

# Tar Sands and Water



GREENPEACE

## WATERSHED ISSUES

Tar sands operations are the largest user of Alberta's groundwater.<sup>1</sup> The natural cycle—rainfall, snow melt and glacial runoff—replenishes the groundwater of underground aquifers, as well as wetlands, lakes and rivers.<sup>2</sup> From the Athabasca River alone, current tar sands projects remove about 370 million cubic metres of water each year, free of charge,<sup>3</sup> nearly twice the annual water use of the City of Calgary,<sup>4</sup> which has a population of almost 1,300,000.<sup>5</sup>

After its industrial use, almost all of this water<sup>6</sup> is contaminated with toxins and must be diverted to tailings ponds, not only depleting freshwater from the Athabasca-Peace-Mackenzie Delta (a World Heritage Site), but removing freshwater from the natural hydrological cycle overall.<sup>7</sup> The degradation and destruction of this finite resource is of special concern, given the predicted scarcity of freshwater that will result from population growth and climate change.<sup>8</sup>

One of North America's longest undammed rivers, and one of its most beautiful, the Athabasca begins in the glaciers of Jasper National Park and flows 1,538 kilometres through the tar sands region to Lake Athabasca in Wood Buffalo National Park.<sup>9</sup>

Water allocations for tar sands production now account for 76 per cent of the water taken from the river each year.<sup>10</sup> When currently planned tar sands projects go ahead, this demand for water will increase by more than 50 per cent. Together, the planned and existing projects are expected to withdraw 529 million cubic metres of water from the Athabasca annually,<sup>11</sup> more water than is used each year by the City of Toronto, which has a population greater than 2,500,000.<sup>12</sup>

Since the 1970s, the total summer flow of the Athabasca River, downstream from the town of Fort McMurray, has declined by nearly one third,<sup>13</sup> making it difficult to use watercraft on this traditional transportation route. In winter, when the water flow is naturally reduced, the Alberta government allows tar sands companies to continue withdrawing water, even when river levels become dangerously low.<sup>14</sup> A river-level drop of even a few centimetres can prevent the spring flooding that is necessary to fill surrounding streams, perched lakes and wetlands,<sup>15</sup> drying up spawning and nursery sites for some of the river's 31 species of fish,<sup>16</sup> and destroying surrounding habitat for other wildlife, such as muskrats and waterfowl,<sup>17</sup> which are also an important food source for the area's First Nations peoples.<sup>18</sup> Under the ice, oxygen levels fall during low winter flows, endangering the eggs and young of fall-spawning fish.<sup>19</sup> Existing and proposed projects will take up to 25 per cent of the river's water during low-flow periods.<sup>20</sup>

Within the larger Athabasca River watershed, the entire Muskeg River watershed,<sup>21</sup> which drains a once-vibrant ecosystem comprising 1,480 square kilometres of wetland, wooded fens and peatlands,<sup>22</sup> will be damaged beyond recovery by both open-pit and in situ tar sands mining operations, according to scientific studies.<sup>23</sup> To date, there have been few attempts at reclamation in this or other tar sands areas.

Water-saving technologies are being developed, but none is expected to reduce water use by tar sands operations before 2030.<sup>24</sup> Although bitumen production is projected to be 3 million barrels per day by 2015 and 5 million barrels per day by 2030,<sup>25</sup> there has been no regional assessment of water availability to determine if the necessary requirements can be met.<sup>26</sup>

### Toxic Tailings Lakes

Hot water and steam are used to extract bitumen from the sand.<sup>27</sup> While a small amount of this water is recycled,<sup>28</sup> the residual wastewater contains tailings – fine clay particles and residues of bitumen as well as salt, naphthenic acids, polycyclic aromatic hydrocarbons (PAHs), heavy metals, cyanide, benzene and other pollutants.<sup>29</sup> Extremely toxic, naphthenic acids in water remain an environmental threat for decades, while PAHs are both carcinogenic and mutagenic.<sup>30</sup>

Ninety per cent of the water used in tar sands operations never returns to the river, but ends up in the toxic lakes that the oil industry calls tailings ponds.<sup>31</sup> Already covering

more than 130 square kilometres<sup>32</sup> along the Athabasca River, these huge "ponds" can be seen from space.<sup>33</sup> By the volume of material used in its mammoth construction, the Syncrude Tailings Dam, which is 22.5 kilometres long, is second only in size to China's Three Gorges Dam, which submerged 13 cities, 140 towns and 326 villages.<sup>34</sup>

The sludge in the ponds is acutely toxic to aquatic life, birds, terrestrial wildlife and humans. Companies use deterrents such as scarecrows, which they call Bit-U-Men, and air cannons to keep birds from landing in these toxic bodies of liquid,<sup>35</sup> but, located along a major flyway, the ponds appear as welcome havens of fresh water, especially to migrating waterfowl. In April 2008, at least 500 ducks died in one incident.<sup>36</sup> Weighed down by the sludge, most birds sink out of sight so quickly, however, that the true number of deaths is difficult to assess.<sup>37</sup> The deaths occurred at Syncrude's Aurora mine site. Nearly a year after the incident, Syncrude announced that 1,600 ducks died. Syncrude has been charged with one count under the Migratory Birds Convention Act and also faces a charge under Section 155 of the Alberta Environmental Protection and Enhancement Act for failing to provide appropriate waterfowl deterrents at the pond at its Aurora North tar sands site in April 2008.

The expectation for renewal of tailings ponds is that the fine clay particles will eventually settle and consolidate,<sup>38</sup> but experts say that could take anywhere from a few decades to up to 1,000 years.<sup>39</sup> There is no proven plan. After more than 40 years, the industry has never demonstrated an ability to renew or reclaim these ponds or deal with this toxic liquid waste.<sup>40</sup> Based on current production, the volume of fine tailings ponds produced by just Suncor and Syncrude are predicted to exceed one billion cubic metres by 2020.<sup>41</sup>

Adding to the danger, the contaminants seep into groundwater, the surrounding soil and the Athabasca River itself.<sup>42</sup> It is estimated that tailings ponds are already leaking more than 11 million litres every day,<sup>43</sup> and it is acknowledged, even by industry, that the damage will be irreversible.<sup>44</sup> The location of ponds alongside the river adds to the risk. People living downstream are seeing deformed fish and animals,<sup>45</sup> and are worried by the rising rate of rare cancers in their communities. Larger-scale failure of the dykes containing these ponds would have more catastrophic consequences from the toxins, which would flow through one of the world's largest freshwater deltas and out into the Arctic Ocean ecosystem.<sup>46</sup>

### In situ drilling operations

At least 80 per cent of tar sands reserves are too deep to mine and must be extracted with in situ techniques, the most dominant of which is steam-assisted gravity drainage (SAGD).<sup>47</sup> Using drilling technology, high-pressure steam is injected into the deposit to heat it and lower the viscosity of the bitumen,<sup>48</sup> allowing the bitumen to flow into a previously drilled well, situated below, from which it is pumped to the surface.<sup>49</sup> In situ extraction requires about a barrel of water to produce each barrel of oil<sup>50</sup>, far more than for conventional oil, with the contaminated wastewater injected into deep aquifers.<sup>51</sup>

To minimize the use of freshwater, almost all in situ projects mix fresh groundwater with saline groundwater from deep aquifers.<sup>52</sup> Using saline groundwater reduces demand on freshwater sources, but treating it before use in the steam generators produces huge volumes of solid waste. In one year, an average SAGD producer can generate 33 million pounds (15 million kilograms) of salts and water-solvent carcinogens, which end up in landfills where they can leach into soil and groundwater, including potable water sources.<sup>53</sup>

A typical SAGD operation occupies an area that is 23 square kilometres; the actual project destroys seven per cent of the land.<sup>54</sup> Tar sands operators would like us to believe that this is the only destruction caused by in situ operations and that they are much less invasive than open-pit mines. SAGD operations are, however, significantly more damaging.<sup>55</sup> They require expansive structures to support their operations; slicing their way through forests and wetlands are thousands of industrial well sites, seismic lines, pipelines and roads that leave the ecosystems fragmented and diminished. The

structures splinter fragile wildlife habitat, resulting in the deaths of woodland caribou, fish, bear, moose and song birds.<sup>56</sup>

Companies that carry out seismic operations are not required to reforest the lines they cut; studies have shown that 88 per cent of lines more than 20 years old still have not regenerated.<sup>57</sup>

The Alberta government has leased more than 37,000 square kilometres of land (and another 48,000 square kilometres await global investors) for in situ projects including SAGD.<sup>58</sup>

## Open-pit mines

The remaining 20 per cent of tar sands reserves are close enough to the surface to be mined with open-pit or strip-mining techniques.

Before the mining starts, waterways are diverted, wetland complexes are drained, the boreal forest is clear cut, a network of roads and pipelines is constructed, and the “overburden” of muskeg, soil and rocks above the deposit is scraped off and hauled away.<sup>59</sup>

In some areas, 100 metres of soil, rocks and vegetation (called “overburden” by industry) are stripped away to reach the tar sands.<sup>60</sup>

In the winter, frozen tar sands may be dynamited to enable excavation.<sup>61</sup> Enormous shovels dig up the tar sands, then transfer their loads to trucks that can transport up to

320 tons apiece. These take the sand to an extraction plant where a hot-water process is used to separate out the bitumen.<sup>62</sup>

About two tons of pit-mined tar sands are needed produce one barrel of oil. To process a single barrel of pit-mined bitumen requires 12 barrels of water; after processing, four of these end up in tailings ponds.<sup>63</sup> The vast open-pit mines may cover 150 square metres and reach 90 metres in depth.<sup>64</sup> To prevent these deep mines from flooding, aquifers underlying the tar sands deposit are further drained, altering the water table.<sup>65</sup>

Surface mining results in irreversible damage to entire watersheds because it is not possible to recreate the ecological diversity and interrelationships of the boreal ecosystem.<sup>66</sup> After 40 years and 420 square kilometres of open-pit mining, only 104 hectares has been certified as reclaimed by the Government of Alberta. International wetland scientists have visited the Muskeg River area and have said the area cannot be reclaimed to its original condition.<sup>67</sup>

Open-pit mines will eventually obliterate 3,496 square kilometres of the existing boreal ecosystem<sup>68</sup> – an area almost three times the size of Rome.<sup>69</sup> The mining will cause destruction of wetlands and peatlands that will be impossible to recreate or reclaim.<sup>70</sup>

Companies have barely even attempted reclamation. Suncor and Syncrude claim to have reclaimed nine per cent and 22 per cent (8.58 square kilometres and 34 square kilometres) of land, respectively, in areas they have mined. But these amounts are insignificant in the face of the total land disturbed by these corporations (about 100 square kilometres and 183 square kilometres, respectively).<sup>71</sup>

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