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**TOWARDS SUSTAINABILITY: ALLOWANCE RIGHTS FOR USING WATER RESOURCES IN
AMAZONAS STATE OF BRAZIL***

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Abstract. The water use permit is one of the instruments of the National and State Policy of Water Resources in Brazil through which the government authorizes the user to withdraw water or to make hydraulic interferences in water bodies necessary for their activities, guaranteeing the right of access to these resources. In the state of Amazonas, the Water Resources Policy (PERH) was reformulated by Law 3,167 of 2007, which latter was regulated by decree 28,678 of 2009, and use permit started to being issued in 2017. The objective of this paper is to contextualize the current situation of this instrument, based on bibliographical review and on the observed practical consequences. The State Water Resources Policy (PERH) exists since 2001, but the implementation of the water use permits issuance in the state has not progressed significantly over the last 15 years. Important advances occurred only in 2016 and 2017, with the establishment of technical parameters for water use. Permits slowly started to be issued in 2017, but still disconnected from the other instruments of the Brazilian Water Resources Policy.

Keywords: sustainability; allowance right; Amazonas; water resources; environmental legislation

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JEL Classifications: Q25; Q28

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1. Introduction

The Brazilian Federal Decree 24,643 published in 1934 was the first law to directly pay aim at water resources in Brazil. The so called “Water Code” had as main objective the public control of the rivers for the use of the hydroelectric potential (Couceiro & Hamada, 2011). The 1988 Constitution brought significant elements to the current management of water resources in the country. It established that the Brazilian Federal Government owns all lakes, rivers and any watercourses that occupy its domain, in addition to those crossing more than one state, serving as boundaries with other countries, and extending to or from foreign territories. Each State, and the Federal District Brasília, owns all surface water or groundwater that flows, emerges or is deposited within its territory only, except for water bodies in which the Federal Government has any related construction activity (Ana, 2011).

Law 9,433 (Brazil, 1977) created legal and institutional instruments for the management of water resources, thus creating the National Water Resources Policy (PNRH), complementing the Water Code. It considers water as a public natural resource that possesses economic value. The PNRH aims at ensuring good quality water availability for current and future generations. It also aims at assuring its rational and integrated use, including waterway transport, giving support for a sustainable development, prevent and defend against critical hydrological events, natural or human driven (Couceiro & Hamada, 2011).

The water use water use permit right is one of the instruments of the “National and State Water Resources Policy” through which the public administration, under pre-established conditions, authorizes the user to draw water or make changes in water bodies (Vatn, 2010). This guarantees the right of access to these resources to all citizens and companies, since water in Brazil is publicly owned. This instrument aims to ensure public access to water in adequate quantity and with the necessary quality (Brasil, 1997), as well as to guarantee the ecological services of water (Amazonas, 2007).

In the state of Amazonas, the water resources policy law was created in 2001 by state law 2,712, amended by law 2,940 of 2004 and reformulated by law 3,167 of 2007. The latter was regulated by decree 28,678 of 2009 and the

permit right uses implemented in 2017. Criteria were established through resolutions of the Conselho Estadual de Recursos Hídricos (State Water Resources Council - CERH) in 2016. Procedures were defined by normative norms of Amazonas Institute for Environmental Protection (IPAAM) and Secretary of Environment of the Amazonas state (SEMA). However, which are constantly undergoing changes.

The objective of this article is to contextualize the current situation of this instrument of the National Water Resources Policy in the state of Amazonas, based on regulated regulations and the implementation of the instrument. Section two shows a theoretical framework of the National and State Water Resources Policy dealing with surface water, ground water, effluent release, hydroelectric potential and water quality/quantity. Section three shows the methodological procedure to gather all information. Finally, the fourth section presents and discusses all information available in the bureaucratic government law water regulation.

2. A theoretical framework

For the implementation of the water use permit, it is necessary to integrate this with the other PNRH instruments. Consideration should be given to the priorities established in the water resources plans, as well as rationalization targets and propositions of areas subject to restrictions of use. According to Nascimento (2012), another instrument is the classification of water bodies into classes, where the main purposes of this instrument are: to ensure compatible quality according to their destination and prevailing use, as well as to reduce the costs of fighting pollution. It is an essential instrument when the purpose of the water use permit is to dilute effluents. The Water Resources Information System shall store information relevant to the analysis of the water use permits applications and shall contain information on the authorized demands in the river basins of the country. For an efficient collection, it is very important that there is a proper and comprehensive database and water use permit database system (Pagiola 2007; Ana, 2011).

Among the uses that are subject to water use permits, according to the National Policy of Water Resources, are:

- I - Derivation or capture of a portion of the water existing in a body of water for final consumption, including public supply, or production process input;
- II – Groundwater extraction for final consumption or production process input;
- III - Launching of sewage and other liquid or gaseous waste, treated or not, with the purpose of their dilution, transportation or final disposal;
- IV - Use of hydroelectric potential;
- V - Other uses that alter the regime, quantity or quality of water in a body of water.

The studies required to support the application for a water use permit should be under the technical responsibility of a professional qualified by the Regional Council of Engineering and Agronomy (CREA). Regardless of the type of interference, the minimum information present in a water use permit is the identification of the applicant; exact site location, including the name of the water body and the main river basin to which it belongs; and specification of the purpose of water use (Nascimento, 2012).

Surface water

The amount of water that can be extracted from a surface water body has to be determined based on the minimum reference flow, for a river or stream, or on the volume of water stored, in a lake or a reservoir. The first one uses long-term flow data and establishes reference flow values using methods such as Q_{90} , Q_{95} and $Q_{7,10}$. The Q_{90} is the flow determined by measurements performed in a given period of time in which, during 90% of it, the flow is greater than that value, that period the flows are equal to or greater than it. The Q_{95} is the flow of 95% permanence. The $Q_{7,10}$ is the lowest consecutive average flow of seven days that would occur with a return period of 10 years.

In the case of water extraction from reservoirs, the main objective is to divide the regularized flow to the users of its surrounding (Ana, 2011). Generally, this flow is obtained through traditional flow regionalization methods, flow proportionality and mass conservation (Moreira, 2014). The user has to provide the extraction information necessary for the request evaluation: maximum instantaneous flow and daily volume to be derived; pumping regime variation, in terms of hours per day and days per month (Nascimento, 2012). This can be summarized as interference conditions.

Groundwater

Requesting a permit for groundwater use begins with asking for an authorization to drill a well, indicating the drilling location, the discharge estimate and the type of aquifer to be tapped. The state environmental agency then, verifies the existence of other wells that can be affected by the new drilling, and possible negative effects on surface water bodies. Extraction rates are determined by pumping tests and aquifer recharge evaluation. The outflow should be sustainable in order to avoid overexploitation (Ana, 2011).

Just as for surface water, the interference conditions have to be informed, including at least: maximum instantaneous and daily discharge; pumping regime variation, in terms of hours per day and days per month (Nascimento, 2012).

Effluent release for dilution purpose

The use of water bodies to dilute liquid effluents has to be done considering the original water quality class of this body. The changes caused by the effluents should not be so large as to change the class. Federal regulations determine that temperature and biochemical oxygen demand (BOD) have to be used as quality references. In places subject to eutrophication (such as natural and artificial lakes), phosphorus and nitrogen are included (Ana, 2011). However, in the other cases in the country, there is no uniformity of criteria for the analysis of grant applications (Zandonadi, Mendonça, & Reis, 2015; Akhmetshin et al., 2017). Applications to using water bodies for effluent dilution purposes have to indicate instantaneous maximum flow and daily effluent volume to be released; flow rate variations; physical, chemical and biological pollutant concentrations and loads (Nascimento, 2012).

Use of hydroelectric potential

The use of hydro-electrical potential has to be requested by the National Electric Energy Agency (ANEEL) to the National Water Agency (ANA) or the state water agency, who then issues a document called *Declaração de Reserva de Disponibilidade Hídrica* (Water Availability Reserve Declaration - DRDH). If the required use is authorized, this request is turned into a water use permit, valid for a period of time defined in the initial request. The whole process has to be backed by studies on the impacts caused by the construction itself, by the dam on the hydrology and on the multiple uses of the water (Ana, 2011).

Other uses that impact water quality and quantity

Other ways of using these resources are subject to water use permits: a) urban drainage; b) channeling and/or rectification of watercourse; c) diversion of watercourse; d) small dams that are disconnected from catchments, with purposes such as leisure, landscaping and others; e) reservoirs for river flow regulation; f) water course watercourse for cleaning or mining; g) watercourse crossing by bridges, culverts and wet passages; h) other uses. However, most of these changes are small in size, and have little impact on the water body. In these cases, water use permits are not required (Ana, 2011).

Due to the peculiarities of some states of the Brazilian northern region (Iorio et al, 2018), such as Amazonas, Amapá and Pará, other uses of the water subject to the concession were added. One can mention the use of

waterways for transportation. Amazonas State law also adds non-consumptive uses involving exploitation of water resources by individuals, for commercial purposes, including recreation and bathing (Ana, 2011). Non-consumptive uses are those that do not cause flow rate changes, but which may impose restrictions on other uses, consumptive or not (Ana, 2011).

After 14 years of PNRH's existence, only three states in northern Brazil are developing management plans for their hydrographic basins, covering only a small proportion of their territories (Couceiro & Hamada, 2011). The Northern States of the Country that developed their *Política Estadual de Recursos Hídricos* (State Policy on Water Resources - PERH) are: Amazonas - Law 2,712 (Amazonas 2001), modified by Law 2,940 (Amazonas 2004), Amapá - Law 686 (Amapá 2002), Acre - Law 255 (Acre 2002), Rondônia - Law 1,500 (Rondônia 2003). However, in general, it is considered that almost nothing was done in these States aiming at the effective management of Water Resources (Couceiro & Hamada, 2011).

3. Methodological procedures

This study was carried out based on bibliographic research in the federal and state legislation related to water resources, resolutions of the State Council of Water Resources, ordinances of the Institute of Environmental Protection of Amazonas (IPAAM) and State Secretariat of Environment (SEMA, former SDS), publications of the National Water Agency (ANA), articles published in periodicals such as *Oecologia Australis*, *Revista Brasileira de Recursos Hídricos* (RBRH), *Revista Ambiente & Água* (A & A) and other related topics.

4. Results and Discussion

In the state of Amazonas, the first law that regulated the “State Policy for Water Resources” and established the state system for the management of water resources was the state law 2,712, dated December 28, 2001, which was amended by state law 2,940, dated December 30, 2004. During the validity of these laws, the issuance of water use permits was never implemented. In 2007, state policy and the water resources management system were reformulated by state law 3,167 of August 27, 2007, was regulated by state decree 28,678 of June 16 of 2009. However, the water use permits were only implemented in 2017, 16 years after law 2,712 was issued.

Among the various types of uses of water resources that may be allowed, some were defined by the national policy: a) derivation or capture of a portion of the water; b) discharge into water bodies; c) use of hydroelectric potential and d) other uses that alter the regime, quantity or quality of water in a body of water (Brasil, 1997). The state policy of Amazonas adds the use of waterways for transportation and also uses of water resources for commercial purposes of recreational and bathing nature (Amazonas, 2007). In the state decree 28.678 of 2009, many purposes are specified for the use of water subject to the concession as industrial supply, urban supply, irrigation, rural supply, other waterworks such as irrigation reservoirs, water mains, riverbed protection repairs, desilting services, landscaping, aquaculture, construction of sanitation works, crossings of water bodies with bridges and pipelines and other activities that are subject to evaluation by the competent instance. Many of these specifications are framed at the federal scope, such as water uses that alter the hydrologic regime, water quality or quantity.

Small water uses can have the necessity of requesting a permit waived. The uses for which it is unnecessary to request water use permits, are: a) accumulations, derivations, abstractions and launches considered insignificant, and b) use of water resources to satisfy the needs of small populations distributed in rural areas (Brasil, 1997). There are also the uses for the satisfaction of the needs of individual character and still small urban population nuclei (Amazonas, 2007). The state decree also gives permit exemption when the use of water is destined to human consumption, domestic or livestock water use. Low water extraction rates can also be exempt of permit

requests. In the case of the state of Amazonas, CERH Resolution No. 02 of 2016 establishes the criteria for insignificant uses. Nevertheless, they will have to be registered, as defined in regulation (Sds / Ipaam, 2005) and inspected in the public interest and for the conciliation of conflicts, whenever insignificant derivations may interfere with each other (Amazonas, 2007).

All water use permits are subordinated to the Planos de Recursos Hídricos (Water Resources Plans - PRH), water frameworks, maintenance of adequate conditions for water transportation and should preserve multiple uses (Brasil, 1997; Amazonas, 2007 and 2009). However, the state of Amazonas does not have other instruments to discipline the permits, since its PRH hasn't yet been created. In 2016, by resolution 01 of CERH (June 19, 2016), technical criteria were established to be used by IPAAM in the analysis water use permit requests in the state of Amazonas. In accordance with the state decree 28,678 of 2009, IPAAM, obeying the technical criteria established in the ordinance of this Institute, will grant the permits on a precarious basis, for a maximum term of five years, renewable or not, until the approval of the Amazonas State PRH, which is currently being contracted (Ana, 2016). After PRH's approval, the permit may be given for up to 25 years, according to a decree that regulates the State Policy on Water Resources (Amazonas, 2009). In other words, the right to use water resources is not definitive, and can be suspended or terminated in cases of non-compliance with previously established conditions, absence of use or to guarantee more important uses.

The state law requests that permit holders make hydrometric, limnological and hydrogeological monitoring of the exploited waters. Penalties apply in case of noncompliance with any of the conditions (Amazonas, 2007). Monitoring data has to be sent to the *Instituto de Proteção Ambiental do Amazonas* (Institute of Environmental Protection of Amazonas - IPAAM), in the form recommended in the water use permit, based on normative instruction of the State Secretariat of Environment (Amazonas, 2009).

In the State of Amazonas, water use permits for both surface and groundwater are issued by IPAAM, which uses the following laws and therein defined criteria:

Groundwater

Both law 3,167 of 2007 and decree 28,678 of 2009 deal specifically with groundwater, but the first one is more detailed:

The Executive Branch may establish protection areas, restrict the flow of wells, establish minimum distances between them, and take other measures required case by case. Abandoned or functioning wells which are causing pollution or represent a risk to the aquifer, as well as drillings performed for purposes other than water collection, shall be adequately sealed in order to avoid accidents, contamination or pollution of the aquifer. The execution and operation of wells for groundwater extraction will depend on prior environmental licensing, in the manner provided in the Regulation, without prejudice to the allowance right for using water, in accordance with this law. The set up of industrial districts and irrigation projects, colonization or others that depend on the use of groundwater or that may impact on them should be preceded by hydro geological studies to evaluate the potential of their water reserves. Therefore, it will establish a correct sizing of the flows to be extracted, subject to the prior approval of them to the norms of this law and to the others that may be established by the State Council of Water Resources. Hydrogeological studies, projects, and well construction, as well as their operation and maintenance, shall be carried out by professionals, companies or institutions certified by the Regional Council of Engineering, Architecture, and Agronomy of the State of Amazonas (Amazonas, 2007).

In 2005, by means of ordinance SDS/IPAAM n^o, 01 the Standard Regulation for drilling deep wells and other underground captures of water resources was approved. After the conclusion of a technical cooperation agreement between IPAAM and the *Serviço Geológico do Brasil* (Brazilian Geological Survey – CPRM), these data were used to supply the *Sistema de Informação de Águas Subterrâneas* (Groundwater Information System – SIAGAS).

According to SIAGAS, there are 8,525 wells in the state of Amazonas (Cprm, 2017). However, other estimates indicate the existence of more than 10,000 wells only in the urban area of Manaus (Aguiar, 2002), meaning there are many unregistered wells.

In the regularization process, the authorization for drilling is given by a single environmental permit according to the State Law No. 3,785, dated July 24, 2012. The construction of the well must follow technical standards established by the *Associação Brasileira de Normas Técnicas* (Brazilian Technical Rules Agency - ABNT), plus extracted volume measurement equipment (hydrometer), water sampling device, auxiliary level measuring tube, and protective tube. It should be noted, however, that the topographic elevation of well heads should always be above the historical maximum flood level of its location (Cerh, 2016a).

The CERH resolution establishes the maximum water level drawdown during pumping at 45 meters below static water level. For commercial activities and services, the 40-meter retraction is limited and for domestic use up to 10 meters. The required studies are: constant discharge and step-drawdown pumping tests, physico-chemical and bacteriological water analyses. Water quality criteria are the same as those adopted by Health Ministry Order 2914 of 2011. It is also worth noting that in case of suspicion of contamination, IPAAM may request further analyses (Cerh, 2016 a).

Surface water abstraction

The reference flow used to obtain water use permits is Q_{95} . The catchment basins and reference data established by the installed stage gauges must be taken into account. These criteria will be valid until the approval of the PRH (CERH, 2016). In this way, the resolution defines that in case of lack of necessary hydrological information, the lowest flow measured in the place will be adopted, preferably the one realized in the period of drought. In a few cases there is monitoring of the basins already exists, so that this reference flow can be defined. The sum of the maximum flows granted in the basin shall not exceed 75% of the reference flow (Q_{95}), and each individual water use permit shall not exceed 20%. In drought situations, the reference flow $Q_{7,10}$ will be adopted .

Release of effluents

The basic water quality parameters used for permitting effluent being released into surface water bodies are determined by the resolutions of the Conselho Nacional do Meio Ambiente (National Environmental Council – CONAMA) since the Amazonas state has not yet classified its water bodies. Therefore, the CONAMA resolution 357 of 2005 that deals with the framing of water bodies and resolution 430 of 2011, that deals with effluent discharge standards, are used (Cerh, 2016).

The resolution also adds expressions to obtain the dilution flow and allowed concentration for the biochemical oxygen demand (BOD). The dilution flow should consider the effluent flow, the BOD concentration in the effluent, the allowed concentration and the natural concentration of the receiving water body. The concentration of the mixture should consider the effluent flow, the river flow, the BOD concentration in the river and the concentration of BOD in the effluent water. The resolution also adds that when effluents are released, the capacity of the receiving water body for the assimilation or self-purification of the amount of dissolved oxygen (Cerh, 2016) should be ascertained.

Use of hydroelectric potential

It is established that projects with a hydroelectric potential equal to or less than 1MW are not required to present Water Availability Reserve Declaration (DRDH). However, they are subject to the obligation to obtain the water use permit (Cerh, 2016). For energy potential higher than 1 MW in the Amazonas state water body, ANEEL must request the following information in the DRDH: a) present the project's technical form; b) copy of the technical note about the enterprise; c) geo-referenced location map; d) hydrological studies; e) reservoir studies; f)

description of the characteristics of the enterprise and also; g) study of hydroelectric use. The issuance of the DRDH may be renewed at the request of ANEEL with the IPAAM, but the conversion of this into a water use permit must be requested by the entrepreneur upon receipt of an ANEEL concession (Cerh, 2016). In the case of a hydroelectric potential greater than 1MW and less than 30 MW, without a basic project, a simplified technical report should be presented (Cerh, 2016).

The other uses of water resources defined in Law 3,167 of 2007 and Decree 28,678 of 2009 were not specified in the resolution that establishes the criteria for water use permits.

After these regulations, the Amazonas State Water Resources Council (CERH) Resolution N.1 of 2016 was established, which defines the criteria for issuing the grants. Also published was Resolution 2 of 2016 which defines criteria and classifies the insignificant uses of water resources. Other regulations were made by means of joint ordinances between the governing and regulatory bodies of the state policy of water resources (PERH), such as normative order SEMA/IPAAM 01/2017. This provides for administrative procedures and documentation required for the issuance of water use permits in the scope of Amazonas state and was abolished by the Resolution 12/2017. Subsequent changes occurred through ordinances 75/2017 and 100/2017, where the changes refer to the deadlines for setting up the allowance right for using.

Among other purposes, these regulations established that all requests for allowance right for using water resources should be inserted by IPAAM in the National Register of Water Resources (CNARH-40). This register is administered by ANA and is used for mandatory registration of natural or legal persons, public or private rights who are users of water resources regardless of the field of use. This should be done for a knowledge of the actual demand for water resources, surface or underground in a given area, river basin or nationwide. However, not all states make this information available at the CNARH (Ana, 2016). The use of this national system also helps as a source of information for management reports, such as ANA's annual reports on water resources.

Between August 2013 and July 2014, 14,322 water use permits were issued in Brazil, of which 1,146 were issued by ANA. Most of them were emitted in São Paulo state (4,038) and the one that issued the least was Pará (ANA, 2015). In 2017, in its first year of implementation in the State of Amazonas, 31 permits were issued, but a significant amount of requests was under analysis (1.1198) (Cnarh-40, 2017). The State has progressed in establishing criteria and in the implementation of water use permits. There is need to advance in the implementation of the other instruments that subsidize the analysis of water use permits. Although they are not indispensable, they are extremely important to provide technical subsidies in the analysis of applications and in the management of water resources.

Conclusions

Analyzing the ordinances, decrees, and laws, it can be said: despite the existence since 2001 of a “State Policy of Water Resources for the Amazonas”, little progress has been observed in the last 15 years, with significant progress of 2016 with the establishment of technical criteria and being implemented in 2017, but occurred isolated from the other instruments of the Water Resources Policies.

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