Updating and maintenance of data models in ModelBuilder

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Abstract

At the end of 2004, the Development Programmes of Water Supply and Sewerage Systems of Agglomeration Units were finished in all region of the Czech Republic. The Programme gives a concept of the water supply and distribution, including the definition of the surface and underground water sources, which may be considered for drinking water in future. It also gives a concept for the sewerage systems and the Waste Water Treatment Plant. Both concepts are planned for the regions until 2015. The end users of the Programmes were Ministry of Agriculture, Czech Republic and Regional Authorities.
One of the most important parts of the projects was graphical output with respect to the geographical information systems.
The aim of the paper is to summarize main steps in the development of data models. The main attention is focused on the maintenance and updating of the data models using ModelBuilder.

Abstrakt

Plány rozvoje vodovodních a kanalizačních územních celků byly dokončeny ve všech krajích na konci roku 2004. Program obsahuje koncepci řešení zásobování pitnou vodou, včetně vymezení zdrojů povrchových a podzemních vod, uvažovaných pro účely úpravy na pitnou vodu, a koncepci odkanalizování a čištění odpadních vod v daném územním celku do roku 2015. Objednavatelem Plánu bylo Ministerstvo zemědělství ČR a Krajské úřady.
Jednou z nejdůležitějších součástí těchto projektů byly grafické výstupy s vazbou na geografické informační systémy.
Článek popisuje hlavní kroky při tvorbě datových modelů v rámci projektu Plánu rozvoje vodovodů a kanalizací. Pozornost je zejména soustředěna na údržbu a aktualizaci datových modelů využitím nejmodernějších nástrojů (ModelBuilder).

Development of data models

The data models were already described in a detail, see [1, 2]. In this paragraph, the summary of work will be discussed. The performed work can be divided in five main steps:

- Collection of input data.
- Layers definition in CAD.
- Data conversion from CAD and/or Microstation to personal geodatabase and/ or shapefile.
- Font creation.
- The development projects in ArcMap and ArcExplorer.

The collection of input data was one of the most crucial steps. Local municipalities mainly provide water and sewerage systems. The collection of input data primarily means to digitize water distribution and sewerage systems directly from "paper maps" or to receive the data from local municipalities as CAD drawings. If data are stored in GIS, it needs to select just layers which are needed for the project.

Most of the companies, which are involved in the projects, are still using mainly CAD and/or MICROSTATION. From this point of view, another major step in data collection was to define layers. The second task was to define how data must be prepared with respect to the conversion to ESRI format.

Fig. 1 shows the layers, which must be included in the project. More then 30 layers were defined. Both current and designed scenarios are included.

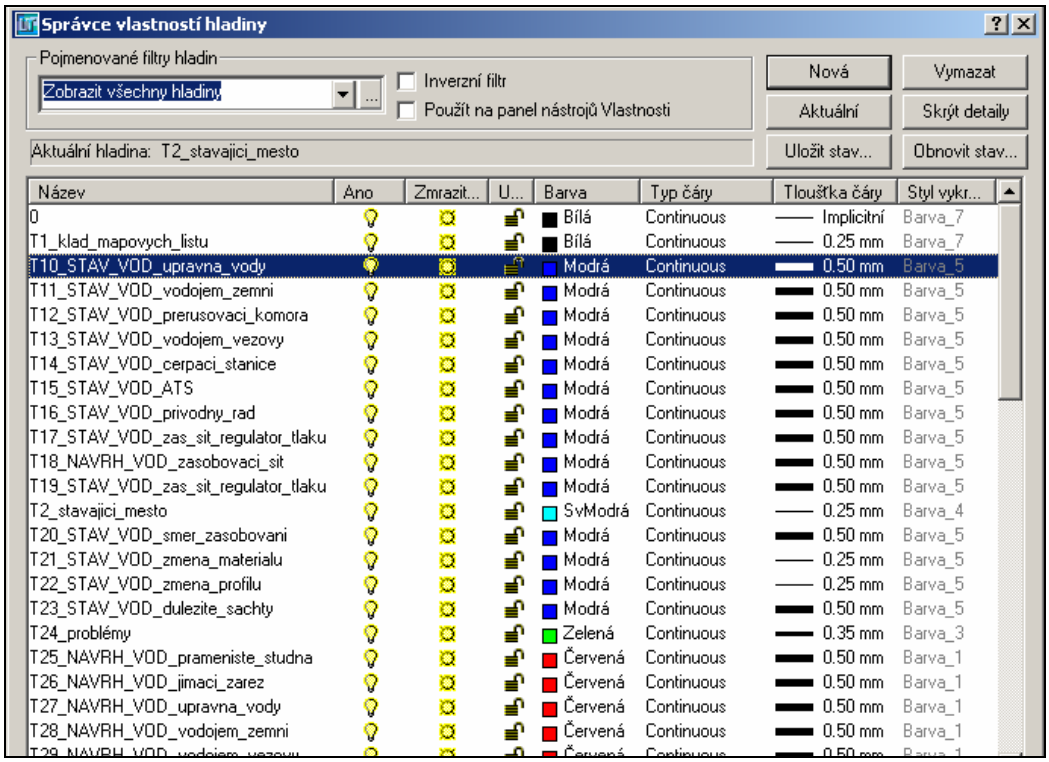

Fig. 1: Definition of the layers.

Data conversion from CAD to ESRI format was described in previous papers; [1], [2].

The symbology should meet the criteria of the Czech Standards (CSN 01 3463, CSN 01 3462) where symbols for the water utilities (e.g. Waste Water Treatment Plant, ground reservoir) are specified. The software package Font Creator 4.0 was applied for the font creation.

The main advantages of using True type font for symbology can be summarized:

- Easy development and modification.
- Fast and safe installation.
- Flexible usage of fonts.

Fig. 2 shows an interface of the software package Font Create 4.0. The software product is able to design True Type Fonts. For more information, please, visit website http://www.high-logic.com/.

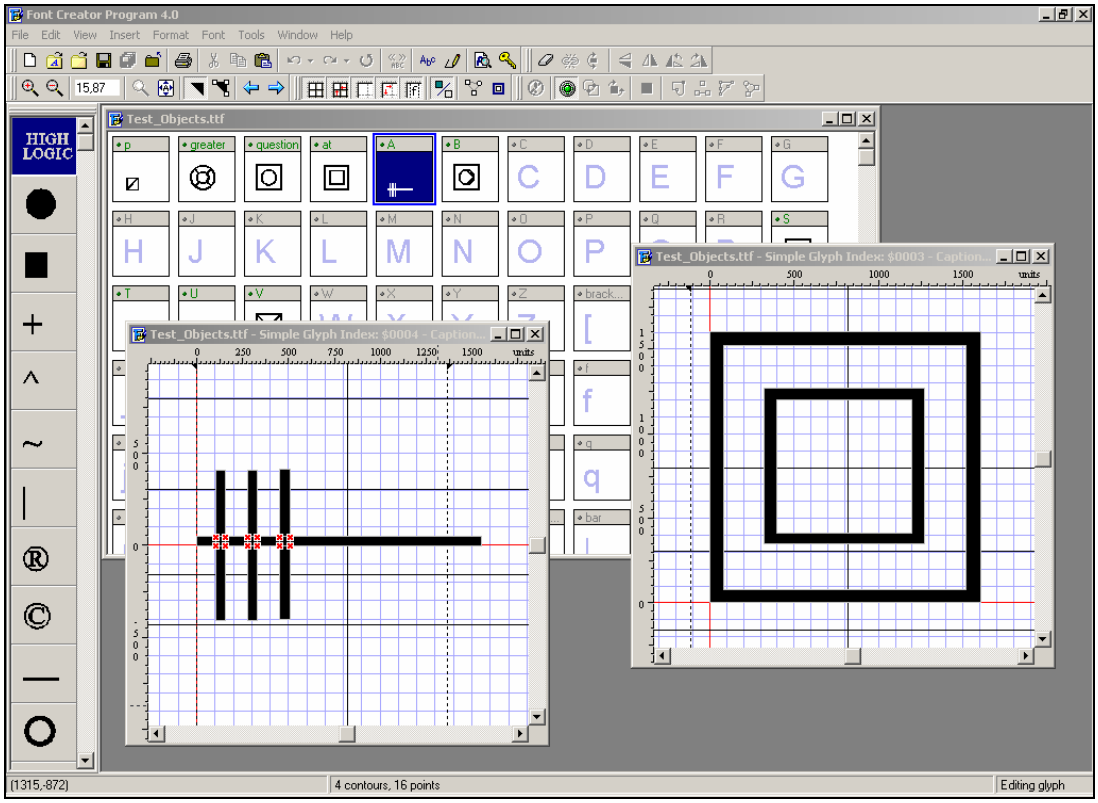

Fig. 2: Creation of the symbols.

The projects were developed both in ArcMap (*.mxd) and in ArcExplorer (.axl). The significant point features (e.g. reservoirs, water treatment plants, pumping stations) in the projects were joined to the detailed MS Access database. The labels were dynamically placed, and label text strings were based on feature attributes. Due to the complexity of labels it was necessary to write VB script. Fig. 3 illustrates a part of VB script for a reservoir.

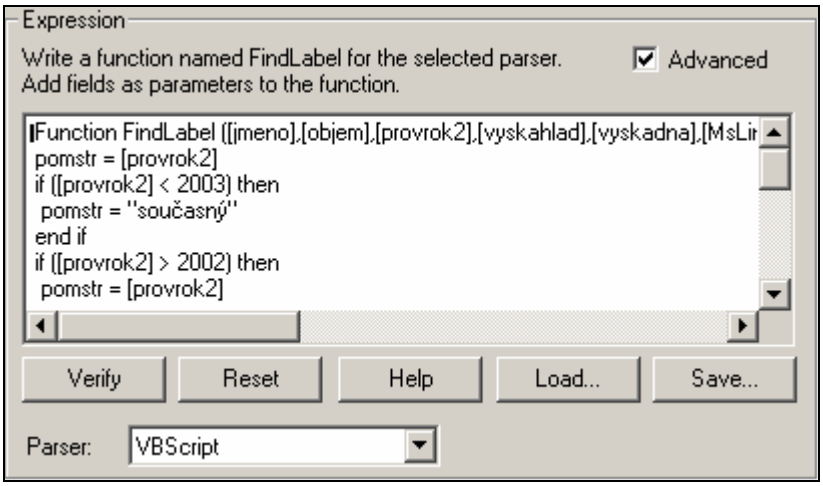

Fig. 3: A sample of labelling for a reservoir.

Fig. 4 shows a detail of the water supply system near the City of Prague. The detailed data model gives information concerning both water supply and sewerage systems. It contains more than 20 layers.

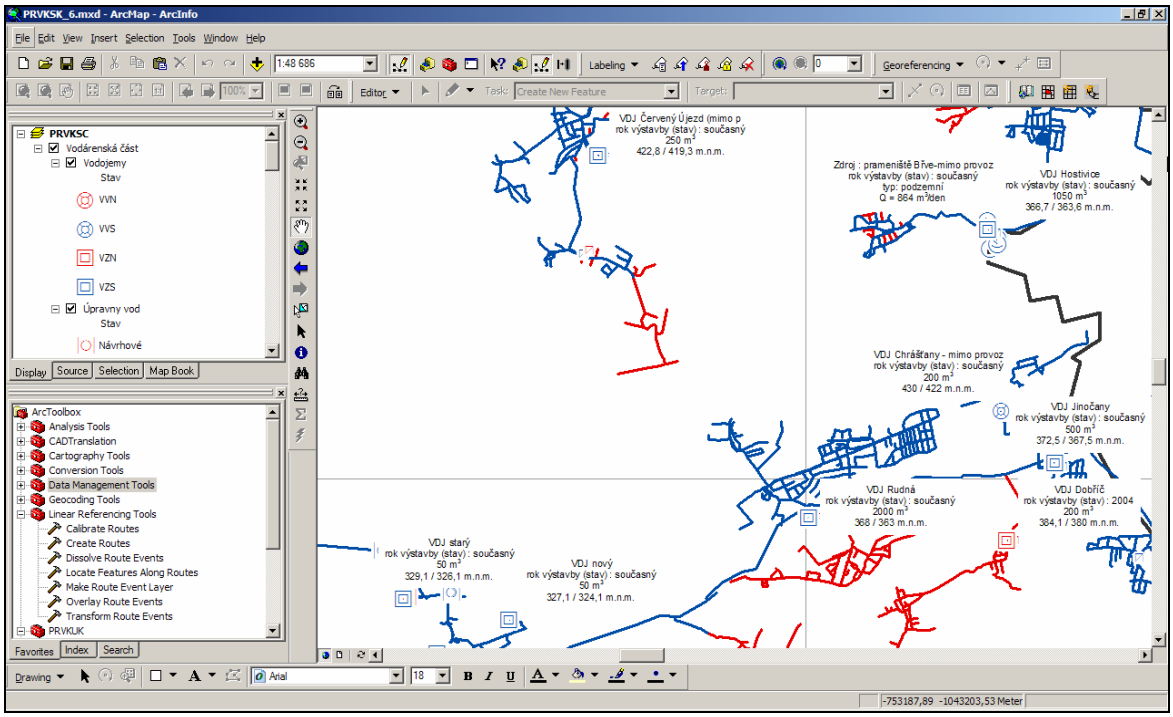

Fig. 4: Water supply and distribution system - Stredocesky Region.

Fig. 5 illustrates the cumulative data model. It gives comprehensive information concerning to the water distribution and sewerage systems in the local units for years 2002, 2010 and 2015.

It shows the thematic map according to the average flow Q_p in 2010. The results of the model can be viewed on website. For more information, please, see http://mapy.kr-ustecky.cz/website/zp/prvkuk/viewer.htm

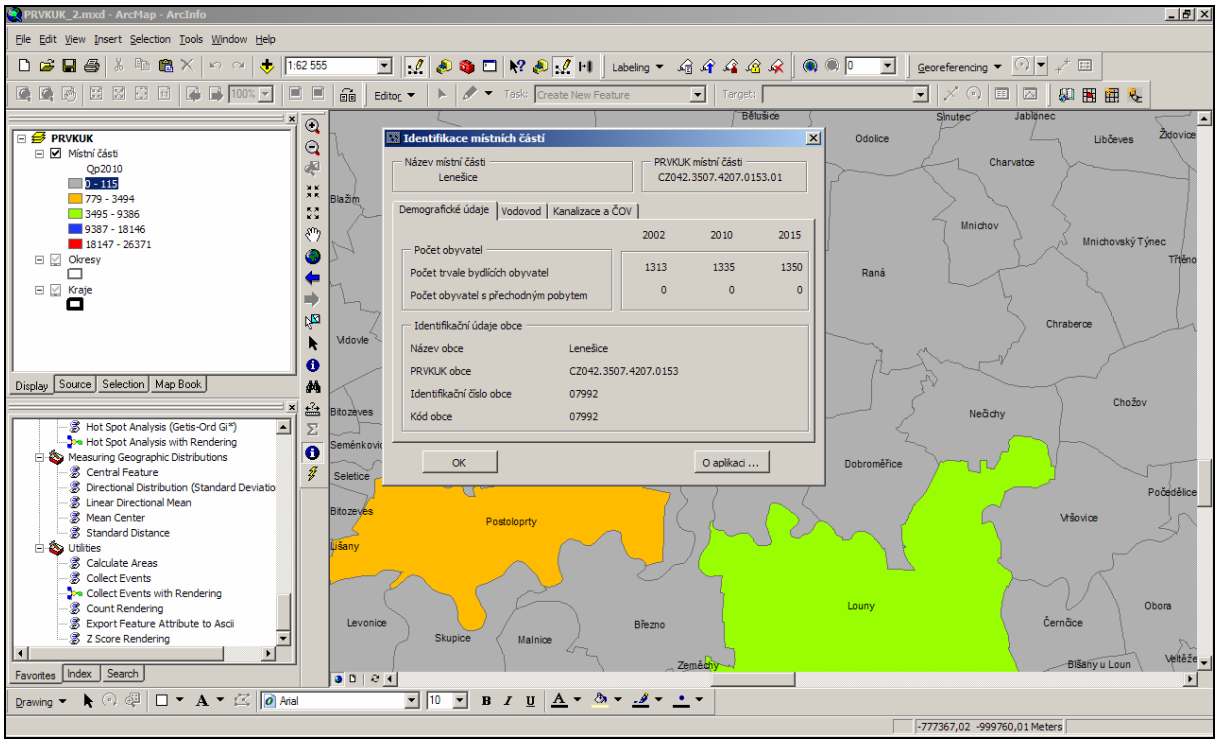

Fig. 5: Development Programme of Water Supply and Sewerage Systems in Usti region – Cumulative model.

Data maintenance and updating

All completed projects reflect current state (year 2003-2004) and the future developments until year 2015. The maintenance and updating of data models including MS Access databases should be done continuously to reflect the changes in the water distribution and sewerage systems. Updating also includes priorities for the future developments, and follow new developments in GIS products. There are two main reasons for updating of data models. Both of them are summarized bellow:

Technology progress:

- Updating of the products.
  - New enhancement in the products.
  - Keeping the data compatibility with others users of ArcGIS.
- New expectations and requirements of clients and/or end-users.
  - To store data in a geodatabase which is more sophisticated then storing data in shapefiles.
  - To develop topology and geometry for both water and sewerage systems.
  - To analyze data and data modelling.
  - To present results and outputs.

Data updating:

- Replacing pipes in the systems due to rehabilitation program.

- Increasing or decreasing existing capacity of water utilities (e.g. increasing of pump capacity, intensification or rehabilitation of Waste Water Treatment Plants).
- Changing of priorities in future developments in the region.
- Changing of legislative in the Czech Republic and/or EU.

According to the Law [3], the Development Programme of Water Supply and Sewerage Systems was finished at the end of year 2004. Based on a new amendment prepared by the Ministry of Agriculture, Czech Republic the projects must be updated each 2 years.

With regard to data updating, the new geoprocessing procedures tools should be designed. In order to automate the workflow and keep track of the geoprocessing tasks it is required to create a model. A model will allow performing a workflow, modifying it, and repeating it over and over with a single click.

Examples

Two examples of model updating are shown bellow.

1. Updating of cumulative data model.
2. Updating of detailed model.

One of the most frequent tasks, which have been performed during the development data model, was changing MS Access database. In order to automate the workflow and performed the geoprocessing procedures, it is effective to a develop model diagram in ModelBuilder. Fig. 6 shows a diagram for updating of the cumulative data model in ModelBuilder.

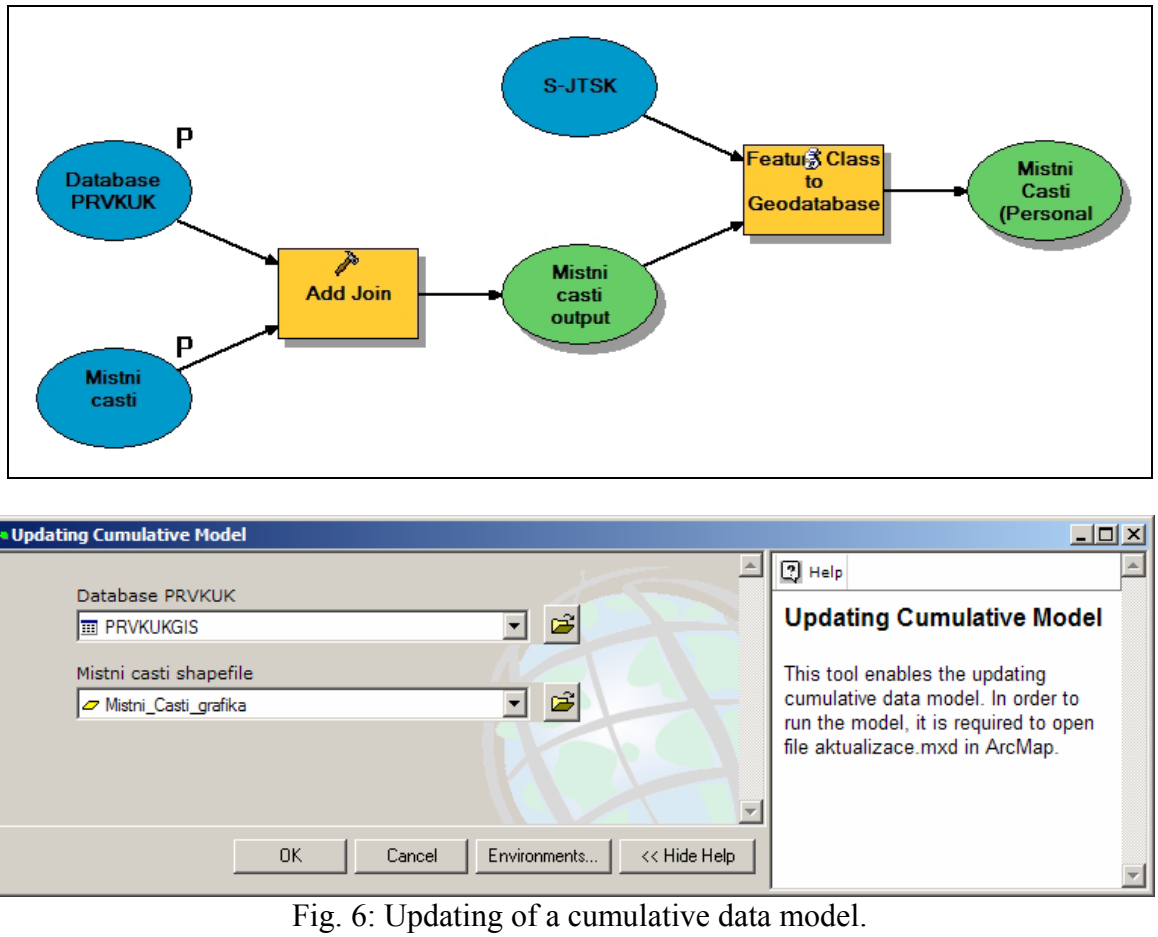

Fig. 6: Updating of a cumulative data model.

Fig. 7 gives an overview for updating one feature class in the detailed data model and creating spatial references. The detailed data model contains usually more then 10 features. In order to performed work more effectively and easily it will be planned to design a cycle for the model.

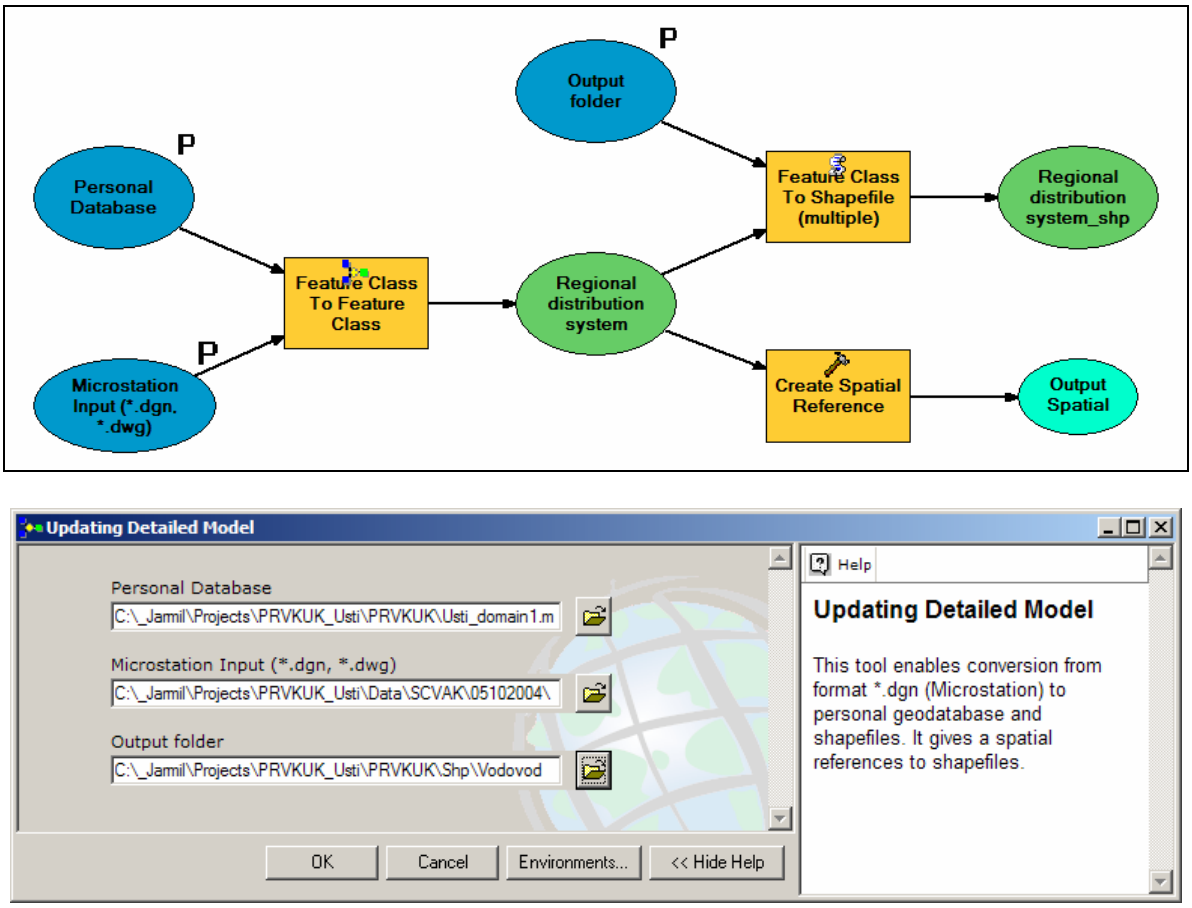

Fig. 7: Updating of a feature of the detailed data model.

Conclusion

The Development Programmes of Water Supply and Sewerage Systems of Agglomeration Units represent basic concept documents for the water supply, the sewerage systems and the wastewater treatment for future 10 years. Each document also analyzes current state of both systems and also plans both technical and economical development of the systems for future rehabilitation in the region.

In order to keep the data actual, the maintenance and updating of models are necessary. ModelBuilder is powerful tool for the updating.

The Development may be used not only by decision makers and/or experts in water distribution and sewerage systems but also by managers, local politicians and also those who are responsible for the environmental protection in the local region authorities.

Literatura

[1] Vycital, J.: Plans of development of water & sewerage territorial unit – the development of data models, ArcRevue 3/2004, pp.13-17, 2004 (in Czech)
[2] Vycital, J.: PRVK – GIS part, Project report, Hydroprojekt CZ, a.s., 2004, (in Czech)
[3] Zákon o vodovodech a kanalizacích pro veřejnou potřebu, č. Sb 274/2001 ze dne 10.7. 2001