

►► Agriculture and Irrigation

LIVESTOCK

Over the years, Alberta's irrigation systems have also helped create Canada's largest beef cattle industry and have fed the rapid growth of Alberta's pork, poultry, specialty meat, and dairy industries.¹⁴

The main livestock types are cattle (beef and dairy), hogs, poultry (eggs and meat), sheep (wool and meat), and horses (recreation, sport, meat, and pregnant mare urine). Recently, farmers have shown a growing interest in specialty livestock. A small number of farms raise animals such as alpacas, angora goats, llamas, bison, elk, wild boars, and even emus and ostriches. Specialty livestock are raised for breeding stock, recreation, meat and other products.¹⁵

Figure 37 shows the numbers of cattle, swine, horses and chickens in the SAL region, and the increases in numbers from 1926 to 2001. Currently, there are approximately 4.5 million head of cattle in the region, which represents approximately 68% of the cattle raised in the province.

Of the top 30 regions in Canada having the largest number of animal units (on May 15, 2001), more than half (17) were in Alberta. They accounted for 18.7% of all Canadian livestock. Lethbridge topped the list with 427,000 animal units or 3.1% of all livestock. In 2001, Lethbridge, which also topped the previous list of the highest number of animal units, was in the fifth position in terms of density, with 143 animal units per square km.¹⁶

Current range management strives for moderate grazing pressure. Grazing systems that maintain the health of the prairie and avoid degradation of areas where livestock may concentrate, such as riparian habitats, can also promote biodiversity while maintaining high productivity.¹⁷ Unimproved grasslands and pastures represent the original ecosystem in the drier regions. Improved pasture is the area of grassland that has been reseeded, fertilized or has had some degree of weed control.¹⁸

Livestock in the SAL Area

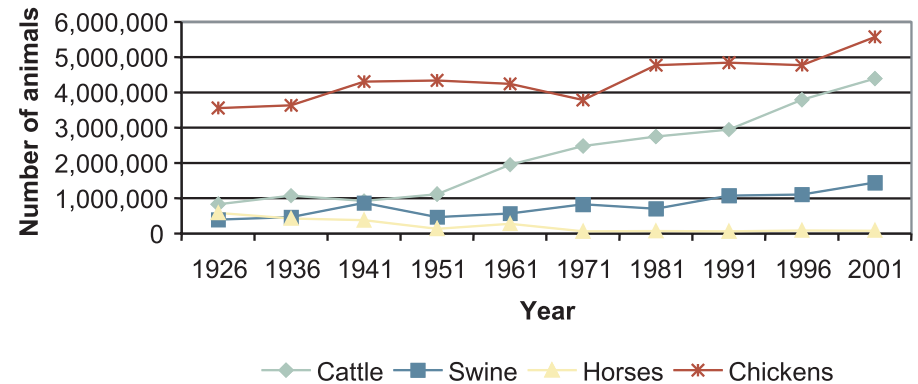


Figure 37. Livestock in the SAL Region



¹⁴ Source: State of Alberta's Water Resources, 2004

¹⁵ Source: Alberta's State of the Environment Report: Terrestrial Ecosystems

¹⁶ Source: A Geographic Profile of Canadian Livestock: 1991 – 2001, Statistics Canada

¹⁷ Source: Prairie Conservation Forum: Prairie Ecosystem Management: An Alberta Perspective

¹⁸ Source: Use Of Remote Sensing For Ecological Monitoring In Canada, Environment Canada <http://www.eman-rese.ca/eman/reports/publications/remote-sens/part6.html>

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Figure 41 shows there remain large areas of “unimproved pasture,” although those areas have decreased and improved pasture area has increased. Figure 42 shows the increase in density of cattle grazing on unimproved land and the decrease in density of cattle grazing on improved land.

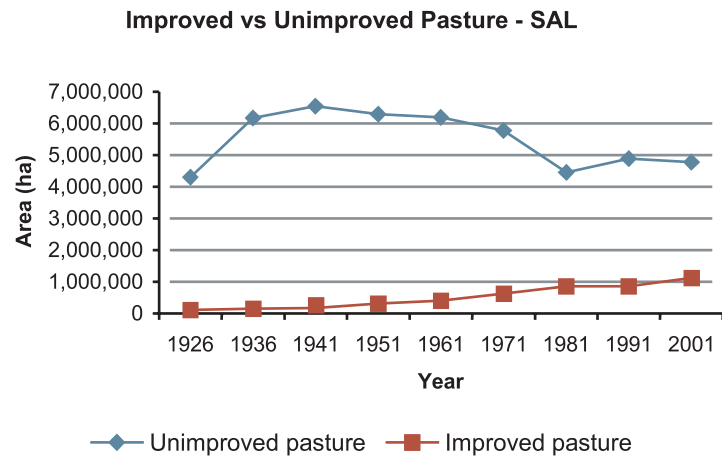


Figure 38. Improved & Unimproved Pasture

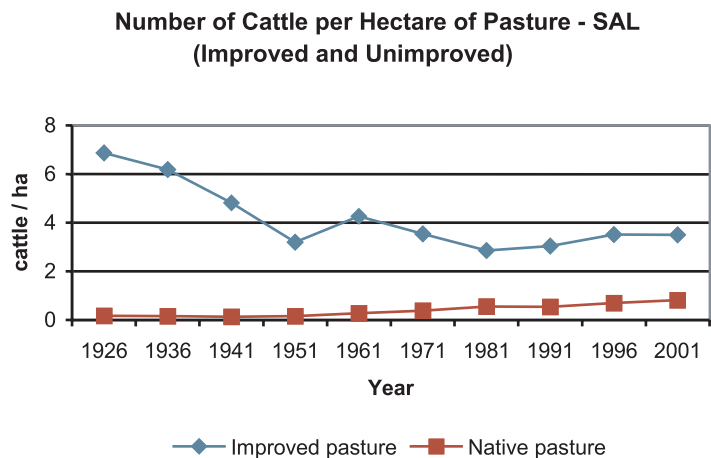


Figure 39. Cattle per Hectare of Pasture

CONFINED FEEDING OPERATIONS

Figure 40 shows the location of Confined Feeding Operations in the SAL region.

The Agricultural Operation Practices Act defines a confined feeding operation as fenced or enclosed land or buildings where livestock are confined for the purpose of growing, sustaining, finishing or breeding by means other than grazing, and any other building or structure directly related to that purpose, but does not include residences, livestock seasonal feeding and bedding sites, equestrian stables, auction markets, race tracks, or exhibition grounds."¹⁹

Alberta’s Agricultural Operation Practices Act (AOPA) regulations, which came into effect on January 1, 2002, launched improved standards for environmental management in Alberta’s livestock industry. The siting requirements of AOPA are intended to ensure that confined feeding operations (CFOs) are environmentally sustainable and are located to reduce potential impacts on neighbours.

The Natural Resources Conservation Board (NRCB) is assigned the responsibility of administering CFO applications and the approval process, and with monitoring compliance with province-wide standards.



¹⁹ Natural Resources Conservation Board, <http://www.nrcb.gov.ab.ca/cfomain/default.aspx>

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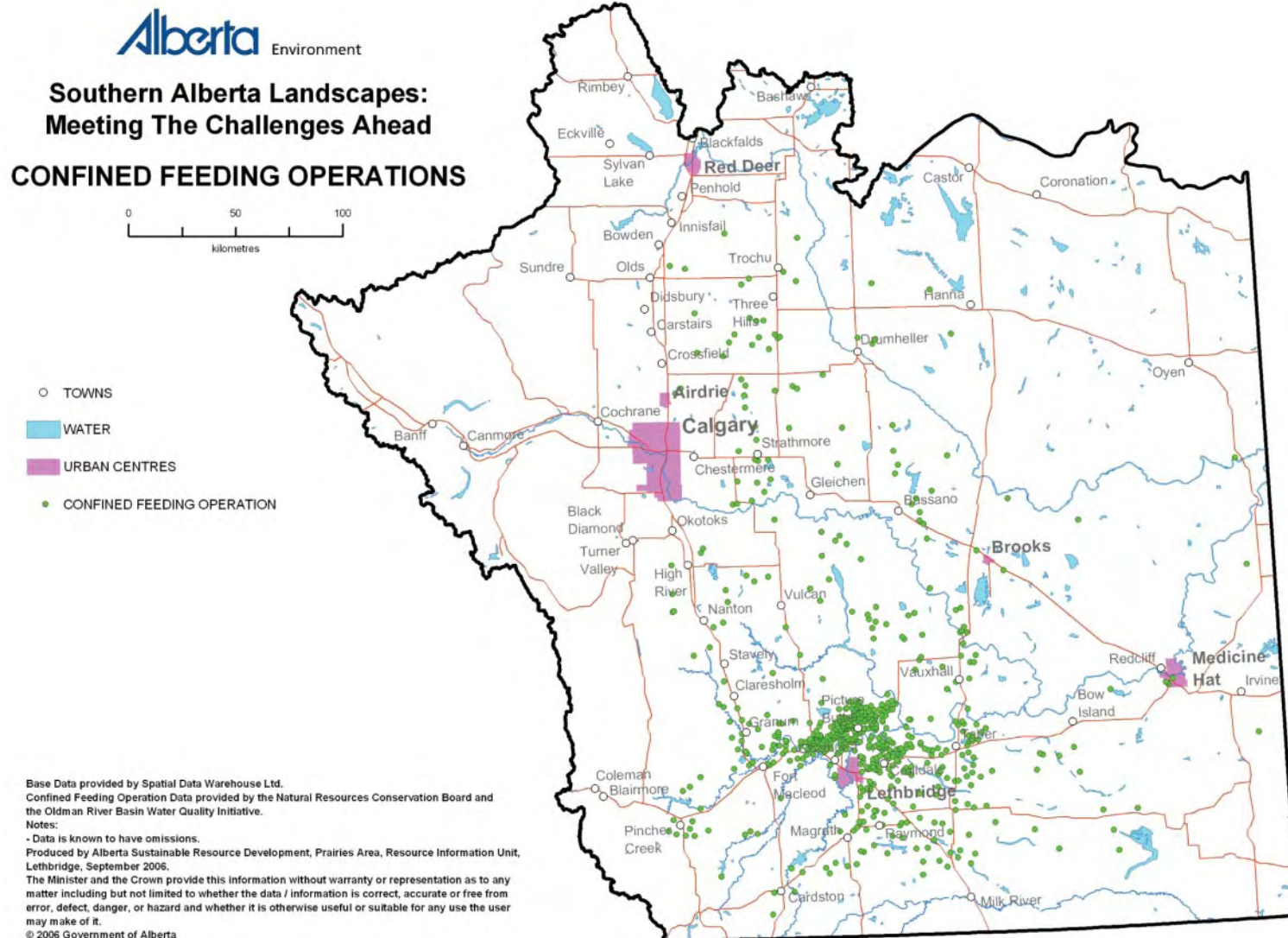


Figure 40. Location of Confined Feeding Operations in the SAL Region

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AGRI-FOOD PROCESSING

In southern Alberta, there are more than 130 agri-food processing companies, accounting for about 50% of Alberta's total food processing sales. The region's food processing industry is also quite diverse. It includes meatpacking, dairy (milk, cheese and other dairy products), feed, cereal grain and flour (mills and wholesale bakeries), canola processing, potatoes (chips, frozen products and fresh market), frozen fruits and vegetables, dry beans, specialty products (such as sunflower snacks and bird seed), and sugar. Federally

inspected cattle slaughter plants include Lakeside Packers Ltd. of Brooks, Cargill Ltd. of High River, XL Foods Inc. of Calgary, and Bouvry Export Ltd. of Fort Macleod.²⁰

Pork slaughter and processing plants operating in the SAL region include Fletcher's Fine Foods Ltd., of Red Deer, Maple Leaf Meats Inc. of Lethbridge, and Trochu Meat Processors Ltd. of Trochu.²¹



²⁰ For information on the Palliser region of SAL and some of the agri-food industries in the area, consult <http://www.palliseralberta.com/Business/agrifood.htm>

²¹ Source: Agriculture Canada <http://www.agr.gc.ca/mad-dam/e/bulletine/v13e/v13n19e.htm>

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Alberta possesses massive energy reserves in the form of oil, natural gas and coal. In 2005, the province produced 10,794 petajoules of energy from all sources, including renewable energy sources such as hydro and wind power. This would be enough energy to supply almost 40 million people for all uses (from housing and transportation to local services and industry).¹

About 70% of the energy produced in Canada from hydrocarbon reserves comes from Alberta. Approximately 83% of the country's natural gas reserves, 68% of conventional oil reserves, 100% of bitumen (oil sand) reserves, and 60% of coal reserves are found in the province.²

In addition, Alberta has a variety of non-energy resources such as metallic minerals, industrial minerals, and sand and gravel deposits. With the exception of oil sands, all these resources can be found in the SAL area.



HISTORY OF ENERGY AND MINING

Important Dates for Non-energy Mineral Development

1670 to 1869: Mineral rights were owned by the Hudson's Bay Company.

1880: Clays from the Medicine Hat area were first used for bricks.

1910 to 1930: The local building stone industry reached its peak.

1930: Mineral rights were transferred to the provinces and the Department of Lands and Mines was established.

1949: The Mines and Minerals Act was passed.

1970: Calgary began an economic boom, resulting in the first gravel rush.

1970: Ammonite shells were found in Alberta.

1982: Alberta became the cement production centre of Western Canada.

1990: Calgary began another economic boom, resulting in a second gravel rush.

Important Dates for Hydrocarbon Development

1882: Lethbridge coalmines were opened.

1887: Banff and Canmore coalmines were opened.

1901: Crowsnest Pass coalmines were opened.

1901: Alberta's first producing oil well came on line in Waterton.

1909: The first major gas field was discovered at Bow Island.

1914: A major oil and gas field was discovered in Turner Valley.

1938: The Petroleum and Natural Gas Board was established.

1950: Early petrochemical operations began to be developed.

1970: Petrochemical facilities were built in Medicine Hat and Joffre.

2004: Oil and gas drilling activity reached record highs.

Important Dates for Renewable Energy Development

1911 to 1972: 13 Hydroelectric Power Plants were built in Alberta.

1996: the Castle River Wind Farm was built near Pincher Creek.

2003: the McBride Lake Wind Farm was built near Fort Macleod.

2004: the Summer View Wind Farm was built near Pincher Creek.

¹ Natural Resources Canada, Energy Efficiency Trends in Canada 1990-2003, http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/data_e/trends05/chapter2.cfm?attr=0

² (Sources: Crude Oil Production data (2003), National Energy Board; Conventional Oil Reserve data (for year-end 2001), NEB; Marketable Natural Gas data (2003), Alberta Department of Energy; Natural Gas Reserve data (2005), DoE; Liquefied Petroleum Gases data (2004), DoE)

³ The City of Red Deer, <http://www.city.red-deer.ab.ca/>

⁴ Alberta Energy Annual Report 2004-2005, p. 26, <http://www.energy.gov.ab.ca/docs/aboutus/pdf/AR2005.pdf>

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HYDROCARBON DEVELOPMENT IN ALBERTA

ALBERTA'S OIL RESERVES AND PRODUCTION

Crude Bitumen (Oil Sands)

The total established reserves of crude bitumen in Alberta are 27.6 billion m³ (approximately 174 billion barrels). Only 2.8% of the initial established crude bitumen reserves have been extracted since commercial production started in 1967.

In 2005 alone, a total of 61.7 million m³ was produced in the province, the equivalent of 169,000 m³/day (more than 1.06 million barrels per day).

Crude Oil

The Energy and Utilities Board estimates the remaining established reserves of conventional crude oil in Alberta to be 255 million m³ at December 31, 2005, a 2% increase from December 31, 2004. The province's remaining conventional oil reserves have declined by half since 1990.

	Remaining	Initial
Established Reserves (million m ³)	255	2,704
2004/2005 Reserves Change (million m ³)	5.6	38.8
Ultimate Potential (million m ³)	426	3,130

Based on its 1988 study, the EUB estimates the ultimate potential recoverable reserves of crude oil at 3130 million m³ (almost 19.7 billion barrels).⁵

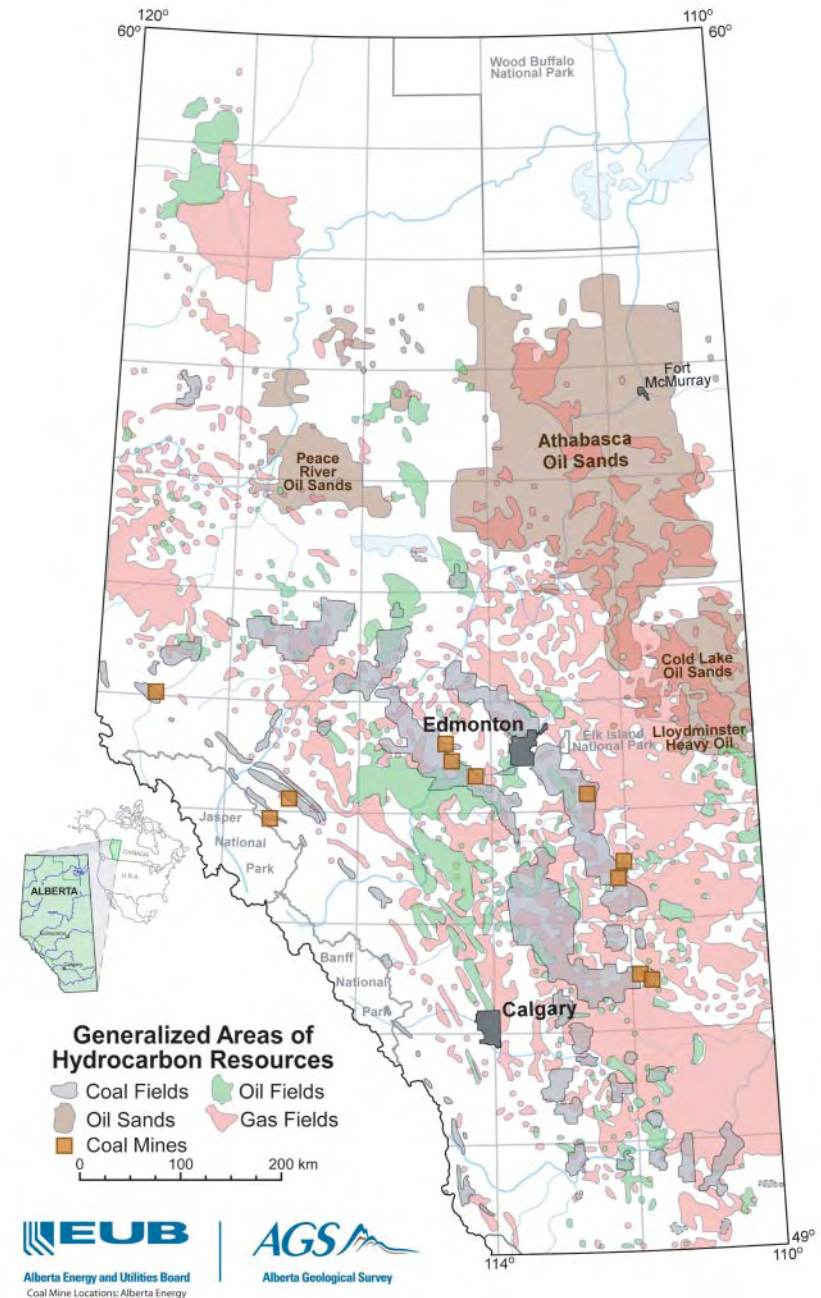


Figure 41. Generalized Areas of Hydrocarbon Resources⁶

⁵ EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook/Overview

⁶ <http://www.energy.gov.ab.ca/51.asp>

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ALBERTA'S NATURAL GAS RESERVES AND PRODUCTION

Natural gas is currently produced from two main sources in Alberta. Conventional sources account for the majority of natural gas production, but production from coal, or coalbed methane (CBM), has grown rapidly in the past two years. Natural gas production from sources such as shale gas may prove to be an additional reserve of energy for the near future.

Coalbed Methane

CBM has been recognized as a commercial supply of natural gas in Alberta for only a few years. "Activity in CBM has increased dramatically from a few test wells in 2001, to more than 5000 wells having some production by 2005.

At the end of 2005, established reserves of CBM in Alberta were estimated to be 20.9 billion m³.

Conventional Natural Gas

At the end of 2005, Alberta's established reserves of natural gas stood at 1120 billion m³.⁷ In 2005, Alberta produced 137 billion m³ of marketable natural gas, of which 8 billion m³ was from CBM.

Some 146 billion m³ of marketable gas were added to Alberta's recoverable reserves in 2004. These additions are a result of discovering new reserves and reassessing reserves already discovered. Total additions in 2004 outstripped production, contributing to a 0.4 per cent increase in the remaining established reserves of marketable gas, to 1127 billion m³ as of year-end 2004.⁷

Total reserves additions of conventional natural gas have failed to keep pace with production, which has increased significantly since 1992. Alberta's remaining established reserves of marketable gas have decreased by about 40 % since 1982.⁸ Several major factors have an impact on natural gas production, including natural gas prices, drilling activity, the accessibility of Alberta's remaining reserves, and the performance characteristics of individual wells.⁹

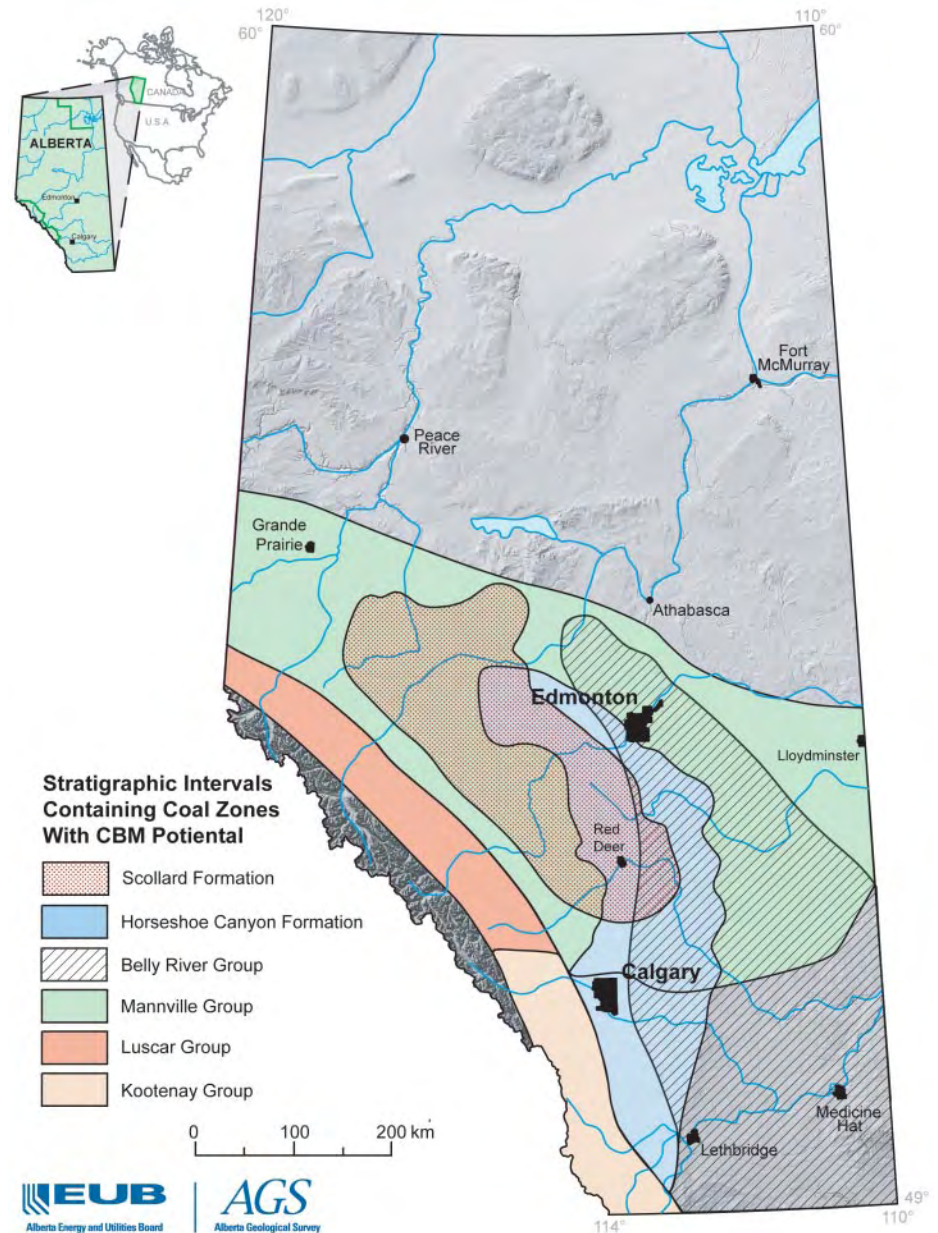


Figure 42. Stratigraphic Intervals Containing Coal Zones with CBM Potential

⁷ EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

⁸ EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

⁹ EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015 http://www.eub.ca/docs/products/STs/st98_current.pdf

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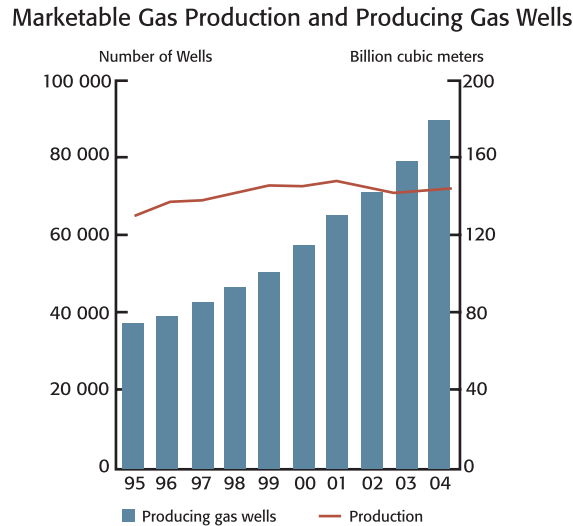


Figure 43. Marketable Gas Production and Producing Gas Wells

Though gas production stabilized after reaching its peak in 2001, the number of producing gas wells has increased significantly year after year. Much of Alberta's gas development has centered on shallow gas wells in southeast Alberta, where more than half of the province's producing gas wells are located. In 2004, a record number of gas wells were drilled and marketable gas production grew by 1.2%. The EUB anticipates that shallow drilling will continue to account for a large share of the activity in the province over the next few years. Over time, however, the focus of exploration will likely shift to the western portion of the province and more productive wells.¹⁰

ALBERTA'S ETHANE, OTHER NATURAL GAS LIQUIDS (NGLs), AND SULPHUR

Ethane

Ethane is a colourless, odourless gas mainly used in Alberta as a petrochemical feedstock. It is also known as dimethyl. Remaining established reserves of extractable ethane are estimated at 121 million m³ as of year-end 2005.

In 2005, the production of specification ethane remained similar to the 2004 level of 40,100 thousand m³/day.

OTHER NATURAL GAS LIQUIDS

The remaining established reserves of other NGLs - propane, butanes, and pentanes - decreased from 169 million m³ in 2005 from 172 million m³ in 2004.

Sulphur

Remaining established reserves of sulphur are 85 million tonnes from natural gas and the upgrading of bitumen from mining areas under active development. Sulphur demand is not expected to increase significantly.

ALBERTA'S COAL RESERVES AND PRODUCTION

Coal

The current estimate for remaining established reserves of all types of coals in Alberta is estimated at about 34 billion tonnes. Alberta's total coal production in 2005 was 30 million tonnes of marketable coal, most of which was sub-bituminous coal. Alberta's coal reserves represent over a thousand years of supply at current production and demand levels. However, sub-bituminous coal production is expected to increase during the next 10 years, to meet demand for additional electrical generating capacity.¹¹

¹⁰ EUB Statistical Series (ST) 2004-98: Alberta's Reserves 2003 and Supply/Demand Outlook 2004-2013

¹¹ EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook/Overview

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NON-ENERGY MINERAL DEVELOPMENT IN ALBERTA

Non-energy minerals are legally defined in Alberta as minerals other than petroleum, natural gas, coal, or oil sands.

Metallic Minerals and Precious and Semi-precious Stones

Metallic minerals currently produced in Alberta include gold and iron. Ammonite shell is quarried in the SAL Region. There are no underground mines active in Alberta at present.

Exploration work continues for gold, platinum group metals, uranium, zinc, lead, and diamonds.

A proposal for a magnetite (iron) operation near the Crownest Pass is under consideration. This operation would supply magnetite to coal operations in southeast British Columbia.

Industrial Minerals Location and Production

Industrial minerals encompass a wide range of substances used in agriculture, the natural resource sector, manufacturing and chemical processes. They are used to make products such as cement, cosmetics and pharmaceuticals, building supplies such as paint and plasterboard, fertilizer, and baking ingredients such as baking soda. Industrial minerals include building stones such as lime-



Figure 44. Distribution of Coal by Rank



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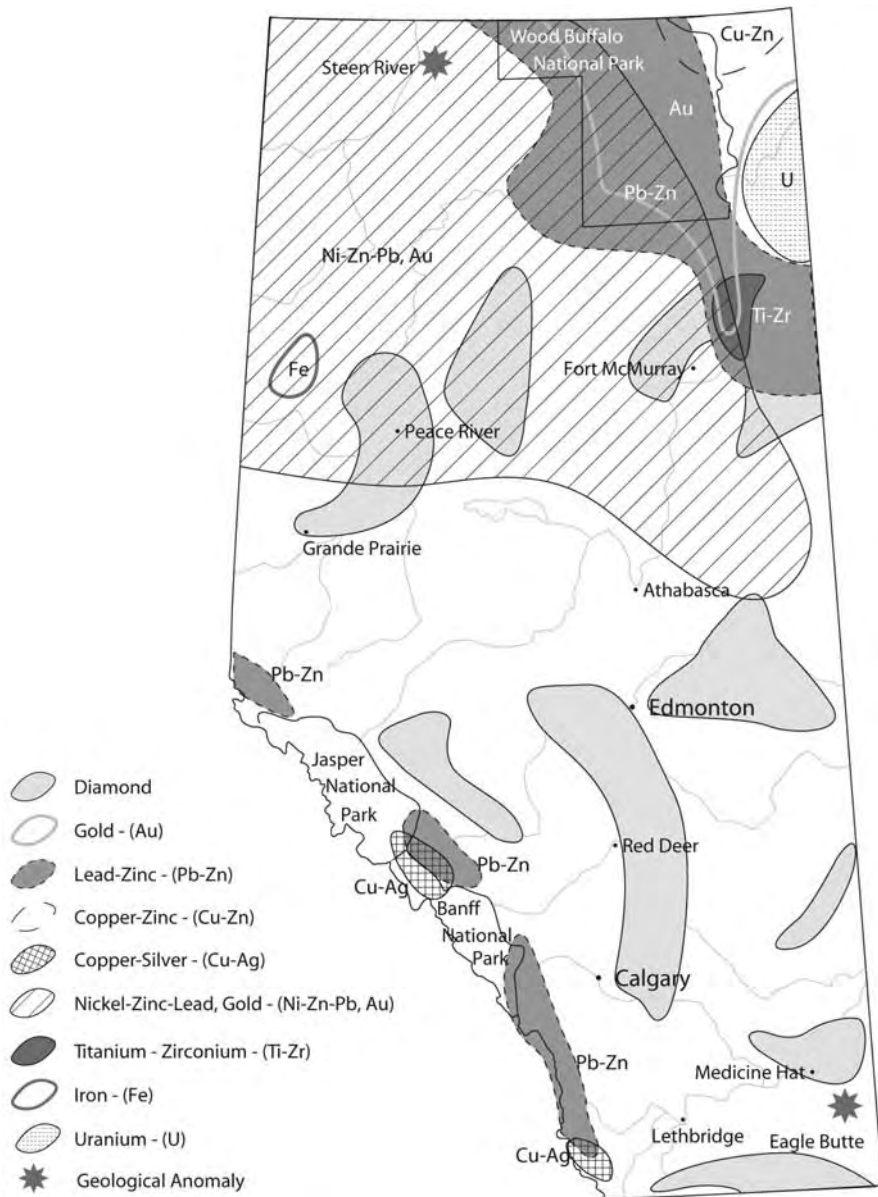


Figure 45. Location of Non-Energy Metallic Minerals

stone, sandstone and granite, and minerals such as gypsum, salt and sulphur. Alberta's limestone plants produce more than 2 million tonnes of cement each year. Small quantities of limestone rock are also quarried for use as building stone and in landscaping.

Gypsum is used worldwide in concrete for highways, bridges, buildings, and many other structures. It is also used extensively as a soil conditioner on large tracts of land in suburban areas, as well as in agricultural regions.

Salt, a residue of ancient seas covering parts of Alberta, is produced in significant quantities.¹²

Sulphur is a common by-product of oil sands and natural gas production in Alberta. This bright yellow powder is used in making fertilizers and other industrial products.

In 2005, Alberta's non-energy mineral production included sand and gravel, cement, elemental sulphur, salt, silica, and stone.



¹² Alberta Energy, Fact Sheet http://www.energy.gov.ab.ca/docs/minerals/pdfs/FactSheet_MineralFacts.pdf

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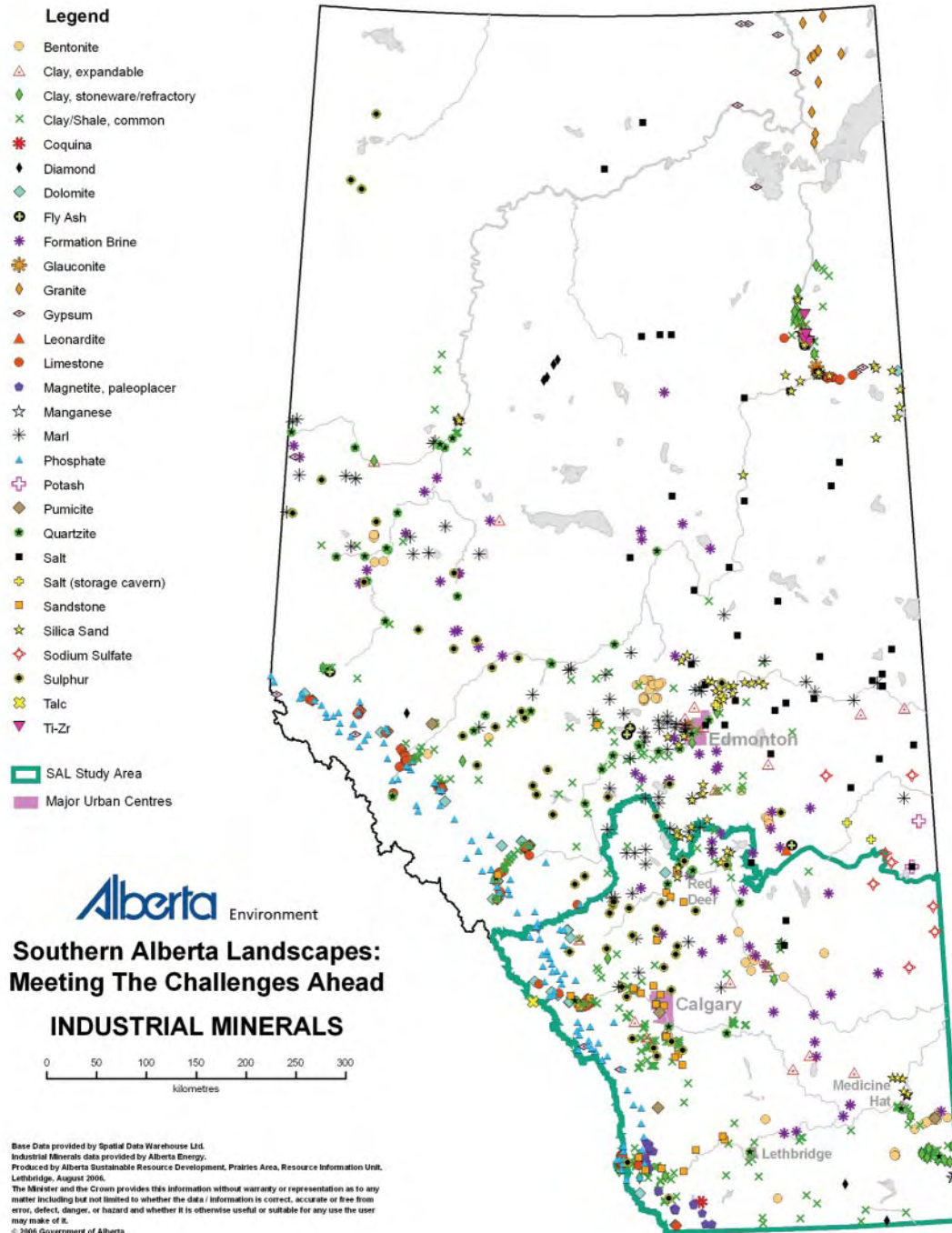


Figure 46. Non-Energy Industrial Minerals

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Sand, Gravel and Other Aggregate Location and Production

The last glaciers deposited much of Alberta's sand and gravel. Natural sand and gravel aggregates and quarried rock are mainly used in cement making and construction aggregate for roads, buildings and other large structures. Gravels such as "Alberta rainbow rock" are also used for decorative purposes in landscaping.

Clay and shale are used to make bricks and other ceramic products. The swelling types of bentonite clay (sodium bentonite) are used for drilling mud in the oil and gas sector in Alberta.¹³



Demand for these products will increase with growth in population and land development, while supplies will be under pressure as existing reserves are depleted or become unavailable due to development of resource-bearing lands for other uses.

Alberta is the cement-manufacturing hub for the prairie provinces. There are two major plants, one near Exshaw in the SAL Region, and the other in Edmonton.

ENERGY AND MINERAL DEVELOPMENT IN THE SAL AREA

ENERGY DEVELOPMENT IN THE SAL AREA

In 2001, energy in the SAL area contributed just over \$10 billion to the province's Gross Domestic Product (approximately 8% of Alberta's total GDP for 2001). Alberta is looking to maximize the recovery of remaining petroleum and natural gas reserves through improved recovery techniques and expanding into 'frontier' areas, such as the eastern slopes of the Rockies, and through the expansion of unconventional reserves.

As of February 2007, wind farms in southern Alberta had a wind generation capacity of 384 megawatts (MW) (provincial electricity generating capacity is 11,500 MW¹⁴)¹⁵. Canada's installed wind energy capacity grew by 113% in 2006, so these figures change constantly.

Energy development occurs throughout the SAL study area, with the exception of the mountain parks. Current development in the study area includes:

- About 51,000 producing oil and gas wells,
- 184 sweet gas plants,
- 124 sour gas plants,
- About 116,860 km of pipelines,
- 1 active coal mine and one proposed,
- 1 coal-fired power plant (Sheerness) and one proposed,
- 1 gas-fired electrical generation utility,
- 4 gas fired non-utilities,
- 12 major petrochemical & chemical facilities,
- About 3,000 CBM wells,
- 21 wind-generated power projects, and
- 18 hydroelectric plants - 11 plants in the Bow River Basin and 7 in the Oldman River Basin¹⁶

¹³ Alberta Energy, Fact Sheet http://www.energy.gov.ab.ca/docs/minerals/pdfs/FactSheet_MineralFacts.pdf, Additional Source: Alberta Geological Survey http://www.ags.gov.ab.ca/GIS/gis_and_mapping.shtml

¹⁴ Alberta Department of Energy: <http://www.energy.gov.ab.ca/537.asp>

¹⁵ Canadian Wind Energy Association, http://www.canwea.ca/production_stats.cfm The Alberta government signed contracts with Enmax and Canadian Hydro Developers to purchase 90% of its electricity requirements from green power starting in 2005. To meet their obligations, Enmax and TransAlta Wind (formerly Vision Quest) have constructed Canada's largest wind farm with 114 wind turbines with a total capacity of 75 MW at McBride Lake. Nearby Soderghen wind farm, with a total capacity of 70 MW, is now complete.

¹⁶ Alberta Environment, Dams in the South Saskatchewan River Basin, http://www3.gov.ab.ca/env/water/regions/ssrb/pdf_phase2/ssrb%20Dams%20information%20sheet/pdf

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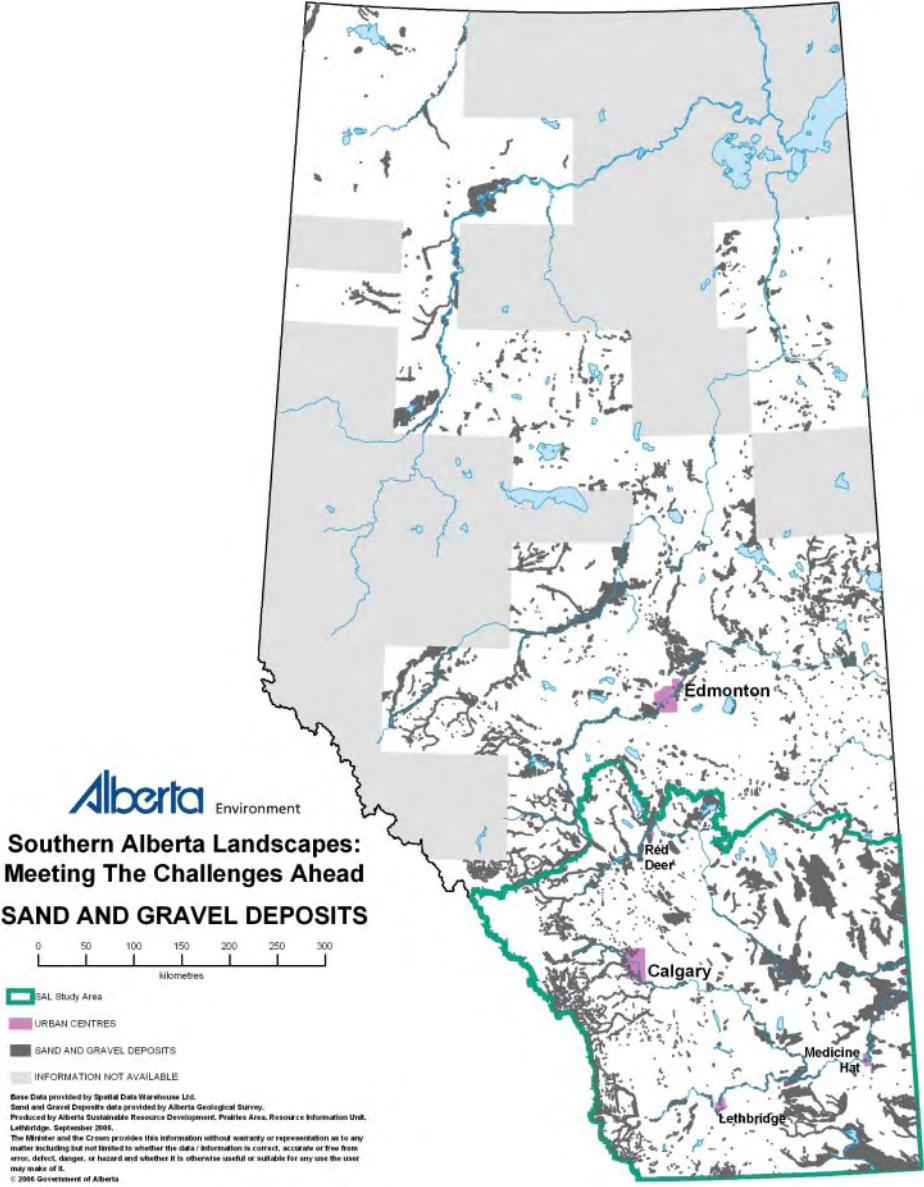


Figure 47. Sand and Gravel Deposits

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The 12 major petrochemical and chemical facilities produce a variety of products, including ammonia, methanol, ethylene glycol, alpha olefins, nitrogen/oxygen and ammonium nitrate. The NOVA Chemicals Joffre site produces ethylene and polyethylene. There is also an ethanol production plant near Red Deer and another has been proposed for an area south of Calgary.

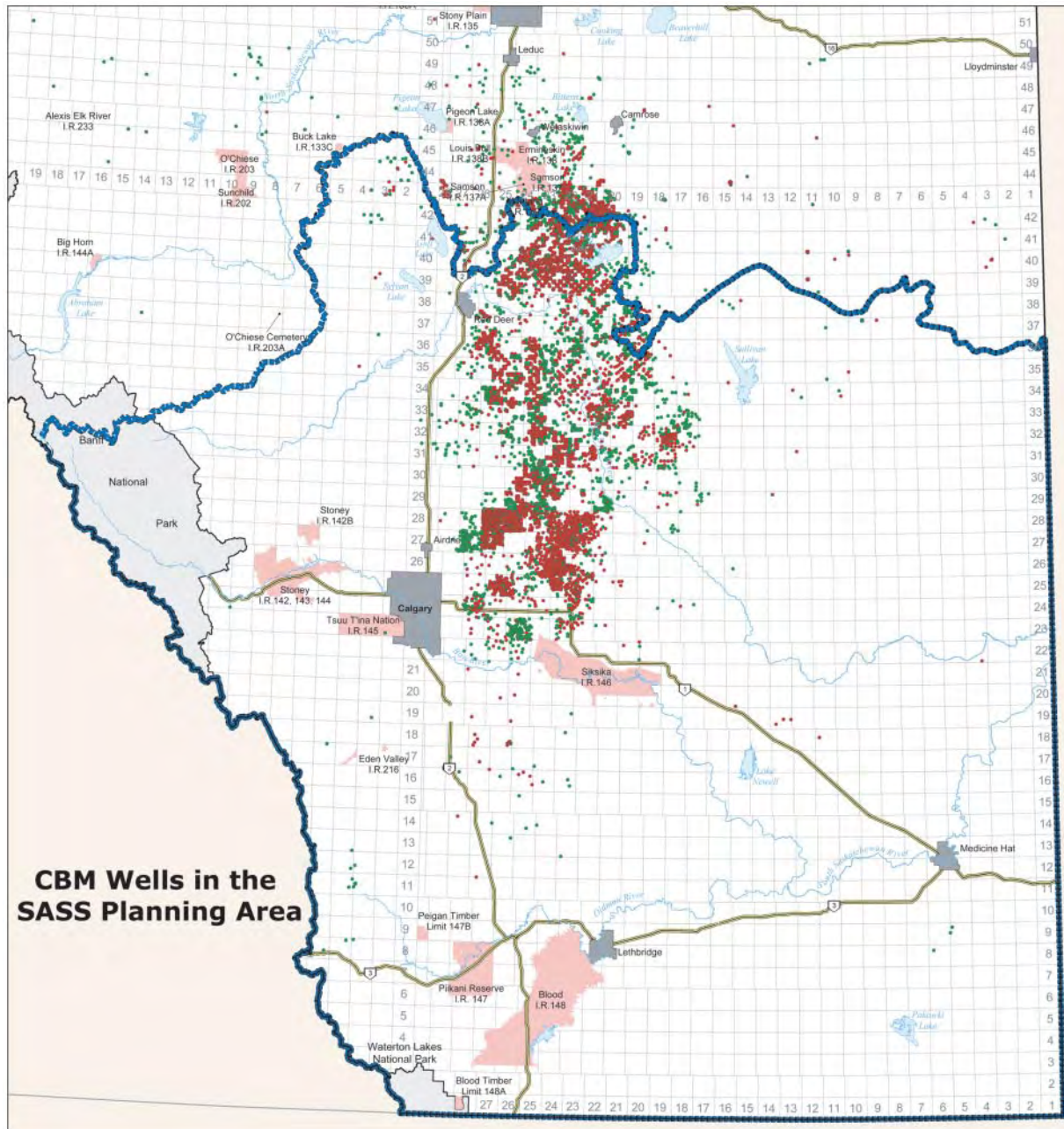
NON-ENERGY MINERAL DEVELOPMENT IN THE SAL AREA

Current development of non-energy minerals within the SAL area includes:

- 29 metallic and industrial mineral permits, covering a total area of 161,869 hectares (ha),
- 61 mineral leases with a total area of 6,524 ha; 34 of the 61 mineral leases are for limestone,
- Proposal for a magnetite (iron) operation near the Crowsnest Pass,
- Lafarge cement plant near Exshaw,
- Lime plants near Coleman, Exshaw and the Crowsnest Pass,
- Brick plant near Medicine Hat,
- Ammonite factory in Calgary, (and ammonite mining along the St. Mary River)
- Gypsum, zeolite and barite facility in Lethbridge, and
- Aggregate mining in the Bow Corridor, west of Calgary.



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Well Selection Criteria: Spud Profile

1. Data source EUB.
2. Selected all wells with a licensed substance of (CBM & Oil or CBM coal).
3. Selected all wells with a well status of (Flowing CBM & Othr, Flowing CBM Coal, Pumping CBM Coal, Susp CBM Coal, Testing CBM & Othr, Testing CBM Coal and ABD CBM Coal Zn).
4. Combine list 2 and 3 resulting in the final CBMNGC well list.
5. Well counts are based on Surface hole location and not production events.
6. These counts include "Active" and "Non Active" Wells.
7. Wells spudded prior to 2000 are not included.

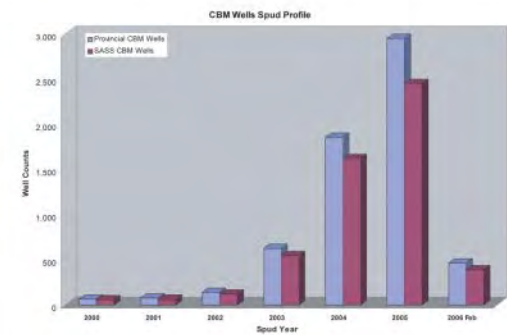
Spud Year	Provincial CBM Wells	SASS CBM Wells
2000	65	56
2001	73	59
2002	140	120
2003	623	544
2004	1,857	1,616
2005	2,949	2,450
2006 Feb	463	386
*Lic Locations	629	460

*Lic Locations : Proposed well locations

Well Selection Criteria: Active V.S. Non Active CBM wells

1. Data source EUB.
2. Selected all wells with a licensed substance of (CBM & Othr or CBM coal).
3. Selected all wells with a well status of (Flowing CBM & Othr, Flowing CBM Coal, Pumping CBM Coal, Susp CBM Coal, Testing CBM & Othr, Testing CBM Coal and ABD CBM Coal Zn).
4. Combine list 2 and 3 resulting in the final CBMNGC well list.
5. Active Wells are wells that reported gas production in 2005/2006.
6. Non Active wells are Depleted wells, Drilled and Cased, Abandoned, Lic Locations or have not reported production in 2005/2006.

Study Area	Active Wells	Non Active Wells	Total
Provincial Counts	4,514	2,713	7,227
SASS Counts	3,901	2,099	6,000



- SASS Boundary
- Active CBM Wells (Reported Gas Production 2005/2006)
- Non Active CBM Wells

Transverse Mercator Projection (10TM)
North American Datum 1983 (NAD83)

DATE: 2006 Feb
AUTHOR: Geology

SOURCE INFORMATION:
Agreements: Department of Energy (LSAS)
Base Data provided by Spatial Data Warehouse Ltd.

DISCLAIMER:
The data represented on this map is compiled from vertical government sources and is for general information only. Users are responsible for verifying the data before making decisions based on the map.

Base Features

- National Park
- Indian Reserve
- Urban Area
- Hydrography
- Primary Highway

Alberta ENERGY

Figure 48. Coalbed Methane wells in the SAL area

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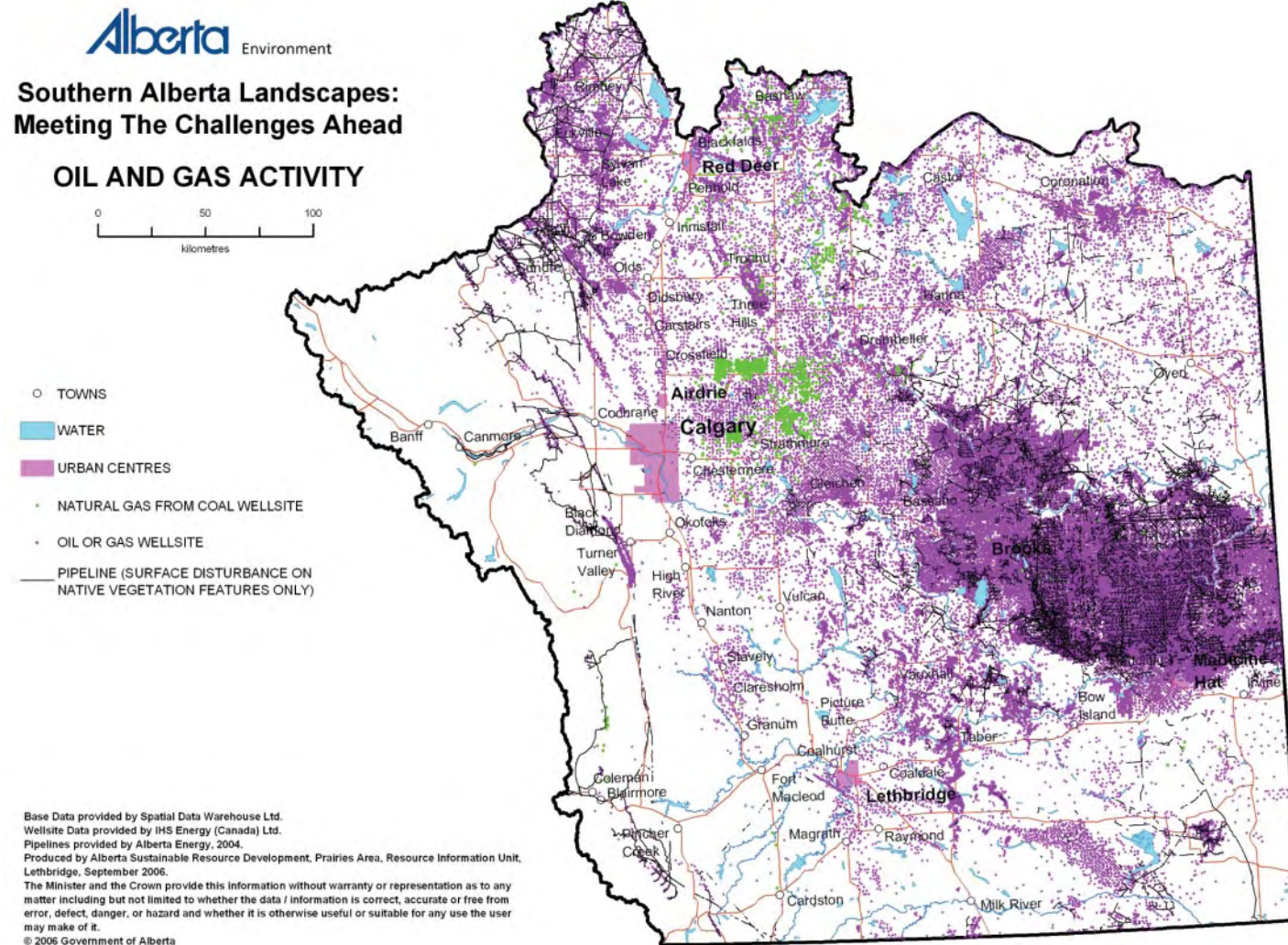


Figure 49. Oil and Gas Activity in the SAL Region