

## RESEARCH ARTICLE

### GENERAL CHARACTERISTICS OF THE BASIN OF NERODIME RIVER

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#### ABSTRACT

Water in the nature, either surface or underground water (flow or stagnant) represent an important element of the nature basis; they determine not only the appearance of a province, but also the value of every territory. Kosovo has a hydrographic net, mainly autochthonous expressing its natural borders and located at the top of Balkan Peninsula precipitation, not by the quantity but for the direction of the flows. Atmospheric precipitations flow in direction of the three following seas: Black Sea, Adriatic Sea, and Aegean Sea that define the Balkan Peninsula. The hydrographic joint where is caused interlacement of the three sea waters of Balkan Peninsula is situated in the western part of Ferizaj in the Dërman hillock (1.364m) and slopes of this hillock are in rivers: Sitnica, Nerodime and Toplluga. As I am describing about Nerodime River, I should mention that the municipality of Kaçanik is situated in the southern part of Kosovo, located between the range of Sharr Mountain and Karadak - Skopje. Thus, Nerodime River is the left branch of Lepenc River, its source is from the eastern part of Jezerc mountain of 1.660 m above the sea level and containing from several small rivers as Big and Small Rivers. Flow direction from the source up to Ferizaj is South – East, whereas from Ferizaj up to the discharge point North-South. The upper flow part up to lower Nerodime village throaty, while the river passes through Nerodime field, at the southern part of Ferizaj of Varosh village is close to the railway Kaçanik-FushëKosovë, passes under the highway Skopje –Prishtinë and 2 km in the southern part of Stagovë village enters again in the throaty up to the discharge point in Kaçanik of 465m above the sea level. In the flat part, Nerodime River receives two bigger ravines: Pleshina and Gaçka, while in the throaty many flooding ravines such as: Runjeva and Tërsteniku. It is important to emphasize that Nerodime River is a small river but with huge hydrographic importance because is a very well-known river in the world for its bifurcation (second case in the world) after Kasikijara River which is located in the South America, where a part of Nerodime River discharges in Sitnica while the other part in Lepenc River, so that this small river "feeds" with water the two following seas: Aegean Sea and Black Sea. In the Nerodime dam there is no solid erosive processes, but from the slant surfaces of the dam comes to the permanent drainage of the cramped material. Ability flow of water of the bottom of Nerodime River is small, so that huge waters in the flat part with severe curves and small gravitation often comes the situation where water comes out of the bottom river where flood often causes huge material damages and do not allow to use agricultural lands.

**Key Words:** Basin, Geomorphology, Hydrography Hydro-Geology, Hydrology.

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#### INTRODUCTION

This study aims to advance the knowledge about hydrographical and hydrological characteristics of the Basin "Nerodime" and at the same time serve as basis for deepening knowledge for future researchers.

Realization of this goal has proceeded to

- Familiarity of hydrological, geomorphological, climate, hydrographic and hydrogeological conditions of Nerodime.
- Possession of knowledge in the field of hydrology and hydrogeology
- Integration of results and their disposition in this paper.

#### MATERIALS AND METHODS

Applied in this study is development, systematic realized with activities in the field and supported with applied researches and professional practices. The study is conceived on the basis of methodology and research-scientific principles, thus presents an importance to be utilized from the new professionals, as well as compilation of projects that have to do with the research, evaluation and administration of nature resources.

Realization of this study is conducted in several phases

- Collection, systematization and analyzing the hydrographic, hydrological and hydrogeological information of Nerodime Basin.
- Analysis and processing of analytical material and observations in the field.
- For its implementation it needed to use a huge literature on hydrography, geology, hydrogeology and hydrology of the park zone, methods used in other analogous situations, it combined with observations in the field and field measurements.

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## GEOMETRY CHARACTERISTICS OF BASIN

Basin is characterized with surface, slope, river density, vegetation, earth characteristics and other physical factors:

### Surface of Basin

The surface of basin is that which collects the system of incoming waters. This surface of basin usually is given in hectares (ha) or in  $\text{km}^2$ . The following formula is given for calculation of surface:

$$L = 1.31 * A^{0.568} = 1.31 * 2176^{0.568} = 101.2 \text{ km}$$

A - Surface of Basin (km), L - length of river (km)

### Wideness of Basin

When we discussed about river basin, we mentioned that in the upper part of flow is narrow, in the middle enlarges and again narrows at the discharge point. The following formula is given to calculate ratio between the basin surface with the length of river:

$$B_m = \frac{A}{L} = \frac{2176}{87.32} = 25.04 \text{ km}$$

A - surface of basin (km)

L - length of river (km)

### Shape of Basin

Shape of Basin presents the quotient between the watershed line L and the perimeter of a circle that has equal surface with Basin.

Coefficient  $K_f$  is given as follows:

$$K_f = \frac{L}{3.55\sqrt{A}} = \frac{233.6}{3.55\sqrt{2176}} = 1.41$$

### Slope of the River bed

Slope of the river bed impacts in the velocity of the river flow where with the increase of slope it increases the speed of water flows through the river bed and is given the following expression:

$$i_{mes} = \frac{H_2 - H_1}{L} = \frac{458.215 - 388.120}{87.32} = 0.81$$

$i_{mes}$  - average slope of flow

$H_1, H_2$  - quotes in the upper and bottom parts of river

L - Length of river

### Affluent Inflow

In the Nero dime River, branches which discharge have an important impact to the main flow. As we know that we have to take into account deformations of the river bed during the joinment and sedimentation, bottom erosion of river and river bank. On the basis of the situation that we have for Nero dime River, location of discharge of branches in this zone is throaty and flat-area. So that the outfall shall respond to the hydrodynamic regime of flow, whereas shall be a modification or change the place of outfall where the outfall is from the bottom part of river.

### Density of river network

Density of the river network is a very important parameter that depends from the surface containing vegetation, amount and precipitation intensity. The following formula is given to determine the density of river where is presented the total of river length to the surface of Basin:

$$D = \frac{L}{F} = \frac{875}{2176} = 0.401 \text{ km}$$

L - Length of River

F - Surface of Basin

## HYDROLOGICAL CLIMATE CHARACTERISTICS

### CLIMATE CHARACTERISTICS

Kosovo Relief is contained from the two shapes: mountains-group of mountains and hollows in bigger and important shapes created in tectonic movements and from erosive shape with special importance created in mountains, hollows and valleys. Relief has many impacts in climate, biography, in the location and development of inhabitation. Relief in our country is different with wide and narrow valleys and hilly-mountains surfaces with climate changes. In the flat area in this part is a continental climate, alpine in the mountains. The climate impacts – during the summer temperatures are high and during the winter temperatures are low and thus depend from the level above the sea of the river Basin.

Form of the relief: mountains, hollows, river valleys that forms the relief of Kosovo and have a great impact in the nature, and thus impact is expressed in climate, waters, creation and erosion of lands and social and economic development in general. Mountains are important factors for life development in Kosovo, where we have the following mountains: Sharri, Albanian Alps, Karadaku Mountains, etc. There are heavy rains in these mountains over 2000 mm in year and are three times higher than precipitations in the hollows and valleys and the snow also stands during the summer days. Rivers and other sources fed from these mountains and have water availability all year. Meanwhile, hollows and valleys have great social and economic importance because there is an impact from another climate where precipitation are less and temperatures are higher than in mountains. All auto-transportation and railways from which Kosovo is connected to other countries passes through throaty valleys located deeply in the suburb and central Mountains.

-Climate which is a very important part of natural environment, atmospheric features and their interaction with land surface have a great importance in organization and activities of social society. Familiarity of climate characteristics is based on meteorological observations in Kosova beginning from XX century. In Kosovo, there are 126 measurement stations – meteorological: one synoptic station in Prishtinë, three geo-physical in Prishtinë, Prizren, Peje, eight measuring station of meteorology, and others are precipitation measurement. Kosovo lies in the southern part of the middle geographic descent of the north semi-sphere impacting to mediterranean – continental climate. Main climate macro-factors that impact are: its position to land mass, water mass, air mass, etc., whereas local factors that impact are: relief, waters, plot and vegetation.

Insolation is a climate element that has its importance and depends on astronomic factors, meteorological and relieve. Insolation is expressed with the number of hours in day, month, and season in year. In the narrow valleys, outfall and mountains areas is smaller due to increase of cloudness with the increasing height above the sea. On the basis of meteorological stations of insulations Kosovo has an average of 2.066 sunny hours during a year and an average of 5.7 hours in day. It is worthy to mention that during the year in the month of July there is the most insolation and there is more sunny time, while in December is less sunny time. Prishtina has the most time of sunny with 2.140 hours in year and less is in Peja with 1.958 sunny hours in a year, whereas Prizreni has 2.099 sunny hours, Ferizaj 2.067 sunny hours and Kacanik 2.028 sunny hours during a year.

- Temperature is the main climate element of air-heat in the ground layers eastern part of Kosovo hollows are colder than in the west side. The annual average temperature in Kosovo is  $9.5^{\circ}\text{C}$  where the warmest month is July  $20^{\circ}\text{C}$  and the coldest month is January -  $1.3^{\circ}\text{C}$ .
- Winds in Kosovo are a common meteorological phenomenon. In the meteorological stations where the measurement of winds is made, it is noticed a calm and high values, winds of dominating direction have great speed. Average speed of winds in Kosovo escalates from 1.3 m/sec to 2.4 m/sec. Extreme occurrences of the speed of winds reaches over 31 m/sec. Great eventualities are in the months of March and April and considered as elementary disaster with different consequences.

### HYDROLOGICAL CHARACTERISTICS

Atmospheric precipitations are important indicators of the climate in Kosovo and present the meteorological element with changes in time and territory. Main precipitations characteristics are from their appearance: rain, snow, hail, drizzle, graupel, their annual amount, their distribution during the year – pluviometric regime, number of days with precipitations and their intensity. In our country all the forms of precipitations are present where more importance has precipitations in the valleys and snowing in the mountains. precipitations in the shape of hail presents features of elementary disasters with serious circumstances, and such precipitations are present mostly during the month of July and August and classified with high intensity, here is an impact of medium type - maritime and medium-continental of the precipitation regime. In the western part there is an impact average maritime where there are more annual precipitations during the year over 700mm where max monthly in November and minimum in July – August, whereas continental impact in the eastern part and is characterized with few precipitations during the year 600mm where max. in May and min. in December-January.

Atmospheric precipitations in our country are characteristic, e.g. in the period October-May there are all over precipitations around 55-65 %, whereas in April-May precipitations increases. From the month of March-May there are heavy precipitations and inflows in these months are higher as they come from the rain, snow and underground water. Domination of water feeding from atmospheric precipitations conditions the increase of water level and often features of huge floodings.

I would like to emphasize that the maximum levels appears at the end of winter season until May, depending from the snow melting in the mountains where the minimum inflow is stable and is present during August and September. So that starting from Nerodime River on the basis of isohypses there are upper parts (mountains) and low (flat) are as where the mountains area has sufficient water capacities, while the flat area is always in lack of water especially during the summer season.

## HYDROMETRY GEOLOGICAL CHARACTERISTICS

### GEOLOGICAL CHARACTERISTICS

On the basis of geological researches, Kosovo has diversity of land. The biggest part of the territory is covered with the land of low quality, a considerable part with medium quality and the smallest part is with the land of a good quality. Different types of lands are created under the influence of diverse relief: field, valley, hilly-mountains, and different geological base, specific climate conditions. Land inside contain friable rocks, compact, cristaland volcanic. There are compact rocks in the suburban mountains area and in the hilly zones of underground waters where more important are carbon rocks, limes and dolomites, whereas friable rocks in the lower parts of hollows are represented by neogene (lake) sediments composed by argile, sandy clay, mergely and river alluvion. These are fatness rocks of hundred meters, and in several places coal layers and characterized with weak filterable attributes. Aresian and Subartezian waters were discovered after deep drillings in the sediments with different deepness. Towards the flow of Nerodime river in the geological composition are in formations of filites, greenschist and sercite schist: in marble and dolomites wehre the hollow is composed by conglomerates: sand, and argile wehre we will ascertain that alluvial plains of river are with sand and river riffraff. Paleozoicis represented with greenschistand concentrated in the northern pasrt of river, in the southern pleistocenit layer and in valleys again alluvial layers. There is a huge spread of paleozoic formations in the mountains from the side of Sharri Mountain. Geological composition in Kaqanik municipality may end into the three morphologic integrals. So that we come to the following conclusion: ruffle which appears in Sharri mountains and Albanian Alps that have a very high height and a tectonic shape, fistures are erratically extended over the holes and valleysand are in lower position and those volcanic which are created after collection of volcanic material coming from the earth inside and in our country there are rare cases.

### HYDROMETRIC NETWORK

With the hydrometric network of Kosovo we come to know that river measurement locations where water level measurements are made and measurements for water intake and these are conducted with measuring levels or limnigraph. There are less data about Nerodime River in regard of this measurement. Measuring point in Kaqanik – in 1979 located in the right side and after that was placed a limnigraph to measure water level close to outfall of Nerodime river in Lepenc river, and hydrological calculations were conducted for upper flow of Nerodime river, for the main project of the hydrosystem Iber-Lepenc. Due to the lack of other measurement locations, I had to use other methods.

### HYDROLOGICAL CALCULATION OF BASIN IN NERODIME RIVER

The most important to intake is the phenomenon of changes in intakes during the time. The study of this phenomenon is made with determination of a water amount max. and the period when this water shall be reported at least once. Accuracy of these results depends from the observation time of this phenomenon. First of all the statistical analysis are made of the water mx. Observed in every calendar year, and after that with the well known functions of separations determine the values of huge water and period of its reporting. Regarding Nerodime river that has a flow surface of  $F=217.6 \text{ km}^2$  have used empiric formulas of several authors, initially from the author: D.L.Sokolovski.

$$Q_{\max} = \frac{0.28Ht * \alpha * F}{t} f \frac{m}{sek}$$

Ht –Height of Precipitations in mm.

f- flow area, in this case 217.6 km

f shape coefficient of flood wave hydrogram

t- duration of increased hydrogram of flooded wave

$$H_t = S (60 * T)^{1/3}$$

S –Wave parameter (mm/min)

$$S = A + B * \log N$$

A and B are maximum parameters of water where: A=4.20, B=3.50

N-Number of years for maximum water

$$T = \eta * t$$

$\eta$  - is coefficient

$$\eta = (t + 1)^{-0.20}$$

$$t = \frac{L}{3.6V}$$

L –Wave length = 41.8 km

V –Speed of wave =3.0m/sec

$$f = \frac{12}{4 + 3\gamma}$$

$\gamma = 3.0$  - is coefficient

**We have the number of years N =10,20, 50, 100 years**

$$S_{10} = 2.60 + 3.5 \log 10 = 6.10 \text{ mm/min}$$

$$S_{20} = 2.60 + 3.5 \log 20 = 7.15 \text{ mm/min}$$

$$S_{50} = 2.60 + 3.5 \log 50 = 8.55 \text{ mm/min}$$

$$S_{100} = 2.60 + 3.5 \log 100 = 9.60 \text{ mm/min}$$

$$t = \frac{41.8}{3.6 * 2.2} = 5.27$$

$$\eta = (5.27 + 1)^{-0.20} = 0.67$$

$$T = 0.69 * 5.27 = 3.64$$

$$H_{t10} = 6.10(60 * 3.64)^{1/3} = 36.67 \text{ mm}$$

$$H_{t20} = 7.15 (60 * 3.64)^{1/3} = 42.97 \text{ mm}$$

$$H_{t50} = 8.55 (60 * 3.64)^{1/3} = 51.38 \text{ mm}$$

$$H_{t100} = 9.60 (60 * 3.64)^{1/3} = 57.70$$

$$\alpha_{10} = 0.15, \alpha_{20} = 0.20, \alpha_{50} = 0.25$$

$$\alpha_{100} = 0.35$$

$$f = \frac{12}{4 + 3 * 3} = 0.92$$

$$Q_{10} = \frac{0.28 * 36.67 * 0.15 * 217.6}{5.27} * 0.92 = 57.3 \text{ m}^3 / \text{sec}$$

$$Q_{20} = \frac{0.28 * 42.97 * 0.20 * 217.6}{5.27} * 0.92 = 89.9 \text{ m}^3 / \text{sec}$$

$$Q_{50} = \frac{0.28 * 51.38 * 0.25 * 217.6}{5.27} * 0.92 = 134 \text{ m}^3 / \text{sec}$$

$$Q_{100} = \frac{0.28 * 57.70 * 0.35 * 217.6}{5.27} * 0.92 = 211 \text{ m}^3 / \text{sec}$$

**From the author D. Srebrenoviq maximum inflow**

**N= 10, 50, 100 years of water**

$$Q_{\max 10} = 0.2446 * F^{0.1359} * J^{0.2334} * K^{1.3183}$$

$$Q_{\max 50} = 0.3457 * F^{0.8910} * J^{0.2543} * K^{1.3468}$$

$$Q_{\max 100} = 0.3967 * F^{0.8992} * J^{0.2585} * K^{1.3525}$$

$$K_u F = 217.6 \text{ km}^2$$

$$J = 14.8 \%$$

$K=0.00111$  Hvjet  
 $Hvjet=748$  mm

$$K = 0.00111 * 748 = 0.83$$

$$Q_{\max 10} = 0.2446 * 217.6^{0.9065} * 14.8^{0.2334} * 0.83^{1.3183} = 46.2 \text{ m}^3 / \text{sec}$$

$$Q_{\max 50} = 0.3457 * 217.6^{0.8910} * 14.8^{0.2543} * 0.83^{1.3468} = 63.7 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = 0.3967 * 217.6^{0.8992} * 14.8^{0.2585} * 0.83^{1.3525} = 77.1 \text{ m}^3 / \text{sec}$$

## PRELIMINARY METHOD

$$P^h = h * J^c$$

$$h = 0.748 \text{ m}$$

$$J^c = 0.148$$

$$P_h = 0.748 * 0.148 = 0.111$$

$$P_i = \frac{Ph * Ji}{L} * 10^9$$

$$J_i = 0.03$$

$$L = 41.8 \text{ km}$$

$$P_i = \frac{0.111 * 0.03}{41.8} * 10^9 = 796.65$$

Coefficient:

$$\eta = \frac{A}{\pi} \arctg \left( \frac{Ph^{0.389}}{0.833} \right)$$

$A=0.9-1.1$  - rating

$$\eta = \frac{1.1}{3.14} \arctg \left( \frac{0.111^{0.389}}{0.833} \right) = 0.33$$

$$h_0 = \eta * h = 0.33 * 0.748 = 0.247$$

$$q = \frac{h_0}{0.0315} = \frac{0.247}{0.0315} = 7.84 \text{ l/sek/km}^2$$

$$Q_{sr} = q * F = 0.00784 * 217.6 = 1.68 \text{ m}^3 / \text{sec}$$

$$Q_0 = \eta_0 * Q_{sr}$$

$$\eta_{0=} = 5.2 * P_i^{0.230} + 1.0 = 5.2 * 796.65^{0.23} + 1.0 = 25.17$$

$$Q_0 = 25.17 * 1.68 = 40.6 \text{ m}^3 / \text{sec}$$

$$\eta_{10god} = 0.51 * pi^{0.1315} + 1.0 = 0.51 * 796.65^{0.2315} + 1.0 = 3.34$$

$$\eta_{20} = 0.84 * 796.65^{0.188} + 1.0 = 3.95$$

$$\eta_{50} = 1.12 * 796.65^{0.1855} + 1.0 = 4.87$$

$$\eta_{100} = 1.31 * 796.65^{0.1985} + 1.0 = 5.93$$

$$Q_{10} = 3.34 * 40.6 = 136 \text{ m}^3 / \text{sec}$$

$$Q_{20} = 3.95 * 40.6 = 160 \text{ m}^3 / \text{sec}$$

$$Q_{50} = 4.87 * 40.6 = 198 \text{ m}^3 / \text{sec}$$

$$Q_{100} = 5.93 * 40.6 = 241 \text{ m}^3 / \text{sec}$$

**VI-4. D. Fullerit**

$$Q_{\max} = Q_{sr \max} (1 + 0.8 \log *T)$$

$$Q_{sr \max} = \alpha * F^{0.8} (1 + 2.661 * F^{-0.3})$$

$$\alpha = 0.80$$

$$F = 217.6 \text{ km}^2$$

$$T = 10, 20, 50, 100,$$

$$Q_{sr \max} = 0.8 * 214^{0.8} (1 + 2.66 * 217, 6^{-0.3}) = 89.6 \text{ m}^3 / \text{sec}$$

$$Q_{\max 10} = 89.6 * (1 + 0.8 \log 10) = 161 \text{ m}^3 / \text{sec}$$

$$Q_{\max 20} = 89.6 * (1 + 0.8 \log 20) = 183 \text{ m}^3 / \text{sec}$$

$$Q_{\max 50} = 89.6 * (1 + 0.8 \log 50) = 211 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = 89.6 * (1 + 0.8 \log 100) = 233 \text{ m}^3 / \text{sec}$$

**Metered Station in Hani i Elezit in the Lepenc River**

$$Q_{\max 10} = 138 \text{ m}^3 / \text{sec}$$

$$Q_{\max 20} = 160 \text{ m}^3 / \text{sec}$$

$$Q_{\max 50} = 202 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = 435 \text{ m}^3 / \text{sec}$$

$$Q_{\max} = \left( \frac{FN}{FL} \right)^{0.47} * Q_{\max}$$

$$Q_{\max 10} = 83.3 \text{ m}^3 / \text{sec}$$

$$Q_{\max 20} = 96.6 \text{ m}^3 / \text{sec}$$

$$Q_{\max 50} = 122 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = 160 \text{ m}^3 / \text{sec}$$

$$-F_G = 52 \text{ km}^2$$

$$Q_{\max 20} = 55 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = 86 \text{ m}^3 / \text{sec}$$

$$Q_{\max} = \left( \frac{FN}{FG} \right)^{0.47} * Q_{\max}$$

$$Q_{\max 20} = \left( \frac{217.6}{52} \right)^{0.47} * 55 = 107 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = \left( \frac{217.6}{52} \right)^{0.47} * 86 = 167 \text{ m}^3 / \text{sec}$$

$$Q_{\max 10} = \left( \frac{102.1}{626.8} \right)^{0.47} * 138 = 58.8 \text{ m}^3 / \text{sec}$$

$$Q_{\max 20} = \left( \frac{102.1}{626.8} \right)^{0.47} * 160 = 68.2 \text{ m}^3 / \text{sec}$$

$$Q_{\max 50} = \left( \frac{102.1}{626.8} \right)^{0.47} * 202 = 86.1 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = \left( \frac{102.1}{626.8} \right)^{0.47} * 266 = 113 \text{ m}^3 / \text{sec}$$

$$F_G = 52 \text{ km}^2$$

$$Q_{\max 20} = \left( \frac{102.1}{52} \right)^{0.47} * 55 = 75.5 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = \left(\frac{102.1}{52}\right)^{0.47} * 86 = 118 \text{ m}^3 / \text{sec}$$

$$Q_{\max 10} = \left(\frac{102.1}{217.6}\right)^{0.47} * 83.3 = 58.4 \text{ m}^3 / \text{sec}$$

$$Q_{\max 20} = \left(\frac{102.1}{217.6}\right)^{0.47} * 96.6 = 67.7 \text{ m}^3 / \text{sec}$$

$$Q_{\max 50} = \left(\frac{102.1}{217.6}\right)^{0.47} * 122 = 85.5 \text{ m}^3 / \text{sec}$$

$$Q_{\max 100} = \left(\frac{102.1}{217.6}\right)^{0.47} * 160 = 112 \text{ m}^3 / \text{sec}$$

On the basis of this calculation we have ascertained that inflow:

$$Q_{\max} = 182.0 \text{ m}^3 / \text{sec}$$

## Conclusion

### Nerodime River Basin

This study gives a clear idea in regard of determination of the maximum flow of rivers which passes through the town and should be checked (their flows due to floodings). Methods applied in this document are feasible methods, efficient and not-complicated. This study is made about Nerodime River and its focus was to protect Kaqanik town with 15.000 inhabitants. Comparison with water demands and availability show that Nerodime Basin may suffer from the water lacks.

In addition, demand for water can be tested by setting effective use of water and needs for water in the future, having into account needs for potable water supply, agriculture (irrigation) and industry. A proper definition for the maximum use of the amount of supply with regenerative water shall be done respecting conditions of rivers and proper use of underground water. Therefore the minimum flow and trends of underground water shall be taken into account:

Improvement of data base shall include as follows:

- Permanent measurement in the measuring stations including levels and inflows: flow can be derived from the flow curve (secured section is necessary).
- Construction of meteorological stations, credible, providing at least data on precipitation and temperature.
- Construction of monitoring points for underground water views.

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