QKan

QGIS and database based system for managing urban drainage system data

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QKan – Managing Urban Drainage Systems with QGIS

contents

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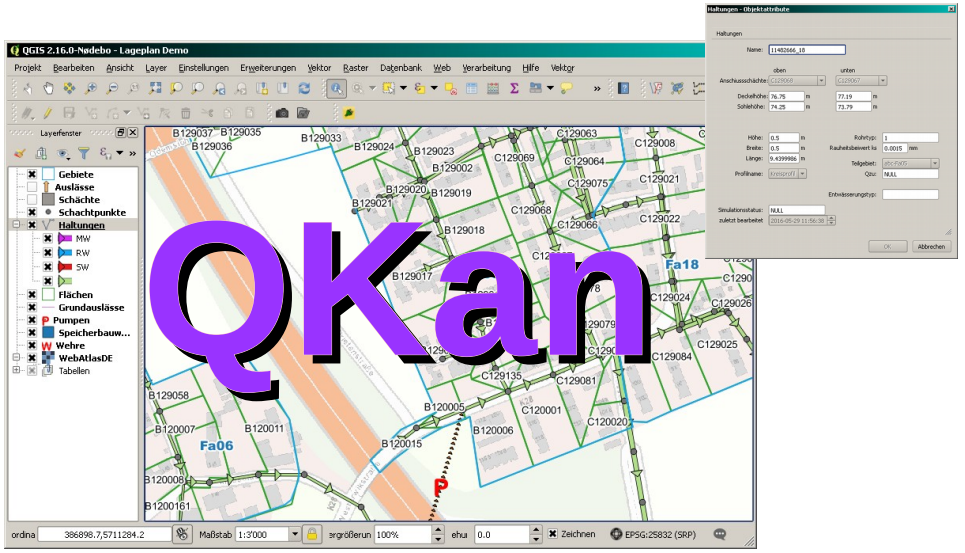

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blue ing.

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What is QKan?

- Set of plugins for QGIS
- Database model

What can QKan be used for?

- Design of urban drainage systems in combination with hydraulic simulation software

Who can use QKan?

- Engineers in consulting offices

Why did the consultant offices give money for open-source software?

- Need for a software aiming at the specific workflow of an engineer
- Good opportunity to (*make staff*) learn QGIS

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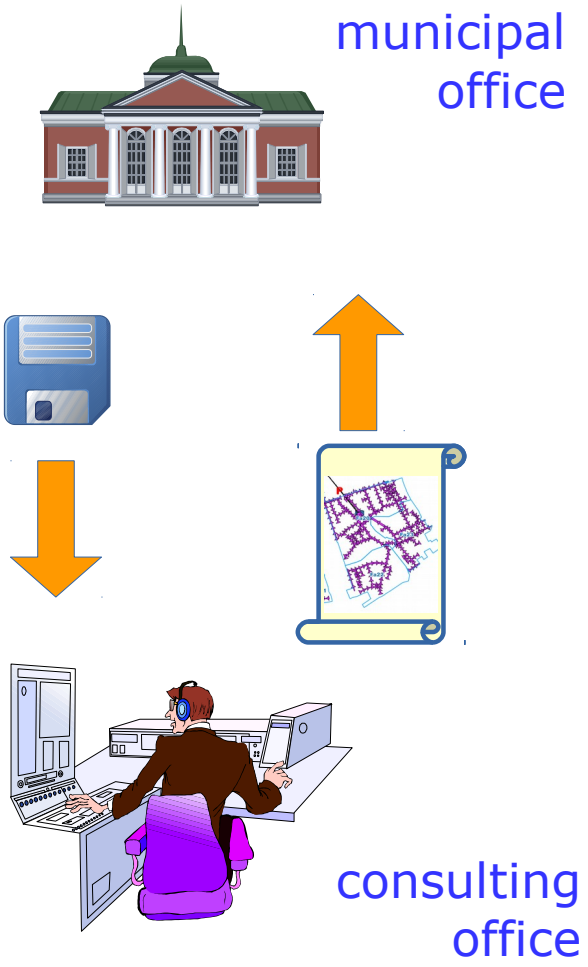
Objectives

1. Urban drainage system data
   - Verification
   - Preprocessing
2. *Hydraulic simulation (external)*
3. Results
   - Analysis
   - Plans
     - Map of sewage system
     - Cross section

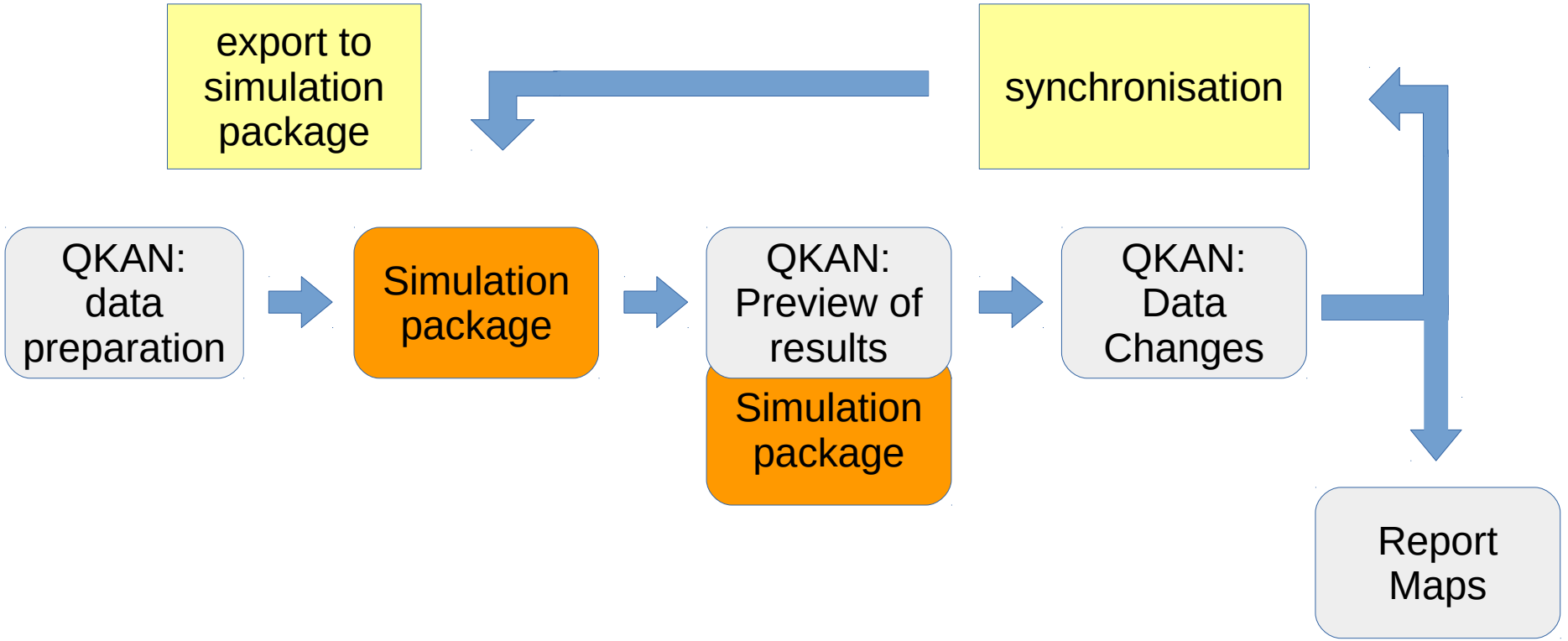


What do consulting offices need?

1. Workflow independent from simulation software
2. Simple data structure
3. Flexible import of sewage system data
   - Table data: ASCII, CSV, Excel
   - Database data: ACCESS tables
   - Data exchange formats: ISYBAU-XML, DWA-XML

Typical workflow...

1. Design of sewage system in an iterative process



Objectives

Widely used simulation packages

- HYSTEM-EXTRAN (ITWH, Hannover)
- Kanal++ (tandler.com, Buch am Erlbach)
- *Mike Urban (DHI, Hørsholm, Denmark)*
- *Rehm Software (DHI, Hørsholm, Denmark)*
- SWMM (EPA, USA)

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Not widely used in Germany…

… but several software packages originate from SWMM

Main functionality

1. Data import
2. Prepare data for simulation
3. Analysis of simulation results
4. Creating maps for printing

… using:

- QGIS
- QKan-Plugins

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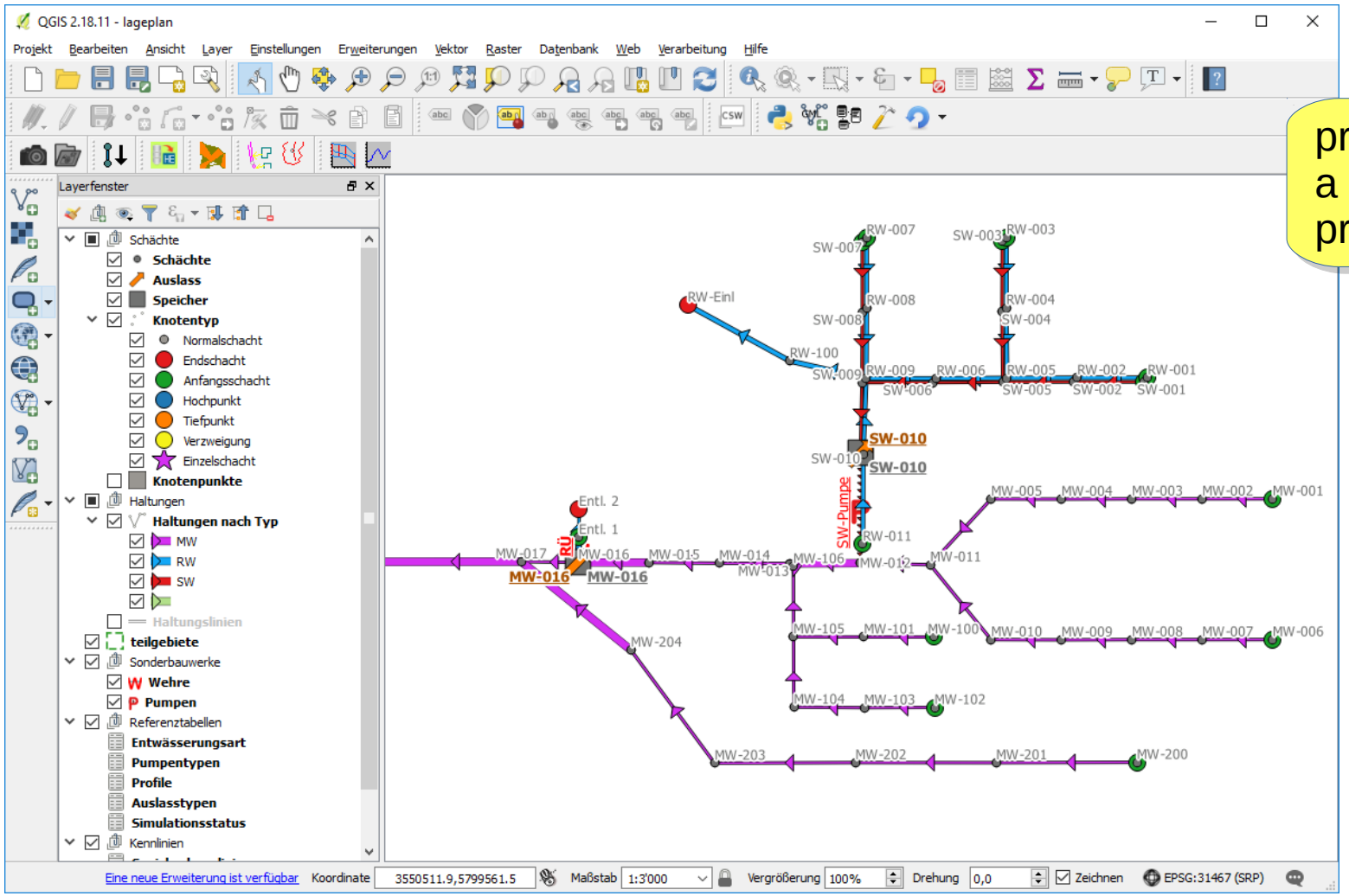
Functionality

Import of network data



provided with a meaningful project file

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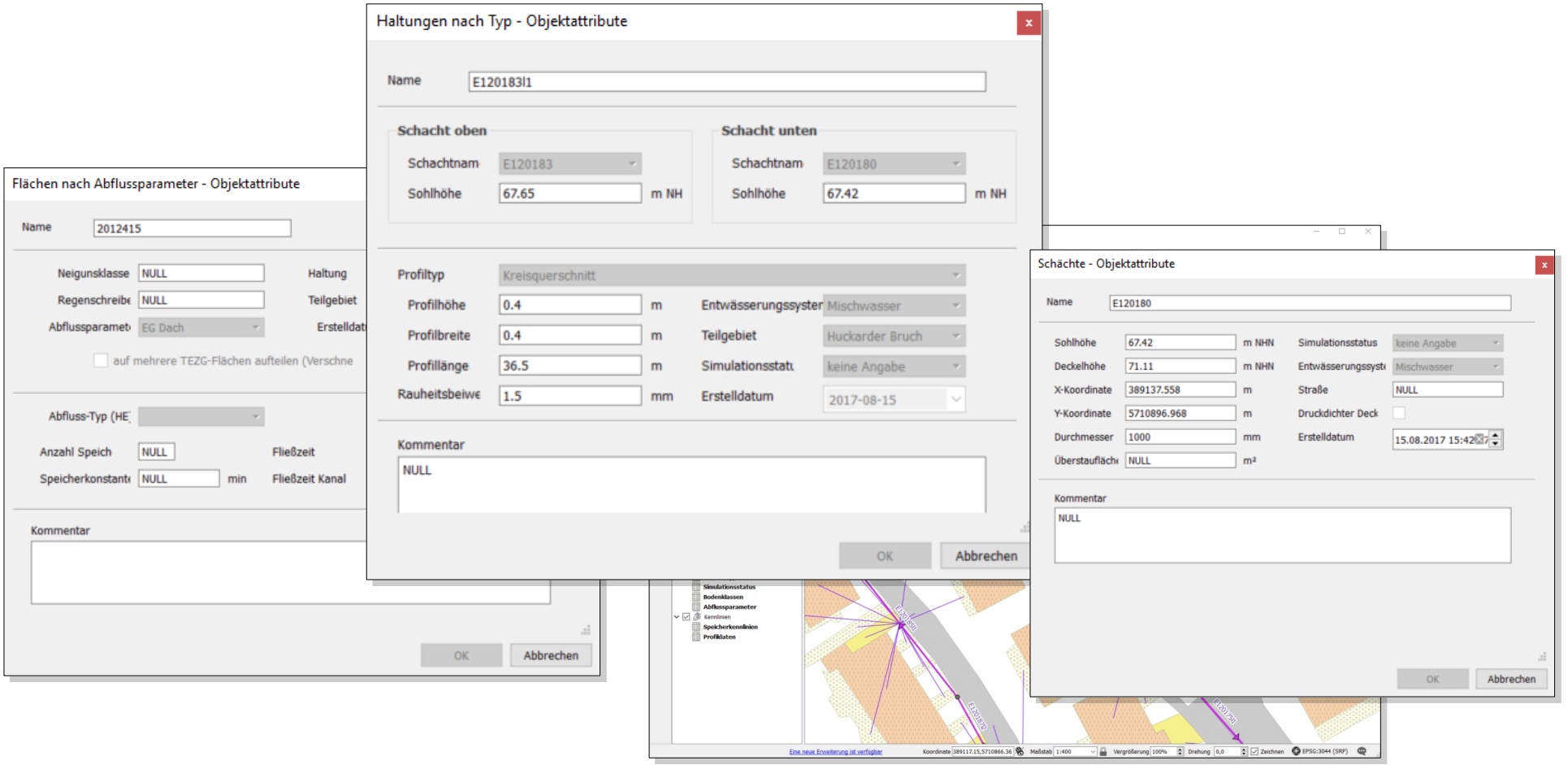
Functionality

Forms for data editing:



Plugins for managing surface areas:

- automatic linking to nearest pipe
- intersection of large surface areas (large building, traffic area)
- creation of surface objects from the space between impervious areas

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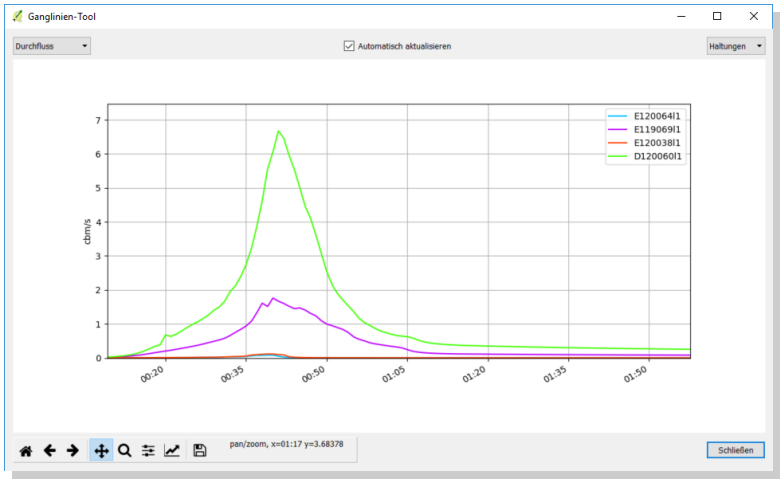
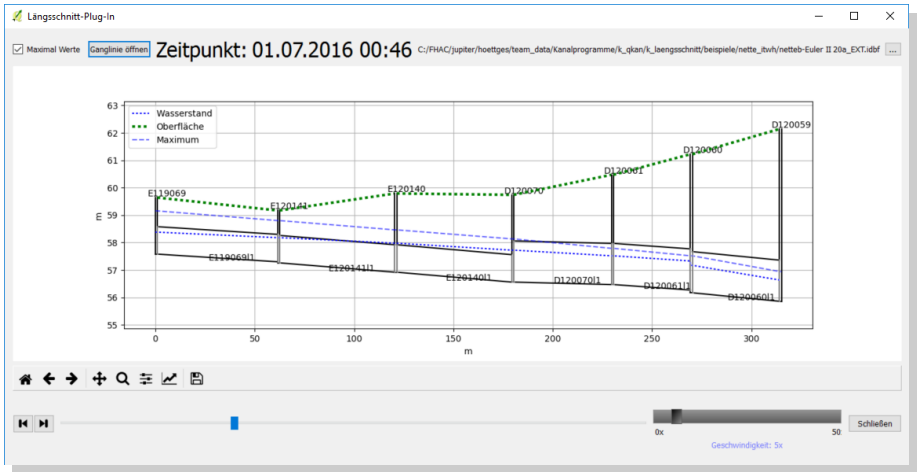
Functionality

Visualisation of simulation results

1. Network data
2. Hydrographs
3. Longitudinal section

… if there is no (free) viewer available

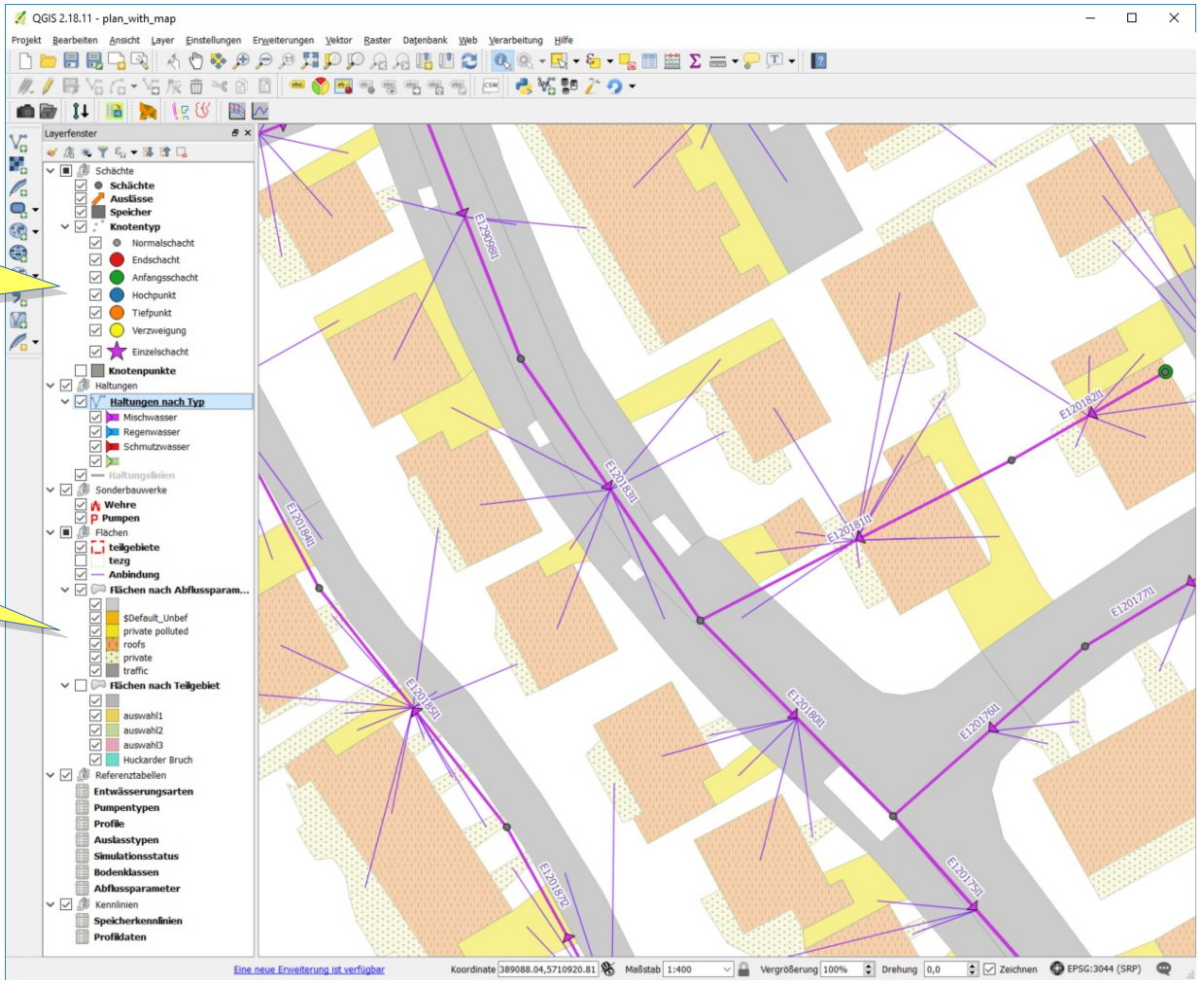




Thematic mapping

Special node types:
- Start node
- End node
- High point
- Low point
- Outfall node

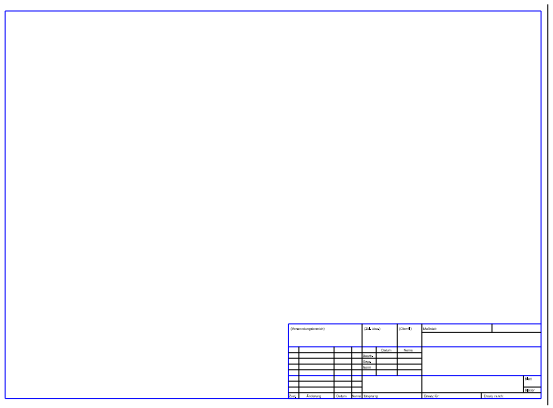
Subcatchment types:
- im-/pervious
- user defined pervious types

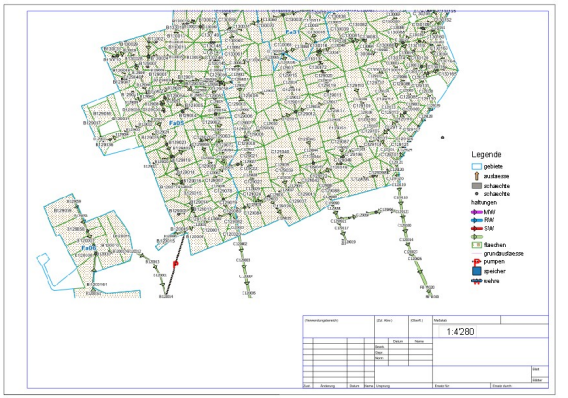


Functionality provided by QGIS:

2. Create Map Layout

CAD-file (*.dwg) → export file (*.dxf) → vector graphics (*.svg) → QGIS → QGIS-template (*.qpt)





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Design characteristics

GIS

1. QGIS

Databases

1. SpatiaLite

2. *PostGIS (not yet)*

Programming Language

1. Python

Forms

1. QT

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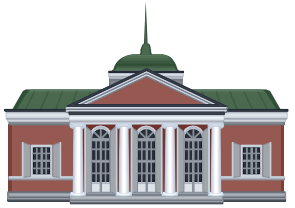
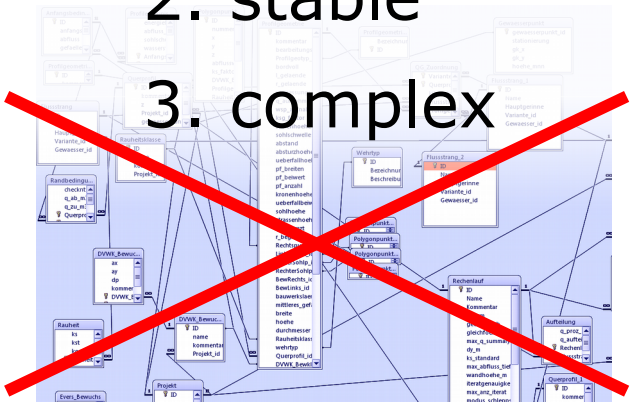
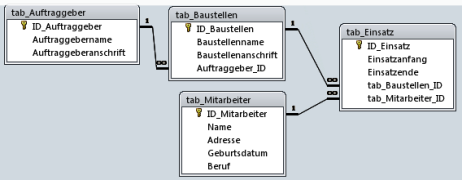
Design characteristics

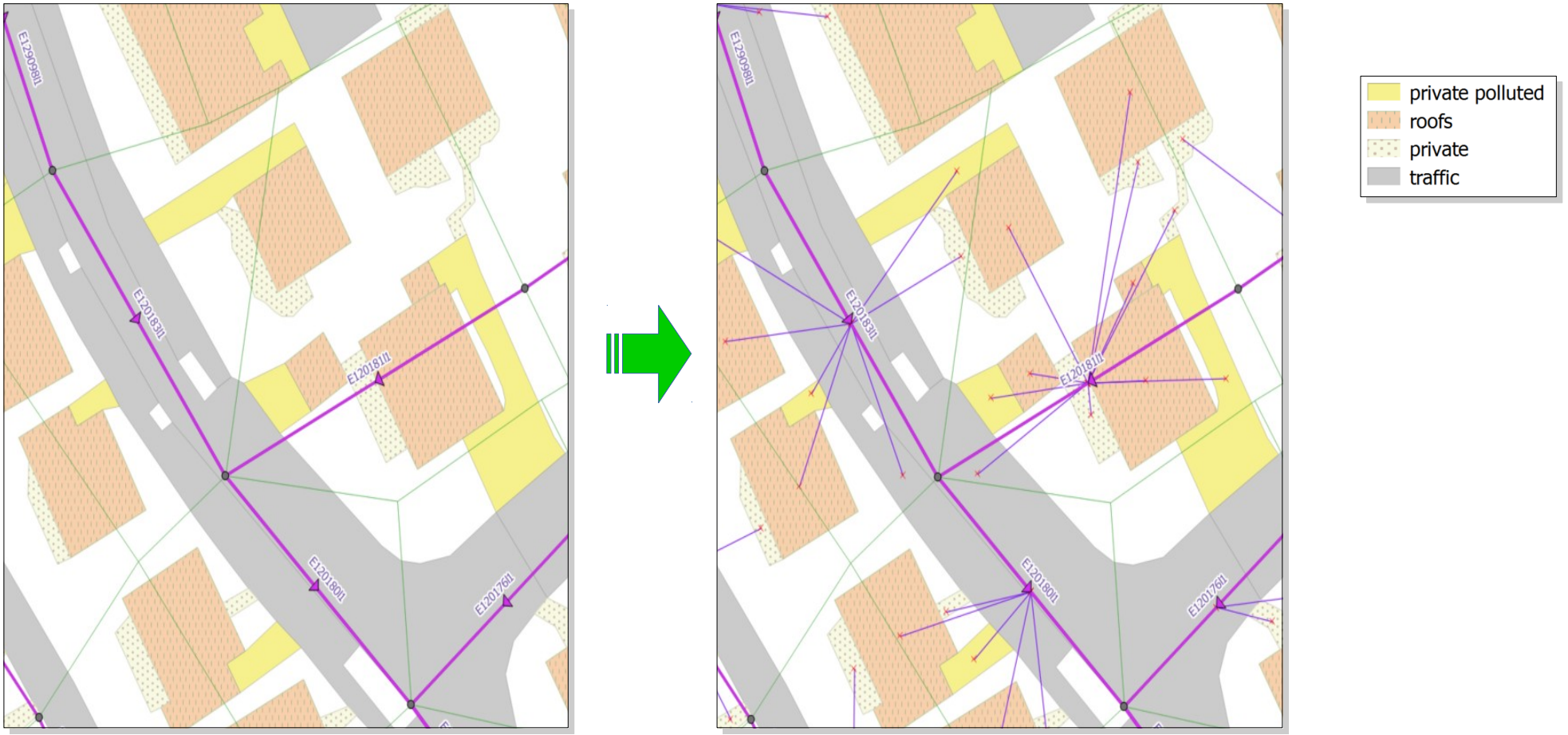


	Operator of the sewage system	Consulting office
Database design	1. long-lasting 2. stable 3. complex	1. flexible 2. simple





Example: Automatic linking of impervious areas



How does it work? → Spatial SQL!

1. Create new table from areas
2. Create buffer
3. Find nearest catchment intersecting with buffer
4. Create line

SQL statement included in the Python code:

```
WITH tlink AS
(    SELECT fl.pk AS pk,
     Distance(hal.geom,fl.geom) AS dist,
     hal.geom AS geohal, fl.geom AS geofl
     FROM
         haltungen AS hal
     INNER JOIN
         linkfl AS fl
     ON MbrOverlaps(hal.geom,fl.gbuf)
     WHERE fl.glink IS NULL)
UPDATE linkfl SET glink =
(    SELECT MakeLine(PointOnSurface(t1.geofl),Centroid(t1.geohal))
     FROM tlink AS t1
     INNER JOIN
     (    SELECT pk, Min(dist) AS dmin
          FROM tlink GROUP BY pk) AS t2
     ON t1.pk=t2.pk AND t1.dist <= t2.dmin + 0.000001
     WHERE linkfl.pk = t1.pk)
WHERE linkfl.glink IS NULL;
```

list of all distances between areas and pipes

line creation…

… only to the nearest pipe

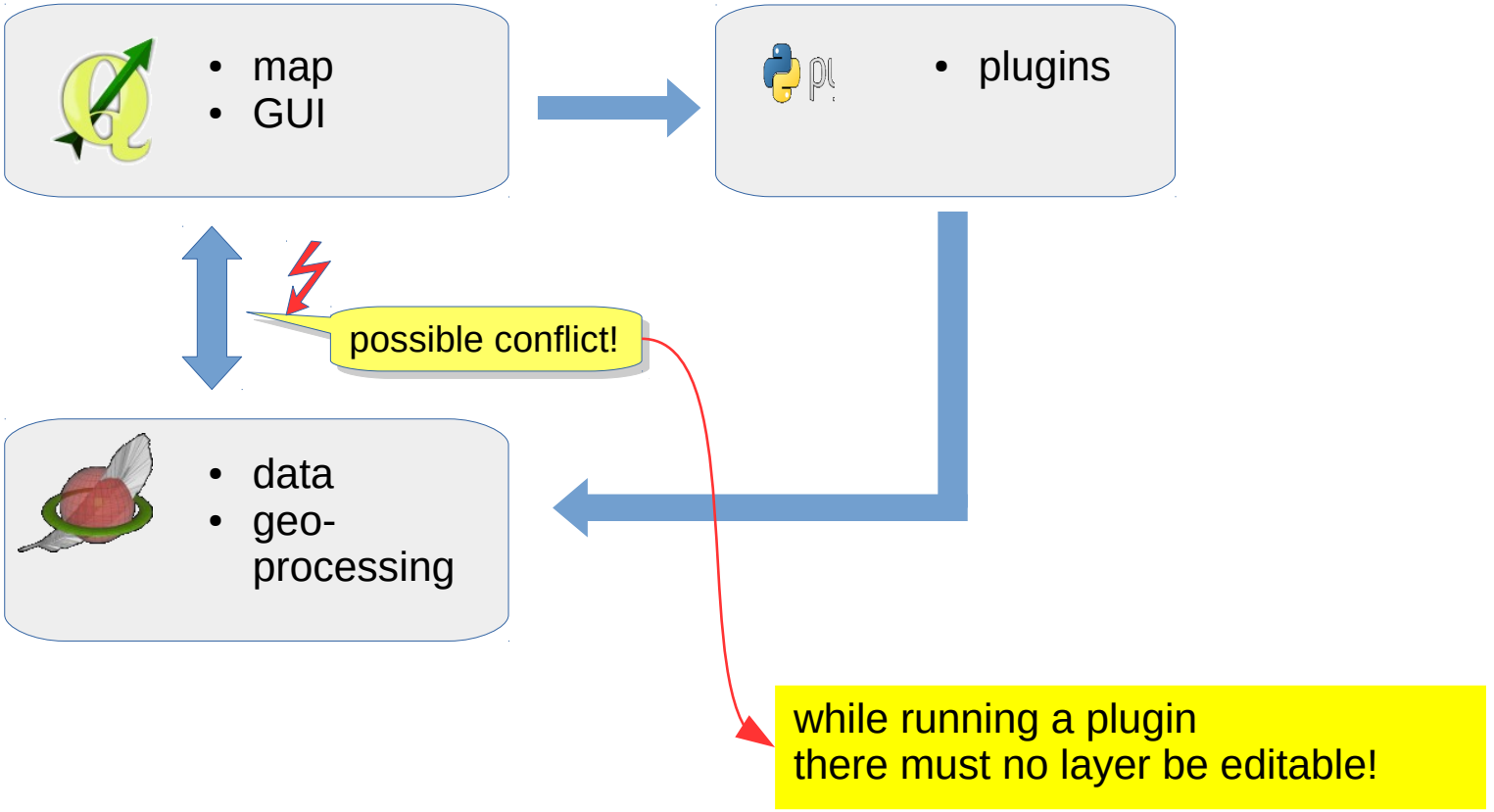
Spatial SQL …

1. Replaces a bunch of Python code
2. Benefits from indexing
3. Requires a powerful database
4. Requires multiple geometry columns

Doesn‘t with GeoPackage!

Does it really?

QGIS and Spatialite-DB



There was a lot to learn besides creating the QGIS plugins:

- adapting a template project file to a new database
  → modification of XML files with a python xml parser
- Awesome QT editor for designing forms
- Writing documentation with Sphinx → autocatically using comment lines in the Python code
- Handle the powerful logging/error-report mechnism

What will be next?

The QKan project is still in progress:

- Adaption to additional hydraulic simulation software packages
- More data handling plugins
- More result analysis plugins

Thank you!