Site-Sutiability Analysis in Ontario's Greenbelt

Young Jun Jeong

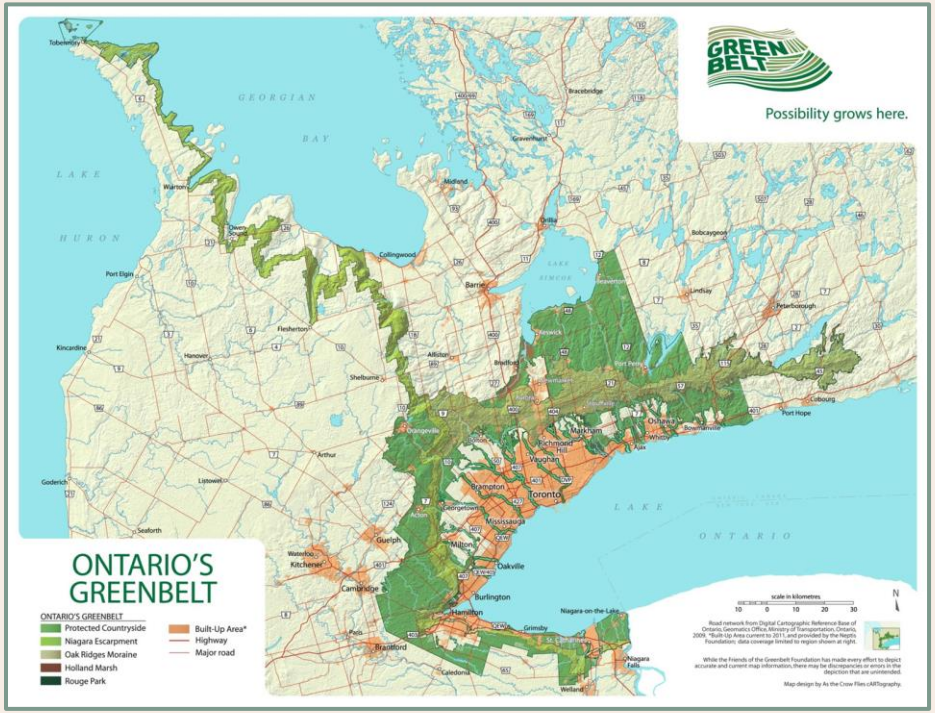
Problem and Background

ON Government wants to build 1.5 million new homes in 10 years

Requires new developable land due to the high costs of construction in city cores

Government wants to move greenbelt land further into the countryside

New land would free up space for residential development



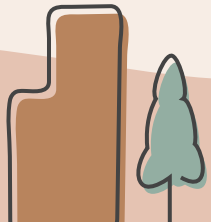
Problem Continued

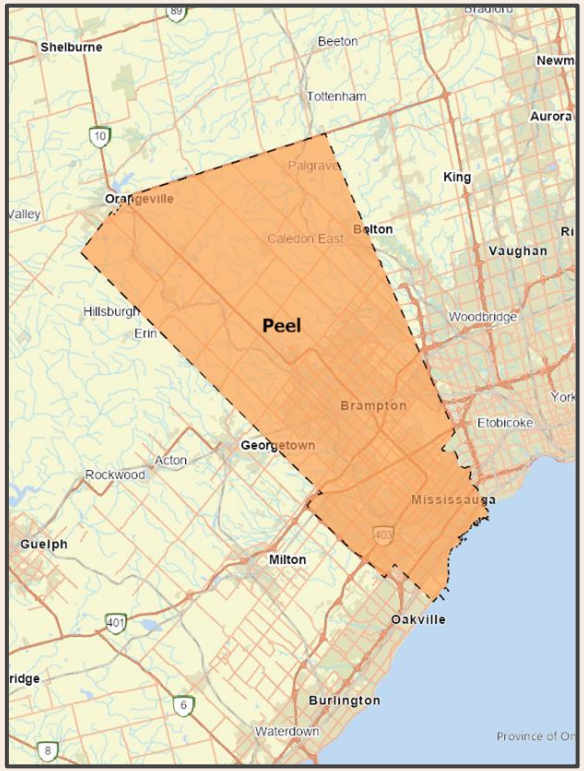
Urban Problems

- ❏ Air and Noise Pollution
- ❏ Traffic
- ❏ Higher Crime Rates
- ❏ Housing Shortage
- ❏ Health Hazards
- ❏ Unemployment Rate

Solutions

- ❏ Urban Expansion Outwards
- ❏ Develop Housing in Suitable Areas





Goal

- ❑ Analyze the greenbelt area contained within Peel
- ❑ Determine suitable areas for development of housing using these considerations:
  - **Slope of the area**
  - **Distance from Roads**
  - **Distance from facilities**
  - **Impassable land cover (Water Bodies)**

Data

- Ontario Digital Elevation Model (DEM)
- Ontario Greenbelt Boundary
- Peel Region Boundary
- Points file of Facilities (Peel Region)
- Ontario Hydro Network - Waterbodies
- Ontario Road Network

Geoprocessing Functions Used

- Erase
- Extract by Mask
- Slope
- Con
- Euclidean Distance
- Raster Calculator

Tool Interface

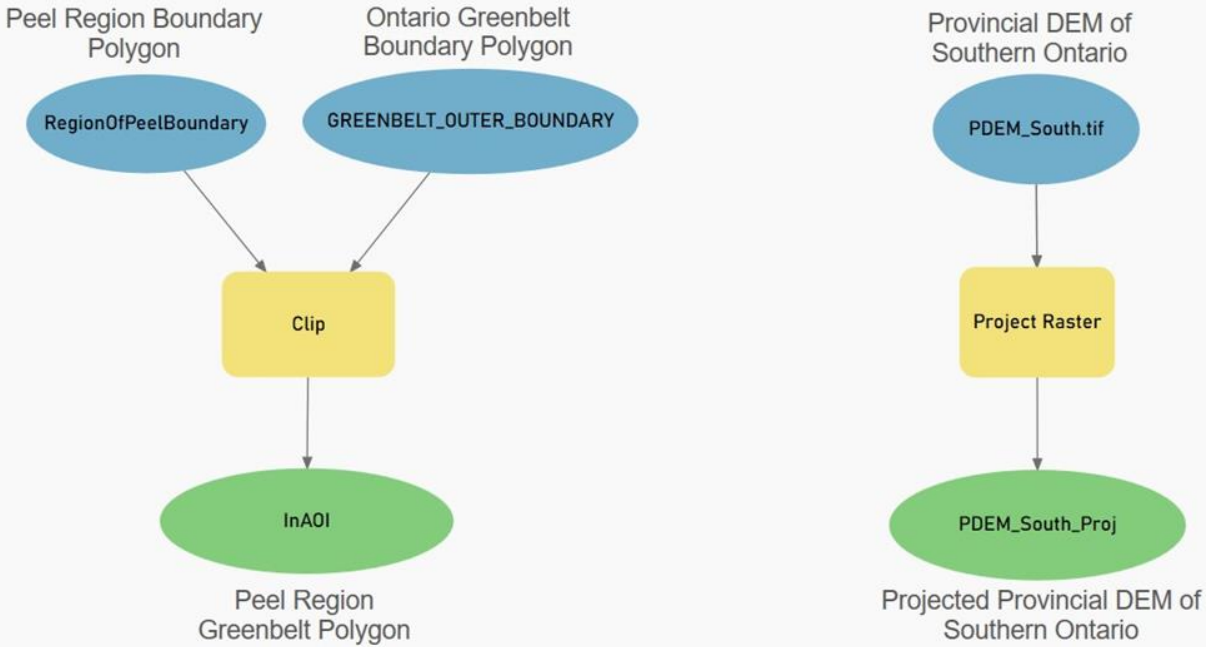
Geoprocessing

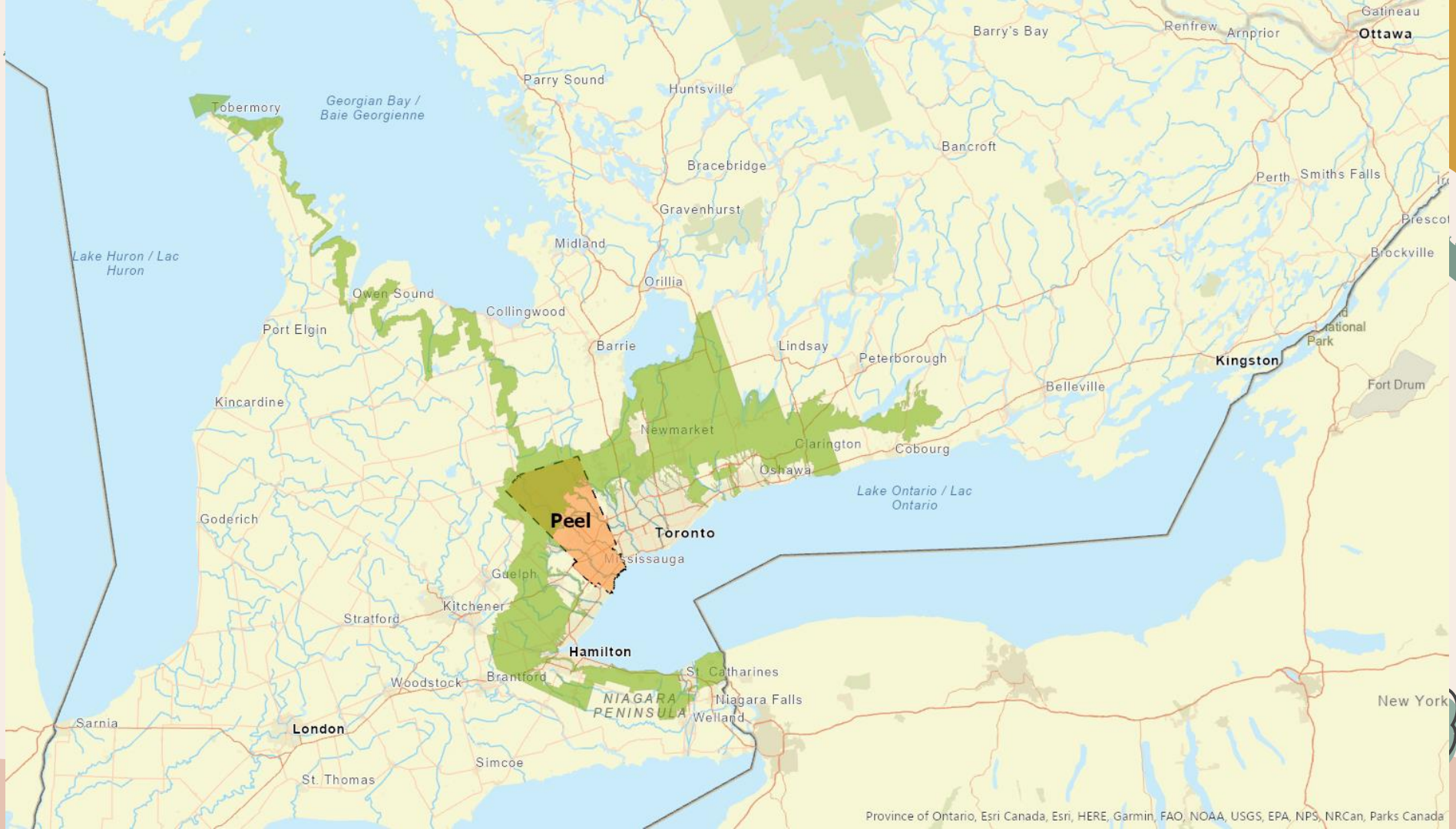
Optimal Constructible Area Analyzer

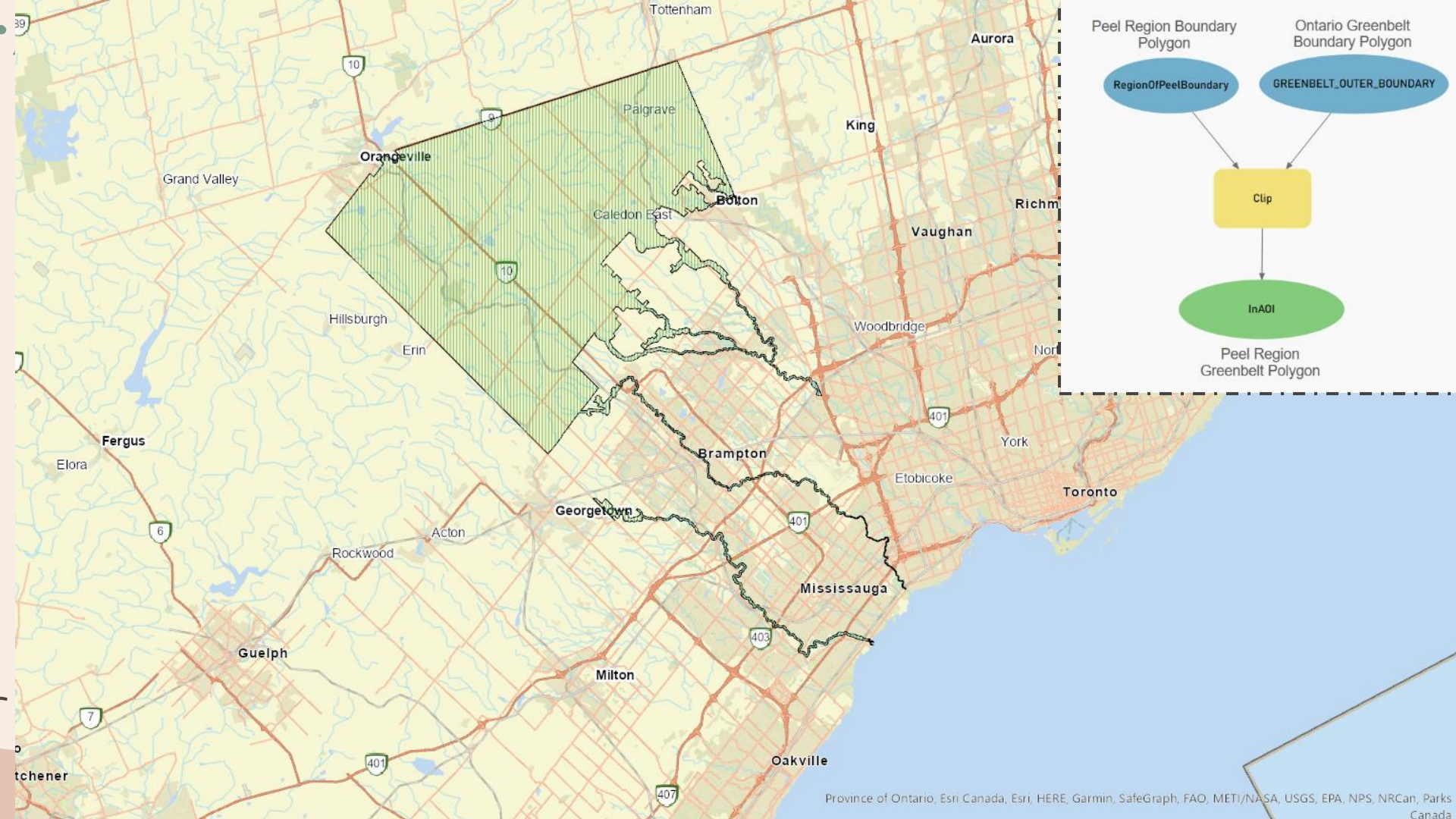
Parameters Environments

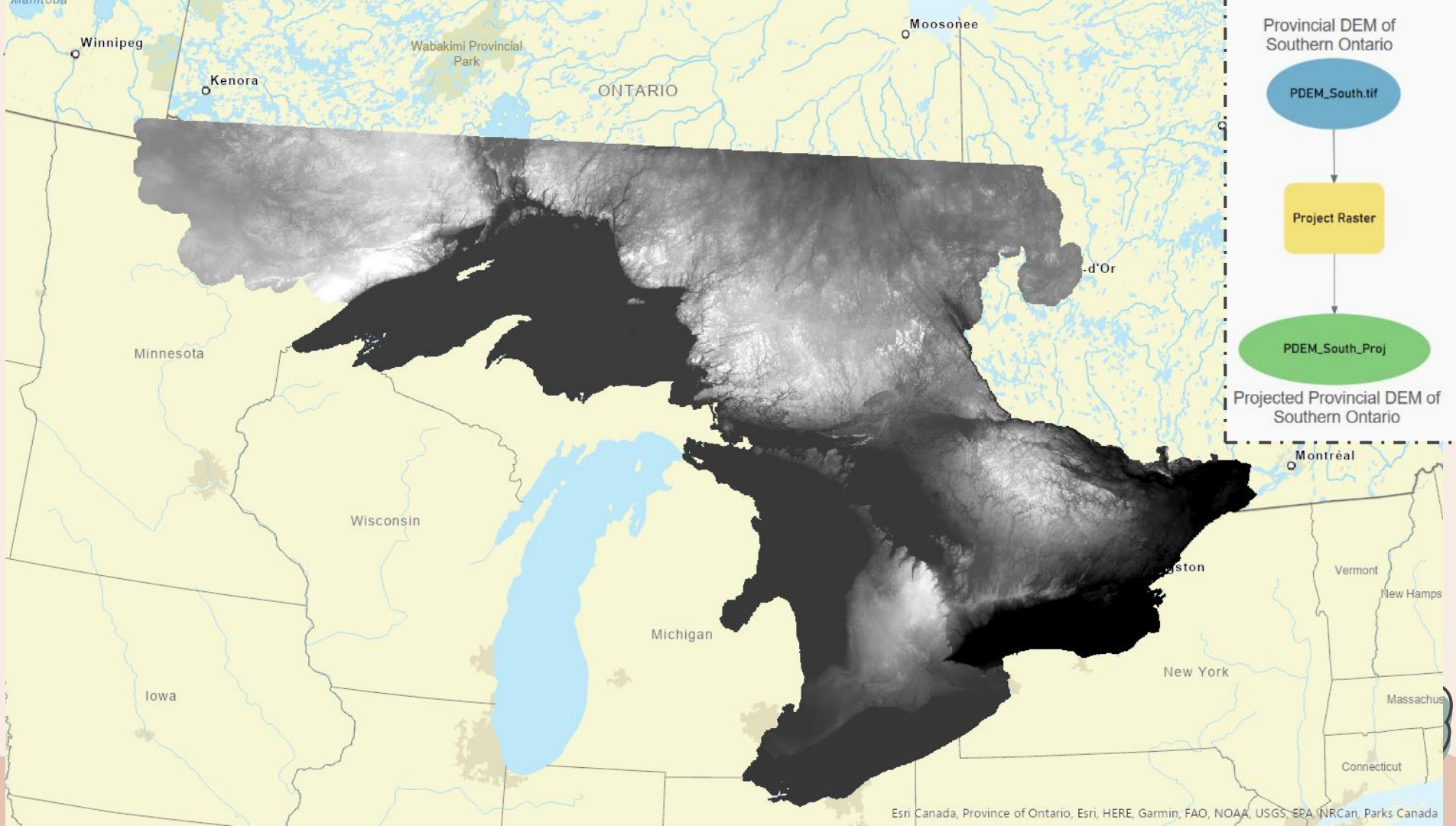
* Input Area
Area for Removal
* Digital Elevational Model (DEM)
* Percent Rise Limit of Slope
* Road Network
* Distance from Road Network
Unknown
* Points of Interest
* Distance from Points of Interest
Unknown
* Output Raster
Run

Model: Local Data Preparation

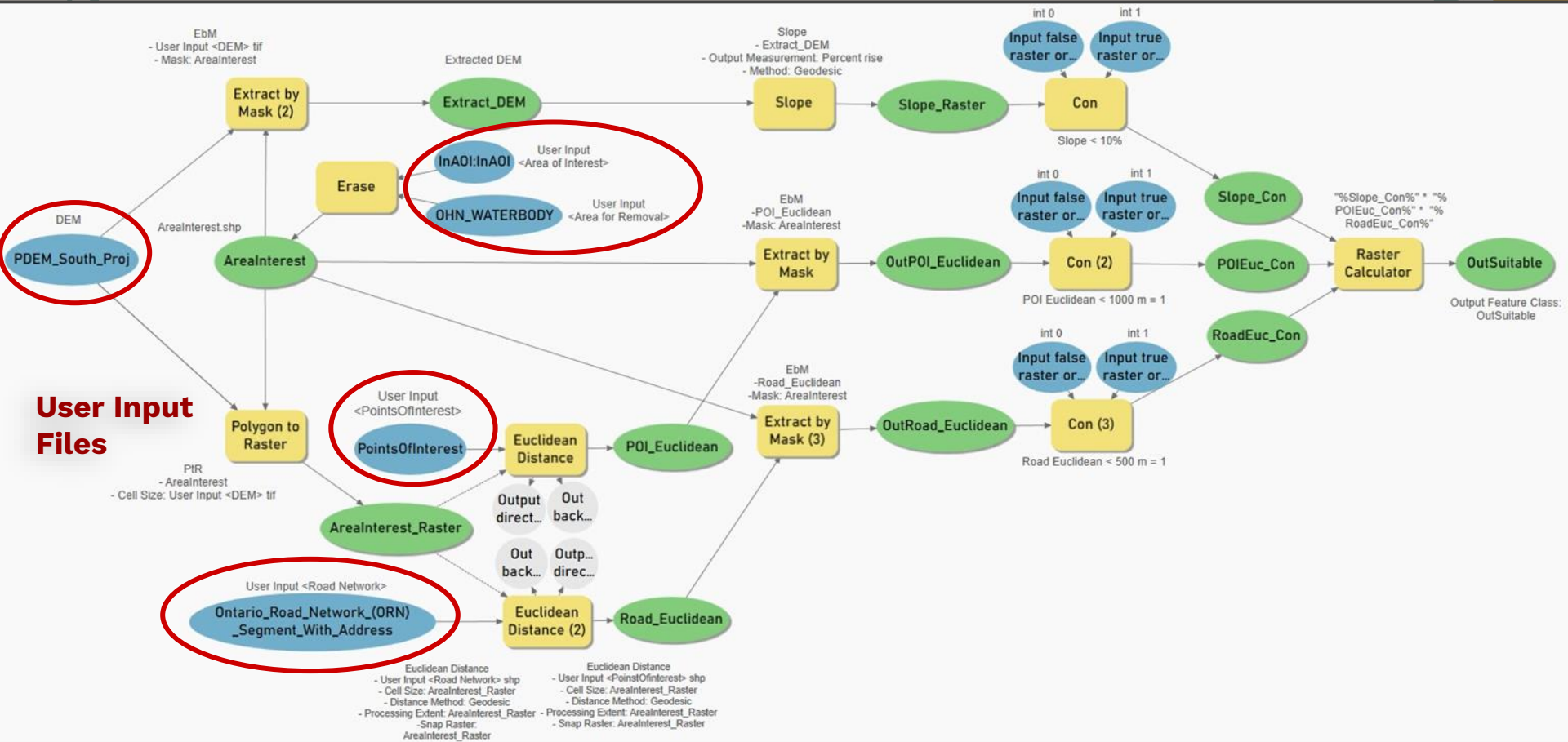



Peel
Toronto
Mississauga
Hamilton
London
Kingston
Ottawa
Barrie
Orillia
Midland
Gravenhurst
Bracebridge
Huntsville
Parry Sound
Bancroft
Barry's Bay
Renfrew
Arnprior
Gatineau
Perth
Smiths Falls
Brockville
Prescot
Tobermory
Georgian Bay / Baie Georgienne
Lake Huron / Lac Huron
Owen Sound
Collingwood
Port Elgin
Kincardine
Goderich
Lindsay
Peterborough
Belleville
Fort Drum
Newmarket
Clarington
Cobourg
Oshawa
Lake Ontario / Lac Ontario
Guelph
Kitchener
Stratford
Brantford
Woodstock
St. Catharines
Niagara Falls
Welland
NIAGARA PENINSULA
Sarnia
Simcoe
St. Thomas
New York
Province of Ontario, Esri Canada, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, NRCan, Parks Canada

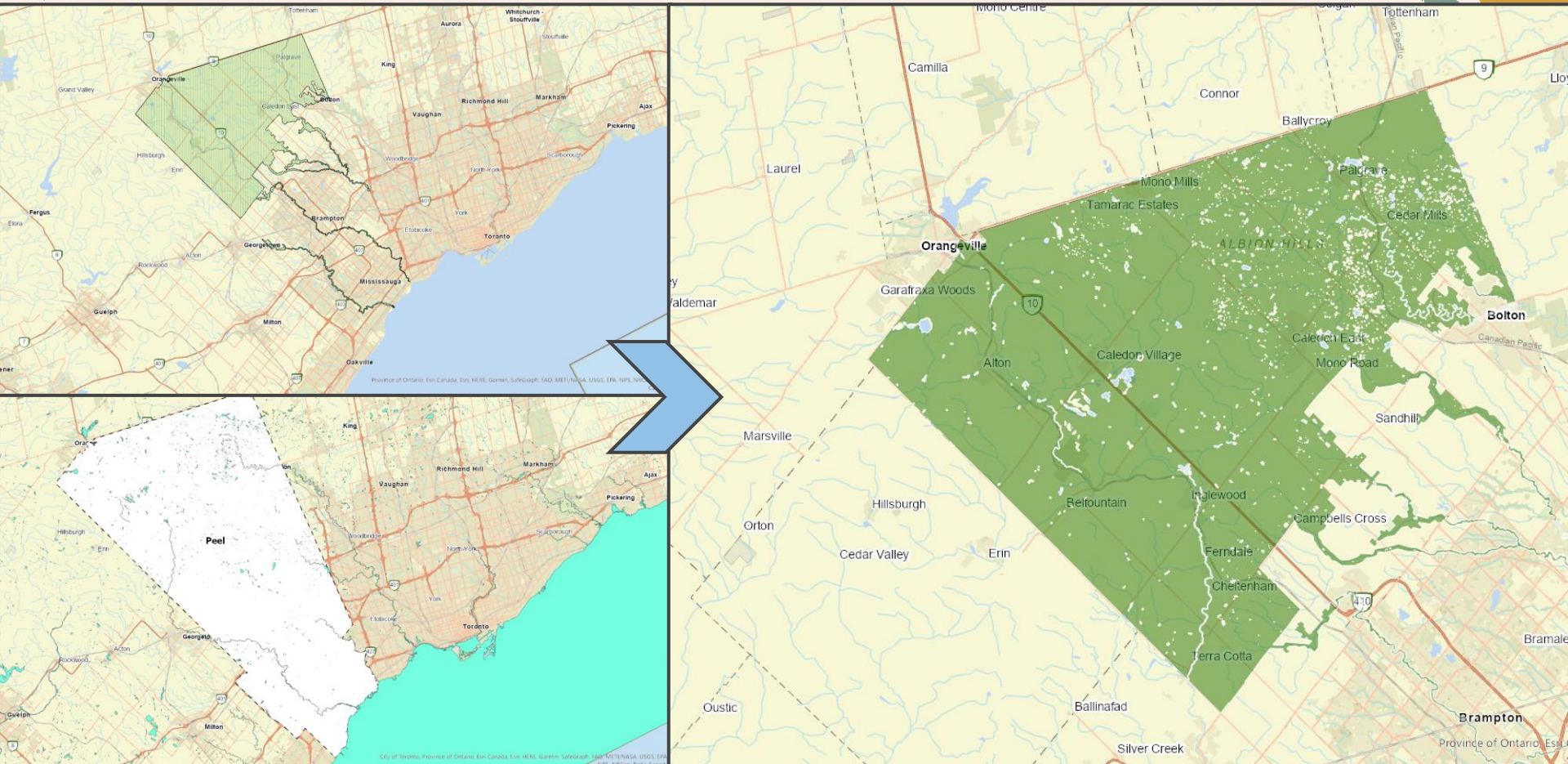

Peel Region Boundary Polygon
Ontario Greenbelt Boundary Polygon
RegionOfPeelBoundary
GREENBELT_OUTER_BOUNDARY
Clip
InAOI
Peel Region Greenbelt Polygon
Tottenham
Aurora
Palgrave
King
Orangeville
Grand Valley
Bolton
Caledon East
Vaughan
Hillsburgh
Erin
Woodbridge
Fergus
Elora
Brampton
York
Etobicoke
Toronto
Georgetown
Acton
Rockwood
Mississauga
Guelph
Milton
Oakville
Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada


Provincial DEM of Southern Ontario
PDEM_South.tif
Project Raster
PDEM_South_Proj
Projected Provincial DEM of Southern Ontario
Winnipeg
Kenora
Wabakimi Provincial Park
Moosonee
ONTARIO
Minnesota
Wisconsin
Michigan
Iowa
Montréal
Vermont
New York
Connecticut
Esri Canada, Province of Ontario, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada

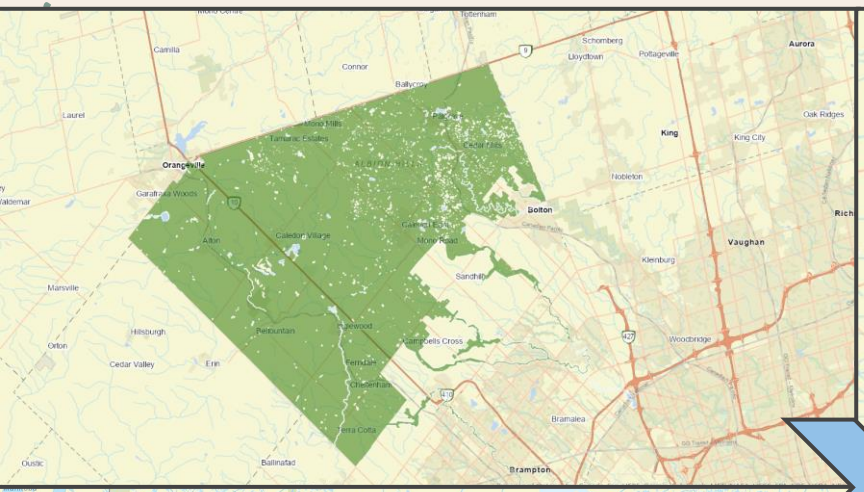
Model: Optimal Constructible Area

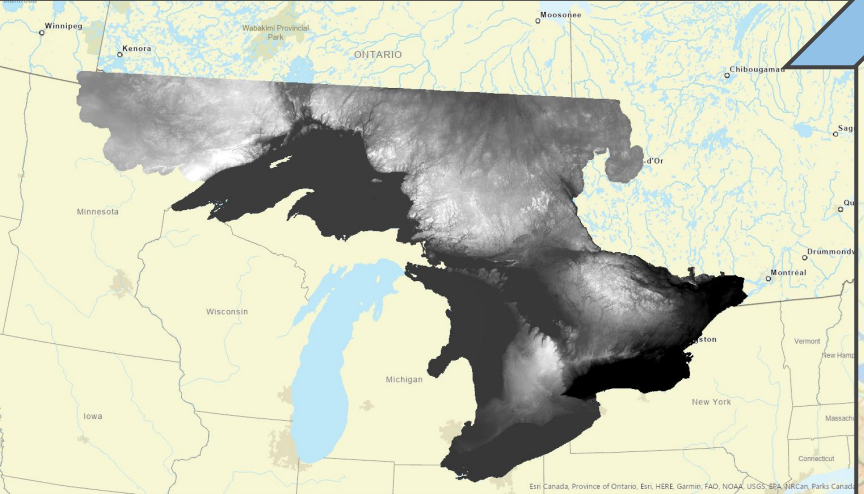


Erase

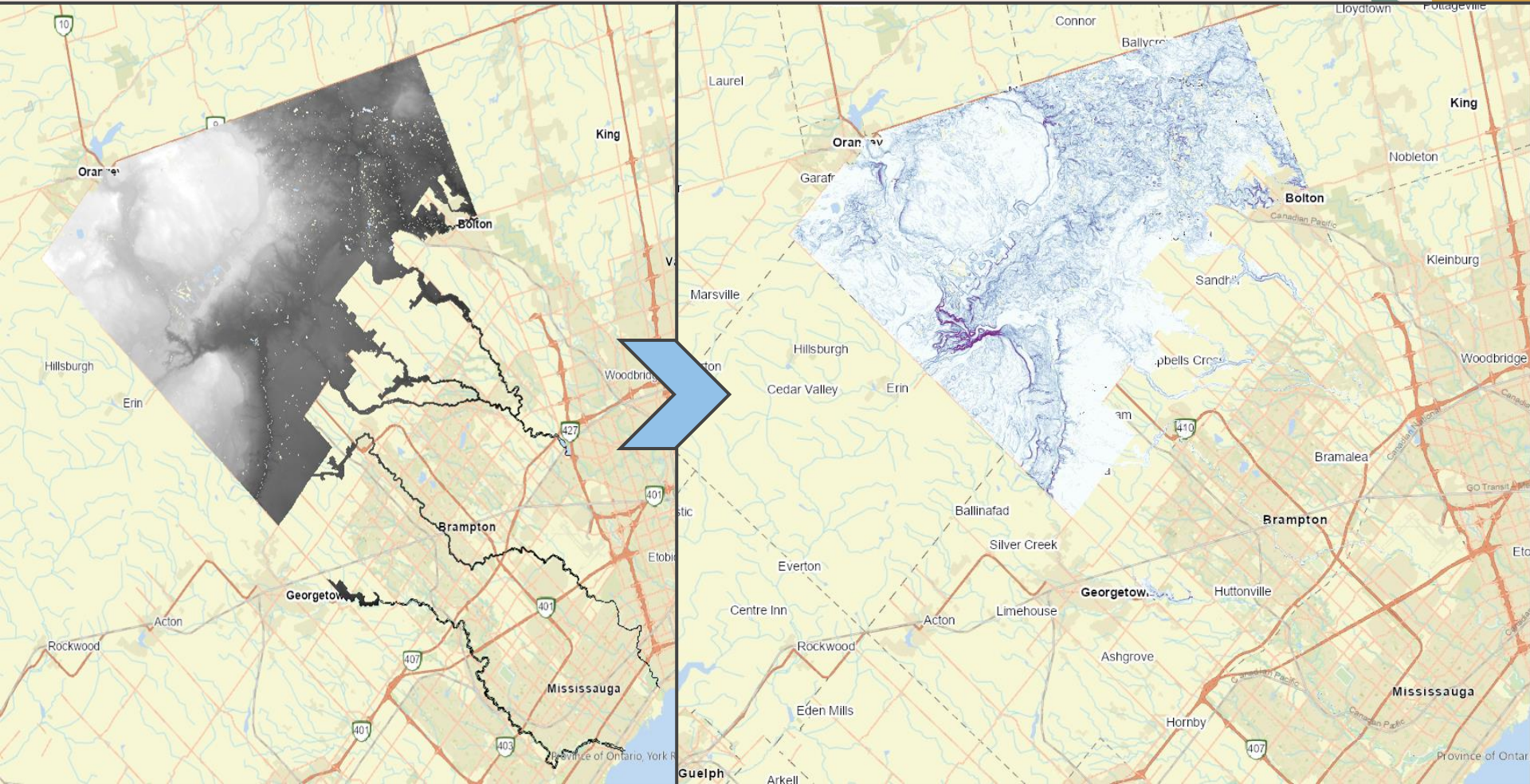

Orangeville
Peel
Brampton
Mississauga
Milton
Oakville
Georgetown
Caledon
Toronto
Vaughan
Richmond Hill
Markham
Ajax
Pickering
King
Aurora
Whitchurch-Stouffville
Scarborough
North York
Etobicoke
York
Woodbridge
Palgrave
Bolton
Hillsburgh
Erin
Fergus
Elora
Guelph
Acton
Rockwood
Grand Valley
Tottenham
Camilla
Laurel
Connor
Ballycroy
Mono Mills
Tamarac Estates
Cedar Mills
Garafraxa Woods
Alton
Caledon Village
Caledon East
Mono Road
Bolton
Sandhill
Marsville
Orton
Cedar Valley
Belfountain
Inglewood
Campbells Cross
Ferndale
Cheltenham
Terra Cotta
Oustic
Ballinafad
Silver Creek
Bramalea
Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, NRCan
City of Toronto, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA

Extract by Mask

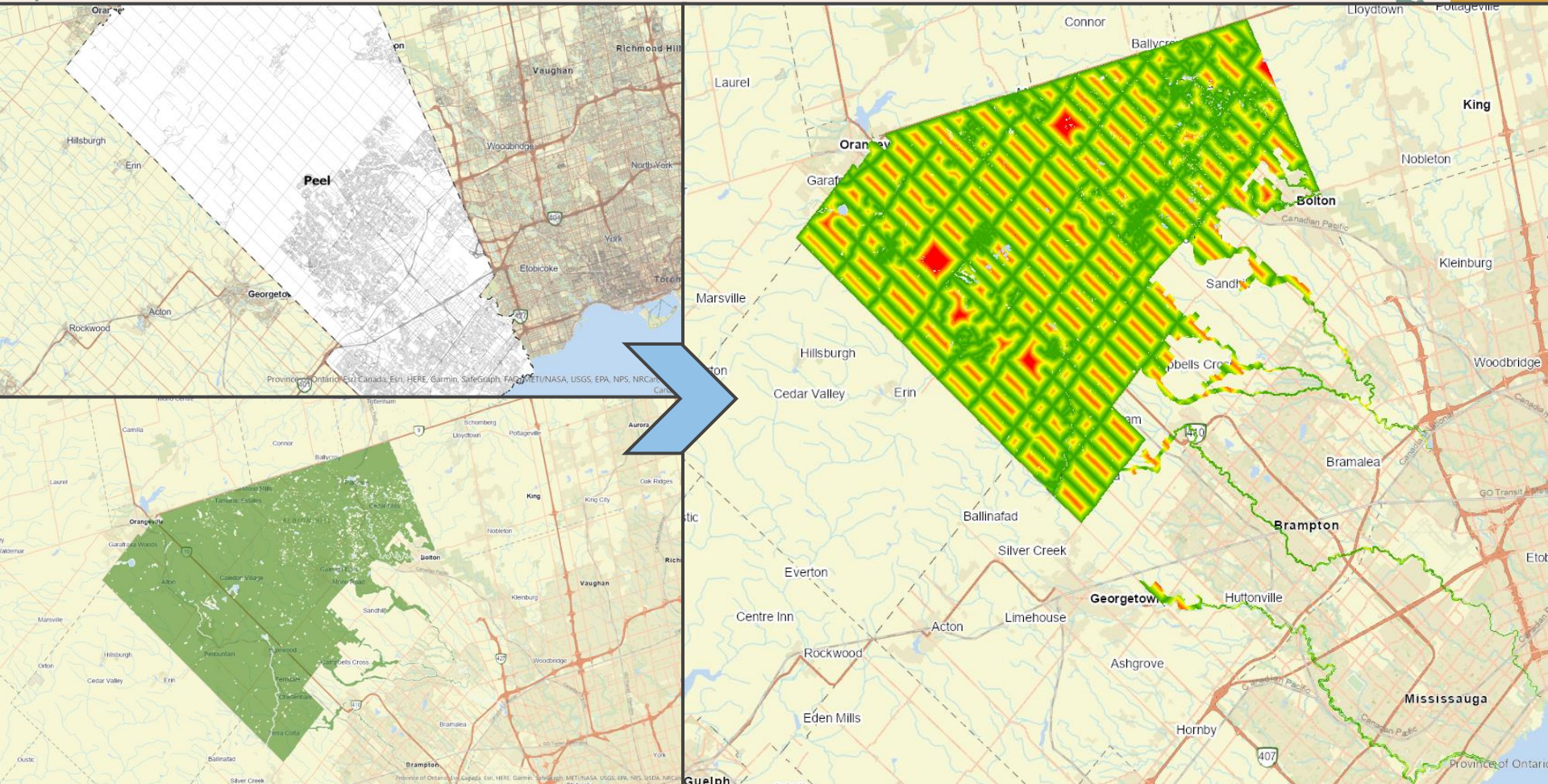




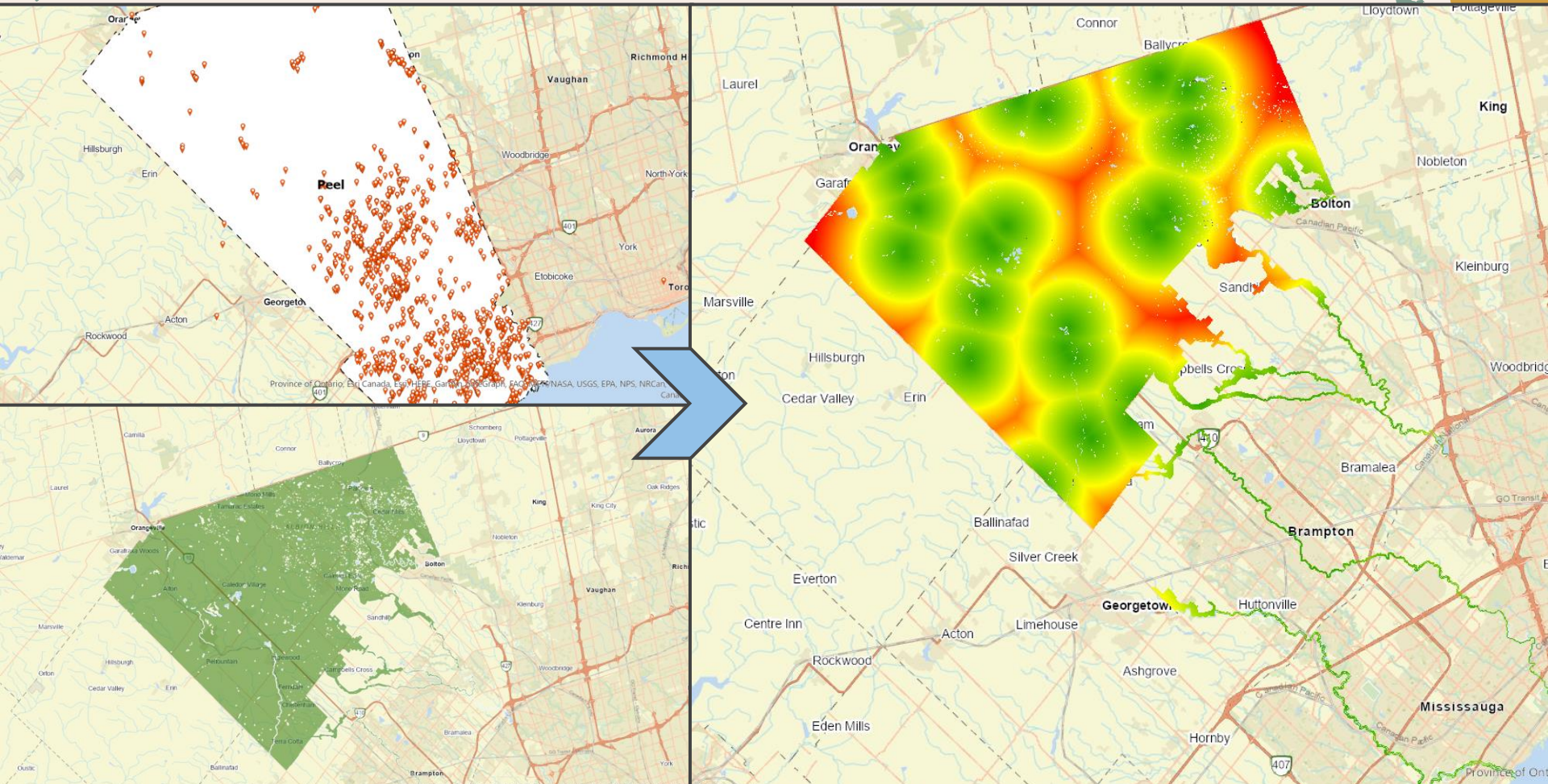
Slope Tool


King
Bolton
Hillsburgh
Erin
Woodbridge
Brampton
Georgetown
Acton
Rockwood
Mississauga
Marsville
Cedar Valley
Connor
Laurel
Nobleton
Kleinburg
Bramalea
Ballinafad
Silver Creek
Everton
Centre Inn
Limehouse
Huttonville
Ashgrove
Eden Mills
Hornby
Guelph
Province of Ontario, York R
Province of Ontar

Euclidean Distance



Euclidean Distance

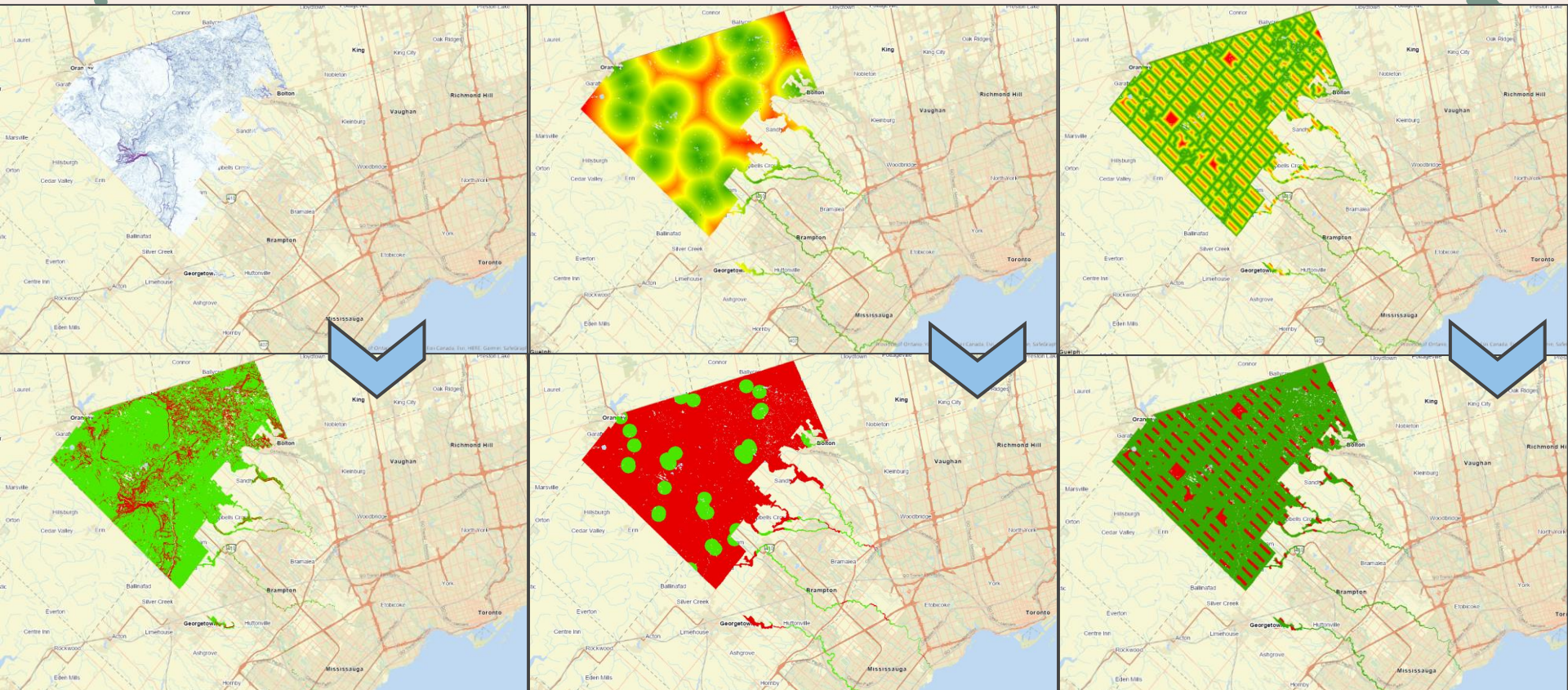


Con Tool

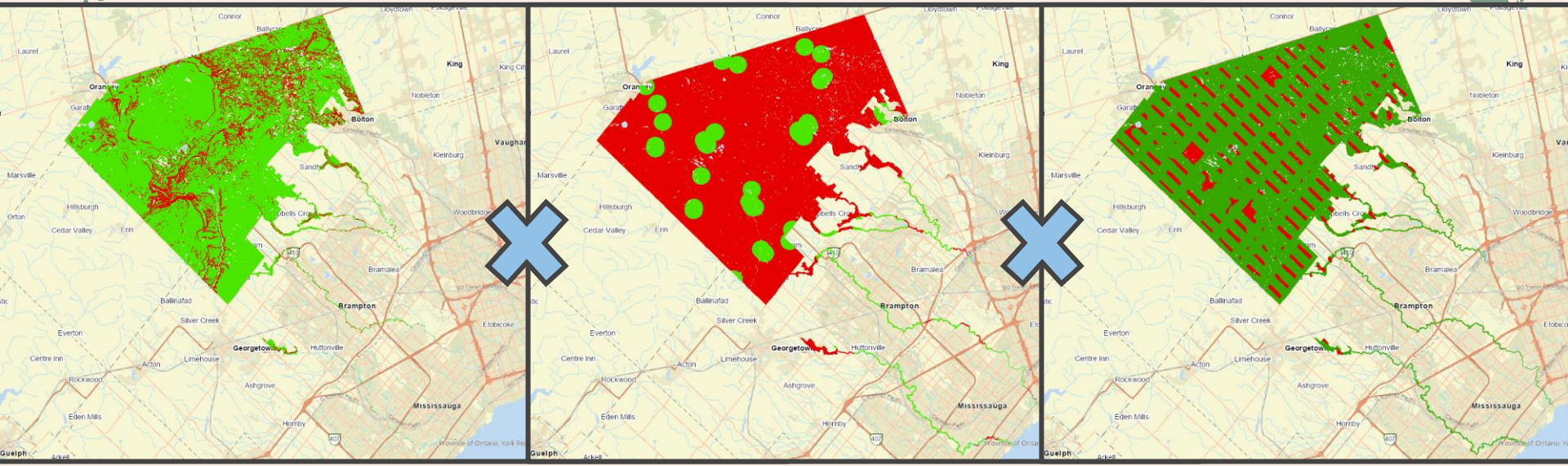
for Slope Layer

for POI Euclidean Distance Layer

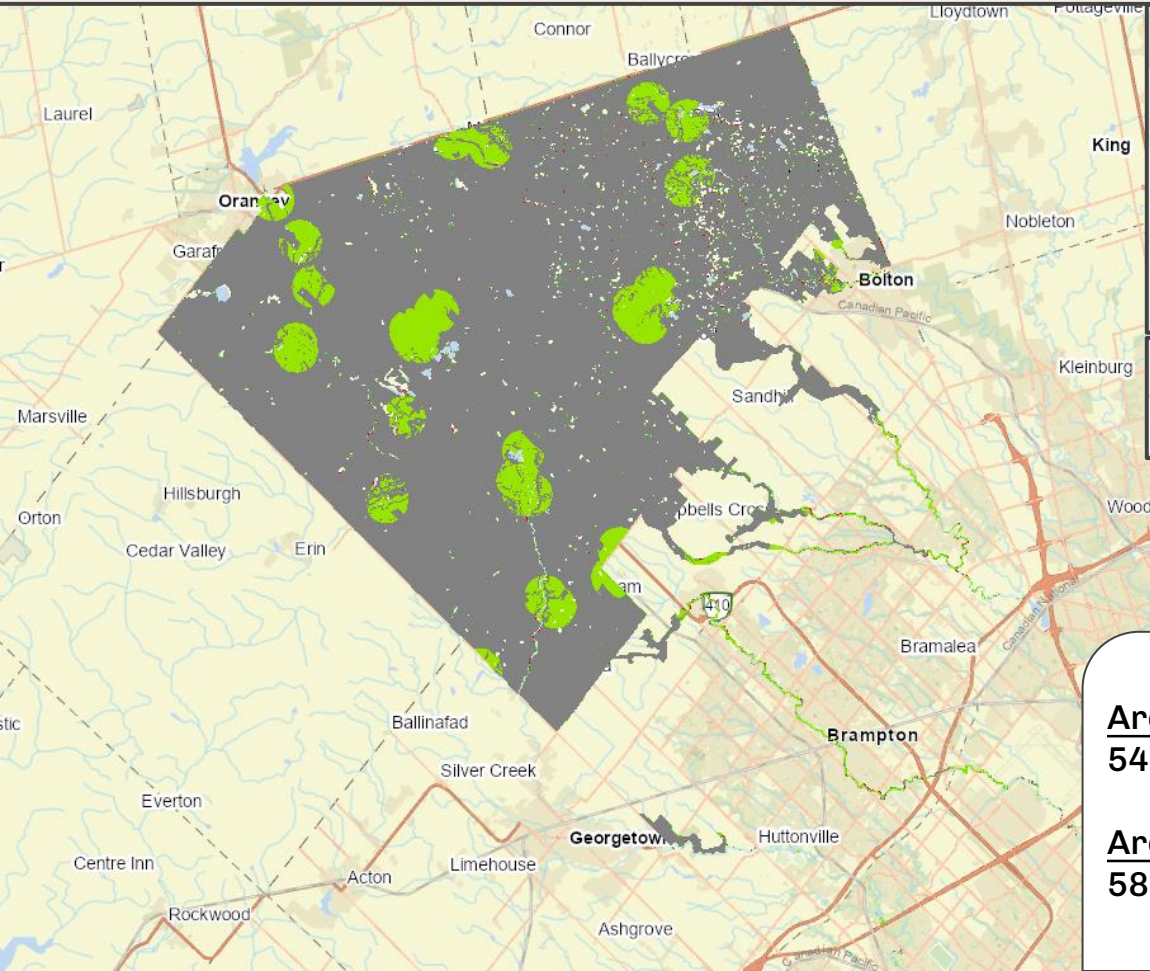
for Roads Euclidean Distance Layer



Raster Calculator



Results



OutSuitable:OutSuitable

Field: Add Calculate Selection: Select By

	OBJECTID *	Value	Count	Suitable
1	1	0	542434	Non-suitable (Gray)
2	2	1	58282	Suitable (Green)

Cell Size X	30
Cell Size Y	30

Area Not Optimal for Construction

542,434 cells × $30^2 m^2/(1{,}000^2 m^2)$ = **488.1906** km^2

Area Optimal for Construction

58,282 cells× $30^2 m^2/(1{,}000^2 m^2)$ = **52.4538** km^2

Limitations & Future Considerations

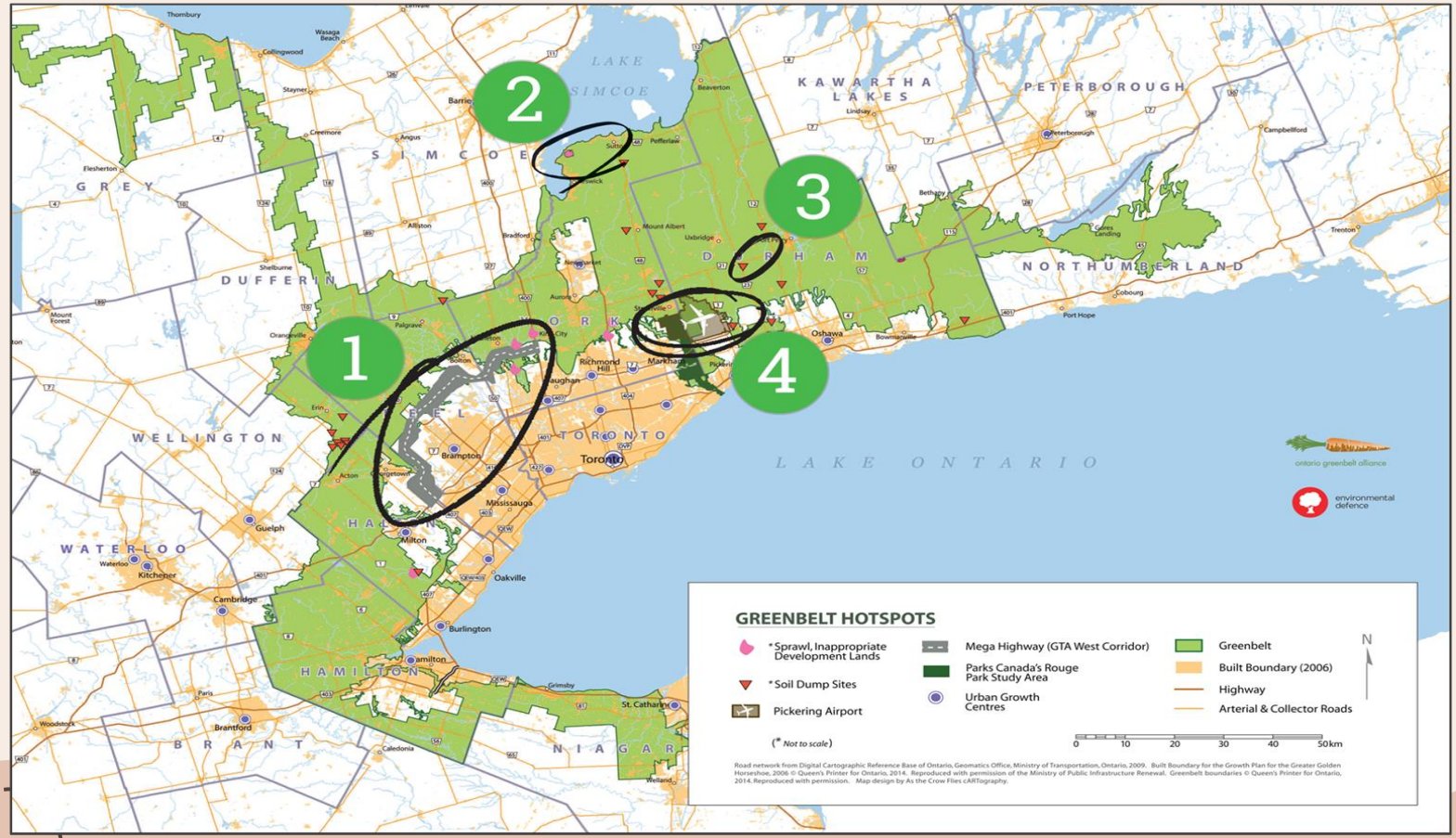
Limitations:

- Could not use land cover because of land reclassification which is unique for each user. Making it hard to have a specific type of reclassification for all land cover inputs.
- Water bodies shapefile was not completely accurate
- Unable to obtain reliable information on suitable land acquisition costs

For Future Considerations:

- Have different weights for the distances from different buildings
- Use walking distance as a factor in areas that have a limited road network
- Split the plots of suitable land by zoning by building type (single-family, townhouses, apartments)

Future Projects



References

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M., Moe, Says, B., Buildingadvisor, Says, J., Jani, says, L., Laney, says, N., Nick, says, C. D., Dalfonso, C., says, K. D., Dunbar, K., says, M., Matts, says, N., Naresh, says, L. E., … Foster, L. (2022, May 5). *Evaluating a building lot -- slope, soils, drainage, radon, and more*. Building Advisor. Retrieved December 3, 2022, from https://buildingadvisor.com/buying-land/site-characteristics/slope-soils-water-vegetation/

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