

RETURNING THE LAND

From old refinery sites to oil sands operations, Imperial is committed to reclaiming the lands it has disturbed

By Brian Bergman



Industrial development disturbs land – there is no way around that. But how permanent or complete must such disturbance be? That, in essence, is the reclamation challenge facing any major energy producer. Societal expectations for how disturbed lands should be reclaimed – and how fast – are constantly evolving. Meeting those changing expectations requires a commitment to research and innovation to find the best ways possible of putting back together what has been rent asunder. A bit of humility doesn't hurt, either.

Stuart Nadeau has spent the last five years overseeing environmental management for Imperial Oil's proposed Kearl oil sands project. While reclamation plans for the megaproject are thorough and exacting, Nadeau is candid about the scale of the challenge ahead.

"This is an incredibly complex undertaking," says Nadeau, environmental and regulatory manager for the mining project, which will tap into an estimated 4.6 billion barrels of recoverable bitumen. "We think we've got a comprehensive reclamation plan based on what we know today, but we will have to adapt and change as new practices and technologies emerge."

For a large, integrated energy company like Imperial, the challenge of dealing with disturbed lands has been an ongoing process. In

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any given year, the company’s surplus property management division oversees the closure or renovation of dozens of retail service stations across Canada and rehabilitates those properties so they can be used or sold for other purposes. The same division handles the recovery of abandoned gas plants, terminals and well sites and is currently coordinating the remediation of lands associated with seven former refineries in or near Vancouver, Calgary, Regina, Winnipeg, Toronto and Montreal.

It’s a major undertaking; Imperial spends more than \$170 million annually to rehabilitate surplus properties, including significant investments in new remediation technologies. For example, Calgary-based researchers are currently working on a promising new technology to turn subsoil into high-quality topsoil, a requirement in so many reclamation projects. Left to nature, this process can take thousands of years; research supported by Imperial is looking to reduce that time frame to a decade or less.

Then there is the challenge of reclaiming land, wetlands and well sites at far-flung operations like those near Cold Lake, Alberta, where the company has planted more than 700,000 tree and shrub seedlings since 1998. And with its Kearl oil sands project near Fort McMurray, Alberta, Imperial will become even more immersed in the complex business of oil extraction and then reclaim-

ing land in the sensitive boreal forest.

Imperial is one of several oil sands operators funding leading-edge reclamation research conducted by the Canadian Oil Sands Network for Research and Development (CONRAD). This includes studies into every aspect of improving oil sands reclamation, including revegetation, watershed management and the development of better reclamation materials. “Jointly, the oil sands operators are spending several million dollars a year on basic reclamation research,” says Ron Myers, manager of Imperial’s facilities and environment research group. “The vision is, how can we get to the desired end point faster, more effectively, and still fulfill all stakeholder expectations?”

What follows are snapshots of efforts to meet the reclamation challenge – past, present and future. They demonstrate that both the science and practice of reclamation are very much a work-in-progress. What was deemed acceptable yesterday often falls short of today’s standards, and that dynamic is bound to continue. So while significant strides have been made in recent years, more will always remain to be done.

The unexpected challenges that are part of reclaiming the site of a decommissioned oil refinery

When a petroleum company, like Imperial,

sets out to rehabilitate a former industrial site, it’s prepared to deal with a wide range of issues, including potential contamination of soil and groundwater due to waste spills or disposals. But sometimes an entirely unexpected challenge arises.

Such was the case with the historic IOCO (Imperial Oil Company) refinery lands, part of which front on the Burrard Inlet, a critical waterway running from the Port of Vancouver inland to Port Moody. The IOCO refinery, established in 1915, was originally built to supply fuel to the West Coast. Security concerns (including the possibility of the First World War reaching North America’s shores) contributed to the decision to amass some 260 hectares of land that helped create a buffer around the refinery.

The refinery ceased operation in 1995 and has since been largely demolished. A portion of the original 75-hectare refinery site continues to be used as a distribution terminal.

The refinery lands straddle two jurisdictions – the Village of Anmore and the city of Port Moody. While urban development was sparse when the refinery opened, that has all changed. Imperial has identified more than 80 hectares that could be sold and redeveloped for residential purposes, including a 60-hectare parcel of land within Anmore.

And that's where the unexpected challenge came in. As with any remediation effort, Imperial first conducted an extensive environmental assessment of the area. It found no evidence of refinery waste on the Anmore lands. But interviews with retired employees revealed that a section of land had been used as a skeet shooting range in the 1930s by a local gun club. Subsequent soil analysis showed elevated levels of lead contamination from scattered lead shot. Even though Imperial had no official connection to the gun club, due to obligations under B.C.'s environmental legislation, it became the company's job to clean it up.

That was no easy task. Because the Anmore lands are heavily forested, significant logging was required to get at the soil. Near streams and sensitive habitats, extra care was needed to minimize the removal of trees. Then the top half-metre of soil, containing the lead, was excavated and removed from the site.

Prior to that, a thorough wildlife assessment was conducted. One of the most elaborate precautions had to do with determining whether the Pacific water shrew, an endangered species, occupied the Anmore lands. "We had biologists scrambling over rough terrain for seven days, 24 hours a day," recalls Peter Nicholson, a project manager with Imperial's surplus property management division. "You try to catch the animals in what are called pit traps, which are essentially ice cream pails buried in the creek bank that contain food the water shrews like to eat. They come along and fall into these pails. But you can't allow any of them to perish, so we had to monitor these traps constantly – in an area where bears and the occasional cougar prowl."

As it turned out, there were no Pacific water shrews. But other steps had to be taken to protect local salmon, trout, frogs and nesting birds. A full-time aquatic biologist was hired to oversee the protection of water habitat, and special bridges were erected over the streams to keep habitat disturbances to a minimum.

The reclamation work is now essentially complete and Imperial expects to have it certified as such by the B.C. government in the near future. But Nicholson acknowledges this was hardly a routine operation. "With refinery property, you don't normally deal with such sensitive surface water streams and forests," he says. "We've faced some unusual challenges."



Pilot project will help reclaim in situ well pads at Cold Lake

Nestled in the boreal forest of northeastern Alberta, Imperial's Cold Lake operation has long been an industry pioneer. With more than 4,000 active wells drilled from some 200 multi-well pads, the Cold Lake operation is the largest in situ oil sands operation in the world. Now Cold Lake operation is running a pilot project that could set a new industry standard for reclaiming the well pads used to get at the oil sands deposits buried too deep for conventional mining.

Since the Cold Lake operation's inception in the 1960s, reclamation efforts have focused mainly on land disturbed due to roadway, pipeline and utility corridor construction. About 65 percent of the disturbed land within the 780-square-kilometre operation lease is currently undergoing reclamation, and about 19 percent has been permanently reclaimed (though it cannot be certified as such until the entire lease ceases operation).

Much of the operation's lease area is made up of wetlands that support diverse species and vegetation. Starting in 2006, Imperial established a new monitoring program to survey and protect these wetlands, installing shallow wells to measure water levels and vegetation-monitoring plots to evaluate different plant species.

A complex, long-term challenge for the

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company is the reclamation of the Cold Lake well sites, many of which are situated on sensitive wetlands. In 2008, Imperial launched a trial program in partnership with Ducks Unlimited Canada to evaluate how best to restore one such site. The work includes removing the clay cap and geotextile liner that is placed over a wetland area prior to construction of a new pad.

"This type of well pad is a kind of island on the wetland," explains Hanna Janzen, Imperial's environmental team leader at the Cold Lake operation. "We want to see if we can remove that island in a way that maintains the proper drainage across the site and allows natural vegetation and wildlife habitat to return."

Imperial removed the liner during the winter of 2008 and was pleased to see water returning as anticipated. Environmental team members from Imperial observed the progress of vegetation over the summer and will continue to do so over the next few years.

Ducks Unlimited is providing technical advice for the trial project. Rick Shewchuk, head of wetland protection and restoration for Ducks Unlimited's western boreal program, says the results could have huge implications for future reclamation efforts. "We're definitely talking about leading-edge research here," he says.

The boreal forest covers a third of Cana-

da's land mass and contains one of the highest density of wetlands anywhere in the country. The types of wetlands are also quite unusual, consisting mainly of bogs, fens and water-saturated peat rather than open bodies of water. How these systems interact and how they will be affected by industrial development remains in question.

The current oil sands boom is occurring entirely in the western boreal forest – and that's a concern for conservationists like Shewchuk. "When you remove a bog or a fen that's developed over thousands of years, you can't expect it to come back quickly," he says. "So you are probably looking at changing the matrix and functions of wetlands and there's lots still to be learned about how you do that."

All the same, Shewchuk says he's been impressed in recent years by industry efforts to manage environmental impacts. "Companies are being more proactive about looking for science-based solutions to make their operations more acceptable. There seems to be a higher level and spirit of co-operation to try to find workable solutions."

Oil sands projects, like Syncrude, are expected to progressively reclaim all disturbed land

Syncrude's Don Thompson knows all about the sensitive nature of resource development in the boreal forest. Thompson joined the oil sands consortium (in which Imperial is a 25 percent partner) as an environmental coordinator in 1979 and now serves as Syncrude's general manager of regulatory and external affairs. Over the years, he has seen some major changes in reclamation objectives and techniques.

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A key advance is Syncrude's instrumented watershed program, which tracks the flow of water through the reclaimed areas. The same system ensures nutrients are properly cycled through the watershed.

Syncrude, which spends more than \$30 million a year on reclamation activities, has also learned a lot about how to make better use of the very top few inches of forest soil, home to the seeds, roots and nutrients vital to forest health. In the early days, this topsoil – what Thompson calls "reclamation

gold" – would get scooped up and mixed in with subsoils, diluting much of its value. Now it's carefully stripped from mine sites and used at the surface of reclaimed lands.

A critical challenge for all oil sands mining operations is how to handle the tailings – a mixture of sand, silt, clay, water and residual bitumen – left after bitumen has been extracted from the oil sand. Currently, this by-product is contained in large settling basins. The problem: there is no quick way to get the tailings to settle and dry out into a substance solid enough to support grass, trees and wetlands.

Progress has been made on what's known as consolidated tailings (CT) technology, a method for "thickening" tailings by using gypsum to separate liquids from solids in order to turn the tailings into material with the consistency of soft clay that can be used in reclamation. The next step includes a Syncrude pilot project focused on "dry stacked tailings" – the removal of water without the need for basins – that promises to further enhance the solidifying process. This, in turn, could significantly increase the pace of reclamation.

And that pace is the subject of some public debate. In 2008, a 104-hectare parcel of land known as Gateway Hill on the Syncrude lease became the first area in the oil sands region officially certified as reclaimed



A reclaimed lake at Syncrude



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by the Alberta government (certified land becomes property of the Crown). Many environmental critics were underwhelmed, pointing out that the reclaimed area represented only a tiny fraction of all lands disturbed by oil sands companies over the past four decades.

Thompson finds that criticism misleading. Along with other oil sands producers, Syncrude is required to reclaim all the land it disturbs, which includes the remediation of tailings basins and mine pits. In fact, by 2012, Syncrude will have filled a decommissioned mine pit with CT produced from fine tailings extracted from the Mildred Lake Basin, the largest of its settling ponds. Syncrude has so far permanently reclaimed 22 percent of its original mining area lease, the largest share in the oil sands industry. “We have another 4,500 hectares that are out there growing and will eventually be certified,” says Thompson. “Some of them are quite far along, but it takes time.”

Those lands, he adds, are now being put to productive use. Gateway Hill is home to a 4.5-kilometre hiking trail, while other reclaimed areas support a thriving herd of 300 wood bison. “The point is we are reclaiming as fast as we can,” says Thompson, “and every aspect of reclamation has been improved by research Syncrude helped lead.”

As society’s expectations evolve, reclamation at Imperial’s Kearl oil sands project will adapt

In his downtown Calgary office, Stuart Nadeau leafs through inches-thick binders containing data and maps on Imperial’s proposed Kearl oil sands project. “There’s five years of my life in these books,” says Nadeau with a smile.

Even so, he stresses that everything he is about to describe is at the conceptual stage. At the time we are speaking, the project is still pending final approval by Imperial’s board of directors. But it’s quite an impressive concept – a multi-phased, 50-year mining operation running in tandem with an even longer reclamation program.

Nadeau also stresses that the initial Kearl plan builds on lessons learned by Syncrude and Suncor Energy Inc. during four decades of oil sands mining. It has similarly benefited from research by industry-supported, multi-stakeholder groups like the Cumulative Environmental Management Association (CEMA) and the aforementioned CONRAD. For example, CEMA, which monitors the cumulative effects of oil sands development, has helped facilitate the sharing of information about new reclamation practices and techniques, while CONRAD has been a leader in advancing tailings man-

agement technologies.

And the Kearl plan will continue to evolve. “There are two key words about this reclamation proposal,” says Nadeau. “First, it’s progressive – we want to get in and begin the environmental work earlier. Second, it’s adaptive, which means this plan will change as new technologies and learnings emerge, and as societal expectations about the desired end point of reclamation continue to shift.”

Those expectations have already changed considerably since the 1960s. Consider just one aspect – protection of fish habitat. Kearl will require the removal of 15 streams on the Imperial lease. As part of its reclamation plan, Imperial documented exactly how many fish, and what species, now exist in the affected streams. The regulatory expectation is that every bit of that lost habitat must be replaced on a two-to-one basis.

Since replacing the streams isn’t feasible, Imperial has proposed a “compensation lake.” As streams are removed, extension lakes will be added to the existing Kearl Lake. The fish will be relocated from the streams and taken to their new home. These new lakes will be deeper, enabling more fish to survive winter freeze-up.

Another key feature is the use of “end pit lakes” to progressively cleanse the water on reclaimed lands. The idea is to channel water that has some hydrocarbon contamination through a series of constructed wetlands and lakes to allow biodegradation to occur before the water is discharged back into the natural watershed.

Yet another challenge is that Imperial’s reclamation plan must be closely integrated with the plans of neighbouring operations to ensure viable drainage patterns and wildlife corridors across the region – something Imperial has already done in conjunction with Syncrude and Shell’s Jackpine oil sands mine. “This requires a huge industry-wide effort, including sharing information and reclamation materials,” says Nadeau. “This was unheard of before. But people now realize that, to put things back together, we have to work together.”

Nadeau is confident that over the life of the mine there will be further advances in every aspect of reclamation, including the critical issue of tailings technologies: “Every year, we advance things from a research standpoint. I have every reason to believe that will continue.” ■