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PRIORITY ALTERNATIVE WATER SOURCES IN BALAKAN RAION OF AZERBAIJAN

SUMMARY

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Priority alternative water sources in Balakan raion of Azerbaijan

EXECUTIVE SUMMARY

This study focuses on identifying priority alternative water sources in Balakan raion, Azerbaijan, which is located in the transboundary Ganikh/Alazan River basin, shared with Georgia. The study is supported by the EU4Environment – Water Resources and Environmental Data Programme.

The main objective of the study was to identify alternative water sources for different communities in the raion and to promote their efficient use by households, particularly in the context of changing climate conditions.

It is important to note that climate change in Balakan raion, as in other regions of Azerbaijan, has resulted in increased evaporation due to rising temperatures and a reduction in precipitation.

According to assessments conducted over the past 12 years (2011–2023), compared to the period 1961–1990, the average air temperature in Balakan increased from 12.8°C to 14.8°C, while precipitation decreased from 959 mm to 877 mm.

As a result, the water resources of rivers have decreased by about 15% over the past 25 years. It is forecasted that, due to climate change (CC), water resources may decline by 20-40% by the end of the century, according to various CC scenarios. In the future, water demand is expected to rise more rapidly, as both water resources decrease and the population increases, with per capita water demand rising due to higher temperatures.

Given the water scarcity observed in almost all regions of Azerbaijan in recent years, the recommendations identified in this report for utilizing alternative water sources can potentially be adapted and applied to other regions of Azerbaijan.

Balakan raion consists of one city (Balakan) and 59 villages, which are grouped into 21 municipalities. Some municipalities contain 2–3 villages. The raion has a population of 102,000, with 15% living in urban areas and 85% in rural areas. Men account for 49.6% of the population, while women make up 50.4%. The total area of the raion is 940 km² (360 square miles), resulting in a population density of 107 people per km². The population of Balakan raion has increased by approximately 40% since the 1990s.

Drinking water demand in Balakan raion increases year by year. Currently, the total demand for drinking water in the entire raion is estimated to be around 6.5 million cubic meters. With a 0.5% annual population growth, this demand could rise to 8.5 million cubic meters by 2050.

Currently, the central water supply system meets only 15% of the total drinking water demand, while the remaining water is supplied through various local sources.

Based on the distribution of precipitation by elevation, areas located above the Baku-Georgian border highway, covering approximately 550 km², receive high levels of precipitation, reaching

1,000 mm. This results in a total of 550 million cubic meters of water, including runoff and evaporation, for the region.

In contrast, areas below the highway receive approximately 500 mm of precipitation. For the territory of around 374 km², the total amount of rainwater is approximately 187 million cubic meters.

These figures demonstrate that there is enough rainfall to meet the technical water demand of all households.

According to the assessment conducted in this study, the use of new groundwater artesian wells can meet both current and future drinking water demand, with a total capacity of 10 million cubic meters. This includes 2–3 million cubic meters for areas above and near the highway, and 7–8 million cubic meters for settlements located in the zone below the highway. Additionally, approximately 4–5 million cubic meters of rainwater can be harvested for technical purposes by households.

The region's rivers, which are currently widely used for irrigation, could be treated and repurposed to supply drinking and household water to nearby settlements and communities.

A key issue in the region's water demand management is the lack of a comprehensive, integrated approach to managing river basin water resources. The mechanism for implementing the river basin approach to water resources management has not yet been defined in Azerbaijan.

As a result of this project, the following work was conducted:

1. The most vulnerable households (residential areas) in Balakan raion were identified through an analysis of the current state of water demand and supply, which included collecting existing data, conducting field assessments, and interviewing local residents and authorities.
2. Future water demand was assessed and documented, taking into account climate change (CC) and population growth in the communities (settlements) of Balakan raion.
3. Alternative water sources were identified and prioritized, including the status of their use by the selected vulnerable settlements in Balakan raion, to meet current and future water demand.
4. Recommendations for local authorities, municipalities, and communities on the use of alternative water sources, including the adoption of best international practices, were prepared.
5. Meetings with relevant local authorities and community representatives were conducted to raise awareness and promote the use of alternative water sources based on the study's findings.
6. UNFCCC presentation.

Background information

Results of the Survey on Water Accessibility in the Region

In July 2024, a visit to Balakan raion was organized, during which meetings were held with various stakeholders. During these meetings, local stakeholders noted that the main sources of drinking and irrigation water in areas above Balakan City and the Sheki-Georgian border highway are the upstream parts of the Balakan, Katekh, and Mazim rivers, along with their tributaries, as well as limited amounts of groundwater. Below the highway, both river flow and groundwater are widely used for various water purposes.



Photos by the author

According to information obtained during the visit to Balakan raion, water supply is sufficient in areas near and above the highway. However, in the lower part of the Gullar settlement, which has been recently established and is not connected to the central water supply system, the percentage of water supply is lower.

In many villages below the highway, which lack a central water supply system, including those that are far from rivers, the level of water supply is low.

As a result of the survey conducted in Balakan raion, the following information was obtained:

1. There are currently 24 sub-artesian and 17 artesian wells under the management of the Balakan Water Canal in the city center and surrounding villages. Additionally, 20 sub-artesian and 5 artesian wells are operated by rural municipalities. Both artesian and sub-artesian wells are used for drinking and irrigation water supply. Furthermore, there are 15-20 groundwater wells in the villages located in the southern part of the region (below the highway).
2. Almost all of the above sources are used for drinking water. Sub-artesian wells operate 1-2 times a day for about 2 hours. In some villages, the water extracted from the wells is distributed to the population through pipes laid within the village. In other areas, the water

extracted from the wells is stored in large tanks (40-50 tons) installed next to the wells, and from these tanks, it is distributed to homes through smaller pipes.

3. The supply of drinking water for Balakan city center and the three adjacent villages Mahamalar, Gullar, and Gerekli comes from the Siltik River, which originates in the mountains and joins the Balakan River. According to the results of the analysis, the quality of this water meets national drinking water quality standards. The water abstraction from the Siltik River is about 60 l/s. In the new water supply project, water from the Garachay River will also be used for this purpose.
4. In Katekh village, one of the largest villages in the raion, drinking water is primarily sourced from the Katekh river by a nearby facility and supplied to the population through a 13 km long water line built within the village. In some areas of the village, groundwater is also used for household water purposes. The village also uses water from the Katekh River for irrigation.
5. In areas near and above the highway, water supply is sufficient. However, in the lower part of the Gullar settlement, which was recently established and is not connected to the central water supply system, the percentage of water supply is lower.
6. In many villages located below the highway, where there is no central water supply system, including those far from rivers, the level of water supply is low.
7. Sub-artesian and artesian wells are dug by the state and are currently managed by the water canal management and municipalities. No artesian or sub-artesian wells are dug by the population. However, in the villages in the southern part of the region, the population digs and uses water wells in their backyards, with a depth of 8-10 meters, using primitive methods.

Existing artesian and sub-artesian wells meet 55-60% of the drinking water demand for all villages. The remaining demand is met by wells dug by the population and water sourced from rivers. There is a significant need for drilling new wells or utilizing alternative water sources.

Proposals for the use of alternative water sources

Water Demand in the Areas of Balakan raion

In order to provide water to populations without access to a water supply system, it will be necessary to utilize alternative water sources such as groundwater and rainwater, as well as increase water use efficiency by reducing water losses.

Treated wastewater from the sewage systems of Balakan, Katekh, and Gullar, with an estimated capacity of around 1-2 million cubic meters, can be used for irrigating green areas after proper treatment.

To meet future water demand, an additional 5 million cubic meters in the summer and a total of 10 million cubic meters annually will be required. This can be achieved through the use of groundwater and harvested rainwater.

To enhance household resilience to climate change by improving drinking water and sanitation efficiency in residential areas of Balakan raion, an important step is to develop and utilize local alternative water sources for each settlement (or community) for drinking water as well as for other household purposes, such as watering yards or gardens where no other water sources are available.

The centralized water supply system in Balakan city, as well as in Gullar and Katekh villages, relies on surface water. It is anticipated that the water supply and sanitation system will be rehabilitated. As currently waste water reuse standards are at stage of development and adoption therefore the wastewater from these areas can be treated according to international standards and used as technical water for irrigating green areas. Additionally, rainwater collected from building roofs and other areas can be used as technical water for irrigation of yards and other spaces. To ensure a sustainable household water supply, artesian wells can be utilized as an alternative water source.

For rural settlements located at the foothills, the groundwater level is low, but sufficient amounts of rainwater are available. This rainwater can be prioritized for various uses. In lower-altitude areas, there is an adequate amount of groundwater available for household use, while rainwater can be harvested for technical purposes.

In areas located above the highway, with an approximate territory of 550 square kilometers, the precipitation is high, reaching 1000 mm. This results in a total of 550 million cubic meters of water for the region, including runoff and evaporation.

For areas below the highway, the precipitation is estimated to be around 500 mm, and for the territory of approximately 374 square kilometers, the rainwater available would be around 187 million cubic meters. Above figures shows that there is enough amount of rainwater to cover technical water demand of all households. For areas located near and above the highway (including Mahamalar, Hanifa, Katekh, Gullar, Gazbina, Garakli, the upstream part of Poshtbina, and Balakan city), water supply is generally adequate. The main water supply issue concerns the newly settled downstream area of Gullar village, which is not connected to the centralized water supply system.

To address the water needs of the population in the downstream part of Gullar village (shown in Figure 1 on the map), artesian wells can be installed to provide approximately 1 to 1.5 million cubic meters of fresh drinking water from groundwater sources. Additionally, up to 2 million cubic meters of rainwater can be harvested annually for use in technical applications.



The drawing is prepared by the author

In areas located below the highway, all households without access to the centralized water supply system can rely on nearby abundant groundwater reserves to meet their sustainable water needs by installing new artesian wells. This is particularly relevant for areas such as Tulu, Talalar, Saribulag, and other small nearby settlements (marked in Figure 2 on the map), where no nearby rivers exist. By installing artesian wells in these villages, around 2 million cubic meters of groundwater can be provided for drinking. Additionally, approximately 1 to 1.5 million cubic meters of rainwater can be harvested annually for technical purposes.

In areas such as Pustatala and Ititala (marked in Figure 3 on the map), new artesian wells need to be installed to avoid the need for manual water drilling. By implementing a rainwater harvesting system, rainwater can be used for irrigating green areas and trees, as well as for technical purposes. In these villages, around 2 million cubic meters of groundwater can be provided through artesian wells. Additionally, approximately 1 to 1.5 million cubic meters of rainwater can be harvested for technical purposes.

In the remaining areas, mostly below the highway, additional artesian wells can be installed to provide around 3 million cubic meters of water to meet permanent drinking water demands where necessary. Similarly, an equivalent amount of rainwater can be used for irrigation and other household purposes.

The artesian installations mentioned above can meet both current and future drinking water demands, with a total capacity of approximately 10 million cubic meters (2-3 million cubic meters for areas above and near the highway, and 7-8 million cubic meters for settlements located in the zone below the highway). Additionally, around 4 to 5 million cubic meters of rainwater can be harvested for technical purposes to be used by households.

Main recommendations

The following recommendations can be proposed for initial discussion with the relevant local authorities, water-related organizations, municipalities, other users, and community representatives. After finalizing the discussions, the recommendations can be submitted to the relevant stakeholders in the region:

For drinking and household water use below recommendations can be proposed based on carried work:

- In Balakan city and the villages connected to its centralized Water Supply and Sanitation System (WSSS) and in the drinking water system of Katekh village around 1 million cubic meters of drinking water is currently provided, which is sufficient for the current water supply needs of their population. To meet the increased water demand in the future (up to 2 million cubic meters) due to population growth, economic development, and climate change, there will be a need to improve water use efficiency in households, reduce water losses during transportation and usage, install water meters, and implement differentiated water tariffs based on consumption per person.
- Additionally, it is important to ensure that drinking water is not used for non-potable purposes. Besides river water, artesian wells can also be installed to supply the system with high-quality groundwater during low-flow periods.
- To supply water to the population in the downstream part of Gullar village (shown in Figure 1 on the map) which is area with scarce surface water, artesian wells can be installed to provide approximately from 1 to 1.5 million cubic meters of fresh drinking water from groundwater sources. Furthermore, up to 2 million cubic meters of rainwater can be harvested annually for technical purposes use.

- In areas located below the highway, all households without access to the centralized water supply system can rely on nearby abundant groundwater reserves to meet their sustainable water demands through the installation of new artesian wells. This is particularly important in areas such as Tulu, Talalar, Saribulag, and other small nearby settlements (shown in Figure 2 on the map), where no nearby rivers exist.
- By installing artesian wells in these villages, around 2 million cubic meters of groundwater can be provided for drinking. Additionally, around 1 to 1.5 million cubic meters of rainwater can be harvested for technical purposes.
- In areas such as Pustatala and Ititala (shown in Figure 3 on the map), new artesian wells are necessary to avoid manual water drilling. With the installation of a rainwater harvesting system, rainwater can be used to irrigate green areas and trees, as well as for technical purposes. In these areas, around 2 million cubic meters of groundwater can be provided by artesian wells. Additionally, around 1 to 1.5 million cubic meters of rainwater can be harvested for technical purposes.
- In the remaining areas, mostly located below the highway, additional artesian wells can be installed to provide around 3 million cubic meters of water to permanently meet drinking water demand where needed. An approximately equal amount of rainwater can also be used for irrigation and other household purposes.
- The aforementioned groundwater artesian installations can meet both current and future drinking water demand, with a total capacity of 10 million cubic meters (up to 2-3 million cubic meters in areas above and near the highway, and 7-8 million cubic meters for settlements located below the highway). Additionally, around 4-5 million cubic meters of rainwater can be harvested for technical purposes for use by households.

Institutional management capacity building towards application of IWRM approach

- Raising awareness among the population and farmers about the necessity of water conservation and reducing water losses is a crucial local task to ensure water security during drought conditions.
- To fully implement an Integrated Water Resources Management (IWRM) approach, it will be necessary to adopt a basin approach (as outlined in the newly adopted Azerbaijan National Water Strategy) with coordination between upstream and downstream users. This will involve basin-wide management of water quality and quantity through the development and implementation of River Basin Management Plans (RBMPs).
- Relevant legal and institutional frameworks must be developed, such as creating mechanisms for applying the basin approach in line with the EU Water Framework Directive (WFD). This includes establishing basin institutions (e.g., Basin Management Organizations, Public Basin Committees, etc.) and increasing public-private participation through the development and implementation of a stakeholder management strategy.

Ways to promote the use of alternative water sources in Balakan and other regions based on carried activities within the project.

Final trip to the region was arranged in November 2024 the recommendations on the proposed alternative water use approaches were introduced to relevant municipalities, water users and community representatives and then based on their suggestions finalize the recommendations and delivered to relevant stakeholders in the Sheki-Zagatala region.





Photos by the author

In order to increase knowledge at local level was conducted meetings with eco-activists to promote by their support use of alternative household water sources and to apply the developed priority alternative water sources to manage current and future water demand to be resilient to future CCs.



Photo by the author

In order to promote use of alternative water sources country wise project results have been introduced at COP29 water events organised jointly with UNECE Water Convention Secretariat and in other different national and regional level events and to the relevant national organizations in Baku on application of proposed approach in similar regions of Azerbaijan.





Photos by the COP 29 assistant taken by author's camera



Photo by the author

In order to promote further the use of alternative water sources nationwide, there will be conducted similar awareness rising work on the basis of experience and outcomes of work carried in Balakan region. Results will be presented at different events and to relevant national level organizations and decision makers. Also there will be carried some activities in the future to increase the capacity of stakeholders in different regions of Azerbaijan through similar training sessions, seminars, and other awareness-raising activities.