



**Yearbook  
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# International Groundwater Law: Towards Closing the Gaps?

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## I. INTRODUCTION

There is a clear contrast between the social, economic, environmental, and political importance of groundwater<sup>1</sup> and the attention international law has paid to this resource. Groundwater represents about 97 per cent of the fresh water resources available, excluding the resources locked in polar ice.<sup>2</sup> More than one-half of the world's population is dependent on it for its basic needs. Accelerated population growth in the latter half of the twentieth century has coincided with improvements in pumping technology and has led to a greater and greater use of, and reliance upon, this resource, especially in the arid and semi-arid regions of the world. In consequence, over the last fifty years, groundwater resources and the social, economic, and environmental systems dependent on them have come under threat from over-abstraction and pollution.<sup>3</sup>

International law has only rarely taken account of groundwater. While surface water has been dealt with in numerous international agreements and other instruments, groundwater is either nominally included in the scope of these instruments, primarily if it is "related" to surface waters or part of a "system of surface and groundwater" (see the United Nations Convention

<sup>1</sup> Groundwater can be defined as "subsurface water occupying the saturated zone", (United Nations Educational, Scientific, and Cultural Organization [hereinafter UNESCO]/World Meteorological Organization [hereinafter WMO], *International Glossary of Hydrology*, 133 (1992)) or as "all water which is below the surface in the ground in the saturation zone and in direct contact with the ground or subsoil" (Article 2(2) of EC Directive 2000/60 of 23 October 2000 Establishing a Framework for Community Action in the Field of Water Policy, OJ L. 327, 22 December 2000, at 1 [hereinafter Water Framework Directive] and Article 2(3) of the [UN Economic Commission of Europe] Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes, London, 17 June 1999, UN ECOSOC Doc. MP.WAT/AC.1/1999/1 of 24 March 1999 [hereinafter UN ECE Protocol on Water and Health]. Water in the unsaturated zone, such as soil moisture, is not groundwater. The saturated zone is part of the water-bearing material in which all voids, large and small, are filled with water (UNESCO/WMO, 257).

<sup>2</sup> Stephen Foster, *Essential Concepts for Groundwater Regulators*, in Salman Salman, ed., *Groundwater: Legal and Policy Perspectives*, Proceedings of a World Bank Seminar, World Bank Technical Paper 456, at 29 (1999).

<sup>3</sup> Jacob J. Burke and Marcus Moench, *Groundwater and Society: Resources, Tensions and Opportunities*, United Nations Publications Sales No. E.99.II.A 1, 7 (2000).

on the Non-Navigational Uses of International Watercourses (Watercourses Convention)<sup>4</sup> or the 2000 Revised Protocol on Shared Watercourses in the Southern African Development Community (SADC Protocol),<sup>5</sup> or intentionally or unintentionally left out. Few treaties and other legal instruments exclusively address groundwater or contain groundwater-specific provisions. Hence, two gaps can be ascertained: an overall lack of addressing groundwater in international law (a formal gap) and a lack of groundwater-adequate rules in cases where groundwater has been addressed (a material gap). These need to be closed.

An analysis of recent binding and non-binding legal instruments reveals some indications of emerging rules of groundwater management. In addition, the International Law Commission (ILC) is currently considering the topic Shared Natural Resources, comprising oil, gas, and transboundary groundwaters. Its special rapporteur for the topic, Chusei Yamada, presented a first set of draft articles on transboundary groundwaters in May 2004,<sup>6</sup> which might contribute to closing the gaps by leading to a new legal instrument.

The objective of this article is to analyze the limitations of the existing legal regime and to discuss and assess some emerging principles of groundwater management. The first part will contain a concise introduction to the specific characteristics of groundwater and the most common reversible and irreversible problems faced in its management. Second, against this backdrop of facts, an overview of the current legal regime and its shortcomings will be presented. Groundwater as the subject matter of the Watercourses Convention, of bilateral and multilateral treaty law as well as of non-binding instruments will be examined. Third, some emerging legal tendencies will be discussed, which might indicate the way for more groundwater-adequate legal regulation. Finally, the already-mentioned activities of the ILC will be outlined.

## II. FACTS ABOUT GROUNDWATER

### 1. Groundwater Characteristics

All groundwater and surface water molecules are elements of the same hydrological cycle. What today is one will, tomorrow, be the other.<sup>7</sup> Despite

<sup>4</sup> United Nations Convention on the Non-Navigational Uses of International Watercourses, annexed to UNGA Res. 229 of 21 May 1997, Official Records of the UNGA, 51st session, UN Doc. A/Res/51/229; also reprinted in 36 I.L.M. 700 (1997) [hereinafter Watercourses Convention]. It was adopted by a vote of 103 for and three against (Burundi, China, and Turkey) with twenty-seven abstentions. It has not yet entered into force.

<sup>5</sup> Revised Protocol on Shared Watercourses in the Southern African Development Community (SADC), Windhoek, 7 August 2000, 40 I.L.M. 321 (2001) [hereinafter SADC Protocol].

<sup>6</sup> Chusei Yamada Special Rapporteur, *Second Report on Shared Natural Resources: Transboundary Groundwaters*, UN Doc. A/CN.4/539 of 9 March 2004.

<sup>7</sup> See Joseph W. Dellapenna, *The Evolving International Law of Transnational Aquifers*, in Eran Feitelson and Marwan Haddad, eds., *Management of Shared Groundwater Resources: The Israeli–Palestinian Case with an International Perspective*, 209, 241 (2001).

this systemic character of the hydrological cycle, surface and groundwater resources differ significantly. Surface water bodies have, in general, linear features that cover only small amounts of territory. Single aquifers or multi-layered aquifer<sup>8</sup> systems in which groundwater is contained are widespread and can underlie vast areas of land. Surface water flows rapidly from upstream to downstream. Groundwater flow patterns are multidimensional and complex. Hydraulic heads and flow directions can change at different depths of the system and at different times, as the aquifer(s) respond to recharge and geotectonic change.

Upstream surface water utilization, such as the diversion of water or pollution, quickly impacts downstream. The utilization of an aquifer can cause effects over the whole of the aquifer, and no clear “upstream”/“downstream” distinction can be made. A groundwater pollutant can travel in all directions depending on the complex hydraulic linkages between surface and groundwater and abstraction activities. The impact of abstraction or pollution sometimes becomes visible only after extended periods of time, because the time-scales of groundwater flow are very long, with most groundwater remaining in the subsurface for tens or hundreds of years before reappearing at the surface. A particular feature of aquifers and the groundwater that they contain is that some deterioration is irreversible. Unlike the pollution of surface waters, the pollution of groundwater tends to be of a one-way nature—pollutants entering the micro-pores of an aquifer or combining with the aquifer matrix are not easily removed. Once polluted, aquifer clean up can be technically impossible or simply uneconomic.<sup>9</sup> Such deterioration of the aquifer can occur through saline water intrusion, the ingress of polluted water, land subsidence,<sup>10</sup> or wellhead contamination.<sup>11</sup>

Aquifer recharge rates range from irregular to regular and from almost zero to full. Aquifers are primarily replenished by rain percolating through the ground but also from rivers (influent rivers). Groundwater can discharge into surface water bodies (effluent rivers), another aquifer, the sea, or it can evaporate. Aquifer systems, sometimes in the form of several overlaying aquifers, can be hydraulically linked with one or more surface water basins, yet they may not conform in extent, hydraulic gradient, and system dynamics

<sup>8</sup> An aquifer can be defined as a “permeable water-bearing formation capable of yielding exploitable quantities of water” (UNESCO/WMO, *supra* note 1 at 15) or as “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” (Water Framework Directive, *supra* note 1, Article 2(11)).

<sup>9</sup> Jacob J. Burke et al., *Groundwater and Society: Problems in Variability and Points of Engagement*, in Salman Salman, ed., *supra* note 2 at 31, 40.

<sup>10</sup> Stephen Foster, *Essential Concepts for Groundwater Regulators*, in Salman, ed., *supra* note 2 at 15, 24.

<sup>11</sup> Wellhead contamination can be caused by inadequate well design and construction, allowing direct ingress of polluted surface water or shallow groundwater. Foster, *supra* note 10 at 19.

to the surface flow system to which they are connected. Where such systems are substantially differentiated in a hydraulic sense, a case could be made for separate management as long as this interdependence is taken into account.

## 2. Special Case of Non-Recharging Aquifers

Some aquifers, which have been treated separately in international law and therefore need to be singled out at this point, receive no, or only negligible, quantities of recharge. They are *de facto* decoupled from active surface water systems and, therefore, under present climatic conditions, contain non-renewable stock resources and are sometimes called “fossil aquifers.”<sup>12</sup> The water in these aquifers can be hundreds or thousands of years old. An example is the Nubian Sandstone Aquifer System underneath Chad, Egypt, Libya, and Sudan. It stores a total amount of 150,000 cubic kilometres of groundwater—corresponding to 1,800 years of Nile discharge<sup>13</sup>—of up to 35,000 years of age, not all of which is, however, recoverable due to great depths. Other examples are the North-Western Sahara Aquifer System, which is better known by its French acronym SASS<sup>14</sup> and is shared by Algeria, Libya, and Tunisia as well as the Qa-Disi Aquifer in southern Jordan and northern Saudi Arabia. The water in these aquifers is often of remarkably good quality and constitutes a strategic resource of vital importance for sustaining life, health, and the integrity of ecosystems in some of the most arid parts of the world. Due to a lack of recharge, it can be exploited only in the form of a “mined” resource.

The ILC and some legal literature have sometimes referred to these aquifers as “confined” aquifers,<sup>15</sup> which is, in fact, technically incorrect. In hydrogeological terms, a confined aquifer is an aquifer overlain and underlain by an impervious or almost impervious formation, in which water is stored under pressure.<sup>16</sup> Confinement is thus a matter of hydraulic state and not a question of being connected or related to bodies of surface water.

<sup>12</sup> Issues of artificial recharge are beyond the scope of this article.

<sup>13</sup> Ulf Thorweihe and Manfred Heintz, *Groundwater Resources of the Nubian Aquifer System NE-Africa 2002*, available at <[http://www.geo.tuberlin.de/\\_downloads/nas\\_syn.pdf](http://www.geo.tuberlin.de/_downloads/nas_syn.pdf)> (last accessed 29 January 2004) at 9.

<sup>14</sup> Système Aquifère du Sahara Septentrional.

<sup>15</sup> See the Resolution on Confined Transboundary Groundwater adopted in 1994 by the International Law Commission [hereinafter ILC] on these resources, which can be found in the *Report of the Commission to the General Assembly on the Work of Its Forty-Sixth Session*, II(2) Y.B. I.L.C., 135 (1994), and the title of the current topic on the agenda of the ILC, which had originally been “confined groundwaters.” See Chusei Yamada, Special Rapporteur, *Shared Natural Resources: First Report on Outlines*, UN Doc. A/CN.4/533 of 30 April 2003. In his second report, the special rapporteur proposes the term “transboundary groundwaters” instead, see Chusei Yamada, Special Rapporteur, *Second Report on Shared Natural Resources: Transboundary Groundwaters*, *supra* note 6.

<sup>16</sup> UNESCO/WMO, *supra* note 1 at 56.

### 3. Uses of Groundwater and Challenges Faced in Its Management

Globally, groundwater provides about 50 per cent of the current potable water supplies; in some European countries, it can be more than 90 per cent.<sup>17</sup> It provides 40 per cent of the demand of industry through self-supply and between 20–30 per cent of water used in irrigated agriculture.<sup>18</sup> Compared to surface water, the economic benefits of groundwater per unit of volume are greater because of ready local availability, drought reliability, and generally good water quality requiring minimal treatment.<sup>19</sup> Groundwater also ensures the baseflow of rivers and lakes, keeps springs flowing, and wetlands wet. It is a major source of water for most surface vegetation. Sufficiently recharged aquifers prevent compaction and land subsidence. Aquifer systems constitute the predominant reservoir and strategic reserve of freshwater storage<sup>20</sup> that can be drawn upon in cases of drought. They also provide a range of more exotic services, including waste disposal and geothermal heat storage.

The rapid expansion in groundwater use due to increasing demand and better pumping technologies has led not only to major socio-economic benefits but also to significant problems that might lead eventually to inter-state problems due to competing uses. Over-abstraction and pollution are the two main problems. Disturbingly, much of the major aquifer depletion and degradation has occurred in a very short space of time (over the past fifty years), is irreversible,<sup>21</sup> and is showing few signs of abatement. Falling groundwater tables cause shallow aquifers that have often been drawn upon for long periods of time to dry up, reduce the dry weather baseflow in some watercourses, lead to localized land subsidence due to aquitard compaction, and damage groundwater-dependent ecosystems.<sup>22</sup> Groundwater quality declines occur due to salinization, the migration of low-quality water, and pollution.<sup>23</sup> There is a wide range of activities that affect groundwater quality. Atmospheric deposition, contaminated rainfall, agricultural

<sup>17</sup> Austria, Croatia, Denmark, Hungary, Italy, Lithuania, and Slovenia. See E. Almásy and Zsuzsa Busás, *Inventory of Transboundary Groundwaters*, UN ECE Task Force on Monitoring and Assessment (1999) (identifying the percentage of groundwater in various European countries' drinking water supplies: Austria (99 per cent), Belarus (80 per cent), Bulgaria (60 per cent), Croatia (90 per cent), Estonia (70 per cent), Finland (57 per cent), Germany (75–90 per cent), Hungary (95 per cent), Lithuania (100 per cent), The Netherlands (67 per cent), Portugal (60 per cent), Slovak Republic (80 per cent), Slovenia (90 per cent), Switzerland (84 per cent), Ukraine (65 per cent)) at 21.

<sup>18</sup> UNESCO, ed., *The United Nations World Water Development Report*, 78 (2003).

<sup>19</sup> Burke and Moench, *supra* note 3 at 1.

<sup>20</sup> UNESCO, ed., *supra* note 18 at 78.

<sup>21</sup> Burke, *supra* note 9 at 31.

<sup>22</sup> In contrast, rising water tables can lead to waterlogging problems.

<sup>23</sup> Examples of these problems can be found in Brian L. Morris et al., *Groundwater and its Susceptibility to Degradation: A Global Assessment of the Problem and Options for Management*, United Nations Environment Programme (2003).

run-off, improperly treated or untreated wastewater, discharge from municipal and industrial sources, and accidental spills of undesirable materials are all potential sources of contamination.<sup>24</sup> In addition, improper extraction techniques can pollute even the deepest aquifer.

#### 4. Transboundary and International Groundwater

It goes without saying that the problems mentioned are not only of a domestic nature. A large number of aquifers exist that are intersected by a political boundary and, hence, are transboundary and international in nature. Others are located entirely within the territory of one state but are hydraulically linked to a transboundary river.<sup>25</sup> They could be regarded as “international aquifers”<sup>26</sup> because they are part of an international system. Such a “system approach” would be similar to the Watercourses Convention, under which it is sufficient for a domestic tributary to be considered as “international” if it is part of a system of waters parts of which are located in different states (see Articles 1 and 2). In some instances, the transboundary—let alone, the international—nature of an aquifer is not clear or contested by one side.<sup>27</sup>

As most of the legal instruments analyzed cover only transboundary aquifers, this article will focus on this particular type. Interesting and difficult questions remain to be addressed regarding the legal regime that should apply to those aquifers that are international, but not transboundary, in nature and their harmonization with existing rules of international water law.

### III. CURRENT LEGAL REGIME AND ITS GAPS

#### 1. Overview

From the point of view of legal recognition, international groundwater law is the poor cousin of surface water law.<sup>28</sup> Whereas numerous treaties deal

<sup>24</sup> Asit Biswas, *Introduction: Water Crisis: Current Perceptions and Future Realities*, in Salman, ed., *supra* note 2 at 1, 8.

<sup>25</sup> Different models have been developed to exemplify in which cases aquifers could be regarded as international. See Julio A. Barberis, *International Groundwater Resources Law*, FAO Legislative Study No. 40, at 36 (1986); and Gabriel Eckstein and Yoram Eckstein, *A Hydrogeological Approach to Transboundary Ground Water Resources and International Law* 19 *Am. U. Int'l L. Rev.* at 201, 231 (2003).

<sup>26</sup> “Transboundary” could be seen as being a sub-category of “international”—that is, every transboundary aquifer would be an international one, but not vice versa.

<sup>27</sup> A UN ECE map of a survey of European transboundary aquifers shows that a number of aquifers had only been indicated by one country as being transboundary. See UNESCO, *International Hydrological Programme, Internationally Shared (Transboundary) Aquifer Resources Management*, at 12 (2001) available at <<http://www.iah.org/News/2001/isarm.pdf>> (last accessed 23 October 2004).

<sup>28</sup> For literature on international groundwater law, see, for example, Barberis, *supra* note 25; Julio Barberis, *The Development of International Law of Transboundary Groundwater* 31 *Nat. Resources J.* at 167 (1991); Joseph W. Dellapenna, *supra* note 7; Gabriel Eckstein and Yoram

with surface waters, very few address only groundwater or contain groundwater-specific provisions. In many instances, the scope of water treaties includes surface and groundwater or a drainage basin, but the substantive treaty norms and the powers of joint bodies are heavily biased towards surface water management.<sup>29</sup> There are a number of reasons for this neglect of groundwater. Among them are the complex nature of aquifers, the fact that the physical and chemical processes remain essentially unseen, the existence of factual uncertainties, and a lack of data. Groundwater, being that it is water in the ground, is also sometimes perceived as falling within the ambit of the exclusive sovereignty of the territorial state. While it is obvious when a body of surface water is shared, it is, to a large extent, invisible in the case of an aquifer. Limitations of sovereignty with respect to shared surface water are undisputedly part of customary international law.<sup>30</sup> The same is less accepted when it comes to groundwater.<sup>31</sup>

## 2. Groundwater in the Watercourses Convention: Gaps in Scope and Normative Content

The Watercourses Convention is the most recent, comprehensive, and authoritative framework of international water law. It clarifies that at least some types of groundwater fall within the remit of international law. It suffers, however, from shortcomings, both in respect of its scope and the adequacy of its articles.

Eckstein, *supra* note 25; Stefano Burchi and Kerstin Mechlem, eds., *Groundwater in International Law: Compilation of Treaties and other Legal Instruments*, FAO Legislative Study No. 86 (2004); Ximena Fuentes, *The Utilization of International Groundwater in General International Law*, in Guy Goodwin-Gill and Stefan Talmon, eds., *The Reality of International Law—Essays in Honour of Ian Brownlie*, at 177 (1999); Gerhard Loibl, *Groundwater Resources—A Need for International Legal Regulation?* 5 *Austrian Rev. Int'l and Eur. L.* at 81 (2000); Stephen McCaffrey, *The Non-Navigational Uses of International Watercourses* (2003) at 414, Chapter 13; Ludwik A. Teclaff, *Transboundary Ground Water Pollution: Survey and Trends in Treaty Law* 19 *Nat. Resources J.* at 629 (1979); and Albert E. Utton, *The Development of International Groundwater Law* 22 *Nat. Resources J.* at 95 (1982).

<sup>29</sup> Teclaff points out that in some cases treaties even protect surface water at the expense of groundwater, *supra* note 28 at 640 *et seq.* His examples are the Convention entre la République Française et la Confédération Suisse pour régler la pêche dans les eaux frontalières, Paris, 9 March 1904, U.N.L.S., Legislative Texts and Treaty Provisions Concerning the Utilization of International Rivers for Other Purposes Than Navigation, Treaty No. 196, Doc. ST/LEG/SER.B/12, UN Sales Publication No. 63.V.4 at 701; and the Convention on the Protection of the Rhine against Pollution by Chlorides, Bonn, 3 December 1976, 16 I.L.M. 265 (1977). In the Protocol Amending the 1978 Agreement between the United States of America and Canada on Great Lakes Water Quality, as Amended on October 16, 1983, 18 November 1987, TIAS 11551, groundwater is dealt with merely as a cause of pollution of surface water—hence, as a threat to surface water quality and not as a resource to be protected in its own right; see Preamble, Article VI para. 1(q) and Annex 16.

<sup>30</sup> The Harmon Doctrine of absolute sovereignty is generally rejected.

<sup>31</sup> See McCaffrey, *supra* note 28 at 417.

*A. Gaps in the Scope of the Watercourses Convention*

The Watercourses Convention applies to international watercourses (Article 1). A watercourse is defined as a “system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus” (Article 2(a)). It is international if parts of the watercourses are situated in different states (Article 2(b)). This definition of a watercourse contains two problematic requirements. The first requirement is a “system of surface waters and groundwaters,” the second is a “unitary whole . . . normally flowing into a common terminus.” They exclude some important aquifers from the scope of the Watercourses Convention. In other cases, they make it difficult to determine to what extent, and between and among which aquifer states, the Watercourses Convention applies.

i. Surface-groundwater system requirement

The requirement of a “system of surface waters and groundwaters” excludes two types of aquifers: non-recharging ones such as parts of the Nubian Sandstone Aquifer System (see discussion earlier in this article) and recharging ones that are not linked to a body of surface water. In particular, the first type—that is, non-recharging aquifers—was intentionally omitted by the ILC. While the ILC had been developing the draft articles of the Watercourses Convention for over twenty years, it included groundwater within the scope of its draft articles only in 1991.<sup>32</sup> Its last special rapporteur, Robert Rosenstock, had proposed to include all types of groundwater.<sup>33</sup> However, a majority of ILC members was of the opinion that non-recharging aquifers should be further studied<sup>34</sup> and that the topic was not ripe for inclusion in the draft articles.<sup>35</sup> Instead, the ILC adopted a resolution on what it misnamed “confined transboundary groundwaters.” With this term it intended to refer—according to the preamble of the resolution—to groundwater not related to surface watercourses<sup>36</sup> (see discussion earlier in this article). It recommended that states “be guided by the principles contained in the draft articles on the non-navigational uses of international

<sup>32</sup> McCaffrey, *supra* note 28 at 417.

<sup>33</sup> Robert Rosenstock, Special Rapporteur, *Second Report on the Law of Non-Navigational Uses of International Watercourses*, II(1) Y.B. I.L.C. at 113 (1994).

<sup>34</sup> *Report of the Commission to the General Assembly on the Work of its Forty-Sixth Session*, *supra* note 15 at 90.

<sup>35</sup> See *Summary Records of the Meetings of the Forty-Sixth Session*, 2 May–22 July 1994, I Y.B. I.L.C. at 172 (1994).

<sup>36</sup> This is evident from the preamble of the resolution in which the ILC defined “confined groundwater” as “groundwater not related to an international watercourse.” See also Fuentes, *supra* note 28 at 180.

watercourses, where appropriate, in regulating transboundary groundwater” (Article 1).<sup>37</sup>

The second type are aquifers that are recharged solely from rain percolating through the ground and which discharge either directly into the sea or into another aquifer, or where the aquifer itself is the end point due to evaporation. One example is the Mountain Aquifer underlying Israel and the West Bank, which is recharged solely by precipitation in the highlands of the Judean mountains.<sup>38</sup> Another one is the Rus Aquifer, shared by Saudi Arabia and Qatar, which terminates in marine springs in the Persian Gulf.<sup>39</sup> It has been argued that these aquifers would qualify as “international watercourses” if they straddled a boundary, because the surface water element of the system requirement would be fulfilled by the fact that the aquifer is recharged from rain.<sup>40</sup> This interpretation seems questionable because rain is not “surface water” in the sense of the Watercourses Convention. The ILC used the term “surface water” only for bodies of surface water—a watercourse was conceived as a “hydrologic system composed of a number of different components” including “rivers, lakes, aquifers, glaciers, reservoirs and canals” and groundwater.<sup>41</sup> All elements of the surface water part of this definition listed by the ILC are distinct bodies of surface water, not diffuse and unchannelled waters such as rain, atmospheric moisture, or surface water run-off.

ii. “Unitary whole” and “common terminus” requirement

The second problematic requirement of the definition of a “watercourse” is that surface and groundwater constitute “by virtue of their physical relationship a unitary whole and normally [flow] into a common terminus.” The ILC was aware of the fact that these requirements in many cases do not correspond to hydrological realities, yet it decided to include them in its definition of a watercourse in order to limit the geographical scope of the draft articles.<sup>42</sup> As a result, there are cases in which the applicability of the Watercourses Convention is difficult to determine.

An aquifer can be hydraulically linked to two or more river basins, and an aquifer and a river can operate as distinct systems, although some hydraulic linkages may exist. While surface water generally flows into a common terminus, often the sea, aquifers may have multiple termini in adjacent

<sup>37</sup> *Report of the ILC to the General Assembly on Its Forty-Sixth Session*, reprinted in *supra* note 15 at 135.

<sup>38</sup> Eckstein and Eckstein, *supra* note 25 at 213.

<sup>39</sup> See <<http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/countries/qatar/index.stm>> (last accessed on 10 January 2004).

<sup>40</sup> McCaffrey, *supra* note 28 at 430.

<sup>41</sup> *Report of the ILC to the General Assembly on Its Forty-Sixth Session*, *supra* note 15 at 90.

<sup>42</sup> *Ibid.*

river basins.<sup>43</sup> As has been stated earlier, aquifer systems can differ from river systems, and surface water and groundwater basins do not necessarily overlap. For instance, the deep flow systems in the tightly folded Copper Belt dolomites straddle the Congo and Zambezi river basin divides and the co-incident international border between Zambia and the Democratic Republic of Congo. In addition, while the majority of the groundwater associated with the Danube terminates, like the watercourse, in the Black Sea, a small portion reappears as the source of the river Aach, which is a tributary of the Rhine. This phenomenon was the object of the dispute in the well-known 1927 *Donauversinkung* case of the German Staatsgerichtshof.<sup>44</sup>

As these examples show, surface and groundwater do not necessarily constitute one unitary whole, otherwise the two or more basins that are hydraulically linked via the aquifer would also have to be regarded as one unitary whole, which is neither foreseen under the Watercourses Convention nor appropriate. The examples illustrate also that surface and groundwater do not necessarily share a common terminus. Each river with which the aquifer is hydraulically linked has its own terminus. In such cases, it is not clear whether any rights and obligations exist under the Watercourses Convention and, if they do, between or among which states. According to the ILC, “as a matter of common sense and practical judgement the Danube and the Rhine remain separate unitary wholes.”<sup>45</sup> Despite the fact that the Rhine and the Danube are hydraulically linked, they are not regarded as one single watercourse. Whether this commentary should be interpreted as excluding from the scope of the Watercourses Convention the aquifer that links the two rivers and all other aquifers with similar characteristics that do not fit the “unitary whole” and “common terminus” requirements is open to debate. Clearly, if such aquifers, or the rivers to which they are linked, are trans-boundary, cross-border effects can occur. Therefore, rules of international law should apply, not only between or among the states sharing the watercourse but also between or among those sharing the aquifer. Remarkably, the German Staatsgerichtshof applied principles that were generally consonant with those of modern international water law in the *Donauversinkung* case. While such an application of the law might lead to complicated and

<sup>43</sup> The qualifier “normally” to the common terminus requirements does not call for a different interpretation. It was intended to cover specific cases as the Rio Grande, the Irawaddy, the Mekong, and the Nile. While, according to the ILC, all these rivers are systems of surface and groundwaters constituting, by virtue of their physical relationship, a unitary whole, they flow into the sea in whole or in part via groundwater, a series of distributaries that may be as much as 300 kilometres removed from each other (deltas) or empty at certain times of the year into lakes and other times into the sea. *Ibid.* at 91.

<sup>44</sup> Staatsgerichtshof für das Deutsche Reich, Land Württemberg und Land Preußen gegen das Land Baden betreffend die Donauversinkung, Decision of 18 June 1927, Entscheidungen des Reichsgerichts in Zivilsachen, Volume 116, Appendix, at 18.

<sup>45</sup> *Report of the ILC to the General Assembly on Its Forty-Sixth Session, supra* note 15.

partly overlapping relationships of rights and duties, it is inevitable in order to adequately manage existing shared bodies of underground water.

The approach of the Watercourses Convention is also unsuitable in cases wherein sections of hydraulically linked surface and groundwater constitute distinct systems rather than a unitary whole. One example is the vast regional multi-termini Guaraní Aquifer, which is shared by Argentina, Brazil, Paraguay, and Uruguay and located in the Paraná and Chaco-Paraná basins that extends over 1,222,000 square kilometres. Almost 90 per cent of the aquifer is covered by a confining layer that prevents direct recharge, so it is primarily fed through rainfall infiltrating in places where the confining layer is not present.<sup>46</sup> There is some hydraulic relationship with the overlying river basins. Yet, the Guaraní Aquifer has a flow system largely independent of surface waters, and its management needs to be distinct from the management of the La Plata River itself<sup>47</sup>—a situation that is not foreseen under the Watercourses Convention.

#### *B. Gaps in the Normative Content of the Watercourses Convention*

To the extent that groundwater falls under the scope of the Watercourses Convention, it is subject to the same provisions as surface water. These provisions are geared primarily towards surface water management and have shortcomings regarding groundwater. In fact, the basic concept of the Watercourses Convention—the watercourse itself—evokes connotations of surface water and not of groundwater.

*Equitable Utilization.* Among the principles that the Watercourses Convention enshrines, the general principle of equitable and reasonable utilization (Article 5) is as adequate for transboundary groundwater resources as for international surface water resources. The list of factors relevant to determining what equitable and reasonable utilization means (Article 6) comprises “geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character,” but leaves out—tellingly—hydrogeological ones, namely those factors that deal with groundwater characteristics. While they do fall under the category “other factors of a natural character,” the omission reveals the emphasis on surface water. A groundwater instrument should specify factors of particular groundwater relevance, such as net recharge, hydrostatic pressure, the time in which the aquifer responds to changes, and chemical as well as geothermal properties, among others. The suggestion to equitably share an aquifer by apportioning a volume of water proportionate to the segment of the aquifer on each state’s

<sup>46</sup> UNESCO, *supra* note 27 at 45 *et seq.*

<sup>47</sup> The hydraulic relationship with the Chaco-Paraná is not yet fully established because of lack of data.

territory<sup>48</sup> has to be rejected as too simplistic. In order to determine equitable utilization, multiple criteria need to be taken into account. In addition, the amount of accessible water does not necessarily correlate to the size of an aquifer segment.

*No Significant Harm.* More problematic is the adequacy of the way in which the obligation not to cause significant harm is formulated in Article 7 of the Watercourses Convention. It reflects the general rule *sic utere tuo ut alienum non laedas* (so use your own as not to harm that of another). As already outlined in this article, the consequences of degrading an aquifer are frequently more far-reaching than the impairment of the quantity or quality of surface water, in particular, because the self-purifying qualities of groundwater are, in contrast to surface water, generally very low. In addition, some of the negative effects of groundwater use on other resources, such as land subsidence due to aquifer compaction caused by lowering water tables, cannot be remedied. Consequently, it has been argued that the no-significant harm rule might need to be applied with greater stringency.<sup>49</sup> The standard of “significant” could be tightened to “appreciable” harm, “significant adverse effect,”<sup>50</sup> or another stricter term.

If a stricter standard is at all necessary, it might not be required for all cases of potential harm. Some types of harm resemble those caused by surface water use. Shallow wells may have been in use for centuries. If modern deep drilling technology allows for the exploitation of an aquifer in a previously unused part, these wells might dry up or cost more to pump. For such a conflict between historic and modern uses, which was discussed extensively during the drafting of the Watercourses Convention, the threshold of “significant” is adequate. It is rather in cases of grave and irreversible effects that a different standard of diligence or harm could be contemplated. However, in these cases, the threshold of significant harm will easily be crossed, particularly if the time factor is given due attention in assessing whether harm is significant or not. There is a need to clarify and spell out what constitutes significant harm, for instance, in an exemplary non-comprehensive list, but not necessarily to develop a new standard. It should also be noted that the significant harm threshold is a standard that is not only used in international water law for drawing the line between what a state is and is not allowed to do.<sup>51</sup>

<sup>48</sup> Julio Barberis, *The Development of International Law of Transboundary Groundwater*, 31 *Nat. Resources J.* at 167, 177 *et seq.* (1991).

<sup>49</sup> McCaffrey, *supra* note 28 at 430.

<sup>50</sup> This term is used in Article 12 of the Watercourses Convention and implies a stricter standard than significant harm. *Report of the ILC to the General Assembly on Its Forty-Sixth Session*, *supra* note 37 at 111.

<sup>51</sup> The same standard was used by the ILC in its draft articles on the Prevention of Transboundary Harm from Hazardous Activities adopted by the ILC at its fifty-third session in 2001, *Report of the ILC to the General Assembly*, Official Records of the General Assembly, 56th Session, Supplement No. 10, UN Doc. A/56/10, chap. V.E.1 and in its work on international

The no-significant harm obligation must be reconciled with the principle of equitable utilization. The “package” of Articles 5 to 7 of the Watercourses Convention deals with this issue. It is convoluted and unclear on how the principles relate to each other and which one takes precedence, although there are some indications that equitable utilization prevails.<sup>52</sup> This problem should be reconsidered with respect to groundwater management since much of the harm that is inflicted upon aquifers or by their use is irreversible. The overall focus of the Watercourses Convention is on the uses of waters rather than on their protection—although the latter is mentioned in Article 5, paragraph 1. Protection and preservation are relegated to Articles 20 to 23. Given the current development of aquifer degradation as well as the need to enable long-term utilization, protection should play a more prominent role. In cases of pollution, the no-significant harm rule of Article 7 needs to be read conjunctively with Article 21. According to Article 21, paragraph 2, “[w]atercourse States shall . . . prevent, reduce and control the pollution of an international watercourse that may cause significant harm to other watercourse States or to their environment, including harm to human health or safety, to the use of the waters for any beneficial purpose or to the living resources of the watercourse.” Unlike Article 7, Article 21 is not qualified by the principle of equitable and reasonable utilization (Article 5).<sup>53</sup> Hence, if a state does not exercise due diligence<sup>54</sup> to prevent, reduce, and control pollution, it violates its obligations under the Watercourses Convention if its action causes significant harm to another watercourse state.

Finally, the scope of Article 7 of the Watercourses Convention is too limited to prevent important types of harm to aquifers. Article 7 only deals with the utilization of an international watercourse and the harm to another watercourse state that results from such utilization. In the case of aquifers, harm is not only caused by the utilization of the aquifer itself but also by the use of other resources such as land or hydraulically linked surface water.<sup>55</sup> For example, agricultural or industrial land use leading to non-point and

liability for injurious consequences arising out of acts not prohibited by international law (International liability in case of loss from transboundary harm arising out of hazardous activities), see Pemmaraju Sreenivasa Rao, Special Rapporteur, *Second Report on the Legal Regime for the Allocation of Loss in Case of Transboundary Harm Arising out of Hazardous Activities*, UN Doc. A/CN.4/540 of 15 March 2004.

<sup>52</sup> Stephen McCaffrey, *International Water Law for the 21st Century: The Contribution of the UN Convention* 118 Water Resources Update at 11, 13 (2001).

<sup>53</sup> McCaffrey, *supra* note 28 at 431.

<sup>54</sup> Articles 21–3 are obligations of due diligence according to a statement of understanding accompanying the Watercourses Convention, Convention on the Law of the Non-Navigational Uses of International Watercourses: *Report of the Sixth Committee Convening as the Working Group of the Whole*, UN Doc. A/51/869 of 11 April 1997, para. 8.

<sup>55</sup> While land use also has an impact on surface water quality, the problem is of greater magnitude regarding groundwater. Different views exist on whether the Watercourses Convention applies to land areas adjacent to watercourses, and there are strong indications that it is not

point source pollution in a recharge zone is likely to cause pollution of an aquifer. Leaking tanks of a petrol station are clearly not “the utilization of a watercourse,” yet they can render the waters of an aquifer permanently unfit for most uses. Diversion or abstraction of water from a river recharging an aquifer (an influent river) can cause a lowering of the water table. A new provision similar to Article 7 should therefore not only prohibit the causing of significant harm to another watercourse state in utilizing an international watercourse, or rather aquifer, but also the causing of significant harm to a transboundary aquifer by other activities.

*Exchange of Data.* Article 9 deals with the duty to exchange on a regular basis readily available data and information on the condition of the watercourse. This procedural obligation has the function to enable compliance with the equitable utilization and no-significant harm rules. Only where sufficient information is exchanged can it be assessed, whether an existing or planned use is equitable or whether significant harm is inflicted upon another state. The assumption behind Article 9 is that, in principle, sufficient data is available in order to make this obligation meaningful. Groundwater management, however, is faced with the difficulty that in most countries availability of data on both groundwater quantity and quality is significantly less than that for surface water.<sup>56</sup> Geological heterogeneity and meteorological variety both contribute to a relatively high degree of uncertainty in the estimation of key parameters to characterize aquifer systems. This uncertainty usually results in substantial error bands in the prediction of the impact of given scenarios of groundwater abstraction and contaminant loading.<sup>57</sup> Hence, what Article 9 achieves for surface water, it will, in many cases, fail to achieve for groundwater. Therefore, a new obligation is necessary to the effect that, in light of the uncertainty about the nature and extent of some aquifer systems, states shall employ their best efforts to collect and generate, ideally in accordance with best available practice, new data and information to define an aquifer more completely. In addition, geological and hydrochemical factors could be added to the factors of a “hydrological, meteorological, hydrogeological and ecological nature and related to the water quality as well as related forecasts” (Article 9).

*Different Kinds of Uses.* Article 10, which deals with the relationship between different kinds of uses, is as relevant for groundwater as for surface waters. In the development of an instrument for groundwater, it could, however, be reconsidered if certain uses, such as the fulfilment of vital

the case. See André Nollkaemper, *The Contribution of the International Law Commission to International Water Law: Does It Reverse the Flight from Substance?* 27 *Netherlands Y.B. Int'l L.* at 39, 63 (1996), but also McCaffrey, *supra* note 28 at 256 (who argues in favour of this assumption).

<sup>56</sup> See Biswas, *supra* note 24 at 8.

<sup>57</sup> Foster, *supra* note 10 at 20.

human needs and environmental requirements should not enjoy inherent priority over other demands, such as those of industry.<sup>58</sup>

*Planned Measures.* Article 11 is the introductory article to Part III on planned measures. Watercourse states shall exchange information and consult each other and, if necessary, negotiate on the possible effects of planned measures on the condition of an international watercourse. It suffers from a similar limitation regarding scope as Article 7. The utilization of an aquifer affects, in many instances, the condition not only of the aquifer but also of other resources. Land subsidence and soil salinization due to aquifer draw-downs are cases in point. Mexico City has, for instance, a land-subsidence rate of up to 0.4 metres per year.<sup>59</sup> According to Article 11, a state would have to exchange information on the effect of a drawdown on the condition of the aquifer, but not on the land overlying it, as land is not part of a watercourse.

*Joint Mechanisms.* The establishment of joint mechanisms for the watercourse is addressed in Article 8 paragraph 2, in the context of cooperation and in Article 24 concerning management. Joint mechanisms and commissions have proved to be of great practical value in facing day-to-day challenges of managing an international watercourse. For aquifers, their potential has until now not yet been fully developed (but see discussion on this subject later in this article).

### C. Assessment

One achievement of the Watercourses Convention was that it clarified that groundwater resources were subject to the principles of international water law, such as the doctrine of equitable and reasonable utilization, the duty not to cause significant harm, and the duty to cooperate. However, unfortunately, there are groundwater-relevant gaps in scope and normative content. The focus of the Watercourses Convention is disproportionately on surface water management. Some important types of aquifers fall outside its scope. Its application to aquifers that are linked with several surface water basins is unclear. The substance of its provisions is not fully adequate to deal with groundwater. None of the provisions address issues that only or particularly occur in connection with aquifer use, such as the specific vulnerability of aquifers and the need for their protection; the risk of harm caused to the aquifer by activities other than the use of the groundwater; or the exchange of information on the effects of aquifer-related measures on other resources, such as land. Finally, the Watercourses Convention does not enshrine, or

<sup>58</sup> For a criticism of the lack of the Watercourses Convention to prioritize, see Nollkaemper, *supra* note 55 at 39, 60 *et seq.*

<sup>59</sup> Morris et al., *supra* note 23 at 19.

only weakly recognizes, a number of principles of environmental law that are increasingly applied to water in contemporary treaty and non-treaty law, such as the principle of sustainable use<sup>60</sup> or the precautionary principle, to name only some of particular relevance for groundwater use and protection.<sup>61</sup>

### 3. Groundwater in Bilateral and Multilateral Treaties

Bilateral and multilateral agreements have only in exceptional cases been concluded exclusively for aquifers.<sup>62</sup> One exception is the 1977 Arrangement relatif à la protection, à l'utilisation et à la réalimentation de la nappe souterraine franco-suisse du Genevois (Agreement on the Protection, Utilization and Recharge of the Franco-Swiss Genevese Aquifer—Genevese Aquifer Agreement), which deals with groundwater quality, quantity, abstraction, and recharge.<sup>63</sup> Among regional agreements that deal with surface and groundwaters is the 1992 [United Nations Economic Commission for Europe (UN ECE)] Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention).<sup>64</sup> Its objective is to protect transboundary waters and to reduce transboundary impact. Transboundary waters “means any surface or ground waters which mark, cross or are located on boundaries between two or more States.”<sup>65</sup> Transboundary impact is defined as “any significant adverse effect on the environment resulting from a change in the conditions of transboundary waters caused by a human activity. . . . Such effects on the environment include effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and

<sup>60</sup> According to Article 5 of the Watercourses Convention, “watercourse States shall utilize an international watercourse in an equitable and reasonable manner. In particular, [it] shall be used and developed . . . with a view to attaining optimal and sustainable utilization thereof and benefits therefrom. . . .” Hence sustainability is not a principle, but only an objective to be attained within the framework of equitable utilization.

<sup>61</sup> Downstream states and some particularly environmentally minded states had advocated the inclusion of these principles in the Watercourses Convention. See Malgosia Fitzmaurice, *General Principles Governing the Cooperation between States in Relation to International Watercourses*, in this volume of the Yearbook of International Environmental Law. According to Tanzi, the reference to sustainability in Article 5 of the Watercourses Convention is “involute” and only “mild,” but brings the convention in line with general international environmental law. Attila Tanzi, *The UN Convention on International Watercourses as a Framework for the Avoidance and Settlement of Waterlaw Disputes* 11 *Leiden J. Int'l L.* at 441, 456 (1998).

<sup>62</sup> A collection of older treaties dealing with groundwater is contained in Ludwik A. Teclaff and Albert E. Utton, eds., *International Groundwater Law* (1981). Newer treaties and non-binding instruments can be found in Burchi and Mechlem, *supra* note 28.

<sup>63</sup> Arrangement relatif à la protection, à l'utilisation et à la réalimentation de la nappe souterraine franco-suisse du Genevois, Geneva, 9 June 1977, *Le Conseil d'Etat de la République et Canton de Genève—Préfet de Haute-Savoie*, reprinted in Teclaff and Utton, *supra* note 62 at 464 [hereinafter Genevese aquifer agreement].

<sup>64</sup> [United Nations Economic Commission for Europe] Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 31 I.L.M. 1312 (1992) [hereinafter Helsinki Convention].

<sup>65</sup> *Ibid.*, Article 1, para. 1.

historical monuments or other physical structures or the interaction among these factors.”<sup>66</sup> By virtue of these wide definitions, the Helsinki Convention does not suffer from many of the limitations of the Watercourses Convention. All transboundary groundwaters fall within its scope, and its transboundary impact provisions are more encompassing than the no-significant harm obligation of the Watercourses Convention. In addition, it incorporates and applies to water some of the fundamental principles of contemporary environmental law such as the precautionary principle, the polluter-pays principle, and the principle of sustainable development (Article 2 paragraph 5(a), (b), and (c)). It thereby demonstrates that the protection of transboundary waters is part and parcel of international environmental law.<sup>67</sup> As accession to the Helsinki Convention is likely to become open to non-member states of the UN ECE, its relevance might further increase.<sup>68</sup>

The 2000 SADC Protocol<sup>69</sup> is largely modelled upon the Watercourses Convention and, therefore, shares its limitations. The revised 2003 African Convention on the Conservation of Nature and Natural Resources (African Convention)<sup>70</sup> aims to enhance environmental protection and to foster the conservation and sustainable use of natural resources, among them surface and underground water (Articles II and VII).<sup>71</sup> For the Member States of the European Community (EC), the EC Directive 2000/60 Establishing a Framework for Community Action in the Field of Water Policy (Water Framework Directive)<sup>72</sup> provides for a detailed and ambitious regime of quantity and quality control for surface and groundwater, including specific and timed steps to be taken. A proposal for a daughter directive on the protection of groundwater against pollution, which will together with the Water Framework Directive eventually replace the current groundwater directive,<sup>73</sup> was submitted in September 2003.<sup>74</sup> The purpose of the daughter

<sup>66</sup> *Ibid.*, Article 1, para. 2.

<sup>67</sup> Fitzmaurice, *supra* note 61.

<sup>68</sup> See, Meeting of the Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Amendment to Articles 25 and 26 of the Convention, Annex, Decision III/1, para. 1(a), UN Doc. ECE/MP.WAT/14 of 12 January 2004.

<sup>69</sup> SADC Protocol, *supra* note 5.

<sup>70</sup> African Convention on the Conservation of Nature and Natural Resources, Maputo, 11 July 2003, available at <[http://www.africa-union.org/Official\\_documents/Treaties\\_%20Conventions\\_%20Protocols/nature%20and%20natural%20resource.pdf](http://www.africa-union.org/Official_documents/Treaties_%20Conventions_%20Protocols/nature%20and%20natural%20resource.pdf)> (last accessed 10 June 2004) [hereinafter African Convention]. Its predecessor is the African Convention on the Conservation of Nature and Natural Resources, Algiers, 15 September 1968, 1001 U.N.T.S. 3.

<sup>71</sup> “Underground water” normally comprises both water in the saturated (groundwater) and in the unsaturated zone.

<sup>72</sup> Water Framework Directive, *supra* note 1.

<sup>73</sup> EEC Directive 80/68 of 15 July 1980 on the Protection of Groundwater against Pollution Caused by Certain Dangerous Substances, OJ L. 20, 30 August 1980, 43 [hereinafter Groundwater Directive].

<sup>74</sup> *Proposal for a Directive of the European Parliament and of the Council on the Protection of Groundwater against Pollution*, 19 September 2003, Doc. COM (2003) 550 final [hereinafter Proposal on the Protection of Groundwater against Pollution].

directive is to establish specific measures to prevent and control groundwater pollution.

Bilateral treaties that specifically address groundwater among other subject matters include, *inter alia*, the 1973 Agreement on a Permanent and Definitive Solution to the Salinity of the Colorado River (known as Minute No. 242),<sup>75</sup> which limits groundwater pumping by both Mexico and the United States close to the Arizona–Sonora boundary near San Luis; the 1994 Treaty of Peace between the State of Israel and the Hashemite Kingdom of Jordan (Israel–Jordan Peace Treaty);<sup>76</sup> and the 1995 Israeli–Palestinian Interim Agreement on the West Bank and the Gaza Strip (Israeli–Palestinian Interim Agreement).<sup>77</sup>

The scope of more and more basin or watercourse specific treaties encompasses surface and groundwater either explicitly, or arguably implicitly, by covering the water resources of a particular basin.<sup>78</sup> Treaties are generally based upon the areal limits of surface water management, primarily the river basin. The substantive provisions often reflect only negligible concern with groundwater or none at all. For example, in the Agreement on the

<sup>75</sup> International Boundary and Water Commission United States and Mexico, Minute No. 242 of 30 August 1973, Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River, 12 I.L.M. 1105 (1973) [hereinafter Minute No. 242].

<sup>76</sup> Treaty of Peace between the State of Israel and the Hashemite Kingdom of Jordan, Arava/Araba Crossing Point, 26 October 1994, 34 I.L.M. 43 (1995), Article 6 and 18 and Annexes II and IV [hereinafter Israel–Jordan Treaty of Peace].

<sup>77</sup> Israeli–Palestinian Interim Agreement on the West Bank and the Gaza Strip, Washington, DC, 28 September 1995, 36 I.L.M. 551 (1997), Annex III, Protocol Concerning Civil Affairs, Article 40, Principle 3(a) and (c) [hereinafter Israeli–Palestinian Interim Agreement].

<sup>78</sup> See, *inter alia*, the Convention and Statutes Relating to the Development of the Chad Basin, Fort Lamy, 22 May 1964, reprinted in FAO, Treaties Concerning the Non-Navigational Uses of International Watercourses—Africa, Legislative Study No. 61, at 10 (1997); the Agreement between the Federal Republic of Nigeria and the Republic of Niger Concerning the Equitable Sharing in the Development, Conservation and Use of Their Common Water Resources, Maiduguri, 18 July 1990, reprinted in FAO, Treaties Concerning the Non-Navigational Uses of International Watercourses—Africa, Legislative Study No. 61 at 219 (1997); the Convention on Cooperation for the Protection and Sustainable Use of the Danube River, Sofia, 29 June 1994, O.J. L. 342, 12 December 1997, at 19 [hereinafter Danube Convention]; the Agreement on Cooperation for the Protection and Sustainable Use of the Waters of the Spanish–Portuguese Hydrographic Basins, Albufeira, 30 November 1998, 2099 U.N.T.S. 275 (English translation at 347) [hereinafter Luso-Spanish Cooperation Agreement]; the Protocol for the Sustainable Development of Lake Victoria Basin, Arusha, 29 November 2003 (on file with the author); and the Convention on the Sustainable Management of Lake Tanganyika, Dar es Salaam, 12 June 2003 (on file with author).

Not all modern treaties comprise groundwater. Treaties for specific projects typically do not deal with groundwater as well as some river treaties such as the ones for the Meuse and the Scheldt (Agreement on the Protection of the River Meuse, Charleville Mezieres, 26 April 1994, 34 I.L.M. 854 (1995); the Agreement on the Protection of the River Scheldt, Charleville Mezieres, 26 April 1994, 34 I.L.M. 859 (1995); or the Agreement on Cooperation in the Use and Protection of Transboundary Rivers Concluded between Khazachstan and China, Astana, 12 September 2001 (on file with author). For some basin treaties, it can be difficult to determine whether groundwater is comprised or not, if the terms “waters of the basins” or “basin” are not defined.

Cooperation for the Sustainable Development of the Mekong River Basin,<sup>79</sup> the “parties agree to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin”<sup>80</sup> and “to protect the environment, natural resources, aquatic life and conditions, and ecological balance of the Mekong River Basin from pollution and other harmful effects resulting from any development plans and uses of water and related resources in the Basin.”<sup>81</sup> Groundwater is, however, neither mentioned explicitly in the agreement nor dealt with by the Mekong River Commission. Tendencies to pay more attention to groundwater will be discussed later in this article. It is noteworthy that in some federal jurisdictions such as Australia<sup>82</sup> and the United States<sup>83</sup> interstate compacts can also provide valuable insights into legal rules for transboundary aquifer management.

#### 4. Non-Binding Instruments

A number of non-binding legal instruments address groundwater with more specific and detailed provisions than treaty law. Already the 1977 Mar del Plata Action Plan<sup>84</sup> lists various recommendations for groundwater management. It focuses primarily on the utilization of aquifers and on increasing aquifer-related knowledge.<sup>85</sup> Fifteen years later, in 1992, in the Dublin Statement on Water and Sustainable Development of the International Conference on Water and the Environment (Dublin Statement),<sup>86</sup> and in

<sup>79</sup> Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, Chiang Rai, 5 April 1995, 34 I.L.M. 864 (1995).

<sup>80</sup> *Ibid.*, Article 1.

<sup>81</sup> *Ibid.*, Article 3.

<sup>82</sup> See, for instance, the Border Groundwaters Agreement, State of South Australia—State of Victoria, 15 October 1985, available at <<http://www.parliament.sa.gov.au/Catalog/legislation/Acts/G/1985.104.htm>> (last accessed 10 June 2004) or the Murray Darling Basin Agreement, 24 June 1992, available at <[http://www.mdbc.gov.au/about/governance/\\_pdf\\_word/MDB\\_Agreement.pdf](http://www.mdbc.gov.au/about/governance/_pdf_word/MDB_Agreement.pdf)> (last accessed 10 June 2004).

<sup>83</sup> See, for instance, the Interagency Agreement in the Matter of the Coordinated Management of the Pullman-Moscow Ground Water Aquifer, 20 April 1992.

<sup>84</sup> Mar del Plata Action Plan, *Report of the United Nations Water Conference*, Mar del Plata, 14–25 March 1977, UN Doc. E/CONF.70/29.

<sup>85</sup> It mentions the studying and analysis of data on groundwater for planning purposes (3(o)); assistance for recording quantitative as well as qualitative characteristics of groundwater resources (4(b)); groundwater databanks (4(b)(ii)); the utilization of groundwater aquifers in the form of collective and integrated systems, to exploit groundwater aquifers to their physical limits and to protect springs and groundwater from overdraught and salinity, as well as to ensure proper sharing of the resources (10(a)); exploring the potential of groundwater basins, the use of aquifers as storage and distribution systems, and the conjunctive use of surface and subsurface resources to maximize efficacy and efficiency (10(b)); and supporting research on low-cost groundwater pumping equipment.

<sup>86</sup> Dublin Statement on Water and Sustainable Development, International Conference on Water and the Environment: Development Issues for the Twenty-First Century, available at <<http://www.wmo.ch/web/homs/documents/english/icwedce.html>> (last accessed 10 June 2004) [hereinafter Dublin Statement].

Chapter 18 of Agenda 21 adopted at the United Nations Conference on Environment and Development,<sup>87</sup> in response to increasing water problems, the focus was no longer on utilization but rather on sustainable use, integrated water resources management, and the protection of water resources and ecosystems.<sup>88</sup> The Conference of the Contracting Parties to the Convention on Wetlands of International Importance Especially as Waterfowl Habitat<sup>89</sup> adopted in Resolution VIII.40 Guidelines for Rendering the Use of Groundwater Compatible with the Conservation of Wetlands.<sup>90</sup>

At the regional level, the UN ECE adopted a Charter on Groundwater Management (Groundwater Management Charter), which deals with groundwater policies; strategies; allocation; legislation; economic measures; exploration, abstraction, recharge, and pollution control permits; wells and boreholes; monitoring and control; impact assessment, inventories, planning, and forecasting; land-use policies; protection zones; pollution from agriculture, urban, and industrial sources; control of mining activities; heat pumps; research; education and information; and international cooperation.<sup>91</sup> The UN ECE also developed detailed Groundwater Monitoring Guidelines.<sup>92</sup> The United Nations Economic and Social Commission for Western Asia (ESCWA) is currently developing guidelines on groundwater management. They are intended to cover what is perceived to be exclusively national groundwater without touching on transboundary issues.<sup>93</sup>

One of the most important instruments with respect to non-recharging as well as recharging groundwater is the so-called Seoul Rules, which were adopted by the International Law Association (ILA) in 1986.<sup>94</sup> These rules render the earlier 1966 Helsinki Rules of the ILA,<sup>95</sup> which were a precursor of the Watercourses Convention, applicable to aquifers unconnected to the surface waters of international drainage basins. Since the Seoul Rules, the

<sup>87</sup> Agenda 21, *Report of the United Nations Conference on Environment and Development*, UN Doc. A/CONF.151/26/Rev.1, Volume 1, Annex II.

<sup>88</sup> See Principle 1 of the Dublin Statement and Agenda 21 Chapters 18.1–18.6, 18.12, 18.23, 18.24, 18.26, 18.27, 18.35, 18.37–18.40, 18.76, and 18.85 among others.

<sup>89</sup> Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, Ramsar, 2 February 1971, available at <[http://www.ramsar.org/key\\_conv\\_e.htm](http://www.ramsar.org/key_conv_e.htm)> (last accessed 10 June 2004).

<sup>90</sup> Resolution VIII.40 Guidelines for Rendering the Use of Groundwater Compatible with the Conservation of Wetlands adopted at the 8th Meeting of the Conference of the Contracting Parties, 18–26 November 2002, accessible at <[http://www.ramsar.org/key\\_res\\_viii\\_40\\_e.pdf](http://www.ramsar.org/key_res_viii_40_e.pdf)> (last accessed 10 June 2004).

<sup>91</sup> Charter on Groundwater Management, adopted by the UN ECE at its forty-fourth session (1989) by Decision E (44), UN Doc. E/ECE/1197 ECE/ENVWA/12 [hereinafter Groundwater Management Charter].

<sup>92</sup> UN ECE Task Force on Monitoring and Assessment, *Guidelines on Monitoring and Assessment of Transboundary Groundwaters* (2000).

<sup>93</sup> Only an outline is available in English up to now (on file with author).

<sup>94</sup> Seoul Rules, reprinted in ILA, *Report of the Sixty-Second Conference Held at Seoul*, at 251 (1987).

<sup>95</sup> Helsinki Rules, reprinted in ILA, *Report of the Fifty-Second Conference Held at Helsinki*, at 484 (1967).

Helsinki Rules apply to all groundwaters intersected by a boundary between two or more states “whether or not the aquifer and its waters form with surface waters part of a hydraulic system flowing into a common terminus.”<sup>96</sup> An aquifer that “does not contribute water to, or receive water from, surface waters of an international drainage basin constitutes an international drainage basin for the purposes of the Helsinki Rules.”<sup>97</sup> Hence, the Seoul Rules dispensed with the requirements that limited the scope of the Helsinki Rules in a manner similar to those of Article 2 of the Watercourses Convention and made them applicable to all cases left out by the latter. In addition, the Seoul Rules contain provisions dealing with pollution; consultation, information, and data exchange; cooperation; and integrated management. Thereby, the ILA recognized that the particularities of groundwater require special rules.<sup>98</sup>

An attempt by a multidisciplinary group of independent scholars to devise rules for transboundary aquifers is the Bellagio “Draft Agreement Concerning the Use of Transboundary Groundwaters.”<sup>99</sup> One of the core suggestions of the Bellagio draft is the establishment of a commission charged with joint management, including abstraction and allocation questions and the protection of the shared resource. The draft contains detailed provisions on the functions of the commission, exploration and development of the resource, databases, water quality protection, conservation areas, management plans, planned depletion, transboundary transfer of waters, planning for draught and the accommodation of differences, and the resolution of conflicts. It was a pioneering effort that could still inspire aquifer agreements, especially if the provisions of the Bellagio draft were complemented by environmental provisions on sustainable use, preventive action, environmental impact assessments, and others. Until now, no groundwater treaty has been modelled upon the draft, which, among other reasons, may be due to the fact that it is clearly tailored to the US–Mexico border situation.

#### IV. TOWARDS CLOSING THE GAPS

##### 1. Tendencies at the Bilateral and Multilateral Level

Despite the relatively rare appearances of groundwater in international law, there are some emerging tendencies to address groundwater-specific challenges and problems, some of which shall be discussed in this article.<sup>100</sup>

<sup>96</sup> Seoul Rules, *supra* note 94, Article 1.      <sup>97</sup> *Ibid.*, Article 2, para. 2.

<sup>98</sup> After finalization of this paper the ILA adopted its new “Berlin Rules on Water Resources” in August 2004, which contain a separate chapter on groundwater. ILA, Report of the Seventy-First Conference Held in Berlin (forthcoming, 2005).

<sup>99</sup> “Draft Agreement Concerning the Use of Transboundary Groundwaters”; reprinted and commented in Robert D. Hayton and Albert E. Utton, *Transboundary Groundwaters: The Bellagio Draft Treaty* 29 Nat. Resources J. at 663 (1989).

<sup>100</sup> Due to limitations of space only provisions that deal specifically with groundwater will be mentioned as evidence of emerging state practice. The same and more trends could be distilled

### A. *Managing Aquifers*

Surface and groundwater basins do not necessarily have the same boundaries. A groundwater basin underlying a surface water basin can be of a different extension and shared by other states than the topographically determined surface water basin. In order to address problems of excessive abstraction and pollution, it may be necessary to manage aquifers, particularly large regional ones, as units in their own right—not just as adjuncts to surface water—and to create institutional mechanisms for their management. In international law, there are developments in this direction. According to the UN ECE Protocol on Water and Health, states “shall develop water-management plans in transboundary, national and/or local contexts, preferably on the basis of catchment areas or groundwater aquifers.”<sup>101</sup> Article VI(2) of the UN ECE Groundwater Management Charter states that “the territorial competence of [water authorities or co-coordinating bodies] with respect to groundwater management should not necessarily be limited to . . . catchment areas, but should allow for encompassing, as appropriate, management of aquifers in their entirety.” The 1992 Dublin Statement commends “effective management [that] links land and water uses across the whole of a catchment *or groundwater aquifer*.”<sup>102</sup> Agenda 21 contains an objective to “have all countries establish the institutional arrangements to ensure the efficient collection . . . of information . . . at the level of catchments and *groundwater aquifers* in an integrated manner.”<sup>103</sup>

For a small number of aquifers, such an approach has begun to become reality. One early and exceptional example is the management of the Genevese Aquifer, which is regulated by the 1977 Genevese Aquifer Agreement,<sup>104</sup> which established a joint commission for the administration of the shared aquifer. For the Nubian Sandstone Aquifer System, a joint authority was established for the study and development of the aquifer system in the early 1990s.<sup>105</sup> Among other matters, the authority is responsible for collect-

from an analysis of legal instruments covering indistinctively surface and groundwater or water resources in general.

<sup>101</sup> UN ECE Protocol on Water and Health, *supra* note 1, Article 6, para. 5(b).

<sup>102</sup> Dublin Statement, *supra* note 86, Principle No. 1 [emphasis added].

<sup>103</sup> Agenda 21, *supra* note 87, Chapter 18.24(d) [emphasis added]. See also the 2003 African Convention, *supra* note 70, Article VII, para. 3, that contains a duty for states, “if need arises, to set up inter-state commissions for the rational management and equitable utilization and to resolve disputes arising from the use of [transboundary surface or underground water] resources, and for the cooperative development, management and conservation thereof.”

<sup>104</sup> Genevese aquifer agreement, *supra* note 63.

<sup>105</sup> It was established first by Egypt and Libya. Sudan and Chad became members of the authority subsequently. An unofficial English translation of the Arabic original of the treaty is on file with the author. In 2000, two concise technical agreements were concluded: one on monitoring and exchange of groundwater information, the other on monitoring and data sharing, both were adopted in Tripoli on 5 October 2000 (on file with author).

ing and updating data, conducting studies, formulating plans and programs for water resources development and utilization, implementing common groundwater management policies, training technical personnel, rationing the aquifer waters, and studying the environmental aspects of water resources development.<sup>106</sup> Cooperation efforts are also ongoing with respect to the North-Western Sahara Aquifer System (SASS). At the end of 2002, Algeria, Libya, and Tunisia agreed to institutionalize cooperation in the management and development of the water resources in the form of a small secretariat attached to the inter-governmental Observatoire du Sahara et du Sahel. The secretariat will ensure continuity of cooperation in hydrogeological data collection and aquifer modelling in aid of domestic planning and decision-making by the concerned countries.<sup>107</sup> For the Guaraní Aquifer, which is shared by Argentina, Brazil, Paraguay, and Uruguay, an institutional framework for management and preservation is being developed as part of a GEF-financed project.<sup>108</sup> For the Iullemeden Aquifer System, overlain by Mali, Niger, and Nigeria, an FAO technical cooperation project has the objective to facilitate the establishment of a legal mechanism for tripartite consultation in the management of the shared aquifer system in order to complement a larger GEF-financed project with the aim of managing hydrogeological risk.

These are encouraging tendencies that show that an aquifer system is increasingly seen as a unit that requires holistic management. States are more and more willing to recognize the shared nature of transboundary aquifers and to draw consequences in the form of institutionalized cooperation. Joint institutions have proven to play an important role in surface water management as demonstrated by the countless joint river or basin bodies and commissions. It goes without saying that where aquifers are hydraulically linked to surface water bodies, it is necessary to integrate the management of the two resources and to find suitable institutional arrangements that either bestow responsibility for both resources on one joint authority or that coordinate the responsibilities and tasks of separate bodies.

### *B. Integrated Water Resources Management*

Integrated water resources management can be defined as “a process, which promotes the co-ordinated development and management of water, land and

<sup>106</sup> Stefano Burchi, Marcella Nanni, and Kerstin Mechlem, *Sustainable Utilization of Groundwater Resources: Legal and Institutional Aspects*, in UNESCO, ed., *Non-Renewable Groundwater Resources—A Guidebook on Utilisation for Water Resource Policy-Makers* (forthcoming 2004).

<sup>107</sup> On file with author.

<sup>108</sup> See the project's website at <<http://www.sg-guarani.org/>> (in Spanish, last accessed on 29 January 2004).

related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.”<sup>109</sup> It implies that surface and groundwater are used conjunctively (this dimension is often called “conjunctive use”) and that water quality and quantity management are integrated. This principle is of key importance for the management and preservation of groundwater. Groundwater and surface water are interrelated elements of the same hydrological cycle. The management of other resources, particularly of land, impacts on groundwater quality and quantity, and, conversely, the management of groundwater affects other resources. The lowering of the water table might lead, for instance, to the drying up of a wetland. A polluted coastal aquifer can cause land-based pollution of marine waters. Surface water can pollute groundwater and vice versa.

More and more treaties and international instruments mention integrated water resources management explicitly or implicitly and often specify that this principle comprises the integration of surface and groundwater management. According to the UN ECE Protocol on Water and Health, “[w]ater resources should, as far as possible, be managed in an integrated manner on the basis of catchment areas. Such an integrated approach should apply across the whole of a catchment area, whether transboundary or not, . . . the whole of a groundwater aquifer or the relevant parts of such a catchment area or groundwater aquifer.”<sup>110</sup> The parties to the African Convention shall take appropriate measures with due regard to the integrated management of water resources;<sup>111</sup> Articles 2(e) and 6 of the Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) contain obligations of sustainable and integrated water/river basin management;<sup>112</sup> and in the 2002 Framework Agreement on the Sava River Basin, the parties agreed “to cooperate on management of the waters of the Sava River Basin in a sustainable manner, which includes integrated management of surface and ground water resources.”<sup>113</sup> Integrated water resources management is also foreseen in Articles III and XVII of the UN ECE Groundwater Management Charter, Principle 1 of the Dublin

<sup>109</sup> Global Water Partnership Technical Advisory Committee [hereinafter TAC], *Integrated Water Resources Management*, TAC Background Papers No. 4, Stockholm, 2000, at 22.

<sup>110</sup> UN ECE Protocol on Water and Health, *supra* note 1, Article 5(j).

<sup>111</sup> African Convention, *supra* note 70, Article VII, para. 2(b)).

<sup>112</sup> Framework Convention on the Protection and Sustainable Development of the Carpathians, available at <[http://www.unep.ch/roe/assets/programme\\_activities/environmental\\_law/04\\_emi/documents/final\\_carpathian\\_convention.pdf](http://www.unep.ch/roe/assets/programme_activities/environmental_law/04_emi/documents/final_carpathian_convention.pdf)> (last accessed 20 April 2004) [hereinafter Carpathian Convention].

<sup>113</sup> Framework Agreement on the Sava River Basin, Bosnia and Herzegovina, Republic of Croatia, Republic of Slovenia and Federal Republic of Yugoslavia, Kranjska Gora, 3 December 2002, available at <<http://www.unece.org/env/water/text/Sava-agreement.pdf>> (last accessed 20 April 2004), Article 11.

Statement, Agenda 21,<sup>114</sup> and the Johannesburg Plan of Implementation of the World Summit on Sustainable Development.<sup>115</sup>

Integrated water resources management is an ambitious goal. In practice, its implementation causes great difficulties as it typically cuts across the mandates and powers of several institutions and exceeds the management and institutional capacities of developing countries, in particular.<sup>116</sup> Nevertheless, it is in keeping with the hydrological cycle and obliges parties and joint bodies to manage all waters and related resources of basins in a holistic way.

### *C. Sustainable Use*

#### *i. Limiting drawdowns<sup>117</sup>*

Aquifers often store vast amounts of water—depletion is typically not the main concern. It is not sheer quantity as such, but the quantity that is economically, physically, and technologically recoverable both now and in the future, that counts. This quantity can be but a fraction of the overall volume and is largely a function of the level of groundwater. Water level decline affects the economics of abstraction, can cause salinization and other water quality decline, and can have negative effects on the sustainability of dependent uses typically long before the resource base itself is threatened with physical exhaustion. Wetlands and stream flows may dry up even when the total amount of water stored in a basin remains huge.<sup>118</sup> In order to utilize an aquifer in an equitable and sustainable manner, not only the quantity of the water but also the pressure and the overall benefits of the aquifer count. In cases in which abstraction exceeds recharge, one question to be addressed is over what time periods the resource balance should be evaluated, especially in the more arid climates where major recharge can occur as infrequently as once in a decade or once in a century.<sup>119</sup>

Allocation, abstraction, and sustainable use have been dealt with in state treaty practice. The 1964 Agreement between the Government of the Polish

<sup>114</sup> See, *inter alia*, Agenda 21, *supra* note 87, Chapters 18.3 and 18.76(c)(iii) (the latter being on conjunctive use).

<sup>115</sup> Johannesburg Plan of Implementation, in *Report of the World Summit on Sustainable Development*, Johannesburg, 26 August–2 September 2002, UN Doc. A/CONF.199/20, para. 26(a) [hereinafter JPOI].

<sup>116</sup> For examples, see Shammy Puri, *Issues in Developing Co-operation or the Sustainable Management of Transboundary Aquifers*, in Janos Bogardi and Saskia Castelein, eds., *Selected Papers of the International Conference from Conflict to Cooperation in International Water Resources Management: Challenges and Opportunities*, UNESCO-IHE Delft, the Netherlands, 20–22 November 2002, UNESCO-IHP (2004), at 37.

<sup>117</sup> The discussion of other uses than water abstraction is beyond the scope of this article.

<sup>118</sup> Burke et al., *supra* note 9 at 39. On the other hand, some reduction may also be desired, since it often improves land drainage and maximizes groundwater recharge rates by reducing “rejected” recharge.

<sup>119</sup> *Ibid.* at 23.

People's Republic and the Government of the Union of Soviet Socialist Republics Concerning the Use of Water Resources in Frontier Waters refers to the protection of frontier groundwaters against depletion and pollution.<sup>120</sup> Minute No. 242 limits groundwater pumping within five miles of the US–Mexican boundary to a certain quantity.<sup>121</sup> The Genevese aquifer agreement aims at ensuring the protection of the waters in the aquifer, foresees yearly aquifer utilization programs, and limits abstraction.<sup>122</sup> The 1994 Israel–Jordan Peace Treaty foresees that “Israel shall retain the use of [the Groundwater in Emek Ha’arave/Wadi Araba] in the quantity and quality detailed” and that neither Israel nor Jordan “shall take . . . any measure that may appreciably reduce the yields of quality of [these] wells and systems.”<sup>123</sup> The possibility of increasing the abstraction rate is limited.<sup>124</sup> In Article 40 of Annex III of the 1995 Israeli–Palestinian Interim Agreement, the parties agreed to “[maintain] existing quantities of utilization from the [water] resources, taking into consideration the quantities of additional water for the Palestinians from the Eastern Aquifer . . . as detailed in this article” and to “us[e] the water resources in a manner which will ensure sustainable use in the future, in quantity and quality.”<sup>125</sup> Groundwater abstraction exceeding certain limits must be notified under the Tripartite Interim Agreement between the Republic of Mozambique and the Republic of South Africa and the Kingdom of Swaziland for Co-operation on the Protection and Sustainable Utilisation of the Water Resources of the Incomati and Maputo Watercourses.<sup>126</sup> In such cases, the UN ECE Convention on Environmental Impact Assessment in a Transboundary Context requires an environmental impact assessment.<sup>127</sup> In soft law, the UN ECE Groundwater Management Charter, among other instruments, calls on states to take account of the amount of groundwater in reserve and of the rate of its replenishment in allocating groundwater resources.<sup>128</sup>

<sup>120</sup> Agreement between the Government of the Polish People's Republic and the Government of the Union of Soviet Socialist Republics Concerning the Use of Water Resources in Frontier Waters, Warsaw, 17 July 1964, 552 U.N.T.S. 175 (English translation at 188), Article 3, para. 7.

<sup>121</sup> Minute No. 242, *supra* note 75.

<sup>122</sup> Genevese aquifer agreement, *supra* note 63, Articles 2, paras. 1 and 9.

<sup>123</sup> Israel–Jordan Treaty of Peace, *supra* note 76, Annex II Water and Related Matters, Article IV, para. 1.

<sup>124</sup> *Ibid.*, Annex II Water and Related Matters, Article IV, paras. 1 and 3.

<sup>125</sup> Protocol Concerning Civil Affairs to the Israeli–Palestinian Interim Agreement, *supra* note 77.

<sup>126</sup> Tripartite Interim Agreement between the Republic of Mozambique and the Republic of South Africa and the Kingdom of Swaziland for Co-operation on the Protection and Sustainable Utilisation of the Water Resources of the Incomati and Maputo Watercourses, Johannesburg, 29 August 2002, Annex III(g), available at <<http://faolex.fao.org/faolex/index.htm>> (last accessed 26 October 2004).

<sup>127</sup> [UN ECE] Convention on Environmental Impact Assessment in a Transboundary Context, Espoo, 25 February 1991, 30 I.L.M. 800 (1991), Article 2, para. 2 and Appendix I, para. 12.

<sup>128</sup> See Groundwater Management Charter, *supra* note 91, Article IV.

ii. Pollution protection

The importance of groundwater protection cannot be overestimated. The possibilities of cleaning up pollution from direct or indirect discharge of pollutants, including both point and non-point sources, from injection of polluted water, and from saline water intrusion are limited. Pollution has long-lasting effects on both the waters and the aquifer matrix due to slow flow patterns. Ludwik and Eileen Teclaff showed in 1979 that existing treaties and institutions established under them were far from adequate to cope with the increasingly serious problems posed by groundwater pollution and that groundwater pollution, and activities that may lead to it, were treated as a minor part of surface water quality management and not as a distinct problem necessitating separate provisions.<sup>129</sup> This assessment is still true to a large extent. The most comprehensive and detailed set of rules for groundwater quality protection can be found in EC law.<sup>130</sup> Due to the special nature of this regime, it shall not be expanded upon in this article, although it does need to be taken into account in water treaties of the EC Member States.

According to Article 3, paragraph 1(k) of the Helsinki Convention, the parties shall ensure that additional specific measures are taken to prevent the pollution of groundwater, and Annex III (Guidelines for Developing Water-Quality Objectives and Criteria) foresees that “water quality objectives and criteria . . . shall take into account specific requirements regarding sensitive and specially protected waters and their environment, for example, lakes and groundwater resources.” The African Convention stipulates that the parties shall take appropriate measures with due regard to the prevention and control of surface and underground water resources through, *inter alia*, the establishment of effluent and water quality standards.<sup>131</sup> Article 6(b) of the Carpathian Convention contains a duty to pursue policies aiming at ensuring adequate supply of good quality surface and groundwater and (c) at conserving groundwater resources.<sup>132</sup> The Agreement on Cooperation for the Protection and Sustainable Use of the Waters of the Spanish–Portuguese Hydrographic Basins foresees the promotion and protection of “el buen

<sup>129</sup> Teclaff, *supra* note 28 at 629, 647, and 660.

<sup>130</sup> Of relevance are, *inter alia*, the Water Framework Directive (*supra* note 1), the Groundwater Directive (*supra* note 73); the *Proposal on the Protection of Groundwater against Pollution* (*supra* note 74); the EC Directive 99/31 of 26 April 1999 on the Landfill of Waste, OJ L. 182, 16 July 1999, at 1; the EEC Directive 80/778 of 15 July 1980 Relating to the Quality of Water Intended for Human Consumption, OJ L. 229, 30 August 1980, at 11 (as amended by EC Directive 98/83 of 3 November 1998 on the Quality of Water Intended for Human Consumption, OJ L. 330, 5 December 1998, at 32); and the EEC Directive 91/676 of 12 December 1991 Concerning the Protection of Waters against Pollution Caused by Nitrates from Agricultural Sources, OJ L. 375, 31 December 1991, at 1.

<sup>131</sup> African Convention, *supra* note 70, Article VII, para. 2(e).

<sup>132</sup> Carpathian Convention, *supra* note 112.

estado de las aguas superficiales y subterráneas” and the prevention of “la degradación de las aguas subterráneas y mejorar su calidad con vistas a alcanzar su buen estado.”<sup>133</sup> According to Article 6 of the Convention on Cooperation for the Protection and Sustainable Use of the Danube River (Danube Convention), states shall, as specific water resources protection measures, “(a) enumerate groundwater resources subject to a long-term protection as well as protection zones valuable for existing or future drinking water supply purposes; [and] (b) prevent the pollution of ground-water resources, especially those in a long-term perspective reserved for drinking water supply, in particular caused by nitrates, plant protection agents and pesticides as well as other hazardous substances.”<sup>134</sup> By mentioning these sources of pollution, the Danube Convention hints at an important issue, namely that of land use regulation, which is often difficult to reconcile with claims of largely unfettered sovereignty in this field. Also, the Johannesburg Plan of Implementation of the World Summit on Sustainable Development calls for the protection of groundwater against pollution.<sup>135</sup>

Special consideration also should be given to the long-term effects of groundwater pollution. This necessity was recognized in the Seoul Rules, according to which basin states shall prevent or abate the pollution of international groundwaters in accordance with international law applicable to existing, new, increased, and highly dangerous pollution, and special consideration shall be given to the long-term effects of the pollution of groundwater.<sup>136</sup> The UN ECE Groundwater Management Charter lists as groundwater protection measures, *inter alia*, the development of groundwater vulnerability maps, the monitoring of groundwater, geo-ecological assessments of the impact of industrial and agricultural activities on groundwater, and the zoning of groundwater protection areas.<sup>137</sup>

## 2. Groundwater on the Agenda of the ILC

### A. Overview

In its 1994 resolution (which was discussed earlier in this article), the ILC had recognized a “need for continuing efforts to elaborate rules pertaining to confined transboundary groundwater.”<sup>138</sup> In 2002, it included the topic “shared natural resources of states,” comprising oil, gas, and “confined”

<sup>133</sup> Luso-Spanish Cooperation Agreement, *supra* note 78, Article 4 and 13, para. 2(b); see also official English translation “satisfactory condition of the surface waters and groundwater” and “[p]revent the degradation of groundwater and improve its quality in order to attain a satisfactory condition.”

<sup>134</sup> Danube Convention, *supra* note 78.

<sup>135</sup> JPOI, *supra* note 115 at para. 66(d); see also para. 25(d).

<sup>136</sup> Seoul Rules, *supra* note 94, Article 3, para. 1.

<sup>137</sup> Groundwater Management Charter, *supra* note 91, Article 2, para. 3. The protection of recharge areas as a legal obligation is also suggested by McCaffrey, *supra* note 28 at 430.

<sup>138</sup> *Report of the ILC to the General Assembly on Its Forty-Sixth Session*, *supra* note 37.

groundwaters in its long-term program of work<sup>139</sup> and appointed Chusei Yamada as special rapporteur for this topic.<sup>140</sup> As already mentioned, the ILC used the term “confined groundwater” for aquifers that are not related to surface waters. It intended to develop rules for those groundwaters that fall outside the scope of the Watercourses Convention, in particular, for non-recharging ones, and to explore their similarities with other non-renewable resources such as oil and gas.

In 2003, Yamada presented a *First Report on Outlines*<sup>141</sup> with a technical addendum on groundwater.<sup>142</sup> The report introduced the topic of shared natural resources, indicated how the special rapporteur intended to approach the subject, and gave an overview of the ILC’s earlier work on groundwater during the development of the draft articles for the Watercourses Convention. The addendum presented the nature of groundwater, concepts, causes of degradation, technical issues, and terminology. Both documents reveal the complexity of the topic. Yamada pointed out that he deemed it necessary to have a good understanding of groundwater and to use hydrologically accepted terminology, expressed doubts about the viability of a legal distinction between some types of groundwaters and others, and indicated that the study of groundwater could take more time than originally foreseen.<sup>143</sup> Some members of the ILC supported the special rapporteur’s views and suggested that priority be given to groundwater and that the topic of oil and gas be postponed until the ILC had concluded its work on groundwaters. Others stressed that dealing with the world water crises was the responsibility of the states under whose surface groundwater was found and that the ILC should not embark on the development of a prescriptive set of rules.<sup>144</sup> During the debate about the work of the ILC in the Sixth Committee of the UN General Assembly, a number of states supported the view of some ILC members that the principles of the Watercourses Convention should not be transposed automatically to the management of groundwater and that, in particular, the provisions regarding harm were too weak or that they required modification given the susceptibility of aquifers to degradation. Stricter standards of use, lower thresholds of harm, and heightened standards of diligence were

<sup>139</sup> *Report of the ILC to the General Assembly on Its Fifty-Fourth Session*, Official Records of the General Assembly, 57th Session, Supplement No. 10, UN Doc. A/57/10, chap. X.A.1, para. 518.

<sup>140</sup> *Ibid.* at para. 519.

<sup>141</sup> Chusei Yamada, Special Rapporteur, *Shared Natural Resources: First Report on Outlines*, *supra* note 15.

<sup>142</sup> Chusei Yamada, Special Rapporteur, *Shared Natural Resources: First Report on Outlines*, 30 June 2003, UN Doc. A/CN.4/533/Add.1.

<sup>143</sup> *Report of the ILC to the General Assembly on Its Fifty-Fifth Session*, Official Records of the General Assembly, 58th session, Supplement No. 10, 30 April 2003, UN Doc. A/58/10, chap. IX, B, paras. 377, 380, 403–6 and Doc. A/CN.4/533.

<sup>144</sup> *Ibid.*, paras. 389 and 391.

mentioned.<sup>145</sup> Neither the special rapporteur's report and its addendum nor the debates in the ILC and the Sixth Committee were limited to groundwater that was not related to surface water. The special rapporteur intends to deal with all aquifers in his work.<sup>146</sup>

In his second *Report on Shared Natural Resources: Transboundary Groundwaters*, the special rapporteur presented a first set of seven draft articles dealing with the scope of a new legal instrument, definitions, principles governing the uses of aquifer systems, the obligation not to cause harm, the general obligation to cooperate, the regular exchange of data and information, and different kinds of uses.<sup>147</sup> An addendum contained case studies and models of several types of transboundary and international aquifers.<sup>148</sup> The debate in the ILC, as well as issues raised during a meeting of a working group of the ILC on transboundary groundwaters with hydrogeological and legal experts<sup>149</sup> focused, *inter alia*, on the scope of the proposed articles and issues of terminology such as the distinction between aquifers and groundwater. At the 2005 session of the ILC, the special rapporteur will present his third report on groundwater in which he plans to propose the outline of a new legal instrument on groundwater and some or all of the remaining articles. A report on oil and gas and a final report containing a comprehensive review of the topic were originally scheduled for 2005 and 2006, respectively, but have been deferred until there has been more progress on the work on groundwater.

### *B. Scope, Principles, and the Type of a New Groundwater Instrument*

The ILC's dealing with the topic might lead to the codification of a new international legal instrument on groundwater. In its work, the ILC faces a number of challenges in addition to the technical complexity of the subject. First, the determination of the scope is problematic in several ways. If, in order to avoid overlap, the scope is limited to those cases that are not covered by the Watercourses Convention, there will be one legal regime for groundwater not related to surface water (the new instrument) and another one for

<sup>145</sup> *Report of the ILC to the General Assembly on Its Fifty-Fifth Session*, *supra* note 143, at paras. 397 and 400 (for the debate in the ILC); and in *Summaries of the Work of the Sixth Committee*, available at <[www.un.org/law/cod/sixth/58/summary.htm](http://www.un.org/law/cod/sixth/58/summary.htm)> (last accessed 2 December 2003) (for the debate in the Sixth Committee).

<sup>146</sup> Summing-up of the debate in the ILC on groundwaters by C. Yamada, United Nations, Geneva, 14 May 2004.

<sup>147</sup> Yamada, *supra* note 15.

<sup>148</sup> UN Doc. A/CN.4/539/Add.1.

<sup>149</sup> The working group sessions took place on 23 and 24 May 2004. Present were hydrogeological and legal experts from UNESCO (Alice Aureli and Raya Stephan), the FAO (Stefano Burchi, Jacob Burke, and the author), and the International Association of Hydrogeologists (Shammy Puri).

groundwater related to surface water (the Watercourses Convention). This situation would be problematic as the challenges faced in the management of both types of groundwater are essentially the same. An analysis of state practice shows that identical rules have been devised for all types of groundwaters (compare the Helsinki Convention or the ILC's Seoul Rules). Regulating essentially the same subject matter in two different ways should be avoided. A second option for the ILC would be to deal with all transboundary groundwaters or—a third option that would widen the scope even further—all international groundwaters (for the distinction between transboundary and international groundwater and its implications, see Part II earlier in this article) and to accept that there will be overlap with the Watercourses Convention, which could possibly be dealt with in a provision that indicates which regime takes precedence. In this case, a set of meaningful groundwater adequate rules could be devised. A fourth option, which is likely to be too ambitious, would be to develop international rules for groundwater in general, comprising international and purely domestic aquifers, and to distinguish between the two where necessary and appropriate. The optimal solution, namely one instrument that covers comprehensively surface and groundwater and their hydraulic linkages, is hardly feasible as the Watercourses Convention already exists. Hence, although surface and groundwater are part of the same hydrological cycle and *de facto* inextricably linked, the law will treat them as two separate subject matters.

In any case, the ILC will have to make use of its competency to progressively develop international law since codification alone will not be feasible due to a certain lack of custom. The new legal regime is unlikely to be the same as for oil and gas—even where only groundwater de-coupled from contemporary recharge is concerned. The indispensability of groundwater for human survival, its vulnerability to pollution, its multiple *in situ* and *ex situ* uses, and the dispersed ways in which it is abstracted, render it very different from oil and gas. Account will have to be taken of the significant developments in environmental law that have increasingly been incorporated into international water law. Sustainable management, the precautionary and preventive action principles, and a well-designed protection regime seem indispensable. A replication of the principles contained in the Watercourses Convention alone would not meet the specific requirements of groundwater management.

Finally, the ILC will have to decide what kind of instrument to develop. Different options exist. One option is a draft of a new groundwater convention. The binding nature of a convention, once entered into force, would be an advantage. However, a convention would be subject to a lengthy negotiation process that would possibly lead to an outcome of the smallest common denominator. A premature attempt at codification could also interrupt the current evolution of norms and could undermine the power of emerging

principles.<sup>150</sup> Another option would be a protocol or annex to the Watercourses Convention. However, as the Watercourses Convention might never enter into force, this seems problematic. Six years after its adoption, the convention has only sixteen signatories and twelve parties<sup>151</sup> instead of the thirty-five ratifications required for its entry into force.<sup>152</sup> A third option is the drafting of a non-binding instrument such as a set of recommendations or guidelines, or of articles for a convention that the ILC would then refrain from recommending for the negotiations of a treaty.<sup>153</sup> In a non-binding instrument, it is more acceptable to progressively develop law and to recognize emerging principles and rules. In many cases, compliance with a non-binding instrument seems to be the same as with a binding one. It could be developed faster, and, as it would not be subject to a negotiation process, its content would not be amended according to political interests. Rather, it would contribute to the development of customary international law and could serve as a stepping-stone towards a binding regime later on. Given that distinct principles of international groundwater law are only slowly emerging, that state practice is patchy, and that some resistance exists to the recognition of the application of international law in this field, a non-binding instrument could be a suitable option.

### *C. ILC as the Adequate Forum*

Some doubts exist as to whether the ILC is an adequate forum to deal with issues that require extensive technical knowledge and where, due to a certain lack of evidence of customary law, the focus on the work is on progressive development of the law rather than on the codification of custom. While both fall within the mandate of the ILC, arguably the strength of the ILC lies in codifying custom on the basis of treaty and legal literature analysis.<sup>154</sup> The ILC might not be the most suitable body for the development of legal rules if there are too few rules to codify and too many policy choices to

<sup>150</sup> Thomas Franck, Non-Treaty Law-Making: When, Where and How? paper presented at a conference on the Development of International Law: Alternatives to Treaty-Making, Heidelberg, 14–15 November 2003.

<sup>151</sup> Status as of 1 December 2003. United Nations Treaty Collection, available at <<http://untreaty.un.org/>>.

<sup>152</sup> Watercourses Convention, *supra* note 4, Article 36.

<sup>153</sup> For the draft articles on state responsibility, the ILC recommended that the UN General Assembly take note of them and annex them to a resolution. Only at a later stage the General Assembly should consider the adoption of a convention. Official Records of the UN General Assembly, 56th session, Supplement No. 10, UN Doc. A/56/10 at 41. On the role of non-binding law in general, see, among others, Edith Brown Weiss, ed., *International Compliance with Nonbinding Accords*, Studies in Transnational Legal Policy, No. 29 (1997) and Dinah Shelton, ed., *Commitment and Compliance—The Role of Non-Binding Norms in the International Legal System* (2000).

<sup>154</sup> Nollkaemper, *supra* note 55 at 39, 51.

make.<sup>155</sup> While groundwater degradation is accelerating, the ILC's work can be painstakingly slow.<sup>156</sup> The drafting of the articles on the non-navigational uses of international watercourses took over twenty years. The speed of work depends not only on the commission itself but also on the states concerned and their approach to, and interest in, a topic.<sup>157</sup>

#### V. CONCLUSION

Groundwater constitutes 97 per cent of available freshwater on earth. At the international level, problems of groundwater over-abstraction and pollution, leading to the overall degradation of aquifers, are increasing. The characteristics of groundwater and the challenges faced in its management are distinct from those of surface water. They require special regulation, but there have been shortcomings in developing groundwater rules. The Watercourses Convention excludes important types of aquifers from its scope and its substantive provisions are not fully adequate to deal with the special requirements of groundwater. It is a typical example of water treaties that either explicitly deal with surface water alone or include groundwater nominally in their scope without paying detailed attention to it. It is primarily non-binding instruments that provide more groundwater-specific guidance.

There is, however, a tendency in state practice to increasingly develop groundwater-adequate rules. In some instances, aquifers are not only managed as adjuncts to surface water but as distinct units in their own right. The principle of integrated water resources management requires that states integrate the management of surface and groundwater, quantity and quality, and of water and related resources such as land. In line with the principle of sustainable use, rules have been devised on limiting excessive drawdowns and for the particular problem of groundwater pollution.

Groundwater is now also on the agenda of the ILC, which will develop a legal regime for its management over the coming years. The ILC's task is a challenging one. Less than ten years since the ILC's adoption of the draft articles on the non-navigational uses of international watercourses, the ILC will need to revisit most of the principles later codified in the Watercourses Convention. While some principles and rules might remain untouched, others will need to be adjusted, and newer ones, such as the principle of sustainable use or the precautionary principle, might have sufficiently matured to be included in a new instrument. Both emerging state practice

<sup>155</sup> *Ibid.* See also the remark made by former ILC member Ahmed Mahiou that the ILC is a codification body and not a think tank. *Summary Records of the Meetings of the Forty-Fifth Session*, 3 May to 23 July, I Y.B. I.L.C. at 97 (1993).

<sup>156</sup> Ian Sinclair, *The International Law Commission*, at 32 (1987).

<sup>157</sup> Bernhard Graefrath, *The International Law Commission Tomorrow: Improving Its Organization and Methods* 85 Am. J. Int'l L. at 595, 603 (1991).



at the bilateral and multilateral level and the work of the ILC could, in the long run, contribute to closing the existing gaps in international groundwater law.

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