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Methods Of Silting Water Reservoirs

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Abstract: It is known that the problem of water shortage in the whole world is increasing year by year. In our country, special attention is paid to this issue, and measures are being taken to use water wisely. In order to improve the management system in the sector, the Ministry of Water Management was established. In accordance with the instructions of the head of our state, the strategy for the development of agriculture until 2030 envisages actual measures for the use of raw water and its conservation.

Keywords: Water Management, water reservoirs, sediment density.

Introduction

55 water reservoirs are serving for seasonal adjustment of the flow of water resources across the country. However, the useful volumes of these reservoirs cannot fully satisfy the demand for irrigated areas of the country. Moreover, these reservoirs, which were built 40-60 years ago, are losing their useful volume due to siltation of their beds. To date, deficiencies such as technical wear and tear of facilities and neglect of environmental factors during operation reduce the reliability of reservoirs in terms of water supply. As a result, the risk of interruptions in water supply to the fields is increasing.

Taking into account the above circumstances, great importance has been attached to ensuring the reliability and safety of the technical condition of the existing hydrotechnical facilities in the Republic, their proper use, and as a result, many improved, effective and effective measures have been established in this field. In this regard, one of the most important tasks is to prevent reservoirs from being filled with mud during operation, to clean mud, and to increase the useful volume of the water reservoir.

Changes in the amount of turbidity in reservoirs

Reservoirs (flood reservoirs) in the territory of the Republic of Uzbekistan:

- the number of reservoirs is 73;
- the total volume is 19.93 billion m3

Water reservoirs located in the Amudarya basin:

- the number of reservoirs is 38.
- the total volume is 14.0 billion m3.
- the amount of muddy sediments is 2-5 times more than in the project.
- the number of reservoirs is 35.

Factors affecting reservoir siltation

muddy sediments brought by rivers, canals and floods;

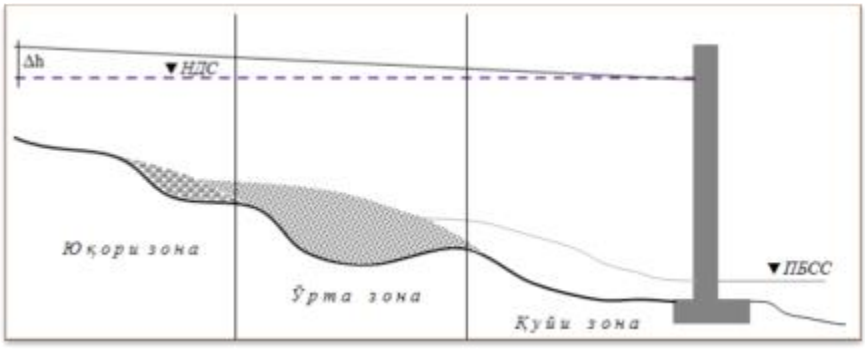
in the processes of filling and emptying water reservoirs and wind and the formation of coasts by waves generated by the impact;

the arrival of dust due to wind.

Effects of silting on reservoirs

- volume of managed water decreases, efficiency decreases;
- the water level curve rises along the upper bef;
- the flooded area expands;
- the slope of the water level increases;
- flow rate changes;
- the speed of movement of mainly suspended solids, partially sediments increases.

The process of silting the reservoir



Clarification of the proper pressure of the reservoir basin in the design

$$T = \frac{W * \rho}{G}$$

Here:

W – Reservoir volume;

G – average volume of multiannual discharges, tons/year;

ρ – sediment density, t/m^3;

0,4 – 0,6 – blurry
1,0 – 1,2 – mixed with sand
>1,5 - sandy.

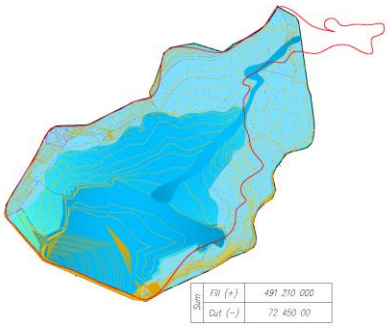
Determining the amount of sediments in reservoir basins

1. Flows in water reservoirs are based on the difference in the calculation weights of transport capacity

2. The methods of the first group are based on field studies conducted in practice

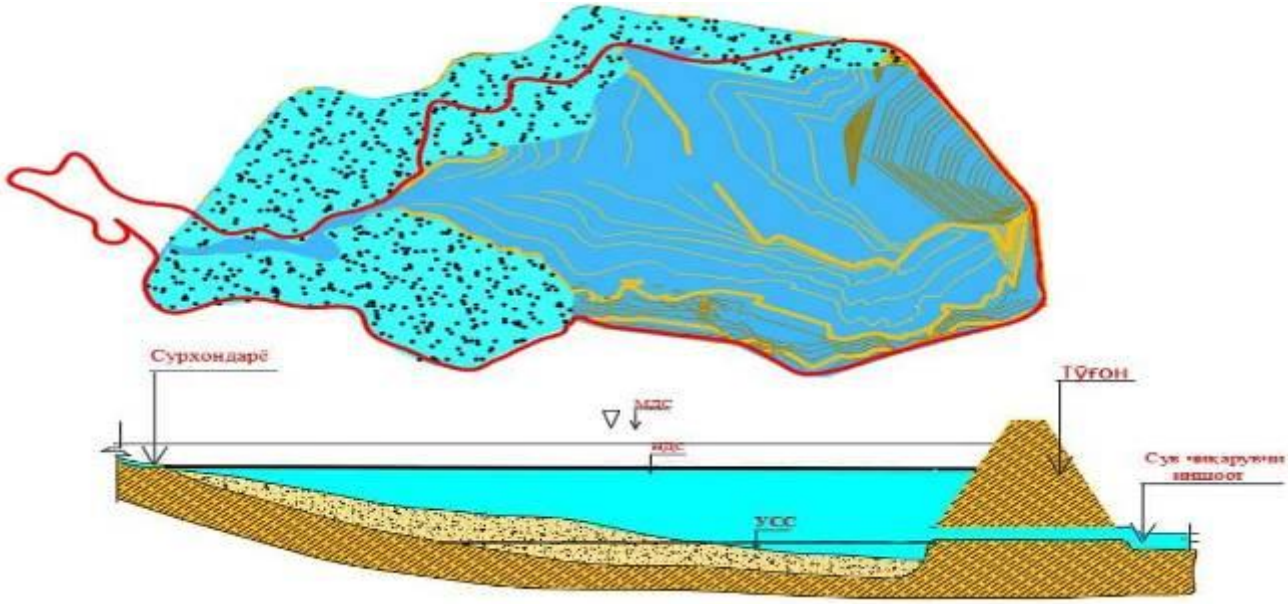
3. The amount of turbidity is determined by taking into account the continuous changes in the characteristics of the river and the current.

Research results



A view of the reservoir bowl in horizontal lines.

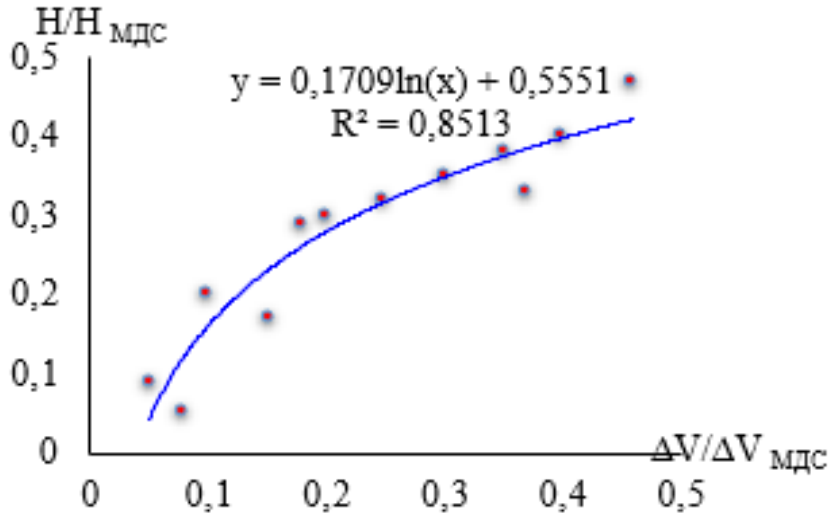
Results of field studies



Formation of reservoir banks

The decrease in the volume of water reservoirs during the period from the beginning of operation to the accounting year can be determined by the following link:

$$\frac{\Delta V_H}{\Delta V_{МДС}} = K_1 \left(\frac{H}{H_{МДС}} \right)^{n_1}$$



Observation data of reservoirs

Reservoirs	**South Surhan reservoir**			
Depth N, m	4	6	9	11
$\frac{H}{H_{МДС}}$	0,154	0,231	0,346	0,423
$\frac{\Delta V_H}{\Delta V_{МДС}}$	0,055	0,145	0,274	0,427

$$\Delta V_H / \Delta V_{МДС}$$

Graph of the relative depth dependence of the volume of relative turbidity of the reservoir.

here, n_1 and K_1 are determined following the method of the smallest squares:

$$\frac{\Delta V_H}{\Delta V_{МДС}} = 0{,}92\left(\frac{H}{H_{МДС}}\right)^{1,23}$$

Comparison of the data obtained as a result of observations with the calculated results.

№	**Comparison of measurement results**	**1975 y**	**2002 y**	**2021y**
1	The amount of turbid sediments determined based on observations mln.m^3 (MDC)	139	297	310,3
2	The amount of muddy sediments determined by the account	136	294,5	308,2

3	Difference %	0,97	0,97	0,96

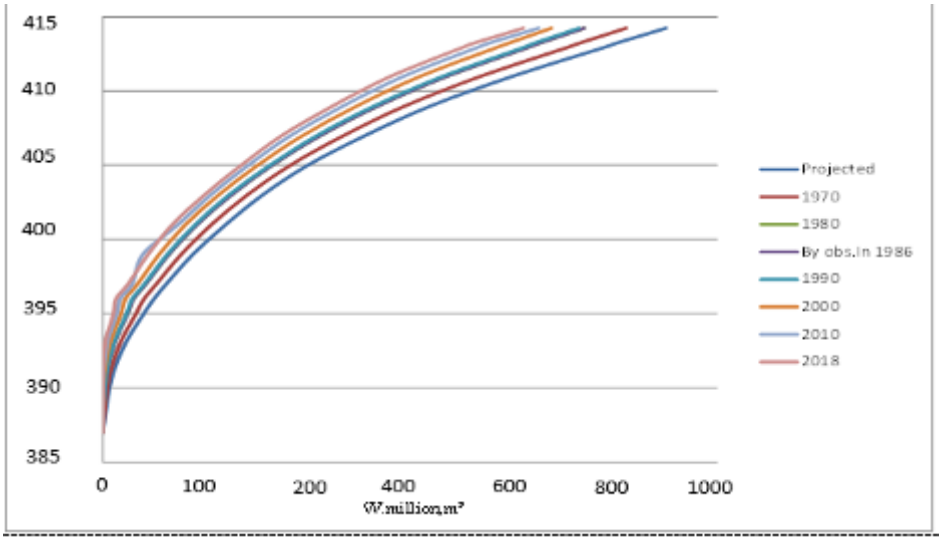
The volume of the reservoir for any year can be calculated by the following formula, depending on the water level in it:

$$V = V_{лой} - \Delta V_{МДС}\left(\frac{\Delta V}{\Delta V_{МДС}}\right)$$

The fact that the reservoir decreases the volume of water for any year depending on the water level in it

water level N, m	in the project	1970	1980	1986	1990	2000	2010	2018	2021
392	0,5	0	0	0,01	0	0	0	0	0
393	10	2,4	1,33	0,67	0,5	0	0	0	0
394	15,5	6,99	4,96	3,79	3,38	1,28	0,33	0	0
396	40	16,8	13,3	11,29	10,6	6,98	4,19	2,08	1,92
398	70	32,3	27,1	24,11	23,1	17,7	13,6	10,47	3,32
400	118	40,3	33,8	30	28,7	22	16,75	12,8	11,21
401	145	52,3	45,8	42	40,7	34	28,75	24,8	24,2
402	178	76,6	68,9	64,48	63	55	39,09	44,26	35,3
404	243	106	97,3	91,96	90,2	80,7	73,42	67,9	50,6
406	314	141	131	125,39	123	113	105,19	99,16	85,23
408	404	183	172	165,06	163	151	141,97	135,09	129,48
410	500	235	221	212,23	209	195	183,28	174,65	163,14
412	603	295	278	268,52	265	248	234,57	224,44	215,61
413	665	369	348	335,98	332	310	393,65	381,06	380,12
414	724	656	532	517,3	513	487	467,97	453,26	426,31
415	800	664	639	625	620	595	575,48	560,71	**489,1**

1. Graph of decreasing reservoir water volume over the years



2. **The flows in the reservoirs are based on the difference in the ability to transport on the calculated stewards**

$$\frac{\partial p}{\partial l} + \gamma \text{b} \frac{\partial z}{\partial t} = 0$$

3. Taking into account the non-stop change in the volume of turbidity and flow characteristics

T. Taylor proposed the following expression of the calculation of sludge-sediments in them, based on data from reservoirs:

$$W_{з} = W_{н}(1-\varepsilon)^{t}$$

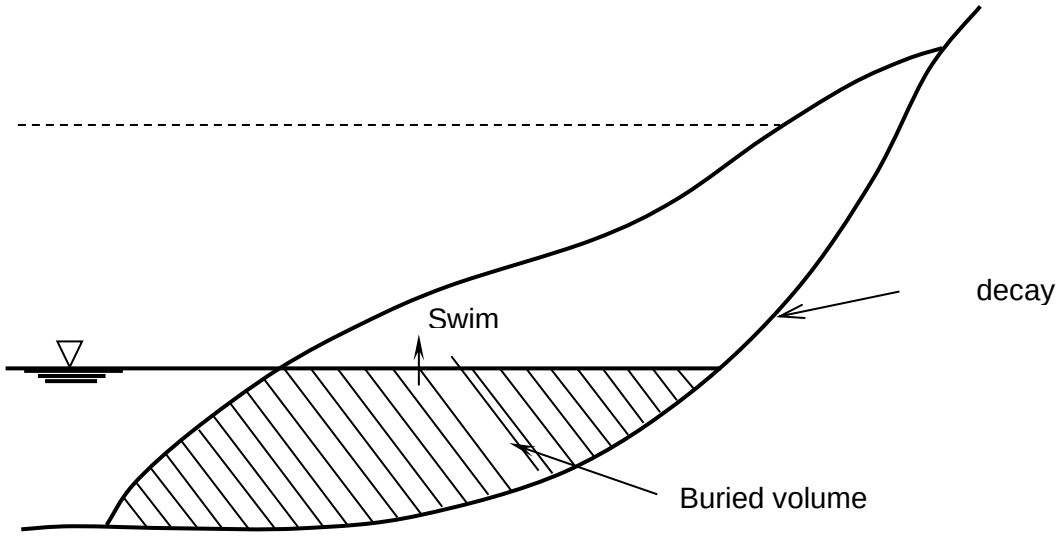
G.I. Based on his research in the reservoirs of Shamov, he expresses the equation for calculating sludge-sediments in the following form

$$W_{св} = W_0 a^t = W_0 - \sum_0^t R_i$$

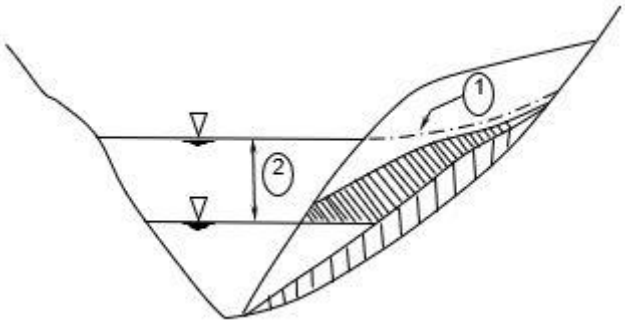
Formation of the shores of reservoirs under the influence of water.

One of the main reasons why reservoirs are overflowing through muddy sediments is such situations as the kissing, eroding of their shores and their displacement

1. Displacement of the banks as a result of a sharp rise in the level of the reservoir.



2. Decrease in reservoir level due to the formation of residual pressure of water vapor as a result of a sharp decrease in reservoir level

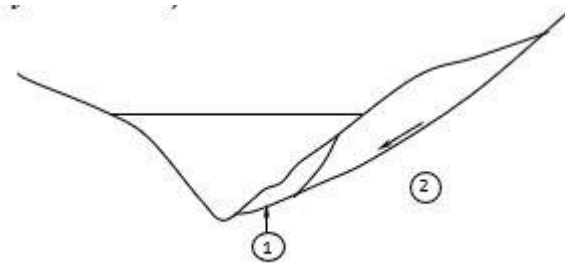


1. Wear when the water is full of ground water levels.
2. A sharp decrease in the level of the reservoir.

Due to coastal migration, a migratory mass is formed, the effect of this mass on the rise of reservoir water is manifested. The volumetric weight of the movable mass is expressed as follows:

$$m = \rho W$$

3. State of burial formed by small outcrops on coasta slopes buried with water



1. Small kiss under the slope
2. Large kiss on slope slopes

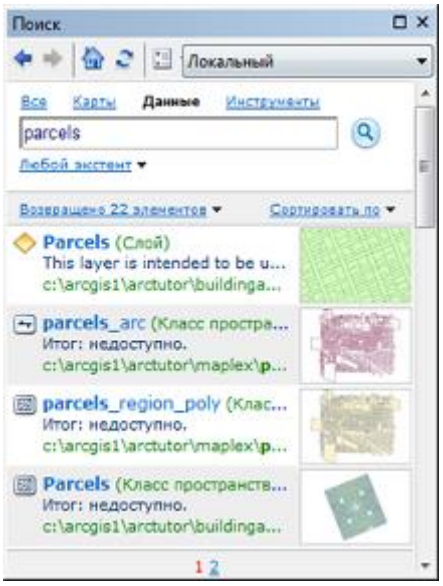
The volume of the Avalanche mass, written through the coordinates of the migration limit, is given by the following reversibility integral:

$$W = \int_a^b dx \int_c^d [Y_1(x,y) - Y_2(x,y)] dy$$

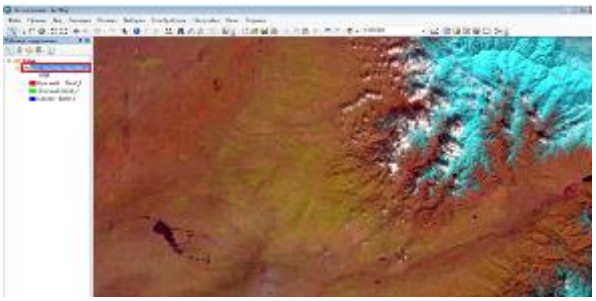
Equation of sedimentation balance of reservoirs

- $W_{чўкма} = W_{кирим} + W_{қирғоқ} + W_{эол} - W_{чиқим} \pm \Delta W$,
- Here: $W_{чўкма}$ the volume of muddy discharge that has sunk in the reservoir;
- $W_{кирим}$ the volume of muddy discharge, caused by rivers, streams, into the reservoir;
- $W_{қирғоқ}$ the size of the Mountaineers who join the reservoir as a result of the erosion, collapse of the shores; $W_{эол}$ sediments formed from dust storms brought by wind into the reservoir;
- $W_{чиқим}$ the volume of muddy discharge leaving the reservoir;
- ΔW represents a change in the volume of sediments in the reservoir during the accounting period.

GIS map of the hydrographic networks of the area where the reservoir is located



Database view



Classification of images at GAT

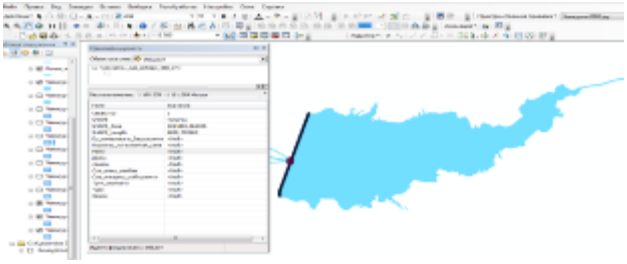
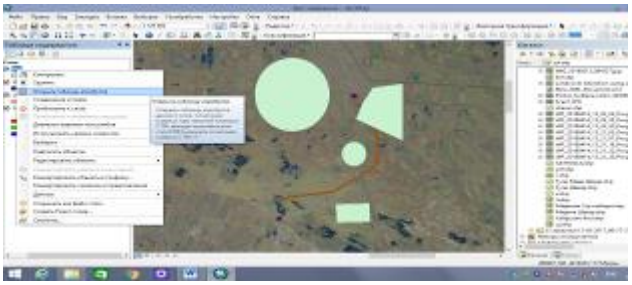
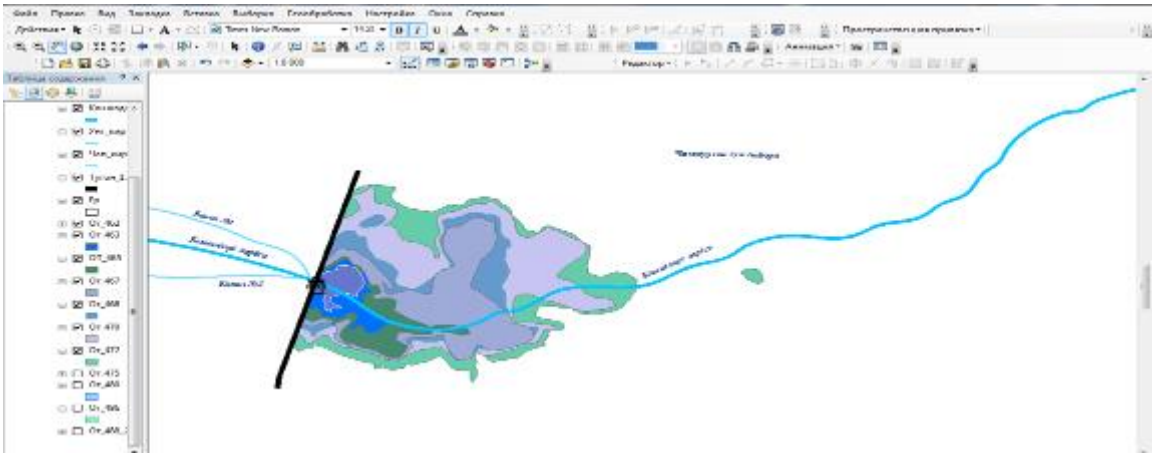


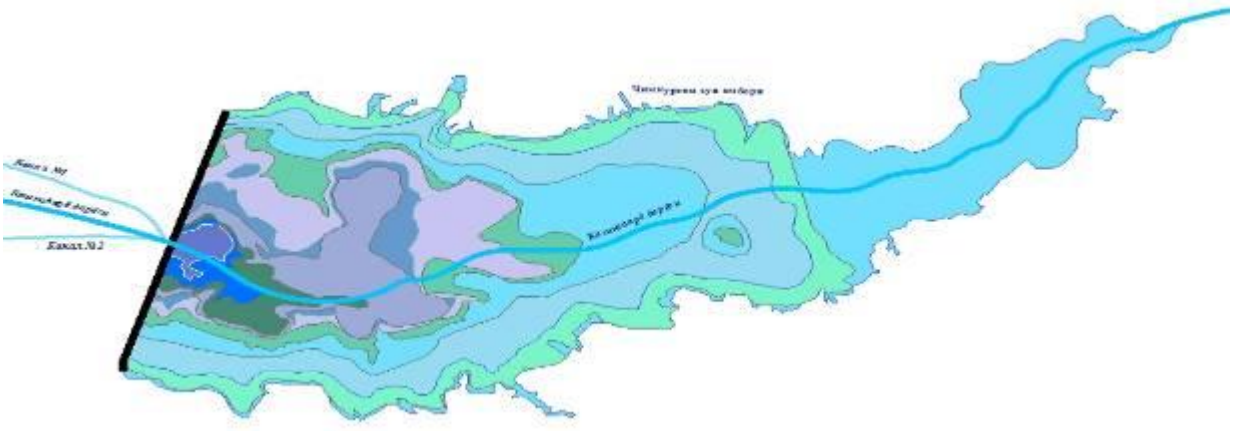
Image of the reservoir shed files



Work in the Arcmap program

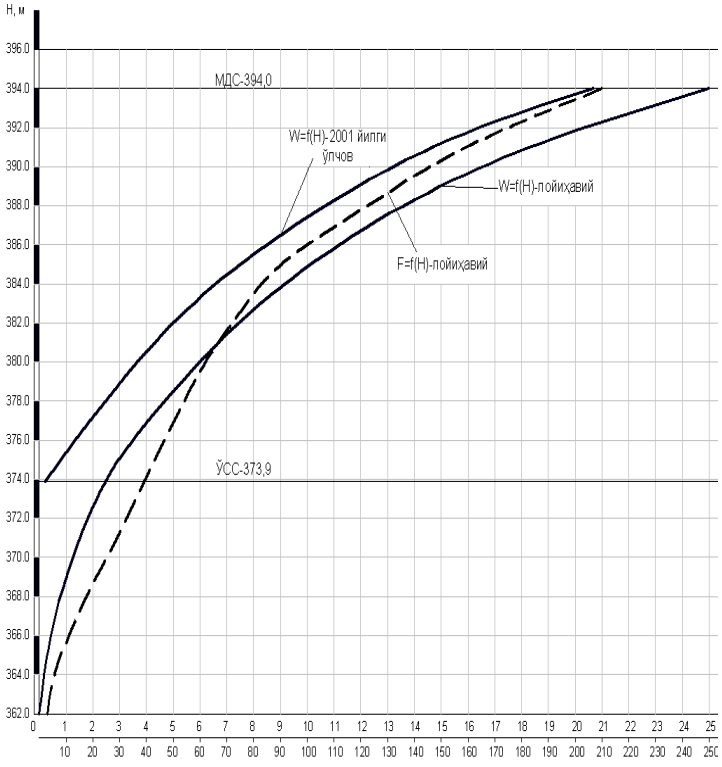
Determination of the water surface area of the reservoir using GIS technologies.





The curve of the connection of the reservoir volume and water surface area to the water level in it

Suv sathi, H (m)	Ҳажм, млн.м³		Suv sathi maydoni,kı
	Loyihada	O'lchov 2001 y	Loyihada
362	0,20		0,00
363	0,80		0,26
364	1,70		0,60
365	2,80		0,80
366	4,00		1,10
367	5,60		1,45
368	7,60		1,80
369	10,00		2,26
370	12,40		2,64
371	15,60		2,90
372	18,80		3,26
373	22,60		3,55
373,9	26,00	6,15	4,00
374	26,60	6,25	4,03
376	35,40	13,5	4,70
378	46,60	23,1	5,46
380	60,20	34,2	6,25
382	74,80	47,7	7,16
384	92,00	64,8	8,20
386	112,00	84,6	9,86
388	134,00	107,6	12,00
390	163,00	131,7	14,50
392	202,00	164,5	17,16
393	226,00	183,7	18,85
394	250,00	207,68	20,00



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