Data, Data, Data
Essential Segment of Hydroinformatics

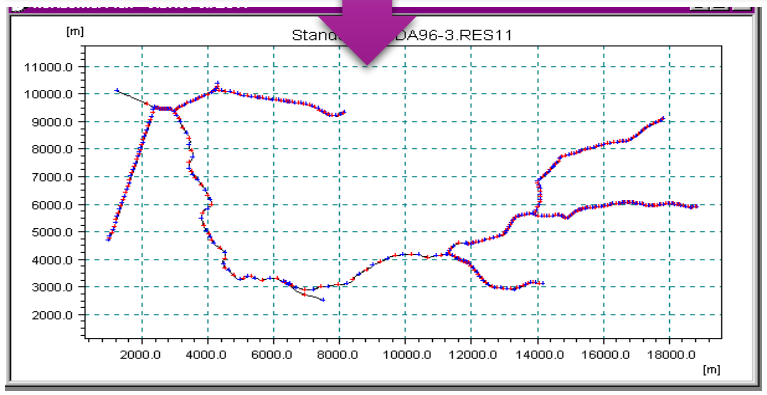
"Since post-industrial organisations will be faced with increasing environmental complexity and turbulence, organisation’s need to process information and make decisions will be substantially increased" (Huber, 1984).

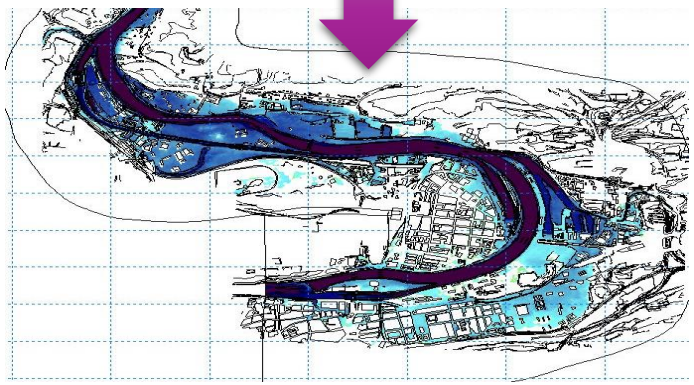
"IT is the primary element that organisations use to anticipate, react and respond to environmental change and to align their structures with the changed environment," (Haefner, 1992)

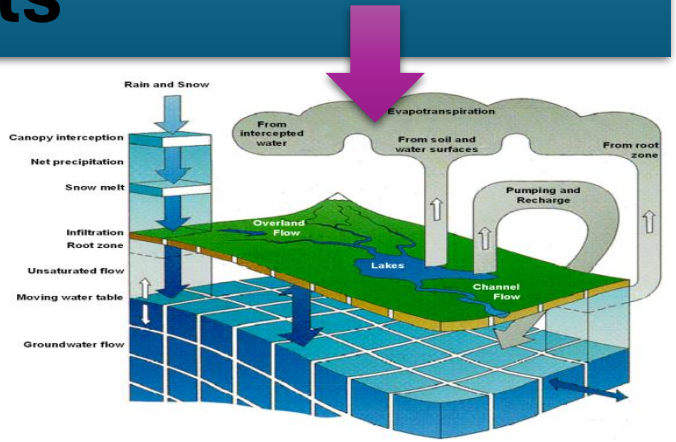
Data for simulation model

1. Structural data
2. Processes data
3. Supplementary data
4. Model parameter data

1D, 2D, 3D simulation models

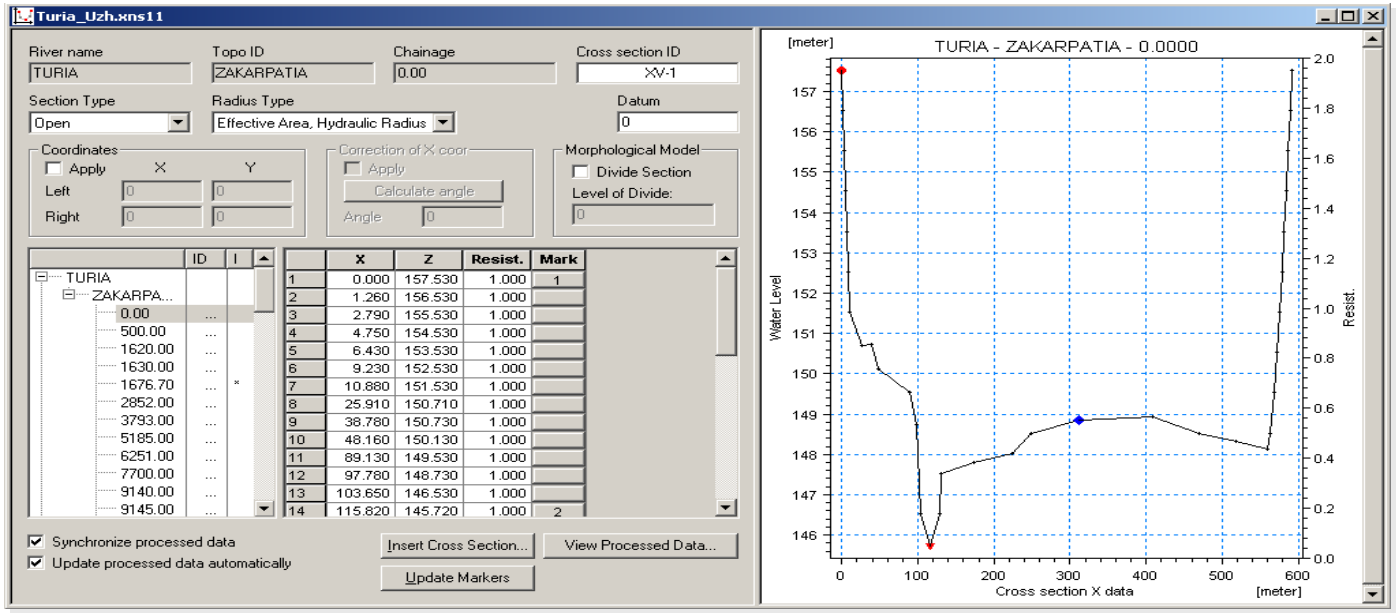






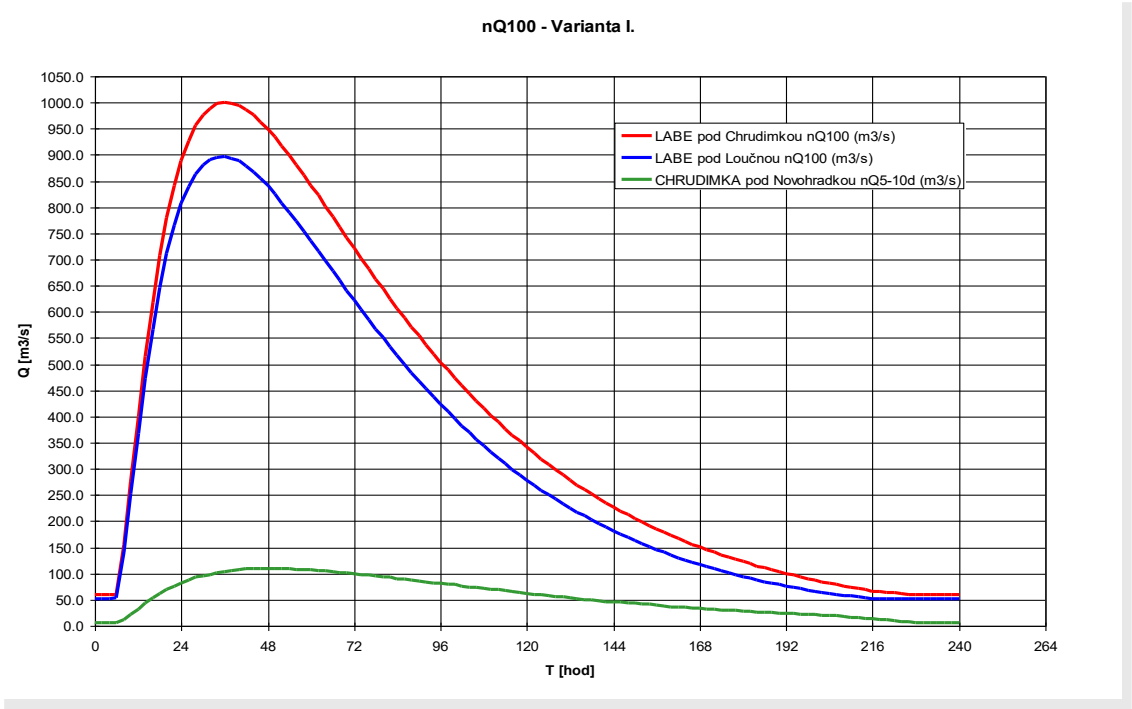
Structural data (sewer system)

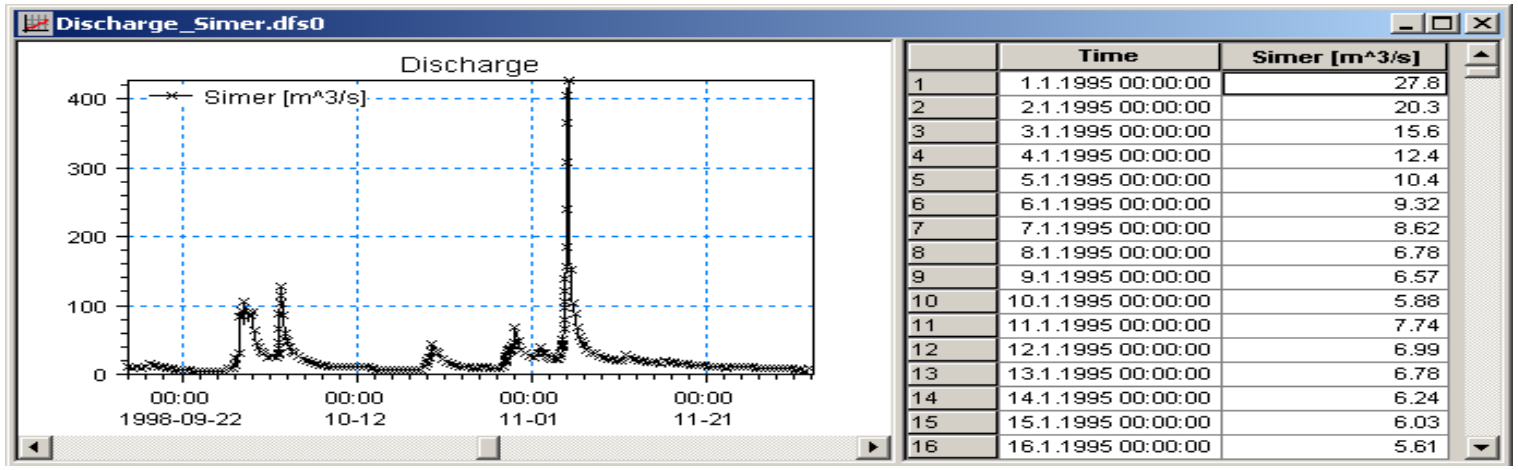
1. manhole (X,Y,Z1,Z2,DN)
2. pipe (X,Y,DN, slope,Z1,Z2,material)
3. pump (X,Y,Z, Q/H curve, operation rules)
4. CSO (X,Y,Z, dimensions, Crest L+h)
5. Basins (X,Y,Z, dimensions)
6. Outlets (X,Y,Z, Water h)
7. topological connections
8. …



Process data (historical or measured)

1. Q,H,P, i, time series
2. Structure opening/close graphs
3. Q/H curves
4. Diurnal variation time series
5. WQ data
6. Other …

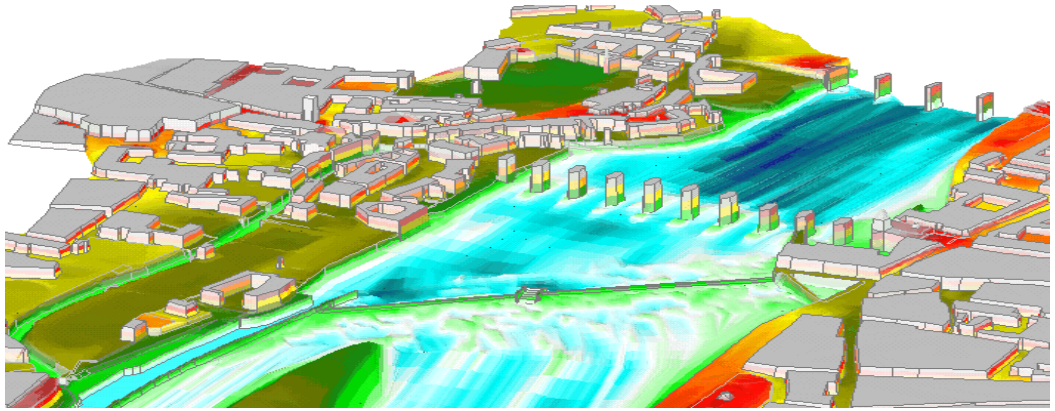




	Time	Simer [m^3/s]
1	1.1.1995 00:00:00	27.8
2	2.1.1995 00:00:00	20.3
3	3.1.1995 00:00:00	15.6
4	4.1.1995 00:00:00	12.4
5	5.1.1995 00:00:00	10.4
6	6.1.1995 00:00:00	9.32
7	7.1.1995 00:00:00	8.62
8	8.1.1995 00:00:00	6.78
9	9.1.1995 00:00:00	6.57
10	10.1.1995 00:00:00	5.88
11	11.1.1995 00:00:00	7.74
12	12.1.1995 00:00:00	6.99
13	13.1.1995 00:00:00	6.78
14	14.1.1995 00:00:00	6.24
15	15.1.1995 00:00:00	6.03
16	16.1.1995 00:00:00	5.61

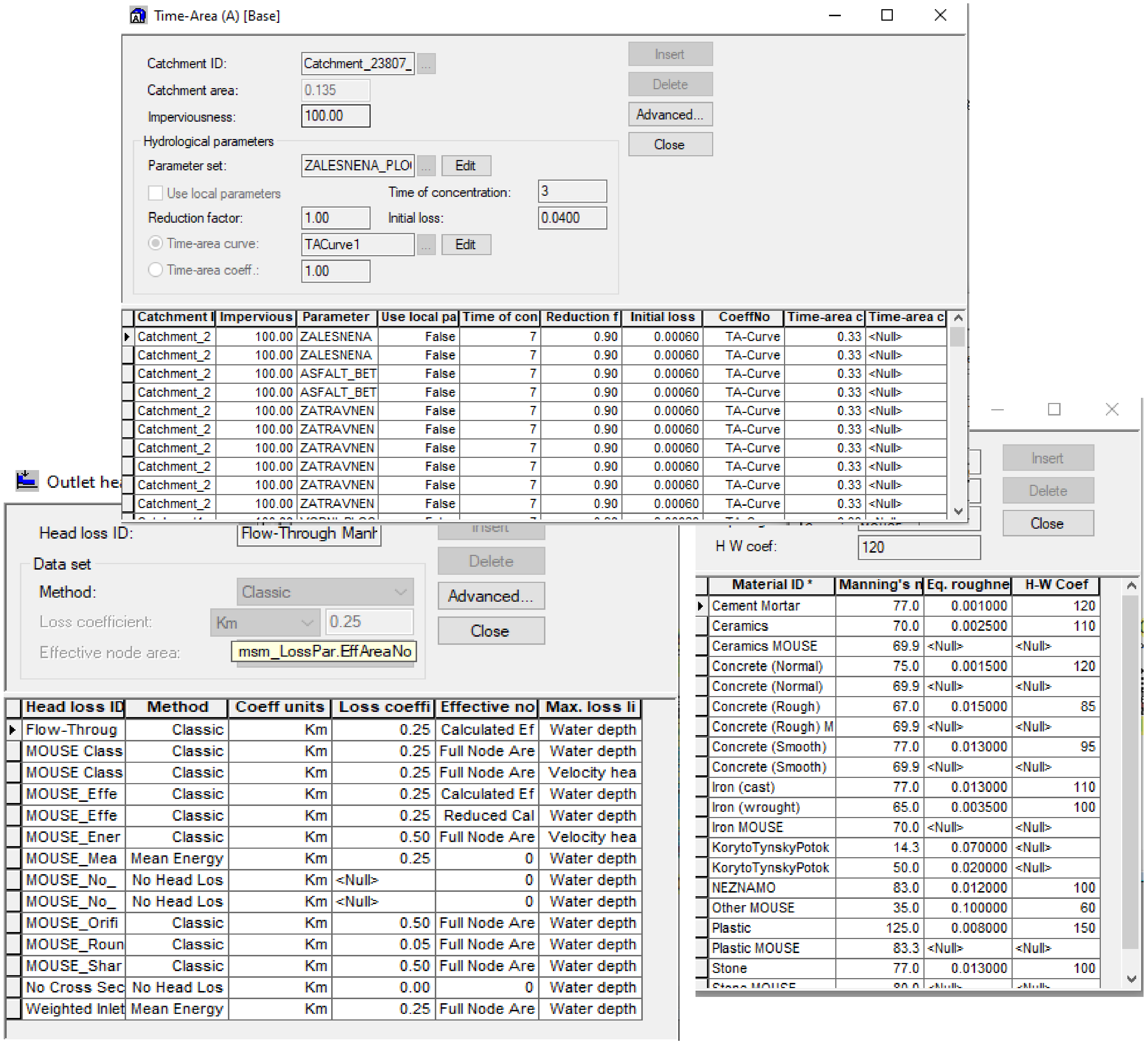
Supplementary Data

- Cadaster data
- aerial photos, orto-photos
- Paper and digital maps
- technical maps of cities
- Digital terrain model
- Demographical data
- Other …

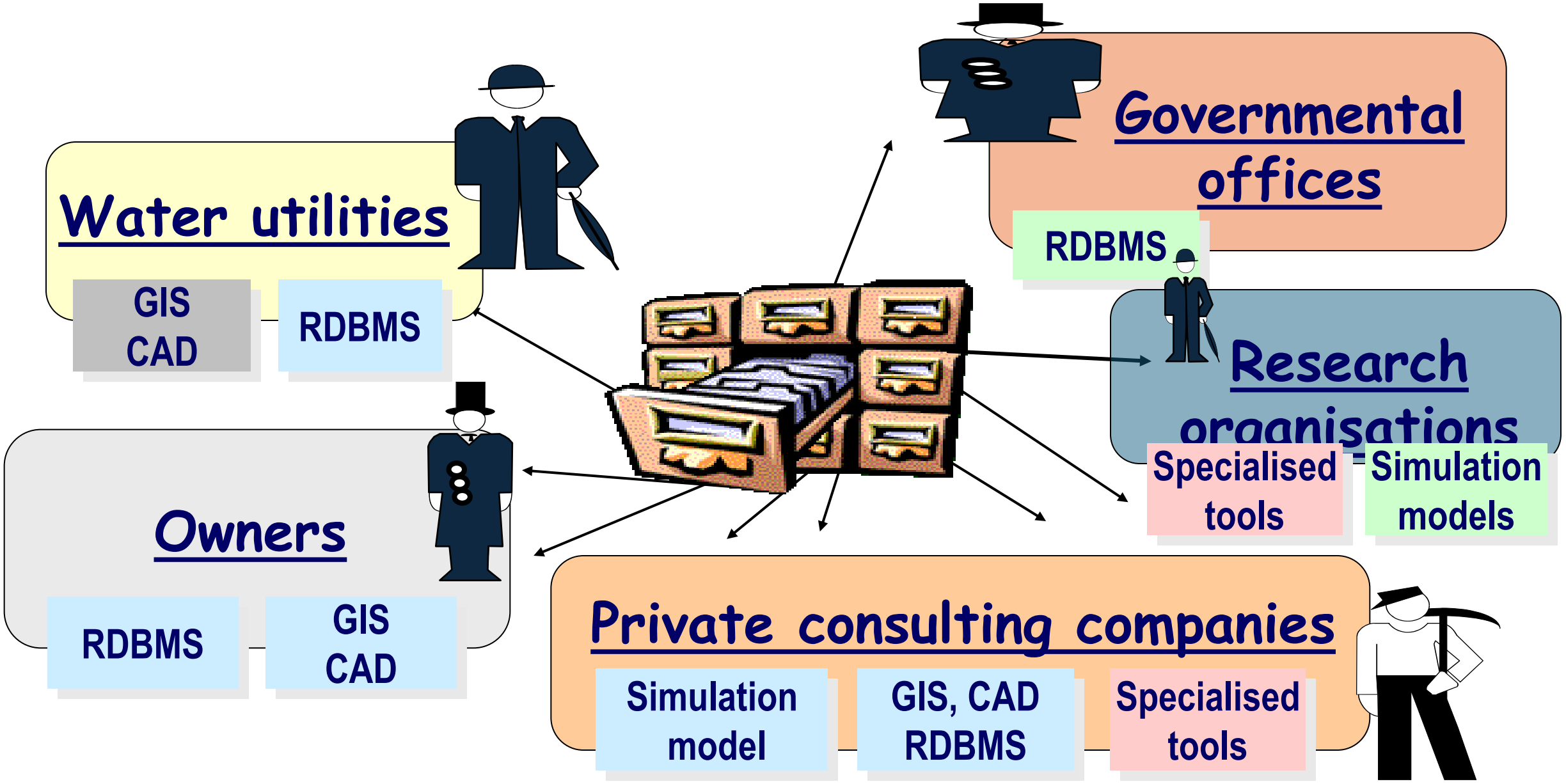


Model parameters

- Time of Concentration
- Roughness coefficient
- Initial loss
- Impermeability data
- Calculation time step
- Model selerity …
- Head and friction loss



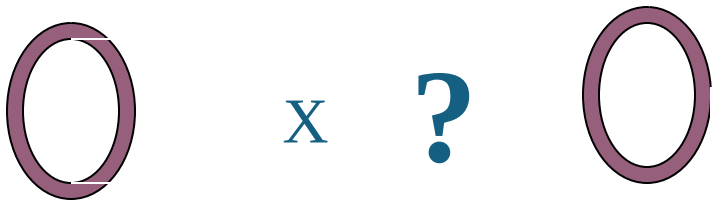
Model data sources



Data interpretation

Adristic sea X *Baltic sea*

- Sewerage network data



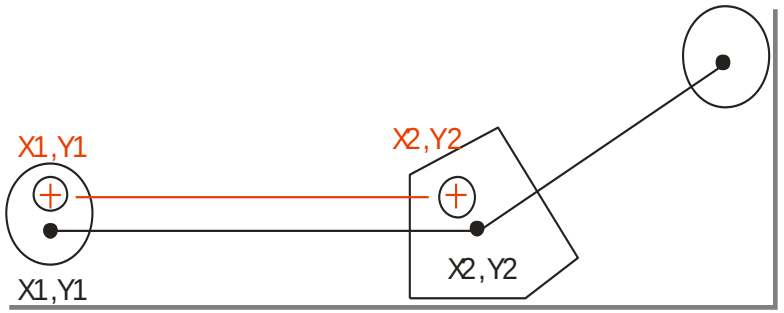
- Number of inhabitants

- Nepropustné plochy

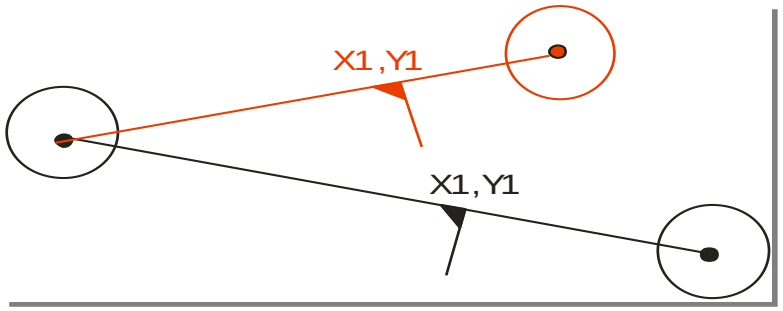
Návrh x Realita

Data interpretation problems

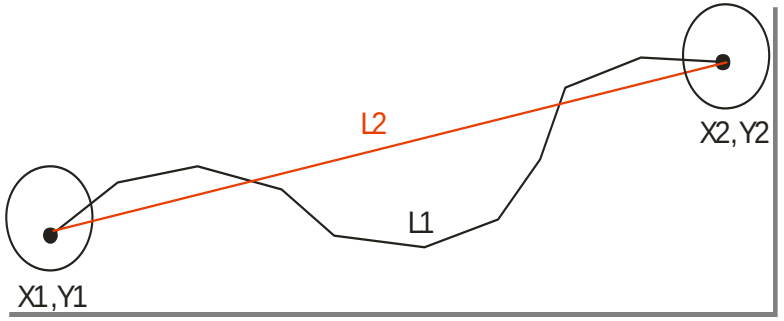
Geodesy



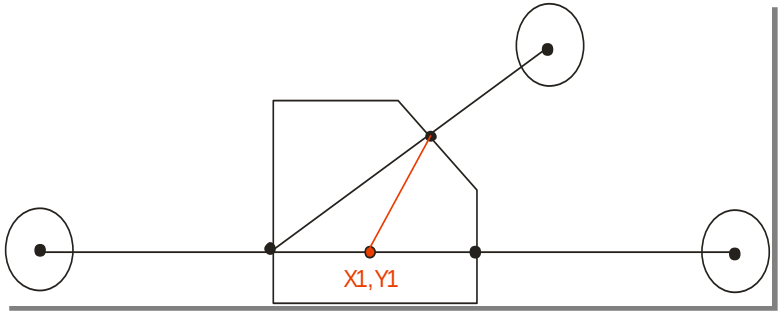
Relative distances



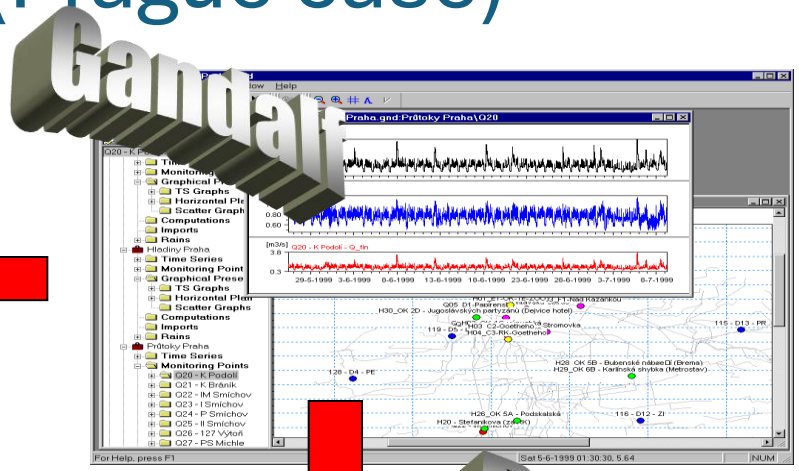
Topology

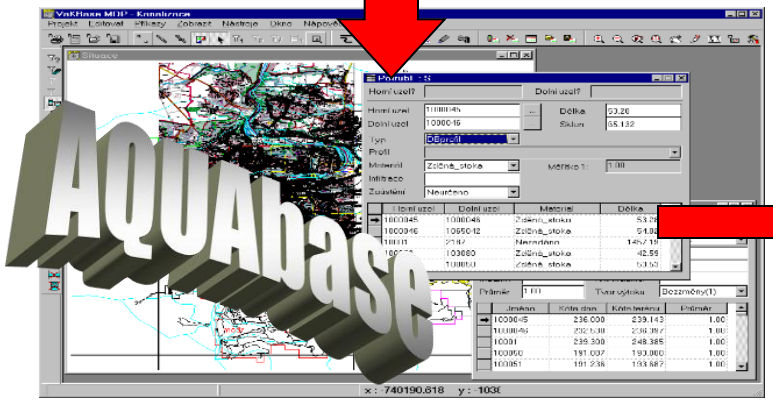


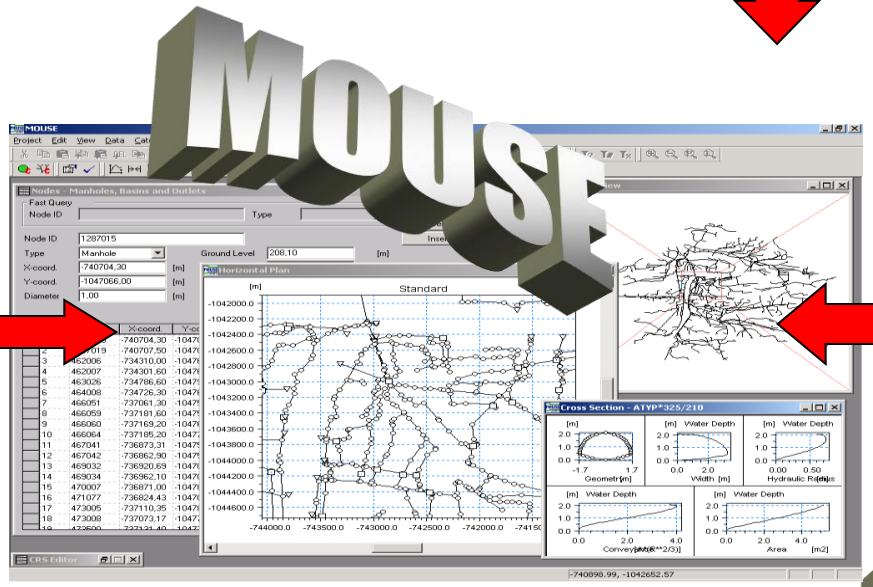
Structures

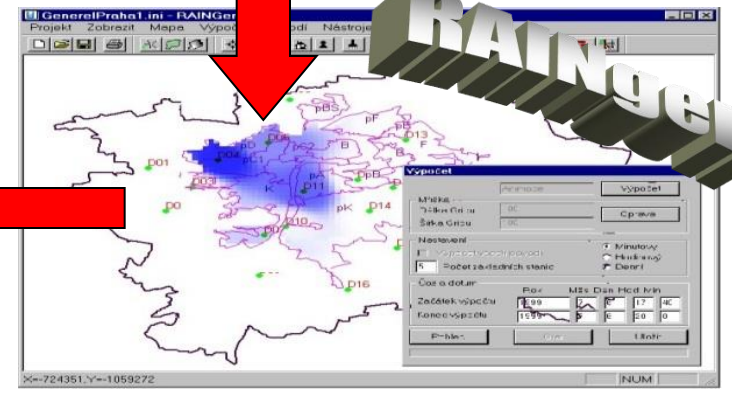


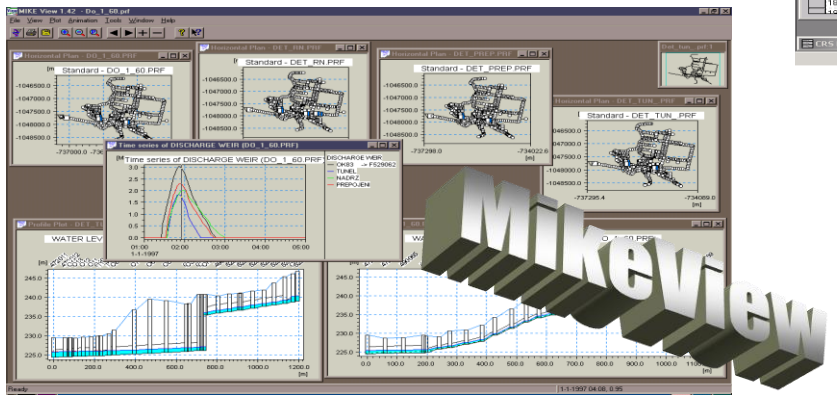
Data integration Challenges (Prague case)

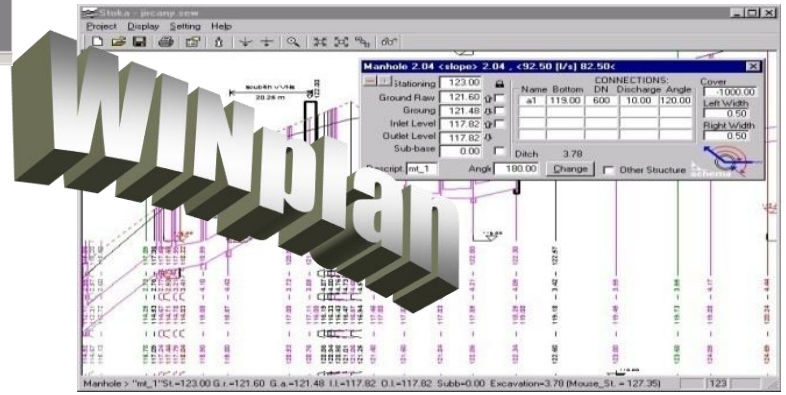




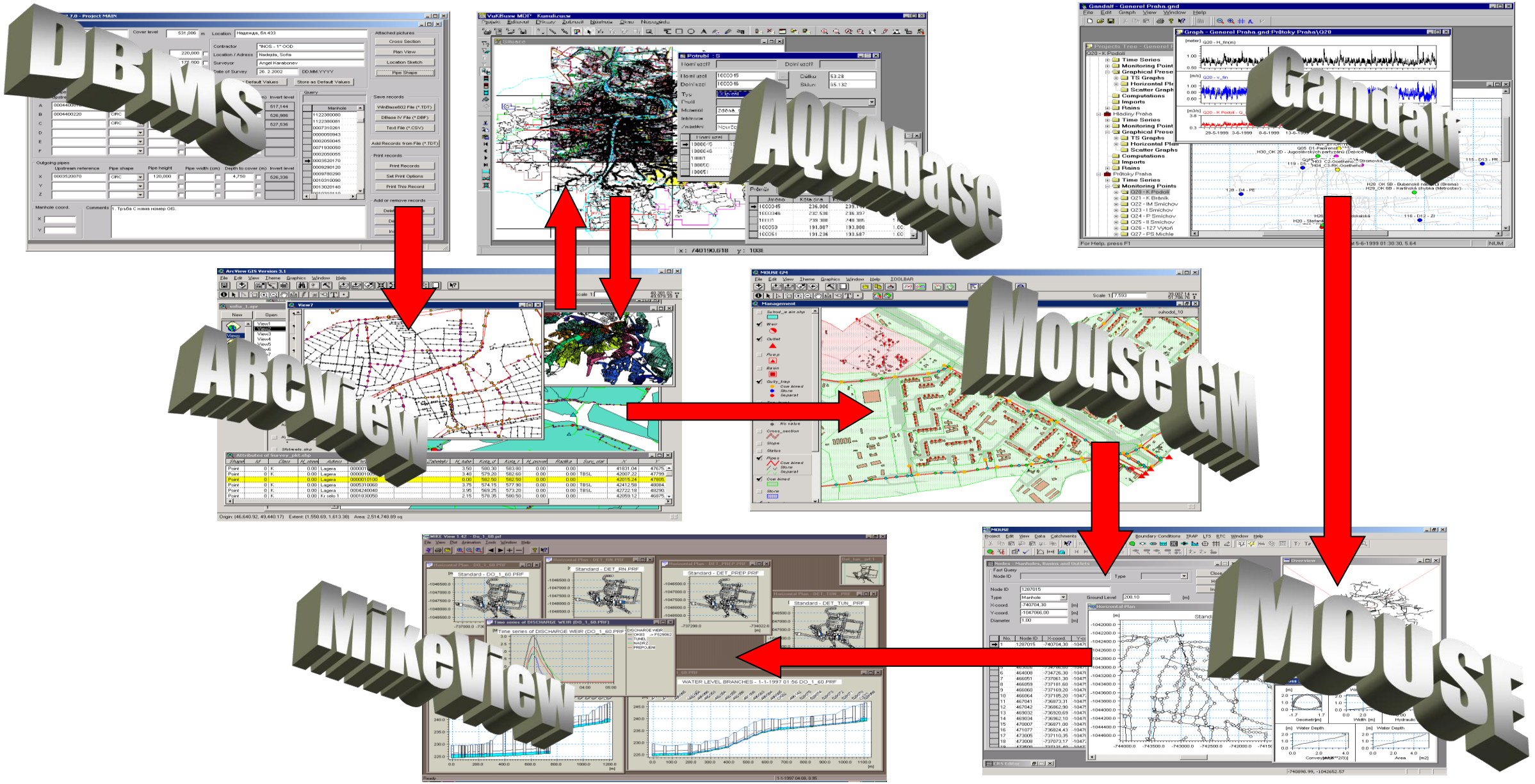




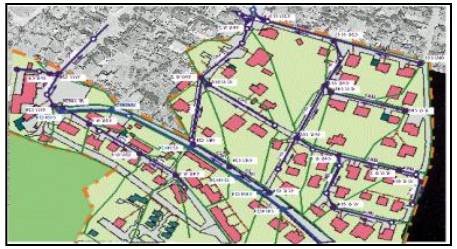


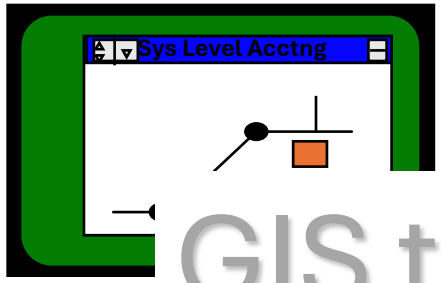


Data integration challenges (Sofia case)

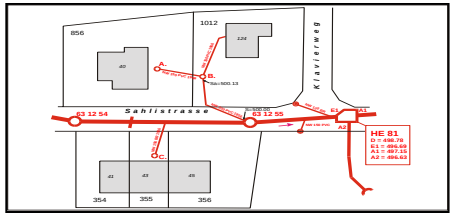


Data integration needs

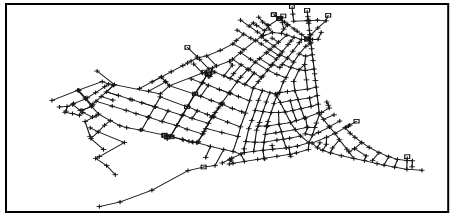


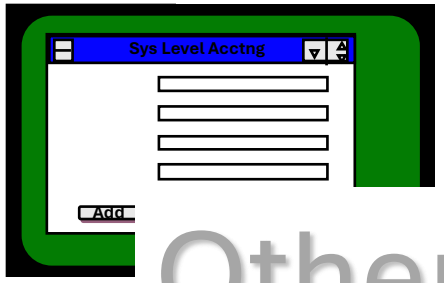


GIS tools

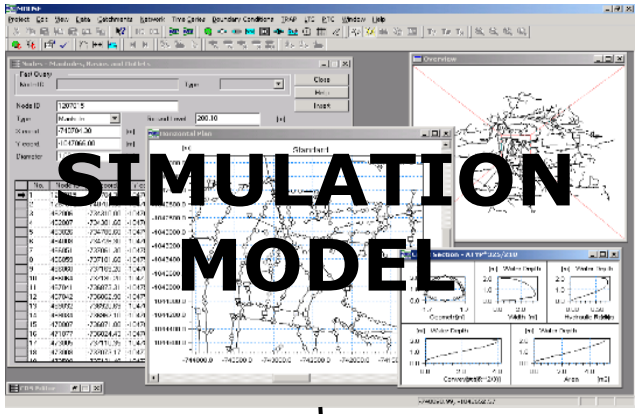


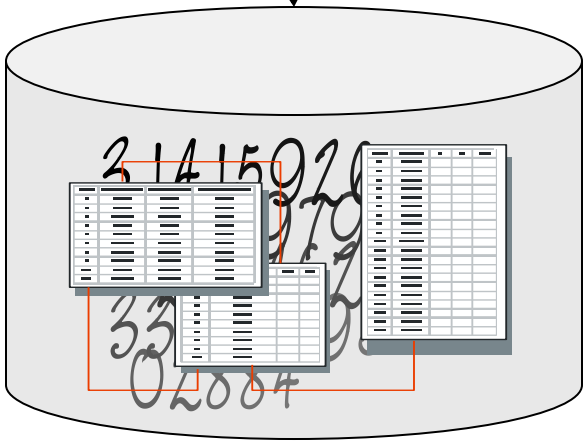
CAD tools





Other tools



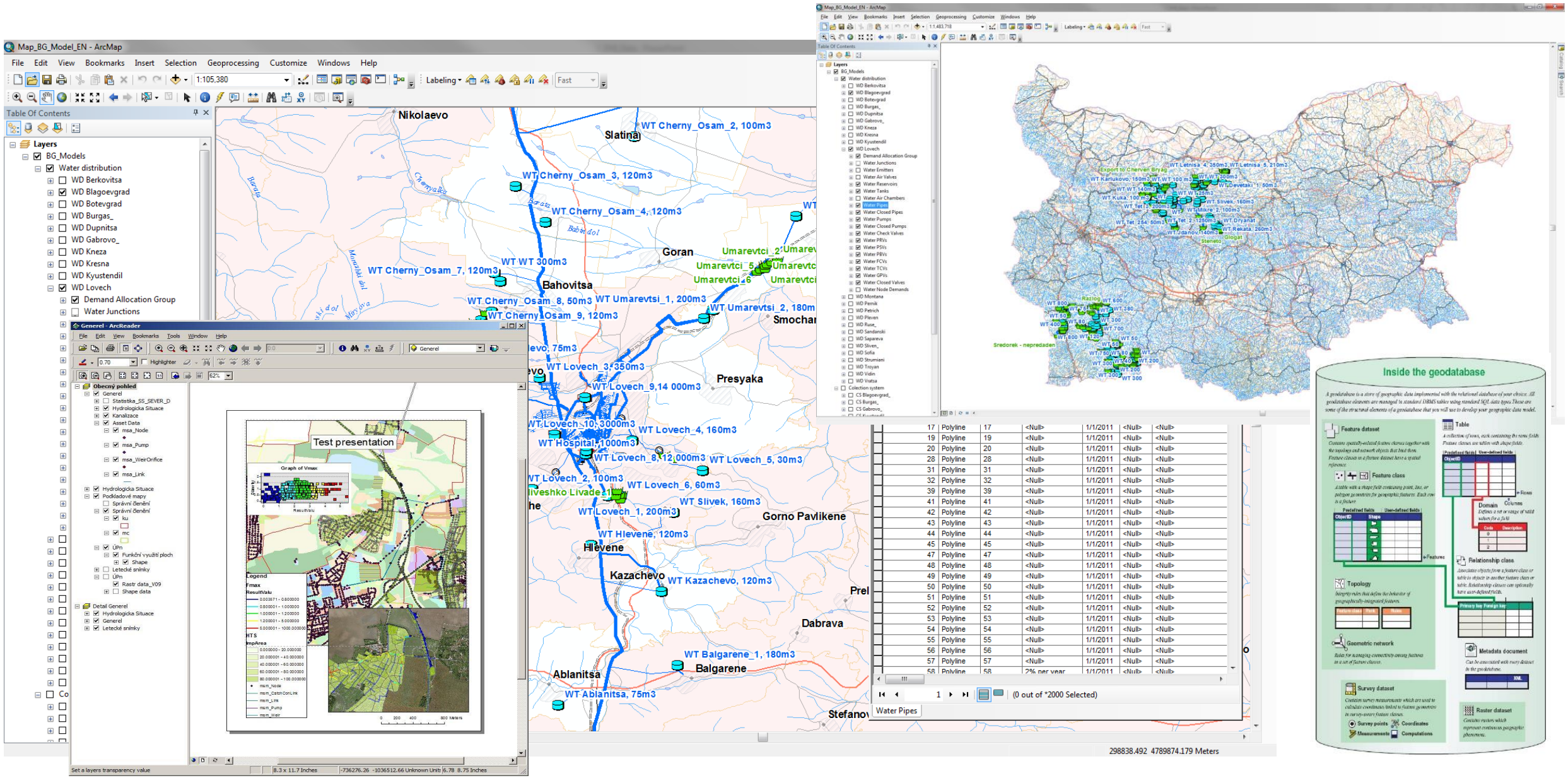


Databases

Use of Databases

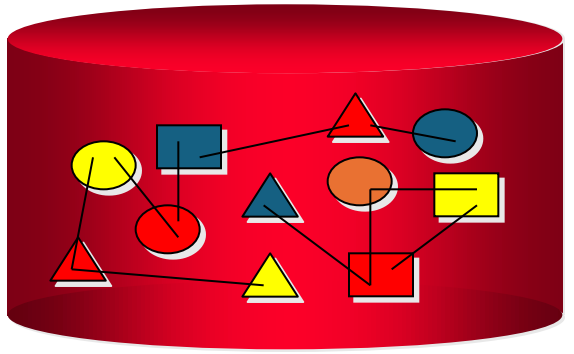
- organization and backup and data management (table and view)
- prioritization of user access (banks, PIN)
- core or base for simulation and GIS tools
- fast data selection and sorting
- analysis of selected data (statistics)
- binding of individual objects and their attributes in accordance with their purposes (sewer GIS data example)

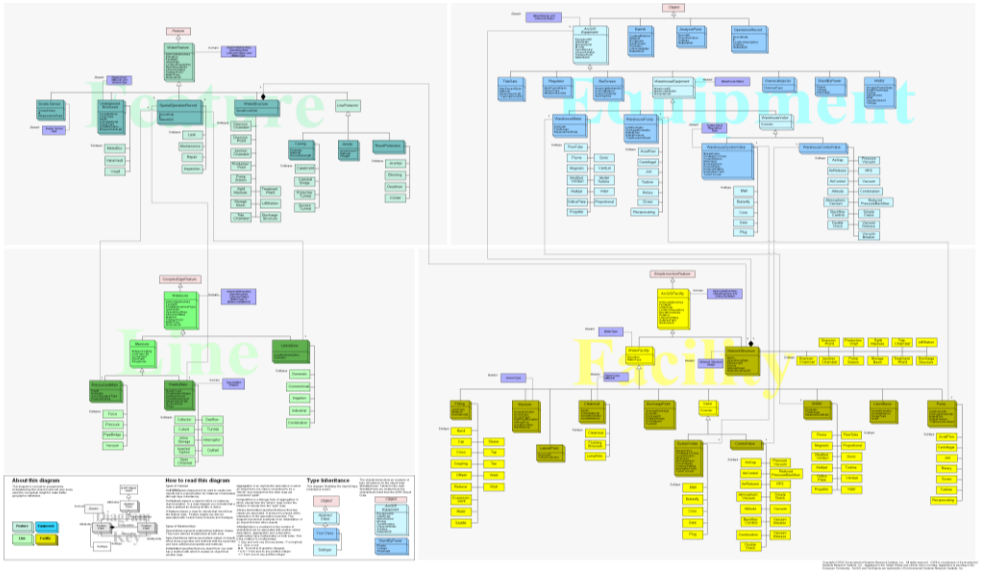
Graphical Databases - GIS systems



Database and Data Models

Data model is a mental interpretation of real world structure into the structure of database entities and relations





Other data aspects

- Data : **Garbage in – Garbage out**
- Data **life time**
- Modeling - **60-70% work with data**
- Random and systematic **errors**
- Data **import/export** aspect
- **Data storage** and use
- Data **volumes**
- **Data processing** – raw data, processed and verified data
- Data **presentation** and **interpretation**
- Data – **monetary value**
- Data acquisitions - **surveys**

Data communication challenges

Data formats- vector and raster data, ASCII x BIN x RDB,…

Data structures – time series, summer/winter calender, structures

Data in/exports- network topology, coordinate systems, units, data conversion

Data manipulation – data volumes, data management, redundanses, updates

Generic – data price, units, formats, semantic misunderstanding, HW, SW

Unproductive, timely and financially demanding activity, danger of random or systematic errors, problem of continuity and data updates

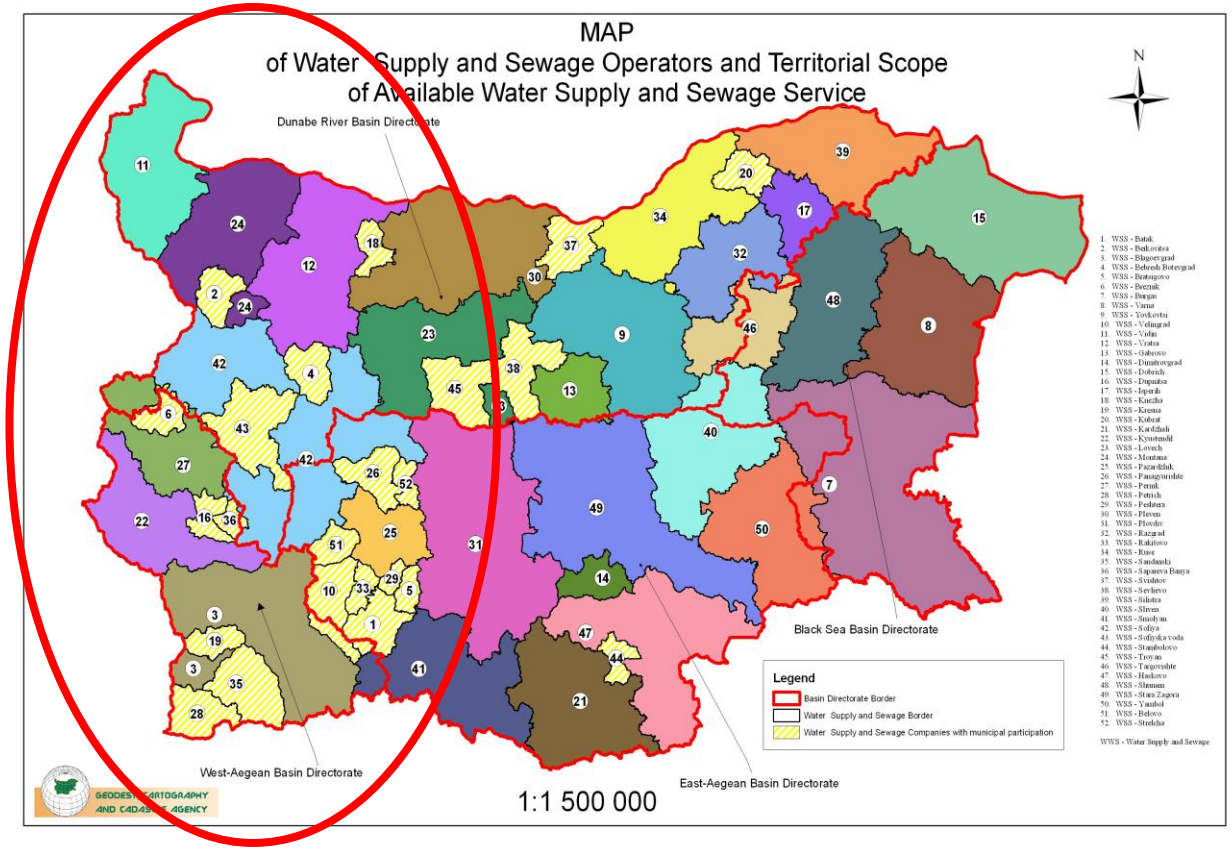
Data and Project Documentation

Case study – Western region project

PREPARATION OF REGIONAL WATER AND WASTEWATER MASTER PLANS FOR WESTERN REGION - MIDP-MP-QCBS3 – 2012-2013

- Client: MRDPW
- Beneficients: Municipalities + WU
- Duration: **18** months
- **DHI, NIRAS, RAMBOLL, SCG, AQP**
- DHI: **Full water supply RMP**

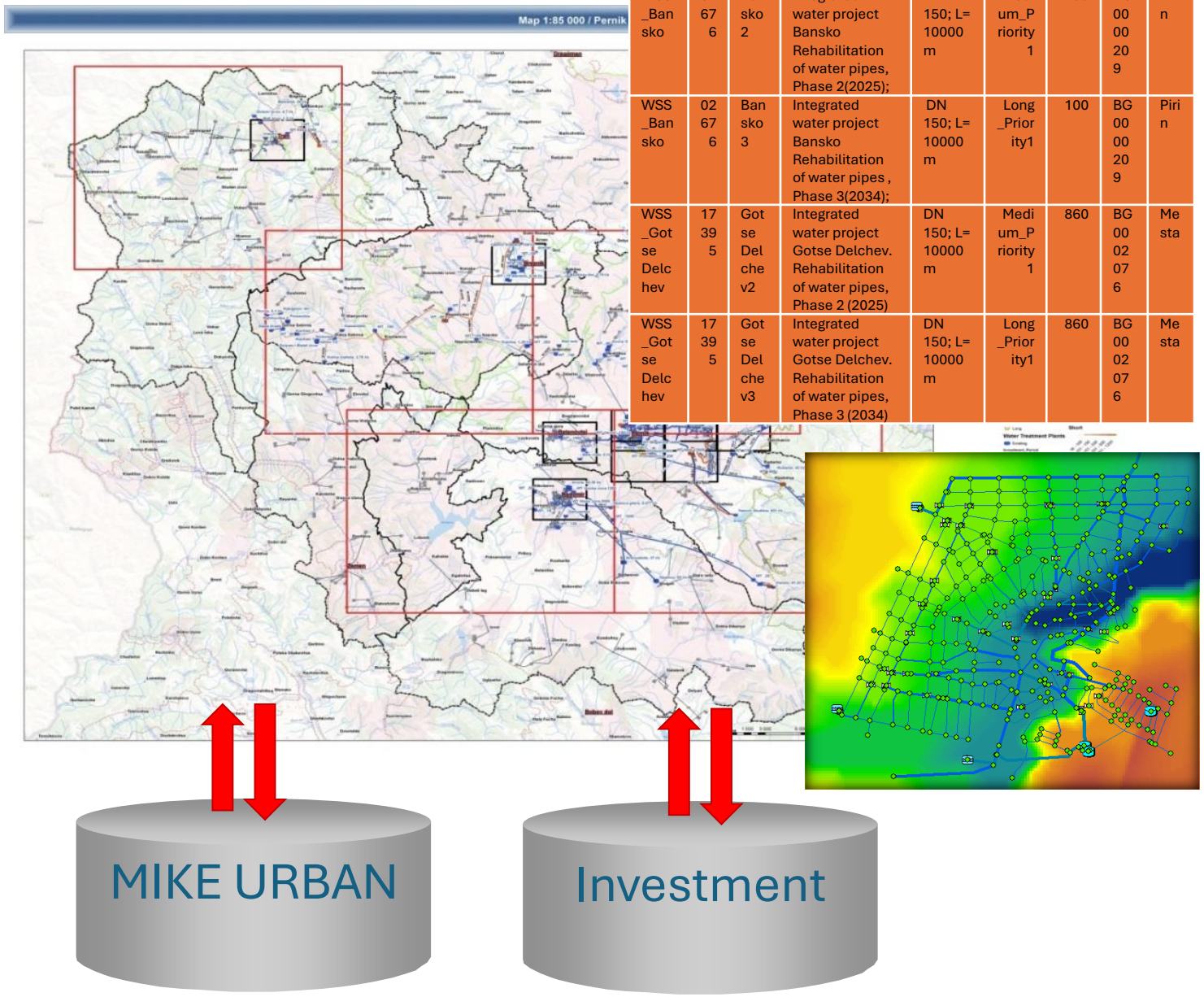
- 19 regions (out of 52)
- Settlements above 2000 PE: **118**
- Total population: **1 166 000 inhabs.**
- Total area size: **40 000 km2**



Use of spatial (GIS) data

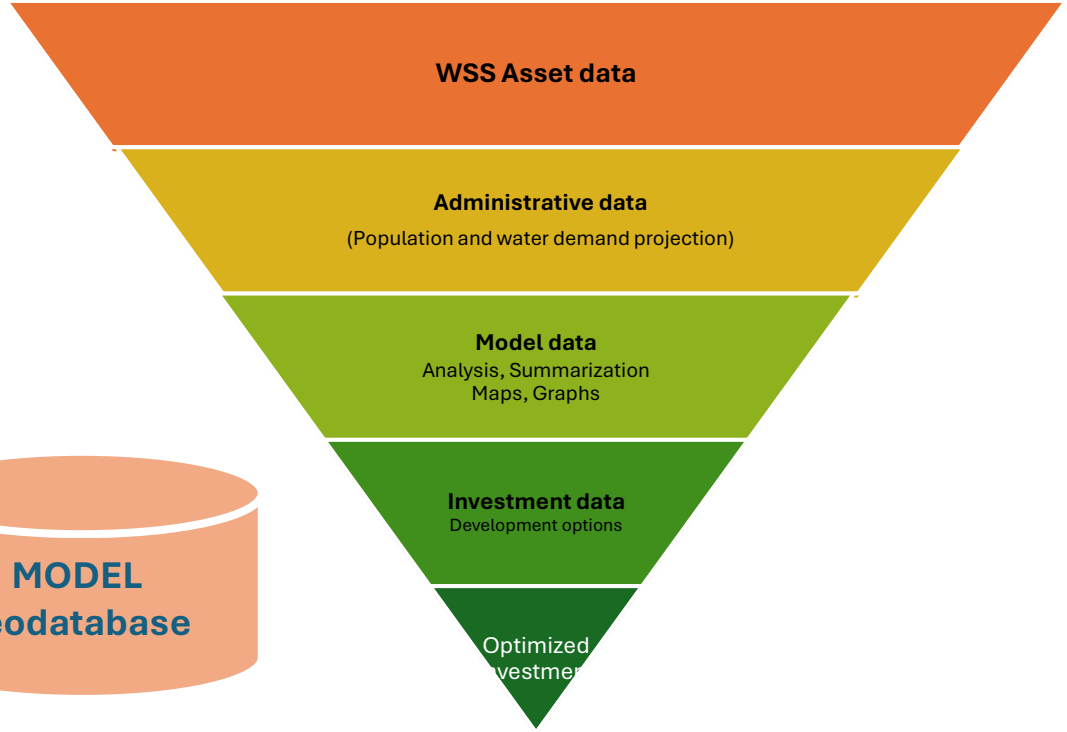
1. Coordinate systems WGS84
2. GIS x CAD data files
3. GIS Layers
   a) Cadaster
   b) Settlements (EKATE)
   c) JAICA (rivers, regions, etc.)
   d) Street maps (or alternative)
   e) Natura 2000
   f) Model results !!!
   g) …
4. Connection to Investments
   a) Automatic data updates

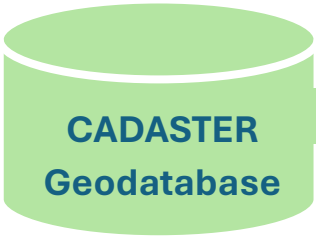
WSS	EKATTE	Investment_ID	Description_Group	Parameters	Priority	Natura2000_dist	Natura2000_code	Natura2000_name
WSS_Bansko	02676	Bansko2	Integrated water project Bansko Rehabilitation of water pipes, Phase 2(2025);	DN 150; L=10000 m	Medium_Priority 1	100	BG0000209	Pirin
WSS_Bansko	02676	Bansko3	Integrated water project Bansko Rehabilitation of water pipes , Phase 3(2034);	DN 150; L=10000 m	Long_Priority1	100	BG0000209	Pirin
WSS_Gotse Delchev	17395	Gotse Delchev2	Integrated water project Gotse Delchev. Rehabilitation of water pipes, Phase 2 (2025)	DN 150; L=10000 m	Medium_Priority 1	860	BG0002076	Mesta
WSS_Gotse Delchev	17395	Gotse Delchev3	Integrated water project Gotse Delchev. Rehabilitation of water pipes, Phase 3 (2034)	DN 150; L=10000 m	Long_Priority1	860	BG0002076	Mesta

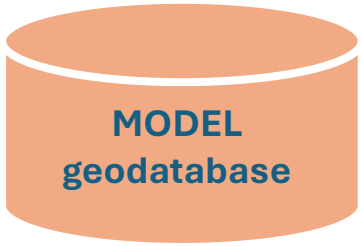


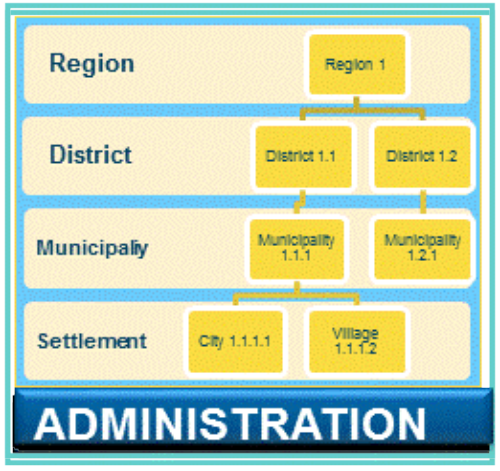
Basic project data structure and storage

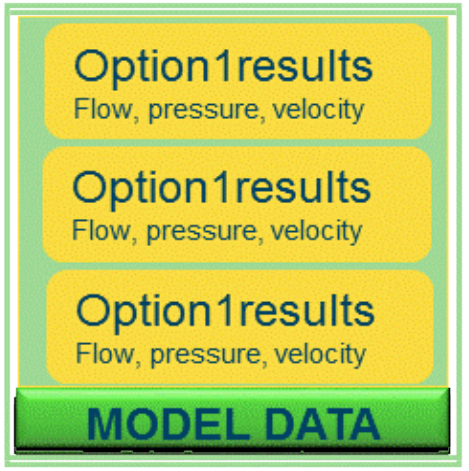
1. Digital processing of all data from A to Z
2. GIS based data structure
3. Core Water data
   a) Asset data
   b) Model data
   c) Administrative data
   d) Investment data











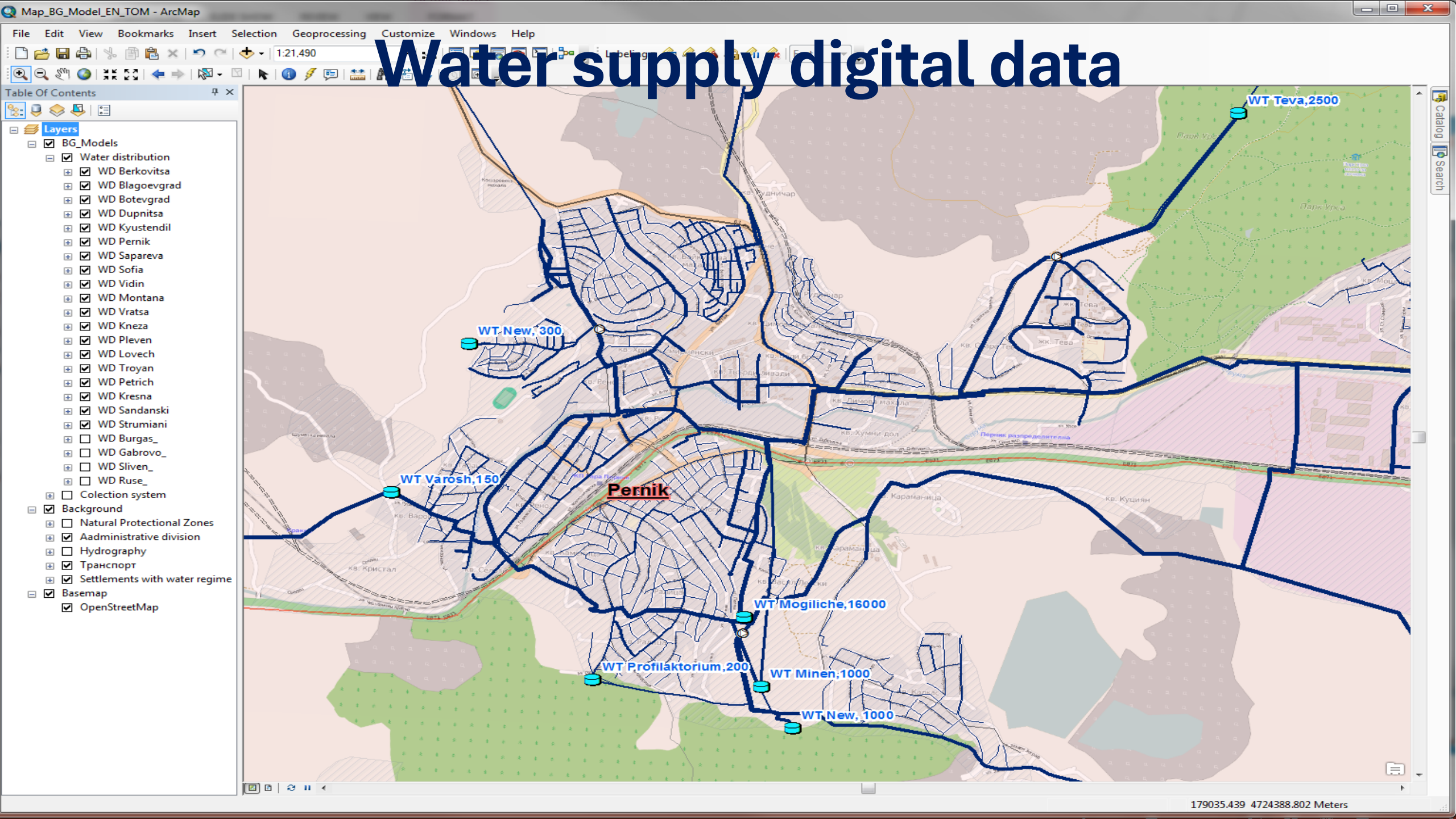
Data Collection activities

- ✓ 2 data digitization groups (6-8 persons)
- ✓ 5 data collection teams (15 persons)
- ✓ 2 monitoring teams (6-8 persons)
- ✓ Data collection period: 6 months

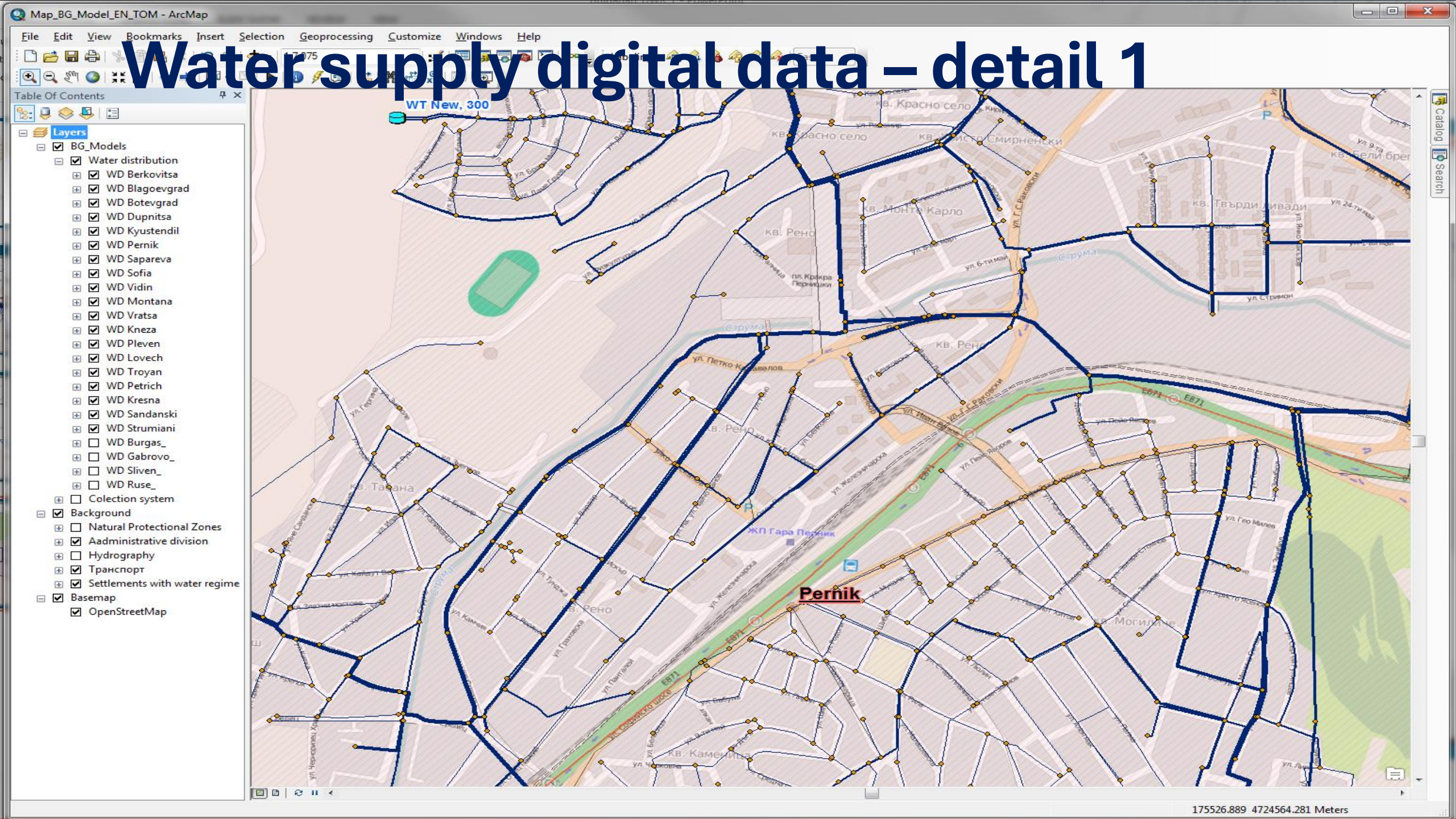
approx. 50-60 manmonths

1. **STRUCTURAL DATA**
   a. pipes (X, Y, DN, Z, material)
   b. pumps (X, Y, Z, Q/H curve,)
   c. Reservoirs (X,Y,Z, dimensions)
   d. Intakes (X,Y,Z, capacity)
   e. Valves (X,Y,Z, operation rules)
   f. topological connections
2. **FUNCTIONAL DATA**
   a. Q,P, time series
   b. Q/H graphs
   c. Water demand time series
3. **OTHER DATA**
   a. Cadaster,
   b. DTM,
   c. surveys, ...

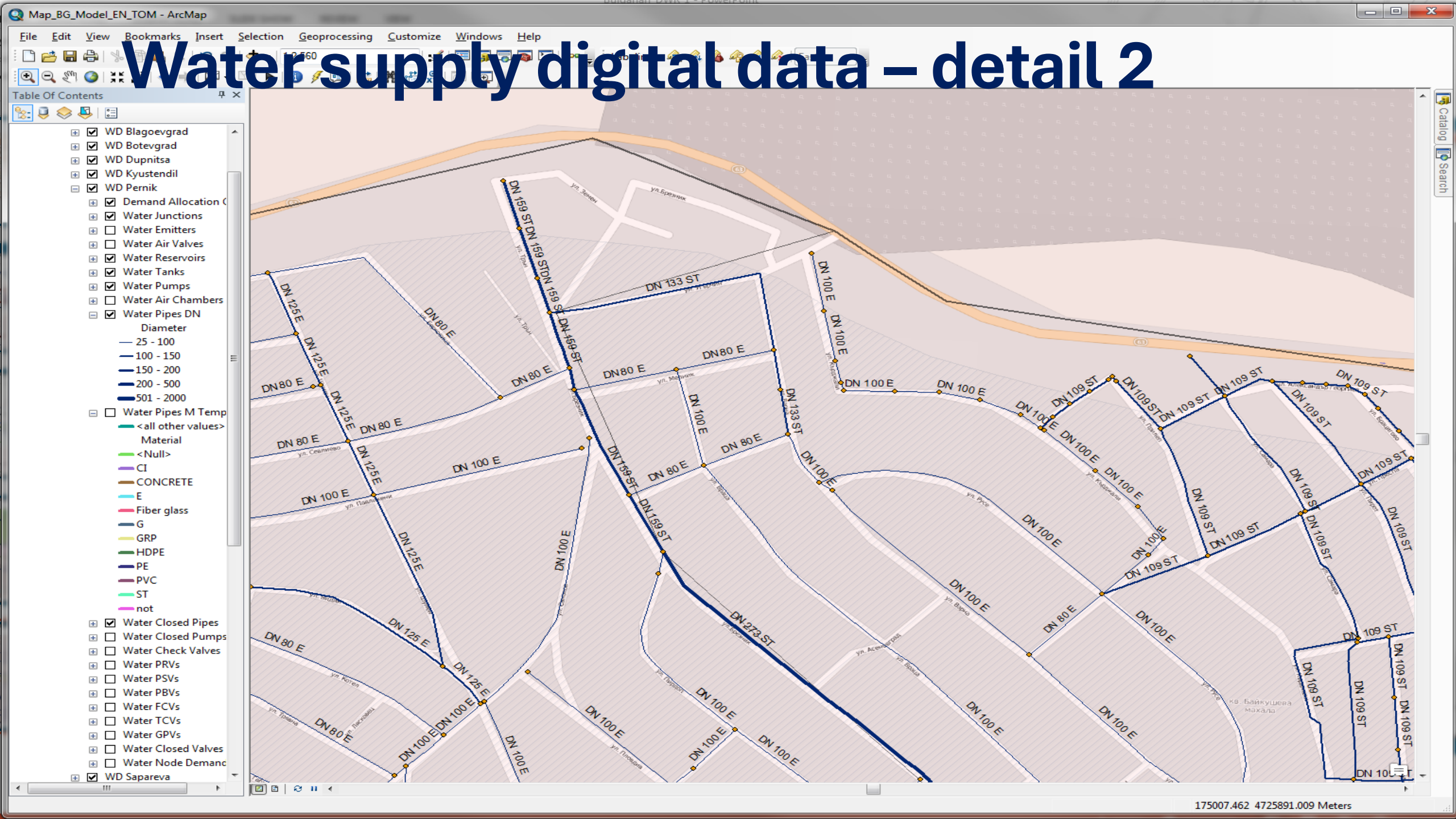
Water supply digital data



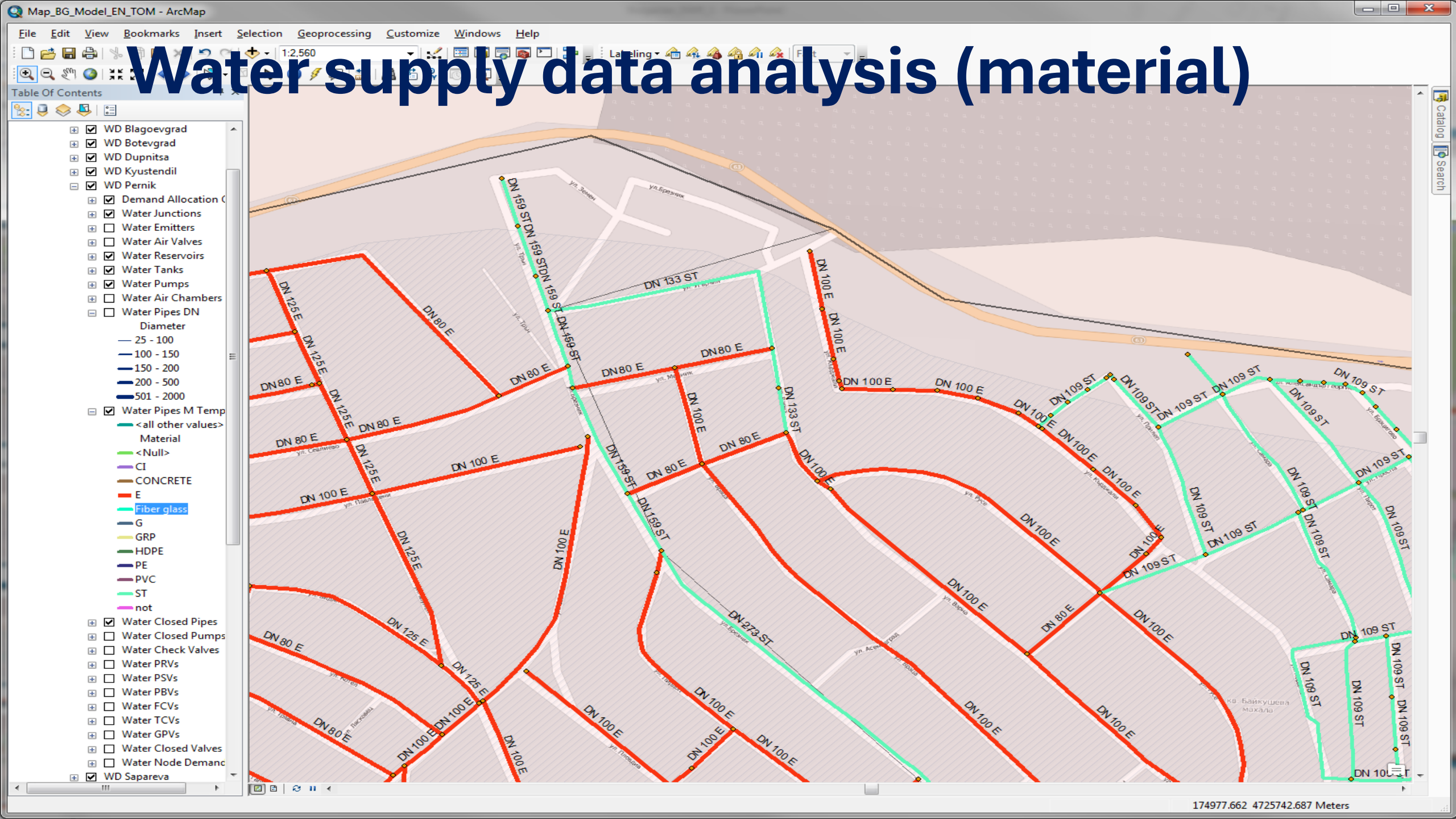
Water supply digital data – detail 1



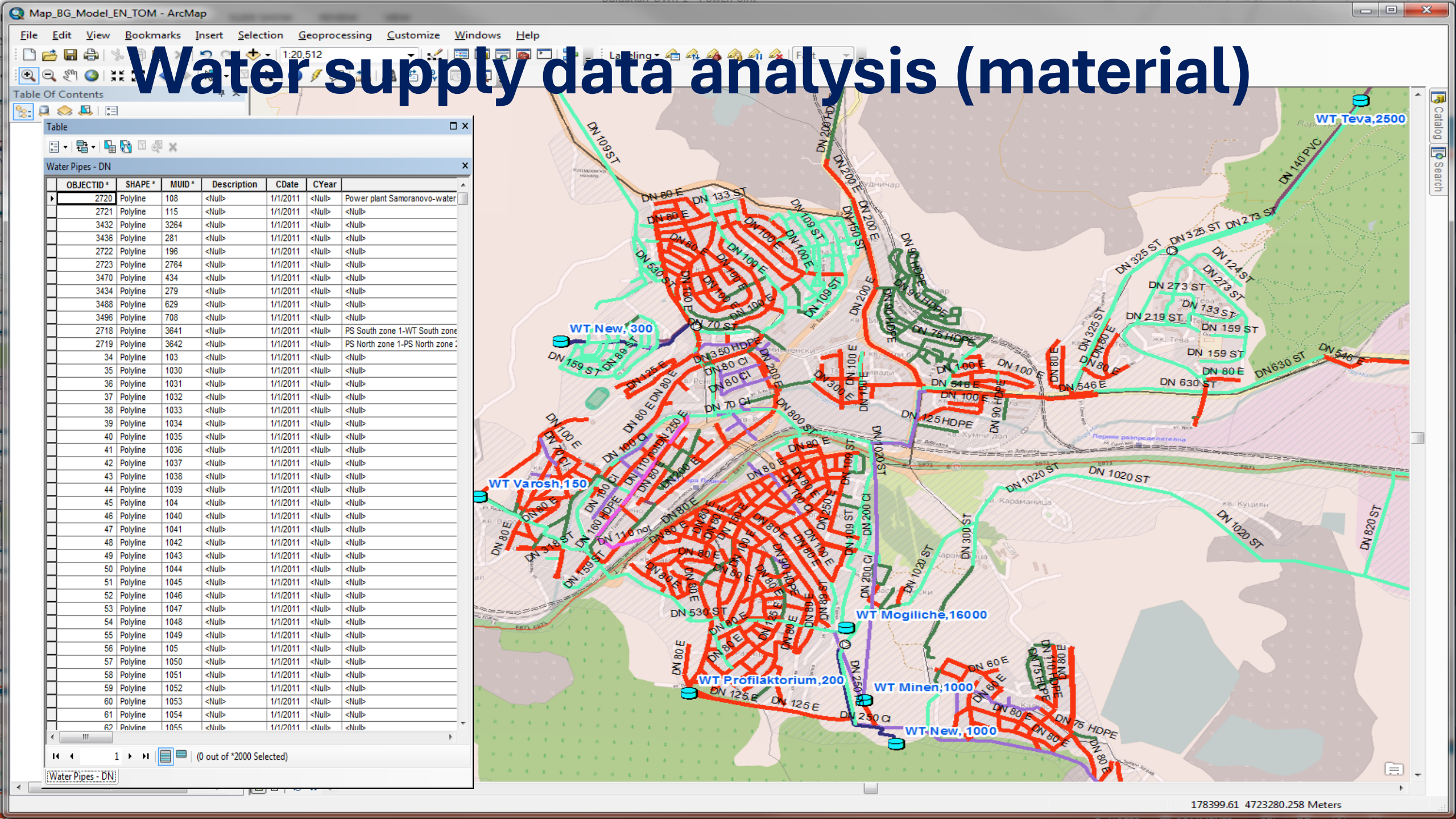
Water supply digital data – detail 2



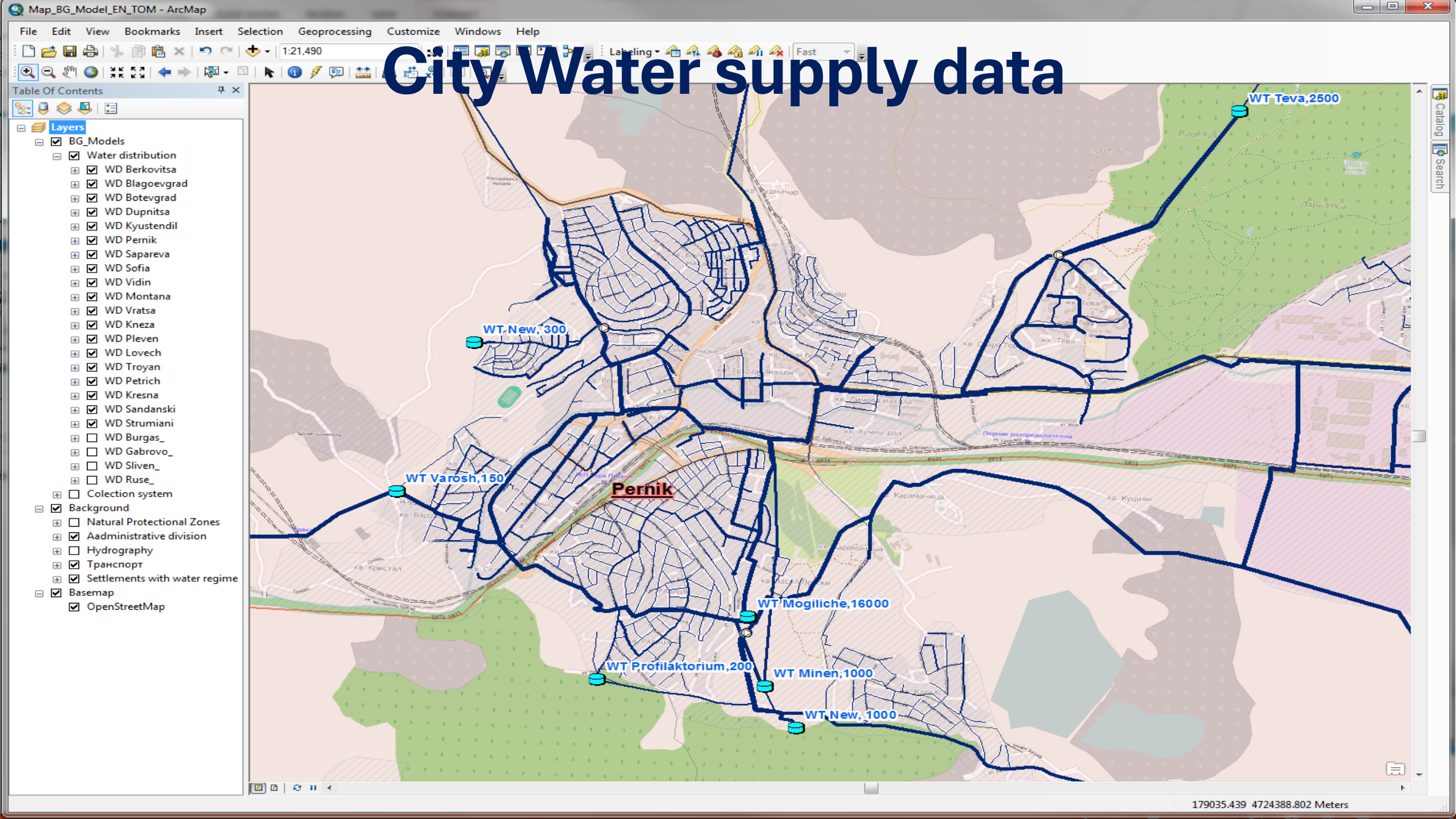
Water supply data analysis (material)



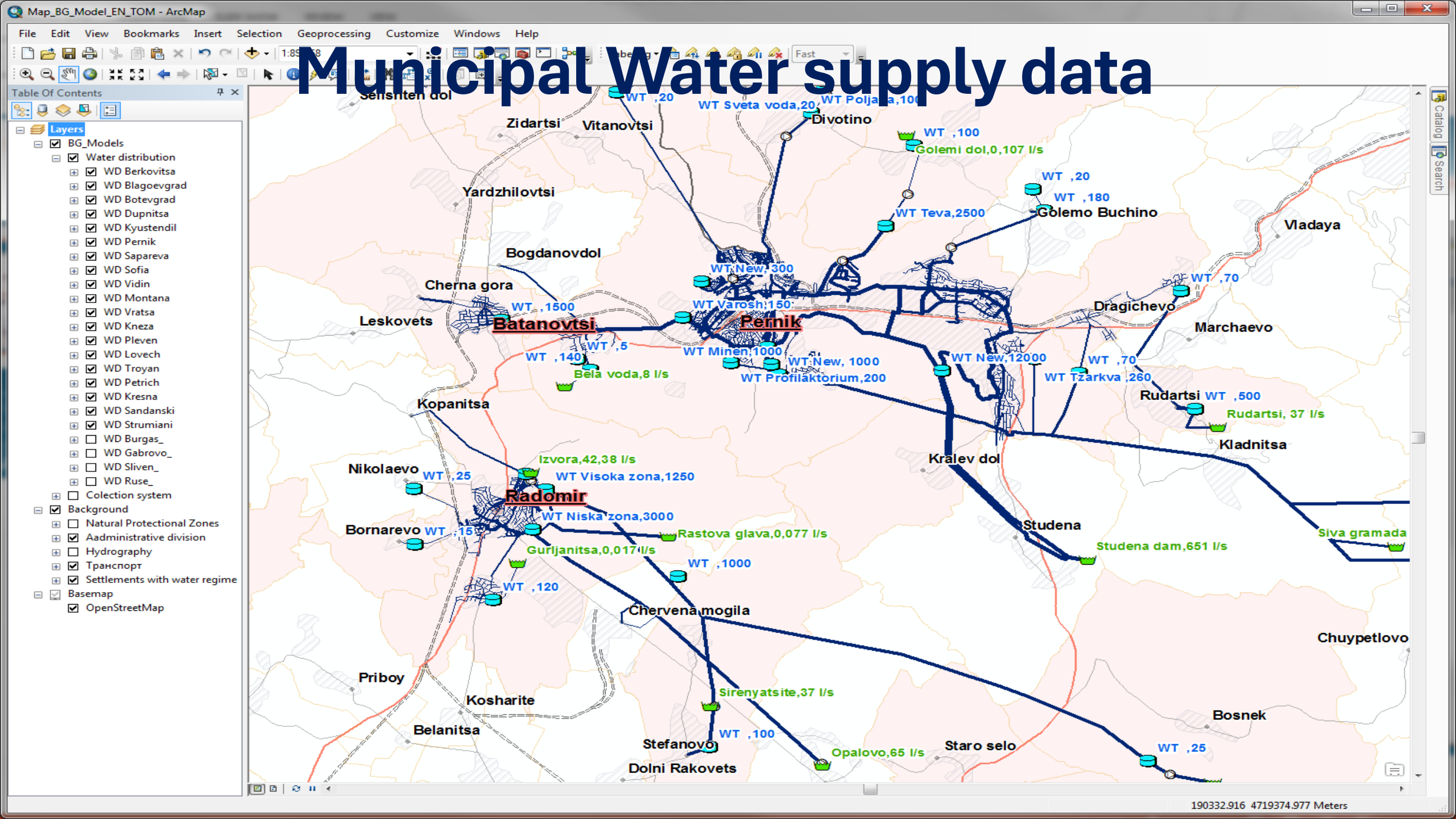
Water supply data analysis (material)



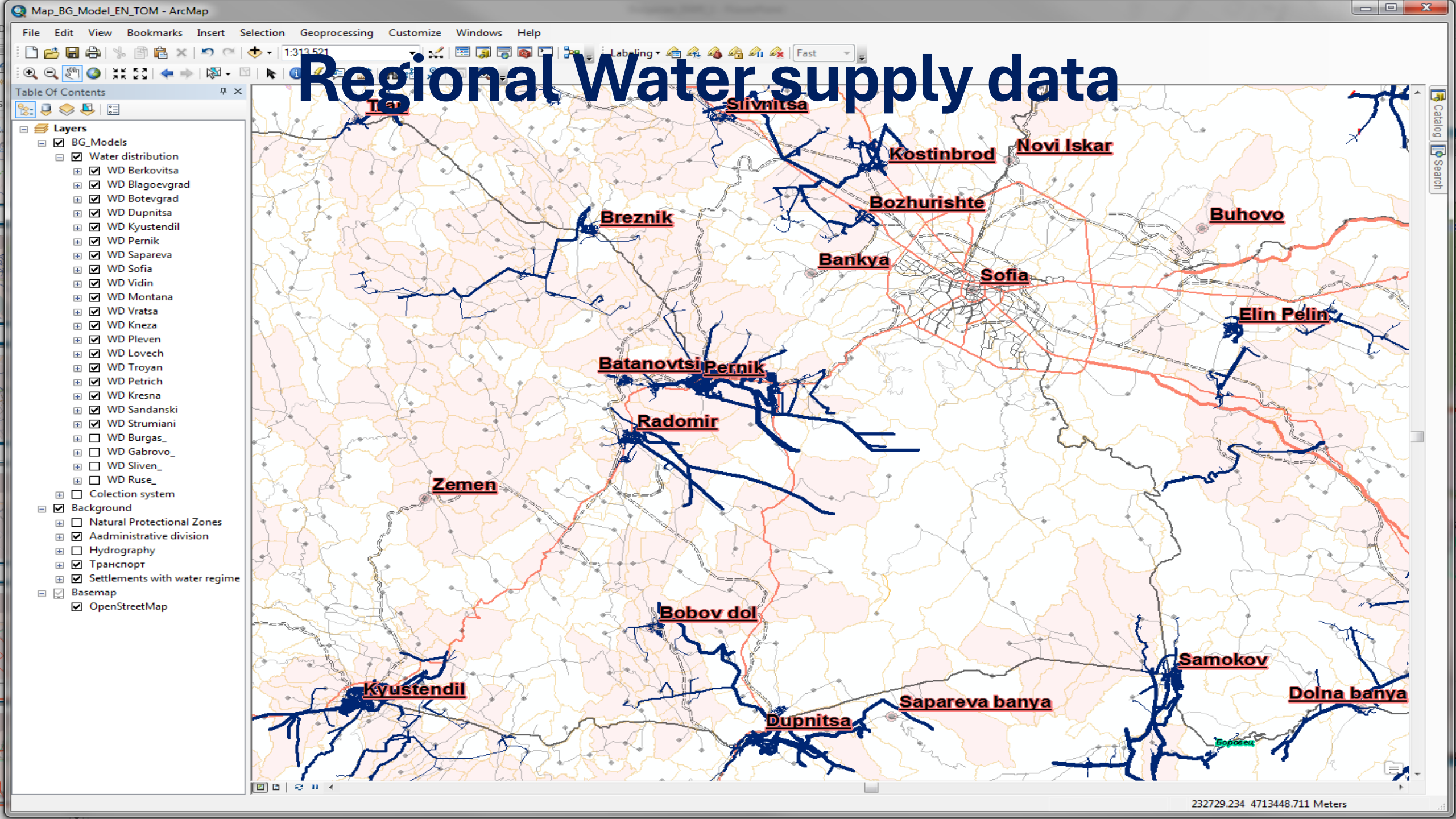
City Water supply data



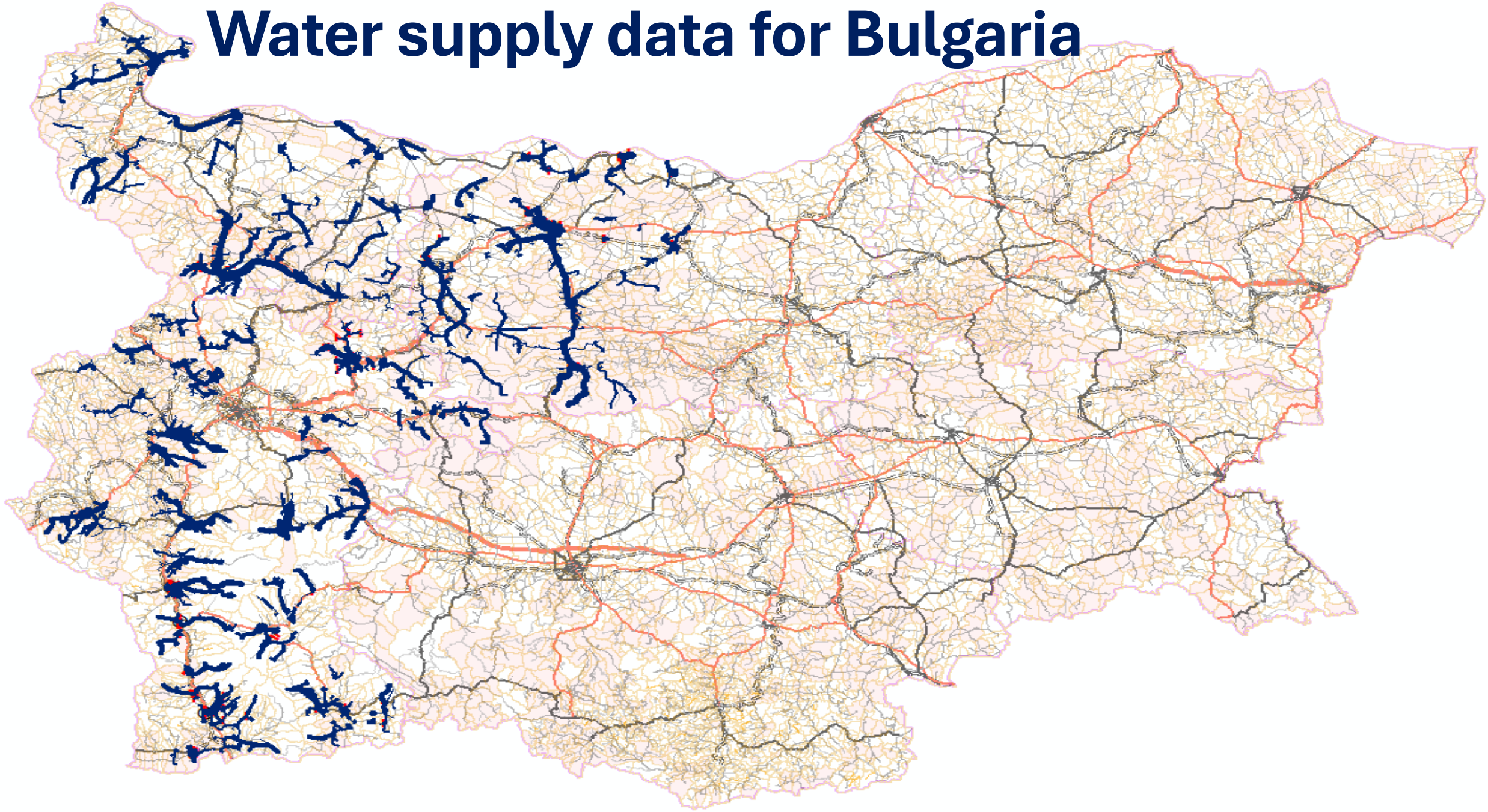
Municipal Water supply data

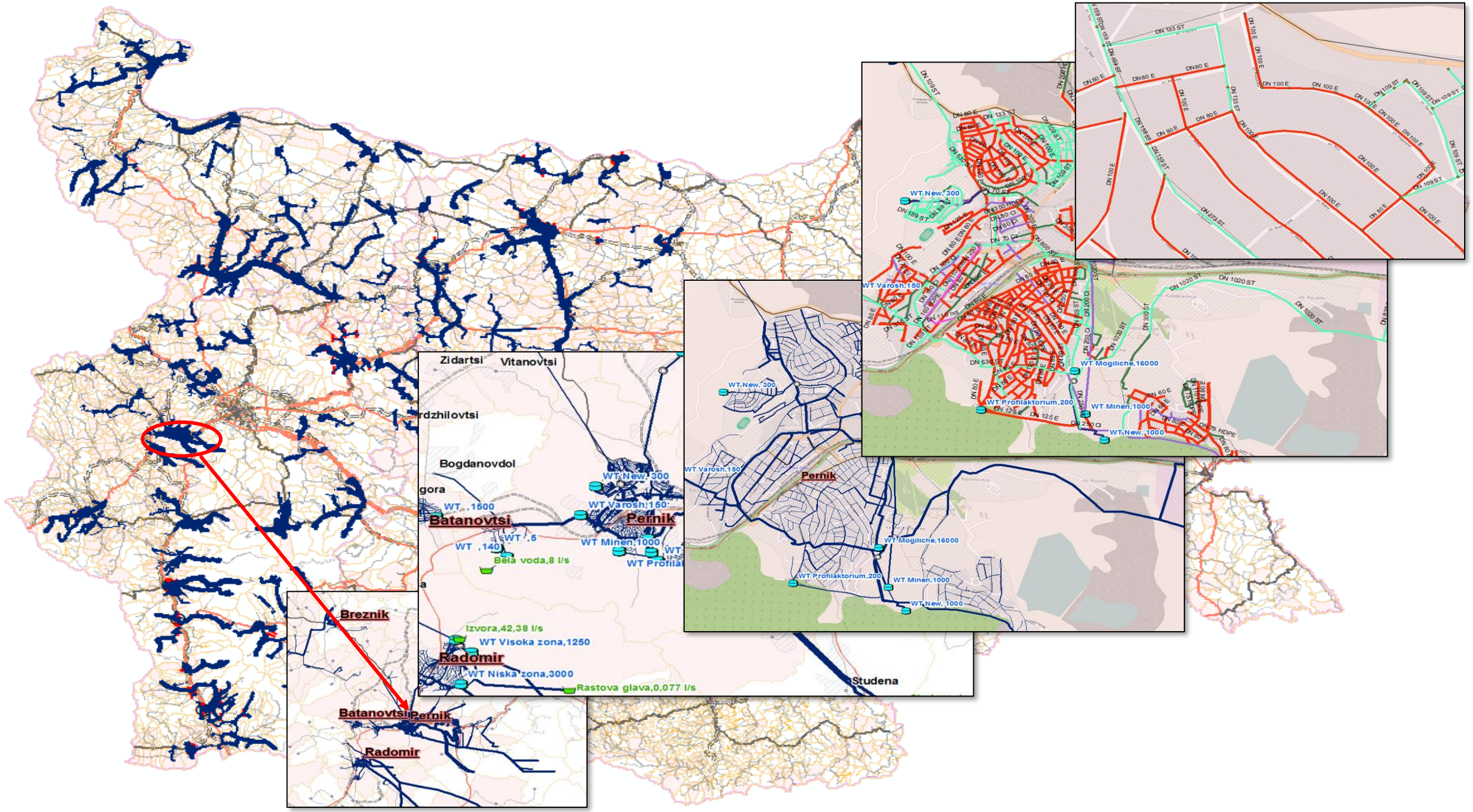


Regional Water supply data



Water supply data for Bulgaria




Zidartsi
Vitanovtsi
rdzhilovtsi
Bogdanovdol
gora
WT New, 300
WT , 1500
WT Varosh,150
Batanovtsi
Pernik
WT , 5
WT Minen,1000
WT ,140
Bela voda,8 l/s
WT Profilak
a
Izvora,42,38 l/s
WT Visoka zona,1250
Radomir
WT Niska zona,3000
Rastova glava,0,077 l/s
Studena
Breznik
Batanovtsi
Pernik
Radomir
WT New, 300
WT Varosh,150
Pernik
WT Mogiliche,16000
WT Profilaktorium,200
WT Minen,1000
WT New, 1000
WT New, 300
WT Varosh,150
WT Mogiliche,16000
WT Profilaktorium,200
WT Minen,1000
WT New, 1000

All it is about data, but….

“Where is the wisdom ?
Lost in the knowledge…

Where is the knowledge ?
Lost in the information …

Where is the information ?
Lost in the data…

Where is the data ?
Lost in the database …”