Home Energy Retrofits: A Data-Driven Approach to Alleviating Energy Poverty in Peel Region

A Report Prepared for the Centre for Community Energy Transformation (CCET)

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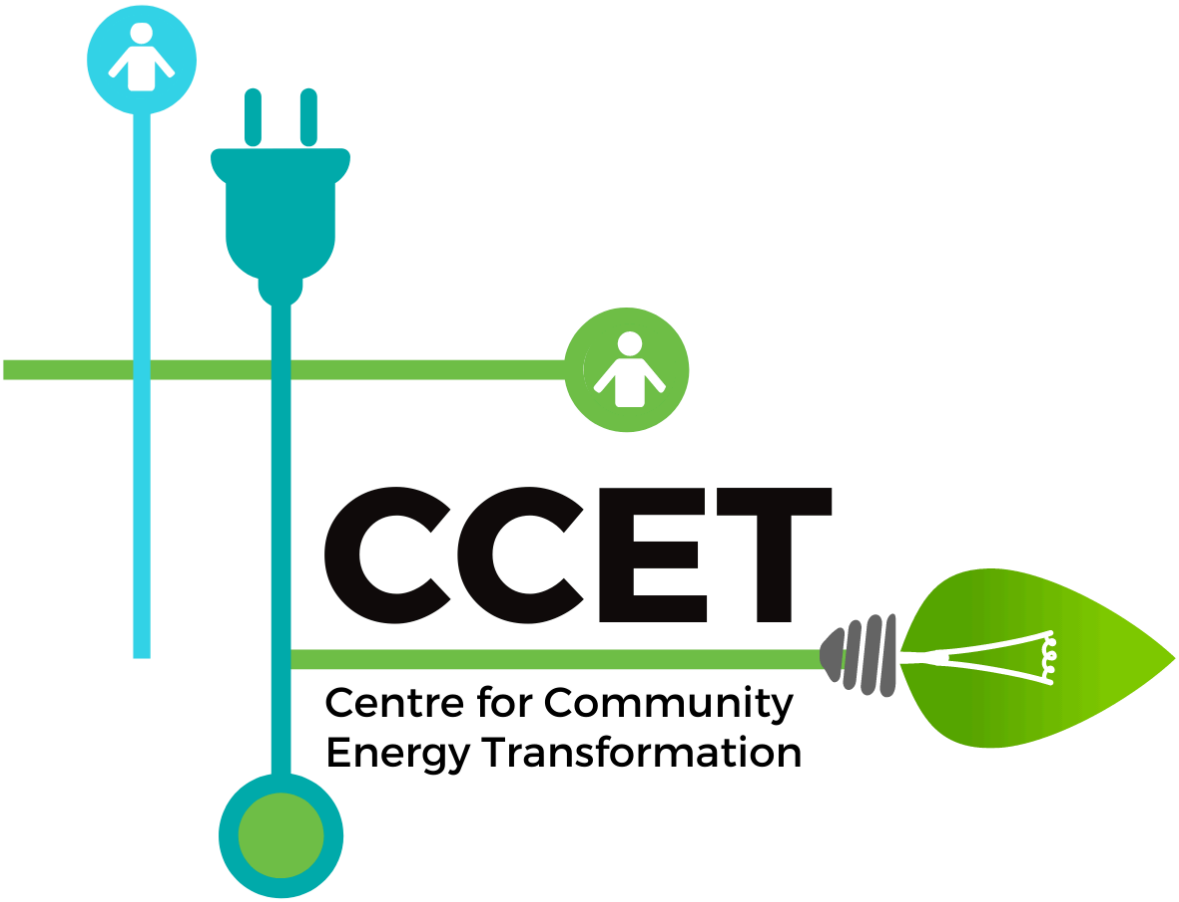

Introduction:

Residential energy use is a major expense for households and a significant contributor to greenhouse gas emissions. In Canada, studies have shown that a considerable portion of low-income households struggle to pay their energy bills—for example, 43% of Nova Scotians face energy poverty (Colton, 2024). Similar challenges are evident in Ontario and other regions. In Chicago, NREL & Elevate demonstrated that advanced retrofit packages can cut energy use by over 50% in older homes, potentially saving citywide energy costs by up to $217 million annually and reducing CO_2 emissions by 2.5 million metric tons (NREL & Elevate, 2022). An analysis of energy poverty initiatives in Ontario from the University of Sussex further supports the view that integrated, data-driven retrofit programs—which combine financial relief, technical upgrades, and policy advocacy—are necessary to alleviate the disproportionate energy burden on vulnerable households (Das et al., 2020).

The present study of Peel Region's energy burden employs Geographic Information System (GIS) visualizations and a detailed dwelling-type analysis to build an evidence-based case for targeted home energy retrofits. Figures 1 and 2 illustrate

property distributions for single-family detached and condominium dwellings, while Figure 3 provides a property-type map of single-family detached homes. These visualizations are intended to highlight areas of high energy consumption and to inform strategic interventions that reduce energy costs and improve living conditions.

Quantifying the Energy Burden in Residential Housing:

GIS analysis of Peel Region indicates that single-family detached homes are densely located in the western part of Peel (Figure 1). These dwellings often feature older construction and less efficient building envelopes. According to the Canada Energy Regulator (2020), households in similar Canadian regions spend a higher-than-average share of their income on energy, which disproportionately affects low-income families. The Pembina Institute's Better Buildings for All likewise emphasizes that inadequate building efficiency contributes to elevated utility bills, while Nova Scotia's A Way Forward identifies that 43% of residents struggle with energy costs (Colton, 2024). The findings suggest that many single-family detached homes in Peel likely share these inefficiencies, making them prime candidates for retrofitting programs aimed at reducing energy consumption and alleviating energy poverty.

Data-Driven Retrofit Strategies and Their Potential Impact:

The Chicago case study by NREL & Elevate (2022) demonstrates how strategic, data-driven retrofits in older housing stock can yield over 50% energy savings. Their ResStock™ energy modeling approach showed that five prioritized housing types—comprising over 75% of Chicago's residential buildings—could deliver annual energy savings of up to 50 million mmBTUs, reduce utility bills by as much as $1,500 per household, and cut CO_2 emissions by 2.5 million metric tons. Das et al. (2020) further note that successful retrofit programs in Ontario incorporate both financial support and community prioritization, ensuring that the most vulnerable households receive immediate and meaningful benefits. Applying similar methodologies in Peel Region could help identify neighborhoods with the greatest need, as shown in Figures 2 and 3, and facilitate targeted retrofits capable of producing measurable reductions in both costs and emissions.

Detailed Energy Burden Analysis by Dwelling Type in Peel Region:

Using data from Statistics Canada (Table 25-10-0061-01), analysis was performed on household energy consumption across various dwelling types in Peel Region. The data categorizes residential units into single-detached homes, duplexes, row or terrace houses, low-rise and high-rise apartments, mobile homes, and other unclassified structures. Our analysis focused on the average annual electricity (in gigajoules, GJ) and gas consumption (in GJ) for each category. For instance, single-detached homes were found to consume an average of 36.1 GJ of electricity and 86.5 GJ of gas annually, which is significantly higher than that of high-rise apartments

(20 GJ electricity and 72.7 GJ gas). These consumption patterns reflect the impact of building age, construction type, and heating method on energy demand.

To translate these consumption figures into economic terms, we applied cost calculations based on regional billing methods. Electricity costs were computed using a formula derived from Alectra's billing method for the Brampton area—ensuring consistency across Peel Region—while gas costs were calculated using the Ontario Energy Board's (OEB) natural gas bill calculator, which reflects Enbridge's pricing. These methods allowed us to estimate the energy cost burden per household. Our findings indicate that the higher consumption observed in single-detached homes, largely due to their reliance on gas-fired hot water heating systems, places a disproportionate financial burden on low-income households. This detailed analysis is consistent with the evidence presented in Nova Scotia's A Way Forward (Colton, 2024) and the Pembina Institute's Better Buildings for All, both of which underscore that inefficient, older dwellings contribute significantly to elevated energy expenses. Moreover, the Chicago case study by NREL & Elevate (2022) reinforces that targeted retrofits can deliver substantial savings—upwards of 50% energy reductions—which supports the argument for implementing similar programs in Peel. Das et al. (2020) further highlight that integrated approaches combining technical upgrades with financial support are critical to addressing energy poverty, a finding that is borne out by our cross-sectional data.

Conclusion:

The evidence suggests that older, single-family detached dwellings in Peel Region are likely to incur disproportionately high energy costs, mirroring findings from Nova Scotia's A Way Forward (Colton, 2024), the Pembina Institute's Better Buildings for All, and NREL & Elevate's (2022) Chicago case study. GIS visualizations and consumption data point to significant opportunities for targeted retrofit programs that focus on older building envelopes and outdated heating systems. Retrofits informed by robust data—such as the approaches outlined by Das et al. (2020)—have the potential to reduce energy consumption by more than 50%, yielding substantial cost savings and carbon emission reductions.

These findings provide a strong foundation for the Centre for Community Energy Transformation (CCET) to pursue funding for large-scale retrofit initiatives. By identifying the specific dwelling types and neighborhoods that stand to benefit most, policymakers and stakeholders can implement equitable, cost-effective programs. Such efforts are essential for improving living conditions, alleviating the financial strain of energy bills on vulnerable populations, and advancing regional climate objectives.

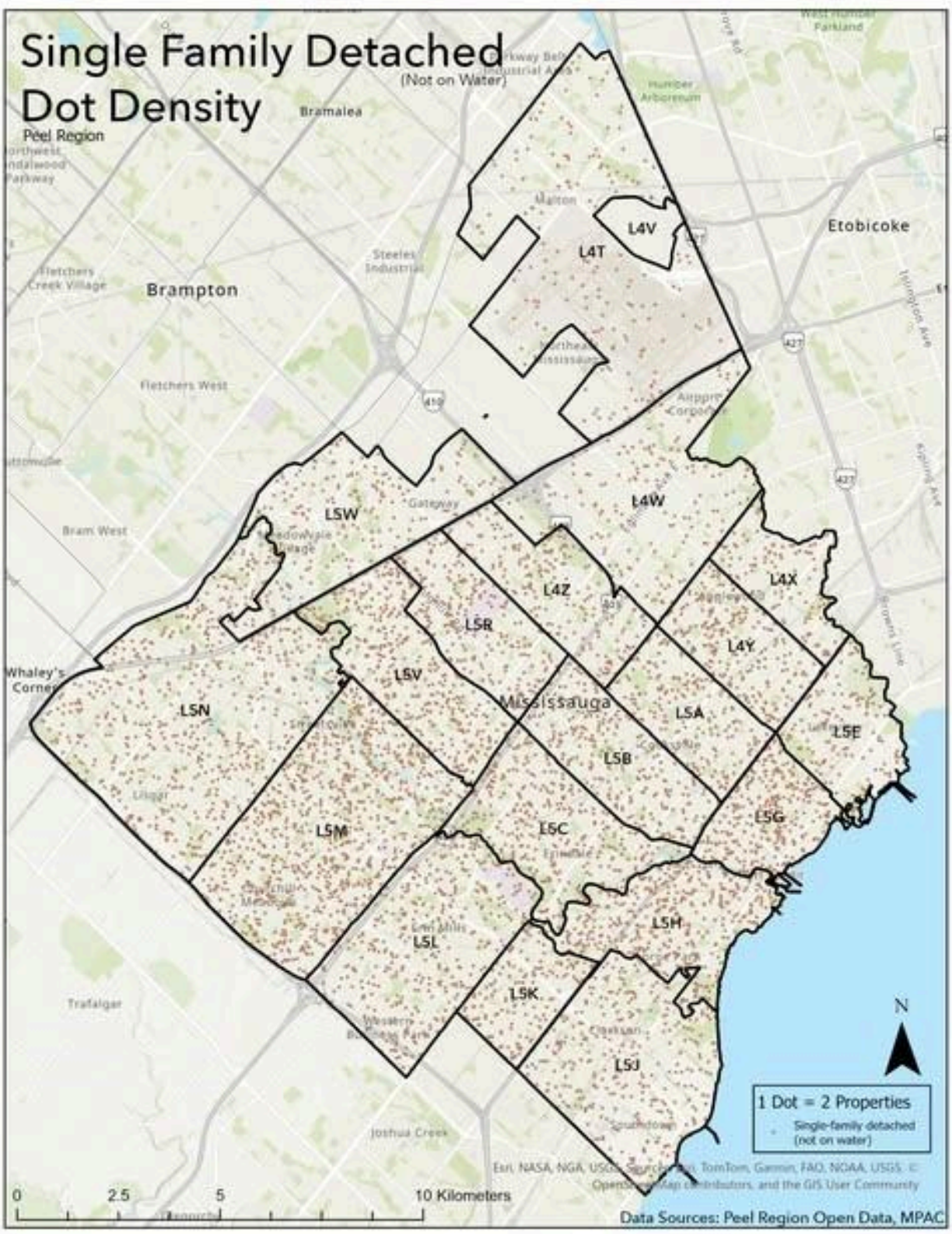
Single Family Detached
Dot Density
(Not on Water)
Peel Region
Bramalea
Brampton
Etobicoke
Mississauga
Fletchers Creek Village
Fletchers West
Bram West
Whaley's Corner
Trafalgar
Joshua Creek
L4V
L4T
L4W
L4Z
L4X
L4Y
L5W
L5R
L5V
L5N
L5A
L5E
L5B
L5G
L5M
L5C
L5H
L5L
L5K
L5J
N
1 Dot = 2 Properties
Single-family detached (not on water)
0
2.5
5
10 Kilometers
Data Sources: Peel Region Open Data, MPAC

Figure 1

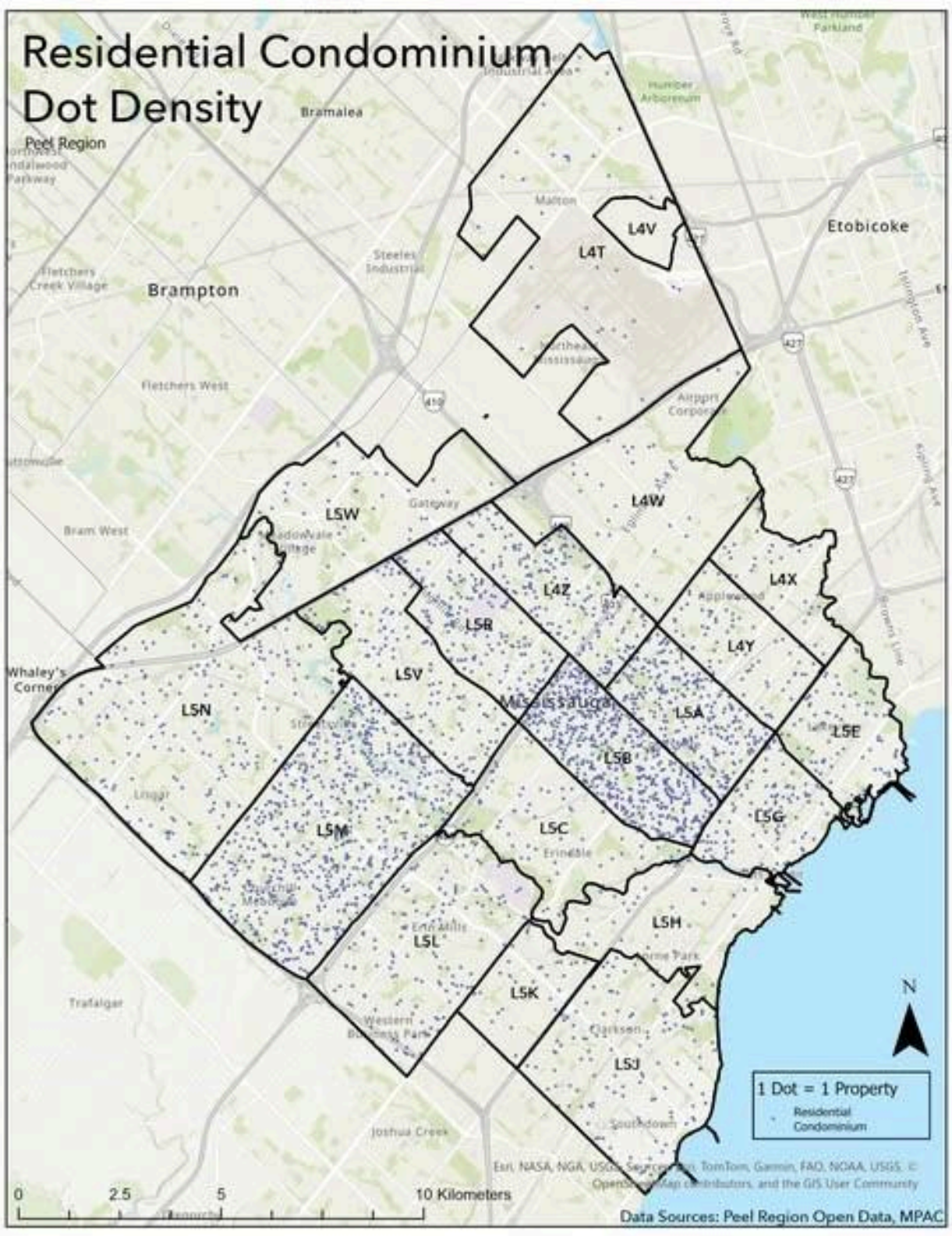
Residential Condominium
Dot Density
Peel Region
Bramalea
Brampton
Etobicoke
Malton
Steeles Industrial
Fletchers Creek Village
Fletchers West
Bram West
Gateway
Whaley's Corner
Mississauga
Trafalgar
Erindale
Clarkson
Joshua Creek
Southdown
L4V
L4T
L4W
L4X
L4Z
L4Y
L5W
L5R
L5V
L5N
L5A
L5E
L5B
L5G
L5M
L5C
L5H
L5L
L5K
L5J
N
1 Dot = 1 Property
Residential Condominium
0
2.5
5
10 Kilometers
Data Sources: Peel Region Open Data, MPAC

Figure 2

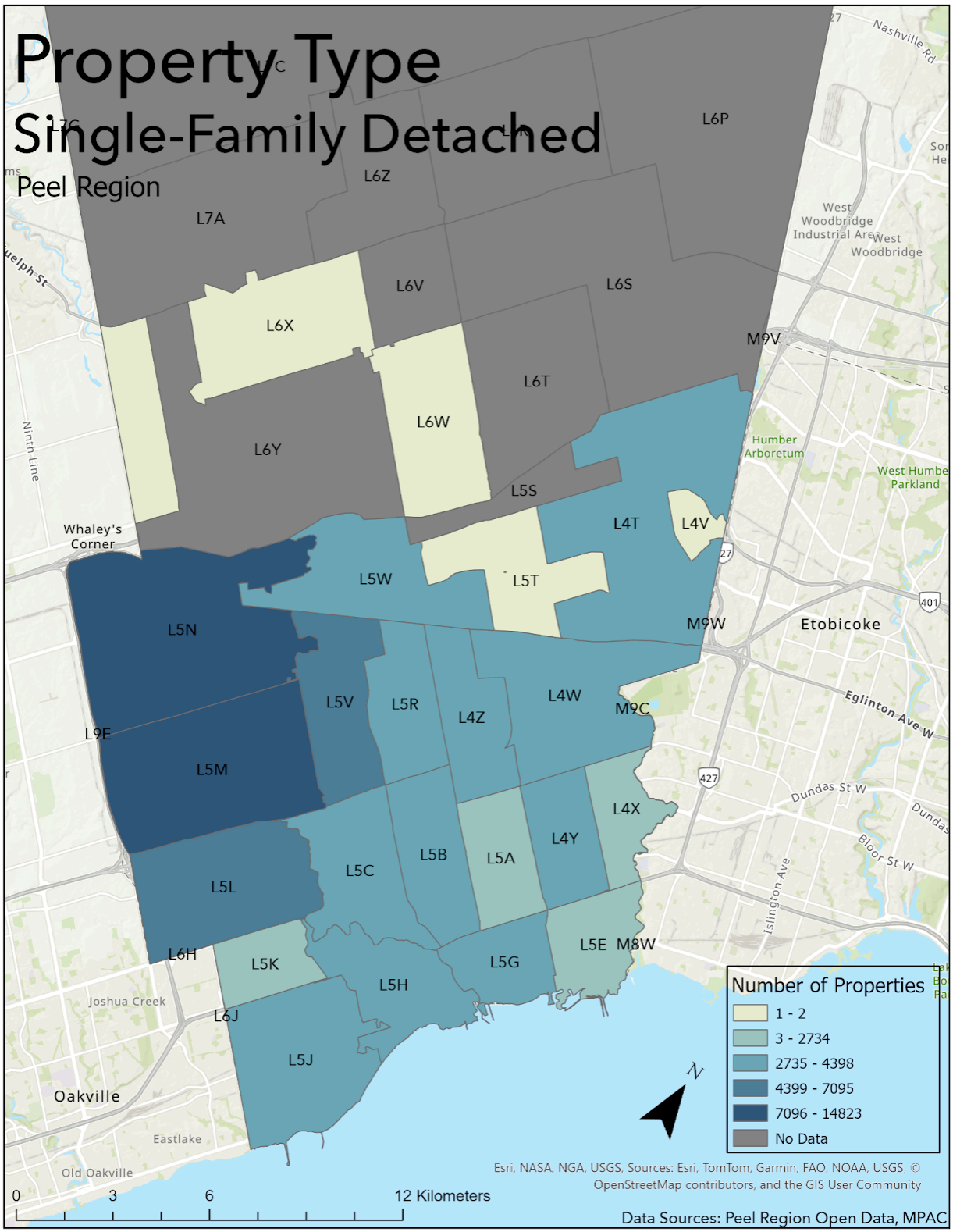
Property Type
Single-Family Detached
Peel Region
L6P
L6Z
L7A
L6V
L6S
L6X
M9V
L6T
L6W
L6Y
L5S
L4T
L4V
L5W
L5T
L5N
M9W
Etobicoke
L5V
L5R
L4Z
L4W
M9C
L9E
L5M
L4X
L4Y
L5B
L5A
L5C
L5L
L6H
L5K
L5G
L5E
M8W
L5H
L6J
L5J
Oakville
Whaley's Corner
Joshua Creek
Eastlake
Old Oakville
Nashville Rd
West Woodbridge Industrial Are
West Woodbridge
Humber Arboretum
West Humbe Parkland
Ninth Line
Eglinton Ave W
Dundas St W
Bloor St W
Islington Ave
401
427
Number of Properties
1 - 2
3 - 2734
2735 - 4398
4399 - 7095
7096 - 14823
No Data
N
0
3
6
12 Kilometers
Esri, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
Data Sources: Peel Region Open Data, MPAC

Figure 3

References

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