AKARÇAY RIVER BASIN

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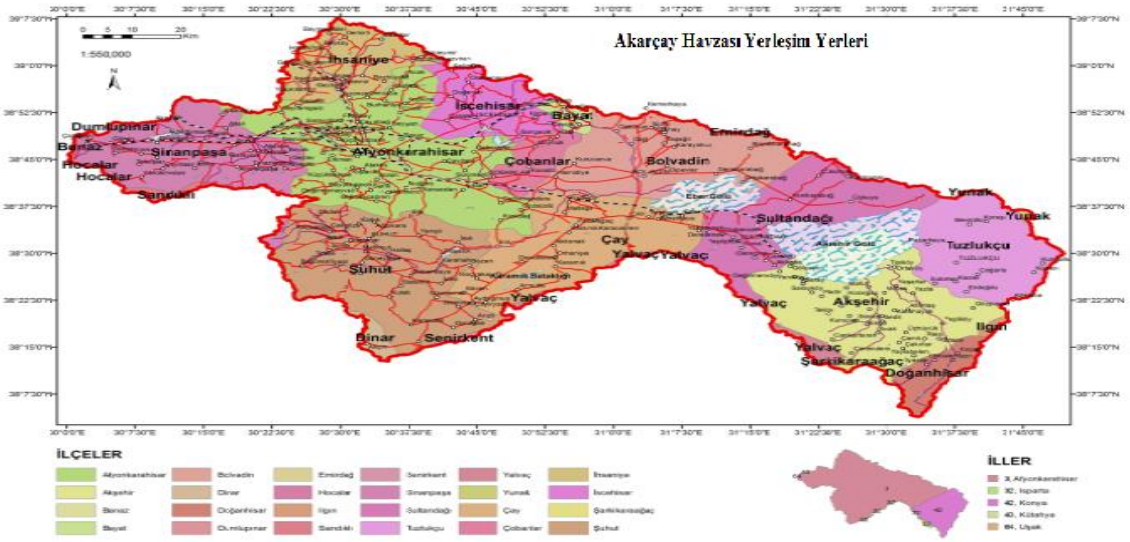
Akarçay River Basin is surrounded by Sakarya Basin in the north and east, Konya Closed Basin and Antalya Basin in the south, and Büyük Menderes Basin in the west and southwest. Due to the natural topography of the basin, it does not have the opportunity to discharge its waters into the sea.

The basin area is approximately 7,989 km^2 and the ratio of the basin to the area of Türkiye is 1%. The precipitation area of the Akarçay Basin is 7.605 km^2, the annual average flow is 0.49 km^3, the annual average precipitation height is 646 mm, and the annual average flow height is 30.44 mm.



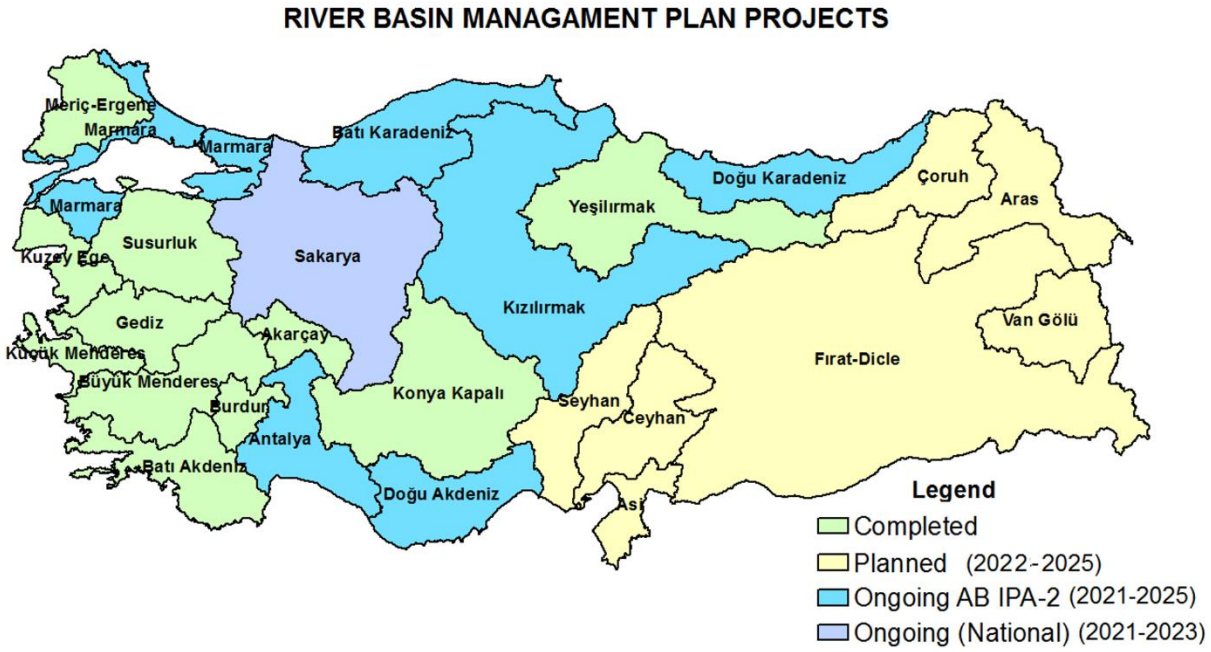
Afyonkarahisar and Konya provinces are located in the Akarçay Basin. The spatial information of the provinces within the borders of the basin is given in the table below.

Provinces and their areas in the basin

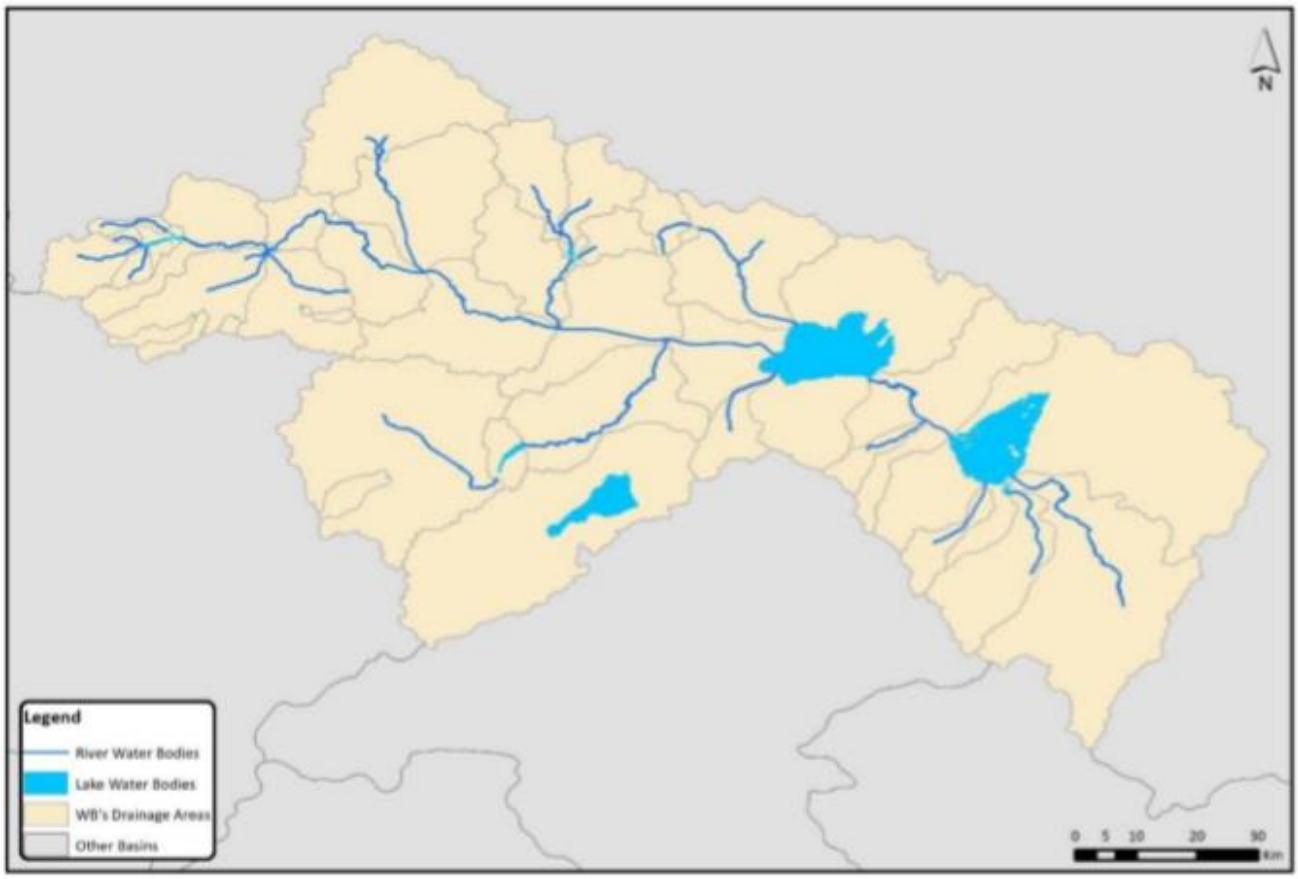
PROVINCES	TOTAL AREA (ha)	THE AREA OF THE PROVINCE IN THE BASIN (ha)	DISTRIBUTION OF THE BASIN BY PROVINCES (%)	THE PART OF THE PROVINCIAL AREA INCLUDING THE BASIN (%)
Afyonkarahisar	1.438.244	606.116	79	42
Konya	3.758.895	161.318	21	4

RIVER BASIN MANAGEMENT PLAN

Akarçay River Basin Management Plan (RBMP) was completed in 2021. Measures determined within the scope of RBMP are followed through the National Water Information System (USBS).

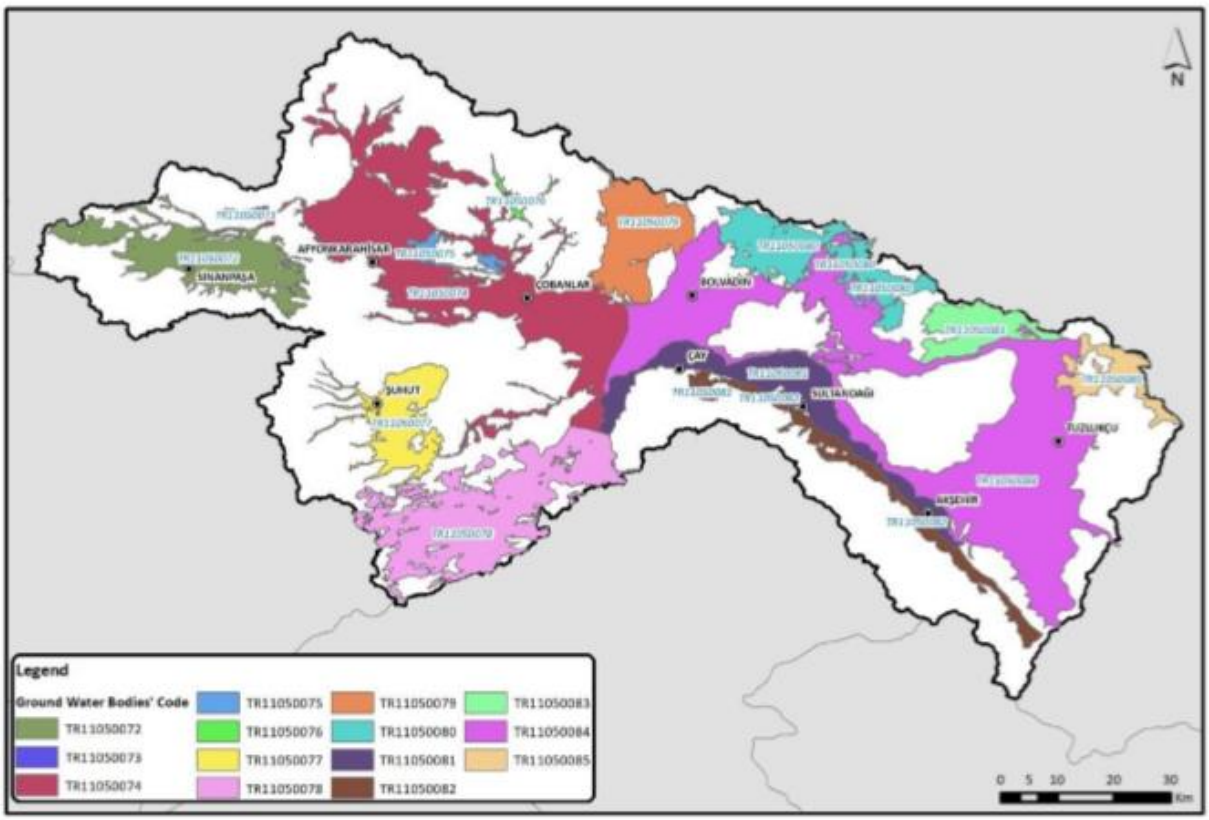


In the Akarcay Basin; There are a total of 40 surface water bodies, of which 28 are river water bodies and 12 are lake water bodies.



Akarçay Basin Surface Water Bodies

There are 14 groundwater bodies (GWB) in the Akarçay Basin.



Akarçay Basin Groundwater Bodies

929 measures have been determined in order to ensure that all water bodies in the Akarçay Basin are in good status and that the ones that are in good status are protected. The main groups of measures are listed below.

- Constructed wetland
- Implementation of Action Plan for water efficiency in the agricultural sector
- Construction of wastewater infrastructure
- Legal enforcement in mining, preparing and implementing waste management plans for disposal of mining wastes in mine waste storage facility
- Construction of manure storage units and implementation of manure management plans
- Implementation of Action Plan for water efficiency in the municipal sector
- Preparation of Surface Water discharges inventory
- Follow-up of areas designated for protection of economically significant aquatic species
- Preparation of surface water abstractions inventory
- Development and implementation of Action plan for Nitrate Vulnerable Zone to implement good agricultural practices
- Closure and rehabilitation of unsanitary landfills
- Review and implementation of current Operational Monitoring (OM) programme in surface water bodies as per the WFD
- Review and implementation of current Surveillance Monitoring (SM) programme in surface water bodies as per the WFD
- Construction of leak-proof septic tanks
- Rehabilitation of mining sites that are abandoned or currently not in service
- Capacity increase of existing WWTP

- Control and management of sewage sludge in urban wastewater treatment plants
- Implementation of green belt along mining sites neighbouring the surface waters
- Good agricultural practices for the reduction and the control of the use of pesticides within Nitrate Vulnerable Zone
- Review and implementation of Chemical Monitoring programme in groundwater bodies as per the WFD
- Preparation of ground water abstractions inventory
- Compliance with the environmental monitoring program determined at EIA stage in Mining sites
- Establishment of measurement systems for the monitoring and control of groundwater abstractions and reinjections, if any, and reporting the monitoring results
- Forming a vegetative barrier along surface waters next to agricultural fields
- Monitoring and control of groundwater abstractions
- Terracing sloping (>20%) agricultural lands
- Construction of a new biological WWTP with secondary treatment
- Define and implement the GW Drinking Protection Zones
- Control of the GW Drinking Protection Zones
- Aforestation (forming green belt) and agricultural activities (as per provisions of the By-Law) in surface water basins that supply drinking water (drinking water protection areas)
- Restoration and improvement of the quality of riparian zone
- Characterise and improve the knowledge about the relationship between GW and the GW Associated Aquatic Ecosystem/the GW Dependent Terrestrial Ecosystems (GWDTEs)
- Quantitative Monitoring programme in groundwater bodies as per the WFD
- Studies for the control of invasive species and fishing
- Development and implementation of Action plan for Nitrate Vulnerable Zone
- Follow-up of industrial discharges to domestic wastewater network
- Installation of monitoring wells in groundwater bodies within the scopes of qualitative and quantitative monitoring programmes
- Review and implementation of current Investigative Monitoring (IM) programme in surface water bodies as per the WFD
- Enhancing the operational efficiency of an existing WWTP by repair and maintenance
- Installing ultrafiltration units to an advanced biological WWTP with N&P removal processes
- Feasibility study to determine the best fish migration scheme
- Sewer connection to the closest UWWTP
- Hatchery mitigation for fish losses caused by impoundments
- Construction of Manure Gasification Plants
- Upgrade of non-biodegradable industrial wastewater treatment plant process
- Characterisation and hydrogeological modelling studies of groundwater body levels in the basin, to justify extended deadline/less stringent objectives, quantitative aspects
- Implementation of Environmental flow regime
- Construction of a new advanced biological WWTP with N&P removal processes
- Characterisation and modelling studies of lakes with high nutrient loads in the basin, to justify extended deadline (natural conditions).
- Forming a green belt along surface waters next to agricultural fields
- Carrying out regular monitoring activities in fish farms
- Environmental flow regime studies to tackle shrinking lake water bodies
- Construction of a common industrial WWTP for an industrial zone

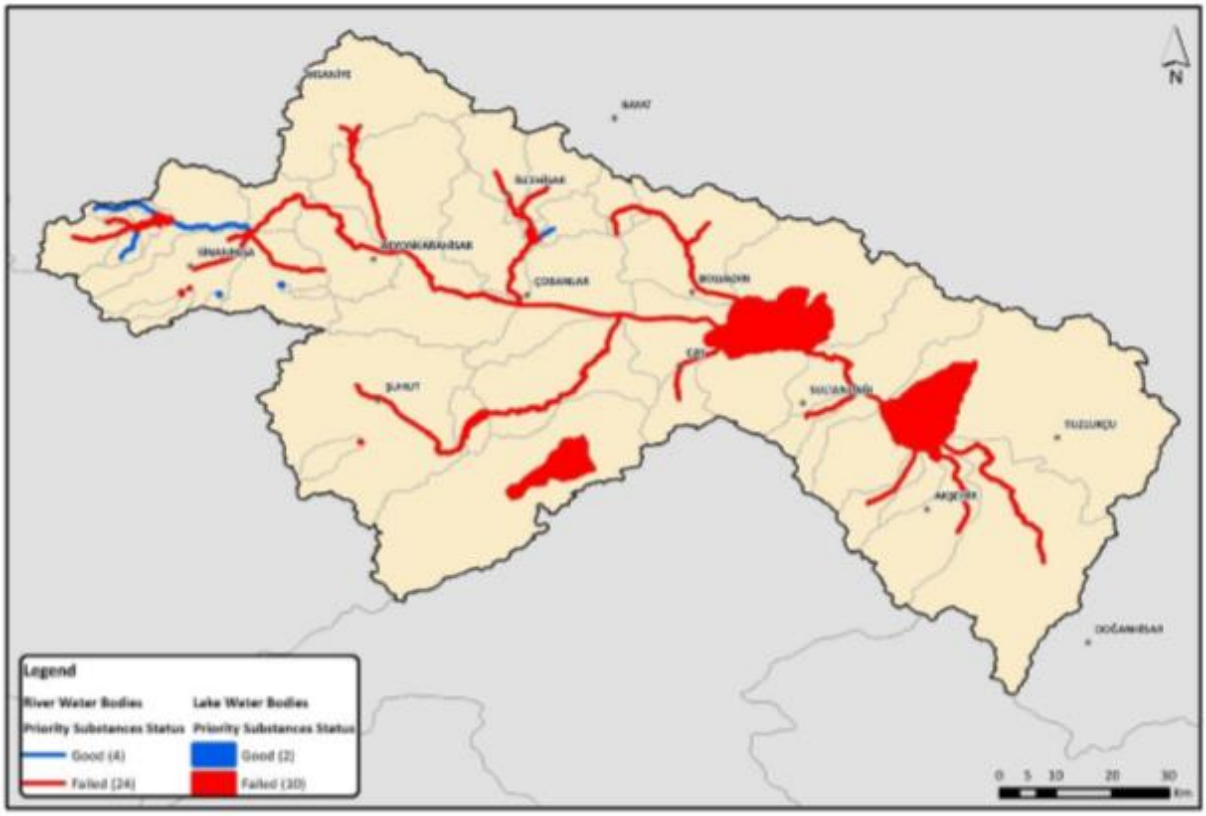
- Upgrade of non-biodegradable industrial wastewater treatment plant process
- Installation of a treatment system that consists a settling tank (and a drum filter, if necessary) for the aquaculture facility
- Construction of 3 chamber septic-tank, stabilization pond and subsurface flow constructed wetland, 3 stage WWTP
- Characterisation and modelling studies of rivers with high hydromorphological pressures, e.g. water abstraction pressure to justify extended deadline (natural conditions).
- Training of fish farm operators and personnel on Best Management Techniques
- Improvement of existing Waste Water Treatment Plant
- Determining Receiving Environment Based Discharge Standards and Transposition them to National Legislation

WATER QUALITY

Surface Water Status

As a result of monitoring studies in rivers, lakes, coastal and transitional water bodies, their ecological and chemical status has been evaluated and their overall status has been determined. Accordingly, out of 40 water bodies, 6 are assigned as bad, 16 as poor and 15 as moderate status. There are 3 surface water bodies achieving the requirements related to the environmental objectives (good and above status) in the current situation.

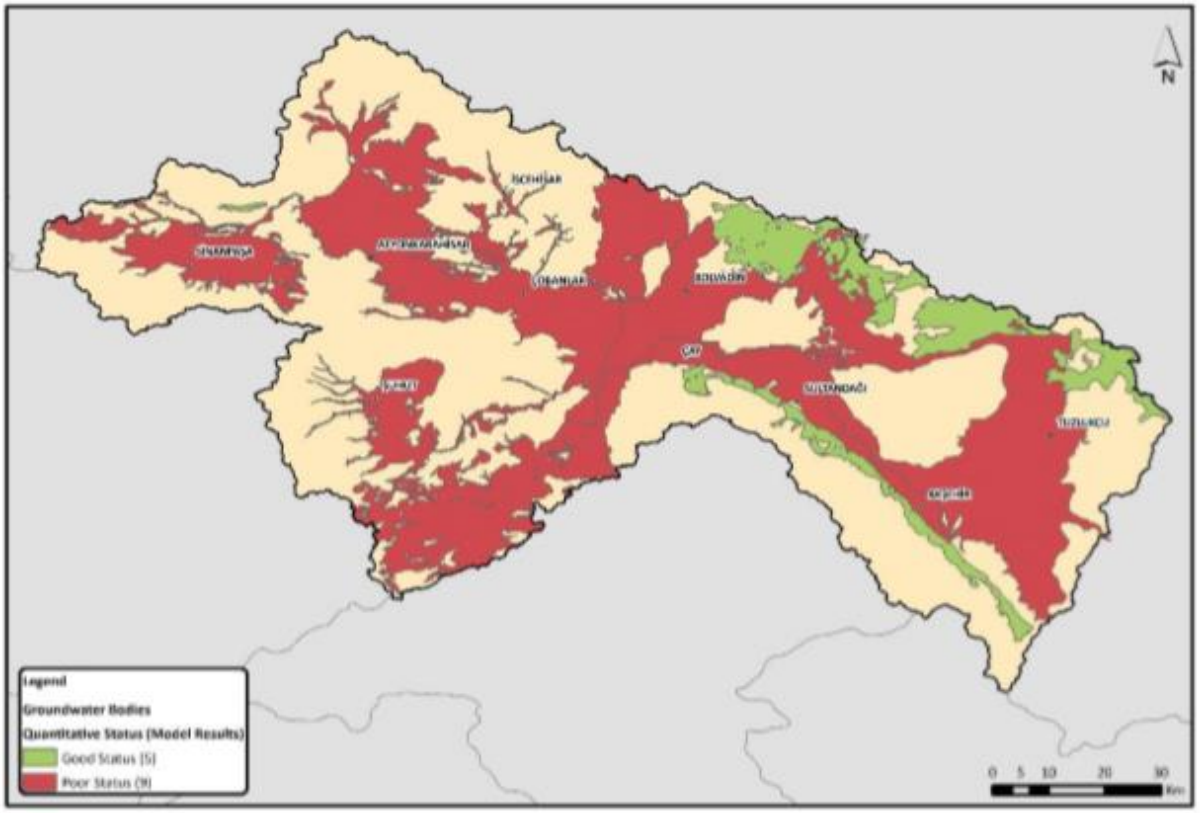
Ecological status (potential), surface water bodies



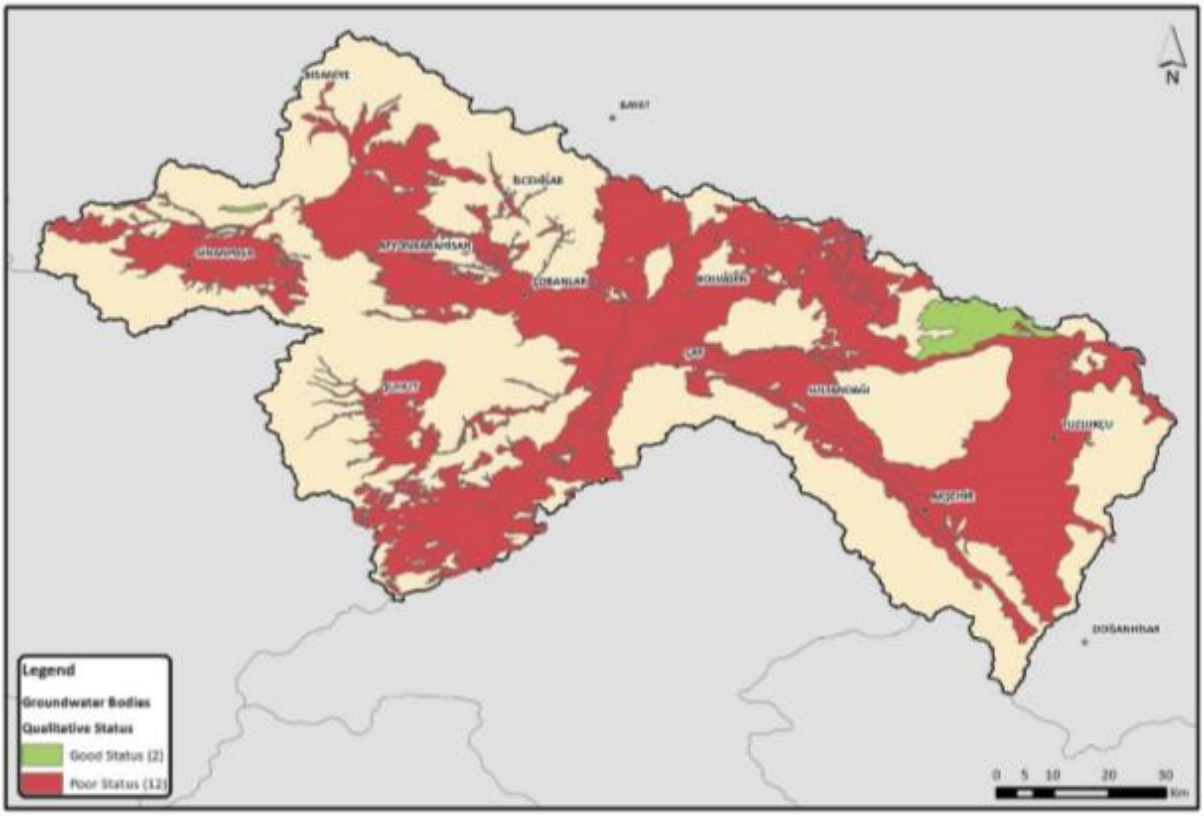
Chemical status (priority substances), surface water bodies

Groundwater Status

In Akarçay Basin, both quantitative and qualitative chemical status of groundwater bodies are given in below maps.



Quantitative status assessment, groundwater bodies



Qualitative status assessment, groundwater bodies

All in all, 2 groundwater bodies are in good overall status while as 12 groundwater bodies are in poor status.

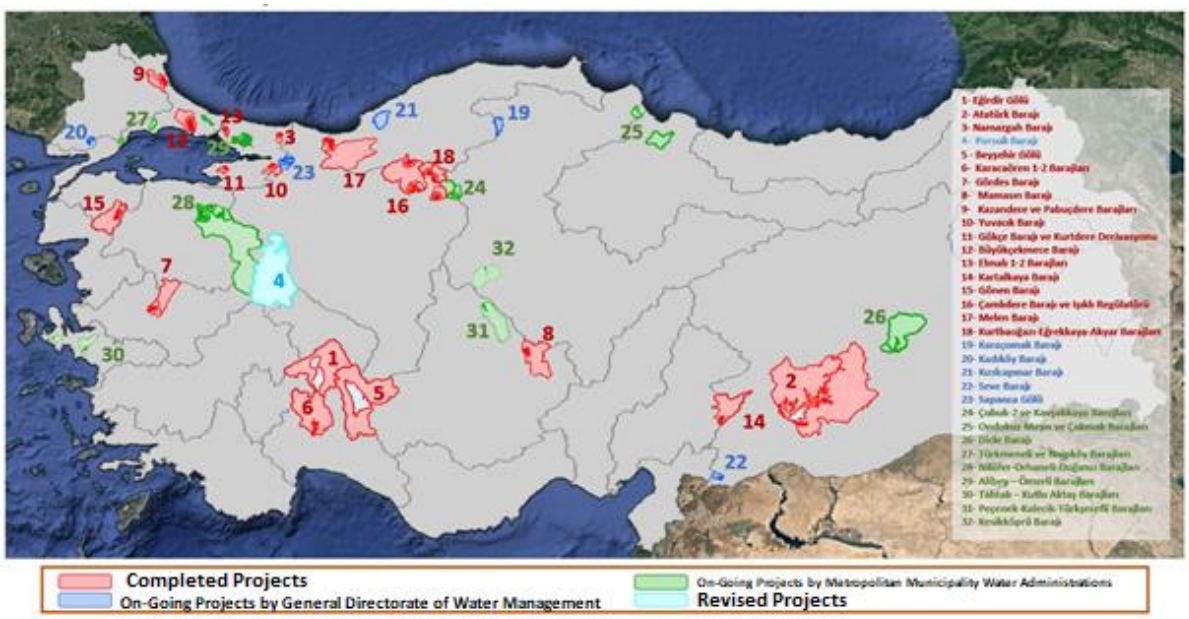
Quantitative Status	Qualitative Status	Overall Status
5 GWB are in good status	**2 GWB are in good status**	**2 GWB are in good status**
9 GWB are in poor status	12 GWB are in poor status	12 GWB are in poor status

DRINKING WATER PROTECTION PLANS

The purpose of drinking water protection plans is to determine basin-specific protection areas and principles based on scientific data to improve and sustainably manage the quality and quantity of drinking water sources.

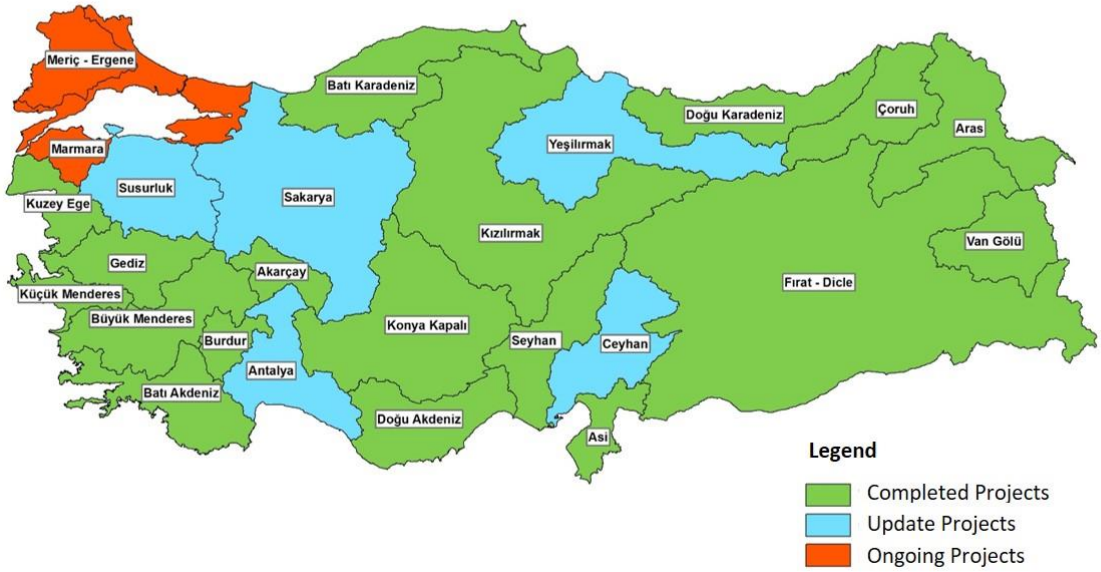
According to the Regulation on the Protection of Drinking-Water Basins:

- Protection plans for surface water sources that provide drinking water to metropolitan municipalities are prepared by the general directorates of water and sewage administrations of metropolitan municipalities in coordination with Ministry;
- Protection plans for surface water sources that provide drinking water to settlements outside of metropolitan municipalities are prepared by Ministry.



FLOOD MANAGEMENT PLANS

Akarçay Basin Flood Management Plan (FMP) started in 2016 and the plan was completed in 2019.

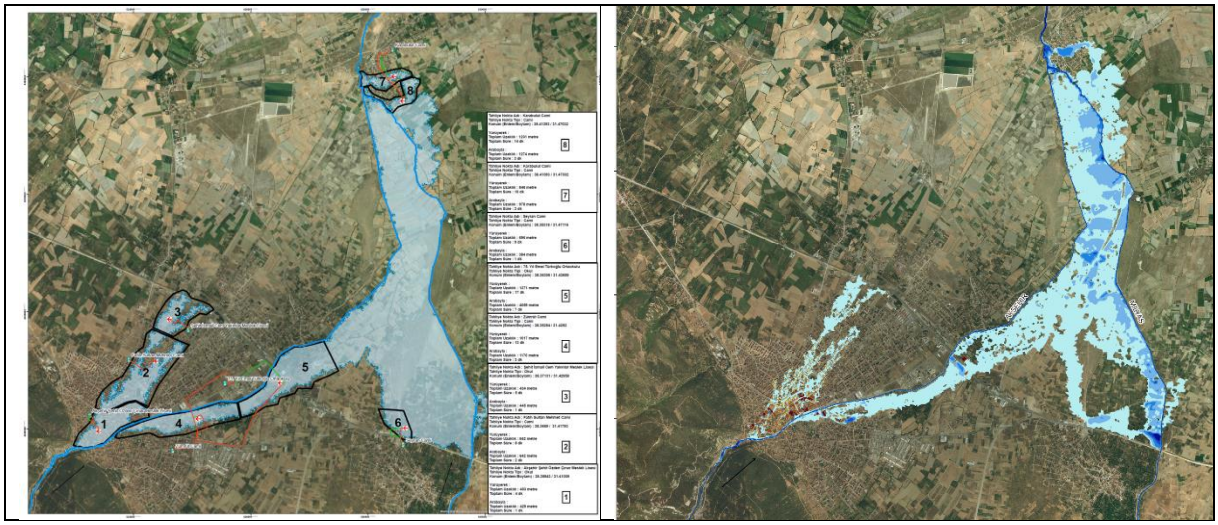


Flood Hazard and Flood Risk maps are generated within the scope of Akarçay Basin Flood Management Plan. The necessary measures to be taken to prevent risks before, during, and after floods have been determined using these maps, as have the responsible institutions and the time of implementation of the measures.

To mitigate the effects of potential flood events in the Akarçay Basin , 109 measures have been identified under the following groups of mitigation measures within the scope of the Flood Management Plan.

- Improvement of bridges
- Cleaning of stream beds
- Improvement of banks well
- Improvement of culverts
- Data-Information Collection/ Production
- Education/ Informing/ Raising Awareness
- Disaster and Emergency Response Capacity
- Stream rehabilitation
-

Mitigation measures determined within the scope of the plan are still being tracked via the Flood and Drought Plans Tracking Web Application in 2019 and the National Water Information System (USBS) in 2020.

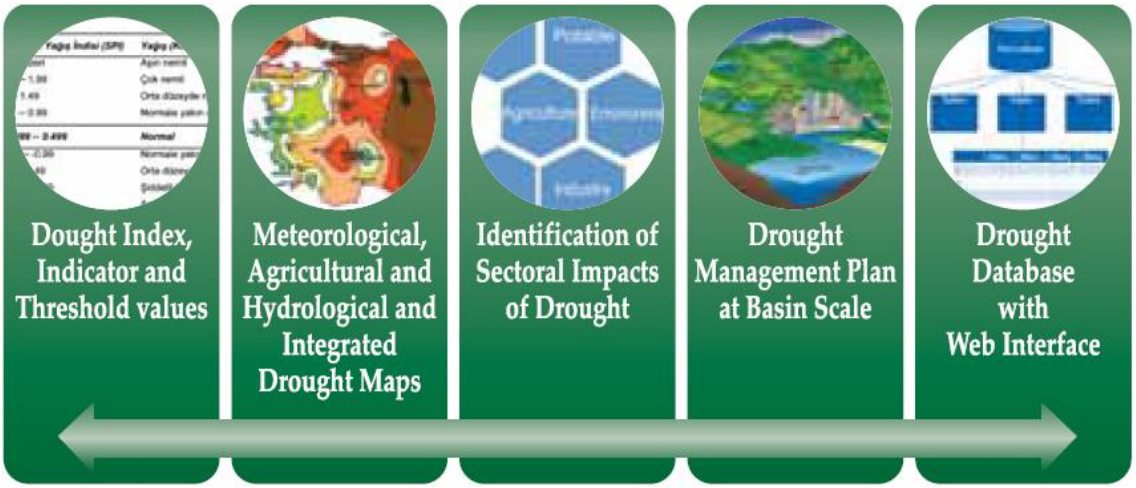


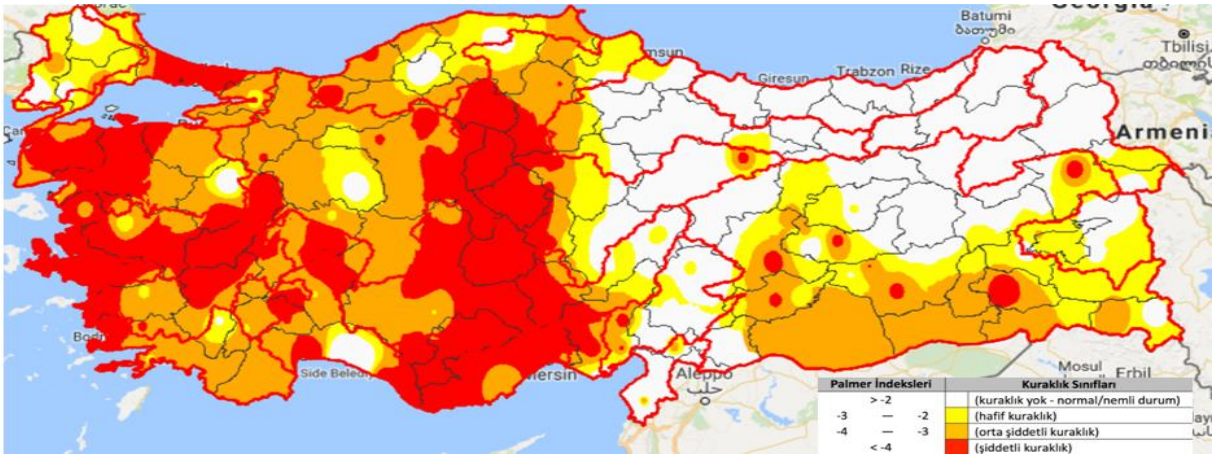
DROUGHT MANAGEMENT

Drought Management Plans (DMPs) are being prepared at the basin level for all of the water user sectors, including agriculture, in order to minimize the negative effects of possible drought risks and be prepared for drought. The aim of DMPs is to mitigate and prevent the negative impacts of possible droughts by determining the measures to be taken during water scarcity and the measures to be taken before, during, and after the drought periods in order to solve the drought problem as quickly as possible. Drought analyses, climatic and hydrological studies, sectoral vulnerability analyses, and drought maps are used to plan and direct studies such as recovery and intervention.

Measures determined within the scope of the plan started to be followed via the Flood and Drought Plans Tracking Web Application as of 2020, and the National Water Information System (USBS) as of 2020. Akarçay Basin Drought Management Updating Plan was started at 2021 and expected to complete by 2023.

Studies During the Preparation of Drought Management Plans:





In order to prevent the damage caused by possible droughts in the Akarçay Basin, 170 measures have been determined under the following groups of measures within the scope of the Management Plan.

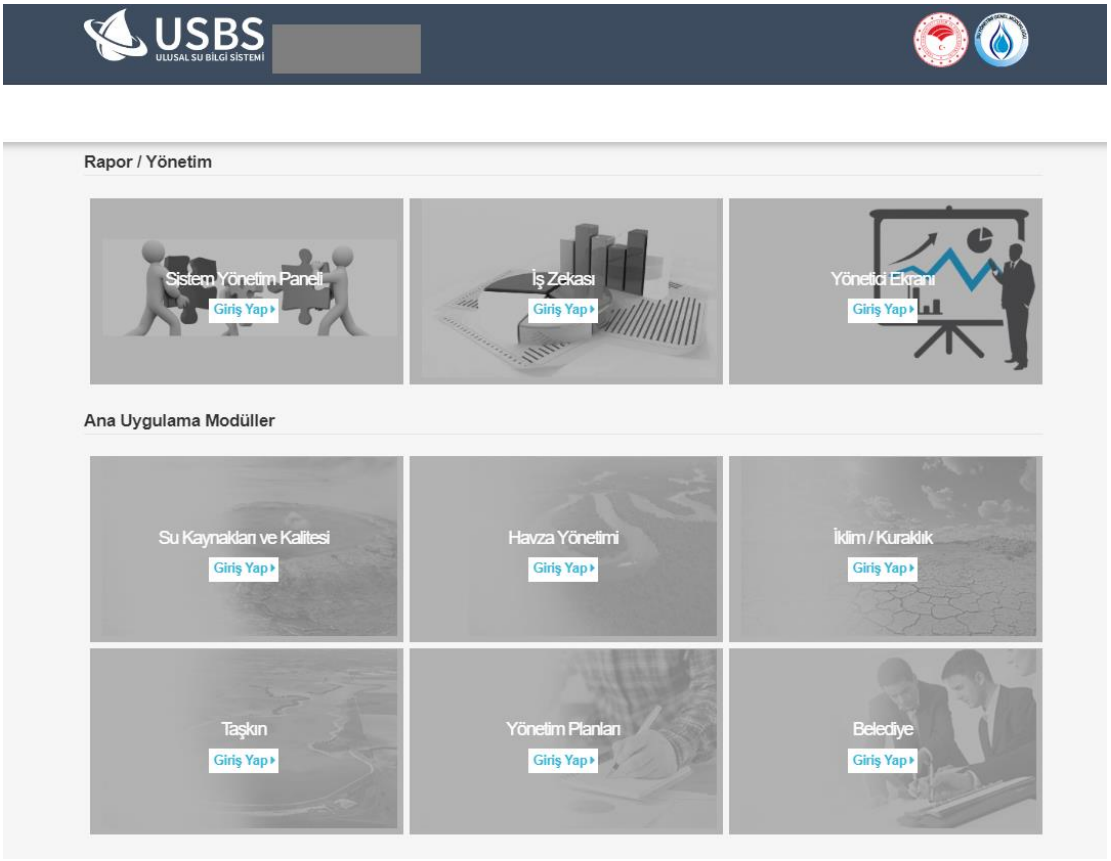
- Land Use
- Waste Management
- Dam Operation
- Combating Desertification and Erosion
- Nature Conservation Studies
- Education/Information/Awareness Raising

- Farming
- Climate Change
- Development of monitoring and measurement network
- Capacity Building/ Technical Support
- Planning
- Insurance System
- Water Supply
- Protection of Water Resources
- Reducing water use/loss
- Irrigation Management/Irrigation
- Agricultural Applications
- Incentive/Compensation Mechanisms
- Product Pattern Management
- Data Management / Monitoring
- Data-Information Collection/Production
- Upper Basin Studies

MONITORING, INVENTORY and WATER INFORMATION SYSTEM

Actions that are taken about water quality and quantity as follows:

- To acquire the data that has been produced for various purposes by different organizations,
- To enhance the quality of data,
- To prevent the repetitive production of data,
- To enhance the accessibility of data,
- To determine and complete the missing/incomplete data,
- To set and apply a watershed-scale and sustainable monitoring system.



Graphical User Interface of National Water Information System (TRNWIS)

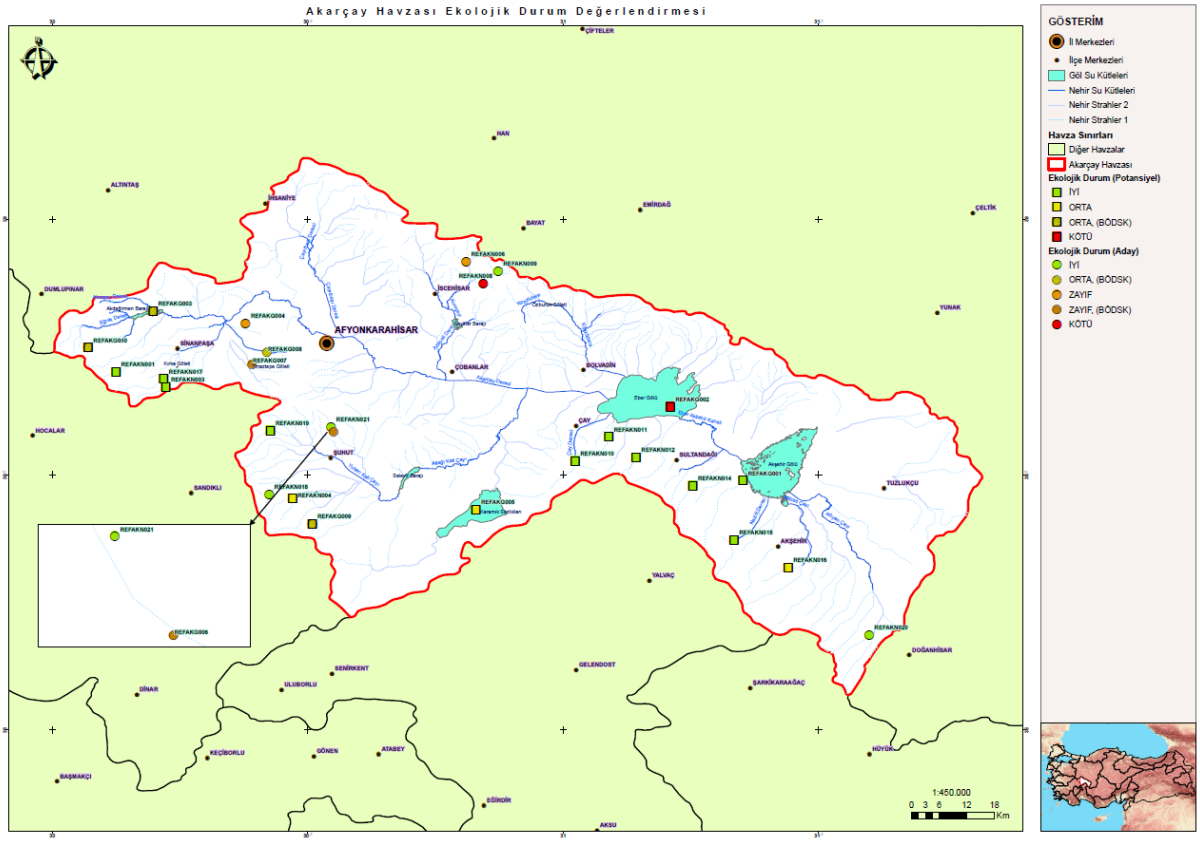
For the purpose of ecological-based assessment of water quality; biological, physicochemical, and hydromorphological monitoring studies were conducted in 25 basins across the country as part of the Project for the Establishment of a Reference Monitoring Network in Türkiye to

identify natural and/or near-natural reference (unpolluted) sites that were not or minimally impacted by anthropogenic activities, and pristine water sources were identified.

Within the scope of the study, monitoring studies were carried out in a total of 27 locations in the Akarçay River Basin, including 17 rivers, 10 lakes (4 natural, 6 heavily modified), and 21 reference (unpolluted) water sources were identified. In addition, the ecological status of the monitored water bodies in the Akarçay River Basin was determined as a result of the monitoring activities.

In the scope of monitoring activities, the smallest possible taxonomic level of all biological quality elements was identified and in this context 11 fish, 228 phytobenthos, 269 phytoplankton, 221 macroinvertebrate, and 45 macrophyte species were identified in the Akarçay River Basin.

Additionally, for each biological quality element, the Reference Monitoring Network and Reference Monitoring Programs have been established, which include the monitoring stations determined in the reference sites, the parameters to be monitored at these stations, and the monitoring frequencies. In line with these monitoring programs, monitoring activities will be carried out regularly.



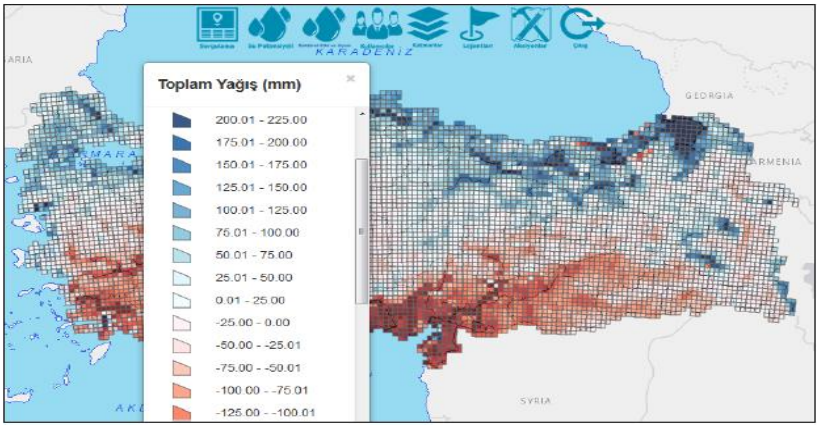
Ecological Status Assessment Results in the Akarçay River Basin

WATER REUSE

In the fight against possible water scarcity in our country in the future, it is necessary to develop practices related to the economical and planned use of existing water resources. One of these strategies, the option of reusing used water, is one of the most important methods of using water sparingly. With the recovery and use of used water, it is planned to reduce the need for existing water resources and to provide significant water savings. In the "Project for the Evaluation of Reuse Alternatives of Used Water", which was prepared specifically for 25 river basins in our country, both the reuse of wastewater treated in wastewater treatment plants and the water returned from agriculture were evaluated. With the evaluation, used water resources and reuse alternatives were determined. Used water resources was determined as waste water treated in wastewater treatment plants, drainage water returning from agriculture, cooling water and rain water. In the light of all this information, in the evaluation made specifically for the Akarçay Basin, the wastewater treated in the wastewater treatment plants and the water returned from agriculture were determined as used water resources.

IMPACTS OF CLIMATE CHANGE

The project on impacts of climate change on water resources was finalized in 2016.



According to the climate change projections made for 2015-2100 period:

It is expected that there will be a continuous increase in average temperatures. It is expected that the average temperature of the basin, which was **11,3ºC** according to 1971-2000 observations, will **increase** by **at least 1,8°C**, **maximum 5ºC** in 2071-2100 period.

According to the observations of 1971-2000, the average annual precipitation amount of the reference period of the basin was determined to be **460,4 mm**. According to the results of the projection carried out, there is a **decrease tendency** in the total precipitation compared to the reference period (1971-2000), and it is predicted that the basin will receive **17% less** rainfall compared to the reference period in **2071-2100**. It is expected that rainfall decreases for this period will predominate in the **northern** parts of the basin.

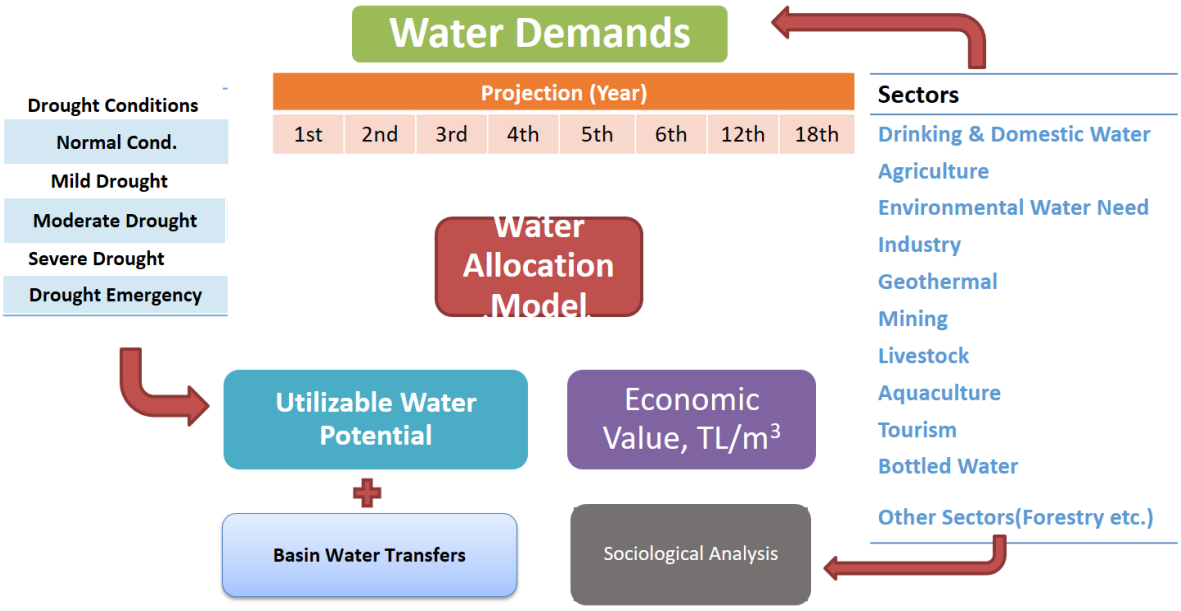
DSİ (Directorate General for State Hydraulic Works) data were used for hydrological model studies and the mean gross water potential of the basin for the reference period was determined to be **678 million ^{3}/year**. With the effect of climate change, it is predicted that in the period **2071-2100**, the gross water potential of the basin could **decrease up to 70%**. However, in the same period, it is expected that the annual amount of water available will not meet the total water need, and the **water deficit** will be around **545 million m^3/year**.

As a result of the hydrogeological studies carried out, the hydrogeological reserve of groundwater of the basin was determined to be **105 km^3**. The technically and economically usable amount of this reserve, the possible reserve is calculated to be **57 km^3**. It is estimated that at the end of the century under the effects of the climate change, the hydrogeological reserve of the basin will decrease by **11%** and possible reserve by **20%**.

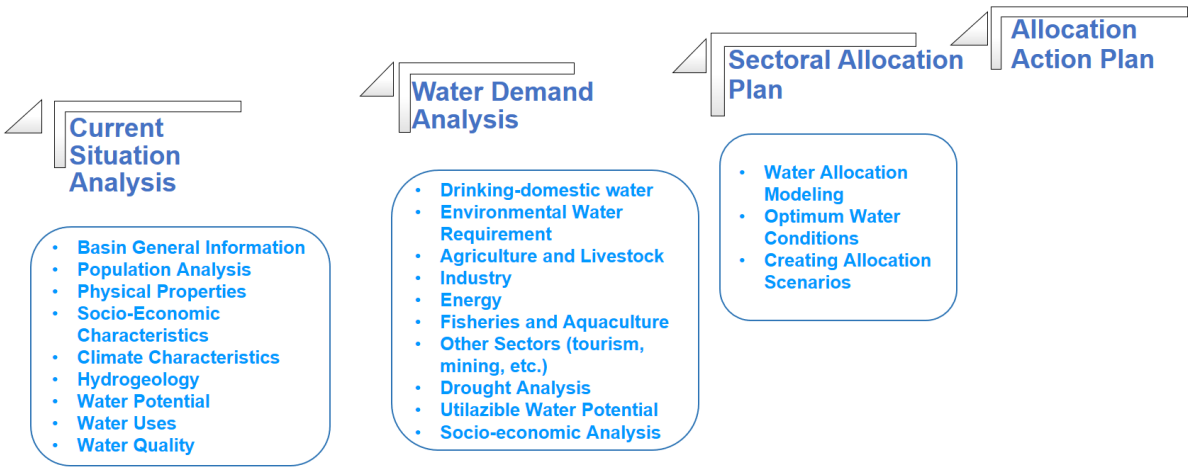
SECTORAL WATER ALLOCATION PLAN

The increasing need and demand for water resources and the lack of availability of them in the desired quantity and quality, both spatially and temporally, require the most efficient use of existing resources for economic, environmental, and social benefits. Sectoral Water Allocation Plans are prepared to ensure the sharing of water resources at the basin and sub-basin scale, to plan for the future and to meet the water needs of each sector in an efficient and sustainable way by taking into account all drought conditions (normal, mild, moderate, severe and drought emergency).

Within the scope of the Sectoral Water Allocation Plans, the current status of the water resources potential at the basin/sub-basin scale is determined. Afterward, based on the results of the drought and climate change adaptation studies; the normal, mild drought, moderate drought, severe drought, and drought emergency conditions and the temporal (the first 6 years, 12th, and 18th years following the end of the project) and sub-basin-wide sectoral changes of water potential are identified in the basin.



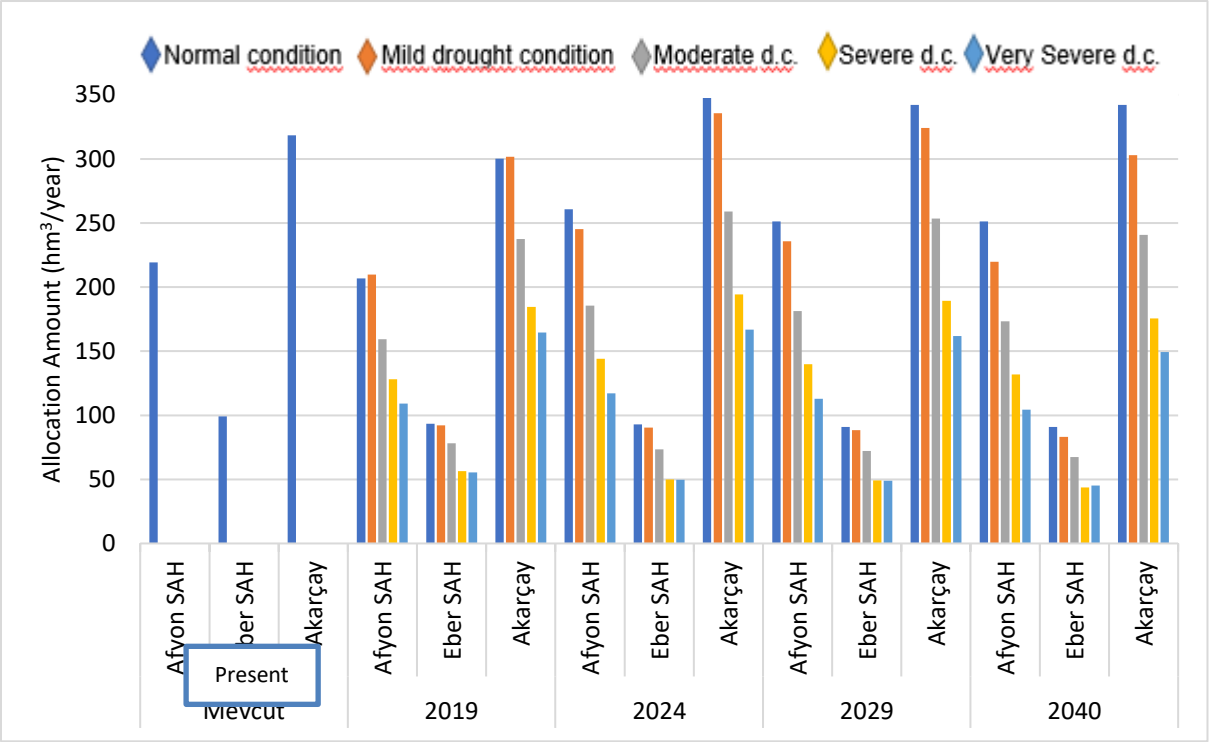
After calculating the water needs of each sector in all projection years; all physical, hydrological, socio-economic, and water quantity data obtained from the analysis studies are correlated with each other and sectoral water allocation plan scenarios are prepared through the model found appropriate. Moreover, in the water allocation model, sectoral prioritization is made by taking into account the socio-economic, hydrological structure, and water potential of the basin.



Akarçay Basin Sectoral Water Allocation Plan studies started in 2016 and were completed in 2018. In the Akarçay Basin, the total water potential was determined as 547.5 hm^3, 275.4 hm^3 above ground and 272.1 hm^3 underground in normal conditions, and 40 water allocation scenarios were studied.

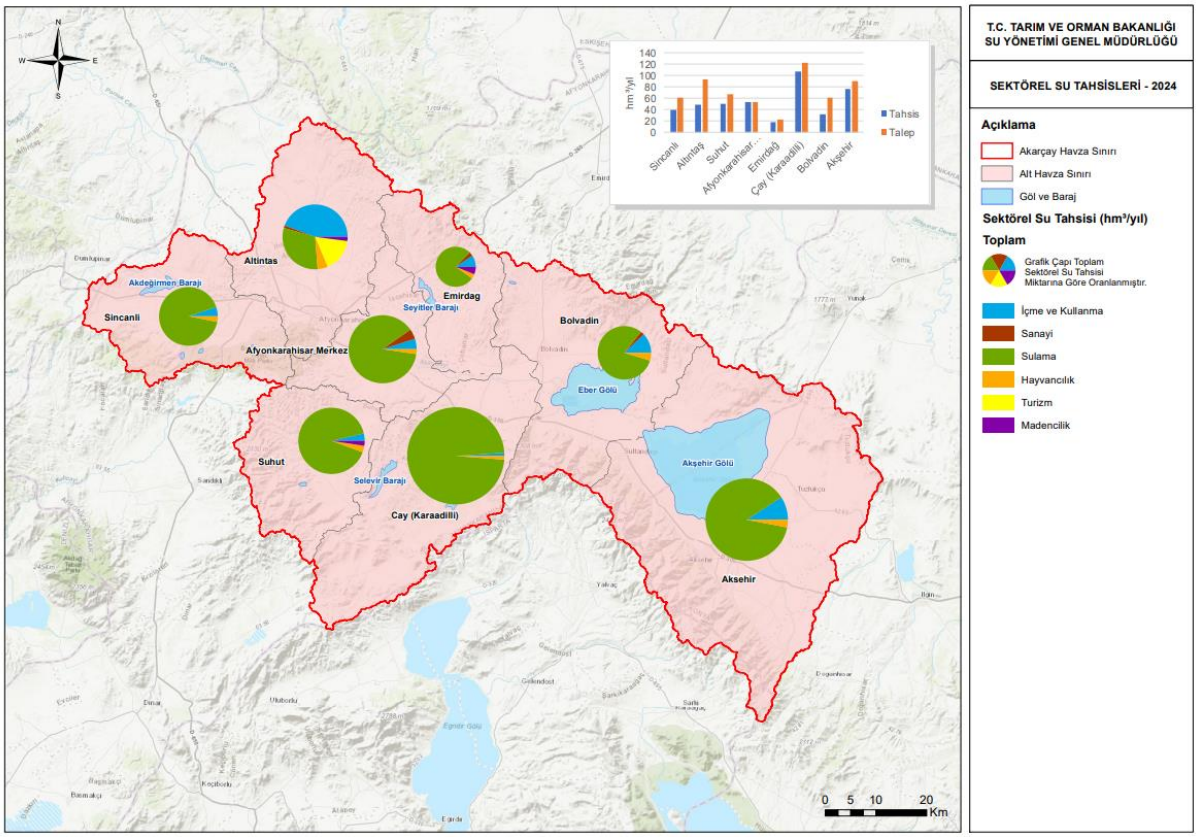
While prioritizing the sector in the water allocation model; criteria such as the hydrological structure of the basin, climatic conditions, drought situation, and socio-economic structure are taken into account. Therefore, sectoral prioritizations differ from basin to basin. However, the first priority is always given to drinking-domestic water and environmental water needs.

One of the most critical issues in Sectoral Water Allocation Plans is plant pattern optimization studies for different drought conditions in the agricultural sector, which uses a significant part of our country's water potential. By determining the water needs of the agricultural sector in advance and predicting possible droughts; optimum plant patterns are created that will enable the producers to continue production and increase their net income even they are faced with decreasing surface and groundwater resources.



Allocation Amounts For Agriculture Sector - Akarçay Basin And Sector Based Sub - Basins

In the plan, the economic added value of the currently allocated water in the sectors and the economic added values within the scope of the planned scenarios are calculated. By determining the optimization of the benefits of water allocation and taking into account all drought conditions, the allocation plan is created on a basin / sub-basin basis. By determining the potential of water resources, the changes, and sectoral developments; Optimum sectoral water usage conditions are decided by taking into account the social effects while maximizing the economic benefit.



Within the scope of Sectoral Water Allocation Plans, Action Plans are prepared in which all responsible/related institutions and organizations are determined for the measures and implementation of the measures. The measures determined in the Action Plan are followed up annually. Akarçay Basin Sectoral Water Allocation Plan and Action Plan entered into force with the Ministry Circular No. 2019/02.