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City of Richmond

Urban Green Space Using Satellite Images

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RADARSAT and the City of Richmond

- Held mini-seminar at RSI for City of Richmond on April 17 2002
- Agreed on pilot project - October 2002 - to explore the possibility of developing a cost-effective means of deriving impervious surfaces and Greenspace extents from high-resolution satellite imagery.

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Objectives

- To map impervious surfaces.
  - Impervious surfaces can be defined as any material that prevents the infiltration of water into soil, thereby changing the flow dynamics, sedimentation load, and pollution profile of storm water runoff.
  - The growth of impervious surfaces is directly related to construction of buildings, roads, parking lots, and sidewalks.

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Issues

- In the municipal setting, impervious surface area calculations have an important role in storm water runoff modeling and assessing water quality.
- Traditional methods of calculating impervious surfaces such as manual air photo interpretation are very time consuming and cost prohibitive.
- Developing a more cost-effective method for determining the extents would allow this information to be utilized more often, and to be regularly monitored and updated.

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Results

Orthorectified, Pan-fused Quickbird Satellite Imagery

Class	Source Resolution (m^2)	Total Area (m^2)	% of Image Area (Terrestrial)(m^2)	User Accuracy (%)	Kappa Statistic
Impervious Surface	2.8	37,822,475	29.23 %	94.66	0.9208
Greenspace	0.7	77,928,341	60.23 %	94.51	0.906
Other	0.7	13,629,323	10.54 %		

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Accuracy

Note:

The impervious surface classification was performed on the Multispectral image data, with a resolution of 2.8 Metres. This step was performed before the newer pan-fused image was available, and the older method of pan-fusion produced an image unsuitable for this type of classification. The result is a classification with a 'resolution' of 2.8 meters.

The Greenspace surface classification used the improved resolution of the panchromatic band and retain the spectral information found in the Multispectral bands, the imagery was 'pan-fused'. The output is a Multispectral image with a spatial resolution of 0.7 meters.

Class

Class

Impervious surfaces included building rooftops, roads, sidewalks, and all other paved areas.

Greenspace comprised all Vegetated land, as defined by an NDVI threshold and textural information

Other represented all features that did not possess a ‘membership value’ sufficient to place in any defined class.

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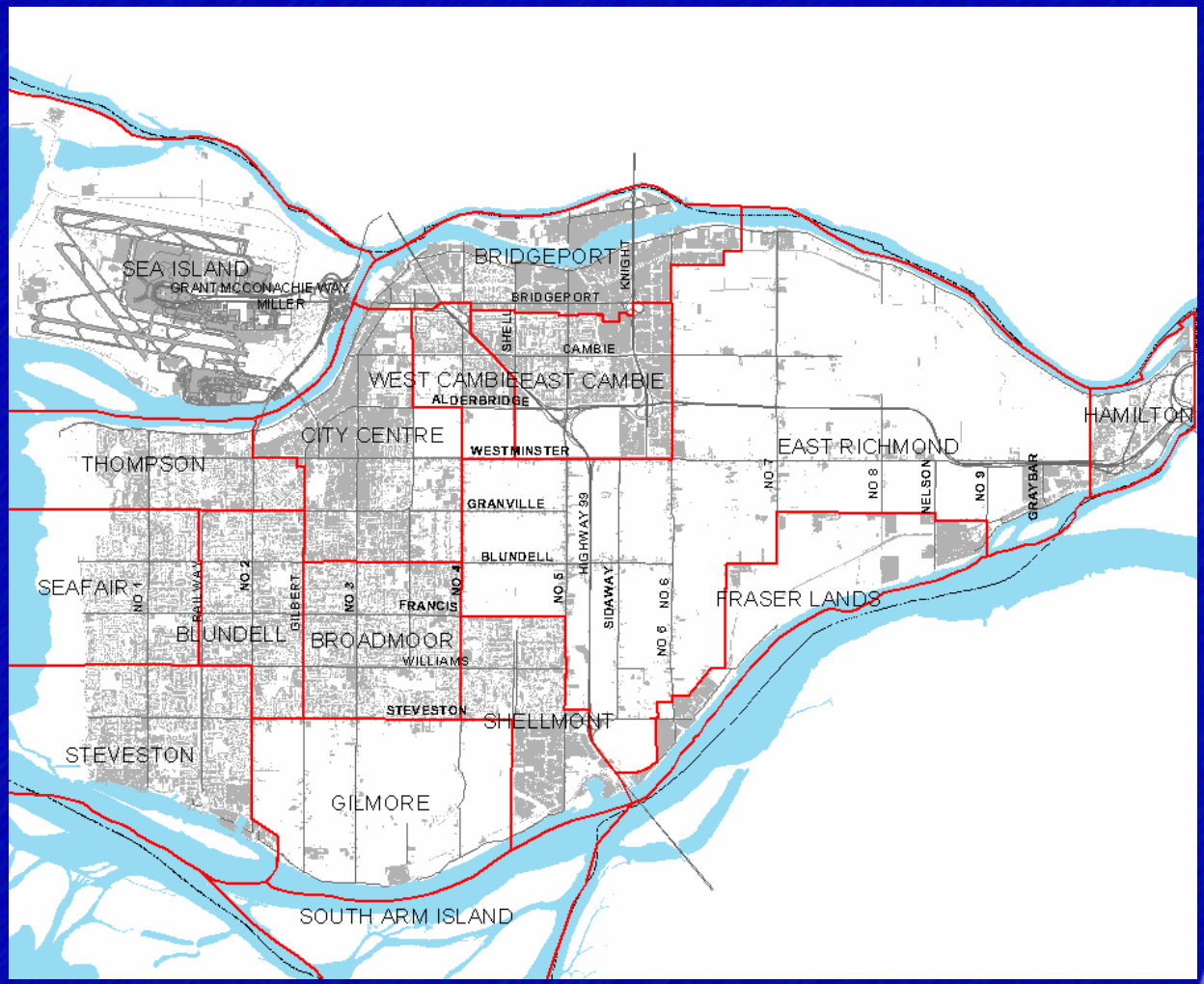
Integration into the GIS



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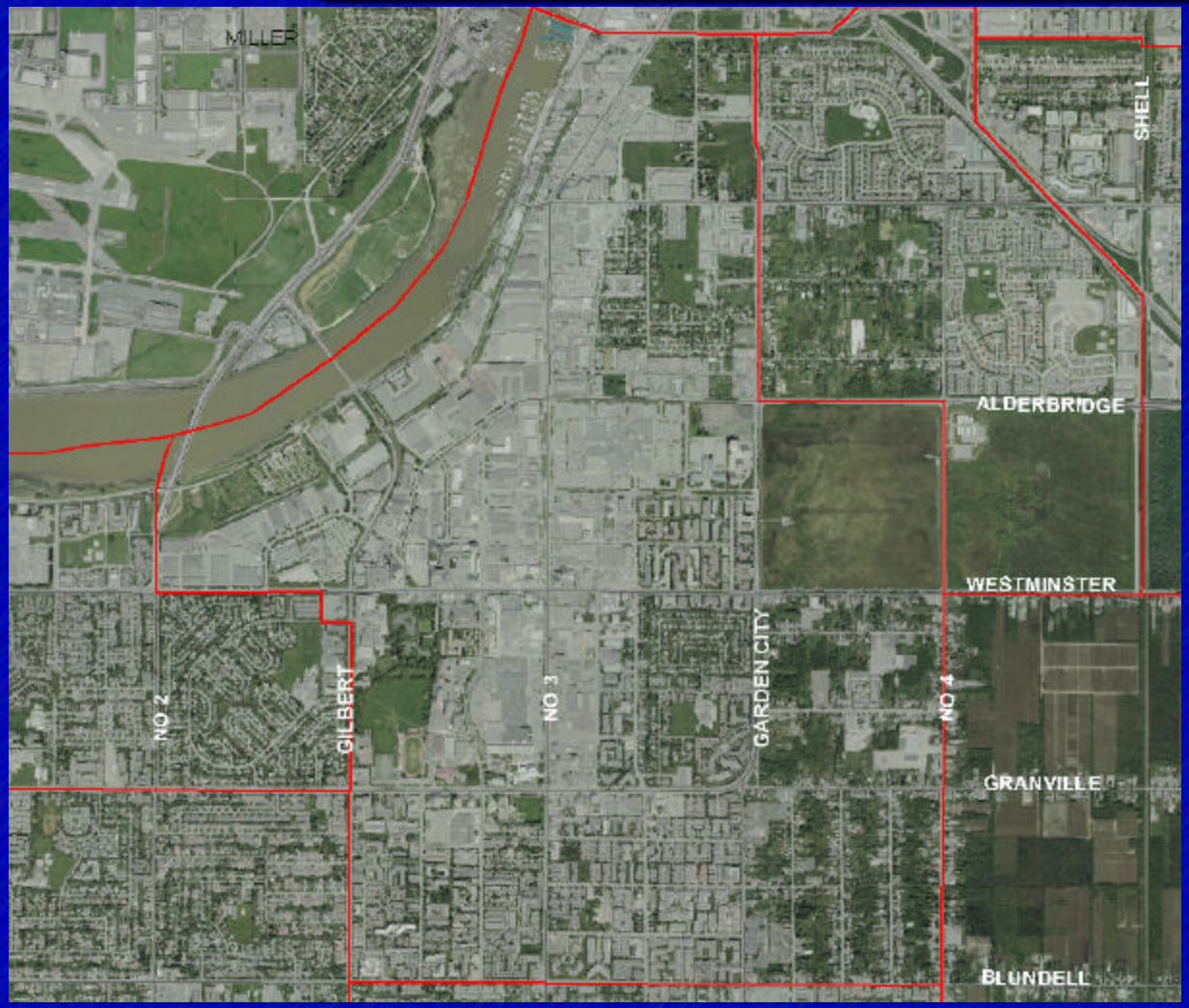

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Role and Uses for the City of Richmond

- The Impervious surface map created in this project will work quite well for aggregate studies concerning hydrological modeling, down to the catchment level.

- As the analysis was performed on the 2.8 metre imagery, and due to the problems with shadow and flat spectral response in the imagery, it is not likely suitable for analysis on the residential parcel level.

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The Next Step of the Pilot Project

May 2003

- The next step was to scale down the size of area to be analyzed and integrate Land Use thematic maps into the image classification process, allowing for similar features to be classified differently depending on where they are found.
- The area defined was Minoru Park.
- The analysis performed solely in this area with higher resolution imagery (60cm) and some revision to the procedure yielded more accurate data.

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Minoru Park

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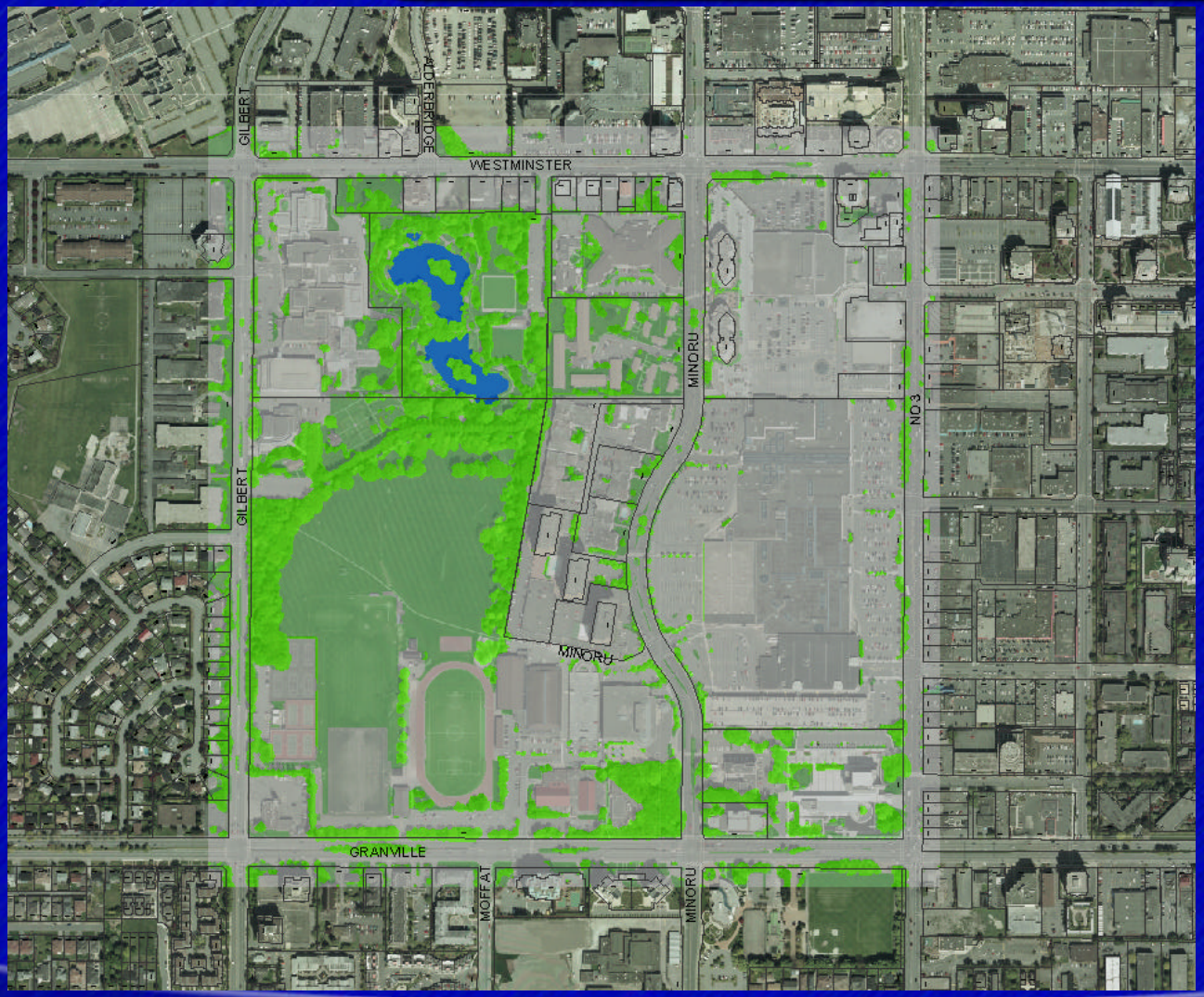
Image Classification



Minoru Land Cover

- Grass
- Impervious Surface
- Tree Cover
- Water

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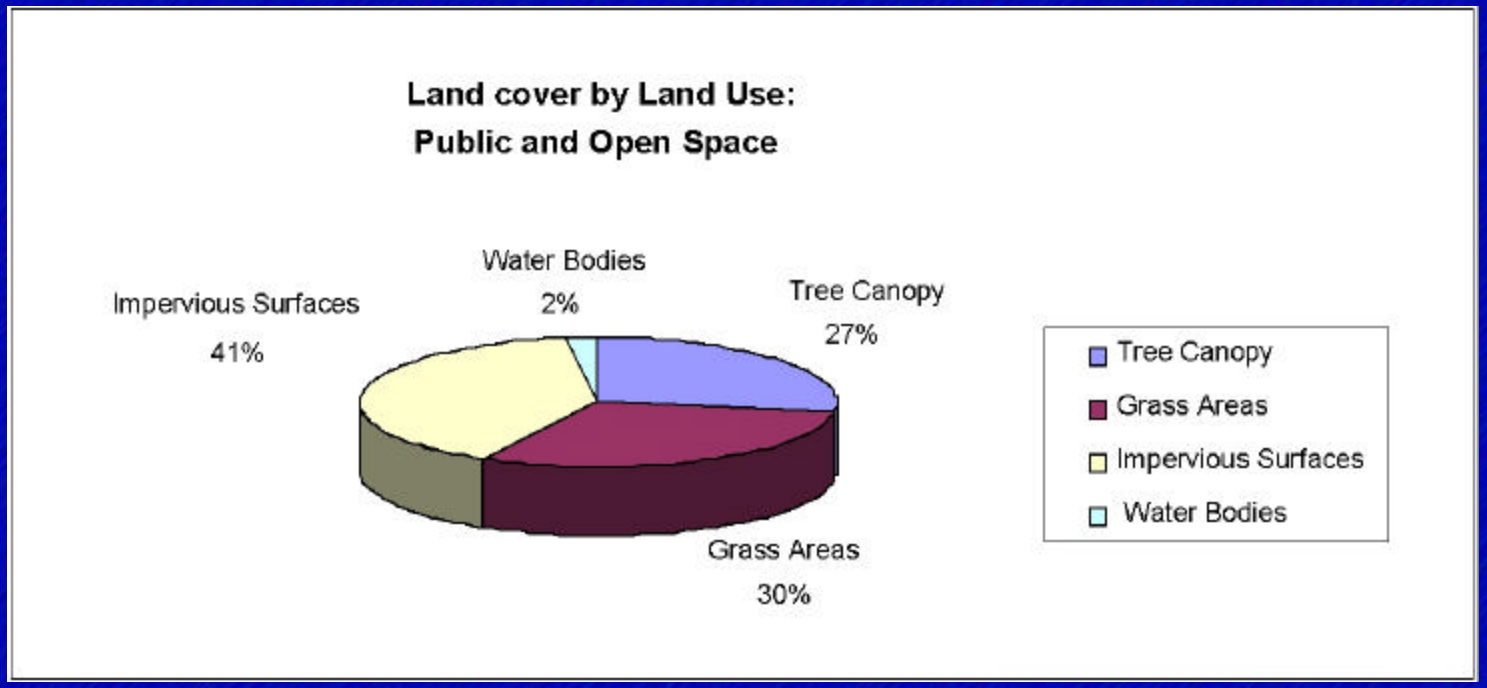
Land Cover Proportions in the Minoru Park Area



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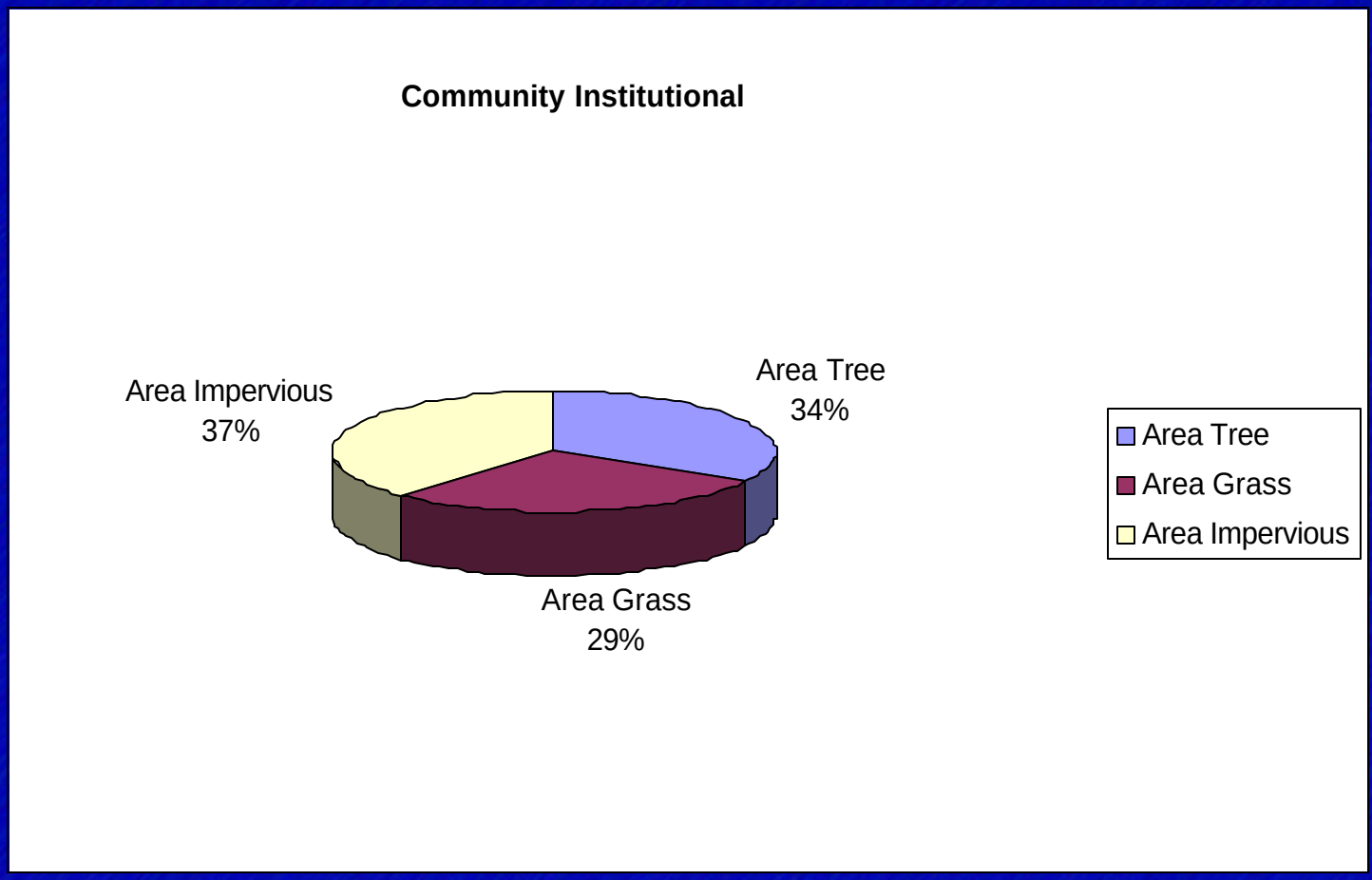
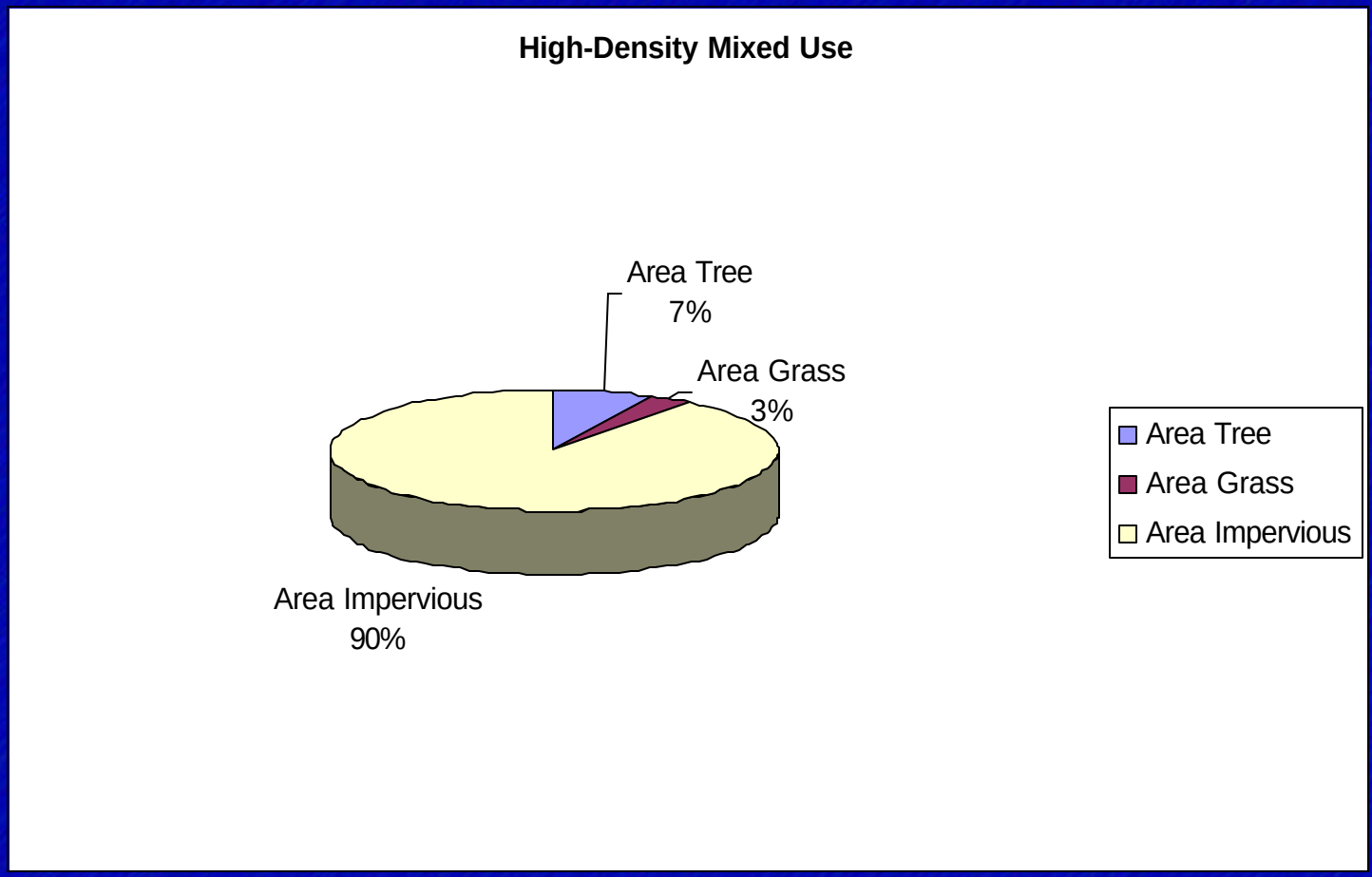
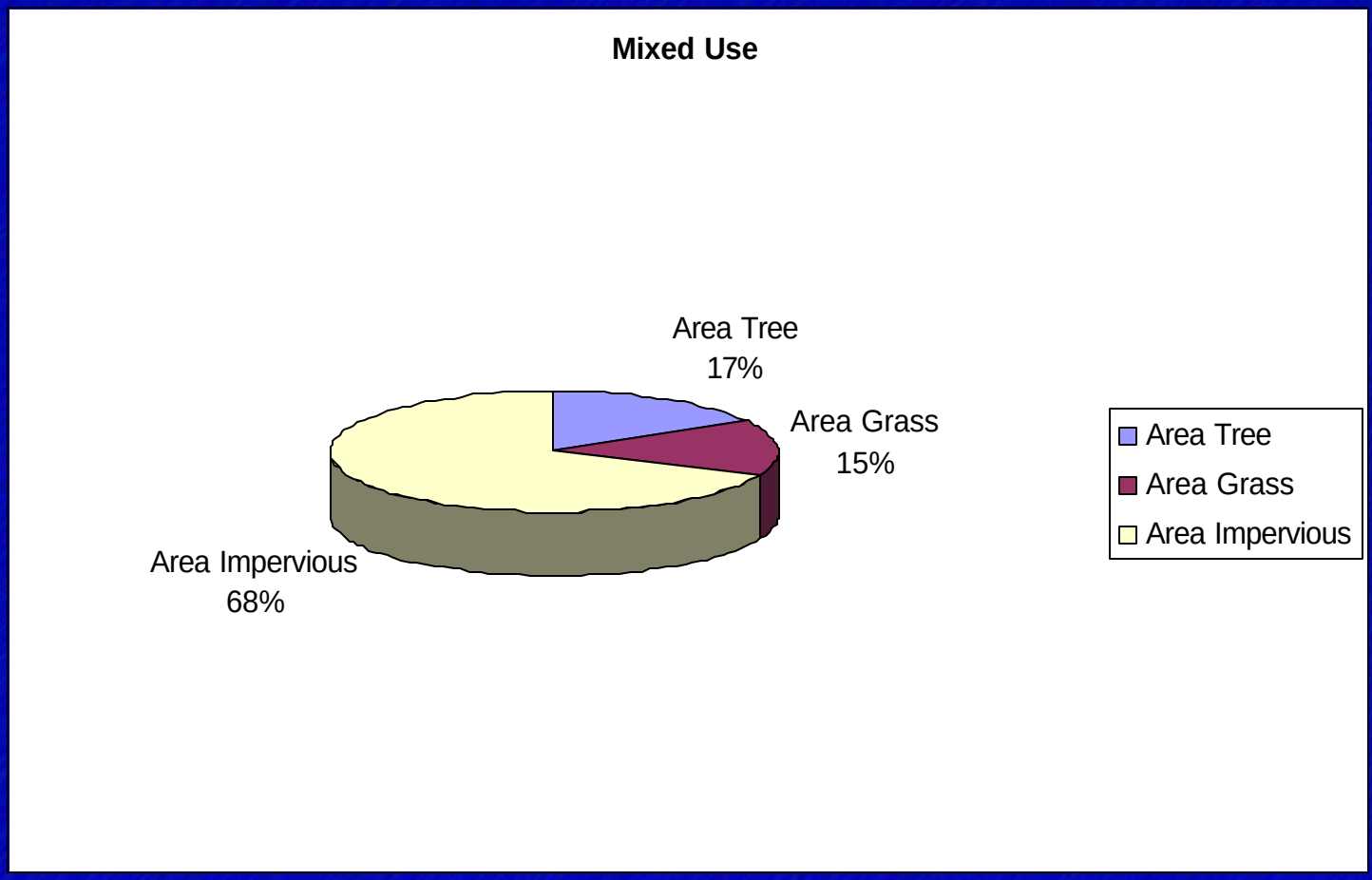
OCP Land Cover Proportions in the Minoru Park Area



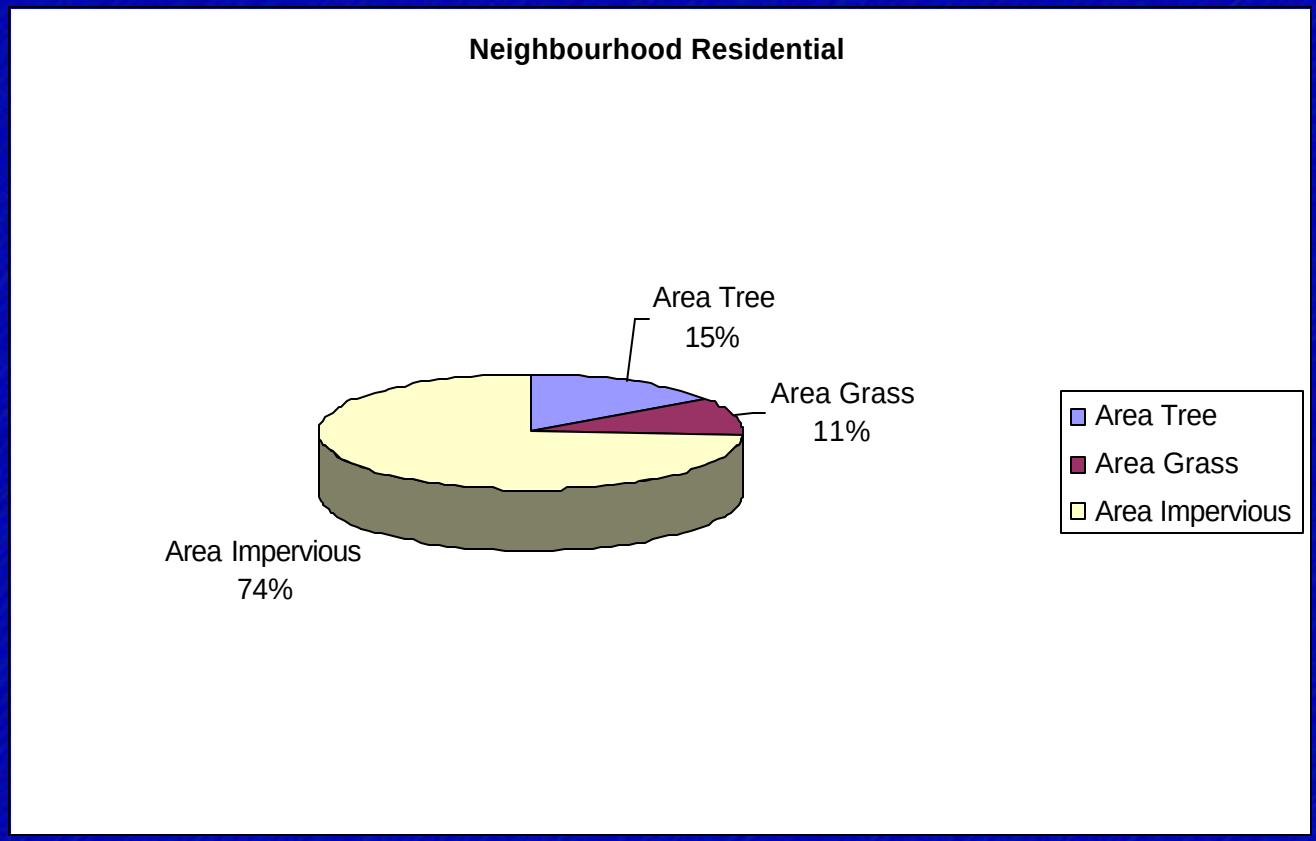
OCP Land Cover Proportions in the Minoru Park Area



OCP Land Cover Proportions in the Minoru Park Area



OCP Land Cover Proportions in the Minoru Park Area



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Conclusions

- With the creation of ‘tree canopy’ and ‘grass’ thematic information come additional applications for land management in the City of Richmond. It is now possible to determine how much tree canopy exists in a given area.
- Tracking tree canopy coverage in the city is important:
  - environmental
  - aesthetic
  - facilities management
  - resource allocation.

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The Next Step

- One possible next step in integrating thematic data derived from satellite imagery would be to perform image classification for all public spaces and agricultural land in the city to determine the following:
  - Overall acres of tree canopy in all city parks and public lands
  - Overall acres of Grass-covered areas within the city's parks and public lands
  - Overall acres of Impervious surfaces within the city's parks and public lands
  - The amount of the ALR that is currently being cultivated
  - The amount of the ALR that is currently Grown-in or otherwise forested

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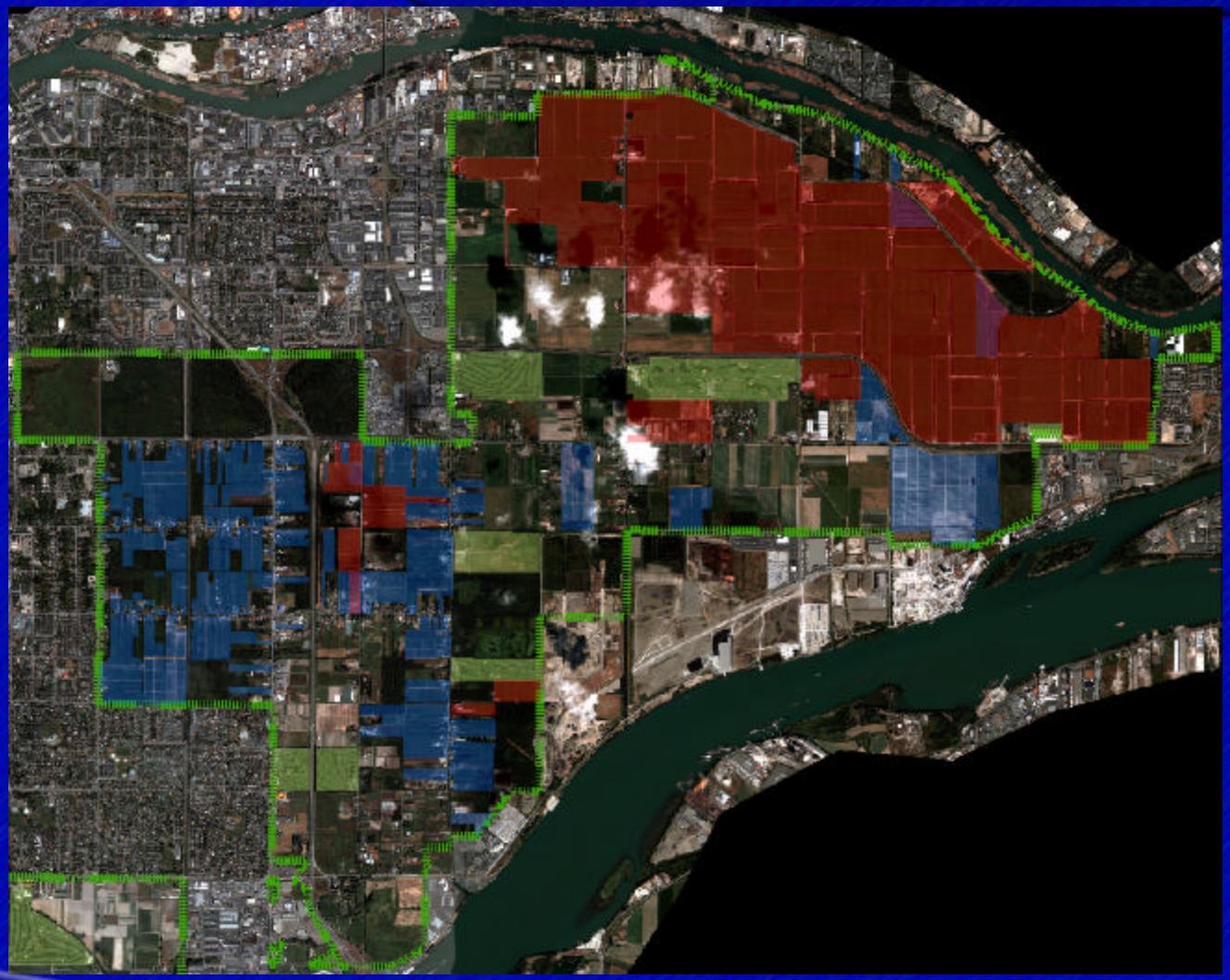
Land Uses in the ALR – East Richmond



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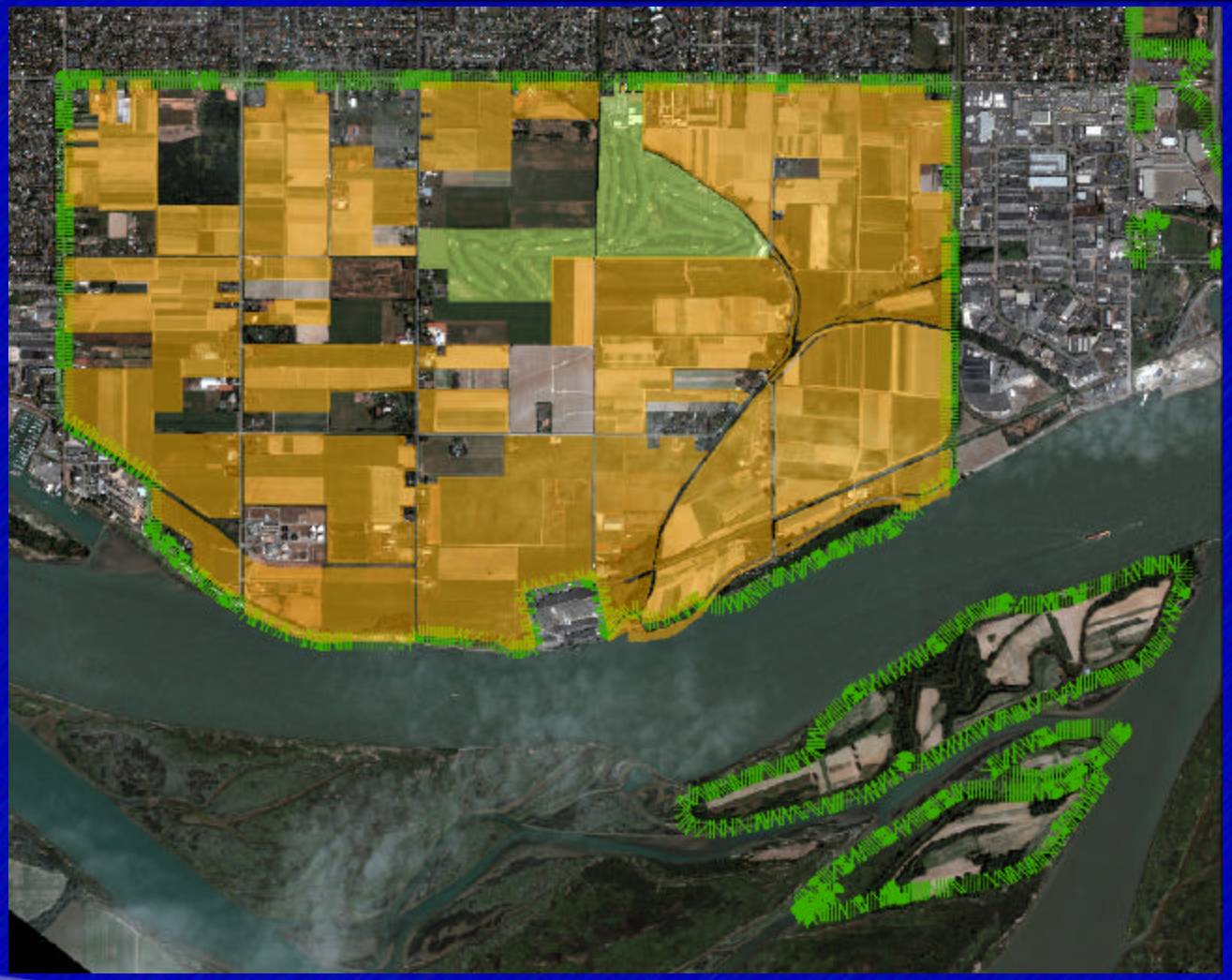
Land Uses in ALR - Gilmore



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