

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

# Model Provisions on Transboundary Groundwaters



UNITED NATIONS

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ECE/MP.WAT/40

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

# **Model Provisions** **on Transboundary Groundwaters**



**UNITED NATIONS**

New York and Geneva, 2014



Les Tines de Parnant, France. Source: UNECE.

# Foreword

With the increasing use of groundwater resources worldwide, the need for stronger specific cooperation on transboundary groundwaters has become ever more evident and urgent. Governments are beginning to realize the need to develop bilateral and multilateral cooperation on the use and protection of their transboundary groundwaters, including exchange of data and information on their status and pressures, joint delineation and status assessment and development of methodologies for joint monitoring, as well as plans for management and protection of these resources.

Taking the lead in this area, Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) developed a study on the specific application of the Convention's principles to transboundary groundwater. Subsequently, they decided to further support progress towards achieving improved cooperation by developing these Model Provisions on Transboundary Groundwaters.

The Water Convention requires Governments to enter into agreements and other arrangements concerning the management and protection of their transboundary waters — both surface waters and groundwaters. The Model Provisions on Transboundary Groundwaters are a basis on which specific groundwater agreements could be developed by riparian States, either in the form of an additional protocol to an existing water agreement, or in form of a transboundary water agreement focusing on groundwater or addressing groundwater along with surface waters.

The Model Provisions are a product of an inspiring collaboration of legal and technical experts who worked assiduously and enthusiastically to find a common language in order to apply often rigorous legal theory to complicated hydrological phenomena and physical processes.

The Model Provisions reflect the current state of international water law with regard to transboundary groundwaters and also show, in the commentaries, the practical ways and examples of its application in inter-State practice. Needless to say, the Model Provisions are a living document, which can be adapted to the needs of cooperating States as well as further developed in the future. Moreover, the Water Convention, through its working and technical bodies, stands ready to further help Governments and interested stakeholders in formulating additional legal and technical details and finding solutions for sustainable management of their transboundary surface waters and groundwater resources.

We encourage both Parties and non-Parties to the Water Convention to use the Model Provisions in order to strengthen transboundary cooperation on groundwaters, as well as on integrated management of transboundary surface waters and groundwaters. In particular, we suggest that Governments analyse their transboundary water cooperation agreements in force in order to clarify their scope in relation to transboundary groundwaters. Such analyses would be instrumental to assess the needs for revising existing agreements or entering into new agreements in order to ensure that adequate legal and institutional frameworks for the management and protection of transboundary groundwaters are in place.



Attila Tanzi  
Chair  
Legal Board (2010–2012)



Heide Jekel  
Chair  
Working Group on Integrated  
Water Resources Management (2010–2012)

Sample collection from an observation well. Source: Boris Korolev.



# Preface

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) was adopted in Helsinki, Finland, in 1992 and entered into force in 1996. It serves as a mechanism to strengthen national measures and international cooperation for the ecologically sound management and protection of transboundary surface waters and groundwaters. As of 31 October 2013, the Water Convention has 39 Parties in the United Nations Economic Commission for Europe (ECE) region, and is expected to achieve broader participation with its global opening to all United Nations Member States.

At its fifth session, in 2009, the Meeting of the Parties to the Water Convention mandated its Legal Board and the Working Group on Integrated Water Resources Management to prepare a preliminary study on the application of the principles of the Convention to transboundary groundwaters.

The study was discussed in 2011 first by the Legal Board and then by the Working Group on Integrated Water Resources Management. The two bodies agreed that the work should also aim at developing draft model provisions on transboundary groundwaters, in order to provide specific non-binding guidance for the implementation of the Convention in that area and to facilitate the application of the principles of the Convention to transboundary groundwaters. The Working Group therefore created a Core Group on Groundwater to develop the model provisions.

The Model Provisions on Transboundary Groundwaters, developed by the Core Group on the basis of a draft prepared by the Chair and the Vice-Chair of the Legal Board, reflect the outcomes of the two meetings of the Core Group on Groundwater in 2012. They also reflect the comments from subsequent rounds of commenting by members of the Core Group, as well as input from the participants at the joint meeting of the Working Group on Monitoring and Assessment and Working Group on Integrated Water Resources Management in July 2012 and by the Convention's focal points following the joint meeting. The resulting document comprises an introduction followed by nine model provisions, each accompanied by a commentary.

The Meeting of the Parties, at its sixth session, held in Rome, Italy, in 2012, adopted the Model Provisions on Transboundary Groundwaters and their commentary and invited Parties to the Convention and other States to use them when entering into or reviewing bilateral or multilateral agreements or arrangements on transboundary groundwaters.

# Acknowledgements

The UNECE secretariat gratefully acknowledges the substantive contributions provided by the members of the Water Convention's Legal Board and the Working Group on Integrated Water Resources Management to the development of the Model Provisions.

The Model Provisions were developed by the Core Group on Groundwater on the basis of a draft prepared by Mr. Attila Tanzi (Italy), Chair of the Legal Board, and Mr. Alexandros Kolliopoulos (Greece), Vice-Chair of the Legal Board.

The Core Group on Groundwater was chaired by Mr. Attila Tanzi (Italy) and was composed of legal and water experts from the following countries and organizations: Ms. Naira Kachyants (Armenia), Mr. Andreas Scheidleder (Austria), Mr. Adishirin Alakbarov (Azerbaijan), Ms. Volha Biarozka (Belarus), Mr. Boban Jolovic (Bosnia and Herzegovina), Ms. Anca Leroy (France), Mr. Antti Belinskij (Finland), Mr. Ivane Shvelidze (Georgia), Ms. Heide Jekel (Germany), Mr. Alexandros Kolliopoulos (Greece), Ms. Reka Gaul (Hungary), Mr. Oleg Podolny (Kazakhstan), Mr. Tom Schaul (Luxembourg), Ms. Tamara Guvir and Ms. Veronica Josu (Republic of Moldova), Ms. Ruxandra Balaet (Romania), Mr. Boris Korolev (Russian Federation), Ms. Dragana Milovanovic (Serbia), Mr. Peter Malik (Slovakia), Ms. Maria Casado and Mr. Antonio Pérez Baviera (Spain), Mr. Ronald Kozel (Switzerland), Ms. Ljupka Dimoska Zajkov (the former Yugoslav Republic of Macedonia), Mr. Grygorii Petruk and Ms. Svitlana Maslienko (Ukraine), Mr. Farkhod Khakimov (Uzbekistan), Mr. John Chilton (International Association of Hydrogeologists), Mr. Serhiy Vykhryst (European ECO-Forum), Ms. Ghene Jalalite (Eco-TIRAS International Environmental Association of River Keepers), Ms. Francesca Bernardini, Ms. Iulia Trombitcaia, Ms. Annukka Lipponen, Ms. Nataliya Nikiforova and Mr. Leonid Kalashnyk from UNECE secretariat.

The Core Group strongly benefited from support and advice provided by Ms. Alice Aureli and Mr. Matthew Lagod of the International Hydrological Programme of the United Nations Educational, Scientific and Cultural Organization.

Ms. Iulia Trombitcaia of the UNECE secretariat prepared the publication. The publication was edited by Ms. Amy Edgar. Mr. Serhiy Vykhryst translated the publication into Russian. Ms. Cammile Marcelo of the UNECE secretariat provided general support to the preparation of the publication.

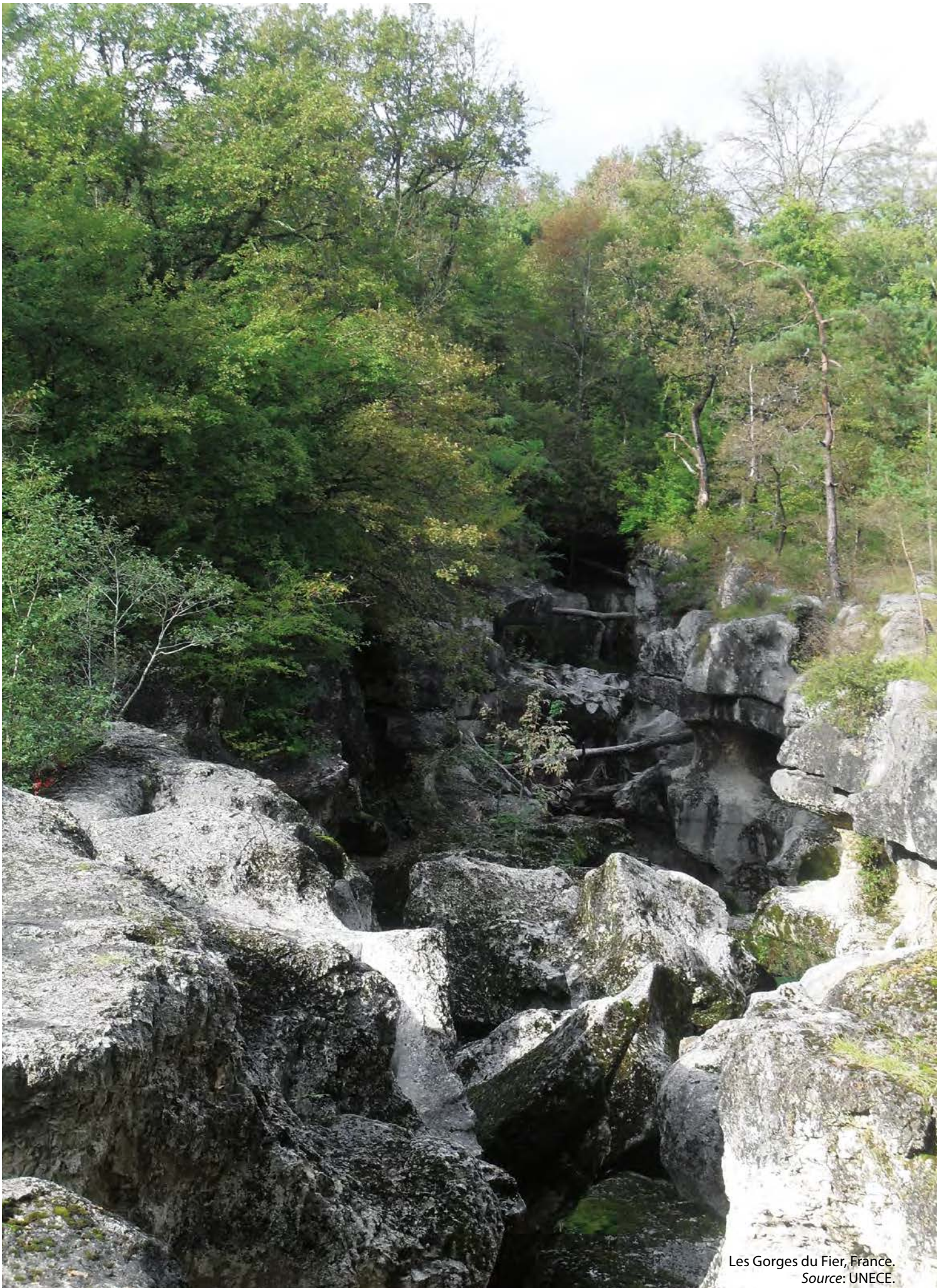


Core Group on Groundwater, June 2012. Source: UNECE.



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Les Gorges du Fier, France.  
Source: UNECE.

## Introduction

1. There is general agreement that groundwater has long been neglected by international water law. The easier accessibility of surface water as compared with groundwater and the “invisibility” of groundwater, together with the generally slow movement of groundwater compared to surface water, largely account for such neglect. However, due to the impacts of climate change and the widespread pollution of surface water as a result of human activity, groundwater, being more protected, will certainly play an increasing role in meeting the need for water worldwide.

2. The majority of international water agreements address transboundary surface waters, while only few contain specific provisions on groundwaters<sup>1</sup> and even fewer are wholly devoted to them. Among the very few such agreements one may recall the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer between the communes of the Annemasse Region, the Genevese communes and the commune of Viry, on the one hand, and the Republic and Canton of Geneva, on the other. This replaced the previous 1978 Agreement on the Protection, Utilization and Recharge of the Franco-Swiss Genevese Aquifer, concluded between the State Council of the Republic and Canton of Geneva and the Prefect of Haute-Savoie. A more recent example is the 2010 Guarani Aquifer Agreement between Argentina, Brazil, Paraguay and Uruguay. In some water agreements their scope of application has been determined to encompass surface and groundwaters alike; nonetheless, their substantive provisions in practice address primarily surface waters.

3. The increasing awareness of the prospects of water scarcity in relation to the growing demands for clean water and to the adverse impact of climate change on the need for water has recently focused the attention of the scientific and diplomatic communities on groundwater. Against this background, given the complex physical specificity of groundwater resources in their hydrological and geological aspects, even if they fall within the scope of the same general international water law principles as surface waters, the need was felt for specific regulatory guidance on the matter. The most relevant and recent development to that effect is the consolidation of the general principles

of international water law applicable in this area in the 2008 draft Articles on The Law of Transboundary Aquifers<sup>2</sup> of the United Nations International Law Commission (ILC Draft Articles), endorsed and commended to the United Nations Member States by the General Assembly in 2008 and 2011.<sup>3</sup> The present exercise builds on that instrument with a view to providing concrete guidance for implementing, with regard to groundwater, the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) in the light of the lessons learned and the experience gained from the implementation of the Convention.

4. It should be noted that the terminology used in the existing international legal texts addressing transboundary groundwaters is not uniform. The Water Convention uses the term “groundwater”, while in the Guide to Implementing the Convention<sup>4</sup> the term “aquifer” is also used: “As for groundwaters, the Convention includes both confined and unconfined aquifers.”<sup>5</sup> In some other legal texts the meaning of the term “aquifer” is distinguished from the meaning of the term “groundwater”. For instance, the International Law Association (ILA) 2004 Berlin Rules on Water Resources (2004 Berlin Rules), as well as the European Union (EU) Water Framework Directive<sup>6</sup> define aquifer as the underground geological formation which functions as a container for water,<sup>7</sup> while groundwater is conceived as the water contained therein.<sup>8</sup> In the ILC Draft

<sup>1</sup> See, for instance, article 7 (e) of the 1992 Agreement between Germany and Poland on Cooperation in the Field of Water Management, or article 6 (a) of the 1994 Convention on Cooperation for the Protection and Sustainable Use of the River Danube.

<sup>2</sup> *Official Records of the General Assembly, Sixty-third Session, Supplement No. 10 (A/63/10)*, p. 19.

<sup>3</sup> See United Nations General Assembly resolutions 63/124 and 66/104 on the law of transboundary aquifers.

<sup>4</sup> The draft guide contained in the annex to document ECE/MP.WAT/2009/L.2 was adopted by the Meeting of the Parties to the Convention at its fifth session in November 2009. Updated version of the Guide was published in 2013, see *Guide to Implementing the Water Convention* (ECE/MP.WAT/39), available from <http://www.unece.org/env/water/publications/pub.html>.

<sup>5</sup> ECE/MP.WAT/2009/L.2, annex, para. 73.

<sup>6</sup> Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

<sup>7</sup> Under article 3, para. 2, of the 2004 Berlin Rules “Aquifer” means a subsurface layer or layers of geological strata of sufficient porosity and permeability to allow either a flow of or the withdrawal of usable quantities of groundwater”, while according to article 2, para. 11, of the EU Water Framework Directive “Aquifer” means a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater”.

<sup>8</sup> According to article 3, para. 11, of the 2004 Berlin Rules “Groundwater” means water beneath the surface of the ground located in a saturated zone and in direct contact with the ground or soil”, while under article 2, para. 2, of the EU Water Framework Directive “Groundwater” means all water



Wetlands in S'Albufera, Mallorca, Spain. Source: UNECE.

Articles, the latter term refers to the water-bearing geological formation, as well as to the water contained therein.<sup>9</sup> The EU Water Framework Directive also refers to “groundwater bodies” meaning the distinct volumes of groundwater within an aquifer or aquifers.<sup>10</sup> For the purposes of the present Model Provisions, the term “groundwaters” refers to the water contained in a geological formation. The present Model Provisions also apply to the geological formation containing the water and allowing the flow of groundwater.

5. As to the determination of the transboundary character of groundwaters, thus falling under the scope of the present Model Provisions, reference should be made to the scope of application of the Water Convention with respect to groundwaters. According to article 1, paragraph 1, of the Convention groundwaters “which [...] cross or are located on boundaries between two or more States” are of a transboundary character. Therefore, any groundwaters which are intersected by State boundaries are considered as transboundary and thus subject to the provisions of the Water Convention, even if those groundwaters are not connected to the catchment area of any transboundary surface waters.<sup>11</sup> Especially with regard to aquifers, the transboundary nature of groundwaters may not be established by mere physical observation, as is the case for surface waters. Therefore, technology, such as isotope tracing, may be necessary in order to define the outer limits of an aquifer.<sup>12</sup>

6. Despite the above considerations, the scope of application of the Convention, given the integrated approach adopted in article 2, paragraph 6, also covers groundwaters located exclusively within the territory of one State if they interact with transboundary surface

waters (e.g., located in the discharge zone of those groundwaters).<sup>13</sup> As is clearly explained in the Guide to Implementing the Convention, “Article 2(6) provides that transboundary waters should not be limited to a water body (e.g. a river, a lake, an aquifer), but should cover the catchment area of the said water body”.<sup>14</sup>

7. In fact, under article 1, paragraph 1, of the Convention the general principles and rules of international water law codified therein are equally addressed to surface waters and groundwaters alike. However, the unavoidable increase of human impact on groundwaters, as well as some of their specific features, call for further specific normative guidance on the proper implementation and application of the principles of the Convention in this area. First, groundwater is usually characterized by more relative purity than surface water thanks to the capacity of many soil and subsoil profiles in recharge areas to protect the underlying groundwater from pollution. If, however, pollutants do reach groundwater, the often very slow movement of groundwater compared to surface water and relative lack of attenuation capacity within aquifers compared to soils may produce a situation in which persistent pollutants remain in groundwater at troublesome concentrations for a very long time.

8. Second, the relationship between surface waters and groundwaters is more variable and less predictable than that between surface waters, i.e., upstream and downstream waters. The pollution of groundwater deriving from wastewater discharges into surface water or surface water stream-flow depletion caused by exploitation of groundwater are less evident, but no less important than surface-to-surface water interactions.

9. Based on the general principles of international water law as reiterated in Model Provisions 1, 2 and 4, the present Model Provisions aim to provide practical guidance for States in the application of such general principles with regard to the specificities of groundwater. Accordingly, the following Model Provisions are meant to offer assistance to States sharing transboundary groundwaters intersected by State boundaries or sharing transboundary surface waters linked with groundwaters in drawing up specific agreements addressing the sustainable use,

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which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil”.

<sup>9</sup> According to article 2, subpara. (a), of the draft “aquifer” means a permeable water-bearing geological formation underlain by a less permeable layer and the water contained in the saturated zone of the formation”. See also para. 1 of the ILC commentary to article 2 of the Draft Articles, where it is stressed that “the definition of an aquifer in subparagraph (a) offers the precise description of the two elements of which an aquifer consists and activities relating to which must be regulated. One element is the underground geological formation which functions as a container for water. The other element is the water stored therein which is extractable” (A/63/10), pp. 34–35.

<sup>10</sup> Article 2, para. 12, of the Directive.

<sup>11</sup> Article 42, para. 1 (b), of the 2004 Berlin Rules provides that “The Rules applicable to internationally shared waters apply to an aquifer if: ... (b) It is intersected by the boundaries between two or more States even without a connection to surface waters that form an international drainage basin”.

<sup>12</sup> See A/63/10, para. 4 of the commentary to article 2, p. 37.

<sup>13</sup> See also article 42, para. 1 (a) of the 2004 Berlin Rules: “The Rules applicable to internationally shared waters apply to an aquifer if: ... (a) It is connected to surface waters that are part of an international drainage basin.”

<sup>14</sup> Para. 74.



management and protection of those groundwaters through cooperation. Obviously, the present Model Provisions should be adjusted by the States concerned according to their specific needs and the particular characteristics of each case. The States concerned, when referring to the present Model Provisions, may also elaborate more detailed or more stringent provisions on a case-by-case basis.

10. Specific groundwater agreements could be in the form of an additional protocol to an existing water agreement concluded pursuant to article 9 of the Water Convention and lacking specific reference to groundwater. Specific provisions addressing groundwaters and transboundary cooperation thereon could also be included in the main body of “agreements or arrangements” under the same article 9. Another possibility would be to draw up a totally new and separate specific agreement on groundwaters, particularly where the States concerned are of the view that a given aquifer is unrelated to surface waters or cannot be easily assigned to a specific international river basin.

## Model Provisions

### Provision 1

1. Each Party shall, in its utilization of transboundary groundwaters, or while undertaking any activity affecting in any way transboundary groundwaters, take all appropriate measures to prevent, control and reduce any transboundary impact.
2. The Parties shall use transboundary groundwaters in an equitable and reasonable manner, taking into account all relevant factors, including under agreements applicable between them.

### Commentary to Provision 1

1. This Provision restates the two general principles which, through their mutual interaction, provide the cornerstone of international law in the field of transboundary waters, whether surface waters or groundwaters. One is the no-harm rule provided for in article 2, paragraph 1, of the Water Convention and the other is the equitable and reasonable utilization principle set out in article 2, paragraph 2 (c), of that instrument. Both are closely interlinked with the sustainability principle, set out in article 2, paragraph 5 (c), of the Convention and spelled out for the present purposes in Model Provision 2. Specific care in the application of the two principles to groundwaters is required in relation to, inter alia, the lower capacity

of self-purification of groundwater as compared with surface water.

2. The equitable and reasonable utilization principle and the no-harm principle are not a novelty in the Water Convention process: they are both based on customary international law, as they have been repeatedly endorsed by the case-law of the International Court of Justice, and other authoritative international instruments, with special regard to the 1997 United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (1997 International Watercourses Convention). Most importantly for the purposes of the present exercise, they are provided for in articles 4 and 6 of the ILC Draft Articles, as well as in article 2, paragraph 1, and article VI, paragraph 1, of the 1989 Bellagio Model Agreement concerning the Use of Transboundary Groundwaters (Bellagio Model Agreement).

3. As already indicated, the principle of equitable and reasonable utilization and the no-harm rule are closely intertwined and neither enjoys priority over the other. This is clear from the very wording of article 2, paragraph 2 (c), of the Water Convention, as well as from articles 5, 6 and 7 of the 1997 International Watercourses Convention. With regard to their application to groundwater, it should be noted that the two principles are merged into a single provision in the Guarani Aquifer Agreement (article 3).

4. There is no pre-established formula providing, for each aquifer, the fair allocation of water between the aquifer States. This kind of assessment is to be made on a case-by-case basis bearing in mind that no use or allocation of groundwater enjoys inherent priority over the others, save for those uses that address vital human needs.

5. The equitable and reasonable use of transboundary groundwaters should take into account all relevant factors for the apportionment of the uses of groundwaters in case of conflicting claims between the aquifer States. Those factors are provided in article 5 of the ILC Draft Articles and in article VIII, paragraph 3, of the Bellagio Model Agreement, and include the social and economic needs of the aquifer States, the population dependent on the aquifer, and the effects of a certain use on the other aquifer States. They also take into account specific technical elements, such as the characteristics of the aquifer or aquifer system, the contribution from within each State to the recharge of the aquifer, the availability of alternative water resources and the role of the aquifer in the related ecosystems.

The importance of each factor is not predetermined, as some of them may be accorded more weight in some cases and less in others.

6. When evaluating transboundary groundwaters, the aquifer States should first assess their status, preferably through joint monitoring and assessment as provided in article 11 of the Water Convention, and exchange all relevant information, taking into account the provisions of article 13 of the Water Convention.

### Provision 2

1. The Parties shall use transboundary groundwaters in a sustainable manner, with a view to maximizing the long-term benefits accruing therefrom and preserving groundwater-dependent ecosystems.
2. To that end, the Parties shall take into due account the functions of groundwater resources, the amount and the quality of groundwater in reserve and the rate of its replenishment, making their best efforts to prevent the diminution of the groundwater reserve from reaching a critical level.

### Commentary to Provision 2

1. Paragraph 1 enunciates the principle of sustainable management of transboundary groundwaters. Article 2, paragraph 5 (c), of the Water Convention provides that “water resources shall be managed so that the needs of the present generation are met without compromising the ability of future generations

to meet their own needs”. This provision addresses both the quality and quantity of water. Having specific regard to transboundary groundwaters, according to article 3, paragraph 19, of the 2004 Berlin Rules: “sustainable use means the integrated management of resources to assure efficient use of and equitable access to water for the benefit of current and future generations while preserving renewable resources and maintaining non-renewable resources to the maximum extent reasonably possible”. Article 4, subparagraph (b), of the ILC Draft Articles also provides that the aquifer States “shall aim at maximizing the long-term benefits derived from the use of water contained therein”.

2. The sustainable use of transboundary groundwaters is closely linked to their equitable and reasonable utilization. In fact, the management of transboundary waters in such a way as to jeopardize their preservation would not be equitable and reasonable for the purposes of international water law. The principle of equitable and reasonable utilization, through its association with the principle of sustainable development, acquires a prospective dimension, ensuring not only actual equity among the aquifer States, but also equity among present and future generations. In assessing whether a certain utilization of transboundary waters is of an equitable character, the aquifer States should take into account the imperatives of conservation, environmental protection and future availability of waters, and not limit themselves to considering whether the planned utilization allows for an optimal use of the waters from a purely short-term economic point of view.



Measuring the oxidation-reduction potential of groundwater.  
Source: Boris Korolev.





Water intake. Source: GESDEC, Canton of Geneva, Switzerland.

3. The sustainability principle is formulated in paragraph 1 in flexible terms, as it applies to groundwaters in a differentiated manner. Namely, in case of recharging aquifers, its aim is to preserve renewable resources, while in the case of non-recharging aquifers, its object is to maintain non-renewable resources to the maximum extent reasonably possible.<sup>15</sup> However, as far as water quality is concerned, compliance with the sustainability principle may require greater protection for groundwater as compared with surface waters because of the greater technical difficulty and higher cost of its remediation.

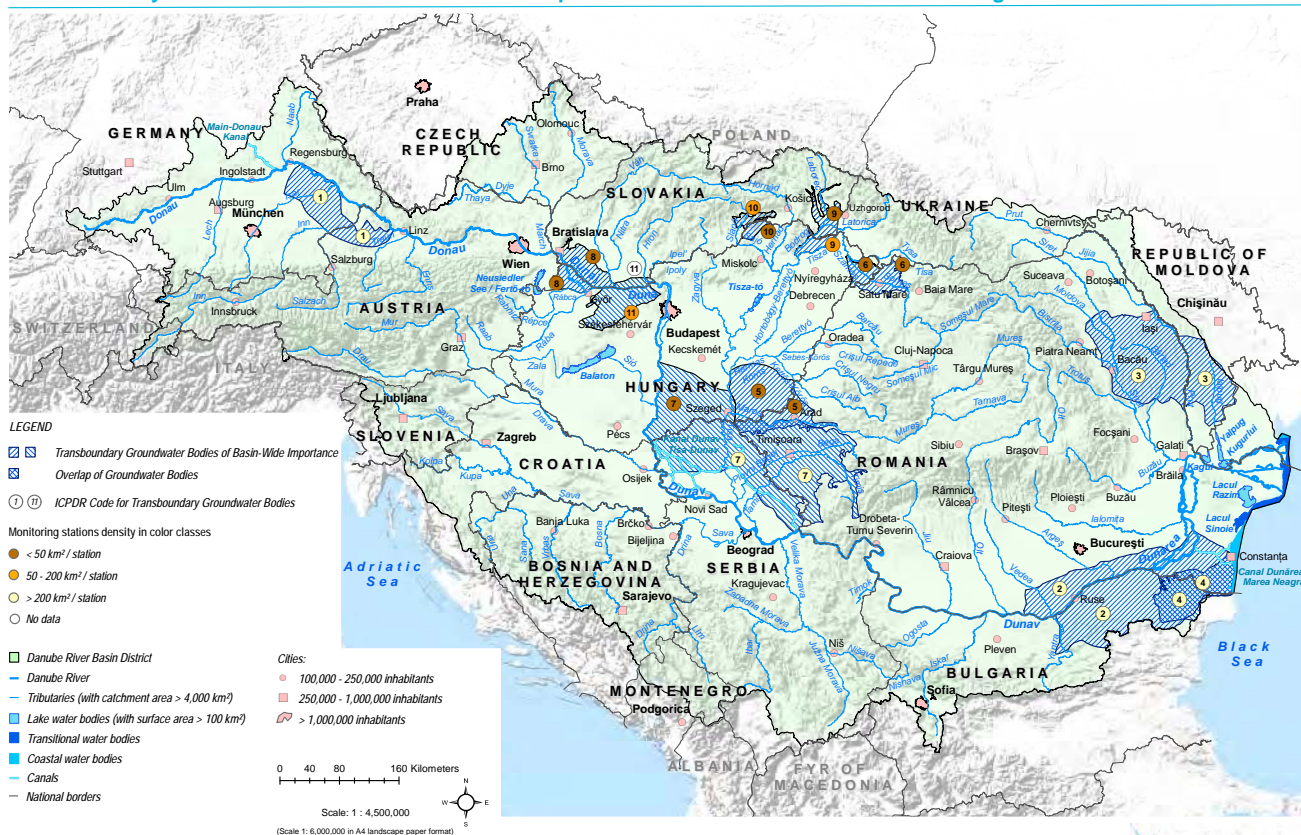
4. Paragraph 2 is a specific application of the sustainability principle to recharging aquifers. It draws from article 4 of the 1989 ECE Charter on Groundwater Management (E/ECE/1197–ECE/ENVWA/12). It aims to strike a balance between abstraction and replenishment of groundwaters. In the same vein, annex V to the EU Water Framework Directive provides that “good quantitative status implies, inter alia, that the level of groundwater in the groundwater body is

such that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction”. In fact, if water withdrawals are not less than long-term recharge, both quantity and quality of groundwaters are compromised, for example, through saline water intrusion in coastal zones or from adjacent aquifers.

5. A practical tool for applying paragraph 2 would be for the Parties to agree on the maximum quantities of abstraction through yearly utilization programmes, as provided in article 1, paragraph 1, of the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer; in article 2, paragraph 1, and article 9 of the previous 1978 Agreement; in article 4, paragraph 1, of annex II to the 1994 Israel-Jordan Treaty of Peace; and in paragraph 5 of the 1973 Minute 242 of the United States-Mexico International Boundary and Water Commission, where the Parties agreed to limit groundwater pumping within a precisely defined geographic region along the Arizona-Sonora border to specifically enumerated withdrawal targets. The Parties could also consider developing commonly agreed hydrological models.

<sup>15</sup> See article 3, para. 19, of the 2004 Berlin Rules.

### Danube River Basin District: Transboundary Groundwater Bodies of Basin-Wide Importance and their Transnational Monitoring Network



This ICPDR product is based on national information provided by the Contracting Parties to the ICPDR (AT, BA, BG, CZ, DE, HR, HU, MD, RO, RS, SI, SK, UA) and CH, except for the following: EuroGlobalMap v2.1 from EuroGeographics was used for national borders of AT, CZ, DE, HR, HU, MD, RO, SI, SK and UA; ESRI data was used for national borders of AL, ME, MK; Shuttle Radar Topography Mission (SRTM) from USGS Seamless Data Distribution System was used as topographic layer; data from the European Commission (Joint Research Center) was used for the outer border of the DRBD of AL, IT, ME and PL.

Vienna, December 2009

[www.icpdr.org](http://www.icpdr.org)



Source: ICPDR.

### Provision 3

1. The Parties shall cooperate in the common identification, delineation and characterization of their transboundary groundwaters. They shall also strive to develop common conceptual models whose level of detail depends on the complexity of the system and the pressures weighing on it.

2. The Parties shall establish programmes for the joint monitoring and assessment of quantity and quality of transboundary groundwaters. To this end, they shall, inter alia:

- (a) Use common or harmonized standards and methodologies;
- (b) Agree upon assessment criteria and key parameters to be regularly monitored, taking into account the specific features of the groundwaters;
- (c) Establish a groundwater monitoring network linked to the monitoring of surface waters, where appropriate;
- (d) Develop appropriate hydrogeological maps, including vulnerability maps and mathematical models where appropriate.

### Commentary to Provision 3

1. The Parties should agree on the identification, spatial extent, recharge and discharge area and on the main flow direction of their transboundary groundwaters, as a prerequisite for their cooperation. Annex II to the EU Water Framework Directive provides specific guidance on the parameters which should be taken into account for the characterization of groundwater bodies. States should identify the location and boundaries of groundwater bodies, assess their uses and their environmental status. This analysis, according to paragraph 2.1 of annex II, may "employ existing hydrological, geological, pedological, land use, discharge, abstraction and other data".<sup>16</sup>

2. In the characterization process the use of conceptual models may be of assistance, as is the case in the context of the implementation of EU Water Framework

<sup>16</sup> See also European Communities, *Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Document No. 2: Identification of Water Bodies* (Luxembourg, 2003), available under the rubrics "Browse categories", "Environment", "WFD CIRCA: 'Implementing the Water Framework Directive'", "Library", "Official documents" and "Published Guidance Documents" from <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp>.

Directive. A hydrological conceptual model describes and may attempt to quantify the relevant geological characteristics, flow conditions, hydrogeochemical and hydrological processes and anthropogenic activities and their interactions. Conceptual models can be developed to different degrees of complexity, from simple qualitative descriptions of the geology to complex combinations of qualitative and quantitative descriptions of hydrogeological processes and their impacts.<sup>17</sup>

3. The wording of the second paragraph draws from article 11 of the Water Convention and from article 13 of the ILC Draft Articles. Article 8 of the EU Water Framework Directive, as well as article 4 of the EU Directive on the protection of groundwater against pollution and deterioration (2006 EU Groundwater Directive),<sup>18</sup> also provide for the monitoring of groundwater status. Joint monitoring and assessment should be conducted primarily on the basis of the 2000 ECE *Guidelines on Monitoring and Assessment of Transboundary Groundwaters* (Guidelines on Monitoring and Assessment).<sup>19</sup> In addition to parameters usually monitored for all water bodies, such as an analysis of the chemical composition of water or the impact of land uses or potentially polluting activities in the recharge area on the groundwaters, monitoring of groundwaters should also take into account their specific features, i.e., aquifer geometry, aquifer vulnerability, recharge rates and interaction with surface waters, the general character of the overlying strata and the hydrogeological characteristics of the aquifer.<sup>20</sup>

4. The establishment of a groundwater monitoring network is suggested in the Guidelines on Monitoring and Assessment, while article 17 of the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer provides for the establishment of a monitoring network intended for the issuance of warnings in case

of accidental pollution. The development of aquifer vulnerability maps is suggested in the 1989 Charter on Groundwater Management, as well as in annex 16, subparagraph (ii), of the 1978 Agreement between the United States of America and Canada on Great Lakes Water Quality. Maps should reflect current hydrodynamical and hydrochemical conditions of transboundary groundwaters as well as their level of protection. Such maps should be developed following common or harmonized methodologies suitable for each particular aquifer type (e.g., different for karst aquifers and different for alluvial aquifers) and taking into account the quality and availability of relevant data.

#### Provision 4

The Parties shall cooperate on the integrated management of their transboundary groundwaters and surface waters.

#### Commentary to Provision 4

1. Where feasible, the Parties should integrate the management of surface waters and groundwaters with a view to progressing towards a so-called “conjunctive use” of the two resources. Such a holistic approach is envisaged in various instruments, such as articles 3 and 17 of the 1989 ECE Charter on Groundwater Management, article 4 of the 1986 Seoul Rules on International Groundwaters of the International Law Association, article 3, paragraph 1 (c), of the 1999 Convention on the Protection of the Rhine and article 11 of the 2002 Framework Agreement on the Sava River Basin.

2. In the same vein, according to preambular paragraph 33 of the EU Water Framework Directive, “the objective of achieving good water status shall be pursued for each river basin, so that measures in respect of surface waters and groundwaters belonging to the same ecological, hydrological and hydrogeological system are coordinated”.

#### Provision 5

1. The Parties shall take appropriate measures to prevent, control and reduce the pollution of transboundary groundwaters, especially those reserved for drinking water supply. In this context, they shall follow the precautionary principle in view of the vulnerability of groundwater to pollution, particularly in cases of possible uncertainty about the nature and extent of transboundary groundwaters.

<sup>17</sup> For information on conceptual models see *Common Implementation Strategy, Guidance Document No. 26: Guidance on Risk Assessment and the Use of Conceptual Models for Groundwater*, available under the rubrics “Browse categories”, “Environment”, “WFD CIRCA: ‘Implementing the Water Framework Directive’”, “Library”, “Official documents” and “Published Guidance Documents” from <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp>.

<sup>18</sup> Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration.

<sup>19</sup> Available from <http://www.unece.org/fileadmin/DAM/env/water/publications/documents/guidelinesgroundwater.pdf>.

<sup>20</sup> See Bellagio Model Agreement, as well as the EU Water Framework Directive, annex II, para. 2.

2. Such measures shall include, inter alia, the following:

- (a) The establishment of protection zones, in particular in the most vulnerable/ critical parts of the recharge area of groundwaters, especially of groundwaters used or intended to be used for the provision of drinking water;
- (b) The adoption of measures to prevent or limit the release of pollutants into groundwaters, such as negative influences on groundwater from point sources;
- (c) The regulation of land uses, including intensive agricultural practices, to combat pollution of groundwater from nitrates and plant protection agents;
- (d) The definition of groundwater quality objectives and the adoption of groundwater quality criteria.

### Commentary to Provision 5

1. Groundwaters are, in principle, less vulnerable to the access of pollutants than surface waters thanks to their protective cover. However, this protection is not ubiquitous, and the vulnerability of groundwater to pollution is highly variable, depending on the nature and thickness of the layer between the source of pollution and the groundwater (the pollution pathway). Pollution may remain in groundwater for a long time, inter alia, due to its slow flow regimes and because the self-purification capacity of aquifers varies according to the type of pollutant and water-bearing material. Moreover, once

polluted, aquifer clean-up can be technically impossible or uneconomic. It is thus of the utmost importance to prevent pollution of groundwater, and, to the extent possible, to improve the quality of groundwater. To this effect, article 3, paragraph 1 (k), of the Water Convention urges Parties to adopt and implement additional specific measures for preventing such pollution.

2. Various legal instruments contain general provisions dealing with the prevention and reduction of pollution of groundwater, similar to that found in the first sentence of Provision 5, paragraph 1. These include the ILC Draft Articles (article 12); the 1994 Convention on Cooperation for the Protection and Sustainable Use of the River Danube (1994 Danube Convention) (article 6, para. (b)); the 1998 Agreement on Cooperation for the Protection and Sustainable Use of the Waters of the Spanish-Portuguese Hydrographic Basins (article 13, para. 2 (b)); and the EU Water Framework Directive (article 4, para. 1 (b) (i)). The latter provides, in addition, in its article 4 (b) (iii), for the implementation of measures necessary to reverse upward trends in the concentration of pollutants.<sup>21</sup>

3. The second sentence of paragraph 1 draws inspiration from article 12 of the ILC Draft Articles and article 38 of the 2004 Berlin Rules, both provisions suggesting a precautionary approach so that States take early action to protect transboundary groundwaters.

4. The measures for combating pollution in the second paragraph are of an illustrative character,

<sup>21</sup> See also annex V of the Directive.



Sanitary protection zone of an abstraction well. Source: Boris Korolev.



Well in Finland. Source: Sirkku Tuominen.

and no hierarchy is established among them, as it is for the Parties to jointly assess the status and the particular needs of each transboundary aquifer and fix the priorities accordingly. For instance, measures for combating point sources of pollution or current diffuse pollution usually differ from those adopted in cases of historical contamination. In the latter case, the appropriate measures might include remediation, if feasible, or other management options such as prohibiting water abstraction for drinking water supply or establishing pumping barriers.

5. The establishment of protection zones is suggested in section 8.1, paragraph (c), of the Guidelines on Monitoring and Assessment; in article 14 of the 2010 Guarani Aquifer Agreement; in article 6, paragraph (a), of the 1994 Danube Convention; in article VIII, paragraph 2 (a) (5) of the Bellagio Model Agreement; and in article 7, paragraph 3, of the EU Water Framework Directive. This policy may also materialize by having recourse to a payment for ecosystem services scheme.<sup>22</sup> Any such initiative should be preceded by the adoption by the Parties of criteria governing the establishment of such zones, as it is usually not feasible to protect the whole recharge area. The Parties might also opt for two levels of protection zones, the first comprising zones with baseline measures of protection and the second enhanced protection zones, where more stringent

<sup>22</sup> See *Recommendations on Payments for Ecosystem Services in Integrated Water Resources Management* (United Nations publication, Sales No. E07.II.E.12).

regulations would apply. In addition, for some types of aquifers, such as karst aquifers, identifying such protection zones is technically difficult as the capture zone from which recharge is travelling to the abstraction point may be uncertain.

6. With regard to paragraph 2 (b), the adoption of measures for limiting or preventing the release of pollutants into groundwater is suggested in article 6 of the 2006 EU Groundwater Directive. Such measures may include the prohibition or strict regulation of the direct discharge of pollutants into groundwater,<sup>23</sup> the requirement for a permit to discharge and dispose of waste<sup>24</sup> and the establishment of a prior authorization regime for any artificial recharge of groundwater or any large-scale abstraction which might compromise the quality of groundwater.<sup>25</sup> Regulation and inventory of well construction and well abandonment is also necessary. In some cases groundwater is polluted through boreholes that are poorly isolated from the surface, or by abandoned wells used as waste disposal points.

7. Concerning paragraph 2 (c), pollution of groundwaters from diffuse sources on urban as well as on rural land is an issue of major concern. One may refer to section 8.1, paragraph (a), of the ECE Guidelines

<sup>23</sup> See EU Water Framework Directive, article 11, para. 3 (j).

<sup>24</sup> See ECE Charter on Groundwater Management, article XI, paras. 1 and 5.

<sup>25</sup> See EU Water Framework Directive, article 11, para. 3 (e) and (f).

on Monitoring and Assessment, or to annex 13, paragraph 1, of the 1978 Agreement on Great Lakes Water Quality. Most of the instruments dealing with this issue focus on the adverse impact deriving from agricultural practices, such as contamination of groundwater from nitrate, pesticides and fertilizers, which is not easily reversible.<sup>26</sup>

8. The adoption by the Parties of coordinated groundwater quality objectives and criteria is contemplated in annex III, paragraph (d), of the Water Convention. In addition, article 17 of the EU Water Framework Directive and, more explicitly, article 3 of the 2006 EU Groundwater Directive provide for the establishment of groundwater quality standards and threshold values which should not be exceeded.

#### Provision 6

The Parties shall establish arrangements for the exchange of information and available data on the condition of transboundary groundwaters, including available data on the parameters prescribed in Provision 3, as well as information on the status of use of transboundary groundwaters.

#### Commentary to Provision 6

1. The obligation to exchange information is prescribed in article 13 of the Water Convention, article 8 of the ILC Draft Articles, article V and paragraph 3, of the Bellagio Model Agreement, as well as in article 12 of the Guarani Aquifer Agreement. Article 16, paragraph 2, of the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer specifically provides that the Parties shall exchange data on the qualitative status of extracted water.

2. In the case of groundwaters, the exchange of information should also encompass information relating to the special characteristics of groundwaters. This is of particular importance if knowledge about the extent and nature of the aquifer, as well as about the identification of its recharge and discharge zones, is inadequate and there is a need to collect more data on the matter with a view to proceeding with the identification, delineation and characterization of relevant groundwaters provided for in Provision 3.

<sup>26</sup> On this issue, see in particular EU Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources and article 7, para. 2, of the 1994 Danube Convention.

#### Provision 7

1. The Parties shall establish and implement joint or coordinated plans for the proper management of their transboundary groundwaters, where appropriate.
2. Such management plans shall provide, inter alia, for:
  - (a) The allocation of water uses, taking into account all relevant factors, including present and future needs, as well as the needs of groundwater-dependent ecosystems;
  - (b) The recording of the volume of water abstractions and the prescription of a requirement of prior administrative authorization for abstraction and artificial recharge;
  - (c) The prescription of pumping limitations, inter alia, in the form of quantification of the aggregate of annual abstraction, and of criteria for the placement of new wells and the development of other abstraction facilities;
  - (d) The development of programmes of measures for preserving and rehabilitating groundwater quantity and quality.

#### Commentary to Provision 7

1. The establishment of plans for the sustainable management of transboundary groundwaters is provided for in article 14 of the ILC Draft Articles, as well as in article VIII of the Bellagio Model Agreement, and is in line with article 2, paragraph 6, of the Water Convention. Those plans should be coordinated among the Parties in case one joint management plan cannot be produced. For transboundary groundwaters related to surface waters, the principle of integrated management should also be taken into account. In such a case, the relevant plan for groundwaters could take the form of a specific management plan supplementing the management plan of the river basin to which the transboundary groundwaters in question are related.<sup>27</sup>

2. The elements of a management plan provided in paragraph 2 are of an illustrative character. Paragraph 2 (a) stems from the requirement of an equitable and reasonable use of transboundary groundwaters, in association with the sustainability principle. Specific reference is made to the needs of groundwater-related ecosystems, as groundwater quality and quantity is vi-

<sup>27</sup> EU Water Framework Directive, article 13, para. 5: "River basin management plans may be supplemented by the production of more detailed programmes and management plans for sub-basin, sector, issue or water type, to deal with particular aspects of water management."

tal for ensuring such ecosystems. Article 2, paragraph 2 (d), of the Water Convention provides, inter alia, that the Parties shall take all appropriate measures to ensure conservation of ecosystems. In this context, the *Guidelines on the Ecosystem Approach in Water Management*<sup>28</sup> should also be taken into account.

3. The recording of the volume of water abstractions should be related to the monitoring of groundwater levels. Paragraph 2 (b) draws on article 6 of the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer, which prescribes that all waterworks should be equipped with a device for the recording of the volume of water extracted, as well as on article 11, paragraph 3 (e), of the EU Water Framework Directive, providing for the establishment of a register of water abstractions as well as for a regime of prior authorization for abstraction, which implies that abstraction without such an authorization should in principle be prohibited.

4. The authorization should also prescribe abstraction ceilings. Paragraph 2 (c) is modelled on article VIII, paragraph 2 (c), of the Bellagio Model Agreement, while article 8 of the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-

Swiss Genevese Aquifer also provides for a yearly ceiling of the aggregate of water abstractions. It should be taken into account that in some climatic zones the inter-annual variability of groundwater recharge is high, and consequently the limit of abstraction needs to be set in relation to the replenishment and impact of abstraction in the long term.

5. Paragraph 2 (d) provides for joint programmes by the Parties aiming to preserve water quantity and quality. Such actions may encompass the measures against pollution of groundwater contained in Model Provision 5. The development by the Parties of programmes of measures for the reduction of pollution is already suggested in article 9, paragraph 2 (f), of the Water Convention.

### Provision 8

1. All planned activities which are likely to have a significant effect on transboundary groundwaters and, thereby, to have an adverse impact on another Party, shall be subject to an environmental impact assessment procedure. In addition, the Party of origin of the planned activity shall notify the other Party accordingly as early as possible and, if the latter so wishes, provide the environmental impact assessment documentation and enter into consultations with that Party.
2. The obligations of paragraph 1 shall apply, inter alia, in cases of large-scale abstractions of groundwater from the transboundary aquifer or in case of significant artificial groundwater recharge schemes.
3. The Parties shall adopt measures aiming at raising awareness and providing access to information, public participation and access to justice with respect to the conditions of transboundary groundwaters, and the proposed activities of paragraph 1.

### Commentary to Provision 8

1. Article 3, paragraph 1 (h), of the Water Convention requires the Parties to ensure that environmental impact assessment (EIA) and other means of assessment are applied. In addition, article 15 of the ILC Draft Articles obliges the aquifer State to assess, notify and consult with the other aquifer State, if it has grounds to believe that a particular planned activity in its territory may affect a transboundary aquifer and hence have a significant adverse effect upon that State. Detailed provisions in this regard are contained in Part III (articles 11–19) of the 1997 International Watercourses Convention, as well as in articles 9 to 11 of the Guarani Aquifer Agreement.



Observation well washing by use of a submersible pump.  
Source: Boris Korolev.

<sup>28</sup> *Protection of Water Resources and Aquatic Ecosystems* (ECE/ENVWA/31, Part One), available from <http://www.unece.org/env/water/publications/pub71.html>.

An obligation to inform and consult with the other Party on measures with significant impact on transboundary groundwaters is also to be found in article 7, paragraph (e), of the 1992 Agreement between Germany and Poland on Cooperation in the Field of Water Management.

2. Where all aquifer States are Parties to the 1991 ECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), they might explicitly refer to the latter Convention in their bilateral or multilateral agreement. But even if some or all of them are not Parties to the Espoo Convention, they should endeavour to take into account its provisions when applying Model Provision 8, as it provides a comprehensive framework for the participation of the potentially affected State in the EIA process. In addition, the 2003 Protocol on Strategic Environmental Assessment to the Espoo Convention is of particular assistance with regard to plans and programmes and, to the extent appropriate, policies and legislation, which are likely to affect transboundary groundwaters.

3. The obligation under paragraph 1 applies also to uses of transboundary aquifers not directly related to groundwater abstraction, such as the mining industry, extraction of mineral resources and construction materials, carbon storage, radioactive waste disposal, hydraulic fracturing, cooling and heating systems, etc. Even if the targets of some of those activities are deep underground, access to them by drilling might cause damage to aquifers located between the ground surface and the target geological formation.

4. Paragraph 2 of Model Provision 8 highlights two cases, specific to groundwaters, where a transboundary EIA process is needed. Paragraph 12 of appendix I to the Espoo Convention, as amended,<sup>29</sup> in conjunction with article 3 of that Convention, provides for an obligation to notify and involve in an EIA procedure any Party that might be affected by the transboundary impact of groundwater abstraction activities or artificial groundwater recharge schemes where the annual volume of water to be abstracted or recharged amounts to 10 million cubic meters or more. Similar provisions are also to be found in annex II, paragraph 4 (g) and (h), of the 1998 Agreement for the Protection and Sustainable Use of the Waters of the Spanish-Portuguese Hydrographic Basins and in paragraph 12 of the annex to the 1997 Agreement between the

Republic of Estonia and the Republic of Latvia on Environmental Impact Assessment in a Transboundary Context, as well as in annex I, paragraph 12, of the 2002 Agreement between Estonia and Finland on EIA in a transboundary context. However, it should be noted that paragraph 1 of the present Provision refers to the significant effect, not the scale, of the planned activity.

5. A useful example of inter-State cooperation in assessing the effects of an activity on transboundary groundwaters is the Garzweiler site in Germany, where mining activity has had an impact on the level of groundwaters shared between Germany and the Netherlands. Dutch experts were involved in the drafting of EIA reports, while the public was informed of the results of relevant monitoring programmes.<sup>30</sup>

6. Paragraph 3 draws inspiration from Provision 2, paragraph (d), of the 2006 ECE Model Provisions on Transboundary Flood Management (ECE/MP.WAT/19/Add.1). Detailed provisions in this regard are provided in the 1998 ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, while, in the field of water, useful guidance may be drawn from the ECE/United Nations Environment Programme co-publication, *Water Management: Guidance on Public Participation and Compliance with Agreements*.<sup>31</sup>

### Provision 9

In order to implement the objectives and principles of the present Model Provisions and coordinate their cooperation, the Parties shall establish a joint body.

### Commentary to Provision 9

The establishment of a joint body is provided in article 9, paragraph 2, of the Water Convention. Some instruments, such as the 2007 Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer or the Bellagio Model Agreement contain very detailed articles on the tasks of such a joint body. However, and as it is also the case with article 15 of the Guarani Aquifer Agreement, the present model provisions

<sup>29</sup> It should be noted that the amended text of paragraph 12, adopted at the third session of the Meeting of the Parties to the Espoo Convention in 2004, has not yet entered into force.

<sup>30</sup> See the website of the Committee for brown coal/lignite of the district council of Cologne (in German): [http://www.bezreg-koeln.nrw.de/brk\\_internet/gremien/braunkohlenschausschuss/index.html](http://www.bezreg-koeln.nrw.de/brk_internet/gremien/braunkohlenschausschuss/index.html).

<sup>31</sup> Geneva, 2000. Available from <http://www.unece.org/fileadmin/DAM/env/water/publications/documents/guidance.pdf>.





The Regensburg Treaty Commission endorses decisions for the German-Austrian aquifer.  
Source: Konrad Stania.

contain a rather brief provision on the institutional cooperation between the aquifer States. The principal reason for this pattern is that the present model provisions will, in most of the cases, either be inserted in an agreement on surface waters or supplement that agreement in the form of a Protocol. Such an agreement will normally provide for the establishment of a joint body for cooperation on transboundary surface waters. The latter should also be entrusted to deal, either directly or through a subsidiary organ such as a subcommittee or a working group, with related groundwaters, so as to facilitate the integrated management of both surface

waters and groundwaters.<sup>32</sup> However, the provision is flexible enough to allow the aquifer States to opt for a different approach, i.e., to establish a joint body dealing only with groundwaters, if they are of the view that a certain deep aquifer is unrelated to surface waters.

<sup>32</sup> In the case of the thermal cross-border water aquifer shared between Germany and Austria, the relevant expert group established by the two States in 2002 operates under the umbrella of the transboundary commission of the 1987 bilateral Treaty on Cooperation and Management of Water Resources in the Danube Basin (Regensburg Treaty). The countries have agreed on a modelling approach, a monitoring programme and on information exchange before issuing thermal water abstraction licences.



Observation well.  
Source: Sirkku Tuominen.



# Model Provisions on Transboundary Groundwaters

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) was adopted in 1992 and entered into force in 1996. It brings together almost all countries sharing transboundary waters in the pan-European region, and is expected to achieve broader participation with its global opening to all United Nations Member States.

The Water Convention serves as a mechanism to strengthen international cooperation and national measures for the ecologically sound management and protection of transboundary surface waters and groundwaters. Furthermore, it provides an intergovernmental platform for the day-to-day development and advancement of transboundary cooperation.

The present Model Provisions on Transboundary Groundwaters—and their commentary—provide specific non-binding guidance for the implementation of the Convention with regard to groundwater and facilitating the application of the principles of the Convention to transboundary groundwaters. They aim to improve transboundary water cooperation with regard to groundwater and strengthen integrated management of transboundary surface waters and groundwaters.

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