

ENCANA'S CABIN NOT SO HOMEY:

CUMULATIVE ENVIRONMENTAL EFFECTS AN UNFOLDING AND EMERGING CRISIS IN NORTHEASTERN BRITISH COLUMBIA'S SHALE GAS PLAYS

AN INTRODUCTORY JOURNEY INTO BC'S DIRTY DOMINO ZONE

COMMENTARY AND RECENT PHOTOS

By Will Koop

November 9, 2010

(With 11 copyright photos by Garth Lenz)



EnCana's hydraulic fracturing at Two Island Lake on Pad 63-K (Oct. 2, 2010). According to preliminary information by EnCana and Trican Well Services on recent completed fracking operations on 9 of 14 wells here, this appears to be *the largest and longest frack job in the world*, doubling the fracking figures on its partner Apache's reportedly world's largest frack, completed in April, 2010. To frack all 14 wells, EnCana may have used 1.8 million cubic metres of water, 78,400 tonnes of sand, and up to 36,000 cubic metres of toxics. A shadow of things to come for the Horn Basin area?

B.C. TAP WATER ALLIANCE

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INTRODUCTION

This report raises questions about the cumulative environmental impacts of natural gas companies operating in north-eastern British Columbia's (BC's) energy zone. The area in question represents just over 15 percent (or over 140,000 square kilometres) of the total provincial land base. The zone area is larger than the State of New York or the State of Iowa. Other identified petroleum zones in BC (see map on page 6) will also be targeted for energy developments in years to come.

Most of British Columbia's 4.5 million residents are far-removed from the province's natural gas zones. But for the relatively small number of residents who live within or on the periphery of such zones, there is an overwhelming evidence of a sharp rise in industry activities, which are having significant impacts on land and water resources. Particularly as the industry's water-intensive hydraulic fracturing or 'fracking' operations expand to stimulate gas production.

Most of the photographs and maps (100 images, maps, photos, etc.) in this report focus on the Horn River Basin (HRB) - one of the five or so petroleum shale 'plays', or geologic basins, in northeast BC. The HRB is estimated to be about 1.3 million hectares in size alone. The HRB has received widespread attention in energy industry publications because of the quality and voluminous amount of natural gas estimated to be trapped in its deeply buried shale formations. It is also the most rapidly developing of Canada's shale basins and part of the so-called "shale gale" that has swept through many US states, including Texas, Colorado, Oklahoma, Pennsylvania and New York.

This report builds on a recent October 13, 2010 report by the author - *24/7 Less Peace in the Peace* - which detailed some of the environmental impacts associated with Talisman Energy's operations near and north of Hudson's Hope, in the western Montney shale formation.

The following (now modified) questions were asked in the beginning of that report:

1. Can the planet afford to burn British Columbia's (BC's) shale gas?
2. Should the citizens of BC allow the shale gas industry to enclose/destroy, impair and fragment the Commons' lands and waters?
3. If we decide that we can afford to burn BC's shale gas, what is the public's "fair share" of industry's revenues? (I.e., the gas industry, like the Alberta tar sands industry, has a mere 2 percent conditional royalty agreement with the B.C. government!)

In the following pages of this report, not only will details on the cumulative impacts to lands and waters in the Horn River Basin be discussed, but questions raised about what plans - if any - the provincial and federal governments have to address such impacts.

In addition, the report will present data that refutes oft-repeated claims by government regulators, energy companies and energy industry associations that natural gas is a clean, or green fossil fuel. In fact, natural gas produced from shale formations may be among the dirtiest fossil fuels on the planet.

On January 28, 2010, British Columbia's Environment and Energy Ministers jointly announced that the provincial government had approved EnCana's proposal to build North America's soon-to-be largest natural gas processing plant near Cabin Lake, in the Horn River Basin.

The enormity of the project and its significant environmental footprint, including the projected greenhouse gas emissions from the proposed plant, had drawn criticism during the provincial environmental assessment review process following the filing of EnCana's application on July 29, 2009. EnCana seemed certain of the review process approval outcome, and began clearing away a square kilometre of northern boreal forest, on the site of the proposed \$1 billion Cabin Gas Plant.

According to EnCana's July 29th application, "each company in the Horn River basin" may "construct their own gas plant", meaning that more, similar large facilities may also be built in the near future. At present EnCana will operate the huge plant by natural gas-fired generators. A proposal for fixed hydro-electric power, *from about 60% of B.C. Hydro's proposed Site C dam* on the Peace River near Ft. St. John to the Horn River deep shale area operations, was presented to BC Hydro by the Canadian Association of Petroleum Producers on December 15, 2008:

The potential exists for significant electric load growth in the greater Ft. Nelson Horn River Basin (HRB) area within the range of 100-350 Megawatts (MW) by the year 2020. This is due to the development potential of the Horn River Basin Shale Gas.... the ultimate potential load for the Cabin Plant is 120 MW (megawatts).



Aerial photo (October 2, 2010) of the cleared big Cabin area, one neat, exact square kilometre in area.

In many ways EnCana's Cabin Plant - with all the complex operations involved in getting the gas out of the ground to all of the energy that is required to produce and transport the gas - *symbolizes the state of cumulative environmental effects or impacts in north-eastern BC.*



Ground zero at the big Cabin clearing site. (September 29, 2010)

QUESTION: Why are cumulative environmental impacts in crisis in northeastern BC's 'Shale Gale?'

ANSWER: There are two answers. BC does not have legislation to legally implement cumulative effects, a frustrating, ongoing concern by BC stakeholders who find no such remedy in the courts. Secondly, despite specific study recommendations for the BC Oil and Gas Commission in 2003 on cumulative environmental impacts (with ongoing recommendations to do so since 1990 by the Ministry of Environment), they are not being implemented by the provincial government. Such environmental assessments should have been carefully accounted for and integrated into a central plan **before** millions of hectares of public lands were leased for gas tenures in northeast BC.

1.1 Background

As part of the British Columbia (BC) Oil and Gas Commission's (OGC) initiative to address environmental effects associated with oil and gas development, an environmental fund was established in 1998 to support research projects over a five-year period. During 2001, three research areas were considered: air emissions; cumulative effects; and ecosystem health and integrity. With regard to cumulative effects, AXYS Environmental Consulting Ltd., Diversified Environmental Services, and Salmo Consulting Inc. proposed to develop a Cumulative Effects Assessment and Management Framework (CEAMF) for northeast British Columbia, including the Muskwa-Kechika Management Area (MKMA). The proposal was accepted by the OGC, and complementary funding was provided through the Muskwa-Kechika Trust Fund, a fund created through the *Muskwa-Kechika Management Area Act* to promote research aimed at addressing ecological sustainability and maintenance of wilderness characteristics in the MKMA by providing information to support planning processes.

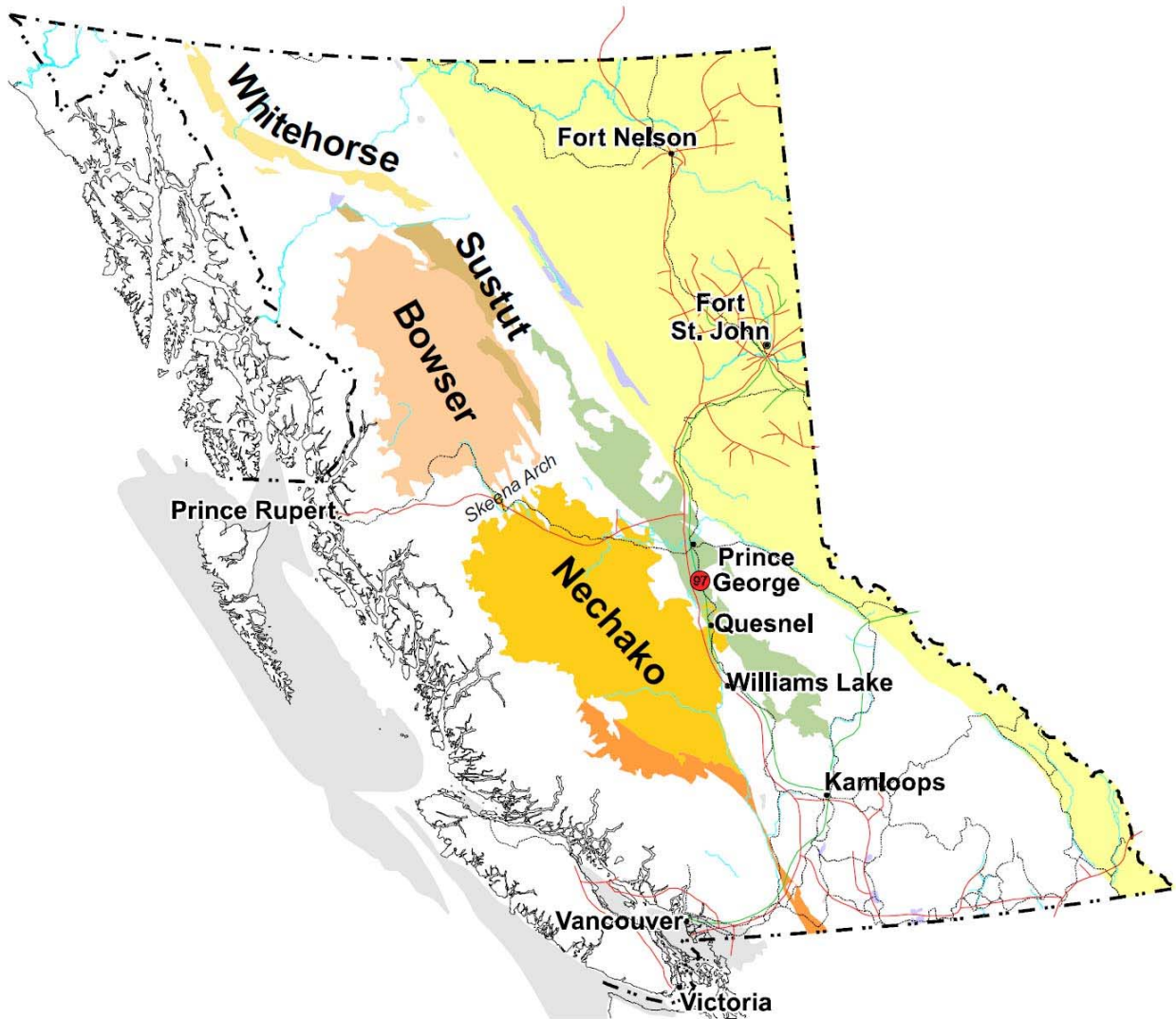
While the proposed framework focuses on cumulative effects associated with oil and gas activities, and what can be done by the OGC to assess and manage such effects, it is recognized that you cannot manage cumulative effects for one sector in isolation of other influences. In the case of northeast BC, various land use activities will potentially contribute to cumulative effects. These activities include, but are not limited to, forestry, mining, hunting, trapping, fishing, hydroelectric development, transportation and utility development, agriculture, recreation, and human settlement. As a result, although the recommendations presented in both volumes of this study are aimed at the OGC and MKAB, specific components of the framework rely heavily on the involvement of other ministries, First Nations, industry, and stakeholders.

Excerpts from the 2003 OGC report, *A Cumulative Effects Assessment and Management Framework for Northeast BC*.



Rich, delicate, muskeg wilderness forested landscape habitats and wetlands are in jeopardy. Below, Oklahoma-based Devon Energy Corporation's operations on large recently cleared pads about 10 kilometres southeast of Two Island Lake (80 kilometres north of Fort Nelson). The lower multi-well pad (most likely the 8-well, Komie 87-G pad) is actively being fracked, with large volumes of fresh water removed from nearby sources. The two round large tanks are filled with toxic waste waters from the fracking. A pad holding Devon's small work force camp is off to the upper left. Devon has a 27 percent working interest in EnCana's Cabin Gas plant. (*Garth Lenz photo, below*)

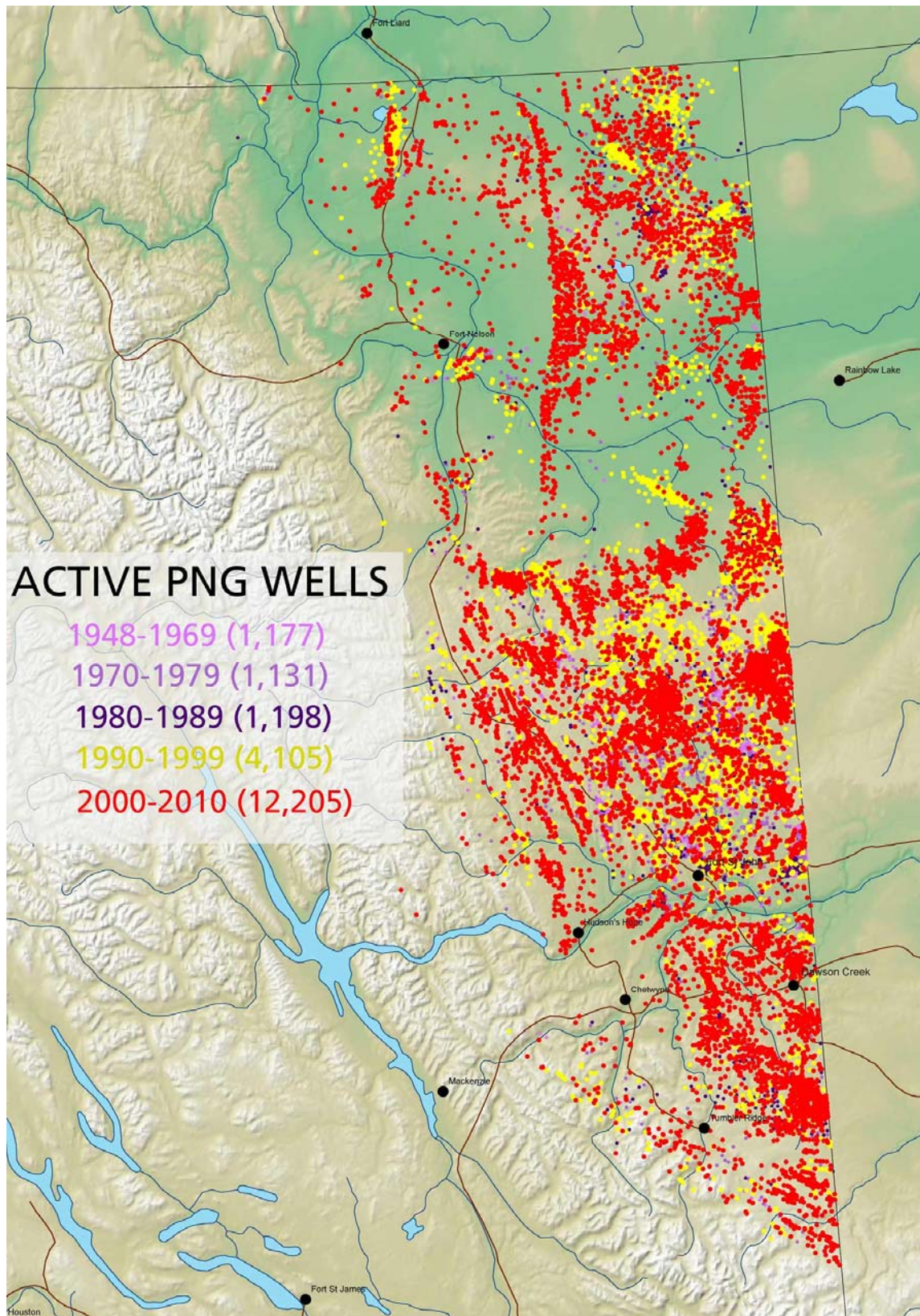




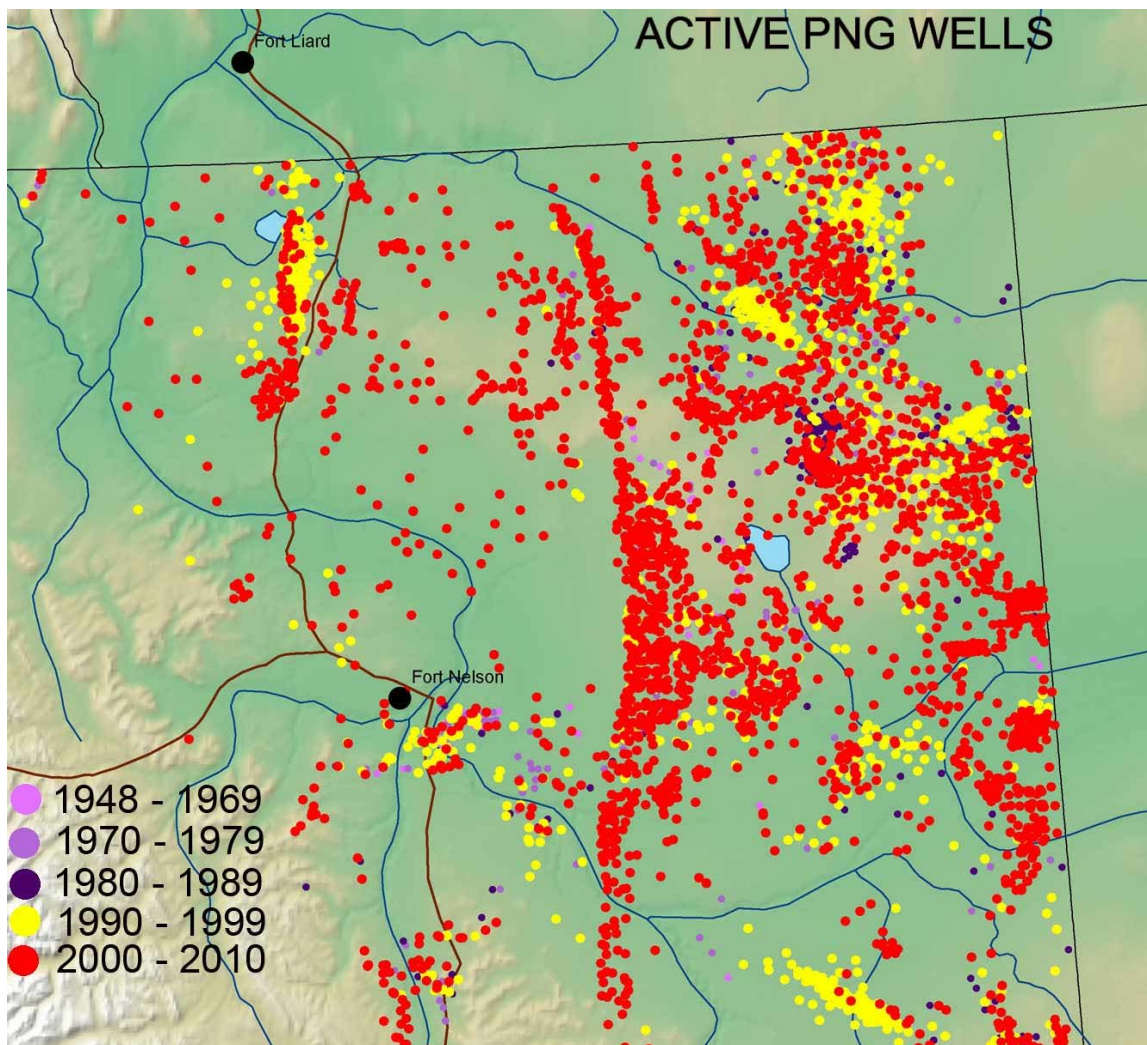
Map of British Columbia showing the various petroleum-related basins. The upper right light yellow, or north-eastern section of this map is the current playground of the oil and gas industry sector. Far fewer activities have occurred in the lower southern areas of the light yellow grid, near the border with the United States, as proposed energy developments are nearer populated areas and the Rocky Mountain federal park systems, with high wildlife and fresh water value corridors.

One of the main reasons why so much gas petroleum and leasing of vast public lands is more readily occurring in the far north, and why energy companies are flocking to the area, is because of low, or non-existent human populations, where energy companies and government encounter little or representative resistance, and where the provincial government provides little to no inspection oversight.

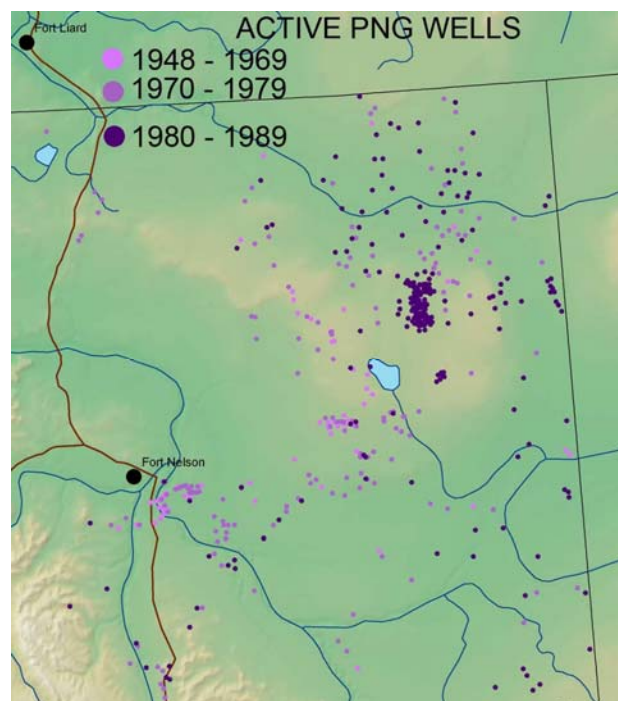
(Map source: BC Ministry of Energy, Mines and Petroleum Resources, powerpoint presentation, *Western Canadian Sedimentary Basin Workshop*, May 18, 2006)



This map (GIS generated by David Leverage, April 23, 2010) shows the evolution of “active” Petroleum Natural Gas wells over a 62-year period in northeast BC. Bottom of red dot area to top of BC border about 600 km. (Ministry of Energy, Mines and Petroleum resources active wells data.)



An overview map analysis of the evolution of “active” Petroleum Natural Gas wells in the greater Horn Basin playground (Liard, Cordova Embayment, Horn, Greater Sierra basins). As seen in the lower map, very little activity occurred in remote boreal wilderness areas east and northeast of Fort Nelson over a 40 year period. The concentration of petroleum developments seems to have occurred northeast of Kotcho Lake (the light blue lake in the middle of the map). The active wells for 1990 - 1999 (yellow dots), in particular, the active wells for 2000 - 2010 (red dots), denote a sharp rise in natural gas activities. In early internal reports by Ministry of Environment staff (1980-1991), repeated concerns were raised over the impacts to wildlife, water and air, and that staff were unable to deal with hundreds of referrals each year (for instance, the impacts from seismic lines). Ongoing calls for cumulative effects assessment seem to fall on deaf ears.



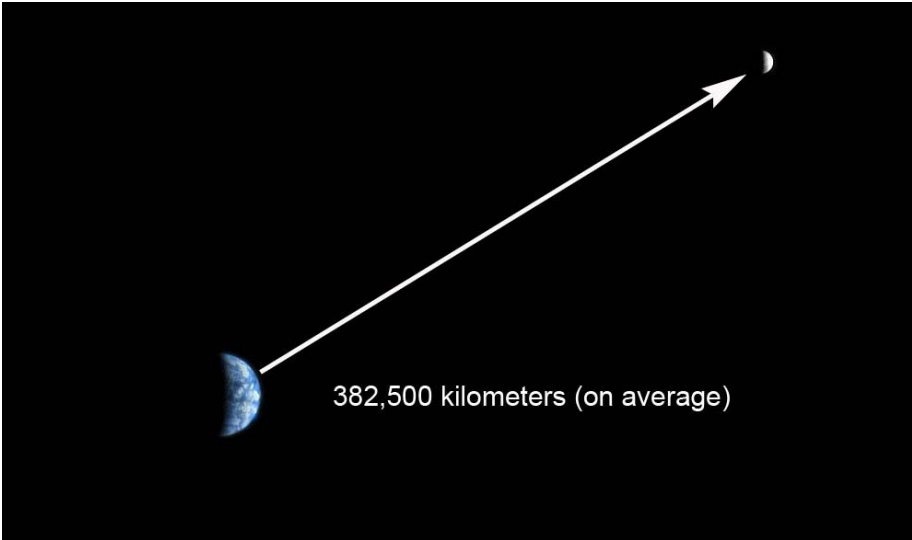
One of the greatest challenges, or obstacles, gas energy companies continue to face in the Horn River deep shale play field, and adjoining deep shale zones, is the lack of transportation infrastructure in the muskeg, boreal wilderness. Enormous energy and funds are required to convert and maintain former wilderness landscapes into complex road and pipeline corridors, for large sites or pads for drilling and fracking, for storing water, for storing equipment, for large camps, etc. Over a 32-year period, energy companies cut about 400,000 kilometres of seismic lines (linear clearcuts) throughout the northeast over an area representing about 15 percent of B.C. Over time, all of these activities related to the energy industry, and all the other industries and uses, will continue to, and more significantly, render impacts upon our environment (water, air, forests, wildlife, fish, etc.). The photo is a multi-well gas pad just northeast of Two Island Lake.





This satellite photo (latitude 59-25-57 N, longitude 121-49-33 W) is about 85 kilometres northeast of Fort Nelson, or 27 kilometres east-southeast of Two Island Lake, in the mid-eastern perimeter of the Horn River Basin fracking development zone. The photo area is 3.5 by 2.0 kilometres (7 square km, or 700 hectares), and the cleared drilling pad in the centre of the photo is 120 metres square.

The photo well illustrates the grid patterns or tight network of seismic line corridors, and includes a wider-sized pipeline corridor (bottom right), a main access road (left to right, in white), branch access roads to drilling pads, seven water burrow pits, and three drilling pads. In this sample photo of a seven square kilometre area, there are about sixty kilometres of seismic, road and pipeline corridors through boreal muskeg wetlands. (Source: Google Earth imagery, June 8, 2005.)



Data from 1982 to 2010 on the annual cumulative amounts of seismic line cut in northeastern BC, indicate that about a total 370,000 kilometres were cut (not including the figures before 1982). This is roughly the equivalent distance of cutting a 5 to 6 meter wide swath of forest lands between the earth and the moon. (Note: this data is no longer available in graph form on the OGC's, Oil and Gas Commission's, public website.)



In what was once a seemingly 'endless wilderness, are now seemingly 'endless' seismic, pipeline, and road access corridors. The cumulative effects problems, for instance, on bird habitat and bird behaviour, the predation concerns and inhibitions to wildlife, in particular, caribou and moose, are being carefully noted by some parties, and their predictions over the future of these lands is disturbing.

For instance, here are some quotes from the Dene Tha First Nation, in a 23-page submission report filed with the National Energy Board, concerning the NOVA Transmission gas pipeline Hearing scheduled for late October, 2010, for new/ revised pipeline corridors from the Horn Basin shales to Alberta.

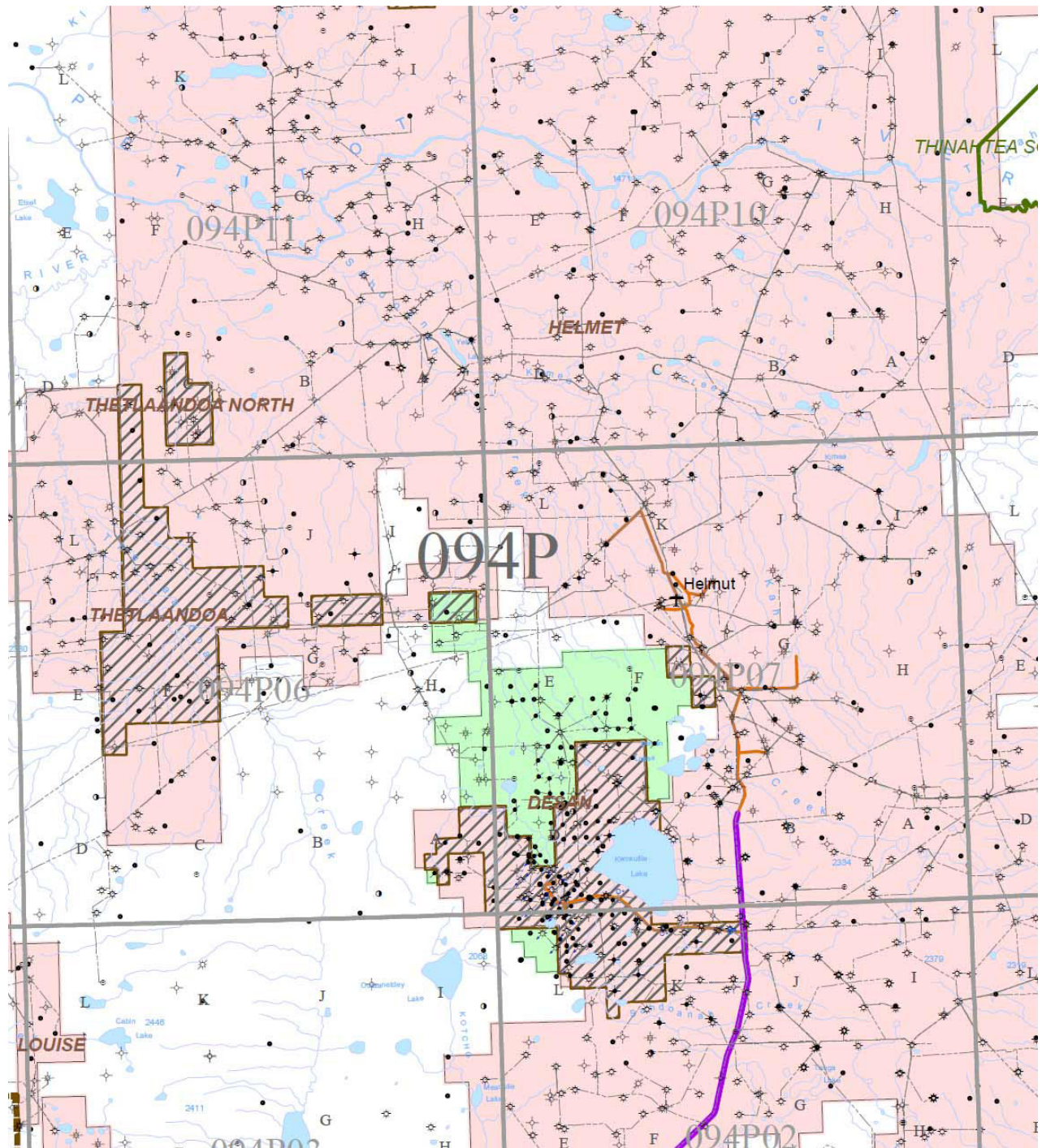
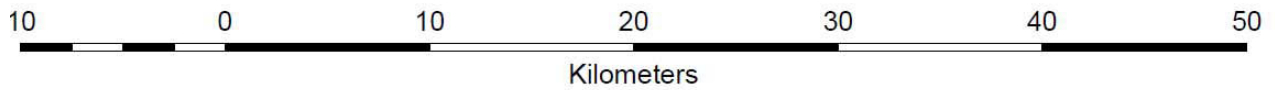
Wildlife habitat and vegetation communities entail resources traditionally used by First Nations. The disturbance of these resources directly affects traditional land use and, using satellite imagery....

If the magnitude of disturbance pushes the system beyond its natural variability into a different state and different set of controls, then social resilience may not be able to withstand that shift. In this study, the focus area is located in B.C. south of 60° N. The total area that was analyzed is 31,908 km².

*To calculate the rate of disturbance from the past to the present and into the future it was necessary to determine the density of linear disturbance (such as roads, pipelines, or power lines) and the area of the footprint disturbance (such as plant sites and well pads). Assuming that the sensory disturbance includes a ZOI (Zone of Influence) of 250 m near any industrial feature, of the 31,908 km² land area in the BC portion of this study, 19% was disturbed in 1993, 27% in 2002, and 31% in 2008. Combining all linear developments that we could detect on the Landsat images, by the year 2008, there were 21,041 km of linear corridors in the BC portion of this study, representing a density of 0.66 km/km². If one assumes that the yearly rate of disturbance remains constant in the future at 260 km² per year, as it was in the past 15 years, then the projected disturbance of all natural land cover will be 100% by about the year 2095 (Figure 3). In other words, past the year 2095 there will be no area left where a person could go to be farther than 250 m away from an industrial feature.... **If the disturbance trend continues, the moose population within the BC Focus Area will likely cease to be viable within a few decades.***

(Source: *Rate of Disturbance in DTFN Territory - Northeastern BC*, October 31, 2009.)

Scale: 1:350,000
(1 Centimeter = 3.5 kilometres)



Segment from the BC Oil & Gas Commission's *Regional Well and Field Location Map, North Half* (October 4, 2010, edition), showing the centre of the Cordova Embayment gas fracking fields (pinkish shaded area), located east of the Horn River Basin. The purple line is the end of the Sierra-Yoyo-Desan access road just east of Kwokullie Lake, the Alberta border is about 25 km off to the right of this map, and the green zone is an oil field. The dotted and solid lines are pipelines, the solid and hollow round black dots are an array of active and inactive oil and gas wells, water and gas injection wells. The map does not include seismic line locations. Most of this area is under license to PennWest.



Close-up of the photo on page 9 near Two Island Lake, adjacent to EnCana Corporation's and Apache Canada's partnership operations in the Horn Basin. Obtaining large volumes of fresh water for fracking, and clearing large sections of public forestlands to store the water, is currently the norm. One of the thorny issues for the Oil and Gas Commission, for the Ministry of Energy Mines and Petroleum Resources, and for the Ministry of Environment is that, more often than not, fresh water is directly diverted from adjacent **unregulated sources into large pits**: road ditches, groundwater, wetlands, rain and snowmelt events. These "free" or "extra bonus" sources of fresh water runoff are never licensed or provided for in permits, nor documented/tabulated by energy companies. The pits are otherwise usually filled by hundreds and thousands



of water tanker trucks or by a network of pipes from a nearby or distant water source pump station. And, all the sourced fresh waters have been free of charge - the energy companies don't pay a dime for them!

This site (left) southwest and near Two Island Lake has just been cleared, and the hewn timber lays stacked in rows. As noted on another site near EnCana's Cabin gas plant far off to the southeast (see below), wilderness timber cut down from these large pads is often left to sit and rot (or burn) due to the poor wood market and closure of local wood mills around Fort Nelson.



This site, referred to above, is located just south of the Cabin gas plant, adjacent to the mainline Komie access road, where timber has been stacked and left to rot for a couple of years already. It takes about three hours to transport anything from this area back to Fort Nelson.

It is the OGC (Oil and Gas Commission), not the Ministry of Forests, that has been granted powers to issue forest cutting permits to the energy companies. The public forest land timber sales are not predicated on stumpage rates or a set price per cubic meter, but sold off as standard block areas (i.e., very low rates). There is no timber scaling involved, no review of the removals on re-calculating annual allowable cuts, no anything as should occur under Ministry of Forests regulations and policies. Currently, as of September, 2010, energy companies Apache Canada Ltd. and Devon Canada Corporation are under a forest practices audit by the BC Forest Practices Board.





There are currently about four large camps, euphemistically called “Lodges”, south or near Two Island Lake, individually, or jointly operated by five energy companies. EnCana’s largest “Horn River Lodge” has all the extravagances of technological modern life, including 40 inch television screens in each living quarter. Diesel engines most likely power this camp located on a large section of former forest, a pad painstakingly prepared and built up high off the ground by many excavators, grooming equipment, and material hauling trucks. In the distance is what appears to be an intact forest landscape, a landscape doomed for development, the future plans for thousands of new wells. All the food and necessities must be trucked in, and the sewage and wastes disposed of or treated. The Northwest Territories border is only about 50 kilometres north of here.



This is Spectra Energy's Cabin Lake Compressor (Booster) Station, B.S. 19. The wide pipeline corridor clearcut which stretches off into the far horizon, is the 25-30 metre wide path of Spectra's 20-inch Louise. (Garth Lenz photo)



Not far, six kilometres directly to the southeast of EnCana's not so homey Cabin gas plant, Spectra Energy is also, and simultaneously, clearing a large swath of forest and wetlands, an area almost identical in area to EnCana's square kilometre clearcut. Spectra's new gas processing facility will gather gas from the other Horn Shale producers and link it, alongside gas from EnCana's Cabin plant, into a new proposed 36-inch main pipeline for NOVA Gas Transmission Ltd. (a subsidiary of TransCanada PipeLines), directly into western Alberta (the pipeline's complex environmental and social impacts were set for a National Energy Board hearing, end of October, 2010). NOVA's new route will head south alongside most of the Komie mainline road (right side of photo above). The Fort Nelson North Processing Facility, is part of Spectra Energy's Fort Nelson Expansion project.



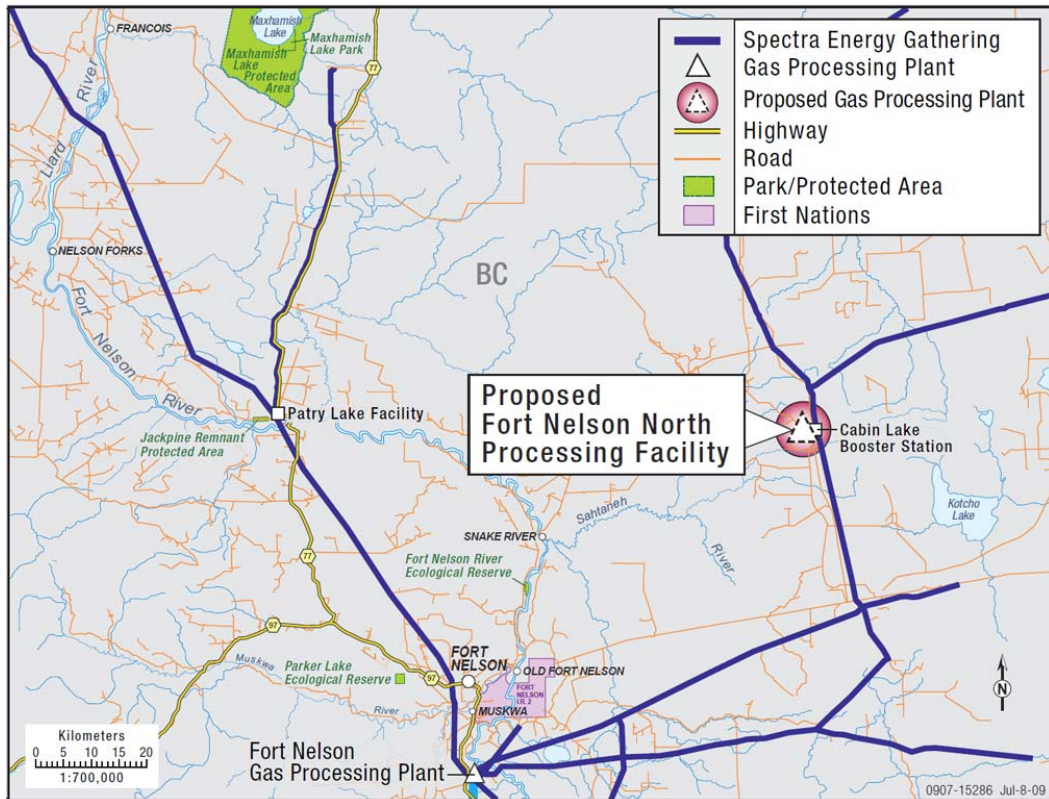


As with EnCana's new plant (photo, page 3), Spectra's new processing plant blight on the environment is not insignificant. Not too far away, 6 kilometres distant, top center, is where EnCana's new Cabin Gas Plant site is located. (*Top photo, Garth Lenz*)

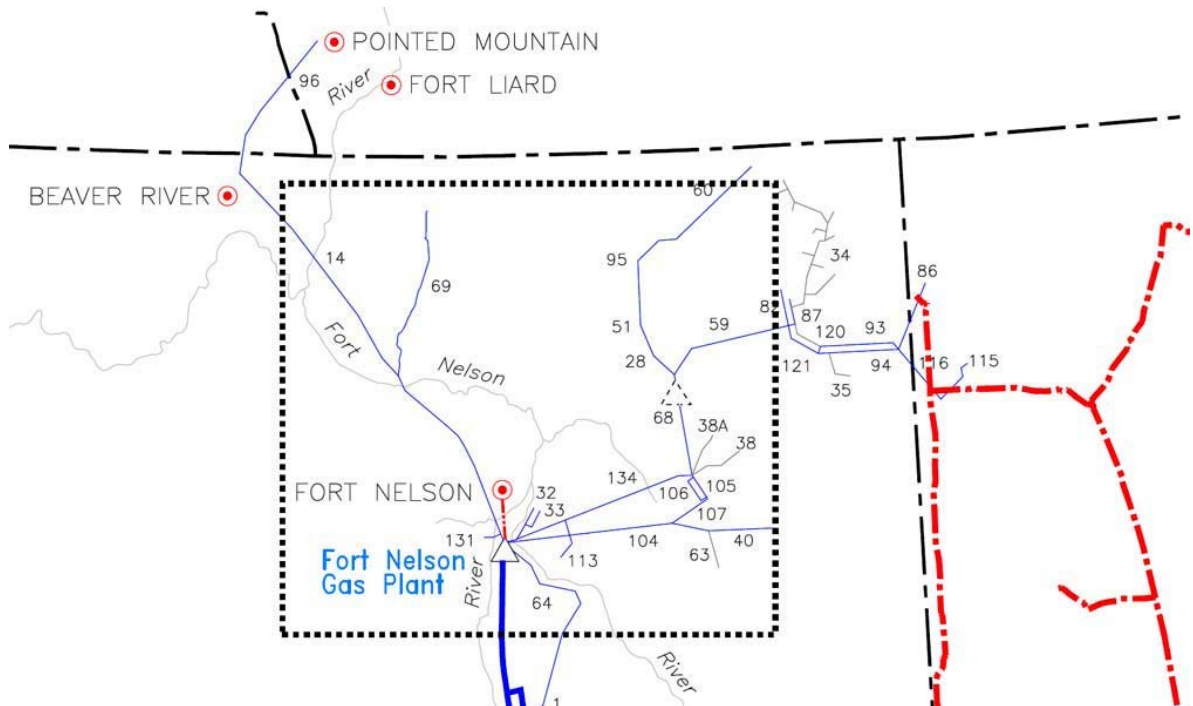


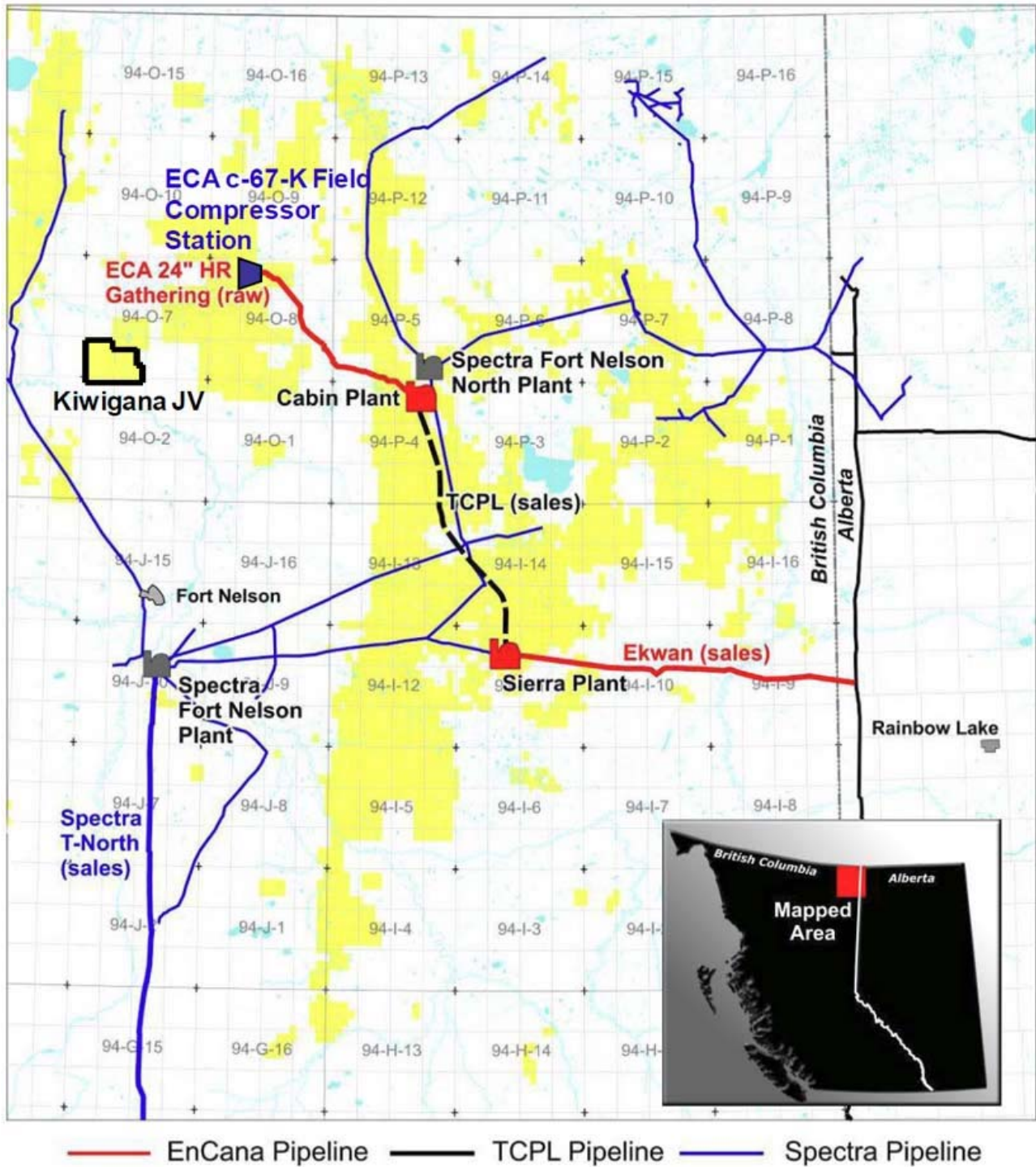
Flare stack at Spectra's Cabin Lake Booster Station, spewing out the Devil's formerly "trapped" breath.





Maps of Spectra Energy’s new Cabin Lake Processing Facility (Source: National Energy Board). The numbers in the map below identify Spectra’s integrated gas gathering lines: 14 (24 inch Beaver River); 69 (12 inch Maxhamish); 60 (8 inch Hossitl); 95 (10 inch Petitot); 51 (12 inch Gote); 28 (16 inch Cabin); 59 (16 inch Helmet); 82 (16 inch North Helmet Loop); 68 (20 inch Louise); 38A (12 inch Kotcho); 38 (10 inch East Kotcho); 105 (12 inch Sierra); 106 (16 inch Sierra Loop); 107 (16 inch Sierra-Sahtaneh); 63 (12 inch Junior); 104 (24 inch Sahtaneh); 134 (24 inch Yoyo); 32 (16 inch Clarke Lake); 33 (16 inch Clarke Lake Loop); 113 (8 inch South Clarke Lake); 64 (16 inch Klua). The red gas line in Alberta is owned and operated by TransCanada Pipelines Ltd. The dotted triangle is Spectra’s new Cabin Lake site. All energy companies use Spectra to transport the gas, all are members of the Canadian Petroleum Producers Assoc.





www.encana.com

The new 'flow' regime of gaseous carbon money. Horn Basin Shales gas sales strategy map diverting British Columbia "trapped" gas now "rescued" or "freed" to Alberta, and, possibly, some to be diverted to the dirty tar sands. (Map source: Encana public relations document.) For the link to documents filed with the National Energy Board on the Horn project: <http://www.neb-one.gc.ca/clf-nsi/rthnb/nwsrls/2010/nwsrls10-eng.html>



Seen in the distance (9 km from where this photo was taken, late afternoon of September 29, 2010) are the smoke stack emissions from Spectra Energy's gas plant located just south of Fort Nelson, one of North America's largest such plants. On this day, the wind is carrying the smoke westward, not northward toward Fort Nelson.

Calgary-based EnCana Corporation, Canada's largest gas producer, along with a consortium of seven other oil companies, is planning to build the biggest gas processing plant in North America in the heart of our 1910 treaty territory.

The B.C. Environmental Assessment Office has declared the Cabin Gas Plant will have significant adverse environmental effects. The last time such a declaration was made -- the Kemess North mine -- the project did not receive an environmental assessment certificate. The risks of significant adverse environmental, social and cultural effects outweighed the project's economic and social benefits. It is our hope that a similar common-sense ruling will apply to the proposed Cabin Gas Plant.

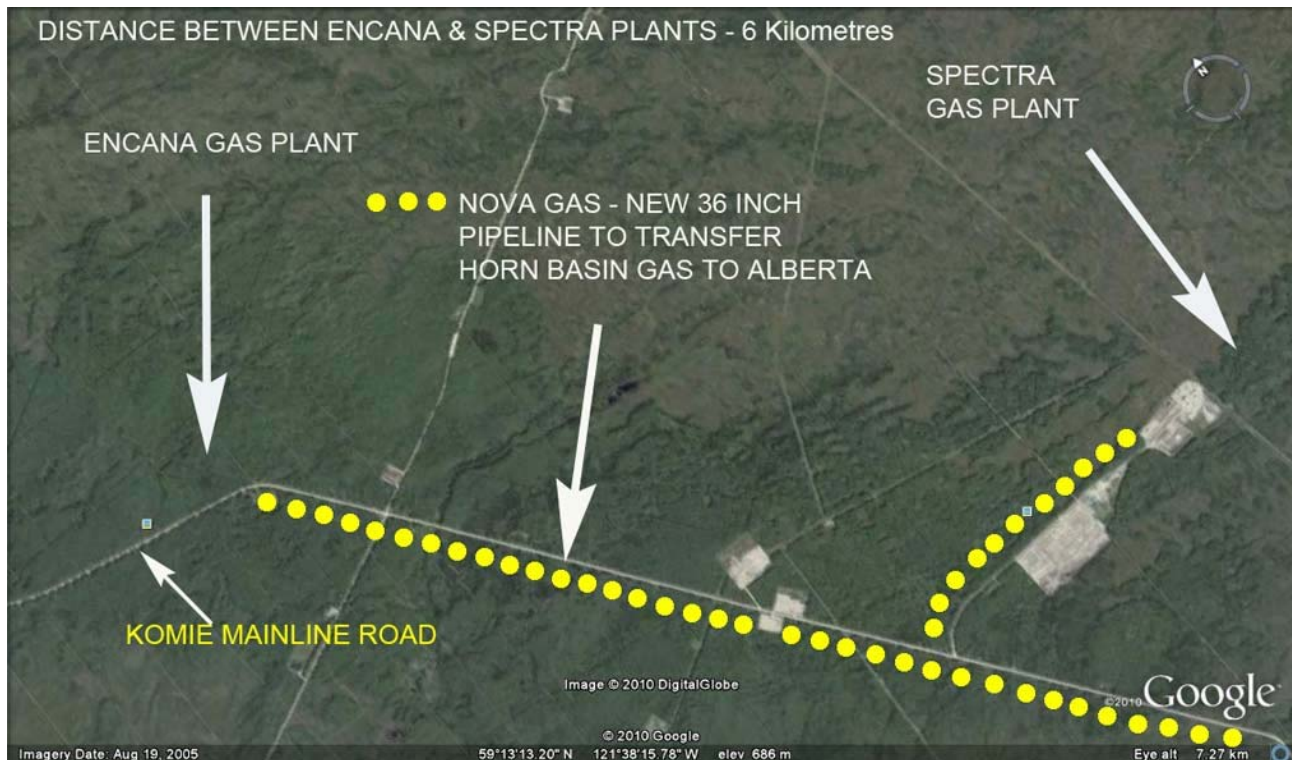
Indeed, the Cabin Gas Plant is expected to be the largest point source emitter of greenhouse gasses in B.C. EnCana anticipates that the gas plant will emit 2.2 million tonnes of CO₂ annually, the equivalent of adding 450,000 cars to B.C.'s roads each year. In all, the Cabin Gas Plant will increase B.C.'s annual greenhouse gas emissions by 3.3 per cent.

We've been told many things by the B. C government as we've tried to participate in the environmental assessment process. One official said that because our 100-year-old treaty doesn't specifically address clean air, we have no say on clean air when it comes to the construction of the biggest greenhouse gas creator in B.C. Imagine being told by a government official in 2009 that you have no say on the quality of air you or your children breathe! What parent would stand for it?

We understand the value to the province of shale gas development in the Horn River Basin. But such economic development, whether for our community or yours, should not come at the expense of a gutting of the land, water, and air where a community lives. We are the only Treaty 8 Nation that lives within the Horn River Basin, and this gas plant, designed to open the basin to drilling, pipelines and gas development, will have an immense effect on our rights and interests. Without the capacity to determine and plan for this development, the survival of the Fort Nelson First Nation is in jeopardy. This plant and the development that it brings must not mean the end of us.

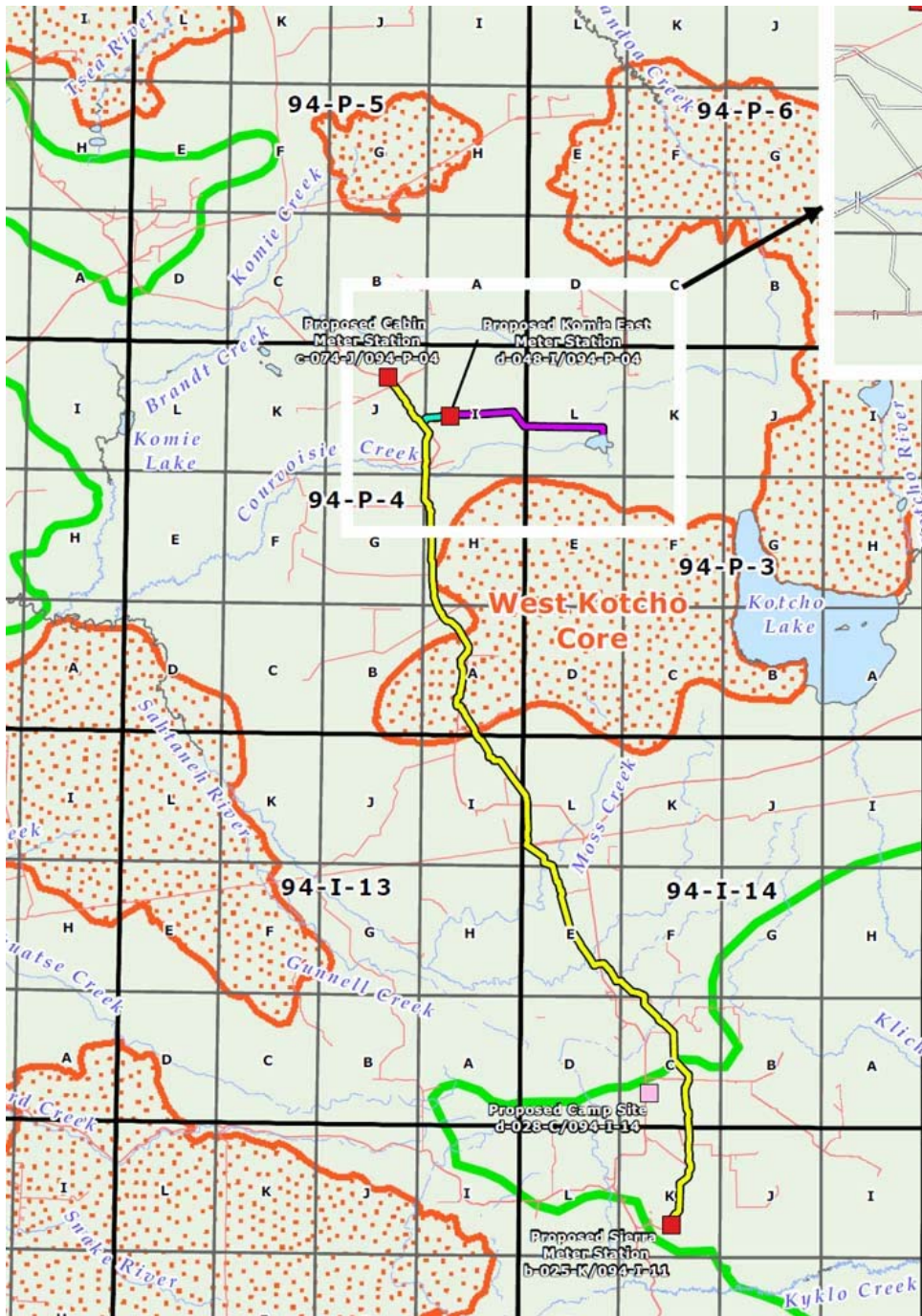
Source: Fort Nelson First Nation Chief, Kathie Dickie, Vancouver Sun, December 22, 2009, Premier's climate-change hypocrisy could doom first nation's way of life.

From a cumulative effects perspective, what are the combined or total green house gas annual emissions from all energy company operations and facilities in northeast BC, and what are the projected increases related to all future projects and operations?



Internal land speculations and marketing deals around British Columbia’s “trapped” deep shale gas, and where that “freed” gas should ultimately go, from this sector of the Horn Shale Basin, were devised years ago by energy companies. In hindsight, the revelation that EnCana’s Cabin gas plant, under major project review with the BC Environmental Assessment Office, was the first part of the Horn River energy export development convergence strategy. Next came Spectra Energy through the National Energy Board assessment. Now, waiting in the wings is Nova Gas’ new 36 inch gas transmission line to Alberta. **Given the close proximity and coordinated business integration of all three major projects, why (one might logically ask) were the three separate projects all not subject to a SINGLE encompassing environmental assessment by provincial and federal governments, in order to review and understand their collective or cumulative environmental impacts?** Will some of British Columbia’s gas be earmarked to fuel Alberta’s tar sands in what now is clearly revealed as the **wholesale export of BC’s gas from the Horn Basin by some of the same companies operating in both jurisdictions**, and if so, how does this knowledge further complicate cumulative environmental impacts between, or within, the two provinces?





One of numerous maps submitted by NOVA Gas Transmission Ltd. to the National Energy Board for its scheduled late October, 2010 review process into its twin phase Horn River Project and Horn River Mainline.

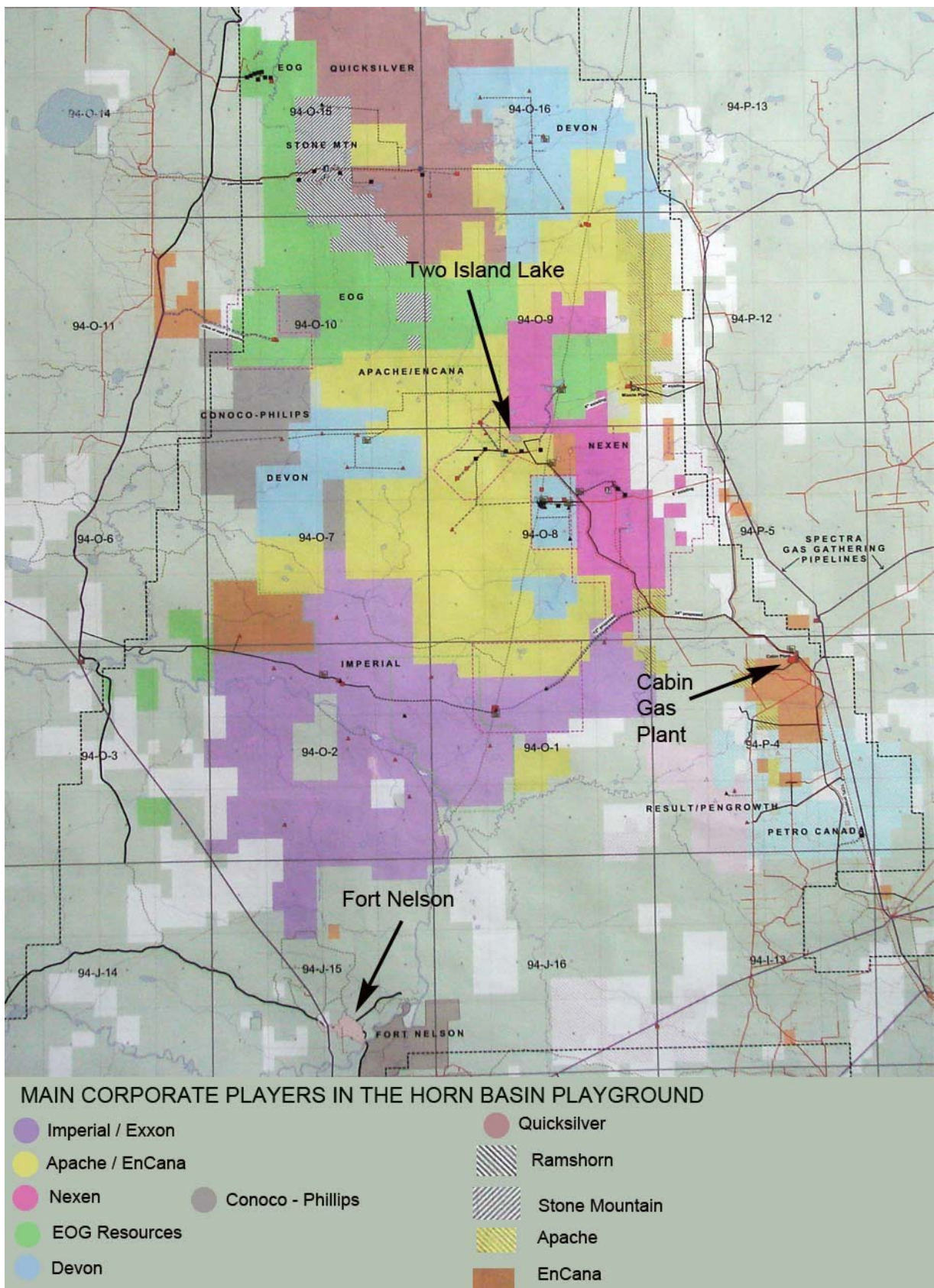
This August 2010 map, designating areas related to a caribou protection plan, shows, in yellow, the 72 kilometre first phase route of new 36 inch transmission pipe, most of which parallels the Komie mainline road. The two red squares at the top area are EnCana's and Spectra's new plant locations. The purple line is an additional gas source from Cabin Lake. The orange solid line areas with orange dots are the boundaries of "boreal caribou core areas".

Temporary infrastructure, such as access roads, stockpile sites, contractor yards and construction camps, will be required during construction. Some new access roads may also be needed for pipeline operations. New electrical power lines and facilities may be required to operate metering facilities and may be constructed, owned and operated by third-party power providers. (NOVA, Horn River Mainline Project, Project Description, May 2009)

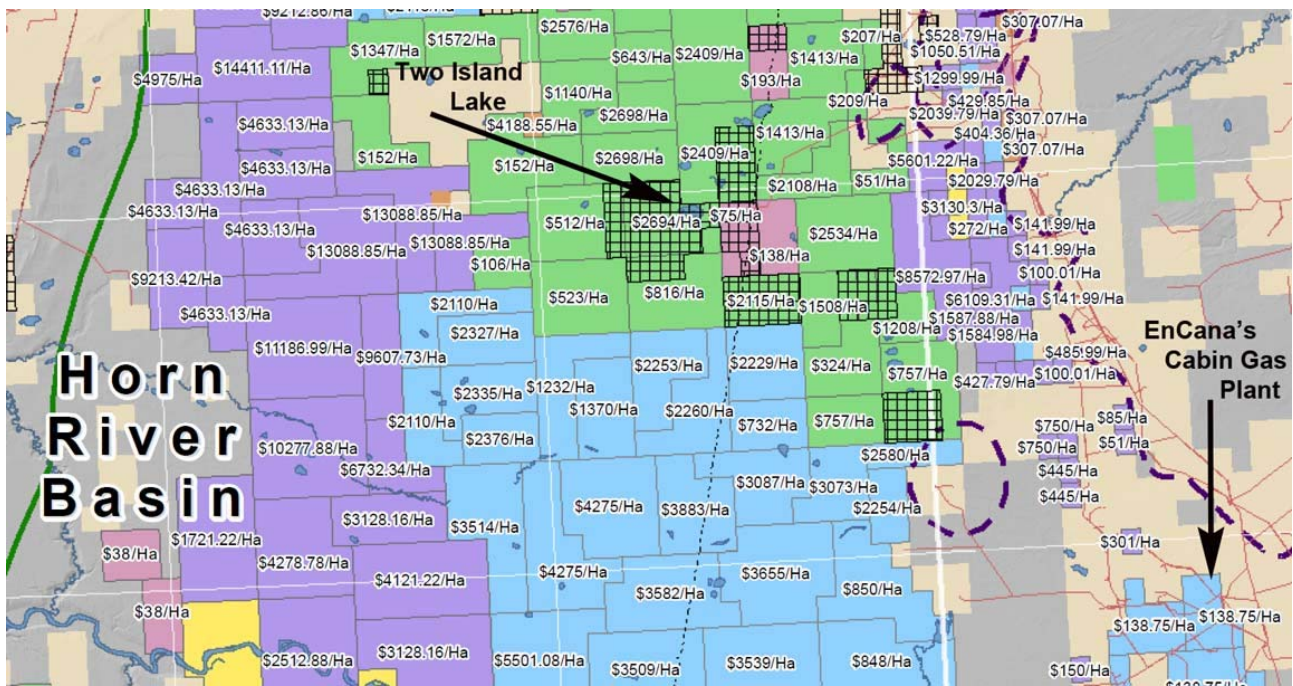


A few hundred metres to the west of Spectra's large clearcut site for its new processing plant is a large clearing for its work force camp (top photo, far left). To the right of the seismic line (middle of photo), that runs down the public forest lands through the clearcut, is the future camp location for EnCana's Cabin Gas Plant work force just under construction, below. (October 2, 2010).

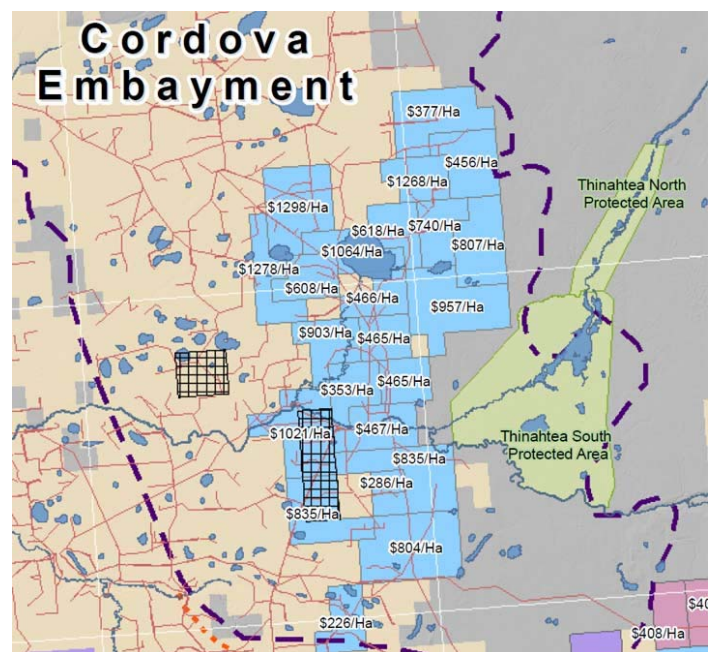




Map showing some of the main players and their public land sales leases in the Horn Basin (Source: 2009-2010 Horn River Activity)



Segments from a BC Ministry of Energy, Mines and Petroleum Resources May 2009 map, *Land Sales in the Horn River Basin, & Cordova Embayment, NE British Columbia*. The maps indicate, in color shading, provincial public land lease sales for petroleum uses from 2005 to early 2009. Revenues have become a hot ticket item for the BC Liberal government. The prices for the large coloured block areas are in hectares: (above photo) blue area, 88,419 hectares; green area, 86,742 hectares; light purple (upper right, with more area not shown) 14,668 hectares. The Cordova Embayment is the shale play east and northeast of the Horn Basin: area in blue, 56,445 hectares.

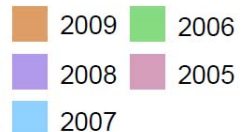


However, **before** the land sales were granted to the highest bidders, **no long-term cumulative, or inter-cumulative, environmental effects studies or related conditional comprehensive regional land planning studies were applied to the multiple enormous blocks of public lands throughout northeastern BC purchased and operated by energy companies.**

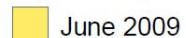
24 YEARS AGO: *Ideally, strategic planning precedes the sale of petroleum rights. This ensures all parties involved are aware of the concerns and constraints associated with development in an area before development is proposed.* (Source: *A Report on the Requirements of the Ministry of Environment for Management of Petroleum Activity in Northeast British Columbia*, March 1986)

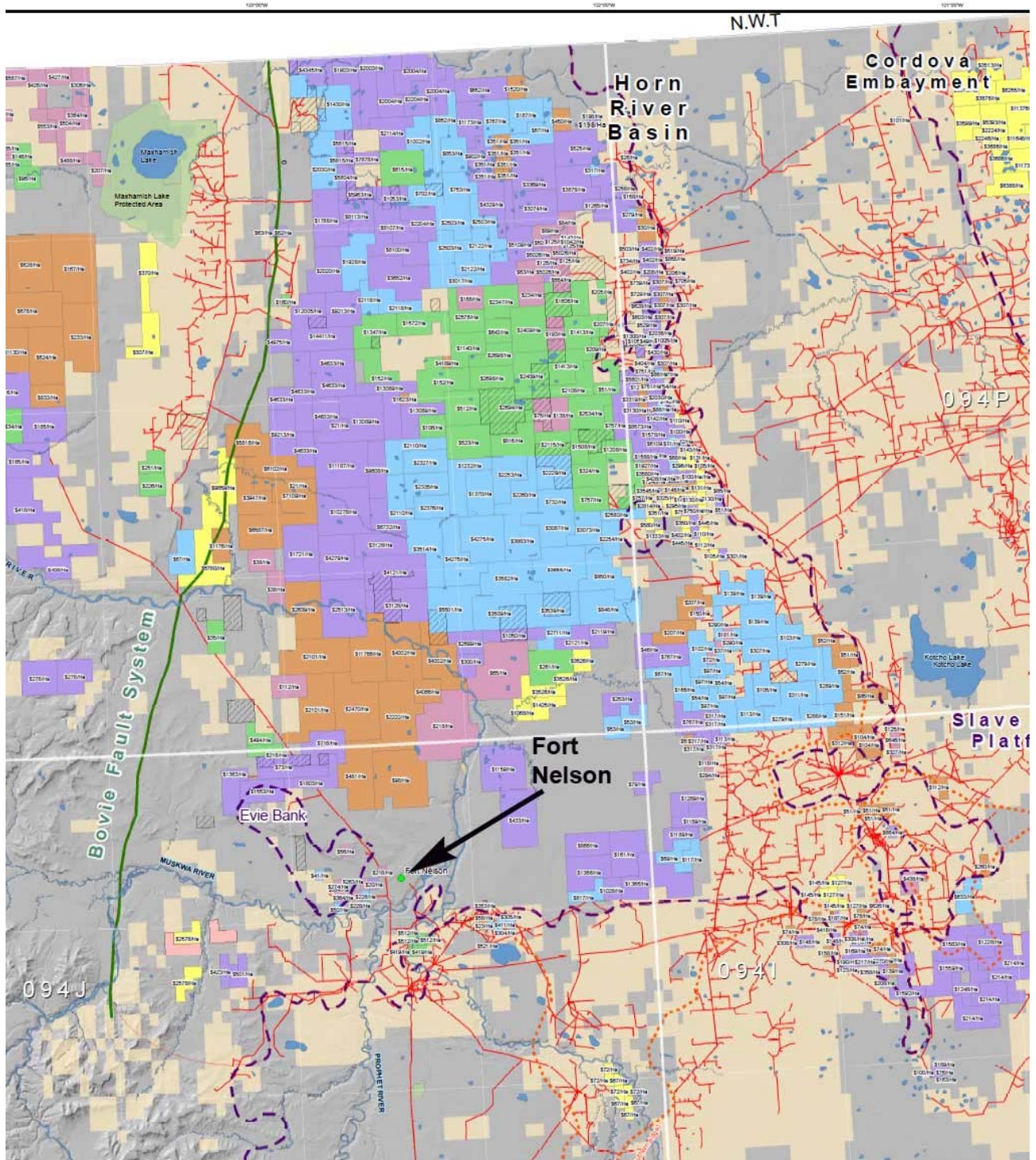
Land Sales

Recent

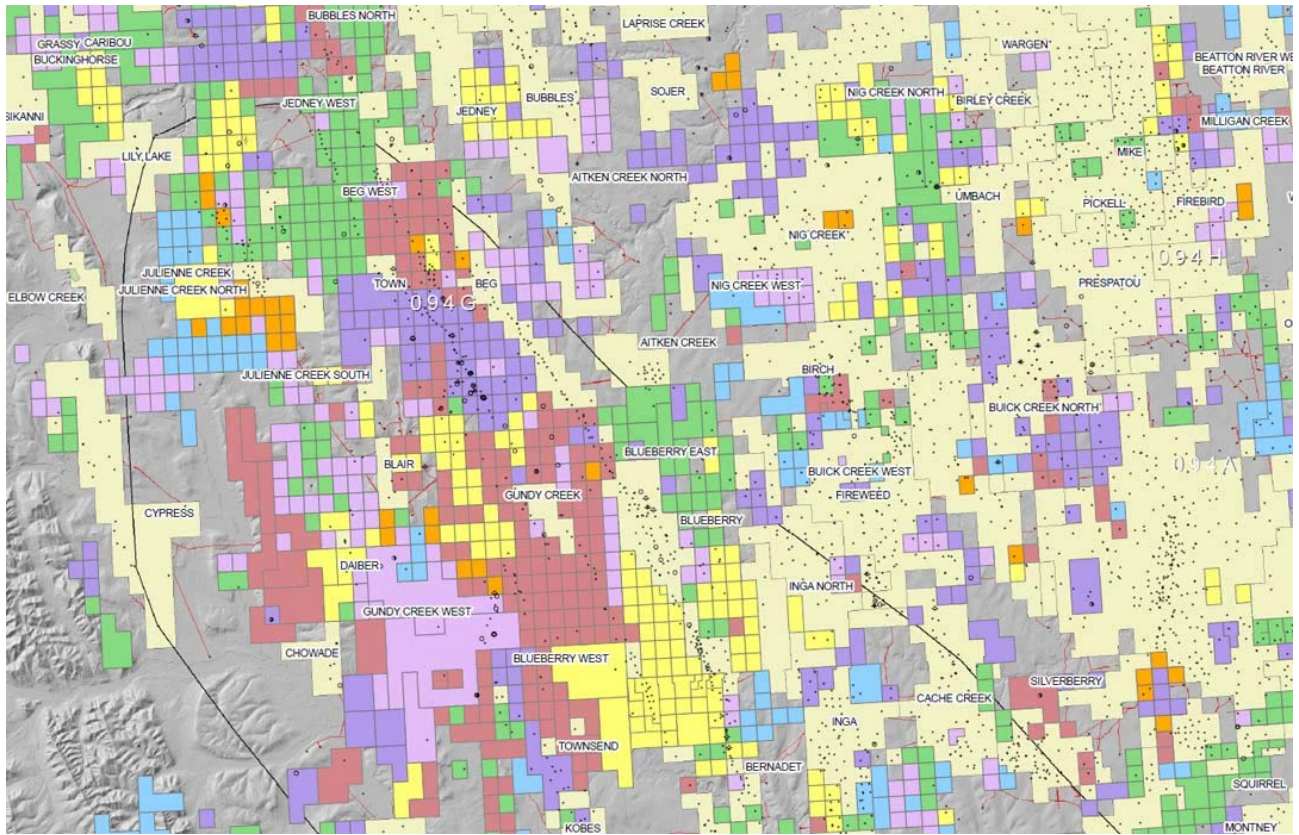


Upcoming

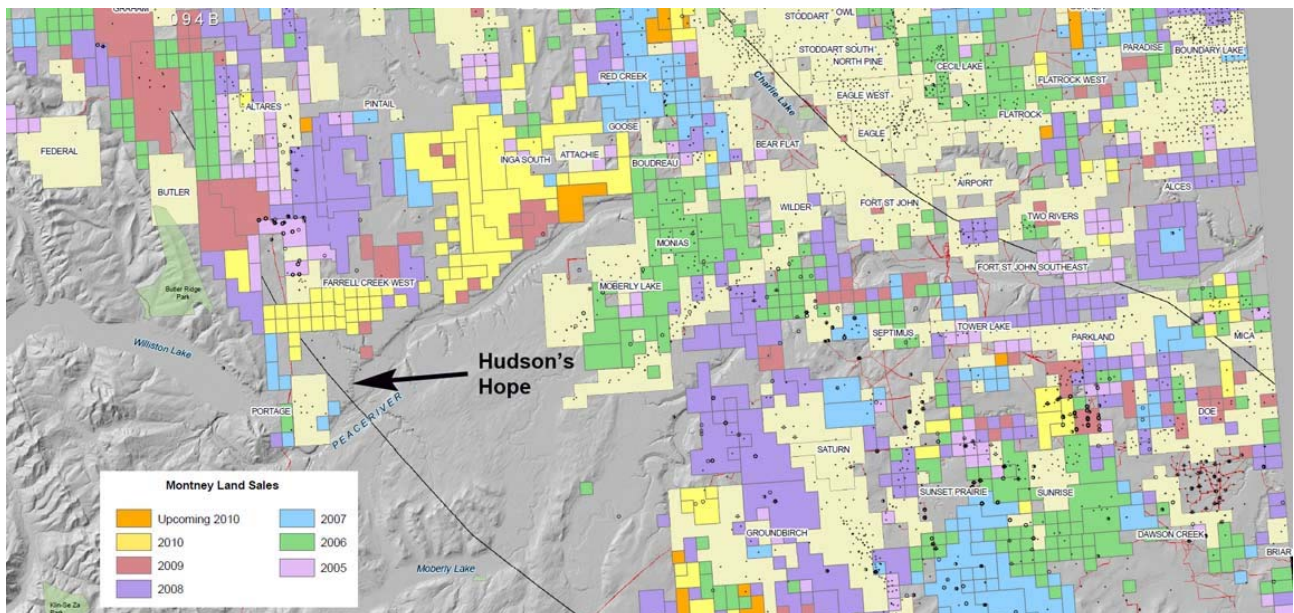


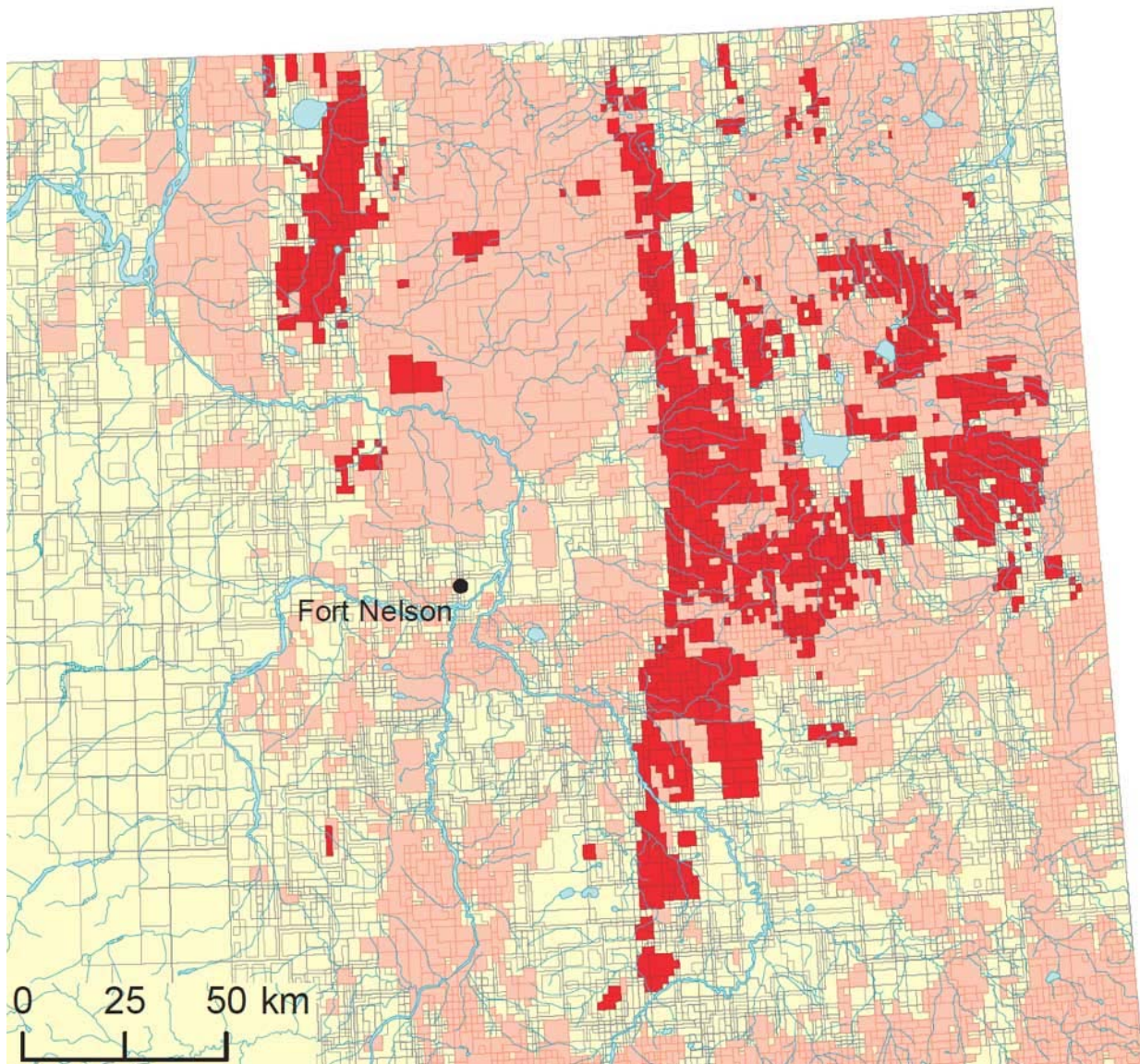


Area of entire 1.3 million hectare Horn Basin (bounded by purple dotted and solid green lines), eastern portion of Liard Basin, and western portion of Cordova Embayment playground land sales. The yellow coloured blocks are 2010 sales, brown blocks 2009 sales, dark purple 2008 sales, blue blocks 2007 sales, green blocks 2006 sales, light purple 2005 sales. It is 140 kilometres in direct distance between Fort Nelson and the Yukon/Northwest Territories border to the north. (Segments from a BC Ministry of Energy, Mines and Petroleum Resources August 2010, *Land Sales in the Horn River Basin, & Cordova Embayment, NE British Columbia.*)



Segments from Montney Basin playground activity land sales map, areas near Ft. St. John. Top map joins and is just north of bottom map. Coloured areas: yellow, 2010; brown, 2009; dark purple, 2008; blue, 2007; green, 2006; light purple, 2005. (Source: Ministry of Mines, Energy and Petroleum Resources September, 2010 map, *Montney Activity/Production NE British Columbia*)





This GIS-generated map of the northern northeast energy zone displays active oil and gas tenures (as of March 25, 2010), as highlighted in pinkish-red and dark red. The light yellow areas, within the many lined grids, are inactive oil and gas tenures. The dark red areas are 100 percent EnCana Corporation owned tenures. EnCana also shares some tenure blocks with other energy companies, tenure areas which are not featured or highlighted alongside EnCana's tenures on this map. As one can observe, EnCana owns significant portions of the four deep shale basins (Liard, Horn River, Cordova Embayment, and Sierra). Information from EnCana's documents indicate that the energy company had an early head start (2003 onward) in obtaining some of the best and largest tenure holdings as part of its forward-looking investment strategy in northeast BC. EnCana also has more tenure holdings in the southern half of northeast BC's energy zone.

What path is British Columbia on? - Quotes from a 1991 Environment Ministry Report



*BCE (B.C. Environment) staff have identified **the need to address the cumulative environmental effects of industrial development in Northeastern British Columbia**. The Ministry is most concerned with the impact of gas field development on environmental resources. Ministry staff want to ensure that environmental resources, and the wilderness values upon which some resource components depend, are not compromised by gas field development. Therefore, petroleum industry activities and associated environmental impacts are the focus of this paper.*

The most pressing issue to be addressed is the cumulative impact of all petroleum industry initiatives on environmental resources. The Ministry is concerned with: (1) the short and long-term impact on environmental resources and supporting wilderness values, and other resource users; and (2) the adequacy of the present management system for planning, assessing and regulating gas field development and petroleum industry operations.

The petroleum industry has the greatest potential for environmental disturbance in the area and it falls to the staff in the Northern Region to manage petroleum industry activity and its associated impacts.

Current ministerial legislation provides for considerable stronger management than is currently undertaken.... An attitudinal change is needed that indicates a higher level of management to be undertaken on petroleum industry activity. If stronger management is desired, the MOE will require a considerable increase in manpower and support.

The high degree of “rubber stamping” of approvals and the lack of monitoring compliance with guidelines is diminishing the credibility of the Ministry while providing little environmental protection.

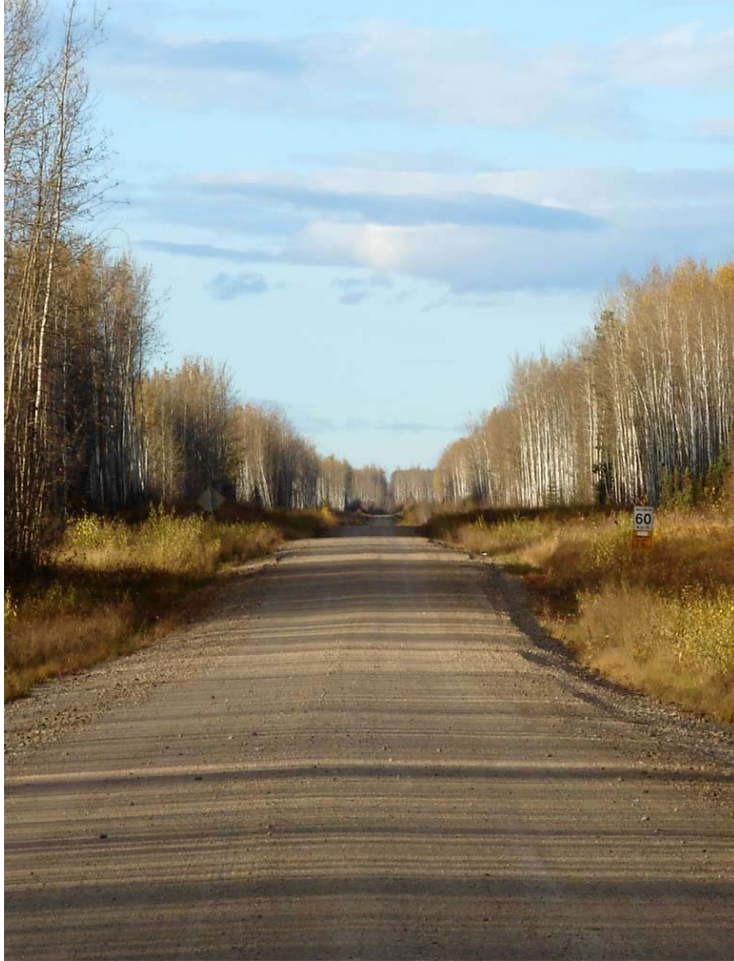
Wildlife recommendations.... A more strategic approach applied to petroleum development could assist the coordinating of activities between projects.... Ideally, strategic planning precedes the sale of petroleum rights. This ensures all parties involved are aware of the concerns and constraints associated with development in an area before development is proposed.

Source: *Environmental Impacts Associated with Gas Field Development Activity in British Columbia: Issues and Recommendations*, October, 1991.



Heavy, constant traffic on the mainline Komie road just south of EnCana's Cabin gas plant. Service trucks await a two hour delay while road maintenance crews continue to repair the road, forcing costly delays. (September 29, 2010)





All-weather access roads are being built throughout the Horn playground. Due to rivalry and road costs, each company is striving to have their own secondary roads. Below: Series of trucks returning from a frack job somewhere in the Horn north of the intersection of the Komie and Sierra-Yoyo-Desan roads.





For the summer of 2010, the provincial government kicked in about \$40 million to pave the first 30 kilometres of the Sierra-Yoyo-Desan (SYD) public access road into the southern quadrant of the Horn shale playground. The Ministry of Energy (through Partnerships BC) signed a 16-year Public Private Partnership agreement with Ledcor Projects Inc. and its “team” in June 2004 to “upgrade” the SYD “as part of the province’s Oil and Gas Development Strategy,” in order to “improve accessibility”. Just after the new paved section, the SYD is riddled with potholes and various depressions (bumps), and graders seem to be constantly grooming the road. Below, the new paved section of the SYD.





Above: government photo of the brand new SYD bridge over the Fort Nelson River, completed in late 2004, for all energy development points east, north-east, and south-east of Fort Nelson. The Fort Nelson River is an engineering and access problem for the Horn playground frackers. The only other fixed access link over the Fort Nelson River for Horn Basin and Liard Basin access is along the Liard Highway 77, the site of the world's longest single-lane bailey bridge (below).



Not too far north of the bailey bridge, and eastward off of Highway 77 at junction Mile 300, is Imperial Oil and Exxon's public road access to its fracking operations. Some 20 kilometres along this access road is a sign stating: "No EnCana Traffic Beyond this Point." The sign indicates access problems and politics within the Horn River Basin producers. (Sign and bailey bridge photos, May 27, 2010)





In the early hours in the not so quiet hamlet of Fort Nelson on September 29, 2010, a team of super horsepower, high pressure diesel engine fracking trucks waits to depart to, or from, a Horn Basin playground fracking assignment. International operative Schlumberger is one of a chosen few service industry companies fracking the energy industry's well pads.

The heavy machinery, with its heavy demand of fuel and its diesel emissions, is one of the cumulative effects in shale gas plays in northeastern BC. In the winter months, long lines of these, and other, trucks are seen idling their engines along the main streets of Fort Nelson, their cumulating emissions hanging over the cold frosty air of the small town like a fog. All of these trucks must travel along the hundreds of kilometres of new and heavily maintained gravel roads to the Horn, Cordova, Liard, and Sierra Basins' paydirt.





The Alaska highway (Oct.1, 2010), about halfway between Ft. St. John and Ft. Nelson. Highway repairs force line-ups, where here, three frack sand double-trailer trucks are waiting, hauling the special 43-ton sand payloads from the Peace River silica mine in Alberta to Ft. Nelson, a 1,320 kilometre round trip. In January to March 2010, about 800 such trips were made to service Apache Canada's 70-K pad in the middle of the Horn River Basin. From Ft. Nelson to the 70-K pad, round trip, is another 500 km. It takes about 5 hours for trucks to drive one way between the energy towns of Ft. Nelson and Fort St. John alone, 380 km distant.





In these two photos, special rail cars on the Canadian National Railway line can deliver specially mined, high quality frack sand from distant sources, such as Nebraska, Saskatchewan, or Texas to CN's railway terminus in south Fort Nelson's industrial zone. Manufactured by American Railcar Industries Inc., each car has a maximum capacity of 3,260 cubic feet (92.3 cubic metres). Sources indicate that these cars deliver 100 tons.



The frack sand is stored in large holding tanks (photo, following page), and others being constructed nearby, where frack sand trucks get loaded, and then head off with their heavy loads to distant frack sites. The sand is also delivered by chartered trucks from points south, i.e. Peace River, Alberta, about 600 kilometres one way to Fort Nelson. Energy companies are now building local frack sand storage areas in the isolated wilderness of the Horn and elsewhere, and plans are in the works to store the frack sand at Canfor's gigantic and idle OSB plant here in Fort Nelson which was shut down almost two years ago.

According to industry documents, the going rate of frack sand is currently about \$250 - \$275 per ton (pre-tax), and a local trucker stated that current trucking charges typically run about \$200 per hour. Combined long distance freight charges, rail and truck, are not cheap. EnCana reported in 2009 that about 70 cents on the dollar for 2009 sand prices was on transportation alone, and that "sand would be in the order of four - six per cent of the total well cost".

Described in an October 2010 World Oil Online report, *Independents and IOCs active in the Horn River Basin*, Apache Canada is reported to have used 50,000 tons of frack sand on its former largest frack on pad 70-K (see below for more details on the location), about 70 percent of which was hauled and delivered by a team of trucks, 24/7, from Alberta, for a total 790 round trips.

On a recent fracturing project, Apache and Sanjel took 111 days to complete three fracture jobs per day. The completions team performed 274 fracs on a 16-well pad, using 50,000 tons of sand and 6.2 million bbl of water. In 2011, Apache expects to complete two more pads with 25-28 wells and bring an additional 42-45 wells on production.

50,000 tons equals 500 rail cars of sand (100 tons/car), or an average of 182.5 tons of sand, or 1.825 rail cars per frack on Apache's pad. At 42 feet in rail car length (coupler to coupler), that's a line of rail cars stretching 21,000 feet or 4 miles (6.4 kilometres) in length! Or, if compared with double-trailer sand trucks at about 60 feet in length, carrying a load of 43 tons each, that's a linear line-up of diesel trucks measuring 69,780 feet or 13.2 miles (21.2 kilometres), bumper to bumper!

Trimac Group's on-line Summer 2010 newsletter, *Interline*, reported that Diversified Industrial Services Company (DISCO), a division of Canadian Silica Industries (LaPrairie Group of Companies), signed a

distribution agreement with DISCO in September 2009 to transport frack sand from Peace River, Alberta, directly to Apache's frack site on Pad 70-K in the Horn River Basin. DISCO's January to March 2010 contract with Trimac was to "transport 34,000 metric tonnes of frac sand from Peace River, AB to Fort Nelson. ... and at its peak required 42 drivers, trucks and trailers on a daily basis to meet the demands of the Sanjel Frac crews on site." (Sanjel operated the multi-frack operations contract for Apache's pad 70-K, at Two Island Lake.) The frack sand mine administrator stated that the double trailers carry 43 tons of frack sand, which means that **790 trips would have been made to haul 34,000 tons**. Later, a new Trimac branch, Canamera Branch 296, was created, and "Branch 296 began its second, and larger frac sand haul for DISCO in late June (2010) with 52 drivers and trucks. ... These drivers had to be trained in loading and handling the sand and in some cases, to cope with conditions on a 1,490 km. round trip route running through the Rocky Mountains and along the beginning of the Alaska Highway. ... Once there, Trimac drivers handed off the trailers to DISCO for onward transport to the drilling sites in the Horn River Basin of northeastern BC."

Based on limited or general information, it was reported by Trican (a large oilfield service company) in a number of 2010 presentations that EnCana's new largest frack at Two Island Lake pad 63-K (see page 41 ff.) recently used about ten percent more sand per frack than Apache's operations, averaging about 200 tons, or two rail cars per frack. (Trican coordinated and operated the frack operations with its integrated fracking rigs on EnCana's site since late May, 2010, with more fracking to do.) With EnCana reporting 255 fracks at the south half of pad 63-K, on much longer horizontal well bores (up to 3,000 metres) than Apache's, that would mean that about 51,000 tonnes of frack sand, or 510 filled rail cars, were required for EnCana's operations so far, on 9 of 14 wells completed. If the projected average use of sand per frack continues over the remaining 5 wells, that's an additional 28,000 tons of frack sand required, or a grand total of 79,000 tons, or 790 rail cars.

At a minimum cost of \$25,000 wholesale per rail car (\$250 per ton, pre-taxes) of sand, the cost to EnCana could be about \$19.75 million. If an estimated factor of 70 percent transportation costs were added on to this figure, at \$13.825 million, Encana's total frack sand costs would come to about \$33.575 million (pre-taxes).

The use of frack sand for only two multi-well pad operations in 2010, Apache's and EnCana's, amounts to about 129,000 tonnes, or **1,290 rail car containers, stretching a distance of 54,180 feet** (10.26 miles, or 16.5 kilometres). It's a lot of sand, and a lot of energy required to mine and deliver it.

As referenced in provincial regulations, the disposal of frack sand as waste from fracking operations is a concern in some provinces, such as Saskatchewan, as some energy companies had disposed this waste sand in municipal landfills. In conjunction with the disposal of enormous volumes of toxic waste water produced from hydraulic fracturing, how is frack sand waste being properly disposed of in British Columbia, and is some, or how much, of this sand radioactive?

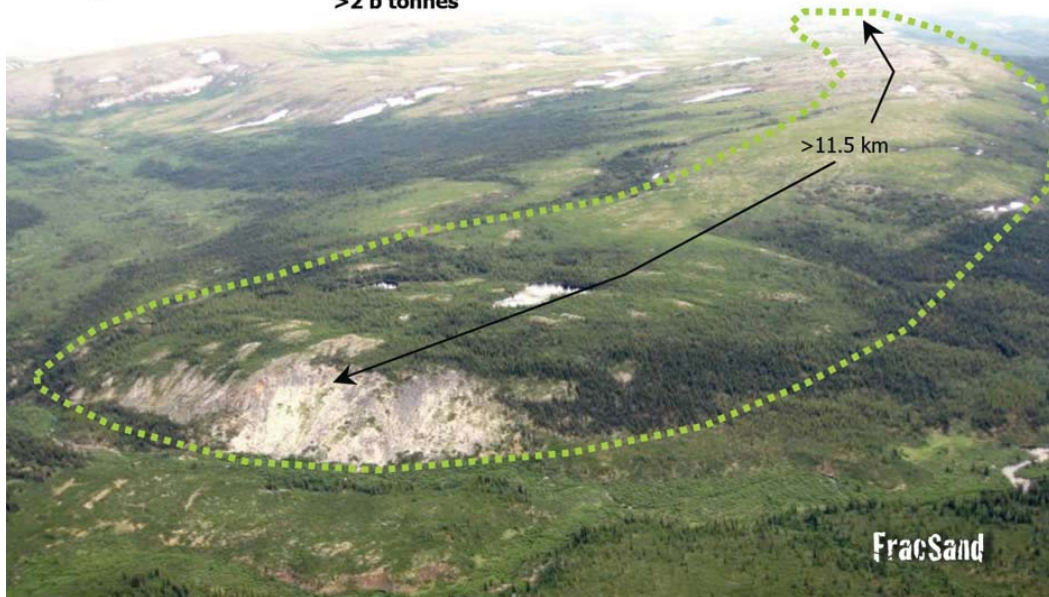
How much combined frack sand was used in 2010 alone for all the deep shale basin frack operations in northeast BC? How many rail cars and double-trailer truck deliveries were there to haul the sand back and forth? How much fossil fuel was used for all of these operations?



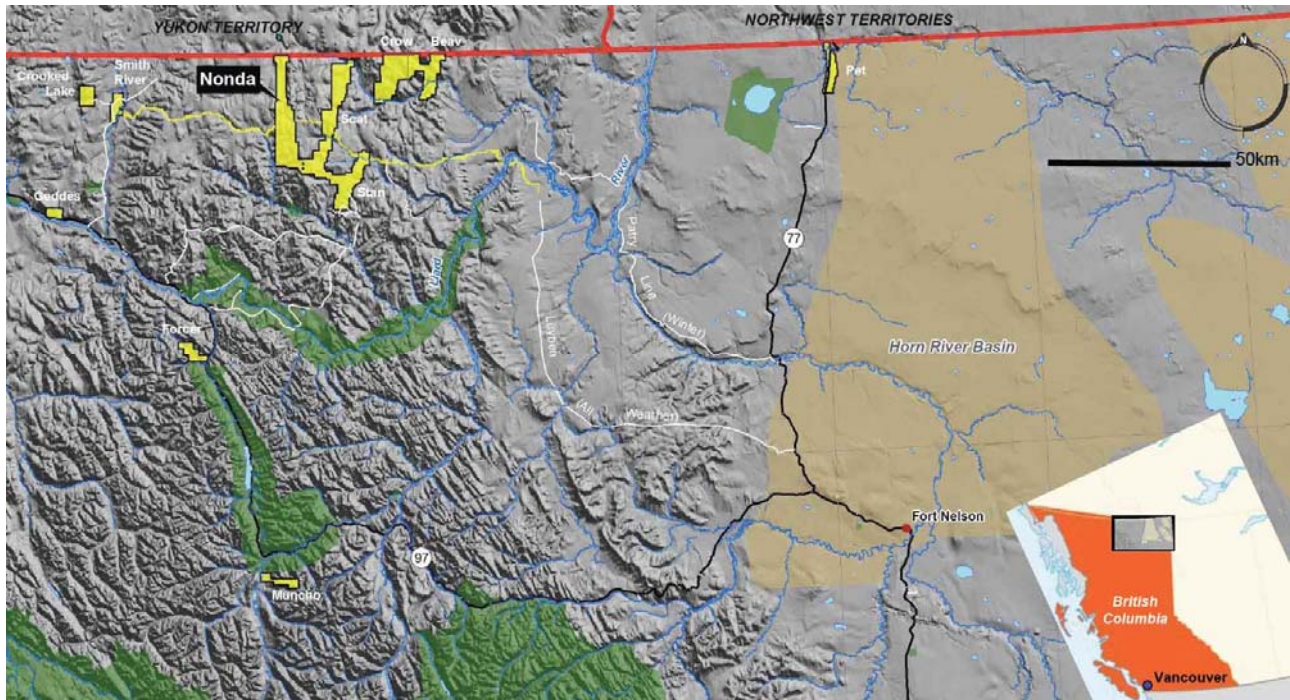


Nonda has Impressive Size

11,500 m long x 1,000m wide x 100m thick
>2 b tonnes



Stikine Gold Resources has been anxiously at work staking mining claims northwest of Fort Nelson near/at the Yukon border in a bid to control the flow of frack sand to the fracking companies in northeast BC. The open pit mining proposals have raised the eyebrows of a few stakeholders and the public. As seen in one of the company's proposed pits above, the environmental footprint of one of its 17 properties (83,000 ha.) is considerable, and so are the service trucking schedule proposals. The proposed pits are shown in yellow in the company's map below. (Image sources from the company's public relations documents). Stikine Resources has reported that at this time energy companies are importing about 300,000 tonnes annually for fracking, just in the Horn Basin alone. (On 2 multi-well pads, Apache & EnCana used 129,000 tons in 2010.)





This is the new main access service road for Apache Canada and EnCana's partnership playground on the Horn Basin Etsho escarpment, south of Two Island Lake, about 80 kilometres north of Fort Nelson.

The Komie mainline access road to and from Fort Nelson is off to the left of the photos, a long day's drive to or from town. More expedient access is via an expensive helicopter trip. EOG and Nexen's playgrounds are just north and east of here, and Devon Energy's just south.

Photo (left), shows EnCana's 16-well, 70-J pad (bottom), and at the top is

EnCana's 14-well, 63-K pad, most likely the site of the world's largest & longest frack job to date!



Up until recently, the one kilometre-long, Two Island Lake (top photo, and part of bottom photo) had been the primary source of fresh water for fracking partners Apache Canada and EnCana Corporation. The Lake was featured in a June 2010 report by the author, *The World's Biggest Frack*, about Apache's 111-day long, continuous fracking, on a 16 multi-well pad off just to the west (left) of these photos (more below).

From field accounts in early June 2010 of activity on **EnCana's 63-K pad** shown here, and from photos of this site in a June 2010 Trican presentation, it appears that the multi-well site has seen continuous fracking since at least late May up until at least October 2 when these photos were taken. According to transcripts from EnCana's 2010, 2nd and 3rd quarterly meetings, 63-K pad received a maximum average 28 fractures per well, over a horizontal distance of about 3 kilometres. On the "south half" of this pad, "with over 255 hydraulic fractures completed", "**this is the largest frac program to date in the Horn River**", with "an average of 2.3 fracks per day", "over the course of about 110 days."

These, and other energy company, operations mark the beginning of thousands of more wells scheduled for development and continued experimental fracking in the 1.3 million hectare Horn Basin boreal wilderness.





Close-up photos of EnCana's 63-K pad. EnCana's 3rd Quarterly transcript failed to clarify to investors that its reported 255 fracks represented only 9 out of 14 wells completed. If the preceding reported average of 28 fracks per well continues over the remaining 5 wells, there will likely be about 140 more fracks, making a total of just under **400 fracks over about 174 days (6 months)**! With a total combined fresh water use (averaging at 4,750 cubic metres/frack) of about **1.86 million cubic metres (744 Olympic-sized swimming pools)**, EnCana has just blown away the competition, essentially doubling the recent record by its partner Apache, setting new world fracking-related records! ***There are no government fees for the use of this water.*** Note the two large water storage pits to the north and east of this site used for the constant fracking. In the lower, or brownish pit (above), one can detect the incoming movement of water, the white overtop the brown. It is not obvious from these photos where the large volumes of toxic frack waste water are stored before removal from the site. It appears as though neither of the two pits have special liners for the waste waters, and no large circular tank containers are visible. Perhaps the toxic waters are pumped off site to another location. One can observe the pipelines adjacent to the road in both photos. (Garth Lenz photos)

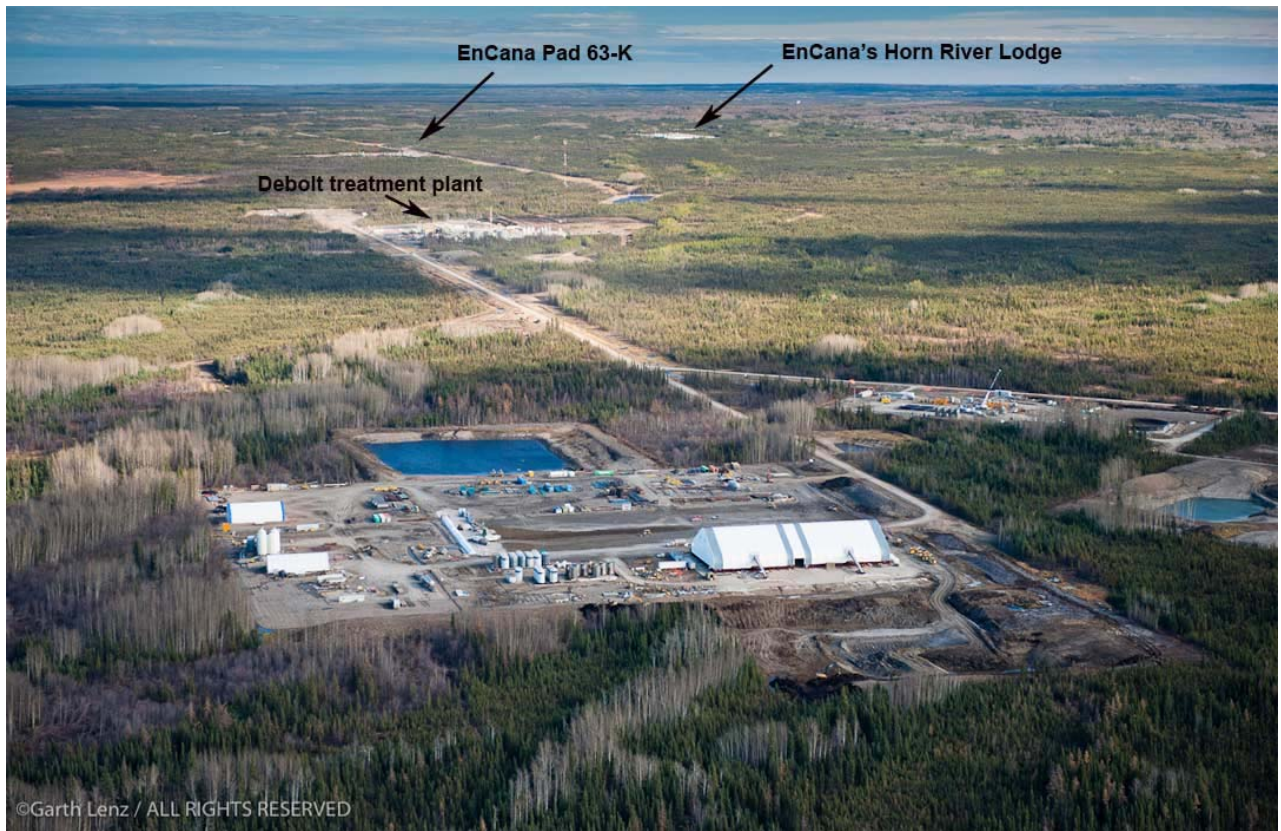




This is another photo of EnCana's 63-K pad (borrowed from a Trican Well Service June 17-18, 2010 presentation). Absent from the photos on above pages, is the drilling rig seen here, in the northeast corner. In addition to confirmation that this pad was being high-pressure-pump fracked in June, 2010, is a closer image (above) of Trican's fracking operations fleet, with up-right frack sand containers off to middle left. There are three monitoring trailers with satellite dishes, about 23 giant horsepower trailers, and about seven other multi-function rigs. In its presentation, Trican reported that the total frack diesel horsepower (HP) for this site was at 40,000.

In another image (below) from Trican's presentation, is the layout of its fracking fleet's recent operations elsewhere. Unlike the EnCana 63-K pad where water is pumped directly from the large reservoirs at the edge of the pad, here water is held in and pumped from 25 black, 64-cubic meter, holding tanks. How much diesel is being used in these operations, and what are the total emissions from all the operations on these sites?





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These two photos are different aerial angles of Apache Canada's 16-well pad 70-K (the pad to the right, top and bottom photos), the site of the recent or former world's biggest/longest frack. Top photo (*Garth Lenz*) points eastward, bottom photo points northwest. A live flare stack is just visible on pad 70K, with the yellow flame spewing out. Apache's large water pit #10 (above, below, center) holds a maximum capacity of 110,000 cubic meters. In the distance (bottom photo) is a drilling rig. Much of the wilderness-remaining land is slated for similar developments.





Apache Corporation reported in July, 2010 on its British Columbia 70-K multi-well pad operation (under Apache Canada) that its Ootla team celebrated the largest completion in North America (photo, above, borrowed from this news release). This was Apache's first completed pad in the Horn Basin. It involved:

... a field team of about 280 workers and requiring some of the largest fleets – pressure pumpers, wireline trucks, cranes, coil tubing service rigs and other vehicles – ever assembled onsite in Canada's energy industry.... Apache worked with industry leader Sanjel, which reported that Apache's Horn River project is nearly four times larger than any project of its nature in North America. The project took 111 days to complete and averaged about three fracture jobs per day. When all was said and done, the completions team performed 274 successful fracs on the 16-well pad, using 50,000 tons of sand and 980,000 cubic meters of water.

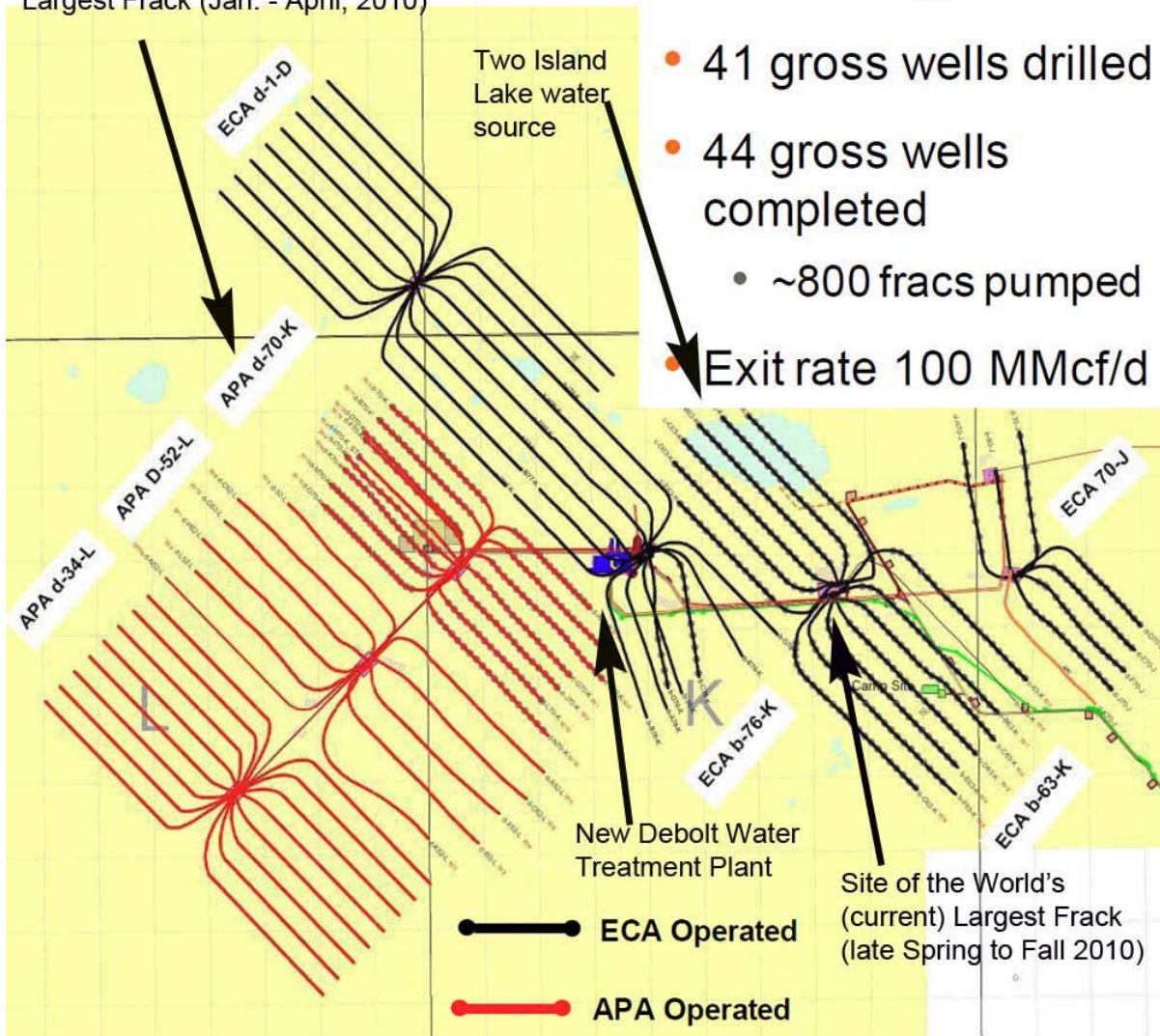
Trican Oil Service reported that EnCana, on its 63-K pad, used an average 4,750 cubic meters per frack over its reported 255 fracks, for a total 1.211 million cubic metres. That's a dramatic increase of water used in comparison to Apache's average of 3,577 cubic metres per frack, a 25 percent increase. It may be surmised that with all the 14 wells fracked on 63-K, for about 392 total fracks, that EnCana will have used in the order of 1.862 million cubic metres of water, doubling the amount of water its partner Apache used. About 0.5 to 2.0 percent of total water weight volume used is comprised of toxic additives, which may account for about **9,310 to 37,240 cubic metres, or 3.8 to 15.2 Olympic swimming pools, of toxics.**



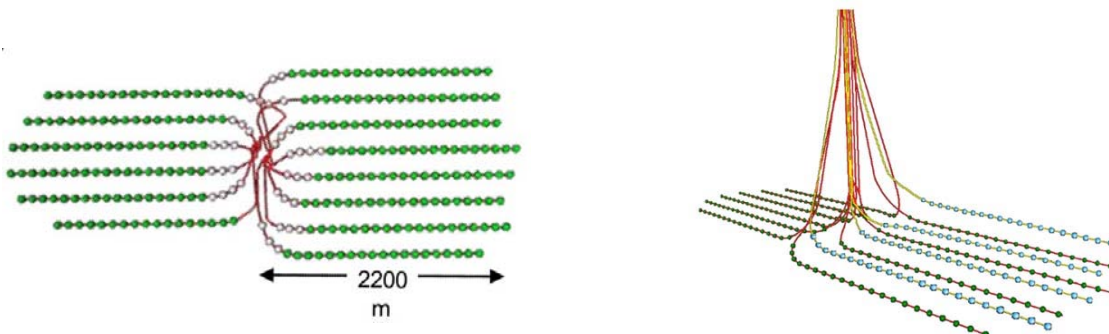
Location site of the World's former Largest Frack (Jan. - April, 2010)

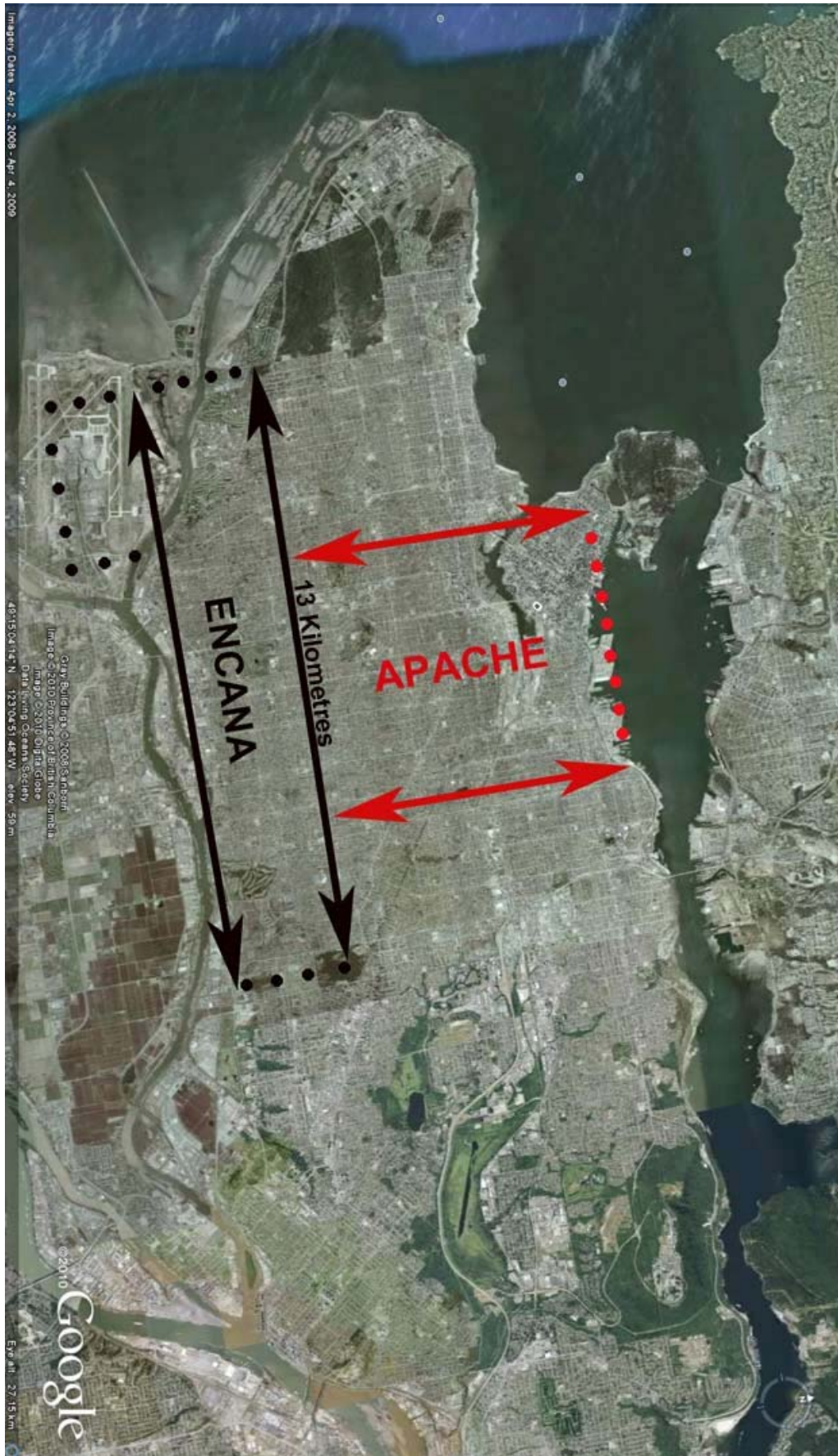
2010F Program

- 41 gross wells drilled
- 44 gross wells completed
 - ~800 fracs pumped
- Exit rate 100 MMcf/d



These diagrams (borrowed from an October, 2010 EnCana public relations document) indicate the joint operations of Apache Canada and EnCana in the Two Island Lake playground. EnCana's wells are in black, Apache's in red. The little round dots in the diagrams along the horizontal well bores are the locations for each perforated frack job. The 16-well pad for the world's former largest frack (January - April, 2010) is APA (Apache) d-70-K, apparently superseded in September, 2010 by EnCana's world's largest frack on pad 63-K. As indicated in EnCana's diagrams, its individual wells in 2010 now extend 2,200 meters (or more) in horizontal length. You can see how the integrated underground operations are efficient, "getting it all". The distance between the end horizontal bores ECA d-1-D and ECA b-63-K is about 13 kilometres.





To help illustrate the **underground**, tentacle development fracking grid footprint area of partner EnCana and Apache's seven operations at Two Island Lake, as shown in EnCana's own map (page 46), is what it might look like if traced over the City of Vancouver.

The under-length of EnCana's two pads, from the end of 1-D to 63-K is about 13 kilometres. That's the distance from the eastern boundary of Pacific Spirit Park to Central Park, at the boundary between the City of Vancouver and Burnaby. EnCana's pad 70-J would include all of the Vancouver international airport area.

The distance between Apache's outer pad 34-L to the northern outer area of EnCana's pads is about 8 kilometres. That's about the distance from Marine Drive in South Vancouver to the new Vancouver Convention Centre at Vancouver's harbour. The length of Apache's three grouped pads would extend from about the Planetarium eastward to Nanaimo Street.

This area over Vancouver only represents 7 multi-well pads in the Horn Basin, **a frack-tion of things to come.**



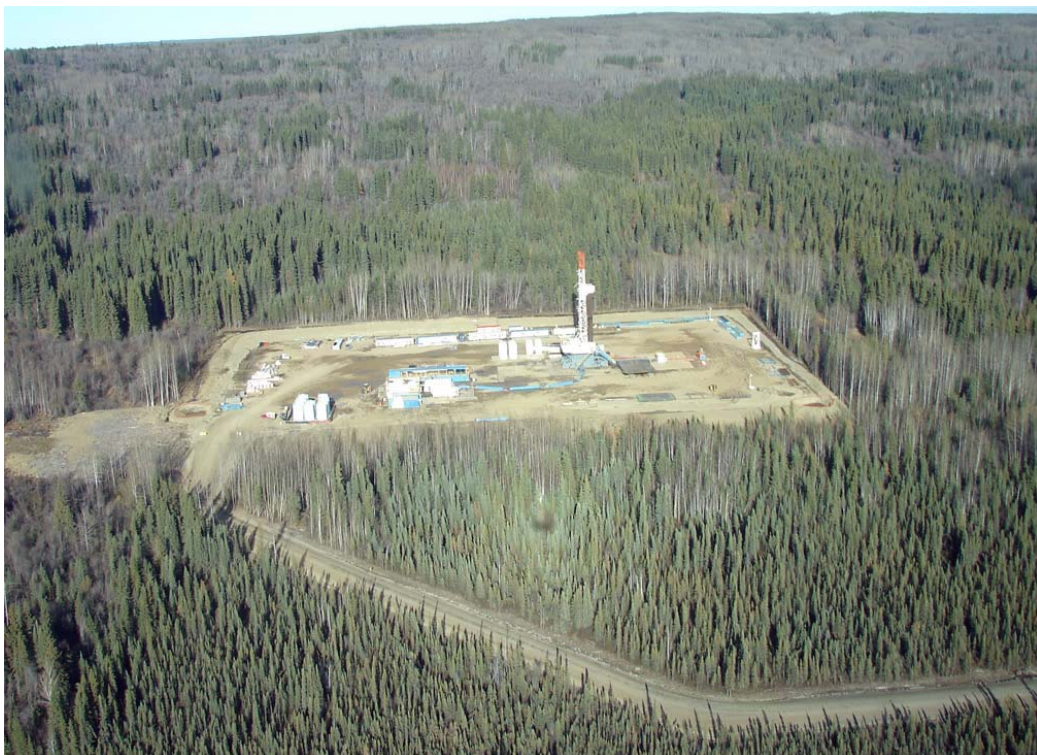
Since the end of May, 2010, much of the water used for EnCana's 63-K pad, largest and longest frack job, came from a new groundwater source, from what hydro-geologists have identified as the Debolt Formation (a regional sour aquifer). EnCana is the first energy company to tap into such a source in the Horn Basin, sharing the water with its frack partner Apache. The saline water from deep below is being pumped into and treated at EnCana's new water treatment facility, shown in the two photos. For its un-reported completed activity of about 392 fracks, EnCana will have used about 1.862 million cubic meters of water (estimating a reported average 4,750 cubic meters per frack). **That's at least 484.12 million imperial gallons of water, or 46,550 double tanker water trucks carrying 40 cubic meters of water each.** The OGC granted EnCana a groundwater well withdrawal permit for the Debolt (EnCana must report and track all the water used here), and **all the water is free of charge!** Note the rather large (being) lined water pit (below) to the left, or east, of the treatment facility (which holds 80,000 cubic metres of water) and how small the large dump trucks and excavators look deep down inside the pit. Why is the provincial government not charging fees for the fracking use of this water? The water pit above (pit #5) holds a maximum capacity of 77,000 cubic metres. (*Garth Lenz photo, below*)



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The top photo (*Garth Lenz*) in the Two Island Lake playground complex could almost be a scene of Florida's Cape Canaveral, showing the rocket ship launching sites. There are two Apache Canada drilling rigs in the top photo (southwest of Two Island Lake). The closest is pad 34-L, with 16 wells being drilled, and the farthest pad 54-L, with 14 wells being drilled. Just beyond 54-L, is Apache's 70-K pad. The horizontal bores where the fracking will later occur in 2011 on these two pads extend like lengthy roots to the left and right



from each multi-well pad site far underground. **Will Apache try and equal, or beat, Encana's new world fracking record on these sites, and use even more water and frack sand?**

The bottom photo is one of Devon Energy's drilling sites just southeast of the photos above, most likely Komie 20-J pad, with 9 wells being drilled.



The extraction, diversion and storage of enormous volumes of fresh water from multiple sources used for fracking, and the resultant pollution of this water from added toxics, remains a huge controversy and problem for the world, and, more specifically, for BC's boreal forest ecosystems. In north-eastern BC, enormous energy is required to create or dig out water pit reservoirs, strewn evermore throughout the wilderness landscapes. (Two Island Lake area.)





Here's how the energy industry in northeast BC begins infrastructure logistics in the undeveloped boreal wilderness.

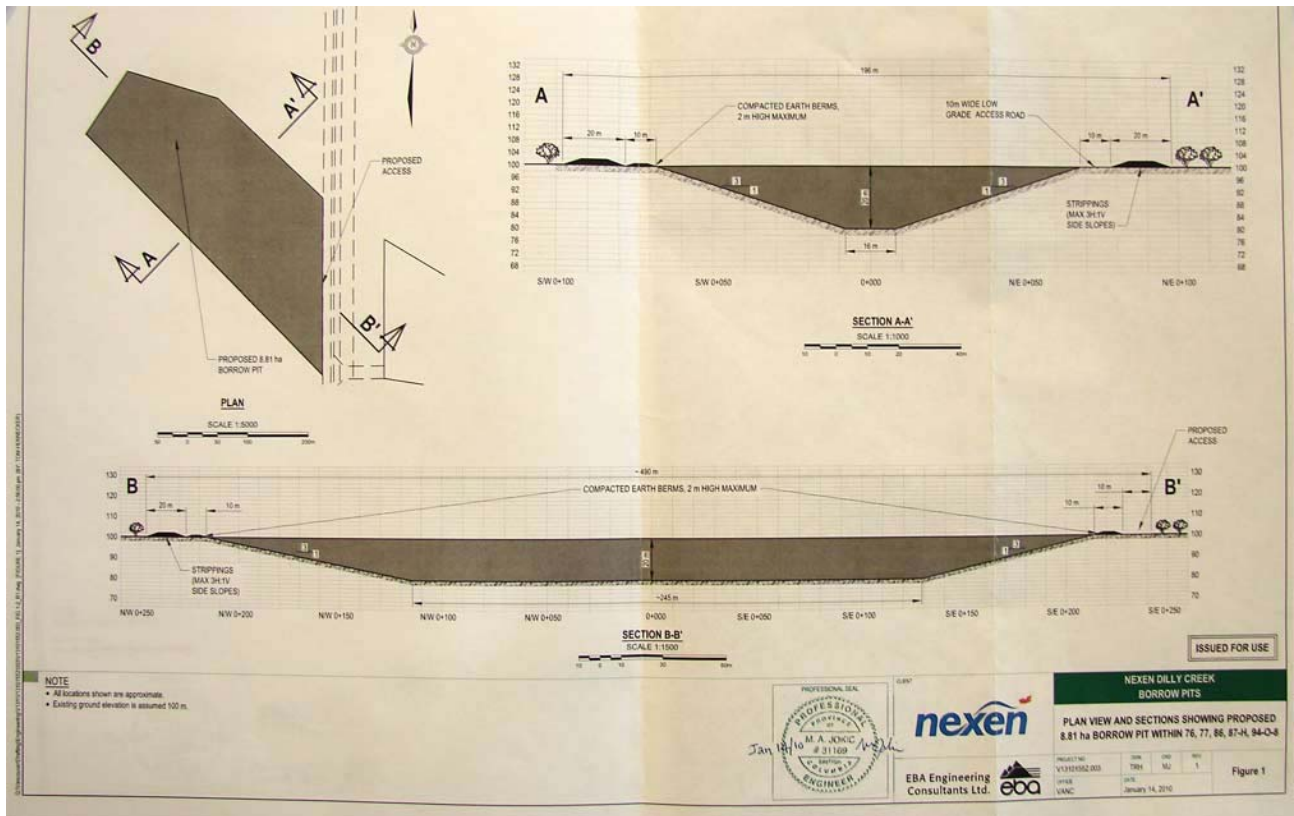
First, road right-of-ways are cleared of "vegetation".

Second, road bed source soil materials are dug out from huge borrow pits. These soils are not only used for the road bed, but for well pads, storage pads, camp pads, etc. These source material pits are almost always used as fresh water storage pits, the first strategic thing to be designed for pit location and pit depth.

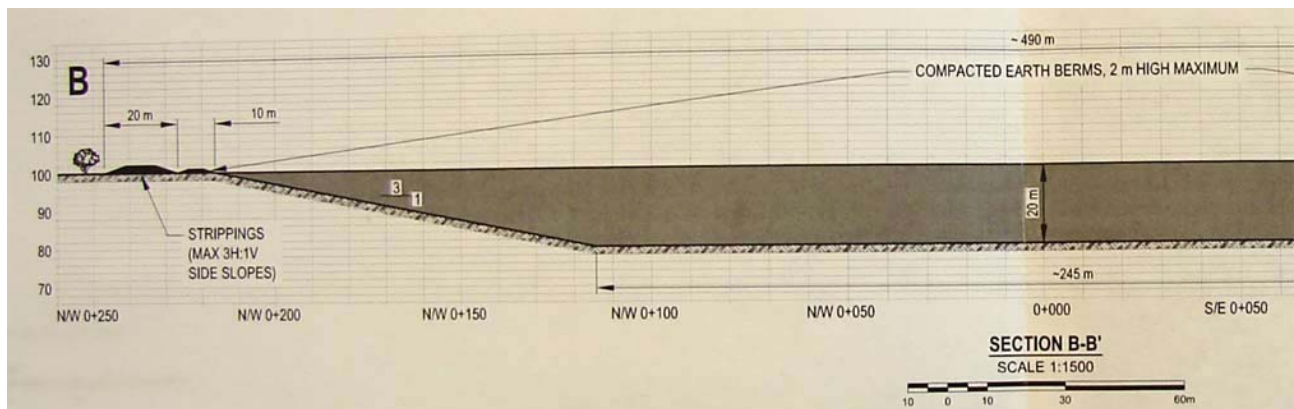
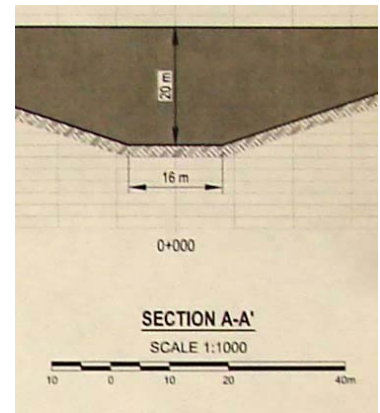
Some of these pits are extremely wide in area, and in some cases, very, very deep. To dig these pits in the hard clays in the north demands a lot of energy from fossil fuels.

What is the future of the hundreds and thousands of man-made pits, how much energy is required to restore them to their

natural state? What are the conditions between the government and energy companies in providing reclamation bonding of these large sites and borrow pits?



This is a standard industry schematic of a water pit. However, this one, which was **recently approved** for Nexen, in the Two Island Lake area, is **not quite so standard**, in relation to its size: area, volume, and depth. It is **8.81 hectares in area** on newly cleared wilderness public lands, and will be **20 (twenty) metres deep!!** According to the five-page December 21, 2009 engineering assessment, Nexen’s “material borrow pit at the Dilly Creek Facility” dimensions is actually classified “as a **small mine**”: the Ministry of Energy, Mines and Petroleum Resources (MEMPR) “are currently preparing requirements for small mines but these have not yet been published.” “After excavation as a borrow source, Nexen plans to use the area as a water reservoir with water either pumped into the pit or allowed to infill naturally.... It is EBA’s understanding that the proposed borrow pit reservoir will be used for storage of natural site water, and that infilling of the reservoir due to groundwater seepage, or loss of stored water due to infiltration, are both acceptable. Consideration of groundwater impacts related to the operation of the reservoir are outside the scope of this review. If there is a potential for contaminated water to enter the reservoir, further consideration of groundwater flow is recommended.”





New branch roads and enormous pads being cleared and built on public lands by Talisman Energy at its Farrell Creek operations north of Hudson's Hope, just west of its compressor site (at LSD b-88I/94-B-1). Road gravels are being hauled continuously by a stream of dump trucks from a giant gravel pit south of here on a newly located site on private farmland. The compactor in the image (top left) is travelling at high speed down another newly constructed road branch, rushing to help fill a large new drilling pad being constructed and levelled in the photo below (*Garth Lenz*). Note the large perimeter berm, the extensive fill, and fill depth for the new pad. This photo shows about 25% of the pad's actual area footprint. There is a tremendous amount of energy and equipment required to initiate the deep shale activities. These activities are multiplied over and over again in BC's northeast fracking energy zone.



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The large-scale deep shale gas developments in the mid-Horn River Basin are setting new records for fresh water use, and demand the importation of various resources, such as frack sand and toxic additives for both drilling and fracking. Above, Devon Energy's camp quarters on the southern slope of the Etcho Escarpment. Below, one of Apache Canada's operations southwest of Two Island Lake.



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The encroaching developments in the boreal forest. Komie mainline access road area near EnCana's Cabin gas plant. Most of NOVA's proposed 36-inch new gas line will be built adjacent to the Komie mainline.





The convergence of a seismic line with a boreal forest/wetland complex, some 40 kilometres northeast of Fort Nelson. The seismic line, reaching out like a connecting cord toward the northeast distant fracking sites on the Etcho Escarpment, may be the precursor of developments to come.

CONCLUSION

The gallop to own, develop, distribute and market deep shale gas over a vast public territory in northeast British Columbia is in its infancy.

These resource-intensive developments have been allowed to proceed virtually unchecked and un-scoped. In this sense, given the backdrop of evermore lax and non-existent legislation and regulations, these developments can be understood as distinct social and political failures.

Juxtaposing these failures alongside the recent implementation of TILMA (Trade, Investment and Labour Mobility Agreement) - an in-house deregulatory accord signed by the three western Canadian Premiers - the outcomes could become evermore frightening. TILMA grants (energy) corporations legal powers (in a standstill clause) preventing new provincial regulations that in any way impede “trade, investment or labour mobility”. In hindsight, is the logical musing that the grand scale developments affecting controversial public resources like BC and Alberta gas and oil shales may be one of the obvious, significant factors behind TILMA. (The Council of Canadians are deeply troubled by TILMA, <http://www.canadians.org/DI/issues/TILMA/factsheet.html>, and made hydraulic fracturing one of their campaign issues.)

Many of BC’s environmental and regulatory problems on the subject were recently and summarily revealed in a paper by Ben Parfitt entitled, *Fracture Lines: Will Canada’s Water be Protected in the Rush to Develop Shale Gas?*, that he presented at the first Canadian public forum on fracking hosted by the Munk School of Global Affairs. Ben Parfitt raised a number of significant concerns, i.e.:

Even supporters of the unconventional resource now admit that “water has emerged as the highest visibility environmental issue” associated with shale gas production. In fact wherever the shale industry has invaded rural communities, controversy about water use, groundwater contamination and the regulation of the industry has doggedly followed. “The largest challenges lie in the area of water management, particularly the effective disposal of fracture fluids,” notes a 2010 MIT report on natural gas. ... Intensive drilling in northern British Columbia has resulted in unprecedented water withdrawals and even a bombing campaign directed against the Encana Corporation to protest the pace of development.

Given the economic importance of the resource and growing concerns about industry’s use of and impact on water, this report examines the implications of shale gas production on Canada’s water supplies. In addition to reviewing the technological drivers of the shale gas revolution, the report also looks at the state of groundwater mapping in shale-rich regions. Lastly, it reviews the adequacy of existing regulatory frameworks to protect water resources, landowners and rural communities.

Unlike the United States where the US Congress and state regulators are fully engaged in public policy debates, neither the National Energy Board nor Environment Canada have yet raised any substantive questions about ‘the shale gale’ or its impact on water resources. The pace of the shale gas revolution demands greater scrutiny before more fracture lines appear across the country.

That there are cumulative impacts associated with fracking is clear. Yet even in Canadian jurisdictions such as British Columbia, where conventional natural gas production has

occurred for decades and fracking is ramping up, regulators appear ill equipped to address and mitigate such impacts. As the province's Auditor General recently observed of British Columbia's Oil and Gas Commission:

OGC's mandate includes an expectation that it fosters a healthy environment. We found that, while the OGC has supported the development of some tools and methodologies to assess cumulative effects, no formal provincial program is yet in place to help manage the environmental effects of developments on the land base.

Against this backdrop, the OGC and the BC's Ministry of Environment are faced with increasing pressure from industry to develop shale gas wells. Similar pressures are soon likely to be felt by regulators in other Canadian provinces, as the industry pushes to develop a resource that it maintains provides both energy security and an environmentally friendly bridge to a low-carbon economy.

Northeast British Columbia's shale gas race will undoubtedly become and remain one of the most significant environmental and public planning issues facing First Nations, the Province, Regional Districts, regulators, communities and residents alike.

(A copy of Parfitt's conference paper can be found on the BC Tap Water Alliance's website, www.bctwa.org/FrackingBC.html, at the link on the right column, *Toronto's Munk School of Global Affairs Public Forum on Fracking*.)