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2002 Edition

A publication of the Ontario Petroleum Institute

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ONTARIO OIL & GAS

VOLUME 1 ISSUE 1

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WELCOME

I AM PLEASED TO EXTEND MY best wishes to the readers of the new publication, *Ontario Oil & Gas.*

Ontario has a long and storied history in the oil and gas industry. The first commercial oil well in North America was established in Southwestern Ontario's Lambton County in 1858. Since that time, Ontario has had a number of other North American firsts, including the first integrated oil company and the first offshore gas well. While Ontario might not be the first jurisdiction that comes to mind when current petroleum production is discussed, it continues to produce significant quantities of oil and gas.

More than 50,000 wells have been drilled in the province since 1858, and oil production now averages about 1.5 million barrels a year. As well, some 15 billion cubic feet of natural gas are produced annually.

I commend the Ontario Petroleum Institute for producing this publication. In its pages, you will find valuable information on how to do business with the province's oil, gas and salt resources industry. I hope you, as readers, will consider investing in Ontario and using the services of the Ontario Petroleum Institute, as well as those of its more than 350 members.

Ontario's oil and gas patch offers a wealth of Ontario investment opportunities.

Hon. Jerry J. Ouellette
Minister of Natural Resources

OPI REPORT

WELCOME TO THE INAUGURAL EDITION of the *Ontario Oil & Gas* annual magazine.

In my travels as Executive Director of the Ontario Petroleum Institute, I am often asked if an oil and gas industry still exists in Ontario. Many people, both in the industry and the general public, are aware of Ontario's historical role in the development of the international industry (if not, you will enjoy the historical article on page 14), but they don't realize that the industry has grown and is thriving today.

Talisman Energy is a major participant in the Ontario industry and we are pleased to feature an article on page 8 entitled, "Talisman Energy Inc. and the Ontario Oil Patch: Does the Shoe Fit?" This article is an excerpt from a presentation at the 40th Annual OPI Conference & Trade Show held last November in London. Several speakers from Talisman will be featured at our 41st Conference in November in Niagara Falls, Ontario, which will be a joint conference with the Independent Oil & Gas Association of New York.

I also have the pleasure of acting as the Managing Director of the Oil, Gas & Salt Resources Trust, a unique partnership with the Ontario Ministry of Natural Resources. The article on page 30, "A Place for the Land that Time Didn't Forget," outlines the history and services of the OGSR Library. All of the industry data on pages 41 to 47 were supplied by the Library's ever expanding information services.

I hope that once you have finished reading *Ontario Oil & Gas*, you will have a better appreciation of the opportunities that abound in Ontario and with the Ontario Petroleum Institute.

Sincerely,

Steve Fletcher
Executive Director
Ontario Petroleum Institute

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Ontario's Big Secret Revealed

Investors in the know are taking a serious look at Ontario. Here's why

BY PETER ROWE
PRESIDENT
ONTARIO PETROLEUM INSTITUTE

For years, [illegible] opportunities in Ontario's oil and natural gas patch have remained a well-kept secret. Not that anyone was putting a great effort into keeping this information to themselves -- this secret was not a well-guarded one. But recent events have worked to create a competitive environment that provides potential investors from outside the area with the keys to gaining access to the information local players have used to their advantage for some time.

We have seen an increase in the number of companies from outside the province looking at Ontario for business and investment. This number is expected to increase as the Ontario Petroleum Institute (OPI) does more promotion of the business strengths the province offers.

High Netbacks

Perhaps highest on this area's list of strengths is the high netbacks available on production. The combination of market area commodity pricing (typically higher than production area pricing) and low operating costs provides field-level cashflows that are higher than those found in Western Canada for the equivalent volume of production.

Location

Many investors have come to Ontario primarily because of its strategic geographic position. Situated in the centre of the rapidly expanding Northeastern Canadian and U.S. markets, and being close to major gas transmission pipelines, the area offers a marketing vantage-point unrivalled in North America. Transportation costs are low, and the area is home to one of the greatest concentrations of underground storage pools in the Northeast enabling an economic advantage in marrying supply with demand.

In the province itself, demand for oil and natural gas is expected to increase by as much as 50% over the next 20 years. Similar growth figures are forecast for the United States, where Canadian

production is expected to account for supplying to an increasing share of the demand. Ontario's role in meeting this demand is expected to come from higher production of the area's oil and gas.

In addition, the need for storage capacity in the region is also expected to grow significantly over the period. Already, the area accounts for more than 60% of the total storage capacity in Canada.

Information

A lack of available data was once considered the major disincentive to those companies considering investing in Ontario. Data wasn't in a format easily handled by modern technology used for analysis, and as a result, the effort wasn't made to take a thorough look at the opportunities here.

However, more recent events have dramatically changed the information environment. Working with the OPI, the Oil, Gas & Salt Resources (OGSR) Library has put all its efforts into making practical and relevant information available in formats that allow for easier forecasting and economic decision-making. This information covers a range of data concerning the subsurface geology, petroleum and salt resources of Ontario. A wealth of well data in digital format is available free of charge, as are reports on monthly drilling and new licensing. The library's extensive geophysical database contains more than 800 kilometres of high-quality seismic data, and digital gravity and magnetic data covering more than 5,000 km of prospective lands. And this is just a taste of the data and additional services offered by the OGSR Library.

"Perhaps highest on this area's list of strengths are the high netbacks available on production."

Geography

Ontario is an area of high-quality reserves and relatively shallow-depth reservoirs. The area's light, sweet crude and

Talisman Energy Inc. and the Ontario Oil Patch:

Does the Shoe Fit?

By Robert Bonnar
Talisman Energy Inc.

Talisman Energy is one of the largest independent oil and gas companies in Canada. Its production comes from Canada, the North Sea, Indonesia, Malaysia, and Sudan, with exploration and development projects ongoing in Algeria, Colombia, Trinidad and the United States. The company's growth has been the result of aggressive exploration and development programs on the most-prospective lands of the companies it has acquired. So, why is it that Ontario continues to play an important role in Talisman's corporate strategy? The answer is simple: because it fits.

Talisman entered the Ontario oil patch on October 21, 1997 with the acquisition of Pembina Resources Limited. This purchase gave Talisman a high working interest in an onshore oil play in Essex and Kent counties and an offshore gas play on the Canadian side of Lake Erie. Through aggressive drilling programs and innovative engineering projects, Talisman has continued to increase both oil and gas production. Participating in a series of property swaps, farm-ins, farm-outs, and purchases, Talisman has been able to focus exploration and production into core areas. The company sees potential for further increases in both oil and gas prodcution in Ontario, and plans to exploit these opportunities in the future.

Talisman's predecessor, BP Canada Inc., first became interested in Ontario following the discoveries of Trenton oil pools in Mersea and Kent counties in the early- to mid-1980s. Following a regional prospectivity study of the Michigan and Appalachian basins, Talisman decided to pursue the Trenton play in Ontario.

On January 1, 1988, BP Canada entered into a farm-in with Ram Petroleum giving them access to 63,000 acres of prospective Trenton land in Essex and Kent counties. Talisman participated in 34 gross wells between the years of 1988 and 1994, resulting in 11 Trenton wells and one Cambrian well, for a success rate of about one in three. Several of the oil producers were only marginally successful, and the economic success rate (a well that pays out all drilling, completing, equipping, and tie-in costs in less than four years) was closer to one in six.

During the 1990 drilling season, several vertical wells were drilled and then followed by drilling a deviated lateral well from the original vertical well. Typically, the vertical well failed to find commercially producible Trenton reservoir and the lateral was an attempt to find better reservoir. Two of the three deviated wells were moderately successful.

In 1993, Tam/Talisman drilled Ontario's first horizontal well targeting the Trenton. The Ram/BP No.2 Mersea 8-16-VIII was successfully converted from a poor vertical oil producer into a good horizontal oil well.

In December 1995, Talisman sold all of its Ontario assets. At the time, Ontario did not meet the company's objective of having Talisman operating the production or controlling the exploration and development programs. Talisman's working interest in the play was also generally low: between 25% and 50%. The land position in the main play areas was highly splintered between several companies and generally tightly held. It was difficult to maintain a high level of drilling activity and thus the play did not have a material impact for a large company.

In October 1997, Talisman returned to Ontario with the purchase of Pembina Resources Ltd. The purchase included the same onshore area that Talisman had worked in the past. Pembina had done a good job of consolidating the land and production, and Talisman acquired 83,000 net acres of prospective Trenton acreage, 8,500 km of 2D seismic, 1,735 bopd and 1.2 mmcf/d related solution gas, as well as facilities and equipment. Talisman also acquired Pembina's Lake Erie assets, which included 800,000 net acres of land, more than 15,000 km of 2D seismic and 17.5 mmcf/d net gas production.

"The company sees potential for further increases in both oil and gas production in Ontario, and plans to exploit these opportunities in the future."

Lake Erie

With the purchase of Pembina Resources Ltd., Talisman acquired 550 producing wells on Lake Erie and approximately 27 mmcf/d of gross

gas production, 17.5 mmcf/d net gas production, all related plants, compressors and infrastructure, and more than 15,000 km of 2D seismic. Gas production is from the Lower Silurian Whirlpool and Grimsby formation and from the Middle Silurian Guelph formation. The Whirlpool and Grimsby are siliciclastics that are stratigraphically trapped as they pinch out against the Algonquin Arch to the northwest. Sweet gas is produced from these sandstones. The Guelph forms as series of patch and barrier reefs that also form stratigraphic straps and produce sour gas (approximately 1.4% H_2S). Talisman is the only operator in offshore Lake Erie and the area is considered a core one within Ontario.

"Lake Erie is considered a core area for Talisman's Ontario operations."

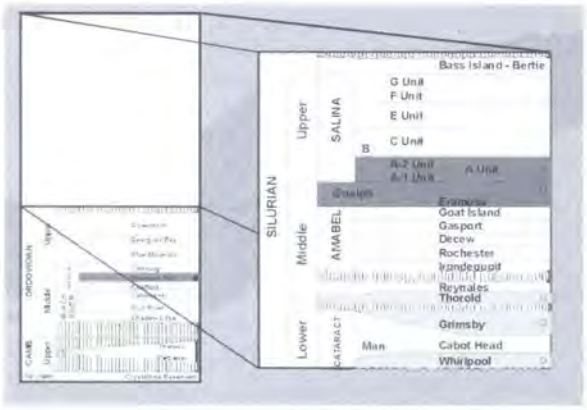
Talisman completed drilling programs on Lake Erie in 1998, 2000 and 2001. The drilling programs have evolved over the years as a result of reinforcing the successes and moving away from the types of programs that caused failure. Generally, the clastic vertical wells have had a lower success rate and the use of horizontal wells targeting the Guelph carbonates has resulted in an increasing success rate and production gains.

In 1998, Talisman drilled 24 wells: 21 verticals and three horizontals. The verticals, targeting mainly the clastics in east Lake Erie, had a 43% commercial success rate (9/21), slightly above the historical success rate of 35%. The vertical wells tend to be low-rate, low-reserve wells with initial production rates averaging approximately 200 mcf/d/well. Two of the three horizontal wells were successful, for a 67% success rate. The successful horizontal wells had an average initial production rate of greater than one mmcf/d and thus were significantly more productive than the successful vertical wells.

In 1999, Talisman elected not to drill. Low commodity prices made it difficult to economically justify drilling. There are significant mobilization and demobilization costs in preparing the offshore drilling rig for a season of work. Generally, Talisman either has a full season of drilling or does not drill. Reduced or partial programs are usually too expensive due to high mob/demob cost allocated to only a few wells.

In 2000, Talisman had a 16-well program consisting of eight vertical and eight horizontal wells. The

Talisman Energy's assets on Lake Erie, including land, pipeline and facilities.



Silurian nomenclature in Lake Erie (top), compiled from Windsor and Sanford, 1972. Gas pool map for Lake Erie (bottom).

horizontal wells take approximately twice as long to drill as a vertical well. The number of horizontal wells was increased from the 1998 program to reinforce the success of the past program. The eight-vertical well program had only one commercial success, for a 13% commercial success rate (1/8). The horizontal wells again targeted the Guelph reefs, and five out of eight wells were commercially successful, for a success rate of 63%. These successes were again very productive for the area, with average initial production of more than one mmcf/d.

The 2001 drilling program was again designed to reinforce the successes of past drilling. The program consisted of 14 wells: 11 horizontal and three vertical. The horizontal drilling was again very successful, with seven of the 11 commercial successes, for a 64% success rate. The three vertical wells were also successful.

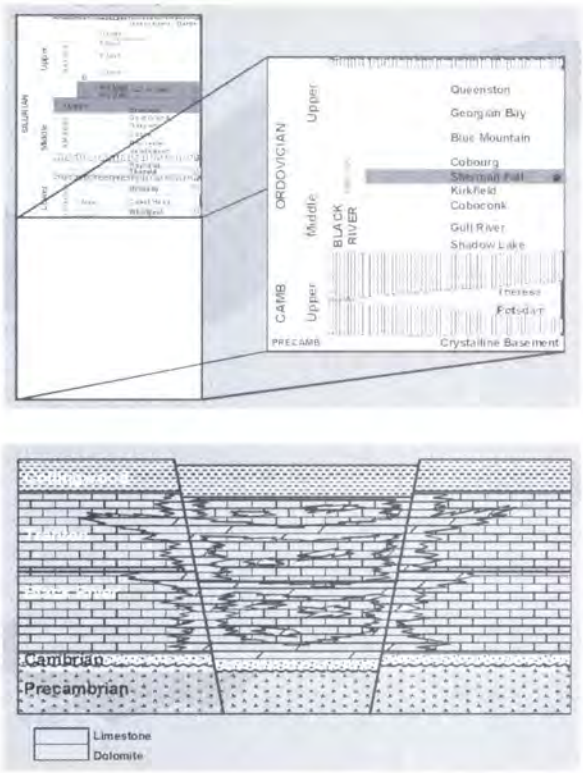
Lake Erie is considered a core area for Talisman's Ontario operations. Talisman operates all production and has a high working interest (65%) in the production and facilities. The Lake Erie operation is a joint venture with North American Life Insurance Co. (NAL), which owns the remaining 35% working interest. Talisman has learned to improve the drilling and completion success rate on the lake by carefully selecting targets that are visible to seismic and by increasing the chance of success by using horizontal wells. The increasing success rate has resulted in Talisman stopping the natural decline of the gas production on the lake and increasing production. We believe that Lake Erie fits into the Talisman corporate strategy.

Onshore Ontario

Talisman has focused on the Trenton play in onshore Ontario by exploring, developing and producing oil in Essex and Kent counties. The Trenton/Black River group is a middle-Ordovician-aged limestone that was deposited in a deep-water, mid-ramp setting. This carbonate shelf unconformably overlies the Upper Cambrian clastics and mixed siliciclastic/carbonates and is conformably overlain by the organic, rich black shales of the Upper Ordovician Collingwood formation.

Most of the Trenton in the area of interest is wackestone with minor to occassional packstone. The upper unit of the Sherman Fall formation of the Trenton group is called the Sherman Fall Fragmental. This unit is predominantly packstone to grainstone as a result of numerous storm deposits originating from the adjacent Algonquin and Findley arches. These more bioclastic-rich units are significant in that they are more susceptible to being dolomitized. The Trenton Group limestone is generally tight with low porosity and permeability and only forms an economic reservoir when it has been dolomitized.

The Trenton has been cut by a series of left lateral strike-slip faults that trend northwest/southwest. When these faults stepped to the left, a trans-tentional zone was created that resulted in negative flower structures forming a series of long, linear and often in echelon grabens. Hot, brine-rich waters, moving up, dip along the Cambrian aquifer from



Ordovician nomenclature for SW Ontario (top), compiled from Winder & Sanford, 1972; Millici & Witt, 1988. SW Ontario Trenton model (bottom).

deep in the Appalachian Basin toward the Algonquin and Findley arches, moved up into the Trenton along the open fractures bordering and within these trans-tentional grabens. These hot fluids dolomitized the Trenton limestones adjacent to these fault zones and within the fractured centre of the grabens. The packstone and grainstones are also preferentially dolomitized. These dolostones form the reservoirs for the Tenton pools in this area.

Several drilling methods were considered to explore and exploit these Trenton oil pools. Talisman has chosen to use horizontal well exclusively to both explore and develop the Trenton, resulting in greatly improved success rates.

Technical Innovations

Talisman has brought several new and innovative technologies to the Ontario oil scene. It was the first company to use multi-arm horizontal wells. In the Lakeshore area, five dual-arm horizontals have been drilled. The advantage of the dual-arm horizontal well is that two or three laterals can be drilled out of a single string of intermediate casing. This results in significant savings; the second arm can be drilled for about one-third the cost of a new horizontal well.

In addition, Talisman introduced the use of long-reach horizontal drilling to Ontario. A long-reach horizontal well has a horizontal length that is at least twice as long as the true vertical depth of the horizontal. In the Lakeshore area of Ontario, the horizontal wells are typically at a true vertical depth of about 825 metres, so any horizontal well that has a total measured depth of greater than about 2,500 metres is considered a long-reach well. The main difficulty of the long-reach wells is that the ratio of drilling time to trip time becomes reduced as it becomes more difficult to get the bit back to the bottom of the hole after tripping. The amount of static friction increases with the amount of horizontal hole. Another significant problem is the decrease in pump pressure in extended wells, which makes it difficult to clean the well of cuttings and to steer the well. This results in significantly increased costs as the horizontal distance increases.

The long-reach wells have been used extensively in the Lakeshore area in developing the extension of the Lakeshore Pool under Lake Erie. Ontario Ministry of Natural Resources legislation prohibits any oil wells on Lake Erie. Horizontal wells that have surface locations onshore are then allowed to be drilled out under Lake Erie to test for and produce oil.

Many of Talisman's oil fields are in highly populated areas, often on the edges of towns, and reducing the impact of the oil business on the local residents is an important consideration. Being a good corporate citizen improves our ability to lease mineral rights and to obtain surface leases to carry out our drilling, completion and production programs. Talisman has implemented measures to reduce the impact of the oil business on the local residents. The use of horizontal wells allows greater flexibility in the surface location of the well site, which can be positioned some distance from the intended target. This often means that the surface location can be moved to a less-intrusive position away from the actual seismic shot-point location of the sub-surface target. This may be the difference

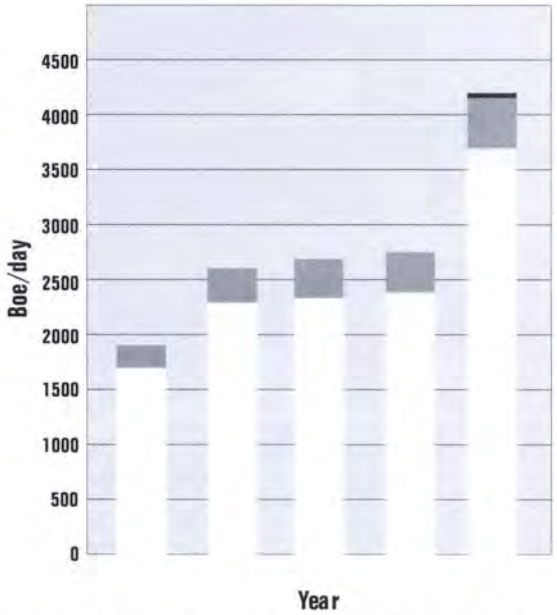
between a well site being located in the front yard of a house or tucked behind a barn at the back of the lot.

It is more efficient from a land-use perspective to group well sites onto one lease wherever possible. The use of horizontal wells makes this more possible. Talisman has eight surface leases in the Mersea/Romney area, with each lease having two separate well sites located on them.

Earth berms and landscaping can easily be constructed around the edges of a well site. The berms, generally about six to eight feet high, can act both as a sound barrier during the drilling of a well and as a visual shield for the local residents both during the drilling of the well and for subsequent production of the well.

Land Summary

To maintain the fast pace of drilling activity in Ontario, it was essential that Talisman complete several land deals. The Talisman land department has successfully completed numerous deals by developing win/win scenarios for each party. In general, Talisman is prepared to fund the exploration costs and take the exploration risk. In return, Talisman expects to achieve a very high working interest in any wells that they fund. The land deals have included purchases, farm-ins, joint wells and joint ventures.



Net Talisman Onshore Production - showing increase in production since Talisman acquired Pembina in 1997.

Onshore Ontario: Land Summary

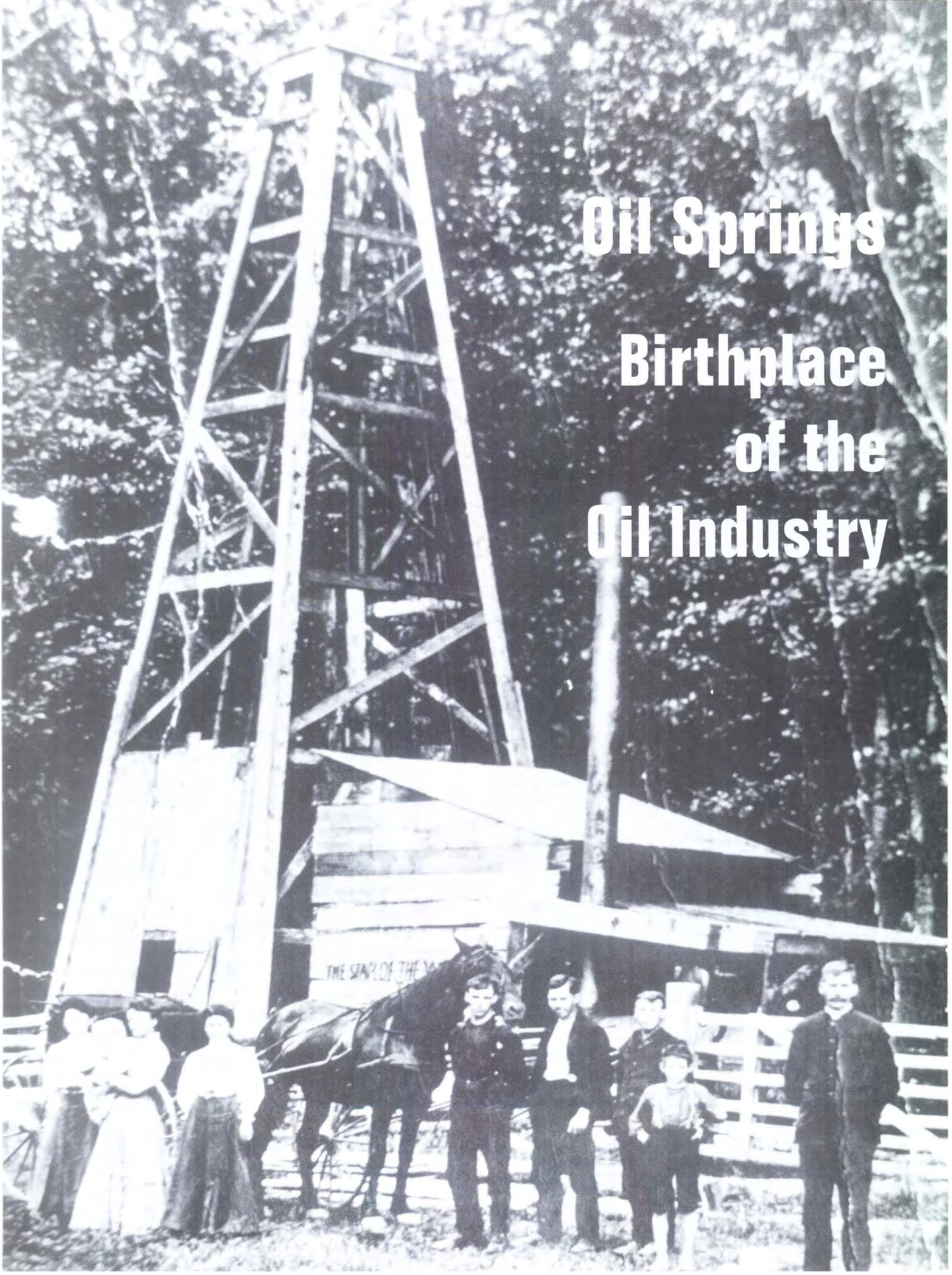
Purchases	West Point Energy Inc.
Swaps	Northrock Resources Ltd. (Rochester Property) Greentree Gas & Oil Ltd.
Farm-ins	St. Clair Pipelines (1996) Ltd. Algonquin Petroleum Inc., et al Clearbeach Resources Inc. Rowe Energy Corp., et al Penwick Resources Ltd.
Joint Wells [Pooling]	Highline Mushroom Limited Columbian Natural Resources Rowe Energy Corp., et al
Joint Ventures	Clearwood Resources Inc. Dell Exploration Ltd.

As a result of the land deals, technical innovation and a successful program, the onshore production has more than doubled from 1,739 boe/d in 1997, when Talisman bought Pembina, to the year-end 2001 rate of 3,540 boe/d.

Conclusion

Ontario fits well with Talisman's corporate and Canadian strategies. Both onshore and offshore, Talisman has maintained a high working interest in production and facilities. The company controls and operates the infrastructure for both oil and gas production. Exploration and development work is focused on core areas where Talisman controls much of the land, production and facilities. The company has brought new and innovative technology to the Ontario oil patch. Talisman has successfully grown both oil and gas production in Ontario.

The shoe fits.



Oil Springs

Birthplace of the Oil Industry

By Connie Bell
Oil Museum of Canada

THINK OIL AND GAS in North America, and the average person conjures up images of pump jacks lined up across vast expanses of Alberta's prairies, or J.R. Ewing-types counting their fortunes in Texas. But would you have thought that the first commercial oil well in North America was in a town in Ontario named Oil Springs in honour of the discovery?

During the 1800s, Oil Springs, Ontario — then called Black Creek — and the surrounding area were comprised mainly of dense bushland, mosquito-infested swamps, unyielding clay soil, and patches of black, sticky crude oil called 'gum beds.' Although area inhabitants found a variety of medicinal uses for this surface oil, like most discoveries the commercial drilling of oil happened quite by accident.

Charles and Henry Tripp arrived in the area and saw the potential of the gum beds. In 1852, they erected a factory and began to chop up and boil the gum beds to manufacture caulking for ships, asphalt, varnishes, and burning fluids. By 1854, the brothers had incorporated the first oil company, The International Mining and Manufacturing Co., and in 1855 they won honourable mention for their asphalt at the Paris Exhibition.

Around 1854, the Tripps dug a well. Their intention was to find water for use in their factory, but instead they struck oil. However, the honour of having the first commercial oil well was not to be theirs as they failed to take advantage of their find. Circumstances soon arose that forced the brothers to sell their business.

James Miller Williams purchased their holdings, not knowing he would become known as the father of the oil industry in North America. In 1858, Williams continued to chop and boil the tar from the gum beds, but also decided to dig down into the beds. At a depth of just 14 feet he had oil flowing into the bottom of the hole at a rate of 50 barrels a day. Immediately he constructed a small refinery on site and began producing illuminating oil for lamps; this oil was being refined into kerosene. This hand dug well in 1858 became the first commercial oil well in North America.

Over the next couple of years, Williams dug several more wells, and the excitement of the find was difficult to keep under wraps. News spread quickly and soon people, giddy with anticipation, flocked to the area by the hundreds. Land prices began to soar.

Hugh Nixon Shaw was one man who came to get in on the action. To settle an argument with his partners, Shaw was given a piece of land near Oil Springs. By the end of 1861, more than 400 wells had been drilled, but the flow of oil was beginning to stop. Shaw persevered. People laughed as he used the spring-pole method to drill deeper into the rock. With his money and credit gone, Shaw pressed on. No one had drilled that deep before and found oil, and the folks around town thought Shaw was crazy. But his efforts soon made him the envy of everyone. After his back-breaking, six-month struggle of drilling he brought in the first oil "gusher" with a spectacular roar in January 1862. Shaw had more oil than he knew what to do with; no market yet existed for the quantities his well was producing.

The year 1862 would prove to be the year of the gusher. With Shaw's success, more prospectors came and the village of Oil Springs sprang up. It was a thriving place and the site of many firsts. It was here that new oil production and refining techniques evolved, including the "jerker line" by J. H. Fairbank. Schemes were unlimited, land prices fantastic. Fortunes were made overnight and lost in a day. This was the pinnacle of the oil era for Oil Springs, Ontario.

But prosperity was not to last. By 1866, sluggish oil

production, low oil prices, the U.S. Civil war, and the Fenian uprisings in Canada all combined to end the oil boom here. At the same time, a significant oil find occurred just eight miles down the road from Oil Springs, in Petrolia. Drilling equipment and even some of Oil Springs buildings were moved to Petrolia as emphasis switched to the new field. The population of Oil Springs dwindled as the population of Petrolia grew.

In the early 1880s, with oil prices on the rise, the Oil Springs fields experienced a slight revival. But the size and grandeur of the original oil boom was never to be repeated.

The expertise gained by the area's oilmen made them experts around the world. During the years from 1874 to the 1940s, men from the Oil Springs and Petrolia oil fields travelled the globe to discover and develop oil fields. They were proudly referred to as the "foreign drillers."

Although the original boom at Oil Springs was short lived, it had a major impact on the fledgling oil exploration, production and refining industries. Oil Springs not only supplied the oil resource for the first commercial ventures, but its residents acquired the technical know-how and devised the innovative equipment needed to both produce and refine the crude. To this day, historic oil fields — some still using the jerker lines — continue to produce around Oil Springs and Petrolia in the Oil Heritage District Of Lambton County.

For more information, please contact:
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Oil Springs, Ontario N0N 1P0
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The Ontario Oil and Gas Industry and the Environment

BY KERRY O'SHEA
SENIOR ENVIRONMENTAL CONSULTANT
DILLON CONSULTING LIMITED

BACK IN 1858, when the drilling of the first commercial well in Oil Springs, Ontario started the oil and gas industry in North America, little concern was given to the environmental issues surrounding this activity. In those early years, the environment was considered an obstacle that had to be worked around. Conservation of resources was not a priority. Pictures from that time show numerous shallow wells constructed from wood and operating in a morass of muddy, swampy and oil-soaked ground.

Since that time, the industry has gone through several boom–bust cycles and has evolved along with the technology for extracting oil and gas from reservoirs. With this evolution has come an expanded awareness of the industry's interaction with environmental resources, such as groundwater, surface water, air and soil.

Today, several environmental issues are facing the industry. These issues include the handling of brine, waste disposal challenges, and the impact on groundwater through drilling and production activities and through the construction of pipelines. The industry in Ontario has been fortunate that a large portion of the exploration, drilling and production of oil has occurred in Lambton, Kent and Essex counties, which have a considerable thickness of clay and silty-clay overlying the various fresh-water aquifers used for the areas' drinking-water supplies. Low reservoir pressures and slow pumping rates have limited the volume of oil and gas that has been brought to surface. With the thick clay sequences, the small scale of Ontario's operations has helped protect groundwater resources and, where impact has occurred, has limited the spread of environmental contaminants.

The environmental impact of the Ontario oil and gas industry is under considerable scrutiny by government regulators. Through legislation such as the *Oil, Gas and Salt Resources Act*, the *Environmental Protection Act* and the *Ontario Water Resources Act*, the government has sought to protect the public and the environment from damage.

The industry has responded generally in a positive fashion to the increased environmental oversight that has been brought about by public awareness of environmental issues. In Ontario, the emphasis is shifting toward full responsibility for those that cause environmental harm. This will require those few companies and individuals that try to avoid environmental issues to become more diligent in their activities.

Having worked closely with many in the oil and gas industry in Ontario, my experience has been that a high level of awareness concerning environmental issues exists within the industry. Ontario's operators and owners try hard to consider the environmental implications of their activities. They realize it is no longer 1885. A negative impact on the environment is not a legacy they want to leave behind.

Kerry O'Shea has worked closely with the Ontario industry for 14 years, and has completed environmental assessments, cleanups and programs on the majority of oil and gas fields in Ontario.

Innovative Approaches to Drilling in a Freshwater Lake Environment

BY LESLIE ZILM
TALISMAN ENERGY

THE GREAT LAKES create the largest system of freshwater on the planet. They provide drinking water to millions, are a source of recreation and beauty, and are home to numerous unique types of marine life. The chain of lakes provides access from the centre of the North American continent to the Atlantic Ocean, easing the movement of resources and materials. And under these lakes lies pools of oil and natural gas.

Given the importance of these lakes, any activity that takes place on — or under — them, must be done with extreme care. Currently, in Ontario, oil rigs are not permitted on the lakes, and drilling that is done for oil must be done from an onshore base through directional — "slant" — drilling.

Drilling for natural gas has occurred on the Canadian side of Lake Erie since 1906 when Union Gas discovered the Tilbury Field that extends offshore in the Port Alma area. Since the early 1900s, more than 2,000 wells have been drilled on the lake. Currently, 550 offshore natural gas wells are producing on the lake, accounting for approximately 75% of the total production of natural gas within Ontario. A further 200 wells exist on Lake Erie in a "suspended" or "shut-in" state.

Wells on the lake are connected by more than 1,700 km of pipeline ranging in diameter from 5 cm to 20 cm. Both sweet and sour gas is produced. The sweet-gas pipeline network consists of a low-pressure system that delivers the gas to onshore compressor stations located at Port Stanley, Nanticoke, and Port Maitland. Sour gas wells produce to one high-pressure and two low-pressure networks that deliver the gas to a compressor station at Port Alma and a gas processing plant at Morpeth.

Drilling and production on Lake Erie differ substantially from other locations, both onshore and offshore. Talisman uses a drill barge (the Mr. Chris) and a completions barge (the Miss Libby) to conduct such operations. Talisman also contracts commercial divers and dive vessels to complete new construction/installation requirements and to regularly monitor existing well heads and pipelines. All routine activities on the lake take place during the spring–to–winter, ice-free season.

In an effort to reduce environmental liabilities associated with drilling on the lake, all extraneous products and chemicals were removed from the Mr. Chris and Miss Libby, and mud programs are designed to incorporate only environmentally friendly components. Drilling mud used on the lake is water-based using fresh lake water as its primary ingredient. No synthetic or diesel invert muds are used. Mud additives include calcium carbonate (a limestone-based cement) mixed with starch. The starch is an industrial-grade form of a food product typically used in products such as salad dressing. A cellulose polymer helps with fluid loss and viscosity. Workplace Hazardous Materials Information Sheets

(WHMIS) indicate no exposure or toxicity dangers associated with these products. Bentonite (a pure form of clay) is used occasionally to control well pressures. Caustic soda is also added to raise the pH of the mud system for control of corrosion and bacteria. Wells are drilled using a closed system, and drilling mud is saved and recycled from well to well. On average, Talisman drills from eight to 12 new wells per year.

All well work-over and stimulation procedures conducted from the Miss Libby are closed-circuit procedures, meaning all fluids pumped from the Miss Libby into the formations are circulated back up the well bore and are contained in tanks on the barge. Wells drilled in siliclastic formations at the east end of the lake are stimulated using liquid nitrogen to fracture the reservoir and silica sand as a propping agent. At the west end of the lake, in carbonate reservoirs, the stimulation involves the injection of 28% hydrochloric acid mixed with fresh lake water. Prior to such "fracing" procedures, the well bore is cased to prevent the acid and any other fluids from the well from entering groundwater aquifers and zones other than the producing reservoir.

Wellheads in Lake Erie are located on the bottom of the lake and identified by surface buoys. All new wellheads on the lake are equipped for sour service even if they are sweet wells, thereby providing an additional margin of safety. Wells located in areas of the lake where fishing and trawling activities occur are located below the lakebed, completely enclosed in a metal caisson with a smooth cover to protect the wellheads from potential damage and allow trawl-type fishing nets to pass over them without problem. Wells are abandoned on the lake if they have a gas leak that cannot be repaired, are physically damaged, or are no longer productive. A sophisticated database keeps track of the condition of the wellheads and automatically identifies the wells requiring work over, repairs or plugs, or abandonment procedures.

The dive operations that Talisman contracts are critical to Talisman's overall due diligence with respect to regulatory compliance and good operating practices on Lake Erie. Talisman has adopted a minimum standard of safe operating practices on the lake based on Ministry of Natural Resources oil, gas and salt resources of Ontario Operating Standards, the pertinent Canadian Coast Guard, Ministry of Transport, Ministry of Labour, and Department of Fisheries and Oceans acts and regulations. These standards of practice include the following:

- Specifications for minimum schedules for monitoring wells and mainline pipeline junctions, including producing wells and problem and/or suspended well locations;
- Emergency response procedures, including direction to dive vessels to respond as soon as possible to all reports received from the public sector, government agencies, or any commercial marine operations;
- The requirement for the establishment and maintenance of an offshore emergency response plan;
- Requirements for annual reporting and seasonal operation activity outlines to the Ministry of Natural Resources, the Canadian Coast Guard, Seaway Welland Control Center, the Canadian Hydrographic Service, the Ministry of Labour, and the Department of Fisheries and Oceans;
- Requirements for the maintenance of a current and accurate pipeline and well facility drawing system;
- Requirements for the maintenance of a current charting system of Lake Erie facilities;
- Requirements for compliance with applicable Ministry of Natural Resources and Canadian Standards Association regulations for natural gas production and pipeline construction activities; and
- The requirement to establish and maintain an acceptable monitoring mechanism to ensure production problems are identified and resolved in a prompt manner.

In 2001, Talisman commissioned an internal due diligence environmental assessment of the Lake Erie operations. This assessment was completed to ensure continued diligence with respect to Talisman's operations as they relate to environmental protection and stewardship of Lake Erie.

Talisman Energy is committed to the safety of the public, its employees and the environment. Talisman employees and contractors who operate on Lake Erie are longtime residents of the local communities and each has a vested interest in ensuring that operations are conducted to high standards so that the lake can be enjoyed by future generations.

Canada's Largest Natural Gas Storage Facility

BY DAVID SWORD
UNION GAS LIMITED

Most Canadians aren't aware that this country's largest underground storage facility resides in their own backyard. The Dawn Market Hub is the largest natural gas facility in Canada and is one of the fastest growing storage and transmission hubs in North America. Recently purchased by Duke Energy, and operated by Duke Energy Gas Transmission, the Union Gas hub offers storage and transportation services for utilities and energy market participants in Ontario, Quebec and the United States. What makes this storage facility unique and in demand is its geologic properties, geographic location, and integrated design.

Dawn's storage pools are depleted gas reservoirs made of very porous rock located about 500 metres underground. Four hundred million years ago, the land in Lambton County was a shallow sea dotted with underwater reefs. As the water retreated, the creatures that lived in this reef died. Their remains fossilized and formed this porous rock, creating an excellent storage vessel. Acting like a sponge, it soaks up gas in the tiny holes. A cap of impermeable rock holds the gas in the depleted reservoir.

Union Gas has more than 20 depleted natural gas pools that can hold 150 bcf of gas, which is enough gas to provide all the energy needs of Toronto (3 million people) for two to five weeks, depending on the season, and delivers more than 2 bcf a day to its storage customers. The Union transmission system can move more the 5 bcf a day on its main transmission line.

Dawn is home to many of North America's largest and most-active energy market players. Located near Sarnia, Ontario, it is strategically positioned between growing eastern North American natural gas markets and western supply basins. It has direct pipeline interconnects with Enbridge Consumers Gas, TransCanada Pipeline, Vector Pipeline, MichCon, and Consumers Power. The Hub provides storage, balancing, gas loans, transport, exchange, and peaking services and other customized services to the more than 90 companies that do business at Dawn.

All storage pools are tied into the central compressor complex at Dawn, giving customers access to Dawn's large-volume reservoirs and high-volume deliverability. Union Gas's transmission system consists of 4,100 miles of transmission pipelines and 17,500 miles of distribution pipelines, and is key to moving natural gas across Ontario and to Eastern and Northeastern U.S.

With expanding natural gas markets and the need to meet customers' storage requirements, retaining and acquiring storage is becoming increasingly important. Natural gas storage and transmission is in demand for a number of reasons, including a growing demand for natural gas from the Eastern Canadian and Northeastern U.S. Markets. There is also a shift toward a market-driven service from a weather-driven service. Lynn Galbraith, manager of lines of business, explains: "The biggest change in

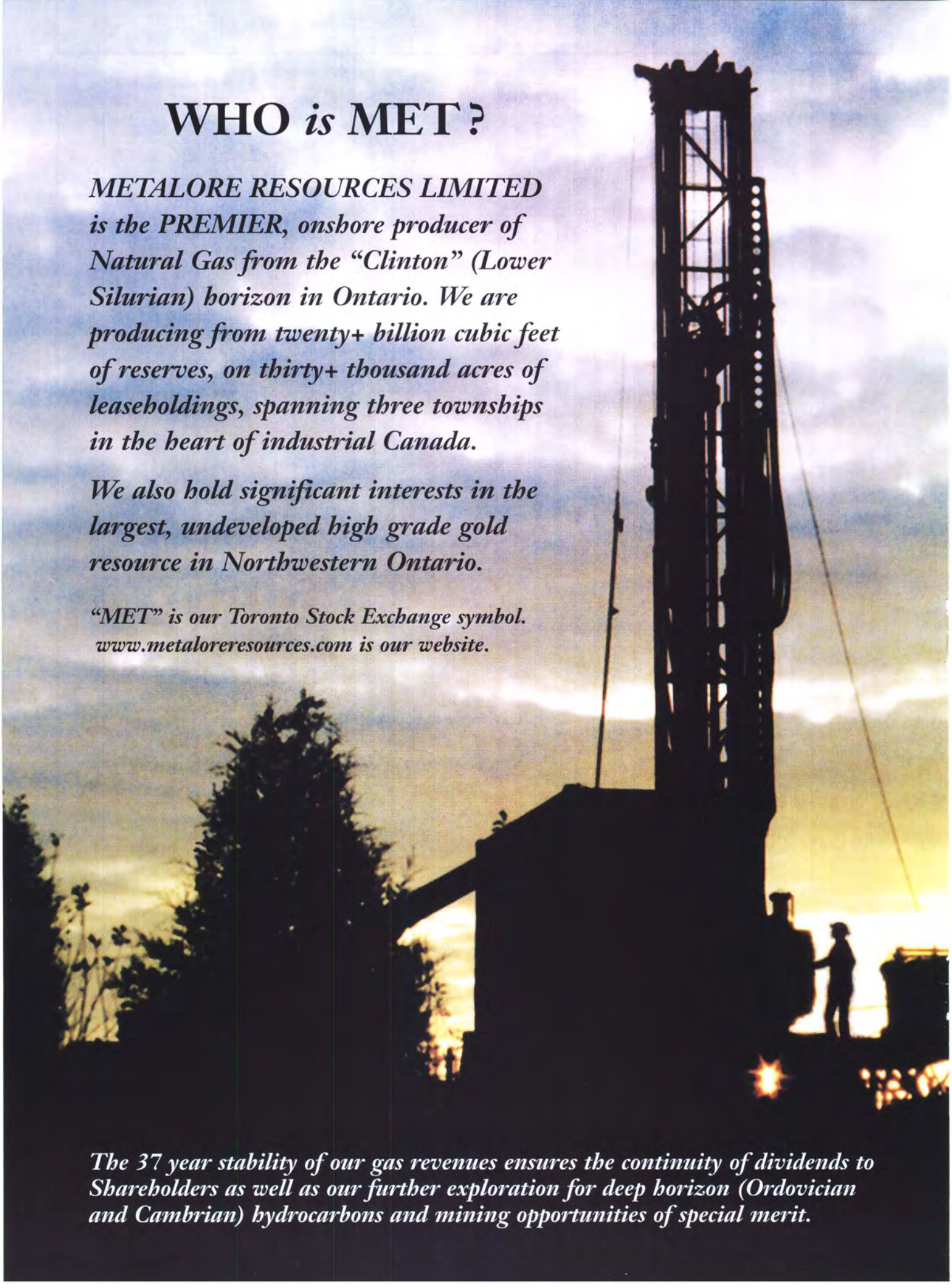
the last 17 years is who is willing to make money buying storage. In the first five years of deregulation, storage was bought to meet winter needs. Today, people use storage like a bank account. They buy and sell based on market conditions. Last year, an average of almost 12 bef a day was bought and sold at Dawn."

Finally, large distribution companies, utilities and energy marketers make huge and erratic gas requirements.

Union Gas also expects an increase in future demand with the deregulation of Ontario's electricity market. New large-scale, gas-fired generating plants are expected to be built, and this will place large and variable demands on the system. Union has ensured that it will be able to meet current and future demands by expanding its storage assets and making changes to its control systems, compression equipment, and pipelines.

"What attracts customers to Dawn is its liquidity and flexibility. There are a lot of buyers at Dawn, making it easy for customers to get a great price and the physical nature of the storage makes it easy for customers to inject and take out of the system," says Jerry Norcia, managing director of business development, Empire pipeline and storage.

With an increasing customer base and promising future opportunities, Dawn is a natural choice for storage and transmission needs.



WHO *is* MET?

METALORE RESOURCES LIMITED is the PREMIER, onshore producer of Natural Gas from the "Clinton" (Lower Silurian) horizon in Ontario. We are producing from twenty+ billion cubic feet of reserves, on thirty+ thousand acres of leaseholdings, spanning three townships in the heart of industrial Canada.

We also hold significant interests in the largest, undeveloped high grade gold resource in Northwestern Ontario.

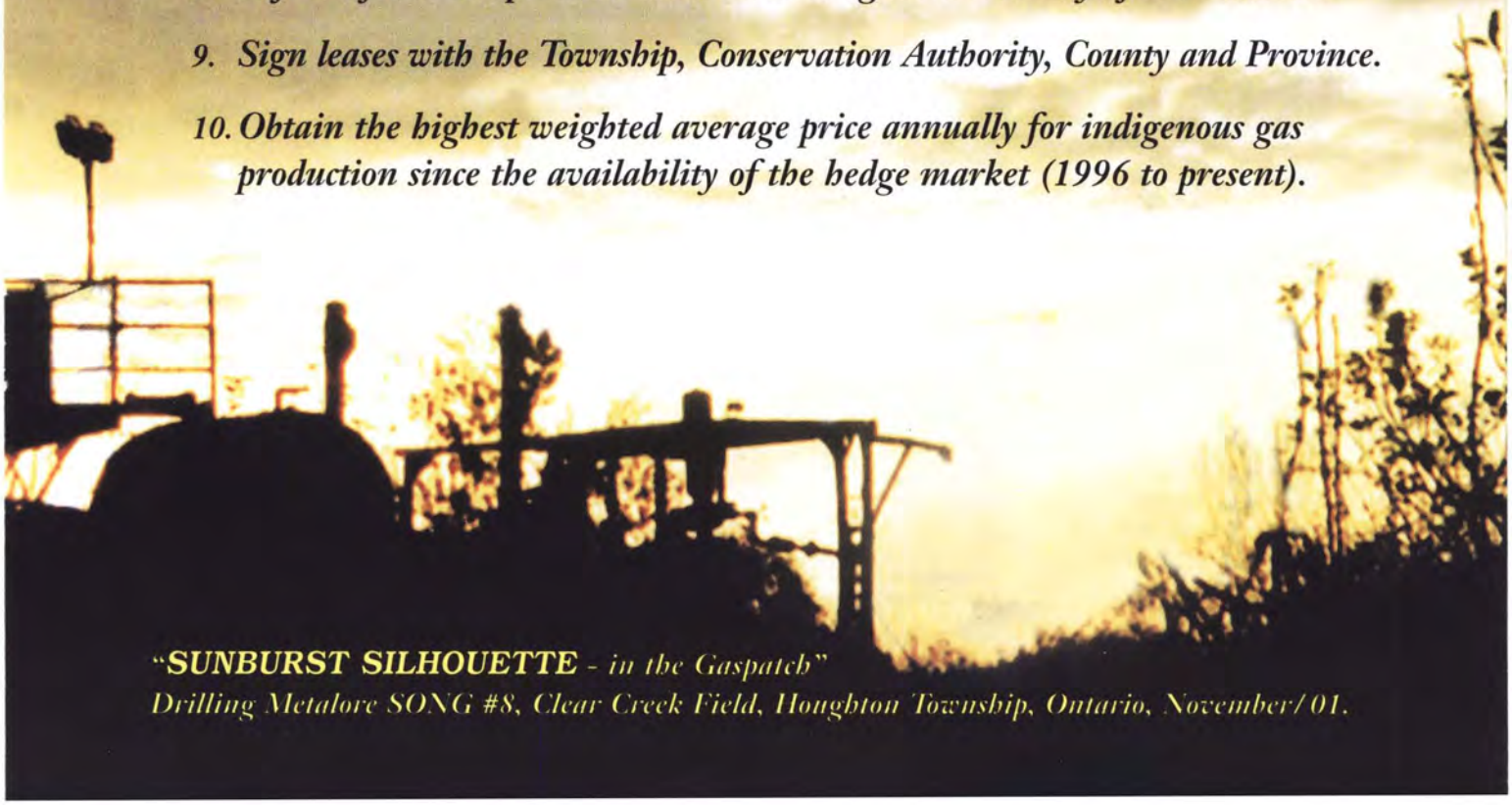
"MET" is our Toronto Stock Exchange symbol.
www.metaloreresources.com is our website.

The 37 year stability of our gas revenues ensures the continuity of dividends to Shareholders as well as our further exploration for deep horizon (Ordovician and Cambrian) hydrocarbons and mining opportunities of special merit.

We Listen to the Concerns of farmer/landowners and are striving to meet their Needs with innovative Solutions; and we ARE "Making a Difference".

Metalore is the FIRST volume natural gas developer in Norfolk County to:

1. *Offer leases with a production royalty to lessors (1964 to present).*
2. *Implement an equitable pooling policy whereby all lessors within a probable drainage pattern would receive a royalty share (1964 to present).*
3. *Accommodate the purchase of gas by customers along our gathering lines, in concert with the local utility (1965 to present, now 70 Field Line Customers).*
4. *Establish much wider spacing patterns to conserve land use and extend the longevity of production per well (1965 to present).*
5. *Mandate the drilling of our wells on untillable lands (1966 to present).*
6. *Implement environmentally friendly policies of (a) cementing in all well casings (Since 1966) and (b) constructing all larger diameter pipelines with "yellowjacket" steel (1970 to present).*
7. *Pioneer mega-fracturing technology (100,000 + gallons) to enhance both short and long term deliverability (1968 to present).*
8. *Refrain from compression to stabilize long term recovery of the resource.*
9. *Sign leases with the Township, Conservation Authority, County and Province.*
10. *Obtain the highest weighted average price annually for indigenous gas production since the availability of the hedge market (1996 to present).*



"**SUNBURST SILHOUETTE** - *in the Gaspatch*"
Drilling Metalore SONG #8, Clear Creek Field, Houghton Township, Ontario, November/01.

in the well files maintained by the MNR at the Petroleum Resources Centre. Public well files at the OGSR Library are updated as part of this process, in particular by photocopying missing well plugging reports. Geographic co-ordinates are corrected by plotting wells with known township lot locations on Ministry digital base maps and using GIS tools to derive the geographic co-ordinates. The Trust allocated $31,000 for this purpose in 2000, $75,000 in 2001, and $92,000 in 2002. Data entry and editing for Essex, Kent and Oxford counties is now essentially complete. Work on Elgin and Brent counties and Lake Erie is in progress. Lambton County is expected to be completed by the end of 2003, and remaining counties to the east of London by the end of 2004.

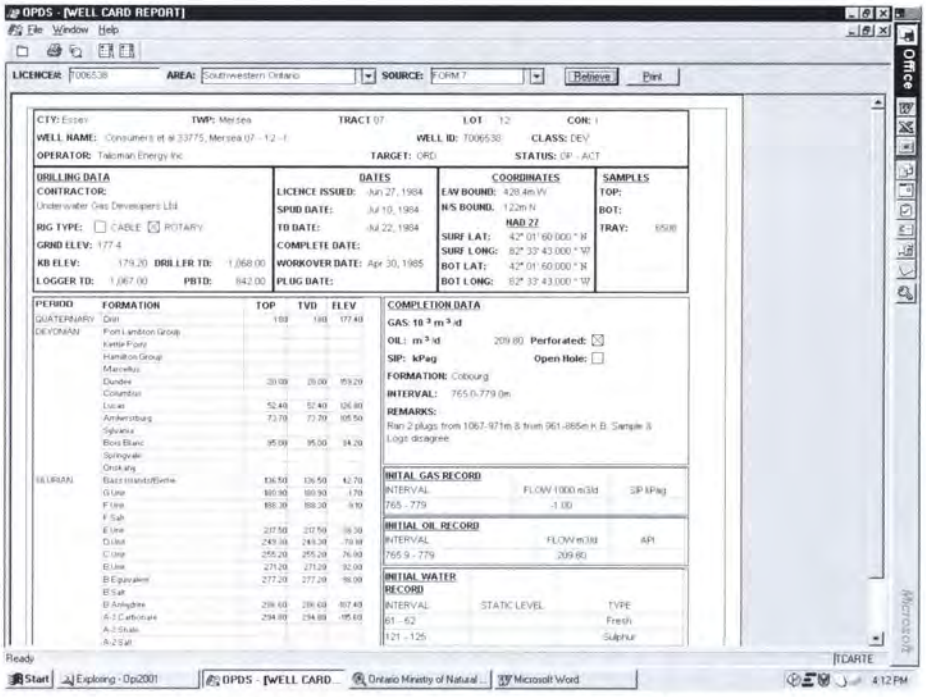


Figure 1. Screenshot showing portion of a well card report and typical data stored in OPDS.

GIS Capabilities

Geographic Information System (GIS) is a method of representing and displaying real-world data as graphic objects in a map view. To generate a graphic display or map, the GIS software uses spatial data about an object's location or physical relationship to other objects and attribute data describing an object's properties. These objects or geographic features can be represented as points (for example, a petroleum well), lines (a pipeline), or polygons (a spacing order, oil pool).

Staff of the south-central region office of the Ministry have designed and written a GIS application in Arcview 3.2 using Avenue script that links some of the OPDS data tables to the Ministry's digital base maps of Ontario. Well locations are plotted using the geographic coordinates recorded in OPDS, and a well symbol is posted based on attribute data about the well type (such as oil well, gas well) and well mode (active, suspended, plugged). Data contained in the linked tables can then be queried and displayed using the standard tools supplied with Arcview or by using custom tools designed by the Ministry GIS staff. The application is also capable of producing a digital or paper map containing information desired by the user. Features displayed on the map include: wells, counties, townships, roads, water bodies, cities, lots, concessions, railroads, and

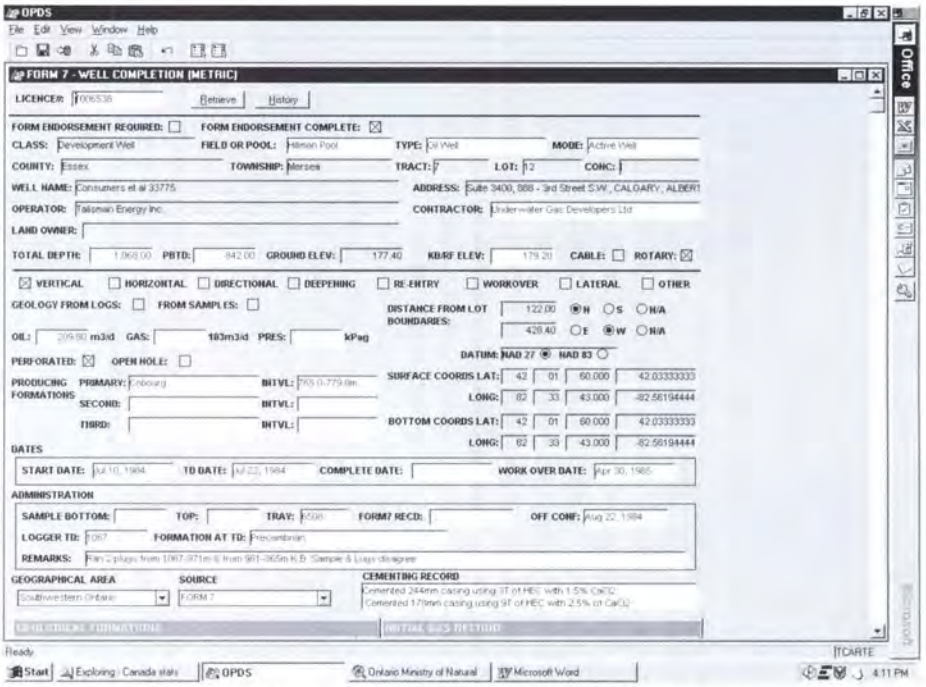


Figure 2: Screenshot of portion of data entry screen for Form 7 well completion report for OPDS.

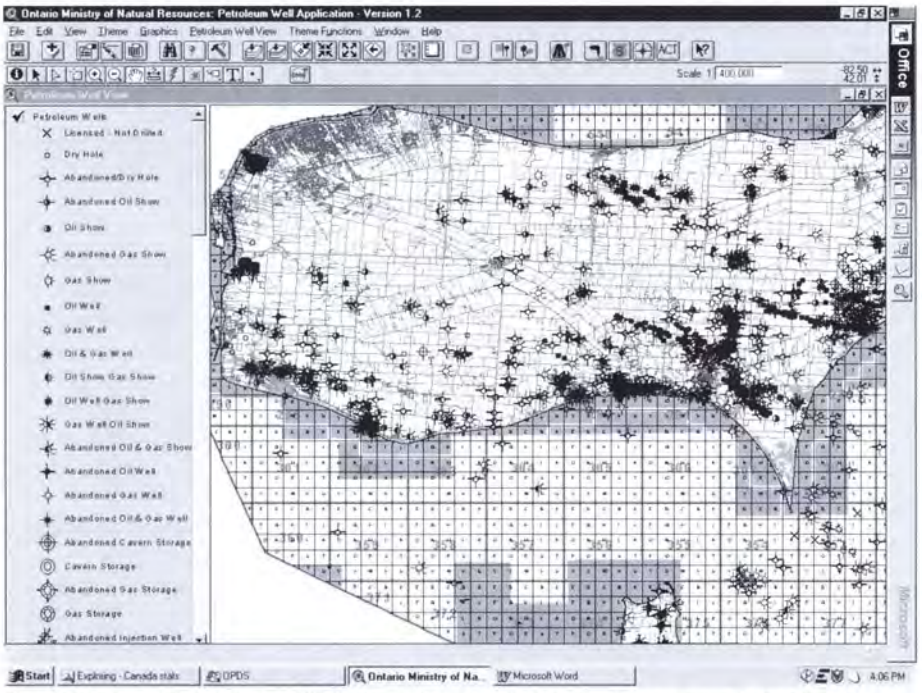


Figure 3: Screenshot from Petroleum GIS showing well locations in Essex County and survey grid for Lake Erie.

buildings (see Figure 3).

Data that can be queried and viewed in the current application include: license number; well name; operator; well status; initial classification; target; total depth; formation at TD; county; township; lot; concession; latitude and longitude; pool name; primary producing formation; initial oil and gas rates; initial pressure; dates; and sample and core information (see Figure 4). Geological formation tops are not yet available. An Arcview application to enable querying of formation tops is in preparation and should be operational by the summer of 2002.

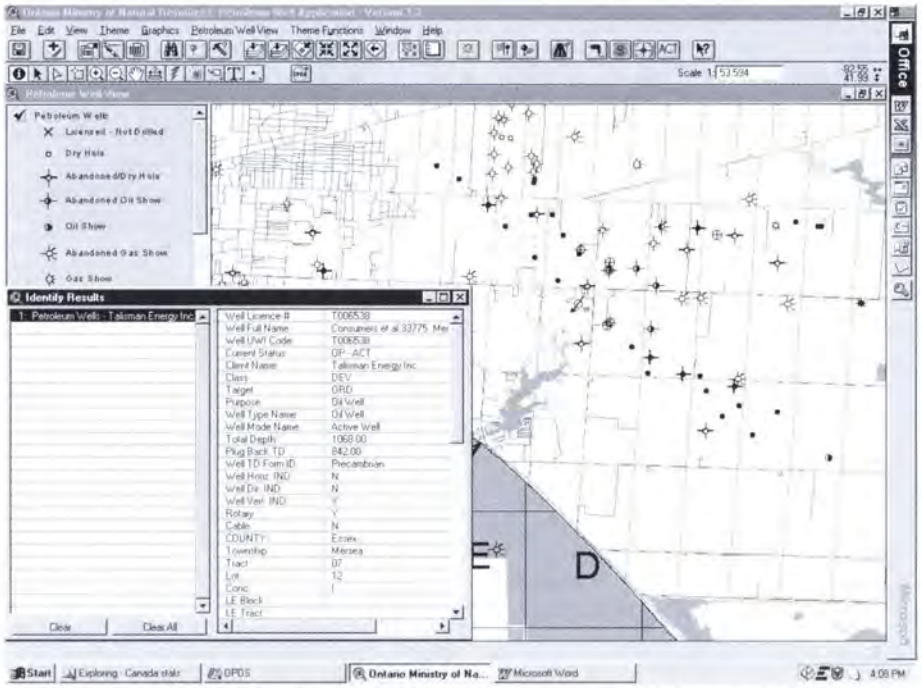


Figure 4: Screenshot from Petroleum GIS showing example of attribute data available for query and display.

Well locations are recorded in OPDS in two ways. In onshore locations in Southern Ontario, the land has been surveyed into townships, lots and concessions. When new wells are licensed, the operator of the well is required to provide a location plan that describes the exact location of the well in relation to the nearest corner of the township lot within which it is located, and the ground elevation of the well site above mean sea level. Measurements are required to be accurate to the nearest tenth of a metre. Since 1997, well operators have also been required to provide geographic coordinates (latitude and longitude) of the well location, measured and reported to the nearest one-hundredth of a second. These co-ordinates are recorded in OPDS in decimal degrees to six decimal places of accuracy, and are then used by the Petroleum GIS application to plot the well location. Conversely, for wells with no geographic coordinates but with known locations relative to township lot lines, the Petroleum GIS can be used as a tool to determine latitude and longitude co-ordinates. Co-ordinates determined in this way have an accuracy of a tenth of a second.

All geographic co-ordinates of existing wells are currently recorded in the NAD27 co-ordinate system. Version 2.0 of the Provincial Standards, which was released in the spring of 2002, requires that all proposed new wells report co-ordinates in the NAD83 co-ordinate system. All NAD 27 co-ordinates in OPDS will be converted to their NAD83 equivalents.

Data Access

The principal public source of Ontario well data is the Oil, Gas and Salt Resources Library. The Ontario Oil, Gas and Salt Resources Corporation signed a resale licence agreement with the Ministry of Natural Resources on October 31, 2000, authorizing the corporation to sell and market data and value-added data products of the Petroleum Resources Centre through the OGSR Library. The licensed material includes print products such as the Provincial Standards, oil and gas papers, well cards, and well location maps, as well as digital well data and data products as they become available.

Basic well data for Essex and Kent counties, including corrected geographic co-ordinates, was made available for free download from the OGSR Library web site at www.ogsrlibrary.com in the spring of 2002. Information available includes: well name; well license number; location; geographic co-ordinates; operator; well type and mode; well classification; geological target; total depth; licence issue date; drill start date; drilling to date; plugging date; drill core number; and pool name.

Future data releases will be on a county-by-county basis dependent on the status of data editing. Access to the database using the Petroleum GIS will be available on a workstation connected to the MNR network. Alternatively, library staff can be contracted to perform custom queries for clients and provide the results as maps, spreadsheets, or database files. At a later date, clients will also be able to purchase data on geological formation top picks; oil, gas and water intervals; and oil and gas production data. Data format and media are yet to be determined.

For information on data access, clients should contact the Oil, Gas and Salt Resources Library, 669 Exeter Road, London, ON N6E 1L3, tel.: 519-686-2772, fax: 519-686-7225, e-mail: ogsrlibrary@odyssey.com, web site: www.ogsrlibrary.com.

Basic well data will also be available free of charge on the Land Information Ontario (LIO) web site of the Ministry of Natural Resources at www.lio.mnr.gov.on.ca. Target date for posting of this data is the autumn of 2002.

NRVIS, LIO and Data Partnerships

The Natural Resources Values and Information System (NRVIS) is a general-purpose system used internally by MNR for managing its geographic information — both spatial and tabular — that supports the major business activities of MNR. The system is developed by the Science and Information Resources Division of the MNR to meet the need within the Ministry for data standardization, maintenance, integration, access, and sharing. More than 600 data types are maintained in NRVIS. Base data, such as roads, streams, water bodies, and township lots, are derived from the Ontario base maps. These base maps have been spliced to form a seamless coverage of the entire province. This spatial data is stored and managed by an ArcStorm database management system. Attribute data on geographic features, such as petroleum wells, is stored and managed by an Oracle database management system. GIS capabilities are provided by ArcInfo. A simplified custom GIS application, known as NRVIS Lite, uses ArcView to provide casual users with a simpler and cheaper means to query and view data. NRVIS is currently under development to a new technology platform. ARCSDE will replace Arcstorm as the spatial data management system, and the application will be served to users through a web browser over the Intranet. Significant improvements in speed and ease of use are expected from this development.

NRVIS is being developed and implemented within MNR in phases. In Phase 1, most of the source data for NRVIS was created and maintained in stand-alone databases in 26 district offices scattered around the province. Phase 2 consists of a single provincial data warehouse synchronized with local databases, such as OPDS. It will also accommodate data classes from and for other Ministries. The data warehouse will be updated from the local databases and will be the primary source of data exports from MNR and a major centre for Land Information Ontario (LIO) data and data access.

LIO is a three-year corporate restructuring initiative of the Ontario government, with the MNR as the lead Ministry. Its objective is to provide information resource management on a provincial scale to ensure that Ontario's land information is managed, accessible, can be integrated, and is affordable. Its initial function is to act as a batch-data distribution hub with free public Internet viewing of non-confidential spatial and attribute data.

The LIO Internet browser is operational and can be accessed at www.lio.mnr.gov.on.ca. Well data is currently limited to basic well locations. The data model has recently been upgraded to accommodate a much broader range of attribute data and should be operational by the summer of 2002. Security levels control data access, therefore not all data can be

viewed by all users.

Data partnerships are one of the defining principles of LIO. These partners may include: other governments at the federal, provincial and municipal levels; other public agencies, utilities, resource users and managers (for example, petroleum industry); and researchers. Staff of the OGSR Library have the same privileges as staff of the Petroleum Resources Centre. The OOGSRC is currently negotiating a data exchange agreement with the MNR. In exchange for sharing non-confidential data from OPDS with other MNR data partners, petroleum industry clients would have access to the NRVIS base-map data and data from other data partners, such as water well data from the Ministry of Environment. To access data, industry clients would have to be paid members of the OGSR Library. Details are yet to be finalized and will be announced on the library web site at www.ogsrlibrary.com, and in the OPI newsletter.

Summary

The Ontario Petroleum Data System is the result of a process that began in 1964, and has involved the efforts of a large number of people. After nearly three years of redevelopment, public access to OPDS data for Essex and Kent counties is now available. Clients will be able to use the Petroleum GIS at the OGSR Library to perform spatial queries and produce reports and maps. Access to additional data will be available on a county-by-county basis as data editing proceeds. This would not have been possible without the funding provided by the petroleum industry of Ontario through the Oil, Gas and Salt Resources Trust.

As electronic data services continue to improve the demand for accurate, high-quality data products is expected to increase and operators are encouraged to exercise diligence in filing their regulatory reports completely and on time.

$1,500. These members have unlimited access to files and samples during operating hours (excluding confidential files). They can also benefit from free digital base maps, and reduced rates for copying data.

The Library is also accessible to daily users who pay a daily or weekly rate. The rate for daily users depends on time spent in the facility and the resources that they use.

The file and sample storage areas are primarily self-serve, however staff members are available if help is required.

Requests for information

Requests for data may be received by the OGSR Library staff via phone, fax, e-mail or through our web site. Service fees are based on research time and reproduction costs. Shipping and handling fees may apply on some products.

LIBRARY FEES

Library fees are based on a member/non-member structure. A copy of the fee schedule can be found on our web site or by contacting staff at the OGSR Library.

The coffee and tea are on. We welcome all members and non-members who are interested in obtaining data from the wealth of information and research material available on the premises.

But just remember: when you come in the front door, please mind the rocks. CLA

For more information, please contact:
OGSR Library
669 Exeter Rd.
London, Ontario, N6E 1C3
Tel.: (519) 686-2772
E-mail: ogsrlibrary@odyssey.on.ca

Oil and Gas Exploration and Development Activity in Ontario in 2001

BY T.R. CARTER
SUBSURFACE GEOLOGIST
PETROLEUM RESOURCES CENTRE, ONTARIO MNR

OIL AND GAS drilling activity continued at the strong levels established in 2000, spurred by record natural gas prices, higher-than-average oil prices early in the year and record production revenues for the previous year. In 2000, Ontario producers received $65.6-million for crude oil shipments and an estimated $102-million for natural gas produced in the province, compared to $44-million and $60-million respectively in 1999. Prices moderated considerably late in the year due to high natural gas storage levels in North America and a very mild winter in 2001-2002.

NATURAL GAS[1]

Natural gas prices soared in January 2001 due to low natural gas storage inventories, high world crude oil prices, high gas demand for power generation, low gas drilling in previous years, and a much colder winter over 2000-2001. January 2001 saw natural gas commodity prices peaking at $13.78 Cdn/Gigajoule (AECO storage hub), an increase of 63% from December 2000. Due to a recession in the U.S. and world economies, and the events of September 11, commodity prices spiraled downward during the remainder of the year, with a December average of $3.39 Cdn/GJ. Despite the downward trend of natural gas prices, the average price in 2001 increased to $5.91/GJ from $4.81/GJ in 2000, an increase of 23%.

CRUDE OIL[2]

Crude oil prices averaged around US$26 per barrel during 2001 (WTI NYMEX), down from an average of US$30 per barrel in 2000. Crude prices dropped as low as US$18 per barrel in early December 2001. Demand for petroleum products and crude oil declined in 2001 as the world economy slid into recession. The overall decline in demand put downward pressure on crude oil prices. The downturn in commercial air travel, created by September 11 events, depressed prices even further. OPEC made several production cuts throughout the year to alleviate the low prices. As with natural gas, crude oil prices were elevated in the first quarter of 2001 due to cold winter temperatures in North America. A warmer-than-average summer, extending into a warmer-than-average winter, resulted in very little upward pressure on crude oil prices at year-end 2001. Canadian pricing was further depressed by a sliding Canadian dollar. Crude oil prices in Ontario were on average 9.8% higher than in Alberta ($43.03 versus $39.21).

EXPLORATION ACTIVITY

Oil and gas drilling activity in Ontario during 2001 remained at high levels as commodity prices for natural gas and crude oil fuelled exploration and development activity. A total of 142 licences to drill and operate new wells were issued by the Ministry of Natural Resources in 2001, compared to 118 in 2000. At the time of writing, drilling was reported to be complete at 117 wells consisting of 37 exploratory wells, 77 development wells, two service wells and one observation well. Horizontal drilling accounted for 36 of the 118 wells drilled in 2001, continuing the increasing popularity of this technology. The

2001 exploratory drilling resulted in 16 wells reported as gas producers and three wells reported as oil producers. Development drilling was very successful with 19 wells reported to be oil producers and 46 as gas producers. Most of the successful oil wells were completed in Ordovician targets, while completions in Silurian sandstone reservoirs dominated the gas-producing wells. Talisman Energy Inc. was the most active exploration company in Ontario's petroleum industry in 2001, with 36 wells drilled. As in previous years, Talisman focused its efforts on the Ordovician oil play and on natural gas pools in Silurian sandstone and reef targets beneath the waters of Lake Erie. Greentree Gas & Oil Ltd. finished the year with 20 wells drilled, all in the Silurian sandstone play in Norfolk County.

Ordovician Play: Drilling was reported to be complete at nine exploratory wells and 19 development wells testing Ordovician targets in 2001. Three of the Ordovician exploratory wells were reported to be completed as oil producers in important discoveries that continue the dominance of the Ordovician as the premier oil play in Ontario. Two of these wells were horizontal wells drilled from onshore locations beneath the waters of Lake Erie. TLM No.1 (Horiz.#1) Romney 8-194-TRS is a new pool discovery. TLM No.2 (Horiz.#1) Romney 5-203-I was also completed as an oil producer in what may be a new pool discovery or an offshore extension of the Romney 5-15-I oil pool. TLM No.1 (Horiz.#1) Tilbury West 3-2-X was completed as a new oil pool discovery on a strike extension of the fault structure that hosts the prolific Rochester oil pools. The Ordovician development drilling resulted in 15 new oil producers and one gas producer, with two wells still under evaluation. Successful oil wells were completed in the Hillman, Mersea 1-16-I, Mersea 5-20-A, Mersea 3-6-V (Wigle), Gosfield North 2-21-VI, Mersea 3-4-IV, Romney 3-8-II, Romney 5-15-I, and Lake Erie Romney 203-I pools. All of these wells were drilled by Talisman Energy Inc. One gas well was completed in the Blenheim 8-13-IX pool by Shiningbank Energy Ltd.

Cambrian Play: Eight wells were drilled to test the Cambrian in 2001; six exploratory and two development. Two development and three exploratory wells were drilled to test for extensions to the Innerkip gas pool. All five wells were completed as gas producers. Talisman Energy drilled three deep Ordovician tests in eastern Lake Erie in 2001. Two of these wells reached the target formations, but did not encounter commercial quantities of hydrocarbons. Drilling of the third well has been suspended prior to reaching the target formation. Drilling is planned to resume in 2002.

Silurian Reef Play: There were seven exploratory tests of Silurian Guelph-Salina reef targets in 2001. Range-St. Clair et al No.1 Enniskillen 4-18-III was reported to have encountered oil and natural gas and was reported as a potential producer. If completed for production this would be a new pool discovery. The remaining wells were all plugged and abandoned.

There were 20 development tests of Silurian Guelph-Salina reefs in 2001. Ten wells were drilled offshore Lake Erie by Talisman Energy Inc. to develop natural gas reservoirs in the Morpeth and Silver Creek platform reefs. All of these wells were either completed for production or reported as potential gas producers. In onshore activity, Clearwood Resources Inc. drilled two wells on pinnacle reefs in Huron County, completing one gas well in the Hay 5-12-XV gas pool and reporting the other as a potential gas producer in the Dashwood pool. The Consumers' Gas Company completed three wells as oil producers in the Corunna and Seckerton North pools and Range Petroleum Corp. completed an oil well in the Courtright reef complex.

Silurian Sandstone Play: There was a major rejuvenation of interest in Silurian sandstone targets in 2001, as high natural gas prices improved the economics of this low-volume, gas-dominated play. A total of 13 exploratory and 35 development wells tested Lower Silurian sandstone targets in 2001. All 13 exploratory wells were reported to be gas producers or potential gas producers. Eight of these wells were drilled by Echo Energy Inc. in exploratory delineation of the boundary of the new Bayham 4-16-I gas pool. GGOL #40 Houghton 8-20-I and GGOL #37 Houghton 3-15-II were both exploratory extensions of the Houghton 7-17-II gas pool.

GGOL #41 is a new pool discovery near the pinch-out edge of the Thorold and Grimsby sandstones in Middleton Township. Metalore 90 North Walsingham 1-21-VII is a successful exploratory extension of the extensive Norfolk gas field. Visser #1 Wainfleet 3-11-V was a successful exploratory extension of the Welland gas field. Thirty-one development wells were reported as gas producers or potential gas producers. Successful wells were drilled in five different pools: South Walsingham 5-6-VI, Bayham 4-16-I, Lincoln, Houghton 8-2-VIII and Houghton 2-13-I. Greentree Gas & Oil was the most active company in the play, accounting for 13 of the new gas wells. Successful wells were also completed by Founder Resources, Metalore Resources, NRG Corp., and Echo Energy Inc. Six other wells were completed as private gas wells in parts of the Welland and Haldimand gas fields. Four wells were plugged and abandoned with no production.

Devonian Play: Only one exploratory well and one development well were drilled to test Devonian targets in 2001. Both wells were abandoned. Two wells for disposal of oil field fluids were completed in Devonian strata in 2001.

Production

Production numbers of oil and natural gas are not yet finalized as submissions are still being received. To date, natural gas production reported is 378,083,103m^3 (1,332 wells) and oil production reported is 256,176 m^3 (1,257 wells).

Recommendations for Exploration

Ordovician reservoirs are still the focus of exploration directed at discovery of new oil reservoirs. Reservoirs located in near-shore locations on Crown land beneath Lake Erie have become very attractive targets in the past two years. Essex County and southern Kent County are still the most attractive onshore locations. Most of the wells drilled in this play utilize horizontal drilling technology.

Considerable untested natural gas potential still remains in Lake Erie and parts of the onshore portions of Haldimand, Norfolk, and Welland counties. If natural gas prices remain high, the economics of all the gas plays in Ontario are greatly enhanced, in particular for those plays in the Lower Silurian sandstone both onshore and offshore, and the platform reef play offshore Lake Erie. The potential exists for discovery of Cambrian gas or oil pools along the pinch-out edge of the Cambrian sandstone in the subsurface, or in fault-controlled structures. Silurian pinnacle and incipient reefs in Lambton County are also gas-prone and have the additional advantage of potential conversion to natural gas storage.

[1] *Natural Resources Canada, Natural Gas Market Update (www.nrcan.gc.ca)*

[2] *Natural Resources Canada, Oil Division (www.nrcan.gc.ca)*

[3] *Fuel Facts Price Monitoring, Ontario Edition, vol.2, issue 24, Dec.18, 2001 (www.mjervin.com)*

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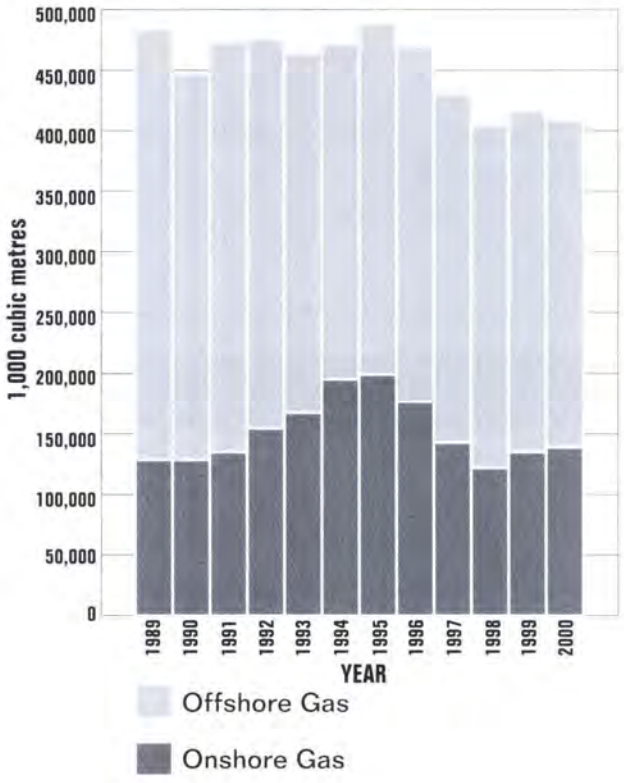
Annual/Cumulative Lake Erie Natural Gas Production

Year	Number of Active Wells	Annual Production (10^3 m^3)	Average Production/Well (10^3 m^3)	Cumulative Production (10^3 m^3)
1957				
1958				981,592.7
1959				
1960	127	102,021.4	803.3	1,083,614.1
1961	145	92,750.8	639.7	1,176,364.8
1962	172	87,687.6	509.8	1,264,052.5
1963	168	100,090.7	595.8	1,364,143.1
1964	196	97,954.7	499.8	1,462,097.8
1965	225	105,758.6	470.0	1,567,856.4
1966	228	125,980.1	552.5	1,693,836.5
1967	200	117,186.6	585.9	1,811,023.1
1968	222	103,471.6	466.1	1,914,494.7
1969	223	117,103.9	525.1	2,031,598.7
1970	250	144,800.2	579.2	2,176,398.8
1971	268	143,558.8	535.7	2,319,957.6
1972	272	175,858.4	646.5	2,495,816.0
1973	285	181,161.6	635.7	2,676,977.6
1974	291	151,038.1	519.0	2,828,015.7
1975	272	160,309.0	589.4	2,988,324.7
1976	279	80,587.0	288.8	3,068,911.7
1977	320	157,891.5	493.4	3,226,803.2
1978	328	212,634.5	648.3	3,439,437.7
1979	344	213,870.3	621.7	3,653,308.0
1980	376	272,426.3	724.5	3,925,734.3
1981	474	324,283.3	684.1	4,250,017.6
1982	444	353,013.6	795.1	4,603,031.2
1983	527	383,651.0	728.0	4,986,682.2
1984	585	407,790.0	697.1	5,394,472.2
1985	610	430,784.8	706.2	5,825,257.0
1986	622	398,031.1	639.9	6,223,288.1
1987	601	389,998.9	648.9	6,613,287.0
1988	628	383,571.8	610.8	6,996,858.8
1989	612	357,289.5	583.8	7,354,148.3
1990	456	324,421.3	711.5	7,678,569.6
1991	503	343,385.3	682.7	8,021,954.9
1992	511	323,477.5	633.0	8,345,432.4
1993	489	300,024.7	613.5	8,645,457.1
1994	538	284,697.1	529.2	8,930,154.2
1995	554	291,474.3	526.1	9,221,628.5
1996	582	302,683.6	520.1	9,524,312.1
1997	551	288,255.4	523.1	9,812,567.5
1998	553	281,939.1	509.8	10,094,506.6
1999	517	285,444.5	552.1	10,379,951.1
2000	631	279,371.2	548.9	10,659,322.3

Natural Gas Production, 1989-2000



Top Producing Natural Gas Pools, 1989-2000

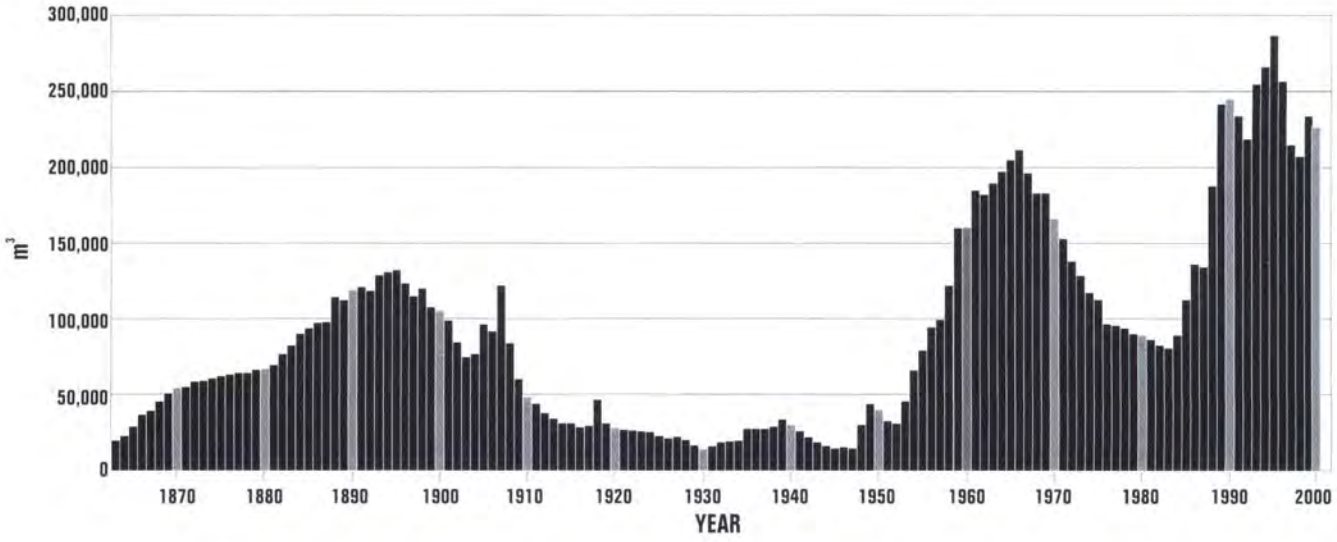
County Produced	Pool Name	Geological Age	Natural Gas 10^3 m^3
Lake Erie	Maitland	Silurian Clinton/Cataract	2,261,930
Lake Erie	Port Stanley (Silver Creek/Clear Creek)	Silurian Salina/Guelph	2,190,847
Lake Erie	Morpeth	Silurian Salina/Guelph	1,864,046
Oxford	Innerkip	Cambrian	606,846
Lake Erie	Nanticoke (Dover+Selkirk)	Silurian Clinton/Cataract	578,121
Lambton	Moore 3-21-XII	Silurian Salina/Guelph	466,794
Norfolk	Norfolk	Silurian Clinton/Cataract	390,728
Kent	Dover 7-5-V E	Ordovician	232,804
Lambton	Dawn 1-27-VI	Silurian Salina/Guelph	199,251
Lake Erie	Tilbury	Silurian Salina/Guelph	162,167
Lake Erie	Port Alma (D'Clute + Tilbury)	Silurian Salina/Guelph	127,320
Lambton	Sarnia 1-8-A	Silurian Salina/Guelph	87,429
Kent	Tilbury	Silurian Salina/Guelph	73,991
Lambton	Oil Springs East	Silurian Salina/Guelph	72,965
Lambton	Coveny	Silurian Salina/Guelph	54,233
Lambton	Oil City	Silurian Salina/Guelph	51,245
Kent	Zone	Silurian Salina/Guelph	48,929
Kent	Chatham 7-17-XII	Silurian Salina/Guelph	45,264
Essex	Mersea 6-23-VII	Ordovician	41,545
Norfolk	Venison Creek	Silurian Clinton/Cataract	40,198
Elgin	Townline	Silurian Salina/Guelph	40,196

NATURAL GAS PRODUCTION IN 10^3M^3 BY GEOLOGICAL AGE, 1990-2000

O&G

	COUNTY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL (1990-2000)
SILURIAN CLINTON/CATARACT	Brant	162.8	625.9	170.0	171.7	235.2	0.0	0.0	0.0	0.0	0.0	0.0	1,365.6
	Haldimand	1,243.8	1,675.4	1,593.0	1,142.7	1,017.5	0.0	380.8	341.5	40.0	1,266.1	1,443.0	10,143.8
	Lincoln	197.4	98.7	0.0	25.1	16.2	19.0	23.8	492.8	0.0	0.0	0.0	873.0
	Norfolk	22,052.1	20,402.0	21,065.4	21,265.5	20,012.5	18,951.3	19,825.4	18,253.3	16,690.5	18,302.5	18,808.7	215,629.2
	Welland	777.3	725.3	687.9	55.8	16.7	7.3	21.7	13.2	0.0	0.0	0.0	2,305.2
	Lake Erie	234,172.0	245,509.1	234,055.9	219,528.6	199,169.4	204,598.1	194,228.9	182,513.0	170,765.4	132,422.2	88,420.7	2,105,383.3
	Total Clinton/Cataract	258,605.4	269,036.4	257,572.2	242,189.4	220,467.5	223,575.7	214,480.6	201,613.8	187,495.9	151,990.8	108,672.4	2,335,700.1
	% of Ont production	56.6%	56.3%	53.1%	51.0%	45.5%	45.5%	44.3%	46.4%	45.5%	36.0%	25.9%	46.3%
SILURIAN SALINA/GUELPH	Elgin	2,261.0	2,455.0	1,970.7	2,261.7	2,649.6	2,481.5	3,322.8	2,921.0	3,887.7	3,780.2	3,038.9	31,030.1
	Huron	2,752.2	3,641.2	3,150.7	2,982.9	3,564.6	1,853.9	1,910.5	8,551.2	8,491.3	10,721.4	10,814.9	58,434.8
	Kent	6,466.8	8,124.8	9,154.1	7,860.6	9,551.7	11,717.5	29,315.2	24,587.4	10,320.4	10,403.4	7,881.1	135,383.0
	Lambton	46,723.0	37,714.0	28,486.0	32,182.7	39,121.3	33,283.5	30,224.6	17,147.4	15,211.6	13,672.6	17,351.2	311,117.9
	Middlesex	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.2	275.4	256.2	626.8
	Lake Erie	90,249.3	97,876.2	89,421.6	80,496.1	85,527.7	86,876.2	108,454.7	105,742.4	111,173.7	153,022.3	190,950.5	1,199,790.7
	Total Salina/Guelph	148,452.3	149,811.2	132,183.1	125,784.0	140,414.9	136,212.6	173,227.8	158,949.4	149,179.9	191,875.3	230,292.8	1,736,383.3
	% of Ont production	32.5%	31.4%	27.2%	26.5%	29.0%	27.7%	35.8%	36.5%	36.2%	45.5%	54.8%	34.4%
ORDOVICIAN	Elgin	158.5	70.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.9
	Essex	0.0	0.0	6,303.3	9,171.7	17,267.9	21,773.6	19,762.1	15,185.4	15,966.4	20,442.6	17,211.9	143,084.9
	Halton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.8	0.0	0.0	0.0	155.8
	Kent	26,561.4	33,535.9	43,634.5	27,243.7	22,022.0	21,244.6	19,345.9	16,304.0	14,308.7	17,197.3	21,158.2	262,556.2
	Lambton	928.9	702.2	569.1	2,240.3	2,334.3	1,621.6	1,464.2	1,132.1	1,167.0	833.8	946.7	13,940.2
	Oxford	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,221.8	2,447.1	4,479.9	8,148.8
	Wellington	91.9	566.8	499.1	576.7	523.5	470.1	539.6	490.8	139.6	0.0	4.7	3,902.8
	Total Ordovician	27,740.7	34,875.3	51,006.0	39,232.4	42,147.7	45,109.9	41,111.8	33,268.1	32,803.5	40,920.8	43,801.4	432,017.6
	% of Ont production	6.1%	7.3%	10.5%	8.3%	8.7%	9.2%	8.5%	7.6%	8.0%	9.7%	10.4%	8.6%
CAMBRIAN	Elgin	0.0	0.0	484.1	299.5	0.0	0.0	0.0	90.6	85.8	327.4	146.4	1,433.8
	Kent	0.0	985.0	1,631.2	1,834.1	1,704.3	1,372.4	1,376.4	1,056.8	879.7	0.0	0.0	10,839.9
	Oxford	21,951.7	22,781.3	42,306.9	65,332.3	79,988.3	85,142.8	54,200.7	39,966.8	41,675.4	36,755.0	37,110.4	527,211.6
	Total Cambrian	21,951.7	23,766.3	44,422.2	67,465.9	81,692.6	86,515.2	55,577.1	41,114.2	42,640.9	37,082.4	37,256.8	539,485.3
	% of Ont production	4.8%	5.0%	9.2%	14.2%	16.9%	17.6%	11.5%	9.5%	10.3%	8.8%	8.9%	10.7%
	Total Ontario Production	456,750.1	477,489.2	485,183.5	474,671.7	484,722.7	491,413.4	484,397.3	434,945.5	412,120.2	421,869.3	420,023.4	5,043,586.3

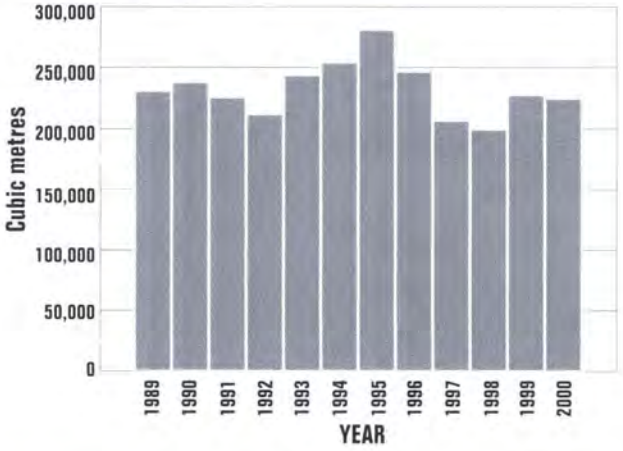
Historical Oil Production 1863 - 2000



Top 15 Oil Producing Pools, 1989-2000

County	Pool Name	Geological Age	Oil Produced m^3
Essex	Mersea 6-23-VII	Ordovician	416,755
Kent	Romney 3-8-II	Ordovician	251,224
Kent	Romney 6-13-III	Ordovician	244,225
Essex	Rochester 1-17-II EBR	Ordovician	227,938
Essex	Hillman	Ordovician	162,618
Kent	Romney 6-13-IV	Ordovician	159,571
Essex	Mersea 3-6-V	Ordovician	140,826
Elgin	Rodney	Devonian	139,594
Kent	Dover 7-5-V E	Ordovician	123,763
Essex	Mersea 3-4-IV	Ordovician	105,894
Essex	Mersea 4-240-STR	Ordovician	89,661
Essex	Rochester 7-17-IV EBR	Ordovician	84,008
Lambton	Corey East	Silurian-Salina	76,373
Lambton	Oil Springs	Devonian	66,004
Kent	Romney 7-10-II	Ordovician	58,865

Oil Production 1989-2000



OIL PRODUCTION BY GEOLOGICAL AGE, 1990-2000

O&G

	COUNTY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL (1990-2000)
DEVONIAN	Elgin	15,886.5	14,892.8	14,651.2	13,612.7	12,551.2	11,623.0	10,790.8	9,871.5	1,732.6	8,521.6	7,544.8	121,678.7
	Kent	1,072.4	1,221.9	993.5	899.9	833.3	955.9	864.2	889.6	994.7	783.9	1,085.6	10,594.9
	Lambton	11,316.3	11,800.4	12,857.0	13,363.0	12,937.2	12,171.7	13,026.8	12,750.7	12,324.8	11,748.4	12,336.6	136,632.9
	Middlesex	30,504.6	29,827.5	29,375.7	28,162.0	26,321.7	24,750.6	24,681.8	23,511.8	15,052.1	21,053.9	20,967.0	274,208.7
	Total	29,389.9	28,871.3	28,938.7	28,018.8	26,321.7	24,750.6	24,681.8	23,511.8	15,052.1	21,053.9	20,967.0	271,557.6
	%	11.9%	12.3%	13.0%	11.0%	10.0%	8.6%	9.6%	10.8%	7.1%	8.8%	9.0%	10.2%
SALINA-GUELPH (SILURIAN)	Essex	37.8											
	Huron	1,472.4	1,700.4	1,316.6	2,027.0	1,442.0	1,525.3	1,515.0	1,144.5	1,191.3	1,352.9	1,408.5	16,095.9
	Kent	983.6	795.9	759.3	645.9	630.7	631.5	425.6	636.0	511.0	584.8	501.1	7,105.4
	Lambton	23,891.5	28,630.1	23,740.5	24,016.0	21,867.4	19,016.5	15,950.7	22,494.4	21,292.4	23,290.5	21,824.7	246,014.7
	Middlesex	85.8	96.1	62.0	69.0	80.0	0	69.5	56.7	0	0	0	519.1
	TOTAL	26,471.1	31,222.5	25,878.4	26,757.9	24,020.1	21,173.3	17,960.8	24,331.6	22,994.7	25,228.2	23,734.0	269,772.6
	%	10.7%	13.3%	11.6%	10.5%	9.1%	7.4%	7.0%	11.2%	10.9%	10.6%	10.2%	10.1%
ORDIVICIAN	Elgin	21.4	33.0	22.0	19.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	127.4
	Essex	82,802.5	91,848.1	99,960.7	132,876.2	155,592.8	165,689.1	144,424.6	116,076.9	115,227.7	127,985.7	104,798.4	1,337,282.7
	Kent	102,169.8	77,700.4	62,200.4	60,949.4	53,226.4	71,590.5	65,662.7	48,925.0	54,399.9	60,712.8	79,454.4	736,991.7
	TOTAL	184,993.7	169,581.5	162,183.1	193,844.6	208,851.2	237,279.6	210,087.3	165,001.9	169,627.6	188,698.5	184,252.7	2,074,401.7
	%	74.6%	72.0%	72.9%	76.2%	79.1%	82.4%	81.6%	76.0%	80.3%	79.2%	79.3%	77.7%
CAMBRIAN	Elgin	4,441.3	3,786.0	3,314.2	3,600.9	3,001.1	2,780.9	2,948.6	2,677.1	2,126.6	1,999.8	2,484.2	33,160.7
	Kent	1,966.7	1,790.5	1,678.1	1,740.9	1,192.6	1,406.0	1,089.6	945.3	851.3	668.3	630.4	13,959.7
	Middlesex	496.5	328.3	323.3	392.9	487.4	595.4	241.0	283.4	229.9	251.5	14.0	3,643.6
	Oxford	65.3	35.0	5.4	14.1	0.0	23.2	385.4	347.6	267.2	266.5	224.0	1,633.7
	TOTAL	6,969.8	5,939.8	5,321.0	5,748.8	4,681.1	4,805.5	4,664.6	4,253.4	3,475.0	3,186.1	3,352.6	52,397.7
	%	2.8%	2.5%	2.4%	2.3%	1.8%	1.7%	1.8%	2.0%	1.6%	1.3%	1.4%	2.0%
	TOTAL PRODUCTION	247,824.5	235,615.1	222,321.2	254,370.1	263,874.1	288,009.0	257,394.5	217,098.7	211,149.4	238,166.7	232,306.3	2,668,129.6

Ontario Petroleum Institute
Membership Application

Please mail completed application and payment to:
Ontario Petroleum Institute Inc.
555 Southdale Road East
London, ON, N6E 1A2 Canada

I am applying for membership in the Ontario Petroleum Institute.

Please check appropriate member category below:

CORPORATE MEMBERSHIP:

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  by special OPI resolution

Member Information

Name

Title/Position

Company

Mailing Address

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Postal Code/Zip Code Country

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- ☐ Drilling Contractor
- ☐ Oil & Gas Field Service & Supply
- ☐ Financial, Insurance, Legal or Accounting Service
- ☐ Leasing & Land Company
- ☐ Consultant (Geological, Geophysical, Petroleum Eng.)
- ☐ Utility
- ☐ Educational
- ☐ Other (specify):

Enclosed is the sum of $_____ being payment of membership fees for the fiscal year starting September 1 and ending August 31. I agree to be governed by the By-Laws of the Ontario Petroleum Institute. GST#104001458

Signed Dated

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