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MEXICO'S LEGAL FRAMEWORK REGARDING WASTEWATER MANAGEMENT: A CASE STUDY OF BAJA CALIFORNIA SUR*

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Abstract: *Wastewater is one of the principal causes of coastal ecosystem pollution and poses a threat to food security, drinking water access, public health, and ecosystem survival. However, wastewater can also be a reliable alternative source of water, provided specific changes are made. Mexico's extensive and complex legal framework involving various governmental agencies and overlapping jurisdictions makes it difficult to ascertain the specific responsibilities of various actors and enforce accountability in the area of wastewater management. The aim of this paper is to analyze the relevant law in order to determine whether it is the legislation itself which is generating adverse environmental impacts, or whether these impacts are the result of the wastewater management system as implemented. In this study, we analyze the legal framework applicable at each*

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of the three levels of government in order to clarify the connections between these governmental entities from a perspective that has not been previously developed, which will be a useful point of departure for future research. To this end, the state of Baja California Sur (in northwestern Mexico) is presented as a case study insofar as it is representative of vulnerable coastal regions facing water scarcity. The methodology and systematic analysis of wastewater regulations employed in this paper facilitate both an evaluation of the efficacy of the current legal framework surrounding wastewater management, as well as the identification of changes needed in order to achieve environmental sustainability and protect water resources for present and future generations.

KEYWORDS: *Wastewater, legal framework, water management, wastewater regulation, Baja California Sur.*

RESUMEN: *Las aguas residuales representan uno de los factores que más contaminan los ecosistemas costeros, poniendo en riesgo la seguridad alimentaria, el acceso al agua potable, la salud de la población y de los ecosistemas. Sin embargo, las aguas residuales pueden ser una fuente alternativa y confiable de agua, en la medida en que haya cambios en varios ámbitos. En México, un reto principal deriva del extenso y complejo marco regulatorio sobre las aguas residuales, que dificulta la definición de responsabilidades y de rendición de cuentas, especialmente en el caso de las diferentes instancias de gobierno relacionadas con el tema. En este artículo se analiza el marco legal para determinar si la legislación en sí misma representa un factor que contribuye a la mala gestión de las aguas residuales, o si bien los problemas ambientales radican en el mal manejo. Así, se caracteriza el marco legal aplicable a los tres niveles de gobierno para dilucidar las conexiones entre las diferentes leyes, desde una perspectiva no desarrollada previamente, lo que puede ser un insumo útil para investigaciones futuras. Se toma como caso de estudio al estado de Baja California Sur, ya que es una zona costera vulnerable que actualmente enfrenta un grave problema de escasez de agua. La metodología y el análisis sistemático del marco regulatorio de las aguas residuales propuesto permite evaluar la eficacia del marco legal y determinar las reformas necesarias para un manejo sustentable de las aguas residuales, cuidando con ello el agua para ésta y futuras generaciones.*

PALABRAS CLAVE: *Aguas residuales, marco legal, regulación de aguas residuales, gestión del agua, Baja California Sur.*

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I. Introduction

Water, a vital resource essential for life, has also become a pressing national security matter[1] requiring international cooperation. The international community has confronted the problem of water quality and availability by gradually adopting principles for the integrated management of water resources. This has led many countries to adopt policies, strategies, domestic laws, and information systems, as well as coordination, financing, and enforcement mechanisms[2] aimed at regulating the water management cycle from freshwater extraction, distribution and use, to reclamation, treatment, reuse and ultimate return to the environment.[3]

Despite these efforts, once water has been used and becomes wastewater,[4] its subsequent fate is often ignored. Wastewater is one of the principal causes of water and coastal ecosystem pollution, and poses a threat to food security, drinking water access, public health, and ecosystem survival. Nevertheless, wastewater management is one of the most overlooked factors in Mexican environmental policy. This neglect has not only led to increased poverty but has also become an impediment to economic development.[5] A desirable paradigm change would include wastewater as a reliable alternative source of water. This would require a change in how wastewater is managed, "shifting

[1] Louise Rolland & Yenny Vega Cárdenas, *La Gestión del Agua en México*, 6 (2) Polis. Investigacion y Analisis Soc. y Psi. 34 (2010).

[2] U.N., *World Summit on Sustainable Development*, working group WEHAB. Johannesburg, (Aug. 26-Sept. 4, 2002), *available at http://www.un.org/spanish/conferences/wssd/basicinfo.html.*

[3] World Water Assessment Programme, *Wastewater: The Untapped Resource*. *The United Nations World Water Development Report 2017*. UNESCO, 18,19 (2017).

[4] *See*, Article 3, VI, of the National Water Law: Wastewater is defined as water of varied composition consisting of discharges from treatment plants and from urban public, domestic, industrial, commercial, service, agricultural, livestock-related, and other uses in general, as well as mixtures thereof. Wastewater discharges are classified as municipal or non-municipal. Municipal wastewater composition varies depending on the diversity of the pollutants released by the various domestic, commercial, and institutional sources. These discharges are collected by municipal sewer systems and routed to treatment plants under municipal jurisdiction. Non-municipal discharges are discharges generated by other uses, such as industry and agriculture, which must be treated by treatment plants at the generator's expense.

[5] E. Corcoran *et al.*, eds., *Sick Water? The Central Role of Wastewater Management*, in Sustainable Development: A Rapid Response Assessment, UNEP, UN-HABITAT, GRID-Arendal, 88 (2010).

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the paradigm from 'treatment and disposal' to 'reuse, recycle and recover'".[6] This paradigm shift could transform wastewater from an environmental problem into a solution to one of the most significant challenges facing humanity.

The prevalence of wastewater-related issues and problems tends to vary in direct proportion to a country's income level. On average, high-income countries treat about 70% of the wastewater they generate, whereas this percentage drops to 38% for medium-income countries, 28% for lower-income countries, and 8% for the lowest-income countries.[7] The absence of adequate wastewater treatment systems exacerbates poverty and increases health problems by directly exposing the population to polluted wastewater.

In Mexico, wastewater is reused in large quantities. Despite the fact that 94% of the water supply destined for individual use has been disinfected, only 58.3% of the wastewater collected through sewer systems is treated to improve its quality before being reused or returned to a body of water.[8] As a result, water for human use, whether taken from surface or groundwater sources, is often contaminated by pathogenic microorganisms, particularly fecal coliforms.[9] Recognizing the gravity of this problem, Mexico has adopted the Agenda 2030 and its sustainable development goal (SDG) regarding water resources, both of which address issues beyond water supply and treatment. In particular, the SDG Target 6.3 provides that signatory countries commit, "by 2030, [to] improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally".[10]

Achieving these goals will require a paradigm change that envisions wastewater as a solution to the problem of inadequate water supply and treatment. Such a change, however, depends on the existence of a comprehensive and effective legal framework concerning wastewater which ensures compliance by both individuals and organizations in order to promote the collective interest.[11] Thus, public policies and wastewater management goals need to be implemented in the form of specific laws and regulations which clearly define the responsibilities assigned to the various involved parties. The effectiveness

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[6] World Water Assessment Programme, *supra* note 3, at 24.

[7] T. Sato *et al.*, *Global, regional, and country level need for data on wastewater generation, treatment, and use*, 130 Agricultural Water Management 1 (2013), *available at: dx.doi.org/10.1016/j.agwat.2013.08.007*.

[8] Comisión Nacional del Agua [CONAGUA], Estadísticas del Agua en México (2017), *available at http://files.conagua.gob.mx/conagua/publicaciones/Publicaciones/EAM2016.pdf*.

[9] Julia Carabias & R. Landa, Agua, medio ambiente y sociedad: hacia la gestión integral de los recursos hídricos en México 221 (UNAM-COLMEX: Fundación Gonzalo Río Arronte, 2005).

[10] U.N. General Assembly, *Transforming Our World: the 2030 Agenda for Sustainable Development*, resolution adopted by the General Assembly, A/RES/70/1 (25 September 2015), *available at www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E*.

[11] World Water Assessment Programme, *supra* note 3.

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of such laws largely depends on how these responsibilities are defined and implemented at the federal, state, and municipal levels.[12]

The problems associated with wastewater management in Mexico begin with the country's regulatory framework, which is characterized by overlapping federal, state, and municipal regulatory layers which inhibit compliance. Specific case studies examining these issues in the national context are needed to help communities understand and anticipate what constraints or problems they may face when attempting to better manage their water resources. This paper provides a comprehensive overview of the existing legal framework regarding wastewater resources and discharges, and a systematic assessment of its efficacy, at all three levels of government.

The state of Baja California Sur (BCS) was selected for examination because it is representative of regions that are highly vulnerable to water scarcity. In that state, the principal source of water is aquifer extraction which highlights the importance of the link between water quality and availability given the fact that overexploitation has given rise to saline water intrusion. Wastewater could become an additional source of water for the state, but the current legal framework complicates and impedes its efficient use and management. A comprehensive, systematic analysis of wastewater regulations is urgently needed to assist in the formulation of new public policies which encourage wastewater treatment and reuse in order to confront the problems of water quantity and quality in BCS.

In order to perform a systematic analysis of the existing wastewater legislation at the federal, state, and municipal levels, a comprehensive survey of documents on environmental law and the related legal framework regarding wastewater resources was conducted using the methodology developed by Dr. María del Carmen Carmona.[13] Her approach provides a new perspective as well as a legal basis for analyzing the effectiveness of legal frameworks so that legislative reforms can be envisioned and proposed which both encourage compliance and facilitate enforcement.[14]

Carmona's methodological framework is comprised of the following steps: a constitutional analysis; a hierarchization of the sources of law; an analysis of the spheres of validity (spatial, temporal, material, and personal); and, a dynamic analysis. We will begin with a constitutional analysis, identifying the specific constitutional provisions that provide the foundation for the legal framework regarding wastewater. Once this has been completed, a deeper analysis of the specific wastewater-related provisions may be performed. This method is predicated on a formal analysis, that is, a systematic analysis of the sources of

[12] *Id*. at 45.

[13] María del Carmen Carmona Lara, *Bases para el Conocimiento Integrado del Derecho Ambiental*, in Temas Selectos de Derecho Ambiental 19-45 (Cámara de Diputados LXI Legislatura, Comisión de Medio Ambiente y Recursos Naturales, Palacio Legislativo ed., 2010).

[14] *Id.* at 19, 20.

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law and their hierarchical structure, as well as an explication of the particular type of legal system in which they are embedded.[15]

II. Legal Background Regarding Wastewater in Mexico

The Mexican regulatory framework regarding wastewater has two sources, one stemming from water-related legislation, the other from environmental law. Water law in general predates environmental law as such. In this way, the first relevant statute to be enacted was the Mexican Transportation Act of 1888 (*Ley General de Vías Generales de Comunicación*). This was followed by the Use of Federal Waters Act of 1910 (*Ley sobre Aprovechamiento de Aguas de Jurisdicción Federal*), the Irrigation with Federal Waters Act of 1926 (*Ley sobre Irrigación con Aguas Federales*), the Nationally Owned Waters Act of 1934 (*Ley de Aguas de Propiedad Nacional*), and finally, the Federal Waters Act of 1972 (*Ley Federal de Aguas*). Subsequent amendments and additions to the Federal Waters Act resulted in the current National Waters Act of 1992,[16] which was last amended in 2020.

The first environmental regulations developed out of a need to protect human health from various sources of pollution. The first such law to be enacted was the Federal Environmental Pollution Prevention and Control Act of 1971 (*Ley Federal para Prevenir y Controlar la Contaminación Ambiental*).[17] It had three regulations:

— Water Pollution Prevention and Control Regulation (*Reglamento para la Prevención y el Control de la Contaminación de las Aguas*).[18]
— Regulation for the Prevention and Control of Marine Pollution from Waste Dumping and Other Materials (*Reglamento para la Prevención y el Control de la Contaminación del Mar por vertimiento de desechos y otras materias*).[19]

[15] *Id.* at 28.

[16] Ley de Aguas Nacionales [L.A.N.] [National Water Act] as amended, Diario Oficial de la Federación [D.O.F], 1 de diciembre de 1992 (Mex.).

[17] Ley Federal para Prevenir y Controlar la Contaminación Ambiental [L.F.P.C.C.A.] [Federal Environmental Pollution Prevention and Control Act] as amended, Diario Oficial de la Federación [D.O.F], 23 de marzo de 1971 (Mex.).

[18] Reglamento para la Prevención y el Control de la Contaminación de las Aguas [R.P.C.C.A.] [Water Pollution Prevention and Control Regulation] as amended, Diario Oficial de la Federación [D.O.F], 29 de marzo de 1973 (Mex.).

[19] Reglamento para la Prevención y el Control de la Contaminación del Mar por Vertimiento de Desechos y otras Materias [Regulation to Prevent and Control of Marine Pollution from Dumping of Waste and Other Materials] as amended, Diario Oficial de la Federación [D.O.F], 23 de enero de 1979 (Mex.).

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— Regulation for the Prevention and Control of Air Pollution Originating from the Emission of Smoke and Dust (*Reglamento para la Prevención y el Control de la Contaminación Atmosférica originada por la emisión de humos y polvos*).[20]

After 1971, a number of constitutional and legal reforms were enacted with the objective of protecting the environment; however, these reforms continued to be primarily targeted to the protection of human health. In terms of institutional changes, in 1972, the post of Environmental Improvement Undersecretary (*Subsecretaría de Mejoramiento al Ambiente*) was created within the Secretary of Health. However, the powers deriving from the Federal Environmental Pollution Prevention and Control Act were sector-specific, with each federal department being assigned distinct responsibilities. For example, the Secretary of Water Resources (*Secretaría de Recursos Hidráulicos*) had jurisdiction over the prevention and control of water pollution, the Secretary of Agriculture and Livestock (*Secretaría de Agricultura y Ganadería*) oversaw the prevention and control of soil contamination, and the Secretary of Industry and Commerce (*Secretaría de Industria y Comercio*) was responsible for the prevention of contamination resulting from industrial and commercial activity.[21]

It was not until 1982 that the first Federal Environmental Protection Act (*Ley Federal de Protección al Ambiente*) was enacted. Pursuant to this Act, various environmental responsibilities were consolidated and centralized which was a significant first step toward the effective protection of the environment and the nation's natural resources. This Act was ultimately superseded by the current Mexican Environmental Protection Act of 1988 (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*).[22] LGEEPA has been subsequently amended several times, most significantly in 1996. LGEEPA's Title Four, "Environmental Protection", Chapter III, "Prevention and Control of Pollution of Water and Aquatic Ecosystems", contains the wastewater-related provisions.[23]

The Mexican Constitution (*Constitución Política de los Estados Unidos Mexicanos*)[24] has also undergone several revisions and amendments, most significantly

[20] Reglamento para la Prevención y el Control de la Contaminación Atmosférica originada por la emisión de humos y polvos [Regulation to Prevent and Control Air Pollution from Smoke and Dust] as amended, Diario Oficial de la Federación [D.O.F], 17 de septiembre de 1971 (Mex.).

[21] Tania García López, Derecho Ambiental Mexicano, Introducción y Principios 29,30 (Bosch, S.A. ed., 2013).

[22] Ley General del Equilibrio Ecológico y la Protección al Ambiente [L.G.E.E.P.A.] [Mexican Environmental Protection Act] as amended, Diario Oficial de la Federación [D.O.F], 28 de enero de 1988 (Mex.).

[23] *Id. See,* articles 117-133.

[24] Constitución Política de los Estados Unidos Mexicanos [Const.] [Mexican Constitution] as amended, Diario Oficial de la Federación [D.O.F], 5 de febrero de 1917 (Mex.). *Available at http://www.diputados.gob.mx/LeyesBiblio/index.htm.*

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to Article 4, in 1999 and 2012, which introduced the following rights fundamental to wastewater regulation:

> All persons have the right to a healthy environment for their development and well-being. The State shall guarantee the effectiveness of this right. Anyone who causes environmental damage or degradation incurs the corresponding liability, as prescribed by law.[25]
>
> Everyone has the right of access to, disposal of, and treatment of sufficient quantities of clean water for personal and domestic consumption, in an acceptable form and at an affordable cost. The State shall guarantee this right and the law shall establish the bases, assistance, and modalities for equitable and sustainable access to, and use of, water resources, establishing the participation of the Federation, the federative entities [states], and the municipalities, as well as the participation of the citizens, in the achievement of these ends.[26]

Another federal law related to wastewater regulation is the Federal Duties Act (*Ley Federal de Derechos*). The 1982 version of this Act included fees for the use and appropriation of national surface water and groundwater, and the 1991 version was amended to include the assessment of fees for contaminated wastewater discharges.

The Water Pollution Prevention and Control Regulation of 1973 was abolished by the Regulations of the National Waters Act.[27] Due to the superseding authority of the National Waters Act over LGEEPA, this new regulation became the effective regulatory law governing the prevention and control of water pollution.[28] This legislative history reveals an abundant but fragmented legal framework regarding wastewater regulation. Due to the different levels of jurisdiction, spheres of application, and hierarchies, the resulting operational framework is complex and can be difficult to navigate.

III. Theoretical Framework

Since the literature on wastewater legislation is limited, we opted to make use of an indirect bibliography in order to examine current wastewater regulation. Agenda 21, a non-binding action plan developed during the Earth Summit of the United Nations Conference on Environment and Development held in Rio de Janeiro, Brazil, in 1992, establishes that all member states, according to their capacity and available resources, should implement effective programs to prevent and control water pollution. Such programs are to be based

[25] *Id.*, as amended, Diario Oficial de la Federación [D.O.F], 28 de junio de 1999 (Mex.).

[26] *Id.*, as amended, Diario Oficial de la Federación [D.O.F], 8 de febrero de 2012 (Mex.).

[27] Reglamento de la Ley de Aguas Nacionales [Regulations of the National Waters Act] as amended, Diario Oficial de la Federación, 12 de enero de 1994 (Mex.).

[28] Raúl Brañes, Manual de Derecho Ambiental Mexicano 432 (Fondo de Cultura Económica ed., 770, 2000).

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on a combination of strategies designed to reduce pollution, assess environmental impacts, and uphold mandatory standards applicable to wastewater discharges.[29]

Agenda 21 sets forth the following objectives related to the prevention and control of water pollution:[30]

- Apply the "polluter pays" principle to the various sources of pollution.
- Promote the construction of treatment facilities for domestic and industrial wastewater and develop appropriate technologies to that end.
- Establish standards regulating wastewater discharges.
- Introduce the "precautionary principle" into water quality regulation, with special attention given to minimizing contamination, preventing contamination via the use of new technologies, reducing point-source contamination, and developing systems to recover, recycle, treat, reuse, and ultimately eliminate wastewater.
- Promote the treatment of municipal wastewater for reuse without risk to agriculture and aquaculture.

Achieving these objectives depends on the existence of both effective institutions and a corresponding, complementary legal framework at the national level. In Mexico, the principles underlying these objectives do, in fact, appear in the regulatory framework. However, the persistence of wastewater-related problems leads to the conclusion that either the current laws are inadequate, or they are not being effectively applied or enforced.

According to Anthony Heyes, given both the increasing number and increasingly coercive nature of environmental laws, one might assume that levels of compliance have improved. However, compliance depends on stable and predictable enforcement. To this end, governmental authorities must implement an effective compliance program.[31] At the outset, any compliance regime requires the dissemination of clear, accurate information that is easily accessed, interpreted and understood.[32] In the area of wastewater regulation, this first step involves compiling and consolidating all applicable laws and regulations. Once this has been done, the effectiveness of the entire regulatory apparatus in promoting the sustainable management of water resources can be assessed, and the need for further amendments or reforms can be more eas-

[29] U.N., Agenda 21, Chapter 18, *Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources*, (1992), *available at https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf.*

[30] *Id.* at 18.40.

[31] Anthony Heyes, *Implementing Environmental Regulation: Enforcement and Compliance*, 17 Journal of Regulatory Economics, 23 (2000).

[32] Consejo Estatal de Ecología Hidalgo, Indicadores Ambientales del Estado de Hidalgo, 71 (2003), *available at http://www.semarnat.gob.mx/archivosanteriores/informacionambiental/Documents/04_indicadores/indicadores_2003_hidalgo.pdf.*

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ily identified. As Ortiz Rendón has observed, "Without accurate knowledge of the problem, it is impossible to implement sustainable policies to address them".[33]

Along these same lines, Carmona points out that the OECD already has identified one particular challenge facing Mexico that pertains to water management in Mexico: the need for implementing legislation targeted to the reduction of pollution and the protection of nature, including increasing the number of inspections and the level of regulatory compliance.[34] In that regard, as González states, "Good water governance calls for the use of mechanisms such as laws and regulations, effective policy, adequate governmental organization, requisite infrastructure, and a culture of efficient use and preservation of water resources".[35] González maintains that sustainable development also requires an explicit system of incentives to encourage the efficient and responsible use of water, and to help preserve water quality. Such a system can only be achieved with a corresponding legal framework that specifically articulates the nation's current needs. He emphasizes that the law should be simple, clear, easy to understand, straightforwardly applicable, and include regulations that define and explain all relevant procedures.[36]

With the foregoing in mind, our analysis will focus on the Mexican legal framework and international guidelines pertaining to wastewater, since they are the platform for the effectiveness of water management policies and enforcement mechanisms, that, as Gilabert-Alarcón states, change with each new presidential administration, resulting in the deterioration in both water and sanitation services.[37]

IV. Study Area: Baja California Sur

BCS is a semi-desert state in northwestern Mexico occupying the southern half of the Baja California peninsula. It is bounded on the north by the state of Baja California, which lies above the 28th parallel, on the east by the Gulf of California, and on the south and west by the Pacific Ocean. It oc-

[33] G. A. Ortiz Rendón, Administración del Agua. Aplicación de instrumentos de política hidráulica en escenarios alternativos 227 (Instituto Mexicano de Tecnología del Agua, 2001).

[34] María del Carmen Carmona Lara, *La gestión integrada por cuencas y la garantía del derecho humano al agua en México*, in Obra Jurídica Enciclopédica, Derecho Ambiental 73-98 (Porrúa, 2014).

[35] Fernando J. González Villarreal, *Gobernabilidad Hidráulica*, in La Gobernanza del Agua: un desafío actual 137,138 (Instituto Mexicano de Tecnología del Agua, 2012).

[36] *Id.* at 139.

[37] Christian Gilabert-Alarcón *et al.*, *Regulatory Challenges for the Use of Reclaimed Water in Mexico: A Case Study in Baja California*, 10 Water 22 (2018), *available at https://res.mdpi.com/d_attachment/water/water-10-01432/article_deploy/water-10-01432.pdf.*

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cupies 73,475 km^2, or 3.8% of Mexico's territory,[38] and is divided into five municipalities, from north to south: Mulegé, Loreto, Comondú, La Paz, and Los Cabos.

MAP OF BAJA CALIFORNIA SUR[39]

The Baja California peninsula is located in one of the most arid regions of the country with a mean annual precipitation 77% lower than the national average, which limits its prospects for social, economic, and environmental development.[40] BCS receives 0-400 mm of rainfall annually. At higher elevations, rainfall reaches an average of 700 mm, while the mean total annual precipitation in the state is less than 200 mm.[41] The climate at lower elevations is dry desert; the temperature exceeds 40°C in the summer and falls below 0°C during the winter. Only the Los Cabos region has a sub-humid, temperate climate due to the influence of cyclones.[42]

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[38] GOBIERNO DE BAJA CALIFORNIA SUR, GEOGRAFÍA, (Nov. 5, 2015), *available at http://www.bcs.gob.mx/conoce-bcs/geografia/*.

[39] Geoatlas.com, *Map of Baja California Sur*, (Feb. 19, 2020), *available at http://www.map-of-mexico.co.uk/espanola/mapa-de-bajacaliforniasur.htm.*

[40] COMISIÓN NACIONAL DEL AGUA [CONAGUA], PROGRAMA HÍDRICO REGIONAL, VISIÓN 2030, REGIÓN HIDROLÓGICO-ADMINISTRATIVA I PENÍNSULA DE BAJA CALIFORNIA (2012), *available at www.conagua.gob.mx.*

[41] INSTITUTO NACIONAL DE ESTADÍSTICA, GEOGRAFÍA E INFORMÁTICA [INEGI], GEOGRAFÍA E INFORMÁTICA. 2018. CUÉNTAME, (Jun. 5, 2018), *available at http://www.cuentame.inegi.org.mx/monografias/informacion/bcs/territorio/clima.aspx?tema=me&e=03.*

[42] GOBIERNO DE BAJA CALIFORNIA SUR. CLIMA, (Nov. 5, 2015), *available at http://www.bcs.gob.mx/conoce-bcs/geografia/*.

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The state's population is 712,029, which amounts to 0.6% of Mexico's inhabitants.[43] The census currently underway is expected to increase that number to one million. The tourism boom in Los Cabos has been a strong driver of both immigration and water demand, increasing the pressure on the region's water resources.[44] From 2000 to 2010, the population of BCS grew by 50%, resulting in a corresponding reduction in annual per capita water availability, which fell to 785 m^3. This state is, therefore, classified as one experiencing water scarcity.[45]

The BCS State Climate Action Plan acknowledges that the only reliable source of fresh water in the state is groundwater, which is recharged by flooding and runoff from intense rainfall. However, groundwater is being mined from all available aquifers at a higher rate than it can be recharged, resulting in seawater infiltration.[46] The main sources of water pollution in the state are untreated municipal, industrial, and agricultural discharges, the low efficiency of treatment plants, infiltration from septic systems, and inadequately sited or uncovered garbage dumps.[47]

The Vision 2030 Regional Water Program recognizes that the water infrastructure in Baja California is insufficient and that wastewater treatment does not, in most cases, comply with the Official Mexican Standard of quality. It further states that there is widespread noncompliance with laws and regulations governing wastewater control, solid waste management, and waste disposal.[48]

V. Systematic Analysis of the Legal Framework Regarding Wastewater

A systematic, step-by-step analysis of the legal framework concerning wastewater can assist interested parties in navigating the complex regulatory scheme and managing the information relevant to their roles. We present such an analysis in the following sections.

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[43] Instituto Nacional de Estadística, Geografía e Informática [INEGI], Panorama Sociodemográfico de Baja California Sur, 16 (2015), *available at http://ceieg.bcs.gob.mx/wp-content/uploads/2016/08/702825082109.pdf.*

[44] *Id.*

[45] Jobst Wurl & Felipe García, Plan Estatal de Acción Climática en BCS, Recursos Hídricos 42 (UABCS, 2012).

[46] *Id.*

[47] Z. M. Tejas Álvarez, Aguas residuales no residenciales en la Ciudad de La Paz: Cumplimiento o incumplimiento con la normatividad ambiental (2013) (unpublished master's thesis in environmental and natural resource economics, Universidad Autónoma de Baja California Sur).

[48] Comisión Nacional del Agua [CONAGUA], *supra* note 35.

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1. *Constitutional Analysis*

The legal framework regarding water in Mexico is grounded in the principle that water is a resource which, by virtue of its strategic importance, is considered to be a matter of national security. As a result, water is regulated in the first instance by Articles 4, 27, 73, 115, and 124 of the Mexican Constitution (CPEUM), which establish the fundamental principles on which all other applicable legislation and public policy must be based.[49]

Our analysis begins with the sixth paragraph of Article 4, which establishes the right to a healthy environment for human well-being and development; the right to health; the right to clean, potable water; and the right to adequate sanitation services. The other referenced articles define and establish the foundations for the nation's sustainable development and the division of jurisdiction over the nation's water resources, and empower the federal government to safeguard the rights enshrined in Article 4. The table below lists the relevant constitutional articles and highlights the principle embodied in each, more specifically, identifying the articles designed to regulate rights, and the articles that establish the wastewater-related powers of the federal, state and municipal authorities.[50]

Table I. Relevant Articles of the Mexican Constitution

Article	*Relevance*
4, sixth paragraph	Establishes the human right to water: Everyone has the right of access to, disposal of, and treatment of sufficient quantities of clean water for personal and domestic consumption, in an acceptable form and at an affordable cost. The State shall guarantee this right and the law shall establish the bases, assistance, and modalities for equitable and sustainable access to, and use of, water resources, establishing the participation of the Federation, the federative entities [states], and the municipalities, as well as the participation of the citizenry, in the achievement of these ends.
27	Provides that water is the property of the nation and grants power to the State for regulating its sustainable use, stewarding its conservation, achieving the sustainable development of the country, and improving the living conditions of the population. Emphasizes that the participation of both the citizenry and the three levels of government is indispensable. Specifies that the nation's dominion is inalienable and imprescriptible, and that the exploitation, use, and enjoyment of water shall take place exclusively by means of concessions granted by the Executive Branch as prescribed by law.

[49] Constitución Política de los Estados Unidos Mexicanos [Const.], *supra* note 24.

[50] Carmona Lara *supra* note 13 at 28-29.

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Article	*Relevance*
73	Establishes the power of the federal Congress to enact laws concerning the use and exploitation of waters under federal jurisdiction, establish compensatory payments for its exploitation and use, and enact laws harmonizing the legislation of the federal, state, and municipal levels of government, within the scope of their respective jurisdictions, as it relates to environmental protection and the preservation and restoration of ecological equilibrium.
115	Specifies that the municipalities will have responsibility over the supply of water to their residents, as well as drainage, sewage, treatment, and disposal services for the wastewater they produce.
124	Provides that powers not expressly granted by the Mexican Constitution to the Federation are reserved to the states.

SOURCE: The authors, based on the CPEUM.

2. *Analysis of the Spheres of Validity*

This step of the analysis will focus on the particular provisions relevant to our evaluation of the legal framework regarding wastewater in Baja California Sur, with reference to the four spheres of validity. This approach could be considered a static vision of the law, since it precisely delineates the extent to which the law applies.[51] The four spheres of validity are:

1) *Spatial sphere*. This sphere refers to the the validity of the applicable provisions based on the geographical space to which the law applies; it may be territorial, extraterritorial, federal, state, or municipal. In the case under examination here, the relevant provisions are the federal laws, BCS state laws, and the bylaws adopted by each of the five municipalities comprising BCS (Mulegé, Loreto, Comondú, La Paz, and Los Cabos).
2) *Temporal sphere*. This sphere refers to the validity of the applicable provisions with reference to time, taking into account the dates on which each law took effect, as well as any subsequent reforms or amendments that supersede or rescind a prior provision. In this study, we have analyzed the most recent texts of all wastewater-related laws currently in force.
3) *Material sphere*. This sphere refers to the legal regime applicable to a given natural resource, understood to be any of the natural elements subject to use under Article 27 of the Constitution.[52] In the present case, we will focus specifically on water law.
4) *Personal sphere*. This sphere refers to the specific individuals or entities who are subject to the law, that is, the natural or legal persons or other entities who acquire rights and obligations, or powers and duties, as a result of a provision.[53] In the case at hand, the subjects in question are

[51] *Id*. at 30.
[52] *Id*. at 32.
[53] *Id*. at 33.

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all natural or legal persons to whom the law applies, including social organizations, nongovernmental organizations, and wastewater-related public entities. Identifying which specific authorities have jurisdiction over wastewater management is crucial to the analysis of the legal system and its effectiveness. Table II lists all the competent authorities at the federal, state and municipal levels.

TABLE II. PUBLIC ENTITIES CONNECTED TO WASTEWATER REGULATION

Level	*Entity*
Federal	SEMARNAT. Secretaría de Medio Ambiente y Recursos Naturales (Secretary of the Environment and Natural Resources).
	CONAGUA. Comisión Nacional del Agua (National Commission on Water).
	IMTA. Instituto Mexicano de Tecnología del Agua (Mexican Institute of Water Technology).
	PROFEPA. Procuraduría Federal de Protección al Ambiente (Attorney General for Environmental Protection).
	Consejos de Cuenca (Watershed Councils).
	Secretaría de Salud (Secretary of Health).
	PGR. Procuraduría General de la República (Attorney General of the Republic).
State	Secretaría de Desarrollo Económico, Medio Ambiente y Recursos Naturales (Secretary of Economic Development, the Environment, and Natural Resources).
	Subsecretaría de Medio Ambiente y Recursos Naturales (Environment and Natural Resources Undersecretary).
	CEA. Comisión Estatal del Agua (State Water Commission).
	Baja California Sur Watershed Council.
Municipal	OOMSAPA. Organismo Operador Municipal del Sistema de Agua Potable, Alcantarillado y Saneamiento del Municipio de La Paz (La Paz Municipal Water and Sewer Commission).
	OOMSAPA. Organismo Operador Municipal del Sistema de Agua Potable y Alcantarillado del Municipio de Los Cabos (Los Cabos Municipal Water and Sewer Commission).
	OOMSAPA. Organismo Operador Municipal del Sistema de Agua Potable y Alcantarillado del Municipio de Comondú (Comondú Municipal Water and Sewer Commission).
	OOMSAPA. Organismo Operador Municipal del Sistema de Agua Potable y Alcantarillado del Municipio de Loreto (Loreto Municipal Water and Sewer Commission).
	OOMSAPA. Organismo Operador Municipal del Sistema de Agua Potable y Alcantarillado del Municipio de Mulegé (Mulegé Municipal Water and Sewer Commission).

SOURCE: Authors.

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3. *Hierarchization of Sources*

Legal systems are characterized by a hierarchy in which certain laws prevail over others. In Mexico, the Constitution is considered the primary law. That document emanates from the sovereign power (the People) via the Constitutional Assembly that promulgated it, and no provision shall take precedence over or contradict it.[54] Article 133 establishes that the Constitution, the federal laws ensuing from it (including the National Waters Act), and international treaties, constitute the first level of the legal hierarchy. The second level is comprised of state laws enacted by state congresses, and the third level consists of municipal legal provisions.

International treaties have special relevance to environmental matters because they establish general guiding principles, such as the "precautionary principle" and the "polluter-pays" principle, which have been incorporated into both federal and state laws. Where water is concerned, various international agreements have served as a foundational framework for advancing the rights enshrined in Article 4 of the Constitution. The universal recognition of the human right to water and sanitation and the international community "calling upon Member States to adopt policies to increase access to sanitation and to ensure that water resources are protected from pollution" have had a global impact on wastewater policy.[55]

TABLE III. INTERNATIONAL WATER-RELATED AGREEMENTS AND PROVISIONS

International		
Provision	*Objective*	*Relevance*
United Nations Conference on Water, Mar de la Plata (March 1977) (not available in electronic form)	Declares that "all peoples, whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs".	First international recognition of water as a human right.
Agenda 21 United Nations Conference on Environment and Development, or "Rio	Chapter 18: Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to	Recognizes that all people have the right to drinking water, which was designated a "commonly agreed premise".

[54] G. Teutli Otero, *El artículo 133 y la jerarquía jurídica en México*, in CUADERNOS DE TRABAJO. SEMINARIO DE DERECHO INTERNACIONA 33 (UNAM-IIJ, 2015), *available at http://biblio.juridicas.unam.mx/libros/libros/libro.htm?l=4056*.

[55] World Water Assessment Programme, *supra* note 3, at 46.

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International		
Provision	*Objective*	*Relevance*
Summit", Rio de Janeiro (June 1992) *https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf*	the Development, Management and Use of Water Resources.	
Dublin Statement on Water and Sustainable Development, International Conference on Water and Environment (ICWE), Dublin (26-31 January 1992) *http://www.wmo.int/pages/prog/hwrp/documents/english/icwedece.html*	Principle 4 states: "It is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price".	By virtue of this principle, water is considered to have an economic value and should be recognized as an economic good; the wasteful or environmentally damaging use of this resource should be avoided.
Fifth International Conference on Population and Development, New York (30 June-2 July 1999) *https://www.un.org/en/development/devagenda/population.shtml www.un.org/popin/icpd2.htm*	Affirms that all individuals have "the right to an adequate standard of living for themselves and their families, including adequate food, clothing, housing, water, and sanitation".	Acknowledges water and sanitation as essential prerequisites for achieving sustainable global development.
World Summit on Sustainable Development, Johannesburg (September 2002) *http://www.un.org/spanish/conferences/wssd/basicinfo.html*	Establishes that supplies of clean, potable water and adequate sanitation services are necessary for the protection of human health and the environment.	Focuses attention on human dignity and the importance of increasing access to basic services such as drinking water, sanitation, adequate housing, energy, healthcare, food security, and the protection of biodiversity.
General Comment No. 15 of the United Nations Economic and Social Council on the Right to Water (November 2002) *https://www2.ohchr.org/english/issues/water/docs/CESCR_GC_15.pdf*	Paragraph 1 reads: "The human right to water is indispensable for leading a life in human dignity. It is a prerequisite for the realization of other human rights".	Reaffirms the right to water in international law.
United Nations General Assembly Resolution A/RES/64/292 (July 2010) *www.ohchr.org/EN/Issues/WaterAndSanitation/SRWater/Pages/Resolutions.aspx*	Officially recognizes access to clean, safe drinking water and sanitation as human rights essential for the full realization of all other human rights.	The Resolution "calls upon States and international organizations to provide financial resources, capacity-building and technology transfer, through international assistance and cooperation, in particular to developing countries, in

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International		
Provision	*Objective*	*Relevance*
		order to scale up efforts to provide safe, clean, accessible and affordable drinking water and sanitation for all".

Source: Authors.

As the above table shows, from its first formal recognition in 1977, the right of access to drinking water has been continually strengthened, to the point that it is now considered to be a fundamental human right and indispensable for living in dignity. It is reinforced by the acknowledgement of the right to sanitation, both of which are prior conditions for the realization of other human rights, and are imperative for the achievement of sustainable development. These international law principles were incorporated into Mexico's legal framework by the addition of the sixth paragraph to Article 4 of the Constitution, published in the Official Gazette of the Federation (*Diario Oficial de la Federación* [DOF]) on 8 February 2012. Subsequently, the entire secondary legal framework for water —the National Waters Act first and foremost— was harmonized to conform with the Constitution.

The secondary legislation applicable to water administration regulates a wide variety of matters that are under the jurisdiction of different authorities. It is extensive and complex. Each of these laws establishes rights and obligations relating to individuals as well as the competent governmental authorities, and each mandate must be put into effect by the promulgation of appropriate provisions and policies. The wastewater management regime is primarily governed by provisions concerning permits and licenses, wastewater quality standards, and zoning. Other provisions address water collection, treatment, and reuse for specific purposes. In addition to these are regulations concerning urban utilities, which include utilities responsible for the supply of drinking water and wastewater management.[56] The following tables present our analysis of the principal legal provisions applicable to wastewater discharges in Mexico.

Table IV. Federal Legal Provisions Applicable to Wastewater

Federal		
Law	*Objective*	*Relevance*
Constitución Política de los Estados Unidos Mexicanos (Mexican Constitution), Articles 4, 27,	The foundational document establishing the rights and duties of the Mexican people, the powers of the Federation (le-	Establishes the human right of access to, disposal of, and treatment of sufficient quantities of clean water for per-

[56] *Id.* at 50.

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Federal		
Law	*Objective*	*Relevance*
73, 115, and 124. DOF, 5 February 1917; latest revision, DOF, 15 September 2017 *http://www.diputados.gob.mx/LeyesBiblio/index.htm*	gislative, executive, and judicial branches), and the three levels of government (federal, state, and municipal). Defines the structure of the government and the organization of its institutions.	sonal and domestic consumption, in an acceptable form and at an affordable cost. Establishes the State's obligation to guarantee this right, as well as the right of access to, and equitable and sustainable use of, water resources. Establishes the necessity of the participation of the Federation, the states, the municipalities, and the public in achieving these ends. Establishes the water property regime and the division of jurisdiction with respect to wastewater management.
Ley General del Equilibrio Ecológico y la Protección al Ambiente (Mexican Environmental Protection Act) DOF, 28 January 1988; latest revision, DOF 19 January 2018 *http://www.diputados.gob.mx/LeyesBiblio/index.htm*	Law enacted in furtherance of the Mexican Constitution regarding environmental matters. Its objective is the promotion of sustainable development, and the prevention and control of air, water, and soil pollution. It lays the foundation for the sustainable enjoyment, preservation, and restoration of water and other natural resources, so that economic gains and societal activities are compatible with the preservation of ecosystems.	Establishes the criteria for the prevention and control of water and aquatic ecosystem pollution by the regulation of wastewater discharges. Establishes sanctions regarding the pollution of water. This is the Mexican federal law that governs wastewater discharges and clarifies the division of jurisdiction set out in the Constitution.
Ley de Aguas Nacionales (National Waters Act) DOF, 1 December 1992; latest revision, DOF, 24 March 2016 *http://www.diputados.gob.mx/LeyesBiblio/index.htm*	Law enacted in furtherance of Article 27 of the Constitution regarding national waters; its goal is to regulate the exploitation, use, and enjoyment of these waters, their distribution and control, as well as the preservation of their quality and quantity with a view to achieving comprehensive sustainable development.	Provides the framework for laws concerning national waters, including wastewater regulation. Governs wastewater quality, the prevention and control of wastewater contamination, wastewater recirculation and reuse, and the construction and operation of facilities for the prevention, control, and mitigation of water pollution, including wastewater treatment plants.

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Federal		
Law	*Objective*	*Relevance*
		In addition, it specifically establishes the division of jurisdiction among the competent authorities.
Ley Federal de Derechos (Federal Duties Act) DOF, 31 December 1981; latest revision, DOF, 7 December 2016 *http://www.diputados.gob.mx/LeyesBiblio/index.htm*	Establishes the fees payable for the use or enjoyment of property in the public domain as well as for the receipt of services provided by the State in its public law capacity. Classifies the zones of water availability and the publicly owned receiving entities for wastewater discharges, and determines the fees for their use, as well as the fees applicable to wastewater discharges as a function of their quality and the nature of the receiving entities.	Establishes the obligation to pay fees for the use or enjoyment of national property in the public domain, such as entities receiving wastewater discharges; for discharging wastewater on an ongoing, intermittent, or accidental basis into rivers, watersheds, river or stream beds, lagoons, ponds, marine waters, or other bodies of water or watercourses; for discharging wastewater into soils or causing it to infiltrate into land that is national property, or where such discharges could contaminate the subsoil or aquifers, as prescribed by this Act.
Ley General de Asentamientos Humanos, Ordenamiento Territorial y Desarrollo Urbano (Mexican Settlement, Zoning, and Urban Development Act) DOF, 28 November 2016 *http://www.diputados.gob.mx/LeyesBiblio/index.htm*	Establishes basic standards and compulsory management mechanisms for the planning of land use and human habitation in Mexico.	Establishes that a comprehensive water and water resource management system, including water supply, drainage, sanitation, wastewater treatment, watershed restoration, and rainwater use, is a matter of metropolitan interest. Provides that the plans and programs in metropolitan areas or conurbations must provide for and include measures to improve the environmental condition and comprehensive management of water.
Ley General de Bienes Nacionales (National Property Act) DOF, 20 May 2004	Identifies the property constituting the national heritage and establishes the public domain regime regarding property of the Federation.	Lists the property subject to the public domain regime of the Federation, significant because wastewater dumped onto national property falls under federal jurisdiction.
Código Penal Federal (Federal Penal Code) DOF, 14 August 1931;	This code regarding federal offenses is applicable throughout the Republic.	Establishes that anyone who illicitly discharges, dumps, or causes the infiltration of

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Federal		
Law	*Objective*	*Relevance*
latest revision, DOF, 9 March 2018 *http://www.diputados.gob.mx/LeyesBiblio/ref/cpf.htm*	Title 25 covers offenses against the environment as well as those affecting environmental management.	wastewater, liquid chemicals, biochemicals, wastes, or pollutants into soils, subsoils, marine waters, rivers, watersheds, lagoons, ponds, or other bodies of water, or watercourses under federal jurisdiction, thus causing a risk of harm or harming natural resources, flora, fauna, water quality, ecosystems, or the environment, or who so authorizes or orders, is liable to a term of 1 to 9 years of imprisonment and a fine of 300 to 3000 times the daily minimum wage. When the waste in question is dumped or flows into or toward a protected natural area, the term of imprisonment increases by up to an additional three years and the fine increases by up to an additional 1000 times the minimum wage.
Ley General de Cambio Climático (Mexican Climate Change Act) DOF, 6 June 2012; latest revision, DOF 13 July 2018 *http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC_130718.pdf*	Establishes the parameters for confronting the adverse effects of climate change.	Sets forth the authority of the municipalities to formulate and apply measures and policies to confront climate change in matters such as providing potable water and sanitation services. Mentions that all three levels of government should take measures for climate change adaptation, including, the payment of taxes for the use of water and environmental services provided by ecosystems set aside for conservation.
Ley Federal de Responsabilidad Ambiental (Federal Environmental Responsability Act) DOF, 7 June 2013 *http://www.diputados.gob.mx/LeyesBiblio/pdf/LFRA.pdf*	Enhances Article 4 of the Constitution by protecting, preserving and promoting environmental restoration, and guarantees the human rights enshrined in that Article. It establishes the legal procedure for the determination of environmental responsibility.	Applicable to all actions that cause environmental damage and provides for the repair or compensation for such damage.

Source: Authors.

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Table V. Federal Regulations Applicable to Wastewater

Federal		
Regulation	*Objective*	*Relevance*
Reglamento de la Ley de Aguas Nacionales (Regulations of the National Waters Act) *http://www.diputados.gob.mx/LeyesBiblio/regley/Reg_LAN_250814.pdf*	The are the regulations relating to the National Waters Act.	Sets out specific and detailed regulations to the provisions of the Act governing wastewater discharges.
Reglamento Interior de la SEMARNAT (Internal Regulation of the Secretary of Environment and Natural Resources) DOF, 26 November 2012 *http://dof.gob.mx/nota_detalle.php?codigo=5366662&fecha=31/10/2014*	Establishes the agency's administrative structure and its distribution of powers.	Sets out the powers of SEMARNAT, including PROFEPA, in the area of wastewater discharges and the jurisdiction of these agencies over the regulation and control thereof.
Reglamento Interior de la Comisión Nacional del Agua (Internal Regulations of the National Waters Commission) DOF, 30 November 2006 *http://www.diputados.gob.mx/LeyesBiblio/regla/n28.pdf*	Establishes the administrative structure of CONAGUA, a decentralized body of SEMARNAT, and specifies its internal distribution of powers.	Establishes the division of jurisdiction over the regulation and control of wastewater discharges.
Reglamento de la LGEEPA en materia de Evaluación del Impacto Ambiental (Environmental Impact Regulations of the Mexican Environmental Protection Act) DOF, 30 May 2000; latest revision, DOF, 31 October 2014 *http://www.profepa.gob.mx/innovaportal/file/1155/1/reglamento_de_la_lgeepa_en_materia_de_evaluacion_del_impacto_ambiental.pdf*	Specifies the parties requiring prior environmental impact approval from SEMARNAT.	Establishes that wastewater treatment plants discharging liquids or sludge into bodies of water that constitute national property must have prior environmental impact approval from SEMARNAT.

Source: Authors.

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Table VI. Official Mexican Standards Applicable to Wastewater

Federal		
Standard	*Objective*	*Relevance*
NOM-001-SEMARNAT-1996 NOM-001-ECOL-1996 DOF, 6 June 1997 *http://www.semarnat.gob.mx/leyes-y-normas/nom-agua*	Establishes maximum permissible limits on pollutants in wastewater discharges into national waters and property.	Establishes the maximum permissible limits on pollutants in wastewater discharges into national waters and property in order to protect their quality and make their various uses possible. Compliance is mandatory for persons responsible for such discharges. This standard does not apply to water discharges from drains separated from rainwater.
NOM-002-SEMARNAT-1996 DOF, 3 June 1998 *http://www.semarnat.gob.mx/leyes-y-normas/nom-agua*	Establishes maximum permissible limits on pollutants in wastewater discharged into urban or municipal sewer systems.	Establishes the maximum permissible limits on pollutants in wastewater discharged into urban or municipal sewer systems in order to prevent and control the pollution of national waters and property as well as to protect the infrastructure of such systems. Compliance is compulsory for persons responsible for such discharges. The standard does not apply to discharges of domestic wastewater, stormwater, or industry-generated wastewater that is routed through a separate drainage system than the process wastewater.
NOM-003-SEMARNAT-1997 NOM-003-ECOL-1997 DOF, 21 September 1998 *http://www.semarnat.gob.mx/leyes-y-normas/nom-agua*	Establishes maximum permissible limits on pollutant levels in treated wastewater reused by public utilities.	Designed to protect the environment and public health; compliance is compulsory for public entities responsible for wastewater treatment and reuse. Where the utility is under the responsibility of a third party, that party is responsible for compliance with the standard from the point of production of treated water to its reuse or delivery, including the piping or transportation thereof.

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Federal		
Standard	*Objective*	*Relevance*
NOM-014-CONAGUA-2003 DOF, 18 August 2009 *http://www.semarnat.gob.mx/leyes-y-normas/nom-agua*	Establishes requirements regarding the artificial recharging of aquifers with treated wastewater.	Establishes requirements in terms of the operation, monitoring, and water quality of artificial systems used in the recharging of aquifers with treated wastewater.

Source: Authors.

Table VII. Federal Environmental Policy Instruments

Regulation	*Objective*	*Relevance*
Plan Nacional de Desarrollo 2019-2024 (National Development Plan 2019-2024) DOF, 12 July 2019 *https://www.dof.gob.mx/nota_detalle.php?codigo=5565599&fecha=12/07/2019*	Its goal is to transform the country's public life in order to achieve inclusive development.	Theme 2. Welfare: Item 2.5.8. Pollution control Issue to be considered: water and sanitation.
Programa Nacional Hídrico 2019-2024 (National Water Program 2019-2024) (executive order) *https://www.gob.mx/cms/uploads/attachment/file/527601/Decreto_PNH_final.pdf*	Guarantees the human right to water and sanitation, especially for the most vulnerable population. Water should be used efficiently to promote sustainable development. Improve water governance conditions.	Document not available for review.

Source: Authors.

Table VIII. BCS State Provisions Applicable to Wastewater

State		
Law	*Objective*	*Relevance*
Constitución Política del Estado de Baja California Sur (BCS State Constitution) Boletín Oficial del Gobierno del Estado (BOGE), 15 January 1975; latest revision, BOGE, 31 December 2017 *http://www.cbcs.gob.mx/index.php/cmply/1486-constitucion-politica-bcs*	Establishes the rights and duties of the state's inhabitants, and defines the various powers of the state government and the division of jurisdiction. Lays the foundation for the state government to promote economic and social development with the assurance that	Establishes the right of all people of access to, as well as the disposal and treatment of, sufficient quantities of clean water for personal and domestic consumption, in an acceptable form and at an affordable cost. The state government guarantees this right and the law must establish the bases,

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State		
Law	*Objective*	*Relevance*
	it is to be comprehensive and sustainable.	assistance, and modalities for the equitable and sustainable access to, and use of, water resources, with the participation of the Federation, the state government, and the municipalities, as well as the citizenry, in the achievement of these ends. Establishes the powers and obligations of the municipal councils, including those related to the public drinking water supply, drainage, sewage and wastewater treatment and disposal functions and services.
Ley de Equilibrio Ecológico y Protección del Ambiente del Estado de Baja California Sur (BCS State Environmental Protection Act) BOGE, 30 November 1991; latest revision, BOGE, 31 October 2016 *http://www.cbcs.gob.mx/index.php/cmply/1508-ley-proteccion-ambiente-bcs*	Enacted in furtherance of the BCS State Constitution regarding the preservation and restoration of the ecological equilibrium and the protection of the environment. Its goal is to establish such principles, standards, and activities, *inter alia*, as are necessary, to determine the best methods for ecosystem preservation, restoration, and improvement as well as the prevention and control of the contamination of natural resources, such as the atmosphere, water, and soil.	Establishes the powers of the state government in preventing and controlling the pollution of waters under its jurisdiction, promoting wastewater treatment and reuse, verifying compliance with the technical environmental standards on wastewater dumping into drainage and sewage systems, and approving wastewater discharges into drainage and sewage systems. Chapter III covers the prevention and control of water pollution.
Ley de Aguas de Baja California Sur (BCS Waters Act) BOGE, 31 July 2001; latest revision, BOGE, 31 October 2016 *http://www.ordenjuridico.gob.mx/Estatal/BAJA%20CALIFORNIA%20SUR/Leyes/BCSLEY03.pdf*	Regulates the participation of the state and municipal authorities, within the scope of their jurisdictions, relating to the operation, desalination, use, and enjoyment of water, the provision of public drinking water, as well as sewer and water treatment services.	This law regulates the water supply, sewer, and water treatment systems; the State Water Commission; public drinking water, sewer, and water treatment services; the organization, operation, and powers of the municipal and intermunicipal water and sewer authorities; the participation of the social and private sectors in the delivery of public drinking water, sewer, and water treatment services; the recovery of expenses and costs of

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State		
Law	*Objective*	*Relevance*
		investment, operation, conservation, and connection fees; and, the maintenance of drinking water, desalination, sewer, and water treatment systems.
Ley de Derechos y Productos del Estado de Baja California Sur (BCS State Duties and Proceeds Act) BOGE, 31 December 2015; latest revision, BOGE, 20 December 2017 *http://www.cbcs.gob.mx/index.php/cmply/1501-ley-derechos-productos-bcs*	Establishes fees for the use or enjoyment of property in the public domain, as well as for the receipt of services provided by agencies and entities of the Executive Branch in the exercise of its public and private law functions.	Covers the services provided by the Secretary of Tourism, Economy, and Sustainability. Declares under the heading of "Environment and Ecology" that fees in an amount of 1,084.00 pesos shall be incurred and paid for the registration of wastewater discharge rights.
Programa Hídrico Regional Vision 2030 (Vision 2030 Regional Water Plan, Water Administration Region I-Baja California Peninsula) *www.conagua.gob.mx*	This plan describes the objectives, strategies, actions, and specific projects corresponding to each of the guiding principles of the region's 2030 Water Agenda.	Establishes guidelines to ensure appropriate access to quality drinking water, sewer, and water treatment services by the entire population, especially the most vulnerable population, and to secure, sufficient and timely financial resources for the implementation of the Regional Water Plan.
Plan Estatal de Desarrollo 2015-2021 (State Development Plan 2015-2021) Last updated 28 March 2016 *http://www.bcs.gob.mx/gobierno/ped-2015-2021/*	Outlines the current administration's vision, mission, and policy positions related to development.	Strategy IV, "Quality of Life", establishes sustainability as one of its strategies. Lines of action: alternative energy, water supply and accessibility. In response to increasing water demand, the government will provide for the construction of desalination plants. Proposed actions include the construction of additional drainage infrastructure and wastewater treatment plants.
Plan Hídrico Estatal 2015-2021 (State Water Plan 2015-2021) Last updated 19 February 2020 *http://cea.bcs.gob.mx/wp-content/uploads/2017/07/PHE-2015-2021-1.9.pdf*	The umbrella document regarding water-related public policy in BCS. One of its principal objectives is improving and increasing the levels of both water sanitation and wastewater reuse.	Establishes the actions that must be taken to increase the level of water sanitation in order to protect aquifers and coasts, and to prevent wastewater from being a source of contamination threatening human health.

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State		
Law	*Objective*	*Relevance*
Programa Estatal de Ordenamiento Territorial para BCS (State Land Use Program) *http://secfin.bcs.gob.mx/fnz/wp-content/themes/fnz_bcs/assets/images/transparencia/marco_program/programas2015-2021/Programa%20Estatal%20de%20Ordenamiento%20Territorial.pdf*	To promote the social, economic, and environmental development of the state through comprehensive and sustainable natural resource management and balanced land use, so as to contribute to the improvement of the quality of life of the population.	The Program states that untreated wastewater discharges are the main source of water contamination. It recognizes that the existing infrastructure is insufficient and that, in many cases, wastewater does not comply with the permissible levels set out in the Official Mexican Standards. To address these issues, the government will build and maintain wastewater treatment plants and reuse reclaimed water.

Source: Authors.

Table IX. Municipal Provisions Applicable to Wastewater

*Municipal**		
Provision	*Objective*	*Relevance*
Mulegé		
Ley de Hacienda para el Municipio de Mulegé, Baja California Sur (Mulegé Taxation Act) BOGE, 5 November 2001; latest revision, BOGE, 31 December 2012	Establishes the taxes, fees, proceeds, payments, remittances, and extraordinary revenues for the administrative expenses of the municipality.	Establishes penalties for wastewater discharges onto public roads, except as prescribed by law. Establishes the fees payable for the supply of water, as well as for drainage, sewer, and wastewater treatment and disposal services.
Plan de Desarrollo Municipal 2018-2021 (Municipal Development Plan 2018-2021) *http://www.mulege.gob.mx/informacion-general.html*	Defines the purposes and strategies for the municipal government to promote development, taking advantage of its natural, historical and touristic resources; identifies the needs of the population as an important consideration for purposes of proper planning.	Identifies wastewater as an issue for the municipality and specifies various lines of action for the immediate term, including commissioning a wastewater treatment plant in the town of Guerrero Negro.
Comondú		
Ley de Hacienda para el Municipio de Comondú del Estado de Baja California Sur (Comondú Taxation Act) BOGE, 5 November 2001; latest revision, BOGE, 31 December 2012	Establishes the taxes and fees payable for the provision of services.	Establishes the fees payable for the supply of water, as well as sewage and water treatment services.

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Municipal		
Provision	*Objective*	*Relevance*
Reglamento de Agua Potable, Alcantarillado y Saneamiento para el Municipio de Comondú (Comondú Water and Sewer Bylaws) BOGE, 30 November 2002	Regulates the provision of the supply of water, as well as sewage and water treatment services.	The municipality may provide public utility services through the Comondú Water and Sewer Authority, which is responsible for the treatment of wastewater generated by any systems under its responsibility prior to the discharge thereof into nationally owned bodies of water. Establishes the powers of the Water and Sewer Authority.
Reglamento de Ecología y Medio Ambiente del Municipio de Comondú (Bylaws on Ecology and the Environment for the Municipality of Comondú) BOGE, 31 August 2019	Regulates the preservation, restoration and conservation of ecological stability, as well as the protection of the environment.	Establishes provisions relating to the prevention and control of water pollution generated by waters discharged into drainage and sewage systems, or into the open air, by commercial or service activities within the municipal territory or on national waters placed under municipal responsibility. Covers the issuance of wastewater discharge approvals and the monitoring of compliance.
Loreto		
Ley de Hacienda para el Municipio de Loreto (Loreto Taxation Act) BOGE, 5 November 2001 Latest revision, 20 December 2017	Governs matters relating to revenues constituting the Municipal Public Treasury.	The owners or holders of land shall be obligated to pay the cooperation fees established for wastewater treatment and disposal.
Reglamento para la Protección al Ambiente y la Preservación Ecológica para el Municipio de Loreto, Baja California Sur (Loreto Environmental Protection Bylaws) BOGE, 31 December 2000	Establishes principles, standards and measures to ensure the preservation, protection, improvement, establishment and restoration of the environment, as well as its sustainable development; seeks the preservation, control, and mitigation of pollutants and their causes for the purpose of avoiding environmental impact and deterioration.	Chapter XIII covers the protection and reasonable use of water. Establishes the power of the municipal council to monitor and control the water pollution generated by municipal public utilities, to require those who discharge or seek to discharge wastewater into drainage and sewer systems to refrain from exceeding the maximum permissible levels, and to verify that they possess an installed treatment system.

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Municipal		
Provision	*Objective*	*Relevance*
Reglamento Interno del Organismo Operador del Sistema de Agua Potable, Drenaje, Alcantarillado, Tratamiento y Disposición de Aguas Residuales del Municipio de Loreto, Baja California Sur (Internal Regulations of the Loreto Water and Sewer Authority) BOGE, 20 March 2000	Establishes the various powers and responsibilities of the Loreto Water and Sewer Authority.	Establishes the powers of the Water and Sewer Authority.
Programa de Ordenamiento Ecológico Local (Local Environmental Zoning Plan) Proyecto 2013 *http://loreto.gob.mx/PDFs/gobierno/programa_de_ordenamiento_ecologico_local.pdf*	Establishes the activities that may be carried out within each specific zone as a function of their suitability for that zone, with reference to the various interested parties.	Provides for optimal wastewater management during preparation, construction and operation as a requirement for the granting of project permits. Provides that the municipal council is responsible for the treatment of residential wastewater, while the developers of residential, touristic and real estate projects are responsible for treating the wastewater generated by their projects or activities.
Plan Municipal de Desarrollo de Loreto 2018-2021 (Loreto Municipal Development Plan 2018-2021) *https://ayuntamiento.loretozac.mx/index.php/plan-de-desarrollo-municipal-loreto/*	Outlines the overall policy of the municipal government and lays the groundwork for the government's vision of the future, providing the necessary procedural mechanisms to achieve higher levels of public well-being and prosperity.	Establishes the objective of working toward the sustainable development of the municipality by taking measures to provide for the expansion of water coverage in rural areas.
La Paz		
Ley de Hacienda para el Municipio de La Paz, Baja California Sur (La Paz Taxation Act) BOGE, 31 March 2001; latest revision, BOGE, 10 December 2017	Establishes taxes, fees, proceeds, payments, remittances, and extraordinary revenues for the administrative expenses of the municipality.	Establishes the fees payable for the supply of water, drainage, sewer, and wastewater treatment and disposal services.
Reglamento de Protección al Medio Ambiente (Environmental Protection Bylaws) BOGE, 10 October 1995	Lays the foundation for the preservation, conservation and restoration of ecological equilibrium and for environmental improvement on the municipality's territory as well as for the prevention and control of water pollution.	Establishes the division of jurisdiction. Chapter 10 covers the prevention and control of water pollution and sets out provisions relating to wastewater discharges.

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Municipal		
Provision	*Objective*	*Relevance*
Reglamento de Uso de la Red de Alcantarillado Sanitario del OOMSAPAS La Paz (La Paz Sewer Use Bylaws) BOGE, 20 February 2007	To prevent and control water pollution, compliance by persons responsible for wastewater discharges into the sewer system is compulsory.	Governs wastewater discharges other than domestic discharges, as well as the particular conditions of discharge in accordance with the maximum permissible pollutant limits established in NOM-00 2-SEMARNAT-1996. Provides that La Paz Water and Sewer Authority, which has responsibility for the water supply, sewage system, and water treatment services is also responsible for enforcing this bylaw.
Programa de Desarrollo Urbano de Centro de Población de La Paz, BCS (La Paz Urban Development Program) Latest revision, 2018 *https://www.comovamoslapaz.org/wp-content/uploads/2018/07/PDUCP-La-Paz-2018.pdf*	Establishes mechanisms for the regulation, management and promotion of an integrated territorial planning scheme to assess the impacts of economic, touristic and urban development, and for the recovery and restoration of the region's historical heritage and natural environment.	Provides an overview of the wastewater regime and also the prevailing situation in the Municipality. Recognizes the potential problem of contamination due to wastewater and urban waste. Sets forth the strategy "Zero wastewaters to the sea" through the introduction of new water treatment plants, rehabilitation of existing plants, new collectors, replacement of sanitary sewer pipes, and also the generation of studies on resource sanitation and the areas where water is discharged.
Los Cabos		
Ley de Hacienda para el Municipio de Los Cabos, Baja California Sur (Los Cabos Taxation Act) BOGE, 5 November 2001; latest revision, BOGE, 20 December 2017	Governs the matters relating to the revenues that constitute the Municipal Public Treasury, consisting of the collection of taxes, fees, proceeds, and other revenues.	Establishes the fees payable for the supply of water, drainage, sewer, and wastewater treatment and disposal services. Establishes the obligation of property owners or occupants to pay wastewater treatment and disposal fees.
Reglamento Municipal del Equilibrio Ecológico y Protección al Ambiente	Governs the preservation and restoration of the ecological equilibrium as well as the pro-	Establishes the powers of the municipal council to supervise and enforce the provisions

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Municipal		
Provision	*Objective*	*Relevance*
(Municipal Environmental Protection Bylaws) BOGE, 20 May 2008	tection of the environment and the municipality's cultural heritage. Aims at improving environmental quality and the quality of life for the municipality's residents, and providing for the sustainable enjoyment of natural resources and their increase.	applicable to wastewater discharges into the sewer system. Title 2, Chapter 6 governs the prevention and control of water pollution arising from industrial and other activity.
Reglamento del Uso de la Red de Alcantarillado del Municipio de Los Cabos, Baja California Sur (Los Cabos Sewer Use Bylaws) BOGE, 31 May 2014 *https://aguapotabledeloscabos.gob.mx/leyes-y-reglamentos/*	Compliance with the provisions of this bylaw is mandatory in the municipality of Los Cabos for users discharging wastewater, and for both natural and legal persons who discharge wastewater into the municipal sewer system under the responsibility of the Los Cabos Water and Sewer Authority.	Guarantees the proper treatment of municipal wastewater and also the prevention of water and soil contamination through the regulation of wastewater discharges into the municipal sewer system, and specifies the appropriate conditions of discharge, in accordance with the maximum permissible limits for pollutants discharged into drainage systems under NOM-002-SEMARNAT-1996. Governs the treatment, management, reuse, and final disposal of wastewater processed by treatment plants operating in the municipality of Los Cabos, pursuant to NOM-001-SEMARNAT-1996 and NOM-003-SEMARNAT-1997.
Reglamento del Organismo Descentralizado Operador del Sistema de Agua Potable y Alcantarillado del Municipio de Los Cabos (Los Cabos Water and Sewer Authority Bylaws) 10 October 1996	Regulates the provision of drinking water and sewage services by the Water and Sewer Authority.	Sets out the Authority's duties and powers, which include providing, administering, and overseeing the water supply and sewer services. Establishes the objective of promoting the reuse of sewage and wastewater.
Plan de Desarrollo Municipal, Ayuntamiento de Los Cabos 2018-2021 (Los Cabos Municipal Development Plan 2018-2021)	Establishes projects, actions, and goals that should be undertaken to help guide the development of the municipal government's public policies.	States that wastewater discharges are the main source of contamination. Identifies the source points and establishes actions and policies designed to alleviate the problem.

* Available at: *http://www.ordenjuridico.gob.mx/estatal.php?liberado=si&edo=3*.

Source: Authors.

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After reviewing the tables above, one might conclude that there is an extensive legal framework in BCS governing the prevention of water pollution and the protection of its water resources. All three levels of government have indeed regulated wastewater within their spheres of jurisdiction, and all governmental agencies have been assigned various duties and responsibilities in relation to wastewater discharges and the control of both water and soil pollution. However, the legal framework for wastewater still remains at an early stage of development in the sense that it has focused primarily on preventing pollution by the granting of discharge permits for a fee, and using the pollutant limits set out in the Official Mexican Standards as the yardstick for such grants.

Despite this shortcoming, the plans, programs and public policies put in place by the three levels of government show that wastewater reduction and reuse have become priorities. The first step toward making reuse an enforceable obligation is for it to be clearly specified in federal, state, and local laws. But the continuing problems associated with the improper management of wastewater discharges show that legislation alone may be insufficient. Despite the existence of an extensive network of wastewater treatment regulations, water pollution is, in fact, on the rise. Thus, research on this issue must focus on the degree to which these statutory obligations are actually being enforced. To that end, wastewater-related laws must be analyzed to determine whether the negative impact on the environment and the nation's natural resources are being caused by shortcomings in the legislation itself, or by the improper administration and enforcement of the existing wastewater regulations.

4. *Dynamic Analysis*

The final step in our methodology is to analyze the legal framework outlined above with reference to four criteria: the law-making process (elaboration), interpretation, enforcement, and extinction of the law.[57]

Law-making process. This refers to the specific process by which laws, regulations, and standards are created. This rule of analysis is important because it determines which law takes precedence so that it can be applied by the relevant authorities to the regulated community. In Mexico, the federal Congress enacts federal and general laws;[58] state congresses pass state laws,[59] and city councils (*ayuntamientos*) adopt bylaws.[60] The Official Mexican Standards are drafted according to the process set out in the Federal Metrology and Stan-

[57] Carmona Lara, *supra* note 13, at 33.

[58] Constitución Política de los Estados Unidos Mexicanos [Const.], *supra* note 24, art. 73 frac. XXIX G, 133.

[59] Constitución Política del Estado de Baja California Sur [B.C.S State Constitution], as amended, Boletín Oficial del Gobierno del Estado de Baja California Sur [B.O.G.E.B.C.S.], 15 de enero de 1975 (Mex.). Art. 64 frac. II.

[60] Constitución Política de los Estados Unidos Mexicanos [Const.], *supra* note 24, art. 115 frac. II.

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dardization Act (*Ley Federal sobre Metrología y Normalización*), issued by the Federal Executive Branch, and are applicable throughout Mexico.[61]

The authority to enact legislation, monitor compliance, and enforce wastewater related regulations is determined by the Constitution, the Ecological Protection Law (LGEEPA), and the National Waters Act (*Ley de Aguas Nacionales*). These laws are then reinforced by state and municipal laws. Federal authorities are responsible for the protection and preservation of national waters. State authorities are responsible for the prevention and control of contamination to waters under state jurisdiction, as well as any national waters to which they have been assigned responsibility. Municipal authorities are responsible for the prevention and control of contamination to waters discharged into municipal sewer systems, and, again, any national waters placed under their authority.[62]

Interpretation. Each law typically specifies the rules for its own interpretation. However, Mexico's wastewater laws do not do so. As a result, interpretation of each law's meaning and scope must be derived from general rules of legal interpretation. Interpretation begins with any definitions set forth within the particular law itself that assist in its interpretation or the clarification of its key principles and concepts.[63] The consistently defined principles and concepts underlying wastewater regulations help to unify the overall legal framework, even though it is comprised of distinct federal, state, and municipal laws. Interpretation of the laws under examination in this study was facilitated by the tables presented above, which provide a comprehensive overview of all water-related regulations and simplify the analysis of the connections between them.

Enforcement. The first step in analyzing the enforcement of wastewater law is to determine which law applies in any specific case. In the case of BCS, this requires an understanding of the entire Mexican legal framework and its various levels, federal, state, and municipal, in order to determine which principles, rights, and obligations apply. As has been shown, BCS is subject to an extensive set of regulations concerning wastewater, yet the state continues to suffer from problems that inhibit sustainable development. Effective enforcement requires targeted government action, including the assignment of adequate budgets for enforcement authorities, the investigation of violations, the application of sanctions, training for inspectors, provisions for transparency, and access to information.[64] Also, clear procedures must be outlined that enable citizens to directly notify the appropriate authorities and thereby assist in the enforcement of the laws and the sanctioning of violators.

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[61] Ley Federal sobre Metrología y Normalización [L.F.M.N.] [Federal Metrology and Standardization Act] as amended, Diario Oficial de la Federación, 1 de julio de 1992 (Mex.). Last amended 30 de abril de 2009.

[62] *See* Articles 27 and 115 of the Const., Articles 5, 7, and 8 of the L.G.E.E.P.A., and articles 6 and 9 of the National Waters Act.

[63] *See* article 3 of the National Waters Law, and 3 of the L.G.E.E.P.A.

[64] Carmona Lara, *supra* note 13, at 41.

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In many respects, the manner in which legal and administrative powers have been divided among the three levels of government suggests that the intent was to establish joint responsibility among SEMARNAT, CONAGUA, the federal health authorities, and the state and municipal agencies regarding the enforcement of wastewater law. However, the specific functions and duties of each authority has not been clearly delineated, and this has led, ultimately, to a failure to act. Put simply, these shared responsibilities mean it is not always clear who does what when it comes to water-related policymaking and enforcement.

Extinction. The general rule states "The passage of a law repeals the previous law". Thus, to determine which law is currently in force, one must ascertain which amendment or revision of the law is the most recent. Federal laws are published in the Official Gazette of the Federation (*Diario Oficial de la Federación*), while BCS state laws appear in that state's Official Bulletin (*Boletín Oficial del Gobierno de Baja California Sur*). Even though the aforementioned rule may be simple, inconsistent procedures regarding the publication of revisions or amendments by the various levels of government has led to a situation in which many of these revisions or amendments, mostly at the state and municipal levels, are not, in fact, published or accessible. This means that it is often difficult to determine which law is currently in force, and is therefore of little use to citizens and other interested parties who could otherwise benefit by having access to accurate information. Nevertheless, the tables presented above contain an up-to-date listing of all wastewater-related laws that are currently in force in Mexico.

VI. Conclusions

This analysis and schematization of Mexico's legal framework regarding wastewater can be used as a guide by legislators, public servants, academics, and members of the general public who wish to obtain a better understanding of how it operates. As previously stated, it is not sufficient to analyze the federal provisions alone. Due to the overlapping jurisdictions of the different levels of government on this subject, state and municipal provisions must also be included in any analysis. To achieve a level of wastewater management compatible with environmental sustainability and protect the nation's water resources for current and future generations, the effectiveness of this legal framework must be maximized. This can only be accomplished after understanding how the entire integrated system of applicable laws and public policies functions, and then determining which laws need to be amended, and in what manner.

To help clarify the extensive and intricate legal framework involving wastewater in Mexico, and, in particular, to assess the compatibility of the various wastewater-related regulations existing at the federal, state, and municipal levels, we conducted a systematic analysis of this corpus. Further research can

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capitalize on this first step in order to evaluate the overall effectiveness of the current legal framework. Although much progress has been made in the implementation of laws and standards governing wastewater at the federal, state, and local levels, the critical water shortage in Mexico and in BCS —a water-stressed state anticipating a rapid increase in population and water demand— suggests a need for the development and implementation of new strategies for water conservation. At a minimum, such strategies should include vastly increasing the treatment and reuse of wastewater, and establishing strict water reclamation and recycling standards. These will only be achieved through the enactment of effective, targeted regulations and a strict enforcement regime.

The development of wastewater legislation is constantly evolving as specific problems become apparent. This development parallels a similar trend in environmental law in general. However, the aim of most current regulation is directed principally at the prevention of pollution. Under this approach, the generation, collection, treatment, reuse, and final disposal of wastewater are addressed by means of regulations dealing with discharge licenses and permits, various fees and duties, and the enforcement of official standards covering water quality. At the municipal level, the bylaws enacted typically limit their focus to the regulation of public services, such as water delivery and sanitation. Although the concept of wastewater reuse does appear in these regulations and has been incorporated into development and environmental plans and programs at various levels, it is not currently a legally enforceable obligation. A paradigm shift recognizing wastewater reuse as a possible solution to the issue of water scarcity will require amending federal, state, and municipal legislation, converting wastewater reuse into a legal obligation, and thereby placing it on an equal footing with wastewater treatment.

A new line of research is therefore needed on the effectiveness of the currently existing, incentives-based model encouraging wastewater reuse, and, on the benefits that a mandatory approach would require for it to be viable. In agricultural production, for example, wastewater is insufficiently regulated, and producers often find that absorbing fines is cheaper than treating wastewater. New legislative measures must eliminate these types of economic disincentives to conservation. In the short term, wastewater regulations should be amended to require the full treatment of wastewater so that it is brought up to a reusable standard. For this to occur, the law must cover the entire process, from generation to routing to treatment and reuse. However, given the fragmented legal framework currently in place in BCS, with each governmental authority being responsible for only a specific part of the wastewater process, any reuse regime would be rendered ineffective. This is a significant problem considering BCS is a region where, at present, only 58.3% of the wastewater collected through the state's sewer systems is being treated before being reused or returned to a body of water.

The enforcement apparatus of the current legal framework related to wastewater is another factor that must be analyzed in order to ascertain its

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effectiveness. As stated above, the existence of overlapping responsibilities has complicated the issue of enforcement. Resolution of this problem will require encouraging coordination among authorities at the various levels, providing adequate institutional funding, and specifically defining the roles played by each governmental agency.

The most significant obstacle to the completion of this study was locating and compiling the relevant information and legislation due to the fact that there is no uniformity among the five municipalities of BCS, and not all regulations and bylaws are available online. Municipal bylaws are particularly elusive: some do not exist in any accessible form, others are outdated, and still others have not been renewed since 2018. None of these provisions are included at the website of the federal Congress, and municipal sites are frequently out of date or offline altogether. An important first step in facilitating research and investigation in this area would be the creation of a straightforward and up-to-date online compilation of all municipal laws, one that is both publicly accessible and easy to navigate.

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