EuroSDR/ICA workshop Automated generalisation and NMAs

PRODUCTION OF SMALL SCALE DATA BASES OF THE NLS OF FINLAND

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Development project of Piekka

- **Piekka is vector based generalization application**
- **Development work started in 2002**
- **Goals**
  - Source data from the TDB (1:10k)
  - Whole process in vector format
  - Avoid interactive generalization work and use automation
  - Generalization tools are universal
  - First 10k → 100k, then 100k → 250k, then 250k → 1milj., then 1milj. → 3milj.
- **Technology**
  - Based on ESRI ArcGis Desktop architecture
- **Piekka application was introduced at the end of 2005**

Development project of Piekka

- **Build**
  - by customizing ESRI ArcMap application
  - by extending ArcObjects architecture with custom components
- **Components are based on COM and .NET technology**
- **More in article:**
  - Vector based generalization application in the production of small scale databases of the NLS of Finland, by Mr. Veijo Pätynen and Mr. Jouni Ristioja, National Land Survey of Finland, Development Centre
  - Especially chapter 3. Technical review of Piekka application by Jouni Ristioja, jouni.ristioja(at)nls.fi

Piekka application

- **Generalization tools are integrated into ESRI's standard ArcMap application, now ArcGIS10.1**
- **ESRI ArcGIS FileGeodatabase**
- **Whole generalization process in vector format**
- **Generalization tools are universal**
  - All parameters for controlling the process are stored into separate control database tables
- **The process can be seen as mixed model- and cartographic-oriented generalization**
  - Most of the process is not intended for any specific map representation
  - In typification of dense building clusters and displacement of buildings we have in mind size of house symbols and width of roads
- **Topological relationships between features are maintained with ArcGIS Topology tools**

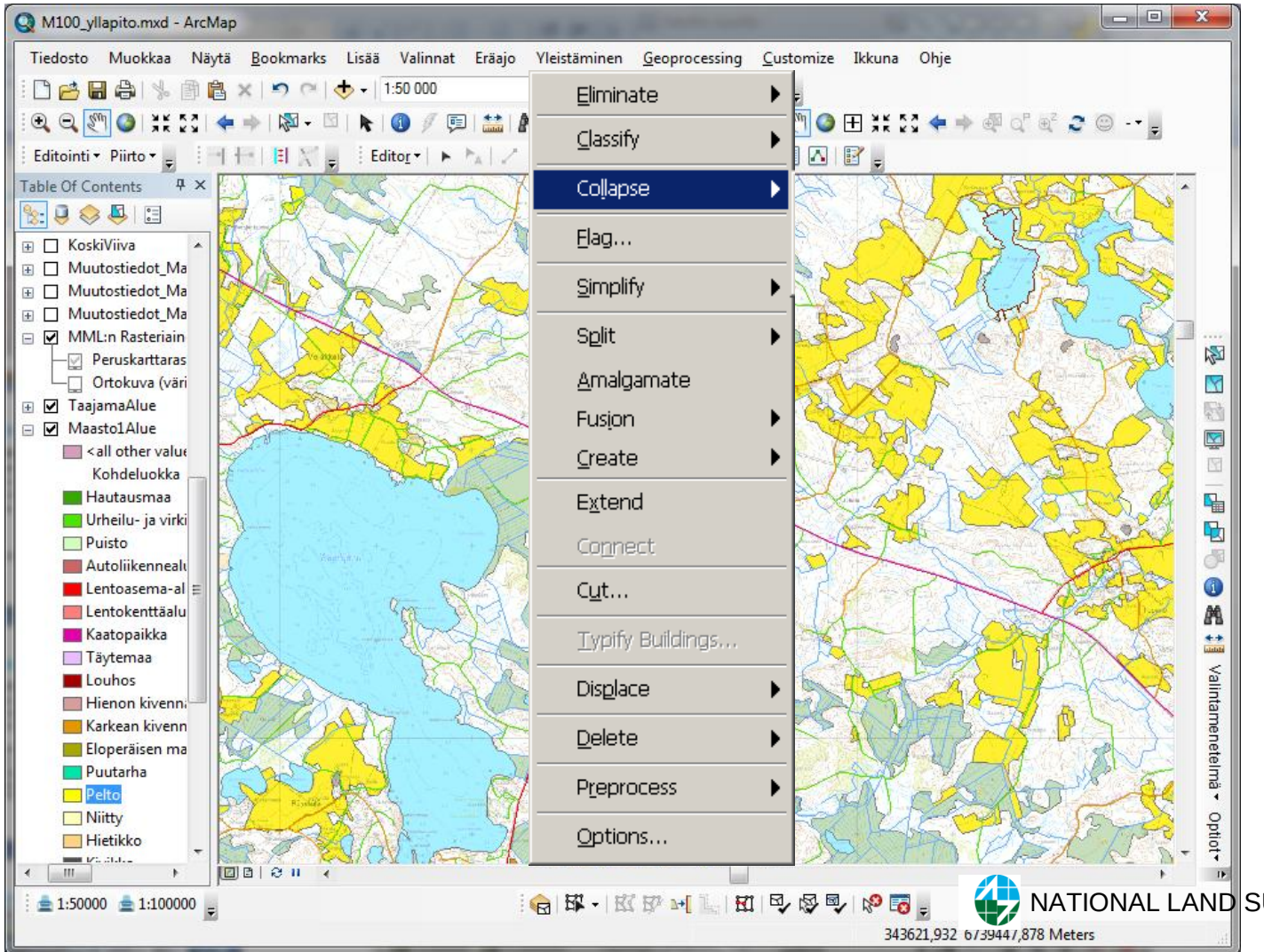
Piekka application

Maintenance of databases

- Piekka application is intended for the creation of databases.
- Development work for appropriate maintenance system of data sets is still to be done.
- We have one tool to find differences between shapes of two time period, but rest is hand work
- We don’t have inspireId nor LifepanVersions

Piekka application

Generalization tools are integrated to ArcMap application



Piekka application

Generalization functionality 1/2

- **Selection by attributes of features**
- **Selection by length or size**
- **Grouping together by reclassifying attribute values**
- **Feature type collapse**
  - polygon → line
  - polygon → point
  - line → point
- **Model-based river network selection**

Piekka application

Generalization functionality 2/2

- **Line fusion and line merge**
- **Polygon aggregation (fusion, merge) using control rules**
- **Removing under minimum length branch lines**
- **Line simplification**
  - by Douglas-Peucker algorithm and
  - by length of curve
- **Displacement of buildings lying near the road line**
- **Typification of dense building clusters (= maintain the general pattern of buildings shown in their approximate locations)**

Piekka production

Terrain

Topographic Data Base 1:10 000

JAKOmtj Smallworld

2006 -2010	**1:100 000**	Topographic Map 1:100 000 Topographic Map Raster 1:100 000
2009 -2010	**1:250 000**	Topographic Map 1:250 000 Topographic Map Raster 1:250 000 Eura Regional Map 1:250 000
2011 -2012	**1:1 000 000**	General Map 1:1 000 000 Topographic Map Raster 1:500 000 General Map Raster 1:1000 000
2012	**1:3 000 000**	General Map 1:4 500 000 General Map Raster 1:2000 000 General Map Raster 1:4500 000 General Map Raster 1:8000 000

ArcGis/Geodatabase

Place names

Register of Place Names

1:100 000	**2008**
1:250 000	**2008**
1:500 000	**2009**
1:1 000 000	**2012**
1:2 000 000	**2012**
1:4 500 000	**2012**
1:8 000 000	**2012**

ArcInfo/Oracle → 2014

2014 → JAKOmtj Smallworld

Piekka production

1:10 000 → 1:100 000, some facts

- Working area 40 km x 40 km, about 250 areas
- **Land use areas**:
  - about 25 land use classes
  - fields, medows, parks, sport areas, graveyards, parking places, rocks, stony areas, swampy soils (4 types), lakes, sea, water course areas etc.
- **Water course lines**:
  - 2 width classes in 1:10 000, under 2 m, 2 – 5 m
  - 3 width classes in 1:100 000, under 2 m , 2 – 5 m, 5 – 20 m

	1:10 000, 40x40 km	1:100 000, 40x40 km
Land-use areas	30 000 - 40 000 polygons	3000 – 6000 polygons
Mean area	20 000 – 30 000 m²	150 000 – 250 000 m²
Water course lines	20 000 - 100 000 lines	5000 – 20 000 lines
Mean length	100 - 150 m	400 – 600 m

MAANMITTAUSLAITOS
200
1812 – 2012
LANTMÄTERIVERKET

Piekka production

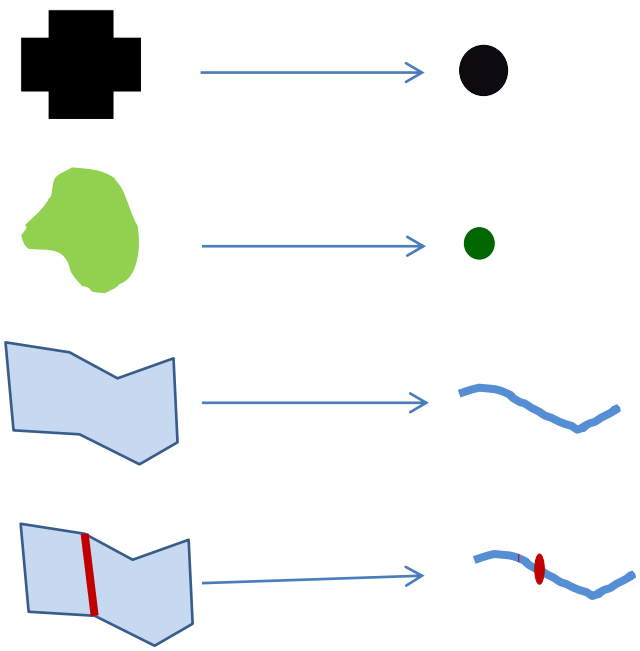
Thank you !

NATIONAL LAND SURVEY OF FINLAND

Piekka application

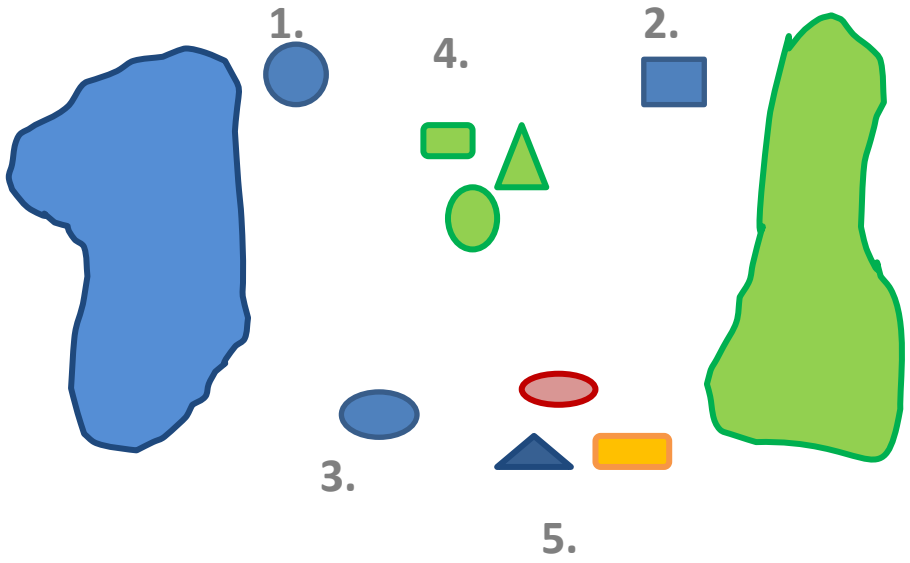
Type collapse

- Polygon → Point
  - Building
  - Small terrain area
- Polygon → Line
  - River
- Line → Point
  - Dam



Piekka application

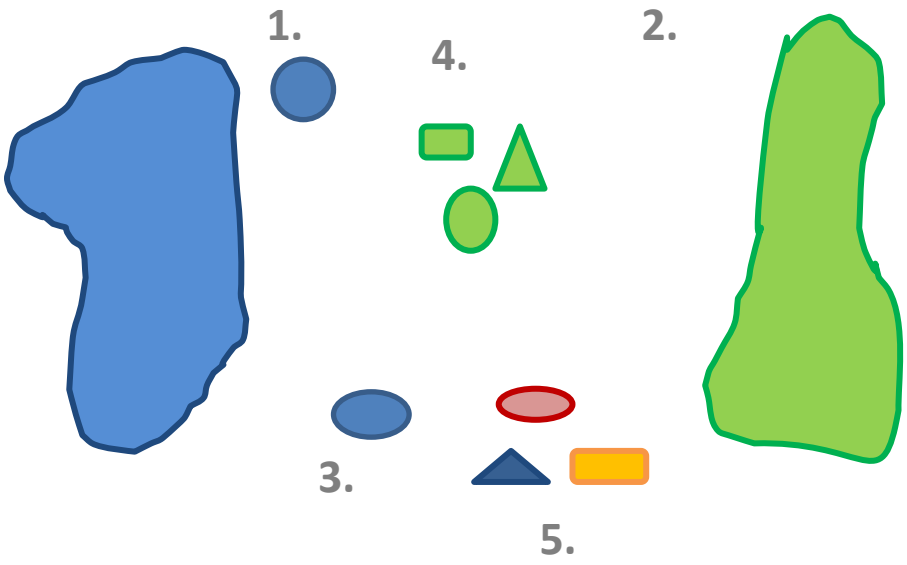
Elimination of small polygons



1. Small and big with same class. Small remains.
2. Small and big with different class. Small will be eliminated.

Piekka application

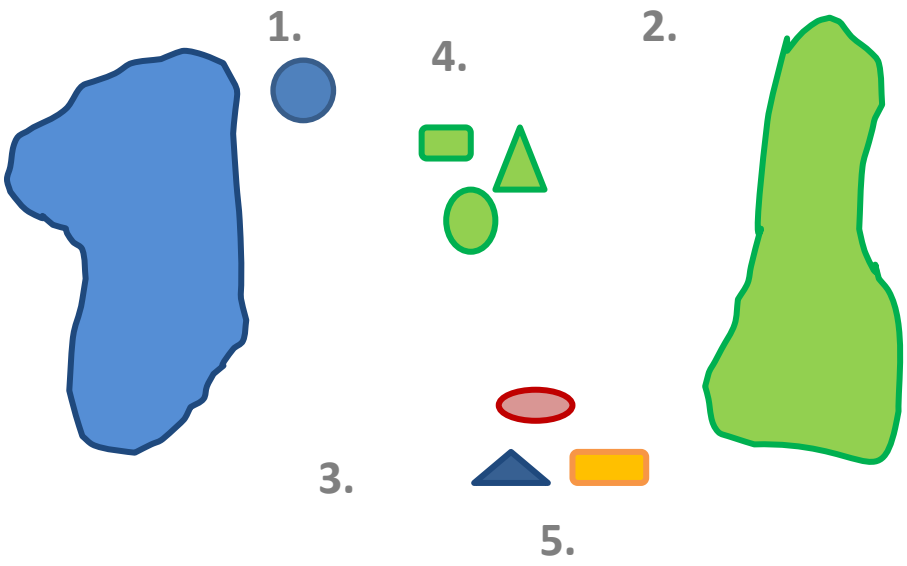
Elimination of small polygons



1. Small and big with same class near to each other. Small remains.
2. Small and big with different class far away. Small will be eliminated.
3. Small and big with same class far away. Small will be eliminated.

Piekka application

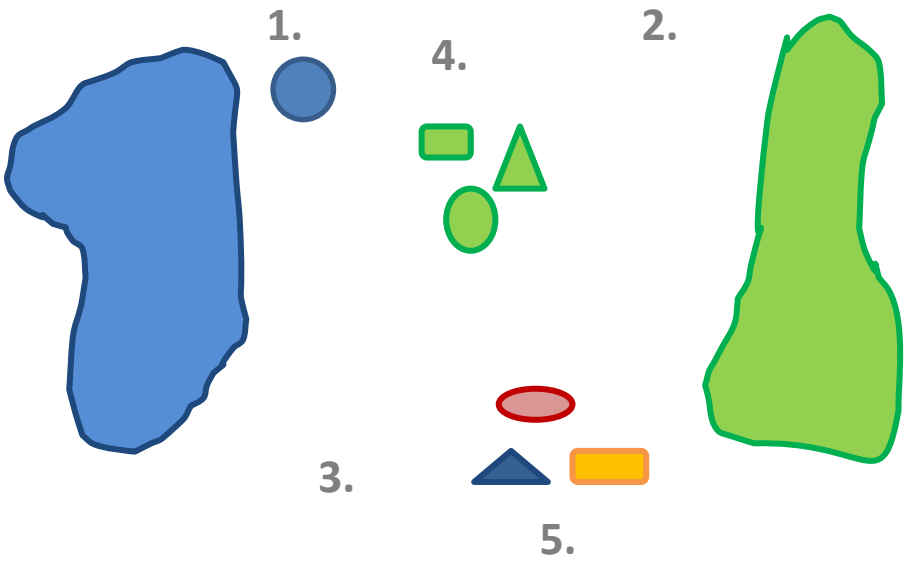
Elimination of small polygons



1. Small and big with same class near to each other. Small remains.
2. Small and big with different class far away. Small will be eliminated.
3. Small and big with same class far away. Small will be eliminated.
4. Several small with same class near to each other. All remains.

Piekka application

Elimination of small polygons



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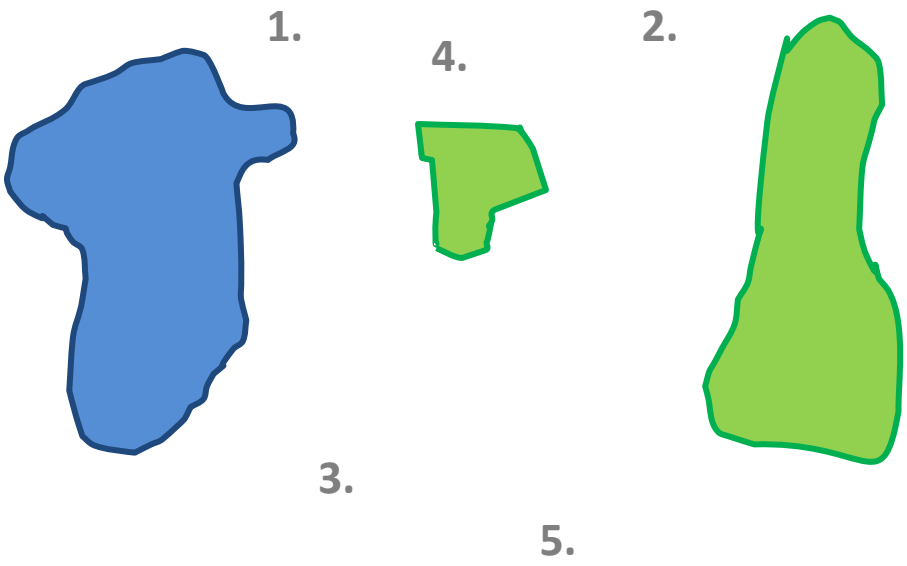
2. Small and big with different class far away. Small will be eliminated.
3. Small and big with same class far away. Small will be eliminated.
4. Several small with same class near to each other. All remains.
5. Several small with different class near to each other. All will be eliminated.

Piekka application

Elimination of small polygons



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3. Small and big with same class far away. Small will be eliminated.
4. Several small with same class near to each other. All remains.
5. Several small with different class near to each other. All will be eliminated.
6. Result

Piekka application

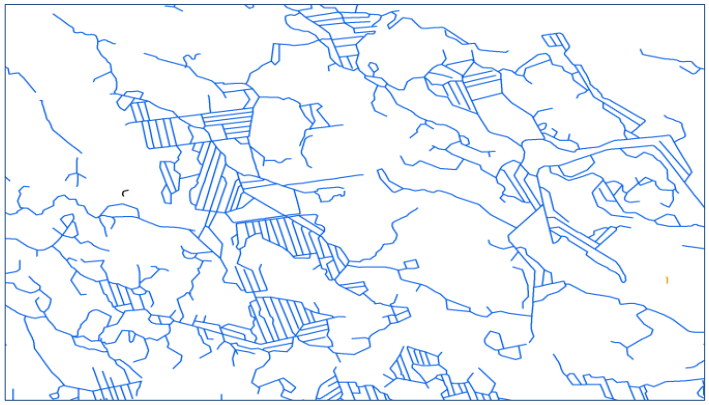
Model-based river network selection

- Similarity analysis: A line will be selected if a certain percentage of its vertex locates inside the buffer zone of a model line
- Old 1:100 000 river network lines are used as model lines for selection. This 1:100 000 river network was produced by using interactive visual selection
- Select automatically from 1:10 000 river network lines those which are similar than current 1:100 000 river network lines

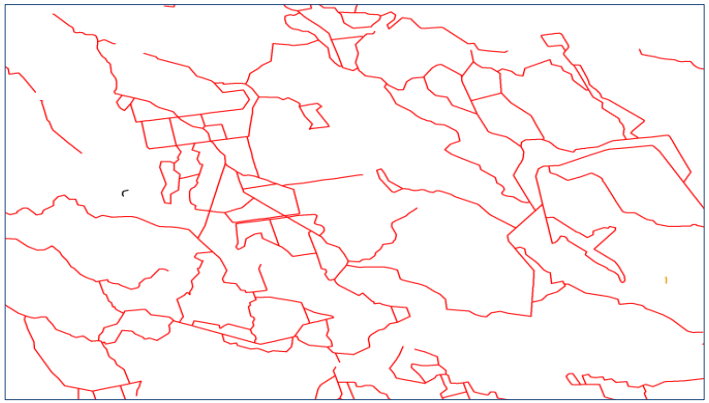
Piekka application

Model-based river network selection

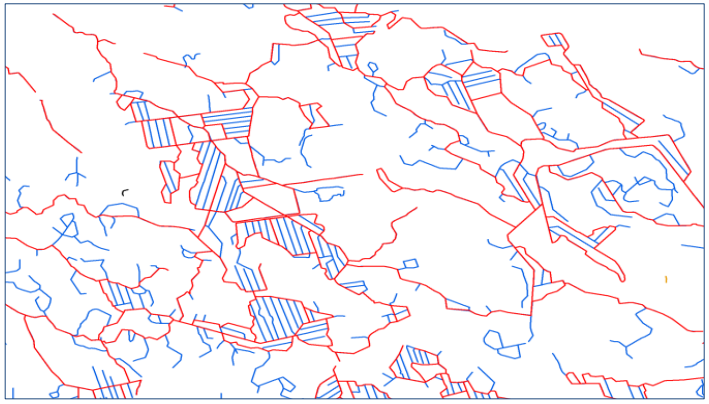
1. River network of TDB 1:10 000



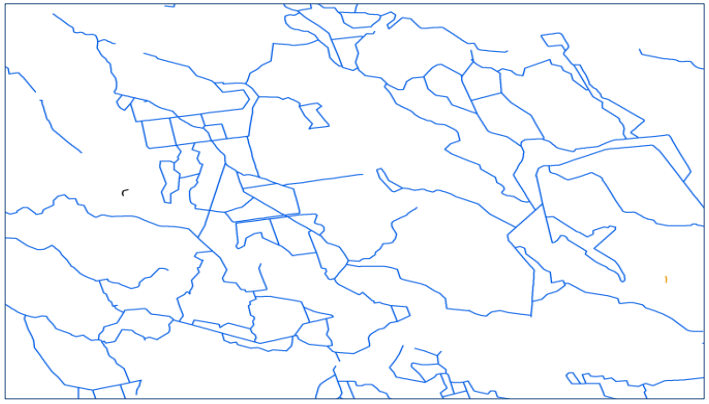
2. Old 1:100 000 river network as a model



3. Old 1:100 000 river network controls automated selection process

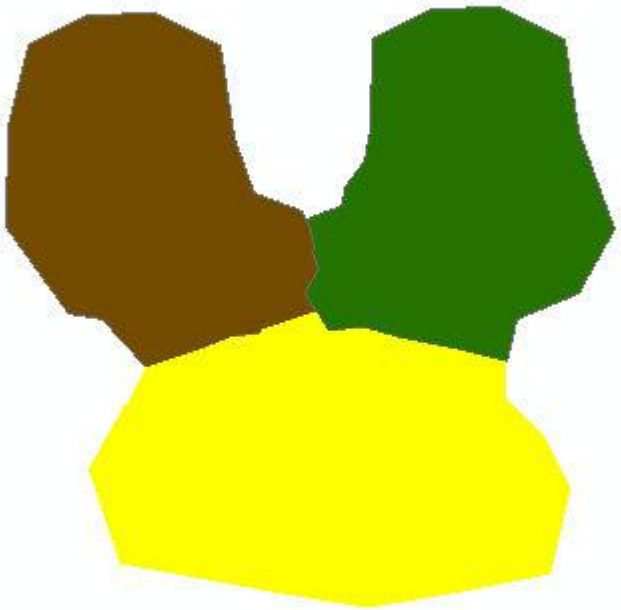


4. Automated selected 1:100 000 river network



Piekka application

Basic method for merging polygons

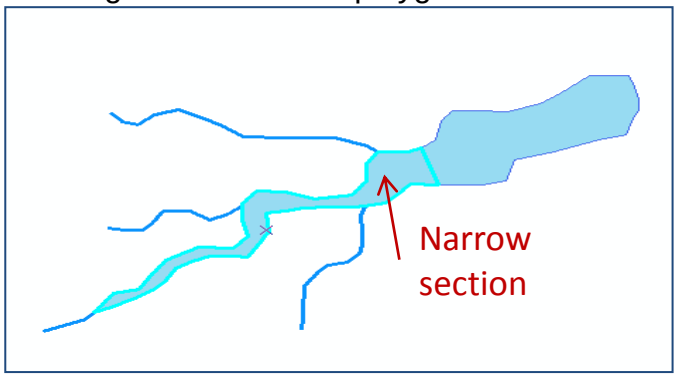


1. Narrow sections
2. Create merging area between polygons
3. Delaunay triangulation is applied to find the centerline of polygons
4. Clip the merging area by using the centerline
5. Join together the clipped parts into neighbor polygons

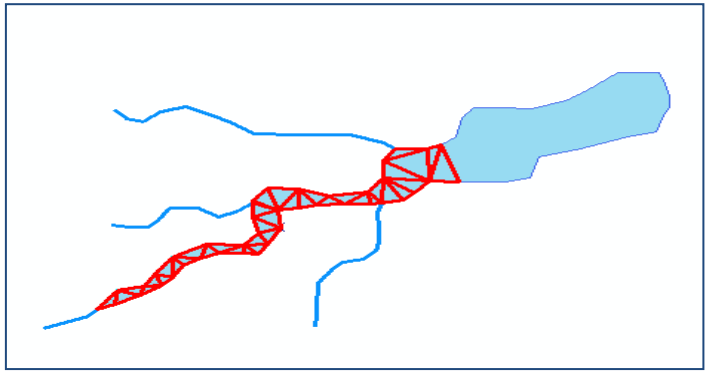
Piekka application

Polygon → Line: Narrow polygon river → Line river

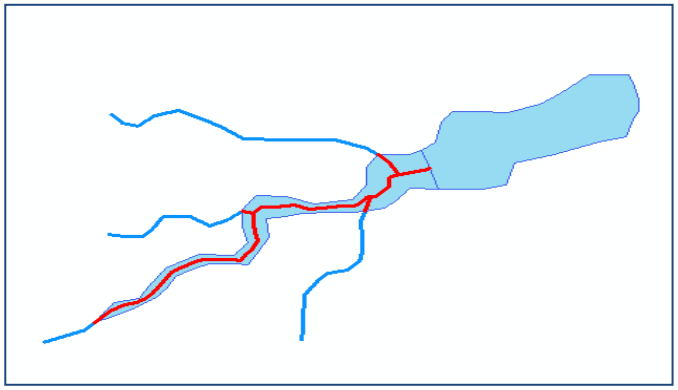
Narrow section of the river found by checking the width of the polygon river



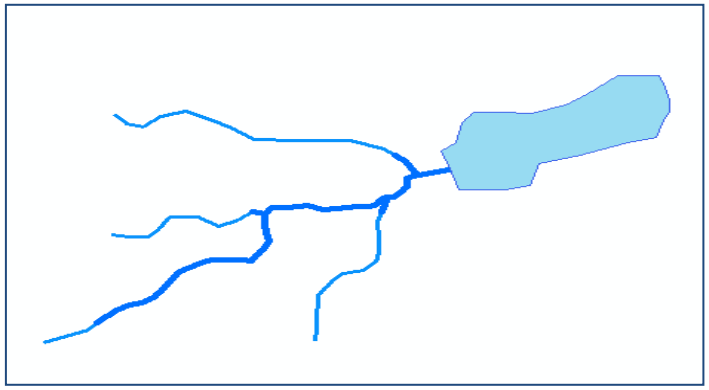
Delaunay triangulation is applied to find the centerline of polygons



Centerline and connecting lines are created automatically



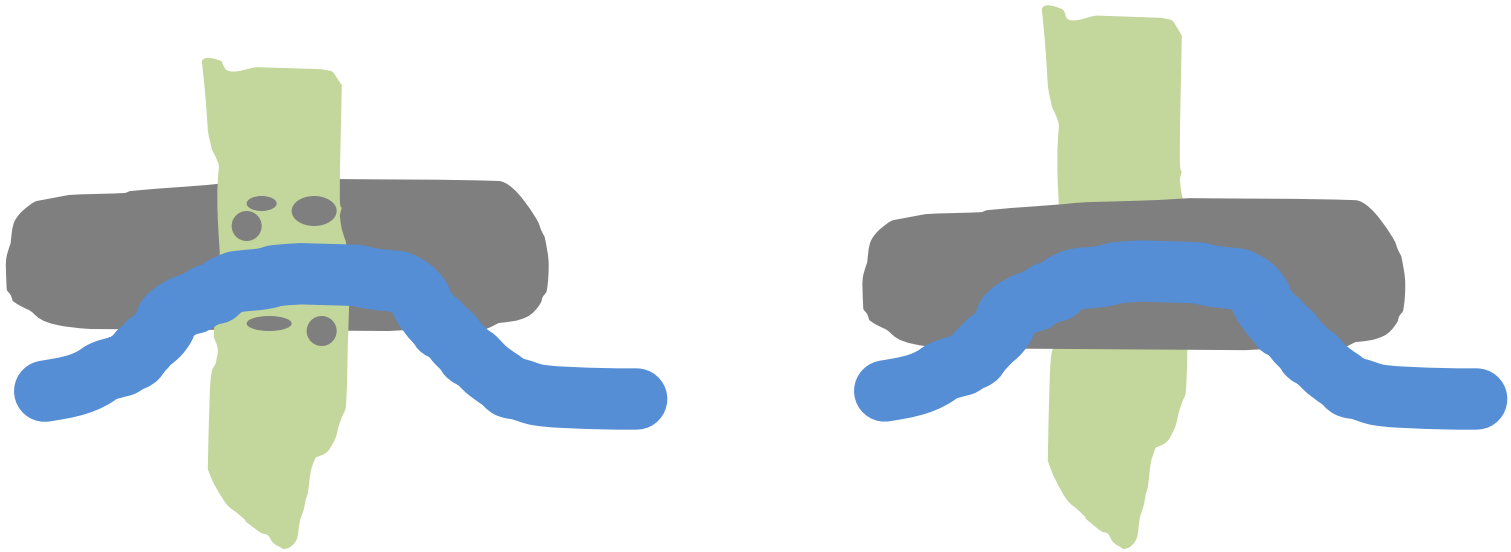
Generalized topologically compatible river network



Piekka application

Merge of features with same class by using priority rules and blocking rules

- We have priority rules in which order the feature classes will be merged
- When the feature class is merged, it will be locked
  - All polygon waters are locked
  - Rocks can join over swamps, then rocks are locked
  - Swamps can’t join over rocks

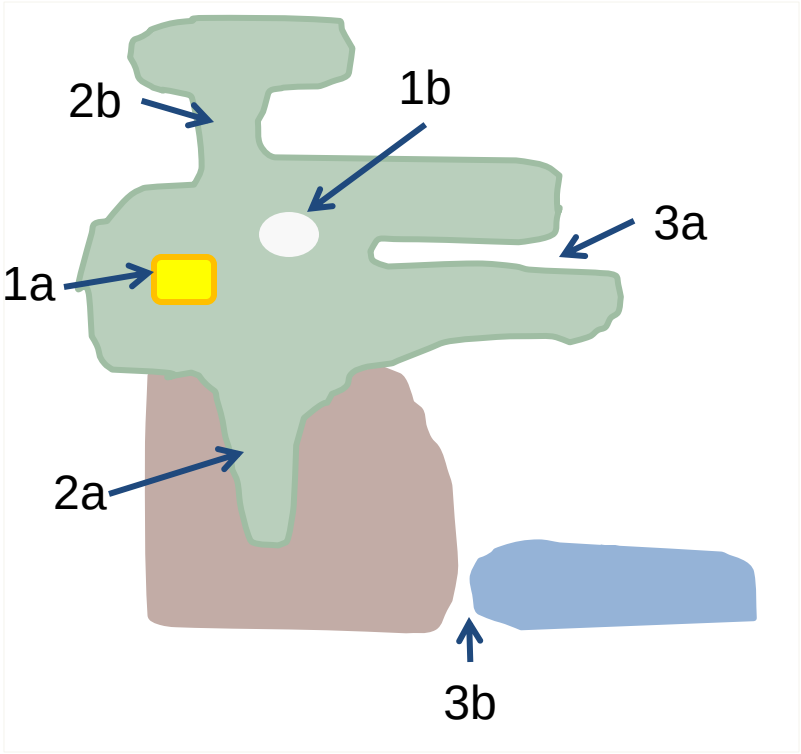


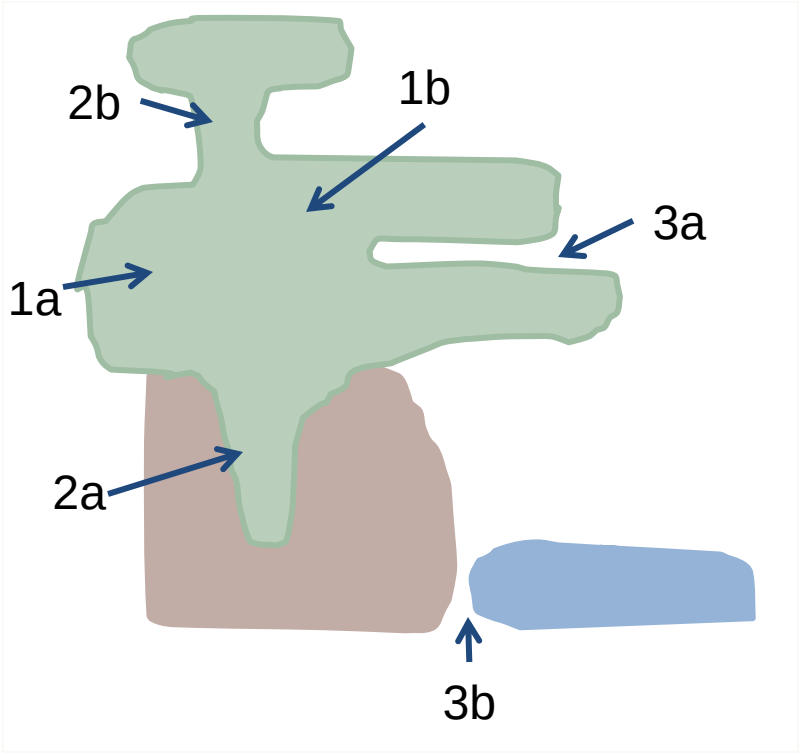
Piekka application

Merging of small areas inside polygon

1. Small area inside big polygon
   a) Small polygon with different class
      ➞ Merge to big polygon

   b) Hole = Background
      ➞ Fill up with big polygon

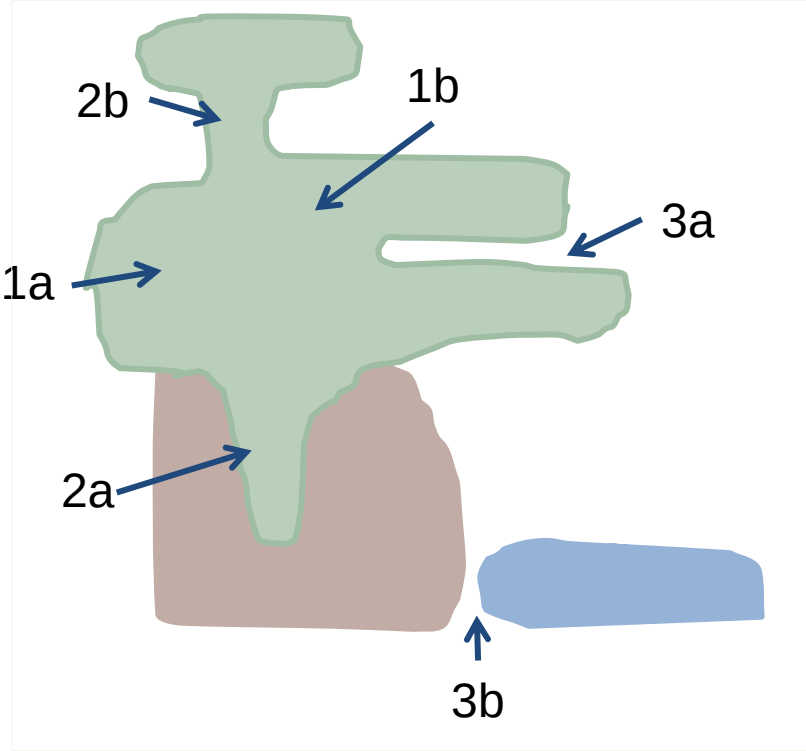


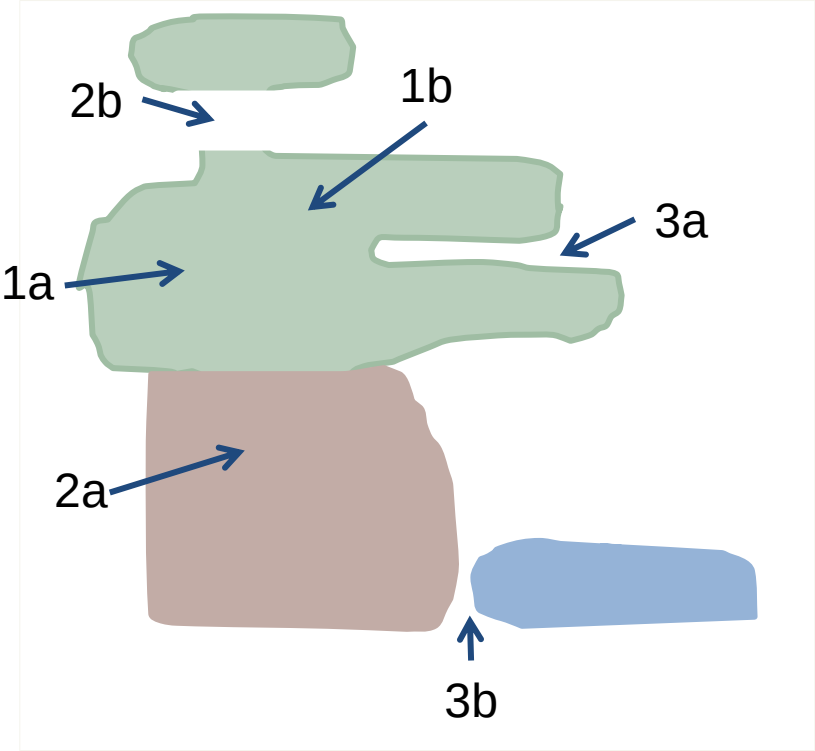


Piekka application

Merging of narrow sections of polygon

2. Narrow sections of polygon
   a) Inside another polygon
      → Merge to another polygon
   b) Surrouded by background
      → Merge to background





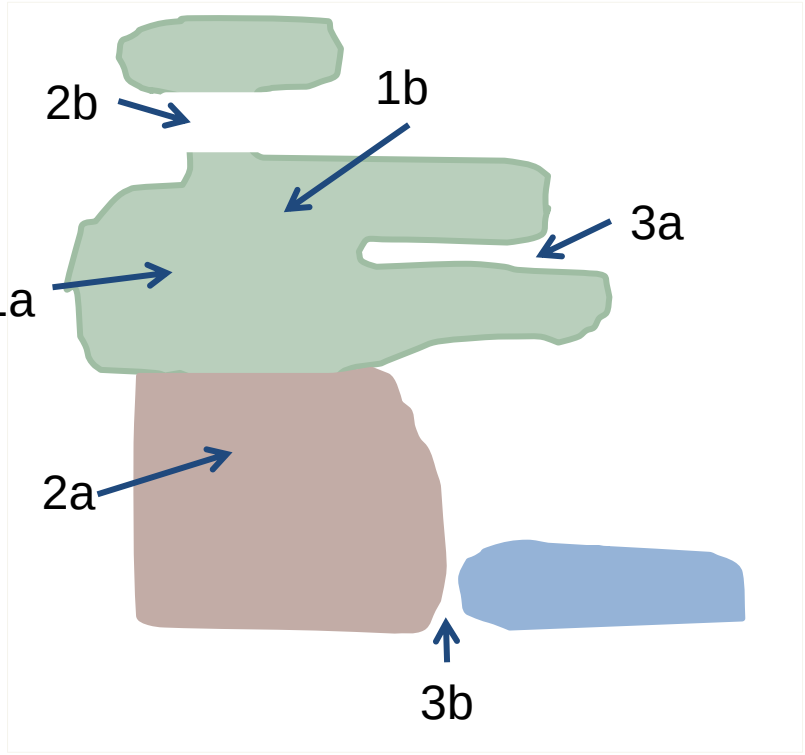
Piekka application

Merging of narrow sections of background

3. Narrow sections of background

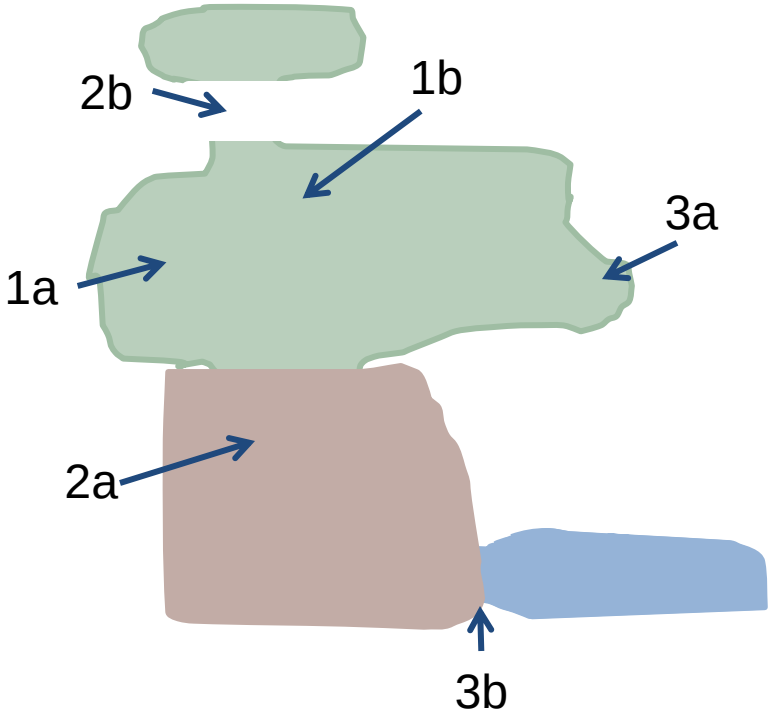
a) Inside of polygon

→ Fill up with polygon



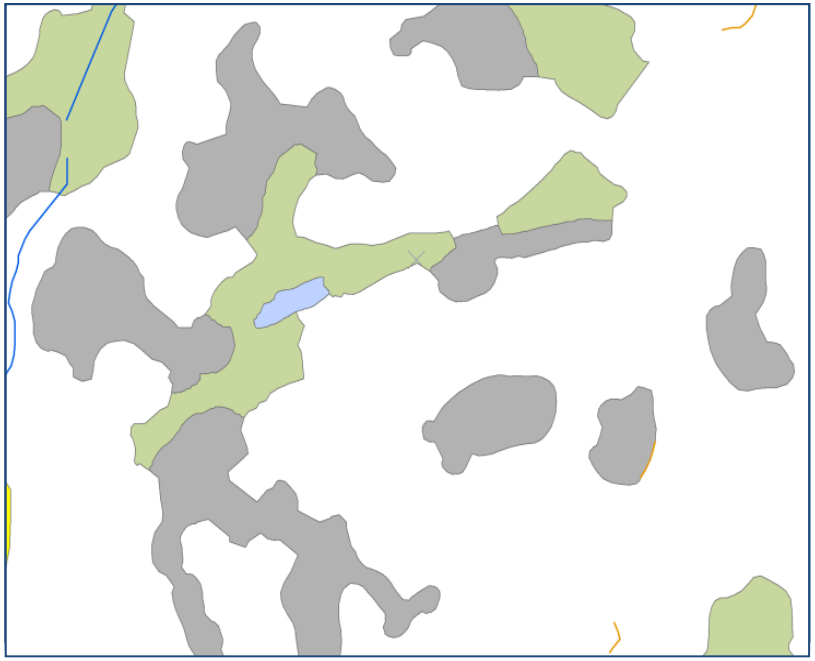
b) Between two polygons

→ Fill up equally with polygons



Piekka application

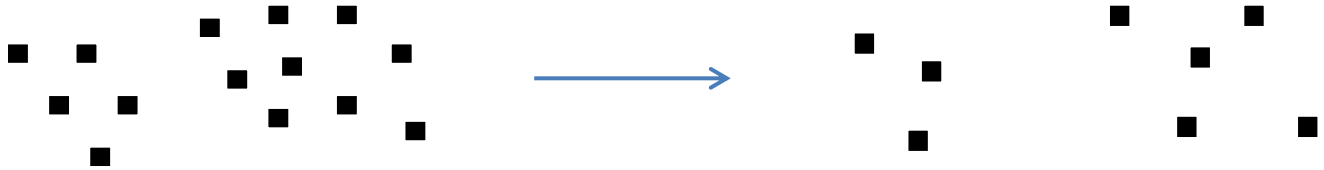
Basic methods used in generalization of polygons



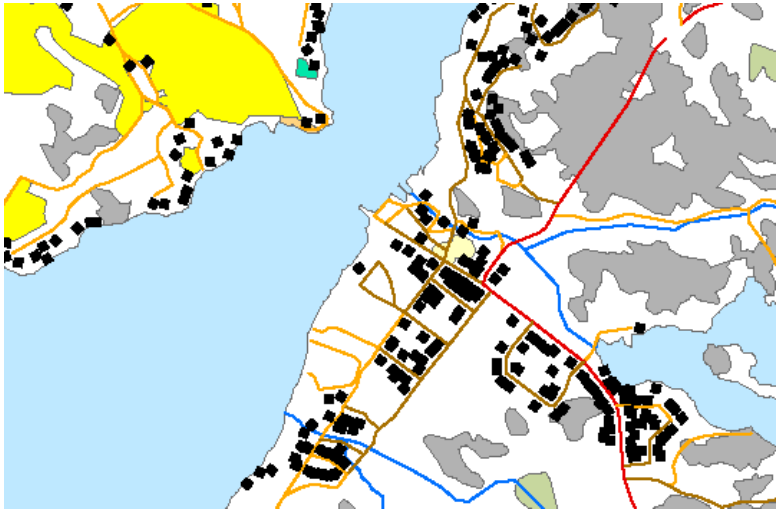
1. Elimination of small polygons
2. Merging polygons of same land use class
3. Elimination of the narrow parts between polygons
4. Elimination of narrow parts of the polygon
5. The result

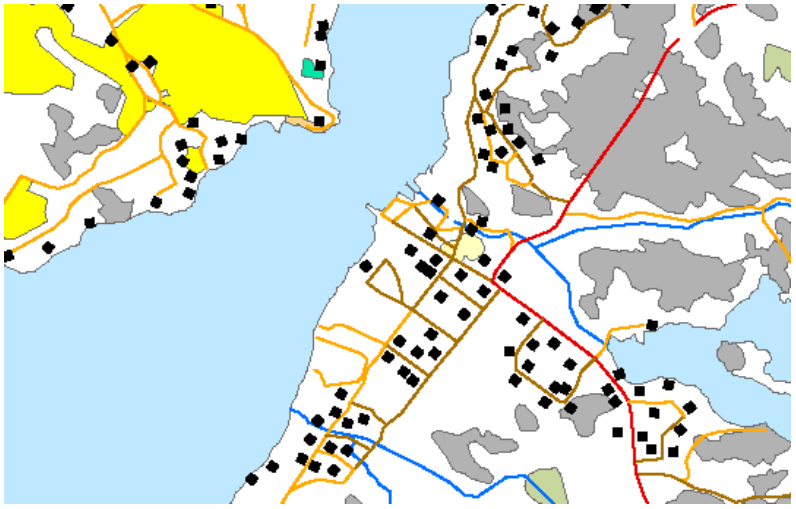
Piekka application

Typification of dense building clusters



- It is defined in control database tables: Buildings must not be moved to water area or over road
- Maintains the general pattern of buildings shown in their approximate locations



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Thank you !