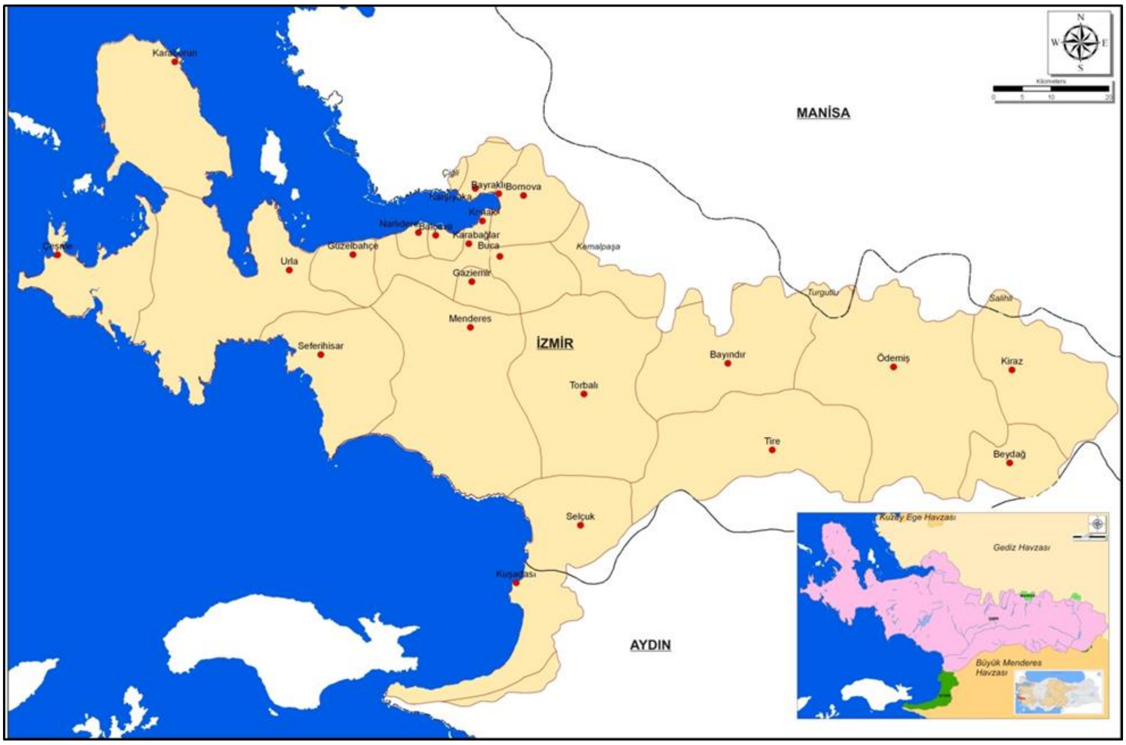
KUCUK MENDERES RIVER BASIN

KUCUK MENDERES RIVER BASIN

Kucuk Menderes Basin is located between Gediz and Buyuk Menderes Basins in western Türkiye and drains its water with Kucuk Menderes River and other streams to the Aegean Sea.



Kucuk Menderes Basin Map

The basin area is approximately 702.931 ha and covers 0.9% of Turkey's surface area. The provinces of İzmir, Aydın and Manisa are located in the Küçük Menderes Basin. The spatial information of the provinces within the borders of the basin is given in the table below.

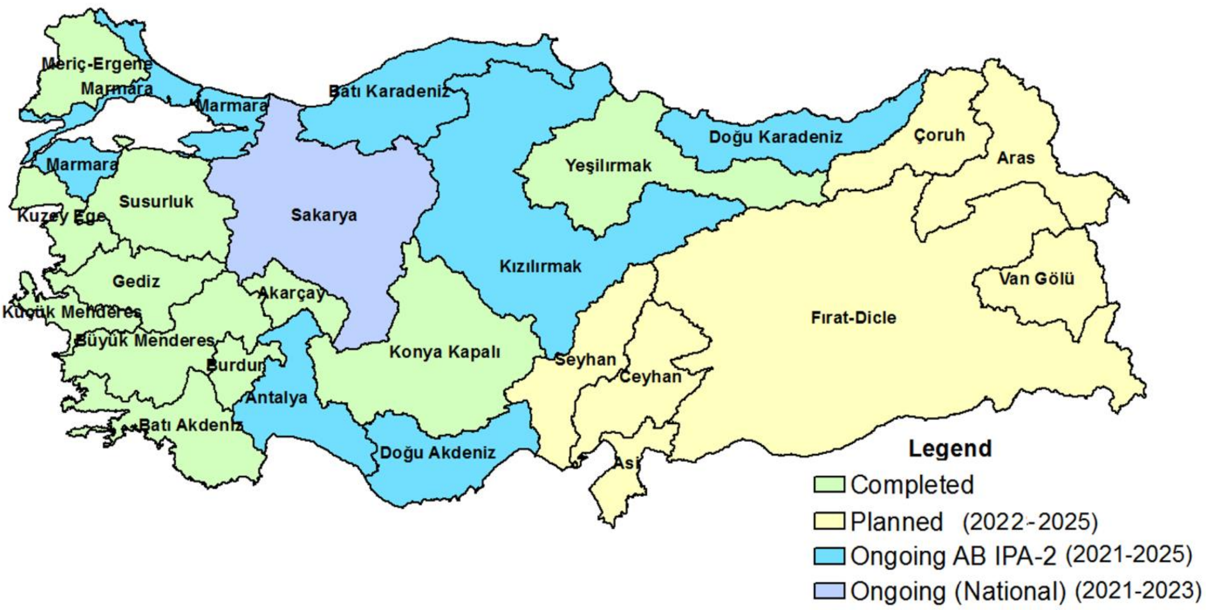
Provinces and their areas in the basin

Provinces	***Area of the Province (Ha)***	***Part of the Province in The Basin (Ha)***	***Ratio of the Part in The Basin to the Total Province Area (%)***	***Distribution of the Basin to the Provinces (%)***
İzmir	1.197.300	668.858	56	95
Aydın	158.200	25.929	16	4
Manisa	1.381.000	5.658	0,8	1

RIVER BASIN MANAGEMENT PLAN

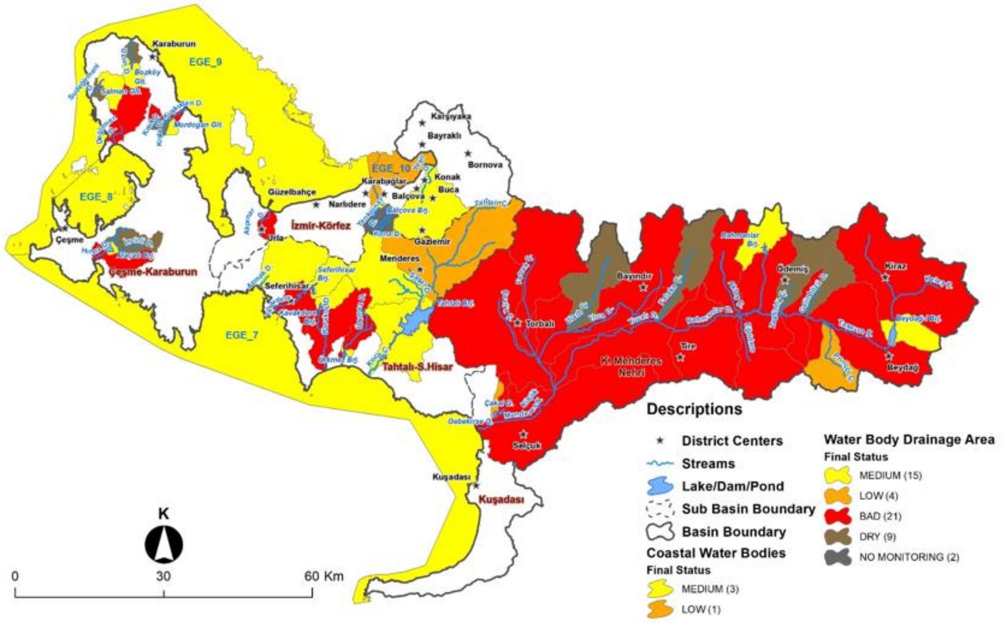
Kucuk Menderes Basin River Basin Management Plan (NHYP) was prepared in 2019, and as of 2020, its implementation has started to be followed through the National Water Information System (USBS).

RIVER BASIN MANAGAMENT PLAN PROJECTS

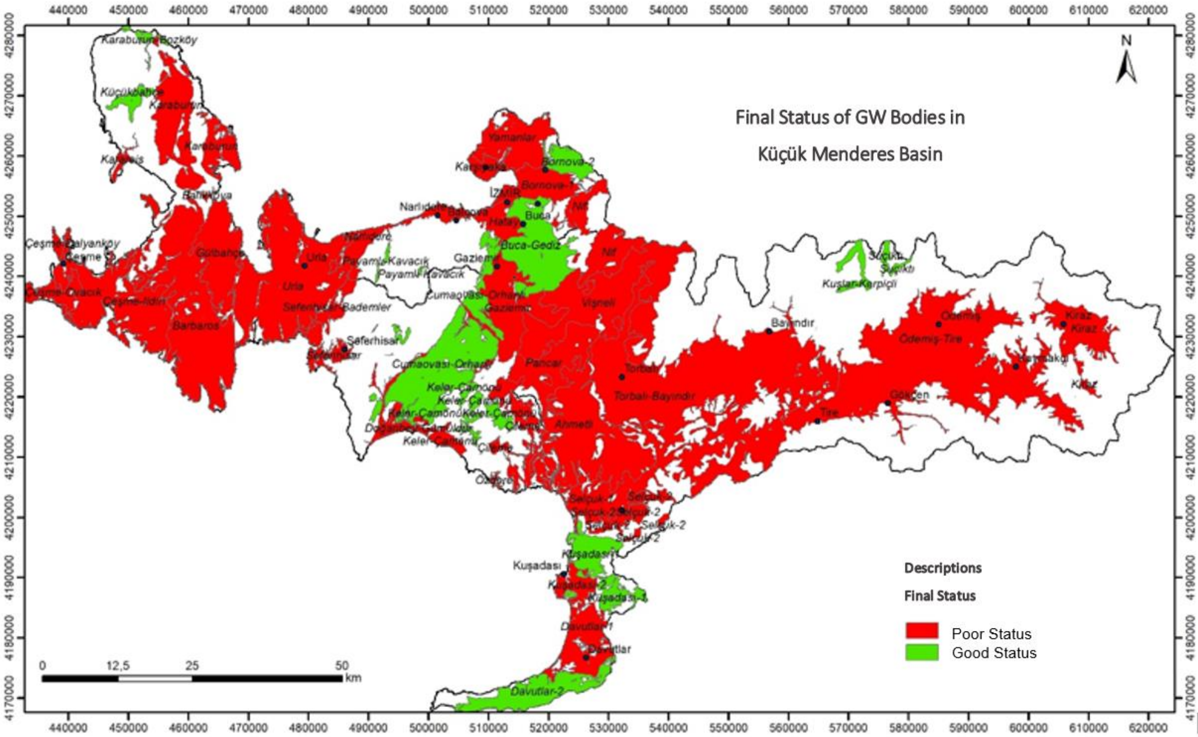


In the Kucuk Menderes Basin; there are a total of 56 surface water bodies, including 38 River Water Bodies, 13 Lake Water Bodies, 1 Transitional Water Bodies, and 4 Coastal Water Bodies.

Küçük Menderes Basin
Final Status of Water Bodies



There are 42 underground water bodies in the Kucuk Menderes Basin.



1055 measures have been determined in order to ensure that all water bodies in the Kucuk Menderes Basin are in good condition and that the ones that are in good condition are protected. The main groups of measures are listed below.

- Construction of a Sanitary Landfill
- Construction of Animal Manure Storage Tank in Animal Farm/Facility
- Implementation of the Good Agricultural Practices Code Communiqué on the Prevention of Nitrate Pollution in Waters Caused by Agricultural Activities
- Detection of existing unregistered wells and prevention of opening new ones
- Improvement of Wastewater Treatment Plants
- Transfer of olive oil factories from 3-phase system to 2-phase system
- Closure of unsanitary landfills
- Combating Invasive Species and Control of Fishing
- Modernization of irrigation
- Crop rotation in agricultural areas
- Implementation of Environmental Flow Regime
- Construction of Fish Passes
- Reducing loss/leakage rates by reducing pressure on transmission lines
- Construction of Wastewater Treatment Plants with Appropriate Treatment
- Construction of sewer infrastructure
- Construction of Secondary Treatment and Wastewater Treatment Plant
- Construction of gasification facility for liquid and solid wastes from Table Olive and Olive Oil Production activities

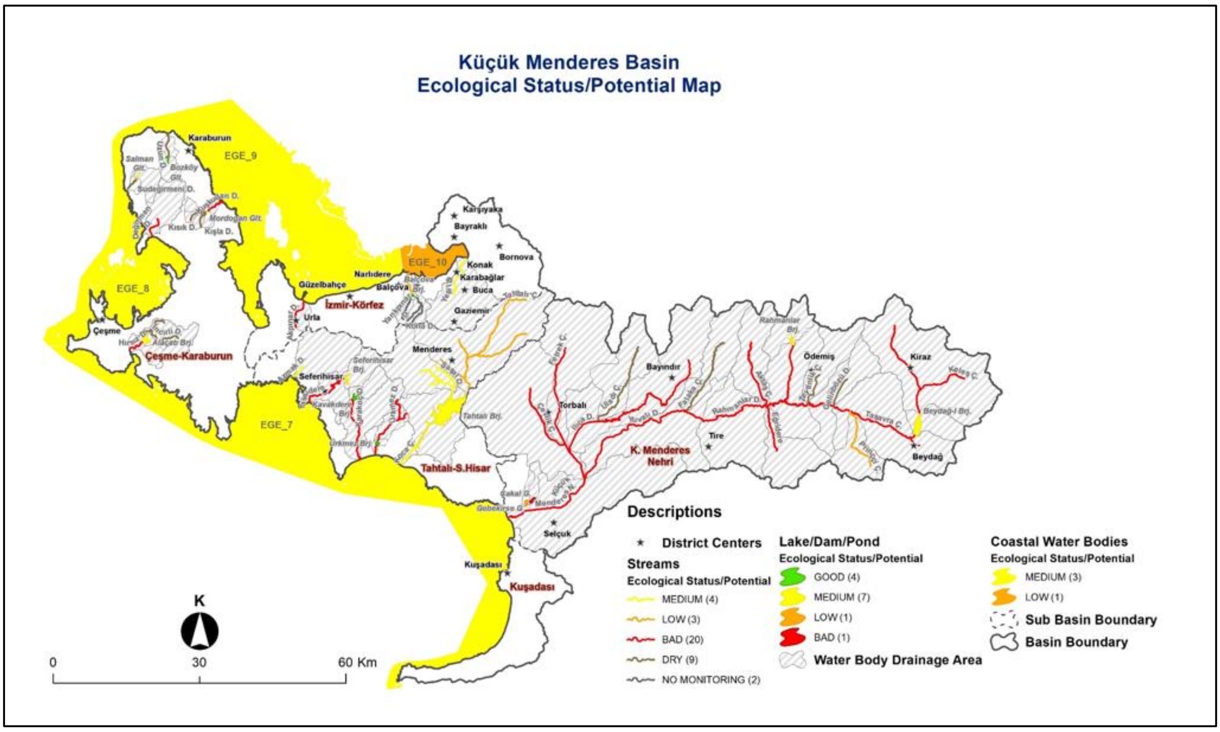
WATER QUALITY

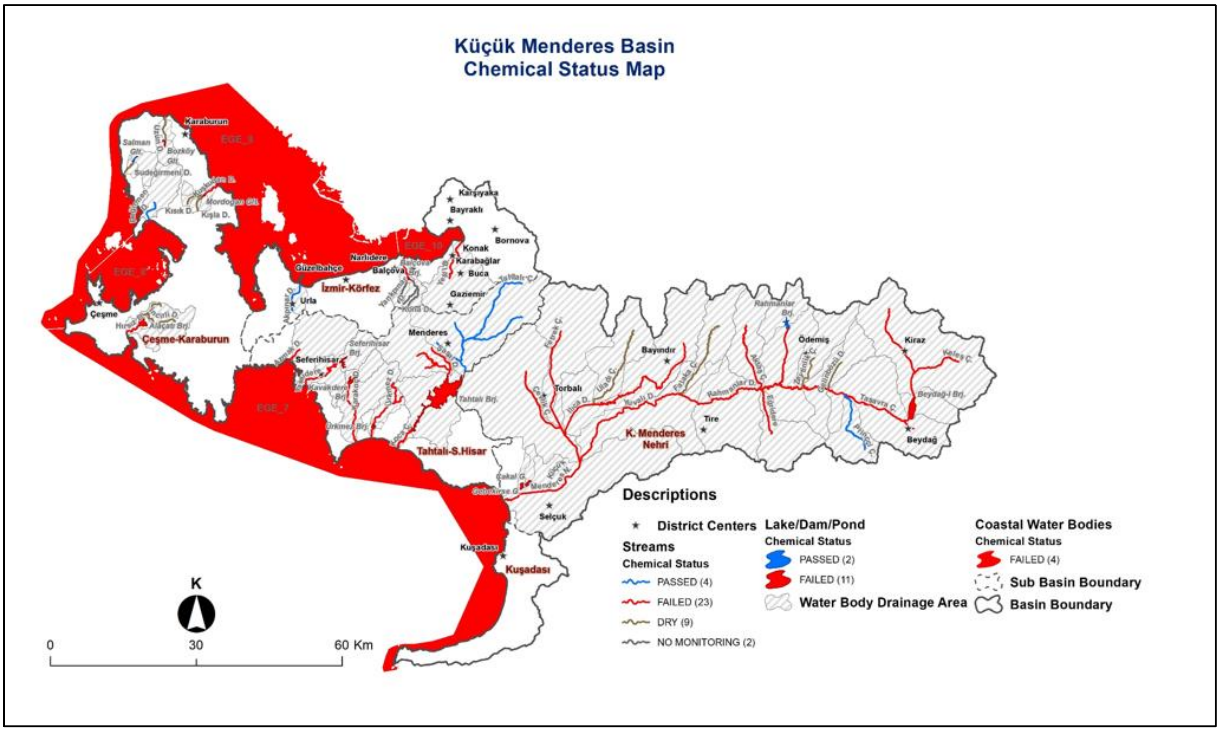
Surface Water Status

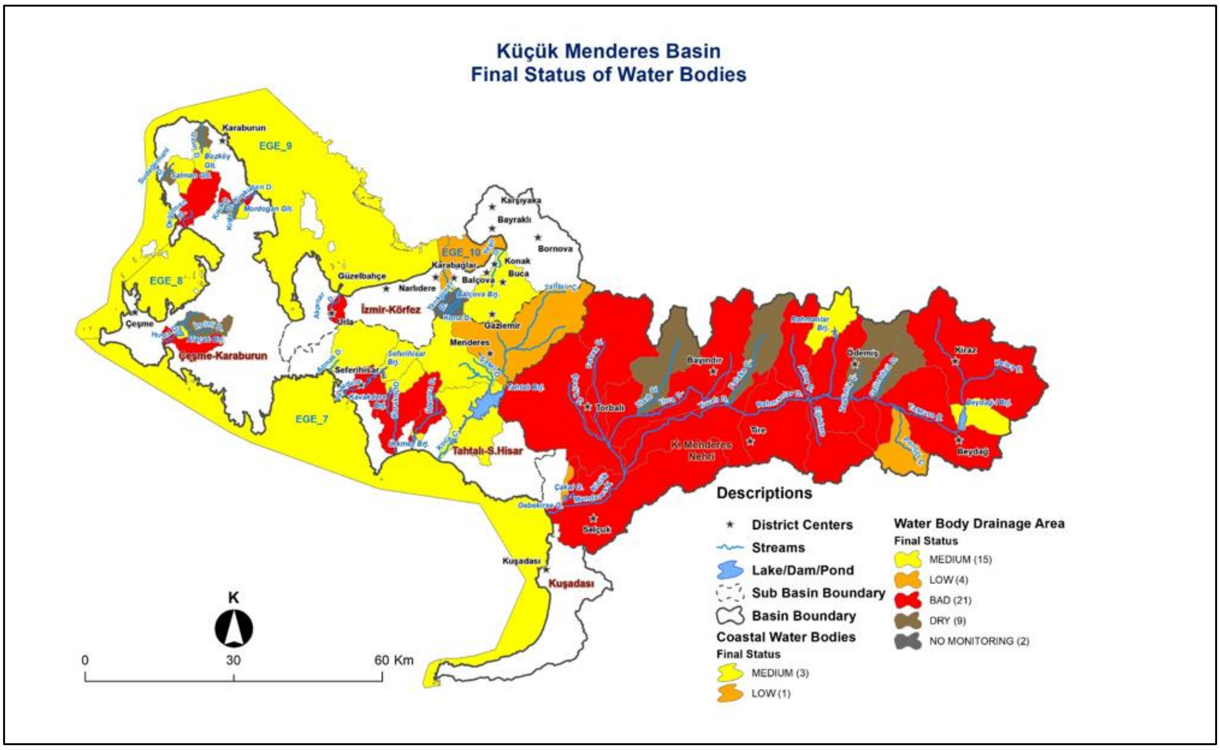
As a result of monitoring studies in rivers, lakes, coastal and transitional water bodies, their ecological and chemical status has been evaluated and their final status has been determined. Accordingly, out of a total of 56 water bodies, 21 are classified as poor, 6 as poor and 18 as moderate.

Final Status of Surface Water Bodies

STATUS	RIVER BODY	LAKE BODY	COASTAL BODY	TOTAL
BAD	20	1	0	21
POOR	3	1	1	5
MODERATE	4	11	3	18
DRY	9	0	0	9
NO MONITORING	2	0	0	2
TOTAL	**38**	**13**	**4**	**55**




Küçük Menderes Basin
Chemical Status Map
Karaburun
EGE_9
EGE_8
EGE_10
EGE_7
Karşıyaka
Bayraklı
Bornova
Konak
Karabağlar
Buca
Gaziemir
Güzelbahçe
Narlıdere
Balçova
İzmir-Körfez
Urla
Çeşme
Çeşme-Karaburun
Menderes
Seferihisar
Tahtalı-S.Hisar
Torbalı
Bayındır
Ödemiş
Kiraz
Beydağ
Tire
K. Menderes Nehri
Selçuk
Kuşadası
Descriptions
District Centers
Streams
Chemical Status
PASSED (4)
FAILED (23)
DRY (9)
NO MONITORING (2)
Lake/Dam/Pond
Chemical Status
PASSED (2)
FAILED (11)
Water Body Drainage Area
Coastal Water Bodies
Chemical Status
FAILED (4)
Sub Basin Boundary
Basin Boundary
K
0
30
60 Km


Küçük Menderes Basin
Final Status of Water Bodies
Karaburun
EGE_9
EGE_8
EGE_10
EGE_7
Karşıyaka
Bayraklı
Bornova
Konak
Karabağlar
Buca
Balçova
Gaziemir
Güzelbahçe
Narlıdere
İzmir-Körfez
Urla
Çeşme
Çeşme-Karaburun
Menderes
Seferihisar
Tahtalı-S.Hisar
Torbalı
Bayındır
Ödemiş
Kiraz
Beydağ
Tire
K. Menderes Nehri
Selçuk
Kuşadası
Descriptions
District Centers
Streams
Lake/Dam/Pond
Sub Basin Boundary
Basin Boundary
Coastal Water Bodies
Final Status
MEDIUM (3)
LOW (1)
Water Body Drainage Area
Final Status
MEDIUM (15)
LOW (4)
BAD (21)
DRY (9)
NO MONITORING (2)
K
0
30
60 Km

Physicochemical Parameters Not Achieving Environmental Objectives in Surface Water Bodies
pH, Dissolved Oxygen, Electrical Conductivity, RES 436-525-620 nm, BOD, COD, Ammonium nitrogen, Nitrate Nitrogen, TKN, TN, TP, Ortho Phosphate Phosphorus, Fluoride, Manganese, Selenium

Priority Substances Not Achieving Environmental Objectives in Surface Water Bodies
Anthracene, C10-13 Chloralkanes, Benzo(a)pyrene, Floranthene, Lead, Nickel, 4-nonylphenol (branched), Naphthalene, Heptachlor epoxide, Cadmium, Dichlorvos, Pentachlorobenzene, 4-nonylphenol, Cypermethrin, Heptachlor, 4-(1, 1',3,3'-tetramethylbutyl)-phenol (Octylphenol)

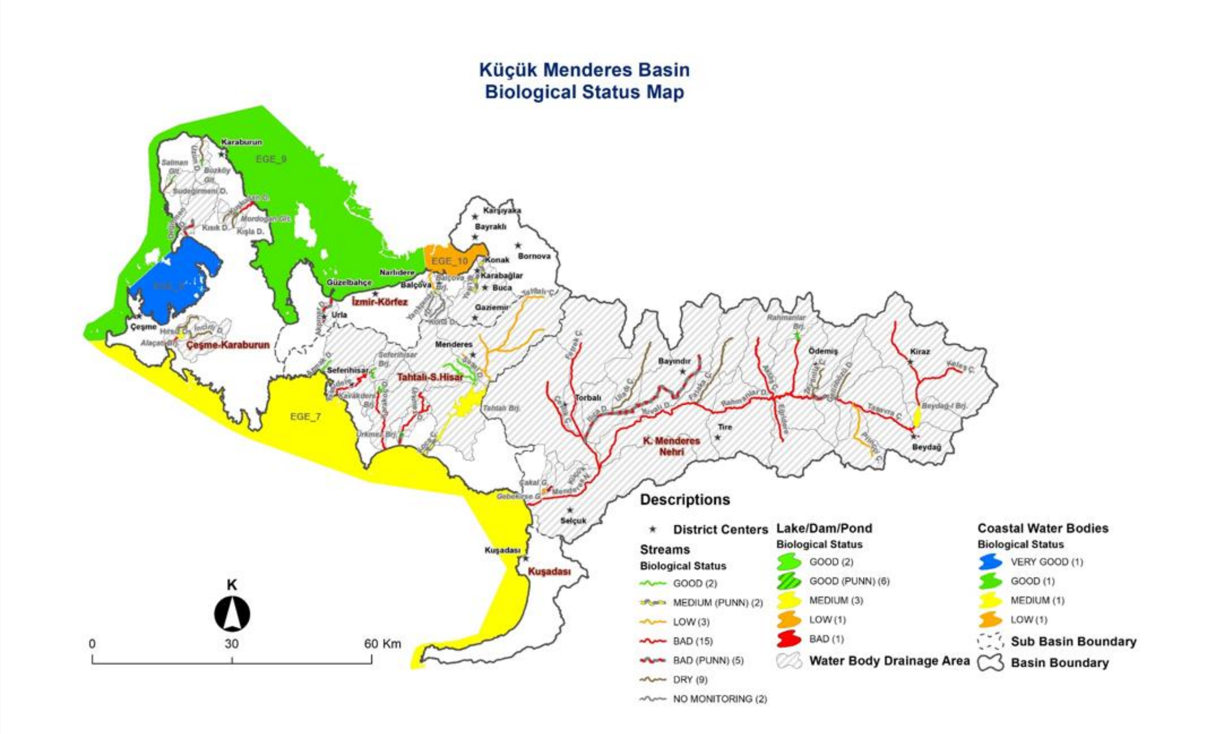
Specific Pollutants Not Achieving Environmental Objectives in Surface Water Bodies
1-Chloronaphthalene, 1-methylnaphthalene, 2,4,6-tri-tert-butylphenol, 2-chloronaphthalene, 4-Aminoazobenzene, 4-chloroaniline, Aluminum, Antimony, Acenaphthene, Copper, Benzo(a)fluorene, Bis (2- ethylhexyl) terephthalate, Boron, Cyfluthrin, Zinc, DDT (total), Decamethylcyclopentasiloxane, Iron, Ethalfluraline, Phenantrene, Florene, Imidacloprid, Chloroacetic acid, Cobalt, Chrysen, Chromium, Parathion Methyl, PCB 28, Perylene, Pyrene, Titanium, Propylbenzene, Tridecane, Vanadium

Biological Quality Indicators

Cladocora

Galathae bolivori

Oxynoemacheilus germencicus

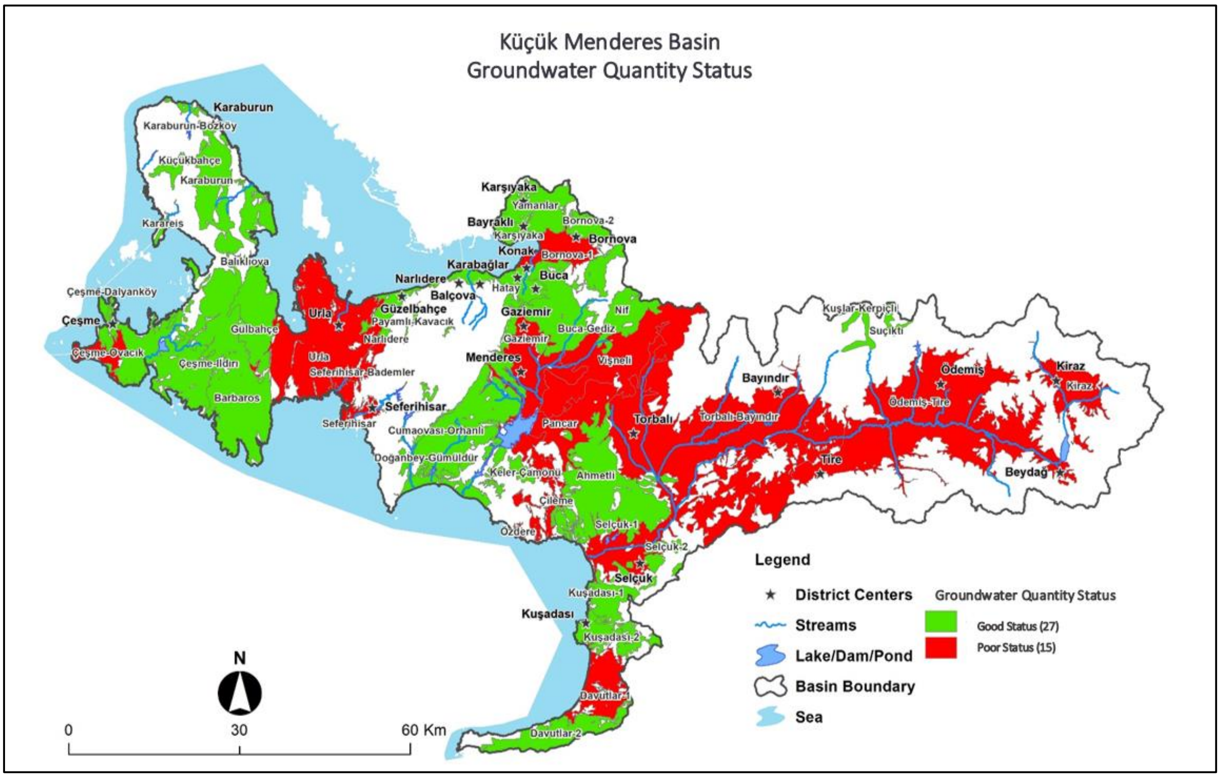


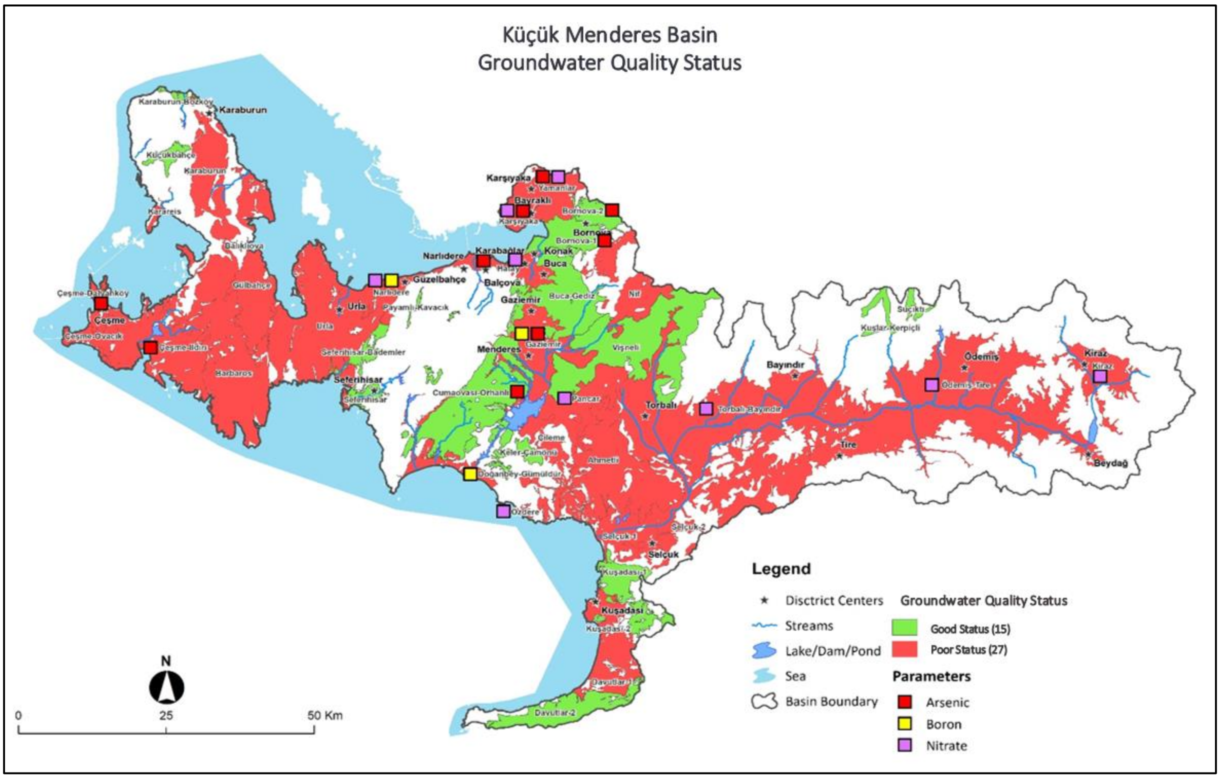
Biological Parameters Not Achieving Environmental Objectives in Surface Water Bodies		
River Water Bodies	**Lake Water Bodies**	**Coastal Water Bodies**
Phytobenthos, Macroinvertebrate, Fish, Macrophyte	Phytoplankton, Phytobenthos, Macroinvertebrate, Fish, Macrophyte	Phytoplankton, Benthic Macroinvertebrate

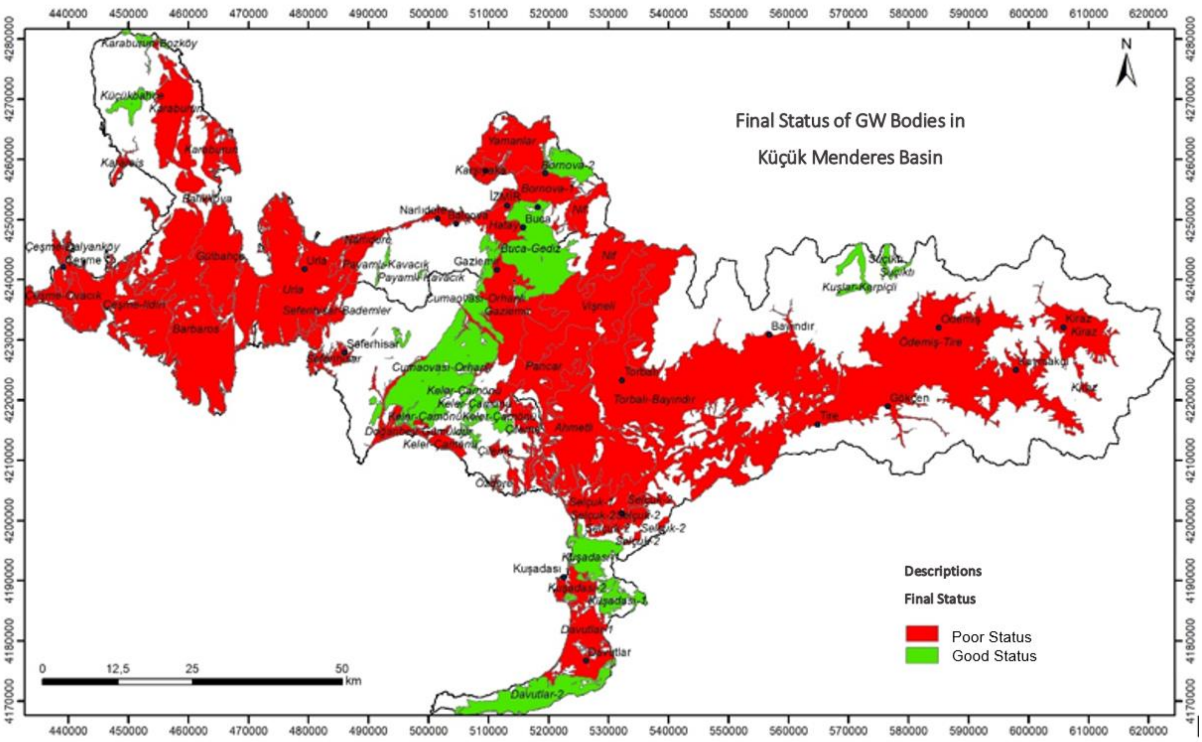
Groundwater Status

As a result of monitoring studies in 42 groundwater bodies, 11 groundwater bodies in the basin are classified in “good status” and the remaining 31 bodies are classified in “poor status”.

QUANTITY STATUS	GWB	QUALITY STATUS	GWB	FINAL STATUS	GWB
GOOD	27	GOOD	15	GOOD	11
POOR	15	POOR	27	POOR	31


Küçük Menderes Basin
Groundwater Quantity Status
Karaburun
Karaburun-Bozköy
Küçükbahçe
Karaburun
Karareis
Balıklıova
Çeşme-Dalyanköy
Çeşme
Çeşme-Ovacık
Çeşme-Ildırı
Gülbahçe
Barbaros
Urla
Güzelbahçe
Payamlı-Kavacık
Narlıdere
Urla
Seferihisar-Bademler
Seferihisar
Seferihisar
Cumaovası-Orhanli
Doğanbey-Gümüldür
Narlıdere
Balçova
Karabağlar
Karşıyaka
Yamanlar
Bayraklı
Karşıyaka
Bornova-2
Bornova
Bornova-1
Konak
Buca
Hatay
Gaziemir
Gaziemir
Buca-Gediz
Nif
Menderes
Vişneli
Pancar
Torbalı
Keler-Çamönü
Ahmetli
Çileme
Özdere
Selçuk-1
Selçuk-2
Selçuk
Kuşadası-1
Kuşadası
Kuşadası-2
Davutlar-1
Davutlar-2
Bayındır
Torbalı-Bayındır
Kuşlar-Kerpiçli
Suçıktı
Ödemiş
Ödemiş-Tire
Tire
Kiraz
Kiraz
Beydağ
Legend
District Centers
Streams
Lake/Dam/Pond
Basin Boundary
Sea
Groundwater Quantity Status
Good Status (27)
Poor Status (15)
N
0
30
60 Km


Küçük Menderes Basin
Groundwater Quality Status
Karaburun-Bozköy
Karaburun
Küçükbahçe
Karaburun
Karareis
Balıklıova
Çeşme-Dalyanköy
Çeşme
Çeşme-Ovacık
Çeşme-Ildırı
Gülbahçe
Barbaros
Urla
Urla
Seferihisar-Bademler
Seferihisar
Seferihisar
Narlıdere
Güzelbahçe
Narlıdere
Payamlı-Kavacık
Karabağlar
Balçova
Karşıyaka
Yamanlar
Bayraklı
Karşıyaka
Bornova-2
Bornova
Bornova-1
Konak
Hatay
Buca
Gaziemir
Buca-Gediz
Nif
Gaziemir
Menderes
Vişneli
Cumaovası-Orhanli
Pancar
Torbalı
Torbalı-Bayındır
Çileme
Keler-Çamönü
Ahmetli
Doğanbey-Gümüldür
Özdere
Selçuk-1
Selçuk-2
Selçuk
Kuşadası-1
Kuşadası
Kuşadası-2
Davutlar-1
Davutlar-2
Bayındır
Suçıktı
Kuşlar-Kerpiçli
Ödemiş
Ödemiş-Tire
Tire
Kiraz
Kiraz
Beydağ
Legend
Disctrict Centers
Streams
Lake/Dam/Pond
Sea
Basin Boundary
Groundwater Quality Status
Good Status (15)
Poor Status (27)
Parameters
Arsenic
Boron
Nitrate
N
0
25
50 Km



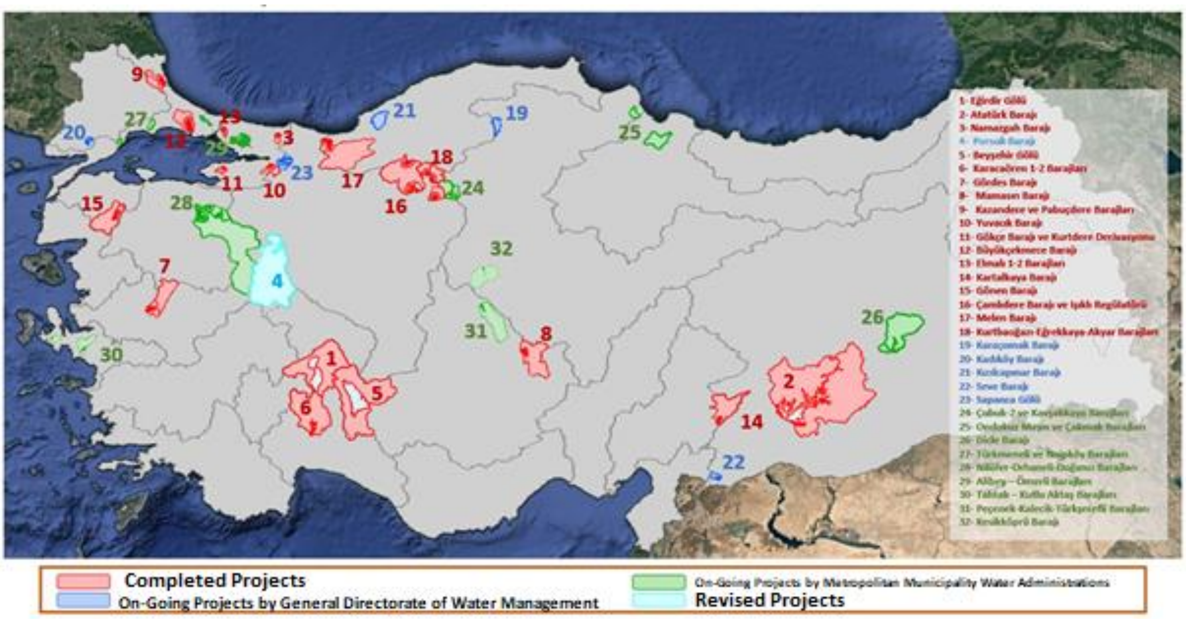
Parameters Not Achieving Environmental Objectives in Groundwater Bodies
Electrical Conductivity, Chloride, Nitrite, Sulfate, Nitrate, Arsenic, Total Kjeldahl Nitrogen, Nickel, Total Nitrogen, Boron, Ammonium, Mercury, Antimony, Iron, Total Phosphorus, Aluminum, Manganese, Titanium

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:

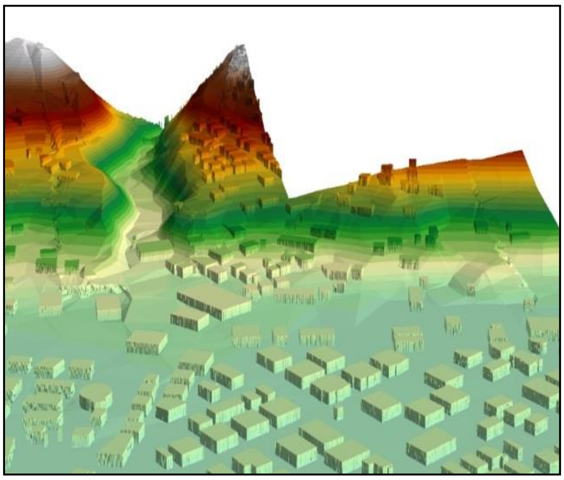
- Protection plans for surface water sources that provide drinking water to metropolitan municipalities are prepared by the general directorates of water and sewage administrations of metropolitan municipalities in coordination with Ministry;
- Protection plans for surface water sources that provide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



FLOOD MANAGEMENT PLAN

Küçük Menderes River Basin Flood Management Plan (FMP) was completed in 2019.

Flood Hazard and Flood Risk maps are generated within the scope of Küçük Menderes River 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 Küçük Menderes River Basin, 248 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 culverts
- Upper basin measures
- Data-Information Collection/ Production
- Education/ Informing/ Raising Awareness
- Stream rehabilitation
- Flood forecasting and early warning system

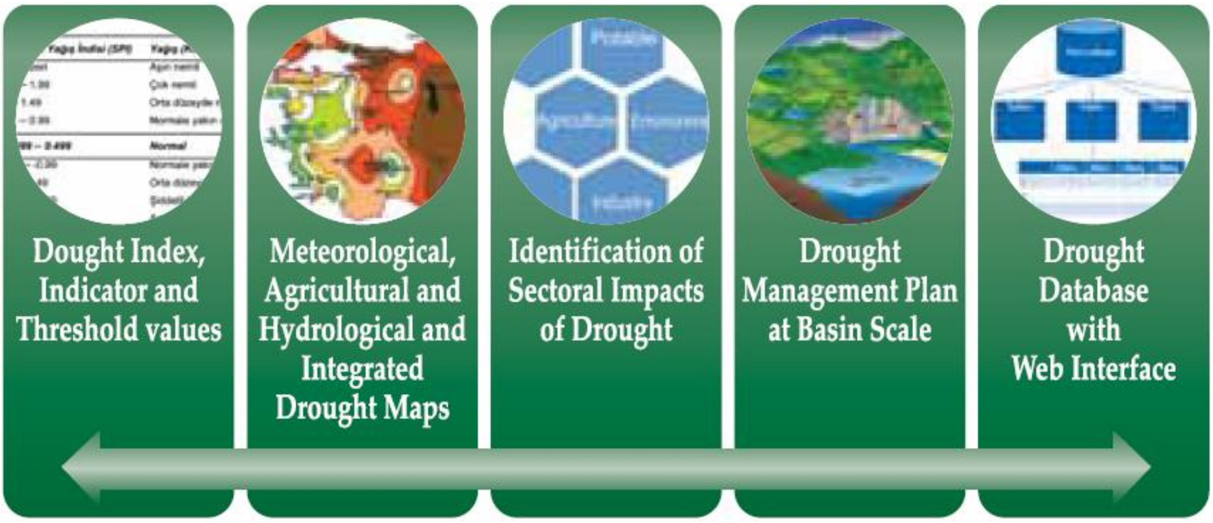
Mitigation measures determined within the scope of the plan are still being tracked via the Flood and Drought Plans Tracking Web Application in 2019 and the National Water Information System (USBS) in 2020.

DROUGHT MANAGEMENT PLAN

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.

Küçük Menderes Basin DMP was started at 2016 and completed at 2018. The follow-up of the implementation of the measures included in the completed Drought Management Plans is carried out in 6-month periods and 6 years after the completion of the project, the update project of the same basin is made. Because of this reason, Küçük Menderes Basin DMP will be revised at 2024.

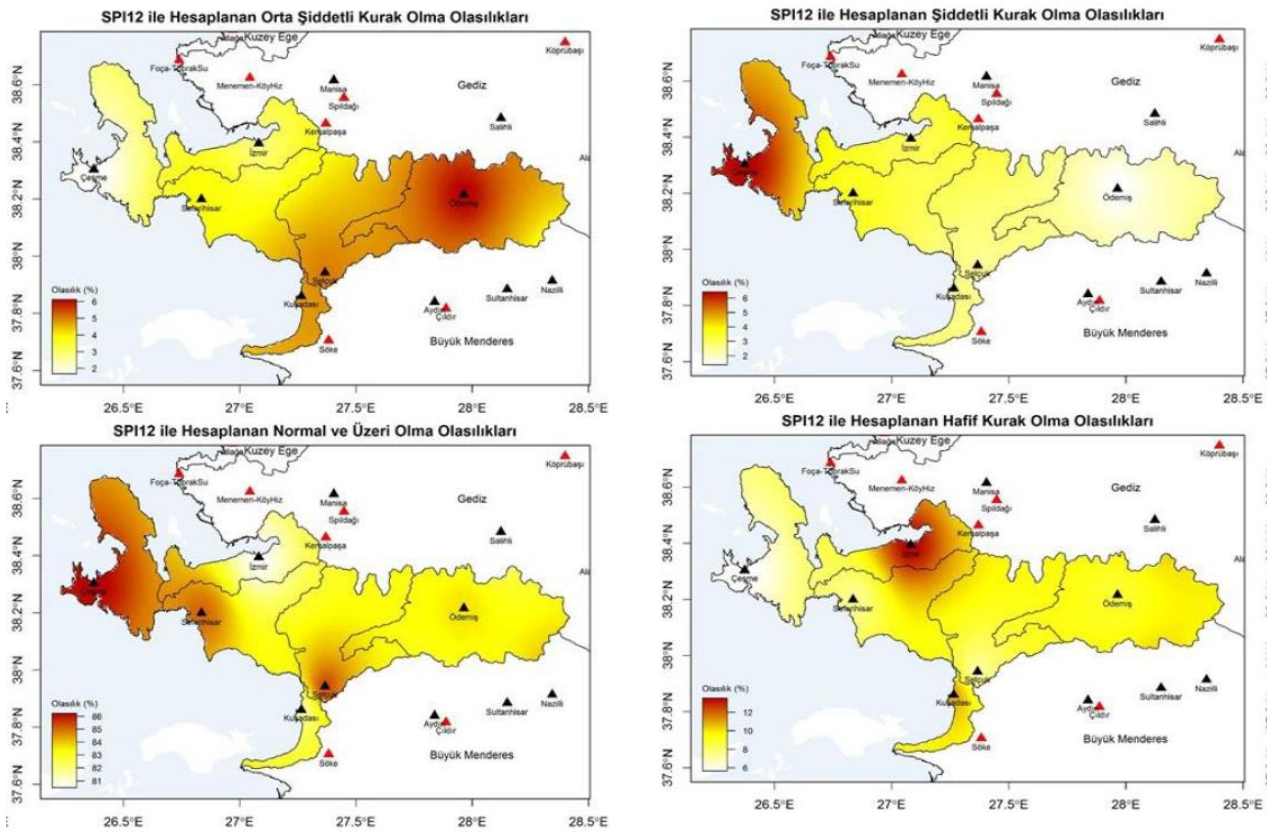
Studies During the Preparation of Drought Management Plans:



In order to prevent damage caused by possible droughts in the Küçük Menderes Basin, 27 measures have been determined under the measure groups of reducing water use/loss and Improving the Monitoring and Measurement Network within the scope of the Drought Management Plan.

Measures determined within the scope of the plan started to be followed via the Flood and Drought Plans Tracking Web Application as of 2019, and the National Water Information System (USBS) as of 2020.

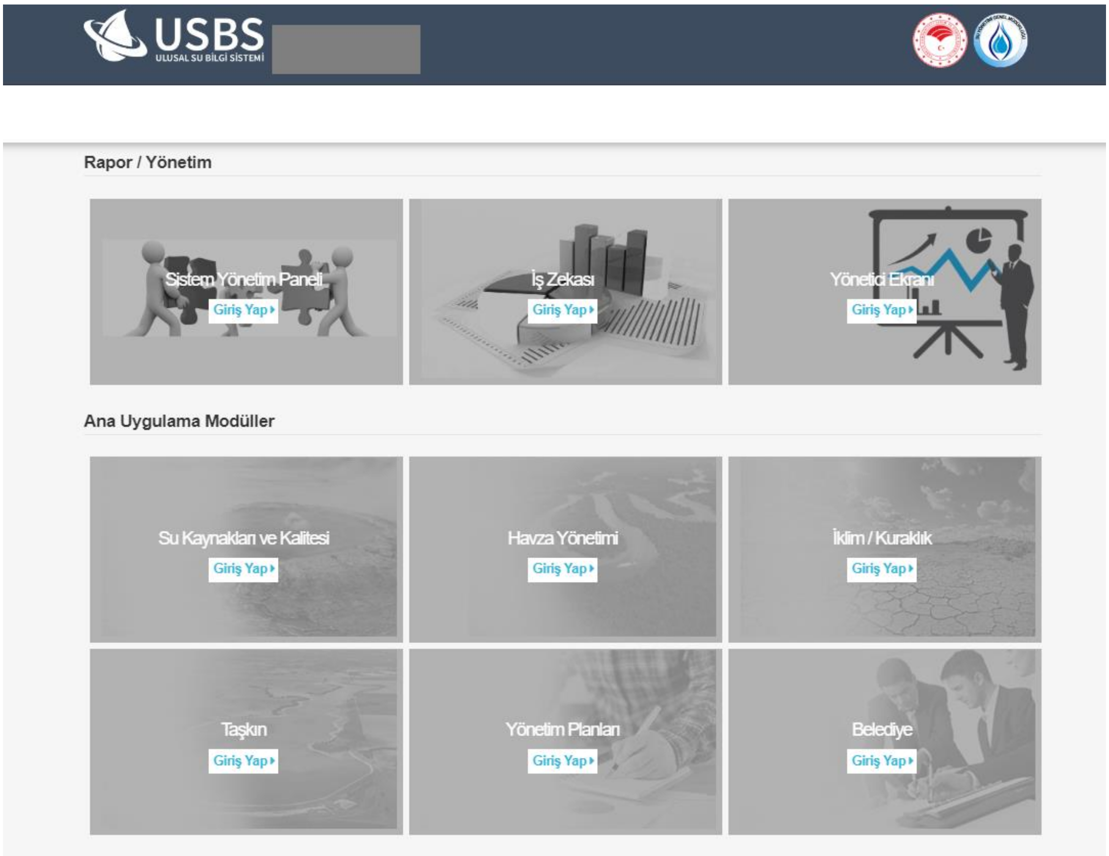
Possible Drought Risks in the Basin



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 production of data repeatedly,
- 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.



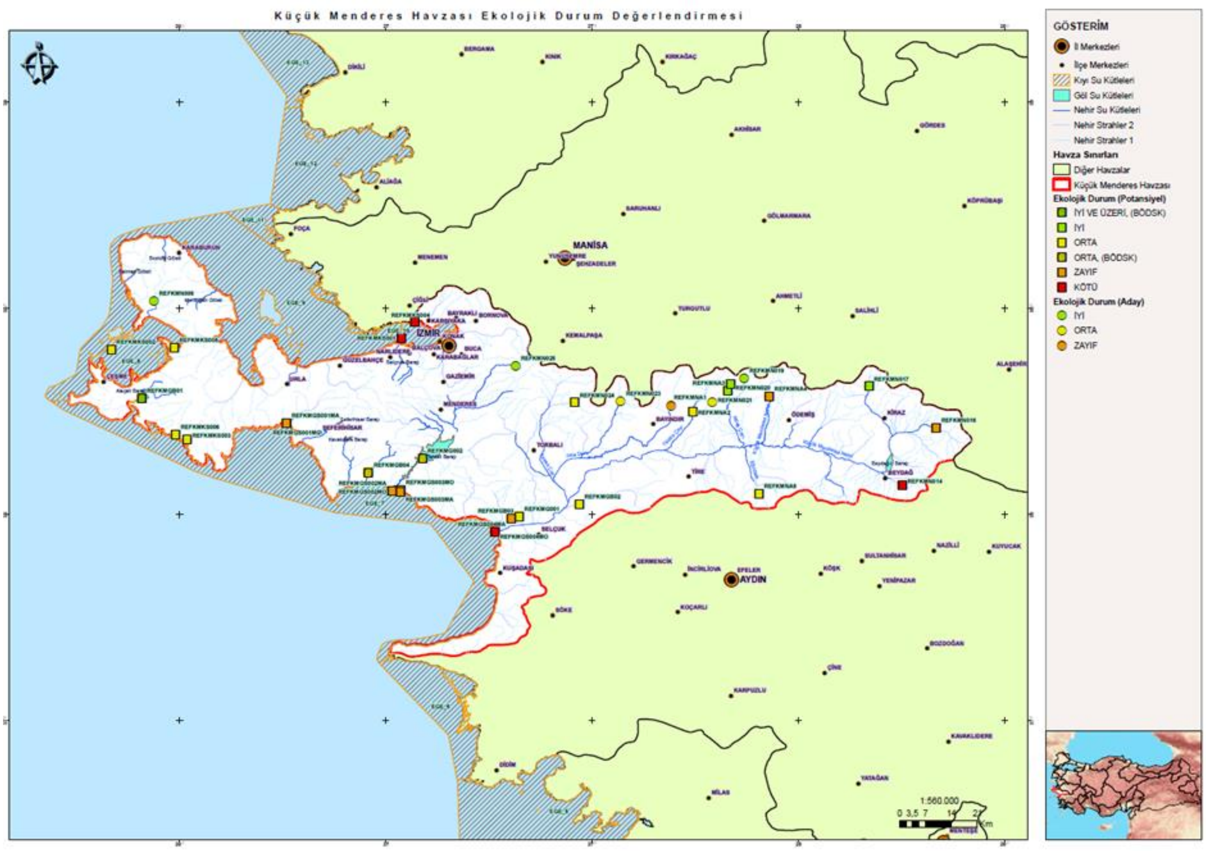
Graphical User Interface of National Water Information System (TRNWIS)

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 37 locations in the Küçük Menderes River Basin, including 17 rivers, 6 lakes (3 natural, 3 heavily modified), 8 transitional waters, and 6 coastal waters, and 26 reference (unpolluted) water sources were identified. In addition, the ecological status of the monitored water bodies in the Küçük Menderes River Basin was determined as a result of the monitoring activities.

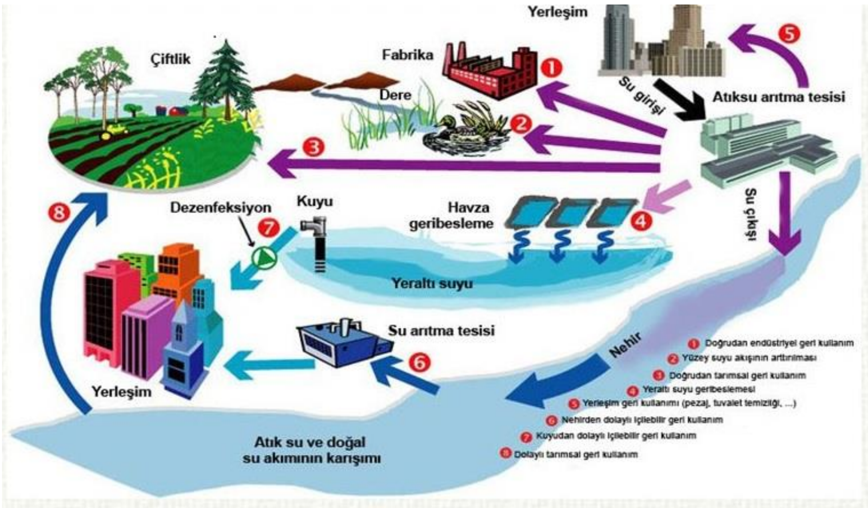
In the scope of monitoring activities, the smallest possible taxonomic level of all biological quality elements was identified and in this context 28 fish, 161 phytobenthos, 185 phytoplankton, 616 macroinvertebrate, 43 macroalgae/angiosperm and 31 macrophyte species were identified in the Küçük Menderes 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.



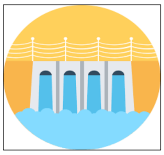
Ecological Status Assessment Results in the Küçük Menderes River Basin

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 Küçük Menderes basin, the wastewater treated in the wastewater treatment plants and the water returned from the agriculture were determined as used water resources.

As a result of the calculations, the reuse potential, usage areas and gains of the used waters in the Küçük Menderes basin are given in the following figure.



11,6 million m^3
Water Storage

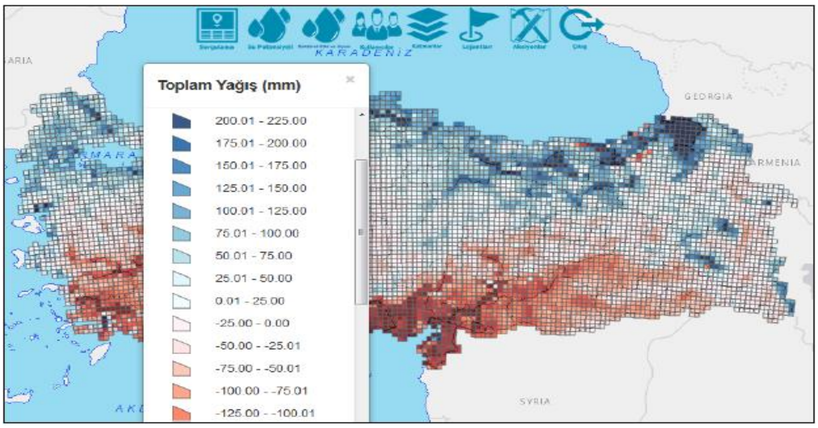
2,973 ha
Agricultural Area Irrigation

2,3 million m^2
Landscape Irrigation

29,5 million m3
Environmental Restoration

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 16,7ºC according to 1971-2000 observations, will increase by at least 1,6°C, maximum 4,7ºC in 2071-2100 period. It is expected that temperature increases for this period will predominate in the areas other than the coasts of Aegean.

According to the observations of 1971-2000, the average annual precipitation amount of the reference period of the basin was determined to be 695,6 mm. According to the 30-year projection results, there is no significant increase or decrease tendency for the total precipitation parameter and it is predicted that the basin will receive 20% less rainfall compared to the reference period in 2071-2100. It is expected that rainfall decreases for this period will predominate in the eastern parts of the basin.

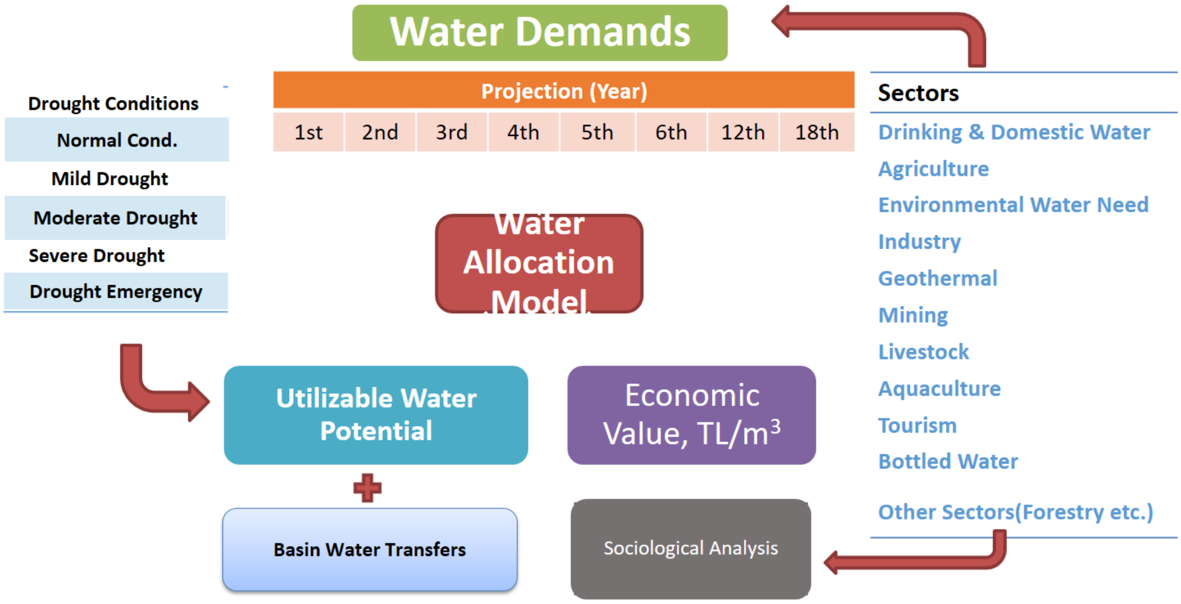
DSİ (Directorate General for State Hydraulic Works) data were used for hydrological model studies and the mean gross water potential of the basin for the reference period was determined to be 1.369 million 3/year. With the effect of climate change, it is predicted that in the period 2041-2100, the gross 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 315 million m3/year.

As a result of the hydrogeological studies carried out, the hydrogeological reserve of groundwater of the basin was determined to be 56 km3. The technically and economically usable amount of this reserve, the possible reserve is calculated to be 32 km3. 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 3% and possible reserve by 5%.

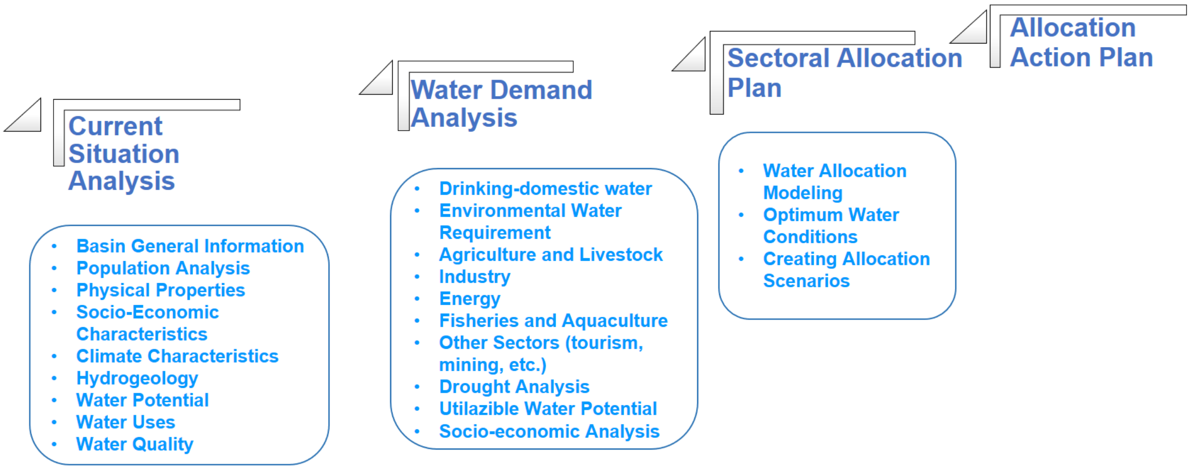
SECTORAL WATER ALLOCATION PLAN

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.



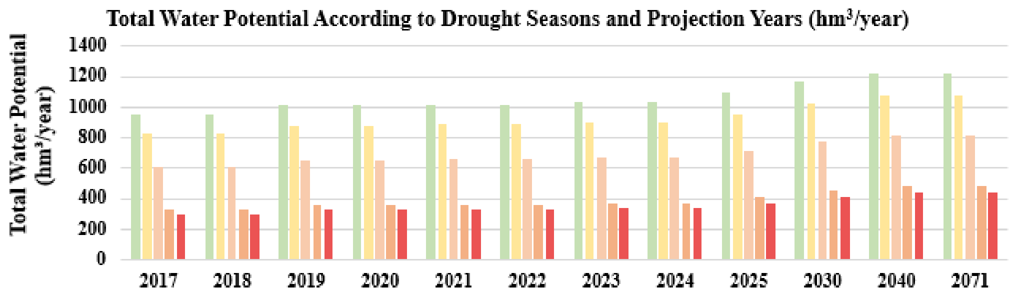
After calculating the water needs of each sector in all projection years; all physical, hydrological, socio-economic, and water quantity data obtained from the analysis studies are correlated with each other and sectoral water allocation plan scenarios are prepared through the model found appropriate. 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.



Sectoral Water Allocation Plan was prepared for the Kucuk Menderes Basin in 2019. In the basin water allocation plan, 40 water allocation scenarios were created in the projection years for the drinking-domestic, environment, agriculture, industry, and energy sectors in drought periods by using the water allocation model.

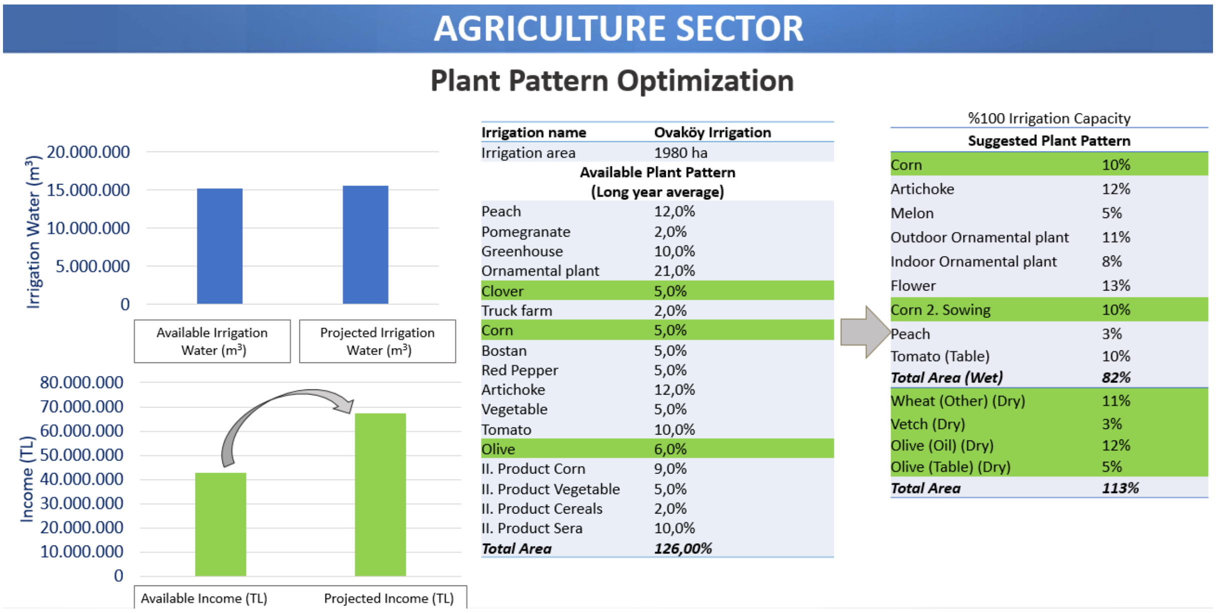
TOTAL WATER POTENTIAL ACCORDING TO PROJECTION YEARS

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2040	2071
Normal	951	951	1010	1011	1017	1017	1038	1038	1095	1166	1222	1224
Mild Drought	826	826	879	881	886	886	905	905	957	1022	1074	1076
Moderate Drought	607	607	652	653	657	657	674	674	717	771	815	817
Severe Drought	326	326	358	359	362	362	375	375	407	449	483	484
Drought Emergency	297	297	326	327	330	330	341	341	371	408	439	440



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.

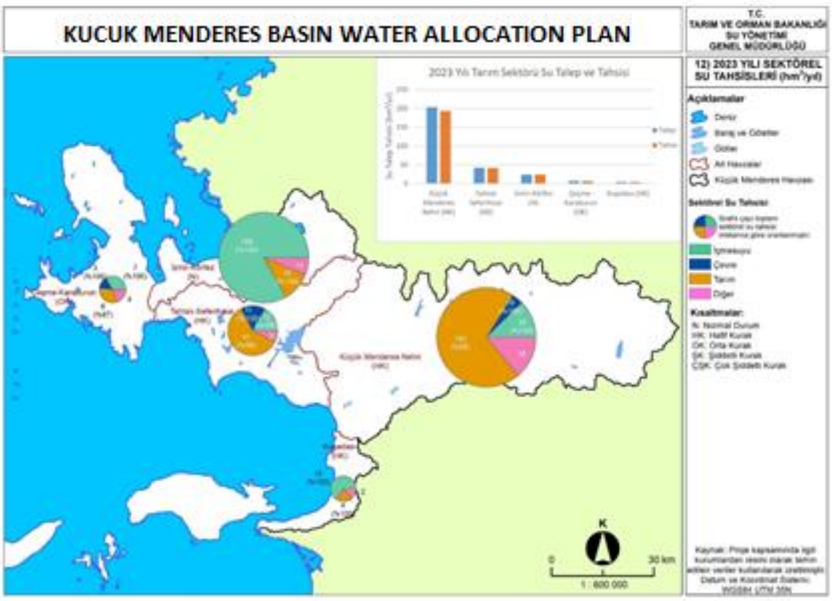
One of the most critical issues in Sectoral Water Allocation Plans is plant pattern optimization studies for different drought conditions in the agricultural sector, which uses a significant part of our country's water potential. By determining the water needs of the agricultural sector in advance and 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.



Irrigation name	Ovaköy Irrigation
Irrigation area	1980 ha
Available Plant Pattern (Long year average)	
Peach	12,0%
Pomegranate	2,0%
Greenhouse	10,0%
Ornamental plant	21,0%
Clover	5,0%
Truck farm	2,0%
Corn	5,0%
Bostan	5,0%
Red Pepper	5,0%
Artichoke	12,0%
Vegetable	5,0%
Tomato	10,0%
Olive	6,0%
II. Product Corn	9,0%
II. Product Vegetable	5,0%
II. Product Cereals	2,0%
II. Product Sera	10,0%
Total Area	***126,00%***

%100 Irrigation Capacity	
Suggested Plant Pattern	
Corn	10%
Artichoke	12%
Melon	5%
Outdoor Ornamental plant	11%
Indoor Ornamental plant	8%
Flower	13%
Corn 2. Sowing	10%
Peach	3%
Tomato (Table)	10%
Total Area (Wet)	***82%***
Wheat (Other) (Dry)	11%
Vetch (Dry)	3%
Olive (Oil) (Dry)	12%
Olive (Table) (Dry)	5%
Total Area	***113%***

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. Kucuk Menderes Basin Sectoral Water Allocation Plan and Action Plan entered into force with the Ministry Circular No. 2020/9.