HUNZIKER BETATECH

WASSER
BAU
UMWELT

www.hunziker-betatech.ch

Automated Drain Area Creation for Municipal Hydraulic Simulations

8. May 2018

GeoPython Conference 2018

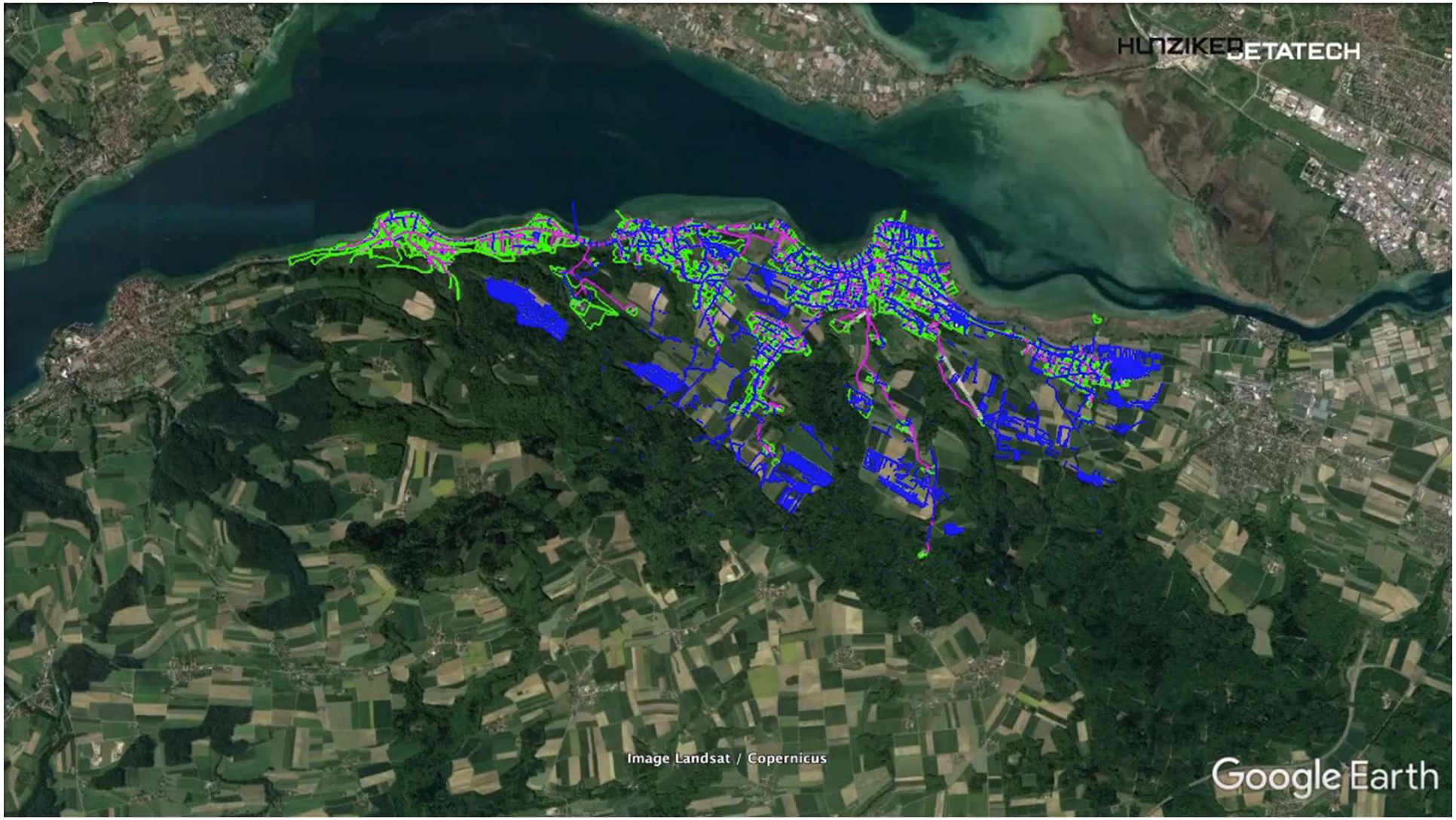
Robin Dainton

HUNZIKER BETATECH

Presentation Structure

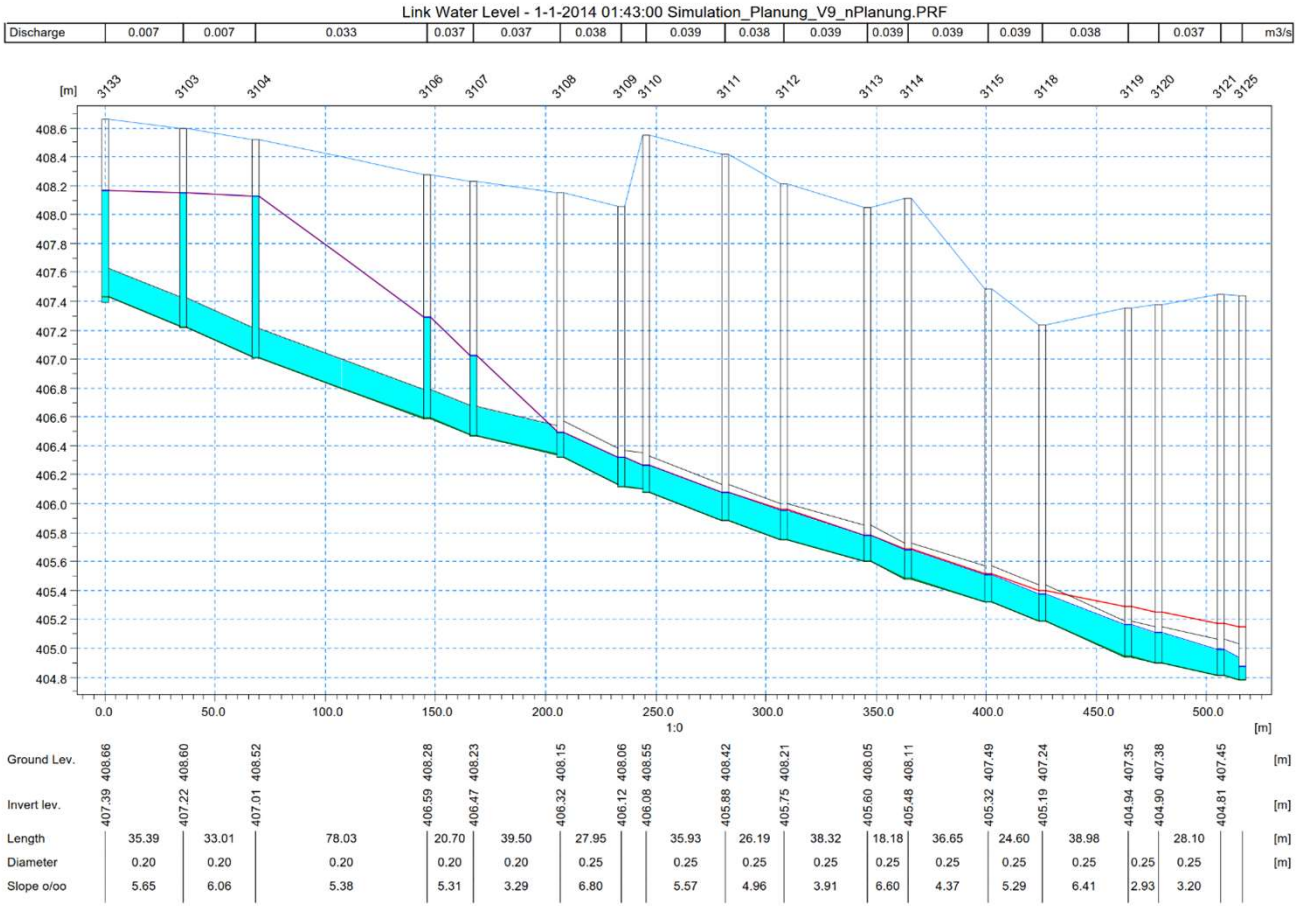
- Drain Area Planning
- Input Data and Official Models
- System Design
- Workflow Examples and Techniques
- Summary

Drain Area Generator



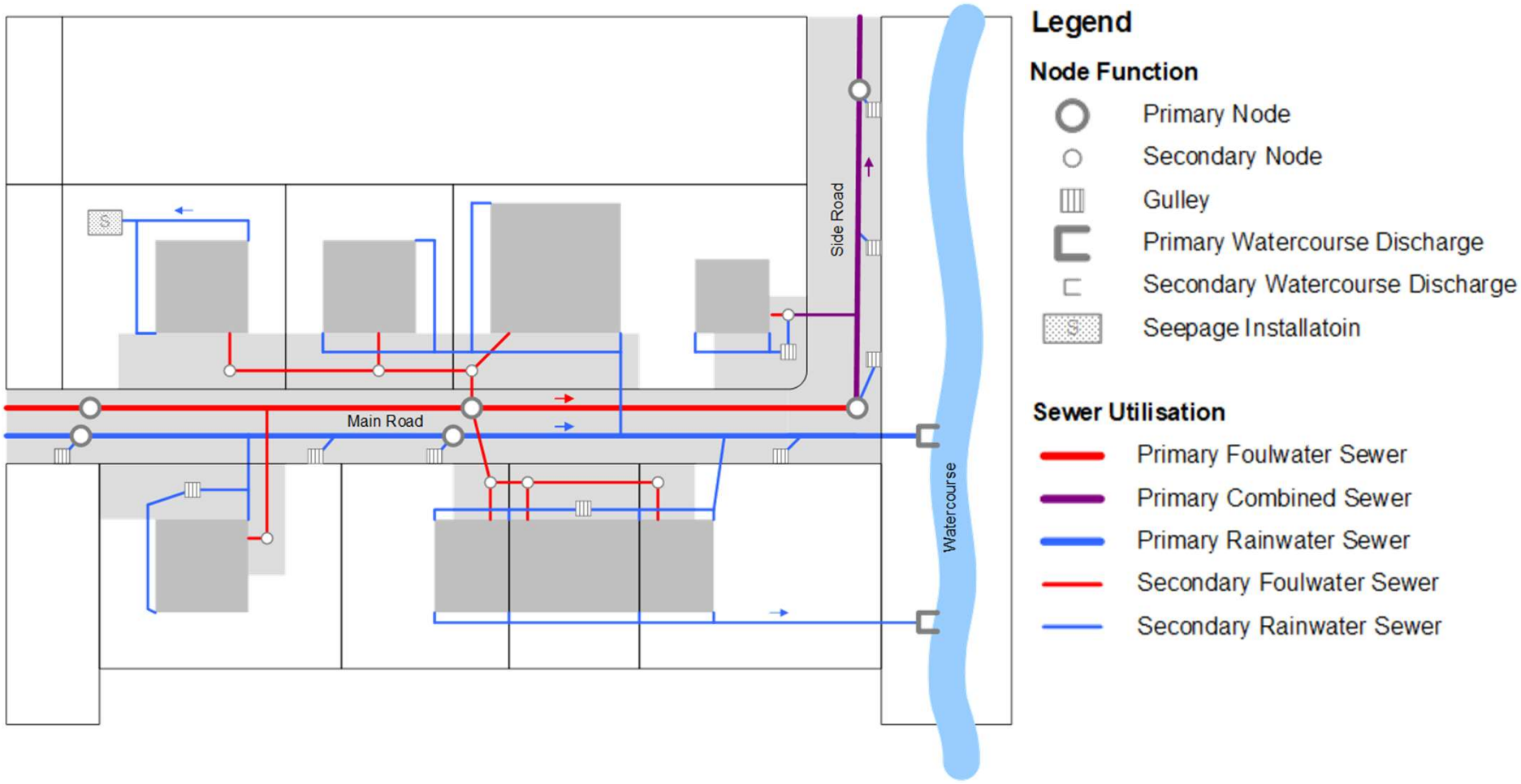
HUNZIKER BETATECH

Drain Area Planning



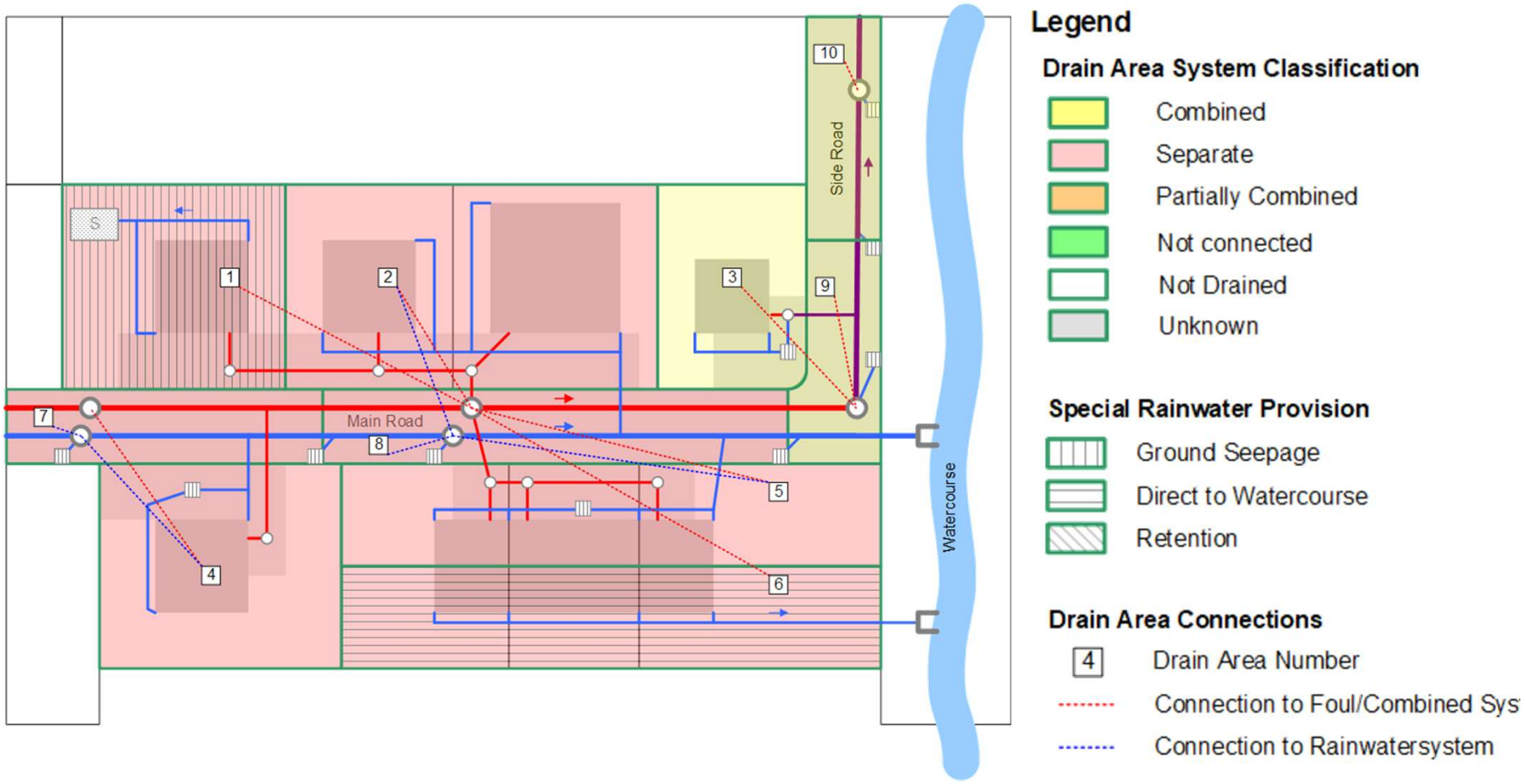
HUNZIKER BETATECH

Network Data

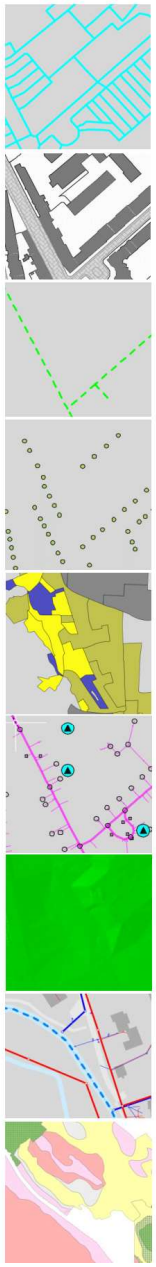


HUNZIKER BETATECH

Drain Area Model



HUNZIKER BETATECH



Land Parcel Data

Ground coverage

Road Axes

Building Entrances

Building Zones

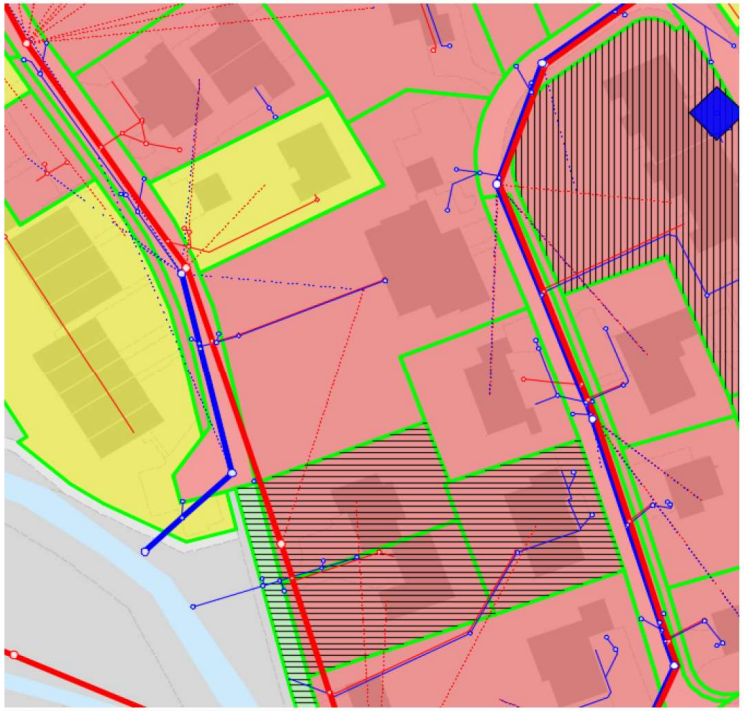
Drain Network

DGM/DEM

Water-courses

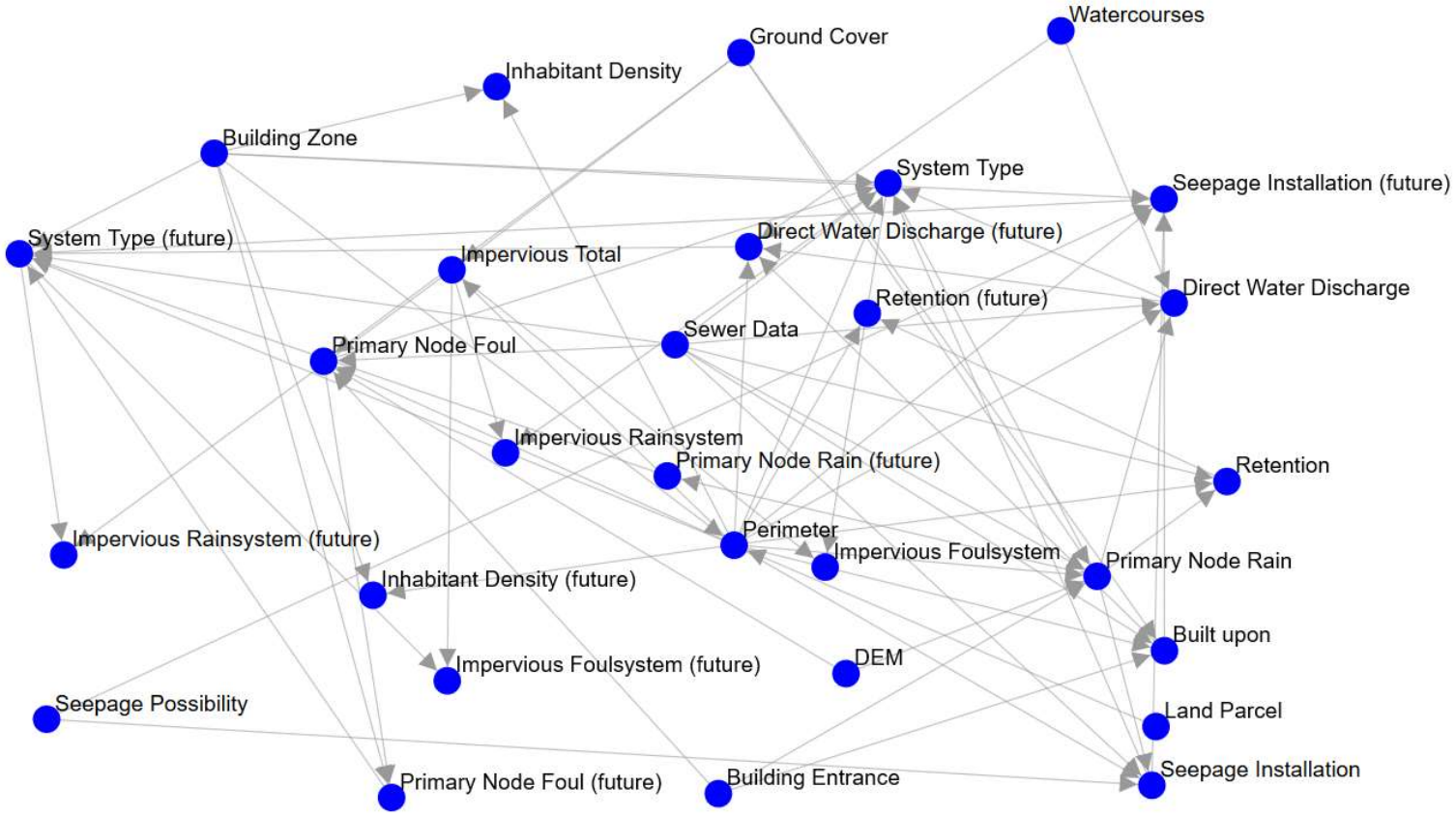
Seepage Possibility

Drain Area Model



HUNZIKER BETATECH

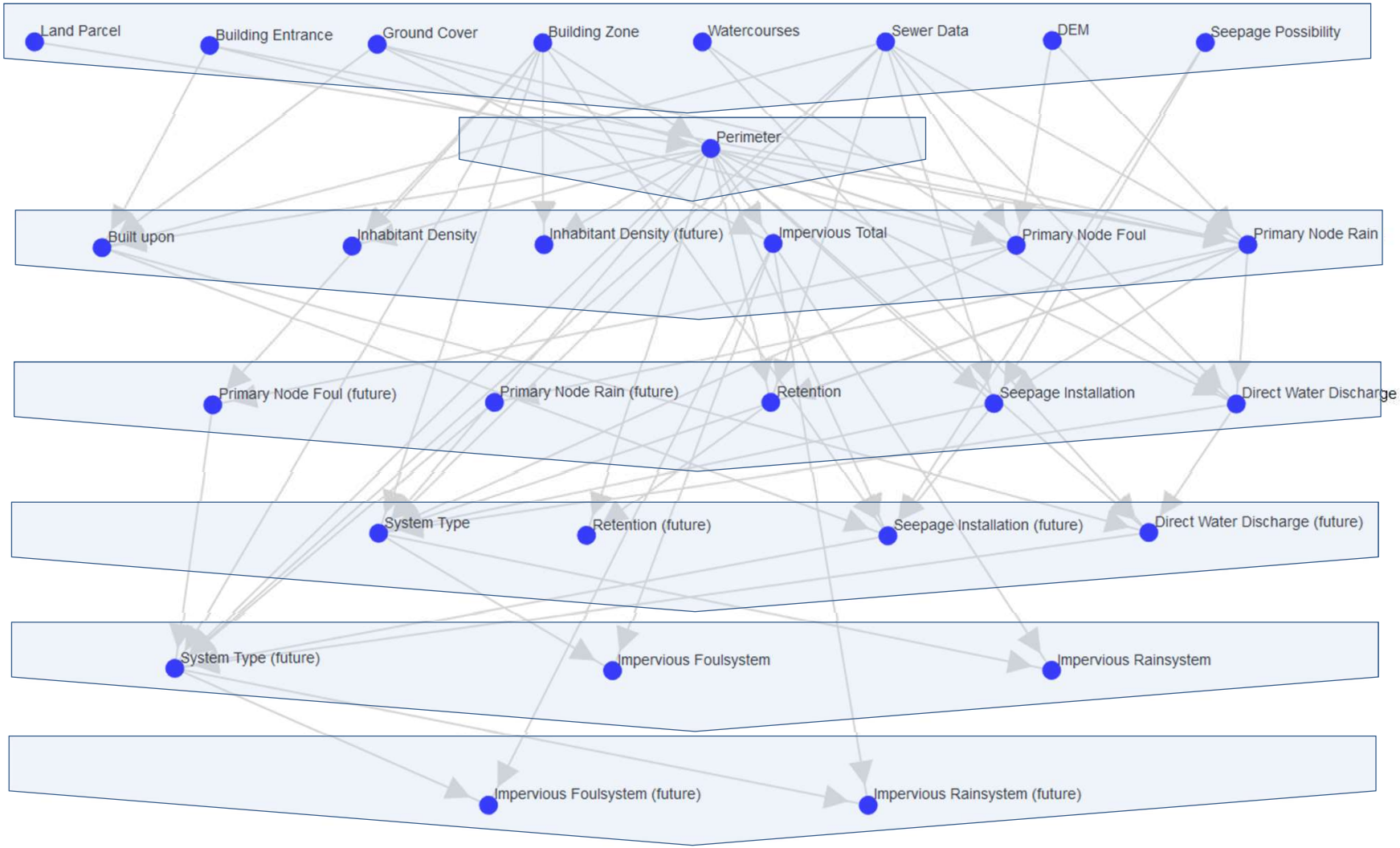
Influence Diagram



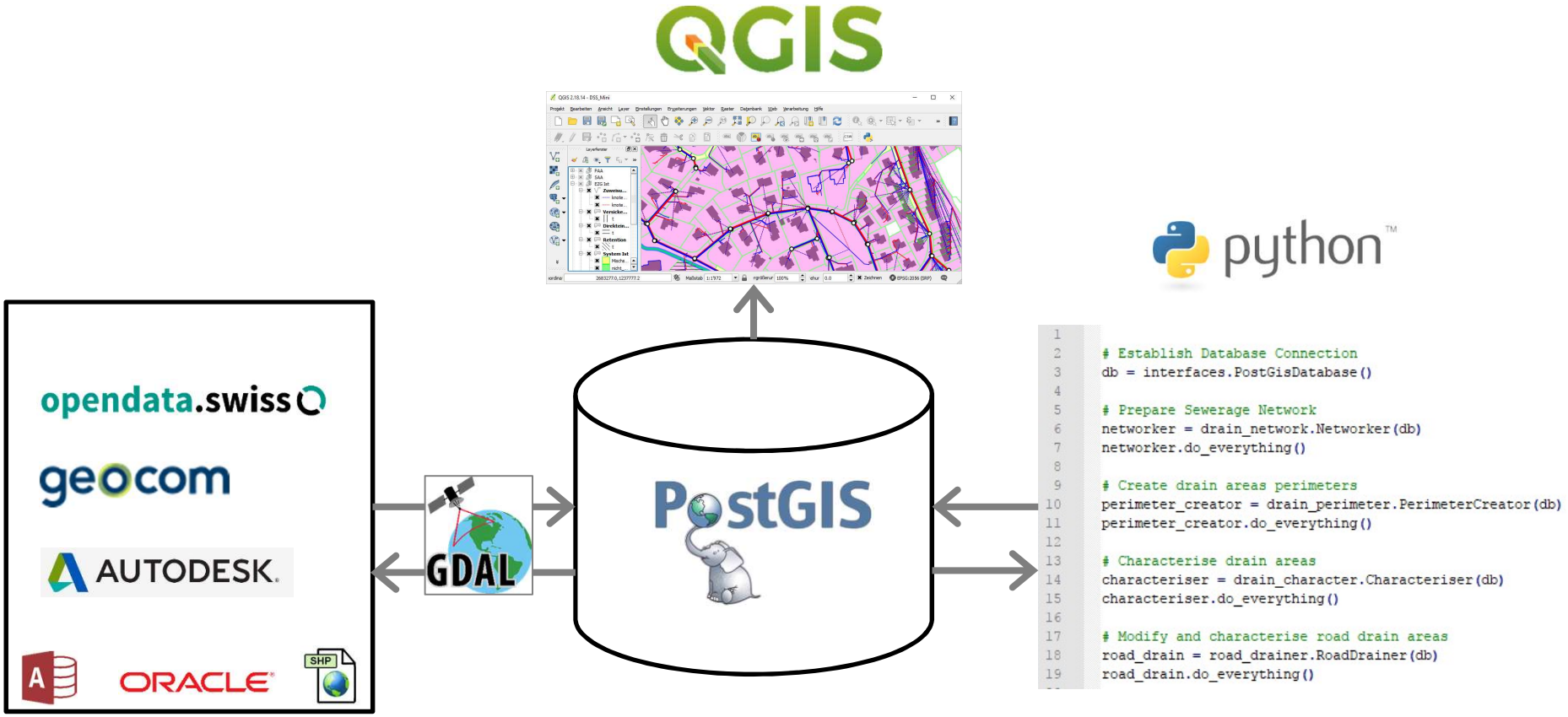
Topological Sorting

```
from toposort import toposort

# Create dependency graph
dependencies = dict()
dependencies['Perimeter'] = {'Land Parcel', 'Building Zone'}
dependencies['Built upon'] = {'Perimeter', 'Ground Cover', 'Building Entrance', 'Sewer Data'
dependencies['Impervious Total'] = {'Perimeter', 'Ground Cover'}
dependencies['Primary Node Foul'] = {'Perimeter', 'DEM', 'Building Entrance', 'Ground Cover'
# Etc...

# Topological Sort
execution_order = list(toposort(dependencies))

print('Execution Order:\n %s\n\n' % execution_order)

""" Output:
Execution Order:
 [{'Land Parcel', 'Sewer Data', 'Seepage Installation', 'Built upon', 'Watercourses', 'Build
{'Perimeter'},
{'Inhabitant Density (future)', 'Primary Node Foul', 'Impervious Total', 'Primary Node Rain'
{'Primary Node Foul (future)', 'Retention', 'Seepage', 'Primary Node Rain (future)', 'Direct
{'Retention (future)', 'System Type', 'Seepage (future)', 'Direct Water Discharge (future)'}
 {'Impervious Rainsystem', 'Impervious Foulsystem', 'System Type (future)'},
 {'Impervious Foulsystem (future)', 'Befestigungsgrad_Rain (future)'}]
```

Workflow

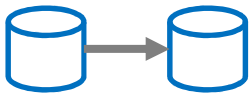

Land Parcel
Building Entrance
Ground Cover
Building Zone
Watercourses
Sewer Data
DEM
Seepage Possibility
Perimeter
Built upon
Inhabitant Density
Inhabitant Density (future)
Impervious Total
Primary Node Foul
Primary Node Rain
Primary Node Foul (future)
Primary Node Rain (future)
Retention
Seepage Installation
Direct Water Discharge
System Type
Retention (future)
Seepage Installation (future)
Direct Water Discharge (future)
System Type (future)
Impervious Foulsystem
Impervious Rainsystem
Impervious Foulsystem (future)
Impervious Rainsystem (future)

System Architecture



Python Modules

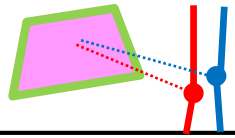
data_loader
- import network and open data



repair_network
- network topology
- establish primary network for simulation

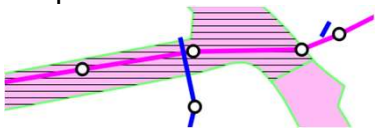
drain_network
- establish connectivity of secondary drain network

drain_character
- establish connection points and drain area attributes



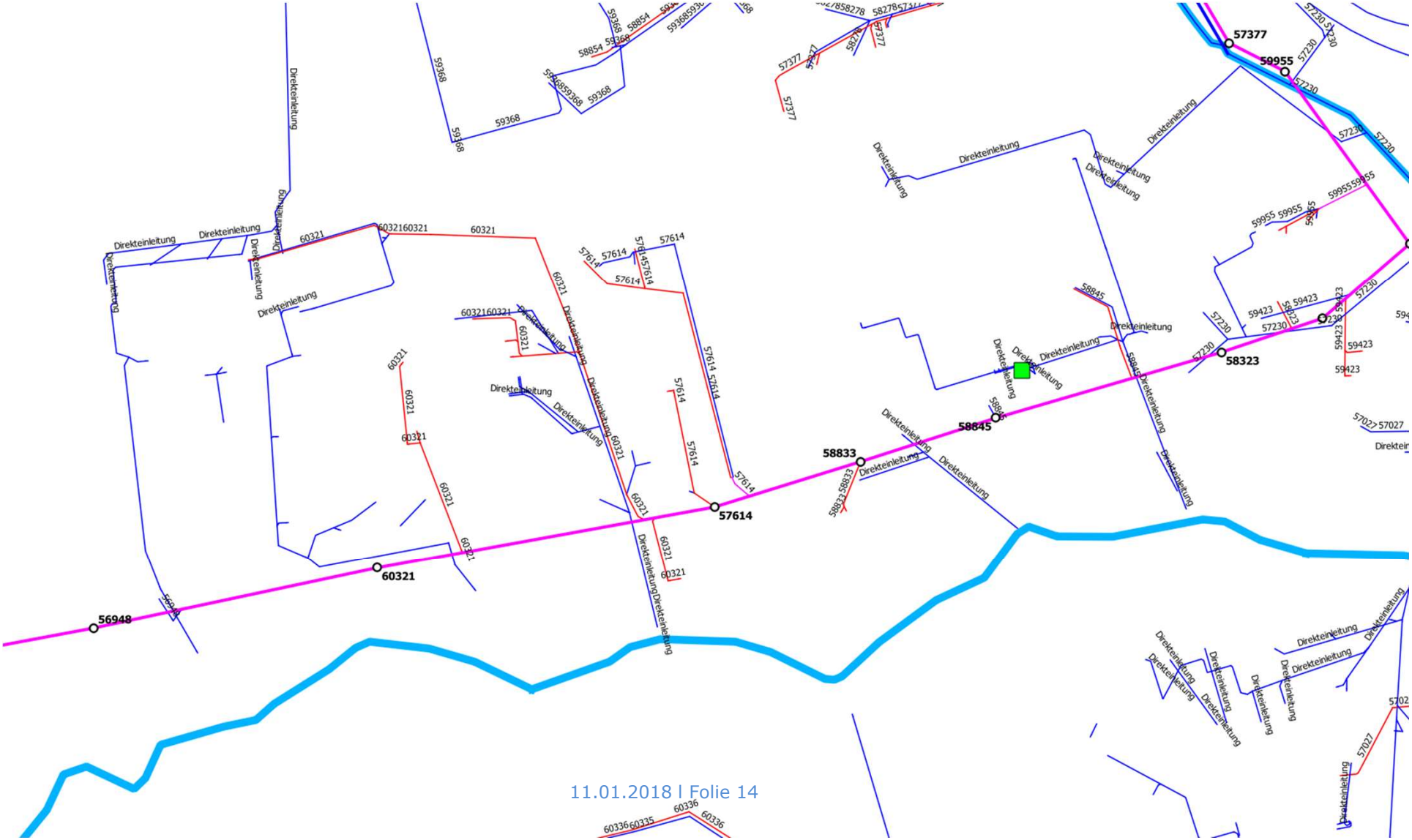
drain_perimeter
- create drain area geometry and identify roads

road_drainer
- create road drain areas from inlet points

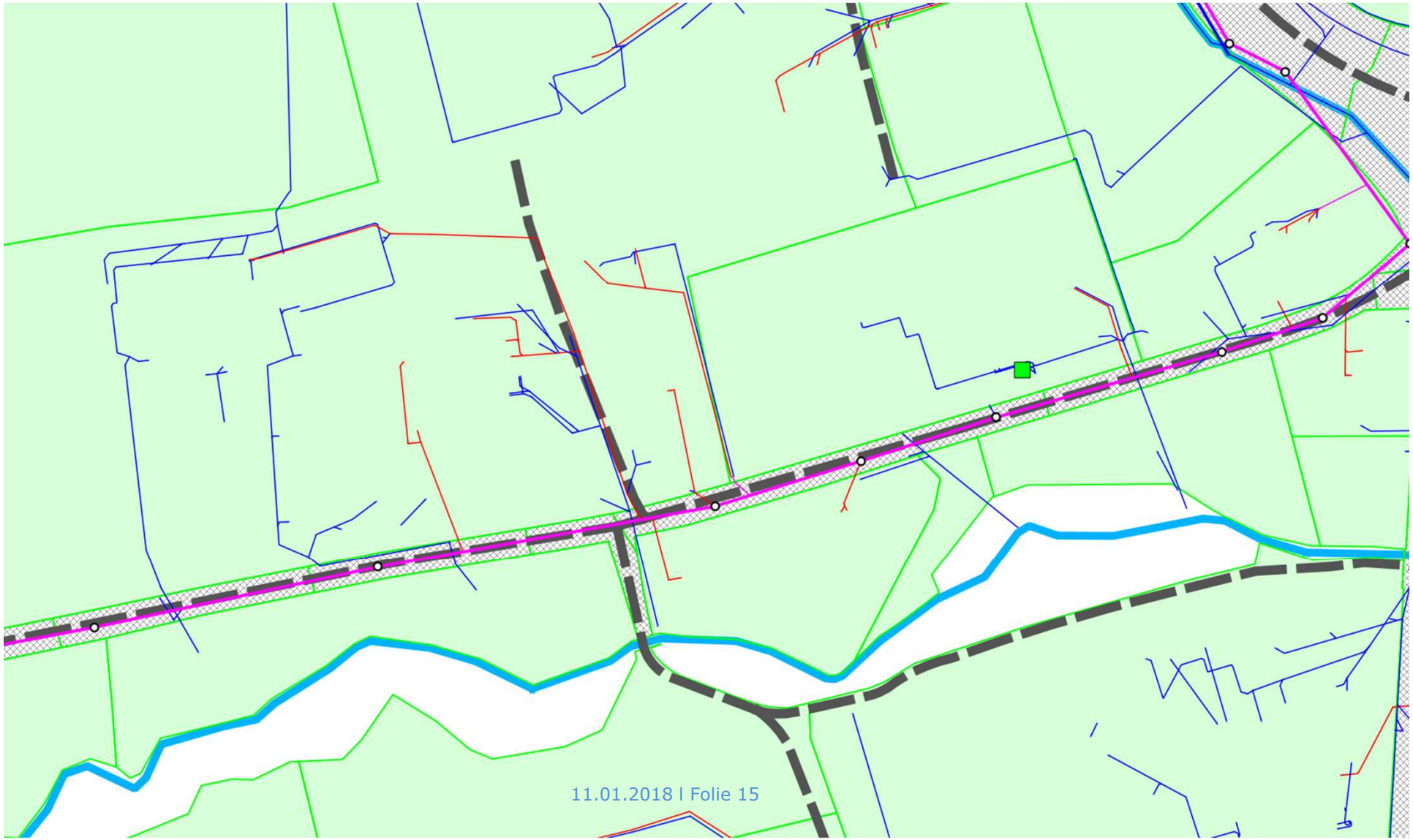


HUNZIKER BETATECH

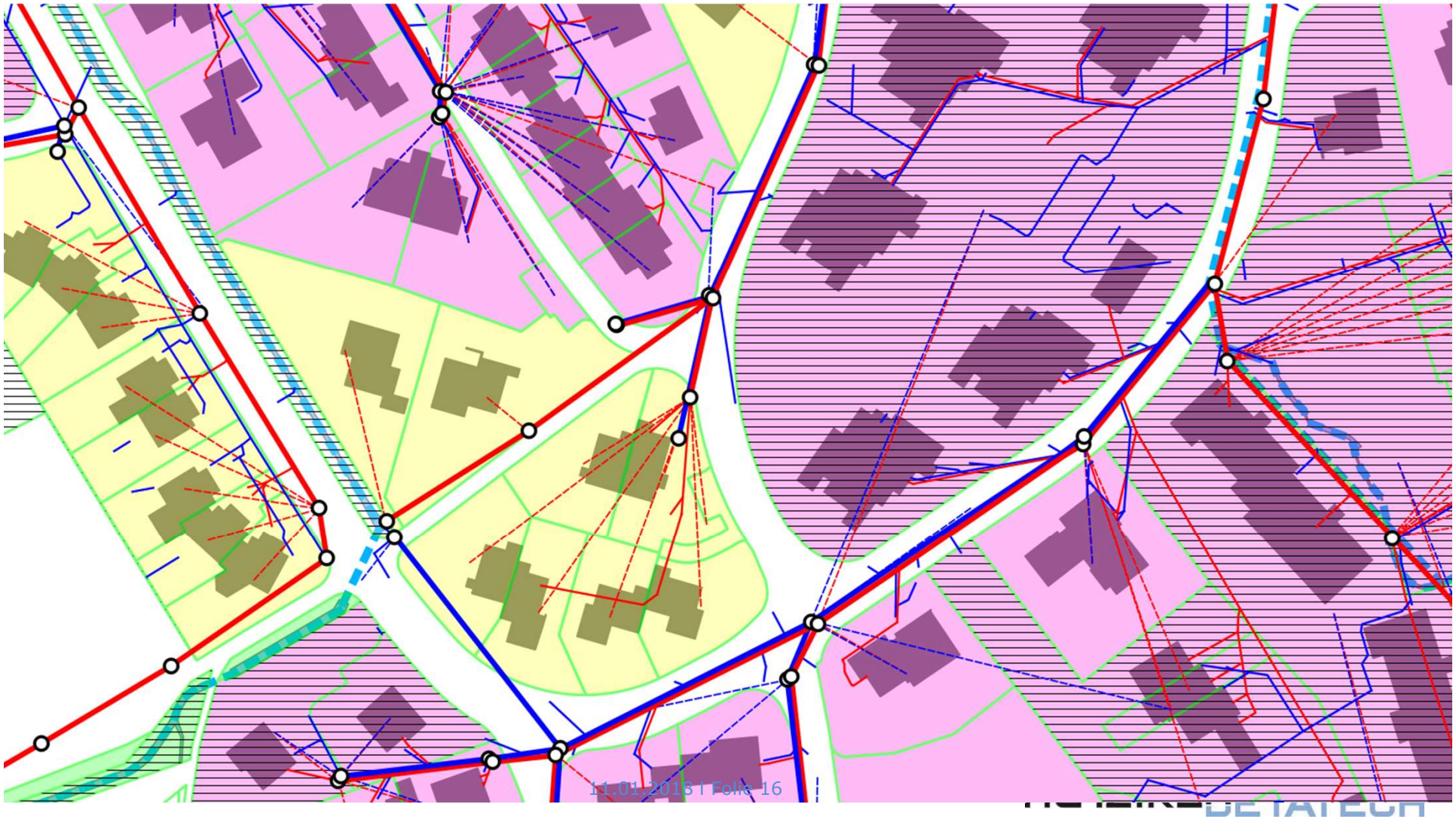
Secondary Network Characterisation



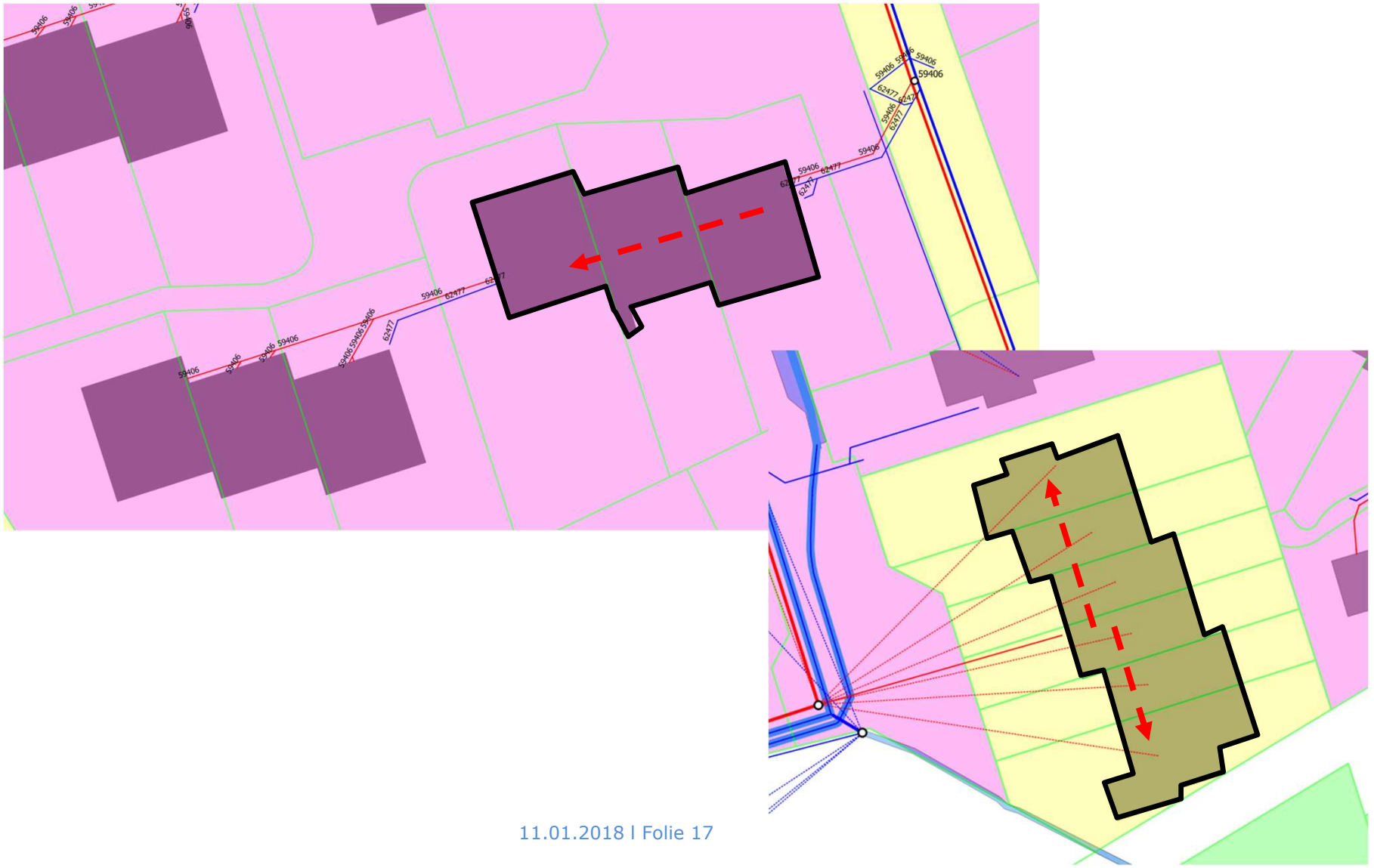
Perimeter



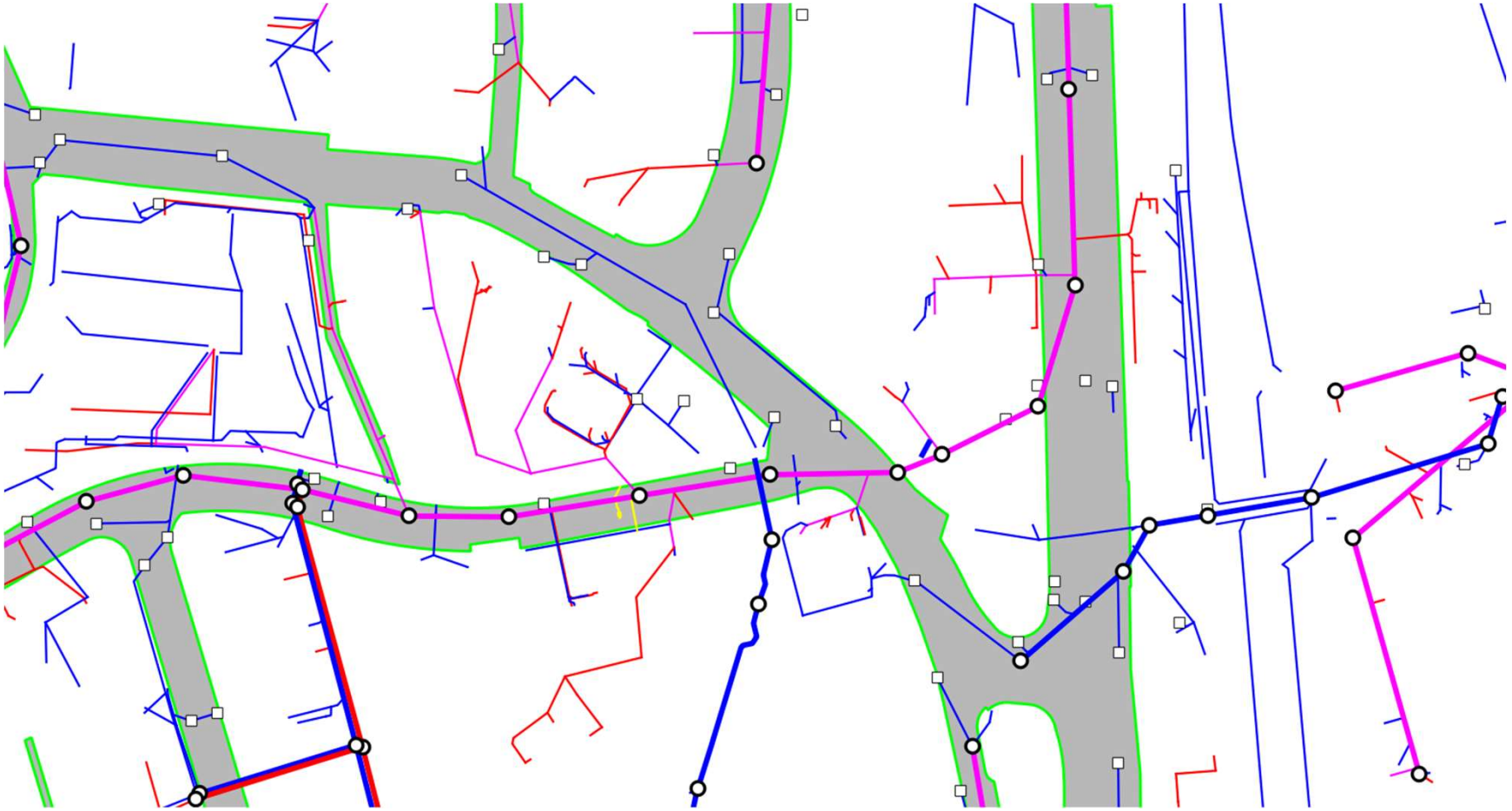
Drain Area Characterisation



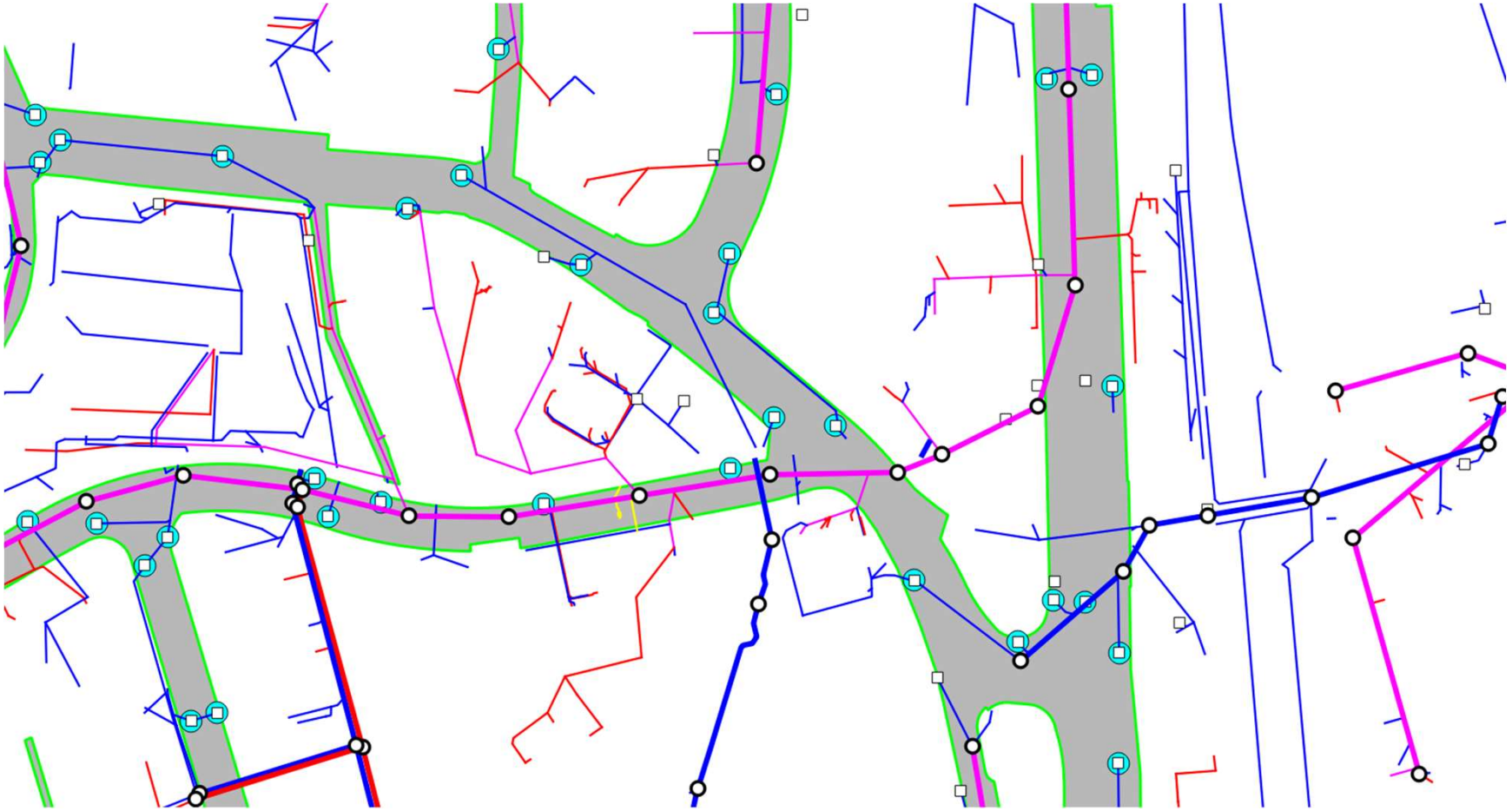
Use of Building Geometry



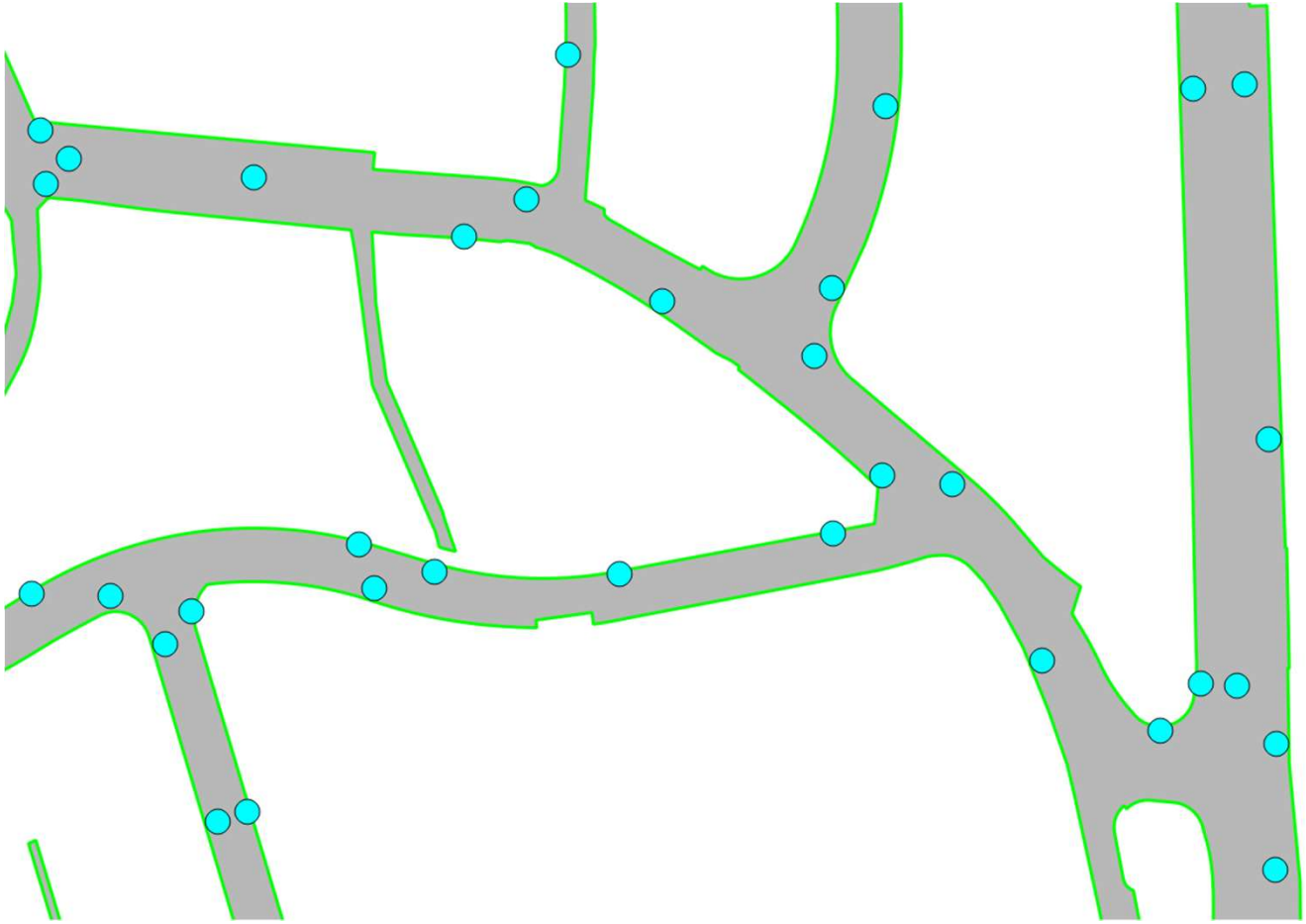
Roads



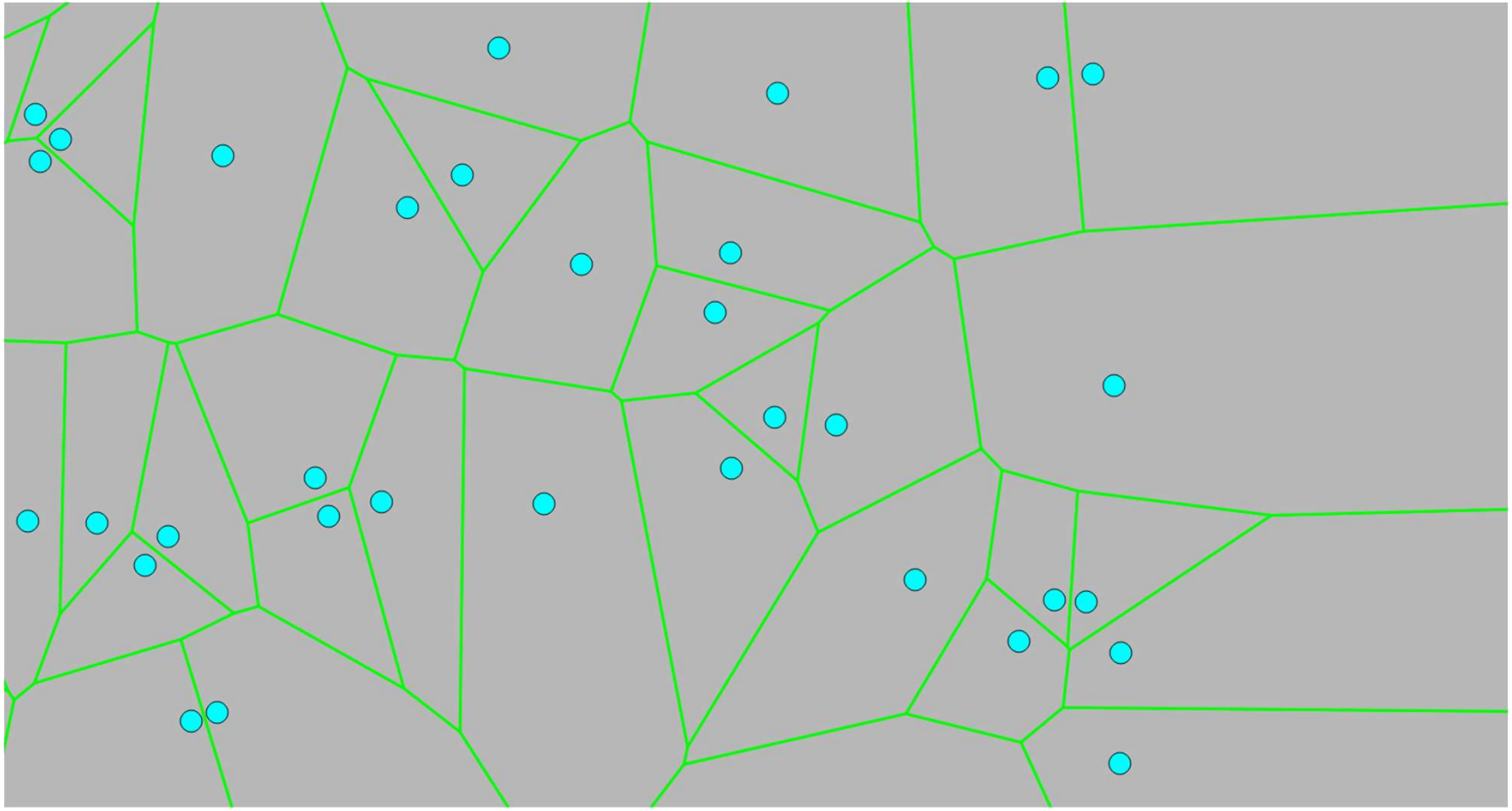
Roads



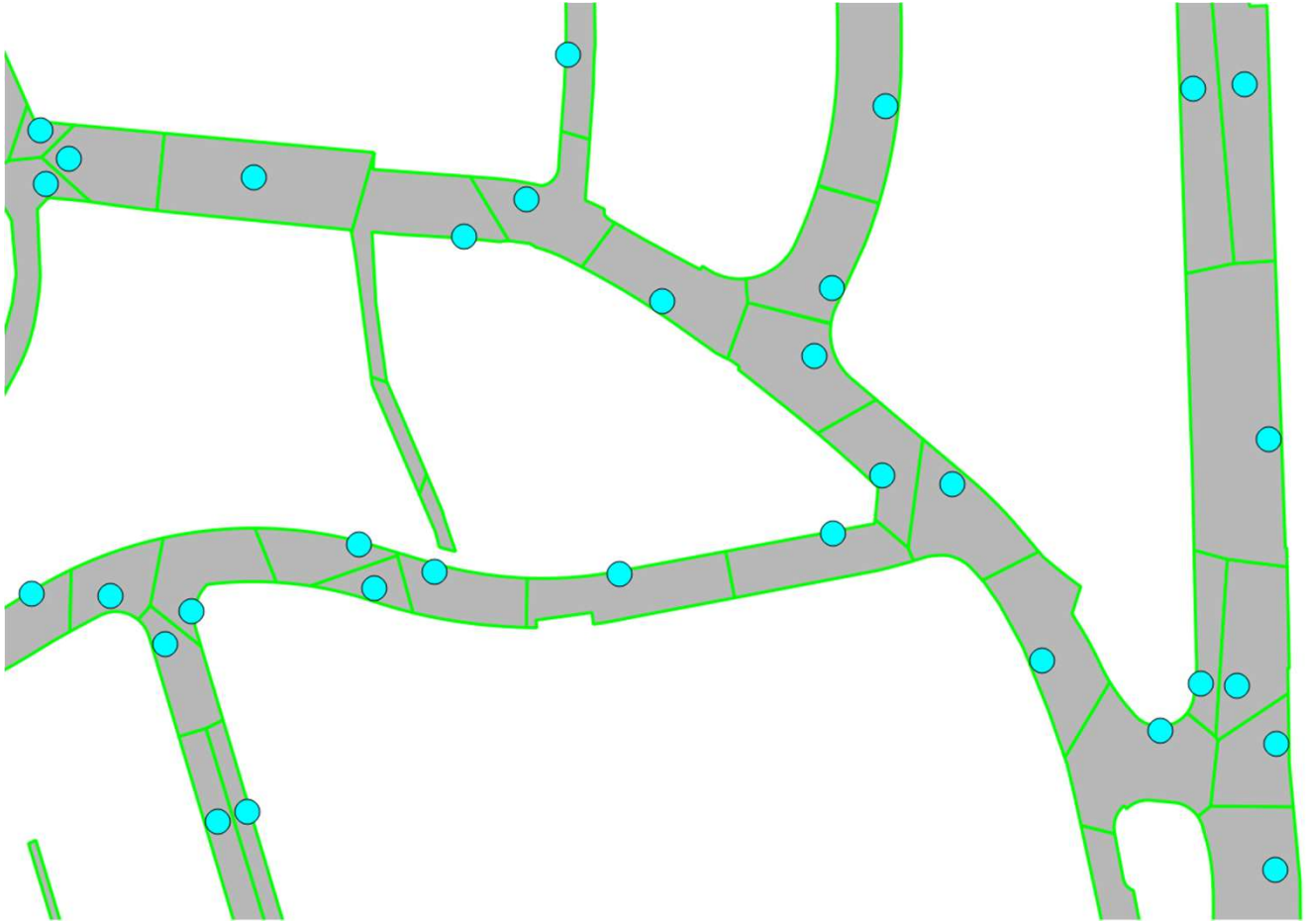
Roads



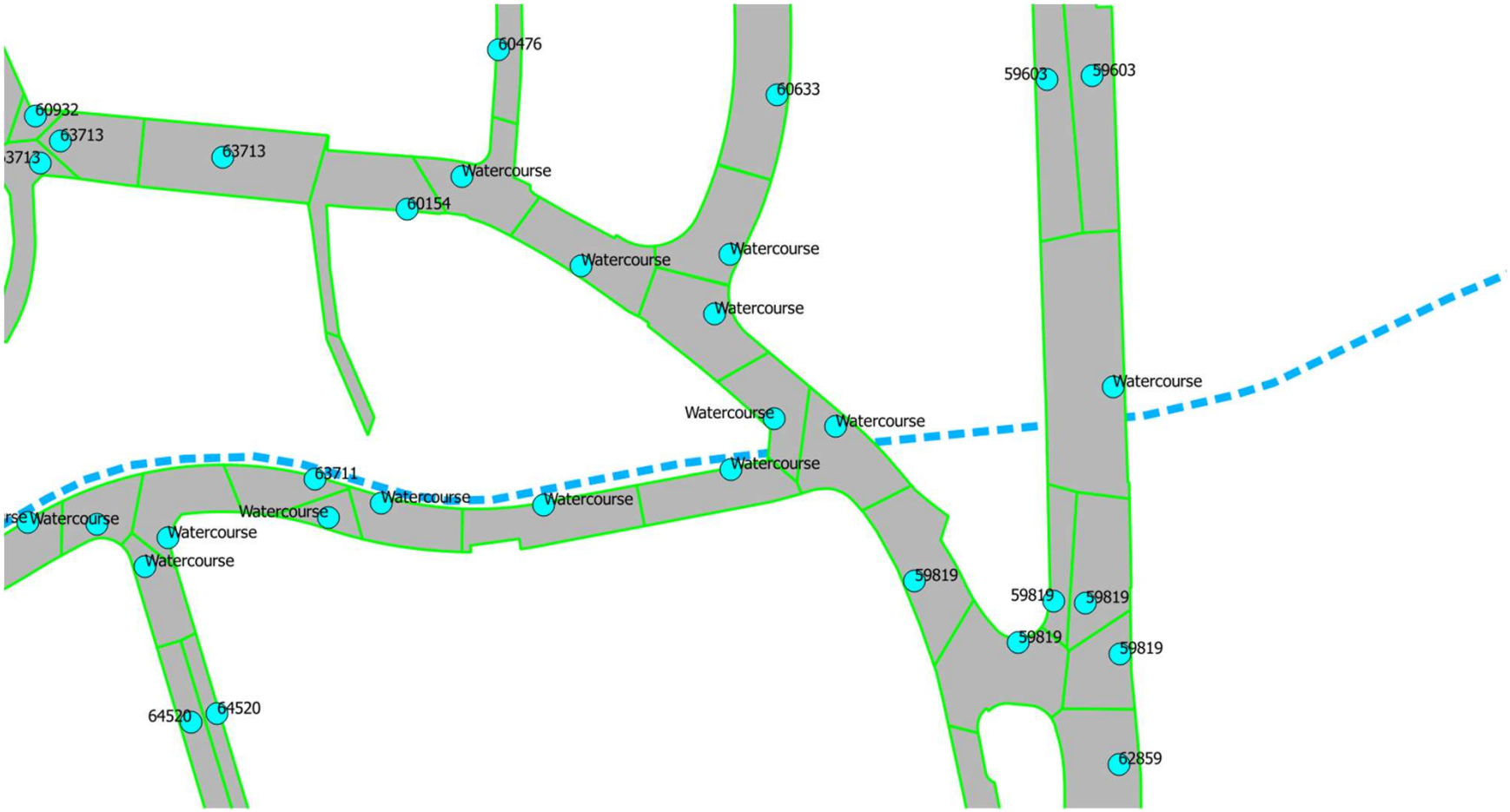
Roads



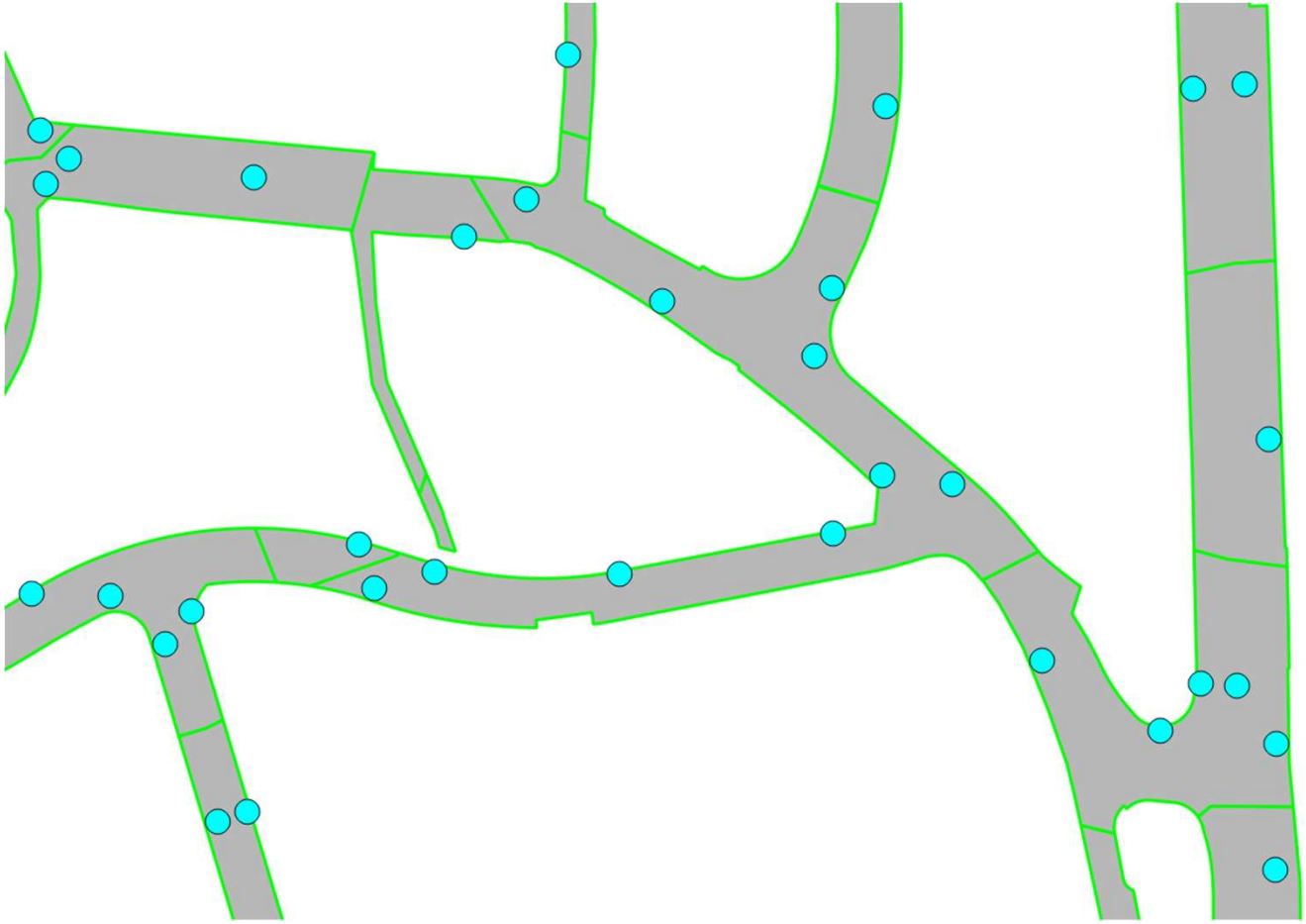
Roads



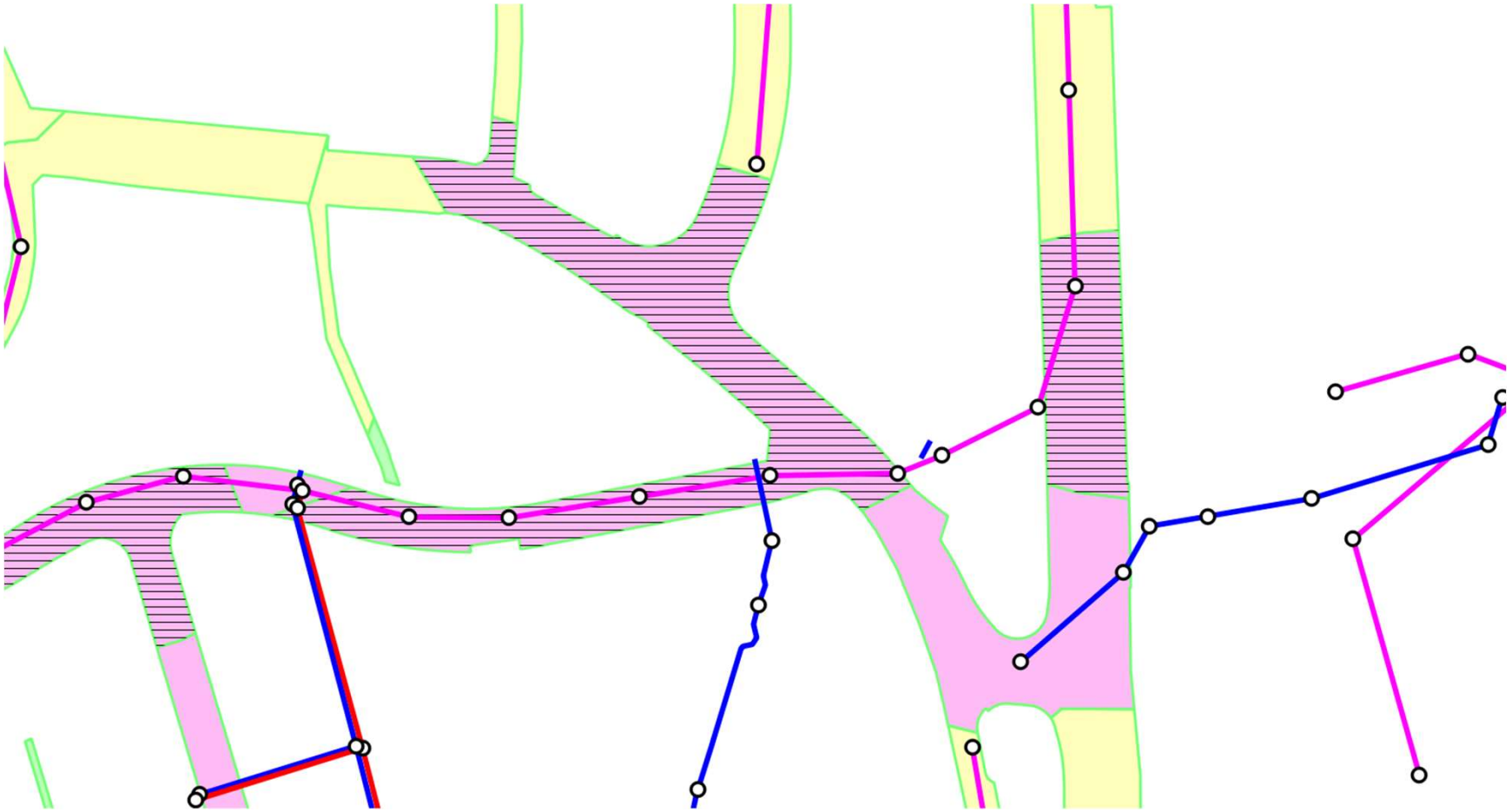
Roads


60476
60633
59603
59603
60932
63713
63713
63713
Watercourse
60154
Watercourse
Watercourse
Watercourse
Watercourse
Watercourse
Watercourse
Watercourse
63711
Watercourse
Watercourse
Watercourse
Watercourse
Watercourse
Watercourse
59819
59819
59819
59819
59819
64520
64520
62859

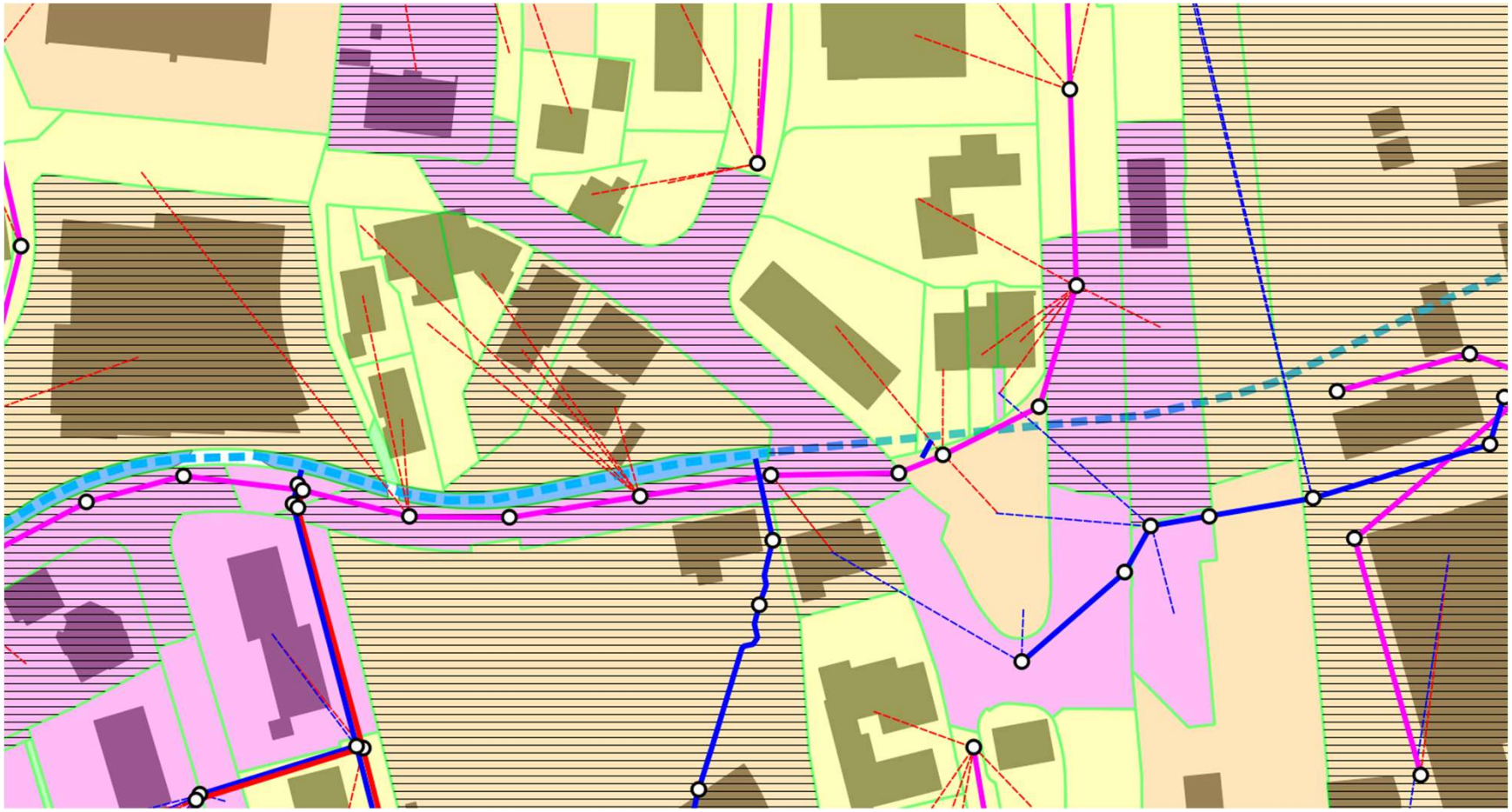
Roads



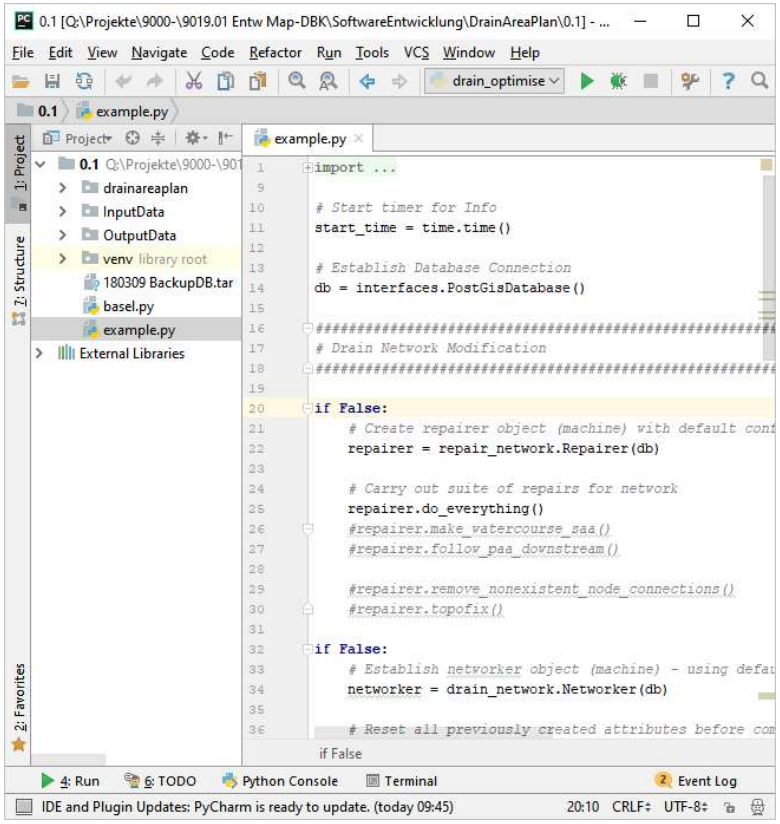
Roads

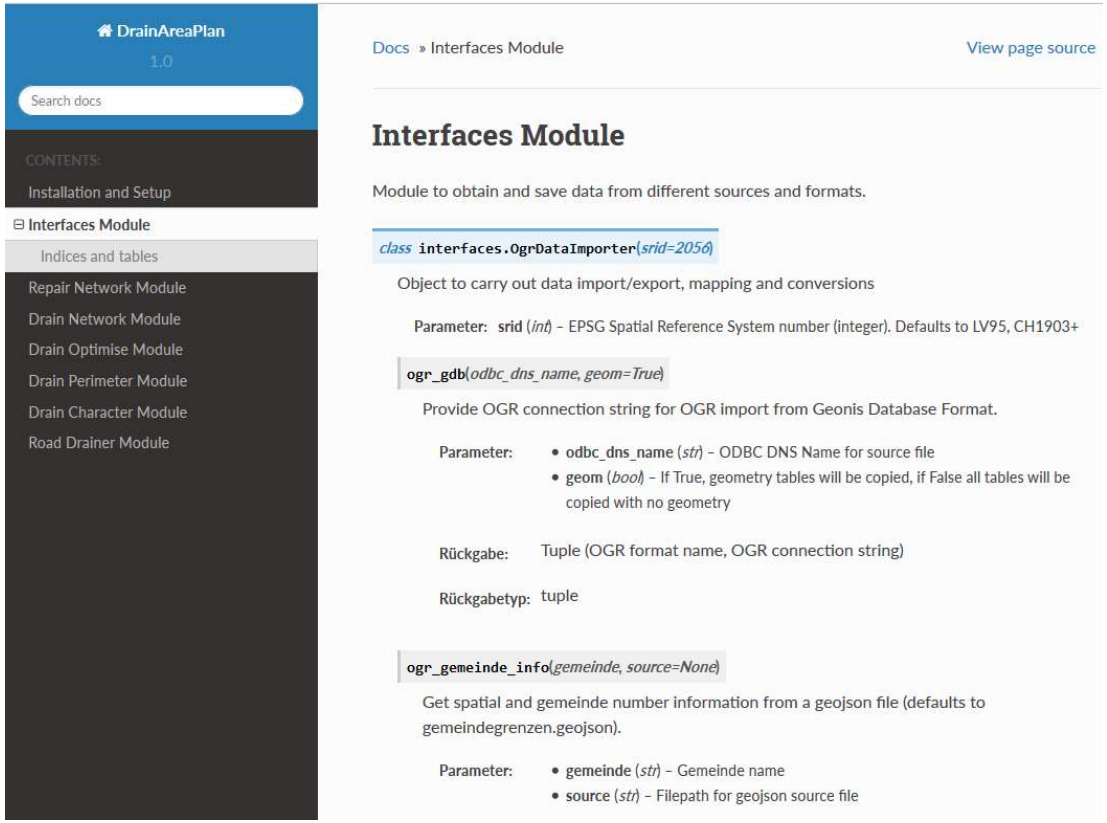


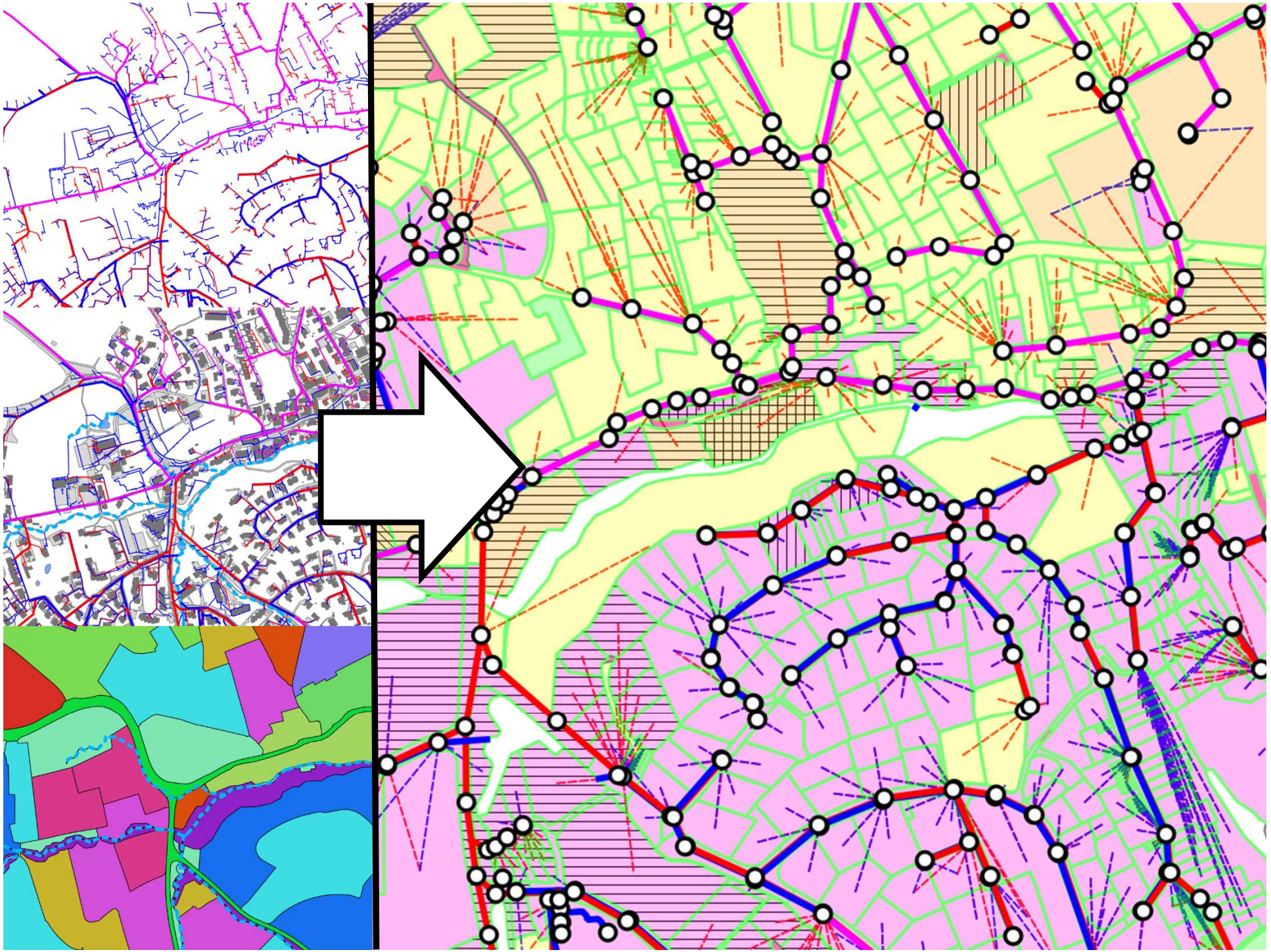
Roads



Use and Documentation








HUNZIKER
BETATECH
WASSER
BAU
UMWELT