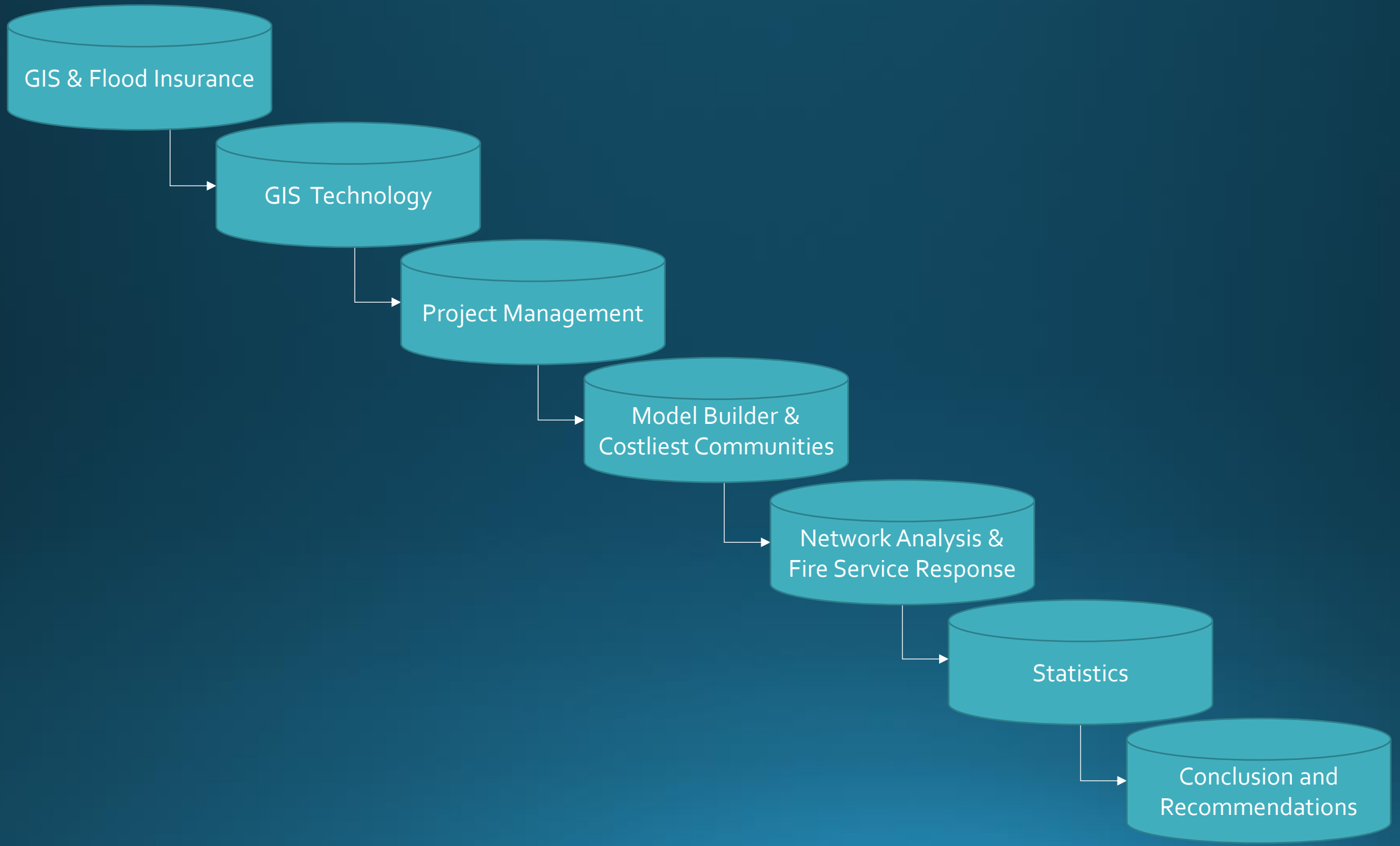
Tavish Prather
Gabrielle Abernethy
Tesfalem Woldeab
Romy Francis

GIS-Based Flood Insurance Modeling for Calgary


GIS & Flood Insurance
GIS Technology
Project Management
Model Builder &
Costliest Communities
Network Analysis &
Fire Service Response
Statistics
Conclusion and
Recommendations

Project Scope

This project aims to answer the question:

Based on the flood levels from Calgary's 2013 flood

event, which communities in Calgary are potentially the costliest to insurers?

The project will focus on two main risk factors:

1)The average value of homes within each community 1:100 flood zone.

2)The proximity of flood-prone homes to fire emergency services as determined through network analysis.

How are Insurers using GIS?

The significance for Insurers' lies in identifying geographic regions that can be calculated as substantial risk.

FEMA (Federal Emergency Management Agency) released a methodology for rating flood risk which includes:

1)Distance of a building to a flooding source, i.e. **the dwelling location**;

2)The **building's replacement cost** (FEMA, n.d.); and

3)The community rating discount based on **reducing damage to insurable property**.

Fuduli, L. 2020. [Online Image]. What is flood insurance and what does it cover?.

https://www.answerfinancial.com/insurance-center/what-is-flood-insurance-and-what-does-it-cover/

Geospatial Technology

Automation

- Model builder

Network Analysis

- Closest facility

Spatially derived statistics

- Summary stats and table joins

Thematic Mapping

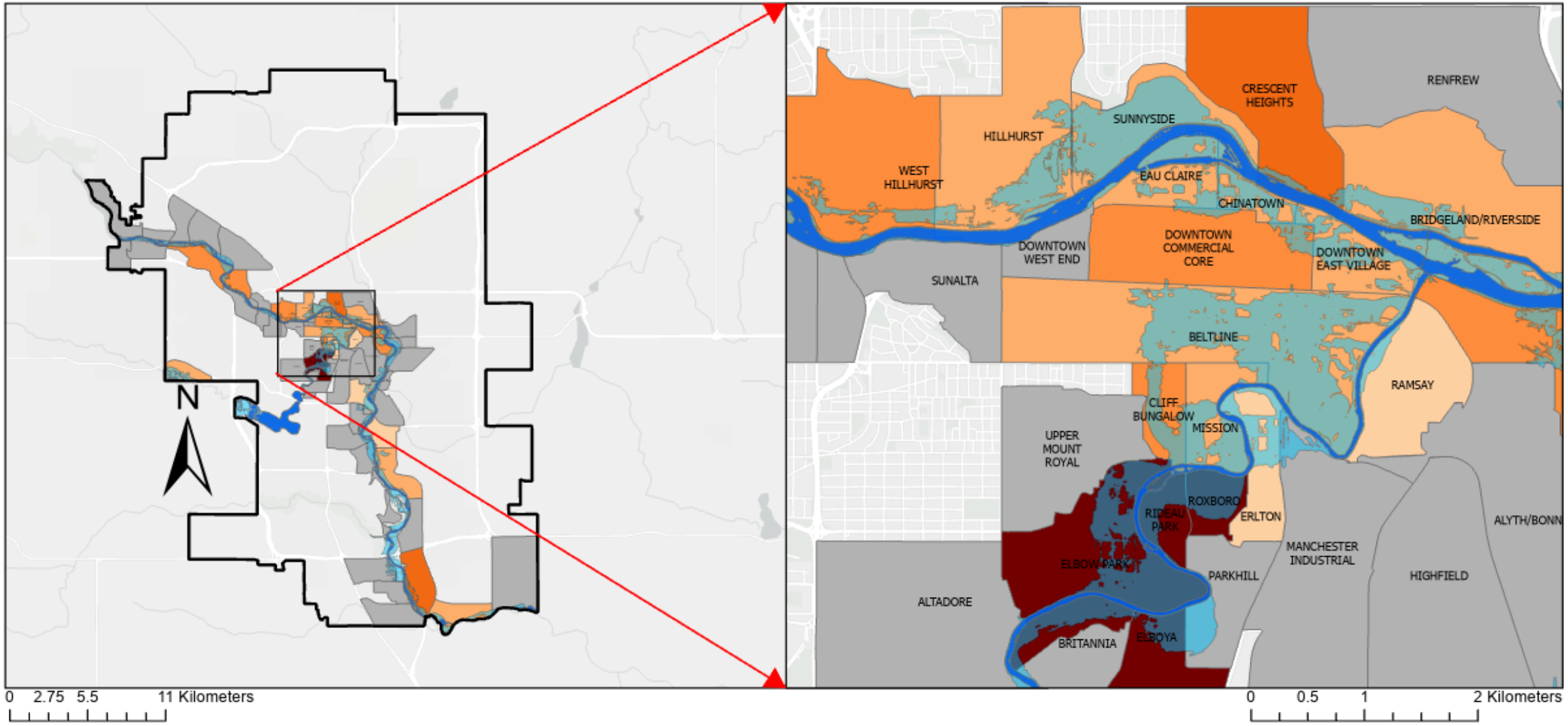
- Fire Service Response
- Costly Communities

Geospatial Project Management

Wagner, L. (2022, Dec 9). *Snake Case Or Camel Case? A Guide To Programming Naming Conventions.* [Online Image]. https://blog.boot.dev/clean-code/casings-in-coding/

Costliest Communities - ModelBuilder

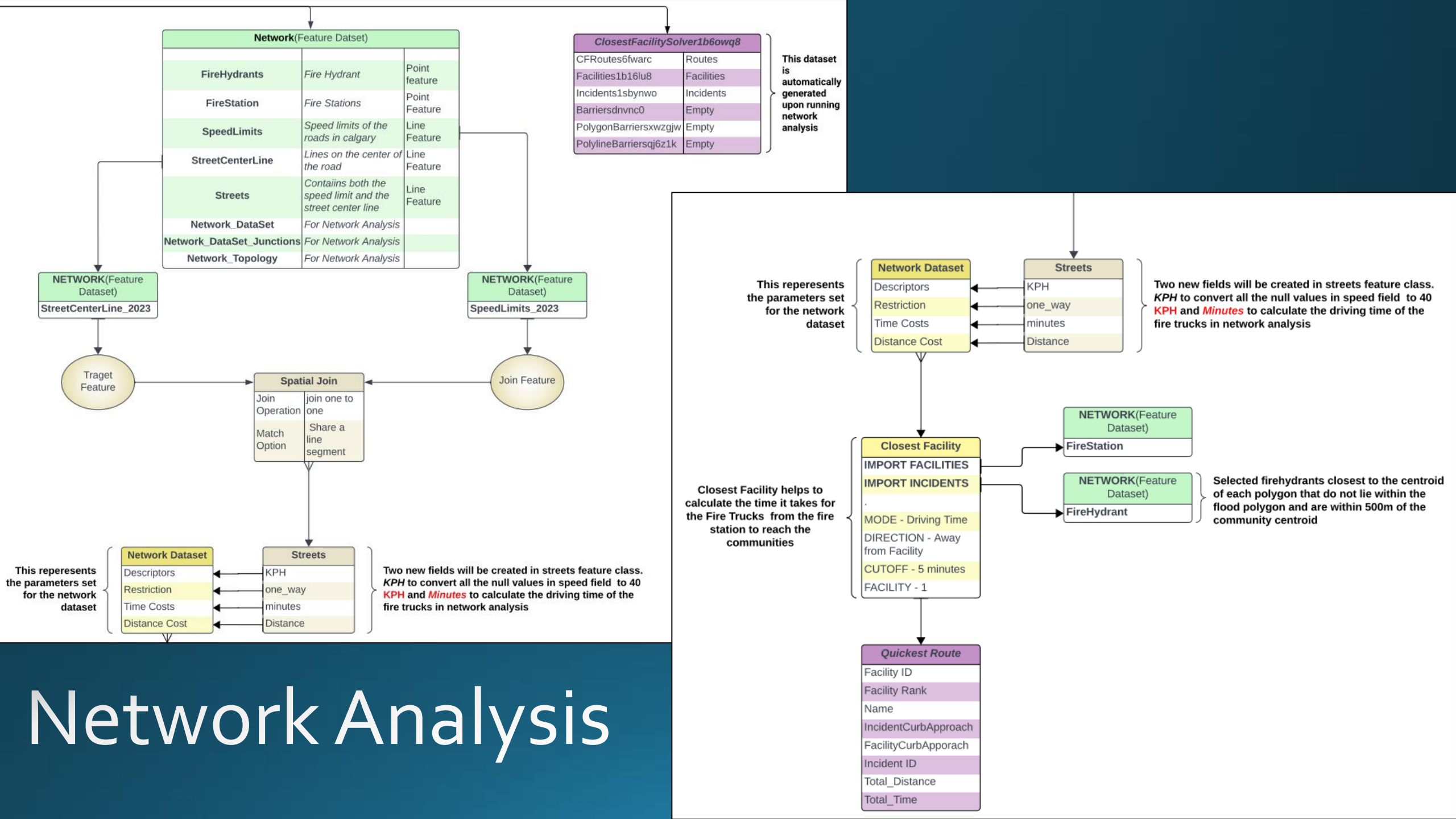
Average Cost of Dwelling in Flood Communities



Author: Group10A
Date: Dec 7, 2023
PCS: Calgary_3TM_WGS_1984_W114
Data Source: Calgary Open Data Portal

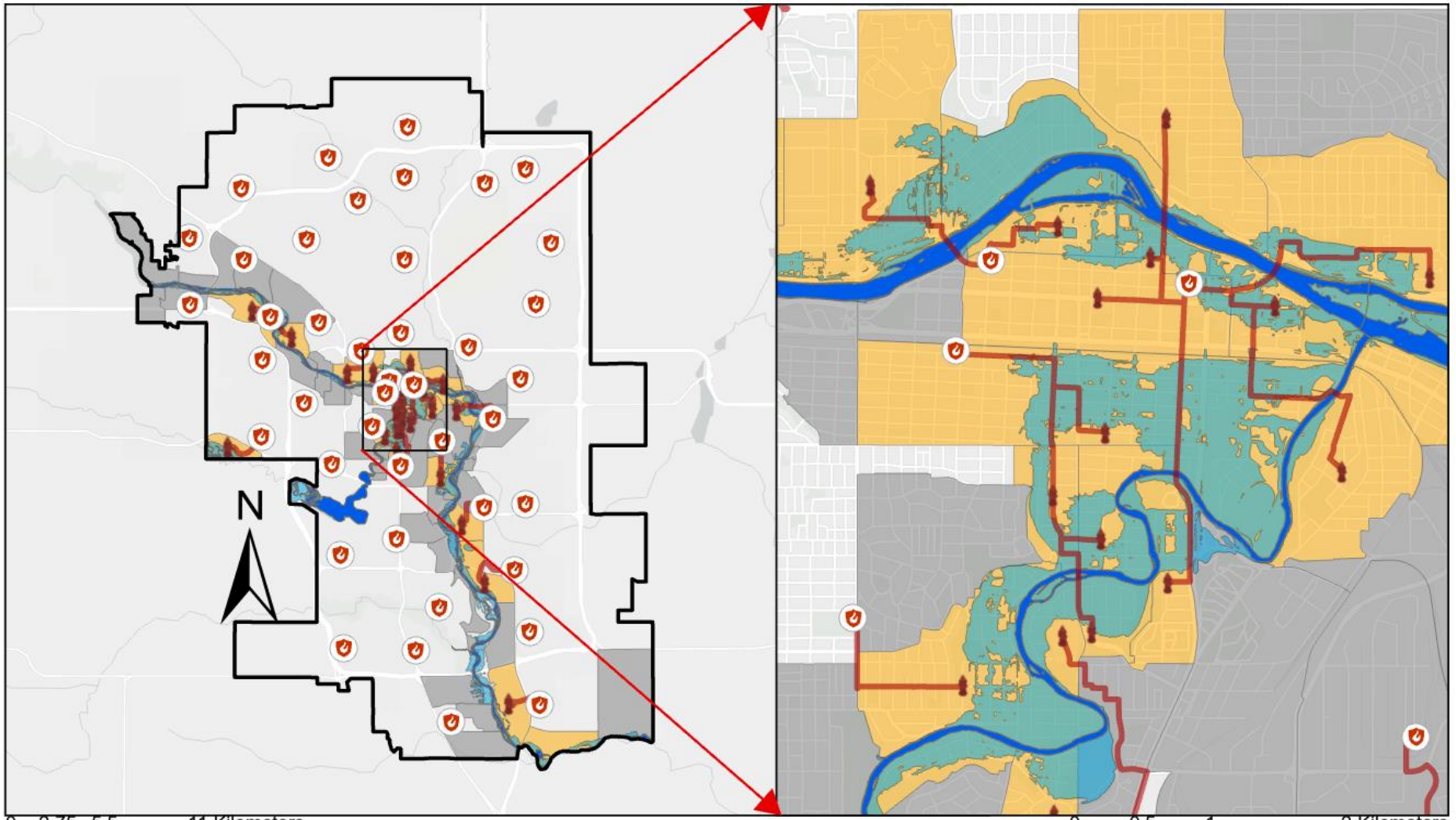
CityBoundary
Rivers
Flood Zone

Avg_Cost
0
1-260000
260000.1-520000
520000.1-780000
780000.1-1040000
1040000.1-1300000
1300000.1-1560000



Network Analysis

Fire Service Quickest Routes

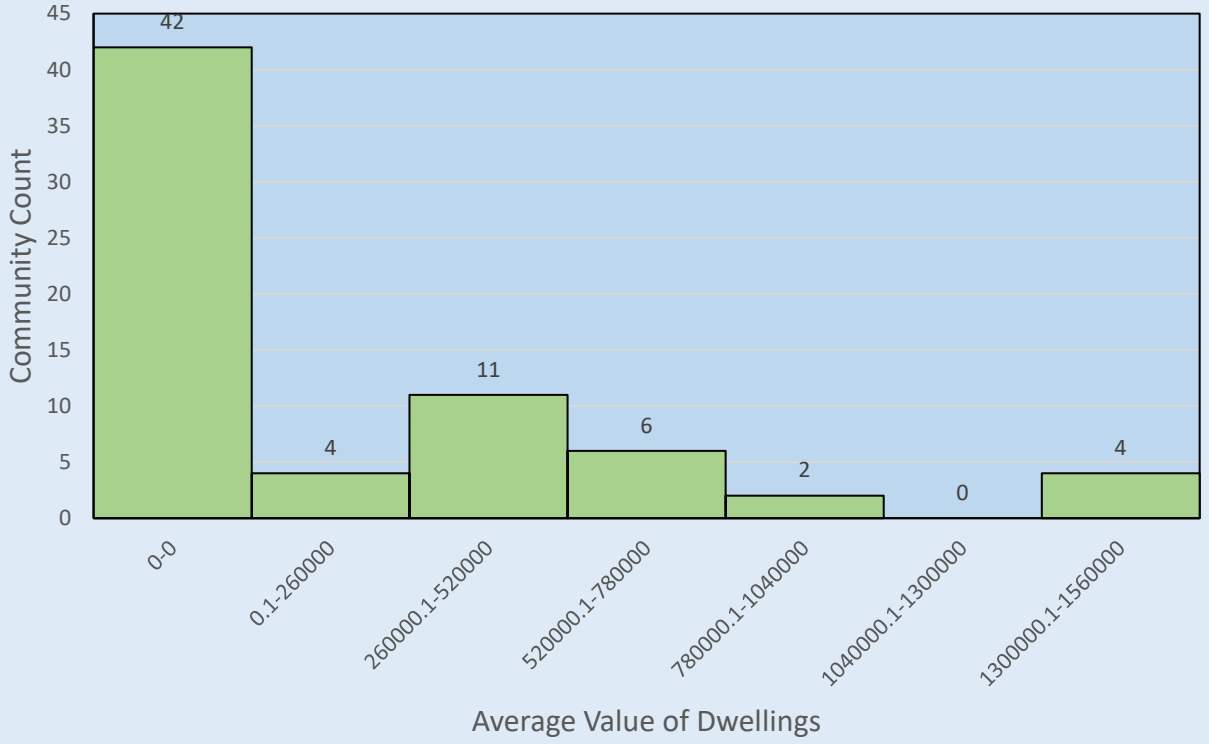


Author: Group10A
Date: Dec 7, 2023
PCS: Calgary_3TM_WGS_1984_W114
Data Source: Calgary Open Data Portal

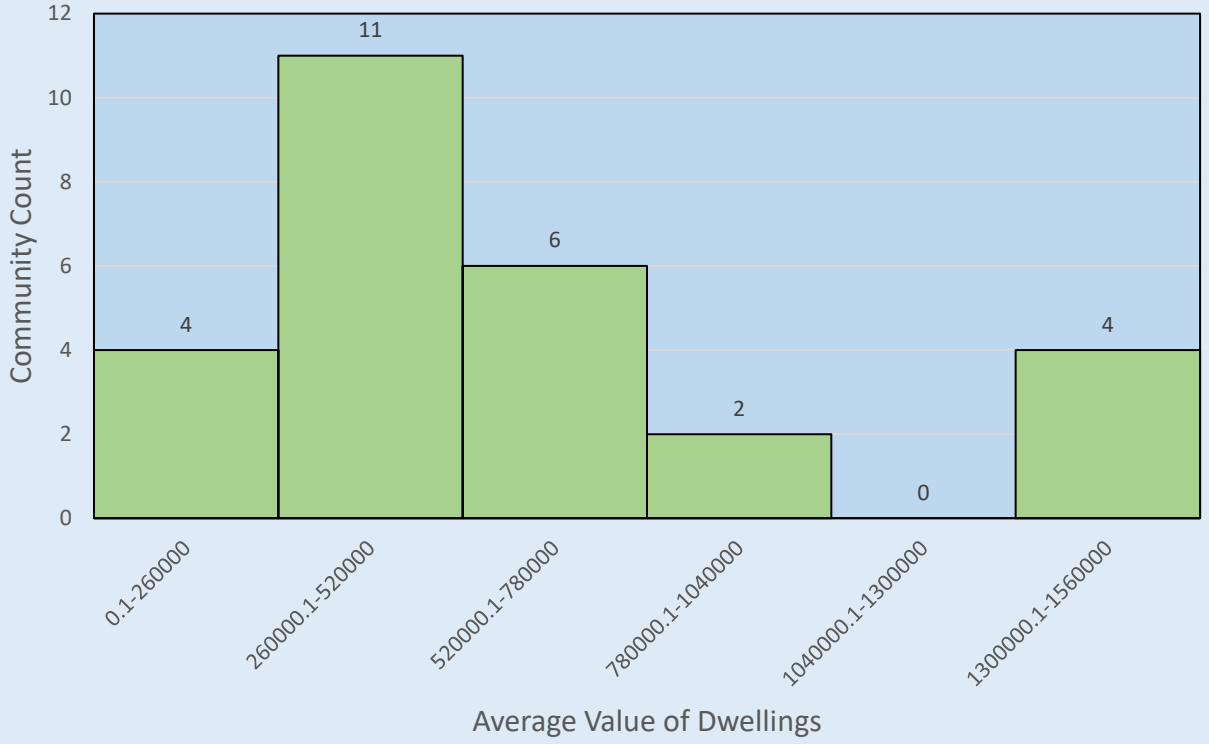
Thematic Mapping Class Break Down

Class No	Class Lmits	Lower Limit	Upper Limit	Mid Point	Absolute Frequency	Relative Frequency	Frequency Percentage	Cumulative Frequency
1	0-0	0	0	0	42	0.6	60.9	60.9
2	0.1-260000	0.1	260000	130000.05	4	0.1	5.8	66.7
3	260000.1-520000	260000.1	520000	390000.05	11	0.2	15.9	82.6
4	520000.1-780000	520000.1	780000	650000.05	6	0.1	8.7	91.3
5	780000.1-1040000	780000.1	1040000	910000.05	2	0.0	2.9	94.2
6	1040000.1-1300000	1040000.1	1300000	1170000.1	0	0.0	0.0	94.2
7	1300000.1-1560000	1300000.1	1560000	1430000.1	4	0.1	5.8	100.0
					69	1.0	100.0	

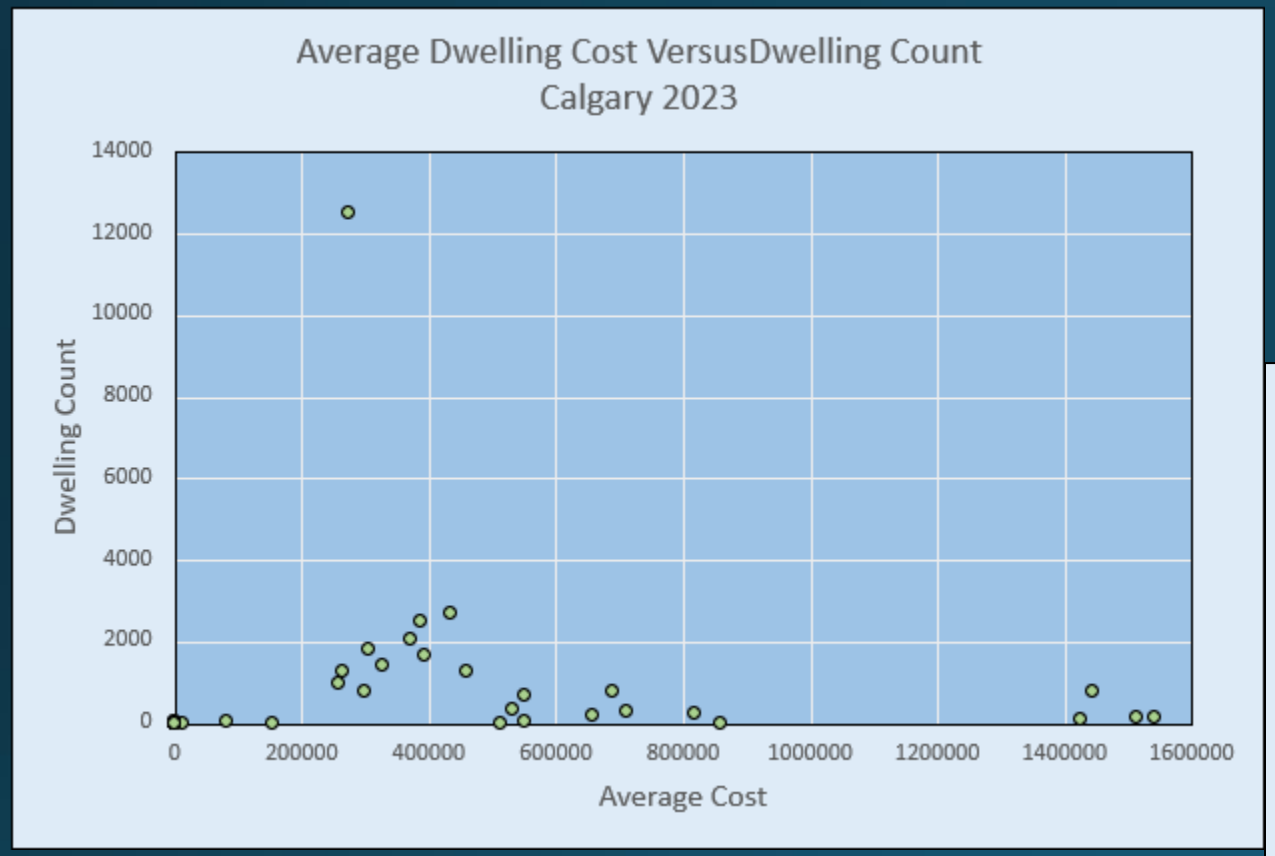
Average Dwelling Value 2023 and Flood Prone Communities in Calgary (Absolute Frequency) – including '0' cost communities



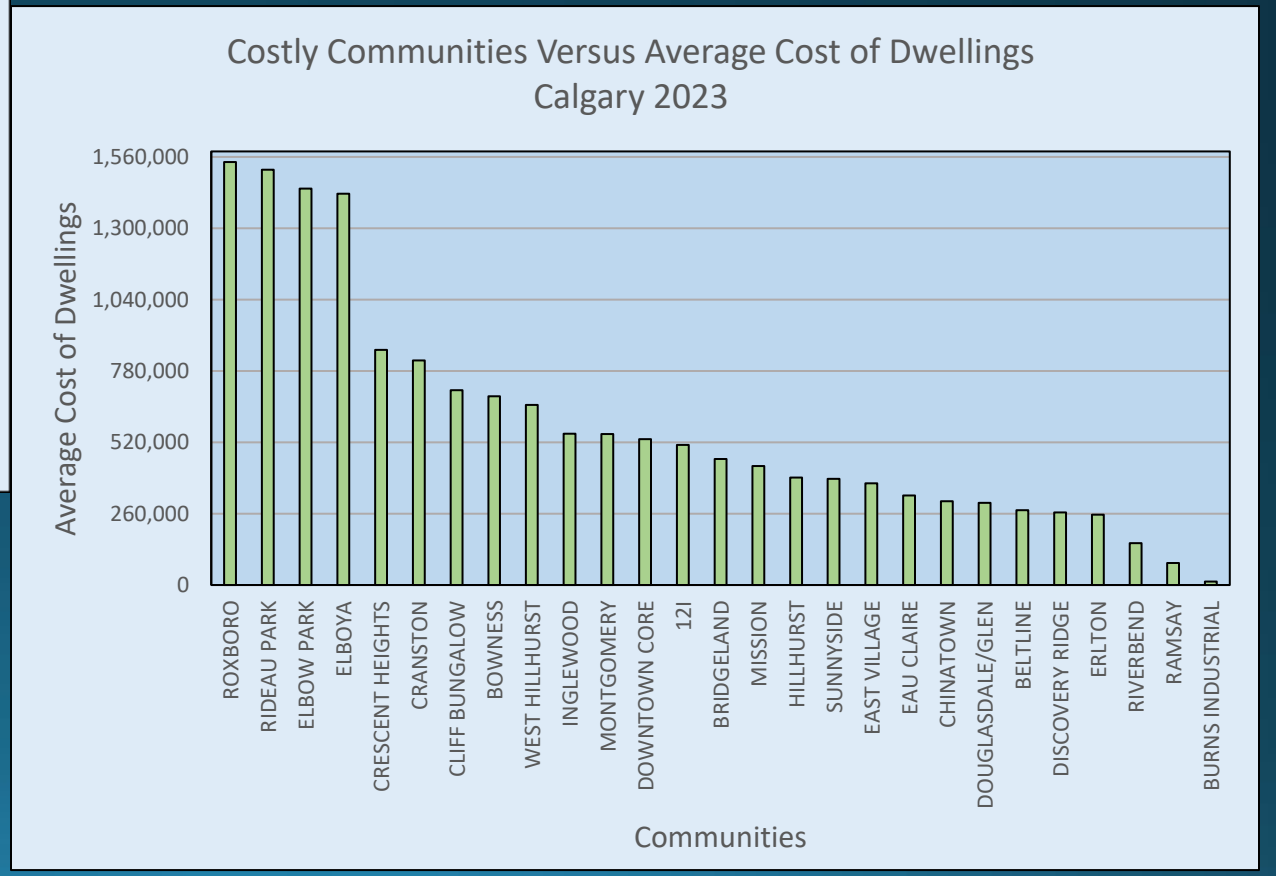
Average Dwelling Value 2023 and Flood Prone Communities in Calgary (Absolute Frequency)- excluding '0' cost communities



Community Breakdown



Four communities were more costly by an order of magnitude!



Beltline identified as an outlier in total dwelling count.

Conclusion: Roxboro, Rideau Park, Elbow Park and Elboya are the costliest communities in Calgary's 1:100 river affected areas.

Roxboro and Rideau Park also have high risk rankings for fire service response making them the definitive top two costliest communities for insurers.

Riverside Community	Average Cost Risk Ranking	Average Cost of Dwelling	Drive Time Risk Ranking	Drive Time (minutes)
ROXBORO	1	$1,541,059.52	3	3.80
RIDEAU PARK	2	$1,513,639.29	4	3.76
ELBOW PARK	3	$1,443,992.20	20	1.82
ELBOYA	4	$1,425,778.35	21	1.30
CRESCENT HEIGHTS	5	$857,313.33	16	2.11
CRANSTON	6	$817,876.54	5	3.71
CLIFF BUNGALOW	7	$709,530.06	15	2.12
BOWNESS	8	$687,386.17	19	1.84
WEST HILLHURST	9	$656,540.54	10	3.16
INGLEWOOD	10	$551,020.94	2	3.95
MONTGOMERY	11	$550,392.86	14	2.59
DOWNTOWN	12	$531,876.20	24	0.97
12I RESIDENTIAL SUB AREA	13	$510,886.25	N/A	
BRIDGELAND/RIVERSIDE	14	$459,721.92	8	3.39
MISSION	15	$433,769.79	12	3.00
HILLHURST	16	$391,536.90	17	2.07
SUNNYSIDE	17	$386,671.78	N/A	
DOWNTOWN EAST VILLAGE	18	$370,059.68	23	1.07
EAU CLAIRE	19	$325,932.19	22	1.17
CHINATOWN	20	$305,412.95	25	0.93
DOUGLASDALE/GLEN	21	$299,024.87	1	4.34
BELTLINE	22	$272,060.41	18	2.05
DISCOVERY RIDGE	23	$264,238.02	9	3.27
ERLTON	24	$256,233.44	13	2.93
RIVERBEND	25	$152,145.83	7	3.47
RAMSAY	26	$80,500.00	6	3.56
BURNS INDUSTRIAL	27	$12,353.85	11	3.10

Lessons Learned

- ModelBuilder has a quirky personality.

Recommendations

- Use Python to automate checks!
- Surface model flood water depth.

Next Steps

- More mapping after 2025!

Thank You!

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