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Central Baltic



EUROPEAN UNION  
European Regional Development Fund

**INSURE**  
Innovative Sustainable Remediation



**Norrköping , SWEDEN**

**FINAL CONFERENCE**

State limited liability company  
**Latvian Environment, Geology and Meteorology Centre**

# Modelling as tool for contaminated sites strategic management

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**10TH APRIL 2019**

# Pilotterritory

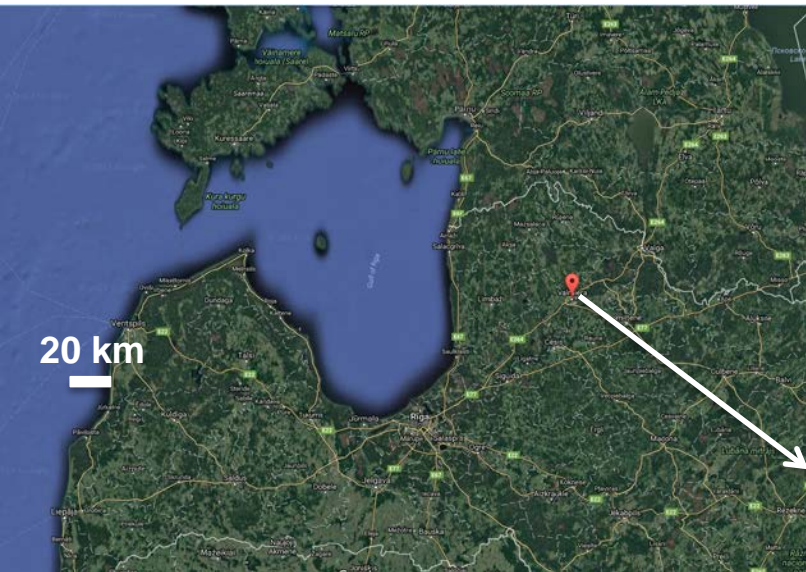


Former black fuel storage facility of Valmiera city heating company

- Closed around 1970s.
- Duration of operation and
- Used black fuel amount is not known.

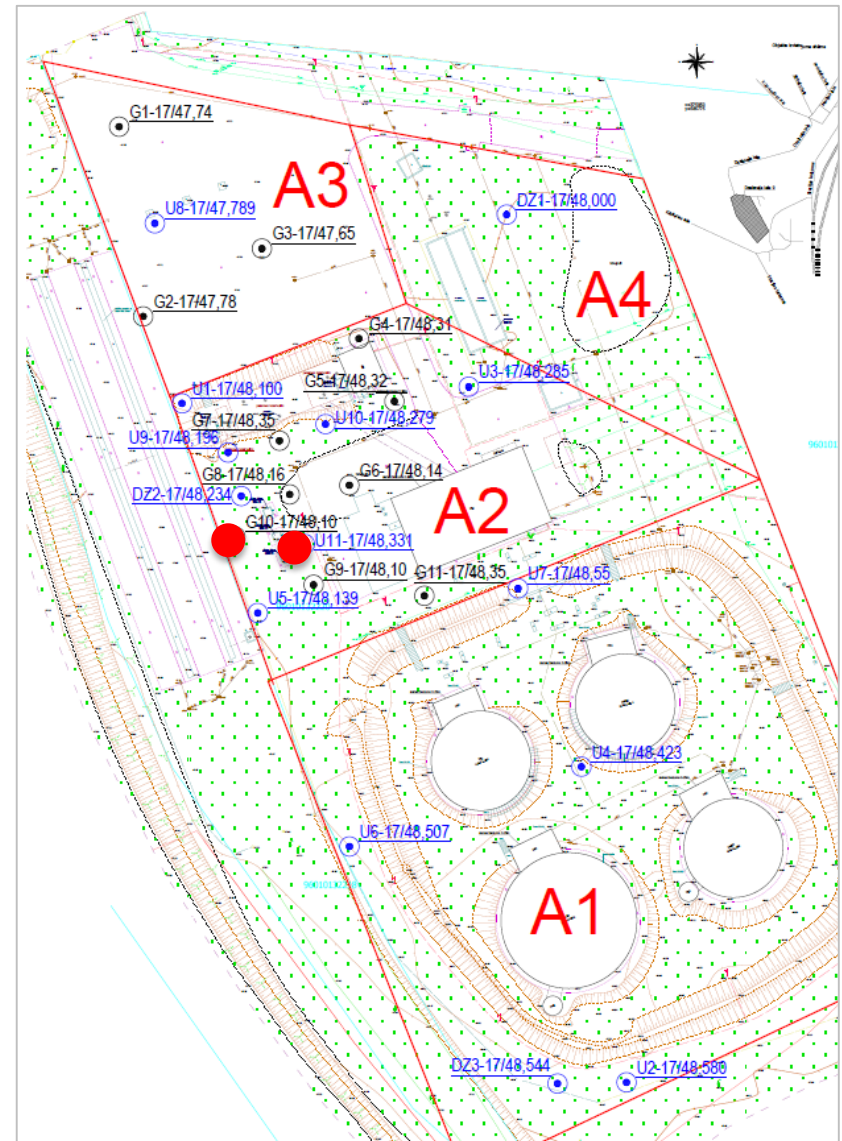
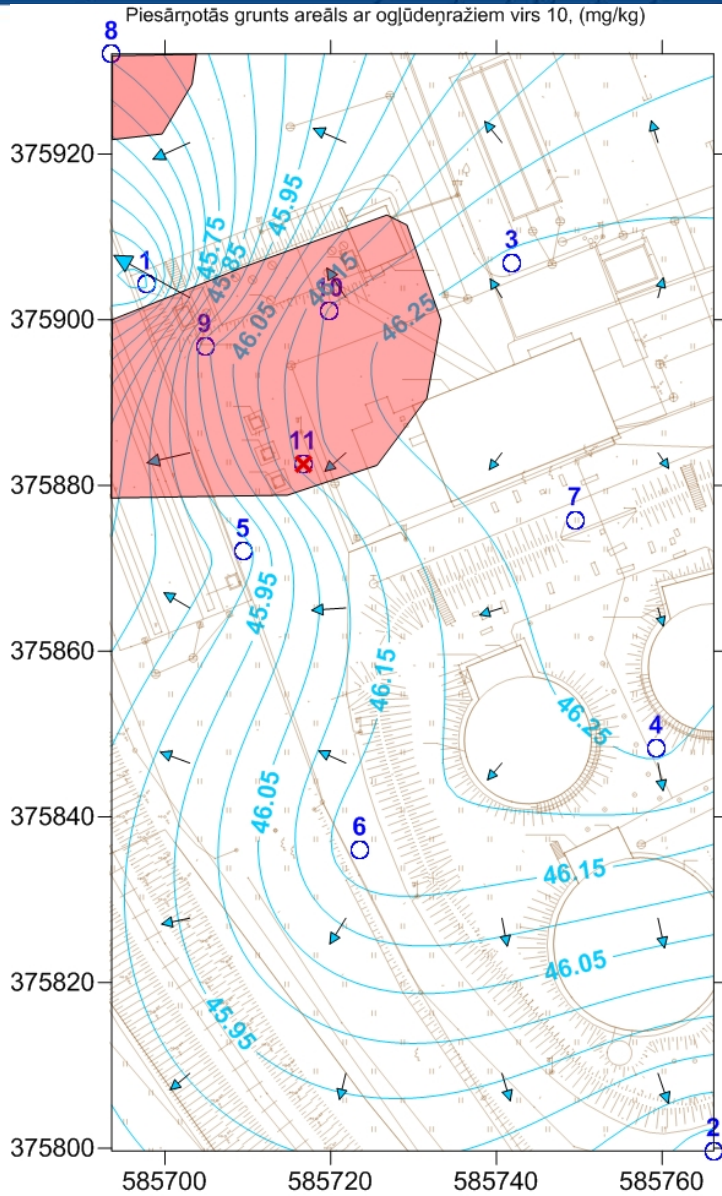
Pilot territory area: 1.2-1.5 ha

1,8 km from Gauja River.

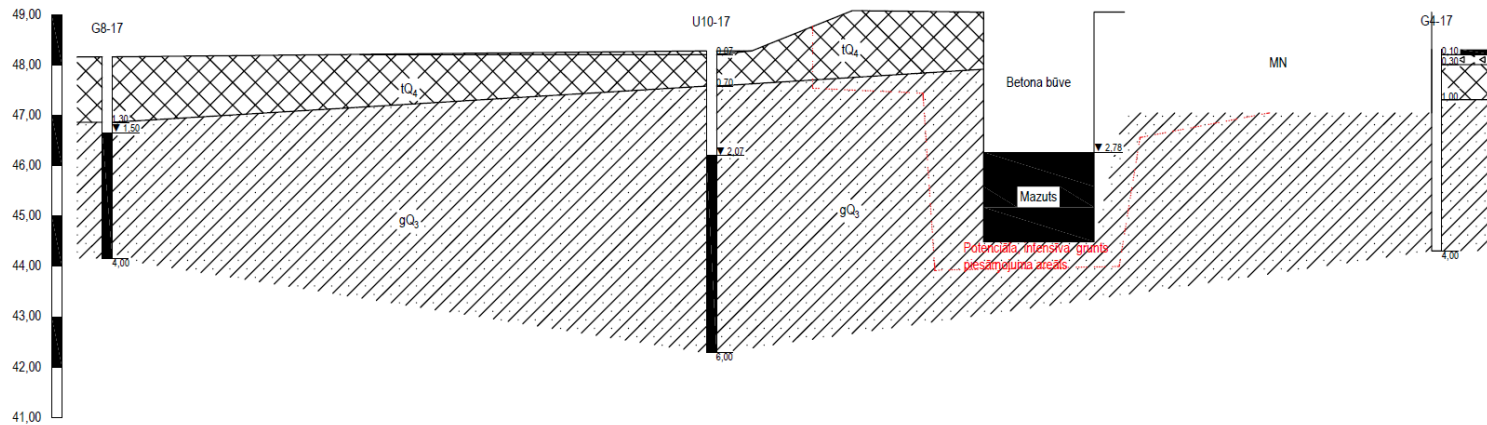




# Geological, hydrological survey



# Geological cross-section



Urbuma atveres abs. atz. (m)	48,16	48,28	48,31
Attālums starp urbumiem (m)	12,00	14,00	
Urbuma dziļuma abs. atz. (m)	44,16	42,28	44,31
Drumta šidena līmeņa abs. atz. (m)	46,66	46,21	nav atklāts
Mērījuma datums	04.07.17	05.07.17	04.07.17

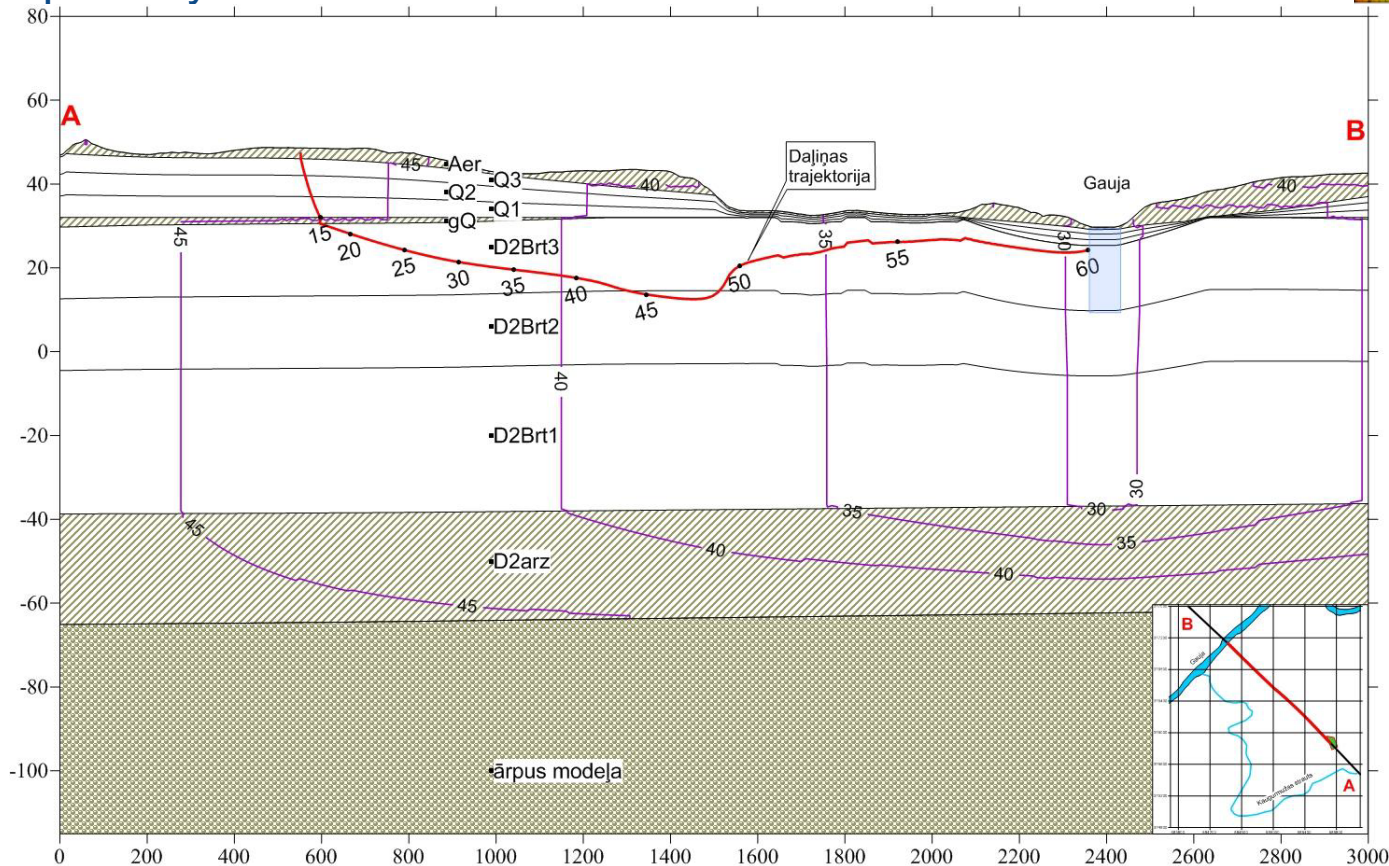
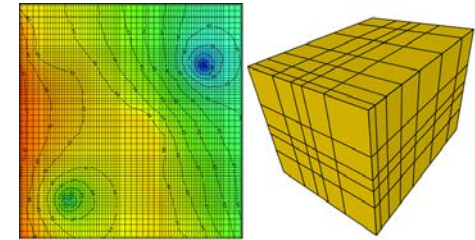




# Hydrogeological model

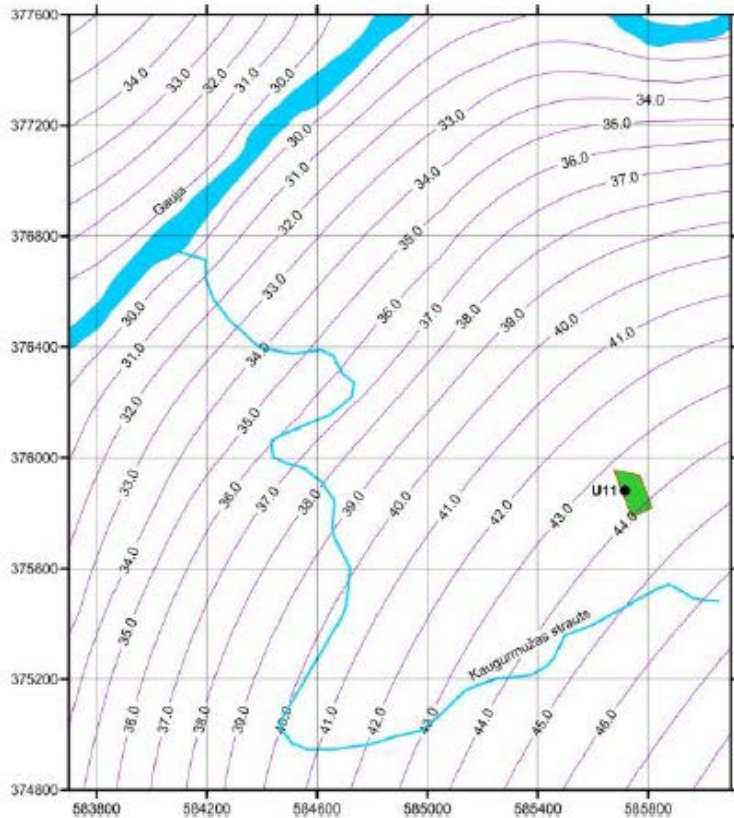


- 11 layers (from Q to D2ar)
- River and stream incorporation into hydrogeological model
- Appropriate geological layer hydraulic conductivity, porosity value selection

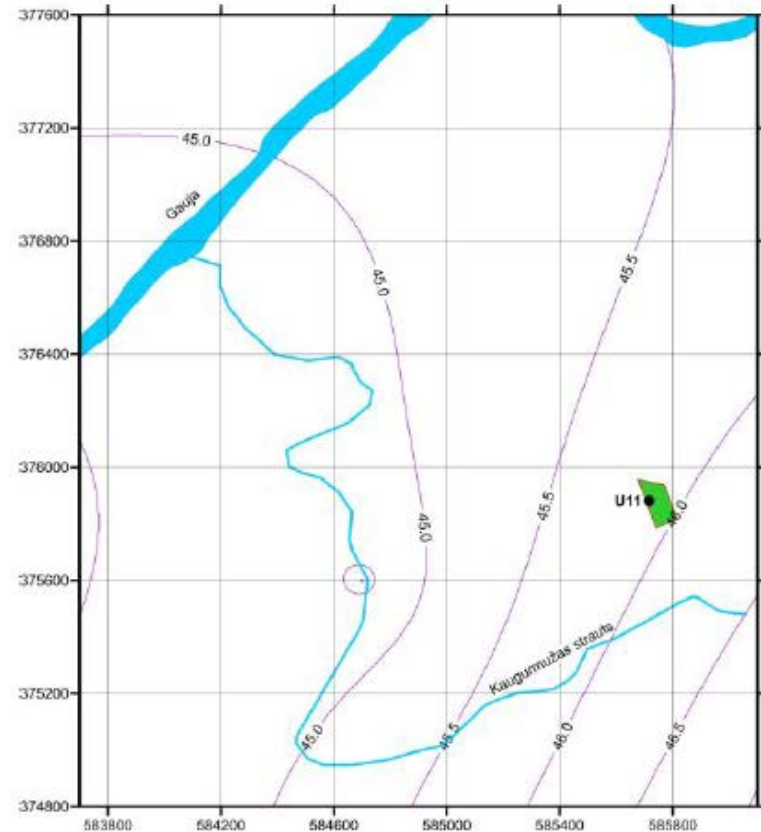


- Model size: 2500x2800m
- Plane step size: 10m

# Modelled groundwater levels

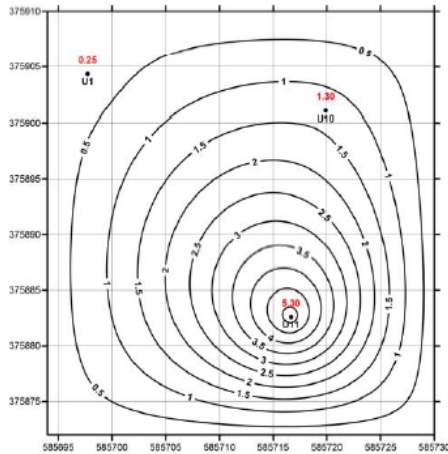


Quaternary

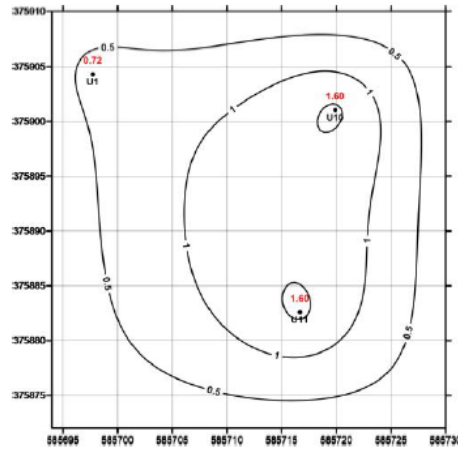


PreQuaternary

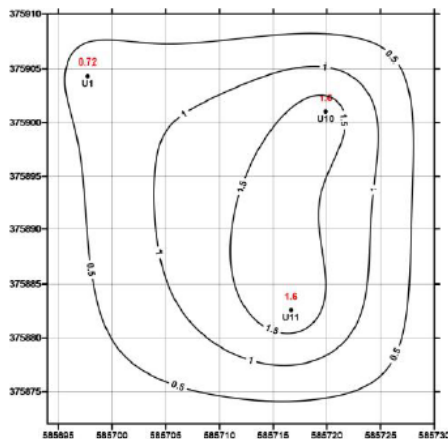
# Groundwater contamination and calculation area



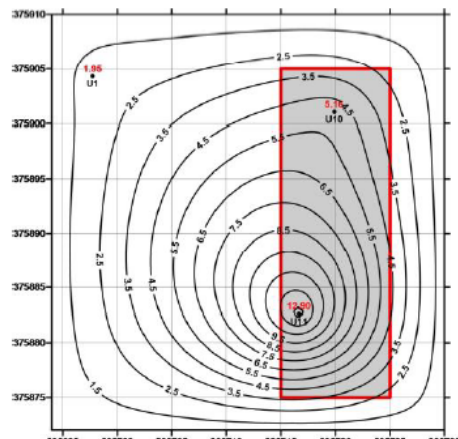
benzols



toluols



etilbenzols



ksiloli

- Kriging interpolation method was used in the calculation area  $36m \times 38m = 1368m^2$
- Area includes wells U1, U10, U11 with a background concentration

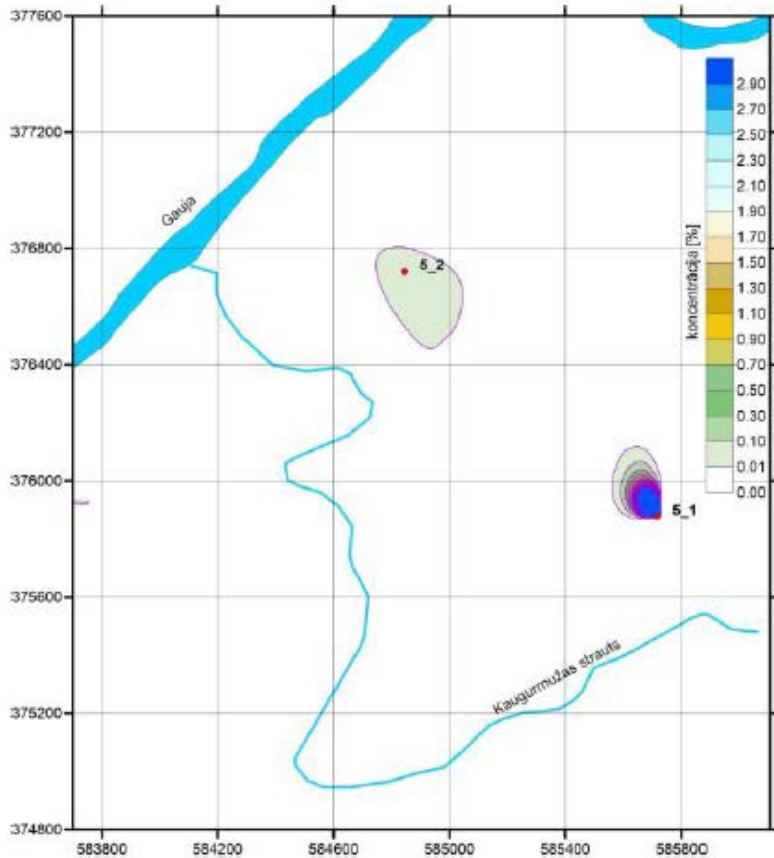


# Data visualization

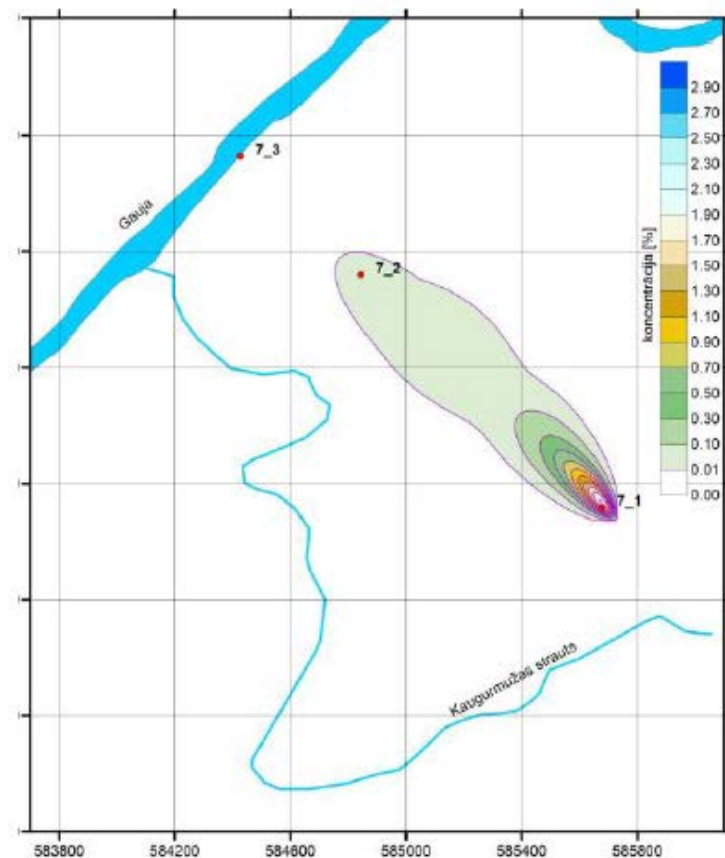


Modelled relative contamination concentrations

Scenario: Contamination source is not liquidated;



Q1 layer after 25 years



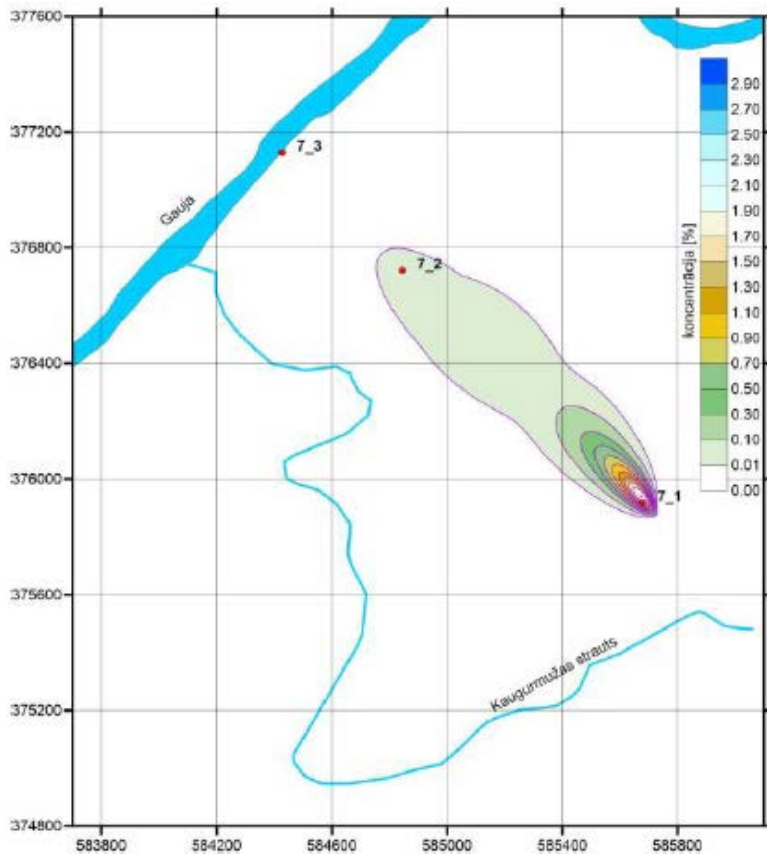
D2brt3 layer after 25 years



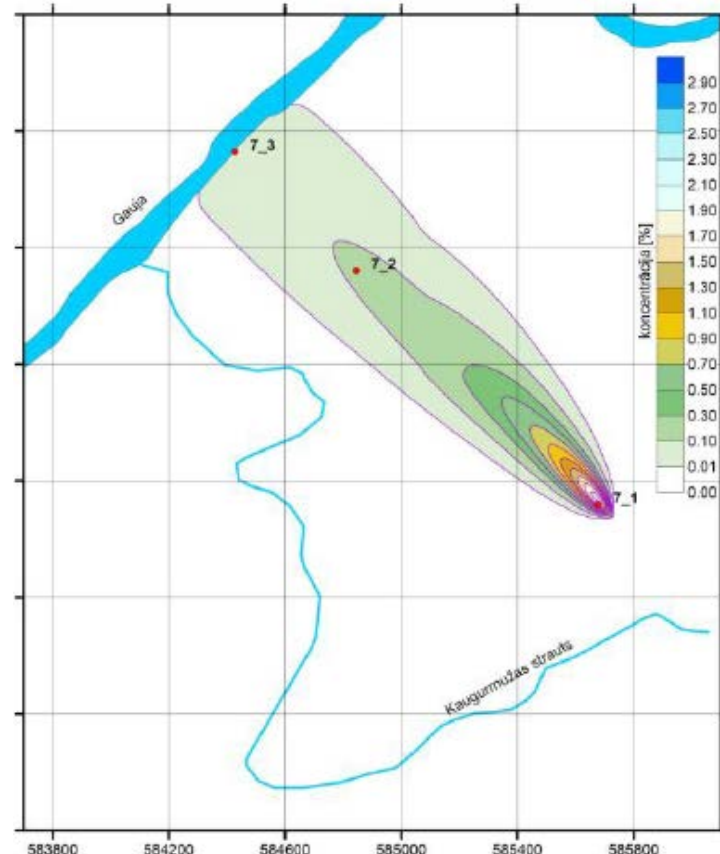
# Data visualization



Modelled relative contamination concentrations  
Scenario: Contamination source is not liquidated;



Q1 layer after 60years



D2brt3 layer after 60years

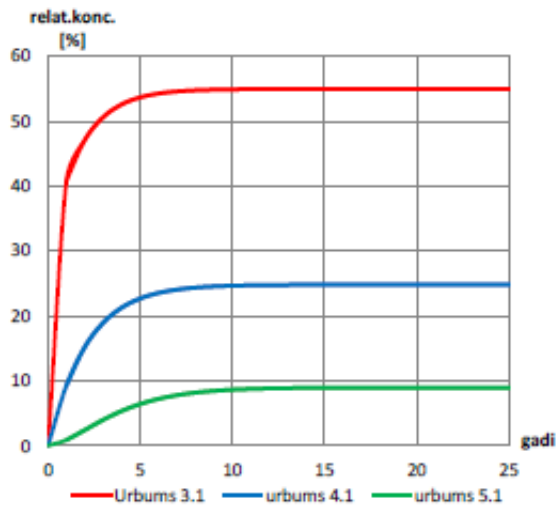
# Hydrograph for contaminant concentration change analysis



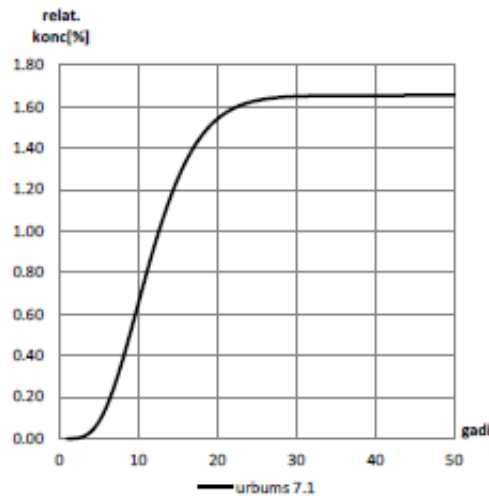
Three scenarios:

- Contamination source is not liquidated;
- Contamination source is liquidated after 25 years;
- Contamination is degraded.

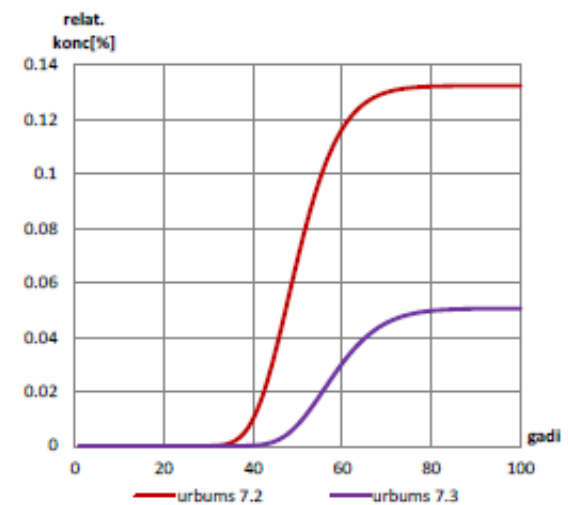
1.scenario: contamination source = 100%



Q3 Q2 Q1



D2brt3



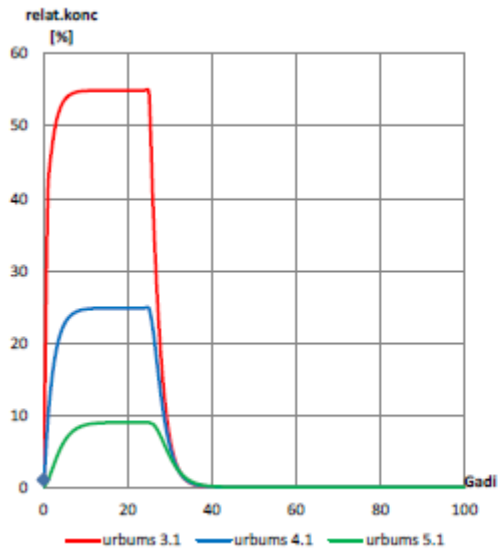
D2brt3



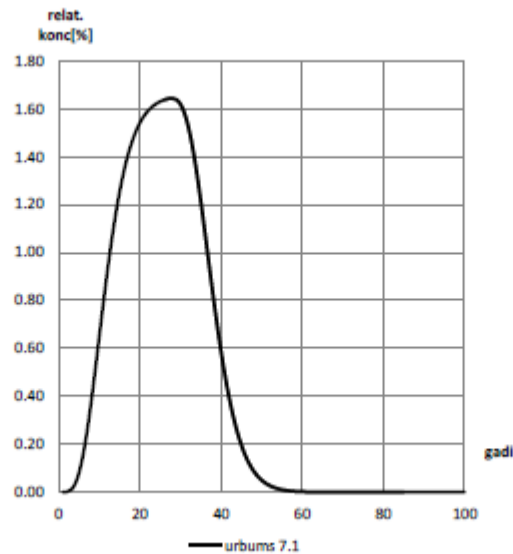
# Hydrograph for contaminant concentration change analysis



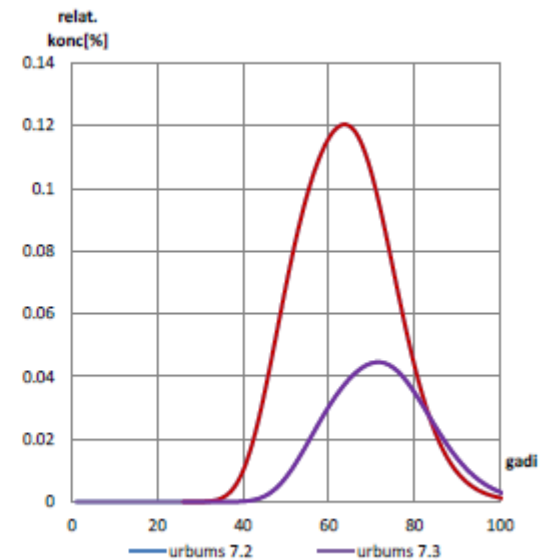
2.scenario: contamination source = 100%, after 25 years contamination source is liquidated



Q3 Q2 Q1



D2brt3

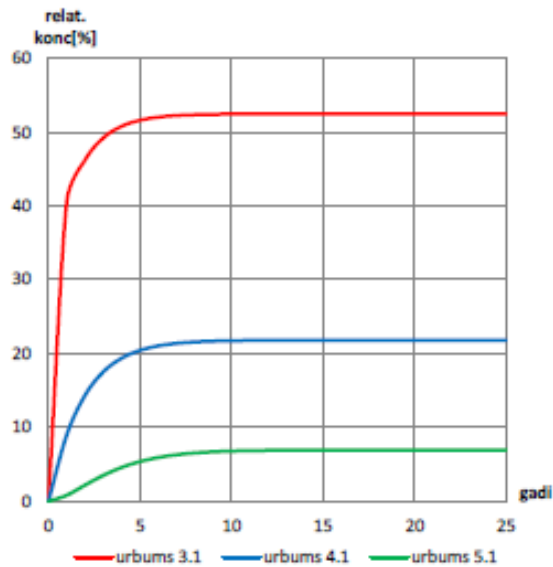


D2brt3

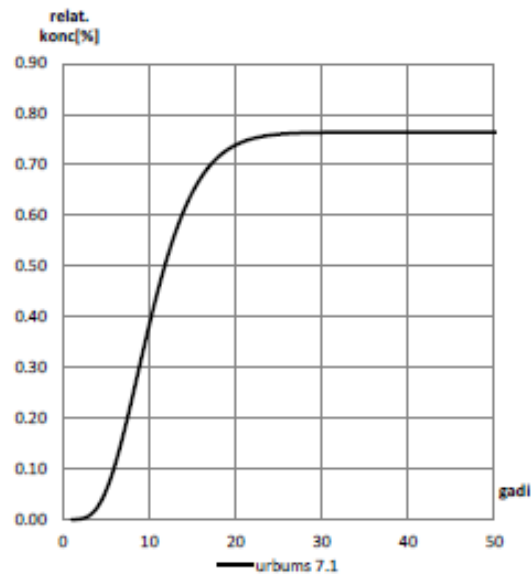
# Hydrograph for contaminant concentration change analysis



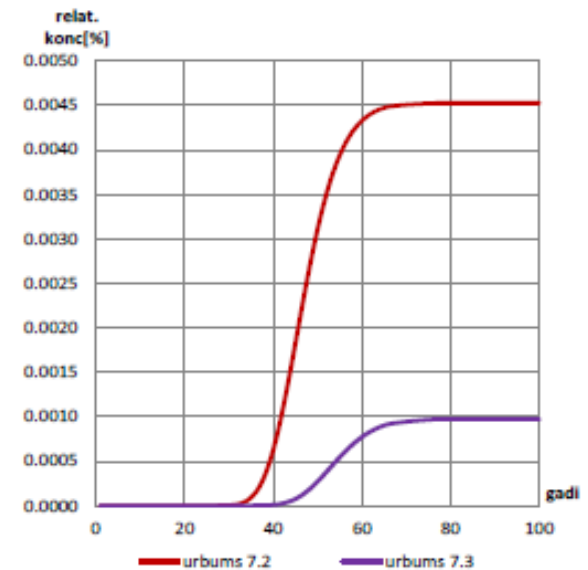
3.scenario: contamination source = 100%;  $t_{0.5}=10$  years



Q3 Q2 Q1



D2brt3



D2brt3



# Conclusions



## Diverse application:

- tool to assess the extent of the territory affected by pollution
  - tool to assess pollution concentrations
  - tool to assess speed of pollution movement
- 
- Reliability of data directly dependant on data quality and quantity.
  - + Limited data or limited available territory for surveying allows to better assess the extent of the problem, prepare future action plans.
  - + Gives an insight to stakeholders what is happening underground (what cannot be seen does not exist).



# Thank you for your attention!

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