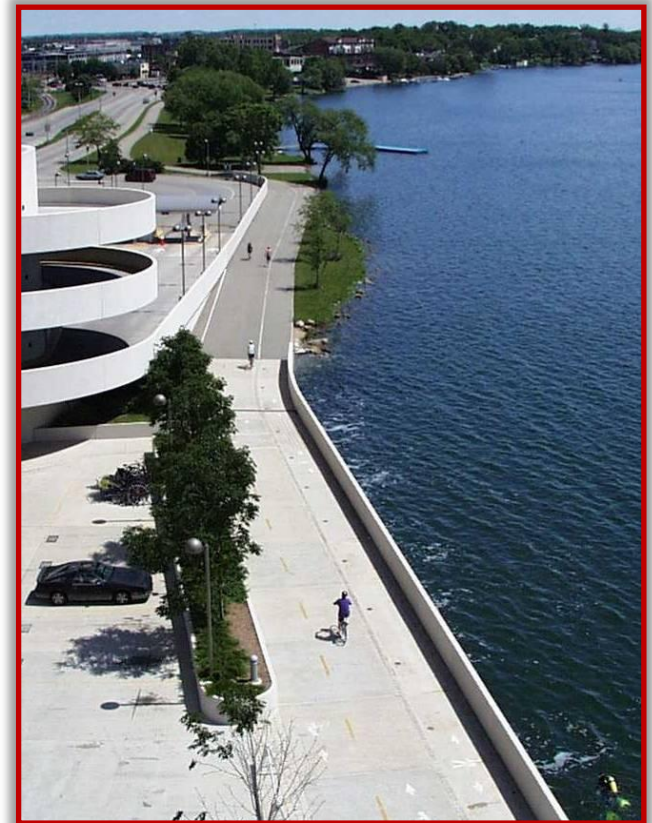


Cycling Analysis in Metro Vancouver (Cycle Zone Analysis)

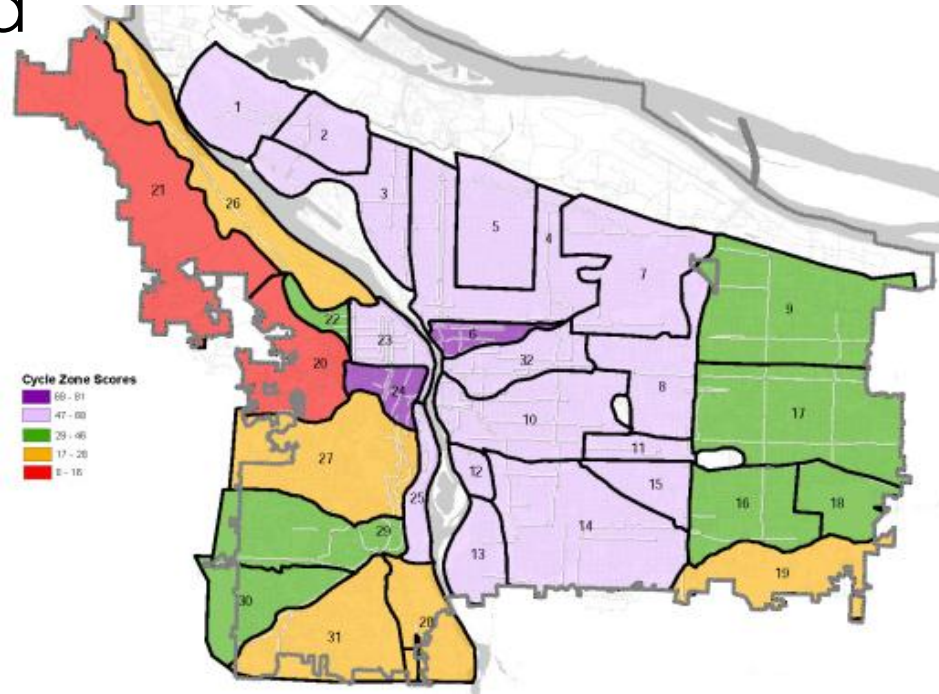


- What is Cycle Zone Analysis
- Zone Analysis
- Bicycle Quality Index (BQI)
- Intersection Quality Index (IQI)
- Data Normalization / Weighting
- Analysing the Results
- Design Considerations

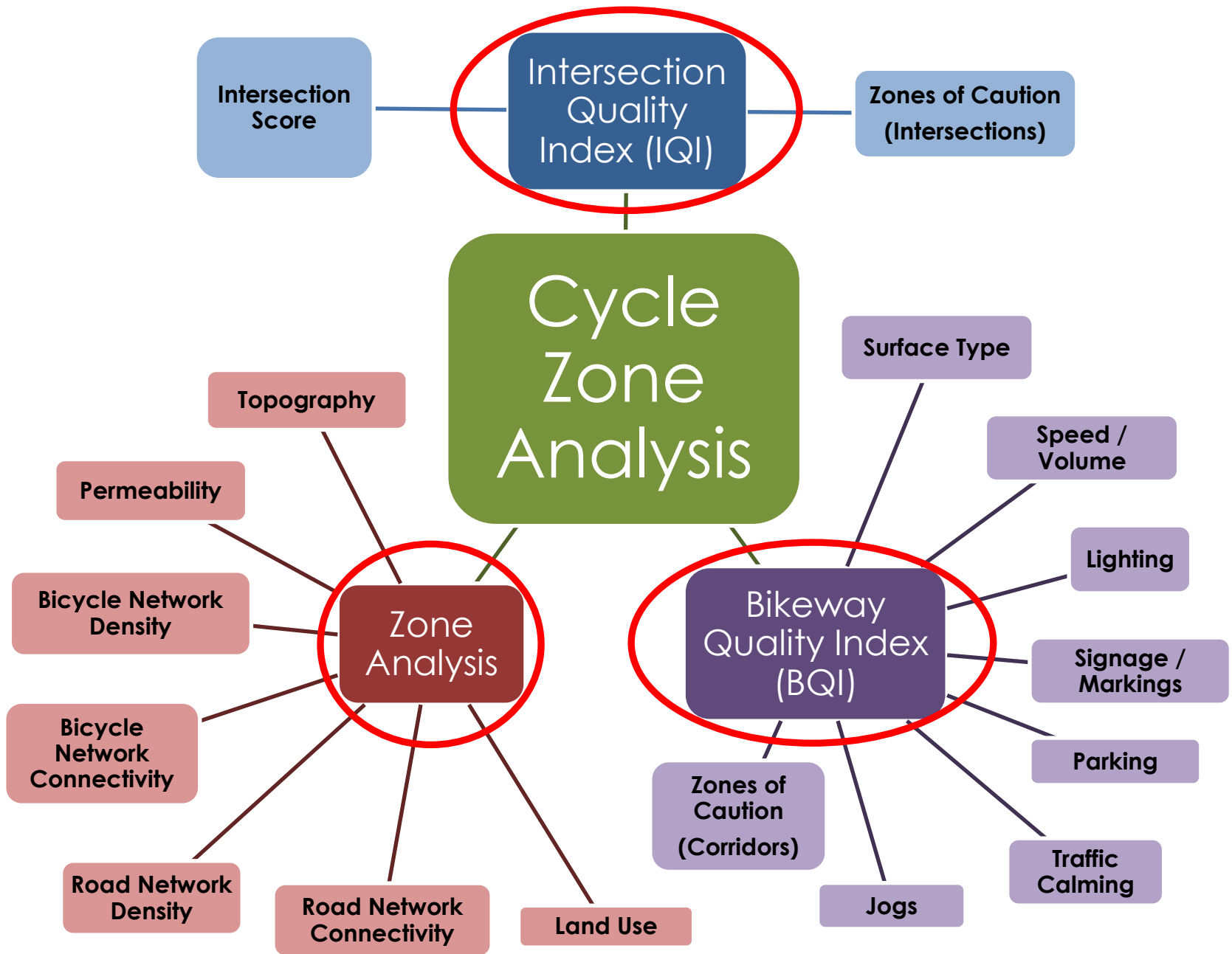


What is Cycle Zone Analysis?

- Part of TransLink's 'Regional Cycling Study'
- Developed in Portland, Oregon
- GIS-based assessment
- Zonal-based approach
- Provides fine-grained understanding of local conditions
- Identifies areas with greatest potential to increase cycling
- Identifies strategic investment opportunities
- Decision-support tool – NOT decision making tool



Cycle Zone Analysis

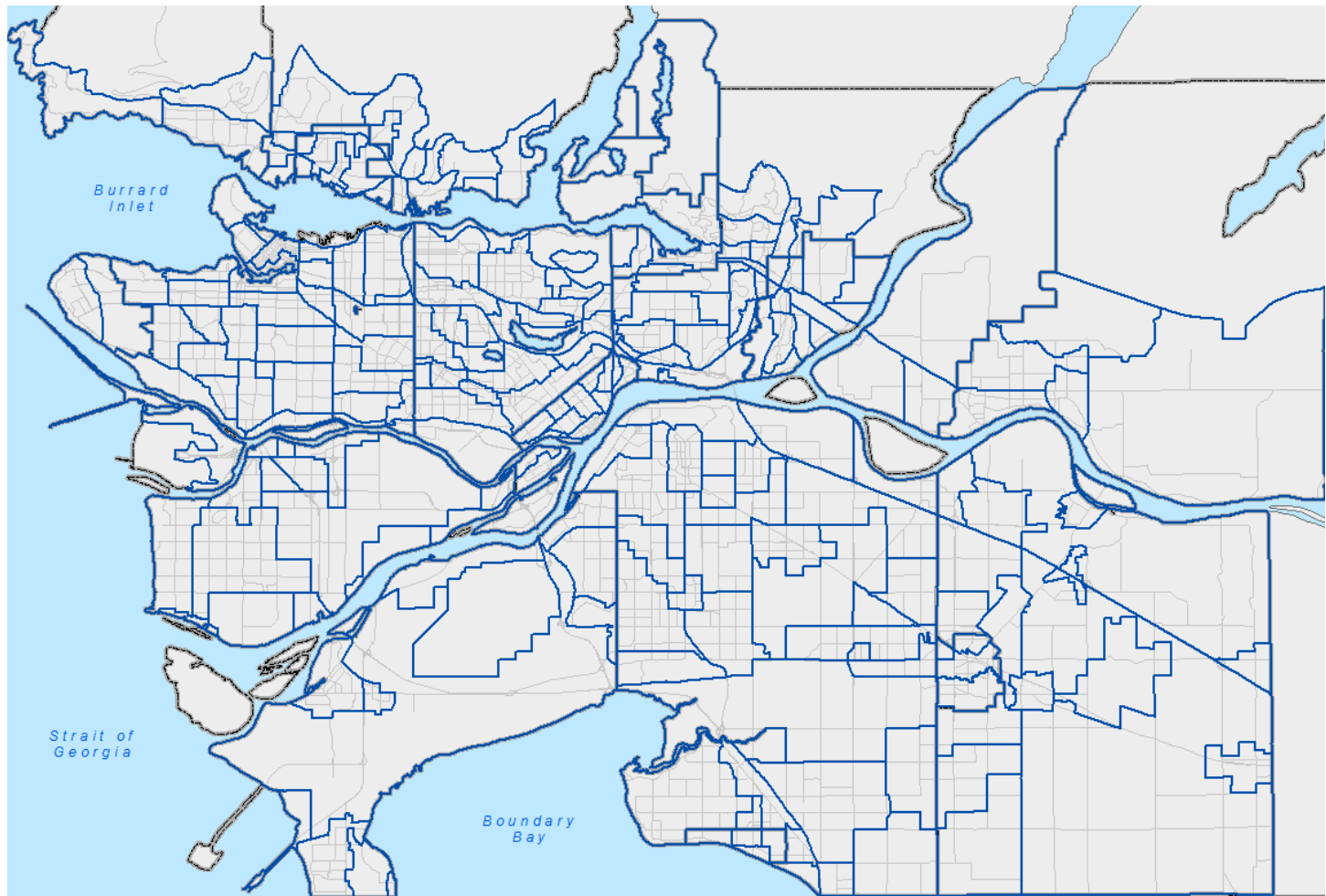


Zone Analysis

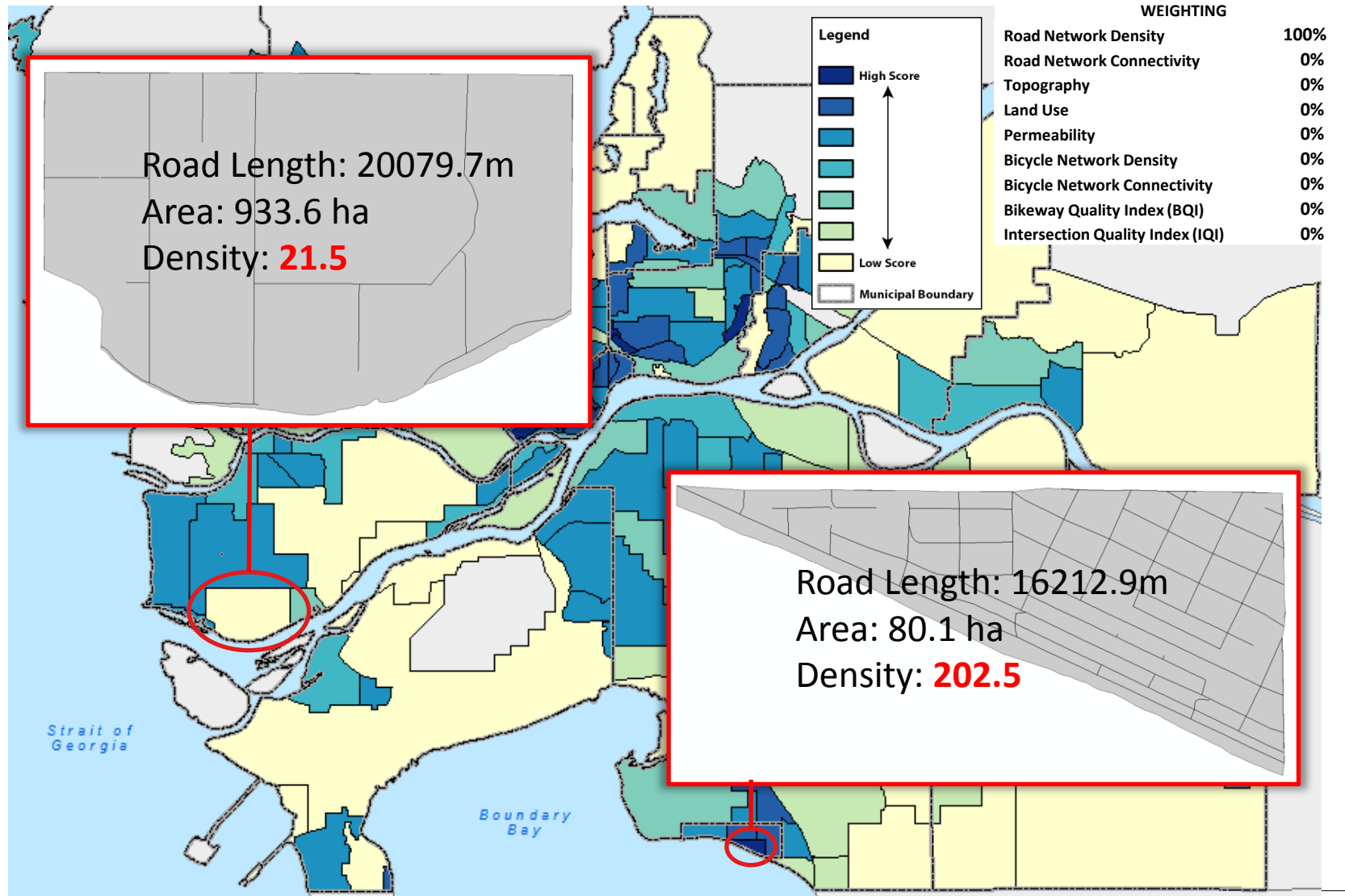
- Analyses factors that influence bicycle use
- Multiple analyses on zonal basis



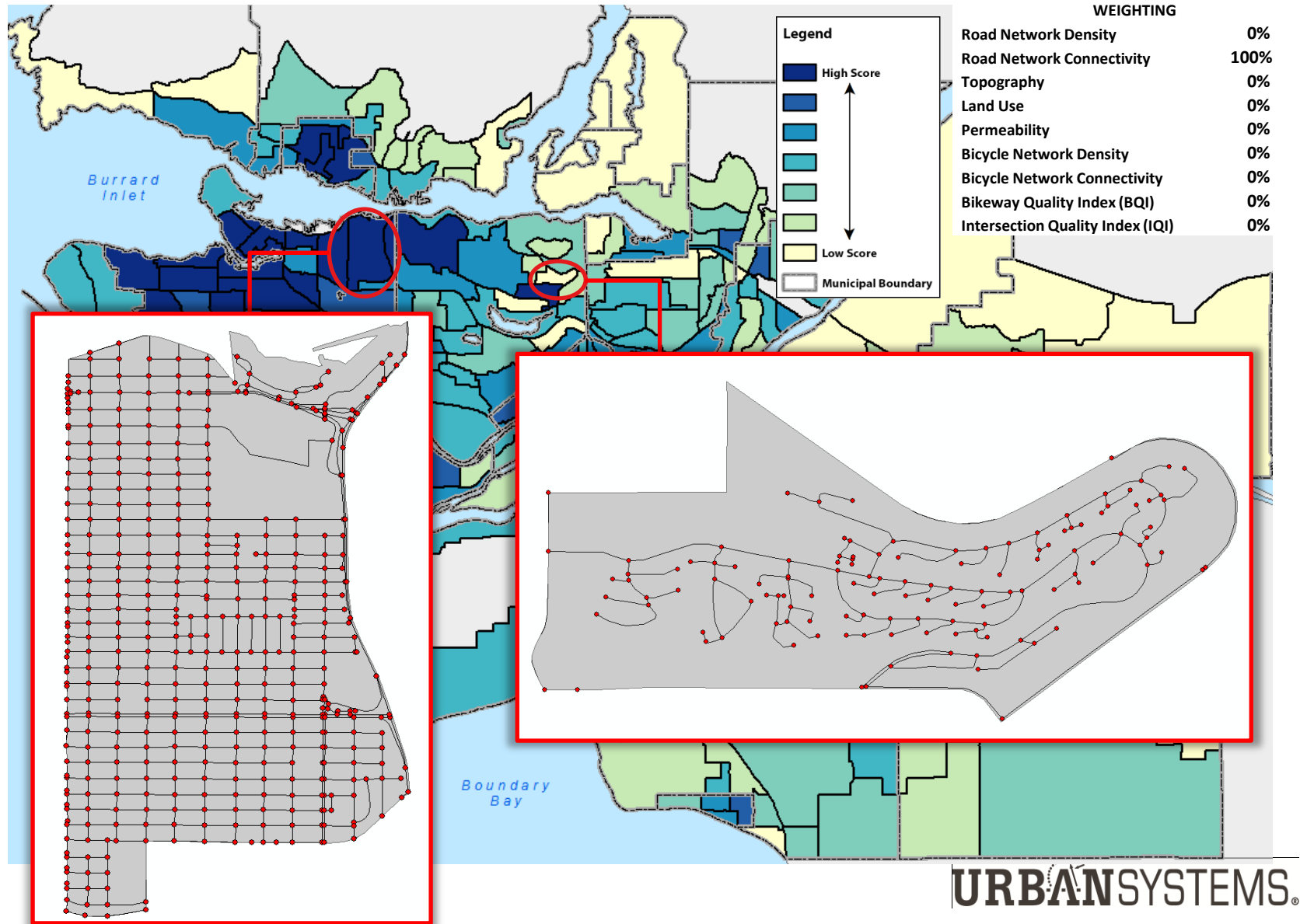
- Zones defined by 'homogenous cycling areas'
- Municipality and stakeholder input



- Greater density of roads = more cycling opportunities

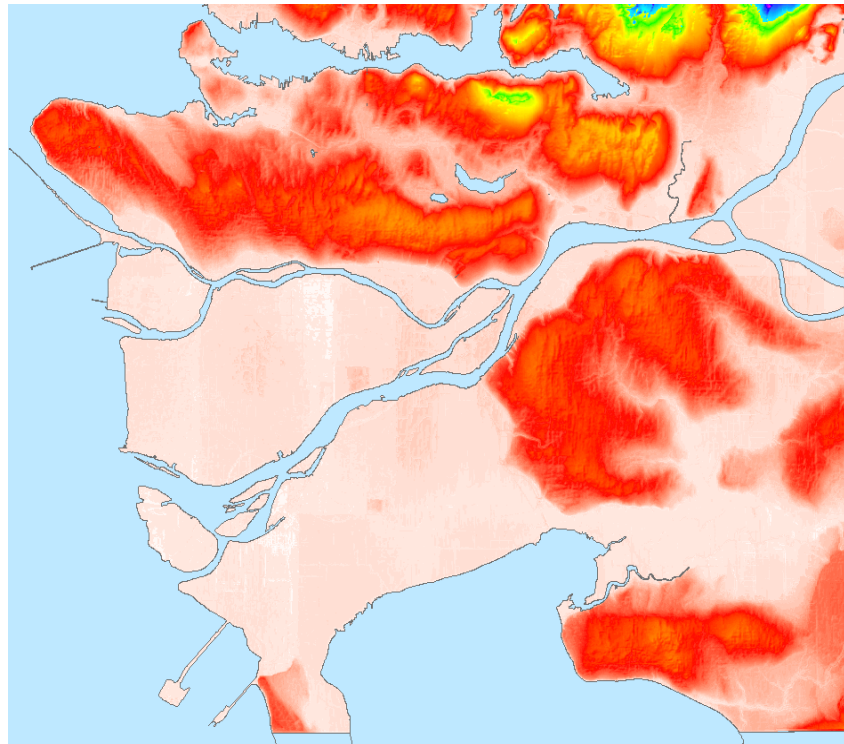


- More connected the road network, the better it is for cycling

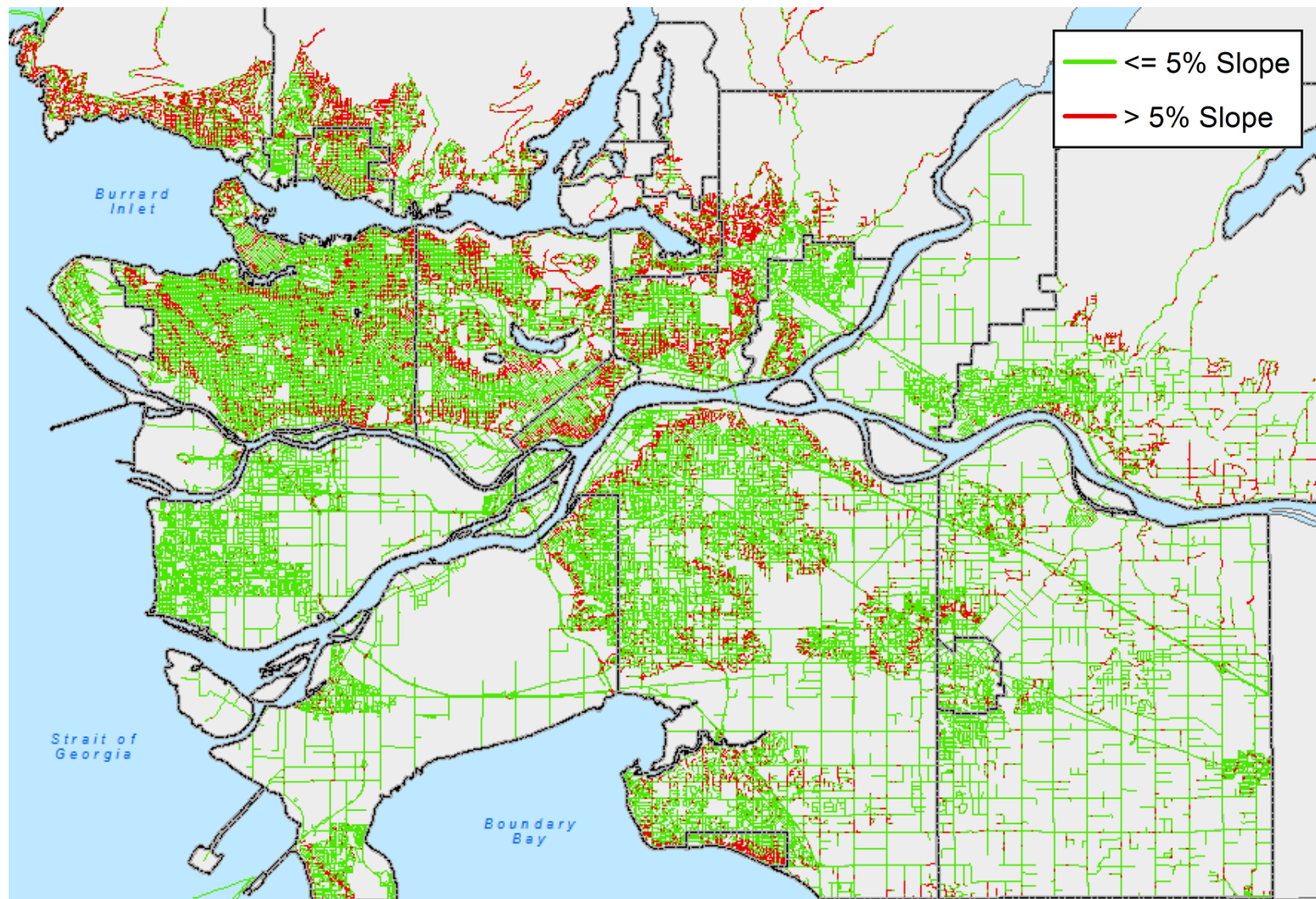


- Flat terrain is more desirable to cyclists
 - Road segments broken into 100m segments
 - Slope calculated for each road segment from 20m raster surface

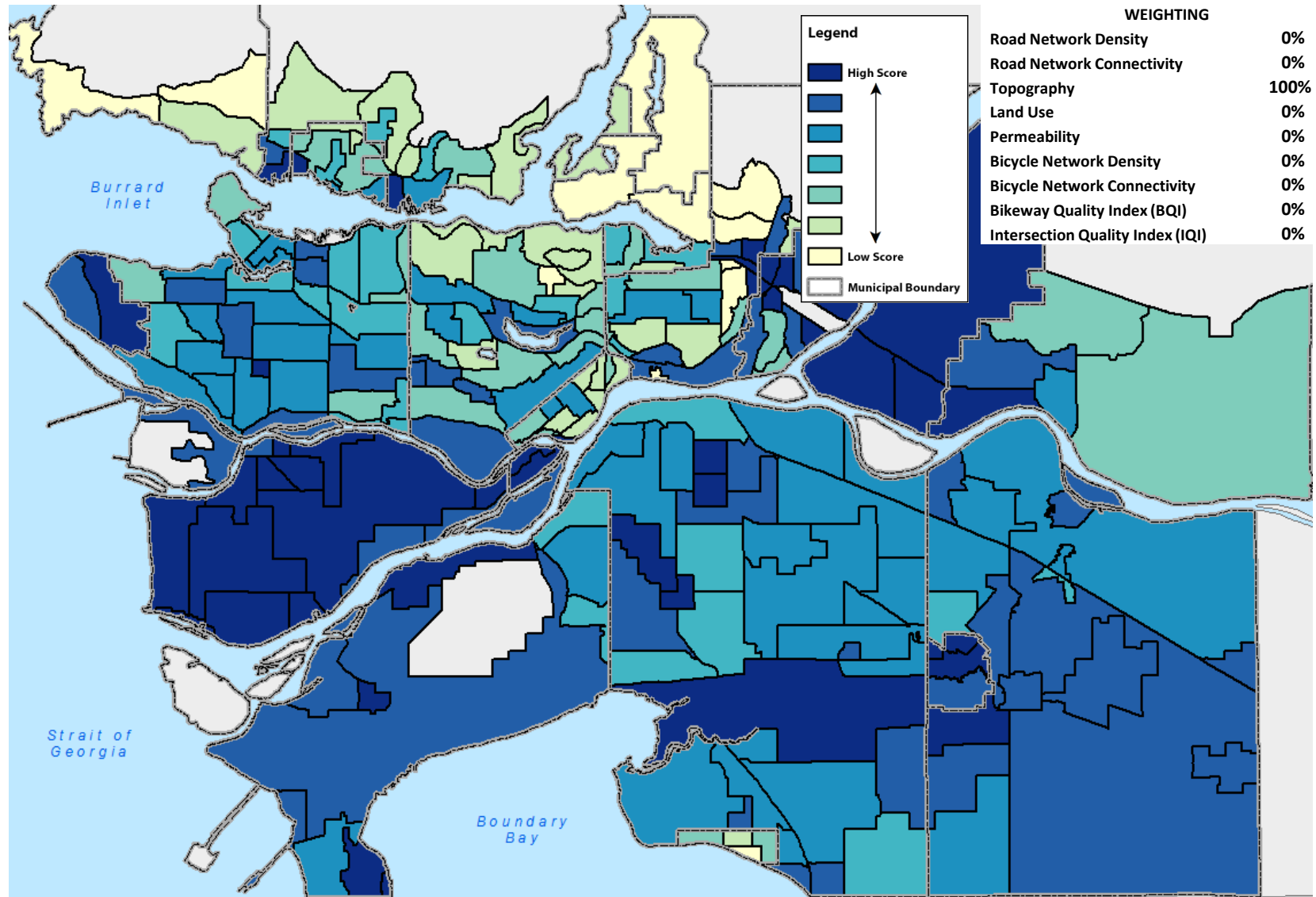
(<http://arcscripts.esri.com/details.asp?dbid=15163>)



Topography cont.



- Density of road segments $\leq 5\%$ slope

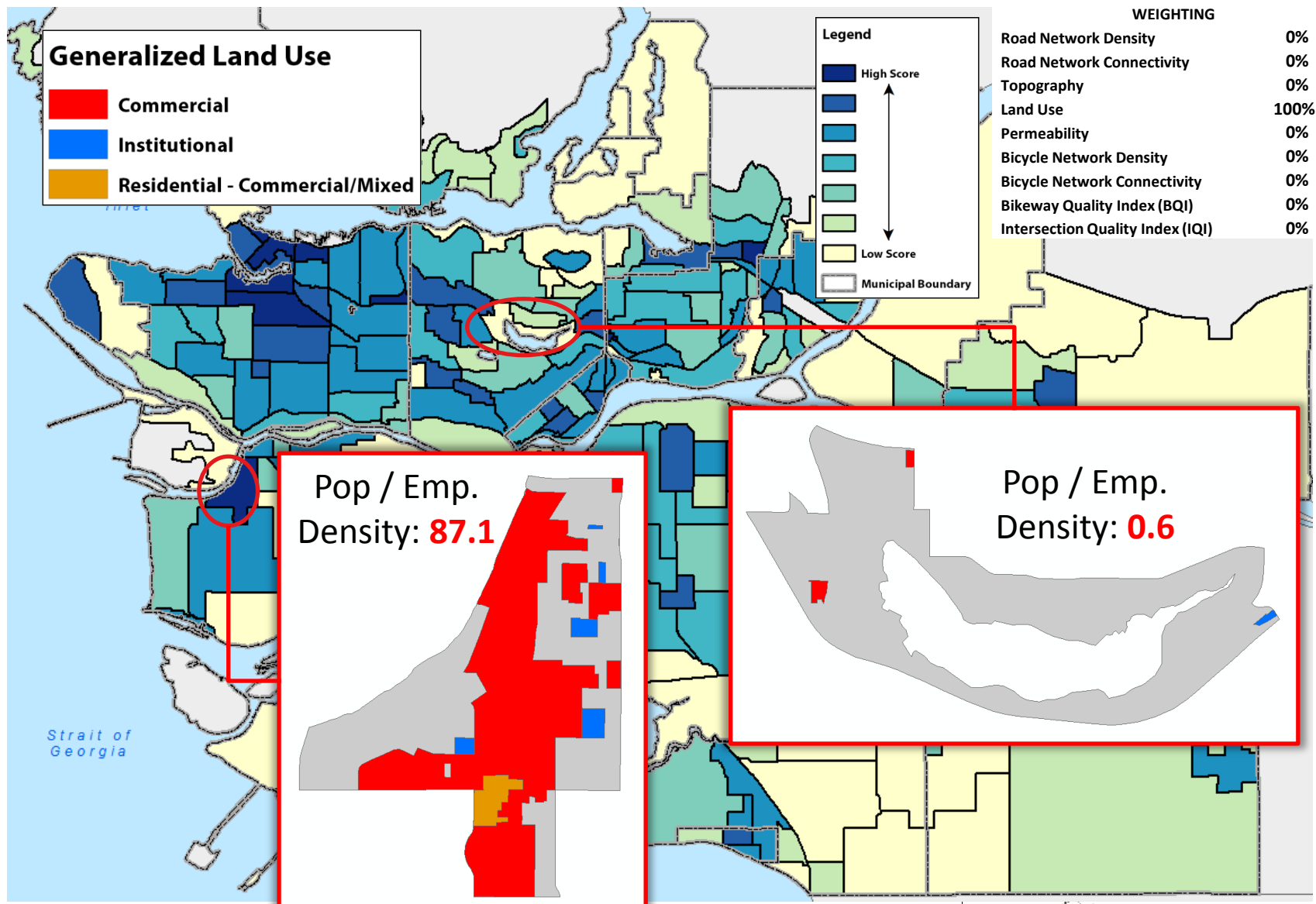


- Combines cycling generating land uses with population and employment numbers
- Commercial, Institutional and Mixed-Commercial-Residential land uses used

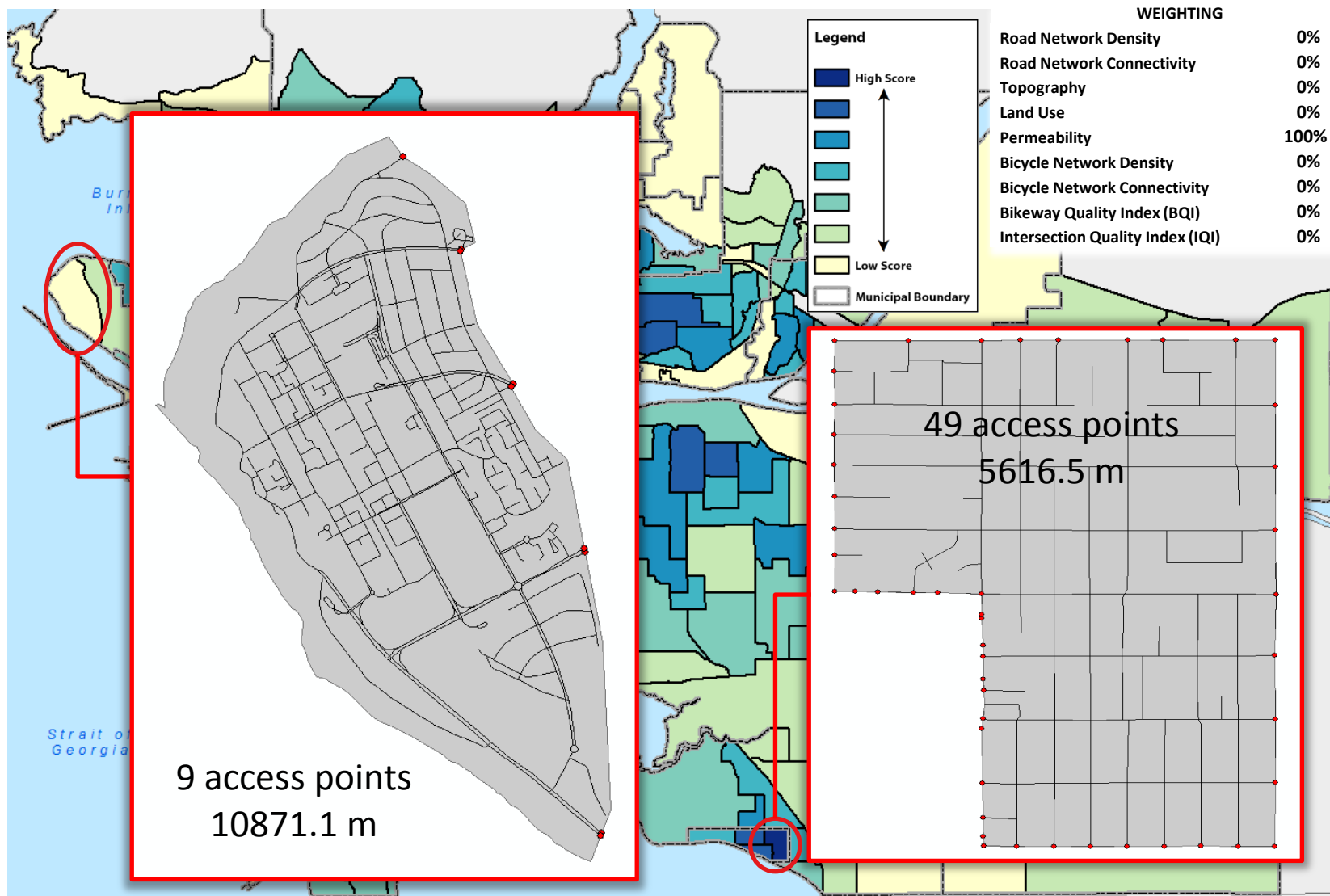
Residential & Employment Density <i>(residents and employees per hectare)</i>							
0 - 3	1G	2G	3G	4G	5G	6G	7G
3 - 9	1F	2F	3F	4F	5F	6F	7F
10 - 24	1E	2E	3E	4E	5E	6E	7E
25 - 49	1D	2D	3D	4D	5D	6D	7D
50 - 99	1C	2C	3C	4C	5C	6C	7C
100 - 199	1B	2B	3B	4B	5B	6B	7B
200 +	1A	2A	3A	4A	5A	6A	7A
Land Use Mix <i>(% Commercial, Institutional, or Mixed Commercial-Residential)</i>							
	40 +	20 - 40	10 - 20	6 - 10	4 - 6	2 - 4	0 - 2

Ratings Scale	
Violet	Highest (8)
Indigo	(7)
Dark Blue	(6)
Light Blue	(5)
Green	(4)
Yellow	(3)
Orange	(2)
Red	Lowest (1)

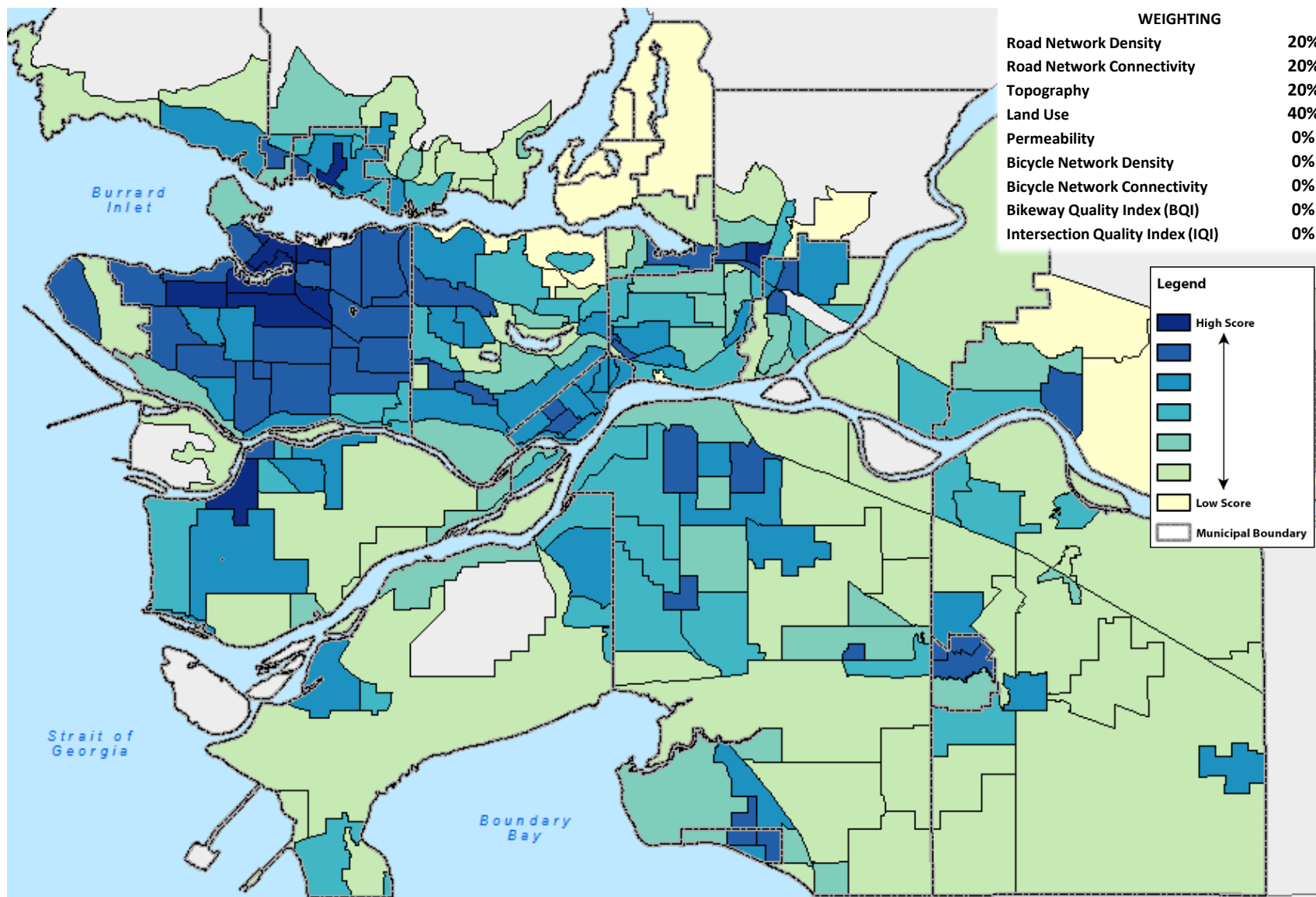
Land Use cont.



- How easy is it to get from one zone to another?

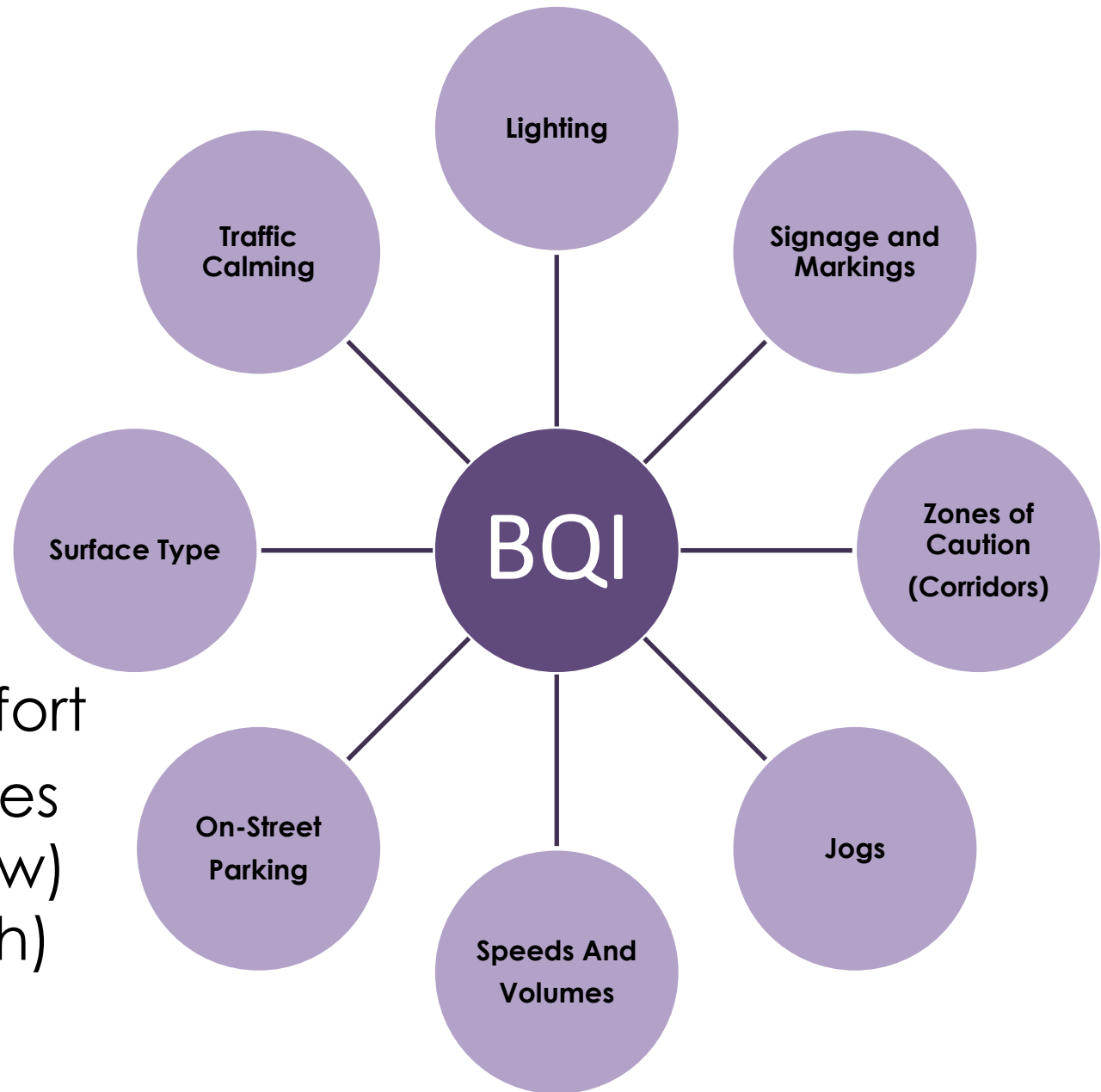


Cycling Potential



Bicycle Quality Index (BQI)

- Analyze existing bicycle facilities
- Assess relative quality of routes
- Based on user comfort
- Total scores from 1 (low) to 20 (high)



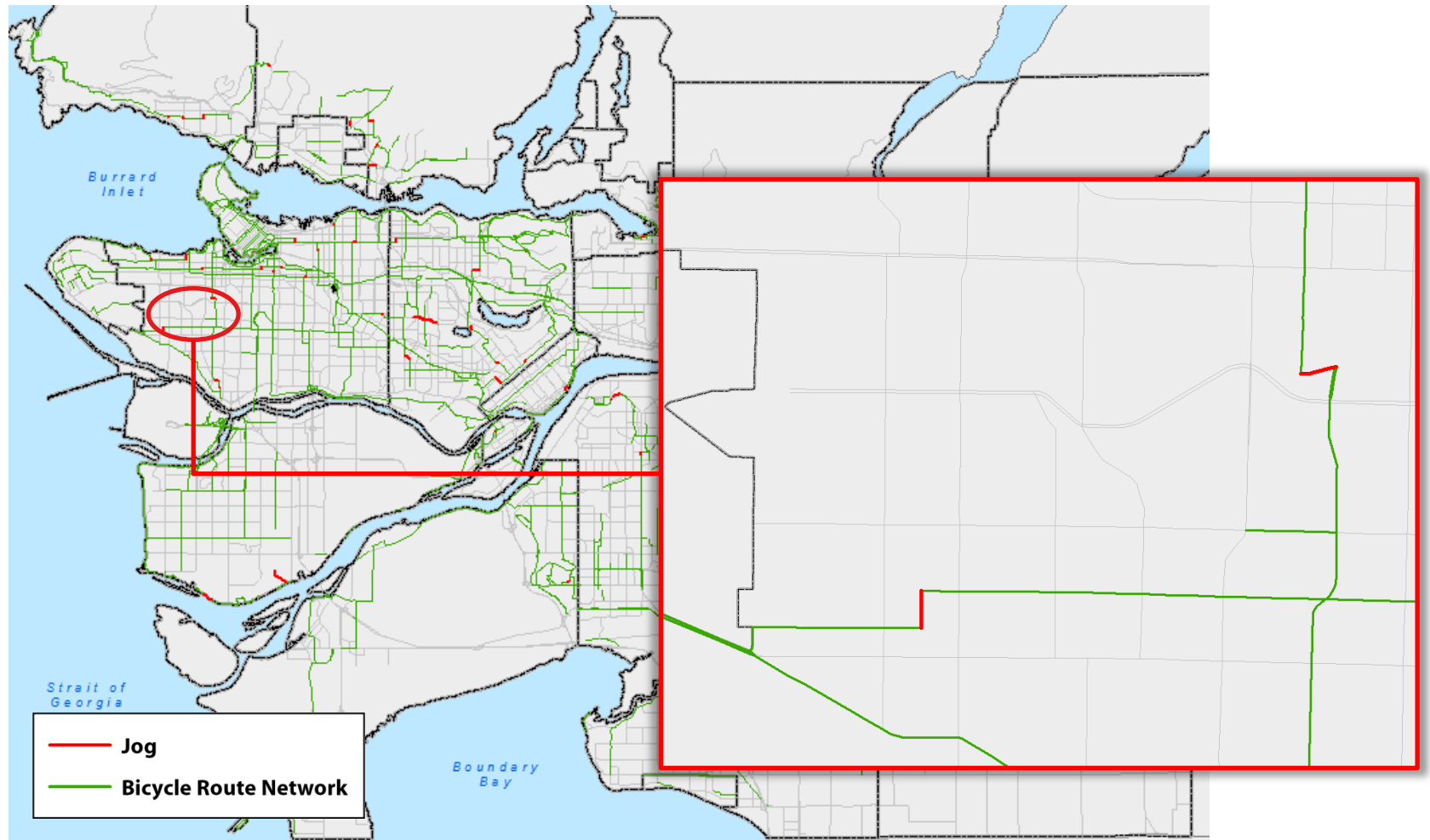
- Analysis done for left and right sides of segments (where applicable)
- Several metrics assigned numeric values for analysis:
 - **Lighting**: present = 1, absent = 0
 - **Parking**: no parking allowed = 2, some parking restrictions = 1, no parking restrictions = 0
 - **Signage/Markings**: marking and sign = 2, sign or marking = 1, no sign or marking = 0
 - **Surface Type**: paved = 1; unpaved = 0

- Traffic speeds and volumes influence cycling experience
- Calculated dominant land use for each segment
 - Used as a 'traffic volume proxy' where data not available

Speed (kph)								
80 or more	n/a	1E	2E	3E	4E	5E	6E	7E
70	n/a	1D	2D	3D	4D	5D	6D	7D
60	n/a	1C	2C	3C	4C	5C	6C	7C
50	n/a	1B	2B	3B	4B	5B	6B	7B
30 or less	n/a	1A	2A	3A	4A	5A	6A	7A
n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Volume (AM Peak)	n/a	n/a	n/a	0-100	101-500	501-1,000	1,001 - 1,500	1,500 +
Land Use	n/a	Residential / park	Other	n/a	n/a	n/a	n/a	n/a

Ratings Scale	
Purple	Best (9)
Violet	(8)
Pink	(7)
Dark Blue	(6)
Light Blue	(5)
Green	(4)
Yellow	(3)
Orange	(2)
Red	Worst (1)

- Routes without jogs more desirable
- Manually identified due to a lack of detailed knowledge about routes

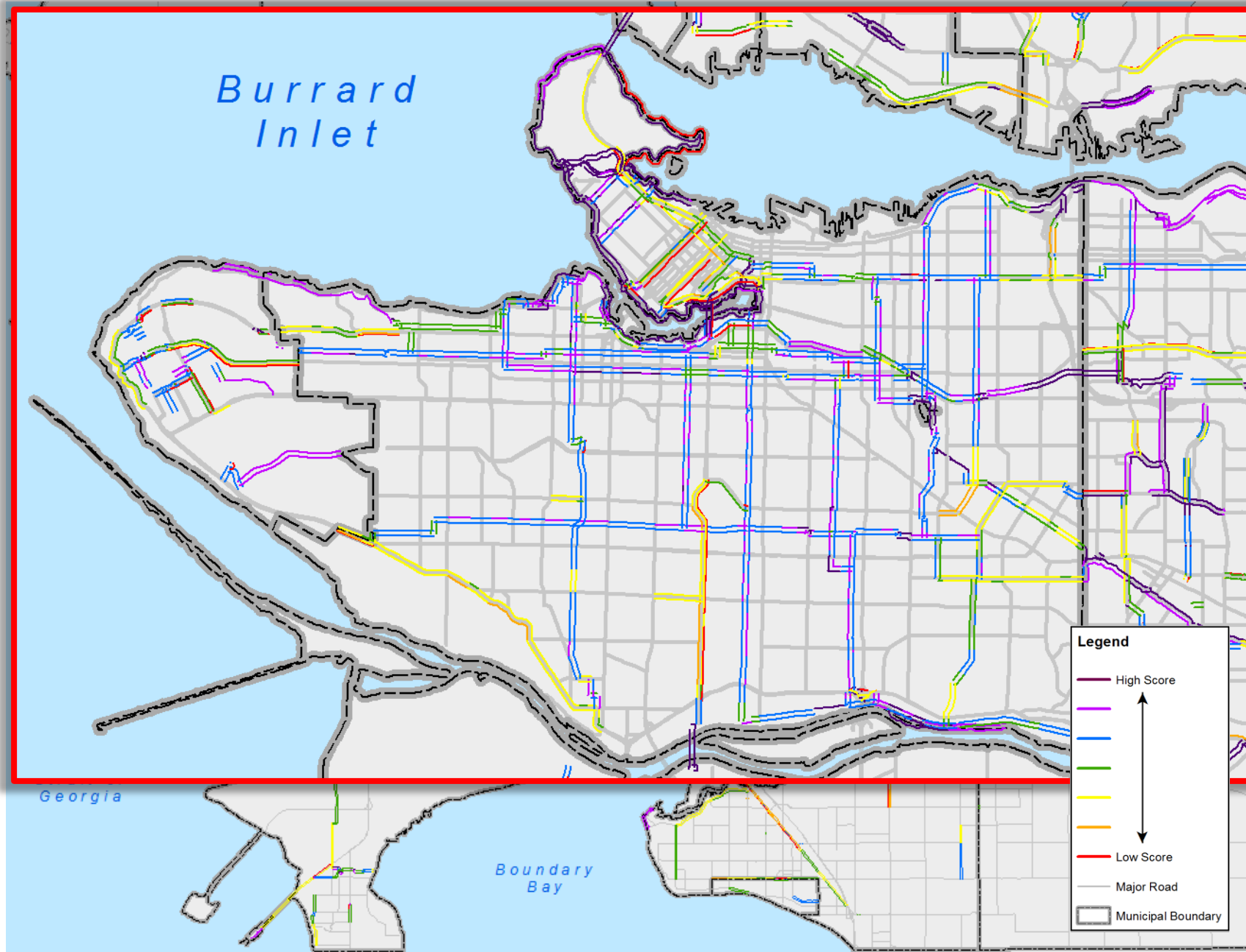


- Traffic calming devices make cycling paths more desirable
- Scores between 0 and 3
 - Directional barriers / median barriers = 3
 - Traffic Circles = 2
 - Speed Humps / Raised Crosswalks = 1



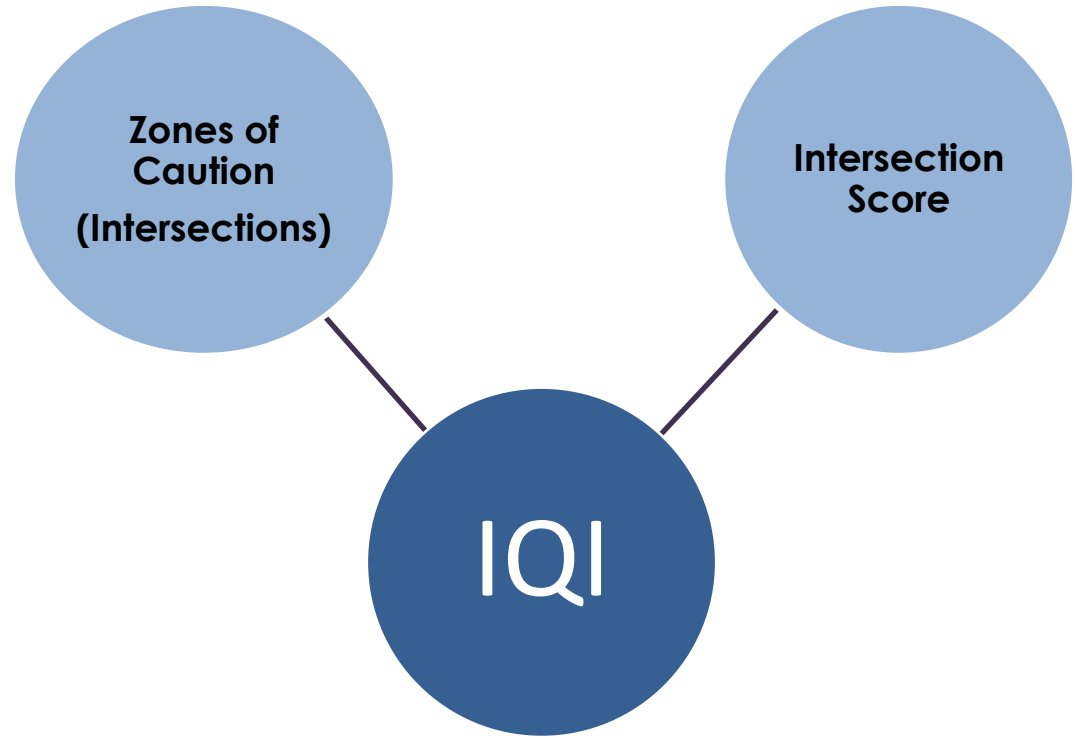
- Corridors deemed by TransLink as being difficult for cyclists
- Determined percentage of each bicycle network segment that falls within a 'zone of caution'
 - Percentage of bicycle segment not within the 'zone of caution' constitutes the score
 - Scores range from 0 (entire segment within caution zone) to 1 (none of the segment within the caution zone)

BQI Results

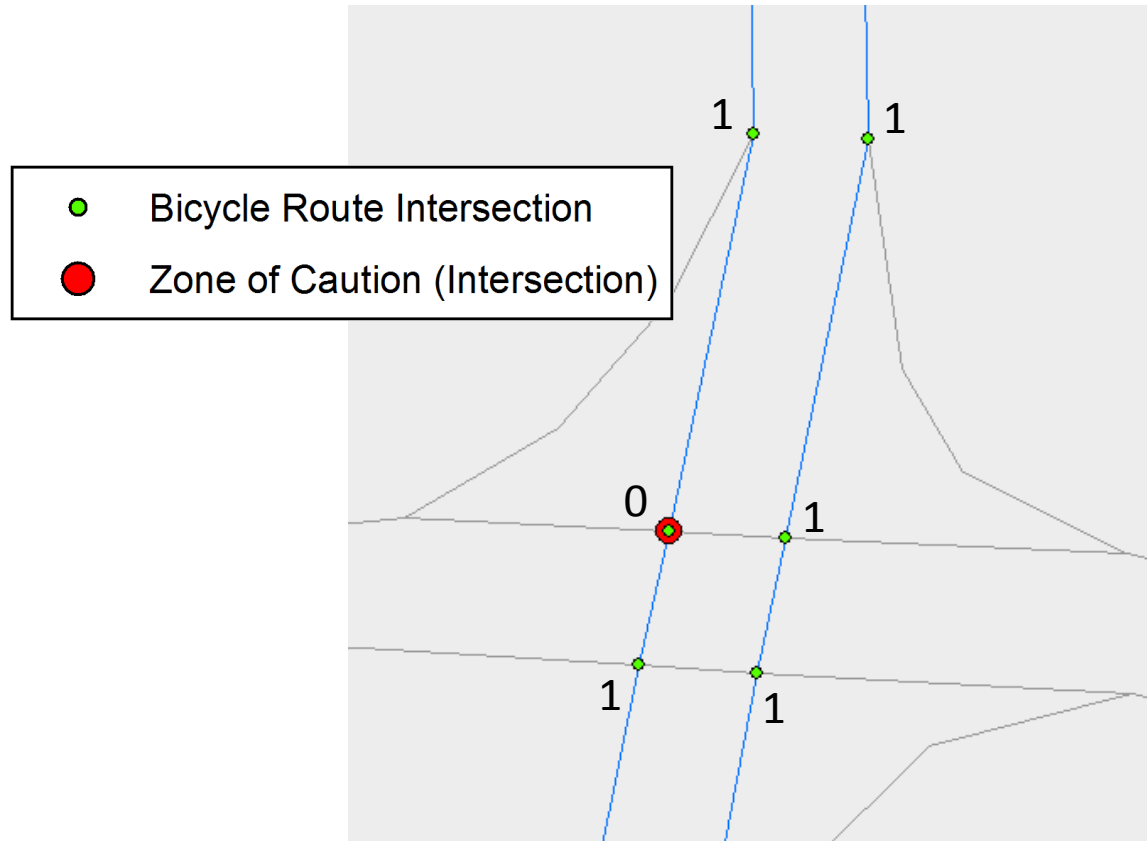


Intersection Quality Index (IQI)

- Analyzed all intersections with bicycle routes
- Assess relative quality of intersections
- Based on user comfort
- Total scores from 1 (low) to 10 (high)



- Indicate whether or not intersection is classified as a difficult intersection or not
- Difficult intersection score = 0; Not a difficult intersection score = 1



- Most difficult analysis of entire project
- Multiple datasets used for inputs
 - Digital Road Atlas
 - Intersection Controls
 - Traffic Calming
 - Bicycle Network
 - Intersections
- Matrix used to score the intersections



Intersection Matrix cont.

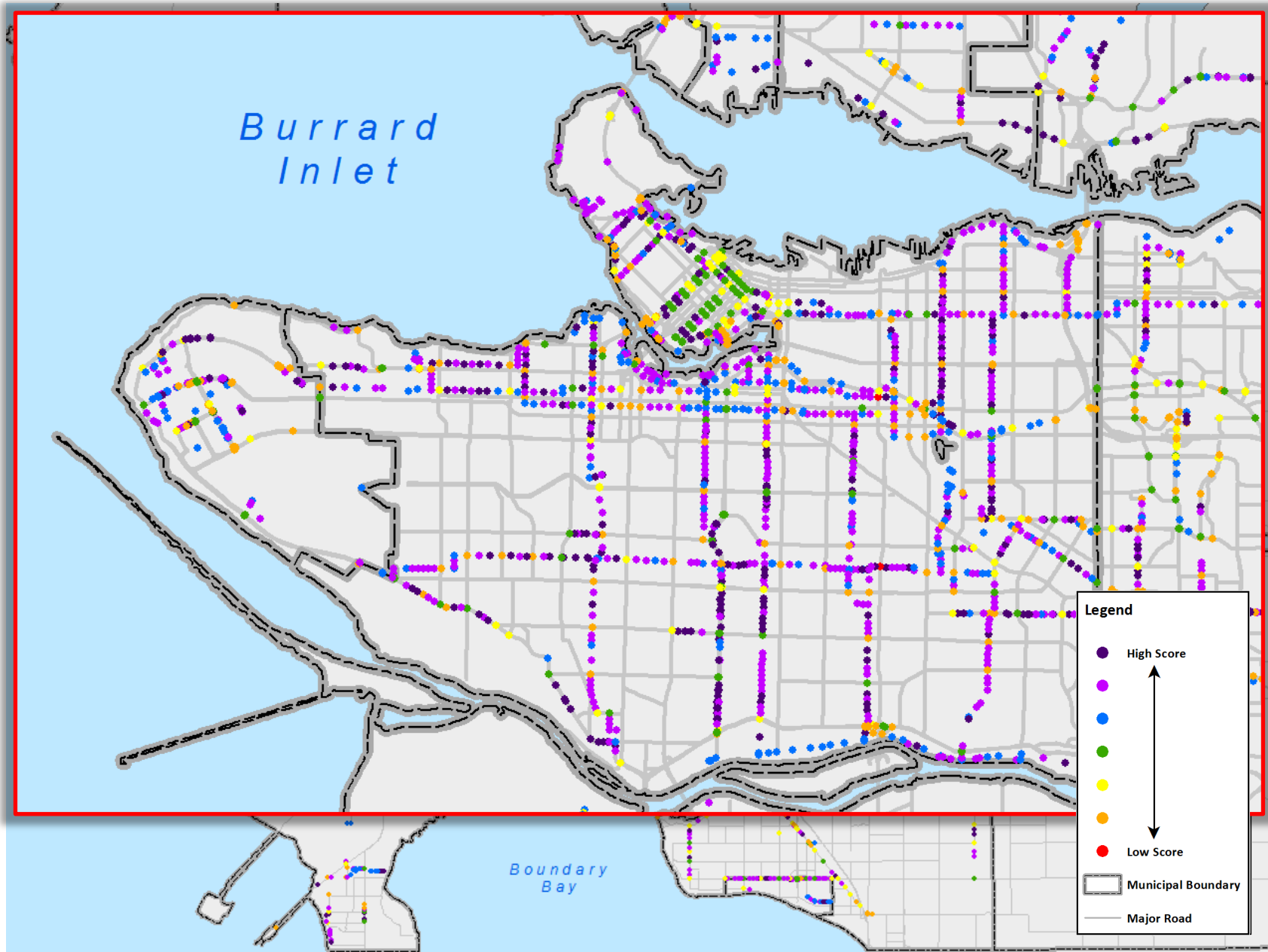
Collector Roads, Arterial Roads, and Highways	Number of Lanes						
	>5	6D	5D	4D	3D	2D	1D
	3-4	6C	5C	4C	3C	2C	1C
	2	6B	5B	4B	3B	2B	1B
	0-1	6A	5A	4A	3A	2A	1A
Intersection Controls	<ul style="list-style-type: none"> • T + L • T + C • S + L • S + C 	<ul style="list-style-type: none"> • T + B • T + M • T + M2 • T + D 	<ul style="list-style-type: none"> • T • R • TC 	<ul style="list-style-type: none"> • S+M • S+M2 	<ul style="list-style-type: none"> • S 	<ul style="list-style-type: none"> • Y • N/A 	

Local Roads	Number of Lanes					
	3-4	11C	10C	9C	8C	7C
	2	11B	10B	9B	8B	7B
	0-1	11A	10A	9A	8A	7A
Intersection Controls	<ul style="list-style-type: none"> • T 	<ul style="list-style-type: none"> • S (Only on Cross Street) 	<ul style="list-style-type: none"> • R • TC 	<ul style="list-style-type: none"> • Y • N/A 	<ul style="list-style-type: none"> • S (On Bicycle Route) 	

Legend		
Data Source	Attribute	Code
DRA	Traffic Signal	T
	Roundabout	R
	Stop Sign	S
	Yield Sign	Y
	--	N/A
Intersection Controls	Bike Box	B
	Cyclist Activated Push Button	C
	Bicycle Loop Detector	L
	Median Barrier	M
Traffic Calming Dataset	Directional Barrier	D
	Median Barrier	M2
	Traffic Circle	TC

Ratings Scale	
Violet	Best (9)
Violet	(8)
Pink	(7)
Dark Blue	(6)
Light Blue	(5)
Green	(4)
Yellow	(3)
Orange	(2)
Red	Worst (1)

IQI Overall Results



- Data was normalized by calculating positive Z-Scores
- Able to apply different weights to metrics to show different results

Cycle Zones - Weighted Total Scores

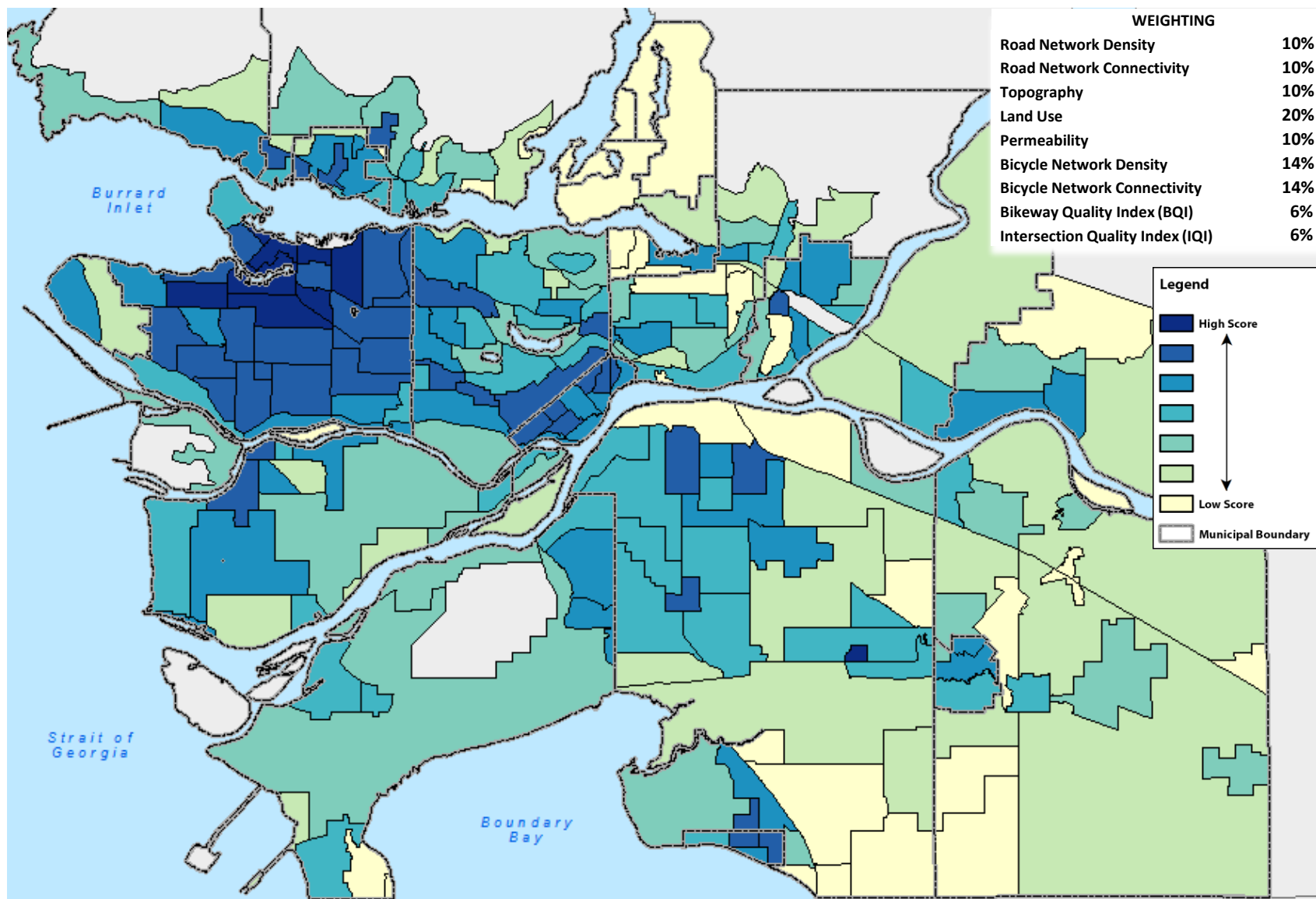
Select Cycle Zone layer:
Cycle_Zones

Weighting %:

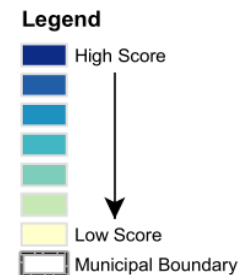
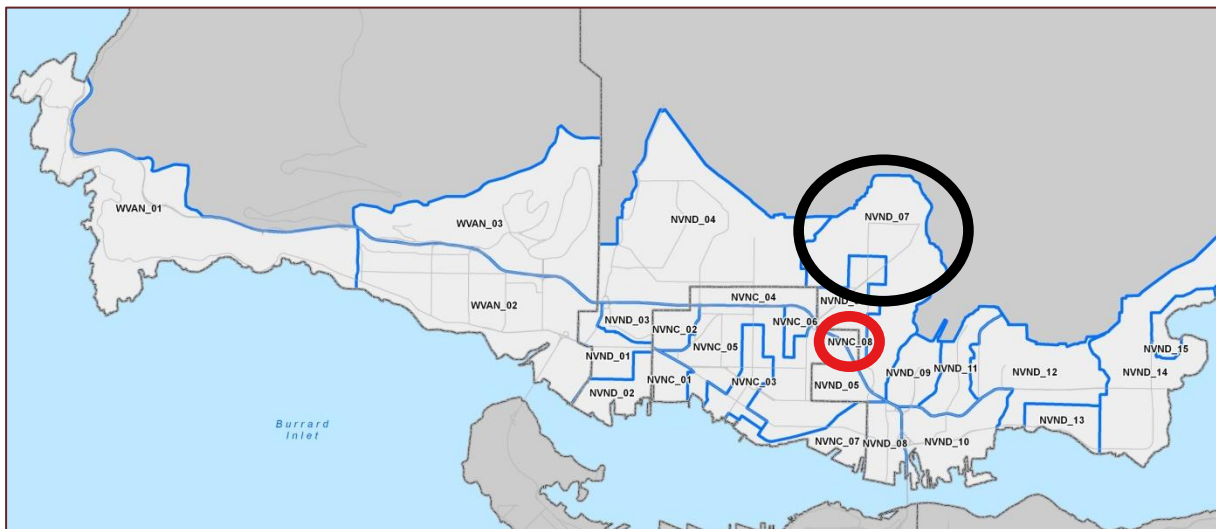
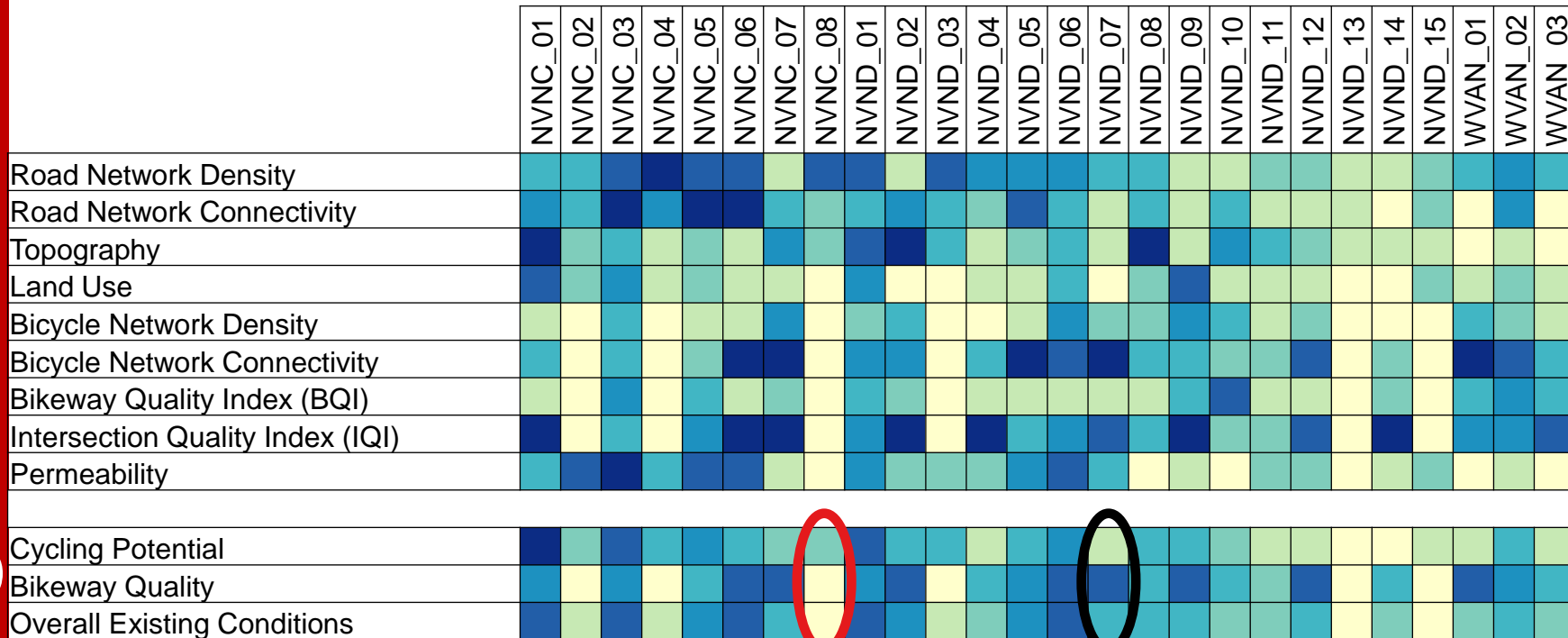
Road Density:	0
Road Connectivity:	25
Topography:	0
Land Use:	18
Permeability:	0
Bicycle Route Density:	6
Bicycle Route Connectivity:	0
Bicycle Way Quality Index (BQI):	0
Intersection Quality Index (IQI):	0

Submit Cancel Total Weighting %: 49

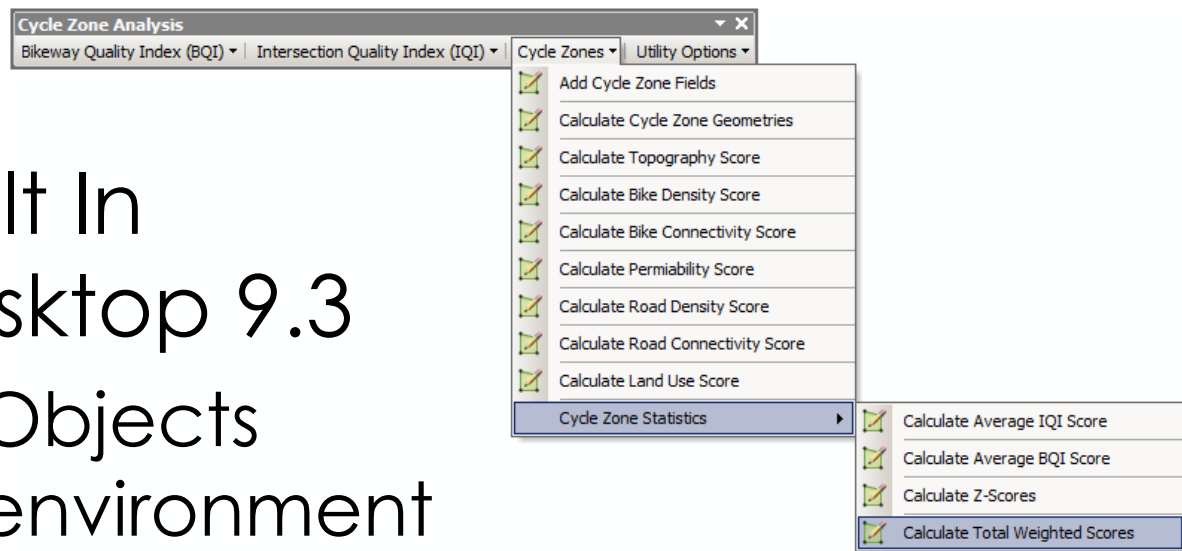
Existing Conditions



Analysing The Results



- Toolset built In ArcGIS Desktop 9.3
 - Used ArcObjects in a VBA environment
 - Transparent, simple, modular design
 - Tried to introduce as much flexibility as possible
 - No extensions available (ie. Spatial Analyst, 3D analyst)





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Thank You!

Brian Patterson
Community Planner
bpatterson@urban-systems.com
(Project Manger)

