

A photograph of an industrial facility, likely a refinery or power plant, situated along a body of water. The facility features several tall smokestacks, one of which is emitting a plume of white smoke. In the foreground, there are stacks of materials and a concrete wall. The sky is filled with large, white, fluffy clouds. The text 'Trouble Brewing in the GREAT LAKES' is overlaid on the image, with 'GREAT LAKES' in a larger, bold, yellow font.

# Trouble Brewing in the GREAT LAKES

Issue Brief • January 2014

Unconventional oil and gas development poses a significant threat to the North American Great Lakes, the largest cluster of freshwater lakes in the world.<sup>1</sup> The Lakes, a non-renewable resource, contains roughly 20 percent of the global surface freshwater supply and is home to 10 percent of the U.S. population, 30 percent of Canada's population and various species of flora and fauna, several of which are endangered or threatened.<sup>2</sup>

But the industry, seemingly hard pressed to make North America the leading producer of oil and gas, is putting the integrity of the Great Lakes in danger with the development of Alberta's toxic tar sands oil and intensive energy extraction methods such as hydraulic fracturing.

From the western boreal forests of Alberta, the expansion of tar sands oil is increasing the need for more pipelines and refineries, which could have devastating impacts on the environment, irreplaceable wetlands and habitats, and the communities in the path of the industrialization.<sup>3</sup> Growing interest in shale gas development in the region has made fracking and drilling a threat to the Great Lakes.<sup>4</sup>

## Tar Sands Oil

Based on data from early 2013, there are approximately 26 operational oil refineries in the Great Lakes region,<sup>5</sup> and planned expansion of tar sands refineries could lead to more toxic air pollution in the area.<sup>6</sup>

Refineries (and natural gas processing plants) turn raw extracted fossil fuels into final products for transportation, industrial, commercial or residential use, as well as petrochemicals used for manufacturing.<sup>7</sup> When refining tar sands oil, toxic pollutants — including sulfur dioxide, sulfuric acid, nitrogen oxides and heavy metals — are released, which can impact both air and water quality as well as public health.<sup>8</sup>



Environmental pollution disproportionately affects low-income, minority communities.<sup>9</sup> Described as “sacrifice zones,” these communities often are repeatedly exposed to toxic industrial pollution, including from refineries in economically disadvantaged areas.<sup>10</sup> As described by a Detroit resident living half a mile from a refinery operated by Marathon Petroleum Co.: “The smell, it was like this burning tar, with that benzene and that sulfur. I wanted to scream.”<sup>11</sup> “We actually are lab rats,” explained another resident and cancer survivor who is chronically exposed to the carcinogenic emissions.<sup>12</sup>

State Representative Rashida Tlaib (D-MI) explained that despite promised jobs, “My residents and I feel that jobs can’t fix cancer. It has to be about the fact that this massive refinery is living next to a very poor, minority community in Detroit with no real protection. When my residents hear sirens, they cross their fingers and hope it’s not some sort of huge explosion.”<sup>13</sup>

### **Piping Bitumen**

As refineries multiply, the demand for pipeline infrastructure rises.<sup>14</sup> But with an aging pipeline infrastructure built largely in the 1950s and 1960s, there is concern about pipeline integrity as the production of unconventional tar sand oil increases.<sup>15</sup>

Bitumen, a form of petroleum extracted from tar sands, is a thick, black hydrocarbon that must be diluted so that it can be transported through pipelines, increasingly, to refineries in the Great Lakes and Midwestern regions of North America. Diluted bitumen, dubbed “dilbit” for short, is a corrosive, acidic cocktail, rich in heavy metals, sulfur and sediments that can grate against the insides of a pipeline, increasing wear and tear and possible pipeline failure.<sup>16</sup>

Although a June 2013 study boasted that dilbit’s corrosiveness does not increase the risk for pipeline failures in comparison to other crude oils, the support for findings rests in self-reported industry data, previously conducted industry-driven research and the involvement of various people that have relationships and affiliations with the oil and gas industry.<sup>17</sup> Contrarily, a Cornell University report found: “Between 2007 and 2010, pipelines transporting diluted bitumen tar sands in the northern Midwest have spilled three times more oil per mile than the national average for conventional crude oil.”<sup>18</sup>

A notably devastating tar sands spill, one of the worst and most expensive oil spills in U.S. history, occurred in July 2010 when a pipeline owned by Enbridge Inc. (Canada’s largest pipeline transporter of crude oil) ruptured near Talmadge Creek, a tributary of Michigan’s Kalamazoo River, spilling as much as 1 million gallons of tar sands crude (dilbit). The inland cleanup cost almost a billion dollars, and the spill devastated sensitive ecosystems and impacted people who live in nearby communities.<sup>19</sup>

The usual spill-response methods — applying skimmers and booms on the surface of the river — were of little use because the heavy, viscous oil sank and spread along the bottom of the river. The fluids used to dilute the tar sands oil had become separated after the spill, and the toxic vapors containing benzene and polycyclic hydrocarbons escaped into the air, leaving the heavy oil to sink.<sup>20</sup>

When exposed to the toxic vapors of dilbit, people can suffer from respiratory problems and other internal damages. According to a sample of Michigan residents, over one-third of people living in communities impacted by Enbridge’s Ka-

lamazoo accident relocated due to local air pollution. Local residents exposed to the spill reported troubling neurological, respiratory and gastrointestinal problems.<sup>21</sup>

Meanwhile, Enbridge is proposing massive pipeline expansion projects throughout the Great Lakes region.<sup>22</sup> This includes the expansion of two pipelines that run under the Straits of Mackinac, a waterway joining Lake Michigan and Lake Huron. These pipelines have not been replaced in six decades, and the company wants to increase the amount of tar sands oil pumped on a daily basis. Any sort of leakage would spew toxins into the Great Lakes.<sup>23</sup> (See Figure 1 below and Table 1 in Appendix.)

## Fracking the Great Lakes

With shale gas reserves underlying vast parts of the Great Lakes region — including Michigan, Ohio, Pennsylvania, New York, Ontario and Quebec<sup>24</sup> — there is the potential for widespread shale drilling and fracking.

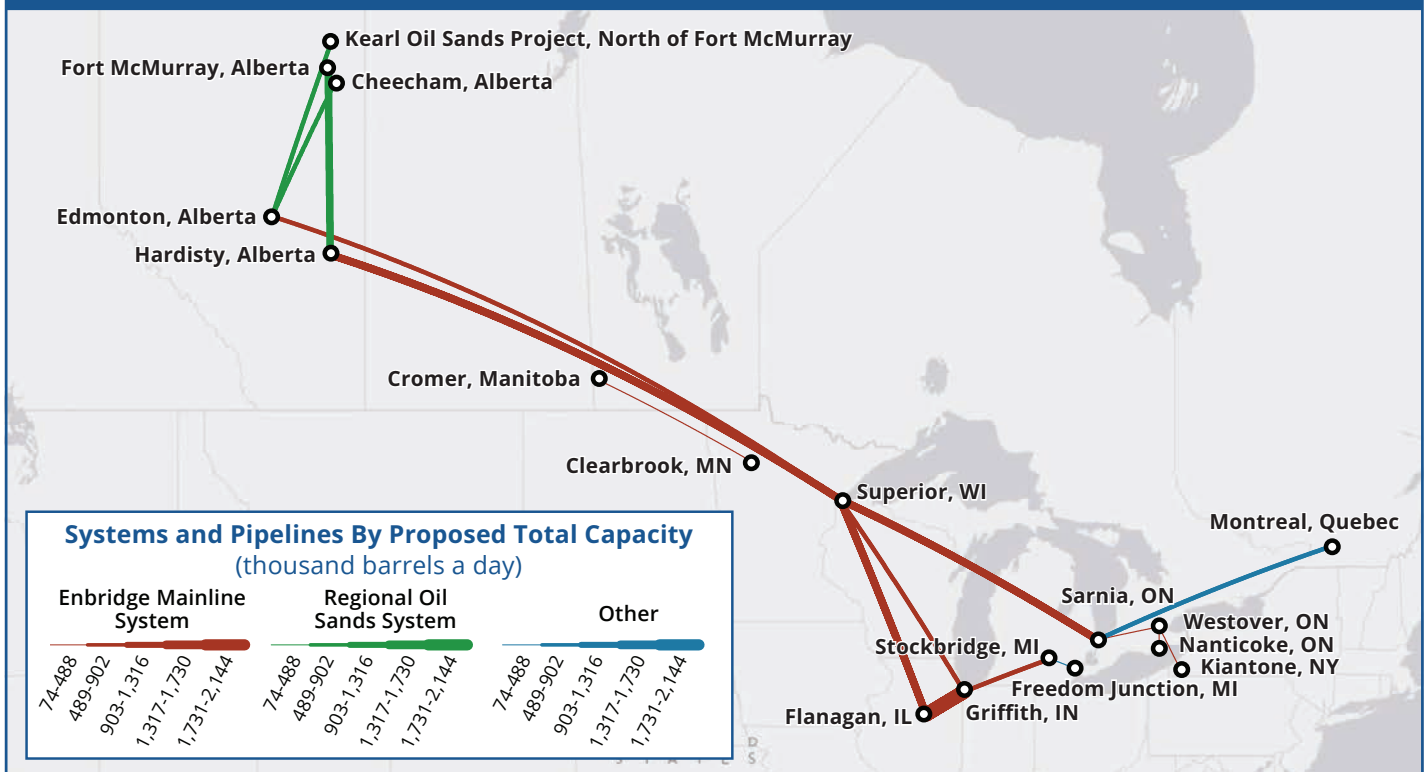
Hydraulic fracturing, or fracking, is a process that injects large quantities of water, sand and toxic chemicals under high pressure to release gas that is tightly held in rock layers.<sup>25</sup> Fracking uses millions of gallons of fracking fluid for a single well; a blend of water, sand and chemicals is pumped underground at high pressure to break up rock, allowing gas to flow into the well.<sup>26</sup> Some of the fracking fluid stays underground indefinitely, and the rest flows back up out of the well.<sup>27</sup>

The flowback wastewater contains, in addition to the original fracking fluids, potentially extreme levels of harmful contaminants that are brought to the surface, which can include arsenic, lead, hexavalent chromium, barium, strontium, benzene, polycyclic aromatic hydrocarbons, toluene, xylene, corrosive salts and naturally occurring radioactive material, such as radium-226.<sup>28</sup> The process releases chemicals that can cause cancer; disrupt the endocrine system; affect the nervous, immune and cardiovascular systems; and/or affect sensory organs and the respiratory system.<sup>29</sup>

A common method of disposing of the flowback is through underground injection wells, a practice that has grown rampant in Ohio and Michigan, turning the two states into dumping grounds for fracking waste. Injecting toxic flowback into underground wells can put aquifers and drinking water at risk and has been linked to increased earthquake activity.<sup>30</sup>

The expansion of shale gas development could harm the Great Lakes with methane leaks and wastewater spills. Already, there are 52 active fracking permits in Michigan, with another 5 pending applications,<sup>31</sup> and Encana has big plans to drill an additional 500 shale wells using 4 billion gallons of groundwater.<sup>32</sup> According to a United Nations Water report: “Scarcity is also a question of water quality .... Water quality degradation can be a major cause of water scarcity.”<sup>33</sup> Problematically, a U.S. Geological Survey publication notes that polluted groundwater sources can be a source of long-term surface water pollution.<sup>34</sup>

**Figure 1. Selected Enbridge Pipelines and Proposed Expansions in Great Lakes Region**



Source: Food & Water Watch analysis of data, see Table 1.

Groundwater sources are often connected to surface waters, and when an aquifer is over-pumped, the water levels of a connected surface water body can fall and water flows can change.<sup>35</sup> With millions of gallons of water needed to frack a single well, withdrawing water from around the Great Lakes could affect local supplies and have cumulative impacts on the basin, further straining already-stressed water sources.<sup>36</sup>

## Refineries, Pipelines and Fracking: A Triple Threat

Piping millions of barrels of toxic tar sands oil throughout North America is simply not in the public interest. It would put the Great Lakes and the region's environment, public health and economy at risk, solely for the benefit of oil and gas industry profits.

Despite the alarming water crisis that the world is facing, private interests are polluting, exploiting and selling water — a resource that is essential for all life. A 2009 publication, sponsored by the World Bank's International Finance Corporation and several for-profit multinationals, predicted that by 2030 global freshwater demand would exceed current available supplies by 40 percent.<sup>37</sup>

It is long past time to move away from dirty fossil fuels and to invest in clean, renewable energy. But the deep-pocketed fossil fuel industry — with its increasingly intensive extraction methods, entrenched infrastructure and lack of investment in energy conservation to slow demand for its product — is trying to derail the necessary transformation. Now is the time for North America to declare independence from the oil and gas industry.

## APPENDIX

Table 1. Selected Enbridge Pipelines and Proposed Expansions in Great Lakes Region					
Systems and Pipelines*	Start	End	Current capacity (barrels per day, thousands)	Proposed expansion capacity (barrels per day, thousands)	Expected service year for expansion
<b>Enbridge Mainline System<sup>A</sup></b>					
<b>Line 1</b>	Edmonton, AB	Superior, WI	237	-	-
<b>Line 2</b>	<i>Line 2a</i>	Edmonton, AB	442	-	-
	<i>Line 2b</i>	Edmonton, AB	442	-	-
<b>Line 3</b>	Edmonton, AB	Superior, WI	390	-	-
<b>Line 4</b>	Edmonton, AB	Superior, WI	796	-	-
<b>Line 5</b>	Superior, WI	Sarnia, ON	491	541	2013
<b>Line 6</b>	<i>Line 6a</i>	Superior, WI	667	-	-
	<i>Line 6b</i>	Griffith, IN	283	500-570	2014
<b>Line 7</b>	Sarnia, ON	Westover, ON	150	-	-
<b>Line 10</b>	Westover, ON	Kiantone, NY	74	-	-
<b>Line 11</b>	Westover, ON	Nanticoke, ON	117	-	-
<b>Line 14/64</b>	Superior, WI	Griffith, IN	318	-	-
<b>Line 61 (Southern Access)</b>	Superior, WI	Flanagan, IL	400	560-1,200	2014
<b>Line 62 (Spearhead North)</b>	Flanagan, IL	Griffith, IN	130	235	2014
<b>Line 65</b>	Cromer, MB	Clearbrook, MN	186	-	-
<b>Line 67 (Alberta Clipper)</b>	Hardisty, AB	Superior, WI	450	570-580	2014
<b>Regional Oil Sands System<sup>B</sup></b>					
<b>Athabasca Pipeline</b>	Fort McMurray, AB	Hardisty, AB	345	570	13-Jul
<b>Waupisoo Pipeline</b>	Cheecham, AB	Edmonton, AB	550	-	-
<b>Woodland Pipeline**</b>	Kearl Oil Sands Project, north of Fort McMurray	Edmonton, AB	210	400-800	2015

(continued on page 5)

(continued from page 4)

Other Proposed Pipeline Expansions to Run Through Region <sup>C</sup>					
Line 9	Sarnia, ON	Montreal, QC	240	300***	2014
Line 79	Stockbridge, MI	Freedom Junction, MI	New Pipeline	80	2013
<b>Current estimated pumping capacity of select pipelines</b>			6,917		
<b>Possible future pumping capacity of select pipelines</b>			8,834		
* Pipelines running through the Great Lakes region are those that run through or within Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, Ontario and Quebec.					
** The starting point for this Enbridge pipeline is currently Imperial Oil's Kearl oil sands project (about 70 kilometers north of Fort McMurray), and the pipeline ends at Enbridge's Cheecham Terminal; a proposed expansion, which would come into effect in 2015, would physically extend the pipeline from Cheecham to Edmonton while increasing the carrying capacity to 400,000 barrels per day (bpd), with the possibility of increasing to 800,000 bpd.					
*** Pipeline reversal as well as capacity expansion is proposed.					
A Enbridge Inc. Pipeline System Configuration. Quarter 1, 2013. Updated January 2013; Song, Lisa. "Map: Another Major Tar Sands Pipeline Seeking U.S. Permit." <i>InsideClimateNews</i> . June 3, 2013.					
B Enbridge. "Liquids Pipelines." Available at <a href="http://www.enbridge.com/DeliveringEnergy/OurPipelines/LiquidsPipelines.aspx">http://www.enbridge.com/DeliveringEnergy/OurPipelines/LiquidsPipelines.aspx</a> . Accessed October 11, 2013; Enbridge. "Enbridge's Regional Oil Sands System at a Glance." Available at <a href="http://www.enbridge.com/DeliveringEnergy/OurPipelines/LiquidsPipelines/regionaloilsandsAAG.aspx">http://www.enbridge.com/DeliveringEnergy/OurPipelines/LiquidsPipelines/regionaloilsandsAAG.aspx</a> . Accessed October 11, 2013; "UPDATE 1-Enbridge to build \$1.3 bln Canadian oil sands pipeline expansion." <i>Reuters</i> . July 25, 2013.					
C Enbridge Inc. Pipeline System Configuration. Quarter 1, 2013 ; Song, Lisa. "Map: Another Major Tar Sands Pipeline Seeking U.S. Permit." <i>InsideClimateNews</i> . June 3, 2013.					

## Endnotes

- Barlow, Maude. The Council of Canadians. "Our Great Lakes Commons: A People's Plan to Protect the Great Lakes Forever." March 2011 at 9.
- Environment Canada and U.S. Environmental Protection Agency (EPA). "State of the Great Lakes 2009." 2009 at 14 and 286; Barlow, 2011 at 9; Schroeck, Nicholas and Stephanie Karisny. "Hydraulic fracturing and water management in the Great Lakes." *Case Western Reserve Law Review*. Vol. 63, Iss. 4. 2013 at 1167 and 1168.
- Bruno, Kenny et al. Corporate Ethics International, EARTHWORKS, Natural Resources Defense Council (NRDC) and Sierra Club. "Tar Sands Invasion." May 2010 at 5 and 9; Barlow, 2011 at 13.
- Schroeck and Karisny, 2013 at 1171; Gosman, Sara et al. National Wildlife Federation. "Hydraulic Fracturing in the Great Lakes Basin: The State of Play in Michigan and Ohio." 2012 at 4 to 11.
- U.S. Energy Information Administration (EIA). Number and Capacity of Petroleum Refineries. Data Series: Total Number of Operable Refineries. Annual (as of January 1.) Available at [http://www.eia.gov/dnav/pet/pet\\_pnp\\_cap1\\_a\\_\(na\)\\_800\\_Count\\_a.htm](http://www.eia.gov/dnav/pet/pet_pnp_cap1_a_(na)_800_Count_a.htm). Accessed September 19, 2013; Canadian Fuels Association. The Fuels Industry, Fuels Production. "Refining sites and capacity." Available at [http://canadianfuels.ca/index\\_e.php?p=65](http://canadianfuels.ca/index_e.php?p=65). Accessed September 19, 2013.
- Sierra Club. "Toxic Tar Sands Oil: An Assault on American Water, Air, Health and Jobs." September 2010 at 4; Barlow, 2011 at 13.
- EIA. Energy in Brief. "What is an oil refinery?" Last updated April 9, 2013. Available at [http://www.eia.gov/energy\\_in\\_brief/article/refinery\\_processes.cfm](http://www.eia.gov/energy_in_brief/article/refinery_processes.cfm). Accessed September 19, 2013; EIA. "How crude oil is refined into petroleum products." Last reviewed June 18, 2012. Available at [http://www.eia.gov/energyexplained/index.cfm?page=oil\\_refining#tab2](http://www.eia.gov/energyexplained/index.cfm?page=oil_refining#tab2). Accessed September 19, 2013; EPA. "Summary of requirements for processes and equipment at natural gas processing plants." April 2012. Available at <http://www.epa.gov/airquality/oilandgas/pdfs/20120417summaryprocessing.pdf>. Accessed August 14, 2013.
- Weinhold, Bob. "Alberta's oil sands: Hard evidence, missing data, new promises." *Environmental Health Perspectives*. Vol. 119, Iss. 3. March 2011 at A128 and A129; Wakefield, Benjamin J. and Price, Matt. The Environmental Integrity Project. "Tar Sands: Feeding U.S. Refinery Expansions with Dirty Fuel." June 2008 at 2 and 4 to 6; Barlow, 2011 at 13.
- Maantay, Juliana et al. "Proximity to Environmental Hazards: Environmental Justice and Adverse Health Outcomes." Prepared for EPA. *Strengthening Environmental Justice Research and Decision Making: A Symposium on the Science of Disproportionate Environmental Health Impacts*. May 12, 2010 at 74.
- Sierra Club. September 2010 at 4; Morris, Jim and Chris Hamby. "Detroit refinery expansion adds more Canadian crude, brings more worries." *Center for Public Integrity*. October 31, 2012; Lydersen, Kari. "Community is torn over expansion of oil refinery." *New York Times*. September 15, 2011.
- Morris and Hamby, 2012.
- Ibid.*
- Ibid.*
- Powell, John. EIA. [PowerPoint Presentation]. "Implications of Increasing U.S. Crude Oil Production." June 18, 2013 at 6, 11 and 15; EIA. "How crude oil is refined into petroleum products.;" Barlow, 2011 at 13.
- U.S. Department of Transportation. "Pipeline Safety Update." September 2012 at 10; Swift, Anthony et al. NRDC, National Wildlife Federation, Pipeline Safety Trust and Sierra Club. "Tar Sands Pipelines Safety Risks." February 2011 at 6.
- Bruno et al., 2010 at 5 and 9; Barlow, 2011 at 13; Been, Jenny. Alberta Innovates Energy and Environment Solutions. "Comparison of the Corrosivity of Dilbit and Conventional Crude." September 2011 at iii and 6; NRDC. "Going in Reverse: The Tar Sands Threat to Central Canada and New England." June 2012 at 6 and 7; Alexander, Jeff and Beth Wallace. National Wildlife Federation. "Sunken Hazard: Aging Oil Pipelines Beneath the Straits of Mackinac an Ever-Present Threat to the Great Lakes." 2012 at 12.

- 17 National Research Council. [News Release]. "Transporting diluted bitumen through pipelines does not increase likelihood of release, new report says." June 25, 2013; Menzies, Tom. National Academy of Sciences Study for PHMSA. Crude Oil Quality Association Meeting. [PowerPoint Presentation]. "More Prone to Release? Transport of Dilbit by Pipeline." November 8, 2012 at 18; Song, Lisa. "Narrow and flawed, federal pipeline safety study fails to settle controversy." *InsideClimateNews*. June 26, 2013.
- 18 Skinner, Lara and Sean Sweeney. A report by Cornell University, Global Labor Institute. "The Impact of Tar Sands Pipeline Spills on Employment and the Economy." March 2012 at 4.
- 19 McGowan, Elizabeth and Lisa Song. "The dilbit disaster: Inside the biggest oil spill you've never heard of, part I." *InsideClimateNews*. June 26, 2012; EPA. [Fact Sheet]. "Oil Cleanup Continues on Kalamazoo River." June 2013; Shogren, Elizabeth. "EPA: Tar sands pipelines should be held to different standards." *NPR, All Things Considered*. April 24, 2013; Hasemyer, David. "The dilbit disaster 3 years later: Sunken oil is looming threat to Kalamazoo River." *InsideClimateNews*. July 25, 2013.
- 20 Anderson, Mitchell. "Spill from hell: diluted bitumen." *The Tye*. May 5, 2012; NRDC, 2012 at 7 and 14; Alexander and Wallace, 2012 at 12 and 13.
- 21 Stanbury, Martha et al. Michigan Department of Community Health. "Acute health effects of the Enbridge oil spill." November 2010 at 8 and 13; Anderson, 2012; NRDC, 2012 at 14 to 15.
- 22 Song, Lisa. "Map: Another major tar sands pipeline seeking U.S. permit." *InsideClimateNews*. June 3, 2013.
- 23 Alexander and Wallace, 2012 at 2 to 4 and 12; Song, June 3, 2013.
- 24 Schroeck and Karisny, 2013 at 1171; Gosman et al., 2012 at 4 and 5.
- 25 American Petroleum Institute. "Freeing Up Energy. Hydraulic Fracturing: Unlocking America's Natural Gas Resources." July 19, 2010 at 1, 2, and 4; Saaïd, Ismail Mohd et al. "Characterization of Malaysia sand for possible use as proppant." *American International Journal of Contemporary Research*. Vol. 1, No. 1. July 2011 at 37; U.S. House of Representatives. Committee on Energy and Commerce. [Minority Staff report]. "Chemicals used in hydraulic fracturing." April 2011 at 2 and 8 to 9.
- 26 EPA. "Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources." (EPA/600/R-11/122). November 2011 at 15 and 22.
- 27 *Ibid.* at 15 and 23, 42 and 43.
- 28 Mall, Amy and Dianne Donnelly. NRDC. "Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy." September 2010 at 8 and 9; 76 U.S. Fed. Reg. 66296 (October 26, 2011); Urbina, Ian. "Regulation lax as gas wells' tainted water hits rivers." *New York Times*. February 26, 2011.
- 29 Colborn, Theo et al. "Natural gas operations from a public health perspective." *Human and Ecological Risk Assessment*. Vol. 17, Iss. 5. September 2011 at Abstract.
- 30 Gosman et al., 2012 at 5, 11, 15 and 22; Ellsworth, William L. "Injection-induced earthquakes." *Science*. Vol. 341. July 12, 2013; Lustgarten, Abraham. "Injection wells: the poison beneath us." *ProPublica*. June 21, 2012; Lustgarten, Abraham. "The trillion-gallon loophole: Lax rules for drillers that inject pollutants into the earth." *ProPublica*. September 20, 2012; Lustgarten, Abraham. "Poisoning the well: how the feds let industry pollute the nation's underground water supply." *ProPublica*. December 11, 2012.
- 31 Michigan Department of Environmental Quality. High Volume Hydraulic Fracturing Active Applications and Issued Permits, as of November 25, 2013. Map available at [http://www.michigan.gov/documents/deq/High\\_Volume\\_Hydraulic\\_Fracturing\\_Activity\\_MAP\\_423435\\_7.pdf](http://www.michigan.gov/documents/deq/High_Volume_Hydraulic_Fracturing_Activity_MAP_423435_7.pdf). Accessed December 11, 2013.
- 32 Alexander, Jeff. "Canadian firm plans fracking campaign that could require 4 billion gallons of Michigan water." *Bridge Magazine* (Michigan). June 25, 2013.
- 33 United Nations Water. "Coping with Water Scarcity: Challenge of the Twenty-First Century." March 22, 2007 at 10.
- 34 Winter, T.C. et al. U.S. Department of the Interior. U.S. Geological Survey. "Ground Water and Surface Water: A Single Source." U.S. Geological Survey Circular 1139. U.S. Government Printing Office. 1998 at 1.
- 35 *Ibid.* at iii and 1 and 14.
- 36 Gosman et al., 2012 at 6 and 7; Kundzewicz, Z.W. et al. (2007). "Freshwater resources and their management." *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, U.K. at 175 to 176; Barlow, 2011 at 15; Harger, Jim. "Watchdog group says 'fracking' operation in Kalkaska County is forced to buy municipal water." *MLive* (Michigan). June 5, 2013.
- 37 The 2030 Water Resources Group. "Charting our Water Future: Economic Frameworks to Inform Decision-Making." 2009 at i and 5.

**Food & Water Watch** works to ensure the food, water and fish we consume is safe, accessible and sustainable. So we can all enjoy and trust in what we eat and drink, we help people take charge of where their food comes from, keep clean, affordable, public tap water flowing freely to our homes, protect the environmental quality of oceans, force government to do its job protecting citizens, and educate about the importance of keeping shared resources under public control.

