STUDY OF WATER SECTOR IN AZERBAIJAN

Baku 2025

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GENERAL INFORMATION

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EXECUTIVE SUMMARY

Key Findings

- Water Scarcity & Quality: Azerbaijan's per capita water availability (~1 000–1 200 m³/year) is among the lowest in the region, with up to 31 % irrigation losses and 20–30 % system leakage. Drinking water quality remains uneven, with industrial and agricultural pollutants challenging compliance with new AZS 929:2023 standards.
- Governance & Institutional Fragmentation: Multiple agencies (ASWRA, MENR, MES, MoA, etc.) share overlapping mandates, impeding integrated water resources management (IWRM) and causing regulatory uncertainty for investors.
- Infrastructure Gaps: Aging supply networks (30–40 % losses), limited wastewater treatment capacity, and insufficient flood-risk infrastructure underscore the need for modernization across urban and rural areas.
- Climate & Transboundary Risks: Reliance on transboundary rivers (70 % of supplies) and projections of a 20–25 % resource decline by 2050 heighten the need for strategic, cross-border cooperation and resilient infrastructure.

Gap Analysis

A structured comparison reveals clear complementarities:

- **Efficient Irrigation:** Dutch drip- and smart-irrigation systems can reduce agricultural water losses.
- **Urban Supply & Leakage Control:** Smart metering and leak-detection technologies align with Baku's network modernization needs.
- **Transboundary Management:** Integrated River Basin Management approaches offer frameworks for equitable Kura–Araz cooperation.
- **Pollution Control & Wastewater Reuse:** Advanced oxidation processes and modular treatment plants can improve industrial/domestic effluent quality.

Strategic Recommendations

- **Pilot Projects & Demonstrations:** Begin with high-visibility, small-scale pilots (e.g., modular wastewater plants in rural districts, smart dike sensors on the Kura embankment) to build local trust.
- **Public–Private Partnerships:** Leverage the PPP model proven in the Sumgayit desalination project to finance larger infrastructure upgrades.
- **Capacity Building & Knowledge Transfer:** Engage Dutch companies and universities through Orange Knowledge and joint degree programs to strengthen human capital.
- **Regulatory Support:** Work with the Embassy and Dutch trade missions to advocate for streamlined permitting and clearer institutional roles under Azerbaijan's National Strategy.

LIST OF ABBREVIATIONS

Abbreviation	Full Form
AWM	Azerbaijan Melioration and Water Management Open Joint-Stock Company
ASWRA	Azerbaijan State Water Resources Agency
AZS	Azerbaijan State Standard
COP29	29th Conference of the Parties (UNFCCC)
EBRD	European Bank for Reconstruction and Development
EU	European Union
FAO	Food and Agriculture Organization (UN)
IHE Delft	IHE Delft Institute for Water Education
IWRM	Integrated Water Resources Management
MAC	Maximum Allowable Concentration
MENR	Ministry of Ecology and Natural Resources (Azerbaijan)
MES	Ministry of Emergency Situations (Azerbaijan)
SDGs	Sustainable Development Goals
SOCAR	State Oil Company of the Republic of Azerbaijan
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
WSS	Water Supply and Sanitation
WUR	Wageningen University & Research

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BACKGROUND AND INTRODUCTION

Azerbaijan is the most water stressed country in the region with a negative outlook as regards climate change induced reduction in precipitation in its watersheds and those of neighboring countries. Moreover, the country relies for 70% of its water (Kura, Araz, and Samur) on surface water sources that originate in neighboring countries with little progress on transboundary agreements. The water situation in Azerbaijan for the last years has undergone significant changes. After gaining independence, Azerbaijan was confronted with insoluble problems such as water pollution, exhaustion of water resources of arid areas, salinization of irrigated lands, drop of the Caspian Sea level, mud slides in mountain areas, development of water erosion, etc.

Azerbaijan's (and the region'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 urbanization (domestic waste), increased industrial production and extensive agriculture practices (use of fertilizers and pesticides), the residues of which may penetrate into surface water and groundwater. Not least, improved distribution of drinking water and overall raising of living standards has increased water withdrawals from surface and groundwater bodies.

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. 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.

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.

Azerbaijan has recently approved the National Strategy for the Efficient Use of Water Resources aiming to enhance water management and address water scarcity in the country. The National Strategy outlines plans for the construction of new reservoirs, the development of smart water management systems, and increased use of desalination and recycled water. It also emphasizes the need for cross-border cooperation on water management.

Azerbaijan, as the COP29 Presidency, launched Water for Climate Action as part of its Action Agenda. The Water Envoy of the Netherlands visited Azerbaijan in July 2024 to offer support to the water action agenda of the COP29 Presidency. As a follow up, the Embassy of the Netherlands in Azerbaijan has organized the visit of the Dutch water trade mission to Azerbaijan in 24-26 September 2024. The mission was co-organized with Export Partner and Aqualink Azerbaijan LLC and the participants were Erasmus University Rotterdam, IHE Delft Institute for Water Education, Nijhuis Saur Industries, Royal Haskoning DHV, Slamdam B.V., Spaans Babcock B.V., Wageningen University & Research.

Consultancy assignment

Consultancy Assignment aimed to conduct water sector assessment in Azerbaijan as a follow up of the Dutch water trade mission to Azerbaijan in September 2024 to propose Dutch water solutions to the existing challenges in the sector.

This study is the continuation of the trade mission conducted in September 2024 and is financed by the Embassy's business promotion budget.

The study is supervised by the Embassy of the Netherlands in Azerbaijan.

Objectives of the study

The objectives of this consultancy assignment are:

- to identify the existing challenges and gaps in the fresh water sector of Azerbaijan, including but not limited to those identified during the above-mentioned Dutch water mission, in the context of the recently adopted National Water Strategy and

- to explore and propose potential solutions to these challenges and gaps over a short-, medium- and long-term perspectives, particularly including those provided by the participating Dutch water organizations in the recent trade mission. However, other solutions available from Dutch business and academia who did not participate water mission should also be considered in the study.

Scope of work

The consultant is expected to provide a rapid assessment of fresh water sector challenges integrating needs assessment of the local stakeholders/authorities including State Water Agency, Ministry of Environment and Natural Resources, Ministry of Agriculture that could be addressed and solved by the Dutch water expertise or the Dutch water organizations' comparative advantage or added value. The scope of the work is as follows:

- Conduct fresh water sector assessment in Azerbaijan specifying the existing challenges in water quality and quantity, water modelling and planning, drinking and irrigation water supply, flood and draught risks in some regions of the country, household and industrial water treatment and sanitation system;

- Assess comparative advantage of the Netherlands' water sector related to these challenges, especially taking into account the expertise of the Dutch water mission participating organizations.

Research objective: To find out the challenges in Azerbaijan fresh water sector and based on the profiles of the Dutch Water mission companies, as well as generally NL water expertise what solutions we can offer to Azerbaijan water challenges.

Targeted auditory: This study is designed to address both Dutch and Azerbaijani audiences, providing insights that are relevant to both countries. It explores the mutual benefits of collaboration, highlighting opportunities and challenges from the perspectives of both the Netherlands and Azerbaijan. By presenting a balanced view, the study aims to foster a deeper understanding and encourage strategic partnerships between the two nations in the water sector.

Relevance of the topic: Regardless of optimistic or pessimistic projections, Azerbaijan is expected to experience water stress in the 21st century. Given the importance of water for human life and ecosystems, it is crucial to enhance water efficiency, ecological sustainability of water bodies, water security, integrated water resource management. Furthermore, ensuring compliance with the National Strategy's goals remains a top priority for the Azerbaijani government, making this study even more relevant.

1. DIAGNOSIS OF WATER SECTOR OF AZERBAIJAN

Key Water Challenges in Azerbaijan

Azerbaijan faces a complex array of water-related challenges that are increasingly pressing due to population growth, climate change, outdated infrastructure, and institutional limitations. As a country located in a semi-arid region and heavily reliant on transboundary water sources, Azerbaijan's water security is closely linked to regional cooperation, internal resource management, and long-term strategic planning.

One of the most critical issues is water scarcity, exacerbated by droughts, inefficient consumption, and growing demand from agriculture and industry. The depletion of water reserves during dry periods highlights the need for comprehensive assessments and sustainable water-saving solutions.

In parallel, water quality concerns persist due to industrial discharge, agricultural runoff, and insufficient wastewater treatment. Poor drinking water quality in some regions poses direct risks to public health and undermines trust in municipal water systems.

Challenges in water governance and management also impede progress. Institutional fragmentation, legal gaps, and overlapping responsibilities reduce the effectiveness of national water policy and hinder coordinated action across sectors.

Water utilization suffers from high losses in irrigation and supply systems, low efficiency in agriculture—the largest consumer of water—and underdeveloped reuse systems. Modernization of infrastructure remains a key priority to reduce losses and improve system performance.

Moreover, water security is influenced by both international and domestic factors. The strategic role of water in transboundary relations, especially concerning shared rivers, demands active diplomatic engagement and robust security planning.

Finally, adaptation challenges due to climate change—including more frequent droughts and extreme weather events—require proactive response mechanisms. These include raising public awareness, addressing the pollution of natural water bodies, and urgently rehabilitating aging water supply and wastewater systems.

Addressing these interconnected challenges requires a coordinated, multi-sectoral approach involving policy reform, investment in infrastructure, capacity building, and enhanced international cooperation. Azerbaijan is faced the following water challenges:

Water Scarcity:

- Assessment of water consumption;
- Impact of drought periods on water reserves;
- Solutions to address water scarcity;

Water Quality:

- Drinking water quality and public water consumption;
- Impact of industrial and household pollutants on water quality;

Water Management:

- Institutional resources in water resource management;
- Legal and organizational gaps in water governance;

Water Utilization:

- Water losses in irrigation and supply systems;
- Efficiency of water use in the agricultural sector;
- Wastewater treatment and reuse;
- Modernization of water infrastructure;

Water Security:

- Management of transboundary water resources and international cooperation;
- Military-political threats and the strategic role of water resources;

Adaptation Challenges:

- Impact of Climate Change;
- Effects of drought and extreme weather conditions on water reserves;
- Public Awareness and Behavioral Challenges;
- Disparities in public knowledge regarding water usage;
- Deterioration of Water Sources' Environmental Condition;
- Pollution of water resources, including seas, rivers, and lakes;
- Need for Infrastructure Modernization;
- Rehabilitation and development of outdated water supply and sewage systems.

1.1. Quantitative and qualitative assessment of the sector

Quantitative and qualitative assessment of the water sector in Azerbaijan could be done through analysis of such water challenges as, water scarcity, quality, utilization, security, adaptation to the climate change.

WATER SCARCITY

Total Water Resources

Total water resources (available water resources in Azerbaijan):

- Azerbaijan's annual water resources are estimated to be approximately 32 billion m^3. However, during drought years, this figure can drop to as low as 23 billion m^3.
- Around 70% of these resources come from transboundary rivers (Kura, Araz, and Samur).

Table 1. Water Resources and Utilization in the Republic of Azerbaijan

Types of water resources		Water resources, km^3	Volumes of water taken from natural sources, km^3
Surface water	Local	10,6	10,1
	Transboundary	20,3	
Groundwater		4,38	1,40
Total		***35,3***	***11,5***

Annual Water Consumption

Total annual water consumption:

- The annual water consumption in Azerbaijan is estimated to be approximately 11-12 billion m^3.

Sectoral distribution of water usage:

- *Agriculture:* Circa 70% (8-9 billion m^3).
- *Domestic water use:* Circa 20%.
- *Industrial water use:* Circa 10%.

Per Capita Water Availability

Current indicators:

- The per capita water availability in Azerbaijan is approximately 1,000-1,200 m^3 per person per year.

Global comparison:

- The global average is around 6,000 m^3 per person per year.
- Azerbaijan's water availability is considered within the threshold of water scarcity.

Hydrometeorological Conditions and Climate Impact

Precipitation:

- The average annual precipitation in Azerbaijan is approximately 250-300 mm, varying by region (higher in mountainous areas, lower in lowland regions).

Drought impacts:

- Between 2020 and 2023, drought periods led to a 10-15% reduction in water reserves.

International Comparison

Comparison of Azerbaijan's water resources with neighboring countries:

- ***Georgia:*** Per capita water availability is approximately 12,000 m^3 per year.
- ***Armenia:*** Per capita water availability is around 2,800 m^3 per year.
- ***Azerbaijan:*** Per capita water availability is around 1,000 m^3 per year, making it the lowest in the region.

Causes of Water Scarcity

Climate Change and Drought:

- Climate change has significantly impacted Azerbaijan's water resources. Forecasts predict a 20-25% reduction in water reserves between 2020 and 2050, and a 30-35% decrease between 2070 and 2100.

Decline in Precipitation:

- There has been an 18-20% reduction in incoming water resources. As of August 2023, the surface area of mountain lakes in Azerbaijan had shrunk by 4.2%.

Pollution of Transboundary Waters:

- Origination of the most part of water resources outside the country, making Azerbaijan highly vulnerable to water stress due to external factors such as pollution and upstream water policies.

Outdated Irrigation Systems:

- Irrigated land in Azerbaijan covers 1.4 million hectares. However, obsolete irrigation systems and poor infrastructure lead to significant water losses. According to statistics from the State Statistical Committee of Azerbaijan, among CIS countries, Azerbaijan ranks first in water loss, with 31% of extracted water being wasted.

Challenges in Reservoir Management:

- The Mingachevir Reservoir is the largest in the South Caucasus. However, based on recent statistics, Azerbaijan ranks 105th among 170 countries in terms of total water resources and 140th in internally generated freshwater reserves. Link

Population Growth:

- The increase in population and rising demand for water, along with global climate change, have intensified drinking water and irrigation issues in most regions of the world. Despite significant efforts to improve water supply infrastructure in Azerbaijan, various factors

continue to create difficulties in ensuring adequate drinking and irrigation water across the country. On July 27, 2020, the President of Azerbaijan issued a decree titled "On Additional Measures to Ensure the Efficient Use of Water Resources," which outlined the existing water supply problems and assigned key responsibilities to relevant institutions for their resolution. Link

Inefficient Water Use in Agriculture:

- Existing resources allow for the expansion of irrigated land up to 4 million hectares. However, unresolved issues in the sector hinder the realization of this potential. Water resources in the country are not used efficiently, and under such conditions, expanding irrigated areas would lead to even greater water losses. Link

Global Climate Change:

- Various assessments indicate that the agricultural sector, water resources, coastal zones, energy sector, forestry, tourism, and healthcare sectors in Azerbaijan are highly sensitive to climate change. The most vulnerable areas include the agriculture sector, water sector, and coastal zones. Link

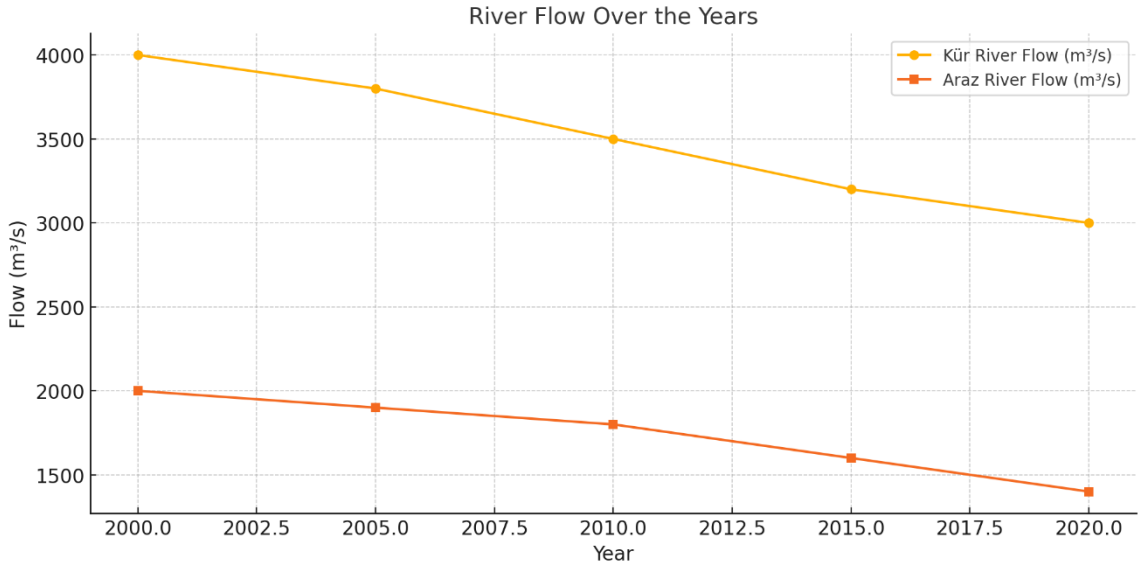

Figure 1. River Flow Over the Years

This graph shows how the flow of the Kura and Araz rivers has decreased over the years. Significant reductions in water flow have been observed due to climate change. Based on statistics from the last 10 years, it can be stated that Azerbaijan's total water resources have also significantly declined.

The government has invested in infrastructure projects such as expanding water supply networks and upgrading water treatment facilities. As a result of these efforts, approximately 95% of the population has gained access to improved water sources. However, access to improved sanitation services remains limited, particularly in rural areas and remote communities, requiring further investment. Link

Water resource management in Azerbaijan is distributed among multiple institutions, which sometimes leads to overlapping responsibilities. To address this issue, the government has initiated reforms in the water sector and established the Azerbaijan State Water Resources Agency

(ASWRA). These reforms aim to ensure integrated water resource management and improve the efficiency of water supply and sanitation services. Link

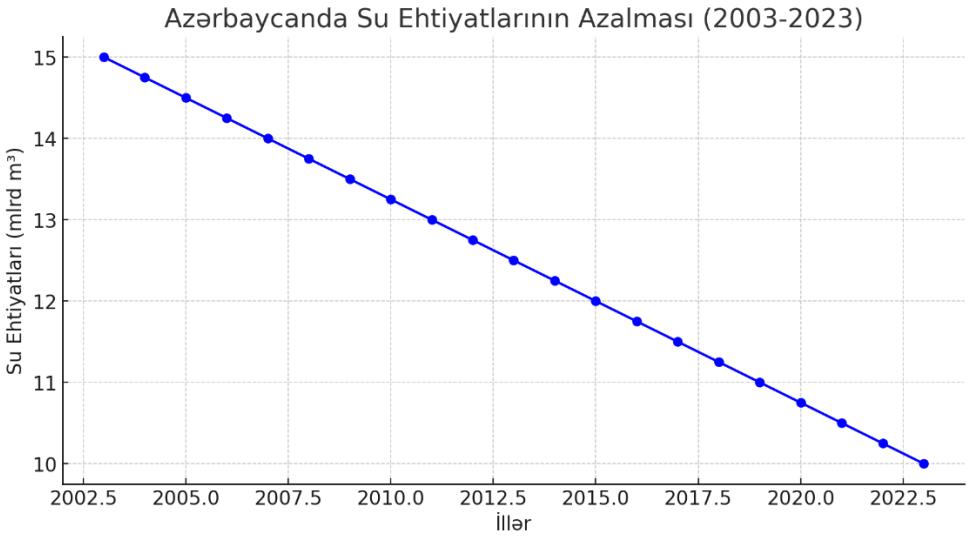

Figure 2. Decline of water resources in Azerbaijan (2003-2023).

Future Projections

Research presents a concerning outlook regarding the decline of Azerbaijan's water resources. The flow of the Kura and Araz Rivers is expected to decrease by 20% by 2030 and up to 25% by 2050. Increasing drought conditions and a 1.2°C rise in average temperature will put over 30% of agricultural land at risk of drought-related challenges.

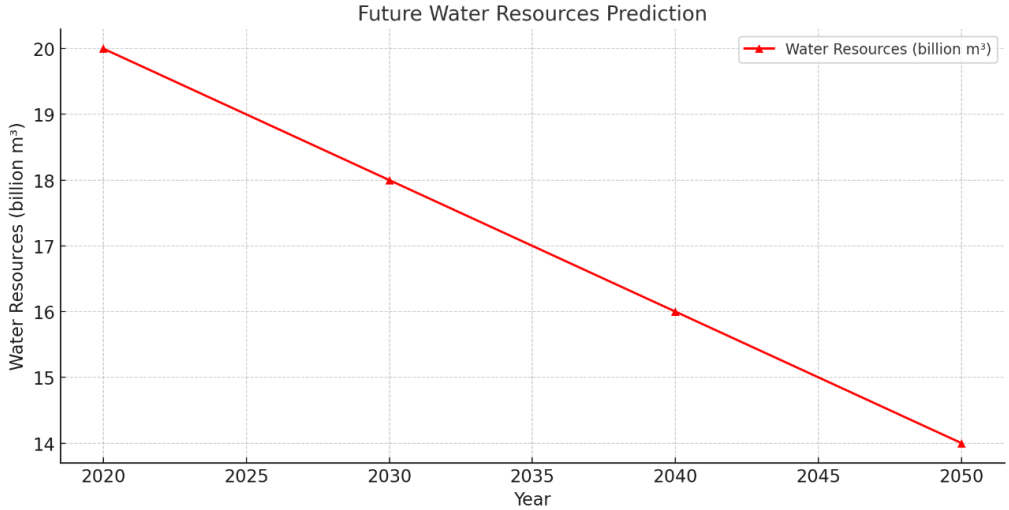

Figure 3. Future Water Resources Forecast

A long-term forecast predicts a significant decline in water resources in the future. Water reserves are expected to decrease considerably by 2050.

Sources:

- National Strategy for Efficient Use of Water Resources (2024): Link
- UNDP Azerbaijan Climate Risk Report (2019): Link

- Institutions and Programs for Transition to an Efficient Water Sector and Addressing Water Security Challenges: Link
- Azerbaijan: Comprehensive Water Security Assessment: Link

Water Risks

Water scarcity could have severe impacts on multiple sectors of Azerbaijan's economy:

***Agricultural productivity**:*

- A 20% reduction in crop yields is expected due to water shortages, posing a threat to food security.

***Drinking water supply**:*

- The existing infrastructure and water reserves may face up to a 30% limitation, affecting access to clean water.

***Industrial activity**:*

- A 10-15% decline in water availability is projected, making it challenging to meet the increasing water demand of the industrial sector.

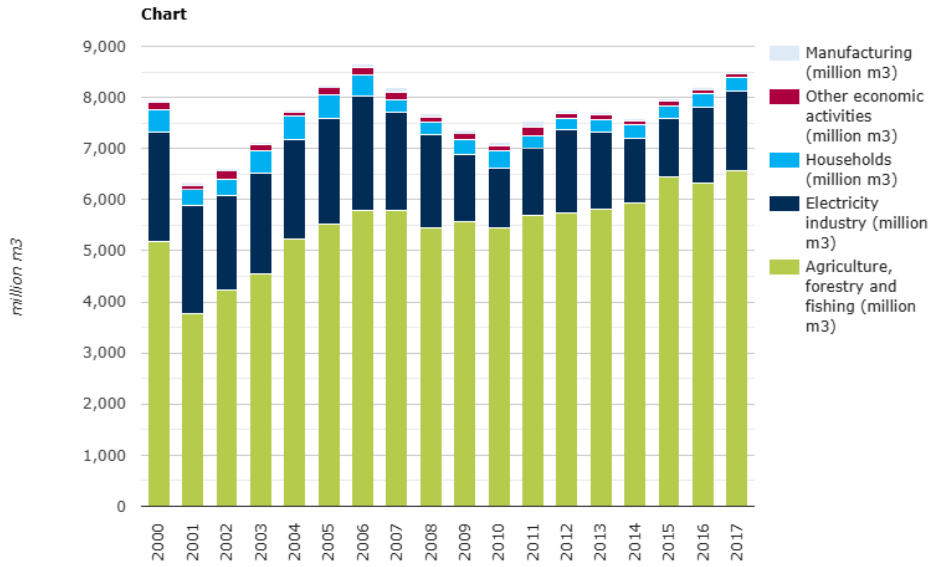

Figure 4. Total water consumption by sector in Azerbaijan (2000–2017).

Data source: ENI-SEIS East Platform, (EEA, 2020).

Sources:

- FAO Comprehensive Analysis of Disaster Risk Reduction System for the Agricultural Sector in Azerbaijan (2022): Link
- World Bank Group: Country Climate and Development Report (2023) Link
- OECD Environmental Performance Review (2024) Link

WATER QUALITY

Drinking Water Quality and Public Water Usage

***Water Quality Ranking**:*

- In 2020, Azerbaijan ranked 84th out of 179 countries in the global water quality index. The country's drinking water quality score was 46.4 out of 100 possible points. Link

Adoption of New Standards:

- In 2023, the Azerbaijan Standardization Institute introduced AZS 929:2023, the state standard for drinking water titled *"Drinking Water: Hygienic Requirements and Quality Control."* This standard regulates the quality of water intended for consumption, food preparation, and other household needs Link

Purpose of the State Standard:

- The adoption of this standard aims to ensure compliance with the United Nations Convention on the Protection and Use of Transboundary Watercourses and International Lakes. It also supports the implementation of Azerbaijan's national targets under the Water and Health Protocol Link

Public Water Usage

Water Supply:

- In 2004, when the first State Program on the Socio-Economic Development of the Regions was adopted, Azerbaijan's drinking water supply coverage was at 40%. Today, this figure has increased to 70%. In Baku, only 29% of residents had continuous access to drinking water, but today, this number has risen to approximately 82%. In regional areas, access to drinking water has improved from 9% to 63%. Link
- According to the 2021 survey results, 89.1% of households nationwide have access to a piped water supply at home. This figure is 96.7% in urban areas and 80.2% in rural areas. Link

Drinking Water Sources:

- 51.0% of households obtain drinking water from an indoor piped water supply.25.1% access water from an outdoor tap in the yard. 10.5% rely on a public water tap.5.8% use spring water. 3.5% obtain water from a well.2.1% rely on other sources. Link

Problems in Water Supply:

- 29.3% of surveyed households experience occasional interruptions in drinking water supply.20.6% report low water pressure in the pipes. 20.5% complain about poor water quality. Link

Daily Water Consumption:

- 45.1% of households use 50-99 liters per day. 25.1% consume 100-149 liters per day. 12.3% use 150-199 liters per day. 7.5% consume 200-299 liters per day. 2.1% use 300 liters or more per day. Link

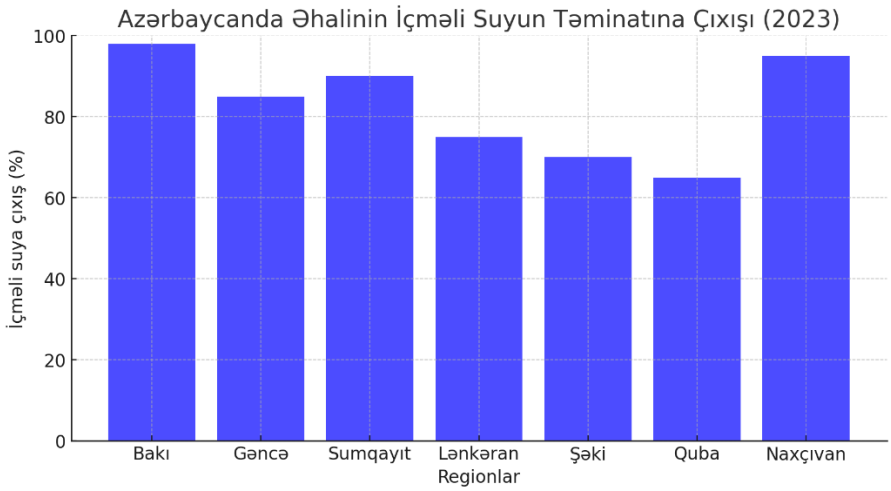

Figure 5. Access to Drinking Water in Azerbaijan (2023)

Comparison of Daily Water Consumption with International Standards

Comparison:

- According to the World Health Organization (WHO), the minimum daily water requirement per person is approximately 50 liters, while a moderate standard of living requires 100-150 liters per day.
- In some regions of Azerbaijan, daily water consumption exceeds this threshold (200 liters or more), indicating water wastage.

WATER UTILIZATION

Wastewater Treatment and Reuse

Current Situation:

- A large portion of Azerbaijan's industrial and domestic wastewater is discharged untreated into the Caspian Sea.
- This leads to environmental problems and contributes to the waste of valuable water resources.

Utilization of Groundwater

Current Situation:

- Extensive use of groundwater significantly impacts the sustainability and security of water resources.

Main Collector Channels Issue

Current Situation:

- Azerbaijan's four main collector channels (Böyük Şor, Ağsu, Qarasu, and Salyan collectors) discharge untreated wastewater into the Caspian Sea.

Future Perspectives

- **Integrated Water Resource Management:** Effective coordination of both surface and groundwater is essential for sustainable water resource management.
- **International Cooperation:** Joint measures should be implemented with neighboring countries to prevent transboundary pollution of the Kura and Araz rivers.
- **Water Security Strategy:** Azerbaijan should develop a long-term water security strategy to ensure restoration, conservation, and efficient utilization of water resources within a comprehensive framework.

The Impact of Industrial and Domestic Pollutants on Water Quality in Azerbaijan

Azerbaijan's water resources are affected by both domestic pollutants and transboundary sources of contamination. Industrial and household waste significantly impact water quality, posing risks to both the environment and public health.

This report will analyze the effects of industrial and domestic pollutants on water quality, referencing documents from international organizations to provide an evidence-based assessment.

Table 2. Drinking water quality and permissible concentration limit.

	Region	pH level (6,5-8,5)	Nitrates MAC – 50 mg/L	Hardness MAC – 7 mmol/L
1	**Baku**	7.2	20	5.5
2	**Ganja**	6.8	35	6.0
3	**Sumgayit**	7.5	25	6.2
4	**Lankaran**	6.2	40	6.8
5	**Sheki**	7.0	45	7.5

Industrial Pollutants

Industrial enterprises, particularly those in the oil and gas sector, metallurgy, and chemical industries, release significant pollutants into water resources. According to a report by the Asian Development Bank, data collected at the Georgia-Azerbaijan border indicate that levels of phenol, petroleum products, metals, and sulfates exceed the maximum allowable concentrations (MACs). Additionally, copper, molybdenum, and other heavy metals in the Araz River entering Azerbaijan exceed MAC limits. Link

Domestic Pollutants

Household wastewater also negatively impacts water quality. According to a report by EU4Environment, the environmental impact of industrial and domestic wastewater discharges should be properly assessed. However, in some cases, these assessments are inadequate, leading to water pollution in various bodies of water. Link

Transboundary Pollution

Approximately two-thirds of Azerbaijan's water resources originate from outside the country. As a result, activities in upstream countries directly affect both the volume and quality of water available in Azerbaijan. A report by the Asian Development Bank highlights that countries located downstream of transboundary rivers do not have the same level of access to water resources as upstream nations. Furthermore, Azerbaijan's lakes and rivers suffer from organic and inorganic contamination due to pollutants carried across borders. Link

WATER SECURITY

Management of Transboundary Water Resources and International Cooperation

Approximately 70% of Azerbaijan's water resources originate from transboundary rivers, highlighting the critical importance of water security. By joining the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention), Azerbaijan has committed to cooperating in the joint management and protection of transboundary water resources. However, the limited participation of other countries in the region in this convention restricts opportunities for sustainable transboundary water management.

Within the framework of the 29th session of the Conference of the Parties (COP29) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2024 in Baku, Azerbaijan's Deputy Minister of Ecology and Natural Resources, Vugar Karimov, spoke at an event on "The Role of Climate-Informed Transboundary Water Management in Ensuring Progress under the United Arab Emirates' Global Climate Resilience Framework." In his speech, Karimov emphasized that Azerbaijan, as a country with limited natural water resources, considers the sustainable use of water resources a priority. He highlighted that, in this context, the country has taken significant steps to protect and efficiently utilize its water resources. For further details, please check official sources such as the Ministry of Ecology and Natural Resources of Azerbaijan or UNFCCC COP29 updates. Link

The Presidential Decree No. 1986, issued on April 15, 2020, established the Commission on Efficient Use of Water Resources, while a 2023 decree led to the creation of the Azerbaijan State Water Resources Agency (ASWRA) and the adoption of the "National Strategy for Efficient Use of Water Resources." These initiatives demonstrate the Azerbaijani government's strong commitment to water resource management.

Although significant progress has been made in this field, Azerbaijan still faces major challenges such as global climate change and increasing water demand. In the future, the country aims to overcome these challenges through water reuse, the adoption of green technologies, and regional cooperation.

The 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes established a crucial international legal framework to ensure the sustainable and efficient management of transboundary water resources. Link

For Azerbaijan, the issue of transboundary waters is one of its strategic priorities. The long-term pollution of the Okhchuchay River in Armenian territory poses a serious threat to the entire region's ecosystem and water security.

Azerbaijan emphasizes joint cooperation in transboundary water resource management based on the principles of international law and has been a member of the UN Water Convention since 2000. However, the lack of participation by other regional countries in the Water Convention makes transboundary cooperation difficult and limits the opportunities for sustainable water management. Link

The fair and sustainable management of transboundary waters is not just the responsibility of a single country but of the entire region. Achieving this goal requires strengthened joint efforts.

International experts emphasize that the effective management of transboundary water resources depends on collaboration, including data sharing, joint monitoring, and coordinated actions. For example, the cooperation between Azerbaijan and Russia on the Samur River serves as a

successful model for the fair distribution and joint management of water resources. Link Increasing such bilateral cooperation efforts can contribute to ensuring water security in the region. Link

Military-Political Threats and the Strategic Role of Water Resources

Water resources are strategic assets with significant military and political implications. International organizations highlight that the mismanagement of transboundary water resources and inadequate cross-border cooperation can lead to regional tensions and conflicts. Since a large portion of Azerbaijan's water resources depend on transboundary rivers, environmental and geopolitical factors directly impact water security.

Transboundary water-related threats, including deliberate restrictions or disruptions, pose security risks and can lead to political and operational challenges. According to the International Centre for Migration Policy Development (ICMPD) in its "Migration Handbook", water scarcity can trigger conflicts between states and groups, limiting governmental influence in conflict prevention efforts. Link

Azerbaijan's Military Doctrine identifies territorial occupation and the potential use of water resources as a strategic threat among the key external forces and political risks. In this context, the protection and management of water resources are considered critical components of national security.

International experts emphasize that to mitigate military-political risks in water resource management, regional cooperation must be strengthened. Mechanisms should be developed for shared management of water resources based on mutual interests to prevent conflicts and promote stability.Link

International experts highlight that water resource restrictions and inadequate transboundary water management can lead to regional tensions and conflicts. In this regard, the protection and management of water resources are considered essential components of national security. Link

To reduce military-political risks in water resource management, regional cooperation must be strengthened. International organizations emphasize the need for mechanisms to facilitate the fair distribution of water resources and prevent conflicts based on shared interests. Link

ADAPTATION CHALLENGES

Effects of Drought and Extreme Weather on Water Resources

Droughts and extreme weather events caused by climate change have a significant impact on the quantity and quality of water resources. Over the past decades, global temperature increases, uneven precipitation, and the reduction of water bodies have further exacerbated water scarcity. This trend is particularly evident in the South Caucasus region, especially in Azerbaijan.

In Azerbaijan, climate change has led to significant decreases in the water levels of the Kura and Araz rivers. These reductions have had negative effects on both agriculture and drinking water supply. The melting of glaciers and the uneven distribution of precipitation have disrupted the sustainability of water sources, leading to increased water demand during drought conditions. Additionally, heavy rainfall and floods negatively impact water bodies, increasing pollution levels and causing infrastructure problems.

International organizations have expressed serious concerns about the impact of climate change on water resources. The Intergovernmental Panel on Climate Change (IPCC) states that climate change increases the frequency and intensity of extreme weather events, making access to drinking and agricultural water more difficult while posing serious threats to ecosystems and socio-economic development. The World Bank warns that by 2030, many countries, including Azerbaijan, may face a high risk of water scarcity. The European Union (EU) and the World Meteorological Organization (WMO) emphasize that to combat climate change, water use strategies must be revised, and sustainable management approaches must be implemented.

To minimize the effects of droughts and extreme weather conditions, several measures must be taken. Efficient water resource management and the adoption of new technologies are crucial. Developing water reservoirs and enhancing renewable water resources can improve water availability during drought periods. In agriculture, the implementation of water-saving technologies and the cultivation of drought-resistant crops are key solutions.

Additionally, awareness campaigns should be conducted to educate the population on efficient water use and climate change. Regional cooperation and participation in transboundary water management programs play a critical role in addressing this issue effectively.

The protection and sustainable management of water resources in the context of climate change is of strategic importance for ensuring ecological balance and socio-economic stability in Azerbaijan and the entire region. In this regard, both strengthening state policies and expanding cooperation with international organizations are essential.

Sources:

- Threat to Progress: Addressing the Impact of Climate Change on Children's Health and Well-being. UNICEF, New York, July 2024. [Link
- Yasin Rustamov, Executive Director of the Institute of Soil Science and Agrochemistry, ANAS – *Challenges in Azerbaijan's Water Supply and Their Solutions.* Link
- UNDP – *Climate Change and Human Development.* Link
- S.T. Hasanov – *Methodology for Forecasting the Impact of Climate Change on Water Resources.* AzHvəM EIB Scientific Proceedings – 2019, Volume 39. Link
- Y. Bakhshiyeva – *Challenges of Integrated Water Resource Management in the South Caucasus Countries,* Institute of Law and Human Rights, ANAS, 2019. Link

Awareness among the population about water usage

Public awareness and behavioral issues play a crucial role in the effective management of water resources. The efficient use of water resources is closely linked not only to infrastructure projects and legislative frameworks but also to citizens' awareness and behavioral habits. In the face of increasing water scarcity, educating the public and fostering a culture of water conservation are essential tasks.

According to international experts, public education should be one of the primary priorities for the sustainable management of water resources. Within the framework of the UN Sustainable Development Goals (SDG 6), raising awareness among citizens about the protection and efficient use of water resources is highlighted as a key step (United Nations, 2021).United Nations, 2021.

The World Bank reports indicate that in many countries, public awareness programs have helped reduce water consumption and prevent waste. Particularly in developed countries, the role of citizen participation and public campaigns in ensuring proper water management is emphasized. (World Bank, 2020).

Scientific research shows that achieving efficient use of water resources is difficult without awareness-raising measures. According to a study published in the "Water Policy" journal, there is a direct correlation between public awareness and water conservation. The research findings revealed that when public awareness campaigns are conducted, water consumption decreases by an average of 15-20% (Gleick et al., 2003) (Link)

In this context, governments and international organizations should implement the following measures:

- Water management and conservation education should be included in curricula at schools and higher education institutions.
- Public awareness about the importance of water resource conservation should be provided through media and social networks.
- Public campaigns should be conducted within the framework of public-private sector partnerships, and awareness-raising activities on water efficiency should be increased.

Achieving sustainable water management is difficult without education and public participation. Therefore, awareness efforts should be strengthened for the conservation and sustainable use of water resources.

Pollution of Water Resources (Seas, Rivers, and Lakes)

The deterioration of the ecological condition of water resources is recognized as a significant issue on both a global and regional scale. Particularly, the discharge of industrial, agricultural, and household waste into water bodies has led to an increase in pollution levels in rivers, lakes, and seas. In Azerbaijan, this problem is particularly observed in the Kura and Araz rivers and the coastal areas of the Caspian Sea.

Main Sources of Pollution:

- Research has shown that anthropogenic loading is high in the river basins of Azerbaijan. The development of industry, urban areas, and agriculture has caused undesirable ecological consequences in the Kura River basin. The Kura River, flowing from Türkiye and Georgia, has had significant changes in both its volume and quality. In many areas (especially in the lower reaches of the river), since the water is used for drinking purposes, it affects the local population's health, leading to an increase in infectious and other diseases. Link

Kura and Araz Rivers:

- These rivers are polluted by industrial waste, agricultural fertilizers, and household wastewater. Particularly, the mixing of pesticides and heavy metals into the water poses a serious threat to ecosystems.
- The activities of industrial enterprises in Ganja and Mingachevir cities further deteriorate the quality of the water in these rivers due to the pollutants being discharged into them. Link

Caspian Sea:

- The direct discharge of oil production, industrial waste, and household wastewater into the Caspian Sea negatively affects its water quality. In particular, the discharge of pollutants from the Sumgayit and Baku industrial zones poses a serious threat to the sea's ecosystem. Additionally, polluted water flowing through transboundary rivers disrupts the ecological

balance of the Caspian. Environmental monitoring conducted by the Ministry of Ecology and Natural Resources has recorded 128 outflows into the Caspian Sea from enterprises and organizations operating in the areas of Azerbaijan's Caspian Sea sector, its coastal zone, floating objects, and the outflows from coastal areas. Link

Restoration and Development of Outdated Supply and Sewerage Systems

Modernization of water supply and sewage infrastructure in Azerbaijan is one of the key challenges. Particularly in urban and rural areas, the existing water supply and sewerage systems are outdated and do not operate efficiently. This results in both water loss and environmental pollution. Link

Existing Problems:

- **Network Leaks**: Water loss due to leaks in the drinking water supply networks in Azerbaijan reaches up to 30-40% in some areas. Link
- **Inadequate Sewerage Systems:** Many residential areas, especially in rural regions, still lack proper sewerage systems. Link
- **Outdated Water Treatment Plants**: Existing wastewater treatment plants are technically outdated, leading to inadequate wastewater treatment. Link

Modernizing the infrastructure will prevent water loss, protect the environment, and enhance the sustainability of water resources.

RECOMMENDATIONS OF INTERNATIONAL ORGANIZATIONS

The role of international organizations' administrations is crucial in improving financial water management.

FAO

Recommends the implementation of drip irrigation and water reuse technologies to reduce water losses in agriculture. This could reduce water use by up to 40%. This is highlighted in the FAO's "Comprehensive Analysis of Disaster Risk Reduction System for the Agricultural Sector in Azerbaijan" document.

Water Resource Management and Sustainable Use: The document emphasizes the importance of improving sustainable usage mechanisms for agricultural lands and water resources. This could contribute to the development of environmentally clean agricultural production and reduce disaster risks. Link

Flood and Drought Risk Management: The agricultural sector in Azerbaijan is vulnerable to natural disasters such as floods and droughts. The document notes that projects have been implemented to improve the management of water and floods. For example, a project conducted by the UN Development Program in collaboration with the Ministry of Emergency Situations aims to integrate climate change risks into water and flood management for vulnerable mountain communities in the Greater Caucasus region. Link

Agrometeorological Services and Early Warning Systems: The document states that the National Hydrometeorological Service provides weather and climate services to farmers and promotes sustainable agricultural development to increase productivity. These services play a key role in the efficient use of water resources and in managing water-related risks. Link

Institutional Coordination and Policy Recommendations: he document recommends strengthening coordination between various institutions responsible for water resource management and developing a national strategy for disaster risk reduction. This approach focuses on the sustainable use of water resources and the management of risks related to the efficient use of water. • Overall, the document recommends strengthening the institutional framework for the sustainable and efficient use of water resources, improving early warning systems, and developing strategies for disaster risk management. Link

UNEP

UNEP suggests strengthening policies for transboundary management of the Kura and Araz rivers, ensuring integration of water management systems with various sectors (agriculture, energy, environment), and developing water management strategies that are adapted to the impacts of climate change, ensuring the sustainable use of water resources.

UNDP

UNDP indicates that if Azerbaijan enhances the impact of climate change, it should modernize its water management policies.

Reducing Water Scarcity: If more modern irrigation systems (such as drip irrigation technologies) are applied, water loss in the agricultural sector can be significantly reduced. These tools will ensure more efficient use of water resources.

Mitigating the Effects of Drought: Better management of agricultural lands and the use of water-based technologies can reduce the impact of drought on agricultural productivity by up to 30%.

Behavioral Changes: Through effective management and awareness campaigns, individuals and households can adopt quicker and more efficient approaches to water usage.

Reducing Water Losses in Azerbaijan: The existing water issues in Azerbaijan are not limited to agriculture and irrigation—they affect all sectors that rely on water usage. The majority of water demand in Azerbaijan comes from the agriculture sector, which is also the largest consumer of water. To ensure efficiency, a modern water policy must be implemented in agriculture by utilizing advanced technologies and minimizing losses. Considering the continuing risk of drought, preventive measures should be initiated immediately. Every drop of water should be valued, and efforts should be made to reduce water losses across all sectors. Link

1.2. Solutions and recommendations to existing challenges in water sector

Azerbaijan faces significant water challenges, including water scarcity, quality degradation, supply issues, and pollution. The following table consolidates solutions from various sources, combining common approaches to address these challenges effectively. Each solution is categorized by its focus area, with specific actions and the water challenges they target.

Infrastructure Improvement

Upgrading infrastructure is critical for addressing multiple water challenges in Azerbaijan. Modernizing irrigation systems, particularly through drip irrigation, can reduce water usage by up to 70% and enhance crop productivity, as evidenced by successful implementations in Israel Rain Bird, 2025. Updating water supply networks and replacing outdated pipelines minimize losses, which is crucial for both water supply reliability and quality maintenance. Strengthening pump stations ensures consistent water pressure, particularly in rural areas. Developing wastewater treatment infrastructure, as highlighted in recent projects World Bank, 2022, reduces pollution, protecting water bodies and public health. Infrastructure projects should be implemented by attracting local and international investments to the water sector.

Water Reuse

Reusing treated wastewater in agriculture is a highly effective strategy for conserving water resources. Collecting and reusing rainwater through infrastructure projects further supports sustainability, particularly in water-scarce regions. However, proper treatment is essential to mitigate risks from contaminants and pathogens, as noted in studies on wastewater reuse Environmental Sciences Europe, 2020.

Transboundary Cooperation

The Kura and Araz rivers, shared with neighboring countries, require international cooperation to manage water quantity and quality effectively. Strengthening diplomatic relations and signing agreements, as proposed by UNECE models, ensure fair resource sharing UNECE, 2018. Joint monitoring programs help address pollution and maintain water quality, benefiting Azerbaijan and its neighbors. Recent discussions on international collaboration, such as with Switzerland, highlight the potential for knowledge exchange Caspian – Alpine Society, 2024.

Public Awareness

Raising public awareness through campaigns can change water consumption behaviors, reducing waste and promoting conservation. The FAO emphasizes that such initiatives increase productivity and reduce water usage FAO, 2021. Educating communities on hygienic water use also supports water quality maintenance. These efforts require sustained engagement to achieve lasting behavioral changes. Moreover, it is essential to raise awareness among the public regarding the hygienic use of drinking water and the importance of a conservation-oriented approach to encourage the use of water-efficient household appliances (e.g., dishwashers and washing machines with optimized water consumption). Moveover, it is necessary to increase public awareness about the ecological impact of wastewater disposal into the Caspian Sea and enhancing government oversight in this area.

Diversification of Water Resources

Innovative technologies like artificial rainfall and desalination offer new water sources to combat scarcity. Desalination, widely used in coastal areas, can provide drinking water, as seen in the

Netherlands UNDP, 2019. Pilot projects and energy-efficient designs are recommended to assess feasibility in Azerbaijan, particularly along the Caspian Sea coast.

Legislation and Regulation

Strengthening water legislation, aligning with frameworks like the EU Water Framework Directive, enhances resource management European Commission, 2000. Enforcing drinking water quality standards, such as AZS 929:2023, and imposing stricter penalties for pollution are critical for protecting water bodies. Effective governance and enforcement are necessary to ensure compliance. It is important to toughen stricter penalties and control mechanisms for enterprises discharging untreated industrial and domestic wastewater into the Caspian Sea and other water bodies and to take effective measures against enterprises that violate environmental regulations.

International Cooperation

Cooperation between the countries bordering the Caspian Sea should be expanded to solve ecological problems. Additionally, stricter laws against pollutants should be implemented, and enhanced monitoring mechanisms should be established to ensure that industrial enterprises comply with environmental standards. International organizations, including the United Nations Environment Programme (UNEP) and the World Health Organization (WHO), report that the pollution of drinking water sources poses a significant threat to human health and ecosystems.(UNEP, 2022). In addition, scientific research shows that when heavy metals and pesticides are at high levels in polluted waters, it negatively impacts biodiversity and the food chain.(Nature Sustainability, 2021).

Monitoring and Quality Control

Development and implementing of digital tracking systems for real-time monitoring, and expanding scope and capabilities of laboratory analysis for drinking water will allow for regular water quality assessments, identifying pollution risks early. These laboratories should be equipped with more modern device. Technologies like SOFREL data loggers are available for efficient monitoring Environmental XPRT, 2025. These systems are essential for maintaining high water quality standards. Special attention should be given to the analysis of water in river basins to identify pollution risks in advance. Implementing water metering systems to monitor and control consumption levels will be useful in increasing of water usage efficiency. Regular monitoring should be conducted to track the ecological status of the Kur, Araz, and Caspian Sea. Pollution levels should be monitored in real-time. The rapid detection of pollution sources and the enforcement of fines should be strengthened.

Financial Support and Investments

Significant investments, such as the $3 billion allocated to Azerbaijan's water infrastructure over the past two decades, demonstrate the importance of funding World Bank, 2022. Public-private partnerships can further support the adoption of new technologies, enhancing water supply reliability and infrastructure development.

Climate Change Adaptation

Adaptation plans to mitigate climate change impacts on water resources (e.g., water source protection, development of alternative sources) are crucial. Protecting river basins and increasing forested areas help sustain water sources, supporting both scarcity mitigation and long-term sustainability. These measures align with Azerbaijan's National Strategy for the Rational Use of Water Resources Caspian – Alpine Society, 2024.

Waste Management

Managing industrial and domestic wastewater through modern treatment technologies reduces pollution and protects water quality. Developing dedicated infrastructure for wastewater treatment, as practiced globally, is essential for Azerbaijan to minimize environmental impacts ScienceDirect, 2023. Control measures should be strengthened to prevent the discharge of untreated waste into water bodies from factories and plants. Modern filtration systems should be implemented for industrial waste in Ganja, Mingachevir, and Sumgayit to treat and recycle wastewater for use in agriculture and industry. Modern treatment plants using advanced technologies should be constructed for wastewater treatment in urban and rural areas. In particular, systems should be established to ensure complete treatment of wastewater from Baku and Sumgayit before it is discharged into the Caspian Sea. Modern biological and chemical treatment systems need to be implemented, especially in Baku, Sumgayit, and Ganja.

Challenges and Considerations

While these solutions are promising, challenges remain. Infrastructure upgrades and innovative technologies require significant investment and technical expertise. Transboundary cooperation depends on diplomatic relations, which can be complex. Public awareness campaigns need sustained efforts to change behaviors effectively. Additionally, wastewater reuse must address health risks through rigorous treatment and monitoring. Legislation enforcement requires robust governance to prevent violations. Despite these challenges, Azerbaijan's ongoing initiatives, such as the National Strategy for the Rational Use of Water Resources and international partnerships, provide a strong foundation for progress Caspian – Alpine Society, 2024.

1.3. Structural and institutional management

INSTITUTIONAL STRUCTURE OF WATER RESOURCE MANAGEMENT

In 1997, Azerbaijan developed the Water Code as legal framework for the protection and use of water bodies and the framework established institutional roles and responsibilities.

Azerbaijan is willing to tackle challenges in the water sector, evidenced by its support of the above said UN Sustainable Development Goals (SDGs) and regional leadership. In the past decades, Azerbaijan invested with the support of International Finance Institutions in large scale WSS infrastructure projects, but on the other hand the management and the regulatory framework is underfunded (EUWI, 2021).

Water resource management in Azerbaijan is governed by a multi-tiered institutional framework designed to ensure sustainable use, protection, and development of the country's water resources. This framework is primarily established under the Water Code of the Republic of Azerbaijan and further detailed in the Law on Water Economy Management, adopted in 2023.

The following public organizations are involved in the water sector in Azerbaijan:

- Cabinet of Ministers of the Republic of Azerbaijan
- State Agency for Water Resources (ASWRA)
- Ministry of Ecology and Natural Resources (MENR)
- Ministry of Emergency Situations (MES)
- Ministry of Finance (MoF)
- Ministry of Economy (MoE)
- Ministry of Health (MoH)
- Ministry of Agriculture (MoA)
- The State Oil Company of the Republic of Azerbaijan (SOCAR)
- AZERENERJI OJSC
- State Committee for Urban Planning and Architecture
- Tariff Council
- Municipalities / Local Government
- Water Commission
- NGOs – Azerbaijan Water Users Association (AWUA)

There are also NGOs which participate in the public hearing while initiating big size projects in the water sector, including construction of the reservoirs, dams and other hydraulic structures for irrigation, water supply and sanitation.

Table 3. Key Institutions and Their Roles

Name of Institution	Role	Responsibilities
Cabinet of Ministers of the Republic of Azerbaijan	Central executive authority	• Approves national policies, coordinates inter-ministerial actions, adopts regulations on water management and infrastructure investment priorities.
State Agency for Water Resources (ASWRA)	National water management authority	• Manages water resources, plans and oversees water infrastructure development, monitors usage, and ensures integrated water resource management (IWRM).

Ministry of Ecology and Natural Resources (MENR)	Environmental protection and monitoring	• Oversees environmental impact assessments, monitors water quality, regulates water pollution, and manages surface/groundwater protection policies.
Ministry of Emergency Situations (MES)	Risk and disaster management	• Responds to floods, droughts, and other natural disasters; manages water-related emergencies and infrastructure safety.
Ministry of Finance (MoF)	Budgetary authority	• Allocates funding for water infrastructure, oversees financial planning, and ensures fiscal control in water-related projects.
Ministry of Economy (MoE)	Economic development	• Coordinates policies for sustainable economic development including investment in water sector infrastructure and services.
Ministry of Health (MoH)	Public health and sanitation	• Ensures drinking water quality standards, monitors health impacts of waterborne diseases, and regulates hygiene in water use.
Ministry of Agriculture (MoA)	Agricultural water use	• Manages irrigation schemes, promotes efficient water use in agriculture, and supports farmer access to water resources.
The State Oil Company of the Republic of Azerbaijan (SOCAR)	Industrial water user	• Ensures sustainable and compliant water use in oil and gas production, including wastewater treatment and water recycling.
AZERENERJI OJSC	Power generation and water use	• Uses water for hydropower and cooling in thermal plants; responsible for sustainable water use in energy production.
State Committee for Urban Planning and Architecture	Urban development oversight	• Coordinates water infrastructure planning in urban and regional development projects and ensures integration into city plans.
Tariff Council	Pricing regulator	• Sets tariffs for water supply and wastewater services, balancing affordability with cost recovery for utilities.
Municipalities / Local Government	Local service provision	• Provide drinking water, sanitation services, manage local water infrastructure and small-scale treatment systems.
Water Commission	Inter-agency coordination	• Facilitates coordination among state bodies involved in water management and policy-making.
NGOs – Azerbaijan Water Users Association (AWUA)	Civil society and stakeholder engagement	• Represents water users (esp. farmers), promotes awareness, capacity building, and community participation in water governance.

Institutional Reforms in the Water Sector

Azerbaijan is increasingly engaging in international cooperation to reform its water management system. The government collaborates with institutions such as the EU, World Bank, FAO, UNDP, and the Netherlands in areas like Integrated Water Resources Management (IWRM), water accounting, climate-resilient irrigation, and institutional strengthening. These partnerships contribute to aligning national policies with the principles of the EU Water Framework Directive and the abovesaid SDGs (particularly SDG 6 on clean water and sanitation).

Water is a strategic and vital natural resource that ensures not only environmental sustainability but also economic development, public health, and food security. Azerbaijan, as a country situated in a semi-arid region with limited renewable freshwater resources, has faced significant challenges in water management, including uneven distribution of water, high water losses, climate change impacts, and increasing demand from agriculture and urbanization. Therefore, institutional reforms and modernization in water governance have become a national priority.

In recent years, the institutional landscape of water governance in Azerbaijan has undergone major reforms aimed at consolidating management functions, enhancing efficiency, and addressing fragmentation.

Establishment of the Azerbaijan State Water Resources Agency (ASWRA)

By the Presidential Decree dated March 30, 2023, the "Azerbaijan State Water Resources Agency" (ASWRA) was established as the central executive authority responsible for managing the country's water resources, taking over fragmented responsibilities in the water sector and assuming key functions such as the planning, allocation, protection, and integrated management of water resources.

This agency consolidates previously scattered institutional roles into a unified governance model aimed at ensuring long-term water sustainability in the country. It operates under its Charter (approved by the Presidential Decree of November 17, 2023 Link), which outlines responsibilities such as managing water bodies, developing basin plans, coordinating stakeholders, and implementing water policy at the national level.

This new agency was formed through the merger and dissolution of the following two major entities (Link):

- "Azersu" OJSC, which was previously in charge of drinking water supply and sewerage systems;
- "Azerbaijan Melioration and Water Management" OJSC, responsible for irrigation, drainage, and melioration systems.

The ASWRA is now tasked with:

- Managing surface and underground water resources;
- Planning and overseeing water supply and wastewater treatment systems;
- Operating and maintaining irrigation and drainage infrastructure;
- Monitoring and assessing the quality and quantity of water resources;
- Coordinating national policies on integrated water resources management (IWRM);
- Representing Azerbaijan in international water-related cooperation.

Legal and Policy Framework

The creation of the ASWRA necessitated updates to existing legal frameworks. The national water strategy has been revised to reflect integrated and sustainable water management principles, in line with the UN Sustainable Development Goal 6 (SDG 6) on clean water and sanitation.

Since the beginning of 2024, **ASWRA** continues modernization efforts under the National Water Supply Strategy, including the digitalization of customer services and the improvement of infrastructure.

Other three ministries are responsible for different agendas in the country's water sector:

The Ministry of Ecology and Natural Resources (MENR) is responsible for the overall management of environmental and natural resources, including water resources, in Azerbaijan. It formulates policies, regulations, and strategies related to water quality, conservation, and protection. Furthermore, it plays a crucial role in ensuring the sustainability and protection of water resources in Azerbaijan, and in promoting responsible and sustainable water use practices.

The Ministry of Emergency Situations (MES) is responsible for disaster management and response, including flood and emergency management in the event of natural disasters, such as floods. The role of the MES in water management has been diminished; the management of large reservoirs has been transferred to ASWRA. The former "State Water Management Agency of the Ministry of Emergency Situations" is no longer the main executing body. The section about this institution should either be shortened, updated, or emphasized to reflect that many of its functions have now been transferred to the new Agency. Following institutional reforms, many strategic functions previously assigned to the MES regarding the management of large reservoirs have been handed over to the ASWRA. This change aims to improve coordination in the sector and eliminate overlapping mandates.

The Ministry of Agriculture (MoA) plays a key role in ensuring the development and sustainability of the agricultural sector in Azerbaijan and in promoting the well-being of rural communities and the wider population.

Regarding to the participation in the water resource management, the Ministry through regional **State Agricultural Development Centers** supports **Water User Associations** and farmers for delivery of the irrigation water to the fields and their fair distribution among the users. The Ministry cooperates with the ASWRM to support working out irrigation plans, and define irrigation water demand at the beginning of each crop growing season and control to keep irrigation schedules during the vegetation period.

The State Oil Company of the Republic of Azerbaijan (SOCAR) is involved in the management and regulation of water resources in the context of the oil and gas industry, particularly in relation to environmental protection and water quality.

The "Space Agency of the Azerbaijan Republic (Azercosmos)" Public Legal Entity is since 2021 the legal successor of "Azercosmos" Open Joint-Stock Company. The Agency is a public legal entity that participates in the formation and implementation of the state policy in the field of space activities, performs regulation, monitoring in that field and functions of the national and public importance in launching into orbit, control and operation of satellites with telecommunications, Earth observation and other missions, participates in international space projects, cooperates with relevant international organizations and governmental bodies of foreign countries in the field of peaceful use of space.

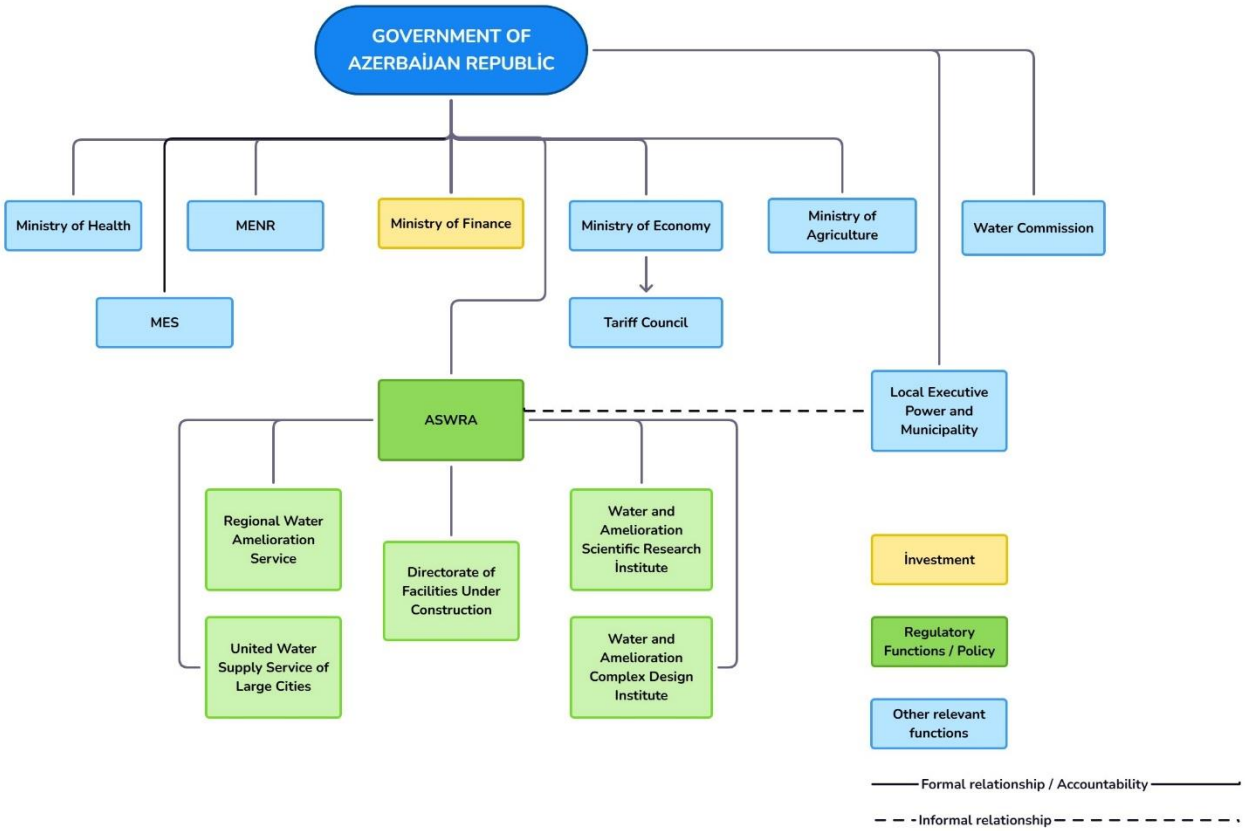

Figure 6. Water Sector Institutional Setting in Azerbaijan (2025)

In addition to the **Azerbaijan National Academy of Sciences (ANAS**), there are other universities e.g., Baku State University or Azerbaijan Technical University, research institutions, and nongovernmental organizations (NGOs) in Azerbaijan that are actively involved in scientific research and activities related to water resources, water quality, hydrology, and environmental studies. These institutions contribute to the research, monitoring, and management of water-related issues in the country.

The MSc in **Water Resources and Management at UFAZ** (**University of Strasbourg** and **Azerbaijan State Oil and Industry University**) was launched to address growing challenges in water sustainability. This interdisciplinary program, taught in English and supported by French academic standards, equips students with advanced knowledge in hydrology, water management, and environmental policy, preparing them for careers in both public and private sectors. Link

In Azerbaijan, various institutions and entities operate at regional, municipal, and local levels to manage water resources, provide water supply and sanitation services, and address water-related issues. Azerbaijan is divided into regions, and each region typically has its own **Regional Water Department** responsible for managing and regulating water resources and infrastructure within that region. **Regional Environmental Agencies** oversee environmental protection and water quality monitoring at the regional level. Local Governments, including municipal and city administrations, play a role in regulating and monitoring water supply and sanitation services in their areas. At local level, environmental issues including water quality and pollution control are addressed by **Local Environmental Departments**.

Particularly in rural areas**, Water User Associations (WUAs)** exist to manage and allocate water resources at the community level. It is reported that the WUAs do not function as intended and expected results are not achieved, especially in terms of ensuring sustainability for infrastructure. WUAs are not delivering the expected results, and the relevance of this issue has increased. Based on international projects (supported by the World Bank and FAO), new programs are being implemented to strengthen the institutional capacity of WUAs. Several recent programs supported by the World Bank and FAO aim to improve the functionality of WUAs by enhancing their capacity to operate and maintain irrigation infrastructure and increasing financial sustainability through reforms in fee collection and management.

1.4. Existing policy and legal framework

National Strategy for Efficient Use of Water Resources

To address these challenges and to mitigate the effects of water resource depletion, Azerbaijan has developed an ambitious "National Strategy for the Rational Use of Water Resources." Approved on 10 October 2024 by the decree of President Ilham Aliyev, the strategy aims to eliminate fragmentation between various government agencies and address the country's water scarcity problem. Azerbaijan's water resources are notably limited, with a total of **26.2 billion cubic meters** of renewable freshwater, of which **13.2 billion cubic meters** are transboundary waters, making water management a critical issue for the country.

The coordination of activities outlined in the National Strategy has been entrusted to a commission established by presidential decree No. 1986, dated April 15, 2020, titled "On Measures to Ensure the Efficient Use of Water Resources." The Cabinet of Ministers of Azerbaijan has appointed the Center for Analysis of Economic Reforms and Communication to monitor and assess the implementation of the strategy. Given the importance of effective water management, the country also aims to improve water accounting and control measures, particularly for the 10,000+ artesian wells in operation, of which accurate water usage monitoring is a challenge.

The National Water Strategy outlines a clear path for Azerbaijan's water sector reform, setting short, medium, and long-term goals for the next 18 years. It aims to improve water security, to promote sustainable development, and address key challenges, such as water scarcity, water pollution and the growing demand for irrigation and drinking water.

The strategy will strengthen Azerbaijan's legal framework and build on modern principles of Integrated Water Resources Management (IWRM), including river basin management and the "polluter pays" principle. Key actions include expanding the national water monitoring system, creating a comprehensive database for surface and groundwater resources, and improving wastewater collection and treatment across the country.

EU's support for the development of a Water Strategy

The European Union has played a pivotal role in the development of this strategy through the EU Water Initiative + (2016-2020) and the EU4Environment - Water Resources and Environmental Data programme (2021-2024). By supporting policy dialogues and providing technical guidance, the EU helped to shape Azerbaijan's strategy in line with EU water management standards, with the support of the programme's implementing partners: UNECE, OECD, the Environment Agency Austria and the International Office for Water in France.

The strategy is set to be implemented in three phases between 2024 and 2040 and aims to increase water reserves, improve access to quality drinking and irrigation water, modernize water resource management, enhance international cooperation in line with global conventions.

First Phase (2024–2027) – Focuses on improving infrastructure and management for efficient water use, including reassessing and expanding water reserves, integrated water resource management, utilization of water resources in Karabakh and Eastern Zangezur economic regions, management of wastewater and rainwater, enhancing water quality and developing water supply infrastructure and reducing losses

Second Phase (2028–2030) – Strengthens foundational conditions by aligning with United Nations Sustainable Development Goals (SDGs), particularly clean water and sanitation, combating climate change, marine and terrestrial ecosystem conservation

Third Phase (2031–2040) – Ensures sustainable water supply through innovative water crisis management technologies, expansion of water reserves utilization of alternative water sources

As part of this strategy, by **2030**, Azerbaijan plans to construct **13 new reservoirs**, reducing its reliance on transboundary water resources and significantly improving water security. The strategy also calls for the improvement of irrigation systems and the enhancement of water use efficiency in agriculture, where currently **50% of irrigation water** is lost before reaching the end-users. Through the adoption of new technologies, including modern irrigation systems, these losses could be reduced by **42% by 2027**. In addition, by **2028**, the country aims to provide drinking water to **85% of the population**, with the goal of achieving **100% water coverage by 2040**.

Additionally, significant attention will be given to reducing water losses in supply systems, where **37% of drinking water** is currently lost due to aging infrastructure. According to government plans, these losses will be reduced to **33% by 2027**. The strategy also envisions the active adoption of alternative water sources, such as desalination and water reuse technologies. By **2040**, Azerbaijan plans to fully integrate alternative sources, including new reservoirs, desalination, and waste recycling technologies, to ensure a sustainable water supply for its growing population and industrial needs.

1.5. Legal and organizational gaps in water management

The following identified legal and organizational gaps in Azerbaijan's water management system can significantly impact private investments—particularly those involving infrastructure, agriculture, industrial operations, or services related to water treatment and supply:

Improvement of the Legal Framework

The current legal system does not adequately reflect the principles of **Integrated Water Resource Management (IWRM)**, a globally recognized approach that coordinates development and management of water, land, and related resources. The lack of such a framework leads to fragmented policies, inconsistent enforcement, and regulatory uncertainty. The "National Strategy for Efficient Use of Water Resources" aims to enhance the legal framework in this area. Link

Impact on Private Investment:

- **Regulatory Risk**: Investors face higher risk due to unclear or incomplete laws governing water use, wastewater discharge, or water access rights.
- **Delayed Project Approvals**: Companies may experience bureaucratic delays or arbitrary interpretation of outdated rules.
- **Investment Insecurity**: Without strong legal protections, long-term investments—especially those in infrastructure or industrial water use—are harder to justify.

What Companies Should Expect:

- Potential **regulatory changes** as the "National Strategy for Efficient Use of Water Resources" is implemented.
- Need for **frequent legal due diligence** to keep pace with shifting policies.

Organizational Alignment Issues

Water management in Azerbaijan is handled by **multiple institutions**, including ministries, agencies, and regional authorities. However, the **lack of coordination and data sharing** between them leads to inefficiencies, duplication of efforts, and contradictory policies. Coordination and information exchange among various institutions responsible for water resource management are not sufficiently effective. This lack of coordination hinders the efficient management of water resources. Link

Impact on Private Investment:

- **Unpredictable Permitting Processes**: Investors may receive conflicting instructions or face long delays due to inter-agency misalignment.
- **Costly Delays in Project Implementation**: Construction, drilling, or discharge permits may be held up.
- **Operational Inefficiencies**: Water availability and usage regulations might change unpredictably, disrupting operations.

What Companies Should Expect:

- Need to **navigate a complex institutional landscape**—possibly engaging multiple stakeholders for a single project.

- Greater value in working with **local consultants** who understand the informal coordination mechanisms.

Unclear Institutional Responsibilities

There are cases of **overlapping authority** (e.g., two agencies responsible for water quality monitoring) or **gaps in jurisdiction** (e.g., no agency clearly responsible for regulating private water use in certain regions)m which creates challenges in water management.

Impact on Private Investment:

- **Legal Disputes and Liability Risks**: Investors may become entangled in disputes between institutions or be held accountable for gaps in oversight.
- **Unclear Enforcement**: Ambiguities around who enforces standards or penalties create uncertainty for compliance.
- **Difficulty in Planning and Budgeting**: Without clear rules and responsible bodies, it's hard to model project timelines or costs accurately.

What Companies Should Expect:

- Need to **clarify institutional roles** during project planning, and to seek written confirmations or MoUs with local authorities when needed.
- Possibly engage in **policy advocacy** to support clearer delineation of responsibilities.

Recommendations for Investors and Companies:

1. **Conduct Comprehensive Legal and Institutional Due Diligence** before initiating water-related projects.
2. **Engage in Policy Dialogue** with government entities and international organizations to stay ahead of reforms.
3. **Establish Multi-Stakeholder Relationships** early—engaging not just regulators but also water basin councils, municipalities, and local communities.
4. **Monitor Reform Processes** under the National Strategy, which may open opportunities (e.g., PPPs) but also introduce new compliance obligations.
5. **Adapt Investment Strategies** to include flexibility in timelines, budgeting for bureaucratic delays, and legal contingency planning.

1.6. Ongoing and planned water projects in Azerbaijan

Prospects for Seawater Desalination

As part of the **National Strategy for the Rational Use of Water Resources for 2024-2040**, comprehensive measures are outlined to ensure effective water resource management, prevent pollution, and utilize alternative sources of water. A significant focus is placed on **seawater desalination**, a key area of development that began in the early 2010s.

In **2012**, a water desalination facility was constructed to treat water from the **Shirvan collector**, with an initial capacity of **2,500 cubic meters per day**. By **2016**, a second facility was added, doubling the capacity to **5,000 cubic meters per day**. These plants are equipped with reservoirs and storage tanks to ensure a steady supply of water, crucial for meeting the increasing demand in the region. In **2013**, a desalination plant was built in the village of **Khydyrly in the Salyan district**, utilizing **reverse osmosis technology** to purify seawater to drinking water standards. As demand for fresh water increased, this plant became a **pilot project**, aiming to gain experience in using alternative sources of fresh water in a country with limited natural reserves of this resource. Initially, the plant was equipped to produce **1,000 cubic meters of fresh water daily**. By **2016**, the plant's capacity was doubled to **2,000 cubic meters per day**, without requiring additional construction. This marked an important step in **Azerbaijan's efforts** to develop alternative water sources and address water scarcity challenges.

Building on these early efforts, in **2023**, **President Ilham Aliyev** issued a decree to launch a **new pilot project for seawater desalination** to improve the water supply for **Baku and surrounding areas**. As **Rashail Ismayilov**, Head of the Department at the Scientific Research Institute of Azerbaijan's Melioration, announced, the desalinated water from the **Caspian Sea** will be supplied to households on the **Absheron Peninsula**, including **Baku**. This initiative is a core part of the **National Strategy for 2024-2040**, which also outlines the **Sustainable Development Goals** related to water and sanitation, with **156 specific objectives** directly connected to water management and environmental sustainability.

Preparations are already underway for this major desalination project, including the planning of a **tender process**. The new facility, expected to be located near **Sumgayit**, will have a production capacity of **100 million cubic meters of desalinated water annually**. The project is set to be implemented over **27.5 years**, marking a significant long-term commitment to addressing water scarcity in the region. For the first time, this project will employ a **public-private partnership model**, with the treated water intended for drinking purposes. Ismayilov further noted that the water will undergo **complex technological processes** and meet all quality standards before reaching the homes of **Absheron residents**. Though it remains a pilot project, it is anticipated that residents across **Baku** and nearby areas will benefit from the distribution of desalinated water.

In addition to seawater desalination, the **National Strategy** includes a project to treat **wastewater at the Hovsan Aeration Station**. After purification, this treated, non-potable water will be used for **irrigation** and other technical purposes, further optimizing water resource use in the country. Agreements have already been signed with leading international companies, including the **Israeli water operator Mekorot Water Company**, and discussions have been held with the **Saudi company ACWA Power** to provide technical support and implement advanced desalination technologies. Furthermore, in **2022**, a **Memorandum of Understanding** was signed between the renowned **Israeli company I.D.E. Water Assets Ltd** and the **Azerbaijan Investment Company** for cooperation in establishing a desalination plant on the **Caspian Sea**. A total of **14 foreign private companies**, including **Swiss companies**, are currently involved in the desalination process.

Regional projects

Special attention to water resource management in Azerbaijan will be directed towards the recently reintegrated territories of the **Karabakh** and **Eastern Zangezur** economic regions. Plans are underway to construct **28 hydroelectric power stations** in these areas, which will not only address water issues but also provide the region with renewable **"green" energy**. These initiatives are part of Azerbaijan's broader strategy to rebuild the infrastructure and ensure sustainable development in these territories. These areas offer vast potential for sustainable development, particularly in the restoration of natural ecosystems. With focused investment, efforts are underway to revitalize forested landscapes and rehabilitate water resources, opening opportunities for green technologies, environmental innovation, and eco-tourism.

The districts of Kalbajar, Lachin, and Zangilan present exceptional opportunities for large-scale ecological restoration and sustainable land use. Spanning approximately 60,000 hectares of forested land, these regions are now the focus of strategic environmental recovery initiatives aimed at restoring biodiversity and improving the ecological balance.

Efforts are also underway to modernize and optimize the management of water resources, which are critical to the agricultural revival of the region. By investing in sustainable infrastructure and advanced irrigation systems, Azerbaijan is unlocking the full potential of its rich water reserves—estimated at **over 2 billion cubic meters**—supporting food security, rural development, and climate resilience.

One of the region's most significant assets is the **Okhchuchay River**, a transboundary waterway with great potential for ecological regeneration and cross-border cooperation. Restoration efforts are being prioritized to improve water quality, protect aquatic biodiversity, and enhance the health of downstream ecosystems, including the Araz River.

Flagship infrastructure projects are playing a key role in this transformation. The **Sarsang Reservoir**, located on the Terter River, with a capacity of 560 million cubic meters, is pivotal in supporting irrigation across over 96,000 hectares of farmland in districts such as Barda, Terter, Agdam, Aghjabedi, and Goranboy. Originally inaugurated in 1976, the facility continues to serve as a cornerstone of regional agricultural productivity.

Similarly, the **Sugovushan Reservoir**—another vital structure commissioned in the same era—is undergoing comprehensive rehabilitation. Once fully operational, it will further strengthen irrigation capacity and boost agricultural output across neighboring areas.

The State Water Resources Agency is currently finalizing the restoration of **five major reservoirs**—Khachinchay, Sugovushan, Kendelenchay-1, Kendelenchay-2, and Lower Kendelenchay. These projects are integral to building a resilient, efficient water management system that will ensure long-term sustainability, enhance food production, and promote green economic growth across the region.

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Water scarcity and drought are not limited to one region. Other parts of the country, including the Absheron Peninsula, face significant challenges due to limited freshwater availability and increasing demand from urban and industrial growth. These challenges highlight the urgent need for a comprehensive national water resilience strategy.

To address this, Azerbaijan is actively pursuing international cooperation and technology-driven solutions. Strategic partnerships with countries such as the Netherlands—renowned for their expertise in integrated water resource management, irrigation innovation, and climate-adaptive infrastructure—are playing a key role.

Technologies such as desalination, rainwater harvesting, and precision irrigation (including drip and sprinkler systems) are being explored and adapted to local conditions. The revitalization projects in Karabakh provide valuable models for scaling smart water practices to other water-stressed regions, including Absheron, supporting a unified and sustainable approach to water security nationwide.

This list includes initiatives aimed at improving water supply, irrigation, infrastructure, and sustainability:

Current Projects (under implementation in 2025)

1. Seawater Desalination Plant – Sumgayit (SWRO)

- **Objective:** To provide drinking water for Baku & Absheron, diversify freshwater sources, and transfer technical know-how.
- **Scope:** 300,000 m³/day capacity, built under a 27.5-year PPP, then handed over to the State Water Resources Agency.
- **Budget & Model:** Fully financed by the ACWA Power + IC İçtaş consortium; public tender called in Feb 2024, winner announced in Jan 2025.
- **Implementing Agency:** ACWA Power (lead), IC İçtaş, Azerbaijan State Water Resources Agency.
- **Proof:**
    - ACWA announcement: "with a daily capacity of approx. 300,000 m³" en.trend.az+13acwapower.com+13economy.gov.az+13caliber.az+3economy.gov.az+3economy.gov.az+3
    - Government tender result confirm consortium win in Jan 2025

2. EBRD–EU FOPIP Support for Ganja

- **Objective:** Strengthen water management operations, financial sustainability, and climate-resilient infrastructure in Ganja.
- **Scope:** Pipeline construction, sewer/stormwater systems, reservoirs, resilience upgrades.
- **Budget:** €35 million (EBRD loan) + up to €5 million EU grant.
- **Implementing Agency:** EBRD + Azerbaijan State Water Resources Agency; executed by Aqwadem Consulting.
- **Proof:** Announced June 25, 2025 report.az

3. BP Partnership with State Water Agency – Regional Rural Projects

- **Objective:** Improve water supply & irrigation infrastructures in rural Azerbaijan (Goychay, Tovuz, Kurdamir, Ujar, Aghdash, Yevlakh, Goranboy, Samukh).
- **Scope:**
  - Goychay: floodwater capture/cleaning (~500,000 m³/year for irrigation)
  - Tovuz: restore sources (~2.5 million m³/year)
  - Other districts: 25 systems (drinking, irrigation, sanitation) benefiting ~25,000 people.
- **Budget:** Total of US $2.6 million over two years.
- **Implementing Agency:** Azerbaijan State Water Resources Agency + BP.
- **Proof:** Report.az, April 2024 en.wikipedia.org+10report.az+10report.az+10

4. Rehabilitation in reintegrated territories (Karabakh, Jabrayil)

- **Objective:** Restore irrigation canals, pumping stations, collectors across newly regained regions.
- **Scope & Budget:**
  - Karabakh: Garabagh canal reconstruction, ~3,740 wells drilled nationwide; new reservoirs like Bargushad to start by end-2025.
  - Jabrayil: Irrigation infrastructure rehab, silt clearance, 5 pumping stations irrigating ~4,810 ha; contract signed with Az Graft Construction LLC for AZN 8.074 million, due by end-2025.
- **Implementing Agency:** State Water Resources Agency + Az Graft Construction LLC.
- **Proof:**
  - Public hearings & canal plans azernews.azcaliber.az+1en.wikipedia.org+1
  - Tender and execution in Karabakh/Jabrayil

5. Upper Shirvan & Karabakh Canal Feasibility

- **Objective:** Modernize irrigation across vast agricultural lands.
- **Scope:**
  - Upper Shirvan Canal: Rehabilitation of 122 km (with 200 km extension) to prevent loss of ~346 million m³ water, revive Hajigabul Lake, irrigate ~230,000 ha.
  - Karabakh Canal: Feasibility studies underway; construction slated for 2025, serving ~115,000 ha across nine regions.

- **Budget:** Not specified yet (likely multi-million USD).
- **Implementing Agency:** Azerbaijan State Water Resources Agency, with international partners (IDB, ADB).
- **Proof:** COP29 coverage & environmental plans report.az+10caliber.az+10lemonde.fr+10

6. Giz Galasi Dam (Border with Iran)

- **Objective:** Generate hydropower and irrigate up to 12,000 ha; a cross-border cooperation with Iran.
- **Status:** Operational since May 19, 2024; part of ongoing water-irrigation usage through 2025.
- **Capacity:** Reservoir holds 62 million m^3; hydro plant 2×40 MW.
- **Implementing Agency:** Azerenerji ASC + Iranian authority.
- **Proof:** Wikipedia details lemonde.fr+3en.wikipedia.org+3en.wikipedia.org+3

2. OVERVIEW OF DUTCH EXPERTISE IN THE WATER SECTOR

2.1. Overview of cooperation between Netherlands and Azerbaijan in water sector

Over the past decade, Azerbaijan and the Netherlands have built a strong, multi-dimensional partnership in the drinking water sector, rooted in knowledge exchange, technical expertise, and joint initiatives. Dutch companies and institutions have played a key role in advancing Azerbaijan's water infrastructure, management systems, and environmental protection efforts through collaborative projects and sustained engagement.

From shaping Azerbaijan's National Water Strategy to addressing challenges such as flood risk, urban water loss, rural filtration, and ecosystem restoration, Dutch support has been instrumental in promoting sustainable water management. This cooperation extends across strategic policy development, infrastructure resilience, urban system modernization, rural sanitation, agricultural water use, environmental remediation, and academic exchange. These efforts are supported by formal agreements, high-level forums, long-term programs, and active private sector participation—reflecting the depth and breadth of the bilateral engagement.

National Water Strategy & Institutional Engagement

- **Azerbaijan's National Water Strategy (2018–2035)**: The Dutch have assisted in its drafting through comprehensive water assessments and planning methodology via governmental collaboration

  hollandtimes.nl+\7netherlandsandyou.nl+7womenforclimate.org+7.

Flood Risk Management & Infrastructure Support

- **Post-2010 Flood Response**: After catastrophic flooding on the Araz and Kura rivers in 2010, a Dutch-led consortium—Rijkswaterstaat, Royal Haskoning and Deltares—formulated an action plan in 2011. It targeted technical and structural solutions including dykes, dams, and training for local officials, with multi-million-euro investment pollutionsolutions-online.com+1content.yudu.com+1. This remains part of an ongoing, long-term flood resilience effort, embedding Dutch technical methodology into Azerbaijan's hydrological planning.
- **Memorandum of Understanding (2014):** Signed between Azerbaijan and the Netherlands to foster long-term cooperation in flood prevention and disaster management. MoU Azertag MoU (origical).

Leak Reduction & Urban Water Systems

- **Non-Revenue Water (Leakage) Projects**: Alexander Khodakov (Nijhuis Saur Industries) and peers highlighted during the 2024 forum that pipe leakage is a major issue in Baku & Absheron, and Dutch solutions are being tailored to these contexts

  womenforclimate.org+4pollutionsolutions-online.com+4content.yudu.com +4azernews.az+2report.az+2today.az+2.

- **Lake Boyuk Shor Rehabilitation:** The major remediation project is being implemented by Dutch engineering consultants, Witteveen+Bos. They are working on landscape

improvement and water quality remediation of nine lakes around Baku, including Lake Boyuk Shor. Each of the nine contaminated lakes must be cleaned by 2030. The rehabilitation of Lake Boyuk Shor is split into two stages. The first stage is now complete, and included the separation of the most polluted part from the rest of the lake using a dam. The second stage will take the longest time as it is focused on the reconstruction of the lake's ecosystem and aims to return the lake to its natural historic state. https://www.aquaread.com/blog/case-study-lake-rehabilitation-baku-azerbaijan/#:~:text=As%20part%20of%20the%20first,to%20isolate%20the%20project%20area.

- Dutch companies, including Nijhuis, are actively engaging with local agencies like ADSEA to pilot leak detection and rehabilitation programs.

Rural Filtration & Community-Level Interventions

- **"Tulip" gravity-based water filters**: In 2010–2011, the Groningen Drinking Water Company (KWR), via WECF and NGO EKOT, donated over €8,700 to pilot distribution of Tulip Water Filters across six rural Azerbaijani villages (Saatli & Sabirabad).
- Roughly 600 filters—produced by Basic Water Needs—were installed in schools and households to improve microbiological safety, with tests suggesting user readiness to pay a subsidized €16 per unit for sustained access

  reddit.com+13womenforclimate.org+13report.az+13.
- These projects underscored the Dutch model of community-based sanitation innovation with cost-sharing and local distribution.

Knowledge transfer, trade missions & strategic forums

- In July 2024, Dutch Water Envoy Meike van Ginneken and later in September 2024 the Dutch water institutions held a visit of water trade mission to Baku also participating in the Water Innovation Forum report.az+1report.az+1.
- **Trade & Academic Missions (Sept 2024):** A delegation including IHE Delft, Nijhuis Saur Industries, Royal Haskoning DHV, Slamdam B.V., Spaans Babcock B.V., WUR Wageningen University and Dr. Farhad Mukhtarov of ISS/EUR undertook site visits in Baku. They met with multiple Azerbaijani ministries to discuss flood and drought resilience, greenhouse irrigation, and water governance iss.nl
- **Caspian Water Innovation Forum (Sept 2024)**: At this high-level event, Azerbaijan officially expressed interest in Dutch expertise, particularly for science, innovation, training and operational partnerships in water management. Ambassador Pauline Eizema reiterated the Netherlands' intent to share its centuries-old water-management know-how, especially flood control, supply safety, and infrastructure resilience iss.nl+4azernews.az+4today.az+4.
- **Visits from Azerbaijani Ministers**: In 2024, the Minister of Agriculture visited the Netherlands to discuss horticulture and water tech, supported by FMO investments in green agribusiness caspianagro.az.

- **Caspian Agro 2025 (May 2025)**: Dutch delegations showcased greenhouse tech, drip irrigation, and horticultural systems—key to sustainable rural water use womenforclimate.org+2caspianagro.az+2netherlandsandyou.nl+2.

Broader economic ties

- As of 2024–2025, around **100–130 Dutch companies** are active in Azerbaijan, and the Netherlands has invested ~$1.5 billion across non-oil sectors, including water, agriculture, port engineering, logistics, shipbuilding, and renewables report.az.

2.2. Key strengths of the Dutch water sector

The Netherlands is a world leader in water management. Our country, often referred to as Holland, is a relatively small, low lying, densely populated deltaic region at the western edge of Europe. Living in this challenging and vulnerable environment, with 29% prone to flooding, spurs innovation and cooperation. By constantly adapting our approach to water over decades, we have gained an advantage and we want to share our knowledge and skills internationally. At the same time, we too face our challenges in light of climate change and would like to learn from others on creating a sustainable future. The **Dutch water sector** is globally renowned for its **innovation, expertise, and holistic approach** to water management, shaped by centuries of battling water-related challenges in a low-lying delta.

The Dutch water sector continues to demonstrate its strong international position. According to the latest **Water Sector Export Index (WEX) report**, compiled by research agency Panteia on behalf of the Netherlands Water Partnership (NWP) and Water Alliance, the sector is expected to reach an **export value of €10.5 billion in 2024 – accounting for 1.88% of total Dutch exports**. Link

The WEX distinguishes two key subsectors:

- **Water technology**, including supply and treatment, industrial water solutions, wastewater collection and reuse.
- **Delta technology**, covering integrated water management, hydraulic engineering, coastal development, dredging and nature-based solutions

Europe and North America remain the largest export markets, but interest is growing in the Middle East, India, Mexico, and parts of Asia and Africa – particularly for delta-related projects. Emerging sector themes include water scarcity, water quality, climate adaptation, circular water use, and nature-based solutions. In addition, digitalisation and artificial intelligence are gaining importance in water-related innovations.

Companies cite challenges such as navigating complex local regulations and securing finance for international activities. To boost global competitiveness, they call for:

- Greater investment in innovation, including pilot and demonstration projects
- More focus on developing sound business cases
- Better use of international networks (e.g. embassies, trade missions)
- Delivering integrated water solutions combining expertise across domains

The WEX report is an important tool for identifying international growth opportunities and guiding investment in the Dutch water sector's global innovation strength. As global demand for water solutions increases, the water sector is becoming ever more vital to the Dutch economy. Export is, and will continue to be, a key driver of economic performance and employment in the sector.

The **key strengths of the Dutch water sector** stem from the Netherlands' long history of battling water-related challenges. The country has developed world-renowned expertise in water management, making it a global leader in this field.

Below are its key strengths:

1. World-Class Engineering & Innovation

- **Delta Works & Flood Defense**: Iconic infrastructure like the **Maeslantkering** (storm surge barrier) and the **Zuiderzee Works** demonstrate cutting-edge engineering to protect

against sea-level rise and flooding. Their **"Room for the River"** program focuses on creating natural floodplains to manage rising water levels innovatively.
- **Smart Solutions**: Innovations such as **sand motors** (coastal replenishment), **floating cities**, and **aquifer storage** highlight adaptive, nature-based solutions.
- **Tech Leadership**: Dutch companies (e.g., **Royal HaskoningDHV**, **Deltares**, **Van Oord**) lead in hydraulic engineering, dredging, and water tech.

2. Agri-Water / Food-Water Nexus

- **Efficient Irrigation & Water-Saving Technologies:** *Dutch expertise in drip irrigation, controlled water delivery, and soil moisture monitoring helps optimize water use in agriculture, essential for Azerbaijan's arid and semi-arid zones.*
- **Climate-Resilient Agriculture:** *Integration of Dutch precision farming and climate-adaptive water management enhances productivity under changing climatic conditions in Azerbaijan.*
- **Water Quality for Food Safety:** *Dutch approaches link water management with food safety, ensuring that irrigation and processing water meet health standards—critical for export-oriented agribusinesses.*
- **Reuse of Treated Wastewater in Agriculture:** *The Netherlands leads in safe reuse of treated wastewater for irrigation, offering scalable solutions for water-scarce regions like southern and central Azerbaijan.*
- **Data-Driven Water Governance in Agri-Sector:** *Advanced Dutch water-data systems can support Azerbaijan in real-time decision-making for agricultural water distribution and drought risk management.*
- **Integrated Water & Land Use Planning:** *Dutch spatial planning experience supports the design of agro-industrial zones with efficient water allocation, reducing conflict between urban, industrial, and agricultural needs.*

3. Innovative Drinking Water Technology

- The Netherlands invests heavily in water technology, focusing on **desalination**, **wastewater treatment**, and **circular water systems**.
- Companies and research institutes develop cutting-edge solutions for **clean drinking water** and **sustainable water use**.

4. Integrated Water Resource Management (IWRM)

- **Multifunctional Design**: Combining water safety with urban planning (e.g., **Room for the River** program, which creates floodplains while enhancing biodiversity). The Dutch approach involves combining urban planning, nature-based solutions, and infrastructure development to create climate-resilient cities. Emphasis is placed on balancing economic activity with environmental sustainability.
- **Circular Water Systems**: Pioneering wastewater-to-resource models (e.g., energy/phosphorus recovery from sewage).
- **Climate Adaptation**: Proactive strategies like the **National Delta Programme**, integrating long-term climate resilience into policy.

5. Policy & Governance

- **Participatory Governance**: Involving citizens, NGOs, and businesses in water decisions (e.g., **water boards** or *waterschappen*).

- **Long-Term Vision**: Policies like the **Delta Plan 2100** address challenges decades in advance.

6. Cultural Mindset

- **Water Consciousness**: A societal ethos of collaboration and urgency around water challenges, rooted in history.
- **Entrepreneurship**: Startups like **Aquabattery** (saltwater energy storage) and **Hydraloop** (greywater recycling) drive sector dynamism.
- **Dutch entrepreneurs look at the integral picture**: They build systems and incorporate into the design, important topics such the role of maintenance and upgrading with new technologies to ensure a long-term earning model

7. Strong Public-Private-Academic Collaboration

- **Triple Helix Model**: Close collaboration between **government**, **research institutes** (e.g., **Deltares**, **IHE Delft**), and **private companies** ensures rapid knowledge transfer and implementation. The Dutch approach involves combining urban planning, nature-based solutions, and infrastructure development to create climate-resilient cities. Emphasis is placed on balancing economic activity with environmental sustainability.
- **Living Labs**: Testing innovations in real-world environments (e.g., **Amsterdam Rainproof**, **Rotterdam Water Square**).

8. Sustainability & Climate Adaptation

- **Climate adaptation strategies** focus on sustainable water use, circular economies, and nature-based solutions to mitigate the effects of rising sea levels and extreme weather.
- **Nature-Based Solutions**: Prioritizing green infrastructure (e.g., salt marshes, dunes) over hard engineering.
- **Energy-Neutral Water Systems**: Utilities like **Vitens** and **Evides** aim for carbon-neutral operations.
- **Resilient Agriculture**: Precision irrigation and drought-resistant farming techniques (e.g., **Dutch Delta Agriculture**).

9. Education & Research Excellence

- **Academic Hubs**: Institutions like **TU Delft**, **Wageningen University**, and **IHE Delft** produce world-leading water scientists and engineers.
- **Capacity Building**: Training global professionals through programs like **Orange Knowledge Programme** and **Netherlands Water Partnership (NWP)**.
- **Research and Innovation**: Institutions like Wageningen University, Deltares, and TU Delft drive research in hydrology, environmental engineering, and climate science. These centers work closely with industry leaders to apply scientific insights to real-world water challenges.

10. Global Influence & Export

- **Knowledge Export**: Dutch expertise shapes global projects (e.g., flood management in Bangladesh, urban resilience in New York post-Sandy).
- **International Aid**: Leading in water-related SDG 6 initiatives through organizations like **IHE Delft** and **Dutch Water Authorities**.
- **Trade Missions**: Government-backed initiatives to promote Dutch water solutions worldwide.

- **International Collaboration and Export of Expertise**: Dutch water companies and consultancies, like Royal HaskoningDHV, Arcadis, and Deltares, work globally on water management projects. They share their expertise in flood risk management, water supply, and urban resilience with countries facing climate change threats.

The Dutch water sector's strengths lie in its **integration of technology, governance, and societal engagement**, making the Netherlands a **global benchmark** for sustainable water management. Its ability to turn vulnerabilities into exportable solutions positions it as a critical partner in addressing 21st-century water crises.

Key Takeaway: The Dutch model proves that proactive, collaborative, and innovative water management can turn existential threats into economic and environmental opportunities.

2.3. Profiles of Dutch Water companies

ARCADIS

Website: https://www.arcadis.com/en

1. About the Company

Arcadis is a leading global design, engineering, and management consultancy headquartered in Amsterdam, Netherlands. Founded in 1888, the company has evolved into a key player in the infrastructure, water, environment, and buildings sectors. With operations in over 70 countries and a team of more than 36,000 professionals worldwide, Arcadis is committed to improving quality of life through sustainable and innovative solutions to complex global challenges.

Renowned for its expertise in creating livable cities and resilient infrastructure, Arcadis integrates technological innovation with deep environmental knowledge to address pressing issues in water, mobility, and urban development. Its strong international presence, dedication to quality, and client-centric approach enable Arcadis to deliver tailored, future-focused solutions that promote long-term sustainability and lasting client success.

2. Fields of Activity

Arcadis specializes in the following key areas:

- **Water Management:** Flood risk management, water treatment, and sustainable water solutions.
- **Infrastructure:** Transportation, urban development, and smart mobility.
- **Environment:** Environmental remediation, climate resilience, and circular economy.
- **Buildings:** Architecture, construction, and facility management.
- **Digital Solutions:** Data analytics, GIS, and smart city technologies.

3. Profile

Arcadis offers a wide range of services, including:

- Consulting and advisory services.
- Design and engineering.
- Project and program management.
- Sustainability and environmental solutions.
- Digital transformation and innovation.

4. Projects

Arcadis has been involved in numerous high-profile projects globally, such as:

- **The Netherlands:** Flood protection programs, including the iconic Delta Works.
- **USA:** Water infrastructure improvements and environmental remediation projects.
- **UK:** High-Speed 2 (HS2) railway project and urban regeneration programs.

- **Asia:** Sustainable urban development and water management in cities like Singapore and Hong Kong.

5. International Cooperation

Arcadis collaborates with governments, private sector clients, and international organizations to deliver large-scale projects. The company is a key partner in global initiatives like the United Nations Sustainable Development Goals (SDGs), focusing on clean water, sustainable cities, and climate action. Arcadis also works with organizations such as the World Bank and the European Union to promote sustainable development.

Deltares

DELTARES

Website: https://www.deltares.nl/en

1. About the Company

Deltares is an independent, not-for-profit knowledge institute based in the Netherlands, specializing in applied research in water, subsurface, and sustainable infrastructure systems. Founded over a century ago, it operates under the Dutch Ministry of Economic Affairs and Climate Policy as part of the TO2 federation of applied research institutes. With a team of over 900 professionals from more than 60 nationalities, Deltares combines fieldwork, advanced research facilities, and cutting-edge software tools to address complex environmental challenges.

Recognized globally for its expertise in climate adaptation, flood risk management, and sustainable engineering, Deltares develops practical knowledge and tools to build climate-resilient societies and ecosystems. The institute collaborates closely with governments, academia, and industry around the world, contributing to solutions that enhance water safety, environmental sustainability, and infrastructure resilience.

2. Fields of Activity

Deltares specializes in several critical areas:

- **Flood Protection**: Developing strategies and technologies to safeguard communities against flooding.
- **Healthy Water Systems**: Ensuring the quality and sustainability of water resources.
- **Resilient Infrastructure**: Designing and implementing infrastructure that can withstand environmental stresses.
- **Sustainable Energy**: Contributing to the transition towards renewable energy sources.
- **Liveable Deltas**: Promoting the development of safe and attractive living conditions in delta regions.

These focus areas are aligned with global missions such as the UN's Sustainable Development Goals and the EU's Horizon Europe, guiding Deltares in its mission-driven work.

3. Profile

Deltares boasts a diverse Profile encompassing:

- **Research Facilities**: State-of-the-art laboratories and experimental setups, including the Delta Flume and the GeoCentrifuge, to simulate and study water and soil systems.
- **Software and Data**: Development of advanced modeling tools and data platforms to support decision-making in water management and infrastructure planning.
- **Publications**: Extensive research outputs contributing to the global knowledge base in environmental science and engineering.
- **Collaborative Projects**: Engagement in numerous national and international projects addressing complex environmental challenges.

4. Projects

Deltares is involved in a wide array of projects worldwide, focusing on:

- **Climate Adaptation**: Implementing solutions to mitigate the impacts of climate change on vulnerable regions.
- **Water Management**: Enhancing water resource management to address issues like drought, salinity intrusion, and water quality.
- **Infrastructure Development**: Designing and testing resilient infrastructure systems to cope with environmental stresses.
- **Innovation Initiatives**: Supporting startups and SMEs through initiatives like the Deltares SME Challenge, fostering innovation in water and infrastructure sectors.

5. International Cooperation

Deltares actively collaborates with a diverse range of international partners:

- **Government Agencies**: Working closely with ministries and public authorities to align research with national and international policy goals.
- **Academic Institutions**: Partnering with universities and research institutes globally to advance scientific knowledge and innovation.
- **Private Sector**: Engaging with consultancy companies, engineering companies, and SMEs through Public-Private Partnerships (PPPs) and Top Consortia for Knowledge and Innovation (TKIs).
- **International Organizations**: Establishing strategic alliances with entities like the United States Geological Survey (USGS), World Resources Institute (WRI), and the National University of Singapore (NUS) to address global challenges.

NIJHUIS INDUSTRIES

Website: https://www.nijhuisindustries.com

1. About the Company

Nijhuis Industries, headquartered in the Netherlands, is a global leader in sustainable water and wastewater treatment solutions with over a century of experience. As part of the SUEZ group—a world-renowned environmental services provider—Nijhuis Industries enhances its global reach and technical capabilities. The company serves a broad range of sectors, including food and beverage, oil and gas, mining, and municipal water management, delivering innovative, efficient, and environmentally responsible technologies. Its mission centers on sustainability, with a strong emphasis on resource recovery and circular economy principles to ensure long-term environmental and economic benefits.

With a commitment to tailored solutions and regulatory compliance, Nijhuis Industries supports industries and municipalities worldwide in managing water resources more responsibly and sustainably. Its advanced technologies and experience in complex infrastructure projects help clients reduce environmental impact, improve operational efficiency, and meet evolving environmental standards. By integrating cutting-edge innovation with a deep understanding of local and global challenges, Nijhuis Industries remains a trusted partner in building a more sustainable future.

2. Fields of Activity

Nijhuis Industries operates in several key fields of activity, each focused on delivering specialized water and wastewater solutions:

- **Industrial Water Treatment**: Providing customized solutions for industries to manage water usage, treatment, and recycling. This includes processes like filtration, disinfection, and desalination.
- **Municipal Water Treatment**: Offering technologies for the treatment of municipal wastewater, ensuring safe and clean water for communities. This includes solutions for sewage treatment, sludge management, and water reuse.
- **Resource Recovery**: Focusing on the recovery of valuable resources from wastewater, such as energy, nutrients, and minerals. This aligns with the principles of the circular economy, turning waste into valuable products.
- **Water Reuse and Recycling**: Developing systems that enable the reuse of treated wastewater for various applications, reducing the demand for freshwater resources.
- **Desalination**: Providing solutions for the desalination of seawater and brackish water, making it suitable for industrial and municipal use.
- **Sludge Treatment**: Offering technologies for the treatment and management of sludge generated during wastewater treatment processes, including dewatering, drying, and incineration.

3. Profile

Nijhuis Industries boasts a comprehensive Profile of products and technologies designed to address a wide range of water and wastewater challenges. Some of the key offerings include:

- **Modular Water Treatment Systems**: Pre-engineered, modular systems that can be quickly deployed and scaled to meet specific treatment needs.
- **Advanced Oxidation Processes (AOP)**: Technologies that use oxidation to break down contaminants in water, ensuring high-quality treatment.
- **Membrane Bioreactors (MBR)**: Systems that combine biological treatment with membrane filtration to produce high-quality effluent suitable for reuse.
- **Dissolved Air Flotation (DAF)**: Systems that remove suspended solids, oils, and greases from wastewater through flotation.
- **Ion Exchange and Softening**: Technologies for the removal of dissolved ions from water, such as hardness-causing minerals and heavy metals.
- **Anaerobic Digestion**: Systems that treat organic wastewater while producing biogas, a renewable energy source.
- **Zero Liquid Discharge (ZLD)**: Solutions that minimize liquid waste by recovering and reusing water, leaving behind only solid waste.

4. Projects

Nijhuis Industries has been involved in numerous high-profile projects across the globe, showcasing its expertise and commitment to delivering sustainable water solutions. Some notable projects include:

- **Food and Beverage Industry**: Implementation of water treatment systems for major food and beverage manufacturers, ensuring compliance with stringent quality standards and enabling water reuse.
- **Oil and Gas Sector**: Provision of wastewater treatment solutions for offshore and onshore oil and gas operations, including produced water treatment and desalination.
- **Mining Industry**: Development of water treatment systems for mining operations, focusing on the removal of heavy metals and other contaminants from process water.
- **Municipal Water Treatment**: Design and construction of large-scale wastewater treatment plants for municipalities, incorporating advanced technologies for efficient and sustainable operation.
- **Resource Recovery Projects**: Implementation of systems for the recovery of energy and nutrients from wastewater, contributing to the circular economy.

5. International Cooperation

Nijhuis Industries has a strong presence in the global market, with operations and partnerships spanning across Europe, the Americas, Asia, and Africa. The company collaborates with international organizations, governments, and private sector clients to deliver water and wastewater solutions that address local and global challenges. Key aspects of its international cooperation include:

- **Strategic Partnerships**: Collaborating with leading technology providers, research institutions, and industry associations to drive innovation and share best practices.
- **Global Projects**: Participation in international projects aimed at improving water infrastructure and access to clean water in developing countries.
- **Knowledge Transfer**: Providing training and capacity-building programs to local operators and engineers, ensuring the sustainable operation of water treatment systems.

- **Compliance with International Standards**: Adhering to global standards and regulations, ensuring that its solutions meet the highest quality and environmental performance criteria.
- **Sustainability Initiatives**: Engaging in global sustainability initiatives, such as the United Nations Sustainable Development Goals (SDGs), particularly Goal 6 (Clean Water and Sanitation).

ROYAL HASKONING DHV

Website: https://www.royalhaskoningdhv.com/

1. About the Company

Royal Haskoning DHV is a global engineering, design, and project management consultancy headquartered in Amersfoort, the Netherlands. Founded in 1881, the company brings over 140 years of expertise in delivering sustainable, innovative, and future-ready solutions. Operating in more than 30 countries with over 6,000 professionals, Royal Haskoning DHV is committed to its mission to "enhance society together" by addressing pressing global challenges such as climate change, urbanization, and resource efficiency.

Renowned for integrating sustainability and digital innovation into its services, Royal Haskoning DHV provides advanced consultancy across infrastructure, water, mobility, and environmental engineering. The company supports governments, industries, and communities worldwide in adapting to environmental and societal shifts, leveraging emerging technologies such as artificial intelligence, smart infrastructure, and green energy systems. Its forward-looking approach continues to position it as a leader in engineering and sustainable development.

2. Fields of Activity

The company specializes in multidisciplinary services across key sectors:

- **Water & Maritime**: Coastal protection, flood risk management, port development, and climate adaptation.
- **Aviation & Transport**: Airport planning, rail systems, and smart mobility solutions.
- **Buildings & Places**: Sustainable urban design, healthcare facilities, and heritage conservation.
- **Industry & Energy**: Renewable energy systems, industrial process optimization, and circular economy projects.
- **Digital Solutions**: BIM (Building Information Modeling), AI-driven analytics, and digital twins for infrastructure.

3. Profile

Royal Haskoning DHV's Profile reflects its **diverse expertise and global reach**:

- **Sustainability-Driven Projects**: Carbon-neutral infrastructure, green energy transitions, and water resilience programs.
- **Public-Private Partnerships**: Collaboration with governments, NGOs, and corporations to deliver large-scale infrastructure.
- **Innovation Focus**: Pioneering digital tools like Resilio (flood risk software) and drone-based environmental monitoring.

4. Notable Projects

- **Maasvlakte 2 Port Expansion (Netherlands)**: Design and engineering for Europe's largest port expansion, emphasizing sustainability.
- **Jakarta Coastal Defense (Indonesia)**: Masterplan to protect 10 million people from flooding using a hybrid seawall.
- **Schiphol Airport Sustainability (Netherlands)**: Reducing carbon footprint through energy-efficient terminal upgrades.
- **Renewable Energy in Africa**: Solar and wind farm projects in South Africa and Kenya to boost energy access.
- **Resilio Flood Resilience Program**: Digital platform for real-time flood risk management in the Netherlands and the UK.

5. International Cooperation

The company thrives on **cross-border collaboration**:

- **Global Offices**: Hubs in the Netherlands, UK, South Africa, Indonesia, and Australia ensure localized expertise.
- **Partnerships**: Works with institutions like the World Bank, UN, and EU on climate resilience and SDG-aligned projects.
- **Knowledge Sharing**: Leverages international teams to transfer best practices (e.g., Dutch water management applied in Southeast Asia).
- **Emerging Markets**: Active in Africa and Asia, supporting infrastructure development in rapidly urbanizing regions.

SLAMDAM B.V.

Website: https://www.slamdam.nl/en/

1. About the Company

SLAMDAM is a Netherlands-based engineering and contracting company specializing in water management, hydraulic engineering, and civil infrastructure, with a strong focus on innovation, sustainability, and climate adaptation. The company combines deep technical expertise with practical, scalable solutions to tackle complex water-related challenges. Rooted in Dutch water engineering traditions, SLAMDAM places safety, durability, and environmental responsibility at the core of its operations—particularly in the development of flood defense systems and coastal protection measures.

Best known for its mobile flood defense and hydraulic containment systems, SLAMDAM delivers technologies designed for rapid deployment, reliability, and minimal environmental impact. Its solutions have been successfully implemented in critical infrastructure projects, meeting the growing global demand for climate-resilient infrastructure. By working closely with stakeholders, SLAMDAM ensures that its flood protection strategies are tailored to local conditions, providing effective and efficient protection for vulnerable communities and assets.

2. Fields of Activity

SLAMDAM operates in the following key areas:

- **Flood Protection**: Design and construction of dikes, dams, and storm surge barriers.
- **Coastal & River Engineering**: Stabilizing shorelines, riverbank reinforcements, and erosion control.
- **Port & Infrastructure Development**: Marine construction, quay walls, and harbor infrastructure.
- **Sustainable Solutions**: Climate-resilient designs and eco-friendly materials.

3. Profile

The company's Profile showcases expertise in large-scale water management projects, such as:

- **Dike Reinforcements**: Modernizing aging flood defenses in the Netherlands.
- **Storm Surge Barriers**: Engineering structures to protect low-lying areas from seawater intrusion.
- **Riverbank Stabilization**: Projects to manage sediment and prevent flooding along major rivers.

4. Projects

Notable projects include:

- **Dutch Delta Program**: Contributions to the Netherlands' national flood protection strategy.
- **Coastal Defense Systems**: Installation of innovative barrier technologies in collaboration with Dutch authorities.
- **International Port Upgrades**: Infrastructure projects for commercial ports in Europe.

5. International Cooperation

While SLAMDAM's primary focus is the Dutch market, it engages in cross-border collaborations through:

- **EU-Funded Initiatives**: Participation in European climate resilience programs.
- **Knowledge Sharing**: Exporting Dutch water management expertise to regions vulnerable to flooding.
- **Partnerships**: Working with global engineering companies on complex hydraulic projects. *(Note: Specific international projects are less prominently highlighted on the website, suggesting a stronger domestic presence.)*

SPAANS BABCOCK

Website: https://www.spaansbabcock.com/

1. About the Company

Spaans Babcock is a Dutch engineering and manufacturing company with over a century of expertise in designing, fabricating, and installing high-quality industrial and environmental equipment. Established in 1912, the company specializes in delivering tailored solutions for sectors including energy, oil and gas, chemical processing, and infrastructure. Renowned for its innovation, precision, and reliability, Spaans Babcock blends traditional craftsmanship with modern technology to meet the evolving demands of global industry.

With extensive experience in water-powered and mechanical systems, Spaans Babcock designs and supplies customized equipment for pumping stations, hydropower plants, and water treatment facilities worldwide. The company is committed to sustainability and technical excellence, supporting both public and private sector clients in achieving operational efficiency. As it continues its international expansion, Spaans Babcock remains a trusted partner in advancing infrastructure and environmental performance.

2. Fields of Activity

The company operates in the following key sectors:

- **Energy**: Equipment for power generation (e.g., boilers, pressure vessels).
- **Oil & Gas**: Storage tanks, heat exchangers, and modular systems.
- **Chemical & Petrochemical**: Reactors, distillation columns, and process vessels.
- **Infrastructure**: Large-scale steel structures (e.g., bridges, offshore platforms).
- **Circular Economy**: Waste-to-energy and recycling solutions.

3. Profile

Spaans Babcock's Profile includes:

- **Custom Fabrication**: High-pressure vessels, heat exchangers, and storage tanks.
- **Modular Systems**: Prefabricated units for rapid deployment in remote locations.
- **Engineering Services**: Design, stress analysis, and project management.
- **Sustainability Solutions**: Waste-to-energy plants and carbon capture systems.

4. Projects

Notable projects include:

- **Waste-to-Energy Plants**: Designed and installed systems for converting municipal waste into energy.
- **Oil Storage Tanks**: Large-scale storage solutions for refineries in Europe and the Middle East.

- **Offshore Platforms**: Structural components for North Sea offshore installations.
- **Chemical Reactors**: Custom reactors for multinational chemical companies.

5. International Cooperation

Spaans Babcock collaborates globally through:

- **Partnerships**: Joint ventures with engineering companies in Europe, Asia, and the Middle East.
- **Export Focus**: Delivers projects to over **30 countries**, including the UAE, Germany, and the U.S.
- **Local Adaptation**: Works with regional contractors to comply with local standards and regulations.

IHE Delft Institute for Water Education

Website: www.un-ihe.org

1. About the Company

IHE Delft Institute for Water Education, based in Delft, the Netherlands, is the world's largest international graduate-level institute for water education. Established in 2003 under the United Nations system and operating under the umbrella of UNESCO, the institute is a global leader in water education, research, and capacity development. Its mission is to strengthen the capacity of the water sector worldwide—particularly in developing countries—through advanced education, training, and collaborative research focused on sustainable solutions to global water challenges.

IHE Delft plays a critical role in bridging science, policy, and practice by training water professionals, conducting interdisciplinary research, and promoting sustainable water governance. The institute contributes to solving pressing issues such as water scarcity, climate resilience, and inequality in water access. Through its commitment to knowledge sharing and international cooperation, IHE Delft supports the development of effective, inclusive, and climate-adaptive water management strategies across regions.

2. Fields of Activity

IHE Delft's core activities span:

- **Education**: Offering MSc and PhD programs in water management, sanitation, hydrology, and environmental science.
- **Research**: Addressing water scarcity, climate resilience, wastewater treatment, and ecosystem restoration.
- **Capacity Development**: Training professionals and institutions in low- and middle-income countries.
- **Policy Support**: Advising governments and organizations on water governance and SDG 6 (Clean Water and Sanitation).

3. Profile

- **Academic Programs**: 15+ MSc specializations (e.g., Water Quality Engineering, Flood Risk Management) and PhD tracks.
- **Research Output**: 1,500+ peer-reviewed publications on topics like urban water systems and groundwater management.
- **Tools & Innovations**: Development of open-source models (e.g., Delft-FEWS for flood forecasting).
- **Alumni Network**: 23,000+ professionals from 190+ countries, forming a global water leadership community.

4. Projects

- **Global Sanitation Graduate School**: A partnership with the Bill & Melinda Gates Foundation to improve sanitation in sub-Saharan Africa and Asia.

- **Water and Development Partnership Programme**: Funded by the Dutch government, focusing on water security in deltas and drylands.
- **Citywide Inclusive Sanitation (CWIS)**: Promoting equitable urban sanitation solutions in collaboration with the World Bank.
- **Ecosystem-Based Adaptation**: Restoring wetlands in Latin America to mitigate climate impacts.

5. International Cooperation

IHE Delft collaborates with:

- **UN Agencies**: WHO, UNICEF, and UN-Habitat for SDG-aligned initiatives.
- **Governments**: Partnering with ministries in Africa, Asia, and Latin America for capacity building.
- **Academic Networks**: Member of the Global Water Partnership and the Water Youth Network.
- **Private Sector**: Engaging companies like Arcadis and Deltares for technological innovation.

VITENS

Website: https://www.vitens.nl/

1. About the Company

Vitens is the largest drinking water company in the Netherlands, serving over 5.8 million people and businesses nationwide. Founded in 2002 as a public utility, Vitens is dedicated to delivering reliable, safe, and high-quality drinking water. The company prioritizes sustainability and innovation to tackle pressing challenges such as climate change and resource scarcity while maintaining exceptional customer satisfaction.

Combining operational excellence with advanced water treatment technologies and digital monitoring, Vitens continuously enhances its service delivery. Beyond the Netherlands, the company engages in international partnerships and pilot projects, contributing valuable expertise and solutions to global water challenges. Vitens remains committed to ensuring sustainable and resilient water management both domestically and worldwide.

2. Fields of Activity

Vitens specializes in the following areas:

- **Drinking Water Supply:** Production and distribution of clean and safe drinking water.
- **Water Treatment:** Advanced treatment technologies to ensure water quality.
- **Sustainability:** Initiatives to reduce water waste, energy consumption, and environmental impact.
- **Innovation:** Development of smart water solutions and digital tools for efficient water management.
- **Customer Services:** Providing tailored solutions for households, businesses, and industries.

3. Profile

Vitens offers a wide range of services and products, including:

- **Drinking Water:** Supplying over 350 million cubic meters of water annually.
- **Water Quality Monitoring:** Ensuring compliance with strict Dutch and EU standards.
- **Smart Water Solutions:** Implementing IoT and data-driven technologies for efficient water management.
- **Sustainability Programs:** Initiatives like "Every Drop Counts" to promote water conservation.

4. Projects

Vitens is involved in several innovative and impactful projects, such as:

- **AquaMinerals:** A subsidiary that recovers minerals and raw materials from water treatment processes.
- **Vitens Innovation Playground:** A testing ground for new technologies and sustainable water solutions.

- **Smart Water Networks:** Implementing advanced monitoring systems to optimize water distribution.
- **Climate Adaptation Projects:** Developing solutions to address water scarcity and extreme weather conditions.

5. International Cooperation

Vitens actively collaborates with international partners to share knowledge and expertise in water management. Key initiatives include:

- **Partnerships:** Working with organizations like UNICEF to improve water access in developing countries.
- **Knowledge Transfer:** Sharing best practices and innovative solutions with global water utilities.
- **Research Collaborations:** Partnering with universities and research institutions worldwide to advance water technology.

WAGENINGEN UNIVERSITY & RESEARCH (WUR)

Website: https://www.wur.nl/en.htm

1. About the Company

Wageningen University & Research (WUR) is a globally renowned Dutch institution specializing in life sciences, agriculture, and environmental studies. Founded in 1918, WUR's mission is "To explore the potential of nature to improve the quality of life." Consistently ranked #1 worldwide in Agriculture & Forestry by QS, the university operates as a collaborative network encompassing universities, research centers, and private-sector partners. With over 12,000 students and 6,500 employees, WUR emphasizes interdisciplinary research to tackle pressing global challenges such as food security, climate change, and sustainable resource management.

WUR leads in advancing sustainable food systems, digital agriculture—including AI-driven farming—water resource management, and climate adaptation. Through practical innovation and strong partnerships with governments and industry, the institution plays a pivotal role in developing resilient and equitable solutions. Its expertise and collaborative approach make WUR a key contributor to building a sustainable future that balances ecological health with human wellbeing.

2. Fields of Activity

WUR's expertise spans:

- **Sustainable Agriculture**: Innovations in crop resilience, soil health, and precision farming.
- **Food Security**: Reducing food waste, improving supply chains, and enhancing nutritional value.
- **Climate Change**: Mitigation strategies (e.g., carbon sequestration) and adaptation solutions.
- **Environmental Sciences**: Biodiversity conservation, water management, and pollution control.
- **Circular Economy**: Developing bio-based materials and closed-loop production systems.

3. Profile

WUR's Profile includes:

- **Education**: Bachelor's, Master's, and PhD programs in life sciences and sustainability.
- **Research Outputs**: Over 7,000 annual publications in peer-reviewed journals.
- **Consultancy**: Advisory services for governments (e.g., EU policy frameworks) and agribusinesses.
- **Innovations**: Patented technologies like **Plant Breedomics** (genetic crop improvement) and **Food Valley** initiatives (agri-food startups).

4. Projects

Key projects highlight WUR's impact:

- **EU Horizon 2020**: Leading the **"SoilGuard"** project to restore degraded farmland across Europe.
- **Global Nutrition Initiative**: Partnering with UNICEF to combat malnutrition in sub-Saharan Africa.
- **Climate-Smart Agriculture**: Piloting drought-resistant crops in collaboration with CGIAR.
- **Urban Farming**: Developing vertical farming systems in Rotterdam to reduce urban food miles.

5. International Cooperation

WUR thrives on global partnerships:

- **Multilateral Organizations**: Collaborates with the UN (FAO), World Bank, and EU on sustainability goals.
- **Research Networks**: Member of the **EuroLeague for Life Sciences (ELLS)** and **Global Research Alliance**.
- **Developing Nations**: Implements capacity-building programs in Asia, Africa, and Latin America.
- **Industry Alliances**: Works with multinationals like Unilever and Nestlé on sustainable sourcing.

WITTEVEEN+BOS

Website: https://www.witteveenbos.com/

1. About the Company

Witteveen+Bos is a Dutch consultancy and engineering company founded in 1946 by Willem Gerrit Witteveen and Goosen Siger Bos to support post-war reconstruction. Over more than 75 years, it has expanded its expertise to address complex global challenges across water, energy, infrastructure, land use, environment, and construction sectors. With a workforce of over 1,500 professionals spread across 23 offices in 9 countries, Witteveen+Bos undertakes nearly 5,000 projects annually, delivering sustainable and innovative solutions worldwide.

Since 1992, Witteveen+Bos has been fully employee-owned, fostering a culture of entrepreneurship, shared responsibility, and collective success through profit-sharing and dividends. The company emphasizes circular economy principles, carbon neutrality, and stakeholder engagement, ensuring its integrated approach aligns technical excellence with societal and ecological objectives. Its strong international presence and holistic methodology make it a trusted partner in realizing complex, sustainable projects.

2. Fields of Activity

Witteveen+Bos operates across a diverse range of sectors, providing integrated solutions that encompass the entire project lifecycle—from policy and planning to design, contracting, and supervision. Their areas of expertise include:

- Spatial Planning
- Landscape, City, and Building
- Energy
- Water
- Industry
- Nature and Environment
- Deltas
- Maritime
- Infrastructure
- Mobility
- Digital Solutions

The company is committed to sustainable practices, aiming to create climate-neutral, nature-inclusive, and circular solutions.

3. Profile & Notable Projects

Witteveen+Bos has an extensive Profile of projects that demonstrate their expertise and commitment to innovation. Some notable projects include:

- **Integrated Building Information System (IBIS) in Singapore**: A web-based platform developed for the Housing Development Board to manage design and construction processes online, integrating the entire workflow from design to construction.
- **Mangrove Restoration in Indonesia**: A United Nations-recognized project aimed at restoring coastal ecosystems through mangrove planting, contributing to biodiversity and climate resilience.
- **Fehmarnbelt Tunnel (Denmark–Germany)**: Collaboration with Ramboll and Royal HaskoningDHV to develop innovative tunnel solutions, focusing on safety, reliability, and sustainability.
- **Cycling Infrastructure in Singapore**: Design and implementation of sustainable cycling networks to promote green mobility and reduce urban congestion.
- **Movable Bridge in Tallinn, Estonia**: Engineering of a movable bridge to enhance maritime accessibility while maintaining urban connectivity.

These projects reflect Witteveen+Bos's dedication to addressing global challenges through innovative and sustainable solutions.

4. International Cooperation

Witteveen+Bos actively engages in international collaborations to expand its expertise and impact. Key partnerships include:

- **Acquisition of NLME in Dubai (2021)**: Strengthened presence in the Middle East, enhancing capabilities in landscape and urban design.
- **Partnership with Oxand**: Joint efforts in data-driven infrastructural asset management and renewal projects in the Netherlands, focusing on sustainable maintenance of civil engineering structures.
- **Collaboration with Ramboll and Royal HaskoningDHV**: Establishment of a co-operation agreement to pursue innovative tunnel projects, combining advanced capabilities in planning and design of tunnels and underground structures.
- **Membership in Netherlands Water Partnership (NWP)**: Active participation since 1999, contributing to cross-industry collaboration in water management, economics, agriculture, and spatial planning.

2.4. Key case studies of Dutch success stories in the water sector related to Azerbaijan

Highly Applicable and Recommended for Implementation in Azerbaijan:

1. Room for the River (2006–2018)

Challenge: Improve flood resilience while restoring ecosystems in overstrained river systems.

Solution: Give rivers space by **lowering floodplains, relocating dikes, and creating "green rivers"** for excess water.

- **Key Projects**:
  - **Nijmegen**: Widened the Waal River and built a secondary channel with urban parks.
  - **Overdiepse Polder**: Farmlands transformed into floodwater storage areas.
    Outcome: Enhanced safety for 4 million people + boosted biodiversity.
    Legacy: A model for nature-based flood management adopted in the US, India, and Indonesia.

Why it's relevant:

Azerbaijan experiences flash floods, particularly in plain river basins like the Kura and Araz. Urban expansion has reduced natural floodplains, increasing flood risk.

Adaptation potential:

- Can be applied in areas like the Kura River basin and flood-prone rural regions.
- Potential to combine with eco-tourism and agricultural reform.
  Implementation ideas: Relocate dikes, create flood bypass zones, and integrate river parks in urban areas like Mingachevir and Ganja.

Source of picture: Link

2. Amsterdam Rainproof (2015–Present)

Challenge: Urban flooding from heavy rainfall in a densely built city.

Solution: A citywide network of **green roofs, water squares, and permeable pavements** to absorb and store rainwater.

- **Key Projects**:
  - **Waterplein Benthemplein** (Rotterdam): A public square that stores 1.7 million liters of rainwater.
  - **Green Jetties**: Floating gardens in canals.
    Outcome: Reduced flooding + improved urban livability.
    Global Influence: Blueprint for cities like Copenhagen and Tokyo.

Source of picture: Link

Why it's relevant:

Baku and other cities face issues with urban flooding due to rapid construction, sealed surfaces, and poor drainage.

Adaptation potential:

- Green roofs, permeable pavement, and water squares could be integrated into new urban planning projects.
  Implementation ideas: Launch pilot projects in Baku's newly developing districts (e.g., White City), and involve developers and municipalities.

3. Smart Dikes (2020s)

Challenge: Aging dike infrastructure.

Solution: **Sensor-equipped dikes** that monitor stability in real-time (e.g., temperature, pressure, seepage).

- **Key Players**: Companies like **Deltares** and **Nokia**.
  Outcome: Predictive maintenance + reduced failure risk.
  Global Use: Piloted in the Netherlands and Texas, USA.

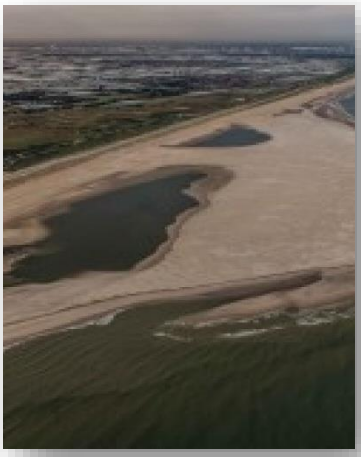
Source of picture: Link

Why it's relevant: Azerbaijan has aging Soviet-era dikes and levees that protect agricultural lands and settlements. Monitoring is minimal.

Adaptation potential:

- Install sensors along critical embankments near the Kura River or reservoirs.
  Implementation ideas: Partner with local universities and international companies (possibly via PPPs) for pilot sites.

4. The Sand Motor (2011–Present)



Source of picture: Link

Challenge: Combat coastal erosion sustainably.

Solution: A **21.5 million m³ artificial sand peninsula** off the Dutch coast, designed to naturally redistribute sand via wind and waves.

- **Key Features**:
  - Reduces need for frequent beach replenishment.
  - Creates new habitats for wildlife.
    Outcome: Protects 20 km of coastline; replicated in the UK (Norfolk) and Caribbean.

Why it's relevant:

Coastal erosion along the Caspian Sea, particularly in areas like Neftchala and Lankaran.

Adaptation potential:

- Azerbaijan could pilot smaller-scale sand nourishment projects to protect tourism zones.
  Caveat: Long-term sediment dynamics of the Caspian must be studied first.

5. Floating Communities (2010s–Present)

Source of picture: Link

Challenge: Housing shortages and rising sea levels.

Solution: **Floating homes and neighborhoods** that adapt to water level changes.

- **Key Projects**:
  - **Schoonschip (Amsterdam)**: A sustainable floating village with 46 households.
  - **Floating Farm (Rotterdam)**: World's first floating dairy farm.
    Outcome: Climate-resilient housing + reduced land pressure.
    Export: Floating city concepts piloted in the Maldives and French Polynesia.

Why it's relevant:

Rising water levels and land scarcity aren't yet critical in Azerbaijan, but floating structures could be useful near reservoirs or as eco-tourism hubs.

Adaptation potential:

- Niche application in tourism, especially around Lake Goygol or the Mingachevir Reservoir.
  Caveat: Cultural and market acceptance would require gradual introduction.

6. Marker Wadden (2016–Present)

Challenge: Restore biodiversity in Lake Markermeer (a stagnant, silting lake).

Solution: Build **artificial islands** using sediment to create wetlands and bird habitats.

- **Key Features**:
  - 1,000+ hectares of new nature reserves.
  - Improved water quality via natural filtration.
    Outcome: Revived fish populations + ecotourism opportunities.

Why it's relevant:

Restoration of biodiversity and water bodies like Lake Jeyranbatan or wetlands in the Kura delta could benefit from similar sediment-use techniques.

Adaptation potential:

- Could serve both as a water purification and biodiversity restoration model.
  Caveat: Cost and scale may require phased, pilot-first approaches.

Source of picture: Link

Why the Dutch Model Works

- **Integrated Approach**: Combines engineering, ecology, and community engagement.
- **Proactive Innovation**: Turns vulnerabilities into exportable solutions.
- **Collaboration**: Public-private-academic partnerships accelerate progress.

The Netherlands proves that **water challenges can drive economic growth and global leadership**. These case studies offer replicable strategies for nations grappling with climate change and urbanization.

Here are **small-scale, practical water-sector projects** inspired by Dutch success stories, tailored to **Azerbaijan's local context**—especially for urban settings, rural areas, and pilot initiatives:

1. Urban Rain Gardens & Green Roofs (Inspired by Amsterdam Rainproof)

Location: Baku, Ganja, or Sumgayit (new neighborhoods or renovated public buildings)
Goal: Absorb rainwater, reduce flooding, and improve urban microclimate
Activities:

- Install rain gardens in schools, parks, and parking areas
- Incentivize green roofs on public buildings (pilot 5–10 rooftops)
- Use permeable pavements in sidewalks or courtyards
  Partners: Local municipalities, architecture schools, international donors (e.g., EU, UNDP)

2. Flood Bypass Parks or "Dry Canals" (Inspired by Room for the River)

Location: Small flood-prone towns (e.g., Sheki, Zaqatala, Guba)
Goal: Temporarily divert and store floodwater while improving public space
Activities:

- Convert unused land near rivers into dry canals or seasonal wetlands
- Integrate walking paths and seating for public use
  Partners: State Water Resources Agency, local governments

3. Smart Dike Pilot Section (Inspired by Smart Dikes)

Location: Kura River embankment near Salyan or Sabirabad
Goal: Monitor levee health and anticipate failures
Activities:

- Install basic sensors to monitor moisture and pressure
- Connect to a dashboard for early-warning data
  Partners: Universities, tech startups, Netherlands-Azerbaijan Water Partnership (potential)

4. Small Sand-Reinforced Beach (Inspired by the Sand Motor)

Location: Neftchala or Lankaran coastline
Goal: Reduce local coastal erosion and support eco-tourism
Activities:

- Create a small artificial sand buffer using local materials
- Monitor sand movement and erosion reduction
  Partners: Ministry of Ecology, local tourism boards

5. Floating Garden Platform (Inspired by Floating Communities)

Location: Mingachevir Reservoir or Lake Goygol (tourist or eco-education site)
Goal: Showcase climate-resilient design and green innovation
Activities:

- Build a small floating deck with planters and solar lighting
- Use it as a classroom or eco-tourism attraction
  Partners: Environmental NGOs, ecotourism companies

6. Sediment Island for Birds & Fish (Inspired by Marker Wadden)

Location: Kura Delta or Ag-Gel National Park
Goal: Restore biodiversity using excess dredged material
Activities:

- Construct 1–2 small islets from lakebed silt
- Plant reeds and monitor wildlife return
  Partners: Ministry of Ecology, birdwatching associations

7. Community-Based Flood Storage Farm (Inspired by Overdiepse Polder)

Location: Rural village in Imishli or Sabirabad
Goal: Combine agriculture and flood mitigation
Activities:

- Designate 1–2 ha of farmland as temporary flood zones
- Compensate farmers with subsidies or technical support
  Partners: Ministry of Agriculture, World Bank, rural cooperatives

3. GAP ANALYSIS AND STRATEGIC RECOMMENDATIONS FOR DUTCH-AZERBAIJANI WATER SECTOR COOPERATION

This chapter presents a comprehensive gap analysis to identify critical areas where Azerbaijan's water sector faces challenges and where Dutch expertise can offer strategic value. By systematically comparing Azerbaijan's current limitations with the Netherlands' globally recognized strengths in water management, we aim to uncover complementary opportunities that can guide effective bilateral cooperation.

3.1. Gap Analysis

Section provides a detailed gap analysis table, aligning Azerbaijan's sectoral weaknesses with corresponding Dutch competencies in areas such as integrated water resources management, flood prevention, wastewater treatment, and climate-resilient infrastructure. The insights derived from this analysis serve as the foundation for the strategic recommendations outlined in subsequent sections, which are designed to facilitate targeted, impactful, and sustainable collaboration between the two countries.

Table 4. Azerbaijan's Weaknesses vs. Dutch Strengths and Expertise

Azerbaijan's Challenges	Dutch Expertise/Solutions	Potential Collaborative Projects
1. Water Scarcity & Inefficient Irrigation		
• High water losses in agriculture (31% loss). • Outdated irrigation infrastructure.	○ Drip and smart irrigation technologies, precision agriculture. ○ Smart water management systems ○ Innovative methods that increase soil water retention ○ Use of recycled water in agriculture	✓ Pilot projects for drip irrigation in Azerbaijani regions ✓ AI-driven water distribution systems
2. Drinking water supply and quality		
• Limited water resources, pollution, inequalities in clean water supply	○ Smart water purification systems (filters, ozone and UV technologies) ○ Rainwater harvesting and recycling systems ○ Modernization of water pipes and reduction of leakage losses	✓ Production and distribution of clean and safe drinking water
3. Transboundary Water Management		
• 70% reliance on transboundary rivers. • Lack of regional agreements.	○ Integrated River Basin Management (IRBM) ○ Diplomatic frameworks for shared resources	✓ Joint Kura-Araz River management program ✓ Regional water-sharing agreements

Azerbaijan's Challenges	Dutch Expertise/Solutions	Potential Collaborative Projects
4. Outdated Water Infrastructure		
• Aging water supply networks (30-40% leakage). • Limited wastewater treatment.	○ Modular water treatment systems ○ Leak detection technologies	✓ Modernization of Baku's water networks ✓ Wastewater treatment plants in Azerbaijani cities, such as Sumgayit
5. Pollution & Water Quality		
• Industrial/domestic pollutants in Caspian Sea. • Impact of industrial waste on water sources, pollution of ecosystems. • Heavy metals in transboundary rivers	○ Advanced oxidation processes (AOP) ○ Circular water systems (waste-to-resource) ○ Advanced biotechnologies for industrial waste treatment ○ Innovative solutions for wastewater reuse ○ Water recycling systems for industrial enterprises	✓ Caspian Sea cleanup initiative ✓ Industrial wastewater treatment in Ganja
6. Water resources management and flood risk		
• Floods, ineffective management of reservoirs	○ Coastal and river flood management projects such as Delta Works ○ Smart reservoirs and dam systems ○ Geographic information systems (GIS) and artificial intelligence-based management	✓ Coastal Protection in Azerbaijani regions
7. Alternative water sources and combating climate change		
• Droughts, floods, and rising temperatures • Declining water reserves (-25% by 2050) • Drought, depletion of groundwater resources	○ Nature-based solutions (sand motors, green rivers) ○ Flood forecasting models ○ Salt water desalination technologies ○ Strategies for adapting water resources to climate change ○ Artificial infiltration systems for groundwater recharge.	✓ Climate-resilient agriculture in arid regions; ✓ Floodplain restoration along the Kura River
8. Legal Framework and Institutional Coordination		
• Overlapping responsibilities among agencies • Weak enforcement of water laws • Lack of coordination in water management, lack of effective legal mechanisms	○ Participatory governance models (Dutch water boards). ○ Policy frameworks. ○ Public-private partnerships in water. management ○ Improvement of water legislation and integrated management model. ○ Regional and international cooperation strategies	✓ Training programs for ASWRA; ✓ Drafting integrated water governance laws

Azerbaijan's Challenges	Dutch Expertise/Solutions	Potential Collaborative Projects
9. Public Awareness		
• Low awareness of water conservation. • High domestic water waste (200+ liters/day).	○ Behavioral change campaigns. Smart metering and public education tools.	✓ "Every Drop Counts" awareness campaigns; ✓ School programs on water efficiency.

Human Capital Development Gap in the Azerbaijani Water Sector

One of the pressing challenges facing the Azerbaijani water sector is the shortage of qualified and specialized water professionals. This gap in human capital significantly affects the capacity of institutions and agencies to plan, implement, and maintain sustainable water management practices.

The current workforce often lacks the advanced technical knowledge, interdisciplinary training, and practical experience required to address complex issues such as integrated water resources management, climate resilience, wastewater treatment, and nature-based solutions.

Dutch education and research institutes, particularly renowned institutions such as IHE Delft Institute for Water Education and Wageningen University & Research, are well-positioned to contribute to closing this gap. These institutions have extensive experience in training international professionals, conducting applied water research, and developing tailored capacity-building programs. Their involvement can support Azerbaijan through joint degree programs, professional training courses, research collaboration, and knowledge transfer initiatives, thereby strengthening the country's human capital base in the water sector.

3.2. Strategic Recommendations for Dutch Companies Entering Azerbaijan

Key Recommendations for Dutch Companies

- **Conduct Market Research**: Understand the specific needs of Azerbaijan's water sector before making investment decisions.
- **Build Strong Local Partnerships:** Collaborate with Azerbaijani companies (e.g., Aqualink LLC) to navigate bureaucracy and leverage local networks.
- **Leverage Dutch Government Support:** Utilize Dutch trade missions, embassies, and business councils to gain insights and establish networks.
- **Showcase Proven Expertise:** Use success stories from other countries to demonstrate the effectiveness of Dutch solutions.
- **Align with Azerbaijan's National Water Strategies:** Ensure projects align with government priorities to increase acceptance and support.

Market Entry Strategy

- **Trade missions and study tours:** Participate in Dutch-Azerbaijani trade delegations (i.a., COP29 follow-ups) to showcase technologies, join to local trade shows and events, like Caspian Water Innovation Forum, Baku Water Week, Azerbaijan International Agriculture Exhibition.
- **Implementation of Pilot Projects:** Focus on high-visibility projects aligned with Azerbaijan's National Water Strategy (2024–2040) and implementation of small-scale projects showcasing Dutch solutions for water purification, desalination, and flood control (Examples: Nijhuis Industries' modular wastewater treatment plants in rural areas; Deltares' flood modeling for the Kura River Basin).
- **Public-Private Partnerships (PPP):** Engage in joint ventures with Azerbaijani government agencies or private sector players to leverage local knowledge and government support. For example, Partner with the State Water Agency (ASWRA) for infrastructure modernization tenders.
- **Technology Transfer:** Offer Dutch expertise in water management through technology transfer initiatives.
- **Participation in tenders:** Leverage expertise to compete in tenders related to infrastructure development and water management projects.
- **Engagement with International Financial Institutions:** work with Azerbaijani partners to secure funding through the World Bank, EBRD, UNDP or EU-backed projects focusing on sustainable water solutions (e.g., $50M irrigation modernization fund).
- **Networking and Advocacy:** Collaborate with trade associations, embassies, and business councils to create strategic alliances and increase visibility.
- **Localization of Services:** Adapt business models to local needs, ensuring compliance with regulations and cultural preferences.

Addressing Challenges

- **Regulatory Hurdles:** Advocate for streamlined permitting processes through the Netherlands Embassy.
- **Funding Gaps:** Provide blended financing (grants + loans) through Dutch development banks such as FMO and Invest International, with disbursement managed via Azerbaijani financial institutions—such as Bank Respublika—to align with the country's preference for strategic investments channeled through local systems.
- **Capacity Building:** Provide trainings to Azerbaijani engineers through Wageningen University's Orange Knowledge Programme further to the requests from the local private companies.

Table 5. Sector-Specific Opportunities

Sector	Opportunity
Agriculture	Drip irrigation systems for 1.4M hectares of farmland.
Urban Water Supply	Smart metering and leak reduction in Baku.
Coastal Protection	Caspian Sea erosion control using sand motors.
Wastewater	Circular economy projects (e.g., sludge-to-energy in Sumgayit).

The Netherlands' **integrated water management** expertise aligns perfectly with Azerbaijan's needs in irrigation modernization, pollution control, and climate resilience. By leveraging Dutch technologies (e.g., Nijhuis' modular treatment plants) and governance models (e.g., water boards), Azerbaijan can address its water scarcity and infrastructure gaps. Dutch companies should prioritize **local partnerships**, **pilot projects**, and **alignment with COP29 initiatives** to establish trust and scale impact.

CONCLUSION

This research identifies the main issues related to water resources management in Azerbaijan and proposes solutions to address these challenges. Problems such as drought, pollution of water resources, outdated infrastructure, and inefficient management pose significant obstacles to the country's water security and sustainable development. However, if appropriate solutions are implemented, Azerbaijan can make significant progress in the efficient use and preservation of its water resources.

The research report, commissioned by the Netherlands Embassy, analyzes the existing challenges in Azerbaijan's water sector from an international perspective and highlights potential investment and collaboration opportunities for Dutch companies. As one of the leading countries in water management with advanced technologies and innovative solutions, the Netherlands can contribute significantly to the efficient management of water, modernization of water supply and sewage systems, and ensuring ecological sustainability by collaborating with the institutions operating in this field in Azerbaijan.

In particular, the application of Dutch companies' expertise and technologies in the following areas can be of great benefit:

- **Reducing the impact of climate change on water resources:** Projects aimed at improving irrigation system efficiency and conserving water resources.
- **Water purification and wastewater management:** The application of the latest biological and chemical treatment systems.
- **Renewal of water infrastructure in urban and rural areas:** Restoration and modernization of outdated water supply and sewage systems.
- **Transboundary water resources management and regional cooperation:** The application of international standards for the efficient management of water resources and the development of relations with neighboring countries.

In response to these challenges, the Netherlands' advanced water management practices and high-tech solutions can contribute to more sustainable management of water resources and the protection of ecosystems in Azerbaijan. There are long-term and mutually beneficial collaboration prospects for Dutch companies in cooperation with the Azerbaijani government, local companies, and international organizations.

In this regard, the Netherlands Embassy's promotion of cooperation in this field and support for the expansion of Dutch companies' activities in Azerbaijan can create mutual economic and ecological benefits.