ensure the implementation of "best management practices," which would be used to reduce pollutants in storm-water discharges associated with construction activity, the agreement said.

The inspector also found that EnCana failed to implement or maintain best management practices in eight instances, according to the agreement. Some of the failures the inspector cited allegedly caused erosion and sediment discharge, according to the agreement.

The CDPHE noted that EnCana "satisfactorily performed all the obligations and actions" required in an Aug. 2, 2006 compliance advisory sent to the company in wake of the inspector's findings.

EnCana, in response to the agency's allegations, said its storm-water

management plan was not reviewed by the CDPHE at the time of its July 18, 2006, inspection.

The company also said that the conditions observed during the inspection did not cause or contribute to “a discharge of pollutants” and that the “alleged violations did not contribute to the pollution, contamination or degradation of state waters.”

The CDPHE noted in the agreement that it did not accept any of EnCana’s positions on the alleged violations.

Steve Gunderson, director of the CDPHE’s Water Quality Control Division, said the agency takes all allegations of storm-water violations seriously. **He added that storm-water discharges can have significant impacts on water quality.** “Just the sediment and the mud can basically, for example, totally destroy a trout stream,” Gunderson said.

EnCana said in the agreement that since it received the compliance advisory from the state agency, it has reviewed its internal procedures, conducted storm-water training sessions for its employees and taken more steps to make sure it complies with permit requirements in a timely fashion. “EnCana is deeply committed to maintaining compliance with all applicable storm-water permitting requirements, as well as all other state and federal regulations which apply to the oil and gas industry,” the company wrote in the agreement.

“EnCana has invested substantial time and resources, both before and since the issuance of this compliance advisory, to diligently ensure such compliance.”

http://www.postindependent.com/article/20081001/VALLEYNEWS/809309964/1001&parentprofile=1074&title=EnCana%20agrees%20to%20pay%20$36K%20fine

On oil, VP debate may matter more

The Edmonton Journal

<!--[if !supportEmptyParas]--> Thursday, October 02, 2008 <!--[endif]-->

Things are weird out there. It's just possible that energy issues affecting Alberta might figure more prominently in tonight's U.S. vice-presidential debate than in our own contest among prime ministerial hopefuls in Ottawa. That might well reflect the ratings, considering the sad, if understandable, lack of interest in our own tilt compared to the historic potboiler down south.

One point of clear departure between Democrats and Republicans this year involves calls to exploit oil resources in ANWR -- Alaska's Arctic National Wildlife Reserve. Sarah Palin, the governor of that state and GOP vice-presidential candidate, is in favour of that initiative, avoided for years by Congress. If there was a defining (and deafening) sound bite at the recent Republican National Convention in Minneapolis that officially selected the campaign team of Palin and John McCain, it was the collective din of delegates chanting "drill, drill, drill."

While Barack Obama has left the door slightly ajar on that one in a moment of campaign weakness, his party has traditionally, steadfastly, opposed the move. After all, sullying the pristine wilderness north of here for relative petro peanuts has not only been slagged by environmentalists across the board, but also by no-nonsense conservative industry titans such as veteran oilman T. Boone Pickens.

Betting folk in this land might well imagine that someone with a resume like Stephen Harper's would support ANWR exploitation for a variety of ideological and commercial reasons, including the value-added construction of a pipeline that would run through Canada on the way to U.S. markets. Successive Liberal regimes have opposed such a move, possibly in itself another reason for Conservatives to support it.

But according to documents obtained by Canwest News Service via Access to Information legislation, the Harper regime has apparently continued to lobby Washington against ANWR drilling.

Indeed, our Foreign Affairs Department's so-called chief "advocacy plan" lists opposing the Alaska project as one of our top environmental priorities with the Americans. The Canadian tactics include targeting "U.S. elected officials (federal and state) along with unspecified 'decision-makers' and 'key influencers' among media, lobbyists and academics."

Considering our own shaky historical credentials on energy-related environmental stewardship in general and our oilsands aspirations in particular, it wouldn't be surprising to expect more than a few of our neighbours to question the height of our high horse in this matter.

In fact, though, we do have a legitimate interest in this fight, which allows us moral and ethical justification for protest. The same caribou herd that would be affected by the oilpatch migrates back and forth between Alaska, Yukon and the Northwest Territories -- and it has been a central element in shared Gwich'in culture for thousands of years. Canada should make its views known on any unilateral development that would impact a resource held in common.

But Canadians adopting a superior attitude to ANWR booster Sarah Palin tonight should temper their smugness with a little reality therapy. In November, Canada will host a conference on the shrinking polar bear population shared with our American neighbours. In May, the United States, with roughly 40 per cent of the population, officially declared the polar bear as threatened under its Endangered Species Act. Canada, under Environment Minister John Baird, has yet to do the same.

As we rightly lobby against ANWR, any hubris should be tempered by an awareness of our own shortcomings. [comment: first thing harper ought to do, is put a stop to the hearing for encanas carpet bombing at suffield]

And let's not not even get into unflattering comparisons of the two countries' prospective leaderships.

Federal Tories lobby U.S. against Arctic drilling

Mike Blanchfield, Canwest News Service

Published: 2:02 am, oct 1 2008

OTTAWA - The federal government has been quietly lobbying U.S. lawmakers in Washington against calls to drill for oil in the Arctic National Wildlife Refuge (ANWR) calls Alaska governor and Republican vice-presidential nominee Sarah Palin supports.
Canada has traditionally opposed drilling in the pristine reserve. Yet the government of Prime Minister Stephen Harper has been publicly quiet on the issue during its 21/2 years in power even as it pushes an aggressive Arctic sovereignty agenda for Canada that includes a greater military presence and economic development.
Harper himself was not asked about ANWR and did not state a position on the drilling issue during his most recent pre-election tour of the Arctic this past summer.
But documents obtained by Canwest News Service show that the Conservative government continued to oppose drilling in ANWR as recently as this past winter as it was monitoring the U.S. presidential primaries.
The Foreign Affairs Department's most recent "Advocacy Plan" for the Canadian Embassy in Washington lists "opposing drilling in the Arctic National Wildlife Refuge" as one of Canada's top environmental objectives with the United States.
With both countries embroiled in national elections, the emergence of the plan comes as the two American vice-presidential candidates, Palin and Democratic Sen. Joseph Biden, and Canada's five federal leaders are due to take part in a series of televised debates this week.
The U.S. VP showdown and Canada's English language leaders debate are both taking place on Thursday.
The document was given to Ottawa researcher Ken Rubin under Access To Information legislation.
It lays out Canada's "strategic representation and engagement" plan with the U.S., on a range of issues including heading off any potential trade barriers in agriculture and dealing with such trade irritants as softwood lumber.
The plan targets "U.S. elected officials (federal and state)" as well as unspecified "decision-makers" and **"key influencers" among media, lobbyists and academics.**
Canada has traditionally opposed drilling in the Alaskan refuge because it would affect the habitat of the porcupine caribou herd in the Yukon, which borders ANWR.
Drilling for domestic sources of oil has emerged as an issue in the U.S. presidential race as both McCain and his Democratic opponent
Sen. Barack Obama face pressure to bring relief to rising prices at the pumps.
Both nominees also want to break U.S. reliance on Middle East oil and gas, which is seen as a security imperative for America.

Obama has said he would tolerate some drilling, but not in ANWR, and only as a compromise as part of a broader plan to foster alternative energy sources.
McCain has pushed hard for drilling, but he continues to oppose doing so in ANWR -- something that also puts him at odds with his Alaskan running mate, a difference the two Republicans have yet to reconcile.
Peter Harder, Canada's recently retired deputy minister of Foreign Affairs under both Harper and the previous Liberal governments, said he hopes Canada does not back away from its opposition to drilling.
"I would certainly oppose that and would hope that we continue to oppose that," Harder said in a recent interview.
<!--[if !supportEmptyParas]--> <!--[endif]-->
"I understand that energy is important," he added, "But simply being a governor from a state that has reserves doesn't make you the expert, necessarily."
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Vol. 1, Section 2: Project Description

from: http://www.encana.com/suffieldeis/project/description/

EnCana has been operating at CFB Suffield, and within the area now designated as the National Wildlife Area (NWA), since 1975.

As of November 2005, 1,145 shallow gas wells had been drilled in the NWA. The average well density ranges from four wells per section (wps) to a maximum of 16 wps. Individual wells are tied into a natural gas pipeline system through 50.8 millimetre (mm) inside diameter (I.D.) (2 in.) lines. The loop2-6lines consist of 101.6 mm, 152.4 mm, and 203.2 mm (4, 6, and 8 in.) I.D. lines. There are estimated to be about 760 kilometres (km) of pipelines in the NWA.

EnCana proposes to drill 1275 shallow infill wells over three drilling seasons to extract the remaining shallow sweet gas from the area. Infill drilling is drilling that occurs within the defined boundaries of an existing natural gas pool. The target formations are between 250 m and 650 m deep. The new wells will be tied in to existing and new local gathering system to transport the additional gas volumes to existing compressor stations outside the NWA. Additional infrastructure required for the Project will include pig launchers and receivers, meters and isolation valves. Existing access roads will be used; no new roads (with built-up roadbeds) will be constructed. However, access routes to each well site will be established. The locations of Project facilities are shown in Figure 2-1 (PDF: 1.1M) and Figure 2-2 (PDF: 1.4M).

The Project will comprise part of EnCana's ongoing shallow gas drilling in the Suffield area, and the infill drilling will displace other segments of EnCana's overall Suffield program in any given year. Therefore, overall activity levels in the area will not increase from existing activity levels.

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2.1 Reservoir Characteristics
2.1.1 Shallow Gas
2.1.1.1 Geology

The natural gas-bearing units in the Suffield Area of southeast Alberta include the Second White Speckled Shale, the Medicine Hat, and the Milk River formations (all as further described herein). The natural gas pools have blanket-like geometries, natural fractures, and are delimited by permeability barriers. The regional extent of these pools is measurable and extends over approximately 35,000 km^2 in southeast Alberta and southwest Saskatchewan (O'Connell 2005) (see Appendix B)

The Second White Speckled Shale Formation is approximately 600 metres (m) deep and 40 m thick in the Suffield area. Production is from a series of regionally extensive distal marine shoreline units that occur within the upper 5 to 10 m of the Upper Second White Speckled Shale Formation. Facies include interlaminated sand and mud, muddy bioturbated sands, and transgressive marine sands (Leckie et al. 1994).

The Medicine Hat Formation is approximately 375 m deep and 60 m thick. The Colorado Shale separates the Medicine Hat Formation from the Second White Speckled Shale Formation. The lowermost facies is dark grey mudstone to silty mudstone, grading upwards to interlaminated and thinly interbedded mudstone, siltstone, and fine-grained sandstone. The First White Speckled Shale Formation lies above the Medicine Hat Formation and was deposited during a maximum marine transgression (Leckie et al. 1994).

The Milk River Formation in southern Alberta forms a sandy clastic wedge that tapers northward, where the top of the Formation is approximately 275 m in depth. The natural gas-bearing unit, named the Alderson Member, is characterized by a thick succession (80 to 100 m) of shallow shelf, marine interlaminated shale, siltstone, and fine-grained bioturbated sandstone. The reservoir is rich in clay, and has high water saturation (ranging from 70 to 95 percent) and low permeability. The Milk River Formation is capped by a transgressive conglomeratic lag, which in turn is unconformably overlain by the Pakowki Formation (Braman and Hills 1990).

The reservoir parameters are summarized in Table 2-1.

Table 2-1 Summary of Reservoir Parameters

Summary of Reservoir Parameters

	Effective Porosity (%)	Density Porosity (%)	Resistivity (ohm·m)	Formation isopach (m)	39% Neutron net pay (m)	Sw (%)	Initial Reservoir Pressure (kPa)
Milk River (Alderson)	5–10	10–17	8–12	90	85	70–95	3300

Medicine Hat	6–12	15	>10	60	8	60–80	4300
Second White Speckled Shale	6–12	15–17	>10	40	5	60–80	5700

NOTES:
kPa = kilopascal
Sw = water saturation

The geologic stratigraphy in the Proiect area is shown in Appendix C.

2.1.1.2 Gas Composition

The natural gas that has been produced within the NWA, and that which will be produced from this Project, is sweet gas, containing no hydrogen sulphide (H_2S). The sweet gas was created biogenetically by the bacterial breakdown of organic matter in the reservoir, resulting in its characteristically high methane (CH_4) composition. Typical gas composition from the Milk River, Medicine Hat, and Second White Speckled Shale formations ranges from 95 to 98 percent methane. The remaining percentage comprises mainly nitrogen (N_2) and carbon dioxide (COM_2). Minor amounts of helium (He), hydrogen (H_2), ethane (C_2H_6), and propane (C_3H_8) are also found in the gas produced within the NWA.

Figure 2-1 Proposed and Existing Infrastructure within the NWA North (PDF: 1.1M)

Figure 2-2 Proposed and Existing Infrastructure within the NWA South (PDF: 1.4M)

A typical breakdown of the natural gas produced in the NWA is presented in Table 2-2:

Table 2-2 Typical Composition of Natural Gas in the NWA

Typical Composition of Natural Gas in the NWA	**Percentage (%)**
He	0.10
N_2	3.05
CO_2	0.76
H_2S	0.00
H_2	0.00
CH_4	95.82
C_2H_6	0.24
$C_3H_8^+$	0.03
Total	100.00

SOURCE: Gas Analysis 3-35-15-5 - Core Labs

2.1.1.3 Production

Natural gas production from wells currently producing within the NWA began in November 1976. As illustrated in the Figure 2-3 (PDF: 25k), development drilling continued until 1986, when production reached a maximum rate of $2{,}386.3 \cdot 10^3$ m^3 (84.7 million cubic feet per day (MMcfpd)). Production rates declined to $845.2 \cdot 10^3$ m^3 (30 MMcfpd) until 1997, when additional drilling added incremental volumes. Moderate drilling activity and production optimization efforts increased production rates to $1{,}155.1 \cdot 10^3$ m^3 (41 MMcfpd). In December 2006, production from the current wells averaged $853.7 \cdot 10^3$ m^3 (30.6 MMcfpd). Total cumulative production to the end of December 2006 was $12{,}190.9 \cdot 10^6$ m^3 (432.7 billion cubic feet (bcf)). EnCana expects the existing wells within the NWA will recover an additional $3{,}400 \cdot 10^6$ m^3 (120 bcf) over their remaining life of 20 to 25 years.

To evaluate the feasibility of the infill development, EnCana conducted a pilot project in the Riverbank and Middle Sandhill areas of the NWA, before the establishment of the NWA, involving well spacing of 16 wps. The pilot project evaluated, and confirmed, the geologic and economic suitability of the area for infill drilling. In addition, production from the pilot project confirmed that recovery of natural gas volumes with the infill wells increasing well density to 16 wps is incremental recovery over well density of 8 wps. These conclusions are also supported by reservoir modeling and simulation, based on EnCana's proprietary analysis methods.

The production and reserves performance observed in the pilot area (and from other areas where development is at 16 wps) were used to forecast the production from the Project. This forecast, which assumed development over a three-year period, is also shown in the figure above. This results in total incremental volumes of $3525 \cdot 10^6$ m^3 (125 bcf) that will be recovered over a period of 20 to 40 years.

Figure 2-3 Suffield Natural Gas Production (PDF: 25k)

EnCana is currently developing the majority of its lands outside the NWA with infill drilling to 16 wps, in accordance with down-spacing and commingling orders approved by the EUB. These orders acknowledge the need for increased well density and multi-zone commingling for best recovery of the natural gas and conservation of the resource.

As of January 2007, EnCana has drilled over 3500 wells in the Western Canadian Shallow Gas Complex to 16 wps density. Other companies including Apache Canada Ltd., Anadarko Canada Corporation and Nexen Inc. have drilled over 3500 wells at this increased density. In the surrounding areas to the NWA, EnCana has drilled 124 sections including the D6/D8 area of the NWA, Koomati area adjacent to the NWA and in the Military Training Area (MTA). The results of the drilling programs indicate significantly increased reserves can be recovered with minimal environmental effects.

The techniques utilized to drill, complete and tie-in the wells for the Project are essentially the same techniques utilized for the surrounding areas since 2003. The wells are drilled utilizing coil-tubing or single drilling rigs and spider plough or chain ditchers are utilized to tie-in the wells. The primary differences between the Project and other 16 wps projects are:

1. Timing of the activities - Winter construction only in the NWA. Outside of the NWA, EnCana conducts activities in appropriate field conditions year round. To minimize the effects on the environment, EnCana attempts to conduct activities in dry or frozen conditions in all projects;
2. Use of caissons - Current practices outside of the NWA, where military activities (including training) may occur, EnCana places the wells underground in caissons. Caisson installation has not been proposed as part of the Project. Caissons increase soil and vegetation disturbance thus increasing the footprint of the wells;
3. Reclamation practices - EnCana adapts its practices based on site conditions and the disturbance levels. In general, EnCana does not seed disturbed areas such as bellholes and tie-in points immediately after the disturbance as is proposed for this Project. The timing of reclamation activities is dependent on military schedules and site conditions so there may be a delay in reclamation timing compared to the proposed schedule for the Project;
4. Reduced potential well sites - EnCana has committed to not drilling on the floodplain of the South Saskatchewan River, near to wetlands or water bodies and other sensitive environments for this Project;
5. Additional Project specific training - EnCana conducts some training sessions for all projects. This Project includes more detailed training including specific training on species identification, environmental practices, etc.; and
6. Additional monitoring and follow-up activities - EnCana follows regulatory requirements on monitoring and follow-up activities. For this Project, EnCana has developed additional practices including additional construction phase monitoring

2.1.2 Other Hydrocarbon Production (Deep Rights)

EnCana recognizes there is a possibility of both Bow Island and Basal Colorado gas reserves underlying the Project area. The Bow Island Formation is approximately 675 m deep and 100 m thick in the NWA. The Bow Island Formation consists of six major coarsening upwards successions from distal marine to shore face and barrier bar facies. Production is generally from the three uppermost sand packages and the lowermost sand package. The Basal Colorado Formation is approximately 775 m deep and 5 m thick in the NWA.

However, the NWA was precluded from deep rights access for petroleum and natural gas development by the DND-Alberta Deep Rights Agreement of 1999; therefore, at this time EnCana does not foresee the deep gas being developed.

The Taber Coals are approximately 130 m deep while the McKay coals have pinched out and are not present in the NWA. Where they occur in the NWA, the Taber coal seams are thin and in proximity to the groundwater aquifers (above the base of groundwater

protection). EnCana does not view these coals as having any potential for gas production in the reasonably foreseeable future. The deeper Mannville coal seams (approximately 825 m deep) are also thin in the NWA.

EnCana has no current plans to develop any deep gas, coalbed methane or oil in the NWA.

The Project phases include wells, gathering pipelines and associated above ground facilities, access, and other infrastructure.

2.1.3 Project Components
The Project components include wells, gathering pipelines and associated above ground facilities, access, and other infrastructure.

2.1.4 Wells
The locations of the proposed wells are shown in Figure 2-2 (PDF: 1.4M) and Figure 2-1 (PDF: 25k). [Updated from original report.] Typical well site layout is shown in Figure 2-4 (PDF: 108k). A typical well schematic is shown in Figure 2-5 (PDF: 19k).

2.1.5 Gathering System
The majority of wells will be tied into the existing local gathering system (laterals) using 50.8 mm (2 in.) I.D. high-density polyethylene plastic (HDPE) pipe. In some cases, new gathering systems (back end loop lines) may be required. To tie in the new wells into the gathering system, approximately 180 km of HDPE is expected to be required. Approximately 40 km of 101.6 mm, 152.4 mm, or 203.2 mm (4, 6, or 8 in.) I.D. steel pipe will be required for loop lines to transport the gas to existing compressor stations outside the NWA. Backend loop lines may be required where there is insufficient capacity to transport the gas in existing laterals. While working areas during construction will typically be 15 m wide, the width of the linear disturbance (i.e., topsoil stripping for ditching installation of steel pipe) will be limited 2 to 4 m.

The gathering system will also include aboveground group meters, pig launchers and receivers for pipeline integrity inspection, and isolation valve stations. Typically, each battery of 12 sections will require one group meter, one pigging facility, and one to three isolation valves.

2.1.6 Access
Existing access roads will be utilized whenever possible and where appropriate. Each well site will have an access route (i.e., prairie trail without a built-up road base) for construction and operations.

2.1.7 Other Infrastructure
Other infrastructure required for the Project will include remote sumps.

Containment sumps for drilling fluids will be designed to improve the separation of liquids and solids via gravity or settling out of the solids, reducing the amount of water

used for drilling by up to 10 percent. Remote sumps will be outside the NWA on previously disturbed areas of CFB Suffield, and will be reclaimed following the construction season using mix-bury-cover methods.

For fast communication, "spread spectrum" radios will be used at each group meter site. The radios have low energy requirements, can use low profile antennas and the configuration settings can allow for repeaters to access low lying areas without additional towers or infrastructure. Transnet, 900 MHz radios will be used for communication to the Supervisory Control and Data Acquisition (SCADA) host from Remote Terminal Units (RTUs) installed at group meter sites; this will reduce the need for and frequency of site visits. The transmitter output power of these radios is 1 Watt (W). A Yagi directional antenna mounted on an aluminum 50.8 mm schedule 40 mast will be required for each radio. The mast height, including antenna, will range between 0.9 and 1.5 m.

Figure 2-4 Typical Well Layout (PDF: 108k)

Figure 2-5 Typical Well Schematic (PDF: 19k)

No temporary power lines will be needed. Direct current batteries with a solar panel (60 cm X 60 cm) will be used to supply permanent power to the group meter site transmitters, RTU, and radio. These solar panels will be mounted on the radio transmission antennae with a 22.5 degree angle to maximize solar cell exposure to the sun. Based on power requirement calculations at previously installed metering setups and polling frequency of sites in the area, each meter site will require one 30 W solar panel and two batteries (100 Amp-hours). Based on past experience, the life cycle of these batteries is expected to be three years.

Existing infrastructure to be used for the Project but which will not require any changes to accommodate the incremental Project production includes the existing produced water treatment facility at 04-03-015-06 W4 and compressor stations (see Figure 2-6 (PDF: 977k)). No new compression capacity is required for the Project, as the production from the infill wells will offset declining production from existing wells. Moreover, peak production rates experienced during the initial start-up of past infill projects demonstrates that the compression horsepower currently in service is ample for the infill development.

Figure 2-6 Existing Compressor Stations (PDF: 977k)

No new lay down or temporary storage areas will be required during construction. Existing lay down and storage areas will be used as required for storage of equipment and materials.

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2.2 Project Phases

The phases of the Project will include preconstruction activities, construction, operations, and decommissioning and abandonment.

2.2.1 Preconstruction Activities

Preconstruction activities include baseline mapping, site selection, and an ordinance sweep done by Suffield Industry Range Control (SIRC). Careful preparation and pre-construction planning is the first and most important aspect of minimal disturbance practices.

Since 2005, EnCana has been developing its baseline mapping tool for the Suffield area to support effective decision-making regarding site and route location. EnCana's baseline mapping process uses an environmental database for the predisturbance assessment (PDA), and is complemented using additional data compiled from a search of available provincial and federal data sources, as well as information gathered during desktop studies or from prior fieldwork undertaken in relation to other EnCana projects at CFB Suffield.

The baseline mapping layers include:

- palaeontological resources and potential (including regional stratigraphy);
- archaeological resources and potential;
- terrain (landscape, slope, and sand dunes);
- soils;
- vegetation;
- wetlands and riparian areas (permanent, temporary, and intermittent);
- wildlife; and
- existing infrastructure (roads, pipelines, well sites, remote metering).

The information compiled through the baseline mapping process will be used to identify ecologically and culturally sensitive areas and to determine the least disruptive locations for well sites, access routes, pipelines, and associated infrastructure.

Once the baseline information for the PDA is compiled, a series of team planning meetings will be held to discuss siting or routing issues and select preliminary sites and routes. These team planning-meetings will typically include personnel involved in the Project, such as geologists, project engineers, construction personnel, and environmental professionals. This process reduces the number of visits to, and the number of crews visiting, each of the sites.

Once preliminary locations are chosen and any outstanding potential environmental issues are identified, then all locations will be field-checked. The field component allows any outstanding issues to be confirmed and addressed at the field level.

A field crew consisting of environmental specialists (e.g., biologists, archaeologists, and botanists), surveyors, and construction staff will visit each location to collect additional site-specific data and to ensure each location is suitable, with respect to terrain, wildlife, vegetation, and other environmental concerns, before construction. Adjustments to locations (or relocations) will be made accordingly. Site-specific mitigation measures will be developed for any potential issues identified in the field, before construction.

In selecting site and route locations, the following criteria will be considered:

- minimization of ground disturbance;
- shortest distance between facilities;
- provincially and federally designated wildlife species at risk;
- sensitive wildlife species;
- critical or sensitive habitat;
- rare plants and rare plant communities;
- wetlands, waterbodies and riparian areas;
- historical, archaeological, and palaeontological resources;
- research locations (e.g., sampling or data collection sites); and
- sensitive and unstable soils and terrain.

EnCana does not anticipate that the Project will require crossing permanent watercourses, and no well sites will be on the floodplain of the South Saskatchewan River.

The existing and potential future access needs of other users of lands in the NWA typically are taken into consideration during access planning, through consultation with the Department of National Defence (DND) and SIRC who are responsible for managing oil and gas personnel access within CFB Suffield. However, no new roads will be constructed for the Project. Well site access routes are not expected to be used by other parties. EnCana is the only active operator within the NWA. No other Project infrastructure is suited to any other user's needs.

2.2.2 Construction

The construction phase includes drilling, completion, tie-in of the wells, and post-construction cleanup.

Once drilling locations have been finalized, access to each well site will be determined. To minimize disturbance to the prairie environment, no new roads (i.e., with built-up roadbeds) will be constructed, and all access routes will be marked in the field to ensure all traffic is restricted to specified routes. Whenever possible, EnCana will use existing access routes. If gravel is required to improve the existing road conditions and reduce rutting, clean gravel will be brought in from existing sources outside the NWA.

EnCana will contractually require that all equipment will arrive in a clean condition (i.e., free of weeds) to minimize the risk of weed introduction, and will be in good working condition to minimize emissions and noise. Weed management is discussed in the Environmental Protection Plan (EPP) in Appendix I.

All wells will be drilled using minimal disturbance techniques to minimize soil disturbance, preserve the soil regime, and maintain the existing seed bed. . Full stripping and topsoil removal is not required during drilling; the only topsoil that is removed is at the wellhead itself. Topsoil will be removed at points of connection (bell holes) between wellheads and tie-in pipelines, and between tie-in pipelines and steel gathering pipelines. Normally topsoil stripping will not be required for the 50.8 mm (2 in.) I.D. HDPE

pipelines, but minimal stripping will occur for steel gathering pipelines installed by trenching techniques. Rock and frozen conditions may require the salvage of topsoil from the anticipated disturbance width. Where feasible, soil handling activities will be completed during unfrozen soil conditions to minimize the environmental effects on vegetation and soils.

EnCana will suspend construction activity when site and weather conditions are such that the soil resource may be adversely affected (e.g., by compaction, rutting, remoulding, mixing, or erosion). All construction activities will comply with EnCana's Environmental Protection Plan (EPP) for the Project.

There is no public access to the NWA. Access to CFB Suffield, including the NWA, is restricted by fencing and gates. EnCana employees and contractors muster at existing gates and facilities outside the NWA and all movements within the NWA are coordinated with SIRC.

Construction figures are available in Appendix O.

2.2.2.1 Drilling

The drilling of the shallow gas wells will involve the following steps.

- A small conductor rig will be moved in and will drill until a 177.8 mm (7 in.) I.D. conductor pipe (or casing) can be cemented in place at depth of approximately 27 m.
- After the conductor pipe has been set, the drilling rig and associated equipment will move onto the lease (approximately five truck loads) and continue drilling. The drilling rigs used to drill the shallow gas wells will be either "single rigs" or coil tubing rigs which have a continuous coil of 60.3 mm (2 3/8 in.) tubing (with 159 mm (6 ¼ in.) bit) which serves as the drill pipe. It will take between 14 and 20 hours to drill each well to the total depth of 450 to 650 m, depending on location.
- A string of 114.3 mm (4 ½ in.) casing will then be run into and along the total length of the well and cemented in place. Cementing the production casing will hydraulically isolate groundwater from the wellbore.
- All drill cuttings and drilling fluid (water) will be collected in on-site tanks while drilling, and removed from the NWA for disposal.

2.2.2.2 Completions

Well completion will follow drilling and allows the gas encountered during drilling to be produced. Well completion will involve the following steps.

- A well logging truck and crew will run an electronic well log from the total depth to surface.
- The wellhead will be installed.
- The well will be pressure-tested to ensure hydraulic isolation.

- A swabbing unit, typically a five-ton truck, will remove the water in the wellbore and collect it in a truck-mounted tank for use at the next wellsite as completion fluid.
- A perforating unit will place perforations in the casing at the appropriate depths as determined through interpretation of the well log.
- A blowback tank (skid unit) will be placed on location for the duration of the completion.
- The well will be fracture (frac) stimulated. This activity involves pumping sand and friction-reduced water down the wellbore at high pressure. The pressure forces the producing formations downhole to fracture and the sand fills these fractures. This operation allows the wells to flow at commercial rates. Fracturing requires 10 to 15 trucks on location and typically takes 4 to 6 hours.
- The well will be flowed back to the blowback tank to remove as much of the water used in the fracture process as possible. There is typically a small amount of sand in the water that is flowed back. The recovered fluid and sand will be contained in the blowback tanks and taken off-site to the next site, where the fluids will be clarified for re-use and the solids transported to an existing sand recycling facility outside the NWA.
- The well will be cleaned, with air, using a small coil tubing unit to remove any remaining fluid.
- The well will be shut in until it is tied into the gathering system.
- The well will be swabbed and turned on when the pipeline is attached.

2.2.2.3 Well Tie-ins

Well tie-in will follow well completion, and will involve the following steps.

- Wells will be tied into the existing or new gathering system using 50.8 mm (2 in.) I.D. HDPE pipe. The HDPE pipe is a continuous pipe that will be brought to location on a large roll.
- In the NWA, it is anticipated that, based on operating experience, all HDPE pipelines can be buried (ditched) using low impact ploughing equipment (such as the spider plough). An assessment of the feasibility of ploughing in pipelines will be done before the initiation of construction and be re-evaluated continuously throughout the activity. Factors which may preclude ploughing include: surface and subsurface stones, frozen soils, adverse topography, heavy clay soils, and wet conditions. Using the spider plough, the roll of pipe will be ploughed into the ground at a depth of 1.5 m (5 feet). This technique results in minimal disturbance to the ground; no topsoil would be stripped. In addition, the width of the pipeline ROW is kept as narrow as possible. Conventional techniques (chain ditcher) will be used if ploughing is not feasible or if it is determined that ploughing in will result in excessive damage to soils and vegetation. The total pipeline length used will depend on the proximity of the existing gathering system to the wellbore. Lengths of tie-ins will typically range between 200 and 400 m.
- Once the pipeline is buried, reclamation activities will take place. Post construction and cleanup activities will occur.
- Once the well is tied-in, the well will be brought on-stream.

- Where back-end loop lines are required, 101.6 mm to 203.2 mm (4 to 8 in.) I.D. steel pipelines will be required to allow for effective transport of the gas to an existing gathering system. These pipelines are expected to average 3 to 6 km in length and will be installed using conventional ditching techniques. Typically stripping of topsoil along these ROWs will be restricted to 1 or 2 m, depending on soil conditions.
- Pipelines will be integrity tested before commissioning.
- Working space for pipeline installation typically will be 15 m, and up to 30 m where required (e.g., curves).

2.2.2.4 Post-construction and cleanup activities

EnCana will commence initial cleanup immediately after construction activities. The final cleanup schedule will vary depending on conditions, time of construction, and any military lockouts. If construction is complete during frozen conditions, final cleanup will typically occur after spring breakup. If construction is completed during nonfrozen conditions, final cleanup will be undertaken as quickly as practical and before freeze-up.

Well leases and pipeline ROWs will be constructed using minimal disturbance and no-strip techniques where possible. No new roads will be constructed. Therefore, it is not anticipated any additional fill or soil will be required for reclamation. In the unlikely event additional fill or soil is required for reclamation of lease areas, ROWs, or access routes, such material will be sourced from an existing borrow pit or stockpile outside the NWA. Once construction is complete, bell holes (i.e., at connections between wellheads and tie-in pipelines and between HDPE tie-in and steel gathering lines) will be immediately backfilled using native subsoil and topsoil.

Disturbed ground will be recontoured, where necessary, and reseeded or left to recover naturally, depending on site conditions. Reclamation of disturbed ground will be described in the Conceptual Reclamation Plan (Appendix H) and the Soil Loss Mitigation Plan (Appendix N). As sites will be on level ground, erosion control or storm water management is expected to be minimal.

All remaining equipment, garbage, and debris will be removed from the well site and ROW.

2.2.3 Operations

The main activities done during the operations phase are well testing, well and pipeline inspection, swabbing (if necessary), refracturing (if necessary), and reclamation maintenance (if necessary). As during construction, access to sites within the NWA will be coordinated with SIRC.

2.2.3.1 Well Testing

Wells will be regularly tested and evaluated. Well site visits in the NWA will average one visit per month in the first year of production and annually thereafter. These visits will involve the use of a ¾-ton truck. Typically, one truck can visit approximately 15 to 20

wells in a day. A yearly test of the well's performance is required by EUB regulations. Wells will only be visited during dry or frozen conditions for this annual test.

2.2.3.2 Swabbing and Well Site Visits

Well site visits, after the first year of production, will average one visit per year providing no water is produced in the wellbore. In the event water is produced at any time in the wellbore, well site visits will average four visits per year. If there is water produced, well site visits would involve the use of a swabbing unit and tank truck. Swabbing, if necessary, will only occur in dry or frozen conditions. The water produced into the wellbore would be removed. All water swabbed out of the wells would be contained in a tank truck and transported to the existing produced water treatment facility. The management of produced water from the Project will not require any new infrastructure.

Siphon strings for produced water removal may be considered for wells that have measurable water production and are in areas difficult to access.

2.2.3.3 Pipeline Protection

Work done to protect the integrity of EnCana's pipeline system is important to shareholders and the environment. For shareholders, this work extends the useful life of a valuable asset; and for the environment, this work minimizes environmental effects associated with pipeline leaks. The root cause of nearly all pipeline leaks in Suffield is associated with metal corrosion. Because of this, EnCana has implemented a number of strategies aimed at preventing corrosion of metal pipelines:

- **Use of HDPE (High Density Polyurethane) pipe**.
  HDPE pipe is not subject to metal corrosion. As a result, HDPE is the material of choice when the expected capacity of a well or wells falls into the capacity range of pipe made with HPDE.
- **Cathodic Protection Program**
  This program is a strategy used to prevent external corrosion. All metal pipelines are cathodically protected and regularly monitored.
- **Biocide and Inhibition Program**
  This program is a strategy used to prevent internal corrosion. The root cause of nearly all internal corrosion is a result of water introduced to the pipeline system from the wellbore. Key contributors to this type of corrosion is the presence of bacteria in water produced from the wellbore and the composition of the water produced from the wellbore. Only wells equipped with a siphon string have the ability to introduce water to the pipeline system from the wellbore. As a result, all wells equipped with a siphon string are placed on the biocide/inhibition program.

To combat corrosion related to bacteria, biocide (Nalco/Exxon EC6222A) is injected into the wellbore through the casing annulas. This allows the biocide to contact and mix with water in the wellbore thus killing the bacteria. Enough biocide is injected to not only kill the bacteria in the wellbore but to also kill bacteria in the pipeline when wellbore water is produced up the siphon string and into the pipeline system. This treatment is performed 2 times per year and each treatment requires 4 litres of biocide mixed with 4 litres of water.

To combat corrosion related to the composition of the wellbore water, corrosion inhibitor (Brentagg T-8084) is injected into the pipeline at the well site pig senders. Corrosion inhibitor coats the internal metal surface of the pipeline thereby preventing water and metal contact. This treatment is performed 2 times per year and each treatment requires 2 litres of inhibitor and 2 litres of water.

Pipeline pigging is an important element of this program as it is used to move the biocide, inhibitor and wellbore water through the entire pipeline system (from the wellhead to the produced water tanks at the production facilities). Once in the produced water tanks, fluids are trucked to a water disposal well for downhole injection.

Because the biocide and inhibitor in combination with wellbore fluid can foam in the pipeline, diesel fuel is sometimes used as a defoamer. It is only used when the pipeline pressure differential (well site to production facility) causes gas production from the wells to be limited. When diesel fuel is used it is injected into the pipeline system through a pig sender. Each treatment usually requires 20 litres and is only performed when required (see Table 2-3).

Table 2-3 Annual Volume Summary of the Products used in the Biocide and Inhibitor Program

Product	Volume
Biocide (Nalco/Exxon EC6222A)	36,400 litres
Corrosion Inhibitor (Brentagg T-8084)	18,200 litres
Diesel Fuel	2,500 litres
Water	54,600 litres

Biocide, corrosion inhibitor and diesel fuel are stored in bulk tanks meeting EUB G-55 requirements. No fuel or chemicals will be stored within the NWA. The following table is a summary of the locations used for storage of products used in the biocide and inhibitor program:

2.2.3.4 Well Inspections and Pipeline Integrity Checks
Pipelines and wellheads will be inspected yearly for leaks and damage. Any leaks detected will be immediately repaired pursuant to EUB regulations. Additionally, EnCana periodically monitors its pipeline ROWs during the operational phase. EnCana's operators are trained to identify issues including subsidence, erosion, and weeds, and will monitor conditions during routine operational activities to ensure integrity. No ROW maintenance is normally required, based on operating experience in the area.

Road and access and lease conditions are one of the primary factors when planning and scheduling operational activities. EnCana's practice is to defer operational site visits and activities when conditions are excessively wet and when site and weather conditions are such that the soil resource may be adversely affected (e.g., by compaction, rutting, remoulding, mixing, or erosion). Where it is necessary to access a site during wet

conditions, EnCana will consider the use of all-terrain vehicles to reduce damage to the environment.

2.2.3.5 Refracturing
Although not typically required, for some wells, it may be necessary to refracture the producing formation. This activity is essentially a repeat of the completion process described above. If required, refracturing would take place 15 to 25 years after the initial completion.

2.2.4 Decommissioning and Abandonment
Decommissioning and abandonment of both production and pipeline facilities will be undertaken at the end of the life of each well and in accordance with all regulatory requirements applicable at the time of such activities. Although regulatory requirements may change before the time of decommissioning and abandonment, current practices would require the producing zones to be isolated with bridge plugs and topped with eight linear metres of cement. The well would then be filled with inhibited fluid. Finally, the well would be cut and capped at least 1 m below the surface. Pipelines will be purged, capped and tagged.

EnCana will employ effective conservation and reclamation measures to ensure land disturbed by the Project is reclaimed to meet the goal of equivalent land capability. Disturbed land will be reclaimed using appropriate site-specific methods (i.e., seed mixes or natural recovery) determined in consultation with regulators. A Conceptual Reclamation Plan is discussed in Appendix H.

2.2.5 Malfunctions and Accidents
EnCana has an Environmental, Health and Safety Risk Matrix to analyze the probability and impact of failure on personnel, the public, the facility, the environment and/or EnCana's reputation. The process EnCana utilizes to determine the risk is:

1. Identify the risk or concern;
2. Estimate the Project effects on four factors: People, Environment, Assets and Reputation;
3. Estimate the probability of the risk/concern occurring;
4. Determine the risk potential; and
5. Determine the risk level and appropriate actions, if necessary.

Risk is categorized in terms of:

- Extreme - the activities must stop until risk controls have been implemented to reduce the risk to a lower level;
- High - extensive risk controls must be implemented immediately;
- Medium - risk controls are required; and
- Low - some risk controls are justified.

EnCana's extensive experience with shallow gas construction, operations and decommissioning and abandonment provides a high degree of certainty in the evaluation of the risk. EnCana's evaluation of the Project is that there is low level of risk due to minor to moderate potential effects on people, environment, assets and reputation with a remote probability.

As part of reducing the risk, EnCana has an emergency response plan (ERP). The emergency response plan is designed to maximize public safety. As part of the emergency response plan, EnCana has identified an emergency planning zone as required by the EUB.

EnCana has considered how the security conditions in the region could be affected by the Project and concluded that there will be no change in the security conditions as EnCana continues to operate under the direction of the military through Range Standing Orders (RSOs) and industry access to the Base is controlled by SIRC. All personnel active in the NWA undergo training by SIRC regarding the specific procedures necessary for CFB Suffield.

This section provides an overview of potential malfunctions and accidental events that, while unlikely, may occur during the Project and may result in potential environmental effects. These include collisions and releases from vehicles, pipeline accidental releases, blowouts and surface casing vent flow, and grassland fires. Design, inspection, maintenance, and integrity assurance programs, as well as proven engineering techniques, will be in place to prevent such events from occurring. All safety procedures will be documented and in place before the commencement of routine operations.

Given the low pressure of the natural gas, any event (including exploding ordinance or human error) that resulted in a large hole in the pipeline or destruction of a wellhead would be remedied by the shut-in of the production until the damage could be fixed. It is extremely unlikely that the release of natural gas would result in a flashfire. In 30 years of operations in the NWA, there has never been significant damage to a pipeline or wellhead as a result of human error, military activities or extreme weather (i.e., tornados).

All fuel, chemicals, and wastes will be handled in a manner that minimizes or eliminates routine spillage and accidents. EnCana's Environmental Protection Plan (EPP) and Emergency Response Plan (ERP) include safe chemical handling and storage procedures, as well as accidental release response measures, such as the use of cleanup equipment, training of personnel, and identification of personnel to direct cleanup efforts, lines of communications, and organizations that could assist cleanup operations.

2.2.5.1 Collisions and Releases from Vehicles

The risk of collisions between vehicles is anticipated to be extremely low, based on compliance with standard procedures and motor vehicle regulations and speed limits. On average, 288 industry vehicles enter CFB Suffield each day. On average, two industry (EnCana) vehicles enter the NWA each day, so the chances of collision and resulting

releases are less in the NWA than in other parts of CFB Suffield. In the unlikely event a collision occurs, EnCana's ERP would address response procedures.

Pursuant to EnCana's Environment, Health, and Safety Best Practices (described below), EPP, and ERP, all vehicles will be inspected regularly and kept in good working order. In the unlikely event there is an accidental release from a vehicle, it will be small in magnitude and extent. Accidental release cleanup will be undertaken pursuant to EnCana's EPP. Vehicle-related accidental releases may comprise hydraulic fluid, diesel fuel, gasoline, waste products, fresh water, produced water, transmission fluid, and methanol.

2.2.5.2 Pipeline Releases

The gas gathering system will be designed and maintained in a manner that minimizes the frequency and extent of any releases. Table 2-4 presents the results of EnCana's ongoing efforts to minimize risks for personnel and the environment. In 30 years of operation in the NWA, pipeline releases have been small enough to be undetectable via conventional gas production measurement equipment. The primary detection devices used to detect pipeline releases are gas ionization equipment used during pipeline integrity inspections and gas detection equipment used by all personnel working on the Suffield Block. For these reasons, release volumes associated with pipeline leaks are estimated to be no more than those volumes released by a surface casing vent leak and deemed non-serious by the EUB.

Table 2-4 Pipeline Releases

Time Period	Releases	Releases per Year
1991-1999	33	3.7
2000-2004	9	2.3
2005-2006	1	0.5

The observed performance improvement can be primarily attributed to the change to HDPE pipe and the implementation of a corrosion inhibition program to combat internal corrosion. As the gas gathering system will comprise primarily HDPE pipe and a corrosion inhibition program is and will be implemented, it is anticipated releases will not exceed one or two per year (due to internal corrosion).

Because the pipelines and wells contain primarily methane, there will be no pipeline releases of hydrocarbon liquids that could pool and adversely affect ecosystem components such as wetlands and wildlife.

Dispersion of natural gas from pipeline or well casing leaks without ignition poses no immediate hazard to humans or the environment. Due to the low pressure of shallow gas reserves in the NWA, safety and environmental risks associated with the dispersion of natural gas from pipeline or well casing leaks are considered low. To further mitigate

safety and environmental risks, all personnel working for EnCana are trained in the detection of leaks and in safe work practices where the potential for leaks exists.

The small amount of released natural gas can become hazardous in the event it is ignited. Based on the level of activity near the wells and pipelines, it is extremely unlikely releases will be ignited outside auto-ignition from the energy released and possible sparks generated in the occurrence of the leak.

The risk to public and worker safety is considered extremely low at the pipeline or wellhead and insignificant more than 25 m from the pipeline or wellhead, given the low likelihood of the occurrence of an initiating accident combined with extremely low ignition probability and a correspondingly low likelihood of people being exposed. Routine inspection and maintenance serves to minimize potential risks. In over 30 years of operations at CFB Suffield, there has never been an injury related to a flash fire.

2.2.5.3 Blowouts and Surface Casing Vent Flow
As the wellhead pressures in the NWA are low (average pressure is approximately 350 kPa), especially after the first year of production, **it is extremely unlikely any well blowout will occur. In over 30 years of operations at CFB Suffield, there has never been a gas well blowout.**

EnCana utilizes gate valves at the wellhead, two ball valves in the gas gathering system and where necessary a check valve to ensure the gas pressure is controlled. Given the low pressures in the NWA, pressure safety valves are not necessary.

Surface Casing Vent Flow (SCVF) is the flow of gas and liquid or any combination out of the surface casing and casing annulus (often referred to as internal migration). Gas Migration (GM) is a flow of gas that is detectable at surface outside the outermost casing string (often referred to as external migration or seepage). A SCFV or GM that is considered serious will be repaired as soon as possible pursuant to EUB Interim Directive 2003-01.

SCVF/GM problems that are not considered serious will be addressed at the time of well abandonment. SCVF/GM instances are rare and historically EnCana has had 56 SCVF out of more than 9000 wells at CFB Suffield.

2.2.5.4 Water Contamination
Information available to date has shown that contamination of underground water aquifers from shallow gas wells has not occurred. EnCana has operated at CFB Suffield for 30 years without contaminating the underground aquifers. **EnCana complies with all regulatory requirements including drilling and cementing practices which greatly reduces the potential of groundwater contamination.**

[comment: from EnCana's own data and hydrogeological report, the statement above is untrue]

The EUB has comprehensive regulations and requirements that are designed to maximize safety during the exploration for, and production of, oil and gas resources. Regulation serves not only to ensure efficient development to maximize resource recovery in the interests of all Albertans, but also to ensure a safe and reliable infrastructure of energy facilities (ERCB website: http://www.ercb.ca/portal/server.pt?open=512&objID=248&PageID=0&cached=true&mode=2)

Based on the distances to the nearest drinking water supply, even if, in the extremely unlikely event, there was a potential problem with communication between the gas formation and the underground aquifer or a casing leak, there is no risk to nearby community or private water supplies. In the extremely unlikely event that there is contamination of the groundwater, EnCana will comply with EUB regulatory requirements and remedy the situation as quickly as possible and alert all affected persons.

Based on EnCana's experience at CFB Suffield and in the NWA, EnCana has determined that a permanent leak detection system is not necessary. EnCana is confident that the existing biocide program and the conversion to HDPE pipelines for the laterals combined with the pipeline integrity testing program is sufficient to reduce the risk of pipeline leaks.

2.2.5.5 Water Requirements

For each well drilled, approximately 75 m^3 of water will be required for drilling and drilling products and approximately 100 m^3 of fluid will be required for well completions. To reduce water use during shallow well drilling, EnCana will recycle water. For drilling, containment sumps will be designed to improve the separation of liquids and solids via gravity or settling out of the solids, reducing the amount of make-up water required by up to 10 percent. For completions, the fluid will be recovered and separated out in temporary storage tanks, reducing the amount of water required by up to 25 percent.

Consequently, for each well, the net demand for drilling water is approximately 67.5 m^3 and the net demand for completion water is approximately 75 m^3. The total fresh water requirement for each well is, therefore, approximately 142.5 m^3. Therefore, total water demand for construction is approximately 181,687 m^3, which will be spread out over three construction seasons, primarily between October and April.

During operations, water requirements will be intermittent, but will occur primarily between October and April. Routine corrosion protection treatment of water-producing wells will require approximately six litres of water twice yearly per treated well. This water is typically supplied by the pigging contractor from municipal water supply in Medicine Hat. The number of wells that will require treatment is unknown at this time, but is expected to be low, based on past operating experience in the area. Refracturing typically requires approximately 75 m^3 per well, of which up to 25 percent may be recycled. If all wells are assumed to be refractured, approximately 71,719 m^3 of water

will be required; refracturing water demands will occur, and be spread out over, 15 to 25 years after initial completion.

EnCana holds a temporary licence for the withdrawal of 18,000 m^3 of water from the South Saskatchewan River at NE 23-17-5 W4. The licence stipulates conditions to protect fish and water quality and quantity in the river, including minimum passing flow, screen mesh size, and diversion rate, among other conditions. Water will be withdrawn from the South Saskatchewan River in accordance with the licence conditions.

Groundwater and surface water allocations are determined by the Alberta Government as such any issues with the allocation of water will be resolved by the Alberta Government. As the amount of water withdrawn from the South Saskatchewan River Basin is relatively small, it is not anticipated to have any negative environmental effects on surface water users who have existing approvals, permits or licenses. It has been proposed by the Alberta Government that conflicts between water users will be resolved by allocating water based on a "first in, first out" principle. Therefore, users who have been allocated water for a longer time period will be allocated water preferentially over new water users.

Any local water issues involving the use of dugouts will be resolved in consultation with the Prairie Farm Rehabilitation Administration (PFRA) and the DND as necessary. PFRA and EnCana have different water sources allocated; therefore, it is not anticipated that there will be any conflicts over water use.

In the event of drought conditions, EnCana will develop contingency plans to obtain the required water from alternative sources. In extreme drought conditions, it may be necessary to stop/avoid certain activities that require water.

Water will be withdrawn from the South Saskatchewan River in accordance with licence conditions, using a water truck equipped with pump and a screened hose.

Water also will be sourced from existing water wells and spring-fed dugouts within CFB Suffield, at 12-6-17-5 W4 (20,000 m^3/yr licensed), 4-4-16-6 W4 (73,000 m^3/yr licensed), 5-2-20-7 W4 (well and dugout), 10-16-20-7 W4 (well and dugout), and 10 16 20 8 W4 (well and dugout), all located within the NWA.

In addition, water has been and will continue to be sourced from the South Saskatchewan River, obtained via purchase from the Municipality of Medicine Hat.

All water for drilling will be sourced locally, from the licensed withdrawal point on the South Saskatchewan River, existing water wells, and dugouts within CFB Suffield. About half of the completion water demands will be met with water sourced from the South Saskatchewan River, obtained via purchase from the Municipality of Medicine Hat, and half will be met with recycled water and locally sourced water. Water to meet operational requirements likely will be sourced locally aside from re-completion requirements, which are anticipated to be sourced the same as completion requirements.

The location of existing water sources is shown on Figure 2-7 (PDF: 838k).

2.2.5.6 Grassland Fires

Wildfires could result from military activities, lightning, oil and gas operations, vehicles, and accidents. In the unlikely event of a wildfire, environmental damage would likely result in the form of ignition and burning of vegetation. Depending upon the timing of the fire, wildlife may be affected during the breeding and nesting season.

EnCana's ERP includes a plan for responding to wildfires that are frequent in the summer and fall at CFB Suffield. Wildfires are rare in the NWA and emergency response in the NWA has been prioritized to limit the damage in the NWA from fires arising in the Military Training Area (MTA). When conditions require, extra care is taken to limit ignition sources at CFB Suffield including in the NWA.

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2.3 Chemicals and Hazardous Materials

Approved drilling mud additives may be used. During well completion, a polyacrylamide friction-reducing agent may be used by the contractor. This would be transported to the site in a truck-mounted plastic bulk tank.

Biocide (Nalco/Exxon EC6222A) and corrosion inhibitor (Brentagg T-8084 or a heterocyclic amine-based inhibitor) will be used to control corrosion in the gathering system. These chemicals will be stored in two 1000-gallon tanks at E Station and two 500-gallon tanks at outside the NWA. These tanks are above ground farm-style tanks within a berm enclosure. Material Safety Data Sheets (MSDS) for these chemicals are provided in Appendix D. Accidental release kits are available at these locations outside the NWA.

Diesel may be used periodically as a defoamer in steel pipe. Diesel is stored in above ground tanks with secondary containment at existing compressor stations outside the NWA. Defoamer (Guardian Chemicals NOFOME 25106) is periodically used at the existing produced water treatment facility (outside the NWA) at a rate of approximately 40 litres (L) per year. Defoamer is stored outside the NWA, in the line heater shack, in a 20 L pail.

There will be no fuel storage within the NWA. Vehicles and equipment will be refuelled as required by a fuel truck equipped with standard accidental release prevention and cleanup equipment.

Pigging trucks are equipped with compressed natural gas (CNG) tanks for use in pigging operations.

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2.4 Emissions, Discharges, and Wastes

EnCana will adhere to all applicable regulations for emissions and waste management. Where no standards exist, EnCana will follow industry best practices, if feasible. EnCana will minimize, to the extent practical, wastes and emissions from the Project.

2.4.1 Air Emissions

The sources and types of air emissions expected during the life of the Project include:

- exhaust from vehicles and rigs;
- short-term venting during completions, tie-in, and maintenance operations; and
- fugitive emissions.

The primary activities associated with air emissions are the combustion of diesel fuel by construction equipment for construction activities, with the main products being water vapour (H_2O) and carbon dioxide (CO_2). Trace amounts of sulphur dioxide (SO_2), nitrogen oxides (NO_x) (comprising nitric oxide (NO) and nitrogen dioxide (NO_2)), carbon monoxide (CO), fine particulate matter (PM), and volatile organic compounds (VOCs) are typically emitted during diesel fuel combustion.

2.4.1.1 Greenhouse Gas

Greenhouse gas emissions from the Project will primarily be the result of diesel fuel combustion and venting of CO_2 and methane (CH_4) during the construction and operations phases. A small amount of CH_4 may be lost through fugitive emissions of natural gas.

EnCana minimizes air emissions (including GHG emissions) related to well testing by conducting in-line testing. In-line testing means that the existing gas gathering system is utilized to conserve the gas. In-line testing is possible in the NWA as there is suitable infrastructure and productivity information.

A significant portion of EnCana's air emissions for the Project are caused by vehicles/engines, EnCana utilizes standard practices/equipment to minimize its emissions. The vehicles/engines have all industry standard emission reduction technologies. EnCana's practices minimize the use of vehicles (including reduced idling times) to further reduce emissions.

The natural gas in the NWA contains no natural gas liquids (being greater than 96% methane and less than 0.01% pentanes or higher carbon chains); therefore, no technologies are utilized for vapour recovery.

Based on 30 years of operational experience at CFB Suffield, EnCana does not anticipate flaring gas including in emergency conditions. The reason that EnCana does not flare gas is that there are insufficient volumes to sustain stable combustion. There are insufficient volumes released to flare as EnCana shuts in at the compressor inlet and no process vessels are required for the Project.

Figure 2-7 Existing Water Sources (PDF: 838k)

In the event of maintenance operations, process upsets or emergencies, EnCana will either shut-in the well(s) or vent the gas for the minimum time period necessary to remedy the situation. EnCana's first option is to shut-in the well(s). Situations resulting in venting or shut-in are rare and generally of short duration. EnCana will comply with all EUB regulations concerning the venting of gas including Directive 060: Upstream Petroleum Industry Flaring, Incinerating and Venting. Pursuant to EUB Directive 060, any vented gas is sweet, free of hydrocarbon liquids, will not be vented for more than 24 hours, and will not constitute an unacceptable fire hazard.

2.4.1.2 EnCana's Approach to Greenhouse Gas Management

Regulatory Context

The Canadian Federal Government (the "Federal Government") has announced its intention to regulate greenhouse gases (GHG) and other air pollutants. In late April 2007, the Federal Government announced its regulatory framework (the "Framework") that outlines its clean air and climate change action plan, including a target to reduce GHG emissions and a commitment to regulate industry on an emissions intensity basis in the short term. The regulations to achieve these objectives will be enacted under the Canadian Environmental Protection Act, 1999 and will be introduced starting in spring 2008. For GHG, the Framework sets a 2010 implementation date for emissions intensity reduction targets.

The government of Alberta (the "Alberta Government") has also passed legislation that will regulate GHG emissions from certain facilities located in the province. The Alberta Government's legislation is called the Climate Change and Emissions Management Act (CCEMA). In March 2007, the Alberta Government circulated draft regulations pursuant to the CCEMA that, starting on July 1, 2007, will require facilities that emit more than 100,000 tonnes of GHG per year to reduce their emissions intensity by 12%.

The Project is not a large emitting facility and therefore the draft Alberta regulations would not apply. As the federal regime is as yet unclear, EnCana is unable to predict the impact to its business. EnCana will continue current activities to reduce emissions intensity and improve energy efficiency. Efforts with respect to emissions management are founded on the following key elements:

- significant weighting in natural gas;
- recognition as an industry leader in CO_2 sequestration;
- focus on the development of technology to reduce GHG emissions;
- involvement in the creation of industry best practices; and
- industry-leading oil sands steam-oil ratio, which translates directly into lower emissions intensity.

Greenhouse Gas Management Policy

EnCana is keenly aware of the growing concern of society that energy is used efficiently and that emissions are managed to reduce greenhouse gas contributions and improve air

quality. EnCana recognizes that true sustainability requires the foresight to steward resources so that it is possible to maintain and grow not only economic capital but also environmental and social capital.

EnCana acknowledges that climate change is occurring and it is a growing public concern. EnCana will do its part by reducing GHG emissions through improvements in energy use, investments in technology, sequestration and innovation. Central to the environmental practice of the organization, EnCana strives to employ capital and energy efficient methods to minimize footprint and to maximize recovery of the resources extracted by employing and advancing technologies and methodologies that reduce environmental effects and minimize waste.

EnCana understands the provincial and federal governments' increasing attention toward this important issue as they develop an appropriate regulatory framework. EnCana will continue to provide advice and assistance to government in this regard, as well as persevere with internal actions to contribute to these efforts and to work within the emerging regulatory requirements.

EnCana's focus on emission reduction is through reducing energy intensity and improving energy efficiency. In this regard, EnCana has developed an energy efficiency built around three mutually reinforcing pillars: operations, employees and community investment.

- Operations will maintain a strong focus on reducing emissions and energy use across the Company and further developing EnCana's existing culture of energy efficiency within the Divisions. Energy assessments are being launched at a small number of facilities to measure environmental performance against best practices and target improvements, and there is a budget that will be allocated through a specific Energy Efficiency Project Approval Request process. This program will start in 2007 with energy audits of major facilities for the purposes of identifying opportunities for improvement.
- EnCana employees will be provided with tools and incentives to make changes in consumer and lifestyle choices. EnCana is developing a rebate program for North American employees that will be linked to the Energy Star program that labels energy efficient products. In addition, employees and contractors have been asked to develop ideas on ways to reduce energy consumption.
- Community investment will serve to further solidify EnCana as a corporate leader on energy efficiency. EnCana is in the process of developing a new partnership to support a community-based effort to enable each household touched by EnCana's North American business to make a change to become more energy conscious.

EnCana believes there is a real need to reduce emission intensity and improve energy efficiency from wellhead production through to the consumer. The best solutions will be those that harness technology and provide timely incremental improvements to ultimate resource recovery.

Corporate Management of Greenhouse Gases
EnCana has tracked the Greenhouse Gas emissions due to its operations in Canada since 2003. The following Greenhouse Gas emissions data has been extracted from EnCana's 2006 Corporate Responsibility Report [http://www.encana.com/responsibility/reporting/index.htm].

EnCana's methodology to measure emissions is based on the specifications outlined in the American Petroleum Institute's "Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry" along with additional guidance provided by Canadian Association of Petroleum Producers (CAPP) and the Global Reporting Initiative (GRI).

As a result of increasing production and the addition of U.S. data, EnCana's 2006 direct CO_2 emissions have increased since 2003 (see Table 2-5). Emissions per unit of production, which represents emissions intensity, have also increased. Emissions intensity is measured on a "tonnes of CO_2e per m^3 of oil equivalent production" basis. Compared to the best available information for the Canadian oil and gas industry from the 2006 CAPP Stewardship Progress Report, EnCana's Canadian emissions intensity is approximately 22 percent below the national industry benchmark. EnCana's Canadian operations direct GHG emissions are 5,924 kilotonnes CO_2 equivalent. (Direct GHG emissions include total direct emissions from combustion, flaring, formation CO_2 and other venting and fugitive leaks from equipment.)

Table 2-5 EnCana Greenhouse Gas Emissions

EnCana Greenhouse Gas Emissions [1,2]	**2003**	**2004**	**2005**	**2006**
Direct CO_2 emissions (ktonnes CO_2e) [2,3]	4,489	5,239	5,469	7,890
CO_2 sequestered at Weyburn (ktonnes)	1,544	1,594	1,842	1,800
Direct greenhouse gas emissions intensity (tonnes CO_2e/m^3OE) [4]	0.145	0.152	0.161	0.160
Canada				0.170
U.S.				0.137
Adjusted direct CO_2 intensity	0.095	0.106	0.107	0.118

NOTES:

[1] Figures for 2003, 2004, 2005 are for Canada only. Figures for 2006 include both Canada and U.S.

[2] Estimates of direct CO_2 emissions for 2003 and 2004 have been recalculated and restated as a result of a change in the interpretation of the definition of "covered emissions" in the Alberta Environment and Statistics Canada reporting protocols.

[3] Includes total direct emissions from combustion, flaring, formation CO_2 venting, fugitive equipment leaks and other reported venting consistent with Statistics Canada/Alberta Environment reporting protocols.

[4] Direct emissions include all emissions generated during oil and natural gas exploration

and production, except emissions associated with transportation activities. Direct emissions include fuels burned to generate onsite heat and electricity.

Project Greenhouse Gases

The expected Project greenhouse gas (GHG) emissions were developed by assessing several activities that will be incremental to current operations. These values are calculated as per the descriptions in the section above.

The Project will use the methods for reducing flaring and venting that EnCana has developed for its shallow gas operations in Southeast Alberta. The primary feature of these methods is EnCana's practice of having pipeline installed to the wellhead before the completion phase of the well. This allows EnCana to take gas from the well into the gas gathering system as soon as the gas quality is sufficient for the gas to be sold. Facility shut down systems are designed to contain gas, except in instances where a significant combustion risk is detected in which case the facility is depressured for safety purposes.

Methods and Assumptions

The Koomati Compressor Station

The increase in production of 9 mmscfd handled by this facility will increase the loading on the main compressor engines. Auxiliary equipment such as generators or office boilers will not be affected. The 2006 GHG emissions calculated from EnCana's Emission Manager database, were apportioned across each engine according to the 2005 fuel usage per engine which was in turn estimated according to the rated horsepower capacity of each engine and the fuel usage of the other fired equipment on site.

The current throughput per engine was then determined by the percentage of fuel used by each engine. The incremental 9 mmscfd was also split in the same manner to identify a new total throughput of 60 mmscfd. The 2006 total GHG emissions were also apportioned across each piece of fired equipment and a current GHG emission per throughput was determined. This value was multiplied by the incremental throughput to get the incremental GHG emissions per machine. These incremental emissions per machine were summed to get the Project incremental value of 13,845.6 tonnes CO_2e/year.

Flaring

Flaring will increase GHG emissions by another 18.5 tonnes due to the incremental throughput. Flaring happens for several reasons, primarily:

- A section of the plant must be depressurized for maintenance and is then purged to put back on stream. This is not dependent on throughput.
- During an emergency, the plant shuts down and depressurizes to flare. This is a fixed volume and not dependent on throughput.
- Safety valves lift due to excessive internal pressures. This is not dependent on throughput and is of short duration.

- Short-term shutdowns of part or all of the plant before the well sites can be cut back. Short-term flaring constitutes most of the flaring, and it will increase in proportion to the number of wells.

Drilling, Completions, and Tie-in of New Wells
Minimal information is available to estimate emissions from a diesel engine operating in a stationary situation at a site. An estimate of the number of gallons of diesel used per hour while stationary was made based on an operating unit's mile per gallon fuel efficiency on the road even thought this number is dependent on speed, type of road surface, weight being hauled, etc. The GHG factor used for diesel fuel is 10.1 kg CO_2e/gallon based on U.S. EPA calculations.

The distance estimated to get on and off the NWA was derived by checking access to the NWA. There is a northwest access to the northeast section of the NWA and there is a Gate C access to the southwest section of the NWA. A worst case scenario for accessing to the wells was assumed to require an average of approximately 20 km of driving through the NWA.

There will not be a camp on the NWA, therefore the highway trucks bringing in the rig will not stay on the site. For water and vacuum trucks, it has been assumed that trucks would haul loads from or to the NWA each day they were required. Trucks used for infrequent efforts such as logging, pressure testing, swabbing and perforating were also assumed to leave the NWA at the end of a day, in addition to well-to-well travel. The plough truck, excavator and backhoe loader we assumed to go from well to well, staying on site overnight. This necessitates that crews will exit the NWA each night in smaller vehicle(s). The emissions from those vehicles are considered minimal and were not included.

New Well Clean-Out
Emissions during cleanout were estimated from data provided by experienced completions personnel. After the completion operation, the completion fluids are flowed back from the well to a blowback tank. For the first 0 to 5 hours, flowback consists of water mixed with carbon dioxide, with the carbon dioxide vented at rates of approximately 200 Mcf/d. For the next 5 - 18 hrs, the flowback changes to a gas that is a blend of an average 50% CO_2 and 50% methane flowing at rate of approximately 150 Mcf/d, and for the final 18 - 24 hrs a gas consistency of 90% methane and 10% CO_2, flowing at approximately 150 Mcf/d.

Operations Activities
For swabbing activities, truck travel was calculated using the same assumptions as for the drilling and completions work. Swabbing and blowdown volumes were based on depressurization of the casing from known operating pressures. The number of wells undergoing each operation was based on the known number of current wells that require swabbing each year. Blowdown operations are required between swabbing operations.

Summary of Project GHG Emissions
Estimated GHG emissions and emission intensity over the duration of the Project is provided in Table 2-6. The Project is expected to result in an increase of approximately 15,000 tonnes CO_2e per year. This Project represents an increase of approximately 0.002 % and 0.006 % of the GHG estimates for Canada and Alberta in 2004, respectively (Environment Canada 2006).

References
Environment Canada National Inventory Report, 1990 - 2004 - Greenhouse Gas Sources and Sinks in Canada
http://www.ec.gc.ca/pdb/ghg/inventory_report/2004_report/toc_e.cfm [Updated from original report)

Table 2-6 Project Greenhouse Gas Emissions

Project Summary, Incremental GHG Emissions:	**CO_2e, tonnes**	
Installation:		
Drilling, completions, Tie-in:	10,166	for the Construction Phase
Well Cleanout:	57,092	for the Construction Phase
Installation total per year:	**22,419**	**tonnes per year**
Operating:		
Operations, Swabbing vehicle:	823	per year
Operations, Swabbing Depressurize:	146	per year
Blowdown to remove water:	210	per year
Koomati incremental emissions	13,864	**tonnes per year**
Operating total CO_2e:	**15,042**	**tonnes per year**
Incremental gas production:	9	mmscfd
With oil at 38.5 GJ/m^3:	96,271	m^3 OE

Project Annual Intensity:	**Year 1**	**Year 2**	**Year 3**	**Annually Thereafter**
% wells on stream:	15.7%	52.9%	90.2%	100%
GHG Intensity	1.485	0.735	0.431	0.156

2.4.2 Noise
Noise emissions from the Project will be generated mainly from equipment in use during the construction phase, and, to a much lesser extent, from vehicles and equipment in use during routine operational activities. It is anticipated the highest noise emissions will occur during the construction phase of the Project. Sound levels from the Project are anticipated to range from 10 to 32 dBA at 1500 m. Predicted noise levels from typical construction phase activities are summarized in the table below.

All activities will comply with EUB Directive 038 (see Appendix E). Directive 038 permits specified sound levels attributable to the facilities at designated receptor points.

The EUB Directive does not apply to noise from construction activities, as these activities are typically short in duration.

The potential environmental effects of noise emissions from the Project are assessed in Table 2-7).

Table 2-7 Predicted Noise Levels From Typical Equipment Operations for the Project Operations

Predicted Noise Levels From Typical Equipment Operations for the Project Operations at Theoretical Receiver Distances in the NWA
Predicted Level (dBA L_{eq})
Wind Directed to Theoretical Receiver Locations

Noise Source *	50 m	100 m	250 m	500 m	1000 m	1500 m
One Typical Fracturing Operation	72	61	57	49	39	33
One Traditional Drill Rig Operation	70	61	55	44	33	27
One Typical Coil Rig Operation	70	61	55	44	34	29
One Chain Trencher Operation	64	55	48	38	28	27
Pipe Laying Operation	57	47	40	32	24	20
Pipe Alignment And Welding Activity	58	49	42	31	22	17
Backhoe Trenching in Soft Ground	57	47	40	31	21	15
Pressure testing valve release of pressure	48	39	31	23	16	12
Total Predicted Level with wind conditions (with all listed activities operating continuously at the same location)	**76**	**67**	**61**	**51**	**41**	**36**
Total Predicted Level under calm conditions (with all listed activities operating continuously at the same location)	**78**	**67**	**60**	**50**	**40**	**34**

NOTE:
* Drilling, fracturing, and pipelining activities do not necessarily take place simultaneously at a given site or within proximity to each other. However, each operation could occur at the same distance to a given theoretical receiver location.

2.4.3 Wastes

Wastes produced from the Project will be generated primarily during the construction phase, and, to a lesser extent, from maintenance activities during operations. The sources of waste from the Project include drilling and completion fluids and solids, produced

water, and routine pigging and well treatment wastes. All waste storage systems do and will comply with applicable EUB guidelines.

2.4.3.1 Drilling and Completion Wastes

It is anticipated the drill mud systems will be fresh and water-based, using approved mud products to provide viscosity, control fluid loss, lubricate the drill bit, control formation pressure, and flocculate drilled solids. All drilling mud additives will be specified as non-toxic (as defined by the Petroleum Services Association of Canada, see Appendix F). Individual drilling wastes will vary in composition and volume for each well under construction. The characteristics of the formations drilled through will influence what wastes are produced.

Drilling each well will require approximately 75 m^3 of water. The water necessary for drilling will be transported to the well site via a truck-mounted tank. Approximately 68 m^3 will be returned as drilling waste, of which 56 m^3 will comprise recovered water (approximately 80 percent of the water used to drill the well). Drilling waste will be stored in containment sumps outside the NWA, on previously disturbed sites. These sumps will be decommissioned using the mix-bury-cover (MBC) method.

Based on previous operations in the NWA, each well will require 100 m^3 of fluid for well completions, of which approximately 25 percent will be recovered. Each well completion will produce approximately 25 m^3 of liquid waste, primarily water, and approximately 5 m^3 of solid waste (primarily sand) per well. The fluid (primarily water) will be separated from solid waste overnight and re-used as completion fluid. The mud will be transported to a sand recycling facility; remaining solids will be trucked to (in loads of 5 m^3) and disposed at an existing provincially licensed waste disposal facility.

2.4.3.2 Produced Water

Produced water will be removed from the wellbore by swabbing. Swabbed wastewater will be transported from the well site to an existing water treatment facility for clarification (in settling ponds). No chemicals are used in this process. Clarified water will be removed from the existing water treatment facility and hauled to an existing licensed water disposal well (6-4-20-7 W4 or 4-11-15-9 W4) for injection. Solids (formation clays and sands) will be removed and hauled to a provincially licensed disposal facility.

Produced water not recovered by swabbing will flow with the produced natural gas to existing compression facilities through the pipeline gathering system. Once at the compression facilities, produced water will be separated from the gas by inlet separators. Following separation, the water will be sent to above ground tanks for storage and clarification. Clarified water will be removed from the storage tanks and hauled to an existing licensed water disposal well (6-4-20-7 W4 or 4-11-15-9 W4) for injection. Solids (formation clays and sands) will be removed and hauled to a provincially licensed disposal facility.

2.4.3.3 Pigging and Well Treatment Wastes

Fluids recovered from pigging and inlet separators, predominantly produced water, will be disposed of in an existing licensed disposal well. The produced water will be injected into the glauconite formation. Solids will be separated and sent to an existing provincially licensed disposal facility.

The composition, quantity, and storage and disposal methods of wastes expected to be generated from the Project are summarized in the following Table 2-8. Detailed waste charts are provided in Appendix G.

Table 2-8 Project Waste Types, Volumes, and Storage and Disposal Sites and Methods

Project Waste Types, Volumes, and Storage and Disposal Sites and Methods

Waste	Quantity	Storage Site	Disposal Site	Disposal Method
Drilling Mud and Cuttings	Approximately 68 m^3 per well (including 56 m^3 of water and 12 m^3 of solids)	Remote sumps on CFB Suffield (outside the NWA)	CFB Suffield	Approximately 10% of water is re-used. Remainder is disposed by Mix-Bury-Cover (MBC) at sump site
Swab water	1,100 m^3/month	D-Station Water Treatment Facility	4-11-15-9W4 6-4-20-7W4	Injection
Produced Water (from facility inlet separation)	1,500 m^3/month	Compressor station(s) and D-Station Water Treatment Facility	4-11-15-9W4 6-4-20-7W4	Injection
Completion fluid	Approximately 5 m^3 of slurry	Remote sumps on CFB Suffield (outside the NWA)	Provincially licensed facility	Recycle sand and dispose of remaining solids at a licensed waste disposal facility
Swab Solids	500 m^3 annually	D-Station Water Treatment Facility	D-Station Water Treatment Facility	Disposal at a licensed waste disposal facility
Pigging and well treatment wastes	Less than 20 litres per well annually	D-Station Water Treatment Facility	Fluids to 4-11-15-9W4 6-4-20-7W4 Provincially licensed facility	Fluids with produced water (injection); solids to disposal at a licensed waste handling facility

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2.5 Schedule

Pre-construction preparation, including site visits, will occur in the summer and fall before each drilling season. Pre-construction preparation for the 2008 to 2009 drilling season will occur in the summer and fall of 2008.

The infill wells will be drilled over three seasons, commencing fall and winter 2008. Construction activity typically will occur primarily between October and April to respect environmental constraints and the military training calendar.

Construction and post-construction cleanup will be completed as quickly as possible, and the time between front-end and back-end operations will be minimized. It is currently envisioned the infill development will commence at the south end of the NWA in the first year with subsequent phases in the middle and northern portions of the NWA in following years.

The operations phase will commence immediately following the construction phase for each well. It is anticipated the wells will produce for 20 to 40 years depending on the reserves and production rates.

The decommissioning and abandonment phase will occur following the operations phase (i.e., in 20 to 40 years). EnCana will suspend a well, in accordance with the requirements established by the EUB, within 12 months after the well last produced. Surface decommissioning and abandonment will occur within 12 months of downhole abandonment operations.

As previously noted, the Project is planned to be implemented across three winter drilling seasons, which will span four calendar years, 2008 to 2012, assuming a start date of October 2008. Certain factors, such as military lockouts due to training requirements and weather constraints, may affect the anticipated Project schedule. If delays caused by these factors are short enough, the Project drilling and construction season may be able to accommodate these schedule interruptions. If the delays caused by these factors are long enough to measurably alter the planned work for any particular construction season, the subsequent season(s) would have to be replanned to accommodate the deferred work. Depending on how these factors affect the three consecutive construction seasons, the amount of work done in any one season may vary from the one third of the total Project planned to be executed in each season. Variances for any season are expected to be accurate within 20 percent of that season's work. Under worst-case conditions, this could require an additional winter construction season to complete the Project.

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2.6 Costs

All referenced costs are in 2006 Canadian dollars unless noted. The total cost of drilling

the new wells is estimated to be about $199 million. Water and waste management costs are included in the drilling and completion costs.

Project operating expenditures will be approximately $5 million per year, similar to current operating expenditures, as no additional permanent personnel will be required. Swabbing and other maintenance operations will be required for the additional wells. However, improved operational efficiency will result from the use of remote gas meters and experience in the area.

Decommissioning and abandonment of each well is anticipated to cost approximately $35,000.

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2.7 Employment

Four to five drilling crews may be employed at any given time during the drilling season (primarily between October and April) in each of the three years of the construction phase. The crews typically work 12-hour shifts. EnCana has a drilling supervisor on site.

A maximum of four completion crews will also be required. Another two or three crews will be required for tying wells into the gas collection system. At this time, the future decommissioning and abandonment best practices are unknown; however based upon today's practices the crew would consist of a welder, a pump truck operator a back hoe operator and a supervisor.

Approximately 120 people will be employed during each drilling season in the construction phase. Additional indirect and induced benefits from Project employment and procurement are described in Volume 5, Section 4: Socio-economics.

The Project is not expected to result in any change in permanent employment during operations. EnCana personnel work shifts of varying lengths and frequencies, ranging from 8.0 hours per day on a one-week rotation to 9.2 hours per day on a three-week rotation. Some people work on four, five, and six week rotations. Shifts commence between 7:00 and 8:00 AM. EnCana employees, including contractors, typically travel from Medicine Hat and travel via Highways 1, 41 and 844, Range Road 83, Box Springs Road, and Bowmanton Road to meet at one of five coordination points.

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2.8 Alternative Means of Carrying out the Project

EnCana has considered alternative means of carrying out the undertaking. An important factor in this analysis was the proximity of existing infrastructure. The Project incorporates the use of existing infrastructure, including access, gathering pipelines, and other above ground and off-site facilities, to the maximum extent practical to reduce both environmental effects and Project costs. The range of potential alternative means is limited to some degree also by the nature of the Project as an infill development.

The alternative means were considered for the following aspects:

- drilling and completion techniques;
- pipeline integrity testing;
- layout and construction of the gas gathering system;
- water supply;
- maintenance and production operations;
- layout and use of temporary and permanent access routes; and
- management, storage, and disposal of waste materials.

The decision to proceed with the preferred development option was based on evaluation of the various alternatives against the following evaluation criteria:

- technical suitability;
- effects on resource recovery;
- effects on economics;
- socio-economic effects;
- safety; and
- environmental effects.

The relevance and contribution of each criterion varied depending on the alternative under consideration. If an alternative was deemed to be technically and economically not feasible, a further assessment of the alternative was not considered.

2.8.1 Drilling and Completion Techniques

EnCana considered two alternatives for drilling: directional and vertical.

Directional drilling is a drilling technique whereby a well is deliberately deviated from the vertical in order to reach a particular part of the reservoir. Directional wells are initially drilled straight down to a predetermined depth and then gradually curved at one or more different points to penetrate one or more given target reservoirs. Directional drilling also allows multiple production wells to be drilled from a single surface location. Horizontal drilling, a more specialized type of directional drilling, allows a single wellbore at the surface to penetrate gas-bearing reservoir strata at horizontal or near horizontal angles to the dip of the strata.

The commercial zones in the NWA are shallow (between about 250 and 650 m depth) and stacked (see Figure 2-8). Directional drilling would not be as effective at draining all of the commercially productive shallow gas zones as vertical wells. Directional drilling would result in a lower recovery rate with reserves stranded. Directional drilling utilized one surface location with multiple downhole locations would also result in reduced resource recovery with significantly increased costs to drill the wells (due to increased time required to drill and complete the wells) and increased operational costs. As EnCana does not construct leases (i.e. strip top soil) or lease roads, the use of well pads would not result in reduced environmental footprint.

Figure 2-8 Commercial Gas Zones (PDF: 28k)

After evaluating the directional drilling technique, it was determined it was neither technically nor economically feasible; therefore, vertical drilling is the only technical and commercial option.

2.8.2 Pipeline Testing Alternatives

EnCana considered two alternatives for testing of pipeline integrity: hydrostatic testing (hydro-testing) and air testing. Pipeline testing occurs before commissioning the pipeline or when returning the pipe segment to operation. Pipeline testing is designed to confirm there are no leaks in the pipeline before it is placed in operation either after construction or after pipeline repairs.

The testing process starts with filling the pipe segment with a fluid system (air, water or methanol). The fluid is then pumped up to a pressure higher (typically 50 percent above) than maximum operating pressure (used when transporting the natural gas). This higher pressure must be maintained for a period of time, typically eight hours. Segments of the pipeline are tested and then pressure is reduced in the test section and the water or air is evacuated into tanks at the monitoring locations. If water is utilized then the line itself will be purged to ensure that no water remains in the pipeline before returning the segment to operational status. Both methodologies are established practices in the oil and gas industry with proven safety records.

EnCana has determined that air testing is preferable where technically possible (see Table 2-9). It is not technically feasible to air test on 8 in. I.D. lines (segments) greater than 3.7 km; therefore, on some backend loop lines hydrostatic testing may be required. EnCana has selected air testing as this methodology has reduced environmental effects and economic cost. The potential environment effect of hydro testing is higher as hydro testing would increase water use for the Project, increase the footprint (additional vehicles and tankage would be required) and require additional time in the NWA. There is a measurable increase in costs ($31 million) associated with hydrotesting. Neither methodology will affect resource recovery over the life of the Project.

Table 2-9 Summary of Pipeline Testing Alternatives

Summary of Pipeline Testing Alternatives							
Alternative	**Feasibility**	**Technical Suitability**	**Effects on Resource Recovery**	**Effects on Economics**	**Socio-economic Effects**	**Effects on Safety**	**Environmental Effects**
Hydro-testing	Yes	Proven technology	No effects	Increased cost and time	Reduced resources (pipeline testing crews) availabilit	No effects	Increased water use, vehicle use and time and footprint in the NWA

Table 2-9 Summary of Pipeline Testing Alternatives

					y for other uses		
Air Testing	Yes- provided the segment is less than 3.7 km for 8 in. loop lines	Proven technology	No effects	No effects	Base Case	No effects	None

2.8.3 Pipeline Routing Strategy

There are two general strategies regarding the routing of gas gathering systems: straight line routing and routing around sensitive environments. Straight line routing minimizes the overall pipeline length. The other alternative is to route the gas gathering system around sensitive environments thus increasing the total length of the pipeline.

At this time, laterals and loop line pipeline routes have not been finally selected. Routing alternatives have been and will be considered in the route selection process. EnCana has determined that the preferred strategy is to avoid, where possible, sensitive environments (i.e., species at risk) and institute appropriately sized buffers for each species and environment based on a consideration of the total environmental effects of the pipeline and Project. The routing decision will be made with input from environmental specialists in the field after a preliminary route is chosen on the basis of the constraints mapping process.

Routing the pipelines around sensitive environments and species will result in increased costs of $3.5 million due to increased time to survey and install the pipeline and increased pipeline lengths.

Table 2-10 Summary of Pipeline Routing Strategy Alternatives

Summary of Pipeline Routing Strategy Alternatives

Alternative	Feasibility	Technical suitability	Effects on Resource Recovery	Effects on Economics	Socio-economic Effects	Effects on Safety	Environmental Effects
Straight line pipeline routes	Yes	Proven technology	No effects	Reduced cost and time	Increased resources (pipeline crews) availability for other	No effects	Reduced construction time, reduced pipe length, increased potential effect

Table 2-10 Summary of Pipeline Routing Strategy Alternatives

					uses		on sensitive environments
Routing around sensitive environments	Yes	Proven technology	No effects	Current practice	Current Practice	No effects	Increased potential environmental effects on nonsensitive environments with less potential effects on sensitive environments

2.8.4 Water Supply

EnCana has identified the following local sources of water:

- South Saskatchewan River (SSR) (in the NWA) at NE 23-17-5 W4 (temporary withdrawal licence for 18,000 m^3);
- water wells and dugouts within CFB Suffield, at 12-6-17-5 W4 (20,000 m^3/yr licensed), 4-4-16-6 W4 (73,000 m^3/yr licensed), 5-2-20-7 W4 (well and dugout), 10-16-20-7 W4 (well and dugout), and 10-16-20-8 W4 (well and dugout); and
- South Saskatchewan River, obtained via purchase from the Municipality of Medicine Hat.

EnCana considered four options for sourcing the water required for drilling and completions:

- Option 1 - obtaining water from a licensed surface water source (SSR) within the NWA;
- Option 2 - using water from wells or spring-fed dugouts near the NWA;
- Option 3 - transporting water from the Municipality of Medicine Hat; and,
- Option 4 - using a combination of all of these sources.

EnCana's preferred option is Option 4. This option minimizes the environmental effects on groundwater levels, surface discharge rates, wetland surface water levels, and air emissions associated with water transport. This approach also provides for flexibility in sourcing of water in the event of any source constraints (such as drought). The analysis of water supply alternatives is summarized in Table 2-11. In selecting a specific water source (from the above list) during Project construction or operations, EnCana will consider the following criteria:

- volume of water required;
- source capacity and licensed withdrawal volume;
- distance between source and use;

- flow in the South Saskatchewan River;
- temperature (i.e., whether surface water sources are frozen); and
- other relevant environmental and technical considerations.

Based on obtaining water from various sources, the costs associated with the alternative water sources for the construction phase are:

1. Water obtained from the City of Medicine Hat costs $0.6 million;
2. Water obtained from the South Saskatchewan River in the NWA costs $0.4 million; and
3. Water obtained from licensed water wells and dugouts at CFB Suffield costs $0.2 million.

Table 2-11 Summary of Water Supply Alternatives Analysis

Summary of Water Supply Alternatives Analysis

Alternative	Feasibility	Technical Suitability	Effects on Resource Recovery	Effects on Economics	Socio-economic Effects	Effects on Safety	Environmental Effects
Obtaining water from licensed surface water sources within the NWA	No, not enough water available to meet Project requirements.	Proven technology	Reduced ability to recover resource	Increased cost and time associated with Project	Reduced availability of water for other users of the SSR	No effects	Potential effect on surface discharge rates and wetland surface water levels within the NWA
Obtaining water from wells or spring-fed dugouts near the NWA	Yes	Proven technology	No effects	No effects	Reduced availability of water for other users	No effects	Potential effect on groundwater levels, surface discharge rates, and wetland surface water levels
Transporting water from Municipality of Medicine Hat	Yes	Proven technology	No effects	Increased costs	Reduced availability of water for other users of the SSR	Increased travel times can result in increased chance of	Increase in emissions from trucks transporting water

Table 2-11 Summary of Water Supply Alternatives Analysis

						accidents	
Using a combination of water from all identified sources	Yes	Proven technology	No effects	Base case for capital costs	No effects on base	No effects	Reduced potential effect on groundwater levels, surface discharge rates, and wetland surface water levels

2.8.5 Maintenance and Production

EnCana considered two potential alternatives for collection of metering data:

- weekly collection by operators of meter charts; or
- use of Supervisory Control and Data Acquisition (SCADA), where information on gas production is transmitted to operators electronically.

EnCana has determined that the preferred alternative is to use SCADA. SCADA allows for faster communication of information as radios at each group meter site transmit production data to operators outside the NWA. This will reduce the need for and frequency of site visits as the alternative is to visit each group meter site once a week to collect the production charts. The use of SCADA will reduce traffic in the NWA resulting in less environmental effects and slightly improved safety. The SCADA meters have an increased capital cost of $0.16 million; however, there will be a resulting decrease in operational costs of $0.42 million. The improved response time to changes in production may result in improved resource recovery.

Table 2-12 Summary of Collection of Metered Data Alternatives

Alternative	**Feasibility**	**Technical Suitability**	**Effects on Resource Recovery**	**Effects on Economics**	**Socio-economic Effects**	**Effects on Safety**	**Environmental Effects**
Meter charts collected weekly by operators	Yes	Proven technology	No effects	Increased operational costs and reduced capital costs	Less operators required - resources for other uses	Slight increase in time in vehicles has the potential to	Increased vehicle use in the NWA due to weekly site visits

Table 2-12 Summary of Collection of Metered Data Alternatives

						increase chance of accidents	
SCADA	Yes	Proven technology	Improved response time may result in improved recovery	Increased capital costs and reduced operational costs. Less total costs	No effects	No effects	No effects

2.8.6 Access

2.8.6.1 Layout

EnCana considered two potential approaches for the layout of access routes during construction and operations.

- Wherever possible, existing disturbance areas will be used to provide access. Where necessary, new access routes would be established on a "one route in and out" basis at the time of construction. These established routes would be used for all activities throughout the life of the Project unless modification is required for the protection of wildlife or soils.
- Wherever possible, existing disturbance areas will be used to provide access during construction. Where new access is necessary, one primary access route would be established at the time of construction for use during construction and by all nonroutine operations.

The following mitigation measures will minimize spatial disturbance associated with new access route development for the Project:

- normally linear disturbance will be minimized by having a single primary access route to well sites (i.e., avoid multiple tracks to the same site);
- access routes and other linear facilities will be chosen based on environmental siting factors and
- EnCana will, where feasible, integrate future land uses and access requirements in determining the placement of primary access routes.

Specific access routes have not been finally selected. Routing alternatives have been and will be considered in the route selection process. The route selection process and the criteria considered in route selection are described in Section 2.8.3. In selecting access routes, EnCana will avoid, where possible, sensitive environments and species at risk and institute appropriately sized buffers for each species and the environment based on a consideration of the total environmental effects of the pipeline and Project. The routing

decision will be made with input from environmental specialists in the field after a preliminary route is chosen on the basis of the constraints mapping process.

After a thorough review, EnCana has determined the preferred option is to establish, at the time of construction, access routes to be used throughout the Project life. There will be increased operational costs of $48,000 associated with this alternative and increased localized effects; however, the total potential environmental effects are anticipated to be less. Determining routes in advance will allow the best route to be determined by specialists in consultation with operators and construction personnel and will allow for more control over the environmental effects of the operations phase. Routes may be altered during operations to reduce the environmental footprint of the Project. New routes will be selected in consultation with environmental advisors and in consideration of the same factors as the original route selection process.

The analysis of these alternatives is summarized in the following Table 2-13.

Table 2-13 Alternative Approaches for Layout of Access Routes

Summary of Collection of Layout of Access Routes							
Alternative	**Feasibility**	**Technical Suitability**	**Effects on Resource Recovery**	**Effects on Economics**	**Socio-economic Effects**	**Effects on Safety**	**Environmental Effects**
Pre-determined Access Routes	Yes	Proven technology	No effects	Slightly increased operational costs due to increased travel times and higher fuel costs	No effects	Increased travel times could result in increased accidents	Higher environmental effects in a localized area, with higher potential for rutting and increased fuel consumption
Shortest distance routes	Yes	Proven technology	No effects	Base Case	No effects	No effects	Reduced environmental effects in a localized area but increased area affected

Vehicle Use
EnCana considered four potential alternatives for the use of vehicles for access:

- Option 1 - the use of trucks;

- Option 2 - the use of trucks that are only used at CFB Suffield;
- Option 3 - the use of four-by-four trucks with balloon tires that are used only at CFB Suffield;
- Option 4 - when conditions are dry or frozen, the use of 4 x 4 trucks, and, where possible, in wet conditions, the use of smaller vehicles (i.e. quads or all terrain vehicles (ATVs)).

EnCana's preferred option is the Option 4 as this option has improved environmental results with no additional capital costs and slightly increased operational costs. The use of four-by-four trucks will result in less potential for rutting and slightly higher chance of accidents. The 4 x 4 trucks will utilize existing access routes, where possible, so will not result in additional access routes (see Table 2-14).

Table 2-14 Alternatives For The Use of Vehicles For Access

	Summary of Collection of Layout of Access Routes						
Alternative	**Feasibility**	**Technical Suitability**	**Effects on Resource Recovery**	**Effects on Economics**	**Socio-economic Effects**	**Effects on Safety**	**Environmental Effects**
Existing trucks	Yes	Proven technology	No effects	No effects	No effects	No effects	Potential for increased environmental footprint in nonfrozen and dry conditions
New trucks, limited to use within CFB Suffield	Yes	Proven technology	No effects	Higher capital costs	No effects	No effects	Slightly reduced chance of spreading weeds from outside CFB Suffield
Trucks with balloon tires	Yes	Proven technology - for some site conditions	No effects	Higher capital costs	No effects	No effects	Marginally reduced environmental footprint
Trucks with 4 x 4 use in appropriate conditions	Yes	Proven technology	No effects	Higher operational costs (cost to rent 4 x 4 trucks) and lower fuel costs	No effects	4 x 4 trucks use can lead to increased accidents	Reduced chance of rutting and reduced environmental footprint

2.8.7 Waste Management

2.8.7.1 Drilling Waste Management

As with all of its activities, EnCana's attempts to re-use or recycle to minimize waste that must be disposed. For the Project, EnCana considered four potential alternatives for the waste (primarily processed water) generated by drilling and completion of wells:

- use of remote sumps outside the NWA;
- transportation to a waste disposal facility; and
- downhole injection

Remote sumps

Remote sumps are typically one-hectare impermeable pits designed to contain drilling wastes temporarily during the drilling season. Best efforts are made to locate sumps on previously disturbed areas to minimize effects on native prairie. Only drilling waste, drill cuttings, and cement returns are placed in sumps. Sewage or other oilfield wastes are not mixed with the drilling waste. Drilling sumps are decommissioned as soon as reasonably possible (maximum of 12 months) following rig release from the last well to contribute drilling waste to the sump. As part of the reclamation activities of the Project, remote sumps would be reclaimed as required the EUB to the standards determined by the AENV.

Typically, the waste from up to 50 wells will be sent to one remote sump location that will be approximately one hectare in size. Each well will generate approximately 68 m^3 of waste, which will be transported in a vacuum truck (in loads of 18 m^3) to a remote sump location. The fluid will be re-used where possible and the remaining solids will be tested pursuant to EUB Directive 50, at the remote sump location. All solids that do not meet Directive 50 requirements will be transported to a licensed waste disposal facility.

The mix-bury-cover (MBC) disposal method may be utilized in combination with remote sumps to dispose of the drilling wastes. This method involves mixing drilling waste solids (and sometimes fluids or the total waste) with subsoils, at a depth below either 1 or 1.5 m, to form a stabilized soil and waste mass below the main rooting zone.

Transportation to a waste disposal facility

The transportation of drilling waste to a waste disposal facility is not considered technically and economically feasible for all of the waste produced as part of the Project. This alternative would result in measurably increased costs related to waste disposal. The majority of the waste is water and drill cuttings, which are nontoxic. This would result in unnecessary volumes of water and drill cuttings being disposed of in a landfill. The additional emissions associated with transporting the materials to the facility also contributed to the decision not to use this technique. Solids that do not meet Directive 50 requirements will be required to be transported to a provincially licensed waste facility. EnCana does not anticipate that drilling waste will exceed Directive 50 requirements.

Downhole injection

Downhole injection involves grinding of drill cuttings, mixing with liquid waste and water to create a slurry, and injecting the slurry into a suitable formation. A large volume of water is consumed to make the slurry. The disposal formation should be highly permeable to accommodate the injected slurry, but should not allow vertical migration of waste. It should not contain hydrocarbons or potable water. The capacity of the injection zone must be calculated to ensure desired volumes of waste can be injected. This technique is not considered to be technically or economically feasible because EnCana has no existing disposal well for drilling wastes on CFB Suffield.

Preferred Alternative

For drilling operations, it was determined the preferred alternative is remote sumps because the environmental effects of remote sumps are known and appropriate practices are well established. The use of sumps will allow liquids from drilling waste to be re-used where possible to reduce water requirements for the Project. The remote sumps will be sited on locations determined in consultation with the DND, such as previously disturbed areas, and will be outside the NWA. The potential effects on native prairie will therefore be minimized. The economic effects, socio-economic effects and effects on safety are approximately the same for the two alternatives (see Table 2-15).

Table 2-15 Summary of Disposal of Drilling Waste Alternatives
Summary of Disposal of Completion Waste Alternatives

Alternative	Feasibility	Technical Suitability	Effects on Resource Recovery	Economics	Socio-economic Effects	Effects on Safety	Environmental Effects
Remote sumps	Yes	Proven technology	No effects	$1.4 MM	No effects	No effects	1 ha area is disturbed for each sump and then reclaimed. Reduced water requirements.
Transport all waste to a disposal facility	No	Proven technology					
Downhole injection	No	Proven technology - no disposal wells at CFB Suffield					

2.8.7.2 Completions Waste Management
EnCana considered three potential alternatives for the waste generated by the completion of wells:

- Recycling and re-use of water and frac sand;
- transportation to a waste disposal facility; and
- downhole injection.

As the majority of the waste stream is water, rock, and sand, EnCana's preferred method and current best practice is to re-use as much material as possible. The recycling of water in completions results in the re-use of up to 40 percent of the recovered water. The recovered frac sand will be separated out and "washed" at a sand recycling facility. EnCana is able to re-use over 80 percent of the recovered frac sand. The nonfrac sand solids will be transported to a provincially approved waste disposal site.

This alternative results in reduced environmental effects through reduced water use and reduced waste that requires disposal (see Table 2-16).

Table 2-16 Summary of Disposal of Completion Waste Alternatives

Summary of Disposal of Completion Waste Alternatives

Alternative	Feasibility	Technical Suitability	Effects on Resource Recovery	Effects on Economics	Socio-economic Effects	Effects on Safety	Environmental Effects
Recycle and re-use	Yes	Proven technology	No effects	Base Case	Base Case	Base Case	Reduced fresh water requirements and new frac sand
Transport all waste to a disposal facility	No	Proven technology	No effects	Increased cost	Increased utilization of waste facility	Increase trucking, increased risk	Increased trucking, increased emissions
Downhole injection	Yes	Proven technology	No effects	Increased costs	No effects	Increase trucking, increased risk	Increased trucking, increased emissions

2.8.7.3 Operations Waste Management
EnCana considered four potential alternatives for the waste generated by the completion of wells:

- Recycling and re-use of water;
- Downhole injection;

- Use of evaporation pond then disposal of solid waste at a provincially licensed facility; and
- Transportation to a provincially licensed waste disposal facility.

Currently, water recovered from swabbing operations is transported to the swab water storage facility at CFB Suffield, where it is treated and then disposed of in an existing provincially licensed disposal well. EnCana is evaluating the potential to utilize produced and swabbed water as completion fluid to reduce fresh water requirements of the Project. If it is technically and commercially feasible to recycle and re-use the produced water then EnCana will undertake to utilize that process. At this time, the preferred alternative is to continue to use the existing process of disposal at a provincially licensed facility.

The use of evaporation ponds is not considered environmentally responsible for this Project as the footprint of the Project would increase substantially as well as the potential to harm wildlife that may use and encounter the evaporation pond.

Transporting the produced water to a provincially licensed waste facility would result in increased safety risk, increased air emission and increased economic and socio-economic costs.

The analysis of the operations waste disposal alternatives is summarized in Table 2-17.

Table 2-17 Summary of Disposal of Operations Waste Alternatives

Summary of Disposal of Operations Waste Alternatives

Alternative	Feas-ibility	Technical suitability	Technical Suitability	Effects on Resource Recovery	Effects on Economics	Socio-economic Effects	Effects on Safety
Recycle and re-use	Yes	Not proven technology – requires pilot project	No effects	Increased operational costs with reduced water costs	No effects	No effects	Reduced fresh water requirements
Transport all waste to a disposal facility	No	Proven technology	No effects	Increased cost	Increased utilization of waste facility	Increase trucking, increased risk	Increased trucking, increased emissions
Downhole injection	Yes	Proven technology	No effects	Base Case	No effects	No effects	Base Case
Evaporation pond	No	Not proven technology	No effects	No effects	No effects	No effects	Large environmental footprint due to the

size of ponds. Potential to harm wildlife.

2.8.8 References

1) Statistics Canada 2004, CANSIM, table 128-0002 and Catalogue no. 57-003-XIB.
2) The International Energy Agency's *Carbon Dioxide Emissions from Fuel Combustion (2003 Edition).*

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