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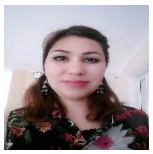

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SECTION 23. Agriculture. Agronomy. The technique.

CALCULATION DEBIT OF THE ARTESIAN WELLS

Abstract*: In this article productivity of a wells is spoken about debit, or. Calculation debit is necessary as at arrangement household water supplying chinks. This concept mean that quantity of water which the wells can give for a time unit. Definitions static and dynamic water levels.*

Key words*: Drilling, static, dynamic, debit, a water level, drawoff, wells.*

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Introduction

Problems with uninterrupted water delivery frequently are a headache of gardeners, summer residents and other land owners. Many try to solve them once and for all, having drilled on the site a deep wells and by that, having provided themselves clean artesian water for long years. Meanwhile pretty often it is possible to meet insufficiently serious relation to this work. It results in a result in misoperation water mined systems, and even necessities of its full reorganization.

At drilling and the subsequent equipment of wells characteristic mistakes which correction at times costs rather considerable money are usually supposed. To avoid it, we shall consider debit wells[1, p. 400].

The design of any wells is very simple. Actually it is the usual metal or plastic pipe introduced up to a level burial of artesian waters. It concerns and to long since used well which can be presented as the same pipe, but the greater diameter.

Materials and Methods

Actually all not so is simple. Those who has seriously decided to drill a wells on the site, at once have set of questions. What optimal diameter of a pipe? What should be depth of a wells that reception of clean water did not appear the expensive? What debit a wells? How to achieve absence in water of extraneous impurity? To answer these and other questions, all over again it is necessary to know calculation debit an artesian wells [2, p. 68]. Debit, or productivity of a wells - the key characteristic of any wells. This concept mean that quantity of water which the wells can give for a time unit provided that the dynamic level does not vary. Debit it is measured at one o'clock, let/sek., let/minutes, let/day, etc [3, p. 64]. It first of all defines an opportunity of use by you of pumps with those or other characteristics and ability of a wells to generate water.

Calculation debit is necessary both at arrangement household water supplying wells, and in gas and a petroleum industry. If to know debit a wells it is easy to pick up the optimum pump equipment as capacity of the pump should correspond to efficiency of a source precisely without problems [4, p. 256]. Proceeding from parameters debit, classification of wells on three groups is carried out: Low debits (it is less than 20 m^3/day); average debits (from 20 up to 85 m^3/day); high debits (over 85 m^3/day). In the gas and oil-extracting industry operation littledebits wells is unprofitable. Therefore preliminary their forecasting debit is the key factor which defines, whether drilling new water wells in developed territory will be carried out.

For performance of calculations it is necessary to learn two parameters of a source - static and dynamic water levels. For this purpose it is required to us rope, with volumetric loaded on the end (such that at a contact to a water table splash was distinctly audible) [5, p. 218].

To measure parameters it is possible on the expiration of one day after the termination of arrangement of a wells. To wait day after end of drilling and washing the quantity of a liquid in a

wells is necessary for that was stabilized. To do gauging it is not recommended earlier - the result can be inexact as in the first day there is a constant increase in a maximum level of water. On the expiration of necessary time it is possible to stand. To do it it is necessary on depth planting columns - to define, what length the part of a pipe in which there is no water has. If the wells is made according to all technology requirements the static water level in it will be always higher, than the top point of a filtering site. The dynamic level is a changeable parameter which will vary depending on conditions of operation of a wells. When the fence of water from a source is carried out, its quantity in planting to a column constantly decreases. In a case when intensity of a fence of water does not exceed efficiency of a source after any time water is stabilized at the certain level.

Proceeding from this, a dynamic level of a liquid in a wells is the parameter of height of a water column which will keep at a constant fence of a liquid with the set intensity [6, p. 76]. At use submersible pumps of different capacity the dynamic water level in a wells will differ. Both these of a parameter are measured in «meters from a surface», that is the below actual height of a water column in an obsidional column, the smaller will be a dynamic level. In practice calculation of a dynamic water level helps to find out, on what maximal depth can be lowered submersible the pump. Calculation of a dynamic water level is carried out in two stages - it is necessary to execute an average and intensive water-fence. To make it is possible after the pump has continuously worked one hour. Having defined both factors, we can already receive the rough information on debit a source - the less difference between a static and dynamic level, the big is debit wells. At a good artesian wells these parameters will be identical, and average on productivity the source has 1-2 meters of a difference.

Calculation debit wells can be made in several ways. For definition debit wells use or the pump of the big productivity, adjusting a water-fence the crane on a surface, or make a water-fence in two various ways - the pump and erlift [7, p. 116].

Evidently it is explained a principle of calculation debit on a concrete example. We shall assume, we have a wells depth in 50 meters, the filter zone (a zone of a fence of water with water supplying horizon) in this wells begins on depth of 45 meters, and the static water level (after a sediment) is fixed on depth of 30 meters. Thus, the general height of a water column in an operational pipe makes 50 - 30 = 20 meters.

Further, suppose, that from our wells for 1 hour have pumped out 2 cubic metre of water then have measured a water level in an operational pipe and have defined, that in comparison with static it during pumping out has decreased on 4 meters and thus, the dynamic level has made 34 meters. In this case, 34 meters are a dynamic water level at debit 2 cube. m/h.

Many borers already proceeding from these figures define debit wells and bring it in the passport. And define thus:

$$Dt = \frac{V}{H_{din} - H_{stat}} * H_w$$

Where: Dt – debit wells (m^3/h); V - intensity откачки waters at gauging (m^3/h); H_{din} - a dynamic water level (measured right after or even in process pumpdown at productivity of the pump equal V); H_{stat} - the static water level measured after «sediment» of a wells in current of day (it is possible less, but will suffer accuracy); H_w - height of a water column in a wells (a difference between depth of a wells and a static water level in it).

In a considered case, value debit will make (2 / 4) * 20 = 10 m^3/h.

It is important to understand, that in such calculation there is one very serious error. Having counted, that at productivity откачки waters of 2 m^3/h the water level in a wells falls on 4 meters, at such calculation we is compelled we assume, that if we begin to extort not two, and we shall tell 4 cubic metre of water at one o'clock the water level will fall too twice more and a difference between static and dynamic water levels will make any more 4, and 8 meters. That is, it is supposed, that at increase in productivity of a water-fence, the dynamic water level in a wells will increase in direct ratio, that actually does not correspond to the validity.

Actually, at increase in intensity of a water-fence falling of a water level in a wells occurs faster, that is real (actual) debit wells will be below counted above, and on how many - directly depends on set of factors and is a specific feature of each concrete wells.

Therefore, more exact picture will be given with measurement specific debit, and the second water-fence is already necessary for this purpose with other intensity, and, accordingly, new gauging of a dynamic water level after that fence.

So, after the first selection of water the wells again needs to give to be defended so that the water level in an operational pipe has reached a static level then we pump out water already with other intensity, say, 3 m^3 of water for 1 hour. And again we measure a dynamic level. We shall assume, in our case the dynamic water level after the second gauging has made 38 meters. That is, at selection of water with intensity of 3 m^3/h, a water level in a pipe has fallen to 8 meters.

Having the data of both gaugings, we count specific debit:

$$Du = \frac{V_2 - V_1}{h_2 - h_1}$$

Where: Du - specific debit (m^3/h); V_2 - the big intensity of selection of water from two gaugings (in

our case is 3 m^3/h); V_1 - smaller intensity of selection of water from two gaugings (in our case is 2 m^3/h); h_2 - falling of a water level at a water-fence of the greater intensity, is calculated as a difference between dynamic and static water levels. In our case, it is 38 - 30 = 8 meters. h_1 - falling of a water level at a water-fence of smaller intensity. In our case, it is 34 - 30 = 4 meters.

Thus, specific debit our wells will make: (3 - 2) / (8 - 4) = 1/4, or 0,25 m^3/h. About what it speaks us? It means, that the increase in a dynamic water level at one meter gives a gain debit on 0,25 m^3/h. Provided that the pump will be lowered not below the beginning of a filter zone, real debit such wells will make:

$$Dt = (H_{filter} - H_{stat}) * Du$$

Where: Dt - debit wells; H_{filter} - depth of the top point of a filter zone (in our case - 45 meters); H_{stat} - a static water level (in our case - 30 meters); Du - specific debit wells (0,25 m^3/h).

Thus, debit wells makes: Dt = (45 - 30) * 0,25 = 3,75 m^3/h. It is a high level debit for an artesian wells (classification highly debit sources begins about 85 m^3/day, at our wells it makes 3,7 * 24 = 94 m^3) As you see, the error of precomputation, in comparison with final result, has made about 60 %.

To define parameters of a wells uneasy at presence of a ruler, a motor-pomp and the elementary adaptation for the measurement of depth made of a thin cord and metal small weight. Measurements are better for making at the end of a summer in droughty weather when the level of subsoil waters is minimal. Measure by a ruler diameter, and a self-made level gauge - depth of a wells. The wet part of a cord will show you height of a water column in a wells, and dry - a static level [8, p. 118].

To define a dynamic level and debit, we use the pump. The soaking up hose is necessary for lowering on the bottom of a wells.

If there is no the big capacity with labels on a level of volume where it is possible to merge water at measurement of a dynamic level, debit it is possible to count up, using the formula for scoping the cylinder [9, p. 200]:

$$V = 3{,}14 * R2 * H$$

In our case: V - volume of the pumped out water; 3,14 - number «p»; R2 - a square of internal radius planting pipes; H - a difference of the measured static and dynamic level.

Having calculated volume give vent waters, it is easy to count up debit Q:

Q = V/t, where t - time pumping-out (in our case of 30 minutes).

If (the difference between a static and dynamic level) makes downturn no more than 1 m., about debit in general to think it is not necessary - any household pump or pump station will approach. In our example an ideal wells with high efficiency which always will give so much some water, how many it is necessary. If downturn from 2 m. and is more, to reduce revolutions of the engine and make measurement still some times - until downturn does not become close to 1 m. If is not present sharpened (marked on levels of various volumes) capacities, at the given operating mode it is possible to define productivity of the pump approximately on position of the handle of an accelerator (on a maximum - 8 cub.m/h., the handle is against the stop revolved to the right, on a minimum - the handle of 2-5 degrees from extreme left position, approximately 1 cub.m/h.). It is necessary to learn, what productivity of the pump most approaches for this wells.

Conclusion

That further there were no problems with shortage of water, the pump which you plan to use, should have productivity on 15-20 % below debit wells. In general, superficial wells «on sand» at correct operation can serve for 20-30 years without change of parameters. But measurements time in 3 - nevertheless is better to carry out 5 years. It will help to trace infringements of work of a wells at an early stage. Below in possible infringements of work, and the reason by which they can be caused are resulted.

Parameters of an operating mode of wells:

Dynamic water level:

- Increase;
- Gradual downturn;
- Periodic downturn;
- Progressing downturn;
- A level on depth of loading of the pump.

Debit wells:

- Reduction;
- Without change;
- Without change;
- Reduction;
- Reduction, suckdown air.

The possible reasons of change of an operating mode of wells:

- The faulty pump;
- Increase funnel depressions (strong downturn, an exhaustion of a level of subsoil waters водоносного a layer in area of a wells);
- Influence of work of the next wells or influence of seasonal factors;
- Malfunction of the filter, silting-up wells;
- Water-selection exceeds opportunities of wells, strong silting-up, malfunction of the filter [10, p. 245].

The above water permeability, the it is better than a condition of inflow of water to rammer wells and, hence, more than it debit, and at the greater debit wells more favorable economic parameters are provided.

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