Buried pipeline route south of Fort McMurray, Alberta, October 2015

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Pipeline Geospatial Datasets in Canada: Hard to Find, Inconsistent, Incomplete

Wynet Smith
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Introduction

Canada is a significant energy producer, with oil and gas accounting for approximately 7.3 percent of Canada's GDP.[1] Given this fact, every Canadian should be interested in the extraction and use of Canada's energy resources and about the infrastructure required to transport these resources to markets inside and out of the country. In recent years, the construction of oil and gas pipelines has been particularly controversial for a variety of reasons including the risk of spills, wider concerns about climate change and other environmental impacts of fossil fuels, as well as increasing recognition of aboriginal rights and title to the land that pipelines cross.

Global Forest Watch Canada (GFWC) is an organization focused on the creation and use of good public geospatial data for improved environmental decision-making. "Open data" - that is, "digital data that is made available with the technical and legal characteristics necessary for it to be freely used, reused, and redistributed by anyone, anytime, anywhere"[2] - is increasingly recognized as being essential to informed public debate. Therefore, to complement GFWC's recent report[3] on the availability of open geospatial datasets on natural resource concessions allocated on public, or Crown, lands in Canada, we decided to research the extent of the pipeline network in Canada and collect geospatial datasets of pipelines. We then assessed whether the datasets qualify as open data and how comprehensive they appear to be. So what did we find?

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It is hard to find exact numbers: estimates range from 760,000 to 840,000 km

GFWC found a range of estimates on the length of the pipeline network in Canada, often summarized in terms of types of pipelines. Generally, pipelines are categorized into four types: gathering lines move oil and gas from source to processing facilities; feeder pipelines move product from processing facilities to transmission pipelines; transmission lines are large pipelines that carry oil and gas long distances from processing facilities; and distribution pipelines deliver natural gas to customers.[4] Natural Resources Canada (NRCan) states on one webpage that there are at least 825,000 km of transmission, gathering, and distribution pipelines in Canada's pipeline network.[5] However, on a separate page, NRCan states there are 840,000 km of pipelines, which includes 117,000 km of large diameter transmission lines, 250,000 km of gathering lines, 25,000 km of feeder lines, and 450,000 of local distribution lines.[6] A factsheet produced by the Canadian Energy Pipeline Association (CEPA) contains these same numbers, except it states the sub-categories add up to "over 830,000 km."[7] The numbers actually total 842,000 km. The major transmission lines of CEPA members total 119,000 km.[8]

On its website, the National Energy Board (NEB) states Canada contains "more than 760,000 km" of pipelines and that they regulate 73,000 kilometers of interprovincial and international pipelines.[9] Statistics Canada reported in May 2017 that there were 46,000 km of transmission and gathering pipelines in Canada, in what is perhaps the most significant under-reporting of the actual pipeline network.[10] Notably, these websites and documents either do not provide the source of their respective pipeline estimates or simply cite a source without specific details, as in the case of a NEB factsheet that cites NRCan.[11] Thus, it is not clear what is the underlying data source for most of these estimates.

GDM Pipelines is a company that maintains mid-stream datasets that they license to users. Their pipeline dataset is the basis for the Canadian Energy Pipeline Association's interactive map on energy transmission pipelines and facilities in Canada. GDM officials graciously analyzed and provided a summary of their dataset for GFWC, which shows a total of 661,407 km of pipelines in Canada. GDM officials noted that this does not include cancelled lines, or those lines that are proposed but not constructed. The length also does not include low-pressure distribution lines, which would account for hundreds of thousands more km. While GDM does not specifically track the pipeline type/category, they estimated an approximate division between transmission lines at 138,498 km versus gathering lines at 522,908 km, although they noted that these figures should not be taken as exact.[12]

Table 1 provides a summary of estimates of provincial and federally regulated pipelines available from Natural Resources Canada (NRCan), estimates of provincially regulated pipelines from provincial websites, as well as numbers based on analysis of datasets GFWC compiled. GFWC has also included relevant estimates from company websites for jurisdictions where

dataset pipeline figures were quite different from NRCan or provincial website estimates. Further details on the government datasets are provided in Table 2.

Table 1. Length of pipeline by jurisdiction

Jurisdiction	NRCan reported numbers (km)[13]	Provincially reported numbers (km)	Dataset numbers (km)	Notes
Alberta	423,419	434,000[14]	463,358 (341,054 operating)	Alberta Energy Regulator is responsible for 422,000 km of pipelines and provides support for 12,000 km regulated by the Alberta Utilities Commission.[15] Dataset excludes low pressure distribution lines.
British Columbia	42,681	43,584[16]	770	BC Oil and Gas Commission regulates provincial pipelines. Dataset only contains pipelines approved since July 11, 2016 so is not complete.
Manitoba	564	None found	216	Manitoba Hydro operates 10,070 km of natural gas distribution pipelines.[17] There are also some propane lines owned by Stittco.
New Brunswick	1,411	None found	597	Dataset appears to only contain main pipelines. Enbridge Gas New Brunswick has at least 800 km of pipelines distributing gas to customers.[18]
Newfoundland & Labrador	None given	None found	No dataset	No record of pipelines in N
Nova Scotia	120	None found	154	Dataset does not contain Maritimes & Northeast transmission pipeline. Heritage Gas operates distribution gas pipelines in Nova Scotia; they provide no estimates but show pipelines on a map.
Northwest Territories	955	None found	871	Enbridge's Norman Wells pipeline is 869 km and includes length in Alberta.[19]
Nunavut	None given	None found		Municipal GIS datasets exist.[20]
Ontario	114,000	None found	3,213	
Prince Edward Island	None given	None found	No dataset	
Quebec	12,521	None found	No dataset	
Saskatchewan	102,400	3,699[21]	No dataset	
Yukon	None given	None found	600	Dataset numbers derived from Yukon's version of CanVec 1:50,000.
National level	73,000	73,000[22]		Interprovincial and international pipelines regulated by the NEB. CanVec lines were not included in total as not necessarily federally regulated.
Total	**771,071**	**554,283**	**469,779**	

All numbers are rounded.

Very Few Open, Good Quality, Public Datasets

Obviously, the range of numbers made GFWC even more curious as to what existing geospatial datasets on pipelines would include. Unfortunately, it was difficult to find good quality, public, geospatial datasets on pipelines in Canada. GFWC was able to locate and obtain pipeline datasets from eight provinces and territories (Alberta, British Columbia, Manitoba, Ontario, New Brunswick, Nova Scotia, the Northwest Territories, and the Yukon). GFWC was unable to obtain data for Quebec and Saskatchewan, although each has as a significant pipeline network. GFWC also obtained the federal CanVec national dataset, which provides some pipeline features across Canada and we found municipal level datasets for Nunavut, although we have not included those in our assessment.

Notably, the total length of pipeline recorded in these various public geospatial datasets sum to significantly less than is reported in any of the available estimates of the total length of the pipeline network, as cited above. NRCan's CanVec datasets[23] contain 43,654 km of pipelines in the 1:50:000 version and 34,571 km of pipelines in its 1:250,000 version. Map 1 is derived from the public geospatial datasets GFWC collected; it clearly falls far short of displaying the true extent of the oil and natural gas pipeline network in Canada. It does appear, however, to be the best that is possible based on publically available geospatial data at this time.

Map 1. Pipeline network derived from public geospatial datasets.

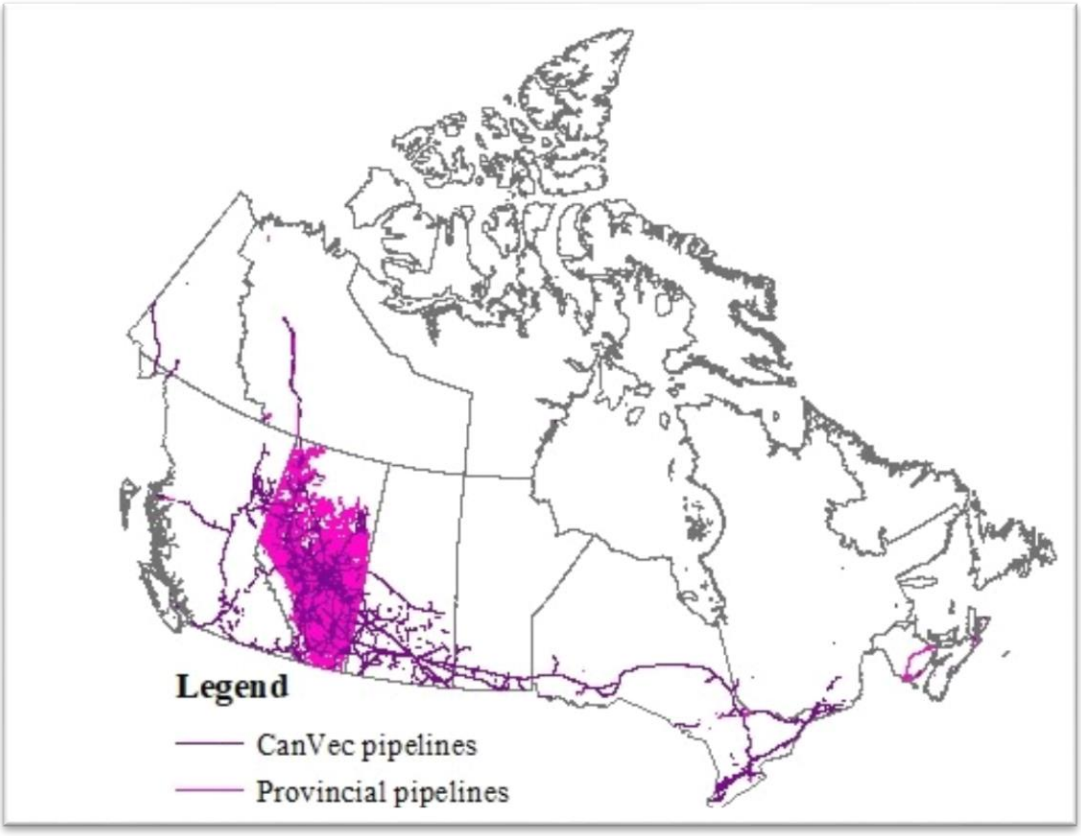

Table 2. Publically available geospatial datasets of oil and natural gas pipelines

Jurisdiction	Dataset	Open Access	Open Format	Machine Readable	Open Licence	Quality of Data and Other Notes
Alberta	Pipelines[24]	Yes	Yes	Yes	Yes	Enhanced Shapefile updated daily.
British Columbia	Oil and Gas Commission Pipeline Segment Permits[25]	Yes	Yes	Yes	No (Access only)	Data is updated on a daily basis.
Manitoba	Pipelines[26]	No	Yes	Yes		Accessing dataset requires user name and password.
New Brunswick	Pipelines[27]	Yes	Yes	Yes	Yes	Dataset includes gas transmission but not distribution lines.
Nova Scotia	Nova Scotia Topographic Database - Utilities[28]	Yes	Yes	Yes	Yes	Also available at: https://nsgi.novascotia.ca/gdd/
Northwest Territories	Utilities[29]	No	Yes	Yes	No	Download function was not working so had to request by email.
Ontario	Utilities[30]	Yes	Yes	Yes	Yes	Last updated 2008 and plan is to retire dataset.
Quebec						No dataset found.
Saskatchewan						No dataset made available.
Yukon	Utilities_Line [31]	Yes	Yes	Yes	Yes	Yukon dataset is from federal National Topographic Database.
Federal	CanVec[32]	Yes	Yes	Yes	Yes	Pipeline features in this dataset range from 1947 to 2015.

Note: The table is colour coded based on an open data assessment. Jurisdictions with open data are in green. Jurisdictions with data that are not open are in yellow. Given there are four criteria required for a dataset to be open, we colour code each of the four criteria (access, machine readability, open format, and open licence). If a jurisdiction only meets some of the open data criteria, we colour code the jurisdiction name and any non-compliant criteria in yellow in the table while the compliant criteria are colour-coded green. For further details on methods see Smith, W. 2017.[33]

Our assessment of whether the datasets qualify as open data is based on four open criteria of open access, machine readable, open format, and open licence, as defined by the Open Definition.[34] Our findings are that five provinces and territories have open geospatial pipeline datasets and that Canada does as well. This assessment is based on the following:

- Seven datasets are considered open access as they are downloadable from on-line portals. The NWT portal was not functioning during the period of GFWC's data collection so GFWC had to request the dataset via email so it cannot currently be considered open access. The dataset from Manitoba is not open access as users must register with the Manitoba Land Initiative (MLI) in order to obtain the dataset.
- All datasets are machine readable.
- All datasets are in an open format.
- Six jurisdictions make their pipeline datasets available with an open data licence or equivalent. The national pipeline dataset, CanVec, is provided under an open government licence. British Columbia provides their pipeline data under an access only licence that restricts use. The Government of Northwest Territories (GNWT distributes their pipeline data under an agreement that restricts unmodified redistribution.

While GFWC does not generally assign "grades," were we to do so, only Alberta would get an A+ for their dataset. The Northwest Territories does have a reasonably comprehensive dataset, although it is not open.

Conclusion and Recommendations

Despite the prominence of the fossil fuel sector in Canada, its importance to the Canadian economy, and the on-going, active, public debate about pipelines, the publically available data on pipeline extent and distribution appear opaque, inconsistent, and incomplete. Conducting analyses on the network of pipelines and its relations to other features of social concern and environmental importance, is virtually impossible without purchasing a licence for a privately maintained dataset. Only Alberta has a solid, comprehensive, publically available dataset, accessible through the Alberta Energy Regulator that is completely open data. Quebec and Saskatchewan had the least amount of information on pipelines available, and had not public geospatial datasets related to pipelines available.

While it is commendable that many governments and agencies are making progress on open data, there is a need for a concerted effort to document major energy infrastructure features, such as pipelines, in a comprehensive manner and to have these datasets available as open data. All Canadians are dependent on, and affected by, the energy infrastructure of Canada. Open access to basic information is essential to support informed public discourse and wider analysis.

Sour gas pipeline route, evident from marker, on eastern edge of Castle Forest Land Use Zone, southwest Alberta. September 2016.

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References

[1] NRCan. "10 Key Facts on Canada's Natural Resources". Available at: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/files/pdf/10_key_facts_nrcan_2016-access_e.pdf. Accessed July 11, 2017.
[2] Open Charter Data Principles. Available at: http://opendatacharter.net/principles/. Accessed July 11, 2017.
[3] Smith, W. 2017. *Open Data Assessment of Geospatial Concession Datasets in Canada*. Ottawa: Global Forest Watch Canada. Available at: http://www.globalforestwatch.ca/node/276.
[4] For further details see: "The Different Types of Pipelines in Canada", Canadian Energy Pipeline Association. Available at: https://aboutpipelines.com/wp-content/uploads/2016/07/CEPA-PipeLinesInfographic-2015_final.pdf.
[5] Natural Resources Canada. "Pipeline Safety Regimes in Canada", available at: http://www.nrcan.gc.ca/energy/infrastructure/pipeline-safety-regime/16440. Accessed June 23, 2017.
[6] Natural Resources Canada. "Pipelines Across Canada", available at: http://www.nrcan.gc.ca/energy/infrastructure/18856. Accessed July 20, 2017. Also see: "Frequently Asked Questions (FAQs) Concerning Federally-Regulated Petroleum Pipelines in Canada" available at: http://www.nrcan.gc.ca/energy/infrastructure/5893 . Accessed June 23, 2017.
[7] CEPA. Factsheet "The Different Types of Pipelines in Canada". Available at: https://aboutpipelines.com/wp-content/uploads/2016/07/CEPA-PipeLinesInfographic-2015_final.pdf. Accessed July 19, 2017.
[8] See: https://www.aboutpipelines.com/en/in-your-community/pipelines-in-your-community/.
[9] NEB. "Pipeline Regulation in Canada", available at: https://www.neb-one.gc.ca/bts/whwr/pplnrgltncnd-eng.html.
[10] Statistics Canada. "Pipeline transportation of oil and other liquid petroleum products", March 2017. Available at: http://www.statcan.gc.ca/daily-quotidien/170519/dq170519e-eng.pdf . Accessed July 20, 2017.
[11] NEB. "Who Regulates Canada's Pipelines?" Available at: https://www.neb-one.gc.ca/bts/nws/rgltrsnpshts/2016/01rgltrsnpsht-eng.pdf. Accessed July 14, 2017.
[12] Email correspondence with J.Thornton, GDM Pipelines. July 2017.
[13] All numbers from "Pipeline Safety Regimes in Canada" and provincial/territorial links at bottom. See: http://www.nrcan.gc.ca/energy/infrastructure/pipeline-safety-regime/16440.
[14] AER information: https://www.aer.ca/rules-and-regulations/by-topic/pipelines.
[15] Alberta Energy Regulatory information: https://www.aer.ca/rules-and-regulations/by-topic/pipelines.
[16] Pipelines in British Columbia: https://www.bcogc.ca/node/11470/download.
[17] Manitoba Hydro information: https://www.hydro.mb.ca/corporate/facilities/natural_gas.shtml.
[18] Enbridge Gas New Brunswick information: https://naturalgasnb.com/en/for-home/customer-care/availability-map.
[19] Enbridge information: http://www.enbridge.com/MediaCentre/News/~/media/www/Site%20Documents/Media%20Centre/About%20Enbridge.ashx.
[20] See: https://cgs-pals.ca/downloads/gis/.
[21] Saskatchewan information: https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/oil-and-gas/oil-and-gas-licensing-operations-and-requirements/pipeline-licensing.
[22] NEB information: https://www.neb-one.gc.ca/bts/nws/rgltrsnpshts/2016/01rgltrsnpsht-eng.html.
[23] CanVec datasets are available at: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/23387971-b6d3-4ded-a40b-c8e832b4ea08.html.
[24] Dataset at: http://aer.ca/data-and-publications/publications/maps-and-mapviewers.
[25] Dataset at: https://catalogue.data.gov.bc.ca/dataset/oil-and-gas-commission-pipeline-segment-permits.
[26] Dataset at: http://mli2.gov.mb.ca/t20k/index_seamless.html.
[27] Dataset at: http://www.snb.ca/geonb1/e/DC/catalogue-E.asp.
[28] Dataset at: https://data.novascotia.ca/browse?sortBy=relevance&utf8=%E2%9C%93&q=pipelines.
[29] Dataset at: http://www.geomatics.gov.nt.ca/wms_chartop.aspx?i=1.
[30] Dataset at: https://www.javacoeapp.lrc.gov.on.ca/geonetwork/srv/en/main.home?uuid=0ba17c47-6951-4ca2-99b7-137ce183ac81.
[31] Dataset at: ftp://ftp.geomaticsyukon.ca/GeoYukon/Utilities_and_Communication/UTILITIES_LINE_50K.
[32] Dataset at: http://ftp.geogratis.gc.ca/pub/nrcan_rncan/vector/canvec/shp/Res_MGT/.
[33] Available at: http://www.globalforestwatch.ca/node/276.
[34] Open Definition available at: http://opendefinition.org/od/2.1/en/.