3-D Geological modelling in Svendborg, DK:

Model improvements gained by adding data from geotechnical and environmental investigations

Peter B. E. Sandersen, Geologist

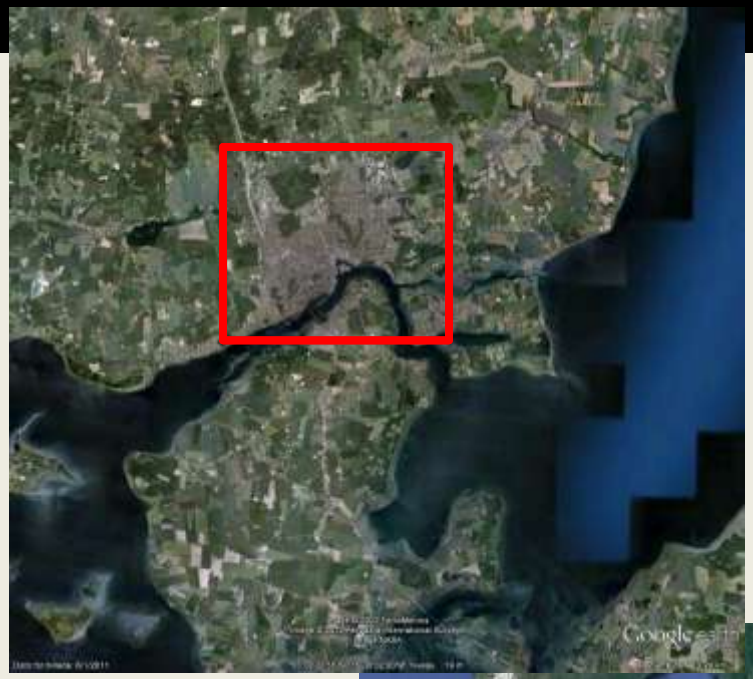
Dept. of Groundwater mapping and Quaternary Geology

Geological Survey of Denmark and Greenland
Ministry of Climate and Energy

NAG-CITY Expert Workshop, Oct. 8-9, 2012

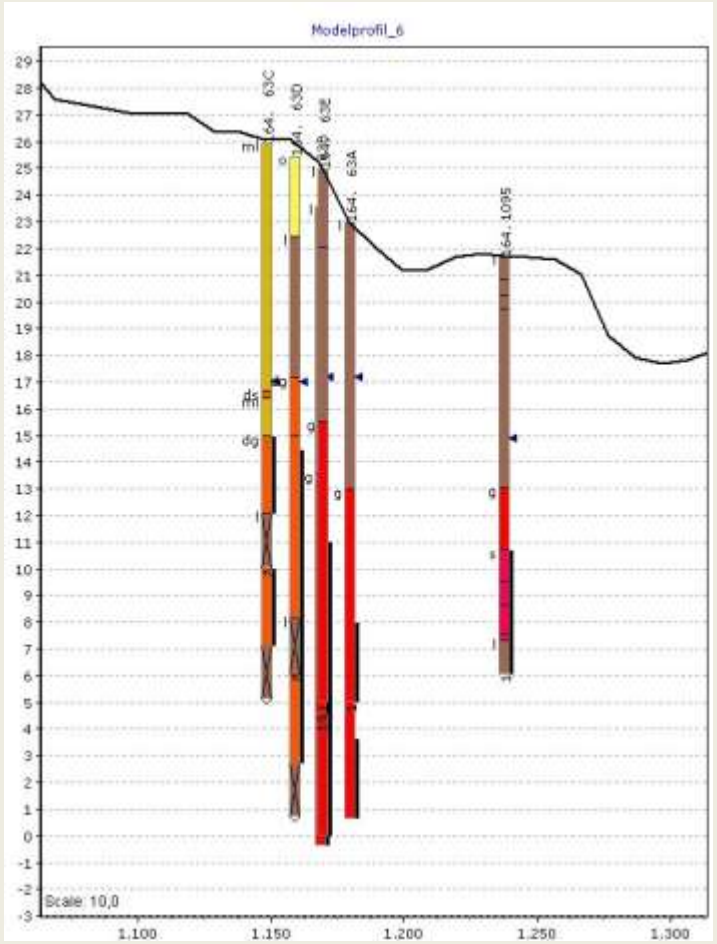
City of Svendborg

- Contamination from point sources
- Risk assessments related to waterworks
- Prioritize remediation
- Detailed 3-D geological modelling
- 3-D modelling requires dense data grids
- No geophysics
- Borehole data



Available data

- Borehole data from The National Jupiter database hosted by GEUS
- Borehole data from geotechnical and environmental investigations
- Local databases in other formats (Access, GeoGIS etc.)
- 3-D geological modelling software uses Jupiter-format (GeoScene 3D)
- Conversion of data to Jupiter-format



Challenges

- Borehole data in local databases
  - Different database formats
  - Different procedures for storage of data (errors and inconsistencies)
  - Purpose of storing?
  - Different purposes of drilling campaigns (geotechnical, environmental, etc.)
  - Varying degree of detail (inconsistencies)
- Can sufficient data be extracted automatically or is manual processing necessary?
- One iteration…… or many?

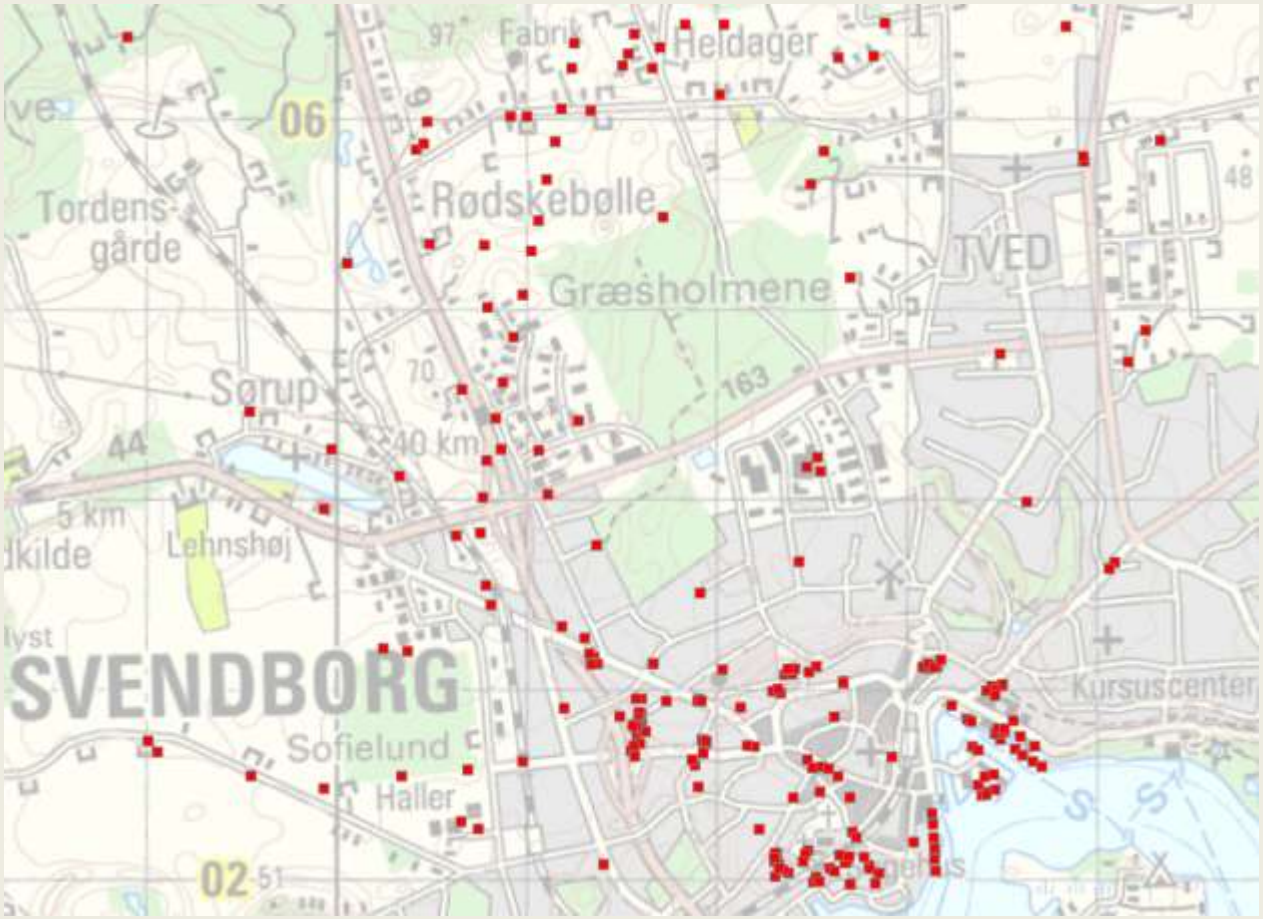
Converting borehole data to Jupiter format

General procedure:

1. Search in different local databases
2. Conversion of coordinate system
3. Checking redundancy
4. Comparison of formats
5. Automatic extraction of columns that fit the Jupiter-format
6. Manual processing of other columns; e.g. lithology (translation of descriptions)
7. Manual control of borehole location (GIS)
8. Visualization/control of borehole in 3-D software

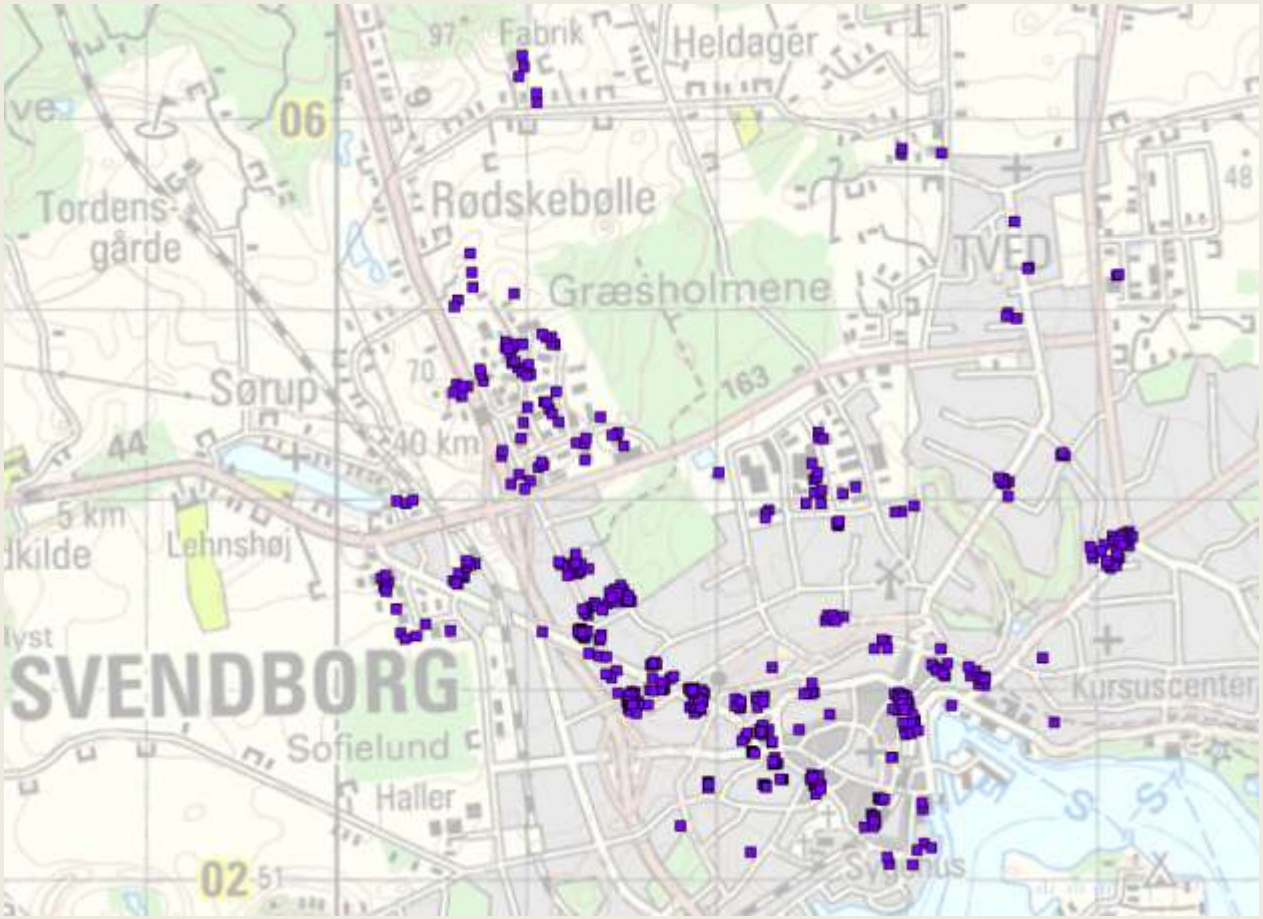
Boreholes in Jupiter database

- 260 boreholes



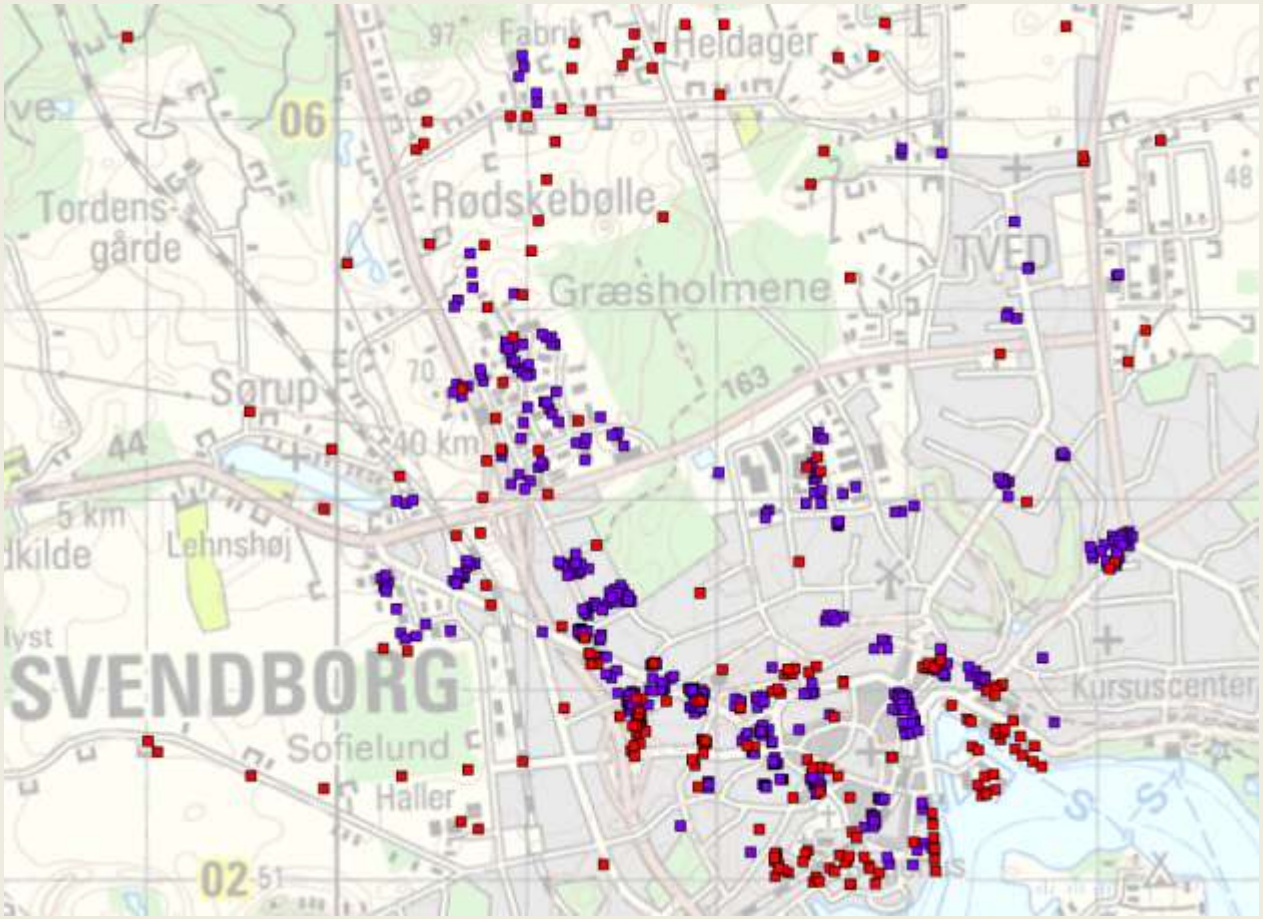
Boreholes in other databases

- 639 boreholes

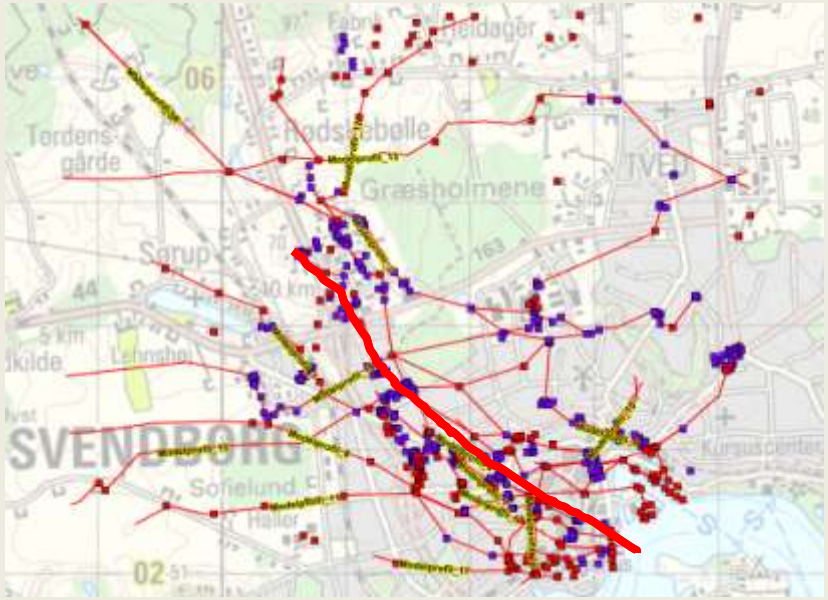


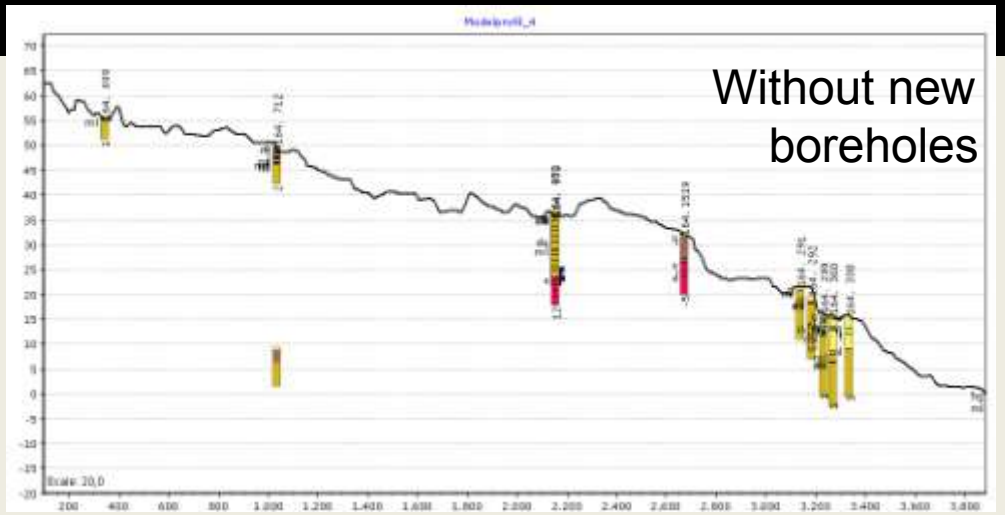
All boreholes

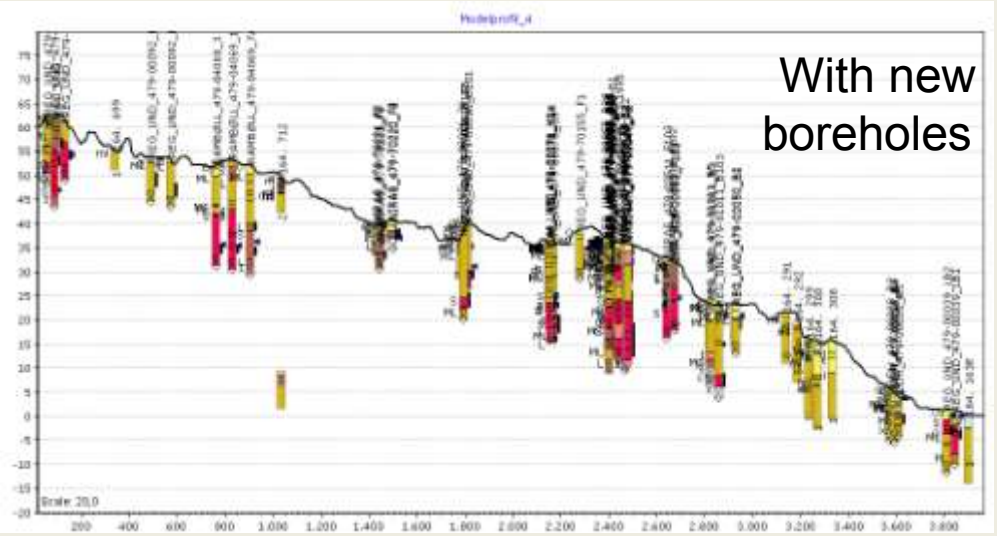
- 899 boreholes



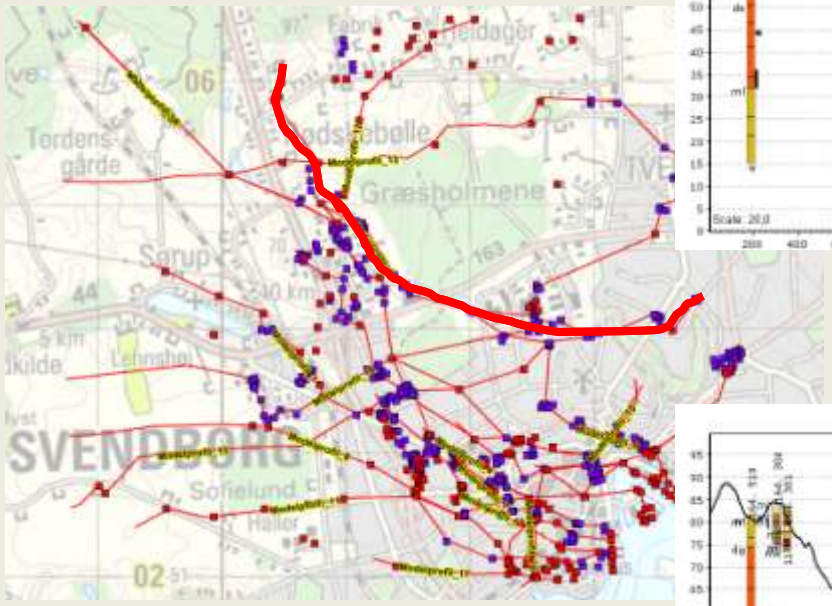
Profile 4

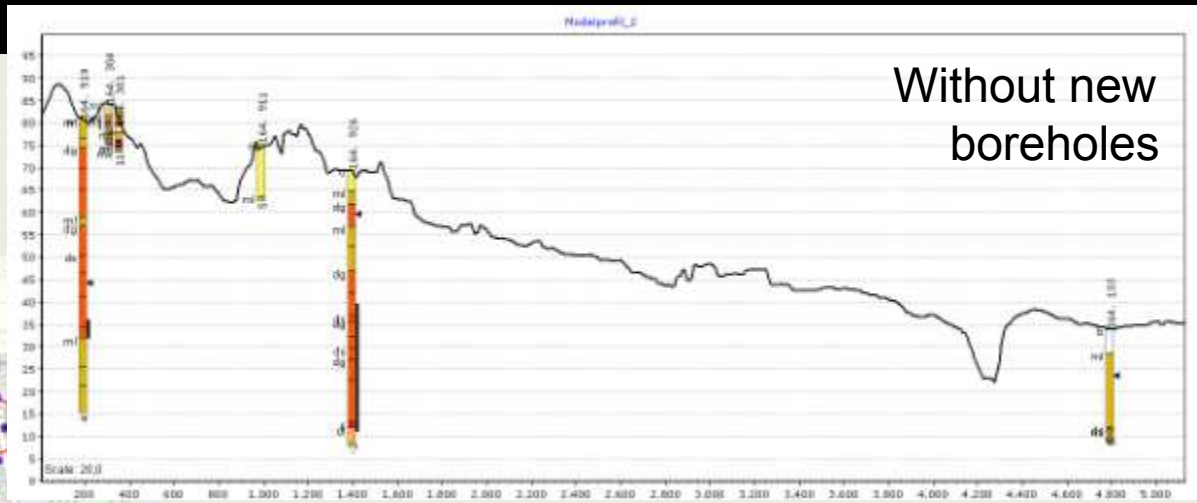

Tordens-
gårde
Rødskebølle
Græsholmene
Sørup
SVENDBORG
Sofielund
Haller
Kursuscenter

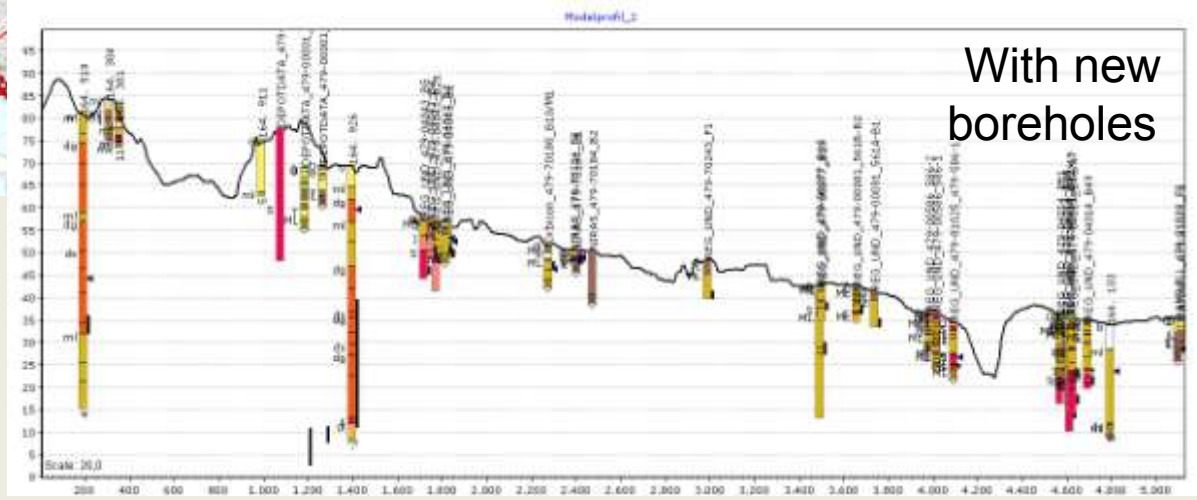

Without new
boreholes


With new
boreholes

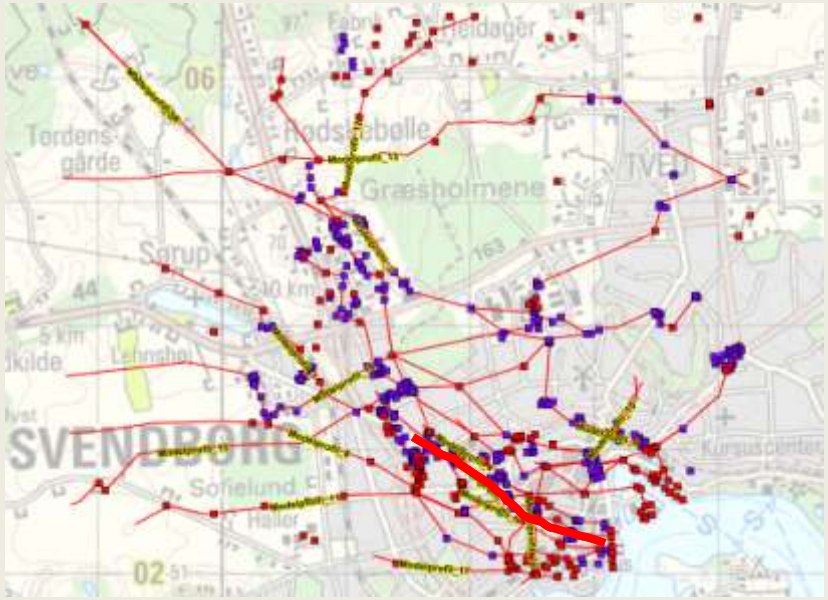
Profile 2

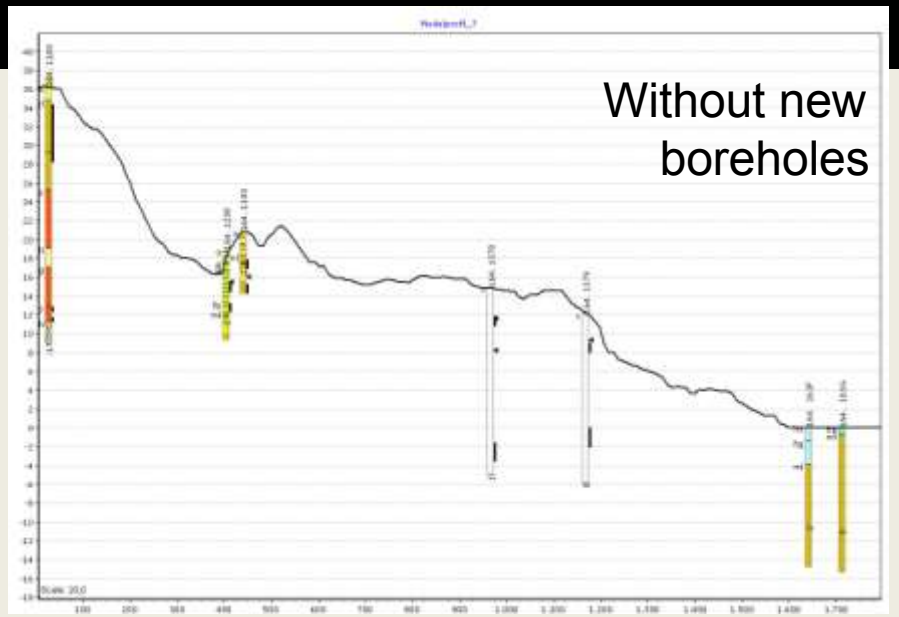

Tordens-
gårde
Græsholmene
Sørup
SVENDBORG
Sofielund
Haller


Without new
boreholes

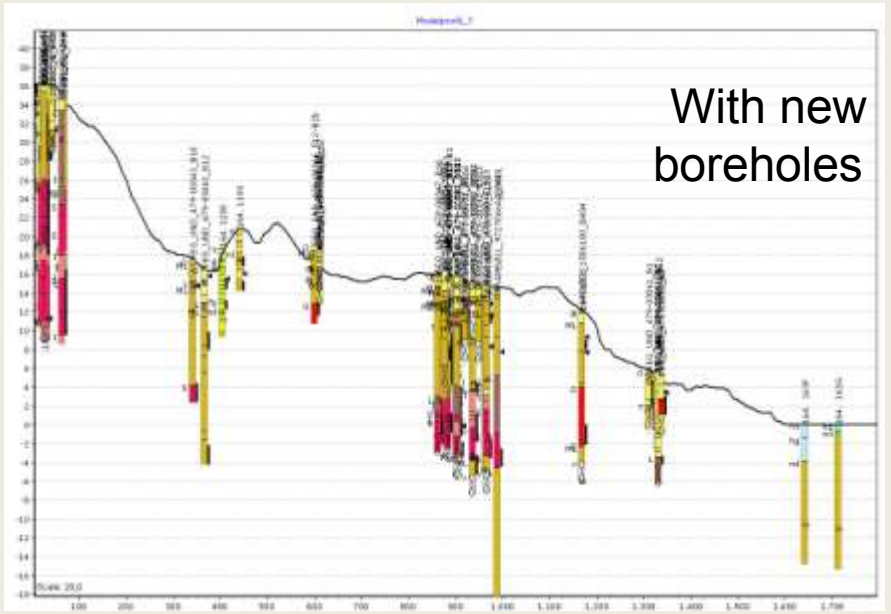

With new
boreholes

Profile 7

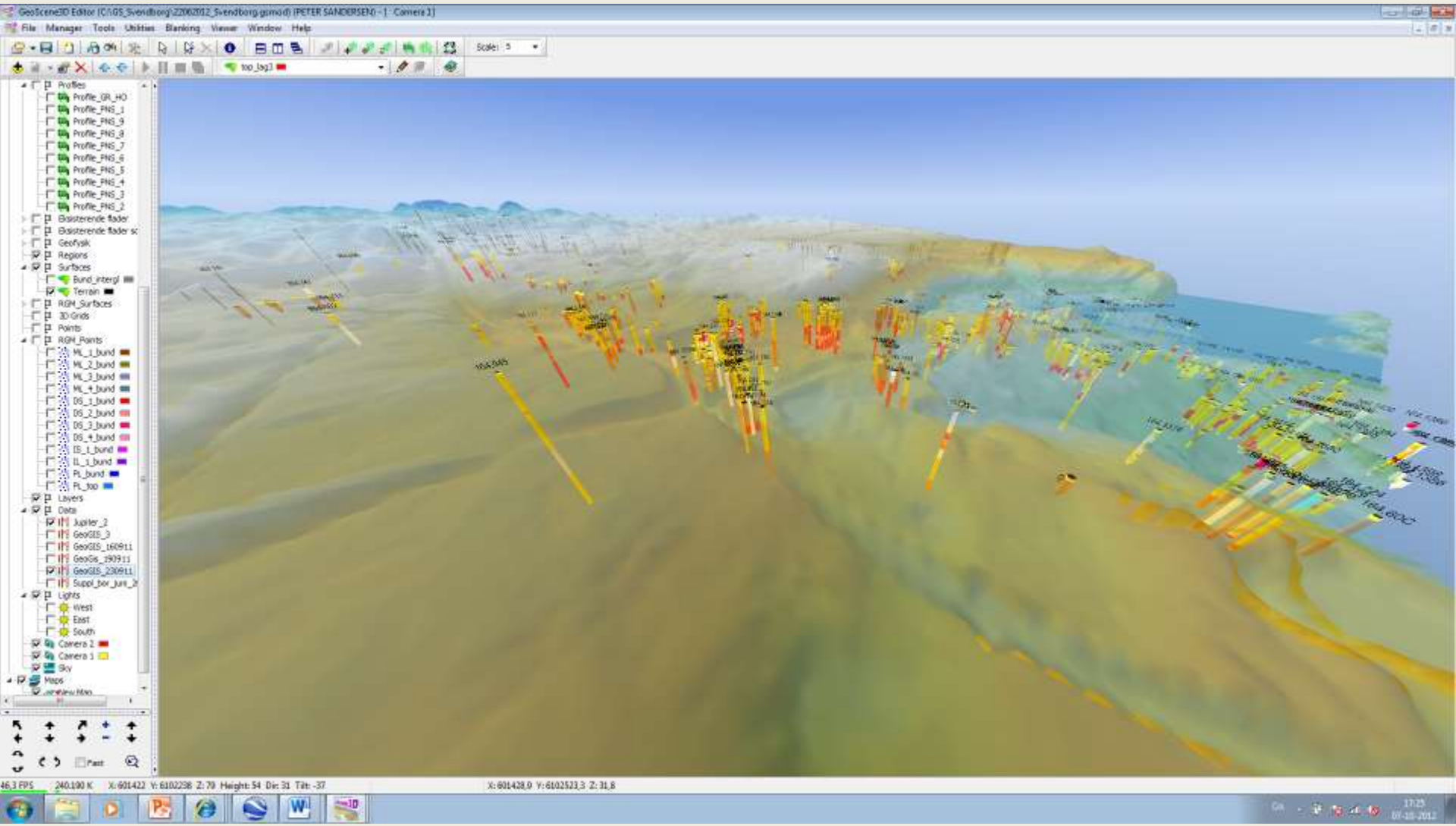




Without new boreholes



With new boreholes


GeoSceneSD Editor (C:\GS_Svendborg\Z2062012_Svendborg.gsmodl) (PETER SANDERSEN) - [Camera 1]
File Manager Tools Utilities Blanking Viewer Window Help
Profiles
Profile_GR_HO
Profile_PNS_1
Profile_PNS_9
Profile_PNS_8
Profile_PNS_7
Profile_PNS_6
Profile_PNS_5
Profile_PNS_4
Profile_PNS_3
Profile_PNS_2
Eksisterende flader
Eksisterende flader sc
Geofysik
Regions
Surfaces
Bund_interg
Terrain
RGM_Surfaces
3D Grids
Points
RGM_Points
ML_1_bund
ML_2_bund
ML_3_bund
ML_4_bund
DS_1_bund
DS_2_bund
DS_3_bund
DS_4_bund
IS_1_bund
IL_1_bund
PL_bund
PL_top
Layers
Data
Jupiter_2
GeoGIS_3
GeoGIS_160911
GeoGis_190911
GeoGIS_230911
Suppl_bor_juni_2
Lights
West
East
South
Camera 2
Camera 1
Sky
Maps
Fast
46,3 FPS
240.190 K
X: 601422 Y: 6102238 Z: 70 Height: 54 Dir: 31 Tilt: -37
X: 601428,9 Y: 6102523,3 Z: 31,8

Problems with ”new” boreholes

- Inconsistent use of columns in databases
- Many boreholes do not have Z-coordinate (adjustment to DEM)
- Inconsistent lithological descriptions – in some cases no descriptions at all!
- Measurements of hydraulic head
  - Many screens in clay till (environmental and geotechnical investigations)
  - Unreliable measurements of hydraulic head (not related to aquifers)
  - Manual sorting necessary
- A full conversion is VERY time consuming!

Conclusions

Pros:

- Significantly larger amounts of data for the modelling
- Higher degree of detail of data (drilling methods)
- Supplementary information (strength, water content….)

Cons:

- Time consuming detective work (finding borehole data)
- Redundant data
- Time consuming conversion between formats
- Different levels of conversions
- Time consuming QA

Conclusions

- The Pros outweigh the Cons
- The 3-D modelling would have a high degree of uncertainty without the supplementary boreholes
- Better models – more accurate risk assessments

Actions

- Initiatives on a project scale/a national scale is needed
- Conversion of old data to a common format
- Initiatives to secure future use of a common format
- The work has started!