

# WATER MANAGEMENT

FOR WATER SECURITY IN THE  
FACE OF CLIMATE CHANGE



**CATHALAC**

Water Center for the Humid Tropics  
of Latin America and the Caribbean

# WATER MANAGEMENT

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CLIMATE CHANGE

Although countries have made huge investments in the management of their water resources, the everyday reality in numerous populations throughout our region demands the analysis of investment policies and management approaches for the purpose of raising the conditions of local water security.



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# PRESENTATION

This document summarizes the results of research conducted by the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC), with a grant from the International Development Research Centre (IDRC), Canada. It addresses different aspects of water resources and sets out what are concluded to be the best practices that contribute to ideal management. The content is illustrated with a sequence that we hope will become a roadmap that brings us closer to producing the intended results through good management.

This effort, which crystallized thanks to the multidisciplinary team that integrates the project, including government entities that endorsed the initiative within their countries, academic entities that strengthened the research of the specialists from the implementing Center, as well as the valuable contributions made by organizations and local governments who shared their experiences, which served as an input to understand the context and the specific problems of each locality.

The object of the research from which this document is derived, is to provide relevant information to decision makers within the regions of Central America and the Caribbean, enabling them to focus their efforts on national policies that facilitate and promote actions and initiatives aimed at achieving water security in the region, especially in the face of Climate Change. This means that the supply of this vital resource must satisfy the demand of a growing population of users who in turn are aware of their own responsibility in this equation.

The results are presented in the form of guidelines supported by robust and interdependent pillars that sustain the structure of Water Management. The approach used, as detailed in the Introduction, considers the perspective and scale of the local municipal governments of two prioritized pilot watersheds in two countries, selected for identification of Climate Change adaptation measures. However, it is hoped that the design of these guidelines will allow for their implementation in other areas and at larger scales.

We then take a tour of this roadmap to understand the results and usefulness of the information contained herein. The tour begins at the first pillar, the “Legal Framework” for water resources, providing a definition which helps us understand its usefulness. It is presented from a general perspective, to be used as the tool that establishes the foundations and rules and integrates the various necessary elements that will potentially allow us to aspire to the ideal management of this resource so vital to existence.

As we continue the tour, we learn about the different “Institutions” and characteristics required to implement this Legal Framework at the national and local levels in the respective countries. We then come to the section on “Participation”, where the different beneficiaries of this management are identified, together with the sensitization efforts that need to be developed to raise their level of awareness regarding this resource that is shared by so many, and which must be shared responsibly and equitably, without overlooking any sector of society.

Continuing along the path, we learn that all of the above is only possible through the development of “Management Capacities”, at which point we enter into the aspects that need to be considered to build complementary capacities.

At this stage of the tour through the contents of this document, we enter the point where the individual chapters make sense and lead us to Integrated Water Management for Water Security, which is the ultimate purpose of this guide. Finally, strengthened with this holistic view, our journey ends with the application of the recommendations found in this roadmap. In the “Supply Management” section, we learn and understand how to manage the water resources on which we rely, in the quantity and quality necessary to meet the demand for this vital liquid, which is discussed in the section on “Demand Management”.

We hope that this publication will provide support for the various users, fulfilling its purpose and becoming strengthened as its contents are put into practice.



**Freddy Picado**

General Director  
Water Center for the Humid  
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Caribbean





“ The international community has found that to advance in terms of Water Security, management of water resources must be integrated ”



# INTRODUCTION

Each year our countries are investing millions in the management of water resources. Nevertheless, we find many cities and communities that continue to experience serious difficulties due to the lack of drinking water in their homes, contamination of water sources, water-related disasters, inaccessibility of historically used water sources, and the impacts these conditions generate across the board in the contexts of health, education, access to development options, poverty, etc.

This daily reality demands that investment policies and management approaches be analyzed in the national context in order to improve local water security conditions. Water Security reflects the degree of success that a given society has in water management. UN-Water (2013) defines it as the “ability of people to safeguard sustainable access to water in the quantity and quality suitable for livelihoods, human welfare and socio-economic development, to ensure protection from water-borne contamination and water-related disasters, and to conserve ecosystems in a climate of peace and political stability.”

The international community has found that to advance in terms of Water Security, management of water resources must be integrated. However, the application of this approach (IWRM) has not been an easy task and has received criticism. For example, the last Report of the World Water Assessment Program (WWAP, 2015) states that this approach has been “too oriented towards economic efficiency when more emphasis needs to be placed on issues of equity and environmental sustainability “. Moreover, Bates et al (2008) mention that IWRM should be a tool to explore climate change adap-

tation measures, but that for the time being, it is in its initial phases. WGF (2012) comments on the tendency to leave the least empowered groups without access to water resources or participation in decisions regarding allocations.

Among the objectives of the project “Water Security and Climate Change in the region of Central America and the Caribbean”, carried out by CATHALAC and funded by the International Development Research Centre (IDRC, Canada), was the analysis of the relationship between local Water Security and the water management responses posed by national governments.

Reflection on the project’s findings led CATHALAC to propose a systemized reference of elements that could be considered, not for prescriptive purposes, but as possibilities to be adopted or adapted according to each reality, approach or initiative related to water management, such as legal, regulatory and policy aspects, or even the operations and practices of institutions or individuals, to support the success of water management.

This proposal is based on a management approach that encompasses supply, demand and participation by institutions and stakeholders, with the goal of integrating aspects that other authors have found to be lacking in the past.

The elements proposed in this document are in no way intended to be a “straight jacket”; it will always be necessary to consider the particular conditions, the diverse views of all groups, and the associated costs and benefits in the short and long term for all stakeholders.

Since the supply-demand relationship and its protagonists are part of a social context influenced by history and culture, water management (and environmental systems in general) urgently requires multidisciplinary participation by specialists in both the natural and social sciences, with value given to empirical knowledge over degrees.

The proposed reference is organized into 6 pillars (Figure 1) described by 35 topics and subtopics supported by references, experiences and lessons documented by institutions and prominent authors. In Figure 1 it can be seen how it all begins with the established legal framework (Pillar A), and how supply (Pillar E) and demand (Pillar F) are managed through institutions (Pillar B) and social participation (Pillar C), based on particular planning, financing and administrative capacities (Pillar D).

If they wish, readers can discuss their experiences in the implementation of this framework and access supporting resources on our website: <http://seguridadhidrica.cathalac.org>





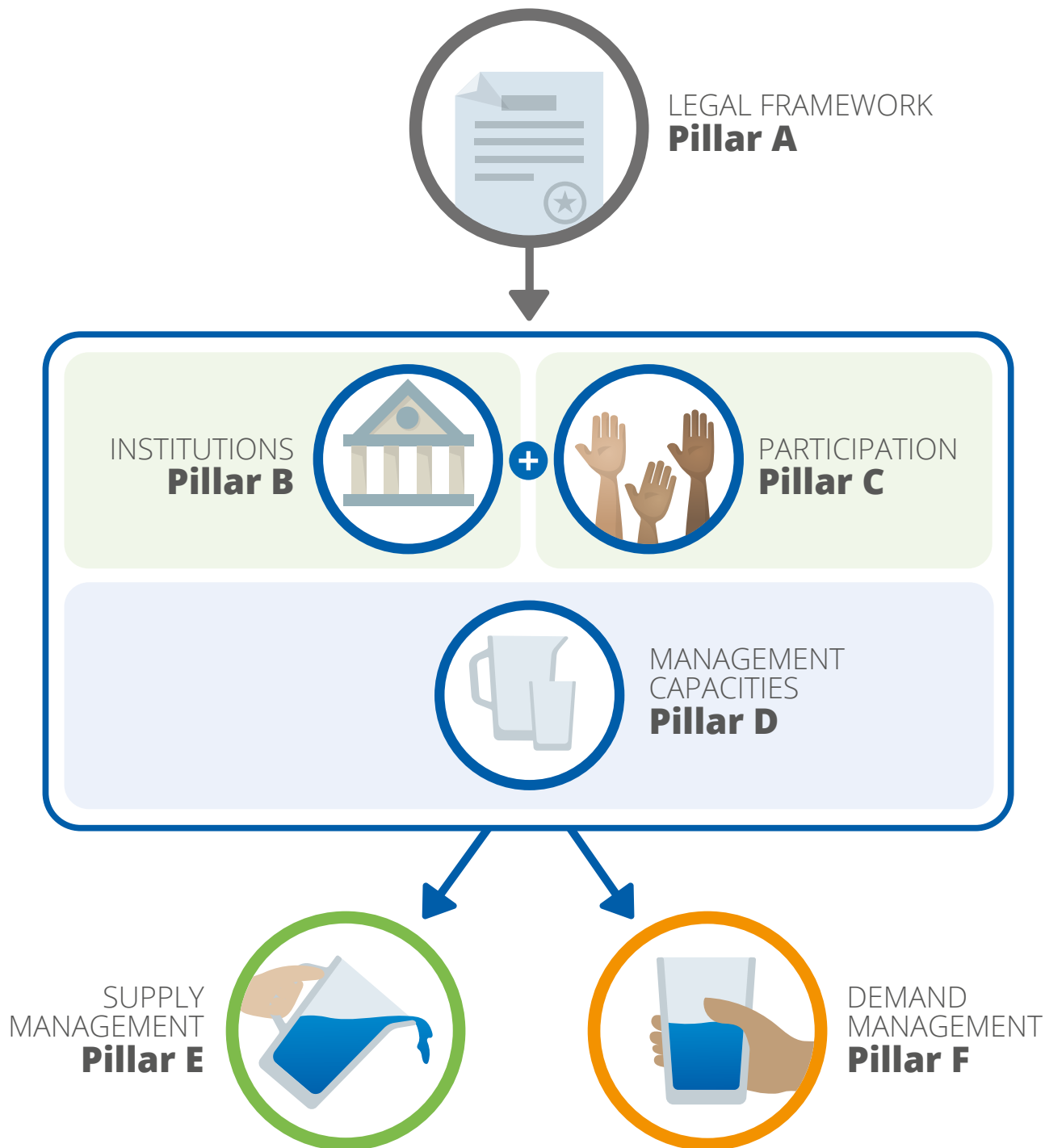


Figure 1. Framework of water management for Water Security



“Water management (and environmental systems in general) urgently requires multidisciplinary participation by specialists in both the natural and social sciences”

# METHODOLOGY OF FORMULATION

Construction of this reference began with an extensive review of documents published by distinguished exponents of the topic in the region, including:

- ▶ Global Water Partnership (GWP)
- ▶ European Commission. Directorate General for Development. Directorate General of Foreign Affairs and North-South Cooperation.
- ▶ United Nations Economic Commission for Latin America and the Caribbean (ECLAC). Natural Resources and Infrastructure Division. Water Resources Area
- ▶ Andean Development Corporation – Development Bank of Latin America (CAF, for its acronym in Spanish)
- ▶ United Nations University Institute for Water, Environment and Health (UNU / INWEH)
- ▶ Institute of Development Studies (IDS)
- ▶ United Nations Organization Educational, Scientific and Cultural Organization (UNESCO)
- ▶ World Meteorological Organization (WMO)
- ▶ Intergovernmental Panel on Climate Change (IPCC)
- ▶ World Water Assessment Programme (WWAP)
- ▶ International Network of Basin Organizations (INBO)
- ▶ Humberto Peña and Miguel Solanes are among the most cited authors.

An analysis, reflection and systematization of documents published in different periods was performed; debates and consultations were held with representatives in the watersheds of the Samala river in Guatemala and the Yaque del Sur river in the Dominican Republic, and with water managers in the municipalities of Quetzaltenango and Santa Cruz Muluá in Guatemala, and Tamayo and Guayabal in the Dominican Republic. In addition, valuable contributions were made by renowned specialists such as Elisa Colom de Moran and Haydee Bermudez.

Recognizing that such a document should be the object of ongoing construction and debate, a portal is provided (<http://seguridadhidrica.cathalac.org/>) to stimulate a communal effort to share and contribute on each topic presented, in order to promote the management of water as a communal resource.







## A. LEGAL FRAMEWORK

The law constitutes a means but does not guarantee any result per se. It is a product of global cultural practice, which is quintessentially dynamic, complex and diverse. It issues from social events of all kinds - in this case associated with the environment and nature - which are then identified, defined and understood as relevant to society and therefore subject to regulation. Public policies and laws are linked to the degree and quality of the social agreement and also reflect the virtues and inequities of society, as well as the actual capacities to manage and govern, among others, water resources (Solanes and Peña, 2003; Colom and Ballesteros, 2003).





# 1. Purpose of the legal framework for water resources

- ▶ The legal framework governing water resources establishes the rules to be followed to help achieve a national vision, consistent with established policies and international principles of Human Rights<sup>3</sup>.
- ▶ The legal framework for water resources seeks to provide a legal basis for water rights through clear and fully justified laws.
- ▶ The legal framework clarifies the rights and responsibilities of water users and providers, the role of regulations, the organization of the participatory process, and conciliation in cases of conflict.
- ▶ Policies guide and facilitate the rational use of water resources and contribute to achieving the goals of other national development plans in a sustainable manner.
- ▶ The aim of the legal framework is to reach equitable goals for water supply, protection and conservation of resources.
- ▶ For Jouralev (2001), water laws must be of a “framework” nature, with links to other laws and broad and flexible criteria facilitating their effective implementation and continuous adaptation to new situations that arise.

## 2. Principles that strengthen the legal framework for water resources

### 2.1 Legal Security

- ▶ Legal security guarantees that the rights of individuals will be respected in all realms, providing certainty of, or access to, information on what is prohibited, ordered or permissible in relation to water resources, and ensuring that the system of concessions is not manipulated<sup>4</sup>.
- ▶ Regardless of the sector’s centralization or decentralization, the State guarantees individuals, organizations, institutions or companies the right to private

property in order to prevent violation of their property and rights, helping bring stability to investments and to the sector’s development.

- ▶ Mechanisms exist to ensure legal security of contractual relations signed between the granting power, service providers and/or users<sup>5</sup>.

### 2.2 Water ownership

- ▶ It is established that water resources are public property, with their administration corresponding to the State<sup>6</sup>.
- ▶ The legal classification of water as a public good subjects it to a special regime of use and protection as a mechanism of State intervention over the activities of individuals, in order to ensure aspects such as sustainability of the resource and solidarity among its users.

### 2.3 Social Equity

- ▶ Social values and interests as well as traditional rights with regard to water are known and addressed.
- ▶ There is an adequate system for allocating water rights that promotes equity and solidarity, preventing situations of dispossession in favor of groups with economic power
- ▶ Budget allocation within the development sector is established according to equity-based criteria, attending to the conditions of rural populations and otherwise marginalized and vulnerable groups, including gender considerations.
- ▶ The justice system is sensitive to the conditions of vulnerable groups, for example by considering the cost implications of mobilization and time required to resolve disputes<sup>7</sup>.

### 2.4 Economic Efficiency

- ▶ Monopolization and control of essential production inputs such as water resources is avoided (Peña and Solanes, *ibid*)<sup>8</sup>.
- ▶ Decisions are made in light of the overall efficiency of the country’s economic system and sustainable development, ensuring that social and environmental considerations are not undermined but promoted.
- ▶ Measures that maximize efficiency in the use of water are promoted<sup>9</sup>.

- ▶ Water policies are designed with consideration not only of the various forms of consumption, but of the different forms of production as well.

## 2.5 Environmental Sustainability

- ▶ In environmental legislation, it is understood that water is one element of a larger and more complex ecological system. Regulations must therefore not be disassociated from, but in harmony with, other regulations.
- ▶ The granting of concessions linked to water systems is done in a manner that ensures that the functions of the associated aquatic and terrestrial ecosystems are maintained, incorporating measures to understand and foresee the environmental impacts of human activities.
- ▶ Water use conditions are established to avoid waste and contamination (See Pillar F).

## 2.6 Respect and identity

- ▶ The principles of water management reflect and reinforce the identity and conditions of the local territory.
- ▶ The water resource management programs and solutions do not adversely affect the social dynamics of the population they are intended to benefit, respecting the traditional knowledge and identity of local communities.

## 2.7 The human right to water and sanitation<sup>10</sup>

- ▶ The human right to water and sanitation is acknowledged<sup>11</sup>. According to the United Nations, water should be:
  - ▷ Sufficient. The per capita water supply must be sufficient and continuous for personal and domestic use. These uses generally include water for drinking, personal sanitation, washing clothes, food preparation, household cleaning and personal hygiene. According to the World Health Organization (WHO), these uses amount to a daily need of between 50 and 100 liters of water per person to ensure that the most basic needs are met and human health-related concerns are reduced.
  - ▷ Healthful. The water required, both for personal and domestic use, must be healthful, i.e., free of microorganisms, chemicals and radiological

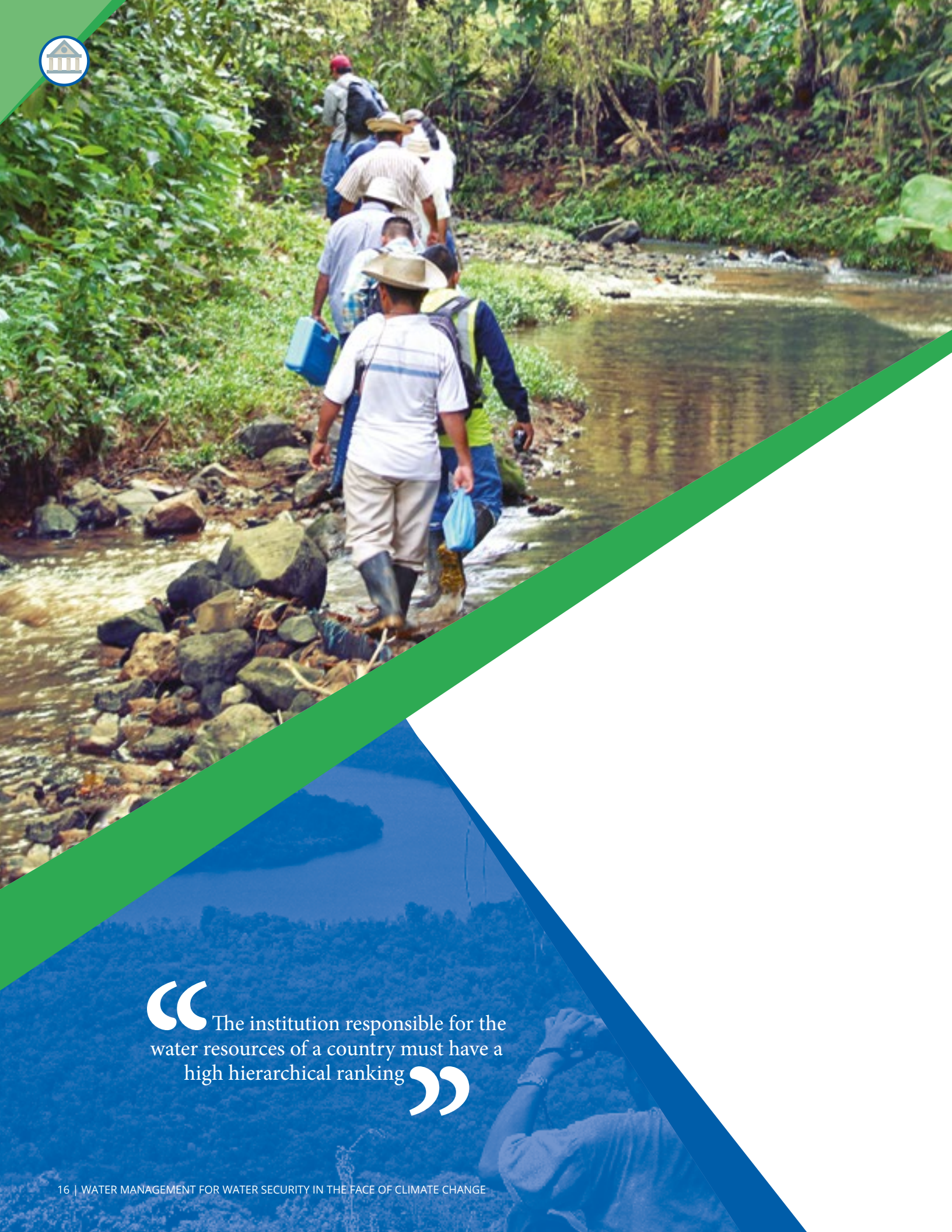
hazards that constitute a threat to human health.

- ▷ Acceptable. Water must have a color, odor and taste acceptable for personal and domestic uses. All water facilities and services must be culturally appropriate and sensitive to gender, life cycle and privacy requirements.
- ▷ Physically accessible. Everyone has the right to water and sanitation services that are physically accessible within or in the immediate proximity of the home, academic institutions, workplace or health institutions. According to the WHO, the water source must be less than 1,000 meters from the home and the time needed for collection should not exceed 30 minutes.
- ▷ Affordable. Water and the services and facilities to access water should be affordable for everyone. The United Nations Development Programme suggests that the cost of water should not exceed 3% of household income<sup>12</sup>.

## 3. International waters<sup>13</sup>

- ▶ Administration of international waterways and aquifers is guided by the general management framework provided by the United Nations Convention on the Use of International Waterways for purposes other than Navigation (New York, 1997) in effect since 2014, the UNECE Convention on the Protection and Use of Transnational Waterways and International Lakes (Helsinki, 1992) opened to ratification by any State party to the General Assembly of the United Nations in 2013, and the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters of the UNECE (Aarhus, 1998).<sup>14</sup>
- ▶ Appropriate bilateral or regional agreements for the proper management of transnational aquifers are pursued, as established in Resolution 63/124 of the United Nations.





“ The institution responsible for the water resources of a country must have a high hierarchical ranking ”



## B. INSTITUTIONS

The functions required to increase water security are diverse and cannot be carried out by a single institution. The opportunities are so great that, setting aside rivalries and with a little creativity and consistency to clarify the limits of the different roles, each institutional actor can draw from their strengths to fill in the gaps identified in water management (the form presented in the Annex is useful for this exercise).

Water-management functions fall under the following categories: governance, provision of services, support in decision-making, direct intervention and social impact. Here, decentralization and private participation are discussed from a critical perspective, as it has been observed in the region that these solutions do not necessarily guarantee success in local water management.





## 4. National water authority

- ▶ The institution responsible for the water resources of a country must have a high hierarchical ranking, effective administrative capacity and autonomy to consolidate its powers and responsibilities for water management.
- ▶ The institutional structure in charge of creating public policy, allocation of water rights and control does not have a functional impact on specific water uses (it is not a user), or has discrete economic activities (Peña and Solanes, *ibid*)<sup>15</sup>.
- ▶ The governing entity has well delineated functions and ensures that the responsibilities of other management elements are properly assigned.

## 5. Centralization and decentralization

- ▶ The various entities at all levels have a clear understanding of their responsibilities, functions, scope, structure and controls for managing water resources and the user community.
- ▶ There are no accusations of poor institutional design, no confusion of responsibilities or gaps.
- ▶ Local or decentralized entities are trained and able to assume the responsibilities given them: operational capacity is not constrained by limited financial, technical, human or legal resources, or by undervaluation of their responsibility.
- ▶ The ability to resolve conflicts of interest is delegated to decentralized administrations with the appropriate faculties and decision-making power.
- ▶ Decentralization of activities does not result in loss of economy of scale. In any event, decentralized management can establish partnerships with similar entities to foster economy of scale (and would be recognized as such in current legislation).

## 6. Private participation in the provision of public water services

- ▶ Private participation<sup>16</sup> does not threaten the returns or income of the sector. There is no monopolization of essential infrastructure<sup>17</sup> or unilateral control of resources.
- ▶ Effective mechanisms are contemplated to ensure private investors of accurate representation of financial performance and provide information that facilitates follow-up and monitoring.
- ▶ Since public services often do not have the characteristics of competitive markets, the State provides an adequate framework for private investment, for example, through reorganization of production and institutional mechanisms and regulations (Peña and Solanes, 2003)<sup>18</sup>.
- ▶ The investment environment in the sector is favorable, however, in cases of private concessions, the regulating entity participates in all stages of the contract.
- ▶ The participation of the private sector adequately addresses issues of scale and efficiency (see last point of paragraph 5).
- ▶ The private entity has sufficient capacity to provide infrastructure maintenance and carry out expansion projects.
- ▶ Special considerations for vulnerable groups are anticipated by private entities.

## 7. Local Water Committees

- ▶ Formal recognition is granted to the existence and legitimacy of local water committees as fundamental institutions for addressing the need for access to drinking water in rural and suburban areas<sup>19</sup>.
- ▶ The operation of local water committees is strengthened<sup>20</sup>, promoting shared management between the State and the communities.
- ▶ The water committees are also strengthened in the topic of sanitation, as well as in other areas such as risk management, according to their abilities and needs.
- ▶ The integration and coordination between Water Committees is further strengthened, for example, in second- and third-level organizations<sup>21</sup>.





## 8. Regulator of Services

- ▶ There is an institution in charge of regulating the prices, conditions and quality of water services. ECLAC (2014) also suggests the participation of these entities in the regulation of service providers<sup>22</sup> and in issues of expansion and maintenance, economic sustainability and subsidies.
- ▶ The regulator of services is independent, stable and subject to the rules of ethics (including transparency); it has sufficient powers and resources. Its technical and management teams are stable (Peña and Solanes, *ibid*).
- ▶ Public enterprises providing public services should also be subject to the general rules for regulated private providers and to those of the regulating entity, to ensure the quality of the services and the rights of consumers<sup>23</sup>.
- ▶ The availability of information and the transparency in decision-making on the part of the regulating entity with regard to society and consumers contributes to institutional credibility and confidence that resources are being protected and that concessions are sustainable (Lorena Alcazar et al, 2000 Peña and Solanes, *ibid*).
- ▶ The numbers of providers monitored by the regulators of public services is manageable, to ensure that they are able to fulfill their assigned functions (Peña and Solanes, *ibid*).
- ▶ User organizations are beneficial but should not replace the role of the state regulator and should be subject to controls (Peña and Solanes, *ibid*).

## 9. Watershed entities

- ▶ Dourojeanni and Jouralev (2001 Dourojeanni et al, 2002) suggest that the success of watershed entities requires certain conditions:
  - ▶ A stable political and institutional system articulated at a national level or at least at the local level, with the visible and honest leadership of a person or groups of people who support the initiative through informed and transparent actions<sup>24</sup>.
  - ▶ Support or at least non-opposition from public authorities and their recognition of the need to establish permanent and solid foundations for water management at the level of watersheds or interconnected water systems<sup>25</sup>.

- ▶ A clear and open demand by water users, resulting from the need to solve conflicts due to insufficient water or poor water governance systems.
- ▶ Una clara y abierta demanda por parte de los usuarios de agua, resultado de necesidades sentidas para solucionar conflictos debido a la carencia o pobres sistemas de gobernabilidad del agua.
- ▶ Among the processes that can boost watershed organizations are: communication, awareness and sensitization processes<sup>26</sup>; creation of alliances and agreements; formulation of scenarios, assessments and diagnostics; operation of hydraulic systems; conservation of water bodies, wildlife habitat and biodiversity; pollution control, restoration of waterways and areas surrounding rivers, recovery of drainage capacity in rural and urban areas; among others (Dourojeanni and Jouralev, 1999 Dourojeanni et al, 2002).
- ▶ Watershed organizations form part of the general water administration and are based on the same principles of sustainability, efficiency, solidarity, equity and transparency.
- ▶ Watershed organizations have either a state-regulated framework or their own stakeholder-approved framework (if they are not covered by legislation) that establishes the conditions for their structure, objectives, functions, decision-making mechanism, formation of Board, etc. Ostrom (1990) defines these as operating rules, rules of collective election and rules of constitutional election<sup>27</sup>.
- ▶ The main instrument of the watershed entity is the watershed management plan, used to organize land use and identify conservation and management measures (see paragraph 25).
- ▶ Watershed organizations have the adequate and timely attention of the authorities, so that their recommendations go beyond mere rhetoric to actual compliance with recommendations.

## 10. Meteorological information and monitoring services

- ▶ There is an entity that performs permanent climate monitoring, confidently manages the databases and allows access to these by stakeholders.
- ▶ There are clearly defined responsibilities for the institution charged with monitoring the quality of water



bodies and maintaining records and reports of these activities.

- ▶ There are clearly defined responsibilities for the entity charged with monitoring and modeling the amount of water in the different sources, maintaining records and presenting periodic reports.
- ▶ The responsible institutions adhere to national policies on the availability and provision of information generated by a public activity.

## 11. Risk management and sectoral user institutions

- ▶ The institutions responsible for the water use sectors are included in integrated management, in coordination mechanisms and in water resource planning.
- ▶ There is an institution responsible for organizing risk management, with supervisory functions for the coordination of the various elements of risk (prevention, mitigation, preparedness, early warning, response, rehabilitation and reconstruction).
- ▶ Sectoral institutions do not manage resources independently or develop infrastructure without coordinating with the institution that supervises the supply or without sharing plans or information (as intermediary institutions of water supply).

## 12. Advisory and training facilities

- ▶ There are technical training facilities and programs to skillfully perform tasks such as: observation of hydrological, meteorological and hydrogeological stations; analysis, processing and storage of data and information; systems for the exchange and dissemination of data and information (UNESCO / MMO, 1992). There are also professional programs in the field of water resources.
- ▶ Recognition is given to the contribution of professional associations, unions, universities, research centers and other organizations able to provide counsel, orientation and scientific and technical support on key issues for the sustainable and integral management of water resources appropriate to the geographical scale.

- ▶ The voice and opinion of professional associations and academia is relevant in the management of water resources; they are active and critical in issues such as evaluating investments or interventions, the type of technology appropriate for each case, associated costs, operation and maintenance, etc.
- ▶ Partnerships with research centers are promoted, for technology development and transfer and research to improve knowledge, sustainable use and regulation of water.
- ▶ Empowerment and not dependence is promoted among the beneficiaries of consultancies, for example by including technology transfer and training in addition to consultancy reports.
- ▶ With regard to the knowledge and management of water resources, innovation and technology development and transfer are promoted and enhanced.

## 13. Research<sup>28</sup>

- ▶ Research is conducted to improve the understanding and calculation of the elements of the water cycle, such as:
  - ▶ Development and downscaling of Climate Change scenarios.
  - ▶ Exploration of effective equipment and techniques for measuring the elements of the water balance and physiographic features (including remote sensing measurement techniques).
  - ▶ Design of networks for monitoring the water cycle.
  - ▶ Study of physiographic features and estimation of interpolation errors.
  - ▶ Analysis of the spatial and temporal relationships between the elements of the water cycle, including meteorological and physiographic factors, along with the preparation of the corresponding models for interpolation in space and time of the elements of the water balance.
  - ▶ Determine the characteristics and establish models of water quality.
  - ▶ Identify statistical characteristics of the chronological series of water cycle data and their relationship to the associated physiographic and technical characteristics, for the synthesis of the series.



- ▶ Efforts are made to improve the understanding of, and relationships between, elements of the water cycle and society, such as:
  - ▷ Analysis of the effects of human activity on the elements of the water cycle and techniques to predict variations in the water regime.
  - ▷ Effects of climate change on all sectors of society and ecosystems.
  - ▷ Evaluation of options for adaptation to the effects of climate change.
  - ▷ Techniques for preserving the quantity and quality of water for better use of water in different elements of the water cycle.
  - ▷ Techniques to increase the amount of water in some elements of the water cycle (e.g., ground-water recharge, retention of floodwaters, reducing evaporation, increased infiltration in soils, increased condensation of moisture in the air).
  - ▷ Techniques for improving water quality and using the residues generated in the treatment process.
  - ▷ Techniques for improving groundwater extraction and transportation as well as the efficiency of hydroelectric and pumping plants.
  - ▷ Analysis of flows and returns for urban development and infrastructure planning.
  - ▷ Warning systems to reduce impacts of hydrometeorological events.
  - ▷ Approaches to increase resilience to climate change.
  - ▷ Assessments on vulnerability and climate-related risks.
  - ▷ Evaluation of the effect of extreme events on the regulation of infrastructure design.
- ▶ Research to improve the different aspects of water management as well as the legal, administrative and institutional procedures regarding:
  - ▷ Water rights and conflict resolution.
  - ▷ Criteria to resolve favorable or unfavorable cases that go to court and the way in which environmental damage is valued.
- ▶ Efforts are made to improve the estimation of the value of water in order to justify the investment in hydrological monitoring components, for example:
  - ▷ Evaluation of the cost of supplying water; calculation of opportunity cost and market prices.
- ▶ Estimation of the economic costs of social and environmental impacts due to uninformed decisions for lack of data on water resources.

“ Formal recognition is granted to the existence and legitimacy of local water committees as fundamental institutions for addressing the need for access to drinking water in rural and suburban areas ”



## 14. Role of the media

- ▶ The media actively participates in:
  - ▷ Translating technical problems to enable society to understand and gain awareness.
  - ▷ Motivating the public to take an interest and feel that it is a part of the possible solutions.
  - ▷ Communication that goes beyond traditional coverage of water-related disasters.
- ▶ Technicians and scientists collaborate with journalists and other communicators through educational processes, information exchange and joint planning.
- ▶ Journalists are trained in the importance of managing water resources and the significance of hydrological information.

“ Research is developed to improve understanding and calculation of the elements of the water cycle ”



Figure 2. Map of Water Management Functions

|                                      | Functions                                    | Principal uses |  |  |  |  |  |  |  |
|--------------------------------------|----------------------------------------------|----------------|--|--|--|--|--|--|--|
|                                      |                                              |                |  |  |  |  |  |  |  |
| Governance                           | Policies, regulations                        |                |  |  |  |  |  |  |  |
|                                      | Planning                                     |                |  |  |  |  |  |  |  |
|                                      | Adaptation to CC and risk management         |                |  |  |  |  |  |  |  |
|                                      | Conflict resolution                          |                |  |  |  |  |  |  |  |
|                                      | Monitoring, control and sanctions            |                |  |  |  |  |  |  |  |
| Social Impact                        | Communications and education                 |                |  |  |  |  |  |  |  |
|                                      | Spaces for participation and cooperation     |                |  |  |  |  |  |  |  |
| Services                             | Service provider                             |                |  |  |  |  |  |  |  |
|                                      | Service regulator                            |                |  |  |  |  |  |  |  |
| Support to decision-making processes | Water monitoring and information systems     |                |  |  |  |  |  |  |  |
|                                      | Research                                     |                |  |  |  |  |  |  |  |
|                                      | Technical assessment, formation and training |                |  |  |  |  |  |  |  |
| Intervention                         | Conservation and protection of water sources |                |  |  |  |  |  |  |  |
|                                      | Infrastructure                               |                |  |  |  |  |  |  |  |



“ Service users and beneficiaries help  
to define gender implications ”



## C. PARTICIPATION

The water management process requires the coordinated actions of many actors, even though they may have diverse criteria and, at times, little knowledge of the effects of their decisions on the water cycle<sup>29</sup> (ECLAC, 1992). Peña and Solanes (ibid) warn that finding ways to solve the allocation of water resources, especially in areas of scarcity where society's interests (domestic, agricultural use) and economic benefits (mining, industry, hydroelectricity) are exclusive, is an important, urgent and pending task, which also requires that users and the public have access to an effective decision-making process where water is concerned. Therefore, the promotion of public awareness regarding the provision of services, environmental protection and especially the management of water resources, is a tool for development and social stability.





## 15. Stakeholder analysis

- ▶ A stakeholder analysis has been made, identifying, at the very least: a) those in charge of directing management policies; b) service providers; c) water users; d) specialists, scientists and scholars; e) organizations, participation spaces and media (see Figure 2).
- ▶ The functions, interests and common concerns of the various stakeholders with regard to water management have been studied.

## 16. Gender considerations<sup>30</sup>

- ▶ The different social, economic and cultural roles assigned to men and women of different ages have been characterized for each context, analyzing the social relationships, rights, responsibilities, opportunities and power dynamics around water use.
  - ▷ For example, the SDC (2005) mentions that there can be implications not only at the household level (the distribution of labor, rights to resources, including water and finances), but also with regard to the possibility of women being employed in water agencies<sup>31</sup>.
- ▶ Gender implications are taken into account at all stages of planning and implementation of water management activities in different sectors, including sanitation, irrigation, disasters<sup>32</sup>, etc.
- ▶ Obstacles to women's participation have been identified in consultations and strategies have been developed to overcome them. This includes an understanding of the fact that different groups of women may also be marginalized because of their ethnicity, social class or caste (SDC, *ibid*).
- ▶ The service users and beneficiaries help define the gender implications and participate in the process of community consultation (European Commission, *ibid*).
- ▶ Men are included in educational activities related to water use and hygienic behavior since their attitude can be decisive within the family and the community (European Commission, *ibid*).

## 17. Spaces for participation

- ▶ The organization of different stakeholders and sectors of water users is respected and promoted, as well as their balanced participation within decision-making spaces at the closest possible level.
- ▶ Participation and consensus in forums and spaces for debate and decision-making are active and ongoing, both in general terms and particularly with regard to emerging situations caused by extraordinary events, including shortages or overabundance.
- ▶ There is a balance of participation and access among users, sectors and interest groups<sup>33</sup>, with a fair representation of vulnerable groups and indigenous peoples. It is recognized that not only the owners of rights and direct water users may have legitimate interests linked to the resource (Peña and Solanes, *ibid*), for example, if the role of water in the environment or other intangible values are considered. That is to say, a broad, active legitimacy is recognized with regard to the defense of these rights before the courts of justice.
- ▶ Figures or entities that participate in water spaces and agendas are integrated by independent specialists or scientific organizations that do not have functional interests or their "own agendas" (Moench et al, 2003).
- ▶ Water users and other stakeholders can freely participate in public hearings or consultations to analyze policies, programs, projects or legislation. Important interest groups are prevented from limiting their participation by conditions such as distances, mobilization costs and time, among others.
- ▶ The participation of the various actors is important at all stages of planning: diagnosis, planning, implementation, monitoring and evaluation of results.
- ▶ There are alternative mechanisms for resolving disputes when participation does not reach appropriate conclusions, both in terms of substance and time (Peña and Solanes, *ibid*)<sup>34</sup>.
- ▶ A record of the results from forums and decision-making processes is maintained and made available to the public.
- ▶ The results of the spaces for participation are heeded and, as far as possible, binding, although this possibility must be defined by law.





## 18. Social Impact

- ▶ The population exercises its rights to participate in decision-making processes.
- ▶ The population has access to information on hydrology, water quality, water permits and similar information.
- ▶ The population has legal mechanisms to safeguard the rule of law, justice and non-discrimination (Laban, 2007 WGF 2012)<sup>35</sup>.
- ▶ The population, its associations and unions are active in participating in spaces for dialogue and decision-making with regard to the development of water projects or other actions which will affect the resources, and in monitoring and auditing management actions.
- ▶ Water institutions, NGOs, the private corporate sector and other relevant interested or affected civil organizations participate in collecting data and information, identifying sources of information, and mobilizing political and public support for the development of water resources.



“ The participation of the various actors is important in all stages of planning: Diagnosis, planning, implementation, monitoring and evaluation of the results ”



“ It is preferable to work towards procedural simplicity to ensure the legality of all actors, rather than complicate processes that may encourage corruption and lack of control ”





## **D. MANAGEMENT CAPACITIES**

Weaknesses in institutional management are often a recurring source of problems in the water sector, necessitating a careful review of the issues of management, planning, financing, human resources and, of course, information systems linked to water management.



## 19. Water sector planning

- ▶ Water Security goals<sup>36</sup> are established in accordance with national development plans.
- ▶ Sector planning involves different categories of plans, programs and projects, such as the National Plans for Integrated Water Resources Management, Sectoral Plans, Climate Change Adaptation Plans, Territorial Plans (watersheds), and Special Plans (risk and other).
- ▶ The possibility of integrating and relating plans at different levels is provided for. In each level and context, problems and solutions are identified, together with their corresponding funding strategies.
- ▶ The watershed can be a fundamental unit for managing the water supply, although the intersections with, and possibilities of, administrative or other types of limits with regard to demand management are also acknowledged<sup>37</sup>.
- ▶ Participatory and democratic planning of the water sector together with stakeholders is implemented, including: those in charge of directing management policies, the private sector, users, specialists, scientists and scholars in the environmental sphere.
- ▶ Water management planning is based on reliable information on the conditions and trends of water resources generated by relevant monitoring and research.
- ▶ The interinstitutional water planning process also implies, in addition to the joint building of plans and programs, that the actors will assume the functions of financing, implementation and management of the corresponding systems and programs (Valencia et al, 2007).
- ▶ The design of measures and solutions takes into account the short- and long-term costs and profits for different social groups.
- ▶ All plans, programs and projects include monitoring and evaluation to incorporate lessons learned from previous periods.

## 20. Funding for the sector

- ▶ Funding sources for both “hard” investments (infrastructure) and “soft” investments (assessment of water resources, training, research, planning, organization of stakeholder participation, monitoring the enforcement of water regulations, etc.) are available and/or anticipated.
- ▶ Financial instruments are applied with the criteria of efficiency, equity, solidarity and sustainability.
- ▶ Provisions are made to strengthen the skills of those responsible for designing and implementing appropriate economic instruments, as well as for managing collaborative projects<sup>38</sup>.
- ▶ Insurance is available to protect against hydrometeorological events, accidents and disasters, for example in relation to flooding of structures or interruptions in the systems operations.
- ▶ Water supply companies are financially sound, with a credit history and financial planning.

## 21. Administration

- ▶ Public water supply companies have their own separate administrative and accounting systems.
- ▶ The institutions that provide water services strive to achieve commercial efficiency, gradually reducing their dependence on the national budget.
- ▶ The entities have business plans and annual budgets based on the needs for operation, maintenance, expansion plans, etc.
- ▶ The performance of the institution (or water company) is not compromised by excessive limitations to decision-making (perhaps delegating an unnecessary burden to its Board of Directors).
- ▶ They submit to auditors in a transparent, timely and ongoing manner.
- ▶ They render accounts systematically regarding the state and management of resources, for example, concessions, uses, volume, revenue, geographical distribution, fines, etc.
- ▶ They maintain low default rates.
- ▶ Water rates reflect actual consumption.
- ▶ The entities are able to increase the performance of management indicators, such as collection rates,





quality of services, expansion of coverage, efficiency, financial health, etc.

- ▶ They promote systems of continuous improvement in all areas of management<sup>39</sup>.
- ▶ Water-related processes and procedures are free of excessive bureaucratization<sup>40</sup> and are congruent and consistent. Standard procedures are implemented, at least with regard to primary functions.
- ▶ Processes and procedures are designed with democratic considerations towards vulnerable groups.

### 22.1. Tenders and contracts<sup>41</sup>

- ▶ The policies for application of funds are transparent and functional, and subject to national financial and anti-corruption laws. The participation of actors with political, short-term or opportunistic agendas in decisions related to the management, operations or finances of the administration is not allowed, to safeguard against unnecessary and inadequate projects or studies.
- ▶ Contractual opportunism, postponement of investments and ignorance of environmental interests are avoided.
- ▶ In the design specifications, analysis of proposals and adjudications of large hydraulic projects, the experience of the operator is given equal or even greater consideration than that of the builder, as well as the participation of specialized workers.
- ▶ Funding from external support agencies helps to prevent constraints on goods and services of the country of origin or pre-assignment without competitive bidding, and is subject to the regular processes of accountability.
- ▶ The possibility of flexible contracts or rights is considered, to ensure long-term social stability.

## 22. Human Resources

- ▶ The number of personnel is adequate<sup>42</sup> to fulfill the institutional mission and achieve the desired results.
- ▶ Satisfactory conditions of employment, motivation and compensation are provided.
- ▶ There are mechanisms to reduce the exit of experienced personnel formed within the institutions, for example, by offering career advancement opportunities.
- ▶ There is a catalog of personnel and job descriptions or functions in the institutions, contributing to overall efficiency.
- ▶ The operating, administrative and planning personnel receive frequent training<sup>39</sup>.
- ▶ The staff has the necessary and sufficient resources to fulfill their tasks and goals: hardware, software, vehicles, travel expenses, other materials and equipment.
- ▶ Included within the management of water resources are professional personnel from multiple disciplines, as well as engineers in water resources, such as hydrogeologists, geographers, environmentalists, biologists, chemists, sociologists, economists, lawyers and financial experts; personnel who can address issues such as rest, recreation, health and public welfare; experts in information systems, instrument repair and electronics (WMO/UNESCO, 1998).

“Water management requires that employees have favorable conditions of employment, motivation and remuneration”



## 23. Information Systems

- ▶ Information services related to water resources must be adequate but not overly sophisticated<sup>43</sup>; the most important aspect is to ensure that different stakeholders have the opportunity to use the information needed to solve problems or improve water management.
- ▶ The information required for the proper daily management of water should be regularly updated and available, implying that the institution does not depend on drawn-out bidding processes to acquire it<sup>44</sup>.
- ▶ There are Geographic Information Systems associated with the management of water resources and watersheds.
- ▶ The location and content of existing data and information, including production methodology, formats, updates and access, is known
- ▶ There is collaboration between agencies and users regarding the evaluation of information and needs, as well as informing and providing requested products and information.
- ▶ GWP-INBO (2009) suggests the need for standardized regulations for producing, processing, sharing and disseminating data and information (rules on access and task assignment) in order to avoid duplication and create synergies between participating organizations, including the interoperability of information systems and the organization of network services in order to make it easier, for example, to identify, view and download data.
- ▶ WMO/UNESCO (ibid) suggests that basic information should be available and shared for purposes of hydrological decision-making, including the uses and demand for water, watershed characteristics and structural and non-structural elements, which are listed below:
  - ▷ Hydrological information:
    - ◆ Precipitation: chronological series of daily precipitation, precipitation statistics, surface distribution of precipitation over several months, seasons, etc., chronological series of snow thickness and water content, snow accumulated on the ground (plus probability of maximum accumulations of snow); temperature data, radiation and humidity, chronological series of the factors determining water quality, relationship between height/duration of rain.
    - ◆ Evaporation: Chronological series of tank evaporation and meteorological data to estimate evaporation rates, especially solar radiation, air temperature, air humidity and wind.
    - ◆ Levels of rivers and lakes: Chronological series of daily levels (occasionally hourly or instantaneous), maximum and minimum daily levels with different probabilities; hydrograms of flood levels for different probabilities or return periods; wetland levels.
    - ◆ River flows: Chronological series of maximum and minimum daily (sometimes hourly) flows; maximum and minimum, daily and instantaneous flows with different probabilities and with ice.
    - ◆ Sediments: Chronological series of daily concentrations and total sediment flow.
    - ◆ Water quality: Chronological series of parameters that determine water quality; relationships between flow and water quality; including water temperature.
    - ◆ Characteristics of the riverbed: Variation of the area, width and depth with the level (flow); velocity of the water, surface slope; etc.
    - ◆ Groundwater: Chronological series of groundwater levels and estimate of water yield and parameters that determine water quality. Hydrogeological data (e.g., drilling records, maps).
- ▶ Information on current water uses and future projections, the watershed and other useful information for decision-making:
  - ◆ Database on the volumes of water allotted and used per unit of time, type of use, source and / or geographic area<sup>\*45</sup>.
  - ◆ In general terms, the value of the water in terms of use and location, and in terms of jobs created, food security, equity, and contribution to social peace and national GDP \*.
  - ◆ Pending demand and future projections, with their respective requirements in terms of quantity, quality, timing and location by type of use \*.



- ◆ Attributes of rivers as they relate to internal uses such as freshwater fisheries or recreation, riparian vegetation and others.
  - ◆ Watershed characteristics that may be related to hydrology, including vegetation patterns, soil moisture, topography and aquifer characteristics such as permeability.
  - ◆ Environmental effects (eutrophication of lakes, damage to natural freshwater and estuarine ecosystems).
  - ◆ Recharge and discharge of groundwater, depletion of groundwater and degradation of quality.
  - ◆ Environmental monitoring indicators related to inland and coastal waters and for evaluating the effectiveness of water policies and the behavior of countries in accordance with established objectives and constraints.
  - ◆ Climate Change Scenarios
- ▷ Information on structural elements:
- ◆ Factors that modify the components of water balance (runoff, precipitation, evaporation, soil moisture, surface treatment, cloud seeding, etc.).
  - ◆ Factors that cause a spatial redistribution of water (intakes for transport and distribution, canals and pipes, intakes, outlets).
  - ◆ Factors that seasonally redistribute water (surface and subsurface reservoirs, other water storage structures).
  - ◆ Factors that consume or supply hydraulic energy (turbines and pumps).
  - ◆ Factors that constrain water (dams, dikes, levees, flood protection structures and others).
  - ◆ Factors that release water (discharge facilities).
  - ◆ Factors that improve quality at the source (reducing soil erosion, salinization).
  - ◆ Factors that improve quality at the point of use (water and sewage treatment plants, cooling towers and ponds).
  - ◆ River development.
- ▷ Non-structural elements:
- ◆ Legislation and regulations.
  - ◆ General, territorial and thematic plans.
  - ◆ Water security goals\*.
  - ◆ Zoning for flood management, preservation of water resources, management of runoff and soil erosion, and protection of wildlife and fish habitat, etc.
  - ◆ Insurance (related to flooding of permanent or temporary structures (cofferdams), interruptions in operations, accidents and disasters).
  - ◆ Predicting flows and levels (continuous prognosis, flood warning, operation of reservoirs and others).





“ The decision-making process is supported by infrastructure for collecting data on the water cycle and from the monitoring of water quantity and quality ”





## E. SUPPLY MANAGEMENT

In a country, the development of water resources should serve as a catalyst for achieving economic, social and environmental goals through the rational use of resources. In that sense, it is essential to maintain the flow of environmental goods and services<sup>46</sup> provided by watersheds for different users, both present and future. This is urgent, since it has been observed that the same human activities responsible for growing demands for services rendered by ecosystems, such as food and pure water, are responsible for reducing the ability of these ecosystems to meet these demands (WRI, 2003).



## 24. Hydrological Monitoring<sup>47</sup>

- ▶ The results of monitoring are shared and used for decision-making and planning<sup>48</sup>.
- ▶ The decision-making process is supported by infrastructure for collecting data on the water cycle<sup>49</sup> and from the monitoring of water quantity and quality. This can be quantified by:
  - ▷ Facilities, density of coverage.
  - ▷ Equipment, maintenance and repair.
  - ▷ Observation program and personnel: observers, analysts.
  - ▷ Laboratories.
  - ▷ Records: duration and continuity.
  - ▷ Strategy for storage, primary processing (catalogs, conventional and automated data banks).
  - ▷ Dissemination of information (newsletters, year-books, abstracts).
  - ▷ Application of systems for standardization and quality control (accreditations, ISO certification, other standards or controls).
- ▶ Scope and characteristics of physiographical information (topography, geology, geomorphology, geophysics, soil, land use and land cover), which help to:
  - ▷ explain the causes of the spatial-temporal variation of the elements of the water cycle and use this information for interpolation where gauging is not done, and
  - ▷ predict spatial-temporal changes in the characteristics of water resources due to water use and changes in watershed conditions (including the impact of Climate Change).
- ▶ Information on the impact of projects on water resources (flow, storage, extraction, diversion and return of water), which helps to:
  - ▷ reconstruct the natural regime of the components of the water balance, and
  - ▷ evaluate future changes in the variation of quantitative and qualitative characteristics of water resources due to development, by means of physical and statistical models.

- ▶ Mechanisms and scope of warning systems for hydro-meteorological hazards.
- ▶ Frequency and type of analysis of water resources (water balances, hydrological capacity of available water sources, minimum, maximum, and average flows, return times, aquifer recharge) and information dissemination strategies.
- ▶ Simulation techniques, optimization models, remote-sensing techniques applied to hydrology.
- ▶ Capacity (systems, software, trained personnel, etc.) for geospatial assessment of hydrological elements and extent or percentage of coverage of this type of information: application of models, for example statistical or deterministic (rainfall-runoff) for surface and ground water, regression, interpolation, remote sensing, mapping (isolines and/or grid) and model calibration (validation error). It is particularly important to have data on the distribution of rainfall, runoff, soil moisture, groundwater levels, their seasonal variations and statistics, geophysics, etc.

### 24.1. Participatory monitoring<sup>50</sup>

- ▶ Consideration is given to the opportunity for participatory monitoring of water resources. Participatory monitoring may be valuable to perform various tasks such as reading measuring devices, activating warning systems, monitoring water quality, assessing environmental quality with simple bio-indicators or bioassays, decision-making based on available information, safekeeping of monitoring equipment and others.
- ▶ Participatory monitoring results are made public, for example through meetings, expositions, posters, etc. The trends are explained and reflected in simple and understandable language appropriate for the general public, for example with graphs, drawings or color illustrations.

## 25. Watershed management<sup>51</sup>

- ▶ The goal of watershed management is to increase and maintain the quality and quantity of water and to reduce the risk of water-related disasters; it can also harmonize with goals related to other environmental goods and service<sup>52</sup>.
- ▶ Watershed management planning objectives can be considered in the context of two realities: on the



one hand, promoting the quality of life of the local population, and on the other, contributing to national development through the export of environmental goods and services.

- ▶ As part of watershed management, human interventions are managed to reconcile economic, social and environmental goals (Dourojeanni, 2009). This is evident in the process of evaluation, inspection and monitoring of environmental impact studies, which in turn must obey the Land Management Plan and the National Development Plan or vision of the country.
- ▶ The watershed management plan includes the definition of responsibilities, associated costs, funding sources, stipulated deadlines, and a system for monitoring and reporting of projects and actions.
- ▶ Watershed management is participatory and self-mobilizing<sup>53</sup>, with social actors trained in the process and involved in the planning, implementation, monitoring and enforcement as stated within the plans.
- ▶ To avoid paternalism<sup>54</sup> in watershed management investments, there is a healthy balance in the share of capital contributed by the state and by the landowners.
- ▶ The main threats to the production of environmental goods and services in watersheds have been identified and characterized, and management alternatives have been specified in a participatory manner.
- ▶ In assessing the problems of watersheds, an analysis is made of the environmental history<sup>55</sup> which accounts for the current situation and encourages joint reflection on the facts, responsibilities and interests involved, and on the measures and principles that should govern accordingly, as a joint commitment.
- ▶ The planning and participatory management of urban watersheds is promoted. In this regard, consideration is given to the relationship between runoff and infiltration, as well as the reduction, separation, and treatment of rainwater and wastewater drains.
- ▶ In the management plans, critical areas in need of attention are identified, such as water recharge areas, areas of importance to ecological conservation, degraded areas in need of restoration, areas susceptible to flooding, areas of increased sediment production, areas prone to landslides, and vulnerability of aquifers, among others.
- ▶ There are assessments of vulnerability to Climate

Change<sup>56</sup> for priority watersheds, and of the impacts to water users. Adaptation results and measures for the territory are considered in other national documents and in international negotiations.

## 26. Infrastructure

- ▶ Emphasis is placed on a multiple-use approach for water infrastructure and on appropriate designs according to the natural, social and economic conditions, which may include micro, small, medium and large infrastructure systems.
- ▶ The conditions and service life of water infrastructure are controlled with adequate systems for surveillance, maintenance and replacement.
- ▶ The participation of different actors is permitted in the development stages of water infrastructure listed in Table 1.
- ▶ Projects with negative global economic impacts are avoided, even when there are sectoral benefits.
- ▶ The procedures and actors responsible for the study, planning, construction, operation and maintenance of hydraulic projects are established.
- ▶ There are technical standards for rural water supply and sanitation systems.
- ▶ Infrastructure design takes Climate Change scenarios into account.
- ▶ Hydraulic project designs are supported by the corresponding environmental impact studies and social validation.
- ▶ The technology used in water systems is suitable for local conditions, considering needs such as replacement parts, costs and expertise (as well as efficiency, competence and social adaptation).
- ▶ Sensitive infrastructure is insured against damage and disasters, and is suitably located to lower the risks of loss by events such as floods or others.
- ▶ Water infrastructure adheres to a national development plan, incorporating local development and involvement and environmental sustainability.



- ▶ Measures are anticipated to ensure that both the benefits and the environmental and social costs of water projects are shared fairly by all of society. Efforts are made to prevent, mitigate or compensate the negative impacts.
- ▶ The convergence of diverse financing sources is taken into account in investments.

Table 1. Stages of water infrastructure development (modified from Bogardi, 1994)

| Stage          | Aspects included                                                                                                                                                                                           |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Evaluation     | Of water resources<br>Uses, needs and future demands<br>Disasters, Climate Change<br>Financial possibilities and restrictions<br>Technical options<br>Dependence on inputs and external consultation, etc. |
| Planning       | Location, scale, size, selection, sequencing, timetable                                                                                                                                                    |
| Design         | Structural design, costs, tender documents                                                                                                                                                                 |
| Implementation | Construction, supervision                                                                                                                                                                                  |
| Operation      | Monitoring and regulation of system performance                                                                                                                                                            |
| Maintenance    | Control, repair, replacement                                                                                                                                                                               |



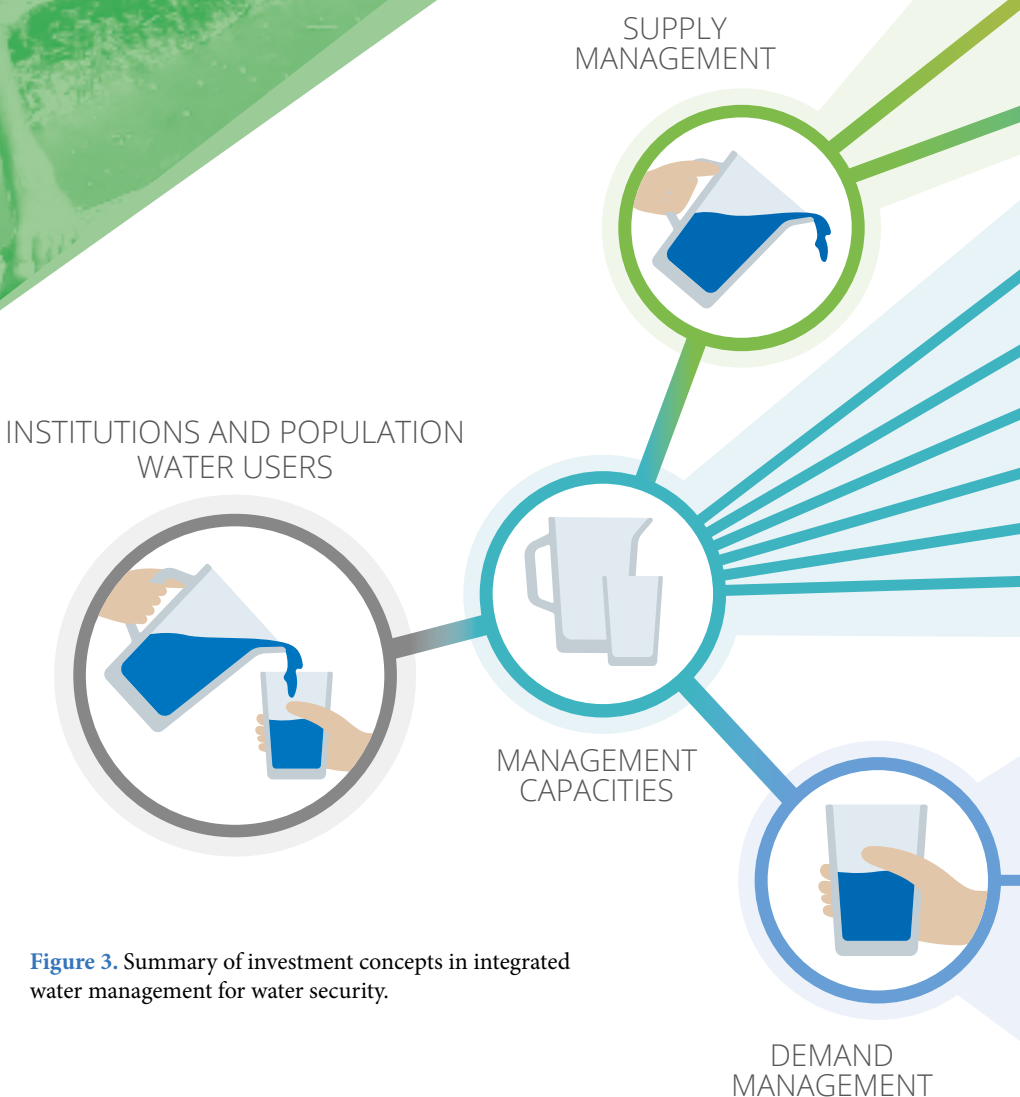


“ The goal of watershed management is to increase and maintain the quality and quantity of water and to reduce the risk of water-related disasters ”

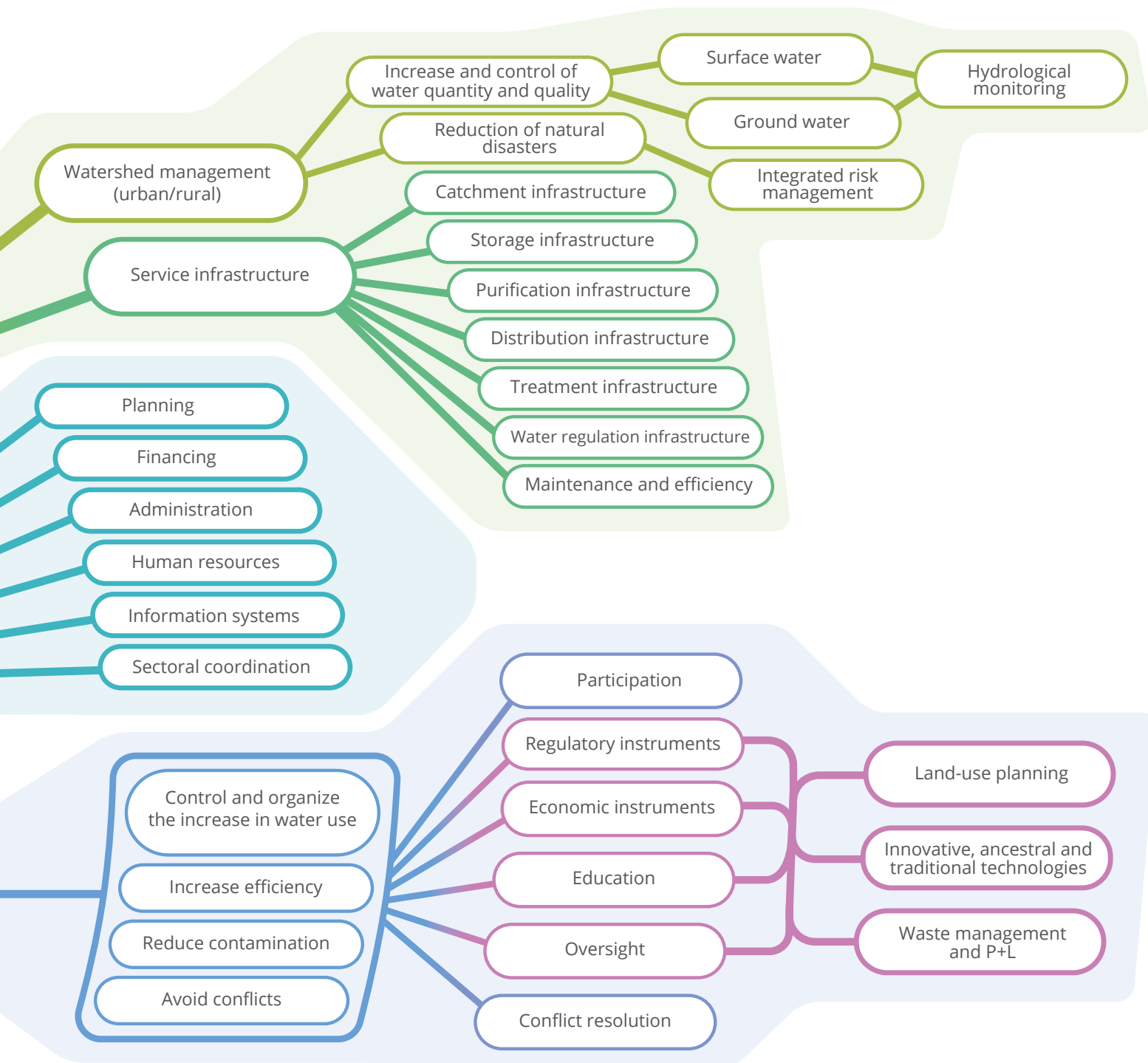




# INTEGRATED WATER MANAGEMENT FOR WATER SECURITY



**Figure 3.** Summary of investment concepts in integrated water management for water security.





“The granting of water rights is in harmony with land use and/or watershed management plans”





## F. DEMAND MANAGEMENT

Integrated water management is so named because the various institutions work together with the population to supply the water needed (supply) and to make proper use of this vital liquid (demand). Managing water demand has four main objectives: a) controlling and managing the increase in water use; b) increasing efficiency; c) reducing contamination and d) avoiding conflicts. This requires support in the design and implementation of a number of instruments: regulatory, economic, educational, participatory, and for coordination, control and conflict resolution.



## 27. Granting of water rights

- ▶ The granting of water rights is based on the availability of flows, ecological requirements and the public interest (Peña and Solanes, 2003).
- ▶ Water rights are maintained when they are effective (i.e., water is being used under the conditions established in the concession) and beneficial (for the owner and do not affect third parties)<sup>8</sup>.
- ▶ The system for surface and groundwater rights, their acquisition and possible transfer, is clear and regulated; there are also rules in place regarding discharge, and restrictions on quantity, time, place and use of technologies.
- ▶ There is a public document detailing all of the procedures for granting water rights which is consistent and uniform and specifies the information that must be provided, where, how and how often.
- ▶ The rights and obligations of the holders of water rights have been predefined in the legislation.
- ▶ The regime of ownership of hydraulic works is clarified in cases involving dam construction, diversions, wastewater or water otherwise subjected to treatment.
- ▶ The granting of water rights adheres to Land Use and/or watershed management plans.

## 28. Pre-existing rights<sup>58</sup>

- ▶ Drinking water and sanitation uses could receive functional priority in the allocation of water rights provided that the level of scarcity is valid and this privilege does not lead to inefficient use.
- ▶ The law recognizes customary uses and rights which are non-appropriative and non-derivational, i.e., in situ uses associated with the natural regime of the waters, such as fishing, livestock watering or even the use of floodwaters<sup>59</sup>.
- ▶ Traditional uses are surveyed and registered to prevent investors (for example, foreign) from not protecting, disrespecting or not compensating these uses because they are not formally registered<sup>60</sup>.
- ▶ All rights to the use of waters, including traditional and indigenous rights and uses, are subject to judicial and legislative rules of use, exploitation, protection, and water conservation.

## 29. Rates, fees and subsidies<sup>61</sup>

- ▶ Cross-subsidies are avoided, as are their negative consequences with respect to efficiency, equity and competition.
- ▶ Water rates are established on the basis of assessments of demand and ability to pay, as well as studies of the social relationships that define the use, management, access and distribution of water, taking into account socio-economic, technological and environmental factors.
- ▶ The water rates reflect a surcharge for inefficient or excessive consumption.
- ▶ Fees for water extraction reflect volumes, potential benefits for different users, various purposes, opportunity costs, season and availability; they will depend on hydrological estimates, demand projections, alternative uses, costs of alternative water sources, etc.<sup>62</sup>
- ▶ Fees for polluting, applied to specific contaminants, are administered as part of a broader regulatory system that includes the establishment of discharge conditions and permissible maximums and/or the application of the “He who contaminates, decontaminates and rehabilitates”, ceding or reversing the burden of proof<sup>63</sup>.
- ▶ There is a system for measuring, inspecting and applying the revenues generated by water fees to the management and conservation of natural resources.
- ▶ The application of schemes for Payment for Environmental Services is a viable option for environmental management when i) an identified demand (need) of ecosystem services has a financial value for one or more stakeholders, ii) the provision of ecosystem services is threatened, iii) management actions contribute to the resolution or reduction of threats, iv) there is an institutionally enabling environment and v) the results can be evaluated (GWP, onlineToolbox).
- ▶ The possibility exists to apply compensation mechanisms<sup>64</sup> related not only to monetary transactions, but also to aspects such as infrastructure, services or rural extension.
- ▶ In irrigation systems, Peña and Solanes (2003) suggest payment by farmers to promote recovery of investments, which would involve a policy of subsidies to the poorest sectors and safeguarding compliance with irrigation projects as originally conceived, as well as regulatory commissions to ensure the user’s right to



uninterrupted service, an equitable allocation and fee regulation<sup>65</sup>.

## 30. Other regulations

- ▶ The use of certain water resources is demarcated, such as closed areas, reserves, the distance between wells or fossil water.
- ▶ There are specific rules for the development of obstructions and projects in riverbeds or riparian zones.
- ▶ The possibility of injecting water and other substances into the subsoil is regulated.
- ▶ The law provides for water easements<sup>66</sup> on public or private property, including their existence, characteristics and continuity.
- ▶ The effects of watershed contamination on marine waters is contemplated in legislation.

## 31. Surveillance

- ▶ The program for monitoring water use is sufficiently equipped with staff, appropriate vehicles and other materials.
- ▶ Progress is being made towards complete measurement of water consumption.
- ▶ There is constant monitoring and tracking of intakes and discharge to prevent contamination and unsustainable use.
- ▶ Surveillance and inspections are carried out to reduce the percentage of losses in the production-distribution system.
- ▶ Participatory monitoring schemes are considered (See paragraph 24.1).

## 32. Sanctions

- ▶ The system governing violations, administrative penalties and delinquent behavior is designed to discourage irrational use, contamination, illegal extraction, etc.
- ▶ The system of infractions and administrative sanc-

tions is characterized by a regime which is applied in a gradual, effective and proportionate manner.

- ▶ Corrective measures are taken in the event of administrative infractions and environmental crimes, including, but not be limited to, orders for the suspension or cessation of activities, obligation of the responsible party to restore or repair the conditions to their the previous state, and compensation for damages, among others.
- ▶ Statistics are maintained on environmental crimes reported and investigated, environmental crimes detected in the watershed, offenses that are punished, and the effectiveness of sanctions.

## 33. Education

- ▶ The participation of stakeholders is encouraged and facilitated by providing access to data and information to promote the opinions and positions with the most support and greatest likelihood of having an impact. This means that:
  - ▶ Civil society understands the rules for designing sectoral policies.
  - ▶ The public has access to the rules for evaluating the economic efficiency of public investment and how it impacts the fulfillment of water goals and national development.
  - ▶ The plans and goals for the development of water resources are made public.
  - ▶ Work is coordinated with the sectors to develop and promote sustainable water use technologies and practices.
  - ▶ Information is made available to promote social awareness around water, including:
    - ◆ Information on water quality and quantity, sources of pollution, management of supply and demand, watershed management plans and urban planning and development, among others.
    - ◆ Information linking water resources to health, the environment and development.
    - ◆ Knowledge and awareness of the value of water



are promoted to encourage a culture of prompt payment.

- ◆ Emphasis is placed on the value of hydrological information to ensure that informed decision-making surpasses its cost<sup>67</sup>.
- ▶ The goal of education is to encourage the population, sectors and institutions to promote and adopt cleaner production, efficient use of resources, and development of sustainable water use technologies and methodologies, among other good practices.
- ▶ Public and private entities that deal with water resources promote participatory practices and disseminate relevant and timely information.
- ▶ There are a variety of channels for communication and debate, both virtual and face-to-face, including forums, social networks, radio, websites, publications, etc., for different types of audiences: professionals, decision makers, NGOs and interested members of civil society.

## 34. Coordination mechanisms

- ▶ Mechanisms for coordination among sectoral institutional users ensure the following, among others:
  - ▷ Fulfillment of national water security goals.
  - ▷ Coordinated planning and decisions on the use of resources.
  - ▷ Promotion of sustainable technologies.
  - ▷ Exchange of information and data on resource use.
  - ▷ Facilitation of studies on future demand for water from the different sectors.
  - ▷ Shared funding.
  - ▷ Standards for monitoring and tracking actions.
- ▶ Spaces for inter-institutional coordination and cooperation are established at a high level and are permanent; they are convened regularly under a set of rules and have specific work objectives.
- ▶ There are mechanisms for delegation of participation in these coordination spaces to ensure that attendees are empowered to make decisions and provide follow-up to those decisions.

## 35. Conflict Resolution

- ▶ There are criteria at every level for resolving potential conflicts, as well as authorities responsible for their application.
- ▶ Regulations are anticipated for the presence and operation of systems for handling customer service and complaints in the water utility companies.
- ▶ In conflict situations there should be a mandatory jurisdiction to ensure that the parties that benefit from the existing situation are obliged to negotiate solutions, while the non-benefitting parties are not left totally defenseless (Peña and Solanes, *ibid*). For these cases, it is mentioned that the administration must have decision-making capacity, administrative quality, and adequate procedural and constitutional guarantees.
- ▶ The ability of groups to appeal to the common law to protect or consolidate their rights is facilitated and promoted<sup>68</sup> (Peña and Solanes, *ibid*).
- ▶ Statistics are kept on the level of satisfaction with processes of conflict resolution and cases are systematized to obtain lessons learned regarding: identification of legal gaps, the need for adjustments in procedures or regulations, improvement of spaces for dialogue and negotiation.





“Through education, the population, sectors and institutions are encouraged to use water efficiently, adopt better technologies and implement good practices.”

# NOTES

1. Human wellbeing has many aspects, including the basics for a good life, freedom of choice and action, health, good social relations, and security (MA, 2003 in UN-Water, 2013).
2. United Nations Conference on Sustainable Development (Planet under pressure, 2012).
3. As defined by the United Nations in resolution A/62/226 2008
4. Possible changes to the legal regime of water must be performed according to standard procedures and established legal practices which have been previously and duly published.
5. For example, in Mexico, the National Water Commission has a Public Registry of Water Rights in order to provide legal certainty to users of national waters and their inherent public goods. On its website it states that its purpose is to safeguard the registered rights and ensure “that everyone has the right to be shown the registration records and obtain proof thereof. The entries in the Register shall be subject to the provisions established by the National Water Law and its Regulations; shall serve as evidence of the existence of concessions, allocations, permits or registered administrative acts, and as elements for the defense of the rights of title against third parties.”
6. It is this determination of state ownership that creates an exorbitant legal regime for water, i.e., one that is outside the property rights of common law, based essentially on its extra commerciality and its inalienable, unseizable and imprescriptible nature, as well as special protection through the system of inventories and catalogs, the right of recovery, the power to impose sanctions and the priority of public interest over private, among others (<http://www.encyclopedia-juridica.biz14.com/d/bienes-de-dominio-publico/bienes-de-dominio-publico.htm>).
7. See paragraph 35.
8. “For large institutional users, the incentives to sell water rights without the penalty of forfeiture for non-use are small compared with the strategic advantages of controlling a key production input” (Peña and Solanes, 2003).
9. Note that “the existence of water markets does not alleviate the situation, as crucial inputs of this kind are not usually traded on competitive markets” (Mark Armstrong et al, 1994 Peña and Solanes, 2003).
10. For WGF (2012), a Human Rights-Based Approach (HRBA) to the allocation of water resources should include not only the issues of access to water, but the fact that people have the right to actively participate in its development and should not be considered as having only needs, but rather legal rights, i.e., not as objects of charity and passive recipients, but active participants in the development process (although it is clarified that these rights include the responsibility to respect the rights of others) (WGF, 2012). It is explained in the same quote that the HRBA identifies substantive rights (such as the right to life, food and housing) and the procedural rights necessary to achieve these (such as access to information, the right to participate in decision-making processes and access to legal redress mechanisms). In this context, the right to participate in decision-making is addressed in pillar C.
11. On July 28, 2010, through Resolution 64/292, the United Nations General Assembly explicitly recognized the human right to water and sanitation, reaffirming that clean drinking water and sanitation are essential to the realization of all human rights.
12. [www.un.org/spanish/waterforlifedecade/human\\_right\\_to\\_water.shtml](http://www.un.org/spanish/waterforlifedecade/human_right_to_water.shtml)
13. The doctrine of international water law does not adopt a single approach to international waters and expresses various terms, including international watercourses, adopted by the United Nations Convention of 1997; the UNECE Convention of 1992 on Transboundary Watercourses and International Lakes; on the other hand, the United Nations International Law Commission, in the proposed article on groundwater, adopts the terms of transboundary aquifers or transboundary aquifer system; other experts propose the international watershed.
14. While the Aarhus Convention is confined to the environmental sphere, it has served as an example in other spheres because it has broken paradigms in the field of International law (Colom, 2015). Former UN Secretary General Kofi Annan stated that “although regional in scope, the importance of the Aarhus Convention is global. It is by far the most impressive elaboration of principle 10 of the Rio Declaration, which stresses the need for citizens to participate in environmental issues and to have access to information on the environment that is held by the public authorities. And as such, it is to date the most ambitious enterprise undertaken in the area of environmental democracy.”
15. Peña and Solanes (2003) note that in these cases, it is common to support projects or water allocations according to functional interests (whether productive or environmental), running the risk of minimizing relevant aspects such as the sources of supply, the security of investments and the economic quality of projects.
16. GWP (online Toolbox) mentions the following types of private participation: outsourcing, leases, concessions, BOOT (Build, Own, Operate and Transfer) and BOT (Build, Operate and Transfer) and incorporation of operating companies.
17. Some possibilities to introduce competition in this sector can be found in areas such as purchasing and acquisitions or project construction (ECLAC, 2014).
18. Regulatory mechanisms are considered to be those that seek to harmonize economic rationality (maximizing profits) and basic social objectives, since the rationality of the decisions of private actors does not necessarily coincide with the social objectives to be fulfilled by public services (coverage requirements, quality and cost) (Phillips, 1993 Peña and Solanes, 2003).
19. The guidelines for cooperation towards development of water resources of the European Commission (2003) recognize the relevance of local administration of water and sanitation services in dispersed, low-income communities, which will be required to coordinate efforts to ensure the sustainability of the services in the long term, reinforcing their sense of responsibility.



ity and communal property.

**20.** These committees have access to training programs, information systems and assessment with regard to infrastructure, demand management and financial and administrative management.

**21.** The principles of institutions that manage common pool resources (see note 27) are applicable.

**22.** For example, evaluating the performance of providers, establishing penalties and awards, implementing incentives, granting operating licenses and certification, generating information and conducting audits; as well as evaluating aspects such as the number of employees, unbilled water, late payment and collection, proportion of operating expenses covered, investment funds, quality of service indicators and political interference in network expansion.

**23.** Since the problem with public companies is that the state regulates itself, ECLAC (2014) suggests measures such as compliance agreements as a prerequisite for loans or subsidies, for example.

**24.** It is desirable to have a promotional team (which may be external) that can take on tasks such as: promoting and organizing efforts and processes, facilitating exchange between the parties, promoting planning, providing follow-up to actions, facilitating communication, stimulating accountability within and without, promoting sustainability of continuity of watershed management. If this team were external, part of its work would also be to strengthen local institutions so that little by little, they can take charge of these responsibilities in the so-called “exit strategy”.

**25.** Inserting the efforts into a national process, such as the framework of watershed management policies or an institutional or constitutional mandate, helps the institution and its initiatives have greater validity and recognition, while increasing the chances of providing sustainability and follow-up to the initiatives that arise. In this sense, the existence of a legal instrument that serves as the framework for the existence and work of watershed organizations is desirable.

**26.** It is positive that the various sectors and users recognize how their activities impact the quantity and quality of water available for use by others.

**27.** Ostrom also defines what she calls “principles of institutions that manage long-term common pool resources (CPR)”, and these are: 1) clearly defined boundaries (individuals or families with rights to extract resource units should be clearly defined, as should the limits of the resource); 2) consistency between the rules of appropriation and provision and local conditions (rules of appropriation that restrict time, place, technology and amount of resource units are related to the conditions, locations and rules of provision that require labor, material and money, or both); 3) collective choice arrangements (the majority of individuals affected by operational rules can participate in their modification); 4) supervision (the supervisors who actively monitor resource conditions and the behavior of appropriators, are accountable to them or are users); 5) graduated sanctions (appropriators who violate operational rules

receive graduated sanctions from other users, corresponding officials or both, depending on the seriousness and context of the infringement); 6) mechanisms for conflict resolution (users and their authorities have quick access to local mechanisms to resolve conflicts between users, or between users and functionaries, at a low cost); 7) a minimum level of recognition of the right to organize (rights of users to build their own institutions are not challenged by external governmental authorities).

**28.** Section taken mainly from the recommendations made by the World Meteorological Organization with the United Nations Educational, Scientific and Cultural Organization (WMO / UNESCO, 1998)

**29.** “Man’s attitude towards water is not constant: water acquires a very high value when it is scarce or does not meet the conditions of quality required for use. However, when its availability is more accessible, its presence goes virtually unnoticed by most. On the other hand, its destructive force is especially evident when heavy rainfall and flash floods occur” (ECLAC, *ibid*).

**30.** “The absence of women in decision-making on the management of water resources and the distribution of services is unfair and at the same time significantly impairs the possibility of achieving the goals of public health programs, food production and quality of life” (European Commission, 2003). The different positions of men and women are determined by historical, religious, economic and cultural realities (UN, <http://www.un.org/spanish/waterforlifedecade/gender.shtml>).

**31.** If women are not taken into account as farmers or water users in the design of irrigation systems, there is a high risk that they will lose access to the land or the products their own labor (FAO, 2013).

**32.** FAO (2013) mentions some questions that need to be considered with regard to natural disasters such as floods, landslides or drought: Which socioeconomic groups will be most affected? Whose land is more susceptible to drought? Do men and women have equal access to water following a disaster? Are women and girls at particular risk of sexual violence when they go to distribution points? Have gender roles and responsibilities changed following the natural disaster? What are the specific tasks of men and women in local infrastructure rehabilitation? Who participates in decision-making and resource allocation following the natural disaster? How do men and women organize themselves after the catastrophe?

**33.** Consideration is given to the fact that some institutions are fundamentally concerned about the interests of their active members, in their geographical areas, and not necessarily about assuming all responsibilities for water management (Peñas and Solanes, 2003).

**34.** GWP (online Toolbox) proposes some techniques and characteristics to achieve consensus.

**35.** For Laban (2007 in WGE, 2012), this is what the Human Rights-Based Focus in the management of water resources is about. It must be said that although the population has the rights that the law permits, currently some of these rights are internationally recognized, such as the right to participate in

development (United Nations General Assembly Resolution 41/128 of December 4, 1986; the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters of the UNECE) (Aarhus, 1998), see footnote number 30.

**36.** Water Security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN-water, 2013).

**37.** The watershed of a river or aquifer facilitates the assessment of potential water resources, while the jurisdictional or administrative and economic regions facilitate planning for the development of resources, infrastructure, etc. (WMO/UNESCO, 1998). Moench et al (2003) warn that the disconnect between the perspectives of management “experts” and people in the communities becomes a limiting factor for water management, when the former propose watershed or aquifer approaches that do not fit social or physical realities in the field.

**38.** WMO/UNESCO (ibid) suggest participation in at least one project with international cooperation agencies.

**39.** The “Guidelines for cooperation towards development of water resources” of the European Commission (2003) note that “interpersonal skills such as communication, negotiation and leadership, and knowledge of project management and hygiene education, are as important as functional skills related to construction and facilities management.”

**40.** It is preferable to work towards procedural simplicity to ensure the legality of all actors, rather than complicate processes that may encourage corruption and lack of control.

**41.** The ideas in this section are taken from Peña and Solanes (2003).

**42.** The WMO/UNESCO (ibid) indicates that to exercise proper management of water resources requires trained personnel performing the following tasks: data requirements for water resources planning; data collection, processing and analysis; geospatial assessment of water balance components; research and development; outstanding participation in the design, development and execution or implementation of management plans and watershed management; monitoring and enforcement of compliance with regulations; and conflict management and resolution. This staff will be in sufficient quantity at all levels according to existing decentralization policies.

**43.** GWP-INBO (2009) states that information systems must be appropriate to the task and for use by institutions and stakeholders; affordable and preferably free, so that there is no discrimination between those providing the information and its users; accessible to all who practice management through the usual channels, without relying on major upgrades of technical infrastructure; and equitable, respecting cultural needs and gender issues, including the participation of those who are in remote areas or from different socioeconomic conditions.

**44.** The institutions could develop their capacities to generate and analyze the updated information they need on a daily basis. Hence the importance of having trained administrative profes-

sionals.

**45.** \* Added.

**46.** The Millennium Ecosystem Assessment (WRI, 2003) describes the services provided by ecosystems as the benefits people obtain from ecosystems. These benefits include supply services such as food and water; regulation services such as regulation of floods, drought, soil degradation and disease; basic services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other intangible benefits.

**47.** Section taken mainly from the recommendations made by the World Meteorological Organization with the United Nations Educational, Scientific and Cultural Organization (WMO / UNESCO, 1998). Monitoring is understood to be the set of actions described in a protocol and which serve to know the status of water resources.

**48.** Monitoring results are useless if they do not mean an improvement in the management of natural resources (Finegan et al, 2004).

**49.** WMO/UNESCO (ibid) provide reference values on infrastructure for the collection of data on the water cycle.

**50.** In participatory monitoring, the actors in a management system plan and carry out the measurement of indicators and/or make decisions based on the information generated. This type of monitoring provides the opportunity to: a) raise awareness and highlight the importance of environmental management activities, b) encourage evaluation in a participatory manner of the causes of progress and setbacks, and c) make decisions as a group (Morán et al, 2006).

**51.** See footnote number 37 on the appropriateness of using the watershed as the unit of analysis of water resources.

**52.** According to WRI (2003), people perceive the condition of ecosystems in relation to the capacity they have to provide services of interest to them. Various methods can be used to assess the ability of ecosystems to provide certain services, and with this information, stakeholders can choose those services which best meet their needs (ibid). It is common for water to stand out in this prioritization, hence the importance of taking the watershed as the unit of planning and management of environmental goods and services, since the dynamics of the water cycle, water balance or calculations of water budgets adhere to this geographical unit.

**53.** Type of participation where people take the initiative to get actively involved in the management and development of their territory in coordination with the responsible institutions.

**54.** The serious consequences of paternalism in community development are known, see: Corbett and Fikkert, (2012). These authors describe paternalism with regard to resources, administration, knowledge, labor and spiritual aspects.

**55.** Angel Maya (2003) describes the environmental problem as a problem of cultural adaptation, resulting from a historical process: “Environmental problems cannot be understood without equally analyzing the way the network of economic and social relations has become interwoven within the city limits and in close relationship with the rural agricultural environment and the ecosystemic environment. Thus, proper



environmental transformation depends not only on an effective technique, but also on culturally adapted social and symbolic instruments. Culture, therefore, is also an adaptive strategy.”

56. Climate change is an additional driver towards the implementation of strategic investments in the water sector. It is recognized that societies have a long history of adapting to weather and climate impacts through different practices, but Climate Change may represent new risks that go beyond existing experience (WG2\_AR4\_IPCC, 2007). Therefore, it has been concluded that adaptation will be needed (and is, in fact, the only available and convenient response) to address the impact of global warming (ibid).

57. See footnote 8

58. All of this section is based on Peña and Solanes (2003).

59. Destroying traditional habitats, livelihoods and/or economies in favor of projects such as irrigation, mining, supplying cities or energy cannot be justified (ibid).

60. Avoiding asymmetrical allocation of water rights due to lack of knowledge on uses by indigenous groups.

61. GWP (online Toolbox) explains the need for water pricing due to the fact that water is a scarce resource with alternative uses and which provides social and economic benefits, and to make it available for human use in the places, times and quality desired involves a cost. Meanwhile, Malvares (2013) notes that in recent years governments have chosen to eliminate interventionist and distributive policies.

62. Argentina has adopted the Water Footprint methodology for calculating rates for water use (<http://www.ada.gba.gov.ar/normativa/DECRETOS/DECRETO%20429-13.pdf>).

63. The legal principle of Burden of Proof, which indicates who is responsible for proving a particular fact before the courts.

64. The compensation scheme should help encourage the production of water in the watershed, reduce or mitigate impacts by human activities or discourage initiatives that threaten the production of environmental services.

65. The authors explain that this measure will help avoid diminished production efficiency and social equity.

66. Water, as a vital resource, warrants the imposition of this easement in favor of those who lack the vital liquid (<http://derecho.laguia2000.com/parte-general/servidumbre-de-acueducto>). The easement is a limitation to the property, which can only be regulated by law.

67. NGOs can cooperate to mobilize public opinion to persuade decision makers about the importance of increasing the information base on water resources and their contribution to sustainable development and environmental protection (WMO / UNESCO, ibid).

68. Particularly in the case of the defense of ethnic and customary interests, Peña and Solanes (ibid) suggest clearly defining the rights and obligations of both the interested sectors and the government, as well as knowing and being able to exercise the substantive and procedural means to avoid indefiniteness and ambiguity, uncertainty and legal insecurity, which ultimately lead to disrespect of the protected interests.

# LITERATURE CITED:

- Carlos Augusto Angel Maya. 2003. The cultural order: introduction to a method of environmental performance. Ministry of Environment, Institute of Development of Higher Education. Colombia. 82 p.
- Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds. 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change. IPCC Secretariat. Geneva. 224 pp.
- Bogardi J. J. 1994. Introduction of system analysis: terminology, concepts, objective functions and constraints. In Multi-criteria Decision Analysis in Water Resources Management. J. Janos Bogardi and Hans-Peter Nachtnebel (editors). UNESCO-IHP. 469 p.
- CATHALAC / UNU-INWEH. CATHALAC and Institute for Water, Environment and Health at the University of the United Nations. Material Diploma in Integrated Water Resources Management.
- Elisa Colom. 2015. Identification and analysis of the base line policy on water resources and adaptation to climate change in the region of Central America and the Caribbean. Work document. Water Security Project Climate Change in Central America and the Caribbean.
- Colom, Elisa and Maureen Ballester. 2003. Effective Water Governance: joint actions in Central America. GWP / Advisory Committee for Central America. 50 p.
- Steve Corbett and Brian Fikkert. 2012. When Helping Hurts: how to alleviate poverty without hurting the poor-and yourself. Moody Publishers. Chicago, USA.
- SDC. Swiss Agency for Development and Cooperation. 2005. Gender and Water. Integration of gender equality interventions in water, hygiene and sanitation. Swiss Ministry of Foreign Affairs (FDFA). 24p.
- ECLAC. United Nations Economic Commission for Latin America and the Caribbean. 1992. Proposal for the management of water management systems in the countries of the region.
- \_\_\_\_\_. 2014 Network Cooperation in Integrated Water Resources Management for Sustainable Development in Latin America and the Caribbean. Circular Letter No. 40. June 2014
- European Commission. Directorate General for Development. Directorate General of Foreign Affairs and North-South Cooperation. 2003. Progress towards sustainable management of water resources. A strategic approach. ECSC-EEC-EAEC, Brussels, Luxembourg. 354p.
- Dourojeanni Axel, Andrei Jouravlev and Guillermo Chavez. 2002. Water management at basin level: theory and practice. ECLAC. Division of Natural Resources and Infrastructure. Natural Resources and Infrastructure Series No. 47. Santiago de Chile. 83 p.
- FAO Food and Agriculture Organization (2013). Passport to integrate gender into water programs. Key interventions in agriculture questions. Made by Esther de Jong, Juan Antonio Sagardoy and Ilaria Sisto. GEWAMED project - Mainstreaming Gender in Development and Management of Water Resources in the Mediterranean Region. 61p.
- Finegan, B. Hayes, J. Delgado, D. Gretzinger, S. 2004. Ecological monitoring for FSC-certified forest in High Conservation Value management Forest: a guide for forest managers and certifiers in the humid tropics. San Jose, CR. WWF Central America.
- GWP / INBO. 2009. Global Water Partnership (Global Water Partnership) and International Network of Basin Organizations (International Network of Basin Organizations, INBO). Manual for integrated water resources management in river basins.
- INBO / GWP / UNECE / UNESCO / GEF / AFC. International Network of Basin Organizations / Global Water Partnership / United Nations Economic Commission for Europe / United Nations Organization for Education, Scientific and Cultural Organization / World Wildlife Fund / AFD. 2012. INBO and GWP. 120 p.
- IPCC. Intergovernmental Panel on Climate Change. 2001 Summary for Policy-makers in Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., Van Der Linden, P.J. and Xiaoosu, D. eds. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, and Cambridge.
- \_\_\_\_\_. 2007. Report of Working Group II (Impacts, Adaptation and Vulnerability) to the Fourth Assessment Report: Climate Change 2007.
- Andrei Jouravlev. 2001. Water management in Latin America and the Caribbean in the twenty-first century. ECLAC. Division of Natural Resources and Infrastructure. Series 27. Natural resources and infrastructure series. Chile. 77p.
- Mirta Malvares Miguez. 2013. Water management in the context of globalization as an approach to analysis from the perspective of risk society on Climate Change, Social Movements and Public Policy. A necessary link. CLACSO (Latin American Council of Social Sciences). Santiago de Chile. 302 p.
- Marcus Moench, Ajaya Dixit, S. Janakarajan, M. S. Rathore and Srinivas Mudrakartha. 2003. The fluid mosaic. Water Governance in the context of variability, uncertainty and change. A synthesis paper. Institute

- of Development Studies (IDS), Institute for Social and Environmental Transition (ISET), Madras Institute of Development Studies (MIDS), Nepal Water Conservation Foundation (NWCF), Vikram Sarabhai Centre for Development Interaction (VIKSAT). Nepal. 66p.
- Morán J. M. Fields Casanoves Louman B. F. Lopez G. 2006. "Using principles, criteria and indicators to monitor, assess and report on the effect of policies and actions in the management of natural resources". CATIE. Turrialba, Costa Rica. (Technical Series. Technical Report 347. Diversified Collection Natural Forest Management. Publication no. 32)
- WMO / UNESCO. World Meteorological Organization, the United Nations Organization for Education, Scientific and Cultural Organization. 1998. Evaluation of Water Resources. Manual for estimating national capacities.
- Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for collective action*. Cambridge, NY (USA). Cambridge University Press. 1990. 280 p.
- Humberto Peña and Miguel Solanes. 2003. Effective governable water in the Americas, a critical issue. Paper prepared for the Third World Water Forum in Kyoto, Japan, 2003. Global Water Partnership South America and ECLAC. GWP SAMTAC project.
- Planet Under Pressure. 2012. Water Security for a Planet Under Pressure: Transition to sustainability: Interconnected challenges and solutions. Rio + 20 Policy Brief No.1. London, Planet Under Pressure.
- UNDP. United Nations Program for Development. 2009. Guidance on methodology for assessing investment flows and financing to address climate change. Version 1.0.
- Claudia Rodriguez Solorzano. 2002. Design of sustainability indicators for watersheds. National Institute of Ecology. Mexico.
- Rio + 20. 2012. United Nations Conference on Sustainable Development. Planet under pressure. Policy Brief No. 1. Water Security for a planet under pressure.
- Miguel Solanes and David Getches. 1998. Report recommended for the preparation of laws and regulations related to water resources practices.
- UNESCO / MMO. United Nations Organization for Education, Scientific and Cultural Organization, World Meteorological Organization. 1992. International Glossary of Hydrology. Second Edition.
- UN-Water. United Nations University. Institute for Water, Environment and Health. 2013. Water Security and the Global Water Agenda. United Nations University. Ontario, Canada. 37 p.
- Uribe Evamaría. 2013. Outlook regulation: options for regulation of universal service. In equity and social inclusion in Latin America: universal access to water and sanitation. Series reflections on social and environmental policies No.2. Andean Development Corporation CAF. 186 p.
- Valencia Juan C. Vargas, Juan J. Diaz Nigenda and Lourdes Vargas Martinez. 2007. The integrated water resources management in Mexico: a new paradigm in water management. In: *The integrated watershed management in Mexico*. Helena Cotler (Compiler). Second edition Secretariat of Environment and Natural Resources. National Institute of Ecology. Mexico DF. 347 p.
- J.M. Paul Van Hofwegen and Frank G.W. Jaspers. 2000. Analytical framework for integrated water resources management. Guidelines for the evaluation of institutional frameworks. Development Agency of the Netherlands (NEDA) and the Inter-American Development Bank (IDB). Washington. 80 p.
- WGF. Water Governance Facility. 2012. Human rights-based Approaches and managing water resources: Exploring the potential for enhancing development outcomes. WGF Report No. 1, SIWI, Stockholm.
- WWAP. United Nations World Water Assessment Programme. 2015. The United Nations World Water Development Report 2015: Water for a Sustainable World. Paris, UNESCO.
- WRI. World Resources Institute. 2003. Ecosystems and Human Well-being: A Framework for Assessment. Summary. Report of the Working Group on the Framework of the Millennium Ecosystem Assessment.

## Pages consulted online:

- Water Authority of Buenos Aires. <http://www.ada.gba.gov.ar/normativa/DECRETOS/DECRETO%20429-13.pdf>. Consulted in March 2015.
- Legal Encyclopedia. <http://www.encyclopedia-juridica.biz14.com/d/bienes-de-dominio-publico/bienes-de-dominio-publico.htm>. Consulted in March 2015.
- GWP. Global Water Partnership (Global Water Partnership). Toolbox online: <http://www.gwp.org/es/TOOLBOX/>. Consulted in March 2015.
- The Guide. <http://derecho.laguia2000.com/parte-general/servidumbre-de-acueducto>. Consulted in March 2015.
- A. United Nations. <http://www.un.org/spanish/waterforlifedecade/gender.shtml>). Consulted in March 2015.
- UNICEF. United Nations Fund for Children. <http://www.unicef.org/spanish/mdg/childmortality.html>. Consulted in March 2015.



# Annex

Annex 1. Map of Water Management Functions

| FUNCTIONS                            |                                              | PRINCIPAL USES |  |  |  |  |  |  |  |
|--------------------------------------|----------------------------------------------|----------------|--|--|--|--|--|--|--|
| Governance                           | Policies, regulations                        |                |  |  |  |  |  |  |  |
|                                      | Planning                                     |                |  |  |  |  |  |  |  |
|                                      | Adaptation to CC and risk management         |                |  |  |  |  |  |  |  |
|                                      | Conflict resolution                          |                |  |  |  |  |  |  |  |
|                                      | Monitoring, control and sanctions            |                |  |  |  |  |  |  |  |
| Social Impact                        | Communications and education                 |                |  |  |  |  |  |  |  |
|                                      | Spaces for participation and cooperation     |                |  |  |  |  |  |  |  |
| Services                             | Service provider                             |                |  |  |  |  |  |  |  |
|                                      | Service regulator                            |                |  |  |  |  |  |  |  |
| Support to decision-making processes | Water monitoring and information systems     |                |  |  |  |  |  |  |  |
|                                      | Research                                     |                |  |  |  |  |  |  |  |
|                                      | Technical assessment, formation and training |                |  |  |  |  |  |  |  |
| Intervention                         | Conservation and protection of water sources |                |  |  |  |  |  |  |  |
|                                      | Infrastructure                               |                |  |  |  |  |  |  |  |

# Description of map:

The first column summarizes the main functions of water management

|         |                                             |
|---------|---------------------------------------------|
|         | <b>FUNCTIONS</b>                            |
| Finance | <b>Policies, regulations</b>                |
|         | <b>Planning</b>                             |
|         | <b>Adaptation to CC and risk management</b> |

And in the first line, the main uses.

| <b>PRINCIPAL USES</b> |  |  |  |
|-----------------------|--|--|--|
|                       |  |  |  |
|                       |  |  |  |

The fields in gray must be filled in, i.e., there must be someone doing that job.

|                |  |  |  |
|----------------|--|--|--|
| ent            |  |  |  |
| solution       |  |  |  |
| g, control and |  |  |  |

Everything can be adapted to the particular conditions, according to the functions and relevant uses. What it is relevant for one reality is not for another.

It is suggested to fill in 4 frames in the following manner:

1. Name the institutions or groups that provide these functions,
2. The main laws or regulations governing these functions,
3. The main programs or projects that put the functions into practice, and
4. The allocated budgets; in this last section a final row and column can be included of the summaries for the sector and for a particular management function.

In the end it may be observed that some functions are performed by various institutions, while others are not done by anyone. Likewise, regulations and programs may overlap, while some gray boxes remain empty. It may also be seen that some sectors receive larger budgets and attention than others, and in some areas more than others.

