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Knowledge Base of Algorithmic and Software Base for Intellectualization of Underground Water Supply Facilities

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Abstract: *This article examines the importance of the knowledge base in the development of an intelligent algorithmic and software complex of underground water intake facilities. When developing the computerized knowledge base of underground water intake facilities, the management knowledge base, the classification of knowledge bases, the use of conventional knowledge bases for creating expert systems and storing information about the facility will be studied. A knowledge base structure will be developed when creating an intelligent algorithmic and software complex of underground water intake facilities. When organizing the process of forming underground water intake facilities, the development of a knowledge base for the watertight properties of single-layer moisture layers will be studied. During the formation of underground water intake facilities, knowledge is calculated to solve the issues of determining the watertightness of single-layer earthworks.*

Keywords: *knowledge base, intellectualization, underground water intake facility, expert, database, well.*

An independent set of materials (ground-based irrigation channels, hydrogeological mathematical simulations, seasonal processes and other similar data), the database of which is presented in an objective form during the operation of an intelligent software complex of underground water intake facilities, is a systematic software tool that can be processed and processed using electronic computers. The knowledge base is important in the development of an intelligent algorithmic and software complex of underground water intake facilities. At the same time, it is necessary to use equipment of all types of underground water intake facilities, technological schemes and seasonal processes, relying on strong knowledge. At the same time, this is mainly an expert system, which is one of the main pillars of the knowledge base of the software complex of underground water intake structures. The degree of accuracy of the expert system will be carried out on the basis of the opinions of specialists with many years of experience, hydrogeologists, scientists of hydrogeological areas and specialists with knowledge of technical systems.

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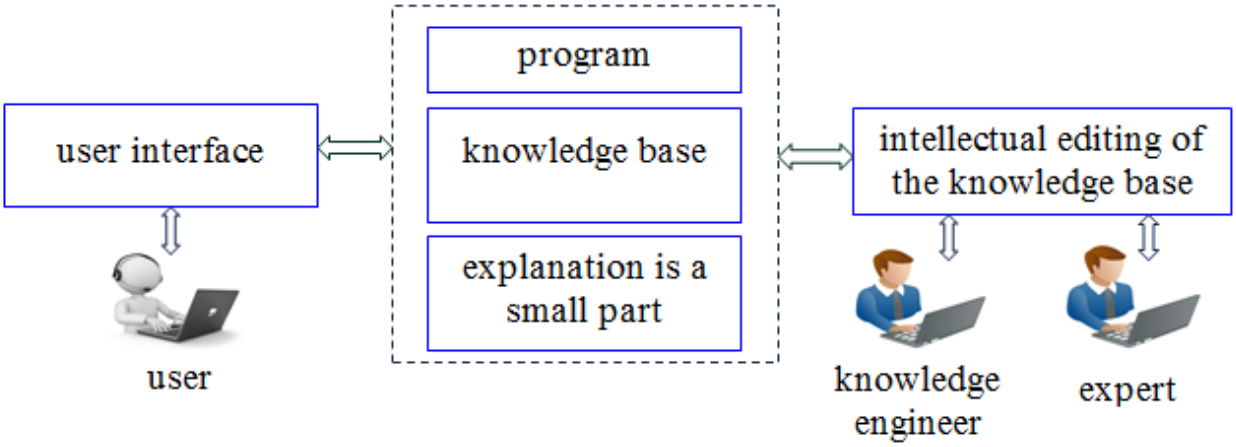

Figure 1. Structure of knowledge base formation based on expert systems.

The knowledge base in research on the intellectualization of the process of formation of underground water intake facilities is a part of the database designed to work on knowledge about groundwater. The knowledge base of the software complex includes data created for use by computer devices or a specialist to cover a certain area of knowledge.

Software complex of underground water intake facilities knowledge base

The knowledge base for managing underground water intake facilities is a special database designed to collect, store, search and process knowledge.

Knowledge base during the intellectualization of underground water intake facilities includes rules for compiling data and conclusions, allowing to make a logical conclusion and meaningful processing of information.

For example, in the algorithmic-software complex, the knowledge base is described in the form of specific facts and rules for drawing conclusions on databases and information processing procedures that logically reflect data and procedural knowledge at the stage of formation, operation and restoration of the main seasonal processes of work.

The most important feature of stored information in the knowledge base (WB) is based on information obtained using conclusion rules included in the knowledge base and the reliability of specific and generalized data in the database. The software package defines "exact" and "indefinite" knowledge values depending on the presence on the database of relevant facts that meet the simplest requests for knowledge bases of the logical programming system. The reliability of the generalized knowledge base data depends on the availability of the necessary facts and the reliability of the data in the knowledge base.

One of the most important parameters of the knowledge base of underground water intake facilities is the quality of the collected knowledge. The excellence of the knowledge base of underground water intake facilities contains important, reliable and up-to-date knowledge base information.

Classification of knowledge bases of underground water intake facilities.

Knowledge bases of underground water intake facilities are divided into the following sections depending on the degree of complexity of the systems used:

- Knowledge bases of underground water intake facilities worldwide;
- National knowledge bases of underground water intake facilities;
- Knowledge bases of scientists;

- Knowledge bases of expert systems;
- knowledge bases of specialists.

Applying Knowledge Bases

The algorithmic and software complex of intellectualization of the process of formation of underground water intake structures, knowledge bases are mainly important for the creation of expert systems and the use of ordinary knowledge bases for storing information about the organization:

- documents;
- benefits;
- technical assistance articles.

The main purpose of creating such databases is to help specialists who are not experienced to find an existing characteristic of how to solve a problem in the field of topic.

The knowledge base is an important component of a smart system. One of the most famous types of such programs is the creation of expert systems. They are designed to create a specialized way to solve problems based on knowledge base records and a description of the user's situation. The use of artificial intelligence systems in agar requires large knowledge bases and knowledge on the computerization of underground water intake facilities. structure of knowledge base in creation of intelligent software complex of underground water intake facilities:

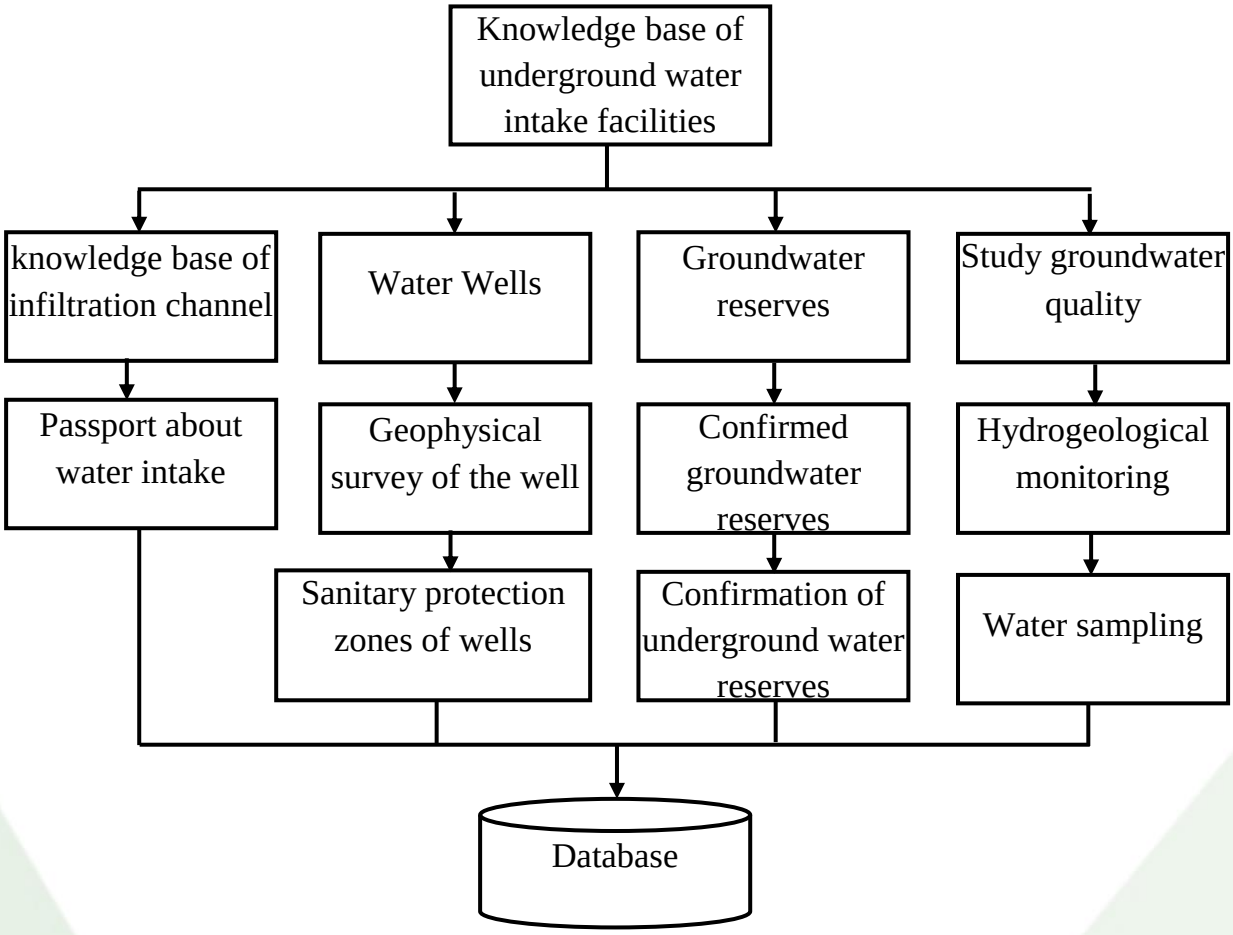

Figure 2. Scheme of underground water intake facilities on the basis of knowledge

The infiltration channel of underground water intake facilities - reflects the knowledge base on filling groundwater reserves of the first water intake on the ground in conditions of low permeable coating or low thickness of infiltration channels (basins, channels, platforms,etc.).

Certificate base of knowledge on water intakes of underground water intake facilities - name of underground water intake facilities; postal address of underground water intake facilities; Head of underground water intake facilities (full name, telephone); person responsible for underground water intake facilities (full name, telephone); number of wells, their numbers according to the state water cadastre; a knowledge base on the allowed flow rate.

In the knowledge base at the well junction of underground water intake facilities - well number, drilling date, coordinates of rivers (X, Y, Z); table of description of geological structure (absolute feature of bedding, geological age, lithological composition); surface of groundwater (appearance and installation); knowledge base based on structure design (column spacing and radius of columns, filters).

Geophysical studies of wells of underground water intake facilities in the knowledge base - table with resistance results, gamma rays, caliper measurement (determination of dependence of well parameters on its depth using manual gauge), flow measurement, thermometry (measurement point depth, parameter values); the text of the conclusion; video recording (full recording of data collected during well drilling through geophysical surveys).

Dimensions of sanitary protection zones - on the basis of knowledge around sanitary protection zones of wells of underground water intake facilities; conclusion of the client's controller on sanitary protection zones (number, date, validity period of the conclusion, scanned pages of the conclusion); water intake inspection certificates (scanned traffic pages, photographs of facilities and sanitary control areas).

Groundwater reserves of underground water intake facilities in the knowledge base - data on the amount of water contained in the water layer in natural conditions or included in it as a result of water management activities.

In the knowledge base based on the approved underground water reserves of underground water intake facilities - operated horizon, conductivity, degree of conductivity, hydraulic mode of operation, permissible level/pressure, actual static and dynamic levels, degree of sharpness, forecast for maximum flow rate; method for estimating groundwater reserves (analytical/hydraulic/modeling); The table of reserve values proposed for approval by category reflects A, B, C1, C2 (good, operated horizon, achieved flow rate, flow rate for confirmation by category).

Protocol of the commission on state reserves - knowledge base based on confirmation of underground water reserves of underground water intake facilities (date, number); Quantity of inventory approved in categories A, B, C1, C2 knowledge base on scanned pages of the state reserves commission protocol.

In the knowledge base for studying the quality of underground waters of underground water intake facilities - sample number, date of sample receipt, conditions for sample receipt; laboratory name; summary indicators, table of water quality indicators for chemistry, microbiology and radiology; scanned pages of water quality study protocols.

In the knowledge base of hydrogeological monitoring - a one-time table of measurement of static and dynamic levels (degree, date of measurement); table of one-time measurements of pump water temperature.

In the base of water intake knowledge of underground water intake structures - pump grade, its installation depth, water meter grade; primary data table (counter index, measurement date) on water production accounting includes knowledge base.

The main organizer of the process of formation of underground water intake facilities, based on the above, is the development of a knowledge base for the watertight properties of these layers. When forming single-layer underground water intake facilities, it is mainly water permeability of four layers (Sandy loam, Loam, Clay, Sand).

The 1st layer of the “Sandy loam” knowledge base is an empty stone or soil consisting of sand and dust particles. Visually, this practically does not differ from dirt.

The 2-layer “Loam” knowledge base is scattered sticky rocks consisting mainly of sand and dust particles with a significant content of left particles.

The 3- layer knowledge base "Clay" is the most stable waterproofing agent and has a waterproof property.

The 4- layer knowledge base "Sand" Sedimentary rocks represented by one or more layers of rocks with different permeability levels and underground layers.

1) Knowledge base for the first layer of groundwater " Sandy loam." At the same time, knowledge is mainly calculated for the permeable properties of the Supes layer, which includes:

$$C_1 = 0 - 1м, C_2 = 0 - 3м, Г = 0 - 6м, П = 20м - n$$

1. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \geq 20$ else (1)
2. IF $C_1 \geq 1{,}1, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,9)
3. IF $C_1 \geq 1{,}2, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,8)
4. IF $C_1 \geq 1{,}3, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,7)
5. IF $C_1 \geq 1{,}4, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,6)
6. IF $C_1 \geq 1{,}5, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,5)
7. IF $C_1 \geq 1{,}6, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,4)
8. IF $C_1 \geq 1{,}7, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,3)
9. IF $C_1 \geq 1{,}8, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,2)
10. IF $C_1 \geq 1{,}9, C_2 \leq 3, G \leq 6, P \geq 20$ else (0,1)

2) Knowledge base for the second layer of groundwater " Loam." At the same time, knowledge is mainly calculated for the waterproof properties of the Suglenok layer, which includes:

$$C_1 = 0 - 1м, C_2 = 0 - 3м, Г = 0 - 6м, П = 20м - n$$

1. IF $C_1 \leq 1, C_2 \geq 3{,}2, G \leq 6, P \geq 20$ else (1)
2. IF $C_1 \leq 1, C_2 \geq 3{,}4, G \leq 6, P \geq 20$ else (0,9)
3. IF $C_1 \leq 1, C_2 \geq 3{,}6, G \leq 6, P \geq 20$ else (0,8)
4. IF $C_1 \leq 1, C_2 \geq 3{,}8, G \leq 6, P \geq 20$ else (0,7)
5. IF $C_1 \leq 1, C_2 \geq 4, G \leq 6, P \geq 20$ else (0,6)
6. IF $C_1 \leq 1, C_2 \geq 4{,}2, G \leq 6, P \geq 20$ else (0,5)
7. IF $C_1 \leq 1, C_2 \geq 4{,}4, G \leq 6, P \geq 20$ else (0,4)

8. IF $C_1 \leq 1, C_2 \geq 4{,}6, G \leq 6, P \geq 20$ else (0,3)
9. IF $C_1 \leq 1, C_2 \geq 4{,}8, G \leq 6, P \geq 20$ else (0,2)
10. IF $C_1 \leq 1, C_2 \geq 5, G \leq 6, P \geq 20$ else (0,1)

3) Knowledge base for "Clay" of the third layer of groundwater. At the same time, knowledge is mainly calculated for the permeable properties of the Clay layer, which includes:

$$C_1 = 0 - 1м, C_2 = 0 - 3м, Г = 0 - 6м, П = 20м - n$$

1. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}1, P \geq 20$ else (1)
2. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}2, P \geq 20$ else (0,9)
3. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}3, P \geq 20$ else (0,8)
4. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}4, P \geq 20$ else (0,7)
5. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}5, P \geq 20$ else (0,6)
6. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}6, P \geq 20$ else (0,5)
7. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}7, P \geq 20$ else (0,4)
8. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}8, P \geq 20$ else (0,3)
9. IF $C_1 \leq 1, C_2 \leq 3, G \geq 6{,}9, P \geq 20$ else (0,2)
10. IF $C_1 \leq 1, C_2 \leq 3, G \geq 7, P \geq 20$ else (0,1)

4) The third layer of groundwater is the knowledge base for Sand. At the same time, knowledge is mainly calculated for the waterproof properties of the Sand Layer, which includes:

$$C_1 = 0 - 1м, C_2 = 0 - 3м, Г = 0 - 6м, П = 20м - n$$

1. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 19$ else (0,9)
2. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 18$ else (0,8)
3. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 17$ else (0,7)
4. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 16$ else (0,6)
5. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 15$ else (0,5)
6. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 14$ else (0,4)
7. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 13$ else (0,3)
8. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 12$ else (0,2)
9. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 11$ else (0,1)
10. IF $C_1 \leq 1, C_2 \leq 3, G \leq 6, P \leq 10$ else (0)

Developed from the watertight properties of four layers of reduced earth, the knowledge base plays an important role in the intellectualization of the process of forming underground water intake facilities.

CONCLUSION

Summing up, the work on the formation of a knowledge base structure during the development of an algorithmic and software complex for the intellectualization of the process of formation of underground water intake structures consists in the following:

1. A knowledge base for the intellectualization of underground water intake facilities has been formed on the basis of quantitative data that allow making logical conclusions and meaningful processing of information, and final conclusions;

2. In the algorithmic-software complex of computerization of underground water intake structures, a structure is created designed to organize a knowledge base as an important component of an intellectual system, create expert systems, create methods for solving specialized problems based on structural data of a knowledge base and describe a user's situation.

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