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# **Generalization for Medium-Scale Mapping: Results and Statistics from One Production Implementation**

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# Topics of Discussion

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- Overview of the Project
- Briefing of Map Data to Generalize
- Project Implementation
  - ◆ Schedule
  - ◆ Workflow and Tasks
- Generalization Results

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information used in this presentation**

# Overview of Project

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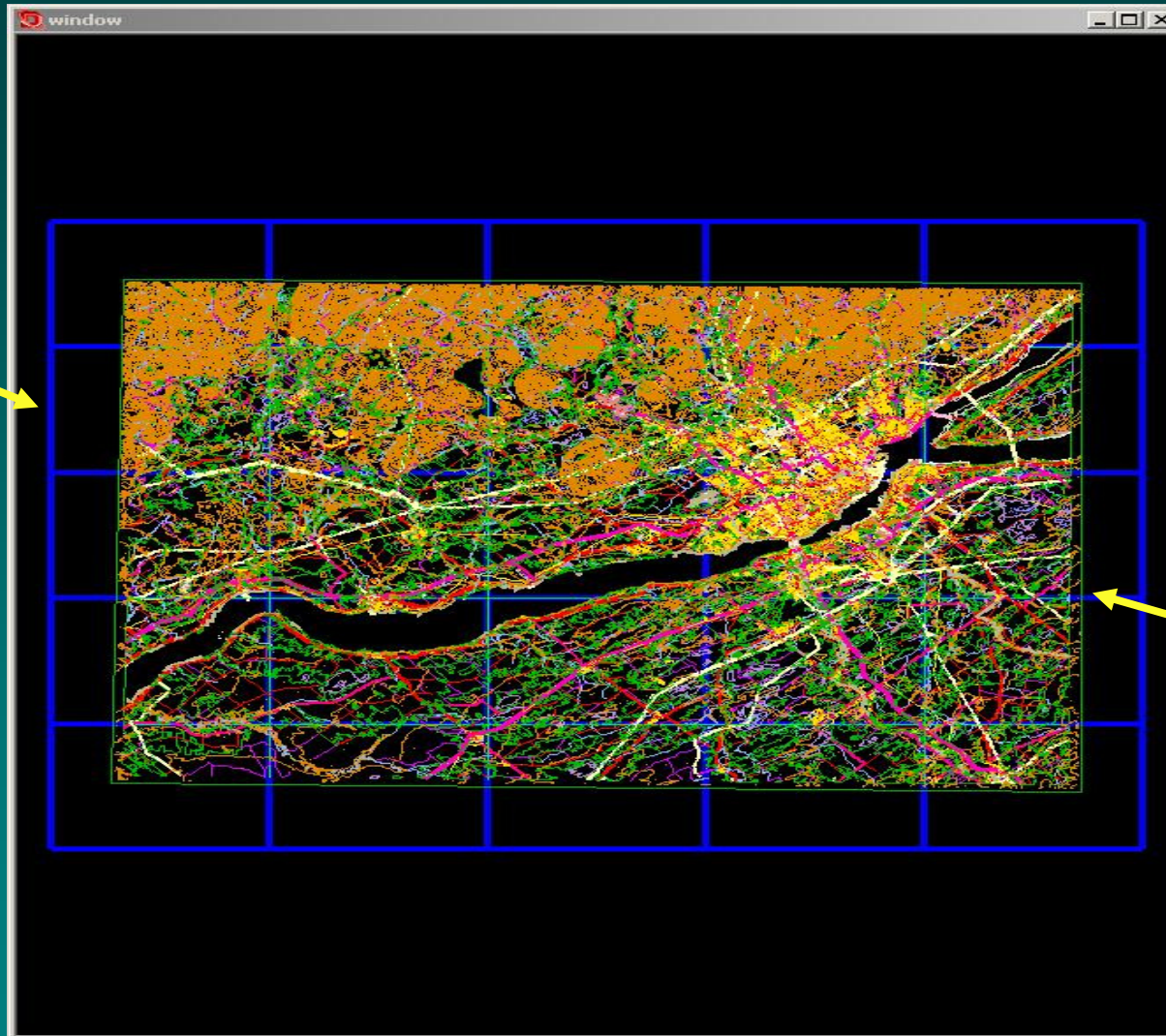
- Build a 1:100,000 scale database from 1:20,000 scale database; both databases are file-based (tiled)
- Not cartographic, hardcopy (paper) generalization, but data model generalization
- Displacement is not to be performed
- Any topological nodes remaining in 1:100,000 scale database are identical in 1:20,000 scale database; in some cases the feature geometries are the same
- Database is not modeled for sharing of geometry or features; therefore two separate databases are maintained at the differing scales

- Area of coverage is southern region of Québec between 45 and 52 parallels
- 2715 total maps at 1:20,000 scale to be reduced to 170 maps at 1:100,000 scale



# Briefing of Map Data to Generalize

Blue Outlines  
1:20K Maps



1:100K Map

## Briefing of Map Data to Generalize

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- 1:20,000 merged data covering 1:100,000 scale geographic area is 300 megabytes in size; maximum size is 450 megabytes
- Features are same as topographic map
  - ◆ Hydrography
  - ◆ Road and other transportation
  - ◆ Vegetation
  - ◆ Buildings and culture
  - ◆ Contours
  - ◆ Etc.
- Majority (square km - not # of features necessarily) of southern Québec is hydrography related – lakes, rivers, islands

# Briefing of Map Data to Generalize

## Statistics for merged 1:20,000 data for single 1:100,000 Map

**109 Different Feature Classes**

**464,874 Total Number of Features**

**35,143 Total Area Features (8%)**

**201,163 Total Line Features (43%)**

**228,568 Total Point Features (49%)**

Feature Class	Type	#	%
Lac	Area	2571	0.55%
CourbeNiveauMaitress	Line	5214	1.12%
Batiment	Area	5420	1.17%
PointCote	Point	8373	1.80%
Batiment	Line	9102	1.96%
LignedeDemarcation	Line	9982	2.15%
RouteLocalePavee	Line	12846	2.76%
CoursdEau	Line	14573	3.13%
CheminNonCarross	Line	19634	4.22%
MilieuBoise	Area	21850	4.70%
CourbeNiveauIntermediaire	Line	21870	4.70%
RuePavee	Line	23425	5.04%
CoursdEauIntermittent	Line	27252	5.86%
CheminCarrosNonPave	Line	32029	6.89%
Batiment	Point	207102	<u>44.55%</u>
TOTAL			90.61%



# Project Implementation – Schedule of Events

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- **Spring 2000: Project start with establishment of standards**
- **Spring 2001:**
  - ◆ Workflow was organized
  - ◆ Training on Intergraph products Dynamo and DynaGen
- **November 2001: Production begins**
  - ◆ November 2001 – March 2002: 10 Technicians
  - ◆ April 2002 – March 2003: 2 Technicians
  - ◆ Technicians have technical degree in geomatics with 10 years experience
- **March 2003: Final 1:100,000 map produced**
- **Next Task – 1:20,000 scale database has been updated resulting in need to regeneralize 60 maps**

# Project Implementation – Workflow and Tasks

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- Workflow of generalization operators:
  - ◆ Feature selection
    - Roads
    - Rivers
    - Buildings
  - ◆ Simplification for all linear features and area boundaries
  - ◆ Merge linear features
  - ◆ Collapse
    - Area to Line for lakes and rivers
    - Area to Point for islands
  - ◆ Aggregation
    - Forest
    - Islands
    - Swamps
  - ◆ Typification
    - Elevation Points

# Project Implementation – Workflow and Tasks

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- Generalization validity controls implemented included the detection of loss or change in topological relationships; also for the detection of small slivers or gaps
- Both interactive generalization (dynamic display and result previews) and automatic generalization was used
- Feature attributes were updated with calculation of widths and area values of area features

# Generalization Results

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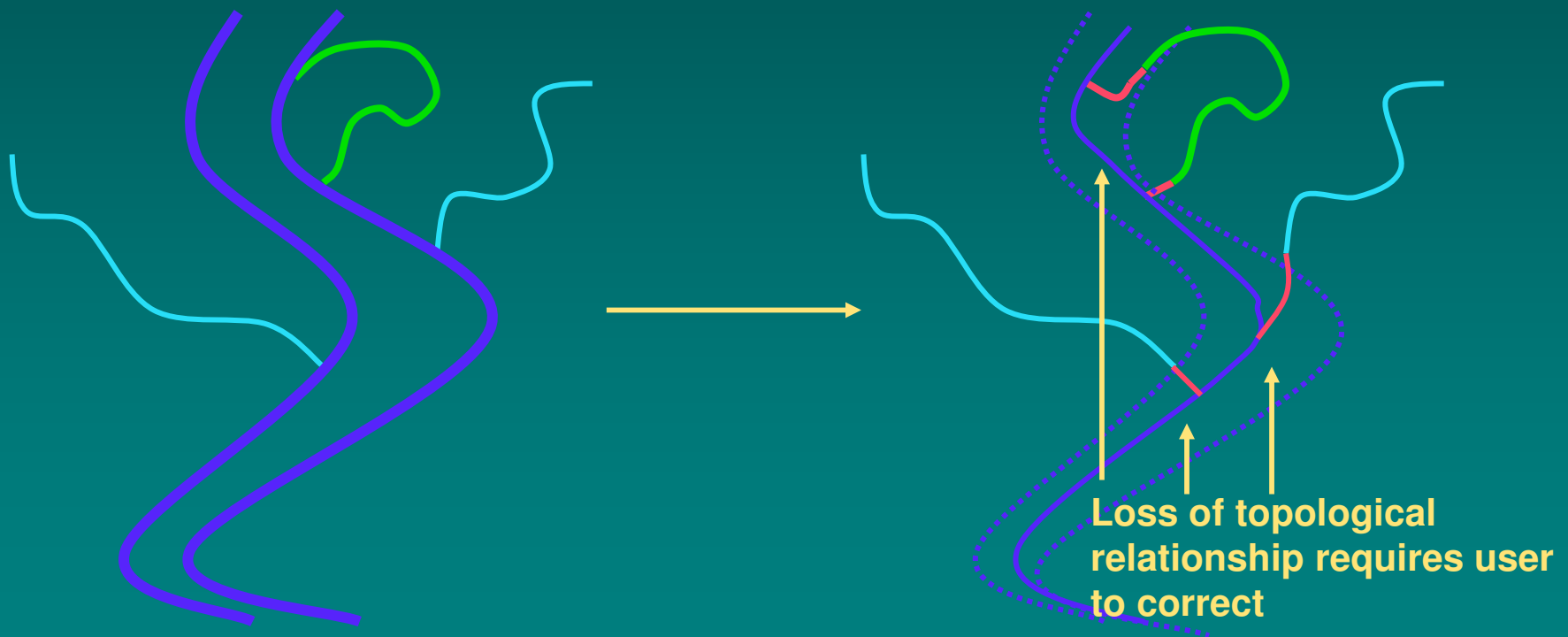
- Average size of 1:100,000 scale map was 50-60 megabytes; about 5-time reduction of merged 1:20,000 map data of 300 megabytes
  - ◆  $100,000/20,000 = 5$  ☺
- Each 1:100,000 map took approximately 4 days to complete
- 3-year project from start to finish – Spring of 2000 to Spring 2003
- 1.5 years of generalization production of 170 1:100,000 scale maps from 2715 1:20,000 scale maps – November 2001 – March 2003

# Generalization Results

- Most used generalization operators:

- ◆ Area to Line Collapse
- ◆ Area to Point Collapse

- 70% of generalization time was spent on hydrographic features due to loss of topological relationship



# Generalization Results

## Statistics for final generalized 1:100,000 Map

	1:20K	1:20K %	1:100K	1:100K %	%Decrease
# Different Feature Classes	109		85		
Total # of Features	464,874		27,901		94%
Total # of Areas	35,143	8%	1,017	3.5%	97%
Total # of Lines	201,163	43%	19,476	70.0%	90%
Total # of Points	228,568	49%	7,408	26.5%	97%

# Briefing of Map Data to Generalize

## Statistics for final generalized 1:100,000 Map

### Review of top 90% from merged 1:20,000

Feature Class	Type	# 1:20K	%	# 1:100K	%
Lac	Area	2571	0.56%	114	0.40%
CourbeNiveauMaitress	Line	5214	1.13%	686	2.45%
Batiment	Area	5420	1.18%	92	0.32%
PointCote	Point	8373	1.82%	1161	4.16%
Batiment	Line	9102	1.98%	0	-
LignedeDemarcation	Line	9982	2.17%	0	-
RouteLocalePavee	Line	12846	2.80%	630	2.25%
CoursdEau	Line	14573	3.17%	2335	8.37%
CheminNonCarross	Line	19634	4.27%	0	-
MilieuBoise	Area	21850	4.75%	449	1.60%
CourbeNiveauIntermediaire	Line	21870	4.76%	2945	10.55%
RuePavee	Line	23425	5.10%	7246	25.97%
CoursdEauIntermittent	Line	27252	5.93%	0	-
CheminCarrosNonPave	Line	32029	6.97%	1251	4.48%
Batiment	Point	207102	45.07%	0	-
	TOTAL		90.61%		60.55%

# Briefing of Map Data to Generalize

## Statistics for final generalized 1:100,000 Map

### Top 85% of 1:100,000 compared to 1:20,000

Feature Class	Type	# 1:20K	%	# 1:100K	%
PointCoteStructure	Point	387	0.08%	376	1.34%
MilieuBoise	Area	21850	4.75%	449	1.60%
RouteLocalePavee	Line	12846	2.80%	630	2.25%
CourbeNiveauMaitress	Line	5214	1.13%	686	2.45%
RueNonPavee	Line	2258	0.48%	687	2.46%
Bretelle	Line	1180	0.25%	775	2.77%
PointCoteExcavation	Point	954	0.20%	897	3.21%
ResivoirdSurface	Point	465	0.10%	1027	3.68%
PointCote	Point	8373	1.82%	1161	4.16%
CheminCarrosPave	Line	3414	0.73%	1250	4.48%
CheminCarrosNonPave	Line	32029	6.97%	1251	4.48%
Lac	Point	0	-	2125	7.61%
CoursdEau	Line	14573	3.17%	2335	8.37%
CourbeNiveauIntermediaire	Line	21870	4.76%	2945	10.55%
RuePavee	Line	23425	<del>5.10%</del>	7246	<del>25.97%</del>
	TOTAL		32.34%		85.38%

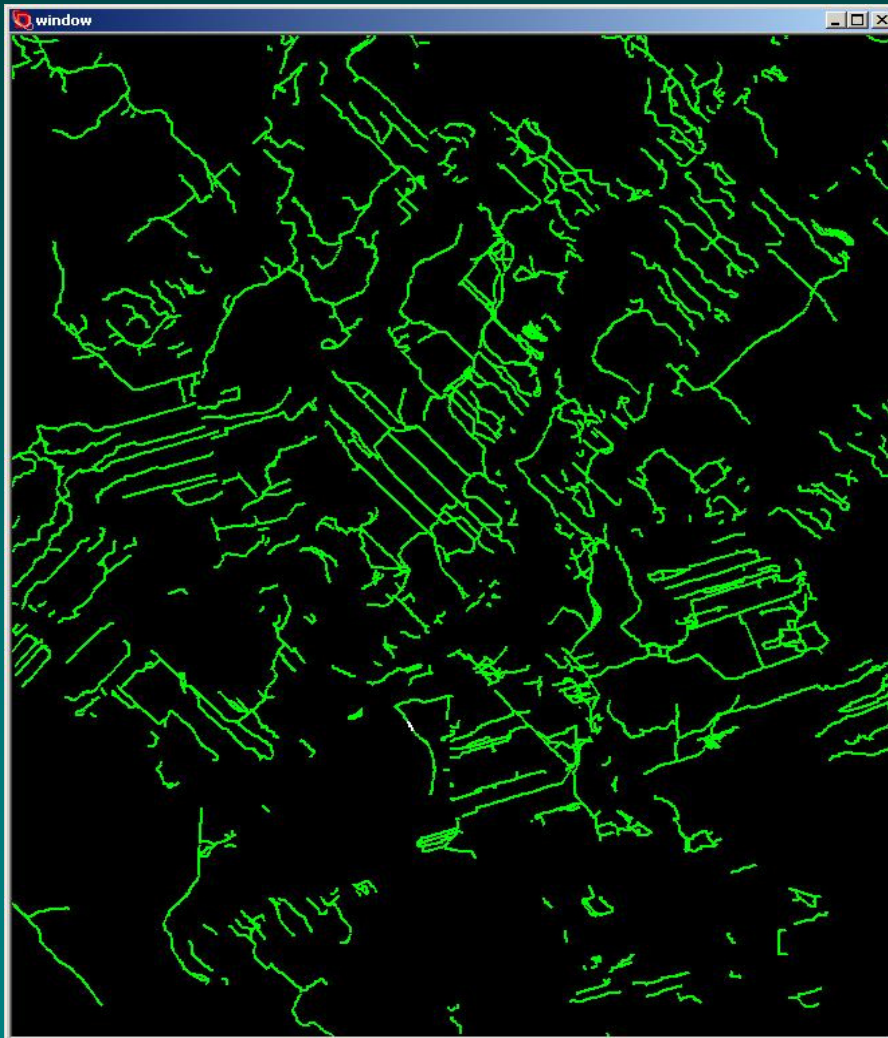
Red = Not in 90% at 1:20K

Yellow = Was part of 90% in 1:20K

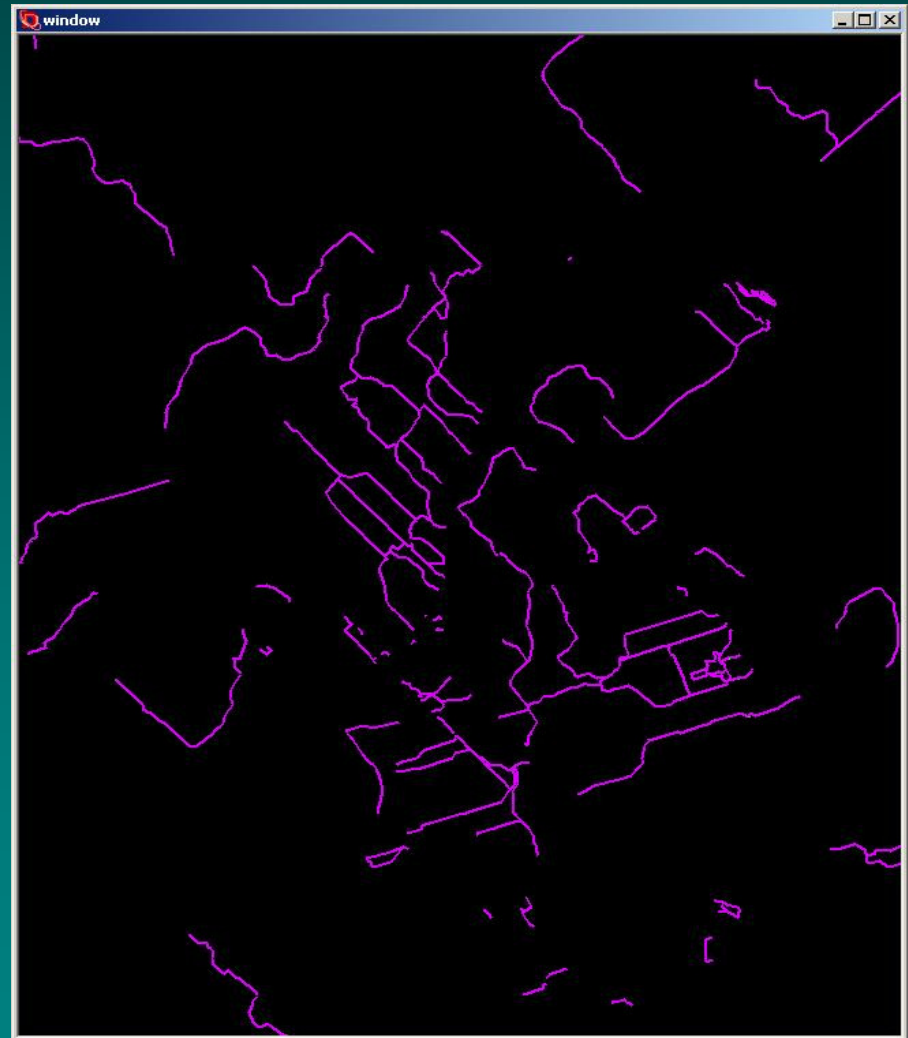


# Generalization Results

CheminCarrosNonPave 1:20K



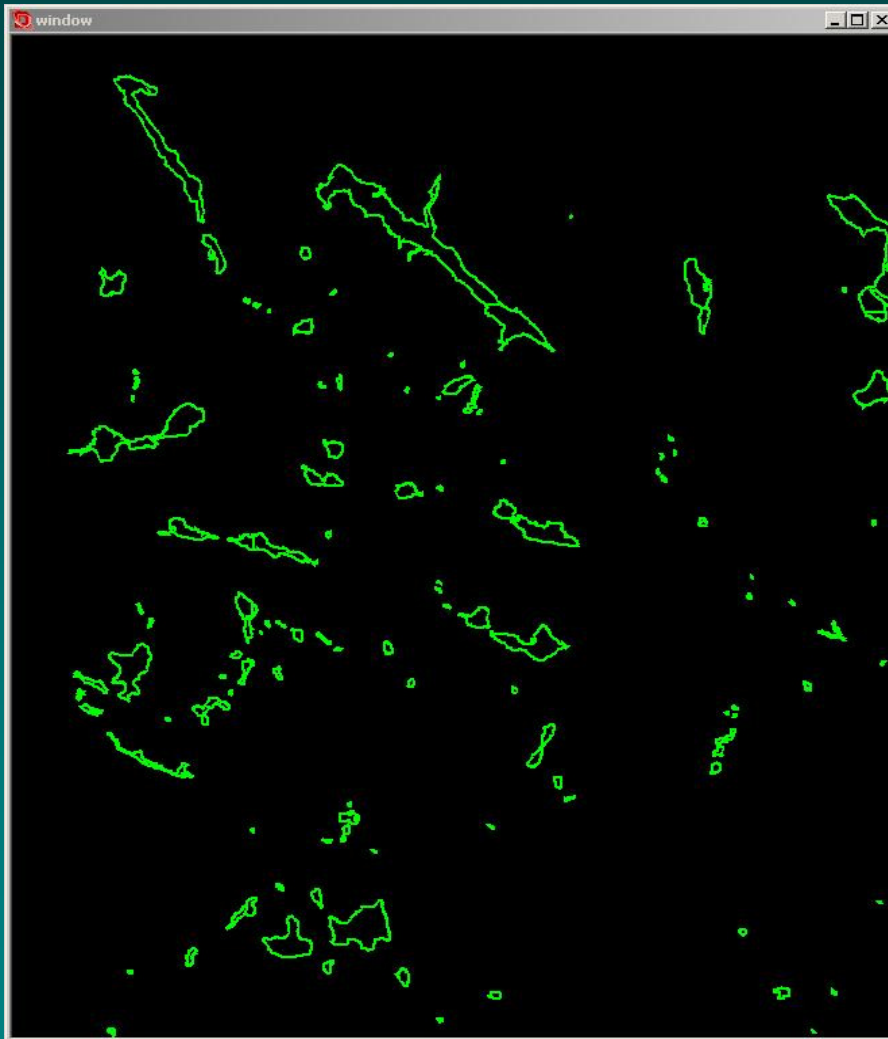
CheminCarrosNonPave 1:100K



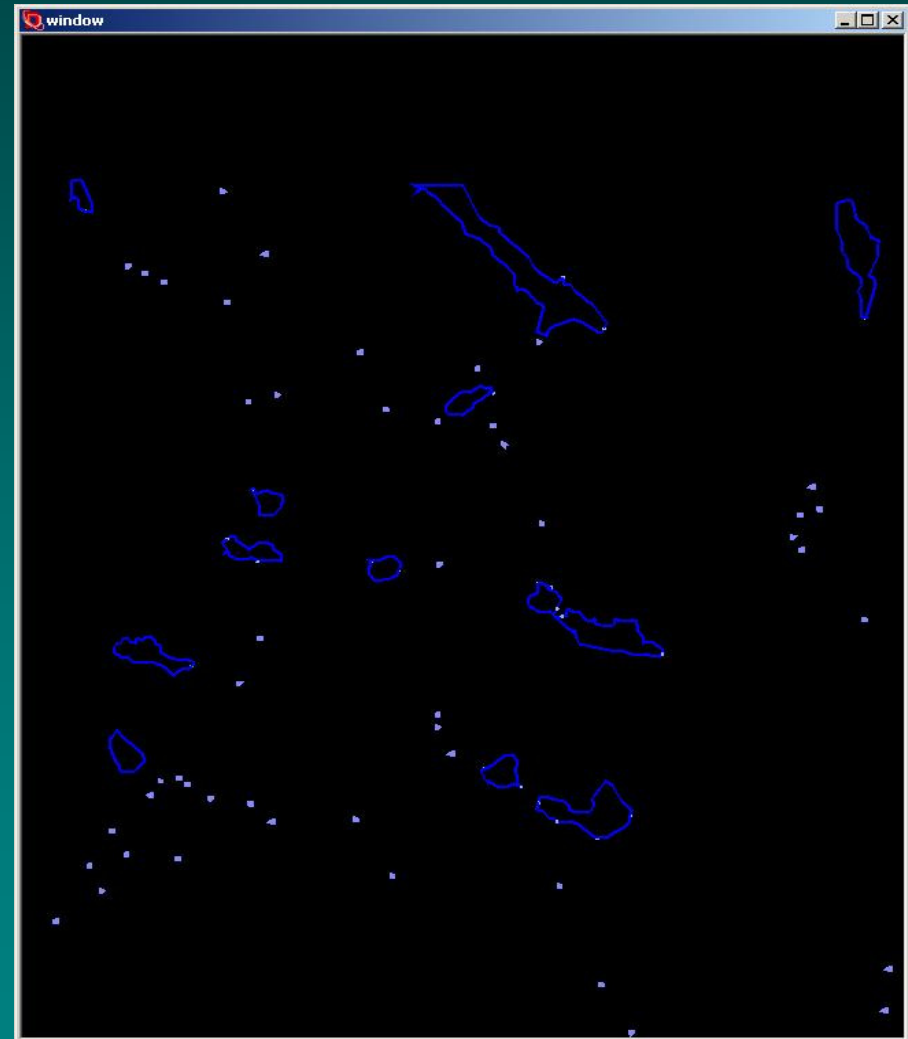
# Generalization Results

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Lac 1:20K



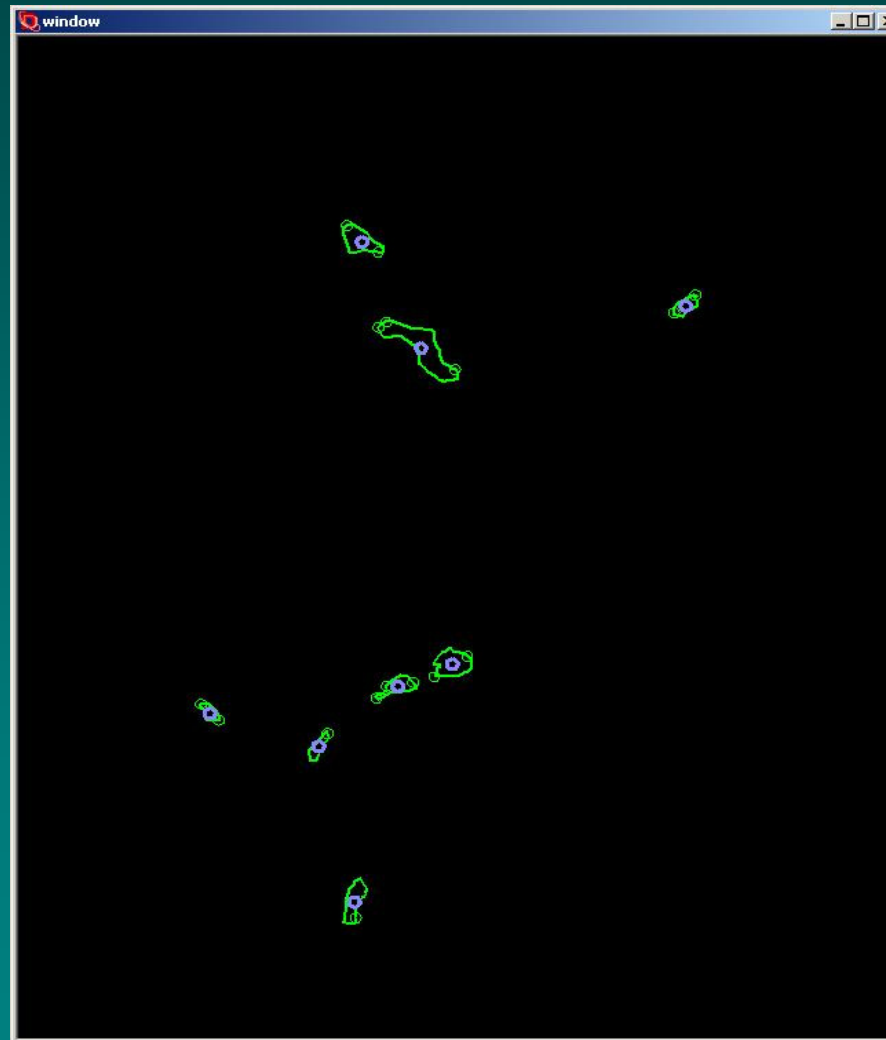
Lac 1:100K



# Generalization Results

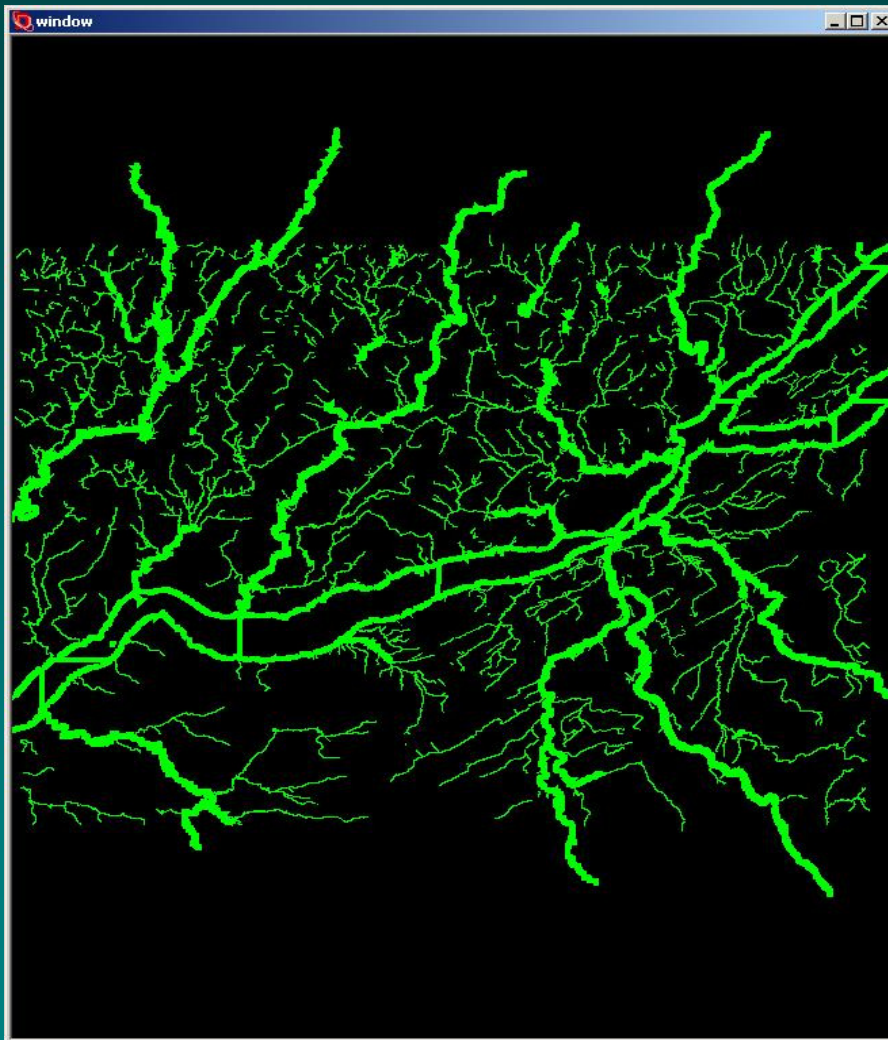
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## Lac Generalization



# Generalization Results

CoursdEau 1:20K



CoursdEau 1:100K



# Generalization Results

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## CoursdEau Generalization





# Generalization Results

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- Collapse of areas to points and areas to lines is important
  - ◆ Area Lac to Point Lac
  - ◆ Area Lac to Line Lac
- Point Typification/Point Distribution not as important
  - ◆ All Point Batiment eliminated
- Feature significance important aspect to consider
  - ◆ Some features more in count at 1:20K were non existent at 1:100K while other less in count still existed
  - ◆ Significant features at 1:20K are also significant at 1:100K – PointCoteStructures count almost identical