THE USE OF GIS IN WATER CADASTER

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Abstract: *This paper proposes the classification of the main issues that GIS have to meet in water cadastre, the possibility to introduce specialized cadastral information in predefined relational data structures, according to cadastral rules and getting the integrated Data Bank in any GIS system. Real world entities are so complex that they should be classified in classes of objects with certain thematic similarities and modeled in spatial database. Objects from a spatial database are defined as representations of the real world that have associated attributes. Generally, geospatial data have three major components: location, attributes and time. Attributes are often referred to as "data subject" or "non-spatial data" and related to spatial or geometric data. An attribute has a defined characteristic of the entity in the real world. Attributes can be classified as normal, ordinal, numeric, conditional or who describe other features.*

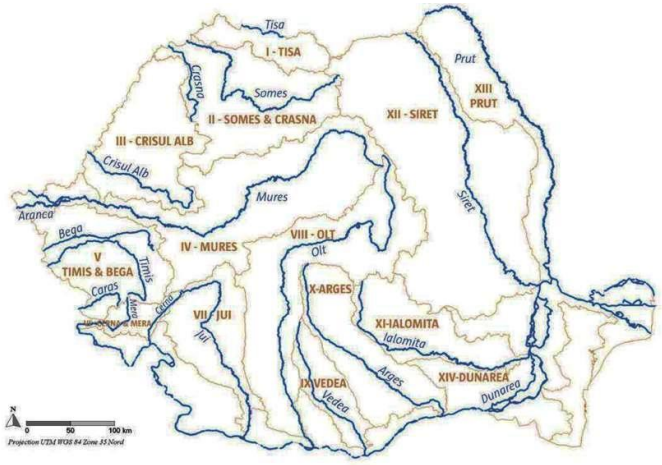
Keywords: *GIS, Water Cadastre, catchments*

1. Introduction

For the solving and regulation of the problems imposed by the efficient and complex water resources management it is necessary to know, through the work of the Information System specific for water management, the data sets that characterize these resources.
In our country, the National Data Fund for water management was organized in 1958 as an inventory required for the preparation of complex development of watershed plans and the national program of water development in Romania. In the first stage, the information system specific for water management conducted a primary inventory and a systematic ordering of the morphometric characteristics of the rivers basins. For this was done first a coding, for the 15 first order river basins, of all tributaries (up to the order six, inclusive) (Figure 1) which satisfy the conditions that the length of the watercourse to be at least 5 km, and the catchment area to be less than 10 km^2 (Water Cadastre Atlas of Romania, 1992).

The Information system specific for water management is the surface water, groundwater and the natural frame of waters.

The system purpose is to solve the knowledge, inventory and systematic record, quantitative and qualitative, of all data regarding the natural water conditions and also the water works for control, use and protection of water resources and water quality (embankments, dams, canals, drains etc.) for all waters in Romania.



1	Tisa superioara	I
2	Somesul	II
3	Crisurile	III
4	Mures-Aranca	IV
5	Bega	V
6	Caras	VI
7	Nera	VII
8	Jiul	VIII
9	Oltul	IX
10	Vedea	X
11	Argesul	XI
12	Ialomita	XII
13	Siretul	XIII
14	Prutul	XIV
15	Dunarea si Litoralul	XV

Fig. 1. Watersheds of the 1st order

2. Materials and methods

The graphic and alphanumeric data which led to the cadastral plans have been acquired from the existing Topo-Cadastral documentation identified in the archives of specialized institutions for the specified area. By scanning and digitizing the documents referred above, there were obtained the cadastral plans in digital format.

A GIS is able to stored plans / maps (graphic representations of spatially distributed entities, the constitution-vector points, lines and polygons, texts - but integrating the needs and bitmap / raster) which gives them both, by association with the base intelligence Descriptive data (each entity and graphics and could correspond to a series of structured attributes) and the convenience of analysis (query based on spatial and / or alpha-numeric)

Along with cadastral objects in a spatial format, in the database are found raster files made available by NARW, which are background layers for the displayed data.

With a scalar architecture and a complex and flexible structure, the geo-referenced database provides key functionality in the spatial information management:

- stores an extensive collection of data types in a centralized location;
- defines advanced models of geometrical discipleship;
- maintains the integrity of spatial data;
- offers integration capabilities with spatial data from external databases;

Polling data involves identifying certain elements or identify all elements that satisfy a certain condition.

Queries can be of three types:

- based on spatial coordinates: searchable cadastral objects based on geographical coordinates (Figure 2)
- based on attributes: searchable cadastral objects based on existing attributes for each entity (Figure 3)
- combined

Possible types of queries on the database by: cadastral axis, accumulation, confluent, groundwater catchments, river sub-basins, gauging stations, regulation, erosion, permanent and temporary reservoirs.

Advanced search involves placing criteria or data filter and perform search. Filters applied to the data are of two types: filters based on attribute and those based on the geographical localization. The filters based on attributes involve completing the following information: cadastral category, cadastral group, the attribute on which will be based on the filtering, filter criteria, the value of the filter.

To perform a search based on the geographical location of objects, one must specify the type of search required:

- based on the spatial database (geografical coordinates)
  - according to a benchmark - objects located within a certain radius or the closest to the reference point
  - the reference area - the objects located within the specified reference area
  - adjacent area – the objects located in the area adjacent to the reference object, line or polygon type
- based on appurtenance to a group of basins, sub-basins, county or watercourse

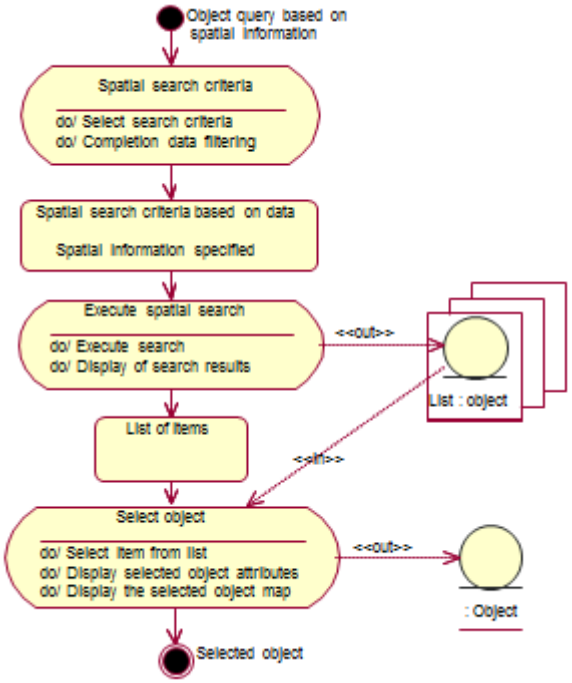


Fig. 2. Object query based on spatial information

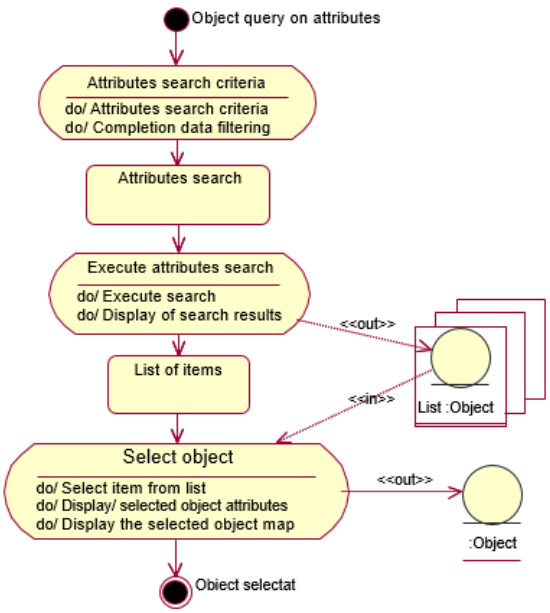


Fig. 3. Object search based on attributes

An objective of water cadastre is the "cadastral water axis" or "the distance-leveling axis". This was carried out on the main water streams and has been materialized in the field by a number of approx. 20,000 concrete terminals, some of them have been included in the network of the country precision leveling. Summary data referring to the records of all encoded water courses and objectives that are on these (without considering the cadastral areas occupied) are included in the Atlas of water cadastre in Romania.

The distance-leveling axis serves for reporting all inventory items in the water cadastre and also as reference for future survey of riverbeds. All identified and inventoried cadastral objects are represented by distances and levels against this frame of reference, items that are checked periodically to determine any changes over time. Also starting from the points of the

distance - leveling axis are determined the absolute altitudes of waterworks, are determined the trends of channel change and the floodplain delineation. The CSA bollards (figure 4) are related to the country geodetic network and are important not only because they are determined by the position of cadastral objects, but also because it serves for the preparation of topographic base needed to design and control the execution of all water works and water use (figure 5) (table 1).

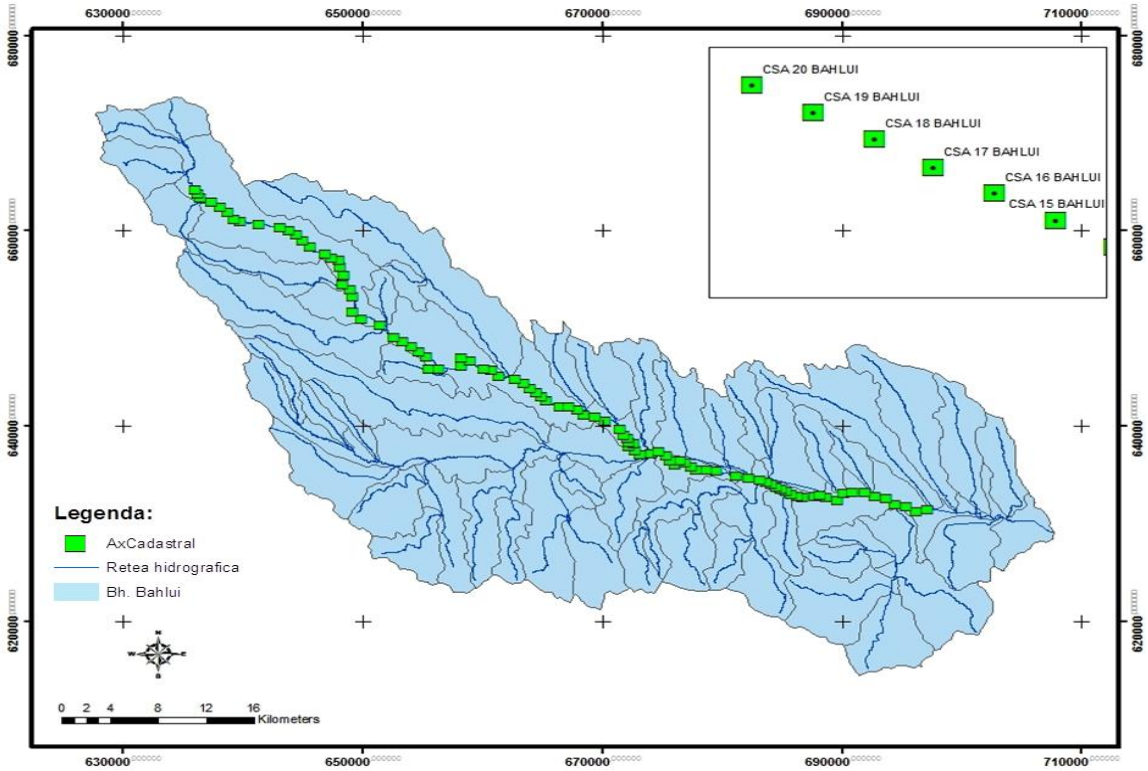


Fig. 4. Query by the bollards that form the cadastral axis of the Bahlui river basin

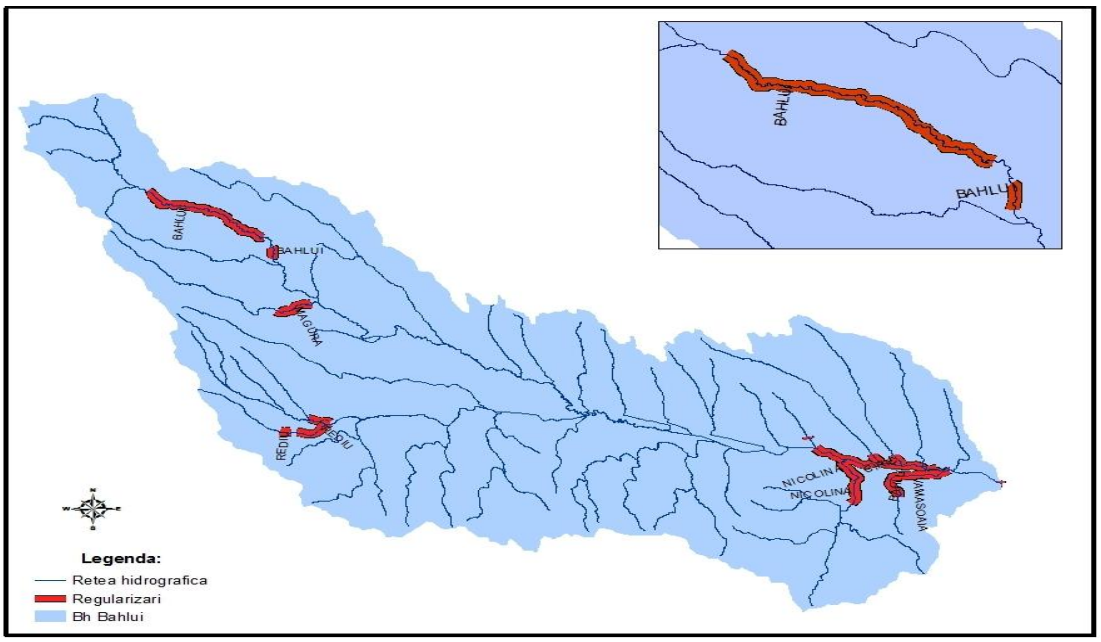


Fig. 5. Query by regularization works

Table 1. Regularization works

No.	Name regularization location	Stream	Cadastral code	Length (m)	Coordinates Stereo 70		Year PIF
					Positioning - began	positioning - finally	
					X,Y	X,Y	
1	Regularization of the Bahlui river downstream ac. Pârcovaci/city Hârlău	Bahlui	13,01,15,32	12000	637527,10 662815,87	645630,65 658323,87	1992
2	Regularization of the Bahlui river at Iași/mun. Iași	Bahlui	13,01,15,32	13850	692406,24 633190,87	704264,35 630295,25	1965
3	Regularization of the Bahlui river, bridge CF Holboca - confluence river Jijia / mun. Iași	Bahlui	13,01,15,32	5470	704264,35 630295,25	707731,13 629130,55	1987
4	Regularization of the Bahlueț river Târgu Frumos/city Târgu Frumos	Bahlueț	13,01,15,32,12	2900	651505,98 636402,29	653060,31 635938,36	1975
5	Regularization of the Rediu river at Târgu Frumos / city Tg. Frumos	Rediu	13,01,15,32,12,04	3900	652314,88 635458,07	652632,10 635861,53	1977
6	Regularization of the Rediu river (Fundu Văii) at Iași / mun. Iași	Rediu (Fundu Văii)	13,01,15,32,19	2000	691554,99 634932,96	692408,86 633185,96	1991
7	Regularization of the Nicolina river / mun. Iași	Nicolina	13,01,15,32,20	6280	694513,62 626027,82	694492,65 631879,76	1965
8	Regularization of the Ciric river, downstream ac. Ciric III / mun. Iași	Ciric	13,01,15,32,22	1400	698632,29 632809,90	699428,57 631159,00	1984
9	Regularization of the Vămășoaia river /mun. Iași	Vămășoaia	13,01,15,32,23a	8000	699310,17 627831,97	702327,42 630012,78	1964
10	Regularization of the Repedea river /mun. Iași	Repedea	uncoded	1000	700431,06 627185,17	699394,83 627957,26	1964
11	Regularization of the Vlădiceni river /com. Tomești	Vlădiceni	uncoded	1070	701281,03 629139,10	701314,90 630165,17	1977

3. Conclusions

The opportunity provided by Geographical Information Systems to combine different data from different sources and get answers in real time is a great advantage for administration and population.

Digital format is making complaints in addition to the requirement of the time, modern and efficient working.

Digital data can be continuously updated and improved by providing a viable image of a territory at any time.

The geographic analysis is performed to meet the set objectives and criteria. The results of geographical analysis are communicated through maps, reports and graphs. Thematic maps, tables and graphics generated by the geographical analysis prove the defining ability of

a GIS to create new information, not only to manage and/or extract, in various ways, previously purchased data, which differs fundamentally a GIS from a databases management system and an automatic mapping system.

The way of the coding of river network in Romania has to be adapted to the geographical specific of the occupied territory. It has to be taken into account all existing possibilities and possible interventions in the natural system. In terms of hydrographic, Romania has some obvious features that are not found in the territory of any state of the European Union, so none of the coding systems of the member countries can be fully calibrated.

The Information System specific to the water domain cannot be created solely by a single institution, but by the effort of all organizations responsible for land management and data processing, as well as specialists in other fields.

4. References

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