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Improving water infrastructure in Azerbaijan using an expenditure support scheme

Designing and costing a green public investment programme

Action implemented by:

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Foreword

Public investment, backed by national governance or regulatory mechanisms, is an essential part of the transition to greener, more sustainable development. Since 2012, the OECD has provided support for capacity development to several countries in Eastern Europe, Caucasus and Central Asia (EECCA), with a view to enhancing the knowledge and practical skills of the local public authorities responsible for environmental and climate change policies in managing public environmental expenditure and assets.

The project “Designing Green Public Investment Programme and Conducting Training in Azerbaijan” was implemented from June 2021 to February 2022 under the “European Union for Environment” (EU4Environment) Action, in close co-operation with the Ministry of Environment and Natural Resources of Azerbaijan (MENR).

At the project launch meeting on 17 June 2021, the ministry and other stakeholders discussed and agreed upon the focus and scope of the proposed investment programme. Guest experts and representatives of other ministries, government agencies and enterprises involved in the water sector as well as the international community active in Azerbaijan confirmed the intention to focus the programme on the security of the water supply in areas exposed to the effects of climate change.

Prioritising the types of project that this investment programme should support was an important part of initial scoping discussions. Meanwhile, the project team gained insight into the complexity of the water supply in Azerbaijan, a significant part of whose water resources comes from outside the country.

Given the limited scope of this technical assistance and considering other ongoing projects that involve large-scale water supply measures, it was agreed that the focus should be on small-scale measures making use of the full range of the water sources available, such as underground water and small catchments (streams, small rivers). In addition to the water supply, the programme would include small-scale measures for irrigation and small wastewater systems in rural areas.

Developing the green public investment (GPI) programme included four main stages: 1) the initial scoping and data collection phase; 2) adjustment of the programming and costing methodology; 3) development of an investment programme in line with good international practices; and 4) preparation of an analytical report. The programme relies on publicly available data collected through desk research as well as information received in bilateral meetings with public and private sector experts in Azerbaijan. Other detailed data – for example on priority projects – were requested at bilateral meetings with state and public organisations and secured subsequently. Wherever possible, the most recent data were used (April 2022).

The activities, both analytical and practice-oriented, included programme design (main elements, methodology, costing model), as well as training on medium-term environmental and climate-related investment planning and management (selection procedures, project cycle management). The measures required to implement the programme were set out, including establishing the timeframe, allocating necessary human resources and adopting administrative procedures. Existing and potential domestic financing mechanisms (including public-private partnerships) were reviewed with a view to facilitating green investment.

The project was undertaken by the OECD in collaboration with MENR, its main counterpart in Azerbaijan in the EU4Environment's Activity Area 3.3. As a major player in environmental and climate change policy, the ministry had an important role in setting the direction (focus) of the programme and co-ordinating the project at the national level. Activity Area 3.3 of the EU4Environment, and its Work Plan for Azerbaijan, will provide technical assistance and capacity development to help government authorities manage public environmental expenditure and resources.

The chief goal of technical assistance was to offer government officials and experts in Azerbaijan know-how and practical skills for designing a public environmental expenditure programme. Such programmes help to obtain adequate resources from the public budget and to leverage international co-financing. Designed in line with international good practices, the programme can serve as a model for preparing other low-carbon public investment programmes within national medium-term expenditure frameworks (MTEFs).

At the two stakeholder meetings and at bilateral meetings held virtually and in person, as the pandemic allowed, other local and international institutions and experts helped design the programme. Better communication between the public administration, citizens and other stakeholders (depending on the type of the programme) will ultimately increase the sustainability of the investment planned.

The project also aimed to facilitate knowledge transfer and experience-sharing between the EU and its Eastern Partnership (EaP) countries on best practices and lessons learnt in preparing large-scale national public support programmes. The project has thus also supported complementary activities and requirements to ensure a successful launch of the programme.

In January 2022, in connection with this project, the OECD held a webinar with water sector experts in the EU countries. The goal was to facilitate knowledge transfer and experience-sharing between the EU and countries in the EaP region on approaches to water supply and sanitation in remote areas. It was also intended to help countries in the region leverage private (non-state) investments in equipment and technologies that divert environmental and climate-related problems connected with the water supply.

The OECD was supported by a team of international and national consultants (contractors and sub-contractors) with experience and practical expertise in preparing, costing and managing multi-year public environmental investment programmes, as well as by the EU4Environment National Action Co-ordinator in Azerbaijan.

The study was prepared with financial support from the EU's "European Union for Environment" (EU4Environment) Programme and Germany's Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, through its International Climate Initiative.

The views expressed in this report are those of the authors only and can in no way be taken to reflect the official opinion of the European Union, its members, the governments of the EaP countries or the EU4Environment implementing partners (OECD, United Nations Economic Commission for Europe, United Nations Environment Programme, United Nations Industrial Development Organization and the World Bank).

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List of abbreviations and acronyms

AAWF	Azerbaijan Amelioration and Water Farm
AZN	Azerbaijani manat
CPT	Clean Public Transport (OECD programme)
DID	District irrigation department
EaP	Eastern Partnership (of the European Union)
EEA	European Environment Agency
EECCA	Eastern Europe, Caucasus and Central Asia
EGS	Ecosystem goods and services
EPIRB	Environmental Protection of International River Basins
EPR	Environmental performance review
EU	European Union
EU WFD	European Union Water Framework Directive
EUR	Euro (Eurozone currency)
EUWI+	European Union's Water Initiative Plus
EWEIS	Electronic Water Economy Information System
FAO	Food and Agriculture Organization
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse gas (emissions)
GoA	Government of Azerbaijan
GPI	Green public investment
HDPE	High-density polyethylene
IFI	International financial institution
IU	Implementation unit

IWRM	Integrated water resource management
KfW	KfW Development Bank (*Kreditanstalt für Wiederaufbau*)
MA	Ministry of Agriculture of Azerbaijan
MA-PCS	Phytosanitary Control Service
ME	Ministry of Energy of Azerbaijan
MENR	Ministry of Ecology and Natural Resources of Azerbaijan
MENR-EcPD	MENR Ecological Policy Division
MENR-EnPD	MENR Environmental Protection Division
MENR-NEMD	MENR National Environmental Monitoring Department
MENR-NGES	MENR National Geological Exploration Service
MENR-NHS	MENR National Hydrometeorological Service
MENR-SEEA	MENR State Environmental Expertise Agency
MES	Ministry of Emergency Situations of Azerbaijan
MH	Ministry of Health of Azerbaijan
MH-CHE	Ministry of Health Centre for Hygiene and Epidemiology
MTEF	Medium-term expenditure framework
NCF	Net cash flow
NGO	Non-governmental organisation
NPD	National Policy Dialogue
NPV	Net present value
NWS	National Water Strategy
OECD	Organisation for Economic Co-operation and Development
OJSC	Open joint stock company
OPTIC	Optimising Public Transport Investment Costs (OECD model)
PCM	Project cycle management
PE	Polyethylene
PE	Programming entity
Pers	Person
RBMP	River basin management planning
RWA	Regional Water Administration
RWR	Renewable water resources
SAARES	State Agency for Alternative and Renewable Energy Sources
SDG	Sustainable Development Goal

SEIS	Shared Environmental Information System
SOCAR	State Oil Company of Azerbaijan
TSU	Technical support unit
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USD	United States dollar
WUA	Water users association
WUA-ISF	WUA Irrigation service fee

Units

ha	Hectare
km	Kilometre
km^2	Square kilometre
km^3	Cubic kilometre
l	Litre
m	Metre
mg	Milligramme
mm	Millimetre
MW	Megawatt
m^3	Cubic metre

Executive summary

What will the programme involve?

The study conducted a market analysis that identified three groups of projects ("pipelines") to ensure safe domestic drinking water supply, secure irrigation water, reduce pollution from wastewater, and reduce water losses:

1. **Water supply**: Investment in increasing coverage of the drinking water supply, by constructing water intakes and wells, pumping stations and a water distribution network with all supporting elements.
2. **Irrigation**: Investment in irrigation and drainage networks by rehabilitating the existing, deteriorated, infrastructure. This will also have the benefit of increasing groundwater recharge rates and reducing soil salination.
3. **Wastewater**: Investment in small-scale wastewater collection network and wastewater treatment plants.

The green public investment (GPI) programme involves two phases: the first (pilot) phase and the second (scaling-up) phase.

The first (pilot) phase will be launched on a smaller scale, in geographical area, number of beneficiaries and also the finances required. It will cover three districts in two economic regions – Astara and Lerik districts in the Lankaran-Astara economic region and Dashkasan district in the Ganja-Dashkasan economic region. The focus of the pilot phase will be on rural areas of these three districts, with a combined rural population of 173 000, which have a low water supply and wastewater connection rate.

In Phase 1, investments in water supply infrastructure will provide 83 000 inhabitants of rural areas with drinking water. The connection rate will increase from 50% to 98% in the three priority districts (Astara, Lerik and Dashkasan). The investments will include construction of water wells or spring capture, pumping facilities, water treatment plants (depending on the quality of water), water storage if needed, the distribution network (pipes, valves, manholes, pumps), connections to households and water meters. Rather than using the new water source, connection to neighbouring existing water distribution systems will also be considered.

In the first phase, 34 000 hectares of agricultural land will be irrigated from rehabilitated irrigation systems – accounting for 30% of the existing 115 000 hectares of irrigated area in the Lankaran-Astara economic region. The types of investments include rehabilitation of canal mains, rehabilitation of off-farm canals, in-farm canals and on-field canals, construction of new canals, and rehabilitation of hydro-junctions, pumping stations and sub-artesian wells, main collectors, closed catchment drains, closed drains and of existing small reservoirs or water storage.

A target of an additional 10 000 people in rural areas in the Astara, Dashkasan and Lerik districts will be connected to wastewater facilities. The investment includes small wastewater treatment plants, wastewater collection systems (pipelines and pumping stations if needed).

The second (scaling-up) phase will extend the pilot phase, covering more settlements and districts in the two Phase 1 priority regions (Lankaran-Astara and Ganja-Dashkasan). These will also be primarily rural areas, where water supply connection rates are much lower than in urban areas. In total, the investments will cover a rural area with a population of 1.22 million. The focus of the irrigation will be the Gazakh-Tovuz and Ganja-Dashkasan economic regions.

In Phase 2, the programme will focus on drinking water supply in additional districts and settlements in the priority regions – Lankaran-Astara and Ganja-Dashkasan economic regions. In the scaling-up phase, an additional 465 000 of the residents in rural areas will get access to drinking water supply, and the connection rate will increase from 60% to 98% in the additional selected districts.

In Phase 2, irrigation facilities for over 35 000 hectares in the Gazakh-Tovuz economic region (which covers 118 000 hectares) and over 23 000 hectares in the Ganja-Dashkasan economic region (78 000 hectares) will be rehabilitated, so that 59 000 hectares of agricultural land, 30% of the existing irrigated area, will be covered by rehabilitated irrigation systems.

Phase 2 is not expected to include any new investments in wastewater infrastructure. The investments from the pilot phase will be evaluated and the programme updated if necessary for this type of investments.

The target by 2030 is to connect 548 000 residents in rural areas to the drinking water supply in Phase 2, increasing the connection rate from 50%-60% to 98% in selected districts in the Lankaran-Astara and Ganja-Dashkasan economic regions. This will rehabilitate 93 000 hectares of irrigation infrastructure in the Lankaran-Astara, Gazakh-Tovuz and Ganja-Dashkasan economic regions. By 2030, it is also hoped to connect 10 000 of the population in the three priority districts in Lankaran-Astara and Ganja-Dashkasan to wastewater facilities.

A possible future third phase to further scale up the potential described in the market analysis may be undertaken after 2030.

The GPI Programme costs and benefits (reduction of emissions of greenhouse gases) were calculated for the pilot and second phases using OPTIC, the OECD's Excel-based model. Although no sensitivity analysis for the scenarios was conducted, the programme's cost-effectiveness could change if the prices used for the costing vary.

The investment cost of the pilot phase (over two years) is estimated at AZN 154 million, and that of the scaling-up phase (year three to year eight of the programme) at AZN 544 million, for a total estimated cost of AZN 698 million. Of the total investment cost, public support of AZN 485 million will be needed, including preparation and implementation expenses of almost AZN 2 million.

What does the programme aim to achieve?

The environmental objective of the programme is to support investment in rehabilitating infrastructure for irrigation channels and water/wastewater pipelines.

Inefficient irrigation can lead to soil salination and lower groundwater levels, and, in general, to a higher concentration of natural and human pollutants in the soil. Equally, lack of wastewater infrastructure can cause soil and water contamination. Improving these two environmental factors can improve residents' health by reducing toxins, bacteria and other contaminants and preventing the spread of disease.

Extended and more reliable water supply and irrigation infrastructure can increase economic growth, by boosting agricultural production and reducing the costs of water treatment. Providing access to good water reduces the time that individuals and communities must spend on this basic human need. Time spent gathering water reduces the time that women and girls in particular can spend on education or work opportunities.

The programme is also designed to contribute to Azerbaijan's climate change adaptation efforts and its transition to a green economic model of development.

How will it be run and financed?

The costs of the GPI Programme will be substantial, and it will be challenging for the public budget to cover all these costs alone. In addition to public financial support, international public co-financing will also be needed. The private sector should cover the remaining financing.

The proposed financing instruments are as follows: public subsidies (grants) to motivate private and public beneficiaries to use their own financial resources to purchase new equipment or installations. These generally require a higher initial investment in purchase cost, but offer the benefit of lower operating costs in future, by reducing water loss.

Co-financing from the state budget is a typical source of financing for state environmental programmes. Given Azerbaijan's budget constraints, only part of the programme costs can be co-financed by the state budget. Demonstrating commitment, however, will be important to encourage potential donors or international financial institutions (IFIs) in securing international co-financing. Regardless of the share of co-financing from the state budget, this must be carefully planned in the budget process and included in documentation on the mid-term expenditure framework (MTEF) and Basic Data and Directions.

Creating the policy framework for green investment

The GPI Programme to improve conditions for water supply and irrigation in Azerbaijan requires commitment on the part of the Government of Azerbaijan in three main areas: policy and regulatory commitment and reform, financial commitment, and institutional set-up.

The success of any GPI programme depends first and foremost on the government's commitment to integrating the programme into national policy, strategic documents, action plans, and budget allocations.

As for policy and regulatory commitment and reform, a major obstacle for the investment programme is the low price of water in Azerbaijan for all uses, in particular for irrigation. The programme may face several barriers in the second (scale-up) phase for similar reasons, the most important of which is the lack of cost recovery tariffs for water supply, wastewater treatment, and irrigation and drainage.

Regulatory barriers may complicate the implementation of even a well-designed investment programme. It is important that before a programme is developed and financed, the Government of Azerbaijan reviews the relevant regulatory basis and eliminates any barriers as far as possible.

As for financial commitment, the economic analysis shows that under current conditions, the level of public support must be very high (between 50% and 75%) to ensure the interest of potential beneficiaries.

Finally, the optimal institutional set-up should be selected only after all elements of the programme have been clarified and consensus has been reached on its priorities. Whatever kind of institutional set-up is chosen, management of the programme should involve an institutional structure and procedures that promote environmental effectiveness, embody fiscal prudence, and use financial and human resources efficiently. The government then needs to make sure that sufficient resources, qualified staff and instruments are provided to run the programme.

1 Introduction

This chapter presents Azerbaijan's renewable water resources in the light of the country's geographical features and climate conditions. It touches upon the main challenges of the sector, such as water shortages and uneven water distribution, as well as on certain policy shortcomings, including the lack of reliable data on groundwater resources and of economic data on water use. The introductory chapter also includes a brief overview of the challenges Azerbaijan is likely to face, such as rapid demographic development and economic pressure on its resources, including water. The chapter provides a brief overview of the main water infrastructure and the associated need for better maintenance and more sustainable practices in various sectors, above all in agriculture. The section concludes with an introduction to the technical assistance provided by the OECD and the main activities and approaches that have been used to design a green public investment programme in the water sector.

Azerbaijan's renewable water resources

Renewable water resources include endogenous water supplies (precipitation), surface water and groundwater. Although the recharge of aquifers is supported throughout the hydrological year by rainfall and internal flow of the rivers, surface waters and groundwater flowing from neighbouring countries (external inflow or inflow from upstream countries) is an important part of renewable water resources in Azerbaijan (EEA, 2020[1]).

Sources of surface water in Azerbaijan are primarily rivers, lakes and water reservoirs. The hydrographic network also includes glaciers, and the waters of the Caspian Sea, which can be used in industrial cities. All Azerbaijan's rivers flow into the Caspian Sea drainage basin, one of the largest non-flowing basins in the world. The surface water hydrography is divided into three groups:

- the Kura River (and its right and left tributaries)
- the Aras River (and its left tributaries)
- rivers indirectly flowing into the Caspian Sea.

Main reserves of surface water are accumulated in the rivers and water reservoirs. Azerbaijan has a network of 8 359 rivers, the majority of which (7 861) are less than 10 km.[1] A majority of these rivers (5 141) flow to the Kura and to the Aras (3 964 and 1 177, respectively).[2]

A significant proportion of the surface water in Azerbaijan is locally produced. About 25% (or 6.5 cubic kilometres/year) of the discharge of the Kura River into the Caspian Sea is from Azerbaijani national rivers. The majority are not perennial or disappear underground before reaching the sea (UNECE, 2011[2]).

The main rivers of Azerbaijan are:

- Kura (length, 1 515 km; basin size, 198 300 km^2)
- Aras (1 072 km, 102 000 km^2)
- Alazani/Ganikh (391 km, 11 455 km^2)
- Iori/Gabirri (320 km, 4 650 km^2)
- Samur (216 km, 7 330 km^2)
- Tartar (200 km, 2 650 km^2), etc.

All major rivers except the Tartar are transboundary rivers, with 22 in total. Kura and Aras are large rivers originating in the mountains of north-east Turkey that play a significant role in the overall water balance of Azerbaijan.

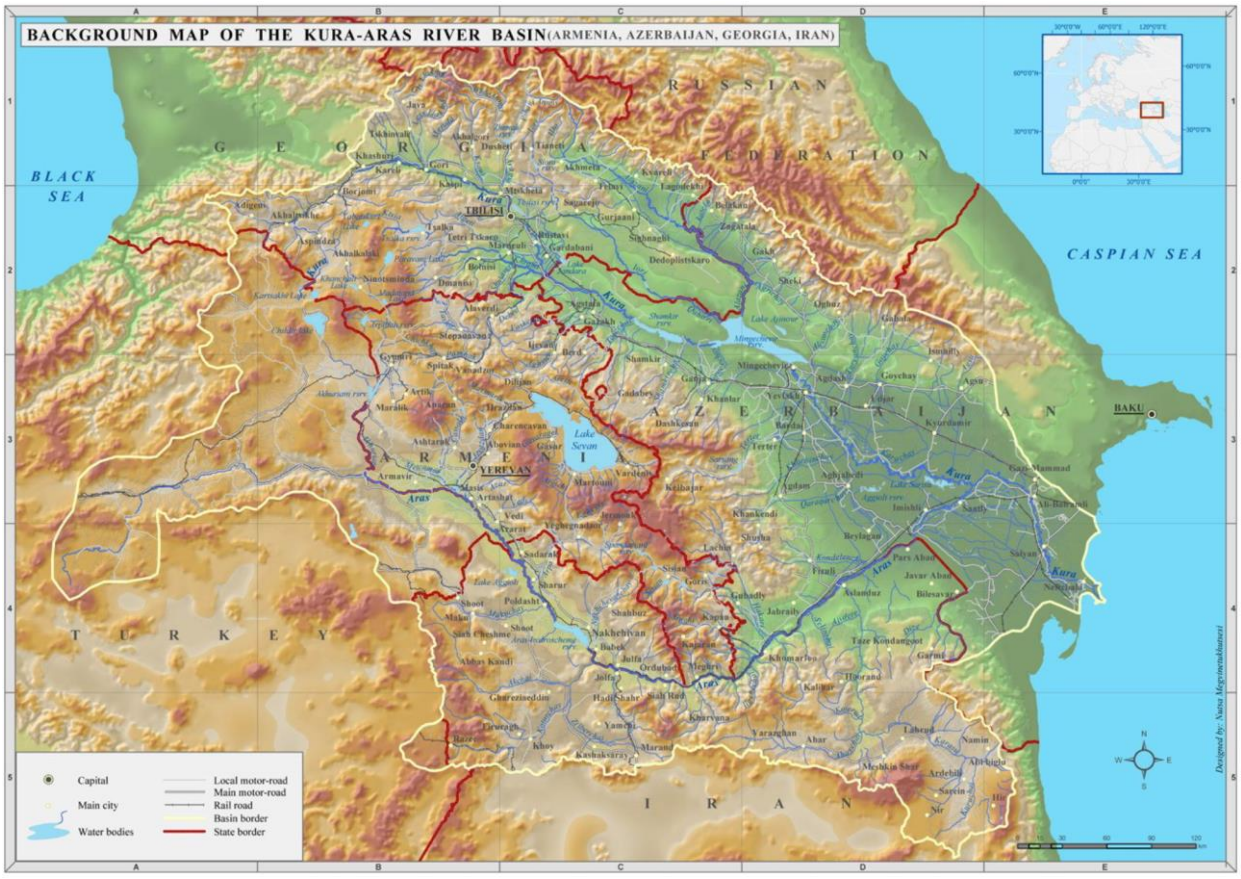
The Kura River (known as Mtkvari in Georgian) is the main water body in the Caucasus region. It originates in northeastern Turkey and drains the water in the Greater Caucasus and the south side of the Lesser Caucasus Mountains. Its main tributary, the Aras River, drains the north side of the Lesser Caucasus. The Kura River basin covers 80% of Azerbaijan, and more than 70% of the country's drinking water supply depends on the Kura River (UNECE, 2011[2]). Beyond Azerbaijan, the Kura River basin includes areas of Georgia, Armenia, the Islamic Republic of Iran and Turkey.

The Aras River is the second-largest river in the country and a right tributary of the Kura River. It rises in eastern Turkey and drains the south side of the Lesser Caucasus Mountains, while the Kura drains the north side. At more than 1 000 kilometres, it is one of the longest rivers in the Caucasus. It flows along or forms the border between Turkey and Armenia, Turkey/Iran and Azerbaijan (the Nakhchivan exclave), Armenia and Azerbaijan, and Iran and Azerbaijan.

The Kura-Aras river system is the principal source of water for industry, agriculture, residential use and energy in three riparian states of the South Caucasus, as well as a sizeable part of the population of Iran.

The basin covers almost all of Armenia, a significant part of Azerbaijan and the populated and urbanised parts of Georgia in the eastern part of the country. The basin also spreads over the northwestern part of Iran and territories of northeast Turkey. The Kura and the Aras contribute about 66% and 34% respectively to the total runoff. There are more than 10 000 rivers in the basin, including many small shallow rivers (UN-Water, 2007[3]).

Figure 1.1. Kura-Aras River Basin geographical map



Source: Kura-Aras River Basin Transboundary Diagnostic Analysis, 2007.

In the northeastern part of the country and the Absheron Peninsula, drinking water supply and irrigation is provided by the Samur River, via the Samur-Absheron channel. The channel provides water along its way from the border with the Samur River, with a basin area of 4 400 km^2 and has an important role in the country. The Russian Federation, however, aims to increase the utilisation of water on its territory (so that it is more evenly shared between the countries), which would result in a reduction in the water available to Azerbaijan (UNECE, 2011[2]); (EEA, 2020[1]).

Azerbaijan has 140 water reservoirs and artificial reservoirs, with a total area of 982.8 km^2 and total volume of 21 464 million cubic metres (m^3) (GoA, 2021[4]). Of these, 63 reservoirs have a volume of over 1 million m^3, of which only four are larger than 1 000 million m^3 (i.e. 1 km^3) – Mingachevir, Shamkir, Yenikend and Aras. The Mingachevir reservoir on the Kura River is the largest, with a capacity of 15 730 million m^3 and is also fed by the Alazani River. The reservoir was built in 1953, together with a hydropower plant, the largest in Azerbaijan, with an installed capacity of 401.6 megawatts (MW). It is also used for irrigation (the Upper Karabakh, and the Upper Shirvan canals irrigate the lands of the Kura-Aras

lowland) (UNECE, 2011[2]). Other complex water facilities and hydropower plants were built on the Kura, Aras and Tartar rivers (e.g. Shamkir, Yenikend, Varvara, Aras and Sarsang) (GoA, 2021[4]).

Azerbaijan has around 450 lakes, providing freshwater resources of 0.90 km^3 (UNECE, 2011[2]). Their total area is about 395 square kilometres (km^2), but only 10 lakes are larger than 10 km^2. The country's largest lake is Sarysu, in the Kura-Aras lowland (with a water surface area of 65.7 km^2 and a volume of 59.1 million m^3) (GoA, 2021[4]).

The Caspian Sea is the largest inland body of water in the world. Its water balance is mainly influenced by about 130 rivers flowing into the sea (UNECE, 2011[2]), and it has historically been subject to significant fluctuations. From 1930-1977, the water level dropped by 28 metres, whereas in the 1990s, it rose annually by 12 to 14 centimetres. In recent years, the fluctuations in the water level were 10%-20%, on average covering an area of 370 000 km^2 (GoA, 2021[4]).

Figure 1.2. Drainage basins of the Kura and Aras rivers

Source: European Union Water Initiative Plus.[3]

Similar to surface waters, Azerbaijan's groundwater resources are limited and unevenly distributed. Renewable groundwater resources are estimated at 86.7 km^3/year and mainly restricted to the foothills and intermountain plains of the Greater Caucasus, Lesser Caucasus, Nakhchivan and Talysh (UNECE, 2011[2]). The unequal distribution of Azerbaijan's groundwater resources is not only regional, but seasonal. The groundwater levels rise mainly during the irrigation period, due to the loss of water from canals and fields, which leaches into the lower layers of the soil and increases its level and volume (GoA, 2021[4]).

The water quality suffers from high salt content in the lowlands (nitrites up to 1.2 mg/l and nitrates up to 75 mg/l), mineral oil contamination in some areas, such as the Absheron Peninsula (up to 50 mg/l), industrial

pollution, e.g. Sumgait (heavy metals) and Ganja (aluminium up to 3.5 mg/l and iron up to 50 mg/l), or bacteriological pollution of the upper aquifers in the irrigated areas, towns and on cattle farms. In addition to the fact that Azerbaijan has no quality standards for groundwater, there is no classification for groundwater types (UNECE, 2011[2]). Still, thanks to its thermal energy and hydromineral content, the groundwater has played an important role in Azerbaijan's economy and the health sector (e.g. iodine-bromine water deposits) (GoA, 2021[4]).

Climate and water distribution in the country

As indicated in the previous section, Azerbaijan is endowed with relatively less water resources than other countries. Azerbaijan's water resources account for only 15% of water resources formed in the South Caucasus and 67%-70% of river water resources originate in the territory of neighbouring countries (GoA, 2021[4]). Due to the unequal distribution of water resources within the country, many regions experience water shortages.

This is largely the result of Azerbaijan's geophysical features, shaped mainly by mountains and lowlands. Its eastern border is entirely formed by the long Caspian Sea coastline, and the centre of the country consists of wide flatlands, i.e. the Kura-Aras Lowland. It is the largest intermontane lowland in the Caucasus (GoA, 2021[4]) and is divided into five plains by the Kura and Aras rivers: Shirvan, Karabakh, Mil, Mughan and Salyan plains. These are ringed by the mountain ranges of the Greater and Lesser Caucasus. The Greater Caucasus Mountain Range forms part of Azerbaijan's northern border with the Russian Federation (almost reaching Baku on the Caspian's Absheron Peninsula).

The Greater Caucasus includes the country's highest peak, Mount Bazardüzü, at 4 466 m above sea level. The Lesser Caucasus range in western Azerbaijan, running almost parallel to its greater northern sibling (historically sometimes called the Anti-Caucasus), is smaller. Its highest peak is Gapichig, at 3 906 m (in the Zangezur range), forming part of the border with Armenia. The far southeast border of Azerbaijan is formed by the Talysh Mountains, adjacent to the Lankaran Lowland, and forms a transition from the Lesser Caucasus to the Elburz Mountains in the Islamic Republic of Iran.

Taken together, the three mountain systems cover about 40% (UNECE, 2011[2]) of the total land area of 86 600 km^2 (Azerbaijan is the largest of the three South Caucasus countries). About 27% of its area is 1 000 m above sea level,[4] and the Caspian lowland is currently minus 26.5 metres below sea level (including Kura-Aras, Samur-Davachi, Lankaran lowlands and the Absheron Peninsula (GoA, 2021[4]).

Azerbaijan's geographical position in the Caucasus, that is, its physical relief and the proximity of the Caspian Sea, strongly influence its climate. This varies from subtropical and dry in central and eastern parts of the country, where winters are relatively mild with high precipitation and summers are hot, dry and long. Although these conditions are typical for Azerbaijan, the country's climate also extends to subtropical and humid zones in the southeast. Eight of the 11 climate types on Earth (according to V.V. Keppen) can be identified in this area: semi-desert, subtropical, temperate or cold climate (GoA, 2021[4]).

Like the surface and groundwater, which flows in from neighbouring countries throughout the hydrological year, precipitation is unequally distributed over Azerbaijan's territory, both in terms of location as well as time of year. Seasonally, the bimodal distribution of precipitation shows average levels above 40 millimetres (mm) per month from April to June (with over 100 mm per month in May and June in the northern and western areas of Azerbaijan), and again in October.[5]

In general, the mountainous parts of Azerbaijan have higher levels of precipitation and lower average temperatures than the central lowlands and Caspian Sea coast, where the climate is drier and hotter. The foothills of the Talysh Mountains have as much as 1 600-1 700 mm annually, whereas for the western part of the Absheron Peninsula, totals are as low as 150 mm to 200 mm. Annual precipitation is less than 400 mm in 65% of the country, however, with significant inter-annual variations. Temperature maxima

range from -32°C to +46°C (GoA, 2021[4]). Net precipitation (internal flow as the difference between precipitation and actual evapotranspiration) replenishes surface run-off to rivers, lakes and recharge groundwater aquifers (EEA, 2020[1]). The evaporation indexes run as high as 93% of annual precipitation, whereas the evaporation indexes in the basin are 61% in Armenia and 50% in Georgia) (UNECE, 2011[2]). Even if the annual precipitation rate remains unchanged, as has been the case in Azerbaijan recently, with the increasing temperatures, the evaporation rate will also increase, decreasing river flows in the Azeri part of the basin (UN-Water, 2007[3]).

Trends in water quality and availability

Despite a general lack of reliable data reported by many recent studies, whether the quantity and quality of groundwater resources (EEA, 2020[1]) or basic economic data on water use (that would, for instance, make it possible to produce reliable and complete cost and benefit estimates (Strosser et al., 2017[5]), it is also reported that Azerbaijan's water resources have decreased by 15% in recent decades. Its inland water resources currently consist of 15% of the water resources of the South Caucasus, mainly as a result of climate change (GoA, 2021[4]).

According to the data published by the European Environment Agency (EEA), Azerbaijan was prone to water scarcity in the period 2000-2017, when the availability of renewable water resources (RWR) was reduced by 27%. Given its dynamic population trend, a remarkable increase of 22% in the period, combined with a sharp decline of internal flow and inflow of water from other countries, the RWR per capita in Azerbaijan fell by 40% (EEA, 2020[1]).

In sum, Azerbaijan's RWR availability was the lowest of the six Eastern Partnership (EaP) countries, a situation that can be largely attributed to its natural conditions.[6] In the EaP region, Azerbaijan is most heavily dependent on the inflow of surface water and groundwater from neighbouring countries, with an average dependency ratio for upstream water greater than 70% of its total RWR (as compared to 38% for the next-ranking country, Belarus) (EEA, 2020[1]). The mountainous areas of Armenia and Georgia, by contrast, have abundant water resources.

However, compounding the natural conditions, ineffective water demand management in Azerbaijan has led to long-term water scarcity. In 2017, Armenia and Azerbaijan overexploited RWR for agriculture and public water supply, with an estimated water exploitation index of 61% and 72% respectively (EEA, 2020[1]). Although the Kura-Aras river basin does not yet have a serious water deficit, accelerated economic activities in the basin since the 1950s have increased pressure on surface water and groundwater resources. Azerbaijan has approximately eight times less water than Georgia, measured both per square kilometre and per person (UN-Water, 2007[3]).

Azerbaijan's economic growth in the second half of the twentieth century brought higher competition for water resources, including large-scale irrigation, flood control and hydropower schemes. It has higher levels of waste (whether wastewater or solid waste), from urbanisation (domestic waste), increased industrial production and extensive agriculture practices (use of fertilisers and pesticides), the residues of which may penetrate into surface water and groundwater. Not least, improved provision of drinking water has increased water withdrawals from surface and groundwater bodies (UN-Water, 2007[3]).

The hydropower sector has exacerbated concerns about changes in the natural river flows. This sector is one of the main competitors for water use in the Kura-Aras river basin, especially in upstream countries. In the 1950s, the Soviet Union started building many dams and canals on the Kura River, and the associated irrigation projects and hydroelectric power stations have led to variation and reduction of hydrological flow, i.e. made the river shallower and flow more slowly. Although hydropower generation is considered a non-consumptive water use, it competes for water resources with agriculture, especially in the summer months, as observed in Georgia and Azerbaijan (UN-Water, 2007[3]).

As noted in the previous section, the level of rainfall is connected with diversified climate conditions on the territory of Azerbaijan, which vary from semi-arid and dry in the central and eastern parts of the country (including the capital, Baku), to subtropical and humid in the southeast. Within its nine climate zones (out of a total of 11), there are also temperate zones in the north, continental zones in the west, and tundra zones, resulting in marked variations in average annual temperature and precipitation in different regions.[7]

Apart from the Lankaran lowland, other agricultural regions rely heavily on irrigation.[8] After the land reform in 1993-2003, uniform and planned cropping disappeared, being gradually replaced by a more diversified system of individual farms, with 3.5 million new landowners holding smaller strips of land.[9] This poses another challenge: finding new effective irrigation techniques to meet Azerbaijan's development goals. The previous system of interconnected irrigation networks helped to create one of the most productive agricultural areas on Earth.[10]

As noted, downstream countries in the South Caucasus have been affected by reduced hydrological flows. In addition, most irrigation canals in Azerbaijan (as in Armenia and Georgia) are open and unlined, with high filtration rates. Water losses can be as much as 40% to 60%, exacerbating water shortages, and affecting mainly water-intensive crops (which are often irrigated only twice, rather than the typical six to seven times). Much of the land irrigated by pumped systems in the Soviet period, however, would not be economical to restore, and many of the built off-channel and on-channel reservoirs have had a negative environmental impact (UN-Water, 2007[3]).[11]

In addition to unsustainable water abstraction, the water quality both of local rivers in Azerbaijan and of transboundary rivers coming into the country from regions upstream has deteriorated. In the Kura basin, water pollution is caused by a number of land-based sources, including industrial and mining sites, agricultural lands, and households in rural areas and municipalities. In the case of the Aras River, the pollution comes from urban areas, agriculture, and industry and mining in both Armenia and Iran. Another major concern is heavy metal pollution from metallurgical and mining sites in Armenia and Turkey (UN-Water, 2007[3]).

In Azerbaijan, downstream irrigation reservoirs are contaminated by significant discharges of untreated municipal wastewater into the Kura River in Georgia, particularly in Tbilisi and Rustavi. But it is not only Georgian municipalities that suffer from a lack of functional wastewater treatment plants. The majority of Azerbaijan's small towns and settlements lack sewerage systems. Large towns and cities have simple mechanical sewage treatment facilities, but these were mostly constructed in 1970s and suffer from neglected maintenance. Some industrial enterprises have local wastewater treatment facilities, many of which are no longer operational (UN-Water, 2007[3]).

Solid waste management poses another challenge, with water quality compromised by the dumping of untreated municipal, industrial, medical and agricultural waste. Agricultural pollution is exacerbated by unregulated use of fertilisers and discharges of animal slurry from cattle and pig farms, especially when snow melts in the spring (UN-Water, 2007[3]). Apart from new systems operating in Baku, most of the waste in the regions is collected in open dumps, where pollutants from waste buried in these areas mix with groundwater. Some landfills are located directly along rivers and floodplains, and require special attention (GoA, 2021[4]).

Generally, the quality of the surface water in Azerbaijan's local rivers only improves where population is minimal (for instance, in the section between the Georgian-Azerbaijani border and Mingachevir reservoir) (UNECE, 2011[2]). At the same time, polluted water resources not only have a local effect, in contaminated water, but can also be observed indirectly, in agricultural production and transported food products (UN-Water, 2007[3]).

In addition to excessive water abstraction, deforestation causes flow reduction. The upper part of river catchment areas, in particular, in the mountainous regions, has led to poor soil protection, with damaging mudslides. The erosion causes high river turbidity, and the Aras River, for example, is said to be one of

the most turbid in the world. When increased sedimentation in the riverbed is combined with increased water level in the Caspian Sea, floods occur frequently, as is the case downstream of the confluence of the Aras River (UNECE, 2011[2]). Land degradation is also partly caused by the construction of large reservoirs in the Kura-Aras river basin, where forested areas were cleared. Despite extensive investments in flood control plans, flooding and mudflow events in the Kura-Aras basin have adverse economic and social implications for the basin countries (UN-Water, 2007[3]).

Table 1.1. Key benefits of improved water resource management presents a simplified benefit inventory framework proposed in an OECD working paper on the Kura River basin and an assessment of transboundary co-operation between Azerbaijan and Georgia (Strosser et al., 2017[5]). It focuses only, however, on the potential benefits both for basic human needs and activities (whether economic or recreational) and for habitat, and does not address the associated benefits of regional co-operation or reduced political tension.

Table 1.1. Key benefits of improved water resource management

Benefits	EGS Type	EGS	Associated benefits	Specification (if applicable)
Increased water quantity	Provisioning services	Water supply increased (or more stable)	Agricultural production increased (or more stable) income from agricultural activities	
			More secure drinking water supply	
			Increased (or more stable) industrial production	
			Increased (or more stable) capacity of hydropower generation	
	Habitat services	Maintenance of biodiversity	Improved ecosystem functioning and integrity	Minimum ecological flows
Improved water quality	Provisioning services	Water supply	Reduced health risks Reduced treatment costs	Clean drinking water: reduced nitrates (and other mineral pollutants)
				Safe drinking water: reduced toxins, bacteria and other contaminants
		Food supply	Regeneration and increase of fish and shellfish stocks	
			Safe food available for consumption	Toxins, bacteria or other contaminants
	Habitat services	Maintenance of biodiversity	Regeneration of existing species and re-installation of previously disappeared species	Improved water quality
	Cultural and amenity services	Opportunities for recreation and tourism	Safer contact waters: improved swimming conditions	Nitrates and phosphorus – toxins, bacteria and other contaminants
			Surface water recreation	All recreational use

Note: EGS = Ecosystem goods and services.
Source: Modified from "The Potential Benefits of Transboundary Co-operation in Georgia and Azerbaijan: Kura River Basin, 2017".

Research by the Center for Climate Change of the Ministry of Ecology and Natural Resources of Azerbaijan and calculations based on a modern model for 2021-2050 and 2071-2100 show that natural water resources are gradually decreasing, and that this trend will continue (GoA, 2021[4]). Azerbaijan already has a shortage of water, largely attributable to losses in water systems. Reducing and ultimately preventing these losses is essential to avoid further deterioration of the situation. Significant changes in water resources by 2050 can also not be excluded.

According to climate models, precipitation is likely to decrease, with runoff expected to drop 15%-20% by 2100. The most vulnerable sectors in the future will be agriculture, hydropower and the water supply. The volume of water per capita will significantly decrease, given predictions that Azerbaijan's population will double or increase by a factor of 1.5 in the period to 2100.

Forecasts for irrigation norms suggest that as a result of the decrease in water resources, the amount of water available for 200 000-300 000 hectares of irrigated land will be reduced. This, in turn, may lead to a decrease in agricultural production. Lack of water in rivers will also affect the operation of hydropower plants and reduce electricity generation by 20%. The growing shortage of fresh water is expected to worsen during the current century, manifested in a 50% decrease in water supply per capita, down to 650 cubic metres (m^3).

How the OECD can help to address some of these challenges

The technical assistance provided through the EU4Environment project "Designing Green Public Investment Programme and Conducting Training in Azerbaijan" aimed to enhance the investment planning and management capacity of government officials and associated experts in Azerbaijan in public environmental expenditure. In particular, the project offered government officials and experts know-how and practical skills for designing a public environmental expenditure programme.

This will increase the chance of securing adequate public resources and leveraging international co-financing. Economically sound and credible multi-year investment programmes are better positioned to compete for public support – both from national and from international sources – for greener, more sustainable development. The programmes, aligned with international good practices, can serve as a model for preparing other low-carbon public investment programmes within national medium-term expenditure frameworks (MTEFs).

The technical assistance, and specifically its costing model, helped Azerbaijan's national public authorities to calculate the public finance needed for the environmental and climate-related targets, which are mostly defined at the national level. Ultimately, a successful green public investment programme will accelerate the country's socio-economic development by, for example, creating green jobs and adopting innovative technology.

Box 1.1. How green public investment programmes are prepared

The methodology applies a programmatic approach to low-carbon public expenditure, by creating pipelines of priority environmental projects to be supported by public sector funds, mainly through subsidies in the form of grants. This will mobilise private investors, by providing them not only with direct financial support – especially before the new technologies reach market maturity – but also giving them guidance on investments that can bring the desired environmental and socially beneficial outcomes.

OECD technical assistance projects apply four main pillars of the programmatic approach towards green public spending:

- Pillar I: Preparing economic analysis that investigates the supply and demand side of potential technologies and equipment within the agreed target sector that could be included in the project pipelines.
- Pillar II: Developing costing methodology and the associated costing model to calculate the amount of finances – both on the supporters' and the beneficiaries' side – required to achieve the desired environmental (or other) outcomes.
- Pillar III: Proposing an institutional set-up that also includes the operating regulations (best practices of project cycle management) that need to be set up, and, conversely, policy and regulatory barriers that need to be eliminated (if any).
- Pillar IV: Providing capacity development to enable those who will implement the programme (national public authorities) to launch it, after the necessary budget and personnel have been allocated to it.

Further areas of support in the designing and costing phase of the project include an overview of possible financing sources (both national and international public sources), as well as an overview of the overall policy and regulatory framework of the target sector (and the associated recommendations).

This project built on previous work carried out by the OECD in the areas of public environmental expenditure management, integrating the environmental sector into medium-term budgetary processes and on climate change economics. The OECD has developed a number of policy tools that aim to support efforts of governments to design and implement green public investment programmes – either at the national or the local level – in a cost-effective way and in line with good international practices.[12]

The OECD applies a programme costing methodology focused on environmental and climate-related investment programmes. An Excel-based model is used to assess the overall implementation costs, in terms of "hard" investments and administration and management expenditures, of a particular investment programme, over its expected and desired environmental impact. This provides those who are to implement the programme an opportunity either to optimise the targets given a specified programme budget, or vice versa, to adjust the programme budget to achieve the set targets. (How the tool works is explained in detail in Annex B).

The model is essentially an analytical tool that can help the decision-making process become better informed and more transparent. The accompanying analytical report puts these calculations into a practical frame. It outlines additional conditions and actions to put in place for a public investment programme (for example, the timeframe, human resources needed, adoption of administrative procedures, etc.).

Since 2016, the OECD has designed green public investment programmes for public transport sectors in three partner countries from Eastern Europe, Caucasus and Central Asia (EECCA). The OPTIC model – called Optimising Public Transport Investment Costs – was developed for Kazakhstan (2016) and subsequently applied in Kyrgyzstan and Moldova (2019). Although adapted specifically for the public

transport sector, the tool can be modified for use in any environmental sector more broadly, where the government aims to spur private investments with public support (e.g. through subsidies in the form of grants, Box 1.2).[13]

Box 1.2. Selected examples of green public investment programmes

Since 2012, the OECD has provided technical assistance and capacity building to public authorities from Eastern Europe, the Caucasus and Central Asia (EECCA) in designing and costing green public investment programmes, as well as in supporting complementary activities and requirements needed for implementation. The green public investment programmes were prepared for energy efficiency in the housing sector (Kazakhstan),[14] as well as clean urban public transport (Kazakhstan,[15] Kyrgyzstan[16] and Moldova).[17]

In the current phase, EU4Environment supports strengthening public spending management in two Eastern Partnership (EaP) countries of the European Union (EU) and two new environmental sub-sectors: water supply and sanitation (Azerbaijan)[18] and biodegradable waste stream (Georgia).[19] All these programmes have been designed in line with international good practices and can be a model for other low-carbon public investment programmes within national medium-term expenditure frameworks (MTEF). Beyond primary technical assistance, capacity development activities for programme implementation are also being conducted under the EU4Environment Action (Moldova).[20]

In 2021-22, the OECD prepared a series of webinars to help partner governments implement green public investment programmes. The first presented the experience from managing public spending in Poland and the Czech Republic, using national environmental funds as implementing bodies.[21] The second introduced another way to manage public finances for environmental investments from Austria, Switzerland and the Netherlands, by outsourcing some of the administration to non-governmental organisations or the private sector.[22]

The next two webinars focused on the substance of the programmes, i.e. the focus sectors. Experts from Denmark, Italy and the international bioenergy sector showed ways of using biodegradable residues for energy purposes.[23] Meanwhile, specialists from Austria, Romania and Slovakia conveyed best practices on increasing water supply and wastewater treatment in rural and remote areas in their countries.[24]

In a similar vein, the Government of Azerbaijan has requested that the OECD help to increase its staff capacity to prepare for green public investment programmes. The project was financially supported by the EU for Environment (EU4Environment) Action – and was also implemented within its framework – and the basic elements of this co-operation were agreed on at the inaugural EU4Environment Regional Assembly meeting in June 2019 in Brussels.[25]

The EU-funded EU4Environment Action supports countries in the EU's Eastern Partnership (EaP) region, including Azerbaijan, to improve national governance and regulatory mechanisms that support transition to a greener and more sustainable development path (Box 1.3). Public expenditure plays an essential part in efforts to create a level playing field for environmental and climate-related objectives. The work area on greening public expenditure (Activity 3.3.1) focuses on assisting the partner governments in utilising public resources – both budgetary and personnel – effectively and efficiently, to achieve countries' national environmental and climate-related objectives, as well to increase the well-being of their citizens.

Box 1.3. About EU4Environment

The "European Union for Environment" (EU4Environment – Green Economy) Action helps the Eastern Partnership (EaP) countries preserve their natural capital and increase people's environmental well-being. To that end, it supports environment-related action, demonstrates and unlocks opportunities for greener growth, and sets up mechanisms to better manage environmental risks and impacts.

It is funded by the European Union (EU) and implemented by five Partner organisations – the Organisation for Economic Co-operation and Development (OECD,) the United Nations Economic Commission for Europe (UNECE), United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO) and the World Bank – over 2019-2024, with a budget of EUR 20 million.

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Notes

[1] Two rivers are longer than 500 km; 22 between 101 and 500 km; 40 rivers between 51 and 100 km; 107 between 26 and 50 km, and 8 188 are less than 25 km in length. See

https://unece.org/fileadmin/DAM/env/water/npd/Management_of_waters_Water_Agency_Arif_Akhundov.pdf.

[2] *Ibid.*

[3] See https://www.euwipluseast.eu/en/about/pilot-river-bassin/kura (accessed on 2 November 2022).

[4] Figures takes from: https://gsaz.az/articles/view/107/Azarbaycan-Respublikasi-arazisinin-relyefi (accessed on 29 June 2023).

[5] For more information, see: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-historical (accessed on 28 October 2022).

[6] Moldova experiences similar water scarcity (1 831 m^3/capita/year), whereas Armenia and Belarus had more substantial renewable water resources (3 123 and 6 355 m^3/capita/year, respectively). Neighbouring Georgia is on the other side of the spectrum (12 418 m^3/capita/year). In 2017, Georgia and Belarus were regarded as water-abundant countries, whereas Moldova (1 831 m^3/capita/year) and Azerbaijan (1 732 m^3/capita/year) were prone to water scarcity over the period 2000-2017. Still, since the Falkenmark indicator sets water availability of 1 700 m^3/capita/year as the threshold for water stress, these countries do not fall into this category (EEA, 2020[1]).

[7] For more information, see: https://climateknowledgeportal.worldbank.org/country/azerbaijan/climate-data-historical (accessed on 28 November 2022).

[8] See also: https://blogs.worldbank.org/europeandcentralasia/azerbaijans-water-services-shifting-focus-building-infrastructure-building (accessed on 8 December 2022).

[9] See for instance: https://www.worldbank.org/en/results/2019/10/10/azerbaijan-managing-irrigation-systems-through-water-user-associations (accessed on 8 December 2022).

[10] See European Union Water Initiative Plus (EUWI+) Project Highlights at: https://www.oecd.org/env/outreach/npd-azerbaijan.htm (accessed on 10 January 2023).

[11] Changing the natural hydrological flow of rivers can lead to degradation of floodplain forests, reduction of fish stock downstream, riparian erosion, etc. (UN-Water, 2007[3]).

[12] Some of these tools include: “Good Practices for Public Environmental Expenditure Management” (http://www.oecd.org/env/outreach/38787377.pdf) and the “Handbook for Appraisal of Environmental Projects Financed from Public Funds” (http://www.oecd.org/env/outreach/38787377.pdf).

[13] The so-called Clean Public Transport (CPT) Programmes are specific green public investment programmes. However, a green public investment programme can leverage private investment in low-carbon infrastructure in any environmental sector (energy efficiency, renewable energy, solid waste management, water supply and sanitation, etc.). Many activities conducted by sectoral programmes will also help increase capacity of public authorities to implement green public investment programmes in general (such as funding application drafting and project selection procedures).

[14] For the final report, see: www.oecd.org/environment/outreach/KAZ%20report_programme%20design_ENG_web%20version.pdf.

[15] For the final report and policy highlights, see: www.oecd.org/env/promoting-clean-urban-public-transportation-and-green-investment-in-kazakhstan-9789264279643-en.htm (accessed on 30 September 2022).

[16] For the final report and policy highlights, see: www.oecd.org/environment/promoting-clean-urban-public-transportation-and-green-investment-in-kyrgyzstan-b6b91b9a-en.htm (accessed on 30 September 2022).

[17] For the final report and policy highlights, see: www.oecd.org/environment/promoting-clean-urban-public-transportation-and-green-investment-in-moldova-31925aae-en.htm (accessed on 30 September 2022).

[18] For the project's final event, see: www.eu4environment.org/events/training-workshop-on-designing-and-implementing-green-public-investment-programmes (accessed on 30 September 2022).

[19] For the project's final event, see: www.eu4environment.org/events/training-on-designing-and-implementing-green-public-investment-programmes-on-bio-waste-in-georgia (accessed on 30 September 2022).

[20] For the project's final event, see: www.eu4environment.org/events/training-on-the-implementation-of-the-designed-clean-public-transport-in-moldova (accessed on 30 September 2022).

[21] For more information, see: www.eu4environment.org/events/designing-and-implementing-green-public-investment-programmes-experience-from-poland-and-the-czech-republic (accessed on 30 September 2022).

[22] For more information, see: www.eu4environment.org/events/alternative-schemes-for-implementing-green-public-investment-programmes-experience-from-austria-switzerland-and-the-netherlands (accessed on 30 September 2022).

[23] For more information, see: www.eu4environment.org/events/utilising-agricultural-residues-experience-from-european-countries (accessed on 30 September 2022).

[24] For more information, see: www.eu4environment.org/events/designing-and-implementing-green-public-investment-programmes-experience-on-water-supply-and-wastewater-treatment-in-rural-and-remote-areas (accessed on 30 September 2022).

[25] For more information, see: https://www.eu4environment.org/events/inaugural-eu4environment-regional-assembly/ (accessed on 5 October 2022).

2 Setting the scene for a green public investment programme

The chapter introduces the main legislative and policy measures that aim to improve the quality and quality of Azerbaijan's water supply, such as more efficient use of water resources and regulation of water/wastewater treatment. It outlines the relevant national documents and objectives in the water sector, as well as the guiding international principles and instruments that Azerbaijan's policy and legislative framework aims to align with. The chapter includes an overview of the main institutional actors and bodies that have been designated to improve co-ordination and management of water resources at the national level. It goes on to explore the prevailing issues in policy, institutional structure and management that have held back Azerbaijan's water-related goals. In the final section, the chapter introduces the main assumptions, rationale and targets of the green public investment programme, which is expected to enhance the resilience and reliability of water supply and disposal.

Water-related policy and legal framework

Water is an essential natural resource, both for nature as well as for human beings' health and economic development. In the Eastern Partnership (EaP) countries, water is mainly consumed by the population, agriculture and industry. Azerbaijan is among the four EaP countries – together with Armenia, Georgia and Moldova – that face comparatively high water-abstraction demands and increasing pressure on water resources (EEA, 2020[1]).

Azerbaijan has taken several important steps on the policy and legislative level to increase the efficiency of water use, make the management of water resources more effective, and ensure the ecological stability of water basins. Water-related objectives are among the key principles of Azerbaijan's environmental policy and its endeavours to ensure sustainable development. Still, underfunded management responsibilities and a fragmented policy framework are among the predominant challenges the country needs to tackle in the water sector.

Recently, Azerbaijan has developed a **National Water Strategy** (NWS, officially known as the National Strategy on Rational Use of Water Resources) and adopted the associated Action Plan.[1] The main goal of the NWS is to increase water resources, improve water quality and ensure efficient use of water resources. Improving the supply of drinking water and wastewater treatment systems and supporting investment in water protection and new technologies (especially in irrigation) are among the main priorities of the strategy.

In developing the National Water Strategy, the Government of Azerbaijan reflects the principles outlined in the European Union Water Framework Directive (EU WFD) and other water-related EU directives, the United Nations Economic Commission for Europe (UNECE) Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) and its Protocol on Water and Health, as well as other water-related instruments and obligations of international organisations (e.g. the Global Water Partnership and the UN "Transforming our World: The 2030 Agenda for Sustainable Development").

The NWS recognises both the objectives of the UN Sustainable Development Goals (SDGs), principally targets under goals 6 and 13, and the objectives of the EU WFD and its associated directives. Although Azerbaijan, unlike Moldova and Georgia, has not signed an Association Agreement with the European Union, it has committed to approximate the EU WFD and to institutionalise its water management framework. SDG 6 of the UN Sustainable Development Goals, on ensuring access to and sustainable management of water supply and sanitation services for all, has been designated a national priority in Azerbaijan. Its aim is access to adequate water sources and their efficient use, as well as access to sanitation services. Of the eight SDGs, protecting ecosystems is also an important goal. The SDG Index was introduced in 2015, and ever since then, Azerbaijan has ranked as a leader among the countries of the South Caucasus countries on all 17 SDGs.[2]

Table 2.1 sets out the main principles of water policy in Azerbaijan, as presented in the National Water Strategy. The table identifies the focus areas of the NWS and the specific objectives within each area. This presentation makes explicit the lack of measurable objectives in the NWS.

Table 2.1. Principles of water policy in Azerbaijan, as set out in the National Water Strategy

Area	Objective
Full access to water supply	Achieve the Sustainable Water Goals (SDG 6 and SDG 11.5)
	Meet the needs of water users, including improving access to water and sewerage services
	Improve water supply and sanitation in rural areas
Ensuring water quality	Improve the quality of drinking water
	Strengthen control and protection by restoring and establishing sanitary protection zones for natural water sources, water reservoirs, pumping stations, dams, canals and collectors, pipelines and other water facilities
	Improve wastewater treatment, using advanced technologies and innovations and increasing the volume of reusable water
Rational use of water resources	Improve efficient use and management of groundwater resources
	Increase efficiency of water use with innovative techniques and technologies in irrigation and water-intensive industries
	Increase efficiency of water use in energy production
	Encourage application of water-saving techniques and technologies, as well as water reuse and recycling
Water security	Ensure the security of water resources
	Ensure the safety of reservoirs and dams
	Strengthen the protection of water resources and aquatic ecosystems
	Reduce and manage the impact of new hydraulic structures on river flow regimes
Strengthening the protection of water resources and aquatic ecosystems	Introduce institutional improvements and develop a legal framework in water resources management
	Expand capacity of water bodies at the national and basin levels
	Co-operate with neighbouring countries in connection with transboundary water basins and, if necessary, with the involvement of sectoral international organisations
	Ensure closer involvement of stakeholders in water protection and management planning
	Expand co-operation between government agencies, regional organisations, civil society, water users and consumers
Expanding the application of environmental standards in water use	Accelerate the construction of sustainable comprehensive measures to reduce wastewater, including water treatment plants, release of wastewater discharged from production facilities to water bodies, on condition of mandatory treatment and improvement of monitoring
	Conduct comparative analysis and harmonisation of standards, norms and rules in the field of drinking water safety, in line with international practice
	Give priority to public-private partnership projects in investment policy

Source: National Strategy on Rational Use of Water Resources.

The National Water Strategy breaks down water-related activities into interventions in the short term (up to six years), medium term (6 to 12 years) and long term (12 to 18 years). The action plan, to be implemented in the short term, is mainly focused on improving institutional capacity and the legal framework, but investments will take place mainly in the medium and long term.

Phase 1 of the NWS, over the period 2021-2026, includes non-investment activities, such as studies, plans and co-ordinating documents designed to improve legislation in centralised and integrated water resources management and water use. Investments will be needed, however, to expand the supply of quality drinking water to the population in accordance with SDG (15.7.4 of the NWS), expand wastewater recycling practices (15.8.4), and monitor water quality, i.e. management information systems (15.10.3 and 15.11.1). Another important section of the Action Plan is managing water demand and efficient use of water. This involves rehabilitation of irrigation infrastructure (15.13.5), on-farm measurement and irrigation-flow monitoring (15.13.3), and reduction of water loss (15.13.7). Water resource inventories and integrated river basin management planning will also be introduced, and efficient water use promoted, based on cost-recovery tariffs (15.13.4).

The Action Plan was approved by Presidential Decree (No. 2178 of 27 July 2020)[3] and also identifies technological innovations, in water modelling and inventories, irrigation technologies and techniques, and water management digitalisation (using the Electronic Water Economy Information System, or EWEIS). The Action Plan also includes several feasibility studies for improving drinking water supply systems (e.g. the Baku II water pipeline, Neftchala city programme, Oguz-Gabala-Baku water pipeline and III Sholar water pipeline), which Azersu also designates as priority projects. The Action Plan sets out a priority list of reservoirs to be created for the collection and storage of mountain river water, as well as reconstruction of hydro-junctions, collectors and irrigation canals. It is assumed that these are large-scale and will require significant investment outlays.

However, it is important to note that although the Action Plan suggests that capital investments be undertaken, no cost estimates are provided. In general, the plan does not include any estimate of the costs of implementing priority activities. Both Azersu Open Joint Stock Company (OJSC) and the Azerbaijan Amelioration and Water Farm OJSC have developed action plans and priority investment lists based on the Action Plan of this Strategy.

Under the National Water Strategy, the President of Azerbaijan also established a **Water Commission** and supporting working groups under the Cabinet of Ministers, to ensure efficient use of water resources and to improve water management and overall co-ordination in the sector.[4] The National Water Commission will be supported by the ongoing National Policy Dialogue (NPD)[5] and act as a co-ordination forum for integrated water resource management (IWRM) and implementation of the NWS and Action Plan.[6]

The commission will also oversee implementation of the National Water Strategy and associated multi-million-euro investments. The application of economic instruments has been a key objective throughout the preparation of the strategy. However, it is important to note that where the strategy suggests that capital investments be undertaken, no cost estimates are provided. In general, the version of the strategy that has been made available does not include any estimate of the costs of implementation.

The NWS is to plan the preparation and application of a water balance estimation, considering the interests and needs of all water users. Attention will be paid to classification and prioritisation of water users according to local climatic conditions, water resources, water quality, water demand, demand for agricultural products and other such factors. The strategy also considers infrastructure investment as a foundation for efficient, integrated use of water resources.[7]

Box 2.1. European Union Water Initiative Plus

In 2016, a major project funded by the EU, the European Union Water Initiative Plus (EUWI+), was launched to help strengthen water management in Azerbaijan and the five other EaP countries. The European Commission selected the OECD and the UN Economic Commission for Europe (UNECE), along with the EU member states of Austria (Environment Agency) and France (International Office for Water), to implement the project jointly.

With EUR 23.5 million from the EU budget and EUR 1 million from Austria and France, the EUWI+ project aimed to strengthen management of national and transboundary water resources and develop tools to improve the long-term quality of all water. It included EUR 6 million of direct investments in the EaP countries, including Azerbaijan, to improve river basin policies, management planning and water quality monitoring.

The regional EUWI+ project built on results from earlier EU-funded water governance actions in EaP countries. These included facilitation of the EUWI National Policy Dialogues by the OECD and UNECE in 2006-15, as well as the EU Environmental Protection of International River Basins (EPIRB) project. EUWI+ has also benefited from synergies with other EU-funded projects and activities, including the Shared Environmental Information System (SEIS) East project. The SEIS aims to facilitate access to environmental information and its integration into the knowledge-based economy.

EUWI+ has helped Azerbaijan develop its Water Strategy and decision-making framework in the water sector, carrying on the work of UNECE, the Asian Development Bank and the EPIRB project. The EUWI+ project has also helped to develop a detailed National Water Strategy Action Plan that will form part of the final document.

Source: EUWI+ Policy Highlights – Azerbaijan.[8]

Several national programmes address, or plan to address, equal access to drinking water for the population and greater access to centralised water supply and sanitation services. They include access to safe drinking water for vulnerable groups, and improving the supply of irrigation water.

- The **State Programme on Socio-Economic Development of the Regions of the Republic of Azerbaijan for 2019-2023**[9] includes tasks related to sustainable regional development, improving living conditions, sustainability of resource management, and improving the supply of irrigation water.
- **Azerbaijan 2030: National Priorities for Socio-Economic Development** includes objectives concerning efficient use of water resources (GoA, 2021[2]).[10]

The primary aim of the State Programme on Socio-Economic Development of the Regions is to transform Azerbaijan's environment, so that its regions can benefit from the sustainability and resilience that development provides. It also aims to build a robust economy founded on sustainable development targets, effective social welfare systems and efficient allocation of natural resources, as well as the protection of local ecosystems and the environment.

Table 2.2 presents a sample of activities set out in the programme, including sample activities in selected rayons. It includes activities of national priority, as well as activities in each rayon. The Action Plan presents activities by sector, with the timeframe for implementation and the body responsible. No budget or indicators are provided.

Table 2.2. Action Plan of the State Programme on Socio-Economic Development of the Regions of the Republic of Azerbaijan 2019-2023

Activities	Period	Body responsible
Improvement of hydrometeorological networks	2019-2023	MENR
Locating and evaluating underground freshwater deposits	2019-2023	MENR
Improvement of irrigation water supply		
- Construction of main and distribution irrigation canals and continuation of works in the field of reconstruction	2019-2023	AAWF OJSC
Expansion and improvement of water supply (irrigation) of farmland in the regions (reservoir construction)	2019-2023	AAWF OJSC
Improvement of irrigation water supply for cultivated fields and demand for sub-artesian wells for drinking water, in order to pay for continuing excavation	2019-2023	AAWF OJSC
Further progress in constructing electric power projects:		
- Construction of small hydropower plants	2019-2023	ME, Azerenergy OJSC
- Reconstructing high-voltage transmission lines and stations	2019-2023	Azerenergy OJSC
- Construction of renewable energy power stations	2019-2023	ME
- Assistance to rural areas by producing biofuels and bioenergy from agricultural waste	2019-2023	ME, MA, local executive authorities
- Use of renewable energy sources in irrigation and household heating systems	2019-2023	ME, MA, AAWF OJSC
- Completion and maintenance of the “Southern Gas Corridor”	2019-2023	SOCAR
- Support for the use of biofuels and solar collectors in heating greenhouses	2019-2023	ME, MA, local executive authorities
Dashkasan Rayon		
- Continuation of works in the field of drinking water supply improvement 2019-2023 Azersu OJSC, local executive power	2019-2023	Azersu OJSC, local executive authorities
Astara Rayon		
- Continued improvement of drinking water supply and sewage systems	2019-2023	Azersu OJSC, AAWF, local executive authorities
- Reclamation and irrigation measures	2019-2023	Ministry of Economy, AAWF, local executive authorities
Lerik Rayon		
- Continuing work in the field of drinking water supply improvement	2019-2023	Azersu OJSC, local executive authorities

Note: AAWF = Azerbaijan Amelioration and Water Farm; MA = Ministry of Agriculture; ME= Ministry of Energy; MENR = Ministry of Ecology and Natural Resources; SOCAR = State Oil Company of Azerbaijan.
Source: National Strategy State Programme on Socio-Economic Development of the Regions of the Republic of Azerbaijan 2019-2023.

Most water-related laws in Azerbaijan were adopted in the second half of the 1990s, and they eventually departed from the centralised planning arrangements of the Soviet era. The guiding legal act in the sector is the **Water Code of the Republic of Azerbaijan** (adopted in 1997, amended in 2017). The Water Code regulates the legal relations connected to ownership, management, use and protection of water bodies in the country, which provide a comprehensive and integrated approach to surface water management.

The Water Code governs the management of the internal waters in Azerbaijan and the Caspian Sea under the sovereignty of Azerbaijan that are used and protected as a basis of quality of life of the population and which support the existence of flora and fauna. Separation of water protection functions from water use

and water management functions or balancing of economic development and protection of environment and natural resources are two of the major priorities (UNECE, 2011[3]).

As for the secondary legislation, the Water Code is complemented by sub-sectoral water laws dealing with water supply and wastewater, amelioration and irrigation, or municipal water management and resources (Table 2.3). The water-related regulation is complemented by legislation from other economic sectors, including passages on water quality or water protection (e.g. from industry, agriculture and the environment).

Table 2.3. Azerbaijan's main legal framework on water resources and managing and protecting them

Title	No.	Year	Note
Law on Amelioration and Irrigation	116-IQ	Adopted in 1996 (amended in 2019)[11]	Identifies the legal principles of activity in land melioration and irrigation, including rehabilitation of priority irrigation and drainage schemes, improvement of water management and financing, ownership rights of drainage and irrigation systems, and the introduction of an irrigation service fee and functioning of water user unions.
Law on Environmental Protection	678-IQ	Adopted in 1999 (amended in 2023)[12]	Determines the legal, economic and social basis of environmental protection, rational use and recovery of natural resources and improvement of quality of the environment, aiming to protect ecological equilibrium, elimination of harmful effects of economic and other activity on natural ecological systems, and preserving biological diversity and the rational organisation of environmental management.
Law on Environmental Safety	677-IQ	Adopted in 1999 (amended in 2020)[13]	Governs relations in the field of ecological safety implied by activities by legal entities and physical persons, state bodies and local government bodies, establishing rights and obligations of the parties concerning the impact on human health and the state of the environment caused by both natural and anthropogenic factors.
Law on Hydrometeorological Activity	485-IQ	Adopted in 1998 (amended in 2023)[14]	Defines the legal basis for conducting observation, research and work in areas with an active impact on atmospheric processes, including elaboration, use and protection of data on hydrometeorology, regulation on environmental monitoring, environmental impact assessment and access to hydrometeorological information.
Law on Industrial and Household Waste	514-IQ	Adopted in 1998 (amended in 2020)[15]	Establishes state policy on environmental protection from industrial and domestic waste formed as a result of human activity in the form of substances and things, decreases the risk of hazardous impact of such waste. Maintains ecological balance in nature, use of waste as secondary raw material. Regulates relations connected to waste, excluding toxic gases, polluted water and radioactive waste.
Law on Municipal Water Management*	159-IIQ	Adopted in 2001 (amended in 2015)[16]	Defines the legal basis for relations between municipalities and government executive bodies and individuals concerning the use and protection of water structures located in Azerbaijan's municipalities.
Law on Safety of Hydrotechnical Installations	412-IIQ	Adopted in 2002 (amended in 2022)[17]	Regulates all issues related to the safety of hydro-technical installation, including their design, construction, operation, reconstruction, restoration, conservation and dismantling; it also defines the duties of state authorities, plant owners and operators.
Law on Subsoil	439-IQ	Adopted in 1998 (amended in 2022)[18]	Governs relations arising in connection with studying (search, investigation), rational use and protection of subsoil of the territory of Azerbaijan, including the Azerbaijani sector of the Caspian Sea. Provides work protection for the interests of the state, subsoil users and citizens when using subsoil.

Law on Water Supply and Wastewater	723-IQ	Adopted in 1999 (amended in 2023)[19]	Covers the rights of individuals and public and private entities connected to water use, principles of providing water supply and sewerage services according to national quality standards, as well as functions of designated water supply and sewerage enterprises responsible for fee-based industrial, domestic and potable water supply.
Water Code	418-IQ	Adopted in 1997 (amended in 2021)[20]	Regulates legal relations involving the use and protection of water bodies in Azerbaijan, including internal waters as well as Azerbaijan's sector of the Caspian Sea, and their use and protection for human activities and the needs of fauna and flora.

Note: * Also referred to as the Law on Water Economy of Municipalities.
Source: Authors' compilation.

Although the Water Code contains a provision on harmonising water resources management with the administrative-territorial principle of the basin (Article 16), the legislation does not currently interpret the mechanisms for applying the IWRM principles and the basin approach to water resources management.

The irrigation service fee was introduced in 2002, changing the basis for calculation from volumetric to a fixed rate per acre, regardless of the crop irrigated. In 2007, the irrigation service fee was adjusted, because the previous methodology did not have the expected effect of encouraging efficient water use (UNECE, 2011[3]).[21]

The Decree endorsing "Strategic road maps for the national economy and main economic sectors" (2016) defines Azerbaijan's development goals and priorities and ensures their implementation. The decree endorses Strategic Road Maps for the development of utilities, including electricity and thermal energy, water and gas.

Contemporary water balance and use in Azerbaijan

As noted in the previous chapter, Azerbaijan is generally considered to have limited water resources, with 119 000 m^3 of water per square kilometre. Water-rich Georgia has 757 000 m^3. Azerbaijan has a total water source per person of 1 661 m^3 (Rustamov and Qashqai, 1989[4]).

Azerbaijan's total volume of water resources is shown in Table 2.4. These annual averages were estimated in 1989, i.e. the last official water balance for the country.

Table 2.4. Total volume of annual renewable water resources in Azerbaijan, annual average

(billion m^3)

	Total	% of total	Of which			
			Surface water	%	Underground water	%
Transboundary	20.6	67%				
Local water sources	10.3	33%	5.991	58%	4.339	42%
Total volume	30.9	100%				

Note: 1989 data, long-term average.
Source: Based on investigations outlined in Water Resources of the Azerbaijan SSR, 1989.

As shown in the table, about 58% of the local water sources is surface water, and the remaining 42% is underground water. Roughly 67% of the river resources (approximately 20.6 billion m^3) originate in neighbouring countries and enter Azerbaijan through transboundary rivers. Moreover, those water flows into Azerbaijan are assessed as highly polluted.

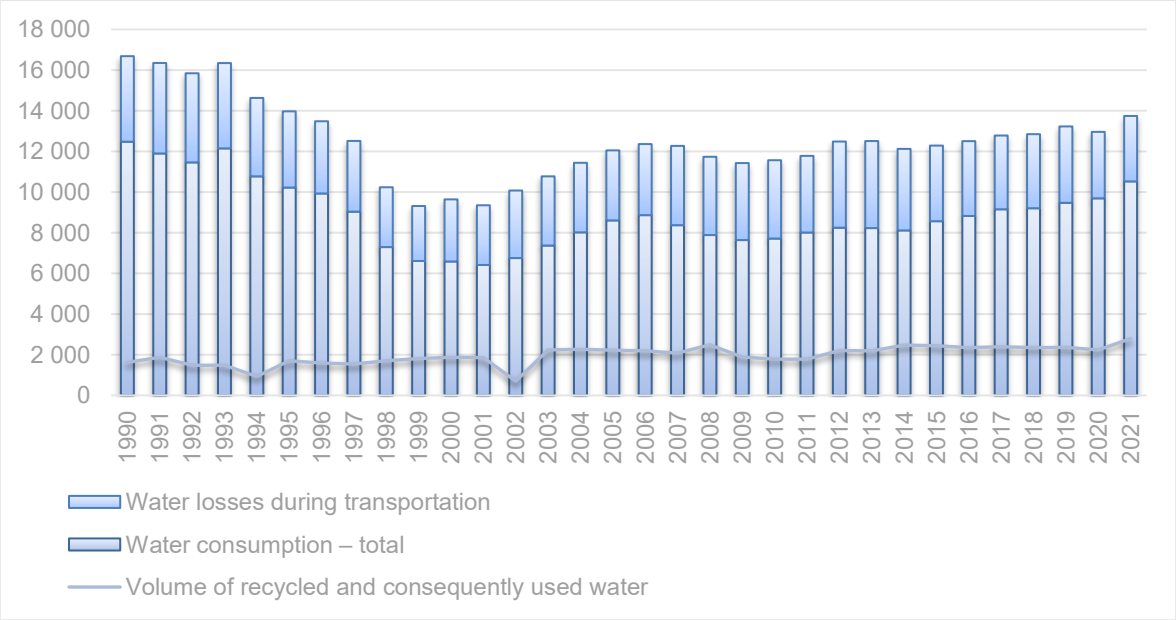
In addition, Azerbaijan's annual water balance, as indicated by the National Water Strategy, is much lower. Water resources formed in the country in 2019 totalled 24.9 billion m^3. The annual forecast reserves of its potable groundwater resources were estimated at about 8.7 billion m^3 and surface water at 16.2 billion m^3. Of 16.2 billion m^3 of surface water resources, 11.4 billion m^3 come in from outside the country through transboundary rivers from neighbouring countries.

In per capita terms, the amount of water is 2 490 m^3/year. Local water resources, however, account for 1 350 m^3/year. As a result of the regional impact of climate change and global warming, water resources in local Azerbaijani rivers have diminished. Meanwhile, floods and periods of drought are increasing in frequency and duration.

Groundwater resources are mainly concentrated in the foothills. In general, groundwater is of high quality. It is mainly used in agriculture and to meet the population's needs for drinking water, as well as in industry. However, groundwater in the lowlands is mainly poorly drained and has a high salinity. In some areas, groundwater is close to the surface and poorly protected. One-fifth of the water consumed in Azerbaijan is obtained from groundwater. As Figure 2.1 shows, water abstraction has increased by 36.4% in the past two decades, from 10 075 million m^3 in 2002 to 13 734 million m^3 in 2021, to meet the demand of the population and various economic activities. This is much lower than the more than 16 000 million m^3 at the beginning of the 1990s, but water losses during transportation account for about a quarter of the total abstracted water (26.0% in 1990, as compared to 23.4% in 2021). As a result, total water consumption in 2021 was 10 526 million m^3. About 21% of the water used in 2021 was derived from water recycling (2 795 million m^3), a slight increase. The reasons for this decline may include economic reforms introduced in the early 2000s and the overall decline in industrial production.

Figure 2.1. Development of water abstraction and use of recycled water, 1990-2021

(million m^3)



Source: State Statistical Committee of Azerbaijan (on the basis of data of Joint Open Company of Irrigation and Water Industry).[22]

Since the beginning of the millennium, while the overall volume of used water resources has trended upward – with some minor fluctuations, such as a drop of water abstraction from natural resources of 935 million m^3 in 2006-2009 – there has also been "*a slight improvement in the efficiency of water use and appropriate water quality considering the end use, in particular with regard to the use of recycled water and alternative sources of water*" (UNECE, 2011[3]).

As shown in Table 2.5, agriculture (including hunting and forestry) is the largest consumer of freshwater resources (72% of the total freshwater consumption in 2021), whereas industry – in particular, the production and distribution of electricity, gas and water – is the largest and almost the sole user of recycled water (99%). On the other hand, agriculture (including hunting and forestry) accounts for the largest amount of water loss during transportation (97%). Agriculture (including hunting and forestry) and industry are the two main sources of discharges of sewerage waters into reservoirs (totalling 92%). Avoiding water losses and increasing wastewater treatment remain a challenge for more efficient use of this public good.

Table 2.5. Main indicators classifying water resources by type of economic activity in 2021

(million m^3)

	Water abstraction from natural resources	Freshwater consumption	Volume of recycled and used water	Water losses during transportation	Discharge of sewage waters	Untreated wastewater
Agriculture, hunting and forestry	11 965.5	7 586.3	-	3 121.4	3 382.6	0.1
Industry:	1 757.4	2 889.3	2 765.5	91.4	1 460.1	264.4
Mining	333.4	342.6	324.0	-	291.4	3.3
Manufacturing industry	30.6	66.4	294.8	3.1	40.6	4.6
Production and distribution of electricity, gas and water	1 393.4	2 480.3	2 146.7	88.3	1 128.1	256.5
Transport, storage and communication	17.3	18.7	9.8	3.6	18.1	7.7
Other branches	2.6	32.0	19.6	0.1	376.3	167.3
Total	**13 742.8**	**10 526.3**	**2 794.9**	**3 216.5**	**5 237.1**	**439.5**

Note: Domestic wastewater is included in the category "other branches".
Source: State Statistical Committee of Azerbaijan (on the basis of data of Joint Open Company of Irrigation and Water Industry).[23]

A simplified overview of the period 1990-2020 in Table 2.6 reveals a decline in some water-related indicators since the peak in the mid-2000s, after an initial decline in the 1990s. While water abstraction from natural water resources (both in total as well as per capita values) and domestic and drinking water use declined, this was not the case for irrigation and agriculture supply.

Table 2.6. Main indicators for protection of water resources and their rational use, 1990-2020

(million m^3)

	1990	1995	2000	2005	2010	2015	2020
Water abstraction from natural water resources – total	16 176	13 971	11 110	12 050	11 566	12 285	12 961
– per capita, m^3	2 293	1 847	1 397	1 438	1 295	1 289	1 300
Water consumption – total	12 477	10 223	6 588	8 607	7 715	8 567	9 693
Including:							
for domestic and drinking purposes	402	327	449	521	405	323	319
industrial needs	3 418	2 173	2 316	2 360	1 742	2 117	2 073
Including drinking water	317	111	82	61	54	46	45
irrigation and agriculture	8 627	7 720	3 819	5 710	5 497	6 057	7 252
Volume of recycled and reused water	1 628	1 696	1 875	2 224	1 787	2 441	2 243
– as a % of total water consumption for industrial needs	32	44	45	49	51	54	52
Water losses during transmission	4 206	3 747	3 053	3 443	3 851	3 718	3 268
Water losses during transmission, % of abstraction	26	26.8	27.5	28.6	33.3	30.3	25.2
Discharge of wastewater	5 026	4 247	4 106	4 878	6 037	5 575	4 759
including untreated wastewater	303	134	171	161	164	305	225

Source: State Statistical Committee of Azerbaijan (on the basis of data of Joint Open Company of Irrigation and Water Industry).[24]

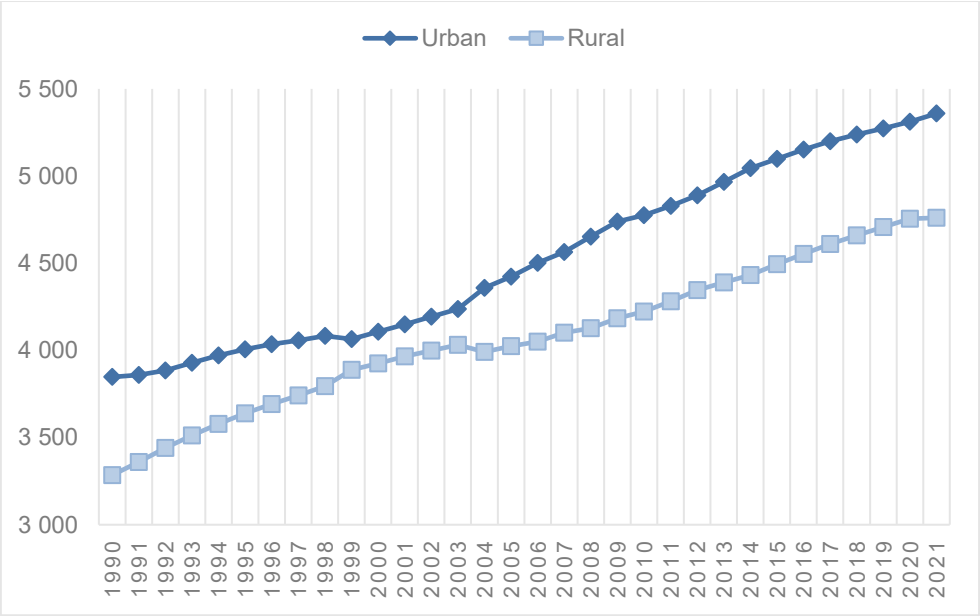
Azerbaijan is not only the largest but the most populated country in the South Caucasus. The State Statistical Committee population figure for the beginning of 2021 is rounded to 10 119 100 inhabitants. With the declared water consumption of 319 million m^3 for domestic and drinking purposes in 2020 (Table 2.5), average per capita water use is 31.5 m^3 (or 31 500 litres). The country average per day is 88.5 litres.

According to the Second Environmental Performance Review (EPR) of Azerbaijan, from 2011, water use in urban and rural areas varies, with consumption of about 100 to 400 litres a day in the cities and 30 to 120 litres a day in the villages (UNECE, 2011[3]).[25] According to the UNECE, the lower consumption of drinking water in Azerbaijan – after peaking in the mid-2000s – can be attributed to a drop in consumption in larger cities like Baku thanks to improvements in the distribution network and water metering. At the same time, it forecasts that domestic and drinking water use will increase in the years to come, due to government policies and programmes that aim to increase access to water throughout the country (UNECE, 2011[3]).

Nevertheless, the urban population has risen more steeply than the rural population since the beginning of the millennium (Figure 2.2).

Figure 2.2. Annual population changes in urban and rural areas in Azerbaijan, 1990-2021

(thousand persons)



Source: State Statistical Committee of Azerbaijan.[26]

Azerbaijan is divided into 63 districts (including 7 districts of the Nakhchivan Autonomous Republic), 12 urban districts (all in Baku city), 68 urban administrative districts and 1 724 rural administrative districts.[27] Table 2.7 outlines the local water consumption of some major cities and industrial centres in Azerbaijan's 14 economic regions. As the table shows, more than half of the water is used for industry.

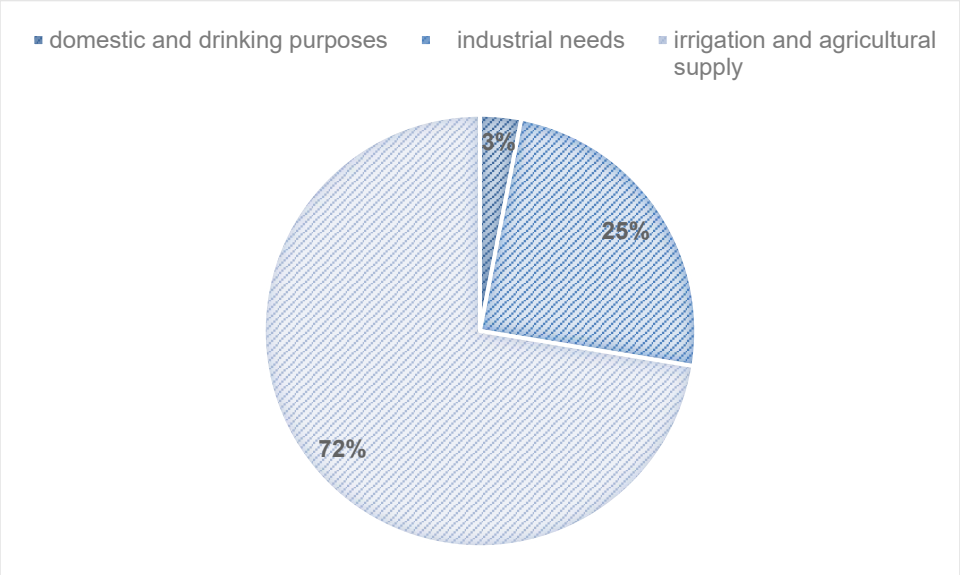
Table 2.7. Population and water supply in selected cities, 2021

	Population*	Water use	Share for industrial purposes
		million m³	%
Azerbaijan	10 119 100	2 795	52
Cities:			
- Baku	2 300 500	657	54
- Ganja	335 800	-	-
- Mingachevir	106 400	1 175	51
- Sumgait	346 400	429	67
- Shirvan	87 900	519	50

Note: * Beginning of 2021.
Source: State Statistical Committee of Azerbaijan (on the basis of data of Joint Open Company of Irrigation and Water Industry).[28]

Irrigation and agricultural supply accounts for 75% of total water use. Industrial use accounts for 22% and domestic (household) demand just 3% of total water use (Figure 2.3).

Figure 2.3. Water use in different sectors of Azerbaijan, 2021



Source: State Statistical Committee of Azerbaijan (on the basis of data of Joint Open Company of Irrigation and Water Industry).[29]

Table 2.8 presents total land use in Azerbaijan in 2021.

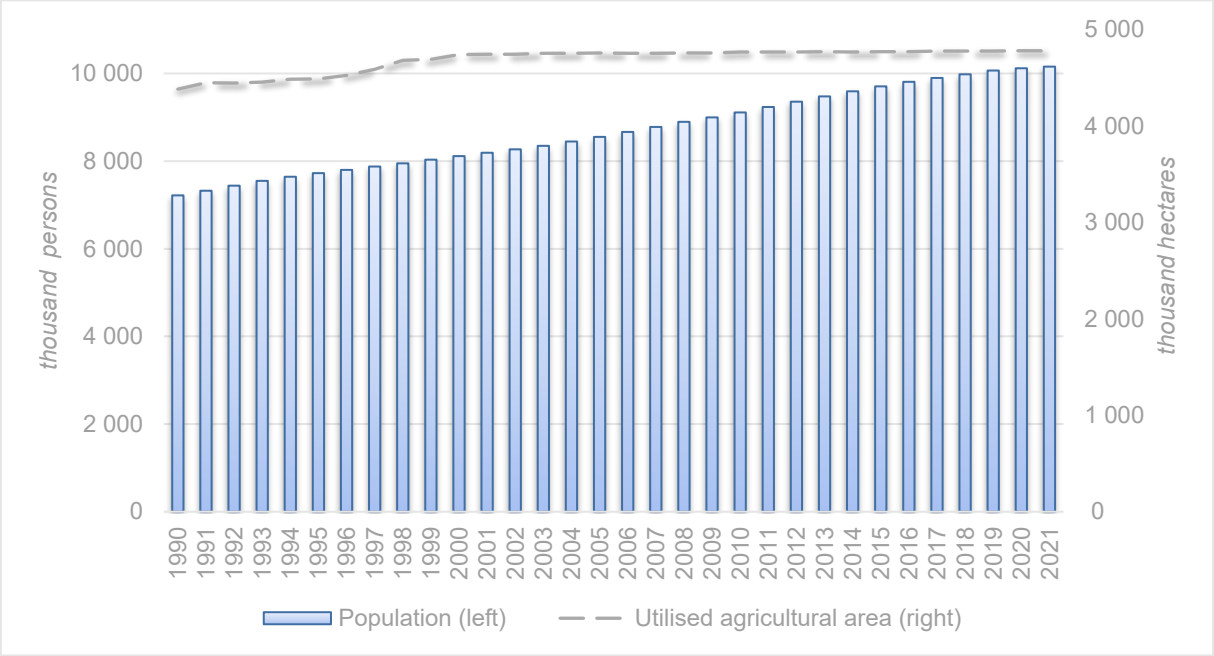
Table 2.8. Main land use indicators in Azerbaijan, 2021

	Country area	Land area	Agricultural area					Forest area
			Total	Including:				
				Arable land	Fallow land	Permanent crops	Hayfields, pastures	
km² (thousand)	86.6	82.65*	47.81	20.5	0.39	2.74	24.18	10.41
% of total**	100	95	55.2	23.7	0.5	3.2	27.9	12.0
% of agricultural area utilised			100	42.9	0.8	5.7	50.6	

Source: Authors' compilation, based on data of the State Statistical Committee of Azerbaijan (including data of the State Service on Property Issues under the Ministry of Economy of Azerbaijan),[30] and the Food and Agriculture Organization's 2019 estimate.[31]
Note: * 2019 figure. ** Does not sum to 100 (categorisation not exhaustive).

Figure 2.4 compares population growth in Azerbaijan with total utilisation of agricultural areas. As population has risen, use of agricultural areas has decreased.

Figure 2.4. Growth of population and agricultural areas, 1990-2021*



Note: * Respective end of the year.
Source: State Statistical Committee of Azerbaijan (including data of the State Service on Property Issues under the Ministry of Economy of Azerbaijan).[32]

Main sector features and challenges

According to the annual water balance of Azerbaijan, the use of water resources in 2021 (freshwater consumption) was 10.5 billion m^3. Of this amount, 7.6 billion m^3 (72%) was used for agriculture and irrigation (including hunting and forestry), and 2.9 billion m^3 (27%) for industry. The majority was used for production and distribution of electricity, gas and water (2.5 billion m^3) and mining (0.3 billion m^3).[33]

First, water resources are unevenly distributed in the country and some rural areas. Owing to the lack of water supply infrastructure (Chapter 1), residents do not have a reliable supply.

Second, the dry climate of the plains of Azerbaijan imposes a great need for water for irrigation. As indicated, agriculture is the main consumer of water. Surface water resources are used through 140 reservoirs and 53 000 km of irrigation canals. Artesian and sub-artesian wells have been drilled to use groundwater for irrigation and other purposes.

Water-saving methods and technologies, and improving agriculture and water management, can help contribute to sustainable use of water resources. Crop rotation based on Azerbaijan's climatic conditions and water circulation plants, as well as the preparation of water turnover and water management reports that consider the interests of all water users, must guide water strategy and lay the foundation for efficient, integrated use of its water resources.

Third, Azerbaijan's existing institutional structure reflects the principles of the sectoral approach and broadly complies with integrated water resource management (IWRM) and river basin management planning (RBMP) principles. These provide for the participation and co-operation of all stakeholders at the national and basin levels. But while the need for national and basin-level bodies responsible for water

resources management for IWRM and for developing RBMP has been recognised, no competent body has yet been designated as specifically responsible for them.

The President of Azerbaijan has established a Water Commission with regulatory authority over water resources management and the distribution of resources among different water users.[34] It nevertheless remains to be seen whether it will assume responsibility for IWRM or RBMP.

The following public bodies are involved in the management of water resources in Azerbaijan:

- the Ministry of Ecology and Natural Resources
- the State Agency for Water Resources of the Ministry of Emergency Situations
- the Ministry of Health
- the Azerbaijan Amelioration and Water Farm Open Joint Stock Company (OJSC)
- Azersu OJSC
- Azerenergy OJSC

The main challenge in Azerbaijan's water sector is an adequate and reliable supply, and in particular the following issues.

Unsustainable water abstraction

- Most of the threat of water deficits results from technical losses in water systems (pipelines and canals), which have increased water withdrawals to meet demand.
- The estimated water exploitation index of 72% has not yet led to a serious water deficit, but it puts increased pressure on surface water and groundwater.
- Owing to excessive withdrawal of water from springs, rivers can fall below the required environmental flow, and sometimes even dry up.

Uneven water distribution

- Groundwater with usability (up to 1.0 grammes/litre) and low mineralisation (1-3 g/l) is unevenly distributed in mountainous and foothill areas, whereas in the lowlands, groundwater is mainly poorly drained and may have high salinity.
- Regional exploitable groundwater reserves in the foothills were estimated in the 1970s and 1980s, when it was estimated that regional groundwater reserves were about 24 million m^3 per day (or 8.67 billion m^3 per year).
- In general, groundwater is of high quality and is mainly used in agriculture and industry. One-fifth of the water consumed is obtained from groundwater. However, in some areas, groundwater is close to the surface and poorly protected.
- The groundwater recharge in the lowlands is highest during irrigation periods, due to the loss of water from canals and fields.
- Mountainous areas have higher levels of precipitation and lower average temperatures than the central lowlands and Caspian Sea coast, where the climate is drier and hotter.

Outdated irrigation infrastructure

- Except in the Lankaran lowland, agricultural regions rely heavily on irrigation. This poses another challenge: finding new effective irrigation techniques to meet Azerbaijan’s development goals.
- Most irrigation canals in Azerbaijan (and also in Armenia and Georgia) are open and unlined, with high filtration rates.

- Water losses can be as much as 40%-60%, further reducing availability, and affecting mainly water-intensive crops.
- Current irrigation methods are ineffective, and work needs to be done to apply drip irrigation and other modern approaches to irrigation.

Extensive water pollution

- Both Azerbaijan and Georgia suffer from a lack of functional wastewater treatment plants – especially in small towns and settlements – and the discharge of untreated municipal wastewater into rivers causes water contamination of both rivers and reservoirs. Surface water in Azerbaijan, mainly from transboundary rivers, arrives in the country already polluted.
- Most of the solid waste in Azerbaijan's regions – including municipal, industrial, medical, and agricultural waste – is collected in open dumps, and pollutants from waste are mixed with groundwater (some landfills are located directly along rivers and floodplains).
- As a result, the water quality of local rivers, as well as transboundary rivers coming to Azerbaijan from upstream regions, suffers from deterioration.[35]
- Downstream irrigation reservoirs are contaminated by significant discharges of untreated municipal wastewater into the Kura River in Georgia, due to the lack of functional wastewater treatment plants.[36]
- Polluted water resources not only affect local water, but have indirect effects that can be observed in agricultural production and transported food products.

Improper land use management

- Construction of large reservoirs in the Kura-Aras river basin has led to land degradation, because forested areas had to be cleared.
- In the upland river catchment areas – particularly in mountainous regions – erosion has led to poor soil protection, with damaging mudslides and high river turbidity.[37]
- Despite extensive investments in flood control schemes, flooding and mudflow events in the Kura-Aras basin have had adverse economic and social implications for the basin countries.

Competing needs of hydropower generation

- The hydropower sector adds to rising concerns about changes in natural river flows. The sector is a large competitor for water use in the Kura-Aras river basin, especially in upstream countries.
- Although hydropower generation is considered a non-consumptive water use, it competes with agriculture for water resources, especially in the summer months.
- Hydropower generation has led to variation and reduction of hydrological flow, i.e. made the river shallower and flow more slowly.

Outdated water resource inventories

- Water resource inventories cited in both academic studies and strategic documents date from the 1970s and 1980s and require revision. This urgent need has been recognised in current sectoral strategies.
- The groundwater cadastre has not yet been developed, and there are only estimates for groundwater use in Azerbaijan (this is also due to a number of unregistered wells).
- There are no quality standards for groundwater, nor is there a classification for groundwater types.

- There are no basic economic data on water use that would, for instance, allow for reliable and comprehensive cost and benefit estimates.
- Detailed service connection rates for water supply and sewage are not available by region, district and settlement. Once again, these data are essential for planning the future use of water resources.

A lack of awareness among the population

- Water users and the population at large should be made aware of the efficient use of water. Wastewater should be treated and recycled for industrial, irrigation and other purposes.

Institutional challenges

- A clear division of the rights and responsibilities of public bodies involved in the management of water resources in Azerbaijan is needed, to prevent wasteful use of water and to ensure water use is managed efficiently.
- Economic analysis is needed, in order to identify the potential benefits of improved co-ordination and co-operation, as is a strong demand for further external support for improving co-operative management. This could help allocate the economic benefits of the Kura-Aras basin more equitably (Strosser et al., 2017[5]).
- Recent changes – for example the establishment of the Azerbaijan Investment Holding to manage state-owned companies and enterprises and increase the transparency and economic efficiency of their investment programmes – should be carefully evaluated for their effectiveness. Water user associations should also play an important role in the planning and financing of the water supply and irrigation sectors.

Initial programme assumptions

Given the already large constraints on water resources, which are expected only to be exacerbated in the future, a national programme to increase the reliability and resiliency of the water supply sector is called for. This would be based on the following factors and considerations:

- The programme requires compliance and logical coherence with water sector strategies, in particular the National Strategy on Rational Use of Water Resources.
- According to Azersu, in 2017, 88% of Azerbaijan's population had access to a potable water supply. As for sewerage, the figure was around 60% in 2017, with coverage in large cities approaching 100% (UNDP/GEF, 2018[6]). Detailed service connection rates, however, are not available by region, district and settlement.
- Water losses after abstraction stand at about 23%, or about 3.2 billion m^3, with the bulk of these losses due to agricultural (irrigation) and industrial use.[38]
- The programme builds on current and planned capital investments, based on priority investment lists in the National Strategy on Rational Use of Water Resources, as well as the priority investment lists of the main stakeholders (in particular, Azersu OJSC and Azerbaijan Amelioration and Water Farm OJSC).

The investment programme will be implemented at the national level but will not initially focus on the country as a whole. In setting the regional focus, the following assumptions were considered:

- All areas of Azerbaijan are vulnerable to climate change and its effects on the sustainability of water supply, and in particular, the Caspian seashore.

- In its pilot phase, however, the programme should focus on a few priority regions and then expand to other areas.
- Transboundary waters are of higher priority, with exceptions (described below).
- Baku is excluded from both phases, since the capital city has already benefited from interest and investment.
- Karabakh was not considered in the programme, because projects located there cannot currently be financed through multi-lateral instruments and because financing for this green public investment programme is expected to include multi-lateral sources.
- The Nakhchivan region was not considered in the programme, because it is not contiguous with the rest of the country.

In consultation with stakeholders, the Ganja-Gazakh and Lankaran regions were identified as priorities for the first phase of the programme, given the importance of transboundary water, the regions' relatively lower level of water supply connection rates, and the relative under-investment in the area. The population of settlements in these regions appears in the following tables.

Table 2.9. Population of priority areas – Ganja-Dashkasan economic region, 2021

District / city / settlement	Total	Urban	Rural
Total for region	611 300	431 000	180 300
Of which:			
Dashkasan district – Regional Water Administration (RWA) No. 8	35 400	15 400	20 000

Source: State Statistical Committee of Azerbaijan.[39]

These localities fall under the administration of three of Azersu's regional offices, with the following parameters (Table 2.10).

Table 2.10. Overview of regional water administration responsible for the Ganja-Gazakh Region

Water administration	Customers			Metering rate		
	Total	Households	Non-HH	Total	Households	Non-HH
United Sukanal (Ganja)	156 499	150 826	5 673	75.1%	75.2%	94.5%
RWA No. 7	35 970	34 892	1 078	61.8%	61.3%	78.9%
RWA No. 8	43 527	42 421	1 106	82.4%	82.7%	85.6%

Source: Azersu OJSC.[40]

Table 2.11 shows the population of the priority districts in the Lankaran Region.

Table 2.11. Population of priority areas – Lankaran-Astara economic region, 2021

District / city / settlement	Total	Urban	Rural
Total for region	953 600	254 400	699 200
Including:			
Astara district	110 500	33 900	76 600
Lerik district	86 600	8 700	77 900

Source: State Statistical Committee of Azerbaijan.[41]

These localities fall under the administration of one of Azersu's regional offices, which has the following parameters (Table 2.12).

Table 2.12. Overview of regional water administration responsible for the Lankaran Region

Water administration	Customers			Metering rate		
	Total	Households (HH)	Non-HH	Total	Households	Non-HH
RWA No. 3	61 950	60 909	1 043	89.3%	89.7%	89.7%

Source: Azersu OJSC.[42]

Pipeline inputs to the programme

Water supply

From these tables, the list of priority investments of Azersu and from information on projects already conducted by Azersu, as well as unit costs from completed water supply projects in Azerbaijan, the following set of assumptions are used to calculate programme costs.

The priority tiers for water supply are as follows:

- Priority of the first (pilot) phase – districts and settlements in the priority regions (see preceding tables) for which projects remain to be implemented with a low water-supply connection rate – Astara and Lerik districts in the Lankaran-Astara economic region, and Dashkasan district in the Ganja-Dashkasan economic region.
- Priority of the second (scaling-up) phase – other districts and settlements in the priority regions, in which it is assumed that water-supply connection rates in cities are high and water supply connection rates in rural areas are lower.

The programme pipeline includes investments to increase drinking water supply coverage, mainly by construction of:

- water intake, wells and pumping stations
- water catchment and storage facilities
- water/wastewater treatment facilities
- water distribution network with all supporting elements.

The investment pipelines and their economic analysis are described in detail in Chapter 4.

Irrigation

The programme pipeline includes investments in irrigation and drainage networks, by construction or rehabilitation of the existing but deteriorated infrastructure, including:

- irrigation and transmission channels
- hydro-junctions, pumping stations and sub-artesian wells
- main water storage infrastructure and small reservoirs.

A UN Development Programme (UNDP)/Global Environment Facility (GEF) study indicated that about 50% of all irrigation and drainage infrastructure requires rehabilitation or modernisation. The study also estimates that only about 25% of irrigated land has adequate access to irrigation water, and indicated that the total costs of providing access to all are estimated at USD 900 million (UNDP/GEF, 2018[6]).

The Food and Agriculture Organization (FAO)/AQUASTAT inventory for Azerbaijan for 2020 indicates that the country has a total irrigation area potential of 3.2 million hectares,[43] with 1.386 million ha now under irrigation. Of this, 60% (832 360 ha) was surface irrigation and 44% (617 730 ha) sprinkler-irrigated. The country has 53 905 km of irrigation canals, of which 2 353 km are main canals, 8 935 km are off-farm canals (72% of which are earthen and only 10% lined), 12 677 km are in-farm canals, and 29 130 km are field canals.[44]

Wastewater

The programme pipeline includes investments in:

- small-scale wastewater collection networks
- small-scale wastewater treatment plants.

Taking into account the high costs of the wastewater services, it is assumed that 10 000 of the rural population will be connected during the pilot phase (Phase 1). No estimation was made for the scaling-up phase (Phase 2). The wastewater pipeline for Phase 2 could be updated after evaluating the results of the pilot phase.

The following table presents the proposed project pipelines, the types of investments by sector (water supply, irrigation and wastewater), and sample investments within each type.

Table 2.13. Proposed programme pipelines by type of investment

Programme pipeline	Type of investment	Sample investment
Water supply	Construction of shallow/deep wells	Shallow/deep well, pumping station, necessary pipes, supply of electricity, automatic control, disinfection system, protection of well
	Construction of small water treatment facilities for water wells that require more than disinfection systems	Filtration systems to reduce turbidity, aeration systems to reduce iron levels
	Construction of new water storage facilities	Cistern, water tower for existing or new water wells
	Construction of new surface water catchments from small water bodies	

Programme pipeline	Type of investment	Sample investment
	Construction of new ground water storage facilities	e.g. ponds
	Construction of small water treatment facilities for surface water catchments	Disinfection, filtration, aeration
	Construction of small, decentralised wastewater treatment facilities	
	Construction of water distribution network	Polyethylene (PE) or high-density polyethylene (HDPE) pipelines, pumping stations, automatic pressure stations
Irrigation	Rehabilitation of canals	Main, off-farm, in-farm and on-field canals
	Construction of new canals	Main, off-farm, in-farm and on-field canals
	Rehabilitation of transmission irrigation channels	
	Rehabilitation of hydro-junctions, pumping stations and sub-artesian wells	
	Rehabilitation of existing small reservoirs	
	Construction or rehabilitation of water storage infrastructure	
Wastewater	Investment in small-scale wastewater collection network	
	Investment in small-scale wastewater treatment plants	

Source: Authors.

In addition to the main types of investments, other investments to support the system include:

- Construction of long-range supply mains for diversity and security of supply may require the construction of long supply pipelines (this kind of investment is becoming necessary in many countries, for example, even including southwest Germany).
- Construction of storage and supply capacity, for bulk water supply areas with sufficient and reliable water supply, may seek to add additional customers.

All investments listed above will require proper maintenance and operation (including an electricity supply), which water users should pay through the tariff. The local utility or Azersu would manage the resulting infrastructure.

Other non-investment measures to support the effectiveness of the programme include:

- inventory of surface and groundwater sources, including the capacity and quality of the source
- campaigns raising awareness, for instance, of the cost of providing a stable and clean water supply and of water savings on the demand side.

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UNDP/GEF (2018), *The cost of water services for public water supply and agriculture in the Kura river basin*, United Nations Development Programme/Global Environment Facility, UNDP/GEF Kura II project. [7]

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UNECE (2011), *2nd Environmental Performance Review, Azerbaijan*, Environmental Performance Reviews Series No. 31, United Nations Economic Commission for Europe, New York and Geneva, https://unece.org/DAM/env/epr/epr_studies/azerbaijan%20II.pdf. [3]

Notes

[1] See the Decree of the President of the Republic of Azerbaijan No. 2178 of 27 July 2020, “About additional measures to ensure the use of water resources” at: https://e-qanun.az/framework/45487 (accessed on 20 October 2023).

[2] In 2022, Azerbaijan ranked 50th among the 193 UN member states, with a score of 73.45, closely followed by Georgia, in 51st place (and a score of 73.35). See the ranking at: https://dashboards.sdgindex.org/rankings (accessed on 8 November 2022).

[3] See the Decree of the President of the Republic of Azerbaijan No. 2178 of 27 July 2020 “About additional measures to ensure the use of water resources” at: https://e-qanun.az/framework/45487 (accessed on 15 November 2022).

[4] See the Decree of the President of the Republic of Azerbaijan No. 1986 of 15 April 2020 "About measures to ensure efficient use of water resources" at: https://e-qanun.az/framework/44899 (accessed on 17 November 2022). See also: https://president.az/az/articles/view/40093 (accessed on 17 November 2022).

[5] For the NPD process in Azerbaijan, see the Water Policy Highlights of the EUWI+ project at: https://issuu.com/oecd.publishing/docs/azerbaijan_euwi_highlights_web-1_ (accessed on 22 September 2022).

[6] See EUWI+ Policy Highlights – Azerbaijan at: https://www.oecd.org/env/outreach/npd-azerbaijan.htm (accessed on 3 November 2022).

[7] The Azerbaijan Investment Holding was established to manage state-owned companies and enterprises and increase the transparency and economic efficiency of their investment programmes, ensure their competitiveness and improve their financial health and sustainability. See the Decree of the President of the Republic of Azerbaijan No. 1120 of 7 August 2020 "About the establishment of Azerbaijan Investment Holding" at: https://e-qanun.az/framework/45612 (accessed on 1 December 2022).

[8] Available, for instance, at: https://www.oecd.org/env/outreach/npd-azerbaijan.htm (accessed on 13 December 2022).

[9] Available from the Ministry of Economy at: https://economy.gov.az/storage/files/files/1029/ckaZ7sv78T43pEDXtvRGR3rexllt6N5g86xeTPyJ.pdf.

[10] See the Decree of the President of the Republic of Azerbaijan No. 2469 of 2 February 2021, "On approval of 'Azerbaijan 2030: National Priorities for socio-economic development'" at: https://e-qanun.az/framework/46813 (accessed on 30 November 2022). See also: https://president.az/en/articles/view/50474 (accessed on 30 November 2022).

[11] See the Law of the Republic of Azerbaijan No. 116-IQ of 5 June 1996 "On amelioration and irrigation" at: https://e-qanun.az/framework/4170 (accessed on 30 November 2022).

[12] See the Law of the Republic of Azerbaijan No. 678-IQ of 8 June 1999 "On environmental protection" at: https://www.e-qanun.az/framework/3852 (accessed on 22 November 2022).

[13] See the Law of the Republic of Azerbaijan No. 677-IQ of 8 June 1999 "On environmental safety" at: https://e-qanun.az/framework/3851 (accessed on 22 November 2022).

[14] See the Law of the Republic of Azerbaijan No. 485-IQ of 17 April 1998 "On hydrometeorological activity" at: https://e-qanun.az/framework/3290 (accessed on 1 December 2022).

[15] See the Law of the Republic of Azerbaijan No. 514-IQ of 30 June 1998 "On industrial and household waste" at: https://e-qanun.az/framework/3186 (accessed on 18 November 2022).

[16] See the Law of the Republic of Azerbaijan No. 159-IIQ of 29 June 2001 "On municipal water management" at: https://e-qanun.az/framework/2760 (accessed on 22 November 2022).

[17] See the Law of the Republic of Azerbaijan No. 412-IIQ of 27 December 2002 "On the safety of hydrotechnical installations" at: https://e-qanun.az/framework/1946 (accessed on 5 December 2022).

[18] See the Law of the Republic of Azerbaijan No. 439-IQ of 13 February 1998 “On subsoil” at: https://e-qanun.az/framework/4273 (accessed on 18 November 2022).

[19] See the Law of the Republic of Azerbaijan No. 723-IQ of 28 October 1999 “On water supply and wastewater” at: https://e-qanun.az/framework/74 (accessed on 18 November 2022).

[20] See the Law of the Republic of Azerbaijan No. 418-IQ of 26 December 1997 "On approval of the Water Code of the Republic of Azerbaijan" at: https://www.e-qanun.az/framework/46940 (accessed on 21 November 2022).

[21] The Law on Amelioration and Irrigation was amended with technical assistance from the World Bank, with the goal of establishing the concept of water user associations that could act as non-governmental operators for water distribution and regulation of the water system operation (UNECE, 2011[3]).

[22] Based on data from Table “9.1. Main indicators classifying protection of water resources and their rational use” (https://stat.gov.az/source/environment/en/009_1en.xls, accessed on 8 September 2022).

[23] Data from Table “9.3. Main indicators characterizing water resources by types of economic activities in 2021” (https://stat.gov.az/source/environment/en/009_2-3en.xls, accessed on 10 September 2022).

[24] Data from Table “9.1. Main indicators characterizing protection of water resources and their rational use” (https://stat.gov.az/source/environment/en/009_1en.xls, accessed on 12 September 2022).

[25] More recent data are unfortunately not available.

[26] Based on data from Table “1.4. Population change” (https://stat.gov.az/source/demography/en/001_4-6en.xls, accessed on 20 September 2022).

[27] For further territorial-administrative divisions of Azerbaijan, see Table “1.16. Administrative territorial divisions by economic regions and administrative territorial units of the Republic of Azerbaijan in 2021” (https://stat.gov.az/source/demography/en/001_16en.xls (accessed on 7 October 2022).

[28] Based on data from Table “9.4. Volume of periodical and consecutive water supply in different cities” (https://stat.gov.az/source/environment/en/009_4en.xls, accessed on 26 September 2022); and Table “1.18. Population by economic regions and administrative territorial units of the Republic of Azerbaijan” (https://stat.gov.az/source/demography/en/001_18en.xls, accessed on 26 September 2022).

[29] Based on data from Table “9.1. Main indicators characterizing protection of water resources and their rational use” (https://stat.gov.az/source/environment/en/009_1en.xls, accessed on 6 October 2022).

[30] Based on data from Table “1.2. Population and area” (https://stat.gov.az/source/agriculture/en/1.2en.xls, accessed on 28 September 2022).

[31] For details, see FAO’s Country Profile of Azerbaijan at: https://www.fao.org/countryprofiles/index/en/?iso3=AZE (accessed on 14 October 2022).

[32] Based on data from Table “1.2. Population and area” (https://stat.gov.az/source/agriculture/en/1.2en.xls, accessed on 28 September 2022).

[33] See State Statistical Committee of Azerbaijan, Table "9.3. Main indicators characterizing water resources by types of economic activities in 2021" (https://www.stat.gov.az/source/environment/en/009_2-3en.xls, accessed on 28 September 2022).

[34] The Water Commission was established by Decree of the President of the Republic of Azerbaijan No. 1986 of 15 April 2020 "About measures to ensure efficient use of water resources" at: https://e-qanun.az/framework/44899 (accessed on 28 September 2022). See also: https://president.az/az/articles/view/40093 (accessed on 28 September 2022).

[35] In the Kura basin, water pollution is caused by a number of land-based sources, including industrial and mining sites, agricultural lands, households in rural areas and municipalities. Pollution in the Aras River comes from urban areas, agriculture, and industry and mining in both Armenia and Iran. Another major concern is heavy metal pollution from metallurgical and mining sites in Armenia and Turkey.

[36] However, sewerage systems are not available in the majority of Azerbaijan's small towns and settlements, whereas large towns and cities have simple mechanical sewage treatment facilities. However, these were mostly constructed in 1970s and suffer from overdue maintenance.

[37] For example, the Aras River is said to be one of the most turbid in the world.

[38] See State Statistical Committee of Azerbaijan, Table "9.1. Main indicators characterizing protection of water resources and their rational use" (https://stat.gov.az/source/environment/en/009_1en.xls, accessed on 9 October 2022).

[39] See Table "1.18. Population by economic regions and administrative territorial units of the Republic of Azerbaijan" (https://www.stat.gov.az/source/demoqraphy/en/001_18en.xls, accessed 5 October 2022).

[40] See Azersu's information on subscribers: https://azersu.az/en/page/43 (accessed 16 March 2022).

[41] See Table "1.18. Population by economic regions and administrative territorial units of the Republic of Azerbaijan" (https://www.stat.gov.az/source/demoqraphy/en/001_18en.xls, accessed on 5 October 2022).

[42] See Azersu's information on subscribers at: https://azersu.az/en/page/43 (accessed on 16 March 2022).

[43] Data on the potential area for irrigation is available at: www.fao.org/3/ca0218en/CA0218EN.pdf.

[44] Over one-third of the area (565 000 ha) is irrigated, using 931 pumping stations, of which 349 000 ha is irrigated by electrical pumps, 68 000 ha by diesel pumps and 148 000 ha from 7 352 sub-artesian wells. The country has a total of about 118 000 hydraulic structures of various types. About 29 640 km of collector-drainage networks provide drainage for approximately 609 000 ha. The remainder, about 55% of the total, have no drainage system. About 570 000 ha are served by on-farm drains. Database available at FAO's AQUASTAT information on Azerbaijan: https://www.fao.org/aquastat/en/countries-and-basins/country-profiles/country/AZE (accessed on 3 November 2022).

3 Main elements of the green public investment programme

This chapter describes the main elements and approach of the green public investment programme in Azerbaijan's water sector. It covers its objectives, phases and investment pipelines, as well as the costs and benefits of the proposed infrastructural investments. The chapter reviews the optimal public co-financing schemes and levels for the construction or renovation of the infrastructure of the water supply, irrigation and wastewater, which is due for an update. It also outlines the applied OECD costing model and methodology, as it has been adapted for the water sector. Not least, it lays out an optimal institutional set-up and timeframe for implementation, along with other steps that need to be organised, such as regular monitoring and evaluation and integrating the programme into planning and budgeting processes.

What are the objectives of the programme?

The proposed investment measures of the public support programme will help to adapt to the expected decline in the supply of quality water and/or increased water demand.[1] The programme will focus on enabling widespread use of non-standard water resources – in particular, groundwater extraction and surface water catchment.

The programme will diversify water supply sources, using an increased mix of surface water and groundwater, to ensure that the water supply does not fall below water demand in the future (taking into account the forecast impacts of climate change on water resources).

The objective of the proposed programme is to provide a safe domestic drinking water supply for the rural population, to reduce pollution from wastewater and to secure water for irrigation in conditions of climate change.

To this end, the programme will include five specific objectives:

- increase water extraction/catchment volumes[2]
- increase available water storage capacities[3]
- ensure groundwater level recovery/increase[4]
- ensure efficient water supply[5]
- ensure available water for irrigation services.

The programme is also designed to contribute to Azerbaijan's climate change adaptation efforts and its transition to a green economic model of development. The key policy document reflecting Azerbaijan's climate change adaptation in the water sector is Presidential Decree No. 2178 (of 27 July 2020),[6] which included measures on efficient use of water resources and constitutes the Action Plan for the National Water Strategy.

What will the programme involve?

In practice, the programme's objectives – to ensure safe domestic drinking water supply, secure irrigation water and reduce pollution from wastewater – will be achieved by supporting investments in the water sector.

The study conducted a market analysis (Chapter 4) identifying three groups of projects ("pipelines"):

- **Water supply**: Investment in increasing coverage of the drinking water supply, by constructing water intakes and wells, pumping stations and water distribution network, with all supporting elements.
- **Irrigation**: Investment in irrigation and drainage networks by rehabilitating existing, but deteriorated, infrastructure.
- **Wastewater**: Investment in small-scale wastewater collection network and wastewater treatment plants.

The proposed investment pipelines should be accompanied by other measures, especially awareness-raising and the introduction of a proper tariff system, at least covering operating costs.

The programme will be rolled out in two phases:

- The **first (pilot) phase** will be launched on a smaller scale. In total, 83 000 inhabitants of rural areas will be connected to the drinking water supply and the connection rate will increase from 50% to 98% in the three priority districts. In addition, 10 000 inhabitants of rural areas in the three

priority districts will be connected to wastewater facilities. Finally, 34 000 hectares of agricultural land in two priority regions will be irrigated by rehabilitated irrigation systems.

- The **second (scaling-up)** phase will extend the pilot phase. The target by 2030 is to connect a total of 548 000 of the rural population (an additional 465 000 people) to drinking water supply in two priority regions, increasing the connection rate from 60% to 98% in the selected districts. In addition, 93 000 hectares of agricultural land will be irrigated from rehabilitated irrigation systems and 10 000 of the rural population will be connected to wastewater facilities (unchanged from the pilot phase).

Phase 1 (pilot phase)

The programme analysis proposes that public support in the pilot phase focus on drinking water supply in the Astara and Lerik districts in the Lankaran-Astara economic region and Dashkasan district in the Ganja-Dashkasan economic region, which together have a rural population of 173 200. The current connection rate of 50% will be increased to 98%, linking over 83 000 new subscribers to the drinking water supply.

The investment in the drinking water supply in rural areas will include construction of water wells or spring capture, pumping facilities and water treatment plants (depending on the quality of water); water storage if needed; upgrading the distribution network (with polyethylene/high-density polyethylene pipes, valves, manholes and pumps); and adding connections to households and water meters. Rather than using new water sources, connecting to neighbouring existing water distribution systems will also be considered.

In the pilot phase, 30% of the existing 114 624 ha of the irrigated area in the Lankaran-Astara economic region, or 34 387 ha, will be rehabilitated. The types of investments include rehabilitation of canal mains, off-farm canals, in-farm canals and on-field canals, construction of new canals, as well as rehabilitation of hydro-junctions, pumping stations and sub-artesian wells, main collectors, closed catchment drains, closed drains and rehabilitation of existing small reservoirs or water storage.

In the pilot phase, 10 000 residents of the rural population in the Astara, Lerik and Dashkasan districts will be connected to wastewater facilities. The investment includes small wastewater treatment plants, wastewater collection systems (with pipelines and pumping stations if needed).

Table 3.1. Key input and output parameters of the programme's pilot phase

	Unit	Phase 1
Total population connected to drinking water supply	person	83 136
Total population connected to wastewater facilities	person	10 000
Total irrigated agricultural area with rehabilitated irrigation systems	ha	34 387
Total cost of installations	AZN mln	153.72
Co-financed by the programme	AZN mln	100.38
Co-financed by private/municipal entities	AZN mln	53.34

Note: The estimate is based on the current connection rate, setting the connection target, and estimating the unit cost of connecting one person.
Source: OECD calculations, OPTIC Model.

Phase 2 (scaling-up phase)

In Phase 2, the programme will expand, to cover a larger area in the priority regions and also to include other regions.

The focus will be on drinking water supply in additional districts and settlements in the priority Lankaran-Astara and Ganja-Dashkasan economic regions. Investments will cover an area with a total rural population of 1 223 000, and the connection rate will be increased from 60% to 98%. An additional 464 740 people will get access to drinking water (Table 3.2).

In addition, 30% of the existing irrigated area in the Gazakh-Tovuz economic region (a total of 118 410 ha) and the Ganja-Dashkasan economic region (a total of 78 132 ha) will undergo infrastructure rehabilitation, including 35 523 hectares in the Gazakh-Tovuz economic region and 23 440 hectares in Ganja-Dashkasan economic region, a total of 58 963 ha.

Phase 2 does not anticipate any new investments in wastewater infrastructure. The investments from the pilot phase will be evaluated and the programme updated for this type of investment if necessary.

As shown in Table 3.2, the target by 2030 is to connect 547 876 of the rural population to the drinking water supply after Phase 2, increasing the connection rate from 50% to 98% in selected districts in the Lankaran-Astara and Ganja-Dashkasan economic regions. Also, 93 350 ha of irrigation infrastructure in selected regions (Lankaran-Astara, Gazakh-Tovuz and Ganja-Dashkasan economic regions). The target by 2030 is to connect 10 000 of the rural population to wastewater facilities.

Table 3.2. Key input and output parameters of the assessed GPI Programme

	Unit	Phase 2	Phase 1 & Phase 2
Total population connected to drinking water supply	person	464 740	547 876
Total population connected to wastewater facilities	person	0	10 000
Total irrigated agricultural area with rehabilitated irrigation systems	ha	58 963	93 350
Total costs of installation	AZN mln	544.28	697.99
Co-financed by the programme	AZN mln	382.62	483.00
Co-financed by private/municipal entities	AZN mln	143.65	196.99

Source: OECD calculations, OPTIC Model.

What will the costs and benefits be?

Using the OPTIC Model to estimate costs and benefits

The costs and benefits of the Programme were estimated using an adjusted Excel-based model called Optimising Public Transport Investment Costs (OPTIC). This analytical tool was developed by the OECD to help public authorities prepare and estimate, as precisely as possible, the costs and environmental benefits of green public investment programmes (Box 3.1). The model was first designed and tested in Kazakhstan.[7] The assumptions surrounding cost calculation and emission reduction factors are described in Annex B, in the section “Programme costing for Phase 1 (pilot phase) and Phase 2 (scaling-up phase)”.

Box 3.1. The OPTIC Model

The spreadsheet-based OPTIC model is a simple, easy-to-use decision support tool prepared exclusively to calculate and optimise total programme costs, as well as the potential carbon dioxide emission reductions and reductions of other pollutants from urban public transport that could be achieved with the proposed project pipelines. The model also makes it possible to calculate the optimal level of subsidy that can be offered to potential beneficiaries.

Optimisation of costs and benefits involves achieving the given targets at the lowest possible cost for the public financier. If underlying economic conditions in the country change over the programme period (e.g. tariffs are increased or interest rates on commercial loans are lowered) and/or the public financing available is reduced or augmented, both targets and subsidy levels can be recalculated (or optimised) and adjusted accordingly.

The model has seven modules: 1) assumptions; 2) emission factors; 3) determining the subsidy level; 4) cost calculation; 5) emissions reductions calculation; 6) programme costing; and 7) results (environmental effects).

The model was designed for public transport, and was adjusted to the use of the green public investment programme focusing on the water sector.

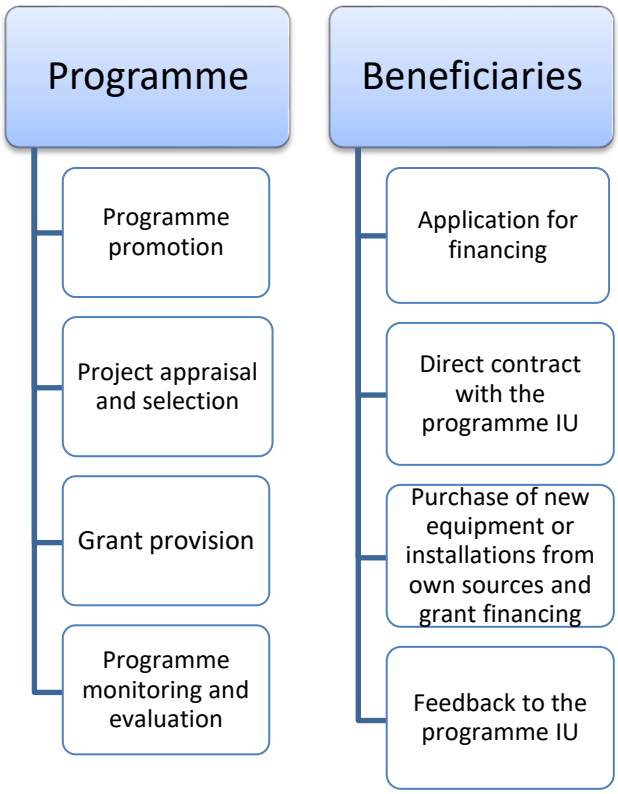
Investment costs and financing

Analysis suggests that the costs of the GPI Programme will be substantial. It is estimated that costs of the pilot phase of the programme will total AZN 153.72 million. The investment cost of Phase 1 and Phase 2 is estimated at AZN 697.99 million (Table 3.2), of which AZN 483.00 million in public support will be needed.

It will be challenging for the public financier to cover all these costs alone. To address this, public financial support will need to be solicited, including from international public financiers.

The proposed financing instrument is as follows: public support in the form of a subsidy (a grant) to motivate private and public beneficiaries to allocate their own financial resources to make investments. These generally require a higher initial investment in terms of purchase cost, but have future advantages (for example, lower water losses).

Figure 3.1. Financing from own sources and public grants

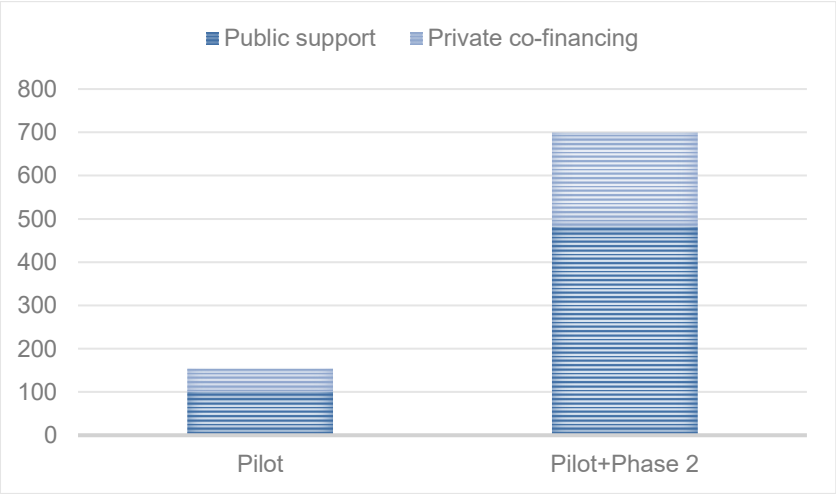


Source: Authors.

Figure 3.2 presents the overall GPI Programme costs for investors (municipalities and private) and public sector financiers (both national and international) in both phases of the programme.

Figure 3.2. Overview of GPI Programme's total investment costs

(AZN million)



Source: OECD calculations, OPTIC Model.

In total investments (Phases 1 and 2), between AZN 50.2 million and AZN 75.9 million will be disbursed annually from public sources. The total cost of both phases for the public budget will be AZN 484.6 million, an annual average of AZN 60.6 million averaged out over eight years of implementation.

Table 3.3 summarises the size, results and associated costs of the GPI Programme over the eight years.

Table 3.3. Summary of GPI Programme costs, Phases 1 and 2

	Overall costs	Public co-financing								
		Total	Year							
			1	2	3	4	5	6	7	8
	AZN million									
Preparation costs (including fundraising)	0.4	0.4	0.2	0.2						
Pilot phase	153.7	100.4	50.2	50.2						
Implementation unit (operating costs)	1.2	1.2			0.2	0.2	0.2	0.2	0.2	0.2
Second phase	544.3	382.6			31.9	47.8	75.7	75.7	75.7	75.7
Total	**699.6**	484.6	50.4	50.4	32.1	48.0	75.9	75.9	75.9	75.9

Source: OECD calculations, OPTIC Model.

Table 3.4 gives an exact estimation of the number of beneficiaries (or the serviced area) per investment pipeline, including total investment costs, the level of subsidy and the net costs for beneficiaries (for detailed numbers, see Table A B.3 in Annex B). Of the total estimated costs of both phases, AZN 698 million, AZN 483 million will be needed in public support. The bulk of the subsidies, AZN 391 million, will go to the water supply pipeline (81% of the public finance part of the programme). Given the overall investment total needed for the first pipeline, the net costs for the beneficiaries will also be substantial for the water supply facilities, despite this support.

Table 3.4. Investment costs, subsidies and net costs for beneficiaries

Type	Number of investment units	Investment costs	Subsidy	Net costs for beneficiaries
	Persons or hectares	AZN million	AZN million	AZN million
Water supply facilities	547 876 persons	521.03	390.77	130.25
Irrigation facilities	93 350 ha	161.96	80.98	80.98
Wastewater facilities	10 000 persons	15.00	11.25	3.75
Total		**697.99**	**483.00**	**214.99**

Source: OECD, OPTIC Model.

What is the optimal co-financing level?

Calculating the optimal level of public co-financing for the rehabilitation or construction of installations is an important element of the analysis. Our estimates suggest that the level of public funds should not exceed the rates provided in Table 3.5. These rates, which represent the optimal subsidy level per project

pipeline, were calculated using the OPTIC Model, based on the net present value (NPV) of selected types of investment.

The rate of financial assistance (subsidy rate) should be set to ensure that it does not replace but instead leverages beneficiaries' spending. The economic significance of this calculation is that the subsidy will encourage potential beneficiaries to participate in the GPI Programme, without aiming to make a profit based on the subsidy. The level of the subsidy should thus be kept at the absolute minimum, especially given the scarcity of public resources. This optimal minimum can be defined as the rate of assistance that makes environmentally and economically important projects financially viable (Annex B).

Table 3.5. Summary of public support for the GPI Programme

Programme pipeline	Investment	Estimated public co-financing
Water supply	Increase in coverage of the drinking water supply, constructing water intakes and wells, pumping stations, water distribution network and all supporting elements	75%
Irrigation	Irrigation and drainage networks by rehabilitating existing, deteriorated infrastructure	50%
Wastewater	Small-scale wastewater collection network and wastewater treatment plants	75%
Accompanying investments	This includes any necessary accompanying investments to ensure the project's success, including purchase of land and arranging access to land.	Provided by municipalities

Note: Percentage values denote the level of public support in the purchase costs.
Source: OECD calculations, OPTIC Model.

It is essential to monitor market developments regularly (e.g. changes in equipment and water prices, development of the market for new technologies and availability of other financing sources) and how they interact with the GPI Programme design (see Chapter 3). Market changes need to be reflected in the programme, and the state subsidy level adjusted accordingly. The section on "Programme costing for Phase 1 (pilot phase) and Phase 2 (scaling-up phase)" in Annex B provides an indicative calculation of the optimal subsidy level based on current (2021) prices. These, however, are offered more as an illustration of how the subsidy level needs to be calculated, rather than as absolute values. The model offers an opportunity to adjust and optimise the programme's assumptions and their effects, by changing the basic data as appropriate.

What will the timeframe look like?

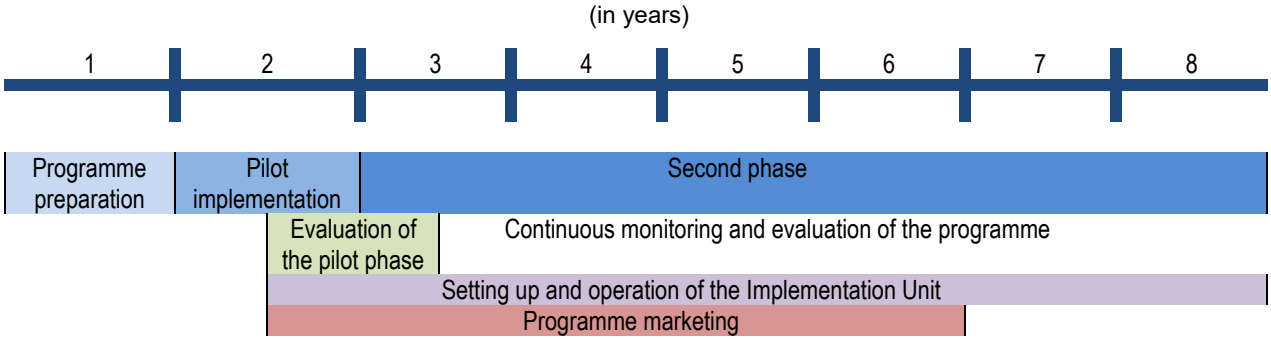
Given that the GPI Programme will be co-financed with public funds, a preparation period will be needed before the first phase, in order to include the programme provisions in the state budget process and to identify and apply for funding from additional financing sources (including donors).

Once project financing is agreed upon, the rollout of the programme will be relatively rapid. The pilot phase could thus take up to two years. The implementation of the second phase will take about six years (Figure 3.3).

In addition, annual evaluations of the programme should be conducted to see whether the selected and implemented projects are helping to meet government objectives and to revise the programme, if necessary. Since the programme is designed to be co-financed through the state budget, any update should be co-ordinated with the existing multi-year budget and its requirements. On this basis, annual financial plans for financing through the regular annual budget should be prepared.

The experience of other countries with similar publicly supported investments suggests that such programmes are best implemented over the medium to long term (5 to 10 years) and linked to government targets. The results of the first phase will be evaluated to decide whether to continue with the second phase. If this is the case, it is proposed that the second phase of the programme be carried out over six years and then reviewed in detail. A decision can then be made as to whether it should be extended or brought to a close, to reflect any new policy objectives and government goals or market developments.

Figure 3.3. Proposed timeline



Source: Authors' proposal.

What is the proposed set-up for implementation?

Carrying out the programme will require institutional arrangements that ensure transparent and cost-effective decision making. The report analyses several institutional options. The institutional set-up proposed in this study includes three levels: 1) a programming entity, 2) an implementation unit and 3) a technical support unit. Their roles and responsibilities are presented in detail in Chapter 5.

Conclusions

The programme is expected to involve investments (Phases 1 and 2) of over AZN 87 million, disbursed annually from both public and private sources over eight years (two years for the pilot phase and six years for the second phase), for a total of AZN 698 million. Given the demands for public financing of infrastructure projects throughout the country, the Government of Azerbaijan will need to consider both domestic (public and private) and international financing sources to meet the policy objectives of both the programme and the water sector.

Notes

[1] Deterioration of water quality reduces the available water supply in the same way as drought (or low precipitation periods). This includes using desalination when the need arises (to correct for the intrusion of saline water in groundwater bodies) or other water treatment in the case of pollution.

[2] With careful attention to groundwater mining risks.

[3] Methods for accomplishing this may include constructing a dam, practicing aquifer storage and recovery, removing accumulated sediment in reservoirs or lowering water intake elevation.

[4] Increasing groundwater storage promotes recharge when surface water flows exceed demand, increasing climate resilience for seasonal or extended periods of drought, and taking advantage of seasonal variations in surface water runoff. The required infrastructure may include percolation basins and injection wells, depending on whether natural or artificial aquifer recharge is employed.

[5] For example, by establishing water trading with other utilities in times of water shortage or service disruption. Other effective measures include, for instance, reduction of water losses (e.g. through rehabilitation of water infrastructure), or treatment and reuse of returned waters.

[6] See the Decree of the President of the Republic of Azerbaijan No. 2178 of 27 July 2020 “About additional measures to ensure the use of water resources” at: https://e-qanun.az/framework/45487 (accessed on 15 November 2022).

[7] “Promoting Clean Urban Public Transportation and Green Investment in Kazakhstan”. Green Finance and Investment, OECD Publishing, Paris, 2017, https://doi.org/10.1787/9789264279643-en.

4 Economic analysis of the Programme

This chapter presents key assumptions of the three main investment pipelines of the water sector public expenditure programme. It outlines the number of units to be replaced (including their length and area) in the water supply, irrigation and wastewater infrastructure, their respective unit costs, marginal costs and the assumed savings for achieving the programme's target connection rate. In the second part of the economic analysis, the chapter describes sources and instruments available for co-financing the programme, both from national and local budgets and from international donors and financing institutions. The chapter reviews similar capital investments in fixed assets and repairs in the recent past, which the programme will complement. Detailed calculations that provide the basis for the financial outcomes presented are detailed in Annex B.

Analysis of programme pipelines

Water supply pipeline

The programme pipeline includes investments to increase the drinking water supply coverage by construction of water intakes and wells, pumping stations, and a water distribution network with all supporting elements.

The investments are complex and not replicable, and the investment costs depend on the individual technical design. Thus, the average unit cost method of estimating the investment costs were used. As per source, the unit cost per person of providing water supply that was used in the economic analysis of the programme was AZN 951 per person.

It is assumed that operating and future investment costs will be covered by user tariffs.

Table 4.1. Key assumptions for the GPI Programme – water supply

District/ city / settlement	Population	Water supply pipe, km	Urban population	Assumed connection rate, urban	Rural population	Assumed connection rate, rural	Unit cost per person (AZN/person)
Priority areas – Phase 1	230 900	115	57 700	Approximately 70%	173 200	Approximately 50%	951
Priority areas – Phase 2	2 009 900	1 568	786 900	Approximately 90%	1 223 000	Approximately 60%	951

Source: Authors' calculations based on existing feasibility studies (indexed costs) and projects recently implemented by Azersu OJSC.[1]

Irrigation pipeline

The programme pipeline includes investments in irrigation and drainage networks by rehabilitating the existing, deteriorated infrastructure. The investments are complex and not replicable, and the investment costs depend on the individual technical design. The investments include many components, as shown in the table below, and the average unit costs method of estimating the investment costs was used. As per source, the unit cost per hectare of irrigated area is 14.79 AZN/ha. As per operating and future investment costs, it is assumed that they will be covered by tariffs paid by users.

The rehabilitation will result in significant savings in water. The calculation of the public support level thus includes benefits from this savings. Details of the value of the savings are provided in "Determining the subsidy level" in Annex B.

Table 4.2. Key assumptions for GPI Programme – irrigation and drainage networks

Unit price assumption	Unit	Unit price in AZN	Units to replace	Assumed savings/unit[2]	Marginal cost of water[3]	Notes
Rehabilitation of irrigation and drainage network[4]	AZN/ha	771-1 735	420 000 ha (30% of 1.4 million)	Up to 3.5 million m³/year	7.4-14.79 AZN/1 000 m³	Alternative calculation
Rehabilitation of canal, main	AZN/m	346	2 000 km (main)	Up to 154 million m³/year	7.4-14.79 AZN/1 000 m³	
Rehabilitation of canal, off-farm	AZN/m	346	6 300 km (off-farm)	Up to 490 million m³/year	7.4-14.79 AZN/1 000 m³	
Rehabilitation of canal, in-farm	AZN/m	346	9 900 km (in-farm)	Up to 756 million m³/year	7.4-14.79 AZN/1 000 m³	
Rehabilitation of canal, on-field	AZN/m	346	20 000 km (on-field)	Up to 1.5 billion m³/year	14.79-25 AZN/1 000 m³	
Construction of new canal	AZN/m	346	890 km	300 million m³/year – new supply (estimate)	New sales: 0.50 AZN/ 1 000 m³	New supply
Rehabilitation of hydro-junctions, pumping stations and sub-artesian wells	AZN/unit	192 000	334 pumping stations	Assume 15% reduction in operation and maintenance costs (assumption)		Part of above
		96 000	7 hydro-junctions			
		96 000	417 sub-artesian wells			
Unit price for installation of main collector	AZN/m	68.85	971 km			Drainage of land
Unit price of installation of closed catchment drain	AZN/m	185.77	8 000 km			Drainage
Unit price of installation of closed drain	AZN/m	52	3 950 km			Drainage
Rehabilitation of existing small reservoirs	AZN/unit	Not provided[5]	58 reservoirs, total capacity 13.3 million m³			
Water storage	AZN/unit	958 000	Up to 10 000 m³ capacity			
Tariff, bulk water (sold to Water User Associations)	AZN/ 1 000m³	0.50				
Tariff, resale bulk water (sold to Water User Associations)	AZN/ 1 000 m³	5-15				
Assumed cost	AZN/	20				

recovery tariff[6]	1 000 m^3					

Source: Azerbaijan Amelioration and Water Farm OJSC (if not stated otherwise) and authors' assumptions.

Wastewater pipeline

The programme pipeline includes investments in small-scale wastewater collection networks and wastewater treatment plants.

The investments are complex and not replicable, and the investment costs depend on the individual technical design. Thus, the average unit cost method of estimating the investment costs were used. The unit cost per person of small-scale wastewater systems is AZN 1 500 per person (international costs adjusted to the conditions in Azerbaijan).

Available co-financing for investment projects

Large-scale investment programmes in Azerbaijan have been financed by public funds (from the state budget and by Azersu OJSC, Azerbaijan Amelioration and Water Farm OJSC), international financial institutions (IFIs), donors and private investment. This section reviews some of the potential financing sources for the GPI Programme.

State budget

Co-financing from the state budget is a typical source of the finance for state environmental programmes. Given Azerbaijan's budget constraints, only a part of the programme costs can be co-financed from the state budget. On the other hand, this share of the financing will be important, to demonstrate commitment to potential donors or IFIs for obtaining international co-financing. Regardless of the share of the co-financing from the state budget, this has to be carefully planned in the budget process and included in the mid-term expenditure framework (MTEF).

As shown in the following table, public expenditures on capital repairs of water and wastewater fixed assets from 2015 to 2020, totalling AZN 9.687 million, for an annual average of AZN 1.615 million. This amount will have to increase as investments in fixed assets increase, in order to ensure that those assets will continue to deliver the expected service levels.

Table 4.3. Capital repairs of fixed assets for environmental protection, 2015-2020

(AZN)

	2015	2016	2017	2018	2019	2020	Total 2015-20	Average 2015-20
Total	1 605 000	1 043 400	5 123 600	3 395 100	971 600	1 920 100	14 058 800	2 343 130
Including:								
treatment of wastewater and rational use of water resources	1 115 400	624 500	4 281 200	1 315 400	548 200	1 802 700	9 687 400	1 614 560
% of total	69.5%	59.9%	83.6%	38.7%	56.4%	93.9%		69%

Source: State Statistical Committee of Azerbaijan.[7]

Public expenditures on capital investments in water resources protection and rational use, however, have been markedly higher. From 2015-2020, these expenditures totalled just over AZN 1 billion, for an annual average of AZN 168 million. This amount will have to be maintained in the coming decade in order to meet programme and state policy objectives.

Table 4.4. Capital expenditure on environmental protection, 2015-2020

(AZN million)

	2015	2016	2017	2018	2019	2020	Total 2015-2020	Average 2015-2020
Total	109.5	133.4	247.9	309.9	170.2	84.7	1 055.8	176.0
Of which:								
- capital investments for protection of water resources and their rational use	109.0	117.4	233.3	294.9	170.2	84.5	1 009.3	168.2
% of total	99.5%	88.0%	94.1%	95.2%	100.0%	99.5%		96.1%

Source: State Statistical Committee of Azerbaijan.[8]

Azersu OJSC maintains a robust investment programme in water supply and wastewater infrastructure, and co-operates with IFIs and donors, including the Asian Development Bank, the World Bank, KfW Development Bank and others.

Azerbaijan Amelioration and Water Farm OJSC

Azerbaijan Amelioration and Water Farm OJSC also maintains a robust investment programme in irrigation and drainage infrastructure.

Possible co-operation with donors and IFIs

Carrying out the programme is likely to involve co-operation with donors and IFIs. Azerbaijan continues to obtain support for policy reforms and capital investments from various IFIs and donors.

According to the World Bank, the combined efforts of the Government of Azerbaijan and several major international partners from Europe and Asia were covering the needs of about 80% of the urban population in rayons outside Baku, and it was expected that the rest would be addressed soon.

Most IFIs prefer larger-scale projects, although a green investment programme aimed at climate change adaptation and resilience could be part of a larger facility that might prove interesting to IFIs. In the case of the Green Climate Fund (GCF), which provides a mix of grants and loans, all climate adaptation measures can be a part of co-financing, and the programme could become part of a more extensive application to the GCF that includes other climate adaptation measures.

Conclusions for the programme

The amounts calculated for implementation of the GPI Programme appear to be within reach of Azerbaijan's financing capacities. At the same time, however, given investment needs in other sectors –

as well as the massive investment required in irrigation and drainage infrastructure – the Government of Azerbaijan should seek support from diverse funding sources, including IFIs and donors. It is also important not to neglect financing from user charges (tariffs), which must be progressively increased to cost-recovery levels.

Notes

[1] Based on information retrieved from Azersu's website (https://azersu.az/az, accessed on 16 March 2022), as well as project descriptions received individually.

[2] UNDP/GEF, "Water supply and demand management", 2018.

[3] World Bank, "Review of World Bank Engagement in the Irrigation and Drainage Sector in Azerbaijan, 2013" – and adjusted for inflation.

[4] *Ibid.*

[5] Although the reservoirs are described as "small" in the Water Strategy, the investment required demonstrated that the project cover large bodies of water – of on average 230 000 m^3.

[6] UNDP/GEF, "The cost of water supply and agriculture in the Kura River Basin", 2018.

[7] Based on data from Table "13.6. Expenditures for capital repair of fixed assets on protection of environment" (https://www.stat.gov.az/source/environment/en/013_6en.xls, accessed on 27 October 2022).

[8] Based on data from Table "13.7. Capital investments directed to rational use of natural resources and protection of environment" (https://www.stat.gov.az/source/environment/en/013_7en.xls, accessed on 27 October 2022).

5 Institutional arrangements and implementation barriers

This chapter illustrates the appropriate structures, procedures and practices for public environmental management. It lays out several possible arrangements for large-scale national public investment programmes, based on best practices from other (OECD) countries. Taking account of the capacity available and of past experience, the chapter reviews several public institutions responsible for the water sector that can take on the roles of the programming/supervising authority, managing entity and the technical support unit. The chapter includes essential operational rules and regulations, as well as other important measures required, such as promoting the programme, awareness building and eliminating policy distortions. As for the set-up for implementation, the chapter gives a brief outline of the lead national bodies in Azerbaijan's water sector – including their proposed functions and responsibilities – and of other relevant stakeholders.

Good practice arrangements for managing public investment programmes

Several good practices can be followed for managing public environmental expenditure. Simple expenditure programmes (e.g. financing research or education, purchasing simple equipment or standard services) may be managed directly, by assigning additional responsibilities to existing government institutions at a variety of levels, using their regular staff and routine budget processes. For larger-scale, targeted programmes, in particular those that involve financing capital investments, like this green public investment (GPI) Programme, special institutional arrangements are recommended. These may take many forms and involve various types of implementing units (OECD, 2007[1]).

Deciding which form is appropriate will depend on a variety of factors, including the sources of finance, the types of disbursements envisaged, and the legal and political culture of governance in a given country. Regardless of the institutional form, public environmental expenditure management should involve institutional structures and procedures that promote environmental effectiveness, embody fiscal prudence, and use financial and human resources efficiently.

Experience shows that these arrangements can take four basic forms:

1. government implementation units
2. environmental funds or similar public finance institutions
3. directed credit or a line of credit to financial intermediaries (such as banks)
4. outsourcing.

Government implementation units are the most common arrangements, and include the following institutional forms:

- government departments with responsibility for procuring goods and services or financing specific projects within the state budget
- project implementation units established in a government department to undertake projects within a specific government expenditure programme included in the budget
- autonomous/decentralised government units financed by the budget but set up to decouple the delivery of services or administrative tasks from policy formulation.

Government implementation units mainly manage government budget resources, although project implementation units may also manage multilateral or bilateral grant resources. Regardless of the type of government implementation unit chosen, carrying a programme to completion requires capacity for project selection, implementation and monitoring. This means hiring skilled, trained personnel with a dedicated focus on the programme. Environmental programmes involving around EUR 50 million annually and about 200 contracts per year in Central and Eastern Europe generally require a staff of more than 20 people.

In the case of the programme discussed in this study, despite the potentially large number of contracts, of which most will be similar in scope and required materials and equipment, only five people will be needed (see Table 3.3 and Table 3.4 for the cost of setting up the programme). On the other hand, much effort will be required for the awareness building and promotion part of the programme. This can be outsourced, for example to NGOs, while the respective budgets are ensured.

In most instances, the institutional arrangement for large-scale (investment) programmes includes both a management (implementation) unit and a supervisory body. The implementation unit's management and staff are responsible for the day-to-day project cycle activities (identification, selection, appraisal and monitoring of projects), development of the annual expenditure plan and budget, and monitoring and preparation of reports.

The supervisory body usually focuses on taking strategic decisions and approving internal operating procedures and rules (including eligibility and appraisal criteria to guide project selection). This division of

responsibilities provides a system of checks and balances and improves the accountability of the programme. The supervisory body retains the final decision-making authority to approve financing of the individual projects recommended by the implementation unit's technical staff after the appraisal process. In the case of the GPI Programme, supervision will be performed by the programming entity.

Outsourcing or contracting out is another option if the government department does not have the capacity to fulfil its duties as an implementation unit. This allows an implementation unit to enter into a contract with an outside supplier for the provision of goods and services typically provided internally. If this option is chosen, good practice requires that outsourcing be conducted through competitive tendering.

Proposed institutional set-up for the programme

In preparing any public investment programme, the public financier needs to ensure that the essential individual elements of the programme are carefully designed and in place before the programme is launched. This section summarises these elements for the green public investment programme in Azerbaijan proposed as part of this study and explains how and why the project team arrived at these solutions.

Effective programme implementation requires the following elements:

- stable and predictable sources of finance for the programme
- institutional arrangements to manage the programme expenditure, with sufficient resources, qualified staff and instruments to meet its objectives
- well-documented principles, rules and operating procedures for project cycle management (PCM)
- clearly defined and robust criteria for appraisal, selection and financing of investment projects
- clearly defined procurement rules.

To facilitate the implementation of this investment programme, this chapter and the annex provide detailed information on the following arrangements:

- a proposal for institutional arrangements at three levels: 1) a programming entity (PE); 2) an implementation unit (IU); and 3) a technical support unit (TSU)
- a proposal for PCM procedures, including eligibility criteria, project appraisal criteria, project-ranking procedures and financing rules (Annex A).

The institutional set-up needs to ensure that sufficient resources are allocated to meet the programme's objectives, and that qualified staff and instruments to implement the programme are made available. In general, programming and project appraisal should be strictly separated. Programming is the responsibility of the programming entity in the government agency appointed to manage the investment programme. Project appraisal is a technical process conducted by competent technical staff recruited on a competitive merit basis and held responsible for their decisions. The implementation unit should be operationally and technically independent and shielded from political pressures by rules and procedures developed by the programme's technical staff.

The role of the programming entity

The Ministry of Ecology and Natural Resources (MENR) is best suited to act as the programming entity. It could use its available staff and resources to undertake its programming duties, while consulting with other relevant government agencies, professional associations, local municipalities and non-government organisations, as appropriate (the main stakeholders are briefly discussed and presented further in this chapter). In addition, representatives of these bodies may be invited to sit on and have an advisory role on the programme's supervisory board.

The programming entity is responsible for designing the programme, including:

- defining priority environmental objectives for the investment programme that are specific, measurable, realistic and time-bound
- developing an investment programme that responds to the overall environmental and climate-related objectives. This programme should include specific targets, cost estimates, descriptions of eligible project types and beneficiaries, terms of financing, procedures, principles and criteria of project appraisal and selection, procurement rules, programme timeframe and indicators of performance.
- determining sources of funds and the size of the financial envelope of the investment programme
- selecting the best institutional arrangements for managing the investment programme – in particular, deciding whether the programme can be managed directly by existing government institutions at different levels, or whether special institutional arrangements are required
- selecting, contracting and monitoring the implementation unit to manage the investment programme
- selecting and monitoring the technical support units required to implement the programme.[1]

Deciding on an implementation unit

The implementation unit (IU) is responsible for drafting the programme's operating regulations. The IU needs to consult with the technical support unit(s) in drafting and using its operating regulations. Because programming is a political process, it is important that the responsibilities for programming and project cycle management are separate and distinct, with the IU managing the project cycle. The IU conducts marketing activities for the programme, identifies beneficiaries and appraises beneficiaries' project proposals for eligibility. It would also provide MENR with information on the planned number of beneficiaries and programme financial needs. The IU would report to MENR on programme expenditure so that MENR can monitor the budget implementation for a given year (or programming cycle) and project type (project "baskets").

The role of IU could be fulfilled by:

- the State Water Resources Agency – for all components (once the agency is fully established and operational)
- Azersu OJSC – for the water supply and wastewater components of the programme
- Azerbaijan Amelioration and Water Farm OJSC – for the irrigation and drainage components of the programme.

Appointing a technical support unit

The technical support unit (TSU) would give specialised assistance, advice and expertise in the areas of water production, wastewater treatment, and irrigation and drainage. As this task is quite broad, no one entity can assume this role. Although TSUs may be defined as deemed necessary and prudent, the skills and knowledge of Azersu OJSC and Azerbaijan Amelioration and Water Farm OJSC in the areas of concern can be deemed adequate for programme implementation.

Fundamental operating regulations

The effective implementation of the programme requires that the implementation unit (IU) define and publicise its operational rules and regulations. At a minimum, the core elements of such rules should include:

- definitions
- general provisions
- definition of eligible projects
- rules for awarding grants
- rules for modifying or terminating a grant contract
- procedures for programme review.

The grant agreement with the beneficiary should include the following terms and conditions:

- the amount of the grant award (as an absolute value or as a share of total project investment cost)
- start and end dates of the project to be financed, as well as planned environmental effects
- the date on which the grant, or its instalments, will be transferred to the recipient
- the rights of the IU to control the awarded grant, as well as the method of recovering the grant if the project fails to meet its stated objectives
- grantees' specific obligations arising under the contract with the programme IU
- conditions under which the contract loses its force
- consequences of contract dissolution
- project durability period and consequences of violating it.

The grant for a project should not cover 100% of the funds earmarked for that type of project in the IU's annual financial plan. This is to leverage resources from other sources and ensure the commitment of the recipients to implementing the project using their own resources.

Given the nature of investments to be financed under the Programme, it is proposed that the programme should be financed by the state budget within the medium-term expenditure framework (MTEF) process. Financial support should be provided in the form of grants.

Other procedural rules also need to be considered. For example:

1. The grant may be transferred to the applicant all at once or in instalments (tranches).
2. A portion of the grant may be transferred in advance (up to 20% of the total value of the project), if project start-up is impossible without advance funding.
3. The recipient of a grant advance should be required to return to the IU any interest resulting from holding the grant in its bank account (or the amount may be deducted from future tranches).
4. The dates for making grant transfers are determined by the IU based on the funds at its disposal and on consideration of an applicant's proposal, as presented in the application.
5. Financial resources from the grant are transferred exclusively for the purpose of meeting the payments required by the grantee. The recipient should allow the IU full access to original invoices prepared by contractors or suppliers.

The OECD Handbook for Appraisal of Environmental Projects Financed from Public Funds includes detailed discussion of all the rules that need to be considered in defining the procedures for the programme IU. It could be useful in further defining the programme's procedural rules (OECD, 2007[1]).

The programme implementation shall strictly apply project durability criteria, i.e. when public support is provided the obligation to use assets for at least five years. This can be imposed on public bodies (municipalities), but a guarantee might also be required from the private entity that will be realised after five years.

Promoting the programme and awareness building

Promotion is essential for the success of the programme and is the responsibility of the IU. The promotion package might include the following elements:

- building awareness among local farmers
- sending programme information to local administrations and potential beneficiaries
- distributing programme rules to local administrations and potential beneficiaries
- maintaining the IU's website with information on rules for awarding grants and application forms
- issuing press releases.

The costs of programme promotion should be included in the programme costs envelope.

Eliminating policy distortions

Various regulatory barriers may complicate the implementation of even a well-designed investment programme. It is important that before a programme is developed and financed, the Government of Azerbaijan reviews the relevant regulatory basis and eliminates any barriers to the extent possible. Combining such regulatory improvements with financial support from the state is more likely to lead to sustainable water supply, irrigation and drainage systems.

The economic analysis shows that under current conditions, the level of public support has to be very high (between 50% and 75%) to ensure the interest of the potential beneficiaries.

One of the biggest obstacles for an investment programme that results in sustainable changes in water supply, wastewater treatment, and irrigation and drainage is the lack of cost recovery tariffs for those services.

Overview of the main actors in the water sector

As noted in Chapter 2, the President of Azerbaijan established the Commission on Water Resources and supporting working groups under the Cabinet of Ministers, to ensure efficient use of water resources, improve water management, and co-ordinate activities in this area.[2] The Cabinet of Ministers ensures co-ordination of the work of stakeholders in the water sector, but also approves by-laws related to issues of management, regulation, safety and protection of water resources. The Cabinet of Ministers also approves national schemes for the placement and development of water supply and wastewater systems, as well as requirements for the installation of water-measuring devices, and co-ordinates the volumes of water supplied to consumers of important sectors of the economy.

The Water Commission was established in 2020[3] to ensure the efficient use of water resources, improve water management and co-ordinate activities in this area.

Water resources in Azerbaijan are state property. As noted in Chapter 2, water resources management is governed by several state bodies, including:

- the Ministry of Ecology and Natural Resources
- the State Agency for Water Resources of the Ministry of Emergency Situations
- the Ministry of Health
- Azerbaijan Amelioration and Water Farm OJSC
- Azersu OJSC

- Azerenergy OJSC
- the Ministry of Agriculture, which, while it is not responsible for managing water resources, is a key stakeholder, since the agriculture sector is the largest consumer of water.

The above-mentioned ministries perform the role of the main regulatory central executive bodies for the management, regulation, security and protection of Azerbaijan's water resources. The state companies (as well as municipalities, which operate water and wastewater facilities) are responsible for issues of exploitation of water management, water supply and sewage networks. Local executive bodies (municipalities) also carry out tasks related to land management near water bodies and execute policies of water intake and water supply. Local executive bodies are not only responsible for water supply and water quality, but also for development of standards for water use (UNECE, 2019[2]); (UN-Water, 2007[3]).

The following sections present general water-related roles and responsibilities of the actors that are suggested for direct implementation of the programme: the Ministry of Ecology and Natural Resources as the programming entity, and Azerbaijan Amelioration and Water Farm OJSC and Azersu OJSC as the implementation and technical support units. Further stakeholders include the Ministry of Emergency Situations, Ministry of Energy, Ministry of Agriculture, Azerbaijan Investment Holding, Water Users Associations and the State Agency for Alternative and Renewable Energy Sources (SAARES).

Ministry of Ecology and Natural Resources

The Ministry of Ecology and Natural Resources (MENR) is the main authority to formulate and implement state policies in environmental protection and pollution prevention. Its sustainability portfolio also includes rational use and restoration of water resources, both of surface water and groundwater. The MENR compiles water balances, evaluates groundwater yields, and deals with the issues of rational use and the regeneration of water resources.

The ministry is responsible for conducting groundwater resource inventories and manages a network of monitoring stations for continuous hydrometric, hydro-geological, and hydro-chemical observations. Significantly, the development and revision of the groundwater cadastre is a key government priority, indicating that the groundwater inventory is out of date. The ministry also issues permits for the abstraction of water from surface water bodies and underground sources. It also establishes and approves standards of maximum allowable discharges (MAD) of the discharge of wastewater into all water bodies (including the Caspian Sea) and supervises them through regional offices.

The MENR includes several water-related departments and services, including the Ecological Policy Division (MENR-EcPD),[4] Environmental Protection Department (MENR-EnPD),[5] National Environmental Monitoring Department (MENR-NEMD),[6] National Geological Exploration Service (MENR-NGES),[7] National Hydrometeorological Service (MENR-NHS),[8] and the State Environmental Expertise Agency (MENR-SEEA).[9]

Azerbaijan State Water Resources Agency

In March 2023, the Azerbaijan State Water Resources Agency was established on the basis of the State Water Resources Agency of the Ministry of Emergencies.[10]

With this act, the Azersu OJSC and Azerbaijan Melioration and Water Farm OJSC, together with their assets, will be placed under the control of the Agency. Until the agency's charter and structure were approved, however, Azersu OJSC and the Azerbaijan Melioration and Water Farm OJSC were to continue their activities under the current structure.

The Agency will:

- organise activities in the field of extraction, processing, transportation and supply of water in the Republic of Azerbaijan
- operate state-owned reclamation and irrigation systems, drinking water supply, rain and wastewater processing and discharge systems, as well as the provision of services in this field
- organise and monitor the technical condition of water management facilities, surface and underground water resources, hydrotechnical facilities, water supply systems in the Republic of Azerbaijan, and implement state policy in these areas.

Azersu OJSC

The Azersu OJSC and its subsidiaries (mainly local and regional water service providers) are fully owned by the Government of Azerbaijan. It is responsible for centralising state policy and strategy on water supply (drinking water) and sanitation services to consumers. The areas of activity include community water treatment and supply, wastewater collection and treatment, as well as transportation and sales of water. Azersu generates revenues from the sale of water, wastewater services and other revenues (sale of water meters, scientific research and design projects). The revenues, however, do not cover expenses, and the company operates at a loss.

The main source of investment activities is the government budget, as well as loans from international financial institutions (including the German KfW, the World Bank, the Asian Development Bank and the French investment bank Natixis). Azersu's primary responsibilities cover: 1) integrated use of water resources and assessing needs in water resources; 2) developing forecasts and norms of water use; 3) forecasting the distribution of water between different sectors of economy; and 4) determining the water use fees (in co-operation with the Tariff Council of the Republic of Azerbaijan, which is regulates the tariffs imposed by natural and government monopolies in the country).[11]

Azersu collects water supply and wastewater collection and treatment fees. As of 1 January 2023, it had 13 900 employees and 1 767 898 subscribers across the country, including 1 697 983 household subscribers and 69 915 non-household subscribers. Approximately 88% of subscribers are metered. The company reports that nearly 80% of subscribers, including 82% in Baku and 73% in the regions, have access to uninterrupted water supply. The company administers 21 000 km of water pipes and 10 500 km of sewerage and stormwater pipes.[12]

On the water infrastructure side, Azersu is responsible for the design, construction, operation and maintenance of intake structures, reservoirs, pumping stations, water pipelines and sewage collectors. It has a history of implementing water supply projects co-financed from international financing sources and has undertaken several water supply investment projects in the past ten to 15 years. Information on key projects, and additional information on Azersu, is presented in the Annex.

Azerbaijan Amelioration and Water Farm

The Azerbaijan Amelioration and Water Farm (AAWF) OJSC is a state-owned enterprise responsible for managing, monitoring and providing irrigation water to agriculture. The AAWF's overall functions and responsibilities include the distribution of water to industries and the agricultural irrigation sector and also the design and construction of new state-owned irrigation and drainage systems, as well as the reconstruction of existing systems.

More specifically, the AAWF provides bulk water supplies to irrigation systems and oversees the development and management of irrigation and drainage systems throughout the country. It also improves the drainage of land and infrastructure, to combat flooding. The agency is financed mainly by the sale of goods and services (water sales) and runs operating surpluses. For example, in 2021, it generated revenues from sales of AZN 513 million. For investments, however, it also obtains financing from the central government.[13]

As for health and the environment, the agency ensures state control in water use and protection, by maintaining a register on water use and conservation or preparing overall plans with other relevant state bodies for the integrated use of surface water use and its protection. The agency is also responsible for mitigating salinity problems on irrigated lands and arranging measures to combat flooding and flood water.

It also determines the water use fees, supervises activities of water users associations and is a key organisation for issuing water use permits for surface water use.[14] The AAWF established district irrigation departments (DIDs) to plan and implement bulk water supplies to water users associations at the farm level. Azerbaijan has 49 DIDs, one in each regional district, as a local representative of the agency. The agency also ensures the use of transboundary water objects, and inter-state joint use of land reclamation and irrigation systems.

The AAWF has developed a ten-year Action Plan aligned with the National Strategy on Rational Use of Water Resources. Priority areas include reconstruction, rehabilitation and maintenance of existing land reclamation and water facilities, such as irrigation canals and water supply facilities for irrigation (e.g. storage reservoirs, hydro-junctions, pumping stations, sub-artesian wells, winter pastures water supply systems and other hydro-technical facilities), promotion of efficient use of water irrigation, information activities and studying approaches for water savings in irrigation, or strengthening scientific support and human resources in the field of amelioration and water management.

It is important to note that none of the identified priority investments include an estimate of capital investment costs.

Other stakeholders

The Ministry of Emergency Situations (MES) is the lead organisation for all aspects of managing emergency situations in Azerbaijan. It co-ordinates activities to protect the population from natural and man-made disasters or accidents, including such water facilities as major water reservoirs, hydro-technical facilities or water supply systems. These responsibilities are assigned to the State Water Reserves Agency of the MES, an executive authority in the field of water resources management and regulation. They range from stocktaking of assets, monitoring technical conditions and developing recommendations to rehabilitate the systems. In addition to infrastructure, the agency is in charge of integrated use and management of water resources, monitoring water bodies (surface and groundwater) and developing protection for them.

At the Ministry of Health (MH), the Centre for Hygiene and Epidemiology (MH-CHE) is responsible for setting drinking water standards and systematic monitoring of the quality of surface waters used for the drinking water supply and recreational purposes. The MH-CHE is a consulting party in the assessment process for issuing water use permits (WUPs) for surface and groundwater use, as well as wastewater discharge. Locally based divisions of the ministry monitor and control water quality and the incidence of water-related diseases as part of sanitary and epidemiological surveillance (under goals 6.1 and 6.2 of the UN Sustainable Development Goals, or SDGs).

At the Ministry of Agriculture (MA), the Phytosanitary Control Service (MA-PCS) was established in 2006, dealing among other things with obsolete pesticides, which still pose a major environmental problem in Azerbaijan. The ministry is also a member of the Water Commission.

Water Users Associations (WUA) are voluntary community farmer associations responsible for management of on-farm irrigation systems. After irrigation and drainage system improvement, WUAs enter into 20-year management transfer agreements with contracts for provision of bulk water supply. In accordance with the Law on Amelioration and Irrigation (1996, amended in 2019),[15] a WUA has the right to set its own WUA Irrigation Service Fee (WUA-ISF) to cover all costs of management at the WUA level. By January 2010, about 550 WUAs, covering an area of 1 320 497 ha, had re-registered under the Law on Amelioration and Irrigation.[16]

The State Agency for Alternative and Renewable Energy Sources (SAARES) is a state-owned company providing public services in alternative and renewable energy sources, as well as identifying sources of renewable energy resources, and carrying out other work related to the development of this field. The company plans and executes small irrigation channels and hydropower plants in mountain rivers.

Conclusions

While there are several possible institutional set-ups for managing the GPI Programme, the optimal option should be selected only after all elements of the programme are clarified and consensus has been reached on programme priorities.

Regardless of the institutional set-up, the programme management should involve an institutional structure and procedures that promote environmental effectiveness, embody fiscal prudence, and use financial and human resources efficiently. The government then needs to ensure adequate resources, qualified staff and instruments to implement the programme.

Not least, it is advisable for larger (investment) programmes like this one to appoint a supervisory body to adopt strategic documents and undertake strategic decisions, as well as to oversee the implementation capacity of the management for project selection, implementation and monitoring (project cycle management).

Both the management and the supervisory body should be protected from political pressures by adopting operating rules and procedures. The Government of Azerbaijan should also aim to eliminate the policy and regulatory barriers that could hold back implementation of the GPI Programme. A reflection on other countries' experiences could provide an indicative checklist of measures and approaches for tackling these problems.

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UN-Water (2007), *Kura-Aras River Basin Transboundary Diagnostic Analysis*, RER/03/G41/A/1G/31: Reducing Trans-boundary Degradation of the Kura-Aras River Basin, https://www.ais.unwater.org/ais/aiscm/getprojectdoc.php?docid=771. [3]

Notes

[1] Adapted from (OECD, 2007[1]).

[2] See the Decree of the President of the Republic of Azerbaijan No. 1986 of 15 April 2020 "About measures to ensure efficient use of water resources" at: https://e-qanun.az/framework/44899 (accessed on 28 September 2022). See also: https://president.az/az/articles/view/40093 (accessed on 28 September 2022).

[3] *Ibid*.

[4] MENR-EcPD defines the main directions of the policy on conservation and protection of water resources from pollution. It co-ordinates the monitoring and implementation of environmental legal acts and enforces compliance of planned activities affecting water resources with existing legislation.

[5] MENR-EnPD verifies compliance of wastewater discharges and law enforcement – fines and claims. MENR-EnPD takes water samples downstream and upstream of wastewater discharges as part of compliance verification procedures.

[6] MENR-NEMD monitors surface water quality, currently using 44 monitoring stations in rivers and reservoirs.

[7] MENR-NGES monitors groundwater and regulates groundwater abstraction, including reviewing water use permit requests for groundwater. Quality standards for groundwater are currently not established. The MENR-NGES maintains a groundwater cadastre with groundwater quality information from over 2 500 boreholes in the country.

[8] MENR-NHS monitors surface water reserves and flows and conducts groundwater quantity monitoring. It is also the focal point for climate change, including the Communications to the United Nations Framework Convention on Climate Change (UNFCCC), and other climate change-related international obligations, including the greenhouse gases inventory. Currently, the MENR-NHS has six regional subdivisions, responsible for 70 stations executing hydrological observations.

[9] MENR-SEEA issues permits for wastewater discharges, including payment of environmental fees, in accordance with the Law on Environmental Protection (1999).

[10] See the Decree of the President of the Republic of Azerbaijan No. 2074 of 30 March 2023 "On improving management in the areas of water resources, water management and land reclamation" at: https://e-qanun.az/framework/53813 (accessed on 7 July 2023).

[11] For further details, see: http://tariff.gov.az/?/en/resolution/view/7 (accessed on 20 September 2022).

[12] About Azersu OJSC: https://azersu.az/en/page/7 (accessed on 30 June 2023).

[13] See financial statements for 2021 at: https://mst.gov.az/assets/upload/files/Muhasibatliq/2021-ci%20ilin%20konsolid%C9%99%20edilmi%C5%9F%20maliyy%C9%99%20hesabat%C4%B1.pdf.

[14] Whenever needed, the AAWF co-ordinates the decision with the MENR-SEEA (on the need for obtaining environmental impact assessments) or the MH-CHE (on the need to comply with water quality state standards, depending on the purpose of water use).

[15] See the Law of the Republic of Azerbaijan No. 116-IQ of 5 June 1996 “On amelioration and irrigation” at: https://e-qanun.az/framework/4170 (accessed on 30 November 2022).

[16] For more information, see, for instance: https://www.worldbank.org/en/results/2019/10/10/azerbaijan-managing-irrigation-systems-through-water-user-associations (accessed on 8 December 2022).

Annex A. PCM procedures, including project appraisal criteria, project-ranking procedures and financing rules

The PCM will involve several stages, including: 1) programme preparations, 2) identifying projects, 3) developing projects, 4) project eligibility assessment, 5) selection of projects for financing, 6) financing of projects and 7) implementation of projects. Each of these stages is detailed in the sections below.

Programme preparations

The programme preparations will consist of preparation of internal procedures, forms and instructions for beneficiaries.

Identification of eligible projects

The first step in project cycle management (PCM) is to identify eligible projects that respond to the strategic and specific objectives of Azerbaijan's environmental and climate policy, as well as the objectives defined in the GPI Programme. As discussed earlier, eligible projects are selected from the project pipelines. Only investment projects (i.e. those involving capital outlays) are eligible for financing under this programme. The list of eligible projects will be reviewed on an annual basis by the implementation unit, to ensure that the list remains responsive to national environmental/climate and water policy objectives.

Development of projects

The second step defines the manner in which projects are developed. Promotion will be carried out by the implementation unit. This will involve the publication of leaflets to be distributed to potential beneficiaries, in which eligible projects, eligible beneficiaries, eligibility criteria and the type of financing are defined.

Eligibility assessment of projects

The eligibility assessment involves the screening of projects for compliance with eligibility criteria. If a project does not comply with the eligibility criteria (i.e. if it receives a negative response to any of the questions in the eligibility assessment), it is rejected and a written explanation is sent to the applicant. The project proposal may be resubmitted and re-evaluated after it has been revised.

If a project is deemed compliant with the eligibility criteria, but the prospective beneficiary has not submitted all necessary documentation, the implementation unit contacts the applicant and requests clarifications.

Typical eligibility criteria for proposed pipelines are: availability of technical documentation, presence of a feasibility study, location of the project in the priority area and financing eligible types of projects.

Selection of projects for financing and implementation

Having passed through eligibility screening, projects are selected for financing and implementation. The process of selecting projects ends when the budget allocated to the type of projects or the GPI Programme as a whole for the given time period (whichever comes first) is exhausted.

Applicants submitting applications and supporting documentation for projects that pass the cut-off level for financing are then contacted by the implementation unit in writing, to inform them that their project has been selected for financing.

Typical criteria for project selection are related to their efficiency, i.e. unit costs or dynamic generation costs. Other criteria may also take into account additional project benefits.

Financing of projects

Once priority projects have been selected for financing, based on the amount of funds available, the proposed financing scheme for the project needs to be designed. This involves determining the amount of the grant required for the project to be viable.

When the proposed financing schedule has been defined, the implementation unit invites the applicant to negotiations and signature of the contract. The contract details the rights and responsibilities of each party to the agreement, the measures to be taken in the event of the beneficiary's non-compliance with the terms and conditions of the contract, as well as a disbursement schedule for the financial support.

Implementation of projects

If the supplier has not already been selected, the beneficiary initiates a tender procedure (in accordance with the public procurement law, if the purchases of this beneficiary fall under this law). Once implementation has commenced, the implementation unit, as per the contract with the beneficiary, maintains the right to monitor and inspect implementation of the project, in a scope not limited to:

- comparing actual to planned results in physical terms (e.g. number and type of equipment)
- monitoring implementation of accompanying investments, if any.

Management of the programme

Settling payment of the grant

The implementation unit settles payment of the grant individually for each beneficiary:

- Public support is transferred to the beneficiary, who organises a tender to select a contractor. The contractor is paid upon delivery of service and submission of invoice.
- Public support is transferred to the beneficiary, who organises a tender to select a contractor, but the contractor is paid directly by the financing institution (government or donor) upon delivery of service and submission of invoice.

Control and monitoring of the projects' effects

In contrast to the control and monitoring procedures during implementation of the project, post-implementation control and monitoring (*ex post* evaluation) involves determining whether the project has met its stated objectives. Control and monitoring of project effects is a primary responsibility of the manager of the GPI Programme.

Since it is difficult to achieve direct, immediate measurement of project outcomes in terms of environmental improvement, it is proposed that only the physical outcomes of the project be monitored, namely: the number of beneficiaries with access to the safe water, wastewater services or number of hectares secured with the irrigation system.

If objectives have not been met, the beneficiary may have to return some or all of the financial support provided under the programme. The contract must clearly regulate such an eventuality.

Maintaining a database of project and programme effects

Finally, a key element of PCM is creating and maintaining a database of project and programme effects. The implementation unit should determine the best format for the database, such as an Excel-based system or a database software. The following parameters need to be reflected and maintained in the database:

Programme:

- expenditures by year for each type of project
- actual expenditures compared to those budgeted
- number of beneficiaries with access to the safe water, wastewater services or number of hectares secured with the irrigation system.

Projects:

- number of projects by type, by year
- physical outcomes by year: number of new installations by type and capacity
- number of beneficiaries of the programme (population connected, hectares of irrigated land)
- project cost-effectiveness: cost per beneficiary of the programme (population connected) or per number of hectares of the irrigated land.

The database should be used to inform future beneficiaries, in order to adjust eligibility and appraisal criteria as needed and ensure relevancy.

Annex B. Explanatory guide for using the adjusted OPTIC Model

The purpose of the spreadsheet-based OPTIC Model is to support the Government of Azerbaijan in the preparing and estimating the costs and environmental benefits of the GPI Programme, in particular in costing the following project pipelines:

Water supply:

- Investment in the increase of the drinking water supply coverage by construction of water intakes and wells, pumping stations, and a water distribution network with all supporting elements

Irrigation:

- Investment in irrigation and drainage networks by rehabilitation of the existing, but deteriorated, infrastructure

Wastewater:

- Investment in small-scale wastewater collection network and wastewater treatment plants

Other similar types of models on the market are focused on the estimation of the greenhouse gas (GHG) emission reductions for a country or for groups of countries. These models mainly focus on GHG emissions from industry and take into account different scenarios for the country's economic development. Such models, however, are not particularly suitable for the purpose of this investment programme, which focuses on expanding access to water services.

Overall structure of the OPTIC Model

The OPTIC Model consists of seven modules: 1) assumptions; 2) emission factors; 3) determining the subsidy level; 4) cost calculation; 5) emission reductions calculation; 6) programme costing and 7) results.

The model has been prepared in Excel and uses macros. When starting the model, the macros in Excel should be enabled. This requires that the security settings be set to "medium". For earlier versions of Excel, security settings can be changed using the following commands: Tools>Macros>Security. For Excel 2010 and 2013, the macro security settings can be set in the "Developer" tab. If the Developer tab is not visible, it can be accessed by going to: File>Options>Customize Ribbon and then selecting Developer from the options in the right-hand window.

Preparation for using the OPTIC Model

The user fills the cells that are highlighted yellow in the Excel sheets.

First, users need to complete the information on assumptions and emission factors. Assumptions can be found under the "Assumptions" tab. The following information is essential for the model:

- the average price of new technologies for each project pipeline.

Determining the subsidy level

The module on determining the subsidy level takes into account both investment costs and savings that beneficiaries may achieve by implementing new technologies. For example, the new irrigation system means less water loss.

The module takes into account the fact that the investments should generate at least a minimum return for beneficiaries; thus, the social discount rate is used to determine the net present value (NPV) of the project. The subsidy is then determined at the level at which NPV is equal to zero. The economic significance of this calculation is that the subsidy will encourage potential beneficiaries to participate in the programme without encouraging them to make a profit based on the subsidy. The calculation of the subsidy level for the irrigation facilities is presented in Table A B.1.

The unit cost of rehabilitation of the irrigation of 1 hectare of agricultural land (AZN 1 735/ha) was compared to the savings in water leakages. It was estimated that rehabilitation of 420 000 ha will save up to 3.5 million m^3 of water annually. Taking into account the AZN 14.79 marginal cost of water, the savings calculates to annual benefits of AZN 123.25 from 1 hectare of rehabilitated irrigation system.

Table A B.1. Calculation of the level of public support for rehabilitation of irrigation

(AZN thousand)

Year	0	1	2	3	4	5	6	7	9
Investment costs for rehabilitation of the irrigation system	1 735								
Required public support	859								
Annual operating cost savings		123	123	123	123	123	123	123	123
NPV	0								

Source: OECD, OPTIC Model.

As for other pipelines, no similar calculations were made – construction of the new infrastructure will not generate savings in operating costs, since the reference situation applies a completely different standard. It was thus assumed that a maximum of 75% of public support is required.

Table A B.2. Assumptions for calculating the level of public support

Type	Investment costs	Savings	Required public subsidy	Calculated subsidy
	AZN	AZN	AZN	%
Water supply facilities	951	0	713	75%
Irrigation facilities	1 735	-123.25	859	50%
Wastewater facilities	1 500	0	750	75%

Source: OECD, OPTIC Model.

Box A B.1. Determining the optimal subsidy level

The level of the subsidy should be sufficient to attract potential investors/beneficiaries to apply for support from the programme, without making the implemented projects very profitable. To evaluate a given project, the net present value (NPV) is calculated by totalling the expected net cash flows (cash inflows, or receipts, minus cash outflows, or expenses) over the project operating period and discounting them using the rate that reflects the costs of a loan of equivalent risk on the capital market. An investment will yield a profit if the NPV is positive. All measures that yield a positive NPV using a discount rate that corresponds to the applied rate of return can be deemed beneficial.

The NPV is calculated as in the following formula:

$$\mathrm{NPV} = \sum_{i=1}^{n} \left(NCF_i \times \frac{1}{(1+r)^i} \right)$$

where:

– NCF_i is the net cash flow in the *i*-th year

– *r* is the discount rate.

Using discounting takes into account the investor's expectations with respect to the measure and that it is sufficient that the NPV is greater than zero during the operating period.

The calculation of the subsidy level should be based on economic principles: if the project is not profitable for the beneficiary but it is socially significant, the subsidy should make it just profitable. In simple terms, the financial NPV including the subsidy should be approximately at the level of EUR 0, which means that the project yields an acceptable rate of return for the investor/project promoter.

The "determination of the subsidy level" module uses this principle by making a simple financial analysis of the cash inflows and outflows in each year of the analysis. Cash inflows (receipts) generated by the project include savings expressed in terms of the money saved by beneficiaries. In terms of cash outflows (expenses), the simple financial analysis totals the difference in investment costs of a clean investment and traditional technologies calculated in the other modules. In the subsidy module, the subsidy is included on the cash outflow side as a negative value.

It was assumed that the investments will be made during the first year of the project and the savings averaged over the nine years of operation. Together, the period of analysis is ten years, a typical lifetime for this type of project. The subsidy is calculated so that the result of the NPV calculation is equal to EUR 0.

This approach to calculating the subsidy will enable the government to avoid over-investing, while at the same time providing an investment incentive for potential beneficiaries without making it too profitable for investors. Essentially, the subsidy level should provide just the necessary leverage for individual potential beneficiaries to undertake clean investments.

Cost calculation

The Cost calculation module, under the tab "Costs", shows the estimated investment costs and the required subsidy by the GPI Programme. This information is provided in a table format (Table A B.3), which contains data on the number of new installations, total investment costs, the level of subsidy and the net costs to

beneficiaries. In this module, users simply input factual information without making any decisions on the programme.

Table A B.3. Investment costs, subsidies and net costs for beneficiaries

No.	Type	Number of investment units	Investment costs	Subsidy	Net costs for the beneficiary
		Persons or hectares	AZN	AZN	AZN
1	Water supply facilities	547 876 pers	521 030 076	390 772 557	130 257 519
2	Irrigation facilities	93 350 ha	161 961 903	80 980 952	80 980 952
3	Wastewater facilities	10 000 pers	15 000 000	11 250 000	3 750 000
Total			**697 991 979**	**483 003 509**	**214 988 471**

Source: OECD, OPTIC Model.

Programme costing

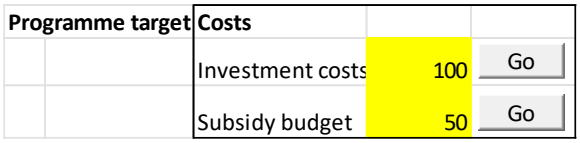
The Programme costing and environmental effects module is under the tab “Decision” (Figure A B.1). This is the main module to support decision making. It can be used for automatic calculation of the programme costs and also for manual adjustments.

The upper part of the screen contains the information on the programme target. Users may define one of the following programme targets:

- investment costs
- subsidy budget (amount of funding available for subsidies)

On clicking the “Go” button to the right of the respective target, the model calculates the programme financial envelope necessary to achieve the target, for that target only, excluding the other targets.

Figure A B.1. Adjusting programme costs and environmental effects



Source: OECD, OPTIC Model.

The results are presented in an Excel table (Table A B.4) that contains basic information on the number of new technologies, investment costs, subsidies and overall impacts. To see details, the “Costs” tabs should be used (described earlier).

Table A B.4. Relationship between programme costs and programme impacts

Project pipeline	People connected/area irrigated	Investment costs	Subsidy
	Persons or hectares	AZN million	AZN million
Water supply facilities	547 876 pers	521.03	390.77
Irrigation facilities	93 350 ha	161.96	80.98
Wastewater facilities	10 000 pers	15.00	11.25
Total		**697.99**	**483.00**

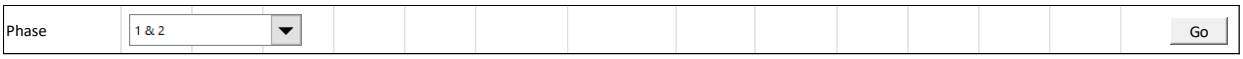
Source: OECD, OPTIC Model.

Users may change the project pipelines by providing their own information on the number of new technologies. The calculations are updated accordingly.

Programme costing for Phase 1 (pilot phase) and Phase 2 (scaling-up phase)

In the spreadsheet titled “Programme targets” (Figure A B.2), users may define whether the calculation is being done for the pilot phase (Phase 1), or for Phase 1 and 2.

Figure A B.2. Adjusting programme targets



Source: OECD, OPTIC Model.

On clicking on the “Go” button to the right of the defined scenario, the model calculates the programme costs and impacts. The targets are thus ignored.

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EU4Environment
Green Economy in Eastern Partner Countries

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Federal Ministry
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based on a decision of
the German Bundestag

Improving water infrastructure in Azerbaijan using an expenditure support scheme

Azerbaijan has fewer renewable water resources than the other countries in the South Caucasus, and its surface and ground-water reserves are expected to decrease even further as a result of climate change. Its infrastructure, largely inherited from the Soviet era, is deteriorating and will not be able to supply its growing population with water of sufficient quantity or quality.

In 2021-2022, under the EU4Environment Action programme, the OECD provided technical assistance to the Ministry of Ecology and Natural Resources of Azerbaijan in preparing a green public expenditure programme designed to help meet the demand for potable and utility water for Azerbaijan's population, agriculture and industry. It focuses on rural districts in selected regions that face significant challenges ensuring a safe domestic drinking water supply, securing water for irrigation and reducing pollution from wastewater. Despite its regional focus, the programme will be carried out at the national level to align with Azerbaijan's objectives for the water sector. It builds on current and planned capital investments set out in the policy documents and listed investment priorities of the major stakeholders.

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