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A firm of high-priced lawyers? No. They're islands built for oil and gas exploration in the Beaufort Sea.

On recent maps of Canada's northern coastline, three mysterious dots have appeared in the Beaufort Sea. These dots, just north of the Mackenzie River delta, represent three tiny new islands, but they are not the result of any upheaval in nature. Rather they are the work of oil in his continual search for new energy deposits. Imperial Oil has built them as drilling platforms from which to search for oil and gas.

This is desolate country. Ice prevails for more than nine months of the year. Temperatures may drop to 70 degrees below in the winter time. It is costly, difficult and even dangerous for men to work under such conditions. Why, then, has Imperial carried the search for petroleum into this frozen sea?

Put the question to Jim Park, Imperial's frontier planning manager, and he readily concedes that 'the normal trend of exploration is to do the accessible areas first.' But the easiest areas in Imperial's 10 million acres of permits in northern Canada have already been explored. Now, the focus must shift to the three million acres of permits that lie offshore.

In warmer parts of the world, most offshore drilling would be done from ships or floating barges anchored over a promising drilling site. But floating barges are useless where the sea is covered with five feet of ice for most of the year, and where ice floes from the north may invade the open water even during the brief summer.

'In the Arctic there aren't enough open-water days for a floating rig -- maybe 80 days in the year,' says Park.

So in 1970, Imperial began the search for drilling methods possibilities. The company looked at steel structures that could be floated into place, but they were rejected as too costly. Ice islands were considered. So was the idea of floating in caissons and filling them with gravel, topped off with cement, for use as drilling platforms.

'But what we ended up with was the island concept, chiefly because of the economics of construction and its natural stability,' says Park.

Man-made islands had the added advantage of being safer and cheaper than the alternatives, at least in shallow water, and in the Beaufort, shallow water extends offshore for miles. Even 25 miles out, the water may be only 60 feet deep.

The Beaufort Sea is already dotted

Adgo, in water only seven feet deep, was the second well drilled from an artificial island in the Beaufort Sea. It discovered oil and gas.
with many natural islands, but nature did not spot them for the convenience of oil companies. Most are not over promising geological structures. Apart from the islands in the Mackenzie Delta, one well has been drilled from a natural island.

Imperial has built three islands so far in its offshore search - Immerk, Adgo and Pullen. Each has been built in a different way as the company seeks the most efficient and economical method of construction.

Immerk was first. Its original design, drawn up by a Vancouver engineering firm, was relatively simple. Gravel would be dredged from the sea bottom less than a mile from the site and piped to the location. There it would be piled up in the water, which was only 10 feet deep.

Imperial spent $9 million building and drilling Immerk, the first artificial island, but the well was abandoned at 8,083 feet because of high pressures.

The building of Pullen Island involved a crew of 50 trucks that worked continuously to bring 80,000 yards of gravel from 67 miles away.

Adgo Island is washing away, as planned. As the silt thaws, the island is gradually eroding into the sea from which it came.
The plan called for 400,000 cubic yards of gravel—enough to cover a football field to a depth of 200 feet. The goal was to create a working platform 300 feet in diameter and 15 feet above the sea’s surface.

Work began in the summer of 1972 with the establishment of a floating work camp for 60 men. But complications developed almost immediately. First, the gravel on the seabed proved to be coarser than tests had indicated, cutting almost in half the rate at which it could be pumped to the site.

Even worse, the weather rebelled. In the Arctic, they talk in terms of 10 or 20-year storms—storms of a ferocity that strike only once in 10 or 20 years. That summer, says Park, there were three or four 20-year storms.

The construction schedule was changed and the rest of that summer was devoted to completing a basic structure just big enough to permit measures of island stability, environmental effects, and ice movements.

When work resumed in the summer of 1973, calculations showed that not enough gravel could be pumped to finish the island before the summer’s end, so a substitute plan was devised. Originally, specifications called for a few beaches which would not be easily eroded. Now, the company decided to substitute steeper, narrower slopes. To keep them from washing away they would be reinforced by layers of plastic mesh and war-surplus anti-submarine netting. That meant less gravel would be needed and completion would be possible by the end of summer. By mid-August, Immerk was ready for the first drilling equipment. About $5 million had been spent on the island’s construction.

The drill began turning in September, with plans to go down to 15,000 feet. But at 8,883 feet the well was abandoned because of high formation pressures. The total cost of Immerk and the well: more than $91 million.

Even before Immerk had been completed, however, Imperial had begun work on its second island, Adgo, experimenting with a different concept. It was late summer and a combination of gravel and silt was being used. The theory, says Gordon Willmon, Imperial’s Frontier operations manager, was that as winter closed in, the silt would freeze, forming a solid base. Located in water only seven feet deep, Adgo was intended for winter drilling only.

“We wanted to build a drilling platform that we could use during the winter when the island was frozen, recognizing it would be washed away by spring breakup and summer wave action,” says Willmon.

Adgo was a rectangular island, 150 feet by 600 feet, surrounded by a gravel-like and protruding three feet above the water. The centre was filled with silt, with a gravel pad in the centre for the drilling rig. Its cost was only $8 million.

When the drilling began from Adgo, Imperial’s luck changed. The company announced on March 13, 1974, that oil and gas had been found. The well was tested and plugged, and the rig was moved to shore over the ice before breakup.

“Our next job will be to find out the extent of the deposit by drilling more wells,” Willmon says.

Adgo is washing away now, as intended. As the silt thaws, the island is gradually disappearing. Permanent islands will be built for the future producing wells, perhaps on Adgo’s site, perhaps elsewhere.

Imperial’s third island, built by still another technique, was prepared for exploration activity last winter. Puffin Island was created in bitter weather and under considerable pressure of time. A ditch-digging machine with the bucket replaced by blades, something like a gigantic chain saw, was used to cut through the five feet of ice covering the sea. When a hole 225 by 375 feet had been opened up, gravel was poured into the 3.5 feet of water welling up into the opening. A convoy of 30 trucks brought 80,000 yards of gravel from a gravel pit 67 miles distant, haulng continuously for a month. When the ice goes out, Puffin will sit eight feet above the water and will be suitable for drilling over the spring/summer period.

Willmon and Park admit that Imperial has been learning a lot about island building as it goes along. For the fourth island, Neterek, to be built this summer, the company will return to the basic design used on Immerk, with some modifications to protect the slopes from erosion, Park says.

Imperial has been gathering information from its three islands through a battery of sensors and monitoring equipment wired into them. These include instruments to measure the ice pressure, slope indicators to check on island movement, monitors to detect settling, and probes to determine the spread of permafrost into the islands.

Some valuable data has been acquired. Park says oceanographic surveys are being carried out to more accurately predict the frequency and strength of wave action on the islands.

Imperial has made application to build a fifth island and will have the capacity of building three a year. Whether the program will proceed at that rate depends on continued exploration incentive: the discovery of petroleum reserves from the test holes and favorable government actions.

‘This whole program is so damn dependent on dry holes and successes,’ Park says.

If a field worth developing is discovered, more permanent islands will be built, but they need not be much bigger than the present ones, Willmon says. A permanent island 300 to 400 feet in diameter—much the same size as Immerk—could be used to drill 15 or 20 wells. The drills would angle to the side, rather than going straight down, so as to cover a larger area. A small field could be drained from one island, says Willmon; a large one might require four or five.

Naturally, the effect of the program on the Arctic environment has been a major concern. Imperial commissioned two environmental and ecological studies in 1972 and 1973 to determine the effects of plucking artificial islands down in the Beaufort Sea. Research has been carried out not only on fish and organisms that live on the ocean floor, but on the white Beluga whales that inhabit the region.

‘The major fear was that the island would interfere with the migration or calving of the whales which the natives depend on for hunting purposes,’ says Park. ‘Nobody had ever studied them properly so we had to do some pretty basic research.’

‘They seem curious,’ says Park. ‘A few of them come close to the equipment and the steady noise of the dredge doesn’t seem to scare them.’

The Belugas are much more fearful of hunters, he says, and will run from any fast boat. Boat traffic is restricted when the 17-foot whales are in the island-building area and federal regulations require observers to watch for them.

The study of 1973 was carried out from June to August, the period when huge blocks of ice, weighing 7 tons apiece, are lifted carefully from the frozen sea by the machine known as a cherry picker.
whale activity and hunting is most intense. Some 3,500 to 4,000 whales were sighted, and 177 animals were taken by the Eskimos, 64 more than the previous year. Although dredging was taking place during the month of July, large groups of whales (200–400) were observed moving past the island during the dredging operations.

The reaction of the local people to the islands has been generally favorable, too, says Park. They have made up about half the work force on the three islands and 'local people are very appreciative of the work done,' he says. In fact, there seems to be a sentiment among the locals that they'd like to see the islands stay after drilling is completed. 'They're convenient to whale or fish from.'

That, however, will be up to the federal government. The government has been involved every step of the way from the initial granting of permits to build the islands, down to the final cleanup after work is completed.

Immerk could last indefinitely with proper maintenance, says Park. For the time being it is being used as a storage platform and equipment base and will probably be used as a landing station for some time. Even if abandoned, it would remain above the water for about 10 years.

The stakes are high for Imperial in the Beaufort Sea. It costs at least twice as much to drill an exploratory well from an island as from onshore. The company needs to hit the jackpot to recover these costs.

'There's no doubt that with the much higher costs we've got to be looking for the bigger prize,' Park says.

It's a drastic change from 1964, the year Imperial obtained the first northern exploration permits. At that time, some oil men couldn't see that it made much difference whether there was oil and gas in the Arctic or not.

'People thought it was crazy,' says Willison. 'Oil and gas prices were such that it would never be economic to develop.

'It doesn't look so crazy now. Since then, Imperial Oil has spent more than $100 million on northern exploration permits. Just last winter, another company followed Imperial's lead by building an offshore exploration island. Immerk, Adgo and Pullen may be only the first of many new dots on maps of the North.'
TIME WAS
The short, bittersweet saga of Canadian clock-making

by Patrick Connon/photos by Barry Dusrley

Despite all this, there were two attempts to mass-produce clocks in Canada, using all-Canadian labor and materials. The Arthur Pequignat Clock Company and The Canada Clock Company. The former was successful and the latter wasn't. In the gap between their products and identifiable American imports lies a long list of clocks that are not exactly one thing or the other.

For instance it was common practice in the 19th century for many Canadian clockmakers with limited production facilities to import the movements for their clocks from the United States and then fit them into Canadian-made cases with suitable decorations like the British coat-of-arms to give them a Canadian flavour. Wealthy citizens of New France had their clocks made locally of pine, using movements imported from France. Often, too, Canadian jewellers not actually engaged in clockmaking would buy clocks from American makers, 'Canadianized' with pasted-on labels that bore the jeweller's

if the current enthusiasm for Canadiana had its own star system, Canadian clocks would be right up near the top alongside pine and bottles and lamps. But clocks are much more scarce.

The chief reason is that they were never produced in substantial volume and consequently weren't as common in their own day as pine and the other collectibles. During the 19th century there didn't seem to be any sense in trying to establish a clock industry here; by the time Canada was beginning to enjoy some sense of national unity, American clockmakers had become acknowledged world leaders in the field. Mass production of clocks had originated in the United States and thousands of American brands were being exported to Canada every year. These clocks were reliable and inexpensive, and Canada was a profitable market for American companies like Avonlea, Sessions, Seth Thomas, New Haven and Waterbury.

This 125-year-old Brantford clock has a case made of cherrywood and birdseye maple

The dial of this 19th Century Quebec clock has maple and butternut wood inlay
name and that of his village or town.

One of Canada's first travelling clock salesmen was Moses Barrett, a genuine eccentric who apparently inspired Judge Thomas Halliburton to create his famous Sam Slick. Barrett was born in Connecticut, the heart of American clockmaking, and later settled in Amherst, Nova Scotia, where he built a profitable clock business. He would fashion the elaborate cases for his clocks during the winter months and use movements imported from the United States. Then, in late spring, he would load his wagon and set out through the Nova Scotia countryside accompanied only by his cat. Not content merely to sell a clock, Barrett invariably had a gooshy tale or a chunk of folksy wisdom for each customer, and he quickly became a welcome annual visitor to the villages on his route.

Connecticut also sent to Canada the five Swiss brothers, who set up a branch plant organization in Montreal in 1821 specializing in grandfather clocks. In order to compete with imported English and Scottish grandfather clocks, they developed a unique method of finishing their cases that was both economical and attractive. Each case was constructed entirely of pine—then in plentiful supply—and meticulously hand-painted to simulate the fine veneers and elaborate marquetry that people expected in a grandfather clock. The effect was startlingly real and it allowed the Swiss brothers to undercut...
their competition substantially. Peter and Doris Unitt, co-author of several Canadian antique price guides, warn that the current value of a Swiss clock diminishes considerably if its original finish is stripped.

During the same period, Joseph Ballanay of Longueuil, and C.J. Arbois, of Quebec City, were turning out clocks with dials sporting floral and geometric designs, sometimes signed by outstanding artists such as Cornelius Knighoff.

The first Canadian factory to mass-produce clocks was the Canada Clock Company, founded in Whitby in 1872 and later renamed The Hamilton Clock Company after moving there in 1875. Under a formerumber sealer named John Collins, the company started manufacturing Canadian versions of popular American clock designs and claimed a monthly production capacity of 5,000 clocks. Whether or not this figure was ever achieved is now a matter of conjecture because there are no existing sales records and the business quietly folded in 1888. These clocks are now extremely rare, a fact that may be a key to the numbers actually produced.

This "looking glass" clock was made in Dundas, Ont., and is marked Upper Canada 1841.

Although the dial reads M. S. Brown and Co., Halifax, the case may have been made in Paris, London or the U.S.

There was a second attempt to mass-produce clocks in Canada, and that was considerably more successful.

Arthur Pequignat (pronounced Pegina), a Swiss immigrant and clockmaker, opened The Arthur Pequignat Clock Company in Berlin (now Waterford), Ontario, in 1904 with an aggressive campaign that appealed directly to Canadian nationalism. His idea was to produce a range of totally Canadian clocks and sell them at prices competitive with American brands. Canadians apparently took to his clocks immediately, because his enterprise flourished until a Second World War brass shortage forced the company to cease in 1941. These days, Pequignat clocks are highly desirable because of their uniquely Canadian quality. Pequignat produced more than 90 different types of clocks, ranging from kitchen clocks to precise railway station timekeepers, but they rarely turn up in antique shops. Perhaps many of them simply haven't emerged from attics or basements yet - or perhaps they've been passed down through families who are now reluctant to part with them.

"Canadian Clocks and Clockmakers" is the only book available to the shopper interested in distinguishing between American, "almost Canadian" and truly Canadian clocks. Written by Edmond Burrows, an Oshawa accountant and clock collector, the book gives brief histories of the important Canadian clock makers and is illustrated with photographs of their clocks.

A Pantheon clock made by Pequignat was apparently modelled after a Greek temple.

Canadian clocks clustered on the wall of the Phillip Museum of Time show similarities of design in their cases.
Shorelines
Montreal-bound oil tankers sail past some interesting places, Samia, Sandwich and thousands of islands.

Of all the world's liquids, which one would you guess has inspired man the most? Forget the wine lists and brandy catalogues. The answer — straight up — is water. That's right, the same colorless stuff that soaks our lawns, cleans our cars, unties our shoes, and wears out our eaves. But get enough of it together to fill a river or lake, and water can also move those who inhabit its shores to levels of creativity, bold thought, and outright curious behavior, the likes of which is rarely seen in land-lubber locales.

It was water, after all, that inspired humanity to such diverse achievements as the marathon swim, the atomic submarine, dog derbies, bikini swim suits, hydroelectric power, concrete canoes and the snorkel. In Canada, we've used our waterways for exploration, confron-
tation, recreation and transportation. Recently, when it became necessary to replace cutout supplies of imported crude oil, large tankers began hauling western Canadian crude oil to eastern refineries. Those places they pass along the route have seen some of the more amazing and amusing moments in Canadian history.

Sarnia: Off from a Rapido's start
In 1836, Sarnia was little more than 44 taxpayers, a few frame houses and two pubs. It was known as The Rapids. Residents wanted a name change, but couldn't make a choice. Sir John Colborne, Government General of Upper Canada, urged them to select something impersonal and significant. Such as? Sir John's 'impersonal' choice was Port Sarnia, after the original Roman name for the Isle of Guernsey — his previous posting.

In the mid-1840's, a Scottish stonemason and builder arrived in Sarnia and became editor of the Lambton Shield, the county's first newspaper. The reformist Shield gave an exuberant roasting to a local Tory cabinet minister who sued for libel and won. It forced the paper to fold. The editor, Alexander Mackenzie, ran for office himself and later became Canada's second prime minister.

When oil was found nearby, Sarnia took to refining. Crude oil was carried from the wells over plank roads. Sometimes it was sealed in barrels and floated log-style down Big Bear Creek to ships in the St. Clair River. North America's first oil pipeline ran between Sarnia and Petrolia, about 12 miles away.

Sarnia's growth as a refining centre made it a logical terminus for later pipelines from Texas and Alberta. It's Alberta crude that is transferred here into tankers for the four-day trip to Montreal.

Windsor: Americans, come on down
Visitors from the U.S. are often surprised to find that in crossing from Detroit into Windsor, they drive south. With car ferries, a suspension bridge

and two tunnels (including an auto tunnel almost a mile long), Windsor is Canada's busiest border community. There are almost as many crossings made here each year as there are people in Canada.

But the border was a lively one long before now. Up until the time of the American Civil War, slaves were smuggled into Windsor via the Underground Railway. In later years, the smuggling operations moved in the opposite direction as Windsor-based rum-runners scooted their wares across the river to an eager market parched by Prohibition.

The Windsor area was first settled by French pioneers who arrived shortly after a fort was established at Detroit in 1701. They laid out their farms in narrow strips along the river, like those on the St. Lawrence. The region first developed as a suburb of Detroit. For example, the town of Sandwich, now part of Windsor, used to be called South Side, in reference to Detroit, farther north.

Sarnia, Windsor, East Windsor and Walkerville were known as the Border Cities until they amalgamated in 1935 under the name of Windsor. Walkerville had been originally named after the distiller who started his business there. For East Windsor the name change was the second in six years. Until 1929, it too had been named for one of its major businesses, Ford.

Amherstburg: Everyone's battleground
Few communities of any size have known such a history of hostility as this little town, 16 miles south of Windsor, near the end of the Detroit River at Lake Erie. Ironically, the first white inhabitants were missionaries on Bois Blanc Island, just offshore from the present townsite. When the Americans took over Detroit in 1796, the British came downstream and built Fort Malden where Amherstburg stands today. Military outposts went up on Bois Blanc Island, and United Empire Loyalists soon quit Detroit for the land around the new fort. Here, in 1812, General Isaac Brock and the celebrated Indian chief Tecumseh plotted their successful invasion of Detroit. But the Americans counterattacked and took over the remains of Fort Malden. The defenders had put it to the torch on their way out.

In 1839, the fortifications of Bois Blanc Island had to be rebuilt once more, this time to guard against supporters of William Lyon Mackenzie. The year before, a rebel schooner, Anne, had fired on the Canadian shore near Amherstburg. But the boat ran aground and her crew was captured by the local militia.

The town even became briefly involved in a completely non-Canadian
conflict. During the U.S. Civil War, a band of Confederate sympathizers climbed aboard the American steamship, Philo Parsons, while it was docked at Amherstburg. Other Confederates got on at Sandwich and the two groups seized control of the vessel.

Fort Malden is now a national historic park and some of the old fort’s original earthworks are still there. But Bois Blanc Island has since become ‘Bob-Lo’ Island Amusement Park. In today’s quieter times, the residents of Amherstburg process tomatoes, manufacture soda ash and work on the Great Lakes boats.

Niagara Falls – honeymoon hotels, Houdini’s hideaway, the Rainbow Bridge. And the magnificent Falls themselves

Point Pelee: 
Ontario’s Deep South

A memorial plaque here records an incident in 1845 in which two steamships on collision course sighted each other in time to avoid collision, but both refused to give way. One ship was damaged, the other sank.

And should anyone believe proximity to water brings out unusual behavior only in homo sapiens, consider some of the goings-on at present-day Point Pelee, the skinny jut of land that shoots out into Lake Erie, six miles south of Leamington. The climate is warm enough here to grow pecans, oranges and cotton. Over 350 varieties of birds, from broad-winged hawk to Carolina wren, pass by on migration or live here.

Point Pelee lies on the same latitude as southern Corsica or northern California. Since 1918, the six-square-mile area has been preserved as a national park. It’s perfectly suited to the purpose, with some 40 miles of beaches and a nature trail that threads through rich stands of red cedar and black walnut.

Welland Canal: 
The Great Lakes great leveller

The present shipping route between Lake Erie and Lake Ontario is the latest of four Welland Canals. The first, completed in 1829, had wooden gates and a maximum depth of eight feet. No less than 40 locks were needed (today’s canal has eight) to make up for the 326½-foot difference in elevation between the lakes.

The second canal progressed to stone locks, some of which can still be seen on the abandoned route near St. Cathar-
In its beginnings, the Welland Canal has evoked strong feeling—not all of it favorable. When the government was asked to provide financial support, William Lyon Mackenzie called the scheme 'a hoax from the start,' claiming that 'Economy and the Welland Canal are as far apart as earth and heaven.' But opinions changed and by 1866 the Welland Canal had become so successful that Fenian raiders considered it a choice target for attack. Their plan was to seize the canal and hold it until Queen Victoria met Fenian demands in Ireland. The scheme, though it failed, served one worthwhile purpose by illustrating how vulnerable the Canadian provinces were to outside attack. This helped encourage a speedier approach to Confederation.

The extensive reforestation along the banks of the canal is more important than it may seem. For while the tree roots help hold the soil together, cutting down on erosion, ecology isn't the only reason they are there. The trees also help screen cross winds, which can slow down travel through the locks.

If you've ever wondered what happened to the original Welland River, it's still there—underground. It runs below the canal in half a dozen concrete tubes.

Niagara Falls: Not easily 'misty'

Had the Dundas Valley not clung up with ice and debris during the Ice Age, Lake Erie might still drain through that route as it once did. Instead, it was forced to push its way through the Niagara River, 10,000 to 12,000 years ago, creating one of the most spectacular sights on earth.

The Niagara Falls suspension bridge, above the start of the Whirlpool Rapids, became almost as big an attraction as the Falls themselves when it opened in 1847. One puzzle for the builders had been to make the initial link across the 700-foot gorge. Inspiration triumphed. A kite-flying contest was announced, with a prize to the first boy who could land his kite on the opposite bank. A New York State youngster, Homan Walsh, pocketed the prize, said to be five dollars, but possibly higher. To Homan's first slender kite string a heavier cord was attached and gingerly drawn across the gorge. Once this connection was made a heavier rope was tied to it and pulled across. The procedure continued until wire cable joined both banks. The bridge, though it has been substan- tially modified, survives today.

Niagara-On-the-Lake: Town with a past

Ontario's oldest community and first capital of Upper Canada sits in picturesque relaxation at the mouth of the Niagara River by Lake Ontario. Since 1792, the town has been variously known as Newark, West Niagara, Lennox, Butlerburg, Oniagara, Niagara, and finally—to avoid mix-ups in the post office—Niagara-on-the-Lake.

Fort George, once the area's main hope for defense, proved sadly inadequate in the War of 1812. When the British withdrew under enemy attack, they demolished the fort. It was partially rebuilt during enemy occupation, but abandoned at the end of the war in favor of the more suitably planned Fort Misi- scouge. Fort George has since been restored.

Niagara-on-the-Lake has switched between prosperity and grim times almost as frequently as it has changed names. It thrived until the routing of the second Welland Canal gave St. Catharines handling access to shipping. Near the end of the last century, Niagara-on-the-Lake flourished once again as a summer resort, linked by rail and electric tramway to other towns, and a regular port of call for lake steamers. But the arrival of the automobile led to the development of other recreational areas, and business waned once more.

Today, Niagara-on-the-Lake is again a popular place for visitors. People come to see the Shaw Festival and Canadian Mime Theatre. But the continuing appeal lies in the town itself. Delightful old buildings have been impeccably preserved and restored, not only as showplaces, but as permanent homes and places of business. In 1909, a land survey revealed that many of the older houses were so close to the street they encroached upon the 66-foot road allowance. Later home owners, building between these older houses, preferred larger front lawns. The result: some of the most charmingly irregular streetscapes to be found.

St. Catharines: Girl Guiding and electric trains

At the eastern end of the Welland Canal sits 'Garden City,' which claims, among other items, North America's first electric streetcar system. Canada's first school of nursing, and first Girl Guide group. Lakeside Park in Port Dalhousie (which is now part of St. Catharines) was once run as an amusement park by the C.N. R. along with the Canadian National Steamship Company, which made regular runs from Hamilton and Toronto. One of the two steamships burned in 1948. The other was sold. But Lakeside Park, now operated by the city, lives on. Near the parking lot sits a small building which was once the Port Dalhousie Gail, which may have been one of the cheerier places in its day: both cells came complete with an open fireplace.

Kingston: Where Dickens took to the pen

At the opposite end of Lake Ontario, a larger prison was built on a wall-treed shoreline west of town. When Charles Dickens visited Kingston in 1842, the efficiency of this penitentiary was one of the few favorable comments he had to make about the city, which was then the capital of the United Province of Cana- da. Two years earlier, a fire had razed 150 of Kingston's buildings. In Dickens' words, 'One half of it appears to be burned down, and the other half not to be built up.'

Kingston was linked to Ottawa by the Rideau Canal at the urging of no less an authority than the Duke of Wellington. The 'Iron Duke,' who had turned his at- tention from Waterloo to waterways, wanted Canada to have a safe route to the east away from the U.S. border. Work on the canal began in 1826.

One of Kingston's more conspicuous early homes was a huge Italian-style limestone mansion built by a prominent food merchant, Charles V. Hales. Mind- ful of its owner's line of business, resi- dents nicknamed the house 'Paxos Pa- goda' and 'Tea Caddy Castle.' When Kingston ran into economic trouble af-
the capital was moved to Montreal. Heles decided to rent the place put to ten-
tants. In 1848, the extravagant trappings attracted an image-conscious young politician, John A. Macdonald, who lived there briefly until setbacks in his legal practice forced him to seek more modest quarters. Bellevue House, as the home was called, was bought by the Federal Government in 1964 as a national historic park.

**Thousand Islands:**
Who's counting anyway?
If you've ever suspected the name is an exaggeration, surprise! It's an understatement. There are about 1,800 islands here, most on the Canadian side of the border. They range in importance from bare rocks peeking through the river to acreages large enough to farm. The islands, which stretch 50 miles along the St. Lawrence between Kingston and Brockville, were the setting for James Fenimore Cooper's novel, The Pathfinder. Although the Thousand Islands have long attracted visitors, few have shown the enthusiasm of George Boldt, once operator of New York's Waldorf-Astoria Hotel. Boldt invested $3 million in a Rhine-style castle on Heart Island near Alexandria Bay. But he died in 1916 before the 11-building complex was completed. The castle has since been abandoned by all except wildlife and curious passersby.

**Upper Canada Village:**
A flood of history
One part of the St. Lawrence Seaway project was to get rid of the Long Sault Rapids, which had always been a serious obstacle to shipping. The solution was to raise the river. This not only buried the rapids, it also wiped out all or part of eight villages; some 6,500 people had to be moved.

One other result was Upper Canada Village, a collection of more than 40 buildings removed from the path of the flood. Each is typical of an early St. Lawrence settlement. Mills, homes, churches, and taverns were carefully relocated and appropriately outfitted for their time between 1785 and 1860. Even the flowers, vegetables and land- scaping were chosen for their historic authenticity.

Oxcarts and bateaux of a bygone age still ply the lanes and narrow canals at Upper Canada Village, while a blacksmith shop, baker, and woolen mill show how skills were practised years ago.

The stages of living standards that a typical pioneer family might have known are demonstrated in the buildings of the village. First requirements were for shelter—any shelter. This usually meant a log shanty, a rough shack representing no more than a few days work, and often without windows or chimney. First priority was to clear land and raise crops. More comfortable log houses would follow, and eventually, perhaps, a 'third-phase' dwelling, such as the fieldstone house preserved at Upper Canada Village. The house has a sophisticated heating arrangement that used stoves instead of fireplaces. A mechanical dumplinger lifts food from basement storage rooms to kitchen.

**Caughnawaga:**
Home of the high-stealers
On the St. Lawrence River's southern shore directly across from Lachine, sits the Caughnawaga (Iroquois) reservation. It began as a Jesuit mission in 1668. By 1732, the Indian population had grown to 900, including 250 warri- ors. Though they fought on the side of the French in the Seven Year's War, the Caughnawaga Iroquois were allies of the British in the War of 1812. And when rebels launched a raid on their community during the Rebellion of 1837-38, the Indians captured their at- tackers. Queen Victoria had gifts sent in appreciation.

Though Caughnawaga Indians excelled as voyageurs and river pilots, they have been demonstrating a much different skill since 1889: high-con- struction work. That was the year a number of them signed on to help build a bridge to Lachine. Their unusual ability to work at great heights was recognized immediately, and soon Caughnawaga Indians were in demand for tall build- ings throughout North America. When the Quebec Bridge collapsed under con- struction in 1907, the tragedy was especially felt in Caughnawaga: 33 tribesmen were killed.

**Montreal:**
Mountain of the River
Just over the bridge from Caughnawaga lies an island, 32 miles long and 10 miles wide. It has over 5,000 residen- tants. North America's only city built around a forested mountain, and one out of every 10 Canadians. After Paris, Montreal's French-speaking population is the largest in the world.

When Jeanne Carrière arrived in 1635, she found the area inhabited by about a thousand Huron Indians who called their settlement Hochelaga. Just over a hundred years later, Paul de Chomedey, sieur de Maisonneuve, built a tiny village on the site and named it Ville Marie.

As governor of Montreal, Maisonneuve administered an effective, if unusual, style of justice. One of the great scandals of the day was revealed in 1660 when a wealthy trader, Jean Audubon, was convicted of improper conduct with the wife of the village's first surgeon: Maisonneuve fined the trader and banished him from the vil- lage. To the erring wife's husband he assigned the right to keep her 'locked up for the rest of her life, or give her back to her father and mother.' The surgeon decided not to give her back, and the marriage survived. Even Audubon was able to return to respectability. He had his banishment revoked and later became a warden of the church.

The nearby Lachine Rapids and Saint Mary's Curtain barred all but the most nimble craft from traveling past Mon- treal up the St. Lawrence. Canals and locks later provided a way through, but they weren't large enough for ocean-going ships. Thus goods were trans- ferred back and forth from vessel to ves- sel and Montreal enjoyed a lively harbor trade.

Though some Montrealers feared the St. Lawrence Seaway would hurt busi- ness in the harbor, port activity in- creased rather than declined. Adding to the traffic this year will be the crude oil tankers, winding up their voyage past some of Canada's most colorful water- front land.

**Montreal, with its futuristic underground city, makes a glittering end to a tanker's trip**

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Upper Canada Village has been so meticulously reconstructed it almost makes our past become our present.
The Energy Crisis That Wasn’t

Last winter’s fuel shortages created problems throughout the world, but Canada remained virtually untouched. How come?

The unimaginable seemed about to happen late in 1973. Canada — a country that produces 2 million barrels of oil per day and uses only 1.8 million — appeared to be on the brink of a petroleum shortage.

How could such a thing happen? How could there be a shortage, particularly when there hadn’t been significant changes in either the rate of consumption or the rate of production?

That’s one of the troubles with statistics: they don’t always give the correct answer. In this case, the real answer is found in geography and economics.

Almost all of Canada’s discovered petroleum is in the West, but the principal markets are in the East. Transporting it from the source to the market — most of it over land — is costly. On the other hand, oil from the Middle East used to be so cheap it could be shipped all the way to Eastern Canada and still cost less than Canadian oil. Consequently, the regions of Canada east of the Ottawa Valley have traditionally imported their crude oil from the Middle East and Venezuela. Ontario refiners may have placated to use the less-costly imported oil, but have been prevented from doing so since 1957, when the federal government decided to reserve the Canadian market west of the Ottawa Valley for Canadian oil in order to stimulate the growth of Western Canadian production. In fact, successive governments actively promoted export sales to the U.S. to provide further incentives in the demand for Canadian oil. Demand grew so steadily and it was not until late 1973 that the industry came close to being able to sell what it was capable of producing. Now the industry is finally producing at near-capacity rates and Canada is exporting what’s left over after meeting its own needs in the market areas served by Canadian oil. On balance, the country is self-sufficient.

However, it’s one thing to be self-sufficient on balance; it’s another thing to be physically self-sufficient. Physical self-sufficiency in the oil industry is a combination of several factors — crude oil supply, transportation facilities to move the crude, refineries and distribution systems. Canada had sufficient crude oil supply, but the transportation facilities — mainly pipelines — stretched only to Port Credit in the east and Vancouver in the west. Refining capacity in Ontario was so tight that concern for last winter’s product supply for that province was being expressed as early as June, 1973.

When some of the Arabian nations began reducing production last fall and imported refined products became scarce, a situation that had been tiged loomed as potentially critical.

Faced with the prospect of a winter without enough fuel oil for several million Canadians, the federal government prudently purchased 1.5 million barrels of heating oil on the inflated international market. It never had to be used.

And so ended the strangest non-emergency that Canadians have probably ever not had to face. Dutch motorists had to make trips into Germany to fill their tanks. Americans spent hours seeking stations with some gas to sell, the Italian government imposed early closing hours on nightclubs and theatres, and British cars waited for gasoline in two-block-long lineups that backed up to Buckingham Palace, but Canadians were making out just fine, thank you. The national crisis, which had loomed so large in November, fizzled into oblivion by spring.

What happened to the crisis?

It was overcome by a combination of good luck and good management. For instance, the one thing that no one could count on was a normal winter. Long-range temperature forecasting is a shaky thing at best, but last fall, when it first became apparent that there could be some shortages, all the signs pointed towards a colder-than-normal winter. So, when the winter turned out to be no worse than usual, fuel oil needs were much lower than anticipated.

There was more to the story than just good weather. Many Canadians took conservation to heart and began driving at lower speeds. Thermostats were set a bit lower than normal, too, and a little petroleum saved here and there by careful individual use added up to a considerable national saving over the winter.

Also, from the moment the potential crisis became apparent, oil companies began building up a backlog of supplies. To avoid regional shortages, contingency plans were made for moving supplies from areas with surpluses.

To offset the shortage of imported crude and refined products in the Atlantic and Quebec regions, Canadian crude oil was supplied by tanker through the Great Lakes and, after freeze-up, through the Panama Canal. This movement is still continuing through the Great Lakes.

And, in the final analysis, more than a little luck was involved. All winter long, refineries were operated at the limits of their capacities — without a single major breakdown. Just one failure in a major refinery could have been critical; it didn’t happen.

The immediate danger passed with the coming of spring and everyone began to breathe easier. Middle Eastern crude supplies returned closer to normal in March. But in general, the Middle East remains a politically volatile area, and nobody can be sure it wants to meet the demands made on its pe-
troleum supplies, even in times of peace. So, in order to reduce dependence on foreign oil, in late 1973 the Federal Government proposed that the interprovincial pipeline be extended to Montreal. This will be a costly measure, justifiable only for the short-term security it provides. Production from Canada's existing western fields won't be able to supply the Montreal market after the early 1980's and the line would not be fully used after that time, unless or until crude oil is available from Canada's northwest frontiers, the tar sands, and other heavy crude oil sources.

More refineries are under construction and some of this additional refining capacity will be ready this year. There may be a necessity again next winter to push the Eastern Canadian refineries to the limits of their capacity but even this necessity will be eased when all the new capacity is on stream in 1975. All the developments, taken together, indicate a less troublesome winter this year than last - barring unforeseen difficulties such as another Middle Eastern embargo combined with bitter winter temperatures.

Which brings us to the end of the good news.

The bad news starts where the good news leaves off - in the existing oil fields of the West. Peak production has almost been reached in the Western fields and will begin to decline soon. The present fields will be unable to meet demand in the early 1980's. They will continue to produce oil for many years after that, but in gradually decreasing amounts.

Estimates by the Geological Survey of Canada suggest that there is an even chance that about 80 billion barrels of oil remain to be discovered in Canada (about six times as much oil as has been found so far in Alberta) but this new oil will be more expensive to find and produce than the Western oil.

One reason is the problem of location. Oil fields developed in the past were located in more-accessible regions; most of Canada's undiscovered reserves of oil and gas are believed to be in fields in the less-accessible frontier regions. Indeed, technology has not yet been developed to permit the industry to explore all areas of potential by drilling, much less to recover the oil. Consequently, a tremendous amount of research will be required even before exploration drilling can begin.

Because of the enormous expense involved, the discoveries must be correspondingly large, at least in the beginning. Small pools, particularly in the frontier regions, cannot be developed economically on their own.

The Geological Survey of Canada estimates there are about 4 billion barrels of oil and 44 trillion cubic feet of natural gas still to be discovered in the Western Canadian basin but, if it is found, it will almost surely be found in small, scattered pools and for these to be developed, the producer's share of the rewards will have to be sufficient to offset the higher costs per barrel of low-volume production.

And the 80 billion barrels of potential reserves is just that - potential. A barrel of petroleum doesn't count for much until it's discovered, developed, produced and transported to market.

Potential reserves are assessed by earth scientists on the basis of the estimated geological characteristics of various regions. Because petroleum was created under special geological conditions millions of years ago, geologists are able to estimate the petroleum potential of a region by investigating its rock formations to see if they were laid down under possible petroleum-creating conditions. Geologists can estimate what total amounts might be found, but they can't tell specifically where the pools are located or the amount of oil that is in each pool. That's the job of the petroleum explorer. And his fortunes depend entirely on whether the area he investigates contains an oil-bearing pool that is economic to produce.

Consequently, the petroleum exploration business is highly speculative. For the few explorers who discover large pools, the rewards can be quite high (and lead to the frequent charge that the profitability of the petroleum industry is excessive). But against these very profitable ventures must be applied the costs of the unsuccessful exploration attempts. For example, in the frontier areas, only one well in eight has discovered significant shows of oil or gas. And risks are not confined to exploration alone. Economic uncertainties - inflation, for example - can be as risky as oil wildcatting, and politically-motivated changes in regulations can turn a potential success into a flop.

The Canadian experience demonstrates the risks of the petroleum business. A very few companies operating in Canada have been significantly successful in exploration. Many more have made only modest returns. And some are still in the red from a cash standpoint. The expectation of being more successful than the others is what keeps exploration going.

Oil company profits have been the principal source of the money needed for exploration and development in the past - last year, for example, Imperial Oil reinvested $124 million of its earnings of $228 million in exploration and development. Continued exploration is essential if Canada's energy needs
The Costs of Energy

The cheapest producible energy in the world today is the oil from the vast pools of the Middle East. In those pools, wells produce at rates 50 to 100 times as great as the Canadian average. With wells so prolific, fewer have to be drilled. For this and other reasons, the investment in facilities needed to produce a barrel of oil per day is very low, about $300.

Canadian oil costs more to produce than that, unfortunately. In the existing fields of the Prairies, it needs between $1,000 and $3,000 of capital investment to add another barrel-per-day of oil production. New oil from the Prairies, because it will come from small fields that are widely scattered, will require investments of between $6,000 and $8,000 per additional daily barrel. Oil from the frontiers — the Arctic and the Atlantic — will require investments of from $5,000 to $8,000. Oil from the tar sands and heavy-oil deposits of Alberta will require investments of $8,000 to $10,000 per daily barrel of production. Energy from gasified coal will require investments of $10,000 to $12,000 per daily barrel equivalent. And from hydro-electric or nuclear sources, the investment required will be the equivalent of $12,000 to $25,000 per daily barrel.

The implication is clear: the days of low-cost energy are gone.

are to be supplied from Canadian sources. The money to pay for these programs will have to come from the earnings of the oil companies or from outside investors. In either case, the companies' performance must be such that they can either generate or attract the money they will need. Therefore, a good earnings record is essential if exploration is to continue.

In the case of the tar sands, where vast amounts of recoverable oil are known to exist, large costs are required for extraction plants. For the tar sands to be developed, the revenues of the developing companies will have to provide an acceptable return on the investment required, and still leave the price of tar-sands crude at a level that is competitive with alternative supplies of energy forms.

Even in currently-producing fields, costs are increasing. As reservoir pressures decline and the amounts of water produced with the oil increase, for example, facilities must be installed to increase the pressure and to remove and safely dispose of produced water.

And so it goes: higher costs and greater risks combine to require proportionately larger revenues if the new petroleum supplies Canada needs so urgently are to be found, developed and brought into production.

For these reasons, the days of cheap energy are gone. But Canadians can take comfort in the knowledge that, given suitable policies, we can be sure of having the petroleum we need.

When Strathcona, Imperial's new Alberta refinery, is finished early in 1975, it will process 140,000 barrels of crude oil daily