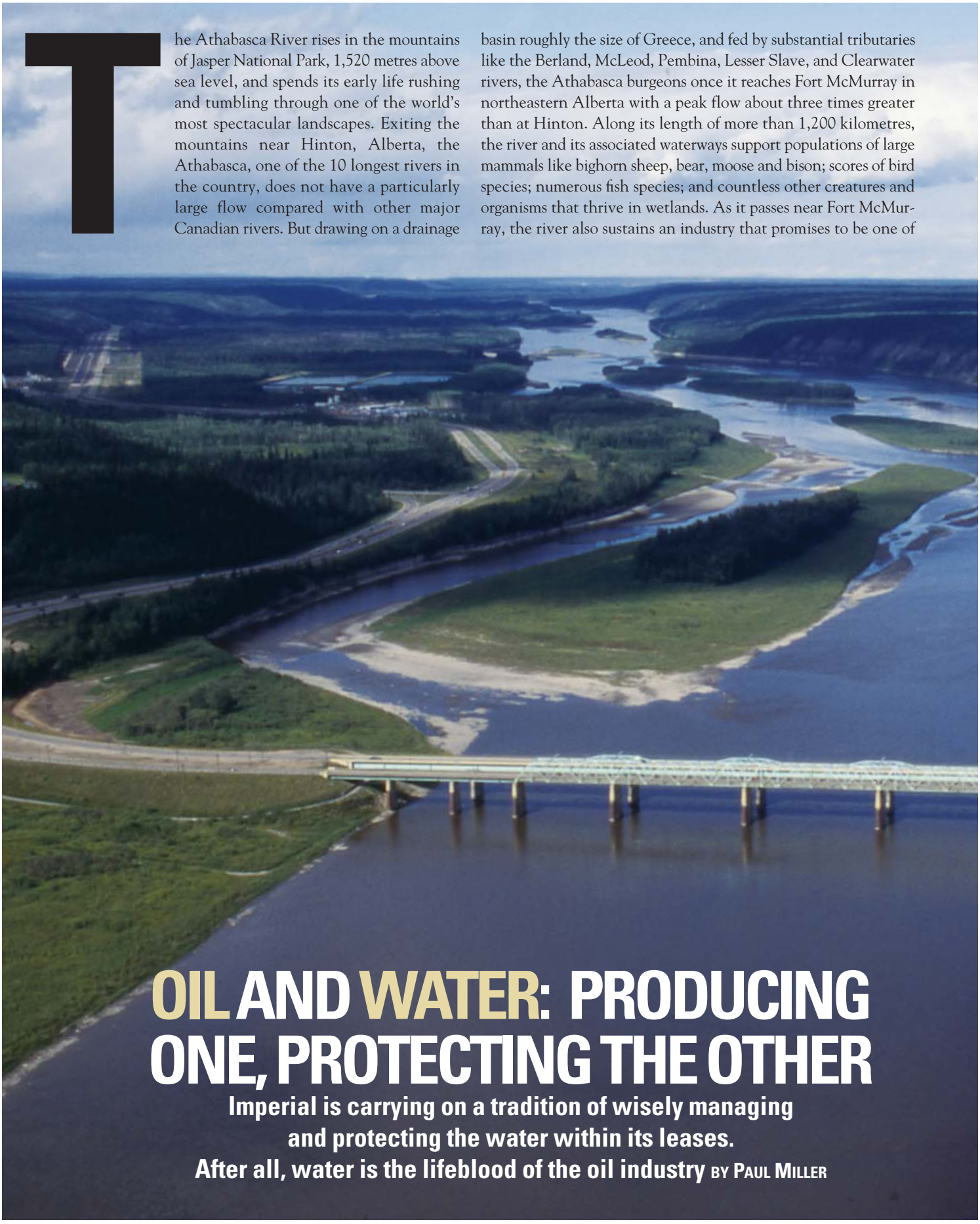


OIL AND WATER: PRODUCING ONE, PROTECTING THE OTHER

Imperial is carrying on a tradition of wisely managing and protecting the water within its leases. After all, water is the lifeblood of the oil industry BY PAUL MILLER

The Athabasca River rises in the mountains of Jasper National Park, 1,520 metres above sea level, and spends its early life rushing and tumbling through one of the world's most spectacular landscapes. Exiting the mountains near Hinton, Alberta, the Athabasca, one of the 10 longest rivers in the country, does not have a particularly large flow compared with other major Canadian rivers. But drawing on a drainage basin roughly the size of Greece, and fed by substantial tributaries like the Berland, McLeod, Pembina, Lesser Slave, and Clearwater rivers, the Athabasca burgeons once it reaches Fort McMurray in northeastern Alberta with a peak flow about three times greater than at Hinton. Along its length of more than 1,200 kilometres, the river and its associated waterways support populations of large mammals like bighorn sheep, bear, moose and bison; scores of bird species; numerous fish species; and countless other creatures and organisms that thrive in wetlands. As it passes near Fort McMurray, the river also sustains an industry that promises to be one of

Canada's best sources of economic growth and energy during the coming century – the Athabasca oil-sands mining industry.

In a world where demand for energy is expected to grow by more than 50 percent during the next quarter century, driven largely by developing nations, Canada occupies an enviable position. Alone among the G7 nations, Canada has the potential to increase production of liquid hydrocarbons in the coming decades and not only meet domestic requirements but supply other markets, continuing a trend that has seen oil and gas exports account for more than half of the country's merchandise trade surplus in recent years.

According to a 2006 report by the National Energy Board (NEB), all of this increase in production will come from the Alberta oil sands. By 2015, output is projected to more than double to three million barrels a day from current levels of just over one million barrels a day, which should more than offset a steady decline in conventional oil production. Achieving this level of growth will require an enormous investment, estimated by the NEB to be in the range of $100 billion between now and 2015, which will create employment opportunities and economic benefits in every region of Canada. Of equal importance, however, this level of

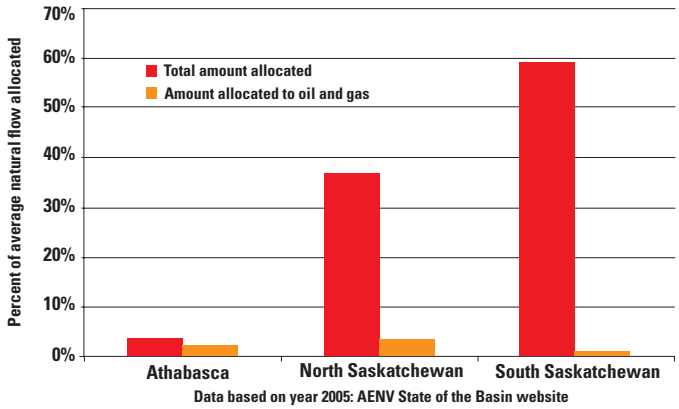
Aerial photo (looking north) of the Highway 63 bridge crossing the Athabasca River, just outside of Fort McMurray.

growth in oil sands production will require reliable supplies of water.

"Water is the lifeblood of the oil sands industry," says Stuart Lunn, a PhD in civil engineering from Queen's University in Kingston, Ont., who is an Imperial Oil specialist on the subject of oil-sands water use and water quality. "Without water, you don't have an oil sands plant. Fortunately, there's more than enough water in the Athabasca River to support the oil sands industry in the Fort McMurray area. The amount of water currently allocated for use by all users in the Athabasca River Basin, including the oil sands industry, is 3.6 percent of the average annual flow. By comparison, about 35 percent of the flow of the North Saskatchewan River, which passes through Edmonton, is allocated for use.

However, as Lunn is quick to point out, the Athabasca is not your average large Canadian river. In fact, it is one of a few major Canadian rivers south of the 60th parallel that have never been dammed. That means water flows in the Athabasca are much more

Allocations as a percentage of natural flow for the Athabasca, North Saskatchewan and South Saskatchewan river basins



Data based on year 2005: AENV State of the Basin website

Taking a core sample in northeastern Alberta.

variable from season to season than they are, for example, in the neighbouring Peace River, which is dammed for hydroelectric power in the mountains of British Columbia. Peak flows in the Athabasca River occur in the early summer, when melting snow and rainfall swell its banks to an average of 1,500 cubic metres a second at Fort McMurray. Existing oil sands operations use five cubic metres a second, with use projected to grow to 11 cubic metres a second by 2011. But the northern Alberta winter locks up flowing water as ice and turns rain into snow, reducing the Athabasca's flow in January and February to a fraction – about one-tenth – of its summer peak.

The existing oil sands industry around Fort McMurray has managed to work within those variations. The Syncrude Canada operation, in which Imperial holds a 25 percent interest, has grown since it began production in 1978 to become not only the largest oil-sands mining operation in the world and Canada's largest single source of crude oil, but also the most efficient facility in oil sands mining in terms of water use.The Syncrude plant now consumes 60 percent less water for each barrel of oil produced than it did in the 1980s. As a result, Syncrude's water requirement translates into just 0.2 percent of the Athabasca's average annual flow, or 1.3 percent of the river's lowest winter flow rate.

"We're still adhering to the same water-withdrawal-licence limit granted to us in the 1970s, when our production was just over a quarter of what it is today," notes Don Thompson, general manager of regulatory and external affairs at Syncrude. "And looking ahead, we don't plan to request an increase in our water limit for the next phases of growth that are under consideration by our owners."

But what about the lengthy lineup of proposed oil-sands mining plants – the roughly $100 billion in new investment the NEB forecasts between now and 2015?

To help ensure that requirements on the Athabasca River are efficiently managed, Imperial has been a prime mover in a cooperative program involving the major oil sands companies operating, or proposing to operate, in the Athabasca area. These companies have committed themselves to a plan aimed at maintaining acceptable flow rates in the river, as set out in a "water management framework" established by Alberta Environment and the federal Department of Fisheries and Oceans.

The plan, which was submitted to two government departments at the beginning of 2007 and signed by representatives from the largest existing and proposed oil sands operators, commits the industry group to develop a detailed cooperative agreement to meet the framework's requirements, which are intended to protect the aquatic ecosystem.

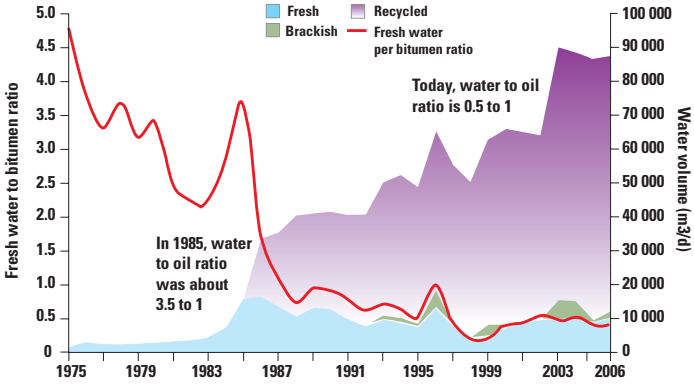
"Every signing company that holds a licence to withdraw water from the Athabasca River has agreed to monitor, take the necessary actions and report on its actual water usage to meet the requirements of the framework during low-water periods," says Eddie Lui, Imperial's vice-president of oil sands development and research, and a signatory to the plan. "The long-established operations at Syncrude and Suncor have agreed to limit withdrawals during those periods to their average rates, rather than the peak amounts they are licensed to withdraw. All other companies will take water from storage, as necessary, to supplement withdrawals from the river and ensure that minimum flow rates will be maintained."

Imperial has a significant interest in the long-term viability of the Athabasca River. In addition to its share of the Syncrude operation, the company holds a 70 percent interest in the proposed Kearl oil-sands mining project, which would be located about 70 kilometres northeast of Fort McMurray and also draw water from the Athabasca River system. The Kearl project was deemed to be in the public interest by the Joint Federal/Provincial Hearing Process in the Fall of 2006, and subsequent approvals from the Alberta Energy and Utilities Board and the Government of Canada were issued in 2007. The project would be developed in stages, with an initial production capacity of about 100,000 barrels a day. Subsequent expansions could increase capacity to about 300,000 barrels a day as early as 2018. The Kearl project would tap 4.6 billion barrels of what are arguably some of the highest-quality remaining bitumen resources in the Athabasca region.

"The research and modeling we've done to date indicate that the water-use requirements of the Kearl project and other developments proposed over the medium term – between now and 2015 – can be accommodated through the application of the principles outlined in our letter," says Lui. "We believe that a combination of increased efficiency of water use, new technology, new water storage and a cooperative effort by the entire industry can result in responsible growth and continued protection of Alberta's vital water resources, including the Athabasca River."

Imperial's history of water use and water protection in the oil sands industry bears him out. In its more than a quarter century of operation, the company's wholly owned bitumen recovery operation at Cold Lake, which supplies about five percent of Canada's total oil production, has become a model for water efficiency in the Canadian oil sands industry.

Cold Lake operation's water use from 1976 to 2006



Stuart Nadeau (left), Imperial's regulatory manager for the Kearl project, discusses the project with Aboriginal elders.

The bitumen deposits at Cold Lake, unlike those in the Athabasca region, are too deeply buried for surface mining. Instead, Imperial has developed and is continuously improving a process whereby large amounts of steam – up to 550,000 barrels a day – are injected into the underground deposits to soften the bitumen so it can be pumped to the surface. When commercial operations began at Cold Lake, about 3.5 barrels of fresh water were used for each barrel of bitumen recovered. By 2006, the freshwater requirement had been reduced by more than 80 percent to about half a barrel of water for each recovered barrel of bitumen.

"Fresh water is basically the last item that we like to call upon for the water needed in our operations," says Sandy Martin, operations manager at Cold Lake. "Our first and largest source is to recycle the water produced along with the bitumen."

The Cold Lake operation recycles more than 95 percent of the water produced with bitumen. Since this water contains levels of minerals and other impurities that would foul the steam-generating boilers, Cold Lake operates one of the world's largest water-softening operations to support this level of recycling.

During periods when recycled water is not sufficient to meet requirements for steam, the company turns to its second choice, brackish water from deep saline aquifers. This water is not fit for human consumption or agricultural use.

The final choice is fresh water either from Cold Lake itself, if water levels in the lake are above a specified level, or groundwater. In terms of absolute volume, however, fresh water is still used more than brackish water as parts of the operation can only run on fresh water.

"Reduced freshwater consumption since start-up of the commercial facilities in the mid-'80s provides confidence that long-term operations will not cause detrimental environmental effects due to freshwater consumption," says Martin.

Another possibility over the long term is that technological developments could fundamentally alter the environmental impacts of oil sands extraction. Imperial is working to turn that possibility into a probability by, among other initiatives, providing $10 million in funding over a five-year period to the Centre for Oil Sands Innovation (COSI) at the University of Alberta in Edmonton. The funds are being used to help recruit more than 50 faculty, graduate students and researchers, encouraging interdisciplinary research and the application of nanotechnology to develop, in part, technology that will use less water in oil sands production.

"One of the two main issues our research is focusing on is the reduction of water use in oil sands mining," says Murray Gray, scientific director for COSI. "This is fundamental research we're undertaking. We're not trying to fine-tune existing processes – we've started with a blank sheet of paper."

Moving the results of COSI's research out of the laboratory and into the field is the job of Ron Myers, a PhD in chemical engineering from McMaster University in Hamilton, Ont., and his team at Imperial's Calgary research centre, one of the leading oil-sands technology facilities in the world.

"COSI's work has already resulted in a couple of very promising leads," says Myers. "Our goal at the Calgary research centre is to take their work and use it as the basis for new oil sands processes which will be ready for scale-up and demonstration within the next two to three years."

While it's unlikely that any of this highly focused effort will result in a commercial-ready technology in time for the first phase of the Kearl project, Myers and others express optimism that new technology will be available for subsequent phases, as well as for possible retrofitting of the initial phase.

"Technological innovation can't be scheduled," says Imperial's Lui. "But with the size and quality of the research effort that's being focused on the issue of oil-sands water use, as well as the industry-wide commitment to a water management framework, I believe that proposed developments in the region can be accommodated, while ensuring the future viability of important waterways such as the Athabasca River." ■