

# HART LAND ASSESSMENT TOOL

## Methodology and Policy Implications

The HART Land Assessment Tool focuses on one of several key mechanisms to address housing need: the use of government-owned land for non-profit and affordable housing development. International research demonstrates that leasing well-located public land to non-profit and affordable housing developers is one of the most powerful tools in scaling up housing supply. (Lawson and Ruonavaara 2020, Woetzel et al 2014). The [World Urban Forum](#) (2019: p. 16) concludes: “Public land ownership holds the key to affordability in cities where middle- and lower-income families are unable to compete with corporate investors”.

For this reason, the City of Vancouver has leased 11 municipally-owned sites to the BC Community Land Trust for development as non-profit housing (Housing Partnership Canada 2020), Ottawa Community Housing is developing more than 700 homes on land owned by municipal and federal government near a new light rail station (Willing 2021), and Indwell, a non-profit supportive housing provider, is providing 45 permanent supportive homes above a fire hall in St. Thomas (Indwell 2023). The Canadian Housing Renewal Association (2023) has called for the use of both existing and acquired new public land as an essential element of doubling non-profit homes to meet the needs of very low to moderate income households most affected by core housing need and homelessness.

The HART Land Assessment Tool identifies vacant and potentially underutilized public land, that is well-located for affordable housing based on its proximity to amenities and services. In collaboration with local, regional, and territorial government partners, we have produced a series of maps of well-located, government-owned land in each of their jurisdictions. The following document outlines the methods used to produce the HART Land Assessment Tool maps, and acts as a guide for others looking to conduct similar assessments.

The HART Land Assessment Tool methodology is broken into two steps:

- **Identifying Candidate Sites:** identifying parcels of land that may be good candidates for affordable housing development.
- **Assessing Proximity to Amenities:** assessing which parcels are relatively well-located based on their distance from various amenities and services.

Limitations: the HART Land Assessment Tool represents an initial estimate of government-owned land that might be suitable for affordable housing development. It is not intended to be a site-level analysis of feasibility. The objective is to encourage an expansive view of the options available for affordable housing. Promising sites identified through the assessment should be evaluated by local governments to determine the feasibility of development. Due to data constraints, the HART Land Assessment Tool focuses specifically on government-owned land. Future land assessments should consider land owned by non-profit organizations as potential sites for affordable housing development. The accuracy of the HART Land Assessment Tool is limited by the accuracy and completeness of the available data.

## Identifying Candidate Sites

### Building an inventory of government-owned land

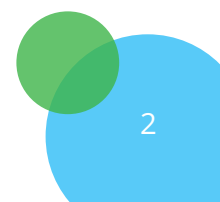
The land assessment process begins with compiling a comprehensive inventory of the parcels of land to be considered in the assessment. The HART Land Assessment Tool considers land owned by all levels of government (municipal, regional, provincial, or federal). Inventories of government-owned land were compiled by combining data obtained from open data portals, and data obtained through agreements with partners and provincial land assessment agencies. We do not include lands held by First Nations.

### Identifying vacant and potentially underutilized land

The HART Land Assessment Tool is focused on vacant lands and lands that contain one- or two-storey buildings that could potentially be redeveloped to include housing units on top (i.e. land that is potentially underutilized). To identify vacant and potentially underutilized land, the inventories of government-owned land were cross-referenced with building footprints:

- Parcels of land containing no building footprints were considered vacant.
- Parcels of land containing only one- or two-storey buildings were considered potentially underutilized.

In the absence of height attributes in the building footprint data, building footprints were compared with LiDAR (light detection and ranging) imagery to determine building heights. Building height was calculated from the median difference between LiDAR-derived Digital Terrain Models, representing the elevation of the ground, and Digital Surface Models, representing the elevation of the tallest surface, within a building's footprint.



The number of storeys in a building was estimated from its height using one of the following linear equations rounded down (where residential and non-residential classifications were obtained from local zoning layers):

$$\text{Number of Storeys}_{\text{residential}} = \lfloor 0.3383222 \times \text{Building Height}[m] - 0.1545 \rfloor$$

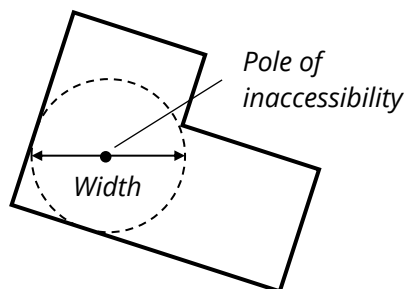
$$\text{Number of Storeys}_{\text{non-residential}} = \lfloor 0.25609267 \times \text{Building Height}[m] - 0.04409657 \rfloor$$

## Defining the exclusion criteria

After establishing an inventory of eligible government-owned lands, we developed and applied exclusion criteria to remove sites that would not be suitable for housing development, leaving only parcels which may be good candidates for housing development. The selection and implementation of the exclusion criteria is dependent on data availability and the local land use regulations. For the HART Land Assessment Tool, we worked directly with our local government partners to develop exclusion criteria unique to their communities, but some standard exclusion criteria include:

### Parcel Geometry:

- In accordance with **minimum lot size** requirements of local governments, parcels with areas under such minimum should be removed. As a baseline, the HART Land Assessment Tool uses a minimum lot size of 300 m<sup>2</sup> because smaller parcels may face development constraints.
- Parcels that do not satisfy **minimum lot width** requirements may also warrant removal. For irregular parcels without width attributes, lot widths can be calculated from the pole of inaccessibility (the internal point furthest from the parcel boundaries, see below). This can be calculated using the Pole of Inaccessibility tool in QGIS.



- **Long linear parcels:** often corridors and paths; these parcels can be identified as those with a low circularity ratio:

$$f_{circ} = \frac{4\pi(Area)}{(Perimeter)^2}$$

For the HART Land Assessment Tool, parcels with a circularity ratio of 0.25 or less were identified as candidates for removal. This threshold was chosen because it adequately captured potential corridors and paths without excluding otherwise appropriate irregularly shaped parcels.

### Current Use:

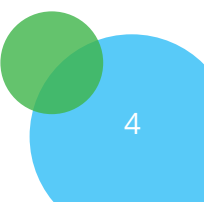
Some parcels of land may be incompatible with housing development. Where data was available, parcels with the following uses were excluded from the HART Land Assessment Tool:

- Parks
- Agricultural land
- Waste and water treatment facilities
- Utility structures
- Airports
- Roads & railways
  - Parcels that intersected a road or railway and were completely contained within a 30 m buffer around roads and railways were identified as candidates for removal, subject to a manual investigation.
- Waterways & riparian zones
  - Parcels that intersected a waterway and were completely contained within a 100 m buffer around waterways were identified as candidates for removal, subject to a manual investigation.

### Undevelopable land:

Where data was available, parcels that intersected with the following areas were excluded from the HART Land Assessment Tool:

- Environmentally sensitive & protected areas
- Floodplains
- Heavily polluted sites
- Heavy industrial zones
- Areas not services by utilities
- Heritage districts



## Assessing Proximity Measures

Parcels of land can be said to be well-located for affordable housing development if they are close to amenities and services that support well-being and participation in society. Adapted from [Canada Mortgage and Housing Corporation's \(CMHC\) social inclusion proximity criteria](#), the HART Land Assessment Tool evaluates whether each parcel is well-located according to their proximity to the amenities below:

- Child care
- Primary education
- Secondary education
- Health care centres
- Pharmacies
- Parks
- Grocery stores
- Public transit
- Libraries
- Community & recreation centers

## The Proximity Measures Database

The geographic scope of the HART Land Assessment Tool was enabled in part by Statistics Canada's [Proximity Measures Database](#) (PMD). Developed through collaboration between Statistics Canada and CMHC, the PMD includes a set of ten proximity measures to services and amenities in support of the National Housing Strategy. The coverage of the PMD is nation-wide, and proximity measures are reported at the level of Dissemination Blocks (DBs), the most granular census geography.

The proximity measures are based on a gravity model that accounts for two characteristics:

- **Mass:** the quantity of an amenity within a DB. The mass may be uniform (DBs are assigned a value of 1 if they contain a non-zero amount of amenity) or non-uniform (where mass scales with the size of service; e.g. a business' number of employees).
- **Distance:** the network distance between DB centroids (as opposed to straight line distances). Network distances were calculated using the [OpenRouteService](#) tool.

The calculation of a proximity measure is given below. The proximity measure for DB  $i$  is a summation of the level of service received from all DBs within the given distance threshold ( $J$ ). The level of service  $i$  receives from DB  $j$  is directly proportional to the mass of  $j$  and inversely proportional to the distance between the centroids of  $i$  and  $j$ . The gravity model uses a minimum distance equal to the radius of a circle with the same area as  $i$  for amenities that reside within  $i$ .

$$Proximity\ measure_i = \sum_{j \in J} \frac{Mass_j}{Distance_{i,j}}$$

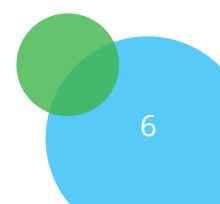
The resulting proximity measures are normalized across all of Canada, such that a value of 0 represents the lowest score and 1 represents the highest score. For DBs without access to an amenity within the

given distance threshold, values are Null. For each proximity measure, the source of the amenity data and the distance threshold is listed in Table 1.

Table 1: Proximity measures within the PMD

Proximity Measure	Source	Mass*	Mode	Distance
Employment	Business Register	Number of employees	Driving, biking, or public transport	10 km
Grocery stores	Business Register	Revenue	Walking	1 km
Pharmacies	Business Register	-	Walking	1 km
Health care centres	Business Register	Number of employees	Driving, biking, or public transport	3 km
Child care	Business Register	-	Walking	1.5 km
Primary education	Open Database of Education Facilities	-	Walking	1.5 km
Secondary education	Open Database of Education Facilities	-	Walking	1.5 km
Public transit	GTFIS	Number of trips between 7a and 10a	Walking	1 km
Parks	Authoritative open data sources, OpenStreetMap	-	Walking	1 km
Libraries	Conglomeration of open and publicly available data sources	-	Walking	1 km

\* a dash (-) denotes uniform mass (i.e. service provision is not expected to scale with revenue, or data gaps complicate the selection of a non-uniform mass).



In the PMD, distance is measured between the centroids of DBs. To assign a proximity measure to a DB requires a degree of abstraction: Parcels that are distant from the centroid of their DB are less accurately described by their proximity measures. In addition to enabling the broad scope of the HART Land Assessment Tool, the methodology of the PMD has the following desirable features:

- It reflects the idea that the closer to the point of service provision, the stronger the potential interactions.
- It captures the possibility of multiple points of access to a given service.
- For grocery stores, health care centres, and public transit, it includes a measure of the size of service provision.

### **Scoring parcels based on their proximity to amenities**

The HART Land Assessment Tool identifies well-located land by assigning each parcel a 20-point composite score based on its proximity to the ten amenities of interest. Parcels that are close to a greater variety of amenities received higher scores. For each amenity present within its specified distance threshold, parcels score points corresponding to the weight of the amenities (see Table 2). To assign weights to the amenities, similar amenities were grouped together (see Table 2), and weights were assigned to each amenity such that the maximum contribution of a single grouping would not have an outsized impact on the score.



Table 2. HART Land Assessment Tool scoring regime

Category	Proximity Measure	Mode	Distance Threshold	Weight
Education	Child care	Walking	1.5 km	1
	Primary schools	Walking	1.5 km	1
	Secondary schools	Walking	1.5 km	1
Health	Health care centres*	Driving, biking, or public transport	3 km	Minimum: 1 Maximum: 2
	Pharmacies	Walking	1 km	2
	Parks	Walking	1 km	3
	Grocery stores*	Walking	1 km	Minimum: 2
				Maximum: 4
	Transit stops*	Walking	1 km	Minimum: 2
				Maximum: 4
Public Facilities	Libraries	Walking	1 km	1
	Community & recreation centres	Walking	1.5 km	1

\* Maximum weights are awarded if the proximity measure is above the median for the jurisdiction.

To compute the composite scores, parcels of land were spatially joined with the PMD by their centroid (i.e. parcels were assigned the proximity measures associated with the centre of the DB). Of the ten amenities considered, nine are included in the PMD. Proximity to community and recreation centres is not reported in the PMD. To supplement this gap in the PMD, the network distance from a parcel to a community or recreation centre was calculated using the [OpenRouteService](#) tool.



If a given amenity was present within the specified distance threshold (as indicated by a non-zero value in the PMD), a parcel received points toward its composite score equal to the amenity's weight (see Table 2). In the PMD, amenities are separated into two categories: those where access is not expected to scale with the size of service (Education, Public Facilities, Pharmacies and Parks) and those that are expected to scale with the size of service (Health Care Centres, Grocery Stores and Transit). For amenities where access is expected to scale with the size of service (i.e. those that have a non-uniform mass within the PMD), weights vary based on the value of the proximity measure: the weight is "**minimum**" if the proximity measure is below the median PMD for the jurisdiction, and the weight is "**maximum**" if the proximity measure is above the median PMD for the jurisdiction.

The design of an amenity proximity score requires some subjectivity, including decisions about which amenities to include and how they are weighted. The HART Land Assessment Tool scoring method represents an attempt to design an easily interpretable index based on a general set of amenities that meet the needs of a broad population, but may not reflect idiosyncrasies in geography or population. For certain communities, some amenities included in the index may be less relevant than others (e.g. for seniors housing, proximity to child care and primary and secondary schools may be less important than proximity to health care centres and pharmacies). Furthermore, some moderate-scoring sites may be more suitable than high-scoring sites based on differences in the local context that are not captured by the score. Promising sites identified through the HART Land Assessment Tool should be evaluated further to determine the feasibility of development and ensure that they can meet the needs of the community.

## Policy Implications

After completing a housing needs assessment, many communities may feel overwhelmed by the scale of their housing deficit. The HART Land Assessment Tool offers insight into one approach to address housing need: leveraging federal, provincial/territorial, and municipal government-owned land supply for non-profit and affordable housing development. Well-located land identified through the assessment may be good candidates for new public housing projects, or leased/provided at low-cost to non-profit housing providers. The use of government-owned land for non-profit housing development can further other related policy objectives, including transit-oriented development in the case of surplus land around transit hubs, and the co-location of housing with civic services like libraries and communities centres.

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