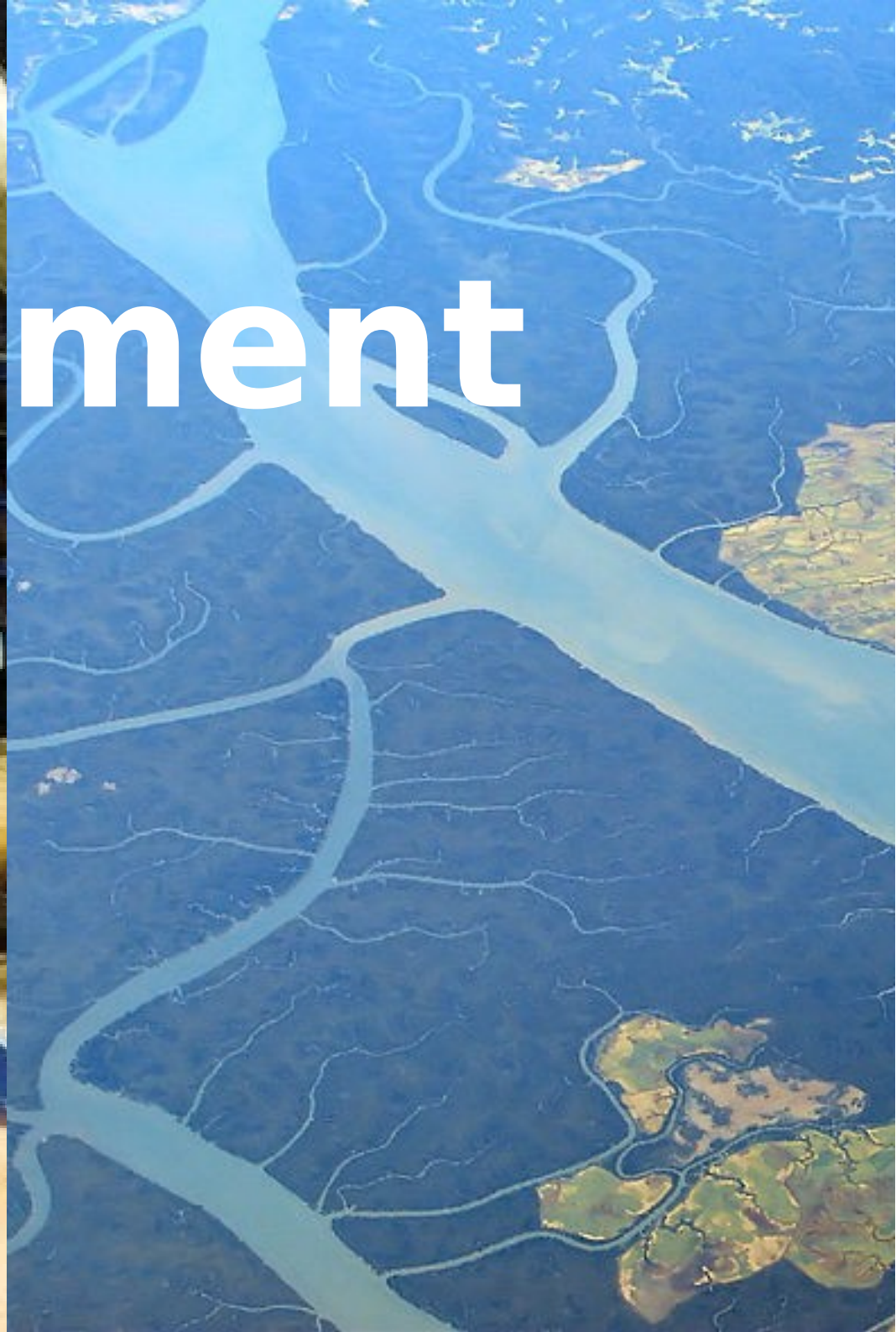
FOSS4G for water management

Vincent Picavet
Oslandia

OSLANDIA

Water management

Hydrology
Hydraulics
Observations



1 - Building blocks

OSLANDIA

Cloud WebServices

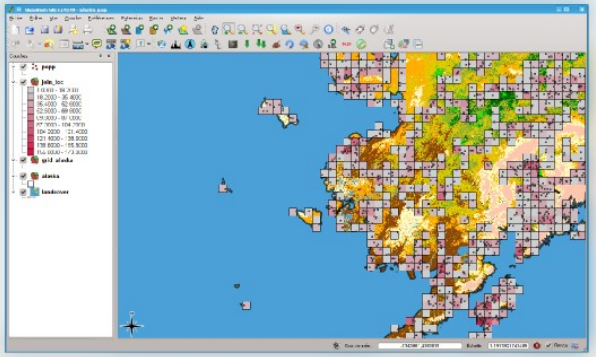
CrayFish

EPANET

TauDEM

Plugins

Quantum GIS



Spatial Database

PostGIS Spatial PostgreSQL

Oracle Spatial and Graph

Microsoft SQL Server

sextante

GDAL

FTOOLS

SAGA GIS

GRASS

PostGIS

OTB

LAS

OPENCV

R

OSLANDIA

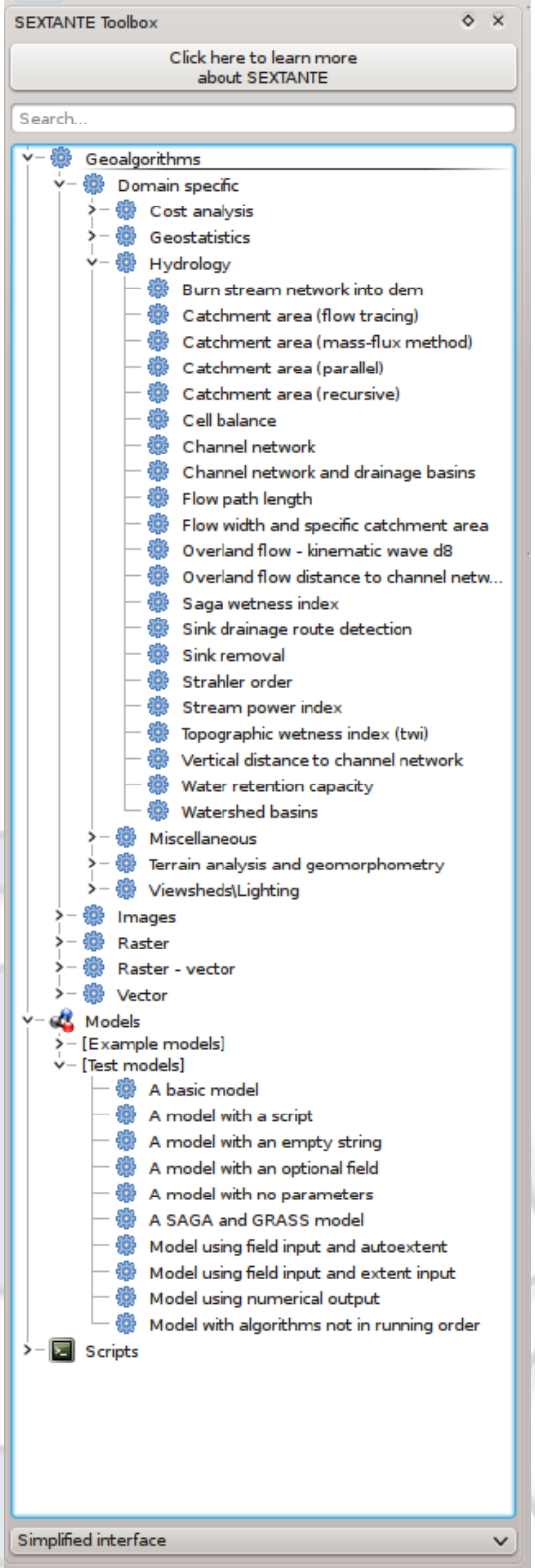
2 - Hydrology

Modules

- GDAL
  - Raster formats
  - Raster analysis
  - DEM
- SAGA
- GRASS
- TauDEM

→ SEXTANTE

Lots of algorithms available for hydrology and network analysis



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GRASS

Flow calculation
Groundwater flow
Hydrological models
Sediment
Stream modules
Watershed
Flooding areas

http://grasswiki.osgeo.org/wiki/Hydrological_Sciences

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SAGA

- Catchment
- Sink management
- Watershed segmentation
- Water retention capacity
- Watershed basins
- Wetness index
- Upslope area

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TauDEM

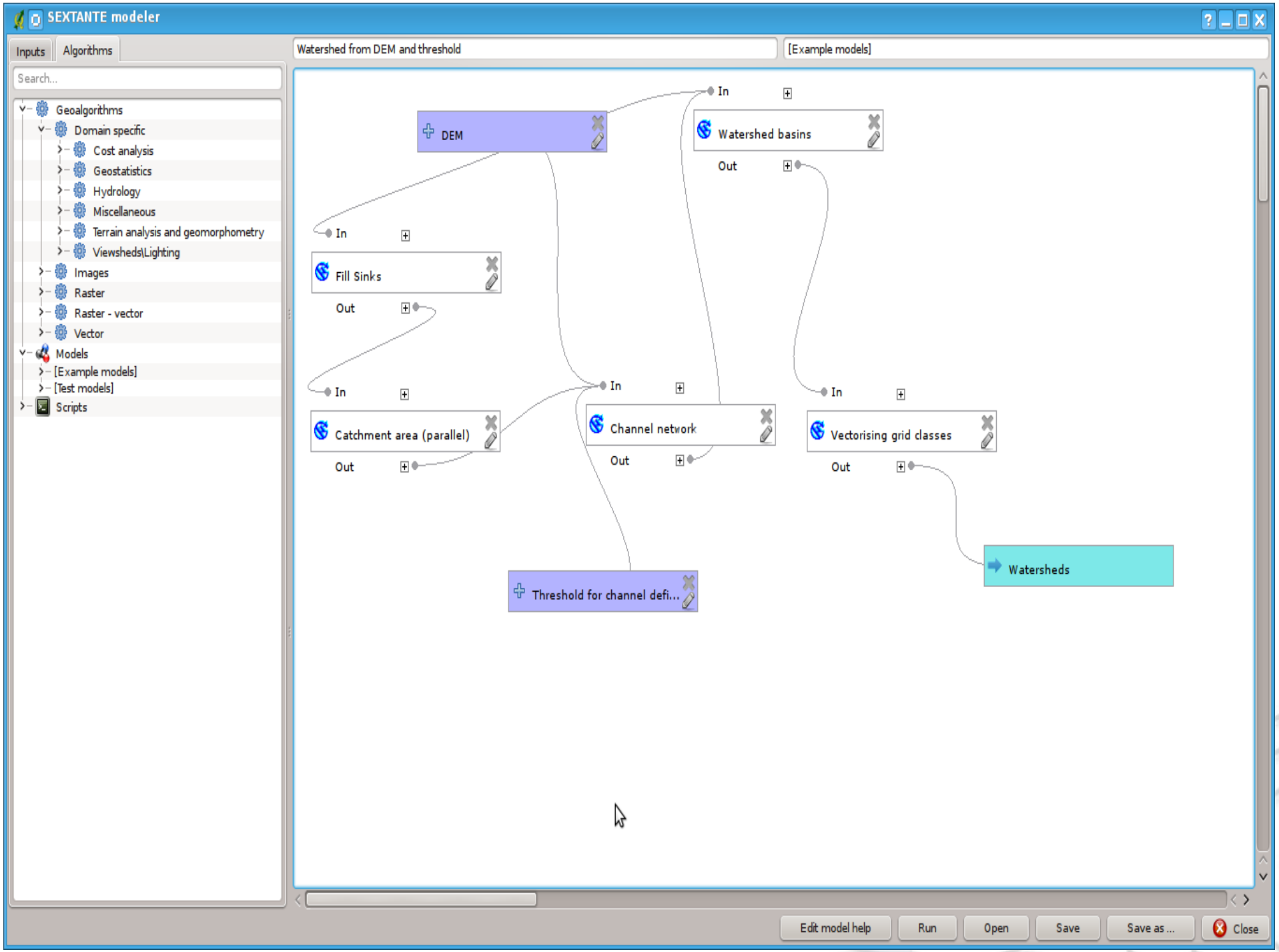
(Terrain Analysis Using Digital Elevation Models)

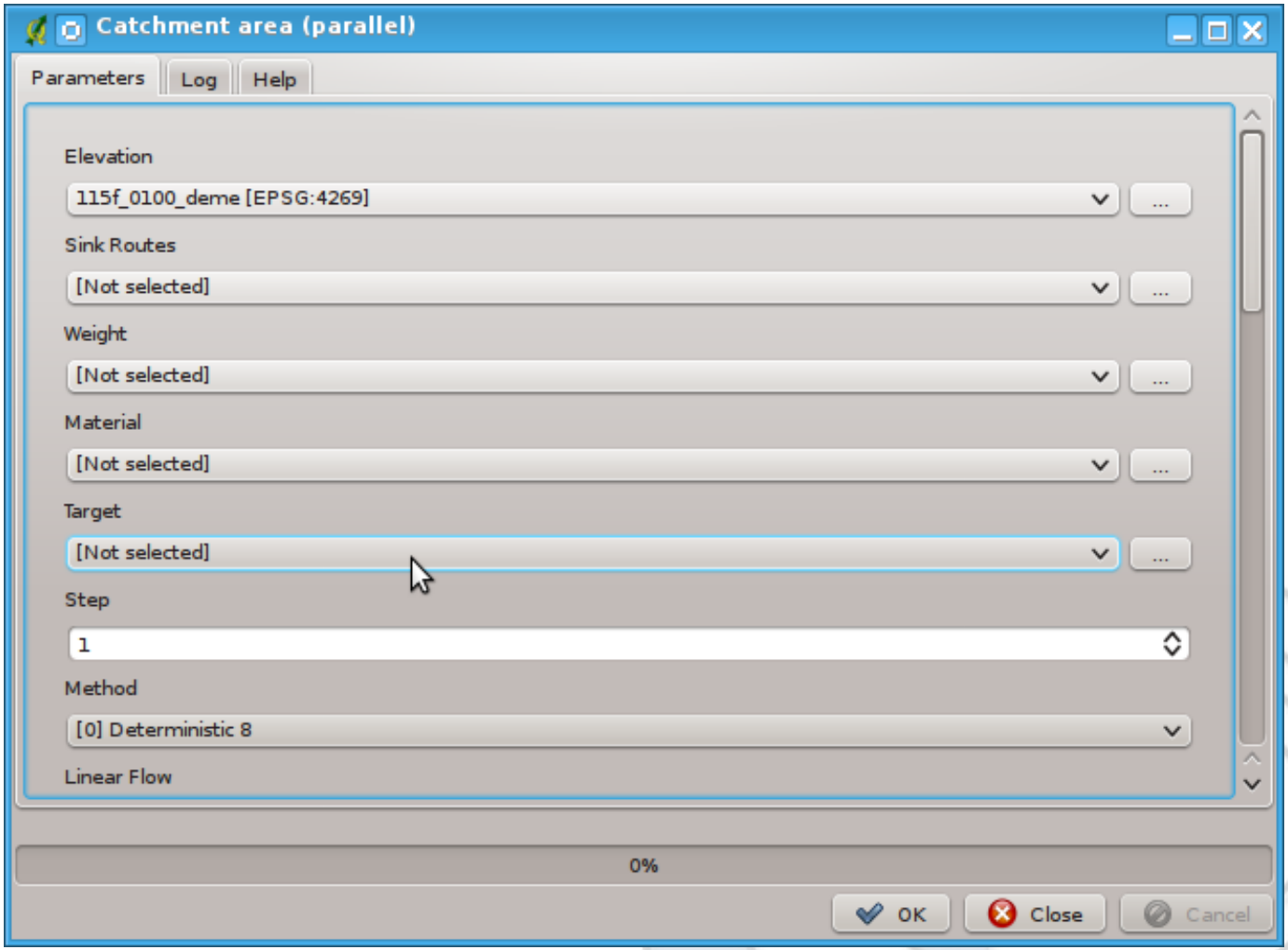
DEM → Hydrology Integrated in Sextante

Flow paths, slopes, contributing areas, stream network delineation, channel network delineation, (sub-)watershed delineation, Watershed / segment attribution, slope/area ratios, accumulation, reverse accumulation, avalanche runout areas...

OSLANDIA

Complex / custom model




Catchment area (parallel)
Parameters
Log
Help
Elevation
115f_0100_deme [EPSG:4269]
Sink Routes
[Not selected]
Weight
[Not selected]
Material
[Not selected]
Target
[Not selected]
Step
1
Method
[0] Deterministic 8
Linear Flow
0%
OK
Close
Cancel

Catchment area (parallel)

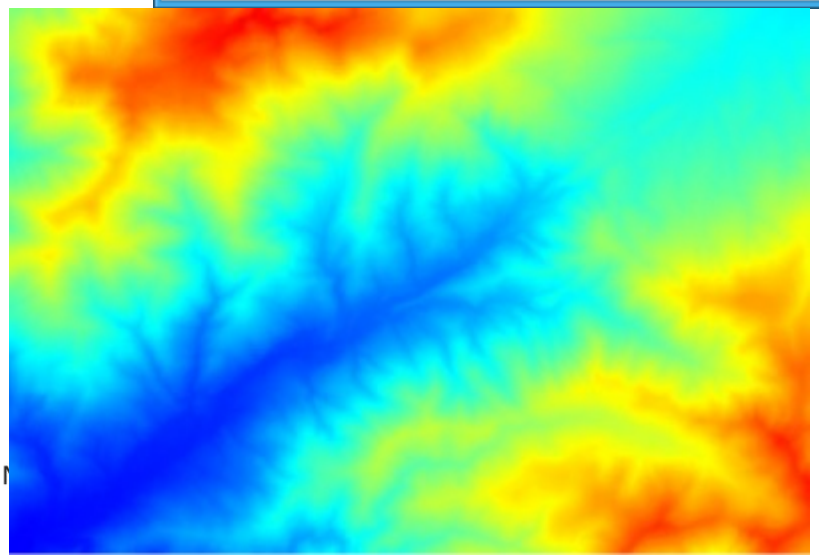
Parameters | Log | Help

```
Grid system: 0.000833, 1201x 1201y,  141x 61y
Elevation: 115f_
Sink Routes: [not set]
Weight: [not set]
Material: [not set]
Target: [not set]
Catchment Area: Catchment Area
Catchment Height: Catchment Height
Catchment Slope: Catchment Slope
Total accumulated Material: Total accumulated Material
Accumulated Material from _left_ side: Accumulated Material from _left_ side
Accumulated Material from _right_ side: Accumulated Material from _right_ side
Step: 1
Catchment Aspect: Catchment Aspect
Flow Path Length: Flow Path Length
Method: Deterministic 8
Linear Flow: yes
Linear Flow Threshold: 500.000000
Linear Flow Threshold Grid: [not set]
Channel Direction: [not set]
Convergence: 1.000000


ready

Create index: 115f_

ready
```

Processing algorithm...

86%

OK | Close | Cancel



3 - Hydraulics

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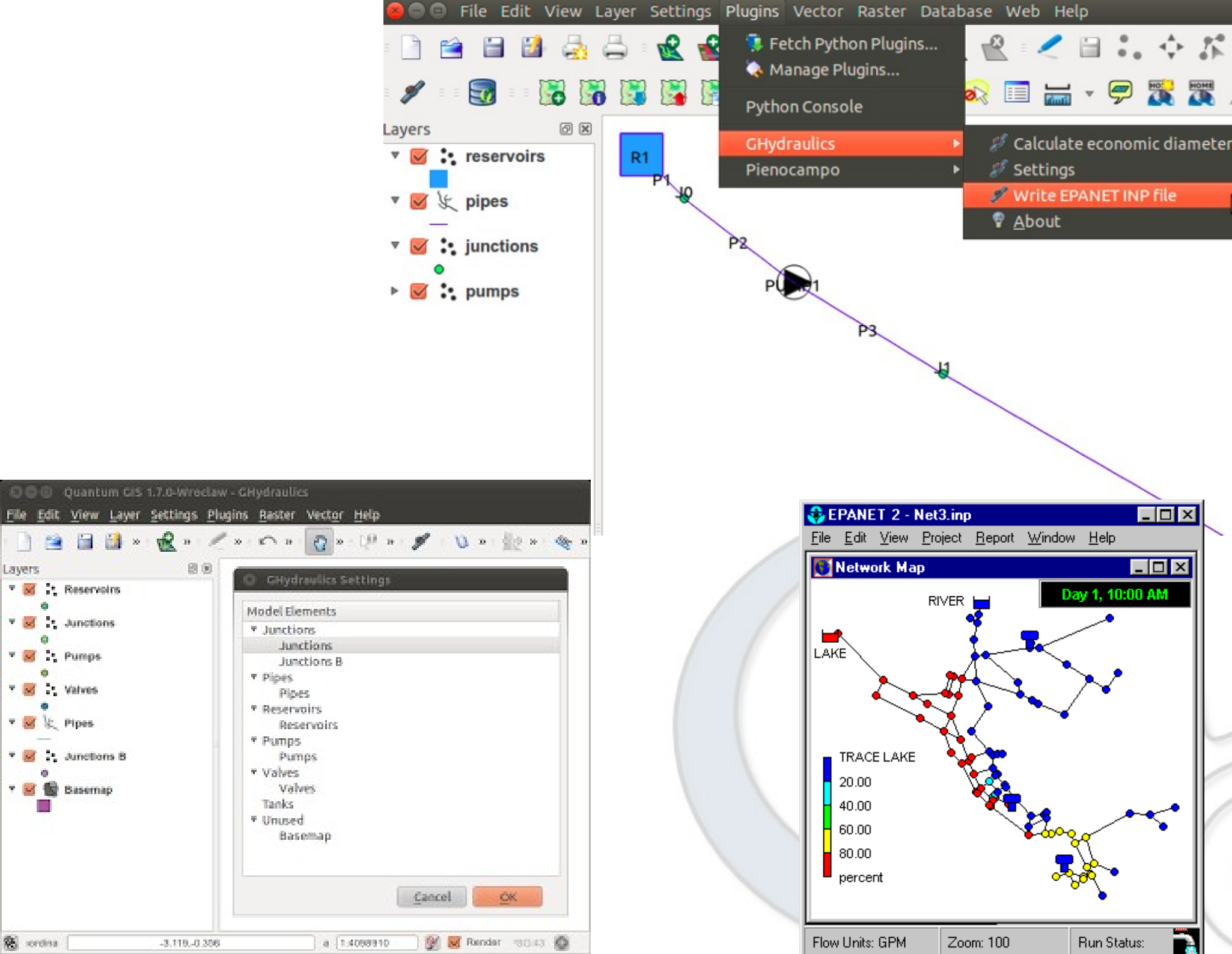
EPANET

OpenSource
Industry standard
Hydraulic simulation

Network solver, Headloss pipes, headflow curves of pumps...

Water quality sim.
Pollutant tracking
Big networks (Millions nodes)
Ghydraulics : QGIS plugin


File Edit View Layer Settings Plugins Vector Raster Database Web Help
Fetch Python Plugins...
Manage Plugins...
Python Console
GHydraulics
Pienocampo
Calculate economic diameters
Settings
Write EPANET INP file
About
Layers
reservoirs
pipes
junctions
pumps
R1
P1
J0
P2
P3
J1
Quantum GIS 1.7.0-Wroclaw - GHydraulics
File Edit View Layer Settings Plugins Raster Vector Help
Layers
Reservoirs
Junctions
Pumps
Valves
Pipes
Junctions B
Basemap
GHydraulics Settings
Model Elements
Junctions
Junctions
Junctions B
Pipes
Pipes
Reservoirs
Reservoirs
Pumps
Pumps
Valves
Valves
Tanks
Unused
Basemap
Cancel
OK
EPANET 2 - Net3.inp
File Edit View Project Report Window Help
Network Map
Day 1, 10:00 AM
RIVER
LAKE
TRACE LAKE
20.00
40.00
60.00
80.00
percent
Flow Units: GPM
Zoom: 100
Run Status:

Network analysis

OSLANDIA

PostGIS

PostGIS topology
Custom topology
Recursive queries
Vector data processing

→ Data quality check

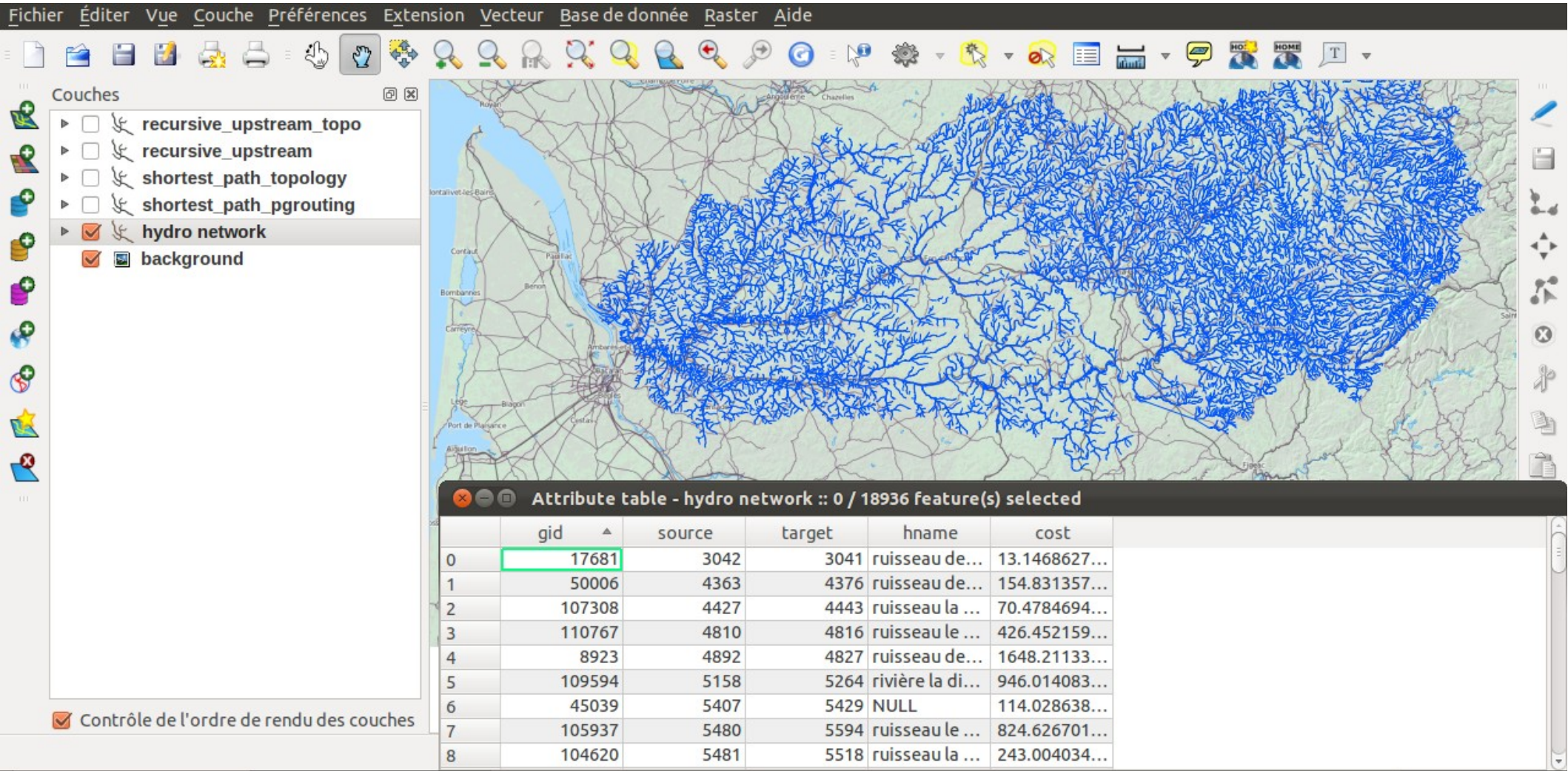
Validity, topology building, constraints, geometry/topology coherence semi-automatic editing

→ Network analysis

Pump activation, area isolation
Multiple networks, history management

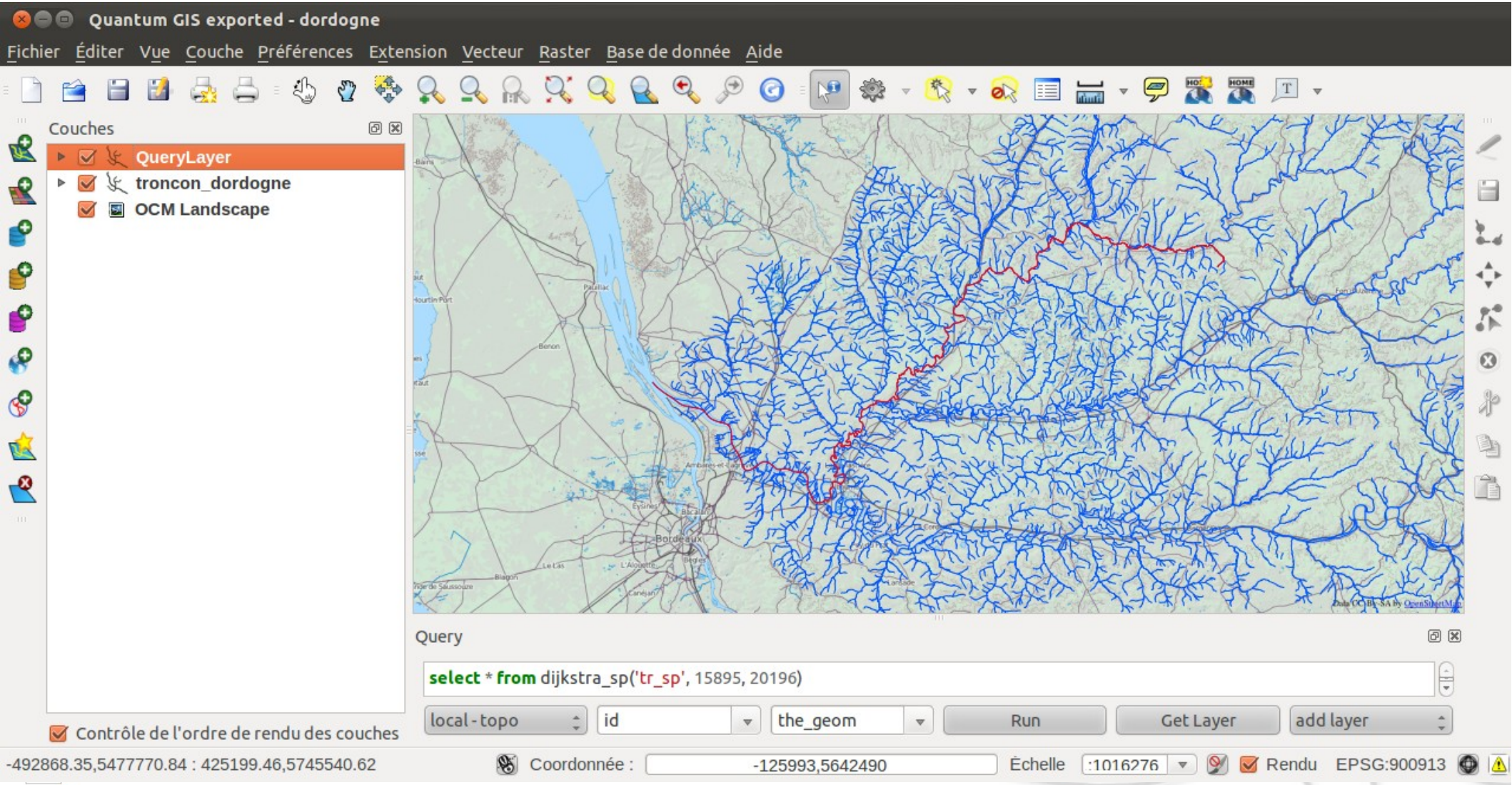
OSLANDIA

Water network

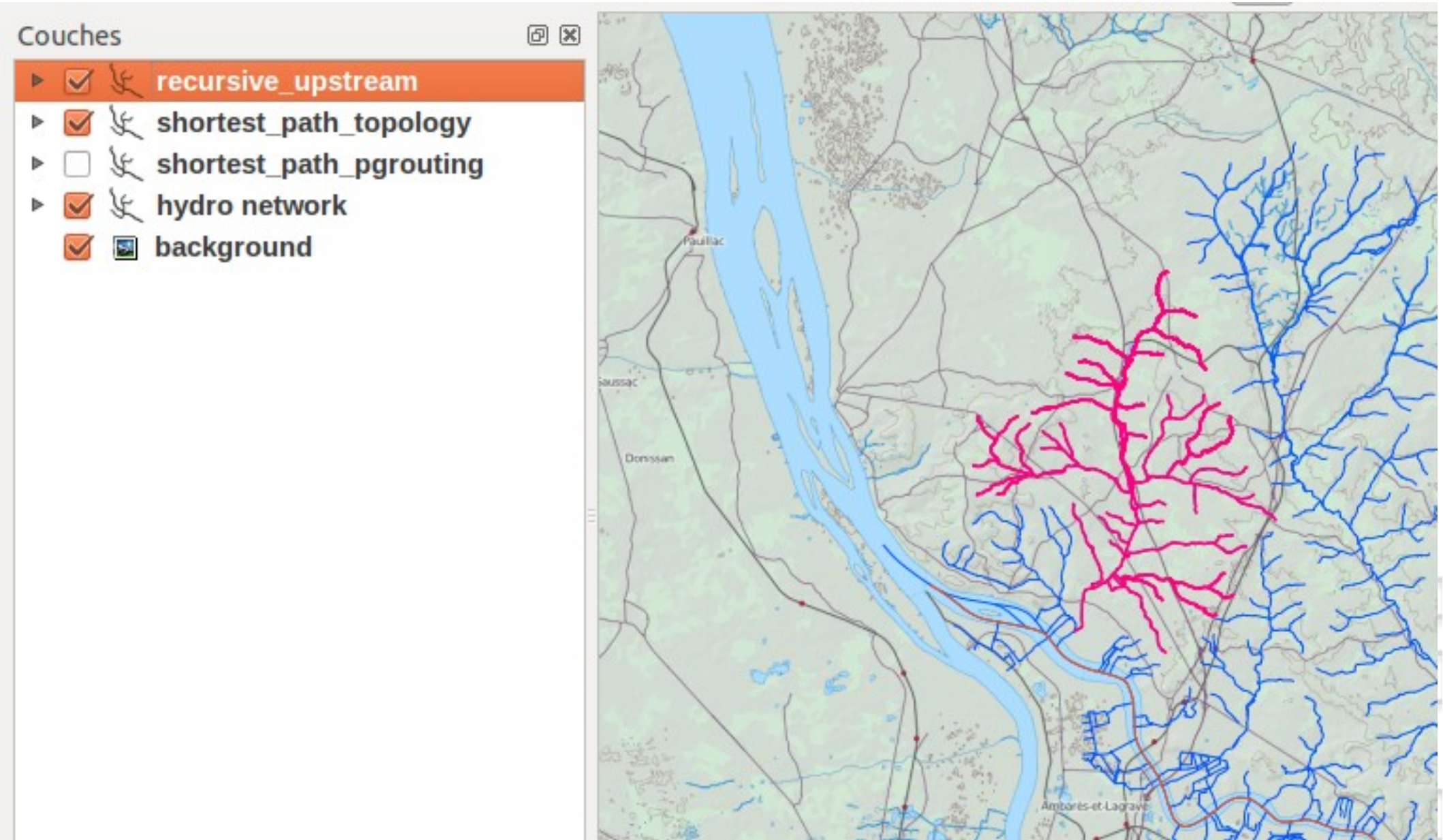


	gid	source	target	hname	cost
0	17681	3042	3041	ruisseau de...	13.1468627...
1	50006	4363	4376	ruisseau de...	154.831357...
2	107308	4427	4443	ruisseau la ...	70.4784694...
3	110767	4810	4816	ruisseau le ...	426.452159...
4	8923	4892	4827	ruisseau de...	1648.21133...
5	109594	5158	5264	rivière la di...	946.014083...
6	45039	5407	5429	NULL	114.028638...
7	105937	5480	5594	ruisseau le ...	824.626701...
8	104620	5481	5518	ruisseau la ...	243.004034...

Find path


Quantum GIS exported - dordogne
Fichier Éditer Vue Couche Préférences Extension Vecteur Raster Base de donnée Aide
Couches
QueryLayer
troncon_dordogne
OCM Landscape
Contrôle de l'ordre de rendu des couches
Query
select * from dijkstra_sp('tr_sp', 15895, 20196)
local - topo
id
the_geom
Run
Get Layer
add layer
-492868.35,5477770.84 : 425199.46,5745540.62
Coordonnée :
-125993,5642490
Échelle
:1016276
Rendu
EPSG:900913

Find upstream



```
create table
        rec_res as
with recursive
        search_graph(gid, source, depth, path, length, cycle) as (
                select
                        g.gid, g.source, 1 as depth, ARRAY[g.gid] as path
                        , cost, false as cycle
                from
                        tr as g
                where
                        gid = 31913
                union all
                select
                        g.gid
                        , g.source
                        , sg.depth + 1 as depth
                        , path || g.gid as path
                        , sg.length + g.cost as length
                        , g.gid = ANY(path) as cycle
                from
                        tr as g
                join
                        search_graph as sg
                on
                        sg.source = g.target
                where
                        not cycle
        )
select
        sg.*
        , tr.geom
from
        search_graph as sg
join
        tr
on
        sg.gid = tr.gid
limit 1000;
```

1

2

3

Recursive CTE

gid integer	source integer	depth integer	path integer[]	length double precision	cycle boolean	geom geometry(MultiLineString,2154)
31913	20850	1	{31913}	2666.0523017	f	01050000206A08000001000
33855	20735	2	{31913,	3473.3086319	f	01050000206A08000001000
32477	20845	2	{31913,	2725.7640259	f	01050000206A08000001000
33854	19909	3	{31913,	7183.7295195	f	01050000206A08000001000

QGEP

OSLANDIA

QGEP

VSA-DSS compatible waste-water documentation and management system based on Quantum GIS (QGIS).

QGIS Plugin + PostGIS
Swiss model **(http://www.vsa.ch/vsa-dss/datenmodell/)**
Digitizing
Profiles
Quality control
Symbology and map exports

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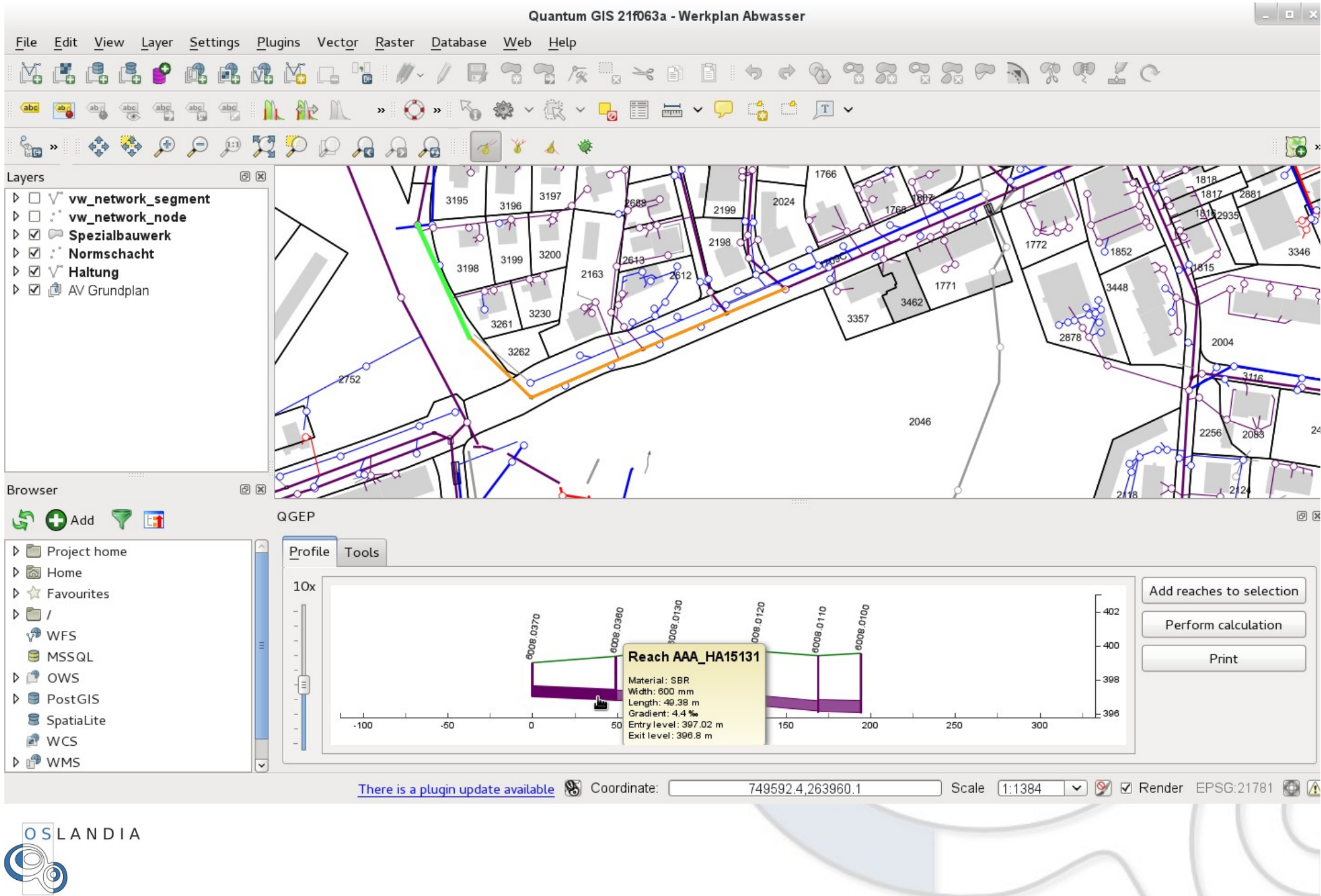
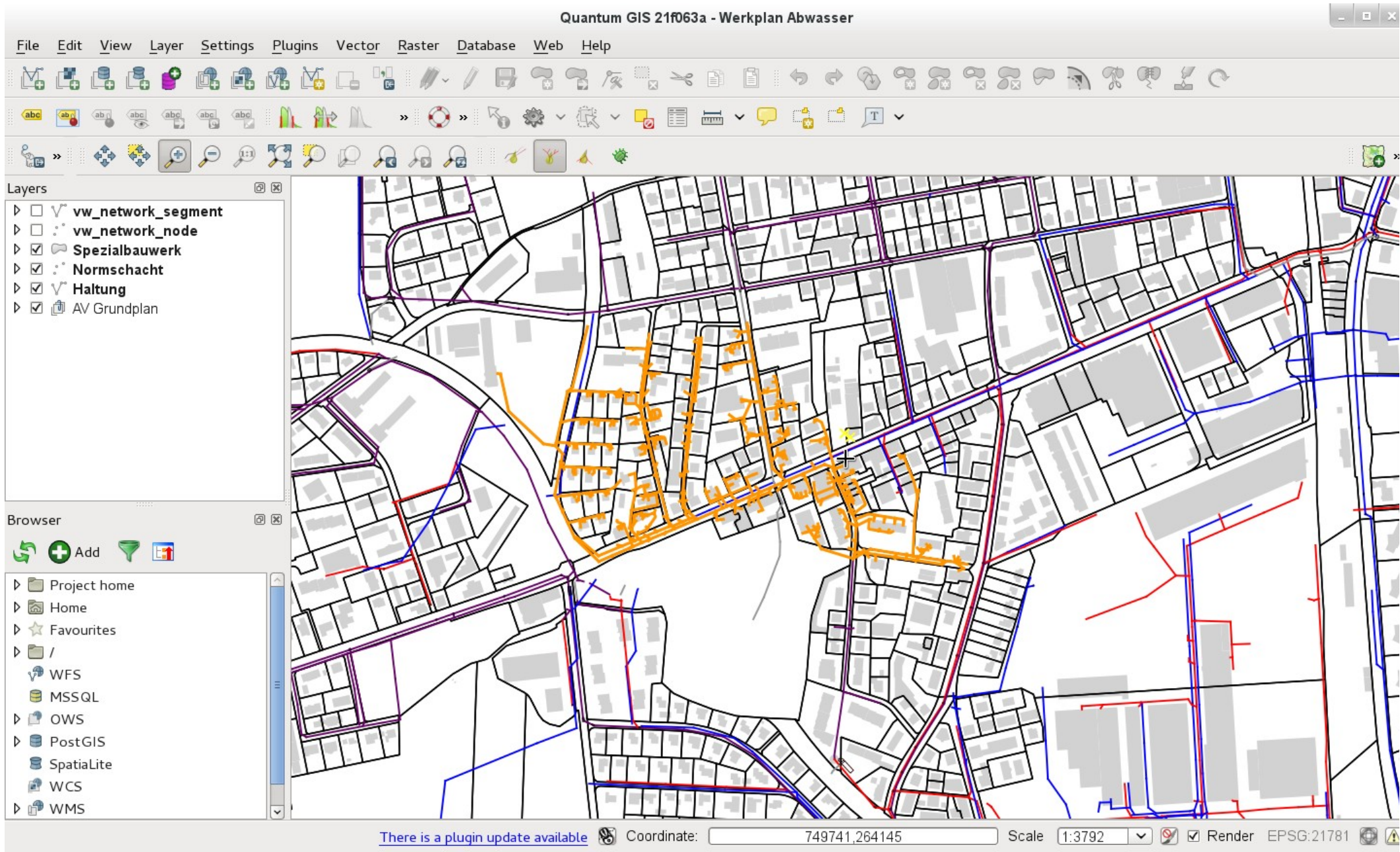

Quantum GIS 21f063a - Werkplan Abwasser
File Edit View Layer Settings Plugins Vector Raster Database Web Help
Layers
vw_network_segment
vw_network_node
Spezialbauwerk
Normschacht
Haltung
AV Grundplan
Browser
Add
Project home
Home
Favourites
/
WFS
MSSQL
OWS
PostGIS
SpatiaLite
WCS
WMS
QGEP
Profile
Tools
10x
Reach AAA_HA15131
Material: SBR
Width: 600 mm
Length: 49.38 m
Gradient: 4.4 ‰
Entry level: 397.02 m
Exit level: 396.8 m
Add reaches to selection
Perform calculation
Print
There is a plugin update available
Coordinate:
749592.4,263960.1
Scale
1:1384
Render
EPSG:21781

OSLANDIA


Quantum GIS 21f063a - Werkplan Abwasser
File Edit View Layer Settings Plugins Vector Raster Database Web Help
Layers
vw_network_segment
vw_network_node
Spezialbauwerk
Normschacht
Haltung
AV Grundplan
Browser
Add
Project home
Home
Favourites
/
WFS
MSSQL
OWS
PostGIS
SpatiaLite
WCS
WMS
There is a plugin update available
Coordinate:
749741,264145
Scale
1:3792
Render
EPSG:21781

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4 - Observations & sensors

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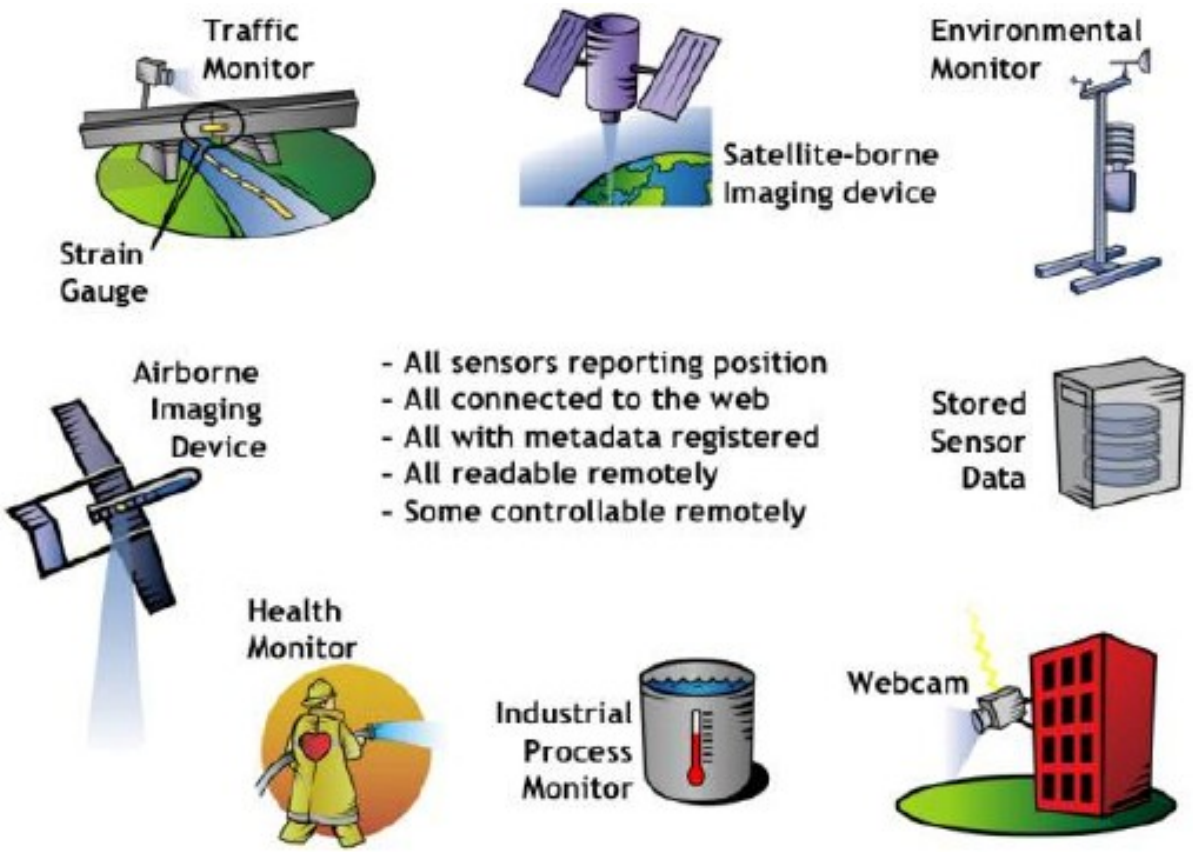
OGC SWE



http://www.opengeospatial.org/ogc/markets-technologies/swe

Acronyme	Nom	
TML	Transducer ML	1.0. No longer developed.
SensorML	Sensor and process descriptions	1.0.1 approved (2007) 2.0 : commenting phase
O&M	Observations & Measurements	2.0. ISO version approved.
WNS	Web Notification Service*	0.9 best practice
SOS	Sensor Observation Service	2.0 approved.
SAS	Sensor Alert Service*	0.9 best practice
SPS	Sensor Planning Service	2.0 approved.
SWE Common	Common data model	2.0 approved

SOS

(Sensor Observation Service)

HTTP
All kind of sensors
Mapserver implementation

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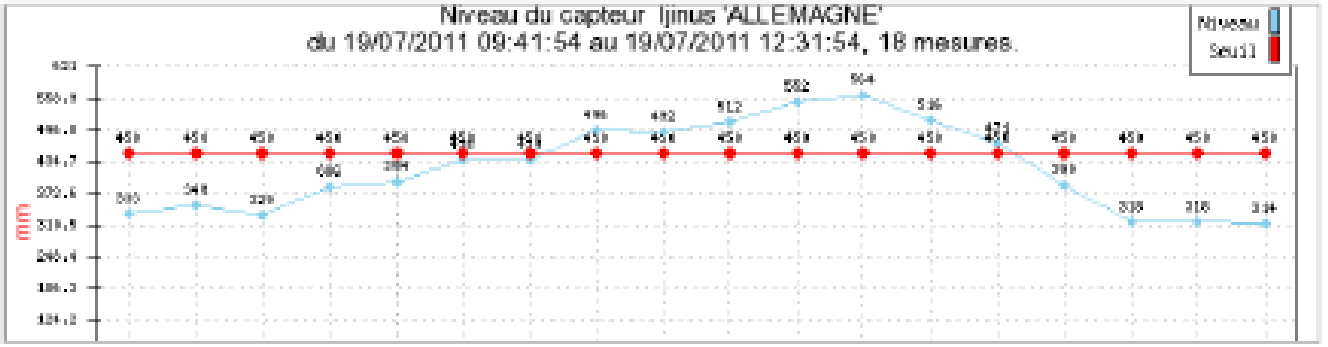
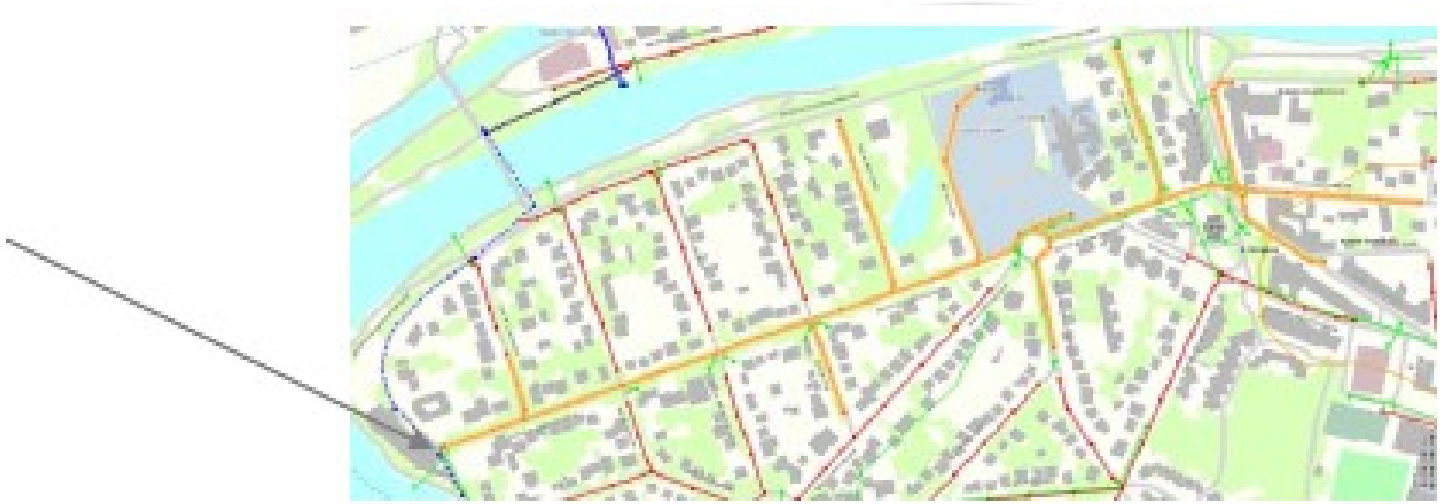


Waste-water



Veolia Eau Ile de France – Direction Technique

H0030 Hopital H0029 Cambacères H0031 place d'Allemagne

Bon état

En surcharge (niveau d'eau > seuil)

Défectueux

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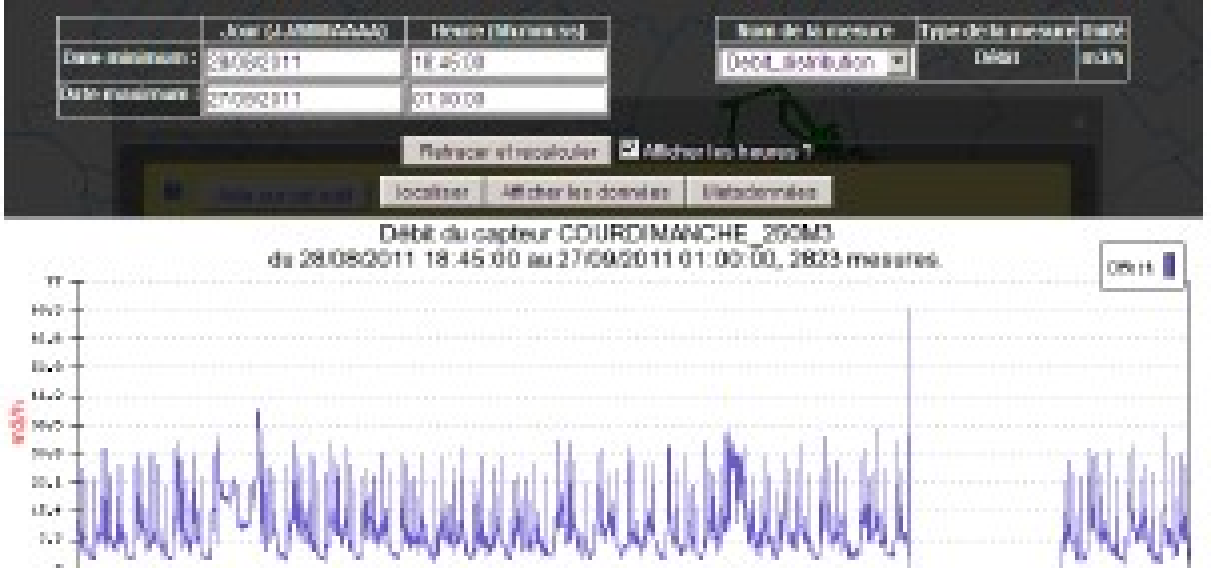
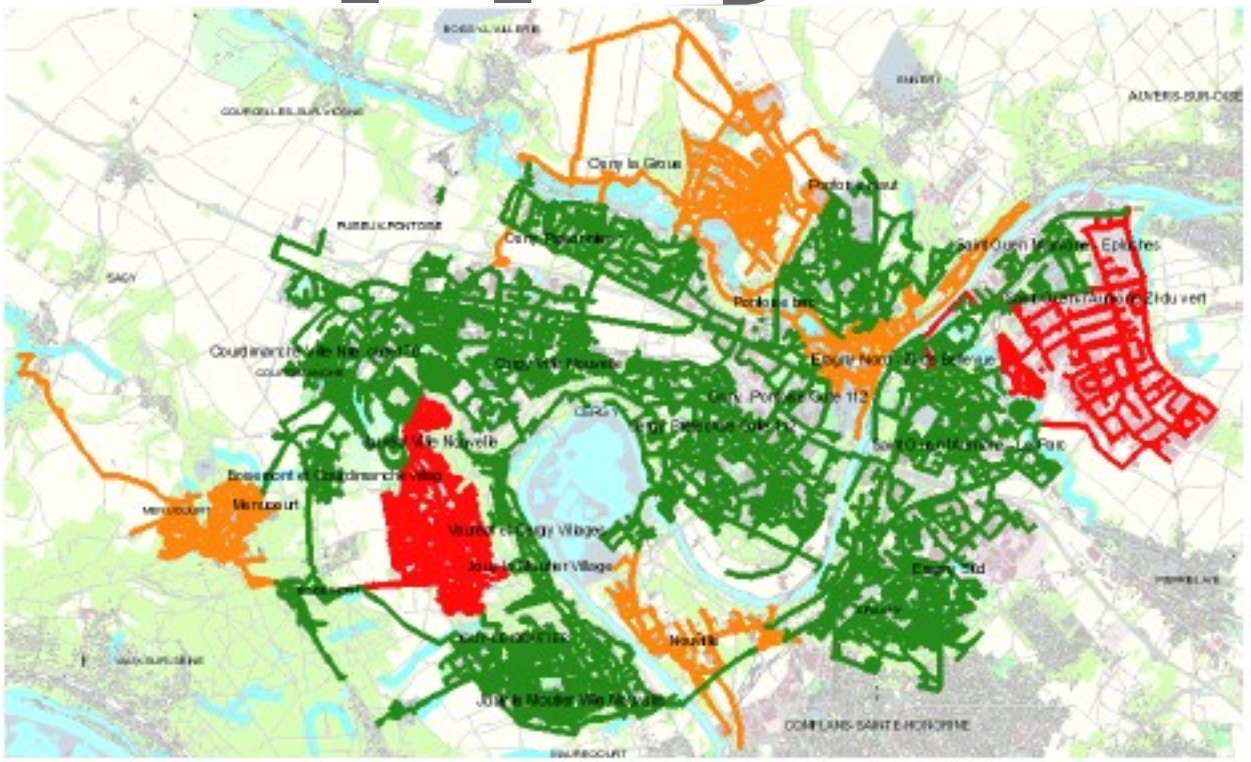


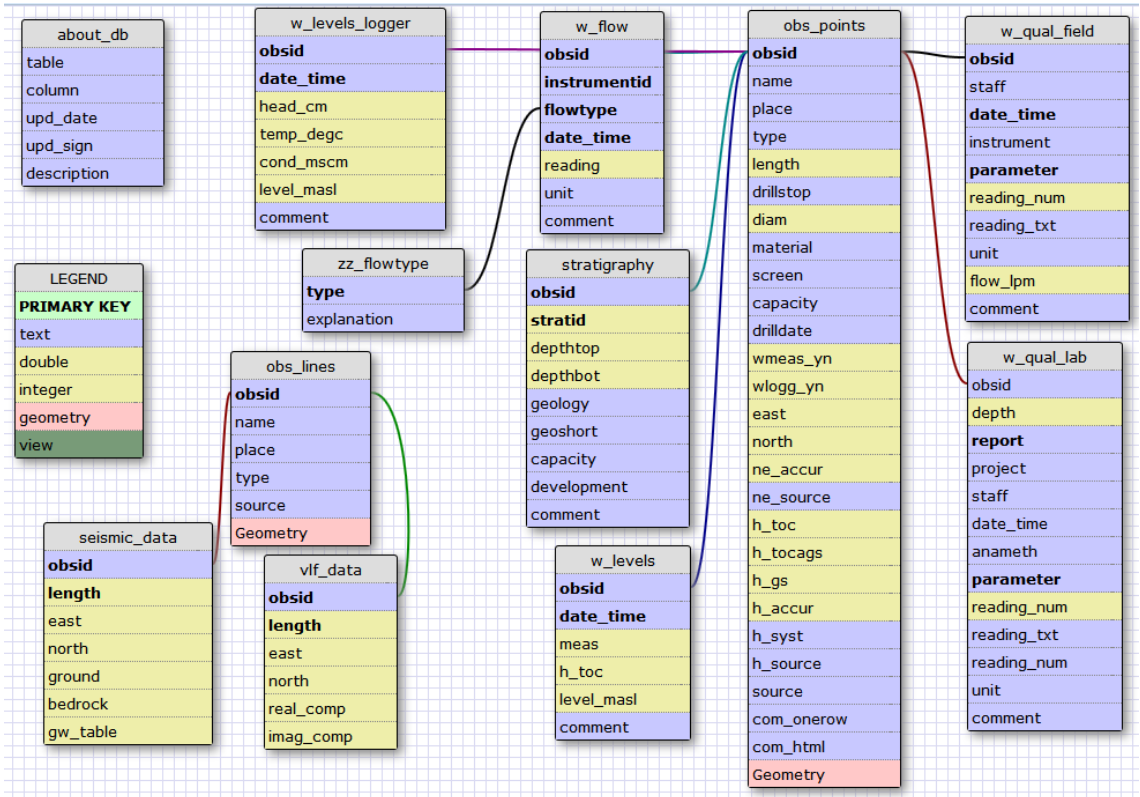
Water supply



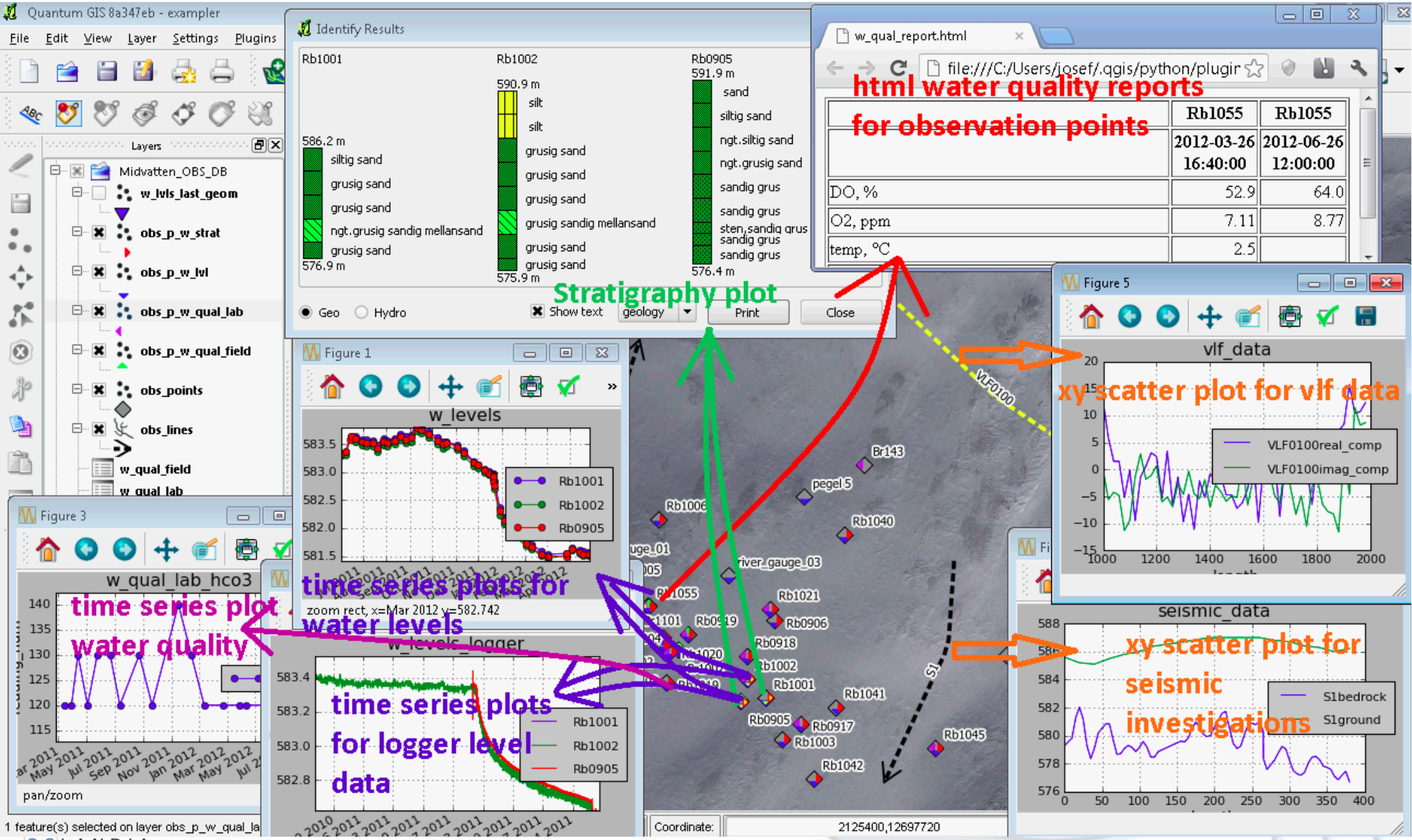
OSLANDIA

Midvatten

QGIS Plugin
Hydrogeological observations
Plots
Reporting
Time series
Database



OSLANDIA


Quantum GIS 8a347eb - exampler
File Edit View Layer Settings Plugins
Layers
Midvatten_OBS_DB
w_lvls_last_geom
obs_p_w_strat
obs_p_w_lvl
obs_p_w_qual_lab
obs_p_w_qual_field
obs_points
obs_lines
w_qual_field
w_qual_lab
Identify Results
Rb1001
586.2 m
siltig sand
grusig sand
grusig sand
ngt.grusig sandig mellansand
grusig sand
576.9 m
Rb1002
590.9 m
silt
silt
grusig sand
grusig sand
grusig sand
grusig sandig mellansand
grusig sand
grusig sand
575.9 m
Rb0905
591.9 m
sand
siltig sand
ngt.siltig sand
ngt.grusig sand
sandig grus
sandig grus
sten,sandig grus
sandig grus
sandig grus
576.4 m
Geo
Hydro
Show text
geology
Print
Close
Stratigraphy plot
w_qual_report.html
file:///C:/Users/josef/.qgis/python/plugir
html water quality reports
for observation points
Rb1055
Rb1055
2012-03-26 16:40:00
2012-06-26 12:00:00
DO, %
52.9
64.0
O2, ppm
7.11
8.77
temp, °C
2.5
Figure 1
w_levels
Rb1001
Rb1002
Rb0905
zoom rect, x=Mar 2012 y=582.742
time series plots for water levels
Figure 3
w_qual_lab_hco3
time series plot water quality
pan/zoom
w_levels_logger
time series plots for logger level data
Rb1001
Rb1002
Rb0905
Figure 5
vlf_data
xy scatter plot for vlf data
VLF0100real_comp
VLF0100imag_comp
VLF0100
seismic_data
xy scatter plot for seismic investigations
S1bedrock
S1ground
S1
Br143
pegel 5
Rb1006
Rb1040
river_gauge_03
Rb1055
Rb1021
Rb0906
Rb0918
Rb1002
Rb1001
Rb1041
Rb0905
Rb0917
Rb1003
Rb1045
Rb1042
Coordinate:
2125400,12697720
1 feature(s) selected on layer obs_p_w_qual_la

X - What now ?

OSLANDIA

Towards FOSS4G water solution

Most features exist
PostGIS + QGIS =
good platform to start with
Integration work
User feedback needed

OSLANDIA

OSLANDIA

Cloud WebServices

CrayFish

EPANET

TauDEM

Plugins

Quantum GIS

Interface Integration

Spatial Database

PostGIS Spatial PostgreSQL

Oracle Spatial and Graph

Microsoft SQL Server

sextante

GDAL

FTOOLS

SAGA GIS

GRASS

PostGIS

OTB

LAS

OPENCV

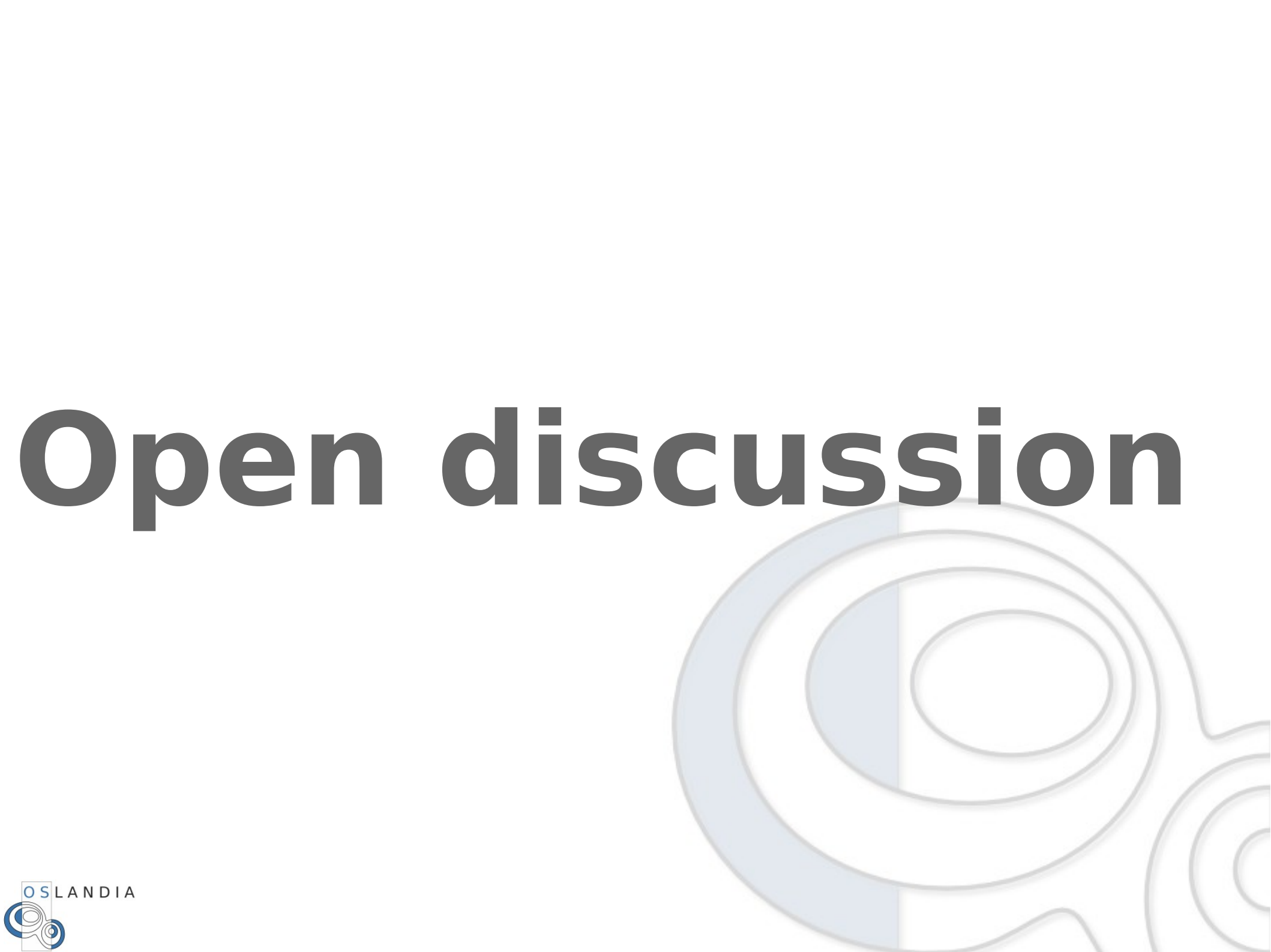
R

OSLANDIA

Open points

- Database models
- Workflows
- Better simulation integration
- Sensor servers integration
- Advanced symbology
- Packaging
- Community
- Mutualization of devs & funding

Open discussion



OSLANDIA

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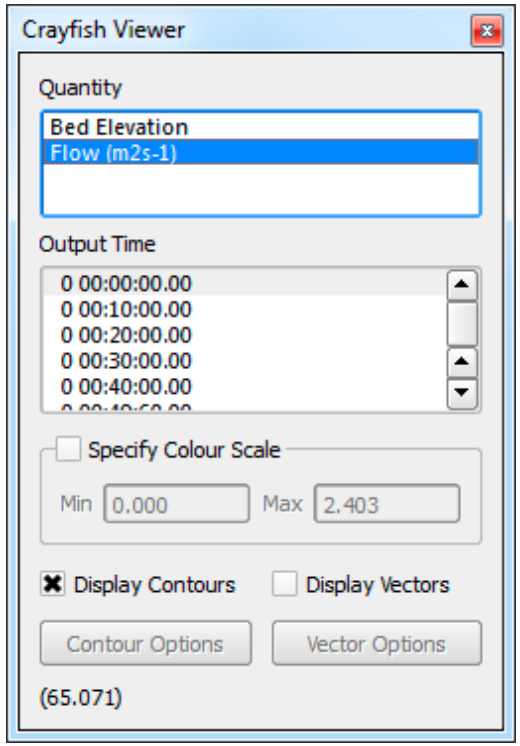
http://www.oslandia.com

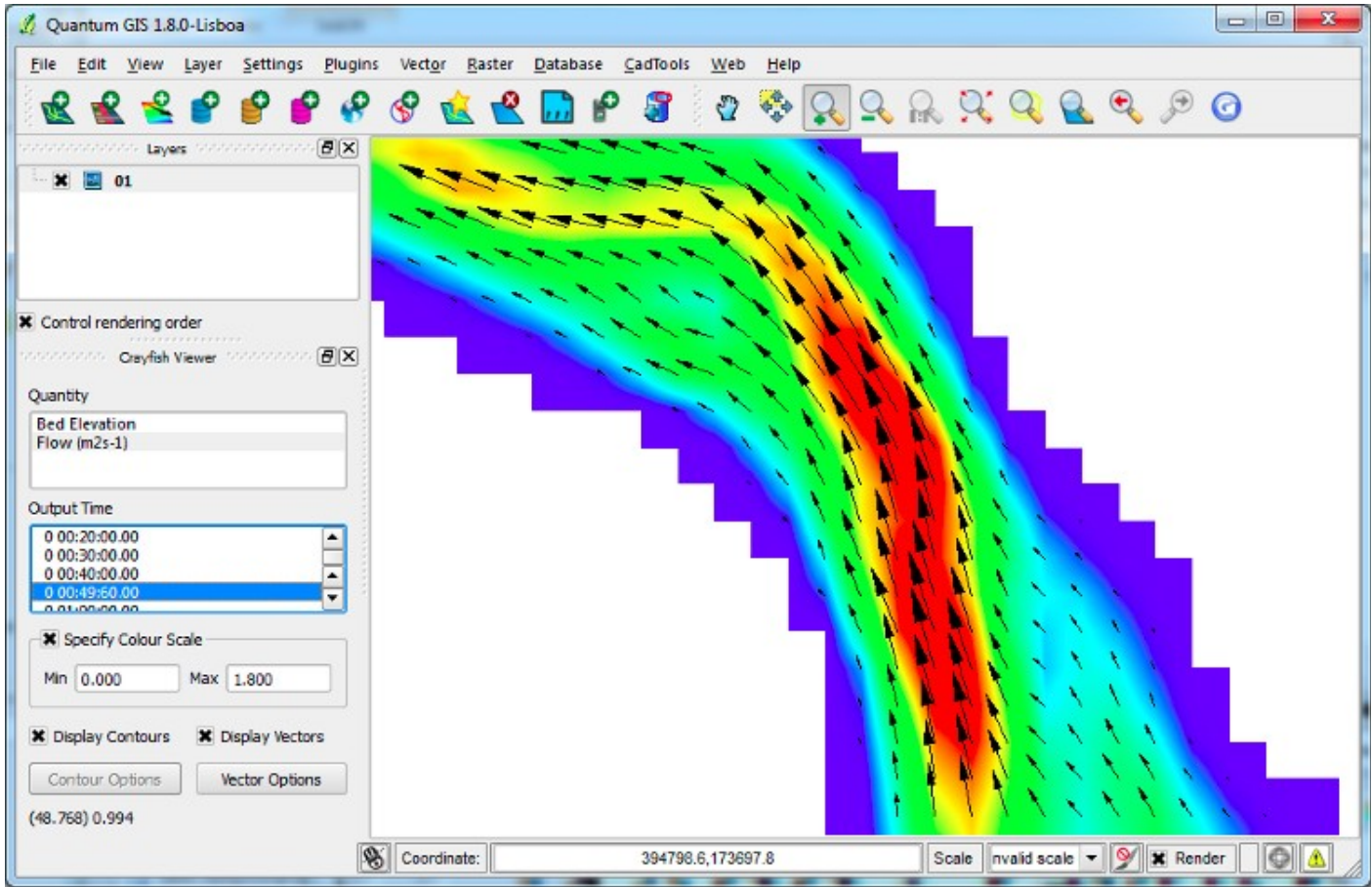
CrayFish

QGIS Plugin

Pre/post modelers processing

Vector rendering (flow)





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