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IMPOUNDMENT PERIOD AND ENERGY PRODUCTION DATE AT ILISU DAM



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REPORT NO: 2020-1**Title :** IMPOUNDMENT PERIOD AND ENERGY PRODUCTION DATE AT ILISU DAM**Authors :** Dursun YILDIZ¹, Yusuf Başlamışlı ²⁽¹⁾DSİ Daire Başkan Yrd (E)

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ABOUT THE REPORT

During the impoundment of reservoirs of large dams on transboundary rivers, the flow released to downstream is considerably reduced, so this issue is important in hydro political relations between riparian states. The Hydropolitic Academy (HPA) has carried out a study on the information and official explanations obtained to prevent the speculation that may take place in Ilisu Dam until the reservoir is filled and the water is released for the Tigris River.

In this study, Firstly ,Hydrological Conditions in the Dam Area, Operation of the Reservoir, Changes in the Water Level Downstream published by the Environmental Group of the ILISU CONSORTIUM has been reviewed. This report includes different models about the assessment of filling time of the reservoir with different scenarios.

In this study carried out by HPA, the most suitable one of these scenarios for the period when the impoundment in Ilisu started, agricultural irrigation and meteorological conditions was determined. Based on this scenario and model, the impoundment period of the Ilisu Dam reservoir and possible energy generation date were estimated.

Regards

Dursun Yıldız

President

January 18, 2020

Main Characteristics of the Dam and Reservoir

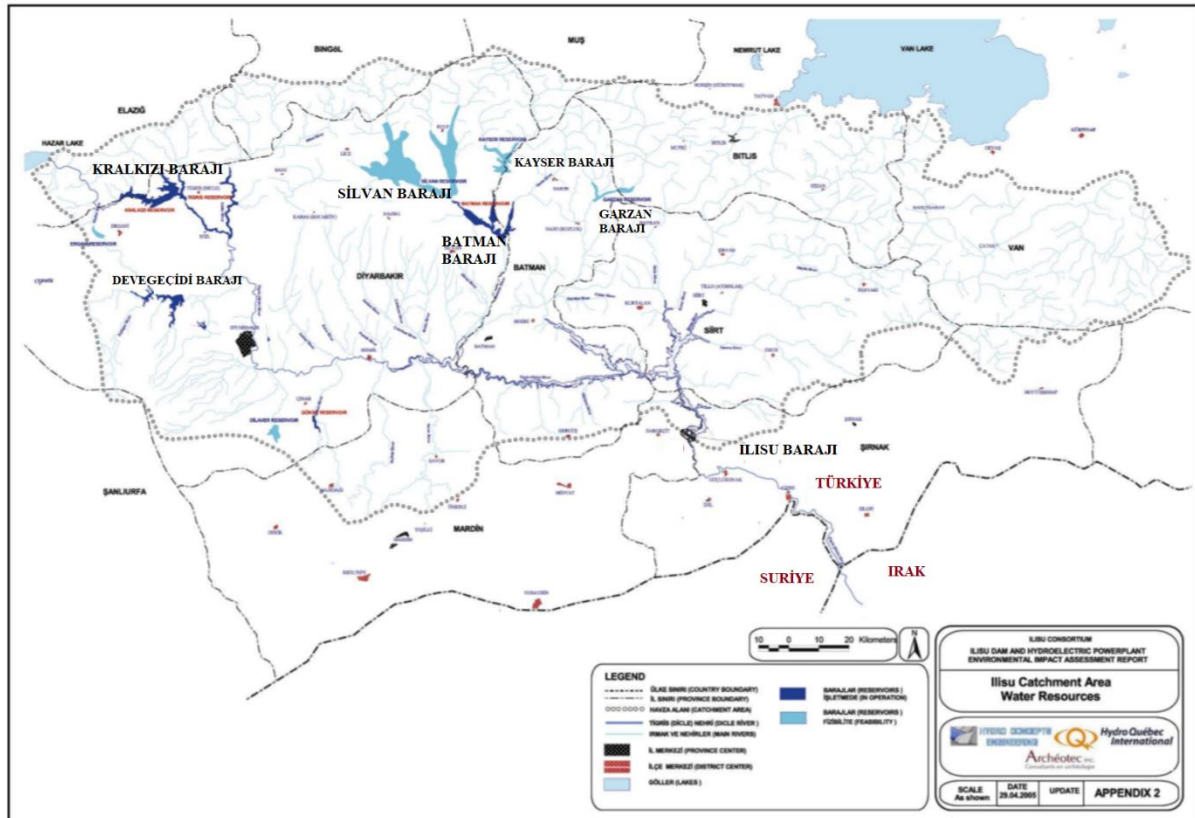


Figure 1: Ilisu Catchment Area and Water Resources

Ilisu Dam and HEPP

PROJECT NAME	:	Ilisu Dam and HEPP
LOCATION	:	Tigris River - Mardin / TURKEY
TYPE OF DAM	:	Concrete Face Rockfill Dam
DAM BODY VOLUME	:	23.760.000 m³
RESERVOIR VOLUME	:	10.400.000.000 m³
RESERVOIR SURFACE AREA	:	526,82 km²
PURPOSE	:	Energy Generation
INSTALLED POWER CAPACITY	:	1.200 MWh
POWER PLANT TYPE	:	Semi Underground
ANNUAL POWER PRODUCTION	:	4.120 GWh
HEIGHT FROM FOUNDATION	:	131 m
CREST LENGTH	:	1.775 m

Main Characteristics of the Reservoir

Reservoir	
Normal Water Level	525 m
Minimum Operation Level	485 m
Thalweg Elevation	400 m
Dead Volume	$2'950 \times 10^9 \text{ m}^3$
Active Storage Volume	$7'460 \times 10^9 \text{ m}^3$
Total Storage Volume	$10'4100 \times 10^9 \text{ m}^3$
Cathcement Area	35,509 km ²

Impoundment Process

The impoundment process in Ilisu Dam and HEPP, which was completed by the DSI General Directorate on the Tigris River announced in June 2019 and started on 23 July 2019.

Since the Ilisu Dam is on the transboundary Tigris River, the water retention in the dam and the filling time of the reservoir were subject to many different estimations and evaluations during the construction of the project. This period assessment was close to three years in drought, and this may increase tension between Turkey and Iraq.

Ilisu Dam is the second largest dam in Turkey after Atatürk Dam in terms of embankment volume and crest length in the category of concrete faced rock-fill dams. Ilisu Dam and HEPP, which has an installed power of 1200 megawatts and an energy generation capacity of 4 billion 120 million kilowatt-hours, is expected to contribute 412 million dollars annually to the national economy.

Water Depth in Dam Reservoir Exceeds 70 m

On November 12, 2019, DSI 16th Regional Director Ali Naci Kösalı stated that the amount of water in the dam reservoir will reach 10.5 billion cubic meters after 6 months and in February 2020, the turbines will be started to produce energy. Prof.Dr. Aydın Durmuş, Rector of Batman University also said, “Our dam was completed and the water level exceeded 50 meters.”(2). Later on, on 28 December 2019, DSI 16th Regional Director Ali Naci Kösalı stated that the height of the water reached 62.8 meters and the volume of stored water was 1.15 billion m³ (3).

On January 18, 2020, when this report was completed, DSI Regional Director Ali Naci Kösalı stated that water level is 70.75 m. He explained that the water volume in the reservoir reached 1.64 billion m³ (4).



Satellite views of the Ilisu Dam Reservoir

Importance of Impoundment Period of Dams on Transboundary Rivers

During the impoundment period of reservoirs of large dams on transboundary waters, river discharge and peak flow are considerably reduced in downstream. Therefore, this issue is important in hydro political relations between countries. SPD Hydropolitic Academy has carried out a preliminary study on the information obtained from official explanations and reports to prevent any speculation about this issue.

In this study, "Hydrological Conditions in the Dam Area, Operation of the Reservoir, Changes in the Water Level Downstream Report Published by the ILISU CONSORTIUM Environmental Group" was reviewed.

This report (1) includes assessment studies on the period required to fill the reservoir. Among these models, the most suitable one to the starting time of impoundment and hydrological and meteorological conditions in the site was chosen and correlated with measured data obtained from the Ilisu dam reservoir.

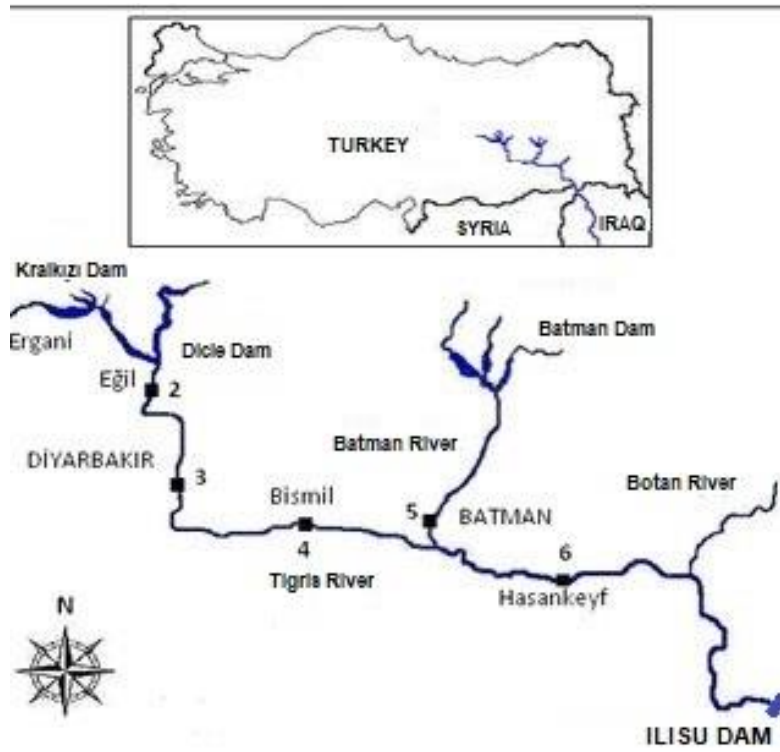


Figure 2. The Ilisu Dam and some dams in the upper Tigris Basin

Precipitation and Flow In the Dam Basin

Ilisu Dam is located in 325 km downstream from the river source. The dam has a catchment area of 35 517 km², and the average annual flow value appears to be 15 842 Million m³. The biggest contribution to this flow is from the Botan River due to the high rainfall drop in the mountainous areas in the north and east of the dam basin.

The catchment area of the dam has a semi-arid climate and the average annual rainfall is 814 mm. The highest values were recorded in Lice, which is 1330 mm, northwest of the basin, and the lowest value was observed in the Bismil plane (400 mm). Most of the precipitation falls in winter and spring, between December and April. The snow melts from January to June and flows to upstream of Ilisu Dam significantly in March, April, and May (1).

Variability in Annual and Seasonal Rainfall

Depending on the location, the seasonal and annual flows of the Tigris river vary considerably at extreme points. The flow rates at the dam site vary significantly seasonally. The highest flows are generally observed from March to May-June and the lowest flows between August and October.

2019 was Rainy in the Region

According to the Turkish State Meteorological Service 's data, the precipitation in the Southeastern Anatolia Region increased by 67% compared to the normal and 98% compared to the previous year's precipitation (Figure 3). During the summer season of 2019, relatively more precipitation fell in the upper basin of the Tigris River than in the previous year (Figure 4).

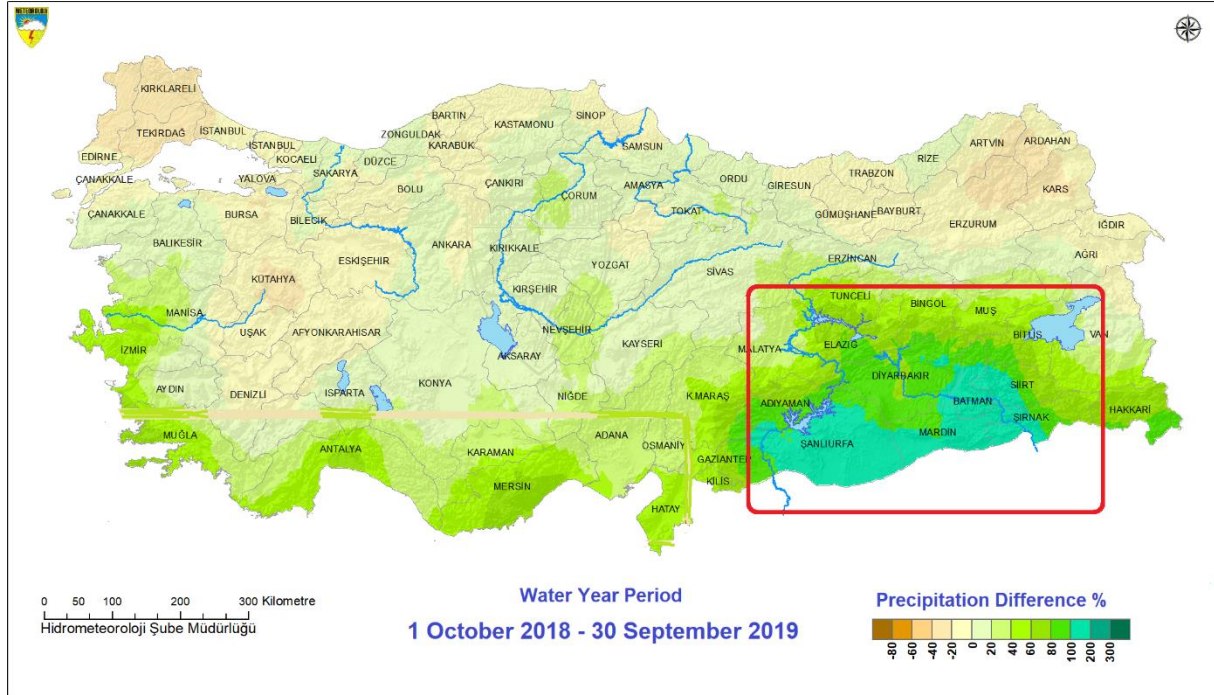


Figure 3: Change in cumulative precipitation in Water Year 2019 compared to Water Year 2018.(MGM)

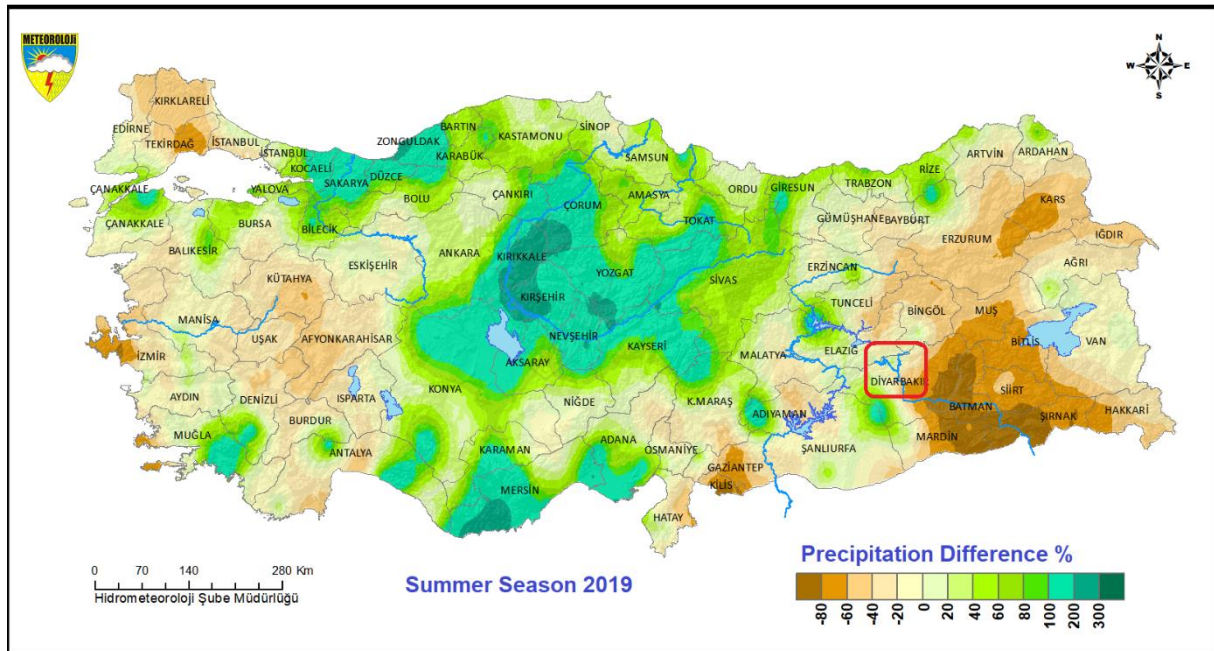


Figure 4: Change in summer precipitation in 2019 compared to 2018.(MGM)

In the region, the autumn months of 2019 were dry compared to the previous year. However, there was a 97% increase in the region's December precipitation compared to long term normal precipitations. As shown in Figure 5, this increase rate reached 300% locally in the upper basin of the Tigris river in December 2019.

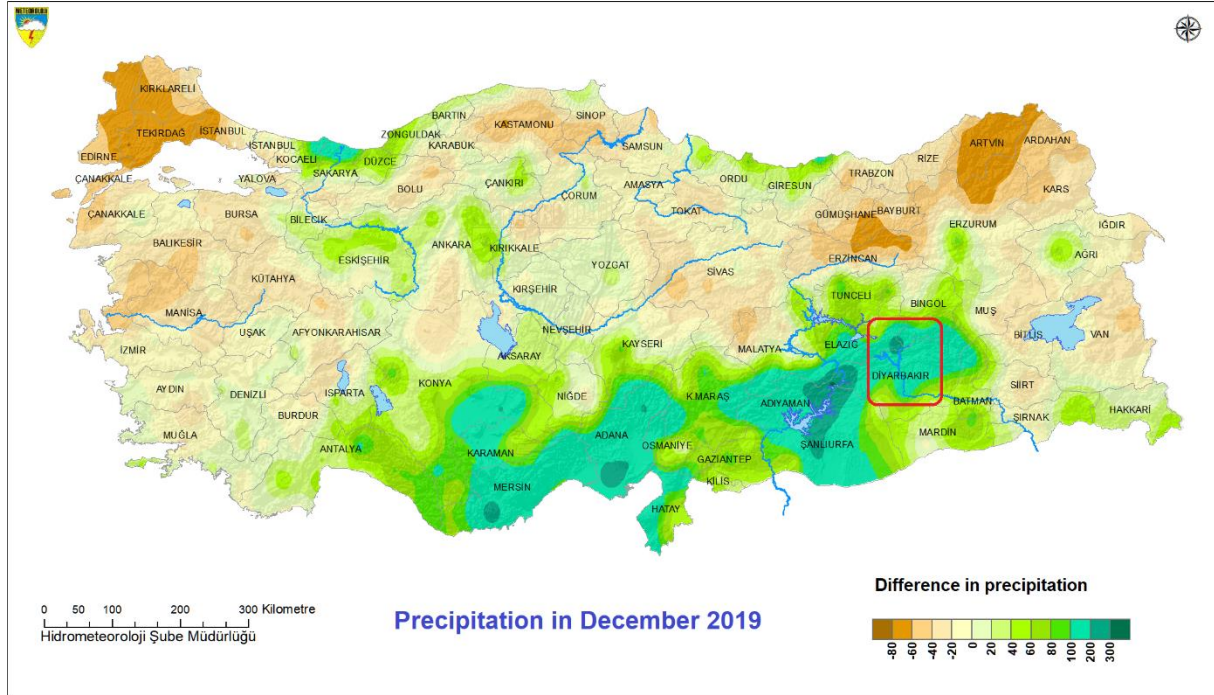


Figure 5: Change in December precipitation in 2019 compared to long term normal precipitation .(MGM)

Factors have Affected the Filling Time of the Dam Reservoir

- 1- In the 2019 ,precipitation in this region increased by 67% compared to normal and 98% compared to last year's precipitation (Figure 1.2).
- 2- Kralkızı, Dicle and Batman Dams and HEPPs that are located in the Upper Tigris River Basin were generated more energy by releasing more turbined water to Ilisu Dam reservoir after 28 July 2019, in addition to the natural flow coming from the sub basins.
- 3- Starting impoundment in the end of the irrigation season has reduced the impact of the converted waters to partly developed irrigation area in the upper basin.

Filling Period of the Reservoir and Possible Power Generation Date

In the EIA 2005 Report (1), the filling period graphs obtained from the best suited model to current situation in the dam site is given in Figure 6. Reservoir water level values announced

by State Hydraulic Works on various dates are marked on Figure 6 (2,3,4). As it is seen in this figure, the water entering the reservoir in 2019 rapidly increased the reservoir level. However, the measured values reveal that the filling in the reservoir will occur with an increase between the dry and normal periods lines given in the EIA 2005 Report.

However, it is likely that the snowfall in the region this year will make this curve parallel to the normal period curve after February. In this case, it is considered that the dam will reach the normal water level of 525.00 m at the end of May.

In addition to the precipitation conditions in the region in 2020, this level can be partially changed depending on the water turned for irrigation in the spring and the turbine operation program of the dams located in upper basin.

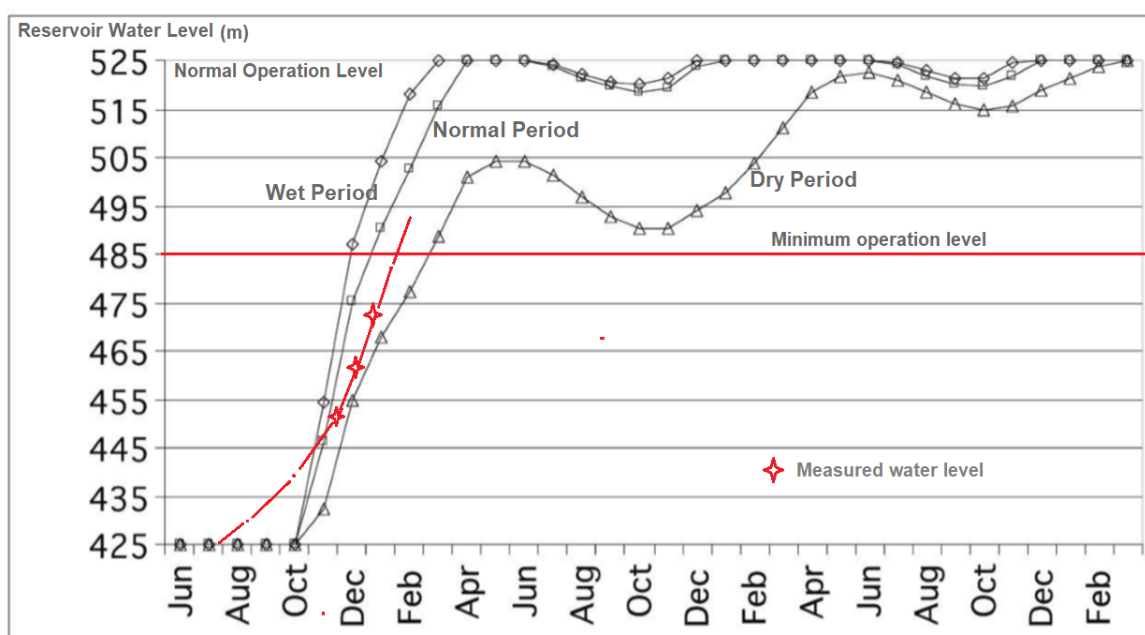


Figure 6. Reservoir filling period for the partial irrigation in the upper basin and starting impoundment in June model and measured values in the dam site (Figure 19 in EIA 2005)

Evaluation and Conclusion

The starting date of the impoundment of the Ilisu dam was under evaluation between Turkey and Iraq. If the impoundment operation of the Ilisu dam would start in a drought period this would create higher tension in the relations of Turkey and Iraq.

Because, in the EIA Report Annex 1 Document, it is stated that the filling periods of the reservoir during the dry period can vary between 16 and 33 months changing with starting months of impoundment. In the same EIA Report (1), it was stated that the starting date is important in rainy periods and the best time to start filling is March 1. However, although impounding has started in the middle of a rainy year 1.15 billion m³ of water was stored in the reservoir by the end of 2019. Flow released from the upstream HEPPs partially effected to this amount of stored water in the reservoir.

In this study, Firstly "Hydrological Conditions in the Dam Area, Impoundment of the Reservoir and Operation, Water Level Changing of the Downstream Part of the River Report Published by the Environmental Group of the ILISU CONSORTIUM" was reviewed (1).

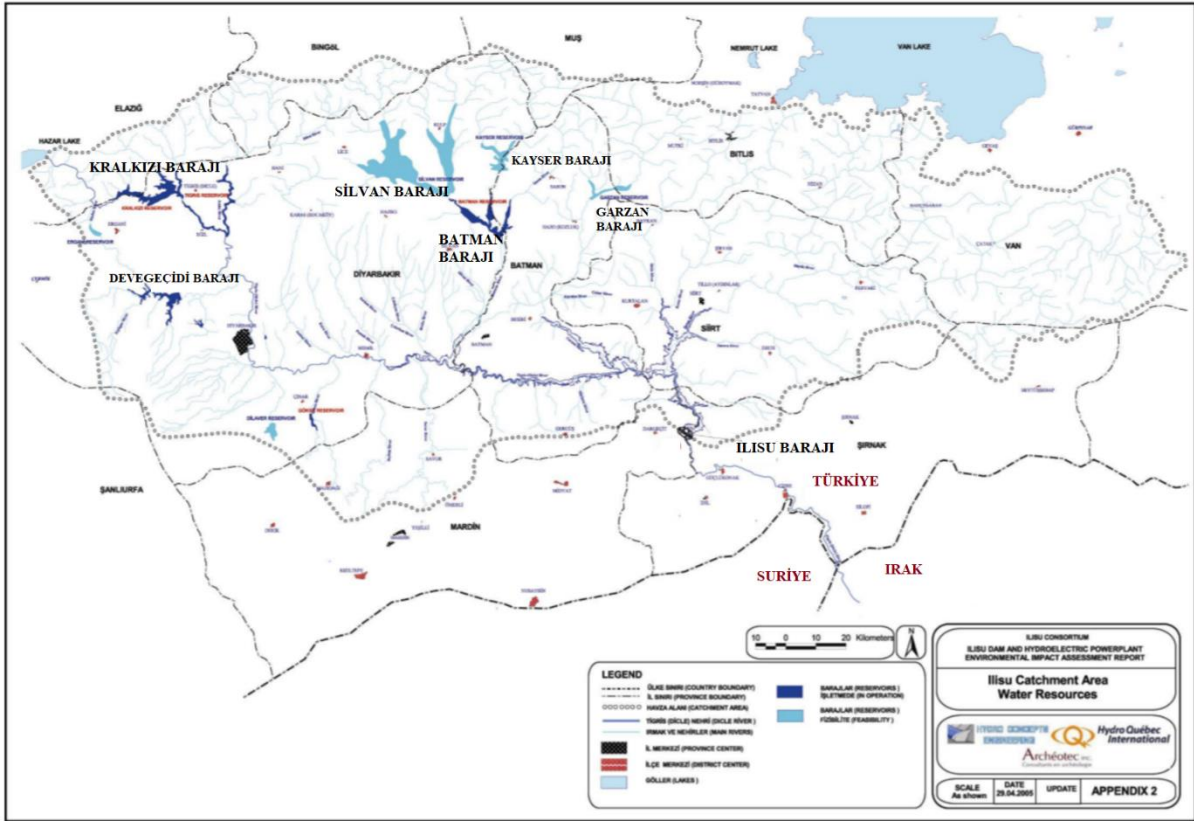
Among the scenarios related to the reservoir filling period in the report, the “scenario where impoundment started in June and partial irrigation in the upper basin ” was taken into consideration and the data obtained from the dam were processed on this chart.

At the end of this study, in parallel with the statements made by the 16th Regional Directorate of DSI, it was evaluated that the reservoir will reach the minimum operating level in mid-February and can start energy production. Besides, it seems likely that the reservoir will reach normal operating level (525.00m) at the end of May due to the effect of snow melting.

As a result, after the impounding process, which started in July 2019 at Ilısu Dam, the reservoir level where the water will be released with energy production will be reached within 7 months. It is projected that the filling process will be completed within 10 months if the flows close to long term seasonal average enter the dam reservoir in coming months

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