Key elements for establishing a Water Pollution Charging System for Belize based on the Polluter Pays Principle

Belize

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Content

Abbreviations

AOX	Adsorbable Organic Halides
BEF	Belgian Francs
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DKR	Danish Krone
DM	Deutsche Mark
ECA	European Court of Auditors
EU	European Union
GW	Groundwater
HFL	Holland Florin
ISO	International Organization for Standardization
NWC	National Water Commission
NRCA	Natural Resources Conservation Authority
OECD	Organization for Economic Cooperation and Development
PPP	Polluter Pays Principle
p.u.	pollution units
SW	Surface Water
SS	Suspended Solids
TSS	Total Suspended Solids
UN	United Nations
WWTP	Wastewater Treatment Plant
WFD	Water Framework Directive

1 Introduction

1.1 The Polluter Pays Principle (PPP)

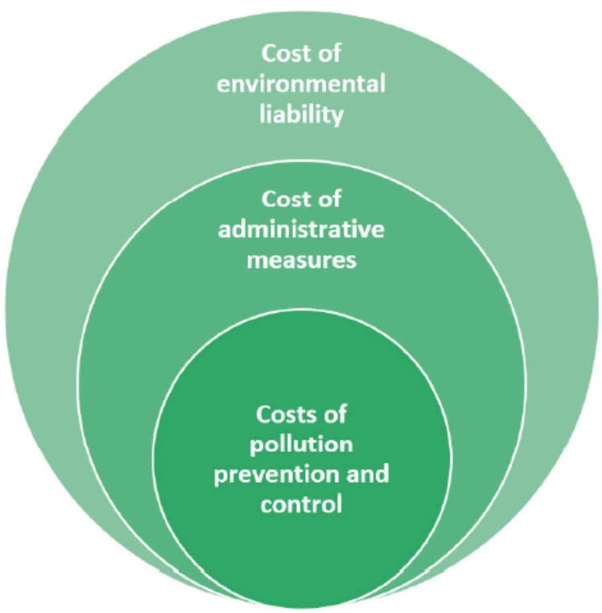
The Polluter Pays Principle (PPP) is an environmental policy principle which mandates that the expenses associated with pollution control and prevention ought to be borne by the entity responsible for the pollution. The principle holds that those who cause environmental harm should be financially responsible for remedying it.

The PPP was initially formulated in the early 1970s as part of the environmental regulations of the Organization for Economic Cooperation and Development (OECD). Its objective was to guide the allocation of pollution prevention and control costs between the government and the private sector (OECD, 1972). The principle was later internationally recognized and spread when it was included as one of the 27 guiding principles for sustainable development in the United Nations Declaration on Environment and Development (UN, 1992a). Additionally, it was adopted as one of the principles for Agenda 21 (UN, 1992b), and included as one of the principles of the Plan of Implementation of the 2002 World Summit on Sustainable Development (UN, 2002).

The polluter pays principle is a fundamental concept in all European environmental policies, including the EU Water Framework Directive (WFD), which outlines the financing requirements for water management in member states. The WFD stipulates that countries must ensure that the costs of water services, including environmental and resource expenses, are adequately recovered, taking into account the PPP. This approach enables policymakers to tackle pollution and rehabilitate the environment by holding polluters accountable for the harm they cause, incentivizing them to avoid environmental damage. Additionally, the polluter, not the taxpayer, is responsible for covering the costs associated with pollution, which is known as internalizing negative environmental externalities in economic terms (ECA, 2021).

The OECD's recommendations for the application of the principle of polluter pays have evolved over time, incorporating new areas of focus for environmental policies. Alongside the costs of pollution control and prevention, there is now also a suggestion to include administrative costs and environmental liability related to actions needed to deal with pollution already emitted. In practice, this means that polluters are responsible for paying for any environmental damage caused, regardless of whether the pollution generated is below the legally established limits.

Figure 1 - PPP scope for environmental policies (Source: ECA, 2021)



The incorporation of the polluter pays principle into a country's environmental policies can occur in three directions (ECA, 2021):

- **Command and control laws** can be used to reduce pollution at its source by establishing environmental standards, monitoring systems, and prohibitions of specific activities. This approach typically involves licensing procedures, bans, setting emission limit values, and implementing administrative orders and sanctions.

- **Voluntary approaches** are implemented to encourage less polluting processes and products. These approaches include voluntary agreements, the implementation of environmental management systems such as ISO 14001, and labeling initiatives.
- **Economic instruments** aim to achieve environmental targets and indicators in a flexible manner. This category includes financial incentives and disincentives used to influence the behavior of polluting institutions, such as subsidies, tariffs, taxes, charges, fees, and other similar mechanisms.

The PPP is a fundamental concept in economic instruments used for environmental management on a national level. It plays a pivotal role in environmental policies concerning the preservation of water resources, particularly regarding the implementation of **pollution taxes and charges for the discharge of wastewater**, whether treated or untreated, into water resources.

1.2 Economic instruments for water and wastewater management

Economic instruments for water and wastewater management are mechanisms that use economic incentives (positive or negative) to influence behaviors and decisions towards enhancing environmental protection. The most applied economic instruments in the water and wastewater sector are presented in Table 1.

Table 1[1] - Types of economic instruments used for water and wastewater services (Source: adapted from Mattheiß, Le mat, Strosser, 2009)

Type of instrument	Function/purpose	Examples
Water and wastewater tariffs	To generate funds for the operation of water supply, wastewater collection, and wastewater treatment.	Tariffs for water supply (user-pays principle), wastewater collection and treatment (PPP), tariffs for irrigation water (user-pays or PPP).
Environmental taxes	To internalise negative environmental impacts and influence behaviour, to collect financial resources for the central budget.	Tax on pollution discharge (PPP), water abstraction (user-pays principle), pesticide and nitrate use (PPP).
Environmental charges	To internalise negative environmental impacts and influence behaviour, to collect financial resources that are allocated to support environmentally friendly practices and projects	Charge on pollution discharge (PPP), water abstraction (user-pays principle), pesticide and nitrate use (PPP).

Water supply tariffs are commonly used as the primary economic instrument for managing water quantity, but their levels and structures vary significantly across countries and regions, leading to varying levels of effectiveness in promoting sustainable water use and cost recovery. Similarly, water abstraction taxes and charges are widely implemented, but their levels differ depending on the water source and user type. Since both water supply and abstraction costs mainly focus on the user, they usually do not include pollution costs. In such cases, the User-Pays Principle serves as a reference point (OECD, 2022).

On the other hand, water quality management and economic instruments to reduce polluting discharges usually rely on the Polluter Pays Principle (PPP) as a reference (OECD, 2022). In these cases, a range of instruments are typically developed for

[1] The list only includes the most common instruments, such as tariffs, taxes and charges, therefore excluding subsidies and other instruments that may be established in this approach (e.g. voluntary agreements).

controlling pollution from point sources and diffuse sources. Tariffs for wastewater services and effluent discharge charges or taxes are often used for point sources. Sanitation companies charge tariffs for wastewater services, which include the collection and treatment of wastewater discharged into the sewer system. Charges and taxes for effluent discharge, also known as **Water Pollution Taxes and Charges**, are implemented to mitigate the adverse effects of effluents on water bodies. Point source pollution charges are part of the environmental policies of 19 EU countries, which account for 70% of member states (OECD, 2022).

As for the diffuse sources of pollution, they primarily originate from agriculture and households, posing a significant challenge in applying economic instruments. Complex procedures are involved in monitoring and regulating this type of pollution due to four key factors that need to be overcome. Firstly, measuring the discharge of pollutants at the individual polluter level is difficult, requiring consideration of unique characteristics such as effluents, soil type, and the receiving water body. Secondly, diffuse pollution exhibits high variability in impacts over time and space, making it challenging to regulate. Thirdly, managing a large number of polluters incurs high costs. Finally, implementing a system involving numerous catchments and jurisdictions requires a variety of agreements and institutional arrangements (OECD, 2022; OECD, 2016; Mattheiß; Strosser, 2009).

Diffuse pollution poses a common issue for many countries in developing charging mechanisms, with only three (Denmark, France, and Sweden) out of 27 EU member states having implemented this type of charging in the form of taxes that are additionally charged to farmers for the use of both nitrates (fertilizers) and pesticides (OECD, 2022). In these countries, the charging of fertilizers and pesticides is part of a national policy for regulating these products, where the governments set a maximum pollution limit per hectare of land, depending on the crop, and the excess applied is charged directly to farmers.

2 Water pollution tax and charging systems for point-source polluters

2.1 General operation of existing systems

The PPP holds that those who discharge wastewater into water resources must bear the environmental and social costs associated with their actions. To enforce this principle, local or national governments often impose pollution charges on point-source polluters, such as Wastewater Treatment Plants (WWTPs) and industrial dischargers, to cover the expenses resulting from their activities. This approach encourages industries with high pollution loads to adopt cleaner production methods or invest in efficient effluent treatment processes, while incentivizing WWTPs to maintain low pollution levels.

Generally, governments impose pollution charges on wastewater discharge with three primary objectives (Kramer; Post, w/y):

- **Implementing economic incentive for water conservation and pollution prevention**, since charging polluters for the negative impact of their wastewater load can encourage them to improve their processes, whether by upgrading their effluent treatment facilities or refining their industrial processes. To ensure effectiveness, it is crucial to set charges that are representative of the actual costs involved but not so high as to render them economically unfeasible.
- **Raise revenues and recover costs**, while facilitating the financing of infrastructure for the sector services or remedying actions to reduce the environmental damage caused. Pollution charges are the main source of funding for Water Agencies in many European countries, which use them to operate management systems, to implement improvements in infrastructure, and to

cover costs related to sector management.

Figure 2 - Allocation of revenues from water pollution charges within the EU Member States (Source: OECD, 2022 based on ECA, 2021)

Revenues go to		EU Member States														
Financing water management (or environment)	SW	BG	EE	DE	FR	LT	LU	PL	PT	SK	CZ	LV	NL	RO	HR	BE
	GW															
General State budget	SW	HU*	LT	DK	LV	NL										
	GW															
Regional, local or municipal budgets	SW															
	GW	CZ														
No information/ unclear/ several uses		ES	SI													

Notes: SW Surface Water

GW Groundwater

- **Awareness raising and economic efficiency**: in terms of awareness, the charge can educate polluters about the true cost of wastewater discharge, considering the environmental and social impacts. Regarding economic efficiency, wastewater discharge prices should reflect all the financial, environmental, and other costs that consumers' water use, and wastewater production impose on the system and the economy.

Various types of charging systems are implemented to tackle the pollution caused by wastewater discharge (Table 2). Thus, the mechanisms implemented in each country differ in terms of how the charge is calculated, who is responsible for charging it and how it occurs, which discharges are charged for, and how the revenues obtained are allocated within the country's water framework.

Table 2 - Overview of existing water pollution charge systems, having as a criterion of relevance the availability of information on their operation (Source: compiled from relevant cases compiled by European Parliament (2001), Kramer; Post (w/y); NRCA (2013); and OECD (2016))

Country	Calculation unit	Object of charge	Allocation of revenues
Belgium	Pollution units and their composition	Direct discharges and indirect discharges	Revenue is used to finance investments in sewerage infrastructure, and water protection policy.
Denmark	Composition of pollution	Direct discharges	Overall budget, and partially – independent Water Fund (used to protect groundwater)
France	Composition of pollution and user type	Direct and indirect discharges	Revenue from pollution fees is used for "water policy": - water pollution control measures - water management (policy) of the 6 water agencies.
Germany	Pollution units and their composition	Direct discharges	The revenue is used to recover the costs of regulatory activities, and for measures to improve water quality (especially financing of WWTPs).
Jamaica	There is no single unit. The calculation is performed from several variables.	Direct discharges	Revenues generated from the wastewater discharge fee are allocated to the National Water Commission (NWC) Wastewater Management Program, which is responsible for the maintenance and upgrading of the country's wastewater infrastructure.
Netherlands	Pollution units and their composition	Direct and indirect discharges	Quality management of local and state waters (also financing WWTPs).
Spain	Pollution units and their composition	Direct discharges	Revenue is used to protect and improve the aquatic environment and to finance municipal WWTPs.
England	There is no single unit. The calculation is	Direct discharges	Cost recovery to finance regulation of permits by Environment Agency.

Country	Calculation unit	Object of charge	Allocation of revenues
	performed from several variables.		

Typically, charges are based on the amount of pollution, which is calculated using specific chemical and biological parameters, such as biological oxygen demand (BOD), phosphorus, nitrogen, heavy metals, etc (Kramer; Post, w/y; OECD, 2016). For some countries, this means charging values separately for each of these parameters, while for others the charge is made after converting the pollution potential of each parameter into a single unit, a **pollution unit**.

Regarding which effluents are subject to charge, some mechanisms only consider direct discharges, which are the ones performed directly into water resources. In contrast, other countries include indirect discharges in the charging when the polluter discharges into the sewage system, which is transported to a Wastewater Treatment Plant (WWTP). When defining the object of charge, it's important to consider other charging systems within the country's environmental framework (European Parliament, 2001). For example, it may not make sense to charge for indirect discharges if the tariff paid for wastewater collection by sanitation companies already includes this service.

Ultimately, the revenue allocation resulting from pollution charges may be directed towards environmental institutions in either the water sector or in a more general sense, at national or local levels. These funds may be used to cover the costs of operating services or financing measures within the sector. In some cases, as in Germany, part of the value can go to investment funds that, under certain conditions, can be accessed by polluters to improve their processes and treatment systems.

2.2 Who is responsible for collecting the charges?

Effluent charges can be collected by national, regional, or local authorities. Typically, the same authorities that grant discharge permits are responsible for collecting the charges, although sometimes different divisions within these authorities, such as taxation departments, may be involved. In some countries, the responsibility for collecting charges depends on factors such as the type of discharger, the size of the treatment plant, or the type of receiving water body.

In countries like England and Jamaica, the central environmental authorities such as the Environment Agency for England and the National Water Commission (NWC) for Jamaica collect the charges, while regional and local offices handle this task in Denmark and Germany. In Belgium, the authorities responsible for collecting effluent charges vary by region: the regional Ministry (*Ministère de la Région wallonne*) in the Walloon Region, the Flemish Environment Agency in the Flemish Region, and the water utilities in the Brussels Region (European Parliament, 2001).

In France, municipalities (or concessionaires in cases of delegation) collect pollution fees from households via water bills, while the Water Agencies collect the pollution levy from industry. In Spain, the Drainage Basin Authorities are responsible for collecting effluent discharge charges (European Parliament, 2001).

In the Netherlands, a unique division of responsibilities exists based on the type of receiving water body. The Office for Pollution Taxes State Waters collects effluent charges for discharges into state waters, while polluters discharging into local waters pay their charges to the Water Boards (European Parliament, 2001).

2.3 To whom is payment mandatory? What are the exceptions?

As discussed in Table 2, the definition of which effluent discharges will be considered in pollution charges also varies from country to country. Discharges can be classified as direct, when the disposal is directly to the water body, or indirect, when the discharge is to the sewerage network.

In Denmark, Germany, Jamaica, and Spain, pollution charges are only applied to direct discharges. Examples of direct discharges from point-source polluters are:

- Industrial effluents;
- Discharges from agriculture;
- Discharges from WWTPs;
- Discharges from effluents and percolation from landfills;
- Discharges from decentralized treatment facilities;

These systems have provisions for exemptions of certain types of effluents (Table 3) (European Parliament, 2001). In Denmark, for instance, mussel plant discharges, fish farm discharges, and combined sewage overflow and stormwater discharges are exempted from the charge. In Germany, no effluent charge is imposed on rainwater from industrial plants that do not exceed three hectares in size. Rainwater from railways is also exempted from the charge.

The effluent discharge charging systems in Belgium, France, and the Netherlands use the same economic instrument in charging for both direct and indirect discharges. Indirect industrial and household discharges into the public sewerage system are included in the charging system. Municipalities with fewer than 400 inhabitants are exempt from the effluent charge. In Belgium and France, effluents from WWTPs into natural waters are exempt from the charge, while in the Netherlands, the WWTPs only pay 10% of the industrial rate. In England, the system charges only apply to direct discharges subject to licensing.

Table 3 - Mandatory payment and exceptions for the Water pollution tax and charging systems (Source: European Parliament (2001))

Country	Mandatory payment	Exceptions
Belgium	Direct and indirect industrial discharges.	Direct discharges from municipal WWTPs.
Denmark	All direct dischargers, including municipal WWTPs, industrial dischargers, and units not connected to sewer system.	Discharges of rainwater and stormwater. Mussel plants and fish farms, if the source of water supply and the receiver are identical.
France	All discharges to surface waters and sewers are subject to the charge, which includes households (water bills), industry and agriculture. Non-domestic dischargers (large industries) are charged for direct discharges, and households are charged indirectly – water utilities pay the charge and pass them on to the client.	Effluent charges from municipal WWTPs. Municipalities < 400 inhabitants.
Germany	All direct discharges into natural waters (including groundwater): industrial and municipal WWTPs discharges, rainwater, agricultural discharges, minor effluent releases, and domestic facilities.	Water that has not been changed in character by use. Water used for mining and discharged into artificial waters. Discharge of rainwater under certain conditions.
Jamaica	Direct discharges to water bodies (including groundwater) from industrial and municipal WWTPs discharges, and agricultural discharges.	Effluents from households and stormwater.
Netherlands	Industrial and municipal WWTPs discharges, agricultural discharges, effluents and leakage from landfills, minor effluent releases and domestic facilities. Municipal WWTPs only pay 10% of the tariff when	There are no exceptions.

Country	Mandatory payment	Exceptions
	compared to the industry ones.	
Spain	Direct discharges to surface waters, including industrial discharges and discharges from Municipal WWTPs.	No information about it.
England	Industrial and municipal WWTPs discharges, agricultural discharges, effluents and leakage from landfills, minor effluent releases and domestic facilities, contaminated surface water runoff from commercial locations.	Discharges from sites with a low level of pollution potential, which are not subject to licensing.

2.4What methods are used to calculate the charges?

As discussed in Table 2, each country has its own approach to calculating its charges and taxes for water pollution. Table 4 presents some of the methods used to calculating these charges and taxes.

Table 4 - Methods of calculation for wastewater discharge charges (Source: European Parliament (2001))

Country	Pollution parameters	Calculation methods	Charging basis
Belgium	Volume, SS, BOD, COD, Ntot, Ptot, heavy metals.	It depends on the region. **Walloon Region**: T= b*CP. b = BEF 360 per p.u. (pollution unit) CP is calculated as the total number of pollution units discharged within a year: - either based on actual measurements of pollution parameters, or - estimated on the basis of coefficients (by sector). **Brussels-Capital Region**: The following equation applies to all direct and indirect industrial dischargers: T=a*Vr+b*CP. T is the resulting tax (effluent charge), Vr the volume, "a" the volumetric factor for the use of the public sewage system (a is zero for direct dischargers).	Based on actual parameter measurements (if analysed) – pollution load and measured water consumption (domestic and industrial).

Country	Pollution parameters	Calculation methods	Charging basis
		CP is the pollution charge calculated with measured parameters or estimated (for smaller companies). The factor b is a monetary unit to be paid for each CP. For households and small businesses, there are two methods to calculate the effluent charge ('taxe'), depending on the number of pollution units: 1. Below a threshold of: a) 20 mill. p.u. for indirect discharges, and b) 50 mill. p.u. for direct discharges the CP is calculated from the estimated water consumption (based on a fixed pollution load). 2. Above this threshold, the charge CP is calculated according to the water parameters analyzed. **Flemish Region** Based on measurements (discharge volume, discharge contents), or on conversion coefficients.	
Denmark	BOD, Ntot, Ptot.	Based on discharge volume and contents: DKR 20 (€ 2.67) per kg Ntot, DKR 110 (€ 14.67) per kg Ptot, DKR 11 (€ 1.47) per kg BOD5. These rates apply to any effluent discharged into any type of natural water.	Major dischargers pay on basis of measured values of discharged solids (concentration x consumption measured). Minor dischargers (e.g., households) pay on basis of standard rates (water consumption).

Country	Pollution parameters	Calculation methods	Charging basis
France	SS, BOD, COD, Ntot, Ptot, inhibiting substances, organic matter, soluble salts, fish toxicity, oxidised N, reduced, N, AOX, heavy metals.	Effluent charge level differs between regions (6 water agencies) **Industry**: based on quantity and quality of effluent. **Discharges to municipal sewerage system**: (indirect industrial discharges) based on volume of discharge. **Households**: standard pollution loads * persons + flat rate.	Based on actual (physico-chemical) parameters measured (industry), measured water consumption (domestic wastewater).
Germany	Volume, COD, P, N, AOX, heavy metals, fish toxicity.	Based on the 'toxicity' (**Schädlichkeit**) of effluent expressed as **pollution units (p.u.)** – 1.5 p.u. reflects approx. the 'toxicity' of the untreated wastewater of one inhabitant per year. Rate per p.u.: 1981: DM 12 (€ 6.14), until 1985 annual increase of DM 6 (€ 3.07) 1986: DM 40 (€ 20.45), 1991: DM 50 (€ 25.56), 1993: DM 60 (€ 30.68), and since 1997: DM 70 (€ 35.79).	Based on values specified in the discharge permit.
Jamaica	BOD, COD, Total N, Total P, Oil and grease, TSS, Total heavy metals (AS, Cd, Cr, Cu, Pb, Hg, Se, Zn), Faecal coliform.	The discharge fee (DF) is charged based on 4 variables: (**MI**) monitoring and inspection fee; (**B**) base discharge fee; (**f**) receptor weighting factor; (**U**) discount for beneficial use: DF= M.I. + B (1+f) – U - MI is a value determined by the environmental agency, which reflects its scheduled costs for the field visits that will be carried out to the WWTP for 5	Based on values specified in the discharge permit.

Country	Pollution parameters	Calculation methods	Charging basis
		years. Each year the polluter is charged one fifth of this amount. - B is the load for each pollutant multiplied by the per kilogram discharge fee rate summed. Each pollutant has a predefined fee. Some examples are: BOD_5 (300 J$/ton); Total N and Total P (500 J$/ton); Total heavy metals (3,000 J$/ton). - f is the Receptor Weighting Factor, which is predefined for five classes: open sea (0); enclosed water bodies (0.8); sensitive marine waters (0.7); surface water (0.5); ground water (0.3). - U is the discount due to the reduction in the volume of water discharged when there is a beneficial use of the effluent, for example for irrigation. In this case, the polluter must prove it with monitoring and must have a Nutrient Management Plan.	
Netherlands	COD, N-Kj, PO4-P, heavy metals, sulphate, chloride.	Charges are based on pollution units (p.u.), varying between water boards (1997: HFL 65 to 135, € 29.50 to 61.26). The average rate (1999) for discharges into regional water is approximately HFL 86 (€ 39.03). For discharges into state waters the rate (1999) is HFL 70 (€ 31.76). **Small dischargers** (<5 inhabitant equivalents) are charged a fixed sum: 1 to 3 population equivalents. **Medium dischargers** (5 – 1000 inhabitant equivalents) are assessed using a coefficient table, based on quantity of water used. **Large dischargers** (>1000 inhabitant equivalent): based on pollution actually measured.	

Country	Pollution parameters	Calculation methods	Charging basis
Spain	No data.	Charge is € 3,01 per p.u. Pollution load (in p.u.) depends on origin of discharge (urban or industrial), differentiated by groups.	Based on pollution content of the effluent (p.u.).
England	Depend on composition of effluent according to charging schemes.	Annual charge (T) based on permitted discharge volume, discharge contents, receiving waters and a financial factor. T= A*B*CD A: volume factor (0.3 - 14) B: contents factor (0.3 - 14) C: receiving water factor (0.5-1.5) D: financial factor (set charge, £ 477, € 772 in 1999). These factors vary according to very broad categories and have no incentive function.	Based on values specified in the discharge permit.

Effluent charges are calculated based on certain **pollution parameters** in most countries (Belgium, Denmark, Germany, Jamaica, France, Spain, and the Netherlands). These parameters typically include COD and BOD_5, nutrients (nitrogen and phosphorous), heavy metals, suspended solids, and discharge volume, with additional parameters used in some countries, such as AOX (Germany, France, England), suspended solids - SS (Belgium, France, England), toxicity (Germany, France, England), sulphates and chloride (France, the Netherlands) (European Parliament, 2001).

In Germany, nitrogen and phosphorous were added to the list of pollutants in 1998 to encourage the reduction of pollution in the North and Baltic Seas. This was achieved by increasing the unit rate and strengthening requirements for tertiary plants. Denmark has also included heavy metals in their charging system (European Parliament, 2001).

Meanwhile, the system used in the England only considers the types of pollutants in the effluent, regardless of their quantities (European Parliament, 2001).

For **calculation methods**, most of the countries use a simple equation, which is a function of a charge rate and discharged pollution units. The calculation of pollution units for an effluent varies between countries and is determined by a specific equation. These equations rely on the measured quantities of different pollution parameters in the effluent (e.g., in kg), as well as the loads indicated in the discharge permit. Estimations are used for small discharges.

The charge for water pollution in Germany is a uniform DM 70 (€ 35.79) per p.u. across the entire country. In contrast, the rate in France varies between the six regional water agencies and varies based on the size of the urban area. The Netherlands has a flat rate of HFL 70 (€ 31.76) for state waters, while the rates for discharges into regional waters differ between water boards and are typically higher than for state waters (HFL 86 (€ 39.03) on average in 1999). In Denmark and Jamaica, fees are charged for each pollution parameter rather than a unified pollution unit.

The calculation method in England and Jamaica differs from that of other countries analyzed, as it does not solely consider the absolute value of discharged pollution. Instead, it considers various factors, such as the effluent type, the receiving water body, and the financial factor (European Parliament, 2001).

There are two main types of **charging basis** used to assess charges for water pollution. In Germany, Jamaica, and England, charges are determined based on the values specified in permits, licenses, or authorizations. This means that even if the polluter discharges less than the allowed amount, they will still be required to pay the full permit. However, if the amount discharged exceeds the permit, additional charges will apply.

In Germany, polluters may be eligible for a **reduction in charges** if they consistently release below their permit, and they request a reduction of their allowed values[2]. In Jamaica, polluters can claim a reduction in their fees based on the reduction in the volume of effluent discharged, if part of it is being used for beneficial environmental uses, such as reuse in agriculture. For this, a Nutrient Management Plan is needed, and a monitoring plan, being possible the reduction only for BOD, nitrogen, and phosphorus.

In contrast, in other countries such as Belgium, Denmark, Spain, France, and the Netherlands, charges are calculated based on actual measurements obtained through self-monitoring and compliance monitoring. In Belgium, Denmark, and the Netherlands standard rates or estimates are used for small discharges.

[2] More information about this in the topic "Further discussion on the German Effluent Tax Act (*Abwasserabgabengesetz - ABwAG*)".

3 Proposal for the Water Pollution Charging System in Belize

3.1 Justification for Exploring the Polluter Pays Principle in Belize

By imposing pollution charges on point-source polluters such as Wastewater Treatment Plants (WWTPs) and industrial dischargers, Belize can ensure that those who discharge wastewater into water resources bear the environmental and social costs associated with their actions. This approach provides a strong incentive for industries with high pollution loads to adopt cleaner production methods and invest in efficient effluent treatment processes. Simultaneously, it encourages WWTPs to maintain low pollution levels, contributing to the overall preservation of water resources.

By implementing this principle, Belize can hold polluters accountable for the harm they cause, promote sustainable practices, and allocate the financial burden of pollution control and prevention to the responsible parties. Ultimately, the PPP will contribute to the preservation of Belize's natural environment, generate revenue for the Revolving Fund for funding improvements in WWTPs and support the country's long-term sustainability goals.

Given the general information on how the PPP is applied to pollution charging systems, and how these systems operate in some countries around the world, this section presents the consultant recommendations for implementing a version in Belize.

The proposed system for potential implementation in Belize draws on experiences from around the world, with a particular focus on the German system, which the consultants consider sufficiently simplified to be a first experience, despite its operational effectiveness. The German system has been in place since 1976 and has yielded various regulatory and environmental benefits for the country.

Therefore, the German system is presented in greater detail, followed by recommendations that should be considered in designing a specific pollution charging system for Belize.

3.2 Further discussion on the German Effluent Tax Act (*Abwasserabgabengesetz - ABwAG*)

The water pollution reduction policy in Germany is founded on three key legal instruments (Rákosi; Ungvári, 2011):

- Discharge Permits (Federal Water Act, implemented in 1957)
- **Effluent Tax (Effluent Tax Act; implemented in 1976)**
- Discharge limits and technological standards (Wastewater Ordinance; implemented in 1997)

Although the three mechanisms complement each other, the Effluent Tax Act (*Abwasserabgabengesetz*, AbwAG) is the primary instrument that governs the implementation of the collection mechanism, in line with the Polluter Pays Principle.

General description

According to the AbwAG, those who discharge wastewater to water bodies [3] are legally required to bear a portion of the costs associated with the use of water resources. This is achieved by paying for the point source discharge of treated wastewater into a water body. It should be emphasized that the payment of effluent taxes does not absolve the responsibility of treating wastewater.

[3] German legislation does not include discharge into the sewage system, in which case the industry or household is exempt from paying the tax. Although these indirect discharges are not subject to regulation, sewage tariffs imposed by municipalities and other public operators of sewerage systems enable pollution charges to be passed on to indirect emitters.

In Germany, all discharges require a permit, which may be granted temporarily or permanently and can be revoked if concerns arise regarding water protection and management. **The effluent tax is based on these permits rather than on actual measurements**. The tax is calculated based on the quantity and level of harmfulness of the substances discharged, which is measured in **pollution units** (in german *Schadeinheiten*, or SE), and is intended to create financial incentives for reducing wastewater emissions as much as possible. (Rákosi; Ungvári, 2001; Kramer; Post, w/y).

The revenues generated from this tax are designated for investments in water quality programs by the Federal States of Germany (*Länder*), such as the establishment of municipal wastewater treatment facilities and the implementation of water quality improvement programs. This tax plays a significant role in motivating improvements in water quality.

Impacts of the water pollution policy mix

The effluent tax in Germany, along with the other policy instruments, has been highly effective in achieving its intended goals. While it cannot be evaluated in isolation, it is clear that the policy mix has led to a reduction of pollutants discharged into waterways by 4% overall, with private emitters reducing their discharges by 18%. Toxicity of effluents also decreased substantially, with mercury discharges from industrial sources being reduced by 99% from 1987 to 2003-2005, and by 65% from municipal treatment plants. Furthermore, nitrogen discharges from point sources were reduced by 76% in 2003-2005 compared to the baseline of 1987 (Rákosi & Ungvári, 2011).

There has also been a significant increase in the quality of water bodies, with 65% of surface water bodies achieving water quality II status. Although the concrete objective of achieving water quality II status for all water bodies by 1985 was not achieved, wastewater treatment plants were upgraded to the state of the art, with 92.6% of effluents undergoing tertiary treatment in Germany in 2007, making it a leader in advanced wastewater treatment compared to other Western European countries

(Rákosi & Ungvári, 2011).

Industries, such as the paper and chemical industries, have developed processes and invested in effluent abatement measures, resulting in considerably reduced discharge of pollutants. The effluent charge has also contributed significantly to capacity building in water management administration. Finally, the polluter pays principle was successfully implemented, ensuring that the costs of mitigating, eliminating, and balancing damage to water bodies were distributed among the polluters (Rákosi & Ungvári, 2011).

Calculation of the effluent tax

The calculation of the effluent tax is based on the amount and toxicity of the substances discharged, measured in pollution units. The effluent tax is determined by multiplying the number of pollution units by the current tax rate per pollution unit, which is **EUR 35.79 as of January 1, 2002**. This rate has been gradually increased over the years to allow polluters to adapt to the new requirements.

The amount of pollution units is calculated by multiplying the volume of wastewater discharged by the concentration of each pollutant defined in the WWTP permit or license. The concentration of each pollutant is then multiplied by a factor that reflects its toxicity (Table 5), and the results are added together to obtain the total number of pollution units. The calculation method ensures that polluters pay in proportion to the amount and toxicity of the pollutants they discharge (Federal Republic of Germany, 2005; Kramer; Post, w/y). Section 3.3 presents a calculation example with the German equation.

Table 5 - Conversion of each parameter to pollution unit (p.u) (Source: Federal Republic of Germany, 2005)

Parameters	Amount that corresponds to 1 Pollution Unit (PU)
COD	1 p.u. = 50 [kg] O2

Parameters	Amount that corresponds to 1 Pollution Unit (PU)
Phosphorus	1 p.u. = 3 [kg] P
Nitrogen	1 p.u. = 25 [kg] N
Halogen compounds as adsorbable organic halogen compounds (AOX)	1 p.u. = 2 [kg] AOX, Halogen as organic chlorine
Metals and their compounds: Mercury Cadmium Chromium Nickel Lead Copper	 1 p.u. = 20 [g] Hg 1 p.u. = 100 [g] Cd 1 p.u. = 500 [g] Cr 1 p.u. = 500 [g] Ni 1 p.u. = 500 [g] Pb 1 p.u. = 1.000 [g] Cu
Toxicity to fish	3000 cubic meters of wastewater divided by the dilution factor GF, by which wastewater is no longer toxic to fish

Reductions and offsets

There are several ways in which polluters can reduce their tax costs, including:

1. If industries and municipal WWTPs (excluding small discharges) meet the permit values in 80% of their monitoring samples (4 out of 5), **they can receive a 50% reduction in taxes**. This is a change from the previous rate of 75% before 1998.
2. **Polluters can make a self-declaration and request a reduction in their permits** since taxes are calculated based on the WWTP permit. This can result in a reduction of the amounts to be paid.
3. Dischargers can **offset the costs of pollution control equipment investments** against their taxes. In practice, if a WWTP is upgraded, built, or expanded, or its operation is structurally improved to permanently reduce the load of one of the assessed pollutants by at least 20%, these implemented

measures can be compensated by the total tax due for this discharge in the three years prior to the planning and implementation of the measure. If the tax has already been paid, there will be a corresponding refund claim, but it will not be subject to interest. However, if the measures have not been put into operation or if the 20% reduction has not been achieved, the amounts due must be paid normally. **It is not possible to use this "investment fund" model if the detected value has exceeded the allowable amount by more than 200%.**

Extra charges

If the permitted quantity or concentration of a discharge is exceeded, the tax applied to the exceeded parameter will be proportionally adjusted. For instance, if the COD allowance for a WWTP is 1000kgCOD/day, but the discharge reaches 2000kgCOD/day, the pollution units for COD will be charged double the amount specified in the permit, while the original tax for other parameters will remain the same. It is important to note that the pollution tax (or charge, in other countries) is a way to internalize the externalities associated with discharged pollution. Therefore, additional fines may be imposed by the country if a polluter exceeds the permissible limits of their permit. In the case of Germany, there is also an additional fine for non-compliance (Rákosi; Ungvári, 2011).

3.3 Example of charging calculation (using the German model)

This section presents an illustrative calculation of the pollution charge for a hypothetical wastewater treatment plant, utilizing the German model as a reference.

Suppose this hypothetical plant has specified permissible values for its operating license, such as COD (Chemical Oxygen Demand) at 90 mg/L, Ntot (Total Nitrogen) at

18 mg/L, and Ptot (Total Phosphorus) at 2 mg/L. Moreover, the plant's flow rate is continuously monitored, with a recorded value of 5,475,000 m^3/year.

From this, the annual load of each parameter could be calculated:

$$\text{COD: } 5{,}475{,}000 \frac{m^3}{year} * 90 \frac{mg}{L} = \mathbf{492{,}750\ kg/year}$$

$$\text{Ntot: } 5{,}475{,}000 \frac{m^3}{year} * 18 \frac{mg}{L} = \mathbf{98{,}550\ kg/year}$$

$$\text{Ptot: } 5{,}475{,}000 \frac{m^3}{year} * 2 \frac{mg}{L} = \mathbf{10{,}950\ kg/year}$$

The loads are subsequently converted into pollution units (p.u.), while also considering the toxicity of each parameter:

$$\text{COD: } \frac{492{,}750\ kg/year}{50\ kg\ /\ p.u.} = \mathbf{9{,}455\ p.u.\ /\ year}$$

$$\text{Ntot: } \frac{98{,}550\ kg/year}{25\ kg\ /\ p.u.} = \mathbf{3{,}942\ p.u.\ /\ year}$$

$$\text{Ptot: } \frac{10{,}950\ kg/year}{3\ kg\ /\ p.u.} = \mathbf{3{,}650\ p.u.\ /\ year}$$

Thus, the sum of annual pollution units is **17,047 p.u**.

Once the total pollution units for the year (in this case, 17,047 p.u.) have been determined, the pollution charge rate (which amounts to **35.79 €/p.u**.) can be applied:

- 17,447 [p.u/year] * 35.79 [€] = **624,428.13** [€/year].

If the polluter has complied with 80% of the samples below the values permitted by its license, it will receive a 50% discount (currently established in Germany). However, let's perform the calculation assuming a 75% discount (previously used in Germany):

- 624,428.13 [€/year] * 0.35 = **156,107.03 [€/year]**.

If the polluter has exceeded the COD parameter by 200%, the amount to be paid will be adjusted proportionally for this parameter. In this scenario, instead of 9,455 p.u., the polluter would have emitted 18,910 p.u. in the year, and the new calculation will result in a payment of **977,138.58 [€/a]** for the applicable pollution charge.

3.4Estimated charging rate for Belize

As previously discussed, the cost of the charge for water pollution should be significant enough to motivate polluters to make improvements from a financial standpoint, but not so high as to render their operations financially unviable. To gain a better understanding of how this principle is applied in practice, the European Parliament (2001) conducted a study on the textile finishing industry in several countries, with the main findings presented in Table 6.

The term "total effluent costs" refers to the combined expenses required for effluent treatment and the water pollution charge. Therefore, the final column of the table is of particular interest, as it displays the percentage of total revenue that these total effluent costs represent for the companies.

The only case where it was possible to calculate the percentage of total effluent costs relative to company revenue was in Germany, where it was found to be 2.7%. Based on these findings, the European Parliament (2001) concluded that implementing charges close to this value would have a financial impact that would not significantly harm companies' competitiveness in the market.

Table 6 - Percentage of the effluent charge in the total effluent costs (Source: European Parliament (2001))

Country	Effluent charge (€ per m³)	Effluent costs (€ per m³)	Percentage of the effluent charge in the total effluent costs (%)	Total effluent costs as percentage of total revenue (%)
Germany	0.03	1.18	2.5	2.7
Netherlands	0.06	0.71	8.5	-
England	0.03	0.93	3.2	-

The consultants used the ratio of total effluent costs to total revenue found in Germany of 2.7% to perform a simulation for a charge rate for Belize, whose results are presented in Table 7. For this simulation, they considered a company with a total revenue of 10 million euros, a net profit of 10% (1 million euros), and effluent treatment costs of 175 thousand euros.

Based on the results presented in the table, it was concluded that a reference for defining the charging rate in Belize could be that the **effluent charge represents 1% of the average total revenue of a polluting company in the country**. This value of 1% means that the relationship between total effluent costs and total revenue will be around 2.8%, a value close to the German reference of 2.7%. It is worth noting that if the company's samples comply with the license requirements, there will be a 75% discount applied, resulting in a new charge/total revenue ratio of 0.25% and a total effluent costs/total revenue ratio of 2%.

Table 7 - Simulation of effluent costs to define an effluent discharge charging rate for Belize.

	More than 20% of samples above the permit	80% of the samples below the permit
Total revenue	10,000,000	10,000,000
Net profit	1,000,000	1,000,000
Effluent treatment costs	175,000,00	175,000,00
Effluent discharge charge	100,000,00	25,000,00 (75% discount)
Total effluent costs	275,000,00	200,000,00
Total effluent costs / total revenue	2.8%	2.0%
Effluent discharge charge / net profit	10.0%	2.5%
Effluent discharge charge / total revenue	1.00%	0.25%

To arrive at a recommended charge rate in BZ$/p.u., further calculations are required. Based on the suggested reference that the Belizean charge rate should be 1% of the effluent discharge charge/total revenue ratio, it is necessary to perform simulations that relate the total revenue of typical industries in Belize to their typical load discharged by their plant. This is further explained in Chapter 4.

4 Recommendations and strategy for implementing the system in Belize

It is recommended that the charging system in Belize be based on the German model, with adjustments made to accommodate the unique circumstances of the country. Table 8 outlines specific recommendations, and for further details, please refer to the relevant sections in this report.

Table 8 - Suggestions for implementing the system in Belize.

Institutional arrangements
• The administration of pollution charges should be integrated into an **integrated regulatory system**, which includes maximum allowable values, penalties for non-compliance, and other related measures. • In order to ensure the success of the charging system, it is recommended to establish an efficient support system for **measurement and inspections**. • If the charges have a significant impact on domestic municipal WWTPs, policy instruments can be incorporated into the **policy mix to ensure that the additional costs are borne by the original polluters**, the households. • It is recommended to dedicate efforts to the **social communication** process to clearly **explain the charging process to polluters, moving away from fines**, and to civil society, emphasizing its principles and the use of the revenues collected.
General charging system operation
• It is recommended that charges only apply **to direct discharges**, which are discharges to water bodies, and not to the sewer system. • **Exception clauses are important** to protect polluters who may face significant financial difficulties due to the charges and should be adapted to the Belizean context. For example,

households, stormwater, and small unlicensed industries may be excluded from the charges.

- It is recommended that the **parameter concentration** used to calculate the charges align with those of the German and Jamaican models, meaning that **the charge is based on permit or license concentration values** rather than actual discharge values. While using the licensed flow for initial calculations may be suitable, it is advised that this eventually progress to measured flows to recognize beneficial practices such as the reuse of effluents in agriculture.
- It is recommended that the **revenue from charges be allocated to a fund for environmental improvement measures**, thus also contributing to public support for charges.

Charging calculation

- Regarding the equation used to calculate the charge, it is recommended to use the same approach as the German model, which involves multiplying the variable "**pollution unit**" by the load established in the permit (provided the permit requirements are met). The pollution units established in the German model are a good starting point as they effectively reflect the impacts of each parameter.
- **For the equations**, it is recommended to adopt the same approach as the German model, which is simpler than the Jamaican one, when calculating the discharge fee (DF). This involves multiplying the total number of pollution units (PU) by a Belizean charge rate:

$$DF\left[\frac{BZ\$}{y}\right] = \sum PU\,[\frac{p.u}{year}] * Charge\ Rate[\frac{BZ\$}{p.u.}]$$

To calculate the total pollution units (PU), it is necessary to convert the load (B) of each parameter (i), using the conversion factors (Table 5).

$$\sum_i PU[\frac{p.u}{year}] = B_i\left[\frac{kg}{year}\right] / \ Conversion\ Factor\left[\frac{kg}{p.u.}\right]$$

- It is recommended to **start charging for basic pollutants**, such as COD, nitrogen, and phosphorus. Over time, new pollutants can be added.
- Pollution charge rates should be set at levels high enough to encourage industries and municipal WWTPs to spend sufficient money on pollution reduction to meet the permits, while maintaining affordable values that do not make the core business of industries unfeasible. It is recommended to apply charges that represent around **1% of the company's**

total revenue. Calculations to set a rate based on a pollution unit can be made considering this percentage, applying it to a group of typical industries in Belize, considering their revenues and permits.

- It is recommended **to define charge rates with progressive increases over the years**, as done in Germany, which allows polluters to adjust their technological processes in a planned manner. The amount to be charged should result from negotiations between public administrators, polluters, and civil society.
- After a few years, and once polluters have fully assimilated the system, it may be possible to implement **weighting factors** related to the type of water body where the effluent is discharged, based on the Jamaican model (Table 4).

Discounts, offsets, and extra charges

- It is recommended to provide a discount, based on the German model, for those who remain below the permitted values. **A discount of either 75% or 50% can be adopted**.
- It is recommended to adopt **the German self-declaration model**, that is, making it possible for polluters to voluntarily lower their permit values and have even more cumulative discounts.
- It is recommended to adopt the **German offset model**, giving to the polluters access to the investment fund once they commit to reducing their discharges through operational or structural improvements. As in the reference model, we suggest that this access to the fund be limited to the polluter exceeding the permit value by a **maximum of 200%.**
- In cases where the industry cannot afford to pay for necessary improvements and access the fund, an **additional offset system** is suggested: Belizean industries may write improvement projects for their WWTPs, which must be executed within five years. In this situation, the industry may be exempt from paying the fee during this period and instead use the owed amount (or a portion of it) as a budget, on the condition that they can demonstrate a minimum reduction in pollution by the end of the five-year period.
- If the permit is not met, we suggest the German model for **extra charge:** recalculate the charge value using the load discharged by the polluter.

To facilitate the successful implementation of the aforementioned recommendations, Annex 1 offers a spreadsheet designed for conducting simulations of the polluter pays charges. This tool enables the testing of various Charging Rates expressed in Belizean Dollars per pollution unit, allowing for the identification of the most suitable conditions for Belize.

It is important to note that the spreadsheet does not provide an exact calculation of the charge to be paid since this would require individual calculations for each sample rather than relying on annual averages. Nevertheless, its purpose is to enable the manipulation of the Charging Rate, allowing for an assessment of its impact on the revenue of the companies involved.

The spreadsheet includes three illustrative examples, considering an initial charge of 80 BZ$/p.u.: one for a wastewater treatment plant (WWTP), one for a brewery, and another for a dairy facility. These simulations have proven valuable in understanding the differential effects of the charge on each entity. Notably, when analyzing the last indicator (Effluent discharge charge/revenue), it became evident that the WWTP would experience a more significant impact due to the volume of effluent it generates. Conversely, the brewery industry would face minimal consequences if it complies with the Belizean Guidelines (0.07%); however, the impact would escalate considerably if they fail to treat their wastewater adequately (e.g., COD = 3500 mg/L). This observation is intriguing as it incentivizes the brewery industry to remain below the maximum allowable values. The same principle applies to the dairy industry.

By employing this spreadsheet tool, the Department of the Environment (DOE) can conduct tests with precise industry-specific data (e.g. data from licensed distilleries and breweries) and arrive at a more appropriate charging rate. It serves as an initial framework for conducting simulations, with the intention of facilitating the determination of more accurate values.

It is important to note that this study serves as an introductory overview and offers preliminary recommendations for the implementation of the polluter

pays principle. However, it is essential to emphasize that the findings have not been discussed with the relevant stakeholders and that specific calculations have to be conducted. Therefore, it is of utmost importance to engage in meaningful discussions and exchange ideas with the key stakeholders representing the various sectors to obtain their opinions, perceptions, and inputs. This collaborative approach will enable to develop a model that aligns with the specific vision and requirements of Belize.

5 References

Barberán, R., & Arbués, F. (2009). Equity in Domestic Water Rates Design. Water Resources Management, 23(10), 2101-2118. https://doi.org/10.1007/s11269-008-9372-3

ECA - European Court of Auditors. (2021). The Polluter Pays Principle: Inconsistent application across EU environmental policies and actions. Retrieved from https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=58811

European Parliament. (2001). Effluent Charging Systems in the EU Member States. Directorate-General for Research: Environmental, Science, and Public Health Policies. (DG-4-ENVI 104 EN).

Federal Republic of Germany. (2005). Abwasserabgabengesetz (AbwAG). Retrieved from http://www.gesetze-im-internet.de/abwag/ Germany.

Interwies, E. (2009). Ökonomische Aspekte der Stillgewässer in der Wasserrahmenrichtlinie. Presentation, Radolfszell, Germany. http://www.globalnature.org/bausteine.net/file/showfile.aspx?downdaid=6891&sp=D&domid=1011&fd=2

Kramer, A., & Post, J. (n.d.). Economic Instruments in Wastewater Management. Adelphi Research. Project funded by the European Union.

Mattheiß, V., Le Mat, O., & Strosser, P. (2009). Which role for economic instruments in the management of water resources in Europe? Economic instruments in water management in Europe. ACTeon.

Nash, J.R. (2000). Too Much Market? Conflict between Tradable Pollution Allowances and the “Polluter Pays” Principle. Harvard Law Review, 24, 465-535.

NRCA. (2013). Natural Resources Conservation Authority act – Wastewater and Sludge Regulations. National Environment and Planning Agency, Jamaica. https://www.fao.org/faolex/results/details/en/c/LEX-FAOC127460

OECD. (1972). Recommendation of the Council on Guiding Principles concerning International Aspects of Economic Policies. Organization for Economic Cooperation and Development, Paris.

OECD. (2016). Improving Economic Instruments for Water Resources Management in the Republic of Buryatia (Lake Baikal Basin). OECD Publishing, Paris. https://doi.org/10.1787/9789264266452-en.

OECD. (2002). The Polluter-Pays Principle as it relates to International Trade. COM/ENV/TD (2001) 44/FINAL. Organization for Economic Cooperation and Development, Paris.

OECD. (2022). The implementation of the Polluter Pays Principle. Organization for Economic Cooperation and Development, Paris.

Pinto, F. S., & Marques, R. C. (2015a). Tariff recommendations: A Panacea for the Portuguese water sector? Utilities Policy, 34, 36–44. https://doi.org/10.1016/j.jup.2014.12.003.

Pinto, F. S., & Marques, R. C. (2015b). Tariff structures for water and sanitation urban households: a primer. Water Policy, 17(6), 1108–1126. https://doi.org/10.2166/wp.2015.188.

Rákosi, J., & Ungvári, G. (2011). Evaluating economic policy instruments for sustainable water management in Europe: WP3 EX-POST Case studies, Water load fee, Hungary. https://doi.org/10.13140/RG.2.1.2315.2167.

United Nations. (1992a). Declaration on environment and development. New York: United Nations. Retrieved from http://www.un.org/documents/ga/conf151/aconf15126-1annex1

United Nations. (1992b). Agenda 21. New York: United Nations. Retrieved from http://www.un.org/esa/sustdev/documents/agenda21

United Nations. (2002). Johannesburg plan of implementation. New York: United Nations. Retrieved from http://www.un.org/esa/sustdev/documents/WSSD [July 2008]

6 Annexes

The developed spreadsheet is available for download at the following link:

https://1drv.ms/x/s!Aj3S7mGmckuHhkJFLU0dGW0HXpTQ?e=K7Iaae

The PowerPoint presentation made about the PPP is available at:

https://1drv.ms/p/s!Aj3S7mGmckuHhkMHRV0aos08eFOZ?e=sUUsXK

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