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**Status and finalization of the second assessment of
transboundary rivers, lakes and groundwaters in the United
Nations Economic Commission for Europe (UNECE) region****Main findings of the assessment of transboundary rivers, lakes and
groundwaters in the Caucasus***Summary*

This document was prepared pursuant to decisions taken by the Meeting of the Parties at its fifth session (Geneva, 10–12 November 2009) that entrusted the Working Group on Monitoring and Assessment, in cooperation with the Working Group on Integrated Water Resources Management, with finalizing the second Assessment of Transboundary Rivers, Lakes and Groundwaters in time for its submission to the Seventh Ministerial Conference “Environment for Europe”, to be held in Astana, from 21 to 23 September 2011 (see ECE/MP.WAT/29). The document presents the main conclusions and trends of the second assessment for the Caucasus, drawing upon the detailed assessments by basin and aquifer presented in documents ECE/MP.WAT/WG.2/2010/5 and ECE/MP.WAT/WG.2/2010/6. Collectively, these three documents make up the draft assessment of transboundary waters in the Caucasus.

I. Background and proposed action by the Working Group on Monitoring and Assessment and the Working Group on Integrated Water Resources Management

1. The subregional assessment of transboundary waters in the Caucasus covers transboundary rivers, lakes and groundwaters shared by two or more of the following countries: Armenia, Azerbaijan, Georgia, the Islamic Republic of Iran, the Russian Federation and Turkey. It has been prepared by the secretariat with the assistance of the International Water Assessment Centre (IWAC) — hosted by the Slovak Hydrometeorological Institute — on the basis of information provided by countries. The present document contains the main findings, tendencies and conclusions of the Caucasus assessment. It draws upon the assessments of the different transboundary rivers, lakes and groundwaters in the Caucasus that are presented in documents CE/MP.WAT/WG.2/2010/5 (transboundary waters discharging into the Caspian Sea) and ECE/MP.WAT/WG.2/2010/6 (transboundary waters discharging into the Black Sea).

2. An important step in the assessment preparation was the workshop on transboundary water management in Eastern and Northern Europe, which was held from 27 to 29 April 2010 in Kiev, Ukraine. The workshop was jointly organized by the United Nations Economic Commission for Europe (UNECE) and IWAC, which funded the workshop, and co-hosted by the Ministry of Environment of Ukraine and the Ukrainian State Committee for Water Management.

3. The assessment of transboundary waters in the Caucasus also contains an assessment of a number of selected Ramsar sites:¹ Javakheti Wetlands area (including Lake Arpi Ramsar site; Modatapa, Bugdasheni, Sagamo and Khanchali lakes and Kartsakhi/Aktash lake); and Ararat Valley fishponds, floodplain marshes on Mount Ararat and Araks/Aras River floodplain. These assessments were prepared in cooperation with the secretariat of the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) and the Parties to that Convention.

4. The assessment is essentially based on information received from Caucasian countries in response to questionnaires from the secretariat. Unfortunately, not all Caucasian countries completed the questionnaires or submitted information in other forms: Azerbaijan only sent input to two datasheets and the comments to the draft assessments were limited to discharge data; and Armenia and the Russian Federation did not comment on the draft assessments. Moreover, for some basins and especially a number of aquifers, little information was provided. Information on management responses and on predicted impacts of climate change was especially limited. When no new information was provided, it was necessary to revert back to the information contained in the First Assessment of Transboundary Rivers, Lakes and Groundwaters,² which reduces the pertinence of this second edition. Delays in the receipt of input by the secretariat also affected the quality of the final product. Furthermore, the information presented in this assessment is incomplete because of gaps in the data. Some mismatches in the figures reported can also be observed.

5. The Working Group on Monitoring and Assessment and the Working Group on Integrated Water Resources Management may wish:

¹ Wetlands designated as internationally important under the 1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat.

² Available at: <http://www.unece.org/env/water/publications/pub76.htm>.

(a) To comment on the preliminary assessments of transboundary rivers, lakes and groundwaters in the Caucasus and in particular on the present document with the main findings and advise the secretariat on how to finalize the document in terms of content;

(b) To express its appreciation to the designated experts from Armenia, Azerbaijan, Georgia, the Islamic Republic of Iran, the Russian Federation and Turkey, as well as IWAC and the secretariat for the substantive work done;

(c) To express concern for the fact that not all countries in Caucasus contributed to the preparation of the assessment to the extent needed, and that the information provided is in some cases insufficient;

(d) To invite Parties and non-Parties to provide amendments and additions to the information contained in documents ECE/MP.WAT/2010/WG.1/3-ECE/MP.WAT/WG.2/2010/4, ECE/MP.WAT/WG.2/2010/5 and ECE/MP.WAT/WG.2/2010/6 by **31 August 2010**.

II. Introduction

6. There are six major transboundary rivers and four major international lakes as well as six transboundary aquifers in the Caucasus (see Table 1 below). By far the largest part of the subregion is covered the basin of the Kura and its tributaries.

Table 1

Transboundary river basins, lakes and aquifers in the Caucasus subregion

<i>Basin/sub-basin(s)</i>	<i>Recipient</i>	<i>Riparian countries³</i>	<i>Lakes in the basin</i>	<i>Transboundary groundwaters within the basin</i>	<i>Ramsar sites included in this assessment</i>
Kura (including Potskhovi tributary)	Caspian Sea	AM, AZ, GE, IR, TR	Lake Jandari, Lake Kartsakhi		Javakheti Wetlands area (including Lake Arpi Ramsar site, AM; Modatapa, Bugdasheni, Sagamo and Khanchali lakes, GE; and Kartsakhi/Aktash lake, GE, TR)
– Iori	Kura	AZ, GE			
– Alazani	Kura	AZ, GE		Alazan-Agrichay (5)	
– Agstev	Kura	AM, AZ		Agstev-Akstafa/Tavush-Tovuz (Agstev-Tabuch, 11; AM, AZ)	
– Debed-Ktsia-Khrami	Kura	AM, GE		Debet (Pambak-Debet 10; GE, AM)	
– Araks	Kura	AM, AZ, IR, TR	Araks Govsaghynyn reservoir	Nakhicheven and Djebail (Middle and Lower Araks, 7; AZ-IR)	Ararat Valley fishponds and floodplain marshes on Mount Ararat and Araks River

³ Country names have been abbreviated as follows: Armenia (AM); Azerbaijan (AZ); Georgia (GE), Islamic Republic of Iran (IR); Russian Federation (RU); Turkey (TR)

<i>Basin/sub-basin(s)</i>	<i>Recipient</i>	<i>Riparian countries³</i>	<i>Lakes in the basin</i>	<i>Transboundary groundwaters within the basin</i>	<i>Ramsar sites included in this assessment</i>
					floodplain (AM, AZ, IR, TR)
– Akhuryan	Araks	AM, TR	Akhuryan/Arpaçay reservoir	Leninak-Shiraks (AM, TR)	
– Arpa	Araks	AM, AZ			
– Vorotan (Bargushad)	Araks	AM, AZ			
– Voghji	Araks	AM, AZ			
– Sarisu	Araks	TR, IR			
– Kotur (Qotur)	Araks	IR, TR			
Samur	Caspian Sea	AZ, RU	...	Samur-Gusarchaysky (Samur 6)	
Sulak	Caspian Sea	GE, RU	...		
– Andis-Koisu	Sulak	GE, RU	...		
Terek	Caspian Sea	GE, RU	...		
Psou	Black Sea	RU, GE			
Chorokhi/Coruh	Black Sea	GE, TR			
– Machakheliskali	Chorokhi/Coruh	GE, TR			

7. Natural availability of water in the Caucasus is quite variable, with good availability in the mountainous areas of Georgia and scarcity in Azerbaijan. But it is the difficulties and deficiencies in water resources management in the subregion that aggravate problems of access to water in sufficient quantity and quality.

8. The Southern Caucasus countries share a common history as part of the former Soviet Union, which heavily influenced the institutional and legal setting for management of water resources, as well as their monitoring, in those countries. In addition, while in the process of recovery, water quality is still influenced by the industrial and agricultural legacy of environmental degradation of the former regime.

9. In addition, past and unsolved political conflicts in the region remain a major obstacle for transboundary cooperation. A lack of trust between the countries persists and it has thus far proven impossible to enter into formal agreements and establish effective institutional arrangements to manage most of the transboundary water resources in the region. A number of positive steps have been taken in the direction of enhanced cooperation, mostly thanks to international assistance projects; however, a stronger political willingness to cooperate is needed to make substantial and sustainable progress.

III. Legal, policy and institutional frameworks for transboundary water management

10. Integrated Water Resources Management (IWRM) is not currently applied in the Caucasus in general, but there are a number of positive developments: in many Caucasian countries the water sector has undergone or is undergoing reform and new water codes have been developed.

11. Moreover, there has been a progressive approximation towards the European Union (EU) Water Framework Directive (WFD). An important driver is the EU Neighbourhood Policy, under which Armenia, Azerbaijan and Georgia signed agreements committing themselves to bring new environmental laws closer to EU legislation and to cooperate with neighbouring countries regarding transboundary water management.

12. Armenia's water code of 2002 is the first in the subregion to meet this obligation. It refers to, among others, development of water basin management plans, introduced since 2005, and to an intersectoral advisory body. In Georgia, water resources are managed according to principles of territorial administration (regional units) and river basin-based management is not applied at present time. A new water law — as a basis for reforming the 1997 water resources management system — is being drafted for Georgia and will include principles of basin management. There are no river basin organizations in Turkey either, but the regional directorates of the General Directorate of State Hydraulic Works (DSI) are responsible for preparing master plans that set priorities for the development of water resources in the respective basins across water-related sectors.

13. Even if there is a lack of comprehensive IWRM plans in these countries, some steps are being progressively taken in that direction. For example, Turkey plans to initiate the preparation of a River Basin Management Plan on the Chorokhi/Coruh River. According to draft strategic orientations of the Ministry of the Environment and Natural Resources of Georgia (2009), the development of a river basin management plan for the Georgian part of the Chorokhi basin is scheduled for the period from 2011–2013. The Islamic Republic of Iran also reports that a comprehensive IWRM plan for the Araks/Aras Basin is under preparation.

14. Groundwater has a high importance in the region for water supply, especially in rural areas. Some 80 per cent of drinking water supplied in Georgia through centralized distribution networks is abstracted from groundwater. In addition, groundwater is also an important source of irrigation water in some areas. Nevertheless, groundwater resources in general receive little attention. Integrated management of groundwater and surface water is not occurring in the region and management of (transboundary) groundwaters is not very advanced.

15. More information on the water resources management frameworks of the concerned countries is included in Annex 1.

16. The lack of formal cooperation between all countries in the Kura basin, in particular the lack of a legal framework and joint body for transboundary water cooperation, is a regrettable limitation; such development has not yet materialized despite the efforts made in various international projects, including the United States Agency for International Development (USAID) South Caucasus Water Programme and an Environment and Security Initiative (ENVSEC) project, where steps were taken towards the establishment of a regional transboundary water commission for the Kura-Araks Basin. Nevertheless, few bilateral agreements and some joint commissions exist such as the agreements between Iran and Armenia and Iran and Azerbaijan or the Interstate Commission of Armenia and Turkey

on the Use of Akhuryan Water Reservoir. The full list of agreements between countries in the Caucasus is provided in Annex 2.

17. However the level of implementation of the bilateral agreements, especially their water management related clauses, remains low and their activities are sporadic. For example, under the existing agreement on environmental cooperation between Georgia and Azerbaijan, no programme or actions have been developed and no official working group or intergovernmental body has been established to regularly oversee or support implementation of the agreements. Thus, the ongoing negotiations between Georgia and Azerbaijan aiming to establish an agreement and a permanent body for cooperation on IWRM are very promising steps forward for the region which could provide a model for the further development of cooperation.

18. In addition to the WFD, the United Nations Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) provides a framework to support water management and related international cooperation. The status of ratification of the Convention is at different stages in the Caucasus: Azerbaijan and the Russian Federation are Parties and Georgia is preparing to become a Party, while Armenia and Turkey are not Parties. Until the entry into force of the amendments to articles 25 and 26 to open the Convention to countries outside the UNECE region, Iran cannot accede to the Convention. Azerbaijan, Iran and the Russian Federation (together with the two other Caspian littoral states, Kazakhstan and Turkmenistan) have ratified the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Teheran Convention). The ancillary protocols of the Teheran Convention under negotiation (four in total) include one on pollution from land-based sources and activities and another on environment impact assessment in a transboundary context. The status of ratification of selected international agreements by the countries in the Caucasus is presented in Annex 3.

19. Economic development is clearly the priority at present time, and efforts to improve economic performance have influenced legislation, including environmental and water legislation. For example, in Georgia, the issuing of groundwater abstraction licences was transferred to the Ministry of Economic Development and the requirement for an environmental impact permit is now limited to major enterprises.

IV. Monitoring of transboundary rivers, lakes and groundwaters

20. Since the break-up of the Soviet Union, monitoring and assessment declined in the Caucasus, demonstrated, for example, by a substantial decrease in the number of operational monitoring stations. Some improvement can be observed in recent years, thanks to international projects. However, there is a lack of continuity to these activities. Monitoring has suffered owing to a general lack of national funding to improve monitoring networks, even if recently the situation has improved in some countries due to an increase in national environmental budgets (e.g., Armenia).

21. Groundwater monitoring and integration of surface and groundwater monitoring are particularly weak. In Georgia, no systematic groundwater monitoring has taken place since 2005 and transboundary groundwaters have not been monitored for the past 20 years.

22. No (hydro)biological monitoring has yet been introduced in the Caucasus. Slow progress is made towards this, thanks to important support from EU assistance projects. Improvement in microbiological and biological monitoring is reported in Armenia.

23. Water quality in lakes is not being monitored in Georgia, with the exception of checking parameters for recreational water quality using samples from lakes.

24. What remains from the Soviet influence, though, is still common reference to “maximum allowable concentrations of pollutants for a specific water use” (MAC), seemingly stringent water quality standards that are difficult to comply with. Adoption and implementation of new water quality standards depends on legislation, and legislative changes are made slowly. Moreover, attachment to familiar systems and resistance to change make for slow progress in the transition from MAC values towards water quality objectives.

25. There are problems of quality assurance regarding data on water quality, not only in the analytics but also in the preceding chain of sampling and processing. There is no data comparability between countries, due to, among others, a lack of consistency in methods. Some international projects, such as the Technical Aid to the Commonwealth of Independent States (TACIS) project “Water Governance in the Western EECCA⁴ Countries” (2008–2010), aim at a higher degree of harmonization in water quality categories and in related parameters. The requirements of the EU WFD give direction to these efforts.

26. There is no systematic control of wastewater. Self monitoring of sewage water by enterprises has been introduced in Georgia, Armenia and Azerbaijan, but enforcement is not always strict.

27. Monitoring of water flow has also been disrupted since the collapse of the Soviet system. There are not enough hydrometric stations (e.g., on the Kura for the purposes of improving flood protection) and the riparian countries do not share them efficiently. Regular exchange of operative data, like daily water levels and weekly discharges, is missing. Early warning is also needed for hydrological extreme events and in case of accidental pollution. The recent exchanges reported between Georgian and Turkish delegations concerning establishment of early warning systems on the Chorokhi/Coruh River are a positive development.

28. Under the existing bilateral agreements, bilateral cooperation on monitoring is currently established between Azerbaijan and Iran, Armenia and Iran, Armenia and Turkey (Araks/Aras and Akhuryan) and Georgia and Turkey. However more cooperation is needed on transboundary water monitoring in the subregion. While recent improvements have been achieved in the field of joint monitoring and assessment thanks to international projects, stable, long-term cooperation is missing in the Kura River basin.

29. The Caucasus has benefited from substantial assistance by international donors, especially in the area of monitoring and assessment. These projects offer opportunities but also risks of overlapping and duplication, and do not necessarily match with the countries’ priorities. The institutionalization of cooperation and the creation of a joint body for transboundary water management would avoid overlapping and duplication, while also ensuring continuity and sustainability of projects and a more effective use of international funds.

V. Main problems, impacts and status

30. Agriculture is the biggest water user in the Caucasus. In the Kura basin in Azerbaijan, some 745,000 ha are irrigated, including 300,000 ha in Azerbaijan’s part of the Araks/Aras sub-basin, and more than 60 per cent of the water withdrawn from the Kura is

⁴ Eastern Europe, Caucasus and Central Asia

used for agriculture. Need for irrigation water has initially partly motivated building of storage capacity in the subregion. In some parts of the Kura basin, agriculture and animal husbandry are the main drivers of the economy, and irrigation systems are being further developed (Gole, Ardahan and Hanak plains). Animal husbandry also exerts pressure on the water resources.

31. There are substantial water losses in irrigation infrastructure, with almost 30 per cent losses in irrigation canals. In Georgia, a high share of its irrigation infrastructure consists of open, unlined channels and consequently the water efficiency is low. The inefficient water use aggravates the water scarcity problem. Irrigation also provokes salinization of soils, especially in more arid parts of the Caucasus and where drainage is not well organized. A decrease in precipitation, which is predicted as a result of climate change, combined with anthropogenic factors that indicate increased abstraction, will add to water scarcity. Unless effective adaptation measures are implemented to reduce the water deficit, this will impact on agriculture and might even contribute to internal displacement of populations.

32. Diffuse pollution from agriculture (e.g., nitrogen and phosphorus), viticulture and animal husbandry, is a significant pressure factor in many basins, for example in the Alazani and the Akhuryan/Arpachay basins. Agricultural pollution in irrigation return flows containing remnants of agrochemical waste, pesticides, nutrients and salts is a concern, especially in the Araks/Aras River. However, in recent years, the application of fertilizers has been relatively limited. There is a collector drainage system in place, which directs the return flows towards the Caspian Sea. Some efforts are being made to address this, for instance, in Azerbaijan the Ministry of the Environment is inventorying pollution sources.

33. Organic and bacteriological pollution from discharge of poorly treated or untreated wastewater is a widespread problem. In particular, water quality in the Kura-Araks basin has been severely affected. Wastewater treatment is commonly lacking for both municipal and industrial (e.g., metallurgical and rubber industry) wastewater. In Georgia, most of wastewater treatment facilities have become non-operational and wastewater is being discharged into rivers without treatment. In the Turkish part of the Araks/Aras, urban areas are connected to sewerage networks, but few wastewater treatment plants have been set up. In rural settlements, wastewater collection is commonly lacking.

34. There is also room for improvement in solid waste management, as a lack of sanitary landfills is common, e.g., in municipalities in Turkey, and controlled dumpsites are reported to exert pressure on water quality, too. Pollution from illegal landfills is a concern also in Georgia and Azerbaijan.

35. Mining of especially copper but also other commodities results in heavy metal pollution due to acid mine drainage from tailing dams. The affected basins include — among others — the Debed and Voghji basins. However, the significance of mining as a pressure factor has substantially decreased since the Soviet era. With the exception of major accidents, its influence probably remains geographically quite limited. Appropriate water quality indicators for assessing the impact of such pollution are a subject of discussion. Wastewater from the ore enrichment and processing industry is also an important pressure factor in some sub-basins, like the Debed.

36. Water-related development projects are seen in the countries of the Caucasus region as the key for socio-economic development, for example in the Araks/Aras basin by Turkey.⁵ The existing and planned infrastructure includes weirs, dams, hydropower plants

⁵ National and regional development strategies for economic and social sectors are defined in Turkey's Development Plan for 2007–2013.

and related structures for electricity generation, as well as constructions for irrigation and water supply purposes. There is concern that the existing and planned hydropower stations will result in some changes in natural river flow regime, river dynamics and morphology. In recent years, hydropower has been developed in the Turkish part of the Chorokhi/Coruh basin, where two hydropower stations are operational at present: Muratli dam (since 2005); and Borçka dam (since 2007). These are part of a scheme involving 10 planned hydropower projects along the main river in a cascade style. The last one of the Lower Coruh projects is under construction (Deriner). The Middle Coruh projects (Yusufeli and Artvin) are in final design stage and investment programme, and the Upper Coruh projects (Laleli, Ispir, Gullubag, Aksu and Arpun) are in different planning stages. This intense development raises concerns of transboundary impacts. Iran and Armenia are studying the possibility of building a common hydropower plant on the Araks/Aras river (Meghri-Ghare chilar). To avoid straining relations between co-riparians with increasing upstream-downstream pressures and to ensure sustainability of use of the water resources, ecological flows have to be considered.

37. Flow regulation affects sediment transport, with reduction of sediments leading to washing away in the coastal zone. But sediment loads are also influenced by the dynamics of land cover/land use: deforestation makes lands more vulnerable to erosion. Erosion of river banks in particular is reported in several basins. Sand mining is also being carried out and international standards are being called for in that area, while on the Kura River sedimentation is a problem, as it blocks water flow, especially during periods of low water levels in the river.

38. Due to topography, climate conditions and a dense network of rivers in certain areas, natural disasters like landslides, mudflows, floods and avalanches are frequent in Georgia. The number of floods, including flash floods, seems to have increased in Georgia in the period from 1961 to 2008. Due to its extensive lowland areas, Azerbaijan is particularly exposed to risks from flooding. The reduction of hydrometeorological monitoring activities in the South Caucasus countries since the Soviet time may have left prediction capacity reduced.

39. Natural disasters (landslides, earthquakes) and their potential consequences, including on industrial facilities with the risk of accidental industrial pollution (for instance from tailing dams or oil pipelines) are perceived as common problems in the region and offer an area for transboundary cooperation.

40. The drying up of rivers threatens ecological continuity. According to some sources, the Iori River also dries up in summer in dry years as result of intensive water abstraction. In the Alazani, reduction of (groundwater) baseflow has been reported. Over-abstraction of groundwater resources without regulation is a problem in the region. For instance in Georgia, only organizations and enterprises require a licence for groundwater abstraction, not households using water for their domestic needs. On the Alazani transboundary aquifer, there is interest in setting up a network to monitor the hydro(geo)logical regime, because an important groundwater intake facility is being set up.

41. Ecological flows are not really considered. Flow regulation and anthropogenic impacts on water quality affect water-related ecosystems. There are two outstanding transboundary wetland areas: the Javakheti plateau with its numerous lakes and marshy wetlands, and the fishponds and floodplain marshes in the Ararat river valley.⁶ The

⁶ These transboundary wetland areas have been assessed in cooperation with the secretariat of the Ramsar Convention and the national focal points in the States parties to that Convention.

Caucasus is among the planet's 34 most diverse and endangered areas identified by Conservation International and is included in the World Wildlife Fund (WWF) list of Global 200 Ecoregions for its outstanding biodiversity. Currently, seven Ramsar sites are designated in the Caucasus region. Transboundary Ramsar sites have not yet been designated in this region. Apart from the two wetland regions mentioned above, other important transboundary wetland ecosystems in the Caucasus include areas in the coastal zones of the Black Sea and the Caspian Sea, as well as the Terek, Sulak, Samur and Kura Rivers and their related, remaining floodplain wetlands. The waters of these river and lake drainage systems provide important resources for domestic water use, hydropower generation and agricultural irrigation — especially in Armenia, Azerbaijan and Georgia. However, the same wetland ecosystems are also providing important services for human well-being, livelihoods and economies, such as recreation, fisheries, hunting and livestock farming, and harbour a rich biodiversity which depends on them.

42. Overfishing is a concern in the Kura-Aras basin, where fishing is an important source of income for riparian communities. Instances of illegal fishing occur, in which unsustainable harvesting methods are being used that threaten fish populations.

VI. Climate change and its impacts on water resources⁷

43. In Armenia, summer temperatures have increased by 1°C during the period 1935-2007, whereas the increase in winter is not statistically significant. Climate change forecasts for Armenia show a significant and consistent increase in temperatures projected for the three time slices — 2030, 2070 and 2100 — with maximal increase in summer season. The central and western regions of Armenia are expected to experience more warming than the rest of the country. In Armenia, air temperature is expected to increase by about 1°C by 2030, with an approximately 3 per cent decrease in precipitation. The predicted reduction in the amount of precipitation (rain and snow) varies somewhat by area/basin: for example for Akhuryan/Arpaçhay it is 7 to 10 per cent; for Voghji, 3 to 5 per cent; and for Agstev 3 to 4 per cent. A decrease of 5 to 10 per cent is predicted in run-off in the area of Agstev, 8 to 10 per cent in Vorotan and 2 to 3 per cent in Voghji. A decrease in groundwater levels is also predicted. Armenia's vulnerability to climate change is linked to the importance of the agriculture sector — highly dependent on irrigation from rivers — for the economy: it accounts for 20 per cent of gross domestic product (GDP) in direct agricultural production and an additional 10 per cent in food manufacturing.⁸

44. Despite uncertainty, long-term forecasts of most global climate models show about 5 per cent decrease in precipitation on the territory of Georgia, with strong inter-seasonal variability. In Eastern Georgia (especially in Dedoplistskaro Region) the predicted decrease of summer precipitation will increase the frequencies of drought and accelerate the desertification process. The decrease of run-off is predicted for two major rivers of Eastern Georgia, the Iori and Alazani. The water from the Iori River is used for irrigation purposes in some regions and for supply of water to Tbilisi, the capital.

45. In Azerbaijan, within the next 50 years an increase in precipitation by 5 per cent is predicted. A decrease of 15 per cent in both run-off and groundwater recharge is expected

⁷ For this section, some replies by Caucasian countries to a survey conducted by the Water Convention's Task Force on Water and Climate in 2008, which explored countries' adaptation needs and the measures already undertaken, was used as complementary information.

⁸ Vulnerability of Water Resources in the Republic of Armenia under Climate Change. 2009. Ministry of Nature Protection of Republic of Armenia.

due to the predicted increase of air temperature by 2 to 3°C. Groundwater recharge is also influenced by reduced surface water flow. The influence of reduced run-off, as well as decreased quality of both surface water and groundwater in the Kura-Araks basin, is assessed as very negative. In the Western part of the country, the impact of reduced groundwater recharge is predicted to be very negative. In general, the coastal zone, lowlands and deserts are rated as most vulnerable to climate change. Implemented or planned adaptation mainly relate to technical flood protection, restriction of development in risk areas, improving flood forecasting and monitoring, technical measures to increase supply of water (for drought/low flow protection), application of economic instruments and improvement of existing coastal infrastructure

46. During the preparation process for their Second National Communications to the United Nations Framework Convention on Climate Change (UNFCCC), Armenia, Azerbaijan and Georgia performed several runs of the PRECIS (Providing REgional Climates for Impacts Studies) Regional Climate Model for different socio-economic scenarios and two Global Climate Models,⁹ to evaluate future climate in the Caucasus region. Towards this end, the countries cooperated by exchanging data and each country validated the baseline data obtained for their territory and used it for climate scenarios and climate change impact assessment studies. Further work on compilation of future climate scenarios and agreement about them at the regional level is expected to be carried out in the framework of the Regional Climate Change Study for the South Caucasus Region financed by ENVSEC.

47. In the Iranian part of the Araks/Aras Basin, average annual temperature is predicted to increase by 1.5 to 2°C by 2050. A reduction of 3 per cent in precipitation is expected. The impacts on land use and cropping patterns and on irrigation needs is expected to be considerable.

48. For the part of the Araks/Aras that is in Turkish territory, Turkey predicts a decrease of 10 to 20 per cent in precipitation by 2070–2100, and increased seasonal variability of precipitation. A decrease of 10 to 20 per cent in run-off is predicted, also with increased variability. A decrease of groundwater levels is also predicted, with negative effects on groundwater quality. Both consumptive and non-consumptive water uses are foreseen to increase in the Turkish part of the Araks/Aras. But the trends are not uniform, as, for example, in the basin of the Chorokhi/Coruh, a comparable increase in precipitation is expected and consequently groundwater levels are expected to rise.

49. Some studies have been carried out, but actual adaptation measures are mostly only being started to be considered. Turkey has developed a “National Climate Change Strategy” (2009), with adaptation strategies identified, but the actual planning of measures lies ahead. Iran has also been developing its national plan for coping with climate change. In general, little has so far been done in the subregion to try to downscale potential impacts at the basin level.

50. More comprehensive and collaborative study of effects of climate change is needed. Due to the data and modelling intensiveness of the related work, as well as the large geographical scope, the countries in the Caucasus could greatly benefit from cooperation, sharing data and comparing results. Furthermore, agreement about the basis and

⁹ Turkey, the Russian Federation and Iran were also involved in this regional implementation process, which was organized and directed operationally by the Hadley Centre for Climate Prediction and Research in the United Kingdom. The Global Climate Models used were HadAM3P and ECHAM4.

assumptions behind the predictions about climate variability and change would help form a uniform picture of the water resources future in the Caucasus.

VII. Responses

51. The adoption of the water code of Armenia marks the way for some progressive legislation in the field of water in the Caucasus region. However, good legislation alone will not solve water problems; such legislation will also need to be enforced and institutional reforms — at times painful — need to follow to ensure the necessary structures. International frameworks, like progressive approximation to EU directives and accession to the UNECE Water Convention, offer elements for developing instruments for water policy.

52. Even if investment in wastewater treatment is still insufficient, some measures are reported to address the discharges of untreated or insufficiently treated wastewater, which is one of the most pressing problems in the Caucasus subregion. In Georgia, a national programme has been set up to rehabilitate the wastewater treatment plant for Tbilisi and Rustavi, with planned/required completion of works by 2017. Pressures on water quality from municipal and industrial wastewater are expected to decrease in the Turkish part of the subregion as a result of installation of wastewater treatment plants. For instance, preliminary work for the installation of wastewater collection and treatment plants for Artvin and Bayburt cities have been prepared to reduce pollution from wastewater in the Turkish part of the Coruh Basin. The Urban Wastewater Treatment regulation adopted by Turkey in 2006 is helping as the necessary basis to address the issue.

53. Despite the current tendency of weakening environmental protection requirements in order to prioritize economic development and some cuts in funding, environmental regulation is evolving; however, the level of enforcement is of key importance. In Georgia, there is an environmental impact assessment process for large enterprises in sectors such as metallurgy, the chemicals industry, hydropower and heat generation plants. To obtain a permit, legislation obliges major polluters to submit to independent monitoring of their discharges, with data provided directly to the Government. According to its strategy for 2009 and 2010, the Environmental Inspection Service of Georgia is moving towards gradually adopting a zero tolerance approach towards violations, which will be given the means to do so in the draft Law on Inspection of Environment Protection. Strengthening of enforcement and inspection has already led to a reduction in violations of discharge regulations.

54. In addition to the above-mentioned urban wastewater regulation, in the recent years Turkey has adopted a series of other regulations in the framework of the Turkish Environmental Law, which provide a means for addressing some of the challenges and improving protection of water resources, namely:

- the Water Pollution Control Regulation (2004, amended in 2008);
- the Hazardous Waste Control Regulation (2005);
- the Soil Pollution Control Regulation (2005);
- the Regulation on the Protection of Waters against Agricultural-Based Nitrate Pollution (2004).

55. The Environmental Impact Assessment (EIA) Regulation and the Solid Waste Control Regulation had already been adopted in the early 1990s.

56. No flood zone mapping has been systematically carried out since the Soviet era, and applying it would improve flood preparedness. In Azerbaijan, which suffers from flooding the most, the capacity to generate accurate and useful flood forecasts is hampered by a general lack of information, together with outdated technologies, equipment and approaches.

57. A gradual transition to basin-based organization is taking place in Georgia, where the lack of joint bodies for the management of transboundary waters and river basin councils is felt to be a constraint. A reform is planned to make the water management system basin-based.

58. New environmental regulations (e.g., Lake Sevan law, Iranian legislation) and investments by operators are expected to reduce impacts on water resources from mining activities. Technological improvement of mining practices also reduces the related loading: for example, Iran has gained experience in controlling pollution from copper mines by developing closed-water circulation in the processes. In addition, involvement and investment of the private sector in water projects in Turkey — hydropower projects in particular — has increased in recent years, notably in the Turkish part of the Araks/Aras basin.

59. In the same spirit, there is interest in encouraging the use of economic instruments, for example in Georgia.

VIII. The way ahead

60. There is pressure on water resources in some parts of the subregion — for example Potskhovi/Posof — owing to economic development and population increases, which are likely to increase water use, both consumptive and non-consumptive. Georgia predicts its withdrawal of water from the Kura to increase by more than 25 per cent by 2015, with withdrawal from the Alazani sub-basin increasing by 10 per cent and from the Iori by 3 per cent. Economic development is clearly the priority for countries in the region, but care should be taken to ensure that neglect of the quality of water resources and of the environment in general does not compromise opportunities in the future.

61. Water scarcity experienced downstream (and seasonally/periodically elsewhere) calls for improving water management in general, improving irrigation system efficiency and the application of water saving measures, as well as the conjunctive use of water, including reuse of drainage and return waters. Controlling the use of pesticides and fertilizers and diffuse pollution from agricultural lands would not only reduce harmful effects on water quality in rivers, but also improve the reuse potential of the return waters.

62. While the needs for capacity-building and for strengthening water management institutions are considerable, there is also valuable experience and competence to share in the region. For example the Iranians have indicated their willingness to share experience with regard to reducing copper mining pollution.

63. There is also the need to strengthen the knowledge base on the impacts of climate change, including through cooperation by riparian countries. Agreement about the models to be used and selection of a common scenario or set of scenarios on which to base the modelling supports the development of a common understanding between the countries, building eventually ground for joint adaptation strategies.

64. Coordination and finding synergies in the activities supported by different donors is crucial. Donors should also ensure that their interventions respond to the priority needs of Caucasian countries and that there is commitment to follow up on the funded activities at

the national level, especially in monitoring and assessment, where sustained investment and continuity are necessary to monitor the effectiveness of interventions and to detect trends. At the same time, recipient countries have to take responsibility for the follow-up beyond individual project life.

65. Above all, increased political commitment to transboundary cooperation is needed to improve the institutional framework and the management of transboundary water resources. The technical cooperation established under various technical projects should evolve in a more long-term, sustainable framework for cooperation to be able to tackle the variety and complexity of challenges for water resources in the subregion.

Annex 1

Brief description of the water resources management frameworks in countries in the Caucasus

Armenia

Water resources management bodies are defined in the Water Code of Armenia, adopted in 2002. The National Water Council (NWC) acts as a high-level advisory body for the National Water Programme. The Dispute Resolution Commission under the NWC mediates disputes related to water use permits.

The State Committee on Water Systems under the Ministry of Territorial Administration is responsible for management of water systems.

The Public Services Regulatory Commission is an independent body, responsible for developing water tariff policy and issuing water system use permits to non-competitive water suppliers.

The Ministry of Nature Protection has a broad natural resources management and protection mandate, which is fulfilled through various agencies.

The Water Resources Management Agency (WRMA) is the State-authorized body for water resources management charged with assessing water availability and ensuring water use efficiency, through the permissions and planning processes. It is also responsible for the management of competing water uses and for ensuring that environmental needs are met.

The Basin Management Organizations are involved in developing water management plans in the five primary basin management areas.

The State Hydrometeorological and Monitoring Service is responsible for monitoring river flows and levels of lakes and reservoirs. The Environmental Impact Monitoring Centre monitors surface water quality.

The Regional Geological Fund provides official groundwater availability letters for water use permit applications.

Compliance, assurance and enforcement of water and environmental legislation are conducted by the State Environmental Inspectorate of the Ministry of Nature Protection through its 11 local inspectorates.

Azerbaijan

The main organization of Azerbaijan for the control of water use for irrigation purposes is the Joint Stock Company for Amelioration and Water Economy of the Ministry of Agriculture. The Joint Stock Company provides economic sectors with water and controls the rational use of water resources, provides drainage systems on irrigated land and operates water supply and land-reclamation facilities that are the responsibility of the Company.

The Ministry of Ecology and Natural Resources is responsible for the conservation and protection of water resources from pollution, defining the related main policy directions. The responsibilities of the Ministry include inventorying water resources and controlling their quality, as well as carrying out hydrometric and other permanent monitoring. Responsibilities for different kinds of monitoring, implementation of environmental normative acts and examination of compliance are delegated to departments. The National Geology Exploration Service (a department of the Ministry) is responsible for groundwater monitoring, as well as regulating and controlling abstraction of groundwater. The Ministry

establishes and approves standards of allowable discharges of wastewater and controls them through regional offices.

Georgia

In Georgia, the management of water resources falls within the competence of several State agencies, authorities of autonomous republics and municipalities.

State management and protection of surface water resources, as well as state control and the creation of a common monitoring system, is the prerogative of the Ministry of Environmental Protection and Natural Resources. The Ministry defines State policy in the sphere of protection and consumption of water resources and thresholds of pollutants in effluent waters. The Ministry also issues permits for consumption of water resources, conducts state inventories of water consumption and controls the compliance with water protection and consumption rules.

Monitoring of surface water is under the responsibility of the National Environmental Agency. The Agency was established as a legal independent entity in 2008 within the Ministry of Environmental Protection and Natural Resources. Its Environmental Pollution Monitoring Department monitors surface water quality, while its Department for Hydrometeorology monitors surface water quantity.

The Ministry of Economic Development issues licenses for groundwater abstraction. Water supply and wastewater development is under the responsibility of the Ministry of Regional Development and Infrastructure and under this Ministry, the Water Supply Regional Development Agency coordinates activities of new companies and sets up regulations and tariffs.

The Ministry of Labour, Public Health and Social Safety conducts supervision of compliance with sanitary-hygienic norms and sanitary-epidemiological rules.

The authorities of the autonomous republics (within the limits of their competence) are responsible for the protection and consumption of water resources on the territories of those areas. In addition, they are responsible for the management of surface waters of national significance located on the territory of the autonomous republics. The authorities of the autonomous republics must take part in the elaboration of complex measures for the protection and consumption of water resources as well as elaboration of hydro-economic balances. They are also obliged to supervise the protection and rational consumption of water resources on their territories, conduct state inventories and registration of water consumption, etc.

Islamic Republic of Iran

The Iran Water Resources Management Company, under the responsibility of the Water Affairs Deputy of the Ministry of Energy, organizes, directs and provides support (technical, engineering, legal, financial and administrative) to its subsidiary companies for identification, study, development and conservation of water resources, as well as for exploitation of hydropower energy and operation of related systems in Iran. The Company also acts as an agency of the Ministry of Energy to enforce the laws and regulations related to water, including the management and control of water resources and assessments of water resources quantity and quality. The Company also prepares input to the preparation of strategies, policies and long- and medium-term plans in the water sector for the Ministry of Energy.

The Company directs and supervises the study and implementation of the projects of water supply and transfer, irrigation and drainage networks, dam stability and safety, river and

bank engineering, flood control and artificial recharge and hydropower energy generation, as well as directing and supervising the operation of the related installations and structures.

The Department of the Environment sets environmental standards.

Russian Federation

The Ministry of Natural Resources of the Russian Federation is responsible for the formulation of state policy, laws and regulations in the field of natural resources, including the inventory, use and conservation of water resources; operation and safety of multipurpose reservoirs and water-resources systems and other hydraulic structures. The Federal Agency for Water Resources, under the Ministry of Natural Resources, is responsible for law enforcement, public service and management of property in the field of water resources. The Agency organizes the redistribution of water resources of federally owned water bodies, organizes restoration and conservation of water bodies, plans and implements protective measures, examines projects related to utilities and hold tenders in its field of competence.

Turkey

In Turkey, water-related activities are centrally planned. The State Planning Organization, under the Prime Minister, is the strategic organization established to guide economic and social development. Water resources management is described in the five-year development plans. The Ministry of Environment and Forestry has overall responsibility for water resources management, although some of the responsibilities are shared with various ministries. As a primary executive State water agency under the auspices of Ministry of Environment and Forestry, the General Directorate of State Hydraulic Works plays a leading role in water resources development in Turkey. With its central organization and headquarters in the capital, it is organized around the 25 major river basins in the country, with Regional Directorates being responsible for planning and preparing master plans that set priorities for the development of water resources in the respective basins. These plans generally integrate development strategies in all water-related sectors. There are no river basin organizations. Instead, the regional directorates of the General Directorate of State Hydraulic Works are the main planning and implementing organizations for water resources development at the basin level. International relations on transboundary water resources are in the realm of the Prime Minister's Office and the Department on Regional and Transboundary Waters of the Ministry of Foreign Affairs.

Annex 2

Existing agreements related to the management of transboundary water bodies in the Caucasus

<i>Countries^a</i>	<i>Water body/ basin concerned</i>	<i>Title/key provisions</i>	<i>Signed (S) Entry Into force (E)</i>
AM, AZ	River Vorotan	The agreement of 1974 between the Soviet Socialist Republic of Armenia and the Soviet Socialist Republic of Azerbaijan on the joint utilization of the waters of the river Vorotan (concerning the diversion of the Vorotan-Arpa-Sevan), which predetermines allocation of 50 per cent of these waters to each party	1974
TR, GE		Protocol on cooperation in field of energy between the Ministry of Energy and Natural Resources of the Republic of Turkey and the Fuel and Energy State of Cooperation of Georgia	1996
AZ, GE		Intergovernmental agreement on Environmental cooperation signed and entered into force on 18 February 1997 in Baku. It covers cooperation within the protection and regulation of transboundary ecosystems. The Agreement provides that the parties "unite their efforts to protect their catchments from pollution, as well as management of water resources".	1997 (S & E)
AZ, GE	Jandari Reservoir (on the Kura) ^b	According to the agreement concluded in 1993 between the State Committee of Irrigation and Water Economy of the Azerbaijan Republic and Department of management of melioration systems of Georgia, a water volume of 70 mln.m ³ is annually delivered from Georgia to Jandari water reservoir, including 50 mln.m ³ for irrigation of 8,500 hectares of land in the Akstaphi region of Azerbaijan and 20 mln.m ³ for maintaining the ecological balance of the water reservoirs.	1993
GE, AM		The agreement between the Governments of Georgia and Republic of Armenia on cooperation in Environmental Protection (1997). The Agreement provides that the parties "will endeavour to establish links between national systems for monitoring status of the environment and relevant databases.	1997 (S)
GE, AZ	Kura River Basin	The Memorandum of Understanding between the Ministry of Environment of Georgia and the State Committee of Ecology and Nature Management of the Republic of Azerbaijan (currently the Ministry of Ecology) on cooperation in the development and implementation of pilot projects for monitoring and assessment of the status of the Kura River basin (1997).	1997
GE, AZ		The Memorandum of Understanding between the Ministry of Environment of Ecology and Natural Resources of Azerbaijan and the Ministry of Environment Protection and Natural Resources of Georgia provides for the establishment of working groups with the objective of exchanging monitoring information, protecting and using transboundary waters and developing a joint programme in this area.	2007 (S)
TR, USSR		An agreement between Turkey and the Soviet Union "Protocol on the beneficial uses of boundary waters" concerning border issues, river bank protection, water allocation, joint commission...etc. The bilateral commissions between Armenia and Iran and between Azerbaijan and Iran operate on this basis.	1927

<i>Countries^a</i>	<i>Water body/ basin concerned</i>	<i>Title/key provisions</i>	<i>Signed (S) Entry Into force (E)</i>
TR, IR	Sarisu and Karasu rivers	“Protocol on the joint utilization of the waters of Sarisu and Karasu rivers” between Turkey and Iran. It includes, for example, basic principles of the water use in the border region, water use for irrigation, minimum water flow and water allocation.	1955 (S)
TR, USSR	Ahuryan/Arpaçay River	The Protocol on the meeting of the Turkish-Soviet Joint Commission pertaining to 1964 the joint construction of a dam on the Arpacay (Ahuryan). The Protocol includes principles concerning joint planning, project, and construction of the dam, construction cost, usage of the reservoir waters, and other issues.	
TR, USSR/ AM	Ahuryan/Arpaçay River	Cooperation Agreement between the Republic of Turkey and the Union of Soviet Socialist Republics on the Construction of a Dam on the Bordering Arpaçay (Ahuryan) River and the Constitution of a Dam Lake. The agreement mainly covers joint construction of the dam and its reservoir, joint operation and use of the waters from the reservoir The dam was operated by Turkey and USSR and, since the 1990s, by Turkey and Armenia.	1975
TR, USSR		Protocol concerning mainly technical cooperation, river bed changes, construction of joint hydro-technical facilities.	1990
TR, GE	Coruh River	Agreement between the Government of Georgia and the Republic of Turkey on cooperation in the field protection of the environment for improving the condition of surface and sea waters as well as exchange of information on the condition of the Chorokhi/Coruh River	1997 (S), 1998 (E)
TR, GE		Protocol regarding cooperation in the energy field	1999
TR, GE		Protocol concerning agricultural, energy and environmental issues	2005

^a Country names have been abbreviated as follows: Armenia (AM); Azerbaijan (AZ); Georgia (GE), Islamic Republic of Iran (IR); Russian Federation (RU); Turkey (TR)

^b National objectives for integrated planning & management of the Kura-Aras river basin. UNDP/Sida project Reducing Trans-boundary Degradation of the Kura-Aras river basin. 2005

Annex 3

Status of ratification of selected international agreements relevant to transboundary water management by the Caucasus and neighbouring countries

Treaty	Countries					
	AM	AZ	GE	IR	RU	TR
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention, Helsinki, 1992)		a			A	
Protocol on Water and Health (UNECE Water Convention, London, 1999)	S	a	S		A	
Protocol on Civil Liability (UNECE Water Convention and Industrial Accidents Convention, Kiev, 2003)	S		S			
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention, 1991)	a	a			S	
Protocol on Strategic Environmental Assessment (SEA Protocol to the Espoo Convention, Kiev, 2003)	S		S			
Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention, Helsinki, 1992)	•	•			•	
Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention, 1998)	R	a	R			
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971)	•	•	•	•	•	•
Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Teheran, 2003)		•		•	•	

Notes: Country names have been abbreviated as follows: Armenia (AM); Azerbaijan (AZ); Georgia (GE), Islamic Republic of Iran (IR); Russian Federation (RU); Turkey (TR). S = signed, R = ratified, A = accepted, a = accessed, • = Party