Escaping the "Polluter Pays" Trap: Financing Wastewater Treatment on the Tijuana-San Diego Border

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Building and operating transboundary environmental facilities requires dividing the cost of pollution prevention between bordering states. When cost-burden questions arise, the solution often suggested is the "polluter pays principle" (PPP). However, when political and economic relations between neighboring countries are asymmetrical other cost-burden principles are often adopted. Given the discrepancy between theory and practice, the aim of this study is to identify some of the available cost-burden principles and to examine when they might replace the PPP. The pollution-prevention regime along the San Diego/Tijuana border, and its cost-burden evolution, over the 20th century is offered as a case study. It was found that under asymmetrical relations there are several competing cost-burden principles that include the polluter pays, the beneficiary pays and the ability to pay. In addition, there are mixed systems that combine these principles. Some principles are adopted since they are perceived, by some, to be fair while others are adopted since they are perceived to provide effective wastewater treatment. The ones that are likely to be effective are those that offset, to some degree, existing asymmetries. This explains why the PPP was replaced in the San Diego/Tijuana case with other cost-burden principles that better offset the asymmetries in power, willingness and ability to pay for wastewater treatment and operational capacities. Thus, they provided better wastewater treatment than the PPP. It is not sufficient for a cost-burden principle to be fair and politically feasible; it also has to offset, at least in part, existing asymmetries. Otherwise the regime set will not be environmentally viable.

Key words: transboundary; wastewater; polluter pays

1. Introduction

An important element in the management of wastewater infrastructure is the manner in which wastewater facilities are funded. Lack of financial resources has often resulted in the inability to build wastewater plants (*World Health Organization, 2004; United Nations, 2004).* Even in cases where a pollution regime has been established, wastewater treatment facilities may not function adequately due to lack of funds needed to properly operate and maintain the facility (*Sanchez, 1995)*. The funding of such facilities is especially challenging when wastewater infrastructure is required to treat transboundary effluents. Funding in these cases requires dividing the cost between the countries that are responsible for the pollution problem and those adversely affected by it.

When the cost-sharing question arises, the solution often suggested is the "polluter pays principle" (PPP) (*Tobey and Smets, 1996*; *Atkinson, 2000*; *Franck, 1995*; *Nash, 2000*; *Hird, 1993*). Indeed, many international organizations have endorsed the PPP. Among them is the Organization for Economic Cooperation and Development *(hereafter OECD 2002),* the European Union[1] and NAFTA (*Fernandez, 2004*; *Tobey and Smets, 1996*). The PPP has also been incorporated in a number of international agreements[2] and mentioned in several protocols and programs, such as the 1992 Rio de Janeiro Declaration *(1992),* Agenda 21 and the 2002 World Summit on Sustainable Development Implementation Plan (*OECD, 2002).*

However, an examination of transboundary wastewater pollution regimes, including successful ones, reveals that, in fact, cost-sharing arrangements other than PPP are often adopted instead. And even when the PPP is applied, the ability of the regime to adequately resolve the pollution problem is unclear. This is especially so when dramatic political and economic asymmetries exist between the countries involved. Such was the case of the negotiations over regulating the Rhine River pollution during the 60-70s that had to confront asymmetries in the willingness to pay for pollution control between Germany and France, the upstream riparians, and their downstream neighbor, the Netherlands. The Netherlands' adherence to the PPP resulted in decades of negotiation deadlock.

[1] The PPP is one of the basic principles of the EU environmental policy (*Martin, 1994*). In addition, the EU recently approved the Environmental Liability Directive that is based on the PPP.

[2] For example, the Convention of the Protection of the Marine Environment of the Baltic Sea Area, the Convention of on the Protection of the Alps and the Protocol on Water and Health.

An agreement was reached only when an alternate cost-sharing formula was identified and adopted (*Bernauer, 1995*).

Given the discrepancy between theory and practice, the aim of this study is to identify some available cost-burden principles and to examine when they might replace the PPP. The paper hypothesis that implementing the PPP often **ignores** the asymmetries between the countries involved in power, their willingness and ability to pay for wastewater treatment and asymmetries in operational capacities. As a result, the PPP's ability to provide adequate wastewater treatment is hampered. In response, neighboring countries sometimes supplement or replace the PPP with other cost-burden arrangements that help to **offset** the existing asymmetries, thereby creating a more politically feasible and environmentally effective pollution control regime. Among these alternative principles are "the beneficiary pays the difference" and "equal division of the cost burden" of wastewater treatment.

To examine the hypothesis the study focuses on the cost-sharing evolution, and its underlying reasons, of the pollution abaitment regime along the twin border cities, Tijuana and San Diego. Interviews were conducted with the key players involved in the case history and the contemporary attempts to regulate the pollution along this border are also examined. In addition, many primary historical documents were reviewed over a period of fourth years, including the negotiations transcripts, as they appear in the US Congressional Records and in the personal files of Manuel Ybarra, the retired Secretary of the US section of the International Boundary and Water Commission (IBWC).

The difficulties and the partial success in stopping Tijuana from polluting the river have been studied from various perspectives. Among them is the influence of the boundary on the willingness of Mexico and the US to act (*Kelly, 1994*); the effect of interests, linkages and uncertainties on the regime formation and effectiveness (*Marty, 2001*; *Salazar. 1999*); and the role of place and scale in the Tijuana/San Diego boundary water quality process (*Michel, 2000*; *Brown, 1998*). In addition, several studies address the US/Mexico border innovations, including the new financing boundary institutions and their shortcomings (*Mumme and Nalven, 1988*; *Mumme and More, 1999*; *Carter 1999*; *Killgore and Eaton, 1995*). However, the evolution of the choice of the cost-burden principles and their underlying reasons have been largely overlooked. In particular, the extent to which the

cost-burden principles were used to offset the asymmetrical relations between the US and Mexico and its impact on the effectiveness of pollution control regime have not yet been explored. Such a study will provide policy makers with tradeoff options when seeking effective cost-burden arrangements for controlling transboundary wastewater pollution.

The paper begins with a brief review of the potential barriers to adopting the PPP. Section two discusses the Tijuana/San Diego case study itself. It outlines the existing border asymmetries, then it shows how the adoption of a regime based on the PPP ignored many of these asymmetries, as well as its adverse implications. Finally, it explores the replacement of the PPP with other options. Section three identifies and discusses the range of choices for cost-burden principles, their effect on asymmetries and their underlying reasons. The final section explores the relationship between the specifics of this case and general features of policy reforms.

2. The barriers to adopting the PPP

The PPP is a normative doctrine, which means that the polluter should be the one to bear the cost of measures to prevent and control pollution. The PPP is assumed to provide economic effectiveness and environmental sustainability by internalizing the entire costs of production and consumption into markets prices. Thereby, the PPP both reduces distortions in the process of products entering into international and internalize environmental externalities (*OECD, 2002, Rio Declaration, 1992*). The PPP was also presented in the last decade as the equitable and fair way for appropriating the cost of pollution abatement (*Franck, 1995*; *Nash, 2000*; *McLoughlin and Bellinger, 1993*).

Yet, the PPP was found to be difficult to implement; this failing was often attributed to the political process. For example, *Tobey and Smets*, 1996, while studying agricultural subsidies in the European Union (EU), noticed that the existing institutional arrangements, which in industrial countries endow agricultural producers with the right to pollute, complicate the applicability of the PPP to agriculture. Thus, the result is a 'weak' PPP, which often requires the government to pay for pollution prevention beyond what is consistent with this principle. Several factors were identified as contributing to the political process of not implementing the PPP. Among them is the difficulty to prove specific injury and causality (*Franck, 1995*), especially in dealing with non-point pollution sources and the strong agricultural lobby. For example, *Seymour et al. (1992)*, in their study on the

PPP's applicability to nitrate pollution in water in the UK, highlight the uncertainty concerning the causes of nitrate leaching that restricts the adoption of the PPP.

Others have stressed the legal ambiguity of the PPP that complicates its applicability. *Aickin (1987*) pointed out that the lack of legal clarity over how much, for what and when the polluter should pay has complicated the implementation of the theory of enterprise liability under which the manufacturer should provide safe products, or else pay for the cost of injury to the consumers. Another example is the discord over the interpretation of the PPP with respect to the use of environmental subsidies in different economic sectors, which raised the need for developing an alternative principle that would be accepted by all sides (*Stevens, 1994*). In addition, disputes may arise concerning the appropriate process to be used to determine how the polluter should pay, i.e., through compensation, pollution prevention, etc. Indeed, many oppose the PPP interpretation that allows the polluter to pay (as long as he compensates the victim) because it disregards future generations (*Franck, 1995*).

Inspired from Rawls theory of justice and fairness (*Rawls, 1958, 1971*), another perspective for why PPP is not adopted is rooted in the debate of what cost-burden principle is fair and equitable *(Bromley, 1997*; *McLoughlin and Bellinger, 1993*). The PPP may allow us to use the resource most efficiently, but may also result in an inequitable distribution of the cost burden. Thus, their will be a need to chose a principle among a variety of fairness principles (some based upon equality, proportionality and even impartial criteria) that brings distributive justice. Indeed, *Rose et al. (1998*) in their study on rules for distributing tradable carbon dioxide emission permits outlined several competing cost-burden equity criteria (in addition to the PPP), some based on welfare economics or inherent rights and others on fairness of the process or its outcome. Hence, in the environment area often a compromise is struck between the PPP and differentiations principles such as ability to pay (*Loefstedt, 1993*). Yet, it seems that determining which of the principles is equitable and fair is not clear-cut since equity is often a function of who the recipients of justice are (*Dobson, 1998*). Thus, the outcome may be fair to a group of parties within a local or issue-specific context but unjust from a broader perspective (Albin, 2002).

Many experts have stressed that the reasons for the difficulty in implementing the PPP are keenly exacerbated when agreement for the cost allocation has to extend across international boundaries.

This is the case when dividing the cost of all global problems, be it climate change, ozone layer depletion, endangered species, or transboundary problems, such as acid rain and river pollution. This difficulty is rooted in the lack of relevant international laws and a central authority that can identify the polluter or mandate enforcement (*Knox, 2002*; *Kettlewell, 1992*), as well as a disagreement on property rights that state who has the right to pollute and who is entitled to a clean natural resource *(McKean, 1996; Barrett, 1996).* Thus, the outcome is likely to be bargaining over competing principles for the cost burden *(Franck, 1995*).

When the relations between neighboring countries are asymmetrical the bargaining over the competing cost-burden principles is especially complex (*Carraro, 1997, p. 1-8*; *Kettlewell, 1992*). It was already found that when there is a strong power asymmetry between nations, principles pertaining to justice or the existing international law are meaningless. This has been the case of the Israeli-Palestinian negotiations over water appropriation (Kinarti, 1999 in *Albin,2001*). Thus, the outcome in many cases is a deadlock in negotiations.

The next sections demonstrate that in this study it is not political feasibility, legal clarity or economic fairness that hinders the use of the PPP. Rather it is the inability of the PPP to address the existing asymmetrical between nations that may result in ineffective pollution regime. It is to this end that the cost-sharing evolution of the pollution prevention regime along the San Diego/Tijuana border is analyzed.

3. The San Diego/Tijuana cost-burden evolution

3.1 The San Diego/Tijuana case and its asymmetries

The San Diego/Tijuana border, dividing the developed and the developing worlds, exhibits several obvious asymmetries. The Tijuana River, which is 17 miles long and the basin is 1668 square miles in size, originates in Mexico about 11 miles southwest of the city of Tijuana. From there it flows northward through the city and subsequently crosses the US/Mexico boundary. In the US it flows for 5 miles before emptying into the Pacific Ocean **(fig 1).** This upstream-downstream geographical relation enables Tijuana to pollute the river without bearing the consequences of pollution. Furthermore, Mexican environmental policy has been traditionally overridden by development objectives. On the US side of the border, environmental regulation is not so closely pegged to

development policy. These differences in policy emphasis resulted in Mexican water quality standards that, until revised in 1988, were considerably lower than its neighbor's (*Mumme and Nalven 1988*). These factors set an asymmetrical willingness to pay for pollution control; it was often the US, needless to say, that sought transboundary pollution abatement (*Integrated Environmental Plan, 1991*).

Another dimension of asymmetries is in the ability of both sides to pay for pollution control. The Mexican federal government traditionally has not prioritized financial allocations for solving the border pollution, and Tijuana's pollution in particular (*Ybarra, 2004*). In addition, the Mexican distribution of funds is often a response to political and economic events which are largely unrelated to local needs (*Ingram et al, 1995 in Carter, 1999*). Mexico's overall ability, in fact, to raise revenues via state taxes and to collect user fees is very limited (*Carter, 1999*). In contrast, in the US the Environmental Protection Agency (EPA) established several grants programs[3] in order to financially support US states' efforts to build wastewater plants (*Melcer and Darche, 1993*). These factors, coupled with the general striking economic disparity between both nations, creates an asymmetry in the ability to pay for pollution control along the entire border (*Kantor, 1993*).

Other asymmetries relate to operational capacities to stop pollution. The Mexican wastewater treatment operation and maintenance practices are limited compare to those in the US (Friedkin, 1986). Between 1963-1986 the Mexican wastewater treatment works in Tijuana experienced 33 breakdowns (Friedkin, 1986). Many of these occurred because of Mexico's limited ability to enforce its environmental laws, regulations and plans, from pretreatment through the entire treatment process.

Finally, there is the striking power asymmetry between the two nations that can be reflected in the military, economic and diplomatic superiority of the US over Mexico.

Table 1 shows the different pollution control asymmetries between Tijuana and San Diego and their indicators.

[3] The EPA's construction grants program is the prime source of capital for wastewater treatment facilities. It was replaced with the Clean State Revolving Funds Program..

Pollution control asymmetries	Indicators	San Diego	Tijuana
Willingness to pay	Location	Downstream	Upstream
	Water quality standards	High	Low
Ability to pay	User fee collection	High	Low
	Economic capacities	High	Low
Operational capacities	Availability of technology	High	Low
	Ability to enforce pretreatment	High	Low
Power balance	Military, economic and political power	High	Low

Table 1: Pollution control asymmetries between San Diego and Tijuana

Next, the cost-burden evolution of the wastewater treatment initiatives between San Diego and Tijuana is presented. In particular, the adoption of the PPP, its failure to provide effective wastewater treatment through offsetting the existing asymmetries and its replacement with other principles that better address the asymmetries are outlined.

Figure 1: Location map and phases of wastewater infrastructure

3.2 Early cost-sharing regime

The first municipal wastewater system was a septic tank constructed in Tijuana in 1928 with a capacity to serve 500 inhabitants. Already in 1933 the system was overloaded, so the city expanded the facility to treat a population of 5000 (*Meyer, 1983*). Within a short while the system was again overloaded, and sewage became a problem in the Lower Tijuana River Valley (*Marty 2001*), fouling the stream and groundwater. Complaints flowed in from the US side of the border (*Duemling, 1980*). As a response to pressure from San Diego on the US federal officials a system that collected the partially treated sewage from the Mexican side of the border to its outfall in the US was constructed – fig 1, phase 1 (*Kelly, 1994*, p. 168). Most of the outfall capacity was for the 16,000 people now living in the city of Tijuana. The portion of the collection system within Mexico was funded by the Mexican Northern Territory of Baja California while the outfall and the other part of the project within the US were paid by the US Federal Public Works Administration (*Kelly, 1994*, p 176). This construction cost was divided on the basis of the expected benefits to the US and its superior ability to pay (*Ybarra, 2004*). Since Mexico had an interest in addressing the power asymmetry between both sides by being seen as an equal partner to the US, the Territory of Baja California and the County of San Diego shared equally the costs of the wastewater plant operation and maintenance (*Ybarra, 2004*).

After the first wastewater facility was built, in 1945 the US and Mexico signed a water treaty (1944 Treaty) and established the International Boundary and Water Commission (IBWC), comprised of a Mexican and an American section. The Treaty included the so-called "minute" mechanism as a means for the two nations to agree to clarify or supplement the treaty to solve an issue, establish a policy, or authorize a capital project (*Eaton, 1992*). The treaty obliged the two governments to find solutions to the border sanitation problems and gave the IBWC the authority to meet this obligation (1944 Treaty, article, 2, 3, 24). Yet, the treaty did not set guidelines for how to achieve this goal financially and how to divide its cost.

3.3 Leveraging a PPP regime

Two decades after the early regime was established, and as the population of Tijuana significantly grew, the quantities of sewage increasingly overloaded the existing US outfall (*Marty, 2001; Meyer, 1983*). Mexico rejected a US suggestion to build one integrated system in the US where the cost would be shared according to the PPP. Instead, it preferred a unilateral solution that was

cheaper (*Graves, 1985* . As a result, in 1958 San Diego built its own wastewater facility in Point Loma and Mexico built two pumping stations that shifted the raw sewage west, along a bypass route, to the Pacific Ocean at a point several miles south of the international border phase.2, fig 1 (*Marty, 2001*). Because of operational problems the Mexican facility was often not functioning (Minute, 270). And because Mexico ran out of funds the pipe was not completed and the water was discharged down a little gully without any treatment (*Delaney, 1984*). As a result of Mexico's inability to operate its wastewater facility in 1965 both governments signed a 20-year agreement (Minute 222) that established an emergency connection of Tijuana's sewage system to the San Diego metropolitan sewage system- phase 3. fig 1. Mexico agreed to fund and built the pipeline on its side, but since it claimed that it could not pay the true cost of treatment in the US, it was agreed that payment for the use of San Diego facility would be set at a fixed rate, regardless of the expected escalation cost (*Frauenfelder, 2004*). The difference was to be paid by the US section of the IBWC.

However, during the 1970s and early '80s the wastewater facility in Tijuana and the Mexican bypass system both broke down and the emergency connection reached its capacity limits (*Graves, 1985*). This led to several miles of San Diego beaches being placed under quarantine (*Graves, 1985*) and hampered the US attempts to recover the Tijuana River Estuarine Sanctuary (*Douglas, 1984*). The pollution problems were expected to exacerbate due to a further increase in Tijuana's sewage flow and a shortage of Mexican funds to improve their existing wastewater systems or build a new one (*Meyer*, 1983). Despite the several environmental framework agreements[4] signed between both governments in this period, a solution to the Tijuana pollution and a cost-sharing formula had to be found since all existing agreements had avoided the question of how the border costs would be divided (table 2).

The solution suggested by the US during the 80s was to build an international water treatment plant (IWTP) and a deep ocean outfall that would carry the treated sewage of the IWTP out to sea. Taking into account the asymmetries in capacities to run the plant, it was proposed that it be built in the US and employ US technology and personnel. The plant was also to address the cities' different

[4] Among them are the 1978 Memorandum of Understanding for Cooperation on Environment Transboundary Environmental Problems and Programs; Minute 261, that assigned the IBWC to resolve the pollution problem, and the 1983 La Paz Agreement for the Protection of the Environment.

water quality standards by adopting secondary wastewater treatment, which in the US had become a requirement with the 1972 Clean Water Act. The cost of the facility was estimated at US$730 million *(Lowry and Associates, 1983*). The US Congress expected Mexico to foot $390 million of the bill, to pay for its treatment expenses *Deddeh, 1984*). The US did not offer any financial help for the Mexican participation in the international facility or for improving its existing wastewater system *(Reavis, 1984*), thinking in terms off fairness and the PPP (*Marty, 2001*, p. 282).

A cost-sharing formula, based upon the PPP, that ignored the difference in ability to pay during an economic crisis that saw a 50% unemployment rate was seen by the Mexican administration as unrealistic (Romero, 1984 in *Mumme and Nalven, 1988*). Furthermore, as Mexico was the upstream riparian, it had not prioritized the pollution problem and this too contributed to the two sides' differing perceptions of the relative importance of the sewage issue (*Eberhardt, 2004*). Finally, Mexico was loath to support the international facility because it was the higher water quality standards of the US that it was expected to uphold (*Saxod, 2004*).

Mexico thus stalled the negotiations for several years (*Baumli, 1984, p. 32*) and finally offered its own solution: it chose to implement the PPP through further development of its existing wastewater system. A unilateral PPP solution was cheaper for Mexico than a binational plant (*Kelly, 1994.p. 278*). Moreover, it would contribute to the Mexican economy as federal money would be spent domestically (*Onorato, 1985*) and it would serve national pride since Mexico would not be seen as a nation that receives foreign support (*Ybarra, 2004).* The authorities planned to convey Tijuana's effluents uphill, towards the south, apply primary treatment (the San Antonio plant) and then dump them into the ocean. In addition, Mexico also agreed to build a second sewage facility – the Rio Alamar plant – in return for US support of a Mexican loan from the Inter-American Development Bank (IDB)[5] for expanding the potable water supply in Tijuana (*Metzner, undated*).

Given the Mexican willingness to solve the pollution problem the US has to accept this solution and, finally, in 1985 Minute 270 and Annex I to the La Paz agreement were signed. The former was a two-phase plans to build the coastal San Antonio plant, the latter paved the way for construction of the inland Rio Alamar plant - phase 4 fig 1.

[5] The IDB is an international organization that works to promote the economic and social development of Latin America.

3.4 Living with the PPP

In 1985 Mexico started building the San Antonio plant, soon after the US complained that the coastal lagoon's location and shape were inappropriate for such a facility. In addition, during that winter the three canyons west of Tijuana discharged wastewater because of malfunctioning in Tijuana's collection system (*McCann, 1986*). These problems resulted in a bill introduced by congressmen from San Diego allocating $37 million for defensive measures. The bill called for both catch basins to capture about 3mgd spills in four canyons, and a pumping station and a pipeline on the US side to carry sewage emanating from the Tijuana River back to Mexico - phase 5 fig 1. (*Lowry & Associates, 1983*).

However, it was quickly realized that the "return to sender" policy was not viable, that since as the existing and future Mexican facilities were not, and would not be in the foreseeable future, capable of treating the water the sewage sent would ultimately find its way back to the US (*Fege, 2004*). Consequently, this measure was deferred (*Fege, 2004*). Also, the planned Rio Alamar became a source of concern since Mexico was about to treat the wastewater with the same technology used on New River, which had proved a failure (*Delaney, 1987*). Even if the Rio Alamar plant would work Mexico refused to process the water beyond primary treatment since it viewed the US requirement for more stringent standards as a US domestic matter (*Gunaji, 1988*). Discharging primary treated effluents to the river would adversely affect the Tijuana River Estuary and US ocean recreation activities *(Delaney, 1988; Metzner, 1987*).

As suspected by the US, just after the San Antonio facility was built it became clear that its conveyance system leaked, that the wastewater treatment level was inadequate and that its operation capacity was already insufficient to deal with the quantities of sewage being sent there. In addition, Mexico had made no progress on its pledge to implement an industrial pretreatment program to prevent the discharge of toxic wastes into the Tijuana's sewage system (*Salazar, 1999*). Because of these problems in 1987 the San Antonio plant was taken out of operation for a year and Mexico was informed by the US that the second phase of the San Antonio plant would not go into effect (*Manager's Report, 1988*). As a result, untreated wastewater continued to flow into the Tijuana River (*Metzner, 1987*). These failings were viewed by many in the US as the ultimate proof of

Mexico's incapacity to allocate the funds and find the technology required to solve the pollution problem (*Wilson, 1984*).

3.5 Escaping the PPP

Many of the Californian agencies were aware that the PPP could not offset the existing asymmetries between the two countries. Thus, there was a need to seek a new cost-burden formula that could provide effective solutions, in the form of the IWTP (*Delaney, 1984*; *Reavis, 1984*). They wanted to divide the cost based on the relative economics and expected benefits of pollution control (*Condit, 1984*.p. 37-8). This implied that Mexico would pay only a small fraction of the cost, if any. Yet, their solution was problematic since the US administration wanted a limit for the US participation in the project (*Ybarra, 2004*; *Frauenfelder, 2004*).

In order for the US to pay for the Mexican share of the project special congressional appropriation was required because facilities to treat wastewater from Mexico were not eligible for regular grants under existing federal or state laws (*Obey, 1993*). To overcome this obstacle, a coalition was built that incorporated four San Diego congressmen, the governor of California, the US section of the IBWC, the mayor of San Diego and the EPA (*Gunaji, 2004*). This coalition already in 1984 solicited the Appropriation Committee to allocate $50 million for the first phase of the international facility (*Martinez*, 1984, p. 65). Later, in 1988, H.R. 5269 was introduced in the House to provide federal funds for the construction of the plant (*Congressional Record, 1988*). Yet, the administration, under President Ronald Reagan, was willing to contribute only $32 million, matched by another $5 million in state funds, to start construction of the international facility – but this was contingent on Mexico paying a reasonable share for the cost of the treatment.

The possibility of the US financing a facility in the US to treat wastewater from Tijuana became real in 1987 when the US passed the Clean Water Quality Act, section 510 of which allows the IBWC US commissioner to seek a grant from the administrator of the EPA for the construction of an international plant to deal with the Tijuana problem. It implies that up to 55% of federal funds could be made available to the plant to process Tijuana sewage (*Metzner, 1987*). Consequently, and following strong local pressure, in 1987 the US section of the IBWC resumed negotiations with Mexico on the basis of the IWTP proposal as the long-term solution (*Marty, 2001, p. 275).*

US IBWC commissioner Narendra Gunaji realized that for Mexico to agree to the IWTP the cost-sharing formula would need to incorporate the principle of the "beneficiary pays" and the "ability to pay" while for the US congress to agree a principle under which the polluter pays some of the cost would be required (*Gunaji, 2004*). To reconcile these conflicting principles, Gunaji argued that the proposed international plant should be in lieu of Mexico's promised construction of the second phase of the San Antonio plant as well as a replacement for the promised Mexican treatment plant on the Rio Alamar River (*Gunaji, 1988*). Mexico's share would be at a cost equal to that which it would have spent on the building and operating of these two plants; in addition, the ocean outfall would be paid by the US federal government and San Diego (*Gunaji, 1988*). To help Mexico pay its share, the State Department suggested that it should be given credit for many of its previous wastewater works (*Aronson, 1990*).

Given the strong local pressure to adopt a more flexible cost-sharing formula, the US administration, now headed by George Bush, in July 1989 agreed to support the federal funding for the IWTP in the fiscal years 1991 and 1992 (*Silva, 2004*). The US spending limit was set by Congress at $239 million (*Balint, 1994*). An important argument for the US paying the lion's share of the pollution treatment was the economic cost of sewage contamination (*Marty, 2001*); building the plant on the US side to ensure control over the wastewater treatment process (*Saxod, 2004*; *Eberhardt, 2004*) and the fact that the US funding would go to US products and services were additional factors. In addition, Mexico was to handle and dispose of the plant's sewage sludge. (McCann, 1988).

Subsequent to a meeting between both country's presidents on October, 3, 1989 construction of the IWTP was agreed upon and on July, 2 1990 Minute 283 was signed - phase 6, fig 1. The minute stipulated that Mexico would share in the construction, maintenance and operation of the IWTP according to the principle of "the beneficiary pays the difference," meaning it would pay an amount equivalent to what it would have expended in the construction, maintenance and operation of stage II of the San Antonio plant and the construction of the Rio Alamar plant. In addition, Mexico was to be given credit for the sewage treatment works currently provided in Tijuana, covering part of its operating cost by supplying electrical energy for the plant. The land and the ocean outfall costs would be paid by the US.

The construction of the IWTP was delayed for several years because of the inability to obtain information from Mexico on sewage content and flow rates (Perciasepe, 1994) and because of disagreements over the Mexican share in the project. It was finally completed in 1997, though the ocean outfall was only completed in 1999. The total cost of the plant swelled to $383 million, of which Mexico paid $16 million (*Perciasepe, 1994*). During construction loans were given to Mexico for its part of the contribution to the project, to be repaid upon its completion (*Valenzuela, 1994*). Until the plant began operating more interim measures were needed to address the sewage problem (*Filner, 1991*). The option adopted was to treat the effluents from Mexico in the San Diego system by money provided by the US government (*City Council of San Diego, 2002*).

4. The new border cost-burden regime

To deal with the difficulty of financing the border pollution problems that in 1993 were estimated at somewhere between $5-12 billion (*Audley, 1993*), several bills were introduced to the US Congress in the early 1990s.[6] Their aim was to authorize the EPA to appropriate funds for the construction of wastewater treatment without Mexico's contribution, on the basis of the US' economic and operational comparative advantage (*Bingaman, 1994*) or on a case-by-case basis (*House Resolution, 1992*). Yet, none of them were enacted. In addition, the resources for "Integrated Border Environmental Plan,"[7] initiated in 1992, were not committed (*Spalding, 2000*).

The turning point in financing the border pollution and offsetting the asymmetries was the negotiations over the North America Free Trade Agreement between Mexico, the US and Canada (NAFTA). During the negotiations many supported a new binational agency with its own funding mechanism to create a border cleanup fund. The fund was to be free of the appropriation constraints that were set in the Tijuana/San Diego case and with a capacity to bridge the striking economic asymmetries between Mexico and the US (*Kantor, 1993*). To achieve this, the US was to provide two-thirds of the bank capital, and accordingly expected to receive two-thirds of the voting rights on the Board of Executive Directors (*House Congress Resolution, undated*). However, fears that such a voting percentage might discourage Mexico to participate in the fund (*Hinojosa, 1993)* and that such a formula may be perceived as foreign help (*Browne, 1996*) resulted in a formula based upon equality, whereby both sides would contribute equally to the bank capital and thus were

[6] Among them are amendments to the Water Pollution Control Act and the Safe Drinking Water Act.
[7] Mexico was to contribute at least $460 million and the US $379 million (Carter, 1999)

equally represented. The equal division of cost was also assumed to give Mexico an incentive to sign up for the greater use of user charges that the polluter pays (*Shafer, 1993*). Indeed, in 1994 the North American Development Bank (NADBank) was established. Both nations have each committed $225 million "paid in capital" and have pledged to back the NADBank with $1.275 billion of "capable" capital. A Border Environmental Cooperation Commission (BECC) was established to evaluate the feasibility, efficiency and effectiveness of proposed projects to the bank (*Killgore and Eaton, 1995).*

Another turning point in financing the border pollution and offsetting the asymmetries was when the EPA obtained in 1994 $400 million for the establishment of a Border Environmental Infrastructure Fund (BEIF). The EPA wanted the majority of the money to be spent on projects in Mexico where the money is more urgently needed while not being seen as foreign aid, which might block Congress support of the program. Thus, the US called on Mexico's federal agencies to equally match the grants (*Memorandum, undated*) and required the projects that are located in Mexico to have a US-side benefit and to meet the US water quality standards (*Eberhardt, 2004*). The grant program was authorized in 1995 in Minute 296. The program was launched in 2000 as both countries signed a Memorandum of Understanding that allocated the US funds for the project on both sides of the border while the Mexican funds were to be spent only on projects on its side (*Memorandum of Understanding, 2000*). Also, it was agreed that the grant program would only finance up to 50% of the project. The rest of the money was to be provided by NADBank loans and would have to meet the BECC eligibility criteria (*Memorandum of Understanding, 2000*). In 1997 the BEIF program became part of the NADBank's responsibilities.

5. The Tijuana/San Diego cost burden today

In 1995 the existing Mexican wastewater systems (agreed in Minute 270) became overloaded and the collection system started leaking. As a response, the EPA, supported by several local organizations, suggested improving the San Antonio plant to provide secondary treatment what would reduce the quantity of raw sewage discharged to the sea that can travel north into US waters (*Orrin, 1993).* It also suggested building a parallel conveyance system as a back up to the Mexican system (*Ybarra, 1997*) and a connection from the IWTP to the conveyance system in Tijuana in order to return effluents intended for disposal in the ocean off Mexico during times that the ocean outfall under construction was not in operation (Minute 298, 1997).

The US was willing to foot the $16 million bill for the conveyance system and $1.5 million for the connection from the IWTP to the conveyance system from BEIF money as long as the figures would be matched by Mexico through rehabilitating their existing wastewater collection system (*Wachtel, 2004*). Another condition was that the $2 million cost of upgrading the existing San Antonio plant and the costs of the conveyance system that exceed the $16 million would be paid by Baja Californian. A loan would be provided by NADBank to help Mexico participate in the project (Minute 298, article II). Besides the benefits to the US from a backup system, another advantage of financing the bulk of the project was the assumption that upgrading the San Antonio plant would replace the conveyance of Tijuana's sewage through the emergency connection. Upgrading the Tijuana system and the parallel system were completed in late 2000 - phase 7 fig 1. Yet, Mexico was unwilling for a few years to accept responsibility for running the system, arguing that that implied increased expenses (*Salazar, 1999*).

A recent ongoing problem was the EPA and US section of the IBWC requirement of many local organizations and the state of California to meet the Clean Water Act by achieving secondary standards for all sewage discharged from the IWTP by December 2000 (*Manager's Report, 2002*). The Congress and the US president responded to these demands in 2000 through the Tijuana Valley Estuary and Beach Sewage Cleanup Act that authorized $156 million for an agreement with a private company in Mexico to provide the secondary treatment (Public Law 106-457). Thus, in 2002 a minute was signed between both countries stipulating the possible agreement (Minute 311, 2002). The decision to employ a private company was seen as a win-win solution: for Mexico it would provide reclaimed water (paid for by the US) while not impinging upon its sovereignty (*Congressional Record, 1999*) and the US would benefit from secondary treatment which, nevertheless, would be of a higher quality than if the wastes were treated by the Mexican government (*Schlesinger, 2004).* - phase 10 fig 1. However, because of disagreements between the US and Mexico concerning the nationality of the private company a solution has not yet been agreed upon (*Rascon, 2004*).

Finally, since many of Tijuana's neighborhoods were not hooked up to sewers even after the ITWP and the conveyance system were built sewage kept flowing to the US side. Consequently, a Congress bill (H. Con. Res. 331) was introduced to force Mexico by international law to share in

the burdens caused by its sewage. But it was opposed since there was a fear that punitive action would jeopardize many of the NADBank projects in which Mexico matches US funding (*Rodriguez, 1998)*. Instead, the Tijuana's collection system is now being rehabilitated through a BEIF $18.5 million grant, matched by Mexico, and a $6 million NADBabnk loan to Mexico (*EPA, 2002b)* - phase 8 fig 1. In addition, a master plan is currently being developed for Tijuana's sewage treatment (*EPA, 2002a*) - phase 9, fig 1. The EPA, in response to a congressional direction, contributed the majority of its cost ($2 million) and the rest was provided by a NADBank grant for implementing the feasibility study's findings. Mexico, in turn, dedicated staff and expertise from several agencies and provided the meeting facilities (*Wachtel, 2005*).

Table 2 outlines the framework agreements, their year of initiation and how they address the cost-burden issue.

Framework agreements	Year initiated	Cost-sharing principle
1944 treaty	1945	Not addressed
Memorandum of understanding	1978	Not addressed
Minute 261	1979	Polluter pays, with exceptions
La Paz Agreement	1983	Polluter pays, with exceptions
NADBank and BECC agreement	1993	Equal contribution
Integrated environmental plan for the US-Mexico border	1992-1994	Approximately equal contribution
Minute 294	1995	US pays and Mexico contributes
Memorandum of understanding and Minute 304	2000; 2002	Equal matching for projects in Mexico

Table 2: Framework agreements, year of initiation and their cost-burden principle

6. Discussion: Balancing fairness and effectiveness

The study reveals that under conditions of asymmetry there are three major competing cost-burden principles: the polluter pays, the beneficiary pays and the ability to pays. It is likely that each country will adopt the principle that best protects its interests dependent on their physical position in the basin in question. It was the US, as the rich and downstream state receiving the pollution, that

advocated for the PPP while Mexico, as the poor and upstream state, advocated for the two other principles. In addition, there are also mixed systems that combine these principles. These are the "beneficiary pays the difference," "equal division of the cost burden" and a soft version of the PPP.

These principles tend to replace each other along time. The current case began with the building of a septic tank, the cost of whose construction was divided according to the respective benefits to Mexico and the US and the latter's superior ability to pay (event 1a), although its operation was divided equally (event 1b). This cost-burden arrangement was replaced with the PPP as Mexico built and paid for its early wastewater system (event 2). Next, a soft version of the PPP was adopted as Mexico paid for the emergency connection pipeline and some of the operation and treatment costs (event 3). Twenty years later there was a retreat again back to the PPP as Mexico built and funded the entire cost of its own advanced wastewater facility (event 4). Again, the PPP was soon replaced with US pays for the defensive measures (event 5) and with "the beneficiary pays the difference" that financed the IWTP (event 6). Then it was the "equal division of the cost burden" (that guided the establishment of NADBank and BEIF) that built the Parallel Conveyance System and rehabilitated the Mexican collection system (events 7, 8). Finally, there is the Tijuana Master Plan and the proposed Bajaagua project, paid almost entirely by the US' EPA (event 9, 10).

Fig 2 delineates the ten Tijuana/San Diego wastewater projects (events) according to their time of establishment and their cost-burden principle. On the one pole of the principles is the PPP and on the other is the ability to pay and beneficiary pays. Fig 2 reveals that there are three cycles in the choice of the cost burden: in each cycle there is a shift from ability to pay and beneficiary pays principles towards the PPP and a retreat backwards. The current cycle (the third) fluctuates between the two poles less than the previous two cycles.

The cycles represent the tension between effectiveness in wastewater treatment and the US interoperation of fairness and the attempts to reconcile them. Both cases of implementing the PPP (events 2, 4) were driven by the US putting their interpretation of fairness at the forefront of the negotiations. Mexico agreed to accept these solution based upon the PPP because of US political pressure, the financial linkages (that helped Mexico to pay) and the Mexican decision to implement the PPP unilaterally. Yet the PPP, despite serving justice to the US administration, ignored the asymmetries between the US and Mexico in operational capacities, willingness and ability to pay

and power (table 3). As a result, as shown, it provided ineffective wastewater treatment. In response, in the former case (event 2) the US replaced the PPP with the soft version of the PPP (event 3) and in the latter case (event 4) with the US pays for the defensive measures (event 5) and the "beneficiary pays the difference" principle (event 6). The soft version of the PPP allowed the wastewater to be treated according to US technological capabilities and standards, thus offsetting the asymmetry in operation. Yet, it ignored the willingness of San Diego to pay for Tijuana's wastewater and the ability of Tijuana to pay for the expansion of the connection (table 3). As a result, the connection was terminated after 20 years. The "beneficiary pays the difference" principle addresses the power asymmetries since it did not depict Mexico as a country that receives foreign aid (*Christensen, 2004*). It also took into account asymmetries in ability and willingness to pay since the formula considered Mexico's limited financial capacities while at the same time forcing Mexico to contribute and thereby satisfying the US administration's concern for that country's financial participation. Finally, it also addressed the asymmetries in capabilities since the US paying most of the cost allowed the plant to be built on the US side and use US technology (table 3). Addressing the asymmetries both contributed to the effectiveness of the solution and to its political feasibility. Given its success to offset asymmetries it is not surprising that this formula was adopted in other cases, such as the Nogales international plant (*Duemling, 1980*) and the Laredo/Nuevo Laredo case (*Rascon , 2004*).

Lately it seems that the tension between effectiveness and fairness is reconciled by the adoption of the principle of "equal division of costs" (events 7, 8) which means that parties receive identical burdens regardless of differences in needs, preferences or other considerations. This principle provides Mexico equal footing in NADBank and the BECC, thereby addressing their interpretation of fairness along with addressing the asymmetry in power (table 3) and thus providing both a politically feasible and effective solution. The "equal division of cost" has also often adopted in other cases[8] and is perceived as an equitable and feasible mean for cost-sharing *(Giordano, 2004)*. However, since this formula ignored the Mexican limited ability to pay already in 1995 Mexico did not transfer its $56 million share to the bank and nowadays finds it difficult to pay its 50% share in the BECC operation (*Rascon*, 2004). Furthermore, Mexico often does not have the money to match the US BEIF program and finds the NADBank market-based interest rates too high. To address these difficulties the EPA often enables Mexico to match funds by crediting it for its past

[8] For example the United States and Canada divided the Salmon harvests equally in the Frazer River Convention.

wastewater treatment *(Eberhardt, 2004*) and asks for the money back on a cumulative basis, though not necessarily for the same project or in a given year (*Lehman, 2001*).

Another means to address Mexico's difficulty in paying is the Project Development Assistance Program (PDAP), which is a US funding program, established recently by the EPA, for wastewater treatment development activities (*Carter*, 1999). The program does not have the matching requirement, with the exception of design costs where the program is limited to a 50% of the total design cost, not to exceed $500,000 (*Wachtel, 2005*). The Tijuana Master Plan (event 9) is an example for the ongoing trend of the US paying the majority cost of the crucial phases of the project (planning and design) to help Mexico overcome the matching requirement and to strike the balance of effectiveness versus justice in favor of effectiveness (*Wachtel, 2004*). The US paying the cost offsets Mexico's limited ability to pay, as well as its operational capacities, and allows the US to determine the technology used and the standards adopted. Yet, this ignores the willingness of the Congress to support such programs and the power asymmetry since it presents Mexico as a nation that receives foreign aid (table 3).

Given the finding that a cost-burden principle that ignores asymmetries is not likely to provide effective wastewater treatment, it is not surprising why the border communities that directly receive the pollution prefer the alternatives to the PPP. This was the position of San Diego congressmen in the IWTP negotiations. It is also the current position of several NGOs for the need to reform the BEIF and NADBank in a manner that allows the US to spend more money in Mexico (*e.g. Sierra Club, 1993, Texas Center for Policy Studies, 2001*). Which principle they prefer depends on the asymmetries they prioritize to offset. For example, to offset the power asymmetry equal contribution may be adopted while to offset the operational capacities the beneficiary pays the difference or ability to pay is likely to be adopted.

In the last decade a greater part of the cost has been allocated to the private sector in financing trans-border wastewater infrastructure. The primary purpose of NADBank is to secure private investment (*Killgore and Eaton, 1995*). Also, in the recent case of IWTP treated water the congressional direction was to seek an agreement with a private company in Mexico to provide the secondary treatment (event 10). The private sector, assumed to have a larger capacity to collect user fees and to operate advanced technology, is perceived to have the ability to offset operational

capacities as well as to address the ability to pay asymmetry. Some even argue that if private international entities would manage transboundary aquifers that may address the power asymmetry since the different parties sharing the aquifer will have to cooperate in order to get the best possible deal from the franchisee (*Feitelson and Haddad 2001*). But their success is yet to be proven, especially since there is not a single case worldwide of an international private entity that manages a shared resource.

Table 3 summarizes the projects built, how they were formalized, their cost-burden principle and the effect of the principles on asymmetries.

Projects built and programs adopted	**Agreement signed**	**Cost-burden principle**	**Effect of cost-burden principle on Tijuana/San Diego asymmetries**			
			Power asymmetry	Ability to pay	Willingness to pay	Operational capacities
Rio Alamar San Antonio	La Paz annex Minute 270	Polluter pays	-	-	-	-
Emergency connection	Minute 222	Soft version of the polluter pays	-	-	-	+
- Septic tank operation and maintenance - Conveyance system - NADBank - BEIF	 Minute 298 NAFTA side agreement Memorandum of Understanding and minute 304	 Equally paid	+	-	+	Not estimated
IWTP	Minute 283, 296	Polluter pays the difference	+	+	+	+
- Septic tank construction - PDAF - defensive measures - Bajagua project - Tijuana Master Plan		Beneficiary pays & ability to pay	-	+	-	+

Table 3: Projects built, their cost-burden principles and the effect of the principles on asymmetries

"-"increase asymmetries

"+"offset asymmetries

7. Conclusion

Only a few of the studies on transboundary pollution make the effort to address the asymmetries between various countries sharing the boundary (*Fernandez, 2002*). This study, by incorporating the effect of asymmetries on the negotiation and implementation processes, has found that asymmetries resulted in competing cost-burden principles; some of these principles were perceived, by some, to

be more fair while others were found more effective in building a pollution control regime. Those that are more environmentally effective are the ones that address the asymmetries. This is why, as hypothesized, the PPP was replaced with other principles that did address the asymmetries.

Each of the principles that replaces the PPP addresses the asymmetries differently. In the Tijuana/San Diego case, "beneficiary pays" addresses the ability to pay and the operational asymmetries but ignores the US willingness to pay and Mexican power inferiority. "Equally paid," on the other hand, addresses the willingness to pay and Mexican power inferiority but ignores the asymmetries in ability to pay. The "beneficiary pays the difference" principle addresses many of the asymmetries but is criticized for not addressing the need to treat the water at the source of the pollution at a lower cost (*Michel, 2000*).

The finding that the different cost-burden principles affect the asymmetries differently and thus correspond with fairness, effectiveness differently explains why there are cycles in the cost-burden formulas. The cycles represent projects whose funding was based upon US notions of fairness that were replaced by projects whose funding is based on notions of effectiveness. The replacement of the PPP with the other cost-burden principles is one example. It also shed light on why the current NADBank funding program and the BECC process contain conflicting cost-burden principles. This is since each component of the program tries to offset a different asymmetry. For example, while projects should be maintained through user fees paid by the polluters to help the polluter to pay (*Carter, 1999*) both nations in order to address the power asymmetry have been paying for the project, nor just the upstream polluter (*Fernandez, 2004*). Finally, it also highlight why financing agreements are often packages since they are based not only on one but several criteria of justice. The adopting of the beneficiary pays the difference that capture both the PPP and the ability to pay principle is one example.

The need to better address the asymmetries explains the recent establishment of PDAP and the restructuring of NADBank that extended its geographical scope and grant component (*Press Release, 2004*). Yet, there is a need for further study to identify which of the principles replacing the PPP is more effective. In other words, whether offsetting the power asymmetry by adopting the equally paid principle is more effective than offsetting the ability to pay by allowing the US to foot

the lion's share of the bill. In addition, the study findings concerning the effect of the various principles on the capacities asymmetries are inconclusive and, thus, should be explored further.

Besides the tradeoffs between fairness and effectiveness several other tradeoffs were found. Tradeoffs exist between the different asymmetries, such as between ability to pay and the power asymmetry. One example of this tradeoff is the Mexican preference to offset the power asymmetry by equal representation in NADBank over the option of offsetting the ability to pay asymmetry by allowing the US to contribute the majority of capital to the bank. Another type of tradeoff found is between the cost-burden principle and the location of the project and the degree of cooperation in its implementation. Insisting on the PPP implied unilateral Mexican projects in Mexico. In contrast, allowing the US to pay the bulk of the cost allowed for joint projects to be conducted in the US.

In conclusion, the study demonstrates that often the PPP is not adopted or replaced not because of its lack of legal clarity, political feasibility or fairness, but rather because of its inability to address the existing asymmetries and thus to provide environmentally effective pollution control. This study thus stresses the need to examine and analyze the effect of the cost-burden principles on all economic and political asymmetries before determining and implementing any given regime.

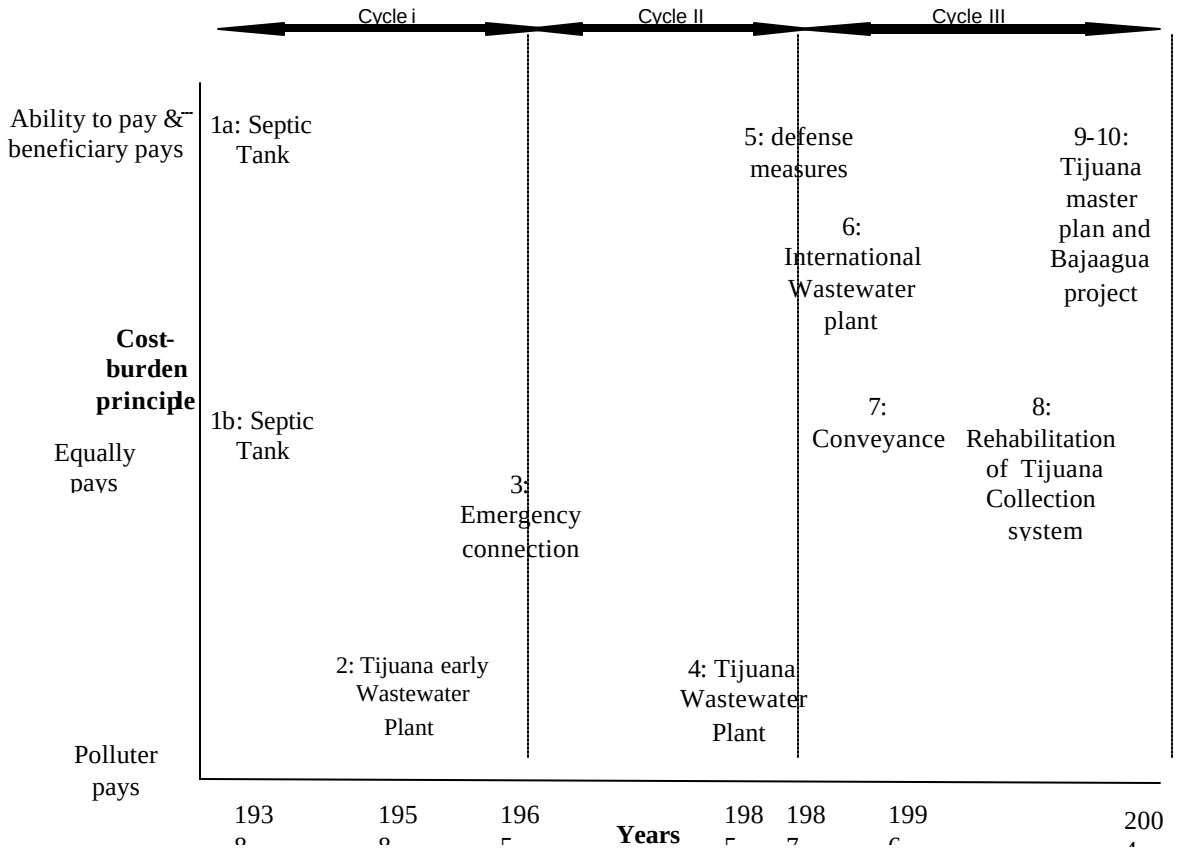

Fig 2: Cost-burden evolution of wastewater infrastructure along the San Diego/Tijuana border

* The numbers correspond with the number of events

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