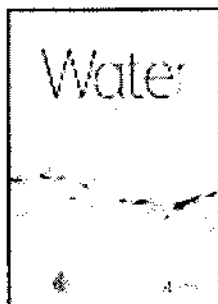


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### International water law and supporting water management principles in the development of a model transboundary agreement between riparians in international river basins

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## International water law and supporting water management principles in the development of a model transboundary agreement between riparians in international river basins

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A set of water management principles are analyzed and form the basis for a template for a model transboundary agreement for international river basins. The tenets of international water law, which support the selection of the principles, are analyzed. The principles include equitable and reasonable utilization and the obligation to not cause significant harm as the interrelated and overarching principles of international watercourse management. The development of a template is undertaken because ratification of the 1997 UN watercourses convention is at hand and a template consistent with this convention may facilitate the protection of shared water resources.

**Keywords:** transboundary rivers; international water law; equitable utilization; no harm; riparian states

### Part I. International water law and supporting water management principles

#### Introduction

The focus of Part I of this paper is a compilation and analysis of relevant water management principles (WMPs) in the context of international water law (IWL) as it pertains to transboundary agreements (TBAs) concerning international river basins. Given that the world's freshwater resources are becoming increasingly taxed and that approximately one-half of the land area of the earth's surface is covered by basins, or watersheds, with a river bounded by two or more countries (see Figure 1), the need for a workable TBA template to promote international cooperation through written agreements is evident.

The template's contents are intended to be consistent with the Convention on the Law of the Non-navigable Uses of International Watercourses ('1997 convention') (United Nations, 1997). Ratification of the 1997 convention by 35 nations is required for it to be entered into force. With Ireland's signing (20 December 2013), 33 countries have now ratified the convention. The template is also consistent with the UN General Assembly resolution on the law of transboundary aquifers (United Nations, 2008), which closely follows the principles of the 1997 convention in its application to transboundary ground-water management.

Part II presents a template for a model TBA for international river basins, as well as a model TBA for the Pilcomayo River basin, which is shared by Argentina, Bolivia and Paraguay.

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Figure 1. International basins worldwide. There are a total of 263 individual basins within the shaded areas of all continents, and the basins cover 45% of the world's land surface. About 60% of the world's groundwater lies within these international basins. Reprinted from Wolf (2002).

### Sources of water management principles

The 1997 convention – primarily authored by the International Law Commission (ILC, 1994), the UN's legal arm – and the 1966 Helsinki Rules, authored by the International Law Association (ILA, 1966), are two foundational sources of WMPs that embody international legal rights and obligations. More recently, the ILA's 2004 Berlin Rules updated and expanded upon these two foundational sources. This update included clarification of the prevention of environmental degradation, and detailed principles of the conjunctive management and allocation of surface water and groundwater, for both national and international waters.

The ILA's Helsinki Rules formed the basis of the 1997 convention. Thus, the Helsinki Rules has emerged as one of the most influential documents within the family of declarations, resolutions, rules and recommendations or 'soft law' (Vinogradov, Wouters, & Jones 2003). Elements of an instrument such as the Helsinki Rules may eventually be adopted by countries, other international organizations, or conferences that contribute to the formation of international law (also referred to as customary international law). In contrast, conventions, treaties and agreements are legally binding, by virtue of their written acceptance by the participating countries or their citation as a legal basis for a judicial decision. Examples are the 1997 convention (as cited in the *Gabcikovo Nagymaros case* [ICJ, 1997a]) and the 1978 Amazon Cooperation Treaty (Amazon, 1978).

To summarize, as defined by the International Court of Justice (ICJ, 2013), the sources of IWL are: (1) customary international law, which is the set of legal rules that have evolved from a general practice of states – elements of the 1966 Helsinki Rules have been widely accepted by the international community as customary international law (Bourne, 1997); (2) international treaties and conventions, which establish rules expressly recognized by contesting states; (3) general principles of law, invoked to establish the respective rights and obligations of states; (4) judicial decisions; and (5) writings of highly qualified practitioners and publicists of the various nations (e.g. McCaffrey, 2007), which can inform the judicial decisions.

Several transboundary agreements have elements that have been generally regarded as appropriate and in many cases proven effective in practice, e.g. the Boundary Waters Treaty

(1909), Indus Waters Treaty (1960), Columbia River Treaty (1961) and Amazon Cooperation Treaty (1978); and portions of these treaties have been incorporated into this compilation and analysis of WMPs. Although not accepted as customary international law, several relevant principles are also taken from the Ulton Transboundary Resource Center Model Interstate Water Compact (Muys, Sherk, & O'Leary, 2007), which is a model TBA for states within America. (The most important contribution from Muys et al. is the incorporation of a relatively simple water allocation methodology to insure consistent streamflow levels.)

### **What constitutes good water management principles?**

#### ***Substantive and procedural rules***

The WMPs selected for inclusion in this compilation can be grouped into two categories: substantive rules and procedural rules. For example, 'equitable and reasonable utilization' of a resource is a substantive rule, and establishment of a mechanism to resolve disputes by designation of a third party is a procedural rule.

#### ***Existing agreements***

Most of the WMPs incorporated into the model TBA have been adopted from existing agreements. Good WMPs have been shown to be effective through their employment in agreements that have proven to be useful tools of cooperation between nations. Some of the WMPs, such as the establishment of emergency contingency plans, have been identified in relatively few existing agreements, and their content has been adapted to promote public safety and minimize property damage.

These WMPs, including obligations to regularly safeguard ecosystems, prevent pollution, protect recharge and discharge zones, monitor water levels and water quality of the watercourse and aquifers, exchange data and information, promote public participation, provide prior notification of planned activities, have access to justice in environmental matters, and complete transboundary environmental and social impact assessments and audits, have been subjected to real-world situations and proven useful. Thus, to varying degrees, they have withstood the test of time and varied conditions, which would seem to be the most stringent test of any principle.

#### ***Court rulings***

In part, the viability of the WMPs in treaties is demonstrated through court rulings. As listed in Table 1, a number of legal decisions support the appropriateness of the equitable and reasonable utilization of a shared river basin (e.g. ICJ, 1997a; Wurttemberg and Prussia v. Baden, 1927).

#### ***Legal organizations***

Four legal organizations have each made important contributions to the advancement of international water law: the International Law Association (ILA); the Institute of International Law (IIL, or *Institut de droit international*); the International Law Commission (ILC); and the Inter-American Bar Association.

### **Analysis of water management principles and tenets of international water law**

This analysis addresses the major tenets of IWL as they pertain to the template for a model transboundary agreement: (1) equitable and reasonable utilization and the obligation to

Table 1. Water management principles (WMPs) and the basis for their application to a model transboundary agreement (TBA) as indicated or implied through the practice of international water law.

Water management principle	Legal decisions, treaties, conventions & rules that support inclusion of WMPs in a model TBA*	Comment
Equitable and reasonable utilization	Helmand (1872); Zwillikon (1878); Wurttemberg and Prussia v. Baden (1927); Oder (1929); Meuse River (1937); Roja (1940); Zarumilla (1945); ILA (1966); Aral Sea Agreement (1993); Mekong (1995); Ganges (1996); ICJ (1997a); United Nations (1997); Senegal (2002); Nile (2010)	Equitable and reasonable utilization is the single most important principle of transboundary agreements. If participating parties consistently cooperate, then effective agreements can be completed.
Obligation to not cause significant harm	Wurttemberg and Prussia v. Baden (1927); Trail Smelter (1941); ICJ (1997a); United Nations (1997); Nile (2010)	In the majority of historic documents that include this fundamental concept, the phrase 'obligation to not cause harm' gradually evolved into 'obligation to not cause significant harm'. This modification was necessitated by the generally universal acceptance that in the course of equitable and reasonable utilization of the water resources of a basin or watercourse there are instances where some or all parties may incur some measure of harm by (for example) a reduction of their volume of water or an economic loss of some kind. Such harm or loss notwithstanding, the achievement of the most even distribution of water and/or attendant economic benefits is the objective in first invoking the concept of equitable and reasonable utilization of the water resources in a basin or watercourse.
Obligation to protect international watercourses and their ecosystems	ILA (1966); Amazon (1978); Aral Sea Agreement (1993); Mekong (1995); ICJ (1997a); United Nations (1997); Senegal (2002); Nile (2010)	The protection and conservation of the water resources and related ecosystems is fundamental. Ecological protection is often compromised because funding is directed toward other priorities. Therefore, the challenge for countries and organizations managing ecological programs is to utilize limited financial resources as efficiently as possible.

(continued)

Table 1. (Continued).

Water management principle	Legal decisions, treaties, conventions & rules that support inclusion of WMPs in a model TBA*	Comment
Conduct transboundary environmental and social impact assessments and audits	Nile (2010); ICJ (2010)	Prior to and following the implementation of projects and activities within the basin, the completion of written environmental and social impact assessments and audits shall be undertaken per the Joint Water Board or other organizations so directed by the Commission.
Prior notification to and consent from other riparians required before implementation of projects or activities	ICJ (1949); ILA (1966); Mekong (1995); United Nations (1997); Senegal (2002); ICJ (2010); Nile (2010)	Prior notification and consent will be required through the Joint Water Board for any project or activity that may affect water quality or quantity. Prior notification and regular consultations between riparian states will promote cooperation and fair use of resources.
Implementation of a procedure that details a public-comment process designed to collect input on planned measures from citizens in the respective countries, followed by evaluation of input by the Joint Water Board and incorporation of amendments to planned measures as appropriate	United Nations (1992); United Nations (2005)	Public participation is not only a desired step in an inclusive decision-making process; it can also provide a platform for useful suggestions that complement the planned measures developed by technical experts and ultimately result in a more effective plan (USEPA "Public Participation Act"; UNU 2005).
Creation of a Joint Water Board with members from each riparian country	Rio Grande (1889); Helmand (1872); Nile (1959, 2010); Columbia (1961); ILA (1966); Ganges (1996); Mahakali (1996); United Nations (1997); Genevois (2008); Nile (2010)	The Joint Water Board will have representatives from each signatory state. These representatives will include not only hydraulic engineers but also technical experts such as planners, ecologists, economists and social scientists.
Creation of a mechanism to share information and technical data between the riparian states, and with the public, through the Joint Water Board	Rio Grande (1889); Columbia (1961); ILA (1972, 1966); Pilcomayo (1995); United Nations (1997)	The signatory states have a duty to share information and technical data to maximize the efficient use of the resource, promote cooperation, and inform the residents of all riparian states of activities and plans.

(continued)

Table 1. (Continued).

Water management principle	Legal decisions, treaties, conventions & rules that support inclusion of WMPs in a model TBA*	Comment
Establishment of an equitable and flexible water allocation methodology that accounts for water fluctuations, in cooperation with the Joint Water Board	Helmand (1872); Lesotho (1986); Komati (1992); Ganges (1996); Senegal (2002); Geneva (2008)	As noted in the 1996 India-Bangladesh Ganges River agreement, implementation of a flexible water allocation methodology can address man-made or climatic water-level fluctuations, as well as changing population needs or changing political values (Wolf, 1999).
Acknowledgement of the existence of groundwater beneath international river basins (i.e. transboundary aquifers); cooperation and equitable allocation of aquifer resources	ILA (1966); United Nations (1997); Geneva (2008)	The Geneva agreement of 1977 (revised 2008) is the only true treaty focusing on the management and allocation of a transboundary aquifer (G. Eckstein, personal communication, 30 October 2012).
Establishment of baseline surface-water and groundwater level conditions and ongoing collection of daily/weekly water-level information throughout the watercourse and throughout the aquifers wherever wells are available	Pilcomayo (1995); Ganges (1996); ICJ (1997a); Geneva (2008)	The ongoing collection of surface-water and groundwater level information will support the development of more effective water resource planning and management.
Establishment of baseline surface-water quality, sediment quality, and aquifer (groundwater) quality conditions, consisting of (funding-dependent) analysis of chemical compounds and metal constituents, and collection of ongoing water quality information	Pilcomayo (1995); ICJ (1997a); Geneva (2008)	Like water-level data, the collection of water quality data (including the completion of laboratory testing) will better support the decision-making process.

(continued)

Table 1. (Continued).

Water management principle	Legal decisions, treaties, conventions & rules that support inclusion of WMPs in a model TBA*	Comment
Establishment of a water quality protection program (surface water and groundwater)	Pilcomayo (1995)	In addition to the implementation of engineering controls that reduce pollutants, water quality protection programs are necessary to raise awareness and promote conservation.
Establishment of a conjunctive water resource planning and management program	Pilcomayo (1995)	Conjunctive management acknowledges the importance of groundwater as well as surface water.
Requirement of a Flood Control Operating Plan and Emergency Contingency Plans to address floods and other natural or man-induced disasters	Columbia (1961); ILA (1966); United Nations (1996); United Nations (2009); Nile (2010)	Individual countries routinely have emergency plans to address flood events or other disasters. However, such programs between nations are less common and should be implemented.
Right of free navigation along the full extent of a watercourse or lake	Jay (1794); ILA (1966)	The right of all countries to use portions of a watercourse or lake that partially exists within the boundaries of multiple countries has been a longstanding practice among countries in the Americas and Europe.
Dispute resolution through a third-party Dispute Resolution Panel	Indus (1960); ILA (1966); United Nations (1997); Nile (2010)	The third party consists of one member selected by each riparian. In the case where there is an even number of riparians, one additional member is selected by agreement from all riparians.
Enforcement action for a lack of adherence to Commission decisions to be implemented by the Council of Ministers, or (if necessary) the third-party Dispute Resolution Panel, established within the TBA	Indus (1960); Columbia (1961); ILA (1966); United Nations (1997); ICJ (2010); Nile (2010)	A formalized procedure for enforcement of treaty provisions, agreed to by all riparians, is a reasonable and necessary mechanism to insure that treaty rules and principles are upheld and to facilitate implementation of decisions.

(continued)



Table 1. (Continued).

Water management principle	Legal decisions, treaties, conventions & rules that support inclusion of WMPs in a model TBA*	Comment
Enforcement by compensation to one party who was damaged by an action of another party – compensation to be addressed initially by the Council of Ministers, and (if necessary) the third-party Dispute Resolution Panel	Helmand (1872); Trail Smelter (1941); ICJ (1949); Indus (1960); Gut Dam (1968)	Commensurate compensation will always be paid by the inflicting party except in those extreme and unusual cases where some portion of the compensation will be borne by the other riparians.
Grounds for treaty termination and rules for riparians desiring withdrawal from a treaty	Columbia (1961); Pilcomayo (1995); Nile (2010)	Provisions for termination, including minimum-advance-notice requirements, are necessary for effective basin planning.

*Note.* Titles such as Joint Water Board and Emergency Contingency Plans are capitalized to indicate their use as specific organs or documents in the template treaty.

\*These citations are primarily treaties and court decisions. Two products of legal organizations – the ILC's 1966 Helsinki Rules and the ILC's 1997 United Nations Convention on International Watercourses – are also cited because they have risen to the level of customary international law.

not cause significant harm; (2) acknowledgement of groundwater beneath basins; (3) establishment of baseline resource conditions through water-well mapping plus collection of surface-water and groundwater level measurements and water quality information; and (4) the need to establish water allocation agreements. Table 1 presents all the water management principles (WMPs) used in the template, and Table 2 summarizes them.

*Equitable and reasonable utilization and the obligation to not cause significant harm.* These WMPs are presented together because they are fundamental and yet, inevitably, often in opposition. For example, in a basin shared by two riparians, the downstream riparian may incur significant harm if the upstream riparian's population growth dictates the need for a substantially greater quantity of water, thus reducing the downstream party's existing allocation. Here, a balanced application of the two principles must be applied, and compromise and cooperation must drive the outcome, to provide for fundamental human needs and protect human health. This basic concept of public protection is consistent with traditional principles concerning trusteeship of earth resources and the welfare of the community (ICJ, 1997b).

The commentary on Article 12 of the Berlin Rules indicates that international basin management can only be effectively conducted through the simultaneous analysis of the obligation of equitable and reasonable utilization and the obligation to not cause significant harm:

With the right to share [the benefits of the transboundary resource] come obligations that can only be fulfilled by acting in an equitable and reasonable manner, having due regard to the obligation no [sic] to cause significant harm to another basin State. The interrelation of these obligations must be worked out in each case individually. (ILA, 2004, p. 362)

Salman (2007) concludes that by subjecting each principle to the other, the 2004 Berlin Rules present the two principles as equal. Tanzi (2011) concurs, observing: "Compliance

Table 2. Summary of water management principles used in the construction of a template for a model transboundary agreement between riparians in international basins.

Interrelated overarching principles:

Equitable and reasonable utilization and  
Obligation to not cause significant harm



Relevant water management principles

Establish a Joint Water Board with representatives from each state to oversee technical aspects of planned and ongoing projects

Establish a water allocation methodology, addressing natural & man-made fluctuations

—Acknowledge groundwater; conjunctive surface-water/groundwater management

—Map existing wells (water supply, irrigation, and environmental monitoring)

—Ongoing surface-water and groundwater level measurement

—Collect baseline and ongoing water quality data, including lab analysis for contaminants

Establish a flood control operating plan and emergency contingency plans

Practice prior notification to riparians prior to initiation of projects

Share technical data and social and cultural information with the public

Allow free navigation along the full extent of the watercourse

Establish a third-party resolution panel for issues riparians cannot settle

Establish a procedure for enforcement of treaty provisions; uphold environmental justice

Establish a procedure to provide compensation to a damaged riparian party

Conduct transboundary environmental and social impact assessments and audits

Develop plans by including a public-comment procedure

Establish grounds for treaty termination and rules for withdrawal from treaty

with the no harm rule is essential to the compliance with the equitable utilization principle, just as well as the reverse is true.”

***Acknowledgement of the existence of groundwater beneath international river basins***

At present, the law of transboundary aquifers is in a relatively early stage of development (Eckstein, 2011). However, a growing body of documentation and practice indicates the emergence of accepted legal standards regarding aquifers and groundwater in general. Since the first mention of transboundary groundwater in an international legal instrument in the 1966 Helsinki Rules (Salman, 2007), an increasing level of sophistication and detail with respect to transboundary aquifers is found in the 1986 Seoul Rules (ILA, 1986), the 1989 Bellagio Draft Treaty (Hayton & Utton, 1989), the 2004 Berlin Rules (ILA, 2004), the 2008 Genevois Treaty (Genevois, 2008) and the 2008 UN resolution on the law of transboundary aquifers (United Nations, 2008). The Seoul Rules define groundwater as either communicating with surface water or having no interaction with surface water (‘fossil water’ or ‘confined water’). The avoidance of groundwater pollution is stressed, given that aquifer restoration typically takes years to complete. The Seoul Rules also include the need to protect groundwater-recharge areas and the establishment of joint water quality standards.

The Bellagio Draft Treaty is a more comprehensive set of articles that support the concept of inclusion of international groundwater within an overall water resource management plan. The Berlin Rules define specific groundwater-monitoring activities that are needed to properly assess and manage a basin drinking-water resource and take into account the interdependent nature of surface water and groundwater.

The 2008 Genevois Treaty, which revised the original 1978 agreement between France and Switzerland, is the first and only treaty that both manages *and* allocates the waters of a transboundary aquifer (Eckstein, 2011). The agreement sets extraction limits; recognizes artificial recharge obligations and allocates funds from both countries to defray costs for the recharge effort; and requires ongoing groundwater level measurement and water quality sampling and analysis and interpretation.

The 2008 UN General Assembly resolution on the law of transboundary aquifers represents significant progress in international recognition that transboundary aquifers supply over one-half of the world’s drinking water (United Nations, 2008). Prepared by the ILC, the resolution is composed of 19 draft articles that are structured in a manner similar to the 1997 international watercourses convention. In December 2011, the General Assembly reiterated its commitment to global groundwater resource management by adopting a related resolution which placed the draft articles on the provisional agenda of its 68th session, in October 2013. This action underscores the need for nations to form bilateral and regional aquifer agreements, based on the draft articles (International Water Law Project, 2012).

***Establishment of baseline surface-water and groundwater level conditions and ongoing collection of water-level measurements; and establishment of baseline surface-water and groundwater quality and ongoing collection of water quality information***

The implementation of a program to establish baseline resource conditions through water-well mapping and surface-water and groundwater measurement along with water quality laboratory analysis and evaluation of the data will support fair water allocation practices and better resource management. The intent is that this growing body of knowledge will

drive responsible decision making and cooperation between riparians as they establish and modify water allocation schedules.

Treaties such as the Indus Waters Treaty (Indus, 1960) and Columbia River Treaty (Columbia, 1961) established surface-water measurement and surface-water quality studies, but did not address groundwater. The Bellagio Draft Treaty (Hayton & Utton, 1989), the Berlin Rules (ILA, 2004) and the Genevois Treaty (Genevois, 2008) provide the most comprehensive guidelines for management and allocation of both surface-water and groundwater resources.

***Inclusion of language that identifies the need to establish water allocation agreements, which account for water fluctuations, in cooperation with technical basin committees***

The responsible management of flow levels and distribution of water resource volumes between riparians is of central importance in any substantive agreement regarding international watercourses. A water allocation agreement between riparians will necessarily be developed by technical experts, and may be facilitated by a formalized procedure that encourages and compiles public comments, and incorporates this input, as appropriate. Several existing treaties created over the last half of the twentieth century address this common theme of management of flow levels and volumes in a relatively straightforward and effective manner, e.g. Indus (1960), Lesotho (1986), Komati (1992) and Ganges (1996).

The 1960 Indus Waters Treaty between India and Pakistan established a standard as a water-sharing treaty designed to increase the amount of water available to both parties through engineering works within the Indus Basin. The objective of equitable apportionment of the waters was achieved by allocating the waters of the three eastern rivers – the Sutlej, Beas and Ravi – to India, and those of the western rivers – the Indus, Jhelum and Chenab – to Pakistan. The treaty stipulates that each country will not interfere with the rivers allocated to the other, aside from some defined exceptions concerning hydroelectric power generation and certain agricultural, domestic, and non-consumptive uses.

**WMPs summary**

The WMPs analyzed in Part I are incorporated into the template for a model TBA in Part II. Most of the WMPs are taken from existing treaties, conventions and rules. In most cases, the WMPs are general but express a basic directive that is critical to supporting cooperation among riparians and effective basin management (e.g. prior notification; transboundary environmental and social impact assessments of planned measures and audits of implemented measures; ecological protection and information exchange).

However, a greater level of detail has been included in the template for several other WMPs because of the critical need to carry out these management measures to insure relatively consistent flow levels, reasonable water apportionment to all riparians, effective planning of water resource utilization, and flood/emergency planning. This detail pertains to surface-water and groundwater level measurement and water quality analysis; utilization of a water allocation methodology; conjunctive groundwater and surface-water resource planning and management; and development of a Flood Control Operating Plan and Emergency Contingency Plans, respectively (terms capitalized because they are used in the template).

Several other principles, not directly tied to water management per se, are also included in greater detail to provide a framework for cooperation in resolving issues that inevitably arise in the course of basin management. These are: procedures for a public-comment process as part of the development of planned measures; enforcement of

decisions; compensation to riparians who incur significant harm; and dispute resolution by a third party.

The Basin Commission and its various organizations (e.g. the ruling Council of Ministers and the Joint Water Board) are comprised of representatives of all riparian states and can establish specific operating rules that can potentially satisfy riparians' objectives, mindful of the inevitable need for compromise that can only be achieved through cooperation. In total, the end product is a template that consists of universal principles that support fair management of the resource over the long term. Principles requiring more details for successful administration have been included sparingly, because an overriding goal is to create a concise template that is relatively straightforward and thus more likely to be implemented by riparians.

## **Part II. A template for a model transboundary agreement for international river basins, and a template agreement for the Pilcomayo River basin in South America**

A treaty template has been prepared for use by riparians of watercourses in international river basins. The template promotes cooperation and discourages unilateral actions by riparians without prior discussion. With regard to principles that directly control management of the resource, the template provides for the maintenance of reasonable flow levels; implementation of a simple water allocation methodology; and groundwater management in association with the management of surface-water quality and quantity (i.e. conjunctive resource management).

### **Template construction**

Whereas the template follows the structure of the 2010 Nile River Basin Cooperative Framework Agreement (Nile, 2010), which draws heavily from the 1997 Convention, the template makes significant amendments and additions. The template also generally follows the principles set forth in the 2008 UN General Assembly resolution on the law of transboundary aquifers (United Nations, 2008). To the maximum extent possible, the template adopts principles generally accepted as customary international law (Table 1). Some text is also applied that has been used or has otherwise recognized in the practice of forging agreements between states but has not yet risen to the status of customary international law. The template is available in the supplemental files at <http://dx.doi.org/10.1080/02508060.2013.880006> (see 'Treaty 1').

In general, the template treaty is intended to be a universal starting point for groups charged with writing such treaties. This is similar to the intent of the model interstate compact created by Muys et al. (2007) for US watercourses shared by two or more states. The model TBA strives for conciseness and simplicity whenever possible. Certain topics are intentionally written at a general level to accommodate ratification and to allow the signatory parties to write more specific procedures through committees populated by their representatives.

The author has incorporated water management principles (WMPs) that will readily apply to most basins, regardless of the unique environmental and political conditions obtaining in individual basins. Other than a few logical additions to previously employed WMPs introduced by the author (e.g. regular well-water level measurements of all existing domestic, agricultural and environmental monitoring wells; preparation of emergency preparedness plans), this template is a compilation of elements from applicable treaties (i.e. Amazon, 1978; Columbia, 1961; Indus, 1960; Nile, 2010), certain conventions and resolutions (ILA, 1966, 1986; United Nations, 1997, 2008), papers by reputable practitioners (e.g. McCaffrey,

2007; Salman, 2007, 2010, 2011; Bourne, 1997), and a model interstate compact prepared for use in transboundary settings in the United States (Muys et al., 2007).

Therefore, by and large, this template does not present new concepts or ideas. It does, however, make choices in selecting the most universal principles that riparians can hopefully agree upon, ratify, and use to facilitate long-term cooperation.

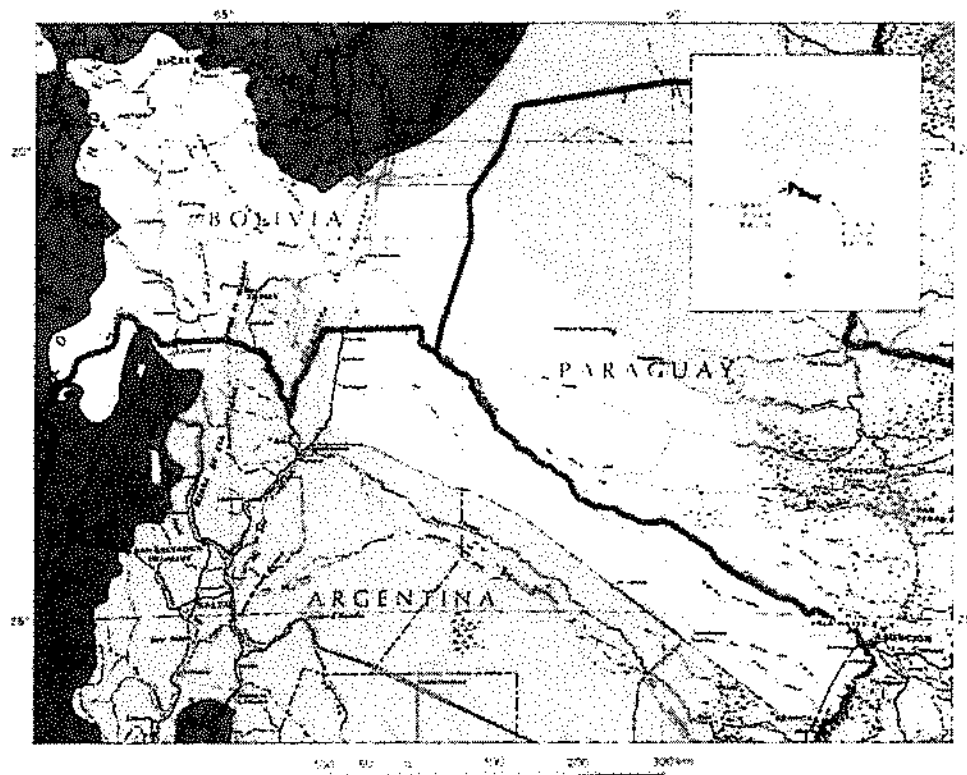
The following are the primary amendments and additions to the Nile (2010) foundational document that are incorporated into the template:

- Requires the implementation of a water allocation methodology to insure that all riparians have continuous access to reasonable flow to address vital human needs and agricultural and economic development project requirements (Annex I).
- Emphasizes the importance of groundwater as a drinking-water resource and stresses groundwater management and the interdependent nature of surface-water and groundwater resources (Annex I) (Eckstein, 2005, 2011; ILA, 1986; United Nations, 1997, 2008).
- Revises the definition of a watercourse as given in the UN convention (1997) by removing the phrase “normally flowing into a common terminus” because of its technical inaccuracy in many natural settings. As defined by the ILA in 1986 as part of the Seoul Rules, all groundwater occurs as two types. One type includes water that seeps into the ground and eventually flows into surface-water bodies, thus displaying a hydrologic connection between groundwater and surface water. In the second type, the water seeps into the ground but does not interact with surface water; this is termed ‘confined groundwater’ or ‘fossil water’. Thus, in this template, a watercourse is defined as “a system of surface waters and groundwaters constituting by virtue of their physical proximity – and not necessarily their hydrologic connectivity – a unitary whole” (modified from ILA, 1986; Rosenstock, 1993, 1994; SADC, 2000; United Nations, 1997, 2008).
- Requires the implementation of a procedure (Article 26 (3)) that details a public-comment process designed to collect input on planned measures from citizens in the respective countries, followed by evaluation of input by the Joint Water Board and amendments to the planned measures as appropriate.
- Requires the preparation of a Flood Control Operating Plan and Emergency Contingency Plans (Annex II) (Columbia, 1961; UNECE 1992; Muys et al., 2007).
- Following the enforcement protocol in Annex III, defines basic events that may justify the payment of compensation (Columbia, 1961).
- Establishes a process to resolve disputes by a third-party Dispute Resolution Panel (Annex IV) (Columbia, 1961; Indus, 1960; United Nations, 1997).
- Provides guidelines for the freedom and regulation of navigation along shared watercourses (ILA, 1966).

#### **A proposed transboundary agreement for the Pilcomayo River basin of Argentina, Bolivia and Paraguay**

A proposed agreement, or treaty, is presented for the management of the surface-water and groundwater resources of the Pilcomayo River basin (PRB) shared by Argentina, Bolivia and Paraguay. The proposed treaty is available in the supplemental files at <http://dx.doi.org/10.1080/02508060.2013.880006> (see ‘Treaty 2’).

The Pilcomayo River and its tributaries represent the principal water resource for approximately 1.5 million people (Trinational Commission, 2010): 1 million in Bolivia,



Location of the Pilcomayo River Basin, Argentina, Bolivia and Paraguay

Figure 2. Plan view of the Pilcomayo River basin, with inset showing its location within the larger Plata River basin. Source and copyright: Property of the General Secretariat of the Organization of the American States; Reproduced with Permission. All rights reserved.

300,000 in Argentina, and 200,000 in Paraguay. The PRB comprises an area of 288,360 km<sup>2</sup> and is situated within the large Plata River basin, which occupies 4,144,000 km<sup>2</sup> (see Figure 2). By comparison, the Mississippi River basin in the United States occupies 2,981,076 km<sup>2</sup>; this is about three-quarters the size of the Plata River basin.

This proposed treaty expands on concepts presented in the 1995 PRB treaty ('1995 treaty') between Argentina, Bolivia and Paraguay, designed to promote economic development and water resource protection. The 1995 treaty is available in the supplemental files at <http://dx.doi.org/10.1080/02508060.2013.880006> (see 'Treaty 3').

The 1995 treaty established a commission with two representatives from each country, charged with the following primary objectives:

- Establish a technical Trilateral Commission to manage the natural resources of the basin and its economic development.
- Establish a General Management Plan to prioritize and finance projects.
- Conduct studies to support flood control, sediment retention and flow regulation.
- Prepare technical/legal documents that constitute studies of possible engineering and environmental projects.

- Establish a surface-water monitoring program and database that measures water levels and analyzes water quality throughout the basin.
- Regularly share and publicize basin-wide information and technical data amongst the signatory parties.
- Establish programs to prevent pollution and protect basin ecology.

The 1995 treaty also contains the following administrative controls:

- A brief dispute resolution procedure, which directs the signatory parties in dispute to resolve the issue through direct negotiations.
- Stipulation that the signatory parties will be participants in the agreement indefinitely, unless notice is given one year in advance of withdrawal.

The proposed treaty is philosophically compatible with the 1995 treaty. It adds to the objectives of the 1995 treaty by mandating the following:

- Implementation of a water allocation methodology to insure that flow levels are maintained to address vital human needs and agricultural and economic development.
- Preparation of a basin-wide groundwater-well map, implementation of a program to measure groundwater levels, and quantification of the groundwater supply.
- Preparation of a Flood Control Operating Plan and Emergency Contingency Plans to address floods and other natural or man-induced disasters (United Nations, 1996, 2009).
- Implementation of a procedure that details a public-comment process (United Nations, 1992, 2005) designed to collect input on planned measures from citizens in the respective countries, followed by evaluation of input by the Trinational Commission, and amendments to the planned measures as appropriate.
- The completion, prior to and following the implementation of projects and activities within the basin, of written environmental and social impact assessments and audits. (The 1995 treaty calls for environmental impact studies but does not define the need for periodic environmental and social impact studies following the completion of projects and activities.)
- Rules for the regulation of navigation along shared watercourses within the basin.

The proposed treaty contains the following administrative controls that expand those established in the 1995 treaty:

- Establishes a formal procedure for enforcement of decisions and, as appropriate, payment of compensation; and provides a procedure for dispute resolution by a third party.
- The signatory parties will be participants in the agreement for a period of 25 years, unless notice is given 2 years in advance of withdrawal.

This proposed augmentation of the PRB treaty will be presented to the Pilcomayo Trinational Commission, the embassies of the three countries, the Organization of American States, and non-governmental organizations including the Bolivian Environmental and Development Forum and the North American Congress of Latin America. In essence, this effort will constitute an educational and promotional exercise



that will ultimately require support of the governments of the three countries if any portion of this proposed treaty is to be adopted. In particular, Bolivia's support will be critical, because their ongoing industrial and development activities most substantially affect basin conditions and because approximately two-thirds (one million) of the basin's population are Bolivians.

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### Supplemental data

Supplemental data for this article are available in the supplemental files at <http://dx.doi.org/10.1080/02508060.2013.880006>

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