

PROPOSAL FOR AN ENVIRONMENTAL FLOWS NATIONAL STANDARD

J. Eugenio Barrios-Ordóñez, Rafael Sánchez-Navarro, Sergio A. Salinas-Rodríguez, J. Alfredo Rodríguez-Pineda, Ignacio D. González-Mora, Raquel Gómez-Almaraz, and Hilda E. Escobedo-Quñones

ABSTRACT

A Mexican National Standard, under a workgroup study defined by National Water Commission, is being proposed based on analyzing and integrating a variety of national and international experiences, related to the establishment of Environmental Flows (EF). The basin is partitioned to be studied in suitable hydrological subsystems, and then the study's results are integrated into the essential management unit, the whole basin. Different basin's management objectives (considering ecological importance vs. water-use pressure criteria) will be used to determine the basin's main vocation. This National Standard proposes the following levels of analysis: Level zero is primarily under the Tennant approach, enriched by a hydrological variability analysis of the Mexican rivers. Level one is a hydrological approach based on The paradigm of a natural river (Poff et.al. 1997) and The biological condition gradient (USEPA, 2005; Davies & Jackson, 2006); provides EF to regulate the operation of water infrastructure in altered basins. Level two respond to an intermediate detailed need of EF determination (i.e. conflicts among water users; presence of Natural Protected Areas). Level three needs a highly detailed EF determination in order to have a very clear impact assessment for water infrastructure projects. The level zero and one are related to specific reference values. The levels two and three require an holistic method approach such as The building block methodology (King, J. & Louw, D. 1998). The National Standard's procedures resolve the basin issues progressively, in order to get a sustainable water balance, which recognizes the ecosystems as the only water provider.

INTRODUCTION

On a global level, the methodologies to determine environmental flows (EF) vary with respect to their nature and approach. EF describes the quantity, quality and timing of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems (The Brisbane Declaration, 2007). These days there are over 200 methodologies in 44 countries, including hydrological, hydro-biological, hydraulic, and holistic ones (Tharme, 2003). All of them consider: a) the availability of water in the watershed; b) the resilience capacity of the rivers; c) the natural hydrologic regime (NHR); and d) maintenance of the habitat for the purpose of ensuring the conservation of the riparian species and ecosystems (Barrios-Ordóñez *et. al.*, 2010). Nevertheless, there are few countries that currently have an official regulatory instrument for the determination of EF (i. e. South Africa and Spain).

In Mexico, various efforts have contributed to the technical diffusion and the application of methods for the determination of EF (i.e. Alonso-EguíaLis *et. al.*, 2007; Santacruz de León & Aguilar-Robledo, 2009; and Barrios-Ordóñez *et. al.*, 2010). This has allowed the development of different case studies in the country and, when coupled with international experiences, has fostered its awareness and implementation.

In 2004, the Alliance of the World Wildlife Fund for Nature (Fondo Mundial para la Naturaleza) and the Gonzalo Río Arronte Foundation (Fundación Gonzalo Río Arronte I.A.P. [WWF – FGRA

Alliance]) began the development of a new model of water management with an ecosystem approach by means of the determination and management of the watershed through environmental flow (Barrios-Ordóñez *et. al.*, 2010). The EF proposals were among the first to be developed in the country and include 33 detailed work sites in three different watersheds (*Op. Cit.*). The results revealed that of the total sites analyzed, the EF is sufficient in 73% of them under the current conditions, requiring only the guarantee of its annual permanence and seasonal occurrence through its official integration into the water balance of the watershed. In 21% of them there is an average level of runoff, although it is uncertain that this occurs on a regular basis. In this case adaptations to the conditions of extraction and operation of the hydraulic infrastructure are required. Lastly, in 6% of them annual reallocation of 88 hm³ of water is required among the users for the protection of the environment (*Op. Cit.*).

At the federal level, these results motivated interest to develop an official regulatory instrument for the determination of EF. The process of issuing a *Norm* for this purpose began in 2007, but at this time there has not been a solid effort of systematization of experiences to deal with the challenge. In order to develop this instrument, discussions were held with international experts as Spanish consultants, and from the following institutions: The Nature Conservancy, WWF, and Mexican governmental agencies such as National Institute of Ecology (Instituto Nacional de Ecología [INE]), Mexican Institute of Water Technology (Instituto Mexicano de Tecnología del Agua [IMTA]), National Commission for Biodiversity's Knowledge and Use (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad [CONABIO]), Institute of Biology and the Institute of Engineering from the National University of Mexico (Instituto de Biología e Instituto de Ingeniería de la Universidad Nacional Autónoma de México [UNAM]), and the Federal Power Commission (Comisión Federal de Electricidad [CFE]). As a result of these discussions an agreement on the conceptual framework was achieved. Contributions from each governmental agency and expert were included, such as the freshwater gap analysis developed by CONABIO; the potential of ecohydrological alteration of Mexican river watersheds developed by INE; and the experience on environmental impact assessment approach to EF from IMTA and CFE.

It was not until “Wild 9”, the IX World Wilderness Congress (Wild Foundation and Unidos para la Conservación A.C., 2010), that the National Water Commission (Comisión Nacional del Agua - CONAGUA) through its General Director, José Luis Luege Tamargo, made the official announcement of the development of the *Procedure for the Determination of Ecological Flow in Hydrologic Watersheds*, which will allow the establishment of a minimum point of equilibrium between the demand of water to satisfy human needs and the subsistence of the ecosystems.

Finally, in 2010 CONAGUA created a working group to adopt this procedure with the participation of government and non-government institutions, as well as academics (among others), with the Technical Secretariat being assigned to the WWF – FGRA Alliance due to its experience on the subject since 2004. This article presents the general procedure proposed to determine EF. Within this, different scales of analysis are considered to allow water planning and management of the Mexican watersheds. The conceptual model use management objectives that are agreed to suit each location. To finalize the procedure, different levels of analysis are used to achieve a degree of specific detail required to each problem, after which the result is integrated in the hydrological balance of the watershed.

METHODOLOGY PROPOSAL

A progressive procedure is proposed to determine EF (Figure 1), which is standardized and considers different hydrological, conservation and management contexts. This proposal has the objective of

achieving a sustainable equilibrium between the use and protection of national aquatic ecosystems.

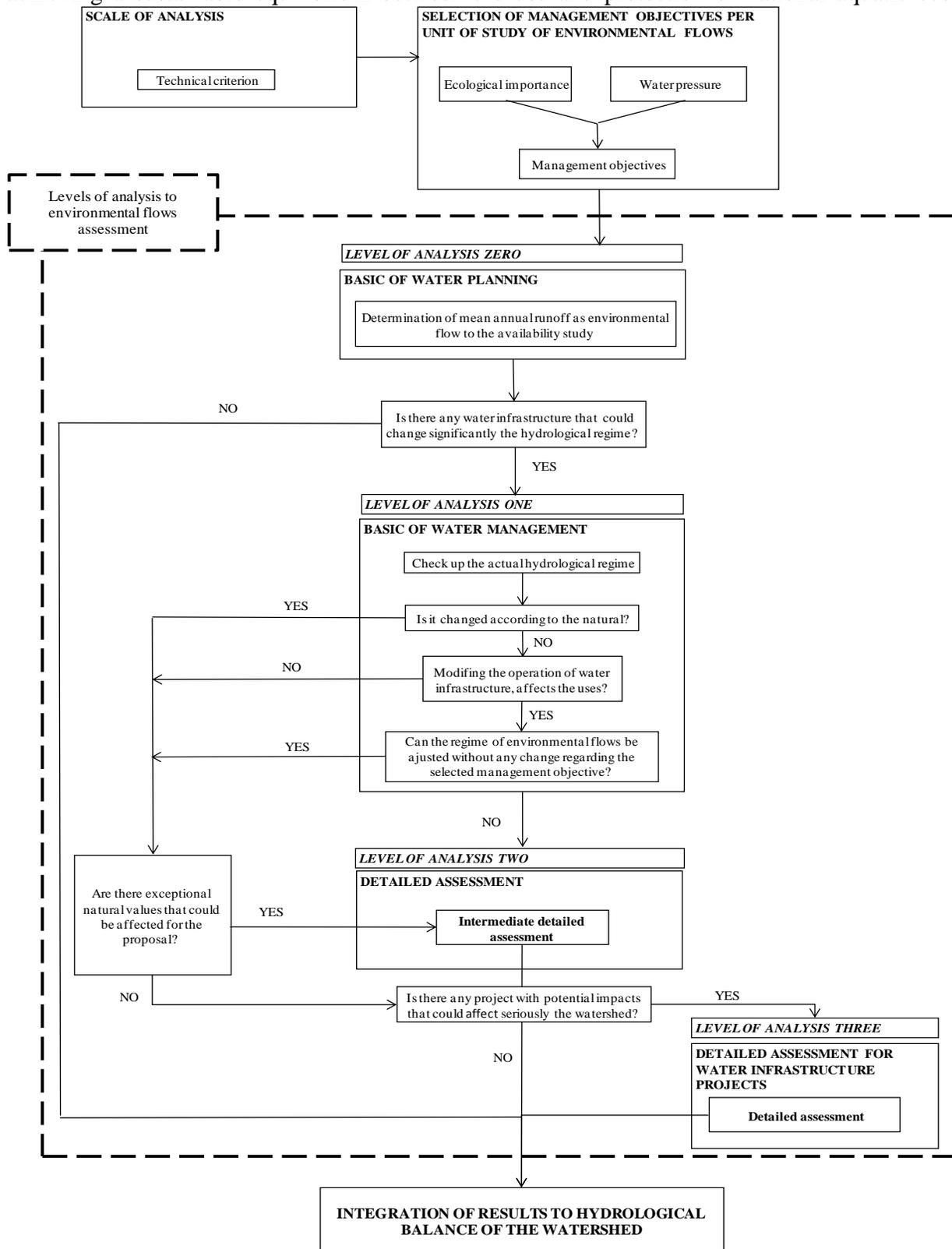


Figure 1. Conceptual procedure for the determination of Environmental Flow (EF)

The procedure starts from the definition of the spatial scale of analysis. The hydrologic watershed is the basic management unit where the results of the study should be integrated to obtain its water balance, and for that reason, it is a study unit for environmental flow. Nevertheless, in those cases where there are segments or sub-watersheds with distinct biological, hydrological or management characteristics within the management unit, it is advisable to group them according to their similarities, making these homogeneous portions of the watershed an environmental flow study unit. In this way, each study unit can be analyzed according to a single management objective.

The management objectives represent the aimed ecological state or level of preservation within the analysis unit. They establish the relationship between the value of conservation of a watershed and its implication for the productive uses of water. That gives flexibility to manage and adjust the quantity of necessary water among the users, in order to obtain a determined ecological state. The establishment of management objectives during the process of the determination of EF, considering the ecological importance and water use pressure in the watershed (Figure 2), allows for reflective, objective, transparent and impartial analysis of the environmental and water user needs. Therefore, the process reconciles their demands or requirements and address the collective discussion on “*what river do we have and how do we want to preserve it?*”

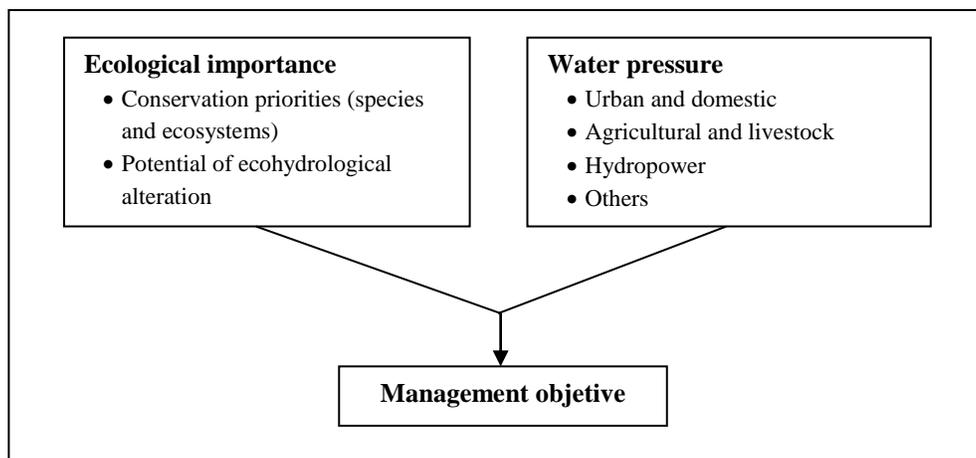


Figure 2. Conceptual diagram for obtaining a management objective

The procedure distinguishes four levels of analysis or evaluation for the determination of environmental flow:

Level zero. Based on a modified Tennant method (1976) enriched by an analysis of hydrologic variability carried out in Mexican rivers. This level of analysis provides reserve volumes of water (mean annual runoff) for environmental purposes, for cases of strategic assessment or water planning in the watershed.

Level one. Consists of the determination of an environmental flow regime sufficient to regulate the operation of hydraulic or hydroelectric infrastructure in watersheds whose hydrologic regime is altered (water management). The proposed method consists of a hydrologic approximation based on *The Natural Flow Regime* (Poff *et. al.*, 1997) and *The Biological Condition Gradient* (USEPA, 2005; Davies & Jackson, 2006), key concepts to understanding the dynamic and functioning of aquatic ecosystems.

Level two. Responds to an evaluation with a medium level of detail in the determination of the environmental flow, in which case there are conflicts among the water users, natural protected areas, Ramsar sites or some other ecosystems and/or species that could be affected by the proposal carried out under the methodological approach proposed in level one. This level of analysis requires holistic methodologies, for which the use of the *Building Block Methodology* (King & Louw, 1998) is recommended.

Level three. Provides a highly detailed determination of environmental flow, required for the evaluation of hydraulic and hydroelectric infrastructure projects that could represent considerable and irreversible impacts to the hydrologic regime of the river and to the watershed in general. Similar to level two, this level of analysis requires the use of a holistic type of methodology, in which it should additionally contain detailed hydrologic modeling and employ methods of habitat simulation, as well as modeling of support scenarios for decision making.

The results of the EF studies by reference site should be incorporated into the corresponding environmental flow study unit, which in turn should be integrated into the watershed or analysis unit of the availability study.

In practice and in general, the real cost of EF occurs as natural runoff. Can be calculated by transfers of volumes committed downstream, naturally or by infrastructure (intake headings, dams, diversions), and by the reserve of an additional volume if necessary.

IMPLICATIONS OF THE PROPOSAL

With the aim of this methodological procedure, EF from the whole watershed is determined progressively from simple to complex. The volume is integrated into water balance of each watershed in accordance with Articles 14 and 15 of the Mexican National Water Law. It provides sustainable support to integrated water resources management (seasonal limits and requirements for extraction of water) that involves local and regional water use objectives, and in which nature and the ecosystems are recognized as the only water provider.

The proposal being set forth within the regulatory framework of a Mexican Norm allows for an expedited publication process and greater versatility for its review. In the future, and as the experiences in the knowledge and application of the procedure increase, the development of an Official Mexican Norm is expected.

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