

Oil and Gas Land Use in Northeast British Columbia

August 2013 | BC Oil and Gas Commission



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Photo sources:
Page 10 – Flower at Toad River, Tim Vo Photography.
Other photos by Commission staff.

About the BC Oil and Gas Commission

The BC Oil and Gas Commission is the provincial regulatory agency with responsibilities for regulating oil and gas activities in British Columbia, including exploration, development, pipeline transportation and reclamation.

The Commission’s core services include reviewing and assessing applications for industry activity, consulting with First Nations, cooperating with partner agencies, and ensuring industry complies with provincial legislation and all regulatory requirements. The public interest is protected by ensuring public safety, respecting those affected by oil and gas activities, conserving the environment and ensuring equitable participation in production.

For general information about the Commission, please visit www.bcogc.ca or phone 250-794-5200.



Mission

We regulate oil and gas activities for the benefit of British Columbians.

We achieve this by:

- Protecting public safety,
- Respecting those affected by oil and gas activities,
- Conserving the environment, and
- Supporting resource development.

Through the active engagement of our stakeholders and partners, we provide fair and timely decisions within our regulatory framework.

We support opportunities for employee growth, recognize individual and group contributions, demonstrate accountability at all levels, and instill pride and confidence in our organization.

We serve with a passion for excellence.

Vision

To be the leading oil and gas regulator in Canada.

Values

Respectful

Accountable

Effective

Efficient

Responsive

Transparent

Purpose of the Report

This report is produced by the BC Oil and Gas Commission (Commission) to provide an understanding of the surface area used by oil and gas activities in northeast British Columbia and a description of the methodology used to calculate the areas by activity.

The Commission identified a need for a standardized methodology for the measurement of surface disturbances caused by oil and gas activities, and published the first report, *Oil and Gas Land Use in the Fort Nelson LRMP Area of British Columbia*, to detail the measurement standards and calculations used. The reports focus on two aspects of oil and gas activities in northeast British Columbia:

- The type of surface activity.
- The surface area used by each activity.

This report provides an overview of surface land use by wellsites, pipelines, roads, geophysical exploration programs, facilities and associated oil and gas activities in northeast British Columbia up to and including January 2013. It also explains the methodology used to collect data, identifies data sources, assumptions and limitations and demonstrates how the Commission is working to improve future statistical reporting.

Future reports, including area-based analyses, will use the methodology and measurements outlined in this report. Previous reports are available at www.bcogc.ca.



What Does the Commission Regulate?

The Commission's core services and related processes are legislated by the Oil and Gas Activities Act (OGAA), which provides statutory authority to the Commission to permit oil and gas activities. Under OGAA, the Commissioner is the statutory decision maker and has authority to make or delegate decisions enabled by specified enactments.

OGAA enables regulation of surface land use primarily through the Environmental Protection and Management Regulation (EPMR). The EPMR defines actions a permit holder and a person carrying out an oil and gas activity must take, or refrain from taking, to protect and/or effectively manage environmental values. The regulation also outlines procedures for restoration and reclamation by permit holders when a site is no longer required for oil and gas activities.

Authority for certain activities related to other provincial acts has been delegated to the Commission through specified enactments (see Appendix I for a list of the specified enactments and provisions).

Memoranda of Understanding (MOUs) with other agencies also provide the Commission with regulatory guidance. As a result, the Commission acts as a single-window agency with responsibility for regulating nearly all aspects of oil and gas activities.

What Is Not Regulated By The Commission?

Certain activities associated with oil and gas activities are not regulated by the Commission. Other agencies are involved in the regulation of these associated activities in British Columbia. These include but are not limited to:

- The Ministry of Energy and Mines for associated activities falling under the Mines Act (such as large quarries).
- The National Energy Board (NEB) for the regulation of interprovincial pipelines and facilities integral to those pipeline systems. However, authority was transferred to the Commission in 2012 to issue authorizations under some specified enactments, including the Water Act and Land Act, for NEB-regulated pipelines (except the proposed Northern Gateway Pipeline).
- Ministry of Environment for wildlife and contaminated sites.

For the purposes of this report the Commission has calculated results based on the use of land to support oil and gas activities, regardless of the responsible regulatory agency. Data has been supplied by other regulatory agencies; however, the Commission does not manage this data. The calculations reflect any potential error in this data, but overall would represent a very small proportion of total activities.

Why Measure Oil and Gas Activity?

In British Columbia, government establishes strategic land and resource objectives by way of legislation, policy, and land use planning, and the Commission regulates oil and natural gas activities by following legislation and policies.

The shift to unconventional gas development is creating opportunities to better understand the interplay between surface use and subsurface resource development, and thereby more accurately assess the surface area used by oil and gas activities. The Commission and provincial government work together to enhance resource stewardship by collaborating with industry, First Nations and other stakeholders to increase land, water, wildlife and forest conservation.

The Commission is undertaking an area-based analysis approach to enhance resource stewardship and reduce environmental and social effects of oil and gas activity in British Columbia. This approach gathers information specific to unconventional gas basins and other defined areas to support regulatory decisions and guide the

implementation of initiatives to reduce overall surface impacts.

Area-based analysis requires a baseline calculation of the surface area used to support oil and gas development and a standardized methodology for the measurement of surface area disturbances. Analyses for the Liard Basin, Horn River Basin, Cordova Embayment and Montney will be summarized using the methodology and measurements outlined in this report.

The measurements used here serve as a template for future reporting of oil and gas land use. For this report, the Commission chose to concentrate on northeast British Columbia (Figure 1). Several smaller subunits are also summarized: the Fort Nelson Land and Resource Management Plan area (FNL RMP), Fort St. John Land and Resource Management Plan area (FSJLRMP), Dawson Creek Land and Resource Management Plan area (DCLRMP), Western Canada Sedimentary Basin (WCSB), Liard Basin, Horn River Basin, Cordova Embayment and Montney.

Figure 1
Northeast British Columbia encompasses approximately 17.5 million hectares of Crown land and is represented by the olive shaded area.



What and Where is Oil and Gas Activity?

Oil and gas exploration and development is concentrated in northeast British Columbia, particularly in the Montney and Horn River Basin. As the resource potential of these areas continues to grow and industry shifts from land acquisition to gas extraction, expanded infrastructure will be required for development, production, processing and transportation of natural gas. Directional and horizontal drilling and multi-well pads used in unconventional gas development are reducing the footprints of new developments as they provide opportunities for enhanced planning and shared surface structures.

Total natural gas production in British Columbia in the 2012/13 fiscal year was 1.5 trillion cubic feet (Tcf), approximately half of which was produced in the province's two most active basins – the Montney (40 per cent) and the Horn River Basin (10 per cent). Of the 444 well drilled in the province in 2012/13, over 85 per cent targeted unconventional sources, 339 of which were drilled in the Montney, 39 in the Horn River Basin, two in the Liard Basin and one in the Cordova Embayment.



Patterns of Oil and Gas Development

Oil and gas development in British Columbia is referred to as either conventional or unconventional. Conventional oil and gas exploration is the exploration and development of porous and permeable rock formations in the subsurface. These types of reservoirs are typically less than 20 metres in thickness and have well defined and limited areal extent. By comparison, unconventional reservoirs such as fine grained sandstones, siltstones and shales occur over large areas and individual formations can reach thicknesses in excess of 300 metres. There are a number of surface requirements for development. During both conventional and unconventional drilling operations, sumps or tanks are used to contain drilling and waste fluids; pipelines connect all producing gas and oil wells to markets and wellpads are accessed by a combination of all-season and/or winter access roads, and occasionally by air.

Figure 2: Conventional and Unconventional Development Patterns

Conventional Development

Conventional development targets porous formations where oil and gas will flow to the surface from a large area surrounding the wellbore. Conventional gas plays are called “pools” and are typically limited in areal extent and contain discrete boundaries. When developing conventional oil and gas pools, drilling and production operations typically require wellpads separated by 500 to 1,500 metres (photo top left) with one vertical well per pad. Land use patterns associated with single-pool oil and gas development have changed little over the years.



Unconventional Development

Unconventional gas resources cover vast subsurface areas and are often referred to as “shale basins” or simply “basins”. Unconventional development in British Columbia primarily focuses on gas held in formations with less porosity that cannot be produced from using conventional drilling and completion methods. These “tight” formations must be fractured to allow the gas to be extracted. The technology used to extract gas by unconventional means is evolving and surface development patterns are changing with the advancements.

A typical unconventional development model is to space wellpads relatively uniformly across the basin on the premise that gas is evenly distributed and equally accessible throughout the targeted area (photo to bottom right). Drilling in northeast B.C. basins typically extends 1,500 to 4,000 metres below the surface, and is then continued horizontally when the target formation is reached, extending 2,500 metres or more from vertical wellbore. Unconventional wellpads can be widely spaced several kilometres apart and one pad can accommodate upward of 16 wells. As a result, less total surface area and fewer wellpads are required to access a greater subsurface volume than conventional development.

Oil and Gas Activities

Seismic Lines

Oil and gas operators use geophysical exploration to indicate the location and characteristics of subsurface formations. The surveys send mechanical energy into the ground and record reflected or refracted energy waves. This activity requires linear clearings called seismic lines to allow the use of sounding equipment.

The Commission reviews applications, issues permits when appropriate, and regulates geophysical exploration. Geophysical exploration programs can be conducted by any qualified contractor without a subsurface tenure.

Historically, seismic lines were cleared with a bulldozer (cat-cut) and the wide clearings disturbed mineral soils that were slower to regenerate. Over the past 10-15 years, low impact seismic techniques have been developed. Seismic lines are now often cleared manually or using a mulching machine and meander to avoid important ecological features such as wildlife trees. This results in significantly less surface disturbance (Figures 3 and 4) and a much faster return to a natural state.

Figures 3 and 4: Seismic Line Cleared Manually and Seismic Line Cleared with a Mulching Machine



Figure 5: Photo of Typical All Season Road



Roads

Roads are constructed and maintained by industry operators to access areas of oil and gas activities or potential activities. Special terms and conditions may be applied to any road permit.

Centralized facilities and multi-well pads reduce the number of roads needed and focus truck traffic on trunk roads, since multi-well pads can house equipment for multiple wells at one location. Existing roads such as highways and forestry roads are used where possible and in some areas snow or ice roads may be constructed during the winter. If there is significant projected activity for an area, a winter road may be upgraded, or an all-season road built (Figure 5), to allow year-round access. The Commission provides approvals for roads directly associated with oil and gas development.

Pipelines

Pipelines are constructed to transport oil and gas products from operations. Flowlines connect most producing wells to larger trunk lines to take the oil or gas to processing facilities or directly to market. The majority of pipelines in British Columbia are buried and regulated by the Commission.

Figure 6: Example of Multi Wellpad Facility



Wells

Oil and gas operators drill wells to extract oil and gas. Wells are also drilled to produce or dispose of water used in exploration and development. To drill a well, operators must hold a subsurface tenure and obtain a permit to build a wellpad. The wellpad houses the equipment required to drill and complete one or more wells (Figures 6 and 7). If the well proves successful, the wellpad will also be used for the production wellhead and the necessary equipment to produce oil or gas.

Unconventional technology has allowed for more wells on a single wellpad, creating a larger footprint in one area, but reducing the overall number of wellpads in a given area.

Facilities

Facilities are defined as systems of vessels, piping, valves and other equipment used to gather, process, measure, store and/or dispose of petroleum, gas, water and waste. Oil and gas are processed at these facilities for transport to market. Oil and gas facilities also include batteries (for storage of crude oil and other liquids), compressors, dehydrators, flare stacks and metering sites. The Commission permits and regulates the majority of oil and gas facilities in the province.

Other Oil and Gas Infrastructure

Other oil and gas activities that do not fit into the above categories include borrow pits (to obtain fill material), above-ground water lines, helipads, airstrips, power lines and campsites. The Commission regulates the majority of these activities where they are directly related to oil and gas operations.

Figure 7: Example of Multi Wellpad





Methodology and Data Limitations

The calculation of the total surface area used by oil and gas activities is primarily based on interpretation of industry submitted spatial data, satellite imagery and government mapping. The majority is Commission data with supplemental checks against other data sources. The calculations are derived from a Commission developed methodology using the data sources, assumptions and limitations detailed in Appendix II.

Anthropogenic disturbances were classified and responsibility for each disturbance was assigned to the appropriate industrial use wherever possible, which allowed a calculation of the net surface area used by

oil and gas activities. The analysis will be refined and updated as data and methodologies are improved.

Given the known data limitations, the Commission's methodology errs on the side of a larger number of surface disturbances than may actually exist. For example, Terrain Resource Information Management Program II (TRIM II) data, which is largely based on the interpretation of older aerial photographs, likely overestimates the number of seismic lines. To reduce this error, the Commission has used a preliminary sampling method to identify seismic lines versus other linear features such as roads; however, vegetation regrowth that has restored ecological function to old seismic lines has not been factored into the calculations presented.



Land Use Results

The Commission calculated the surface footprint resulting from the following disturbances:

- Wells
- Roads
- Facilities
- Pipelines
- Seismic lines (resulting from geophysical exploration)
- Other oil and gas infrastructures (such as camps)

The data is summarized in four tables. Table 1 summarizes the net area used by all oil and gas activities in northeast British Columbia, as well as by Land and Resource Plan (LRMP) area and five geological formations. These reporting units are shown on the maps in Figures 8 and 9 on pages 12 and 13.

Tables 2, 3 and 4 summarize the gross and net area by activity for each of the reporting areas within Table 1.

Oil and gas activity ranges between 1.28 and 4.08 per cent of the reporting area. This variability depends upon the overall size of the reporting area as well as the length of time that oil and gas activity has been occurring. These areas may vary in other surface area related reports due to data uncertainties, improvement activities, different assumptions and more detailed analyses.

Table 1: Summary of Results

Reporting Area	Total Area (ha)	Net Area Used for Oil and Gas Activities*	Per cent of Reporting Area
Northeast British Columbia	17,534,537	375,600	2.14
Land and Resource Plans (LRMP)			
Fort Nelson LRMP	9,868,063	148,833	1.51
Fort St John LRMP	4,676,637	160,271	3.43
Dawson Creek LRMP	2,989,837	66,496	2.22
Geological Formations			
Western Canada Sedimentary Basin	13,450,458	375,111	2.79
Horn River Basin	1,145,989	36,474	3.18
Liard Basin	934,304	11,939	1.28
Cordova Embayment	315,867	9,735	3.08
Montney Play Trend	2,985,906	121,950	4.08
* The net area occurs when the area shared by overlapping permit types is removed.			

Table 2: Surface Area Used for Oil and Gas Activities in Northeast British Columbia

Activity	Area Used for Oil and Gas Activities	Per cent of Northeast B.C.
Wells **	30,226	0.17
Roads **	83,492	0.48
Facilities **	1,543	0.01
Pipelines **	43,893	0.25
Other Oil & Gas Infrastructures **	12,672	0.07
Geophysical Exploration (seismic lines) **	227,815	1.30
Total Area Used for Oil and Gas Activities **	399,641	2.28
Net Area* Used for Oil and Gas Activities	375,600	2.14
** The total area occurs when the area shared by overlapping permit types is not removed.		

Figure 8: Land Resource Management Plan Areas

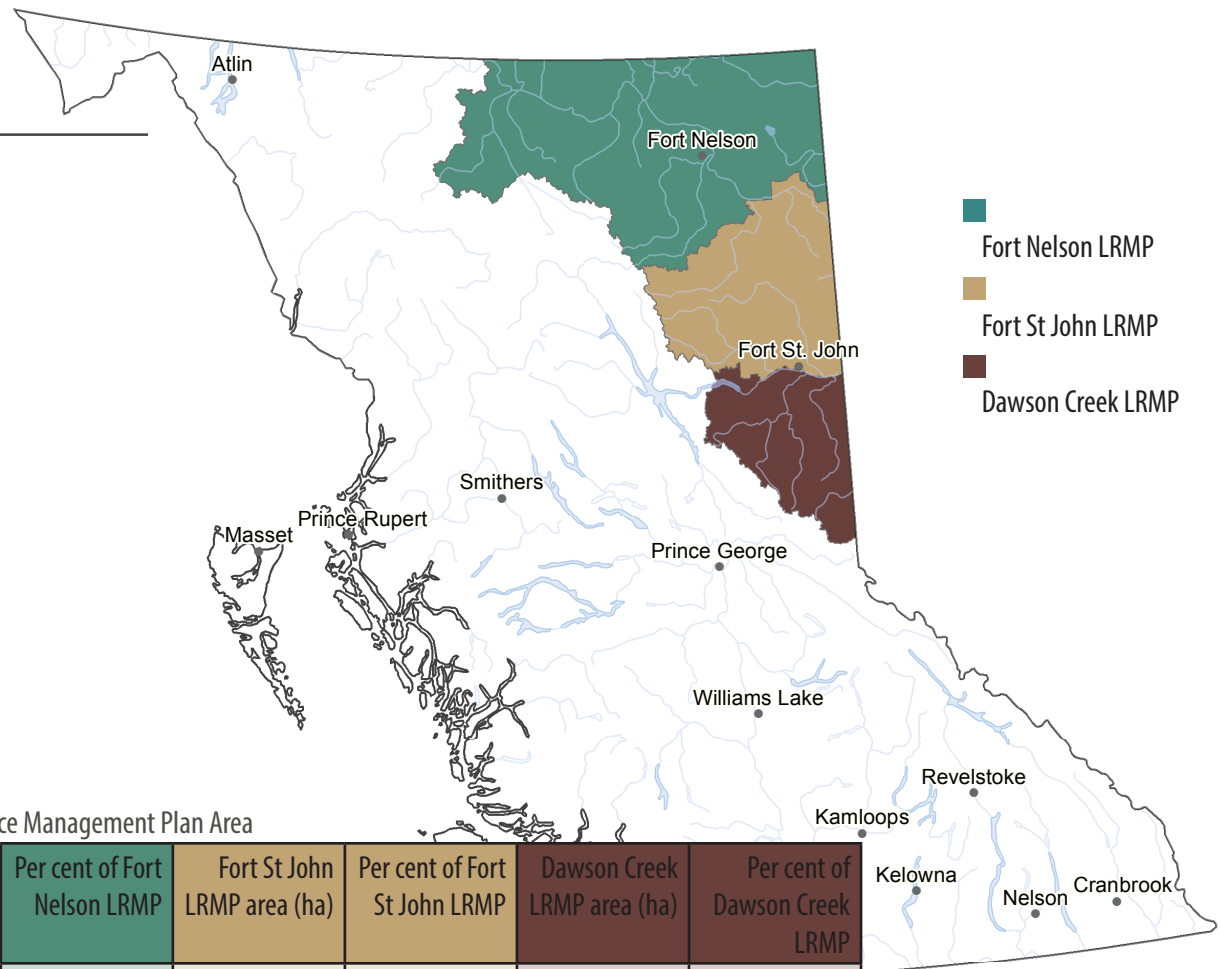


Table 3: Surface Area Used for Oil and Gas Activities by Land Resource Management Plan Area

Activity	Fort Nelson LRMP area (ha)	Per cent of Fort Nelson LRMP	Fort St John LRMP area (ha)	Per cent of Fort St John LRMP	Dawson Creek LRMP area (ha)	Per cent of Dawson Creek LRMP
Wells**	6,415	0.07	18,603	0.40	5,208	0.17
Roads**	30,836	0.31	39,855	0.85	12,802	0.43
Facilities**	514	0.01	574	0.01	455	0.02
Pipelines**	13,150	0.13	21,179	0.45	9,564	0.32
Other Oil & Gas Activities**	6,120	0.06	2,990	0.06	3,574	0.12
Geophysical Exploration (seismic lines)**	100,899	1.02	88,539	1.89	38,377	1.28
Total Area Used for Oil and Gas Activities**	157,934	1.60	171,739	3.67	69,980	2.34
LRMP area	9,868,063		4,676,637		2,989,837	
Net Area Used for Oil and Gas Activities *	148,833	1.51	160,271	3.43	66,496	2.22

* The net area occurs when the area shared by overlapping permit types is removed.
** The total area occurs when the area shared by overlapping permit types is not removed.

Figure 9: Shale Gas Basins

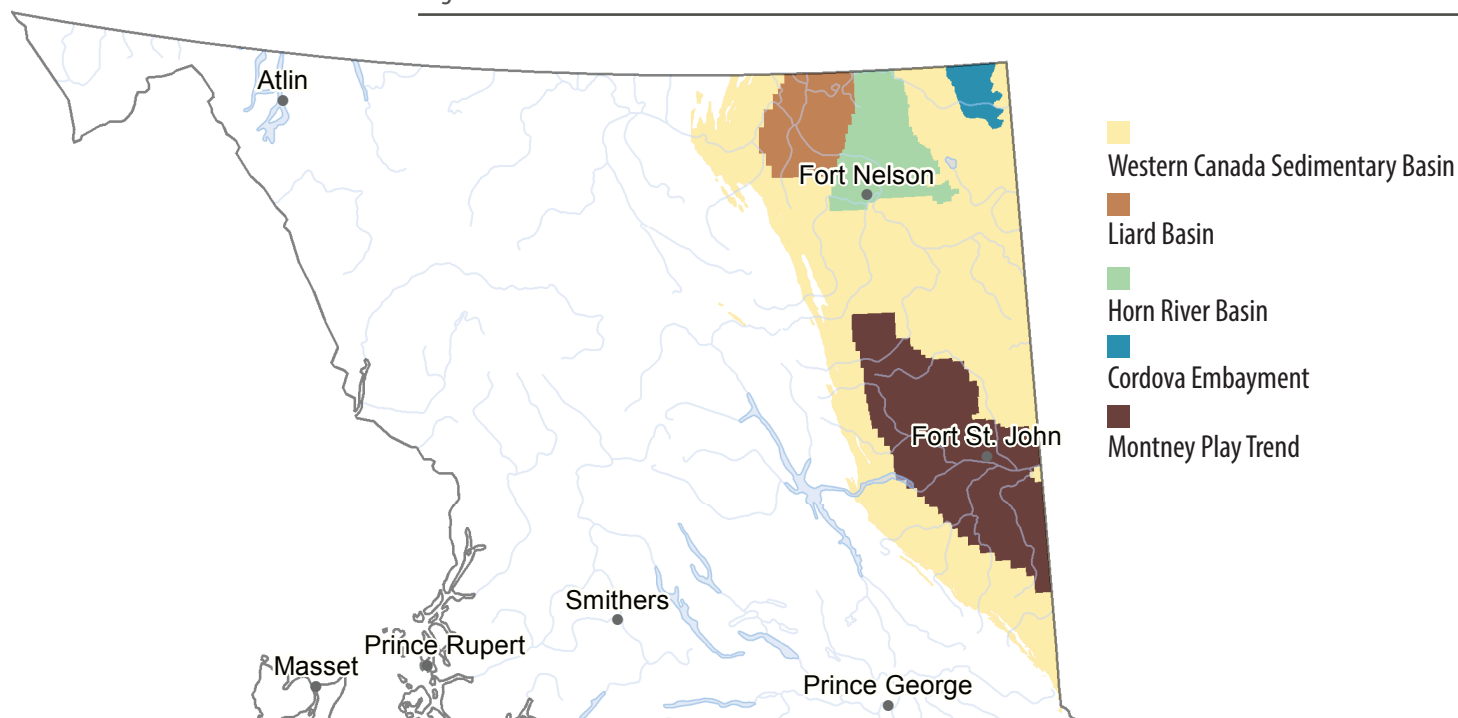


Table 4: Surface Area Used for Oil and Gas Activities by Geological Formation

Activity	Western Canada Sedimentary Basin (ha)	Per cent of Western Canada Sedimentary Basin	Liard Basin (ha)	Per cent of Liard Basin	Horn River Basin (ha)	Per cent of Horn River Basin	Cordova Embayment (ha)	Per cent of Cordova Embayment	Montney Play Trend (ha)	Per cent of Montney Play Trend
Wells **	30,207	0.22	367	0.04	1,240	0.11	499	0.16	13,628	0.46
Roads **	83,454	0.62	3,613	0.39	6,490	0.57	2,974	0.94	25,352	0.85
Facilities **	1,543	0.01	45	0.005	286	0.02	16	0.01	739	0.02
Pipelines **	43,785	0.33	1,177	0.13	2,630	0.23	1,182	0.37	16,749	0.56
Other Oil & Gas Infrastructures **	12,683	0.09	507	0.05	3,838	0.33	347	0.11	5,356	0.18
Geophysical Exploration (seismic lines)	227,497	1.69	7,208	0.78	23,941	2.09	5,634	1.78	67,381	2.26
Basin Area	13,450,458		934,304		1,145,989		315,867		2,985,906	
Total Area Used for Oil and Gas Activities **	399,169	2.97	12,989	1.39	38,425	3.35	10,651	3.37	129,205	4.33
Net Area** Used for Oil and Gas Activities	375,111	2.79	11,939	1.28	36,474	3.18	9,735	3.08	121,950	4.08

* The net area occurs when the area shared by overlapping permit types is removed.

** The total area occurs when the area shared by overlapping permit types is not removed.

Next Steps

This report presents a snapshot of existing oil and gas land use in support of analyses specific to northeast British Columbia, three LRMP areas, and five geological formations. It also provides a baseline for future comparisons.

Measuring oil and gas activity is one way the Commission is enhancing resource stewardship and increasing understanding of the interplay between surface and subsurface impact. The Commission is undertaking an area-based analysis approach to gather information and data specific to each basin to allow for better informed regulatory decisions. The approach evaluates oil and gas activity in order to improve understanding of the relationship between various oil and gas activities across a specific basin or area, and informs the implementation of initiatives that reduce surface and subsurface impact.

A key element of each area-based analysis is the baseline definition of the surface area already used for oil and gas activity. A large proportion of this area is presently taken up by seismic lines resulting from geophysical exploration. The land use will change over time as the pattern of land use changes to unconventional development and as anthropogenic impacts are reclaimed or naturally recover. Ultimately, natural succession and reclamation will restore the surface area used to a biologically functional state. As a

result, the land use report will be updated periodically to reflect landscape changes. The analysis for each basin or area will be summarized and updated regularly to reflect current land use reporting.

Next steps include:

- Periodically updating analyses to reflect future oil and gas activities and report on outcomes.
- Investigating knowledge gaps to improve data. The Commission recognizes the limitations with the data used for these calculations and the methodology errs on the side of a higher number of surface disturbances than may actually exist.
- Reviewing and improving the data assumptions that provide the framework for analysis. For example, vegetation regrowth and potential surface recovery have not been factored into any of the calculations presented. Future reporting may incorporate calculations of vegetation regrowth and other relevant parameters.
- Continually updating processes and procedures in response to public input gained through project notification and consultation, and in response to feedback from industry, First Nations and stakeholders.
- Working with government to improve outcomes and incorporate new direction as it becomes available.

More Information

Contact www.bcogc.ca

This report was published in August 2013 and is updated as required. For specific questions or enquiries regarding this report, please contact:

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Appendix 1: OGAA Specified Enactments

Authority for certain activities has been delegated to the Commission through specified enactments. These enactments set approvals or authorizations and establish compliance and enforcement oversight. Specified enactments for oil and gas activities and related provisions are listed below in Table 5.

Table 5: OGAA Specified Enactments and Provisions

"Specified Enactment"	"Specified Provision"
Environmental Management Act	(a) any of the following provisions of the Environmental Management Act: (i) Section 9 (hazardous waste storage and disposal). (ii) Section 14 (permits). (iii) Section 15 (approvals).
Forest Act	(b) Section 47.4 (licence to cut for persons occupying land or for oil and gas purposes) of the Forest Act, but only in relation to a master licence to cut, and Section 117 (road use permits for industrial use) of the Act.
Heritage Conservation Act	(c) Section 12 (permit authorizing certain actions) of the Heritage Conservation Act.
Land Act	(d) any of the following provisions of the Land Act: (i) Section 11, but only in relation to a lease or grant described in Section 11 (2) (b) to (d) (disposing of Crown land). (ii) Section 14 (temporary occupation of Crown land). (iii) Section 38 (lease of Crown land), but not to the extent that it relates to the granting of an option to purchase land. (iv) Section 39 (licence of occupation). (v) Section 40 (right of way and easement). (vi) Section 96 (1) (occupational rental).
Water Act	(e) any of the following provisions of the Water Act, but only in relation to an approval as defined in Section 1 of the Water Act: (i) Section 8 (short term use of water). (ii) Section 9 (1) (a) (changes in and about a stream). (iii) Section 26 (permits over Crown land). (f) a prescribed regulation under a specified enactment.

Appendix II. Data Sources, Assumptions and Limitations

Standards and criteria have been established for data and specific data sets have been chosen for calculating surface area used by the oil and gas industry in British Columbia. Data assumptions act as the framework for analysis results and are continually being upgraded and improved. For the purposes of this report, where the data is potentially inaccurate, the most conservative numbers have been used and regrowth is not factored into the calculations. As a result, the surface area used by the oil and gas industry may be overstated.

While calculations produced for this report are derived from a Commission-developed methodology, the available data is known to contain limitations preventing the exact reporting for certain oil and gas activities. Data collection and management technology has advanced and changed over time and the vast size of the study area has placed limitations on the precision of some data values. The Commission is working to improve the data and will use the most accurate data available for future reporting.

Data Sources

A description of spatial and non-spatial data is provided below and data sources are listed in Table 6. The data sets are combined to provide estimates of the amount of surface area currently being used for oil and gas activity.

Spatial Data

Spatial data is currently collected by the Commission mainly through the Electronic Petroleum Application Spatial Submission System (ePASS). This tool was originally developed and implemented for pipelines in October 2004, then expanded in 2006 to include all other surface applications. It requires industry to submit spatial files detailing location information (for oil and gas applications) to the Commission. Spatial data submitted through ePASS is updated daily to the Commission FTP site, as well as the B.C. Geographic Data Warehouse.

Other spatial data is collected from internal and external databases such as:

- Integrated Resource Information System (IRIS).
- Spot 5 satellite imagery.
- Terrain Resource Information Management Program (TRIM II).
- Knowledge, Enterprise, Resource, Management, Information and Technology (KERMIT).
- Historical information prior to the implementation of ePASS is collected for the Commission through the process of digitizing, or is provided by other agencies.

Non Spatial Data

Non-spatial data used in the calculations is extracted from KERMIT and IRIS. KERMIT is a database application where industry makes electronic submissions for pipelines and facilities. Data extracted from KERMIT includes information such as the status and total surface area of applications.

IRIS is an internal database storing information on all other oil and gas applications including wells, geophysical exploration and roads. Data extracted from IRIS also include the status and total surface area of applications.

Data Limitations

The majority of data used in the analysis is provided to the Commission by industry and therefore the accuracy of the data is dependent on the quality of data submitted. Though quality assurance techniques are in place when submissions reach the Commission, historically there have been limitations on data administration accuracy due to technology, systems and processing procedures. The issues surrounding data limitations are a priority and the Commission is committed to continuing to develop a plan to fill knowledge gaps and improve data management systems.

Other Spatial Data

Historical oil and gas spatial application data used in the analysis has been collected through in-house digitizing and from external GIS sources. For example:

- Historical petroleum development roads spatial file used in the analysis was created by the Ministry of Energy and Mines (MEM) using historical datasets.
- Historical geophysical exploration data compiled by MEM from disks provided to the Commission with the final plan locations.
- Crown Tenures data was used for estimates of historical application of surface areas.
- The Commission currently holds no historical spatial data for some oil and gas features including facility sites, pipelines, access roads and miscellaneous applications (gravel pits, campsites, pullouts, etc). In order to create a more accurate calculation, the Crown Tenures data is used to estimate locations of these features.
- Pre-1996 Geophysical Exploration Data – Prior to 1996, GIS-capable spatial technology was not in place to capture or collect data specifically for geophysical exploration. TRIM II data is available for historic land use in British Columbia; however, it does not exclusively distinguish between geophysical exploration activities (for instance, seismic lines) and

other cutline-linear features, such as roads, trails, and pipeline rights-of-way. Therefore, use of the entire TRIM II data file is expected to overestimate the amount of geophysical exploration activity. The Commission used the methodology described in the Geophysical section of the Data Assumptions table to address this issue. A more detailed explanation of the pre-1996 geophysical sampling methodology can be obtained from the Commission.

Data Assumptions

In all cases the Commission has erred on the high side with its assumptions in order to calculate oil and gas activity. All historical activity has been captured with no attempt to remove activities from the calculation where surface disturbances may have recovered.

Data assumptions are further detailed in Table 7.

Table 6: Data Sources for Land Use Calculations

Oil and Gas Activity Type		Source	File Name	Geometry	Timeline	Update Cycle	Notes
Roads	Access Roads	Commission	aaoa_BC	polygon	>2006	Nightly	Current ePASS data
	Development Roads	Commission	aaoa_BC	polygon	>2006	Nightly	Current ePASS data
	Access and Development Roads	GDM	ard_gdm	line	all	Quarterly	Data use agreement with GDM to use
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical Access and Development Roads
Pipelines	Pipelines	Commission	aprow_BC	polygon	>2004	Nightly	Current ePASS data, actual clearing application size
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical pipelines
Wells	Wellsites	Commission	awsit_bc	polygon	>2006	Nightly	Current ePASS data, actual clearing application size
	Well location	Commission	awell_bc	point	all	Nightly	Coordinates from IRIS, Average 1.44ha applied
Facilities	Facility Sites	Commission	afsit_bc	polygon	>2006	Nightly	Current ePASS data
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical facility and site locations
Other Oil and Gas Permits	Ancillary and Other Applications	Commission	aaoa_BC	polygon	>2006	Nightly	Current ePASS data
	Crown Licences	ILMB	WHSE_TANTALIS.TA_CROWN_LICENSES_SVW	polygon	all	Daily	Used for historical facility and site locations
Geophysical	Geophysical	Commission	ageo_bc	line	>2006	Nightly	Current ePASS data
	Historical Geophysical	Commission	agphys1996_2004	line	1996-2004	NA	Historical data collected from multiple sources
	Historical Geophysical	Commission	agphys2002_2006	line	2002-2006	NA	Historical data collected from multiple sources
	Historical Geophysical	GeoBC	TRIM II – ShapeID: tcull, TRIM Class: Corridor Landmark, and Description: Cut Line/Seismic Line	line	<1996	NA	Historical data from aerial photography to TRIM II standards

Table 7: Data Assumptions

Oil and Gas Activity	Data Assumptions
Roads	<p>The Commission began to collect data on Access and Development roads in October 2006 and actual widths are used for these calculations. The Ancillary and Other Applications (AAOA) file is tested to pull out road data and roads associated with specific wells are tested for the status of the associated well (note, same criteria as Wells script, below).</p> <p>To capture roads constructed prior to October 2006, the Commission utilizes a private sector database from Geomatics Data Management Inc. (GDM). This data is tested to pull out all oil and gas roads, and these roads are assigned an average width of 20 metres for calculation purposes.</p> <p>The 20-metre average is based on average road widths from submitted data and has been verified by a sample test of the roads within the LRMP. The results of the sample showed road widths varying between 12.75 and 19.45 metres. All road data is then combined, compared and overlapping areas are removed.</p>
Pipelines	<p>Pipeline Right-of-Way (RoW) data has been collected since 2004 and includes actual RoW widths. The pipeline RoW script queries all pipelines that have a “construction start” date. Pipelines that do not have a construction start are tested to determine if they have a “leave to open” (LTO) date. The LTO date informs the query that the pipeline has been constructed to prescribed standards.</p> <p>For pipelines constructed prior to 2004, the Crown Tenures file is used to query “Oil and Gas Pipeline” then queried further for the tenure type “Right of Way”. This data provides the actual widths of the historical pipelines. All pipeline data is then combined, compared and overlapping areas are removed.</p>
Wells	<p>Wells data has been collected by the Commission since 2006 and provides the actual wellpad size. The data is queried to filter out wells that are cancelled or do not yet have a well authorization date. The wells that are queried out are then tested to add back in any cancelled well that has surface disturbance.</p> <p>Wells constructed prior to 2006 are queried through IRIS and are assigned an average size of 1.44 ha. This number is based on a typical wellpad size under permit regulations of the day. This average was tested based on sampling within the Liard Basin. Results show an average wellpad size of 1.37 ha; providing verification that 1.44 ha is a reasonable assumed average.</p> <p>All well data is then combined, compared and overlapping well areas are removed.</p>

Oil and Gas Activity	Data Assumptions
Facilities	<p>The Commission began collecting data on facilities in 2006. This data is tested to identify those facilities that have a 'leave to open' (LTO) date. The LTO date informs the query that the facility has been constructed to prescribed standards.</p> <p>To capture information on facilities that were built prior to 2006, the Commission queries the Crown Tenures file for Oil and Gas features that are NOT Pipelines or Well sites and ARE classified as facilities (for example, a compressor site as opposed to a decking site).</p> <p>All facility data is then combined, compared and overlapping areas are removed.</p>
Other Oil and Gas Permits	<p>This is a catchall category which includes all oil and gas activities that do not fit into the following categories: wells, pipelines, roads, geophysical programs or facilities. The Commission has been collecting this data since 2006.</p> <p>From the Ancillary and Other Applications (AAOA) file all data is tested to remove 'ROAD' data because it is captured in other queries.</p> <ul style="list-style-type: none"> • AAOA features that are associated with pipelines are queried for construction start and or leave to open (LTO) date (the same criteria as the pipelines script). • AAOA features that are associated with specific wells are tested for the status of the associated well (the same criteria as the wells script). • AAOA features that are not associated with wells or pipelines are tested to determine if they are related to KERMIT oil and gas activities or 'Other'. Once tested all KERMIT files are tested for LTO status; the 'Other' are tested to determine if they are approved. <p>To capture information on other Oil and Gas Permits that were built prior to 2006, the Commission queries the Crown Tenures file for Oil and Gas features that are NOT already captured.</p> <p>Features associated with energy production data that are not wellsites or facilities are included here (i.e., campsite, inlet site, landfarm etc.). Quarrying and Industrial permits that are issued by the Commission are also included in this query.</p> <p>All other oil and gas permit data is then combined, compared and overlapping areas are removed.</p>

Oil and Gas Activity	Data Assumptions
Geophysical	<p>Data has been collected and managed by the Commission on geophysical activities since 1996. This data is tested as follows:</p> <ul style="list-style-type: none"> • 2006 to current uses the actual width associated with each line because it is available in the data. • Pre-2006 data does not include seismic line width information and therefore the following assumptions have been made: <ol style="list-style-type: none"> 1. Two Dimensional programs – cat cut is assumed at seven metres wide. 2. Three Dimensional programs – source Lines are assumed at seven metres and Receiver Lines are assumed at two metres. <p>The seven and two metre width assumptions are based on submitted geophysical exploration data and sample testing.</p> <p>Prior to 1996 spatial technology did not exist to capture or collect data specifically for geophysical exploration in British Columbia. In response to this issue, the Commission developed a preliminary sampling method to assess the potential magnitude of TRIM II data needed to represent the area used by the pre-1996 geophysical activity. The method involves combining TRIM II data with other newer data sets to display all linear features. These features are put into a mapping program with the latest spot satellite imagery, zoomed in upon, and sample areas are tested and interpreted to assess how much of the data is interpreted as seismic and how much may be other linear features. The width of the interpreted lines was also tested. The sampling did not assess the level of potential vegetation regrowth for the pre-1996 geophysical exploration activity.</p> <p>A five per cent sample of the 89,976 km TRIM II sourced miscellaneous cut lines (excluding lines that overlapped with other linear features such as roads, pipes, etc.) was completed with the following results:</p> <ul style="list-style-type: none"> • Ninety-seven per cent of the samples were classified as visible and geophysical based. • 1.7 per cent were classified as visible and partly geophysical. • One per cent was classified as not visible/not geophysical. <p>This report uses the above results to calculate the pre-1996 geophysical exploration area used. The resulting number is added to the Commission's post-1996 data to arrive at a total for surface area used for geophysical exploration.</p> <p>A more detailed explanation of the pre-1996 geophysical exploration sampling methodology can be obtained from the Commission.</p>

