ARARAT VALLEY ATLAS

USAID
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REPUBLIC OF ARMENIA
MINISTRY OF ENVIRONMENT

ARARAT VALLEY ATLAS

YEREVAN 2021

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ABBREVIATIONS

Abbreviation	Explanation
AHGW	ArcHydro Groundwater
ASPIRED	Advanced Science and Partnerships for Integrated Resource Development
BMA	Basin Management Area
CADI	Computer Assisted Development, Inc.
CCSM	Community Climate System Model
CN	Curve Number
CSJC	Closed Joint-Stock Company
DEM	Digital Elevation Model
DSS	Decision Support System
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographic Information System
GMS	Groundwater Modeling System
HMC	Hydrometeorology and Monitoring Center
IPCC	Intergovernmental Panel on Climate Change
ME	Ministry of Environment
ME&A	ME&A, Inc.
METRAS	Mesoscale Transport and Stream
MTAI	Ministry of Territorial Administration and Infrastructure
NASA	National Aeronautics and Space Administration
RA	Republic of Armenia
RCP	Representative Concentration Pathway
SRTM	Shuttle Radar Topography Mission
SWCIS	State Water Cadaster Information System
WUA	Water Users Association
WUP	Water Use Permit
USAID	United States Agency for International Development
USGS	United States Geological Survey

DATA SOURCES

Section	Source
Introduction: Republic of Armenia	• SWCIS Data Warehouse of the RA ME, 2020 • RA Government Decision N: 549-N on Defining Elements of Water Balance and Distribution of Water Resources and Water Reserves per River Basins of Armenia, Dated May 29, 2008 • RA Government Decision N: 338-N on Approving the Management Plan for the Ararat Basin Management Area for 2016-2021 and Priority Measures for Effective Management, Dated March 31, 2016 • RA Government Decision N: 539-N on Approving the Management Plan for the Southern Basin Management Area for 2016-2021 and Priority Measures for Effective Management, Dated May 26, 2016 • RA Government Decision N: 240-N on Approving the Management Plan for the Akhuryan Basin Management Area for 2017-2022 and Priority Measures for Effective Management, Dated March 9, 2017
1. General Characteristics of the Ararat Valley	• SWCIS Data Warehouse of the RA ME, 2020 • Water Committee of the RA MTAI, Water Supply Services in the Ararat Valley, 2020 • Water Committee of the RA MTAI, WUAs in the Ararat Valley and their Service Areas, 2019 • Water Committee of the RA MTAI, Water Infrastructure and Drainage Network in the Ararat Valley, 2019 • RA MTAI, Population of the Ararat and Armavir Marzes of Armenia as of January 1, 2020 • Republican Geologic Fund State Non-commercial Organization of the RA MTAI, Geologic Map of the Ararat Valley, 1983 • USAID Clean Energy and Water Program, Final Report on Assessment Study of Groundwater Resources in the Ararat Valley, 2014 • USAID ASPIRED Project, Report on Digital Hydrogeologic Map of the Ararat Valley and Three-dimensional Model of the Ararat Valley Groundwater Basin, 2018
2. Inventory of Groundwater Wells, Natural Springs and Fish Farms in the Ararat Valley	• SWCIS Data Warehouse of the RA ME, 2020 • USAID ASPIRED Project, Final Report on Inventory of Groundwater Wells, Natural Springs and Fish Farms in the Ararat Valley, 2016
3. Water Balance and Water Supply and Demand Balance of the Ararat Valley	• SWCIS Data Warehouse of the RA ME, 2020 • HMC of the RA ME, Data from the Meteorological Stations and Hydrologic Observations Posts of the Ararat Valley and Ararat Valley Catchment Area for the Period of 1961-2016 • USAID ASPIRED Project, Final Report on Inventory of Groundwater Wells, Natural Springs and Fish Farms in the Ararat Valley, 2016 • USAID ASPIRED Project, Report on Methodology and Calculated Values of Natural Flow and Water Balance of the Ararat Valley, 2018 • USAID ASPIRED Project, Report on Calculated Values of Water Balance and Water Supply and Demand Balance in the Ararat Valley Using Modeling of the Ararat Valley Groundwater Basin, 2021
4. Modeling of the Ararat Valley Groundwater Basin and Assessment of Its State in 2016	• SWCIS Data Warehouse of the RA ME, 2020 • USGS, Hydrogeologic Framework and Groundwater Conditions of the Ararat Basin in Armenia, 2017 • USAID ASPIRED Project, Report on Digital Hydrogeologic Map of the Ararat Valley and Three-dimensional Model of the Ararat Valley Groundwater Basin, 2018 • USAID ASPIRED Project, Report on Calculated Values of Water Balance and Water Supply and Demand Balance in the Ararat Valley using Modeling of the Ararat Valley Groundwater Basin, 2021
5. Assessment of Water Resources Quality in the Ararat Valley	• SWCIS Data Warehouse of the RA ME, 2020 • HMC of the RA ME, Hydrochemical Monitoring Data from the Water Quality Monitoring Points of the Ararat Valley and Ararat Valley Catchment Area for the Period of 2016-2017 • RA Government Decision N: 75-N on Defining Water Quality Norms for Each Basin Management Area, Taking into Consideration Peculiarities of the Area, Dated January 27, 2011 • Order of the RA Minister of Health N: 876 on Defining N-2-III-A 2-1 Sanitary Norms and Rules for Drinking Water: Hygienic Requirements for the Centralized Systems of Water Supply, Quality Control, Dated December 25, 2002 • United Nation's FAO, Water Quality Standards for Irrigation, 1985
6. Assessment of the Impact of Climate Change on the Ararat Valley Catchment Area	• SWCIS Data Warehouse of the RA ME, 2020 • HMC of the RA ME, Monitoring Data from Meteorological Stations and Hydrologic Observations Posts in the Ararat Valley and Its Catchment Area for the Period of 1961-2016 • USAID ASPIRED Project, Report on Climate Change Analysis in the Ararat Valley, 2019

Introduction

The Advanced Science and Partnerships for Integrated Resource Development (ASPIRED) Project of the United States Agency for International Development (USAID) is a project with duration in 6 years that supports the Government of the Republic of Armenia (RA) in sustainable management of water resources and promotes advanced practices of water use in the Ararat Valley through the use of science, technology, innovation, and partnership initiatives. The ultimate goal of the project is to reduce the rate of groundwater abstraction in the Ararat Valley to sustainable levels. The ASPIRED Project is implemented by ME&A, Inc. (ME&A).

To support the Government of Armenia in developing and implementing data-driven policies for sustainable management of groundwater resources in the Ararat Valley, the ASPIRED Project, in a close collaboration with stakeholder institutions, has focused from the start of the project on establishing a comprehensive and reliable data system on water resources, as well as developing decision support tools for the Ararat Valley.

The results of ASPIRED's work are summarized in this single publication, the Ararat Valley Atlas. This Atlas integrates both data and information on Ararat Valley water resources, provided by state institutions, as well as geospatial data that was collected and analyzed by the ASPIRED Project. It contains both cartographic and statistical information.

The Ararat Valley Atlas was prepared by ASPIRED Project, in close collaboration with its key partner - the RA Ministry of Environment (ME), other stakeholder institutions and international partner organizations. Its content was discussed with the specialists of the Ministries of Environment, Economy, Territorial Administration and Infrastructure of Armenia. Modeling and analytical work were performed in collaboration with and through guidance from Computer Assisted Development, Inc. (CADI), a U.S. consulting company, and Aquaveo, a U.S. modeling software company. CADI and Aquaveo specialize in providing technical solutions to governments and businesses worldwide on sustainable management of water resources and nature conservation, using extensively applied information technology and advanced solutions for hydrologic and hydrogeological analyses and modeling. The Ararat Valley groundwater basin modeling builds on the scientific investigation report, *Hydrogeologic Framework and Groundwater Conditions of the Ararat Basin in Armenia*, prepared by the United States Geological Survey (USGS).

The cartographic materials of the Atlas are based on the geospatial layers and images gathered and stored in the unified Ararat Valley geodatabase. Analytic and cartographic works were implemented using the ASPIRED Project's applied innovative technologies and state-of-art modeling tools. Specific technologies and tools include the following:

- The ASPIRED team applied remote sensing technologies to analyze the Sentinel-2 high resolution satellite imagery of the European Space Agency in order to obtain data on land cover and land use classification in the Ararat Valley. These datasets were further used to determine the annual value of natural surface runoff that originates in the Ararat Valley, using the "precipitation-runoff" curve method.
- The Project team customized a Decision Support System (DSS) to conduct quantitative and qualitative assessments of water resources in the Ararat Valley, and climate change impact analysis in the Ararat Valley and its catchment area. The customized DSS is an extension programmed within the geographic information system environment. The extension was developed by the USAID Clean Energy and Water Program in 2013-2015 and was further calibrated for the Ararat Valley and its catchment area in 2016-2020 under the USAID ASPIRED Project.
- The ASPIRED team applied ArcHydro Groundwater Tools to develop the 3-dimensional lithologic model of the Ararat Valley groundwater basin. The model is based on data from the inventory of groundwater wells that was conducted by the ASPIRED Project in 2016, including the geographic coordinates of wells, altitude above sea level, stratigraphy (rock structure, thickness, and depth), and geological structure of rocks.
- The ASPIRED Project used the Groundwater Modeling System (GMS) and MODFLOW modeling tools for constructing the digital groundwater flow model of the Ararat Valley. This model allows assessing the state of aquifers under conditions of groundwater use.
- The Project utilized the Global Digital Elevation Model and Hillshade Image generated based on the National Aeronautics and Space Administration's Shuttle Radar Topography Mission (NASA SRTM) imageries, as well as World Imagery from the Environmental Systems Research Institute (ESRI) for improved visualization of the maps.

The Ararat Valley Atlas consists of 48 thematic maps that are grouped into the following 6 sections:

- *General Characteristics of the Ararat Valley*: this section presents the Ararat Valley and its catchment area, administrative boundary and population density, topography, and geology of the studied area. Maps are also presented showing land cover and land use classification, water infrastructure and water supply services, as well as networks for monitoring surface and groundwater resources in the Ararat Valley.
- *Inventory of Groundwater Wells, Natural Springs and Fish Farms in the Ararat Valley*: this section provides baseline data on groundwater use in the Ararat Valley as of 2016, including maps and statistical data on status and purpose of operation of the inventoried wells, condition of the natural springs, and status of the fish farms.
- *Water Balance and Water Supply and Demand Balance of the Ararat Valley:* this section of the Atlas presents the multiannual average water balance for the period of 1961-2016 for the Ararat Valley and its catchment area, and annual water balance for the Ararat Valley for 2016. Similarly, it provides data on usage of surface and groundwater resources, and water supply and demand balance for the Ararat Valley in 2016. It also displays data on permitted water use in the Ararat Valley for 2019, and measures taken by the Government of Armenia during 2014-2019 on regulating groundwater use in the Ararat Valley.

- *Modeling of the Ararat Valley Groundwater Basin and Assessment of Its State in 2016:* this section provides maps on the hydrogeologic structure of the Ararat Valley groundwater basin and boundaries of pressure zones, as well as the three-dimensional model of the groundwater basin with its seven main hydrogeologic units. It presents the calculated values of the total volume of each hydrogeologic unit, total pore volume of the water bearing units, and the values of natural and elastic groundwater reserves in the Ararat Valley Groundwater Basin. The section also displays the values of natural groundwater resources recharging the groundwater basin, volume of usable groundwater resources or sustainable rate of groundwater abstraction for the year 2016 as estimated using modeling tools.

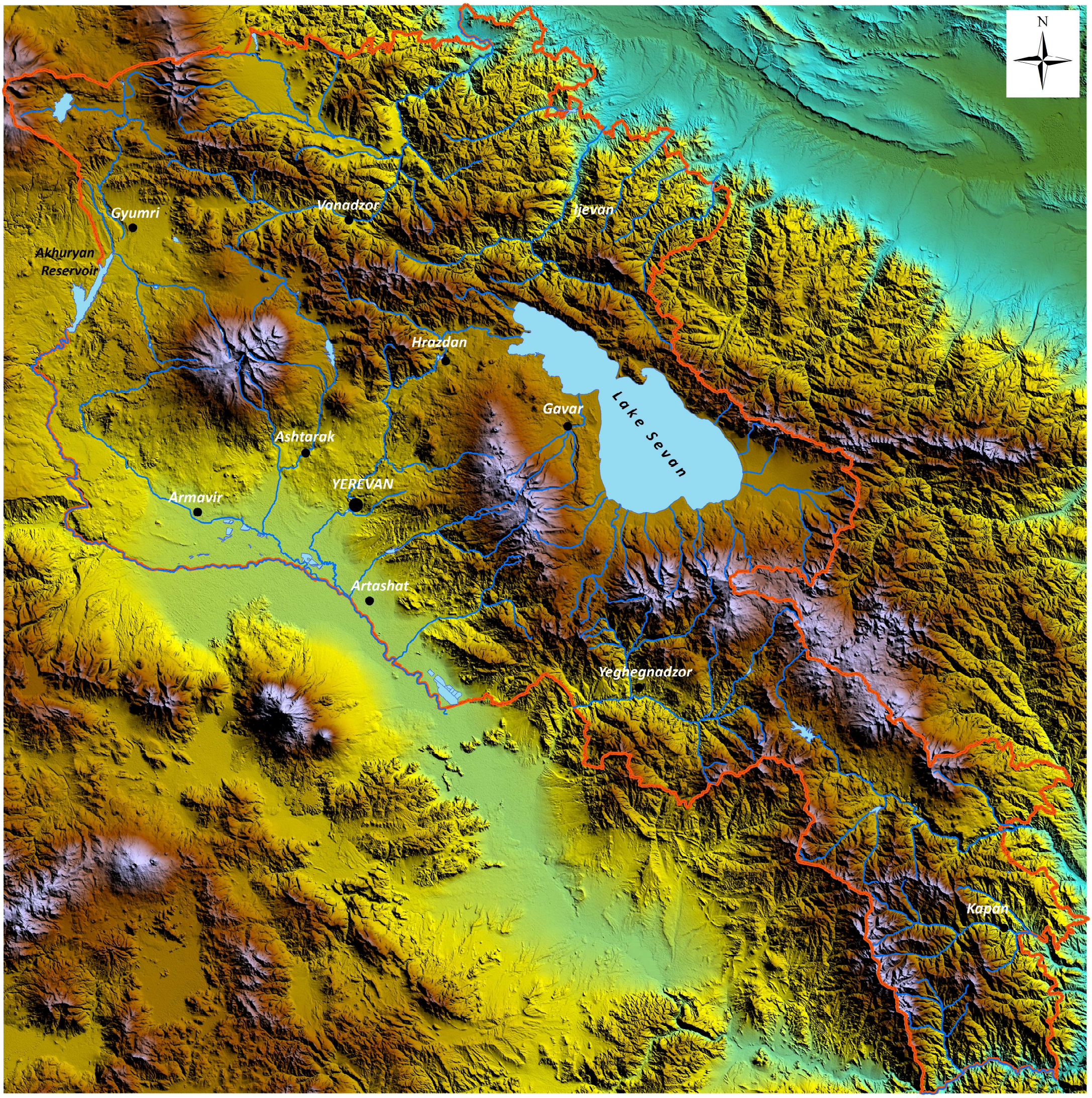
- *Assessment of Water Resources Quality in the Ararat Valley:* this section presents the results of assessment and classification of the surface and groundwater resources quality, using monthly data from hydrochemical monitoring of water resources in the Ararat Valley for the period of 2016-2017 conducted by the Hydrometeorology and Monitoring Center (HMC) of the ME.

- *Assessment of the Impact of Climate Change on the Ararat Valley Catchment Area:* this section presents the dynamics of the changes of main climatic elements in representative meteorological and hydrologic observation posts in the Ararat Valley for the analysis period of 1991-2016, in comparison with the established baseline period of 1961-1990. It also presents the projected changes in average annual values of air temperature, atmospheric precipitation, and natural surface flow for the periods of 2011-2040, 2041-2070, and 2071-2100 under two scenarios of CO_2 emissions as recommended by the Intergovernmental Panel on Climate Change (IPCC): Representative Concentration Pathway scenarios 8.5 and 6.0 (RCP 8.5 and RCP 6.0).

The Ararat Valley Atlas was prepared by the ASPIRED Project Specialists Aram Gevorgyan, Data Management and GIS Specialist, Benyamin Zakaryan, Hydrologist, Lilith Harutyunyan, Basin Management Planning and Environmental Specialist, along with Tom Sheng, President of CADI Inc. In addition, Nara Mnatsakanyan and Inga Siradeghyan, interns of the ASPIRED Project and students of the Master's program on Cartography and Geomorphology in the Faculty of Geography and Geology of the Yerevan State University, contributed to preparing this Atlas.

The Ararat Valley Atlas was prepared in both Armenian and English languages and is available to all interested entities in both paper and electronic formats. The digital version of the Atlas is available at the webpages of the USAID's Development Experience Clearing House at **https://dec.usaid.gov** and ME at **http://env.am/**.

Republic of Armenia



General Information

The Republic of Armenia is a landlocked country located in the north-eastern part of the Armenian Highlands, in the Southern Caucasus region.
Average elevation above sea level is 1,800 m. The highest peak is Aragats Mountain (4,090 m). The lowest point is Debed river canyon (375 m).
Ethnic breakdown: Armenians (96%), Russians (1%), Yezidis, Kurds, Assyrians, Greeks, Ukrainians, Jews.
Religion: Christianity (Armenian Apostolic Church), professed by the vast majority of the population.

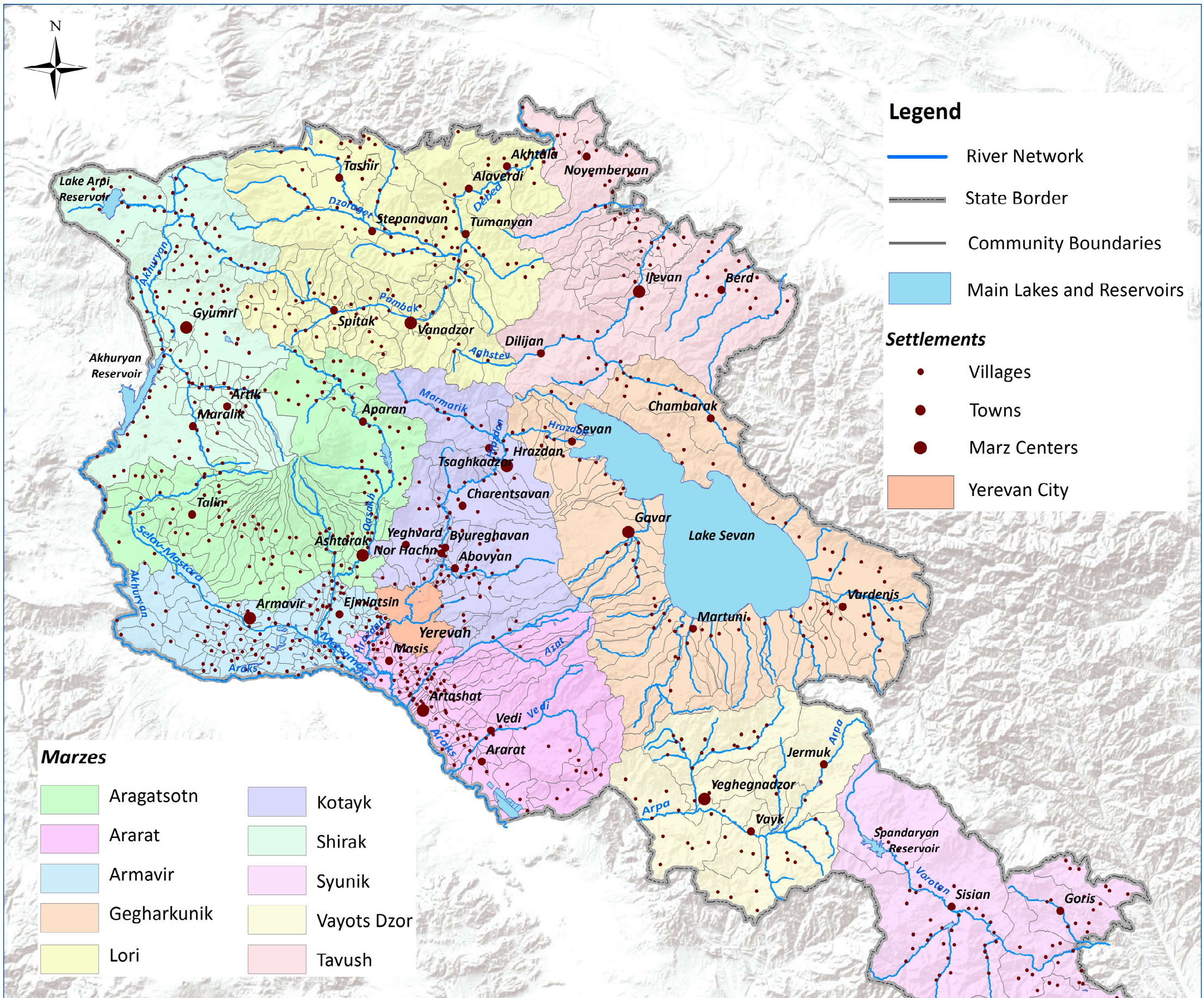
Legend

- Main Cities
- Main Rivers
- State Border
- Main Lakes and Reservoirs

0 10 20 40 60 km

Coordinate System: WGS-1984
Projection: UTM Zone 38N
Date: June 2020

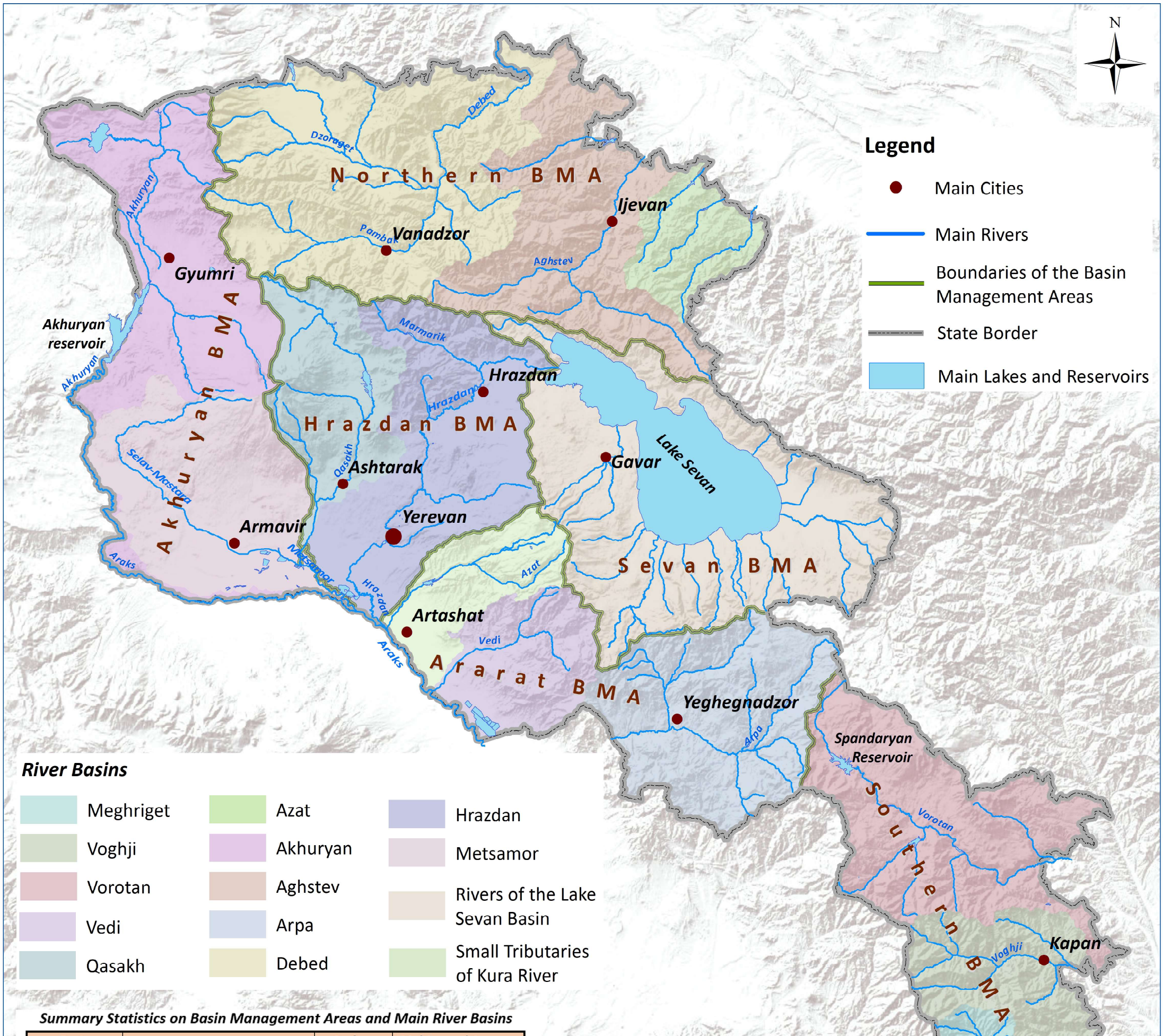
Administrative Map of the Republic of Armenia



Statistics on Marzes and Communities in the Republic of Armenia (as of June 2020)

Marz	Surface Area		Number of Communities			
	km²	% of Total	Urban	Rural	Total	% of Total
Aragatsotn	2,752	9.3	3	69	72	14.4
Ararat	2,095	7.0	4	91	95	19.0
Armavir	1,232	4.1	3	94	97	19.4
Gegharkunik	5,326	17.9	5	50	55	11.0
Lori	3,804	12.8	8	48	56	11.2
Kotayk	2,094	7.0	7	35	42	8.4
Shirak	2,680	9.0	3	39	42	8.4
Syunik	4,506	15.1	5	3	8	1.6
Vayots Dzor	2,317	7.8	3	5	8	1.6
Tavush	2,725	9.2	4	20	24	4.8
Yerevan	212	0.7	1	0	1	0.2
Total	**29,743**	**100**	**46**	**454**	**500**	**100**

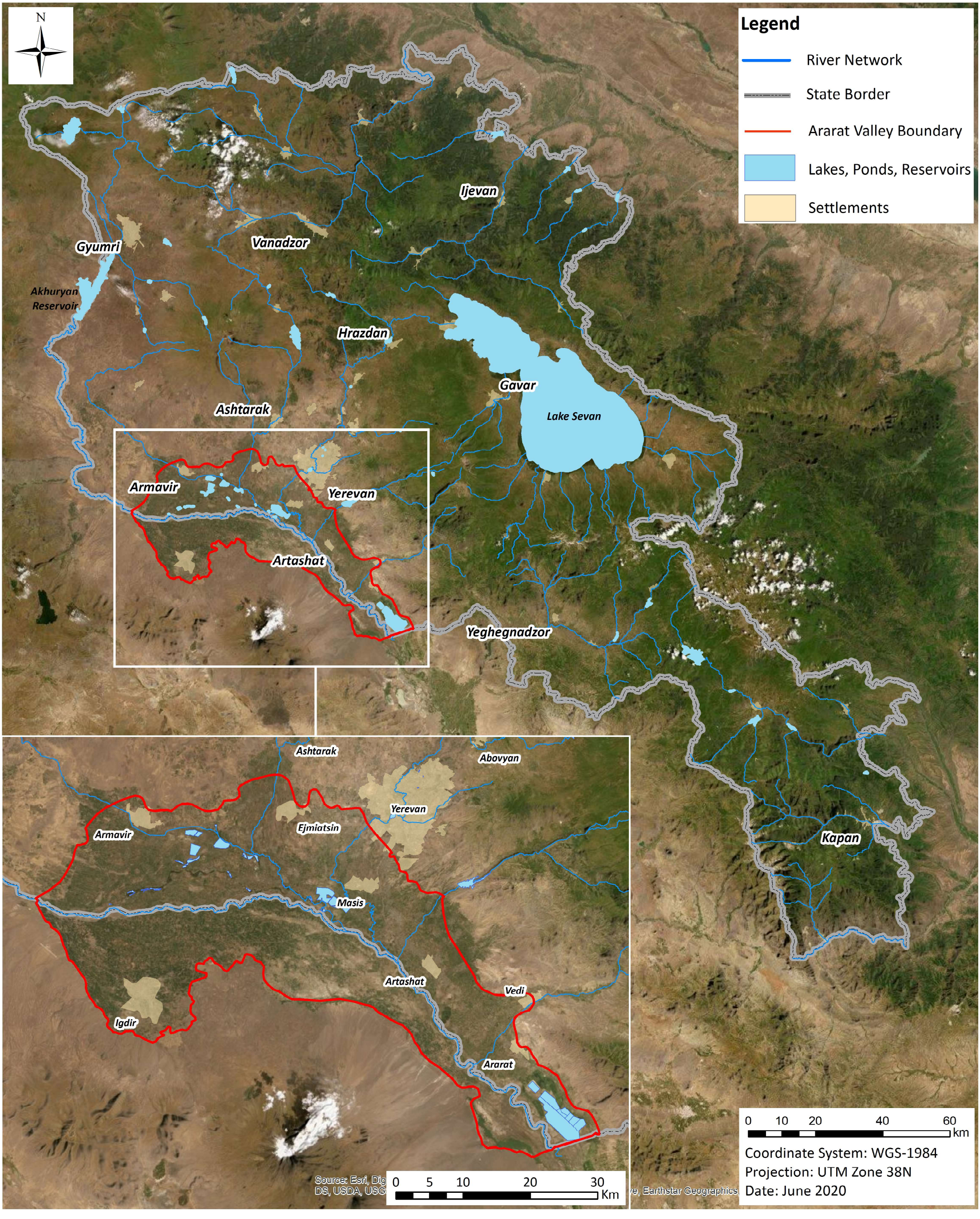
Basin Management Areas and Main River Basins of the Republic of Armenia



Summary Statistics on Basin Management Areas and Main River Basins

Basin Management Area	River Basin	Surface Area (km^2)	Multiannual Average Natural Surface Flow (million m^3/year)
Northern	Debed	3,888	1,203
	Aghstev	2,416	445
	Small tributaries of Kura River	793	199
	Subtotal	*7,097*	*1,847*
Hrazdan	Qasakh	1,389	329
	Hrazdan	2,600	733
	Subtotal	*3,989*	*1,062*
Sevan	Rivers of the Lake Sevan basin	4,739	265
	Subtotal	*4,739*	*265*
Ararat	Azat	955	402
	Vedi	1,129	167
	Arpa	2,306	723
	Subtotal	*4,390*	*1,292*
Akhuryan	Akhuryan	2,784	701
	Metsamor	2,245	778
	Subtotal	*5,029*	*1,479*
Southern	Vorotan	2,597	764
	Voghji	1,241	429
	Meghriget	661	102
	Subtotal	*4,499*	*1,295*
	TOTAL	***29,743***	***7,240***

Satellite Image of the Republic of Armenia and Ararat Valley



Section 1. General Characteristics of the Ararat Valley

The Ararat Valley is an inter-mountain depression of the Armenian Highlands. It lies in midstream of the Araks River, between Haykakan Par and Urts mountain ridges, Geghama volcanic mountains, and Ararat (5,165 meters above sea level) and Aragats (4,095 meters above sea level) volcanic massifs. The Araks River divides the Ararat Valley into two sides: the right bank (Turkish territory) and left bank (Armenian territory).

In the Republic of Armenia, the Ararat Valley lies in the midstream section of the Araks River, extending from northwest to southeast approximately 120 km in length and ranging between 10-25 km in width. The valley is located at elevations ranging from 800 m to 930 m above sea level and occupies an area of about 1,177 km^2. It is a natural groundwater storage area, with water entering into the aquifers from the surrounding Ararat and Aragats mountains, and from the Geghama and Haykakan Par mountain ridges.

According to its geomorphology, the Ararat Valley represents an inter-mountain depression associated with the valley of the Araks River and its tributaries - the Akhuryan, Metsamor (Sevjur), Qasakh, Hrazdan, Azat, Vedi Rivers in the territory of Armenia, as well as Kars River basin and the area of Igdir Province in the Turkish territory. The ancient buried valleys of those rivers, covered by the volcanic lava and sub-surface deposits of modern drainage networks (rivers), serve as the flow paths of groundwater entering the Ararat groundwater basin. The surface area of the Ararat Valley catchment area comprises 21,187 km^2, out of which 11,075 km^2 is in the territory of Armenia.

The geologic setting of the Ararat Valley has formed as a result of the eruption of the upper and lower quaternary basaltic lavas. The area is characterized with limnofluvial and effusive water bearing formations, with thickness reaching up to 500 meters. Beneath those formations, a folded non-water bearing formation is represented by Paleozoic and Mezocainosoic sandstone, clay and carbonate rocks. The Ararat Valley is currently filled with alluvial, proluvial, and lacustrine sediments. The Ararat Valley groundwater basin contains geologic sub-layers made of dense clay, gravel, sand, volcanic basalt and andesite deposits.

Highly fractured volcanic rocks and their porous subtypes cover over 90% of the Ararat Valley catchment area. Due to fractures and pores of the rocks, a significant portion of atmospheric precipitation and surface runoff in the catchment area infiltrates the aquifers. A portion of this infiltrated water is discharged in the form of natural springs in the mountainous and pre-mountainous areas of the Ararat Valley catchment area at a rate ranging from 10-1,000 liters per second or higher. These springs are typically equipped with catchment structures and are used to supply drinking water to the households in the area. The rest of the infiltrated water enters the Ararat Valley from the pre-mountainous zone of the catchment area as transit flow following old under-lava riverbeds.

The Ararat Valley aquifers are mainly fed by the upward discharge of water from the second confined aquifer, which is formed by volcanic rocks. Historically, significant reserves of groundwater have been formed here, some of which are discharged due to high hydraulic head in the Ararat Valley, forming the Metsamor River, Sis, Kapuyt Lake, Artashat and other natural springs. The rest evaporates and flows out of the boundaries of the depression.

The Ararat Valley and the premontane zone of its catchment area are the most densely populated areas of Armenia. About 50% of Armenia's groundwater resources of strategic importance are in the Ararat Valley groundwater basin. The boundaries of the Ararat Valley nearly match those of the Armavir and Ararat Marzes of Armenia.

While the Ararat Valley accounts for only 4% of the territory of Armenia, it represents most of the country's arable land. The soil is fertile, and climatic conditions are favorable for crop production. The Valley has specialized in high-value vegetable and fruit production, wine production, and to a lesser extent, the raising of livestock and poultry. Both surface and groundwater resources are used for irrigation purposes.

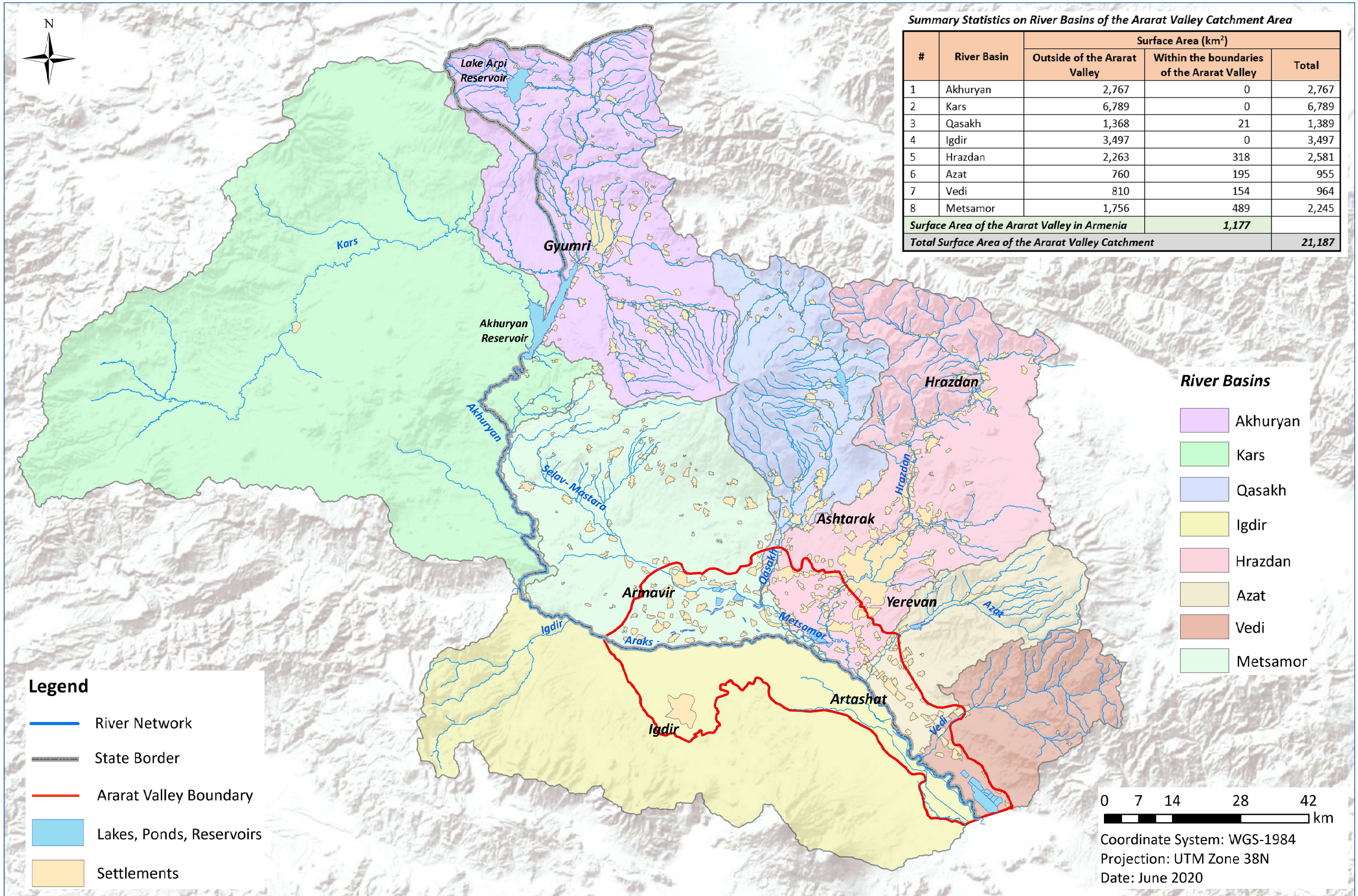
Before the 1990's, only the first confined aquifer was used for irrigation, while the second aquifer was exclusively used to supply drinking water. At that time, water use and both aquifers were regularly monitored. By 1973, regular monitoring results demonstrated a trend of reduced discharge from self-flowing wells in the Ararat Valley. In the 2000's, fish farms began using water from the second aquifer to breed trout and Siberian sturgeon.

Maps included in this section of the Atlas present the catchment area, administrative boundary, population density, topography, and geology of the Ararat Valley. Additional maps show land cover and land use classification, water infrastructure and water supply services, as well as networks for monitoring surface and groundwater resources in the Ararat Valley. All maps contain relevant statistical data.

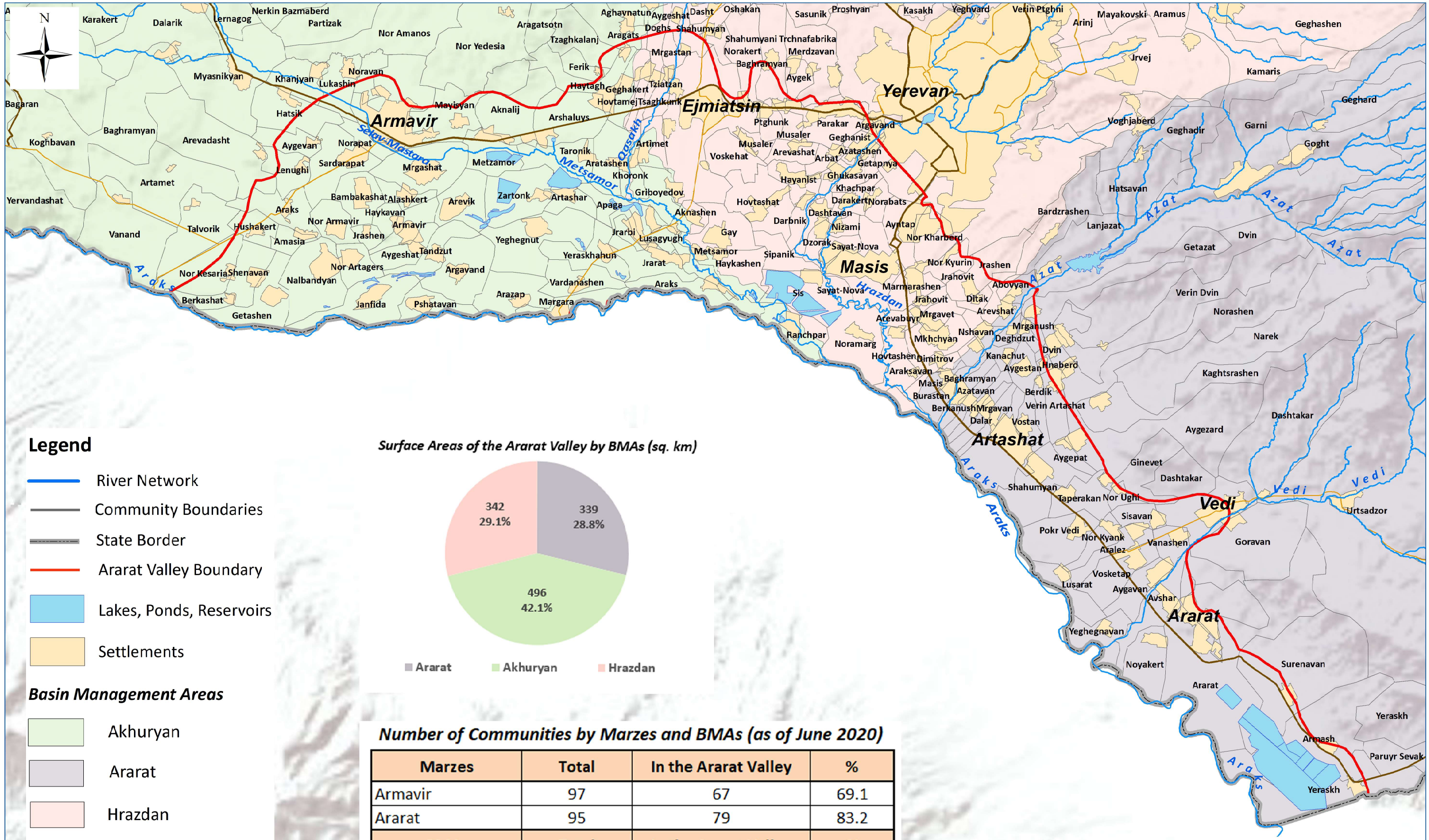
Catchment Area of the Ararat Valley

Summary Statistics on River Basins of the Ararat Valley Catchment Area

#	River Basin	Surface Area (km²)		
		Outside of the Ararat Valley	Within the boundaries of the Ararat Valley	Total
1	Akhuryan	2,767	0	2,767
2	Kars	6,789	0	6,789
3	Qasakh	1,368	21	1,389
4	Igdir	3,497	0	3,497
5	Hrazdan	2,263	318	2,581
6	Azat	760	195	955
7	Vedi	810	154	964
8	Metsamor	1,756	489	2,245
Surface Area of the Ararat Valley in Armenia			*1,177*	
Total Surface Area of the Ararat Valley Catchment				*21,187*



Administrative Map of the Ararat Valley



Legend

- River Network
- Community Boundaries
- State Border
- Ararat Valley Boundary
- Lakes, Ponds, Reservoirs
- Settlements

Basin Management Areas

- Akhuryan
- Ararat
- Hrazdan

Road Network

- Interstate
- National

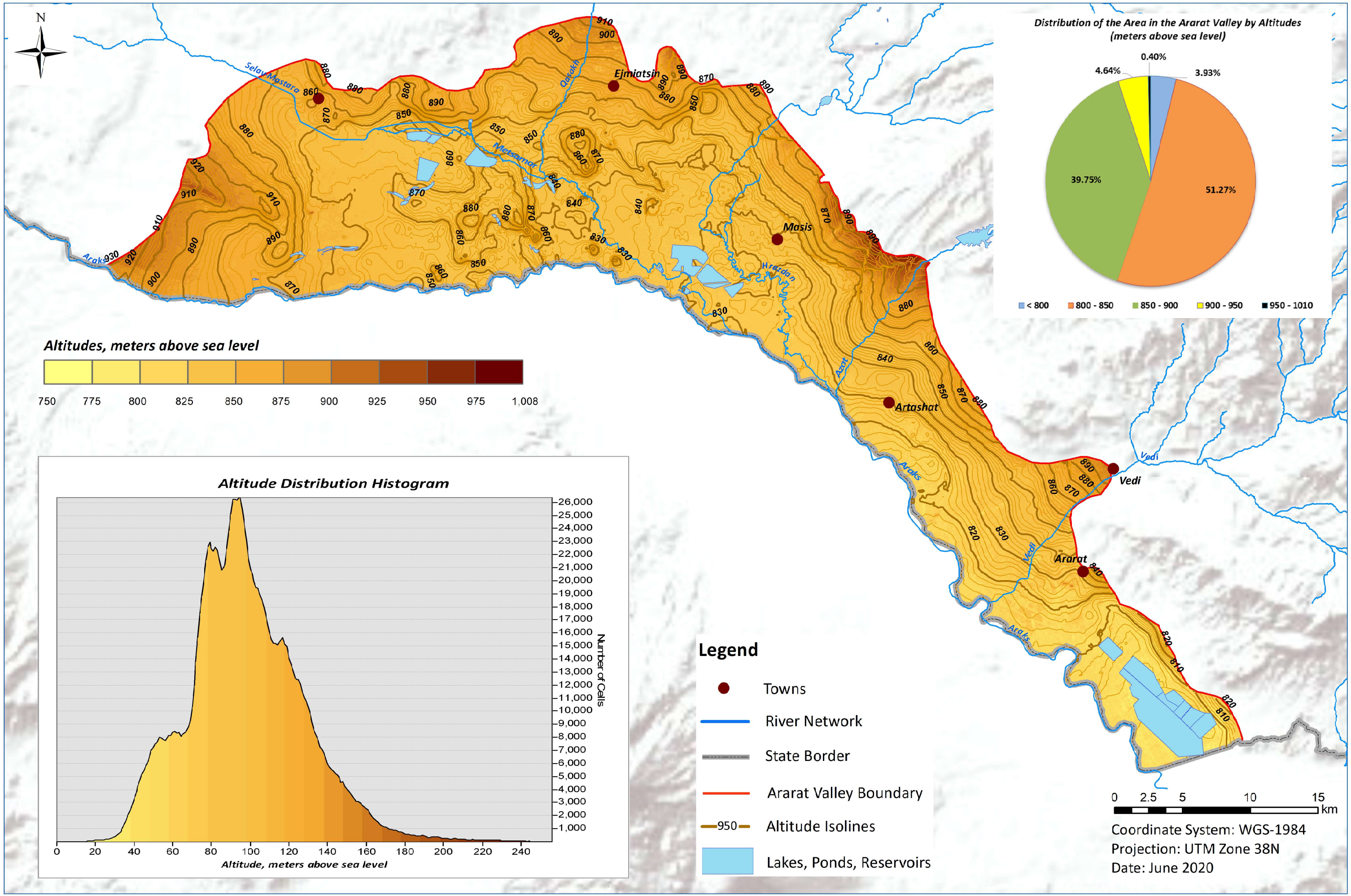
Surface Areas of the Ararat Valley by BMAs (sq. km)

Number of Communities by Marzes and BMAs (as of June 2020)

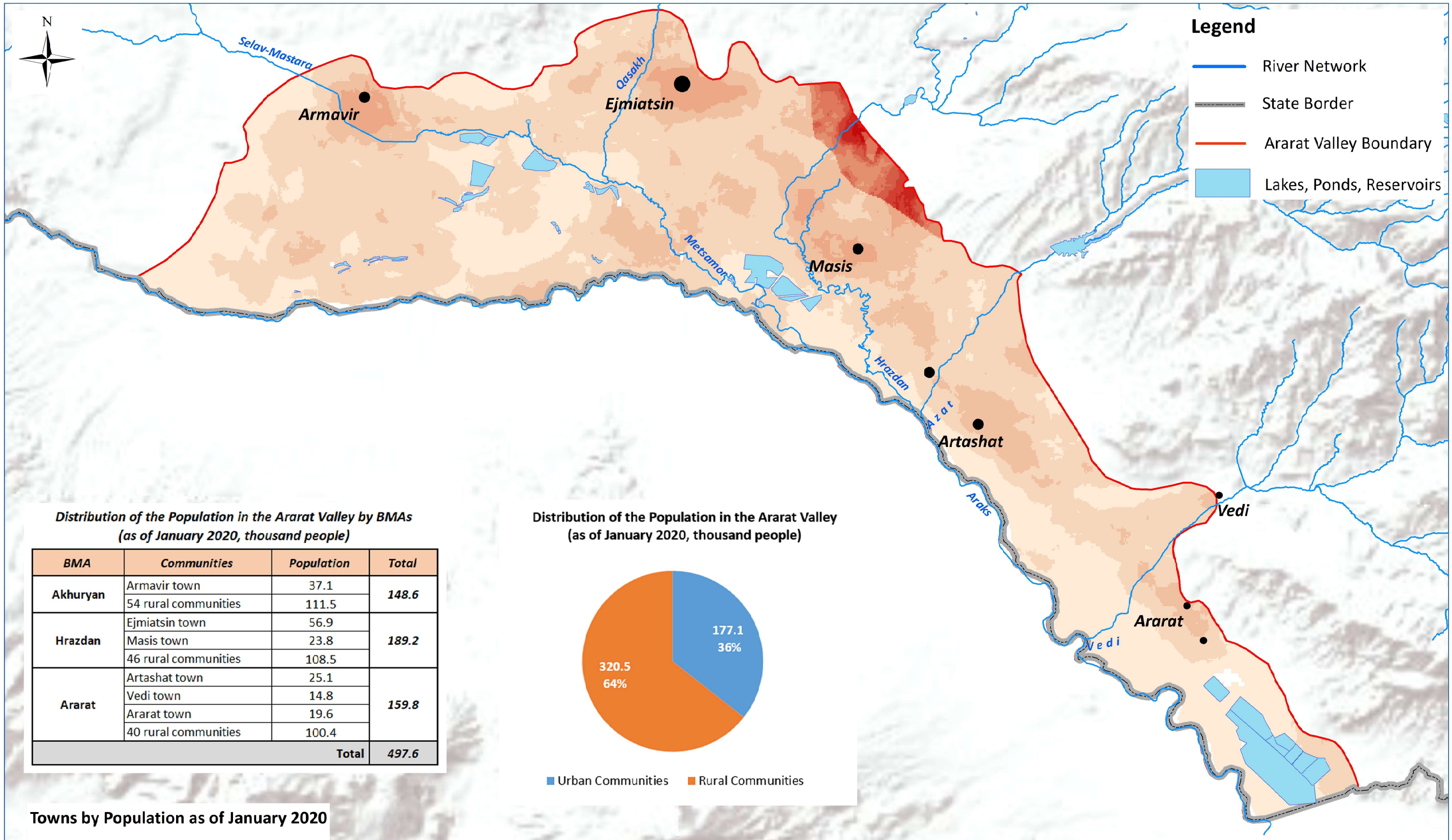
Marzes	Total	In the Ararat Valley	%
Armavir	97	67	69.1
Ararat	95	79	83.2
BMAs	**Total**	**In the Ararat Valley**	**%**
Ararat	72	43	59.7
Akhuryan	168	55	32.7
Hrazdan	121	48	39.7

Coordinate System: WGS-1984
Projection: UTM Zone 38N
Date: June 2020

Topography of the Ararat Valley



Population Density in the Ararat Valley



Distribution of the Population in the Ararat Valley by BMAs (as of January 2020, thousand people)

BMA	Communities	Population	Total
Akhuryan	Armavir town	37.1	*148.6*
	54 rural communities	111.5	
Hrazdan	Ejmiatsin town	56.9	*189.2*
	Masis town	23.8	
	46 rural communities	108.5	
Ararat	Artashat town	25.1	*159.8*
	Vedi town	14.8	
	Ararat town	19.6	
	40 rural communities	100.4	
		Total	*497.6*

Distribution of the Population in the Ararat Valley (as of January 2020, thousand people)

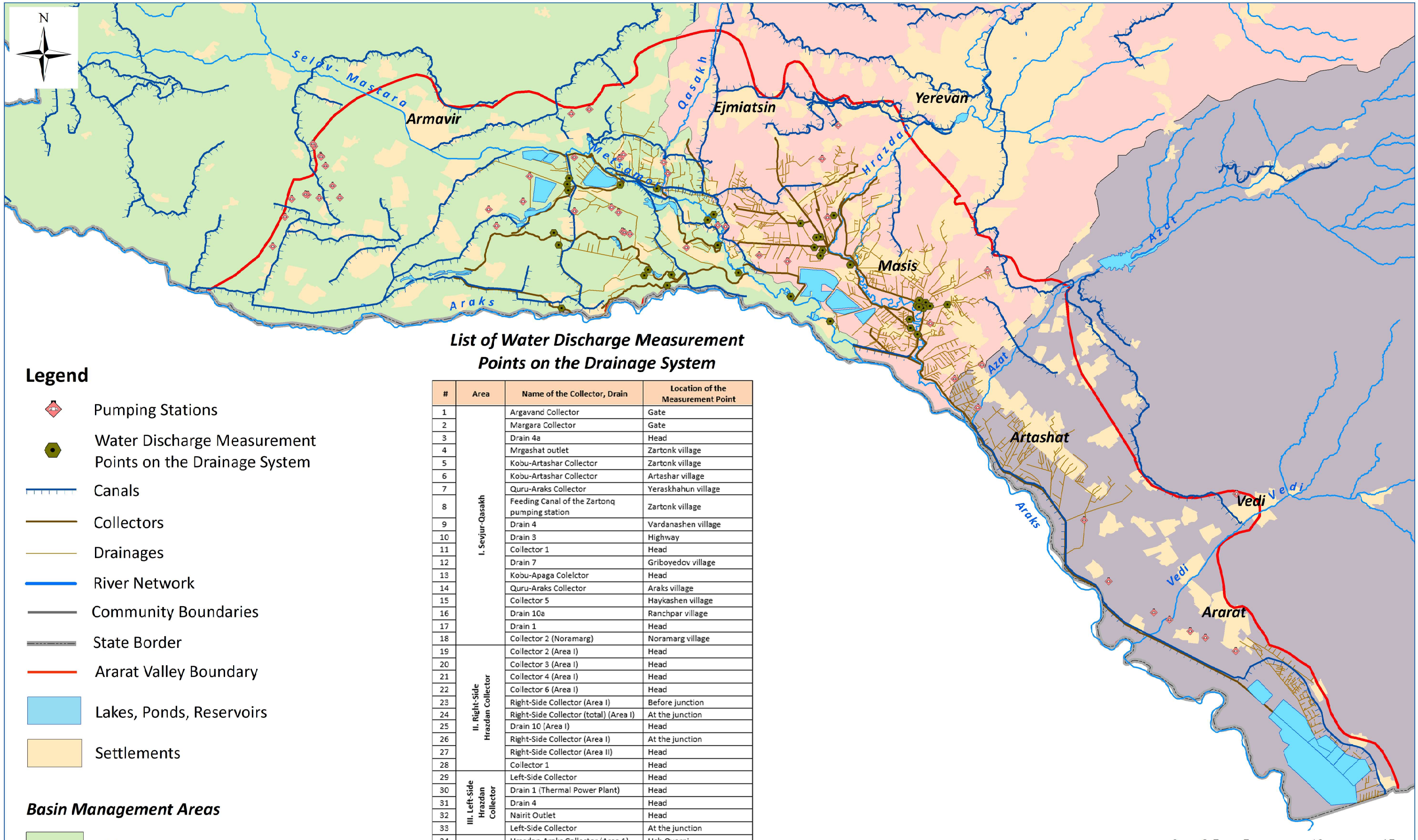
Towns by Population as of January 2020

- < 20,000
- 20,000 - 40,000
- > 40,000

Population Density (people per square km)

0 2 5 10 20 30 40 50 60 70 90

Water Infrastructure in the Ararat Valley



List of Water Discharge Measurement Points on the Drainage System

#	Area	Name of the Collector, Drain	Location of the Measurement Point
1	I. Sevjur-Qasakh	Argavand Collector	Gate
2		Margara Collector	Gate
3		Drain 4a	Head
4		Mrgashat outlet	Zartonk village
5		Kobu-Artashar Collector	Zartonk village
6		Kobu-Artashar Collector	Artashar village
7		Quru-Araks Collector	Yeraskhahun village
8		Feeding Canal of the Zartonq pumping station	Zartonk village
9		Drain 4	Vardanashen village
10		Drain 3	Highway
11		Collector 1	Head
12		Drain 7	Griboyedov village
13		Kobu-Apaga Colelctor	Head
14		Quru-Araks Collector	Araks village
15		Collector 5	Haykashen village
16		Drain 10a	Ranchpar village
17		Drain 1	Head
18		Collector 2 (Noramarg)	Noramarg village
19	II. Right-Side Hrazdan Collector	Collector 2 (Area I)	Head
20		Collector 3 (Area I)	Head
21		Collector 4 (Area I)	Head
22		Collector 6 (Area I)	Head
23		Right-Side Collector (Area I)	Before junction
24		Right-Side Collector (total) (Area I)	At the junction
25		Drain 10 (Area I)	Head
26		Right-Side Collector (Area I)	At the junction
27		Right-Side Collector (Area II)	Head
28		Collector 1	Head
29	III. Left-Side Hrazdan Collector	Left-Side Collector	Head
30		Drain 1 (Thermal Power Plant)	Head
31		Drain 4	Head
32		Nairit Outlet	Head
33		Left-Side Collector	At the junction
34	IV. Hrazdan-Araks Collector	Hrazdan-Araks Collector (Area 1)	Uch Qyorpi
35		Hrazdan-Araks Collector (Area 1)	Feeding Canal of Mkhchyan pumping station
36		Dotation Canal	By-pass
37		Hrazdan-Araks Collector (Area 2)	Araksavan
38		Hrazdan-Araks Collector (Area 2)	Gate
39		Hrazdan-Araks Collector (Area 2)	Head
40		Arazdayan Collector	Gate

Legend

- Pumping Stations
- Water Discharge Measurement Points on the Drainage System
- Canals
- Collectors
- Drainages
- River Network
- Community Boundaries
- State Border
- Ararat Valley Boundary
- Lakes, Ponds, Reservoirs
- Settlements

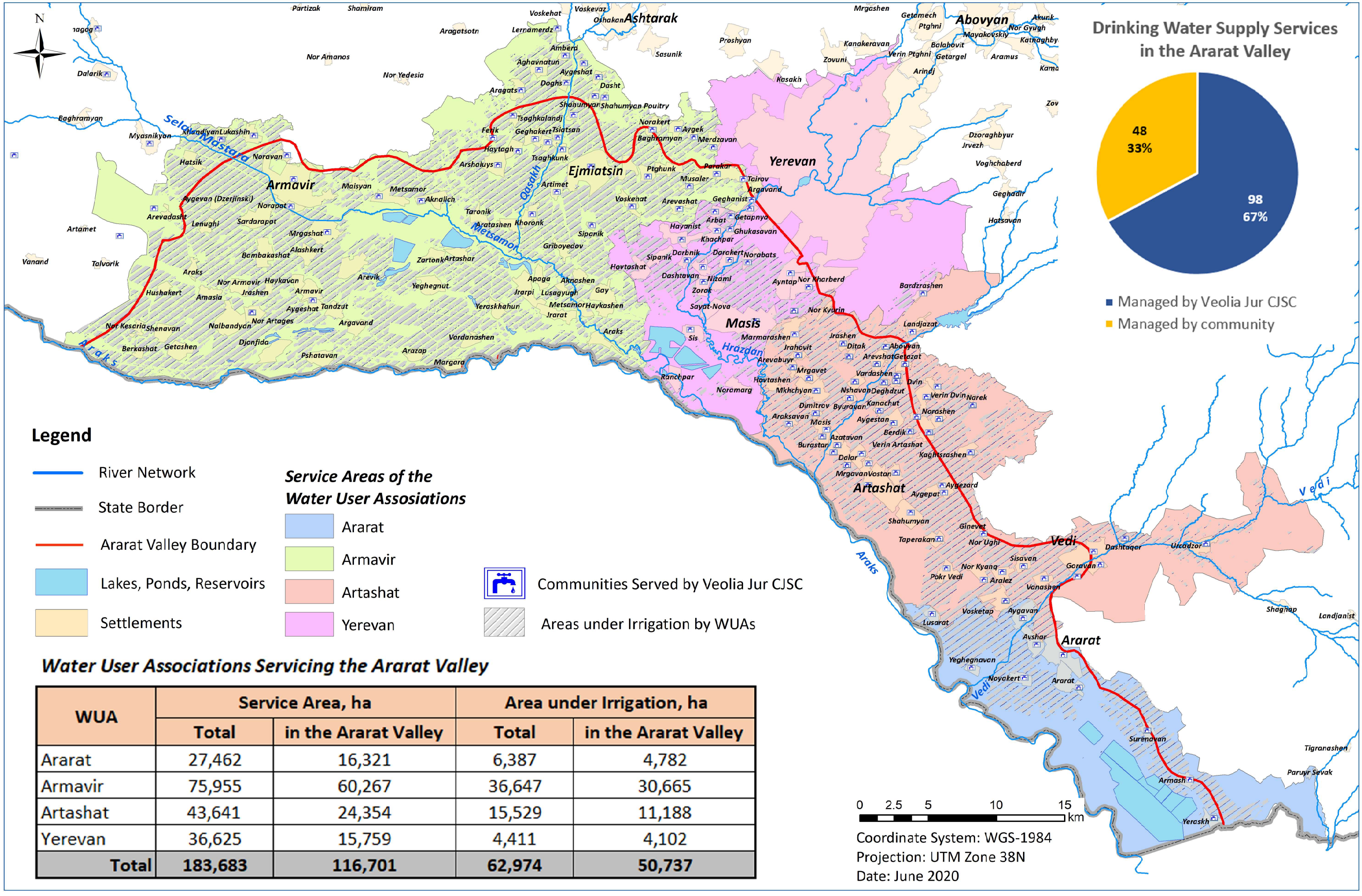
Basin Management Areas

- Akhuryan
- Ararat
- Hrazdan

0 2.5 5 10 15 km

Coordinate System: WGS-1984
Projection: UTM Zone 38N
Date: June 2020

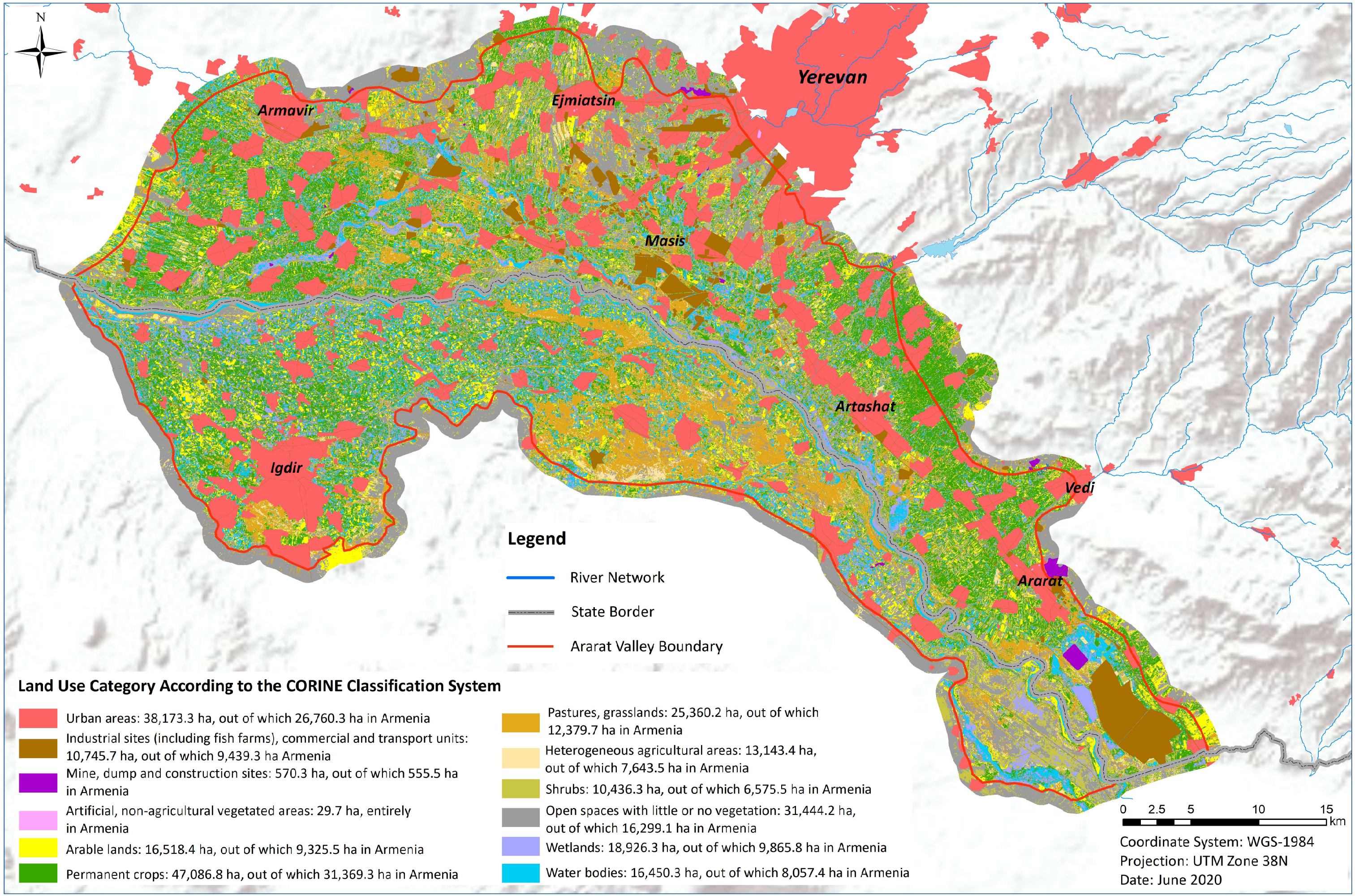
Water Supply Services in the Ararat Valley



Water User Associations Servicing the Ararat Valley

WUA	Service Area, ha		Area under Irrigation, ha	
	Total	in the Ararat Valley	Total	in the Ararat Valley
Ararat	27,462	16,321	6,387	4,782
Armavir	75,955	60,267	36,647	30,665
Artashat	43,641	24,354	15,529	11,188
Yerevan	36,625	15,759	4,411	4,102
Total	**183,683**	**116,701**	**62,974**	**50,737**

Land Cover/Use Map of the Ararat Valley



Land Use Category According to the CORINE Classification System

- Urban areas: 38,173.3 ha, out of which 26,760.3 ha in Armenia
- Industrial sites (including fish farms), commercial and transport units: 10,745.7 ha, out of which 9,439.3 ha Armenia
- Mine, dump and construction sites: 570.3 ha, out of which 555.5 ha in Armenia
- Artificial, non-agricultural vegetated areas: 29.7 ha, entirely in Armenia
- Arable lands: 16,518.4 ha, out of which 9,325.5 ha in Armenia
- Permanent crops: 47,086.8 ha, out of which 31,369.3 ha in Armenia
- Pastures, grasslands: 25,360.2 ha, out of which 12,379.7 ha in Armenia
- Heterogeneous agricultural areas: 13,143.4 ha, out of which 7,643.5 ha in Armenia
- Shrubs: 10,436.3 ha, out of which 6,575.5 ha in Armenia
- Open spaces with little or no vegetation: 31,444.2 ha, out of which 16,299.1 ha in Armenia
- Wetlands: 18,926.3 ha, out of which 9,865.8 ha in Armenia
- Water bodies: 16,450.3 ha, out of which 8,057.4 ha in Armenia

Geology of the Ararat Valley