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Stormwater Management Utility Fees: A review

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Abstract

The need for adequate and steady funding mechanisms in municipalities is the main issue affecting various regions of the United States. Stormwater management utility fees (SWMUFs) is a dependable process of funding for the maintenance of water resources, environmental protection, and flood control. SWMUFs are an estimated fee for all property owners, including homeowners, businesses, governments, and schools. The pros of SWMUFs include the provision of credits to those who incorporate best management practices on their parcel, which reduces stormwater runoff at the source, thereby protecting the waterways. This paper is a literature review paper on the mechanism of SWMUFs, rate structure, and factors to consider in establishing a stormwater utility fee. The findings from this review show that the equivalent residential unit (ERU) is the most prevalent funding method used in several municipalities, which is found on impervious areas, and many jurisdictions need to implement the SWMUFs.

Keywords: Stormwater management, Utility fees, Stormwater finance, BMPs

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1. 0. Introduction

The Stormwater Management Utility Fee (SWMUFs) provides a sustainable and dedicated source of revenue for controlling, continuing, and improving the physical infrastructure of the stormwater management system, and for practices to enhance the quality of water (Howard County Maryland, 2017). It is an estimated fee for all property owners, including homeowners, businesses, faith-based organizations, governments, and schools. These fees are calculated by measuring the amount of impervious surface cover within a parcel. Stormwater utility fees have been used for over forty years and have become a popular choice as a steady source of funding for stormwater management programs (Fedorchak, Dymond, & Campbell, 2017). More municipalities are looking toward Stormwater utility fees for several reasons, including economic pressures, increased regulations, and maintenance of aging infrastructure. There are various methods used to determine stormwater utility fees, and the revenue needs to balance both the demand for service from each parcel along with the resources of data with the personnel required to compute the charges. The use of stormwater utility methods for financing urban stormwater programs is increasing in popularity in the United States. A stormwater utility creates a fund that is stable, adequate, equitable, and dedicated to managing stormwater (Brisman et al., 2002; Reese et al., 2007). It improves stormwater management programs that are in-depth, cohesive, and steady from year to year. Also, the funds may be used to support educational stormwater programs to draw in networks and enroll their help in distinguishing issues and taking a shot at answers to improve water quality

Stormwater pollution is one of the most important sources of contamination of waterways, which ranks as the second most prevalent source of water quality impairment and the fourth most pervasive source of impairment in lakes in the United States estuaries (United States Environmental Protection Agency (EPA, 2017). Following a rain, stormwater runoff may mobilize high levels of contaminants, such as sediment, suspended solids, nutrients (phosphorus and nitrogen), heavy metals, and other toxic pollutants.

Table 1.1. Characteristics of Stormwater Pollutants

Pollutant group	Measurement parameter	Impacts	Sources
Solids (suspend solids, SS)	Total suspend solid (TSS)		Construction site, pavement wear, atmospheric affirmation

Sediment		Lessens the measure of light in the water accessible for plant growth, diminishing the supply of food for other organisms. It can obstruct and harm delicate tissues, for example, the gills of fish. Can choke out living beings that live on or in the bed of lakes and streams by framing thick stores when the suspended material settles out.	Car washing, construction site, land surface erosion, organic matter, spillage, atmospheric affirmation.
Nutrients	Nitrogen and phosphorous	An expansion of nutrients in water invigorates the growth of aquatic plants. Also, the causes over the top development of aquatic weeds and green growth that may gag lakes and streams and immediate emotional every day changes in broken down oxygen levels.	Animal feces, organic matter, fertilizer, atmospheric fallout.
Heavy metals	Pb, Zn, Cu, Cr, Cd, and Ni.	Toxic living organisms or harm their life processes.	Vehicle wear, atmospheric affirmation, septic tank leakage, sewer overflow, spillage.
Pathogenic microorganisms	Total coliforms	Contain high quantities of microscopic organisms and infections. A portion of these life forms can cause sicknesses, including hepatitis and gastroenteritis	Organic matter decay, septic tank leakage, sewer overflow, spillage.
Toxic organic	PAHs, PCBs, and MTBEs.	Toxic living organisms or harm their life processes.	Sewer overflow, spillage, septic tank leaks, herbicides, pesticides.
Surfactants such as detergents, oils.		Exceptionally lethal to fish and other oceanic life.	Car washing, asphalt pavement, spillage, organic matter.

Table1.1 Source: (Hvitved-Jacobsen et al., 2010; McCarthy et al., 2008).

The several States in the United States have incorporated stormwater utility fees except for states such as New Jersey and New York. Florida has the most stormwater utility fees (180), Minnesota (163), Wisconsin (120), Washington (113), and Texas (103) (Fedorchak, Dymond, & Campbell, 2017). Also, there are about 1,700 stormwater fees implemented in different jurisdictions across the country, but there are no stormwater fees in Louisiana (Campbell et al., 2019).

1.2. Historical Trends of Stormwater Utility Fee in the United States

The issue of water pollution in the United States leads to the implementation of water pollution control measures nationwide. The increase in stormwater pollution to the rivers and streams as the population continues to grow is a major environmental problem. Congress's efforts to control water pollution leads to the creation of the Federal Water Pollution Control Act of 1948. The clean water act was created in the year 1972, which is an amendment to the Federal Water Pollution Control Act. The segment 402 of the clean water act incorporates the National Pollution Discharge Elimination System (NPDES), which set up the fundamental structure for managing pollutant releases into the surges of the United States (US EPA, 2017).

The United Stated legislature recognized that there is a need for improved water pollution control measures. In the year 1987, the U.S. legislatures required the United States Environmental Protection Agency to control stormwater discharges into United States streams (EPA, 2017). The following National Pollutant Discharge Elimination System (NPDES) of the Clean Water Act (CWA). In the year 1990, the first phase of stormwater pollution discharge control into the streams and waterways was implemented by the United States Environmental Protection Agency (US EPA) in response to the federal regulations in which the US EPA created NPDES permit program. Phase II of stormwater regulation by the US EPA was in the year 1999. The phase I and II NPDES permit program established requirements for municipal separate storm sewer systems (MS4) and industrial activities, including construction.

The NPDES permit program ensures that there is an improvement in water quality in the United States, and this is exigent to accomplish base on the increase in the number of impervious surfaces. The operation of this regulation to achieve water quality has been a challenge as there is an increase in various governmental organizations that need to be permitted. Also, the maintenance of these laws has been a challenge for state administrations hence the need for another alternative such as green measures to prevent stormwater runoff into rivers and streams (US EPA, 2017).

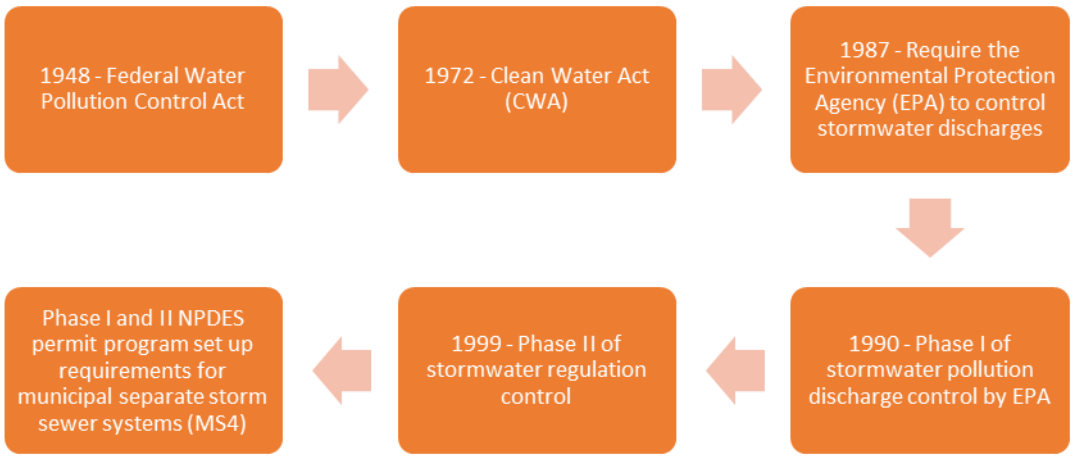
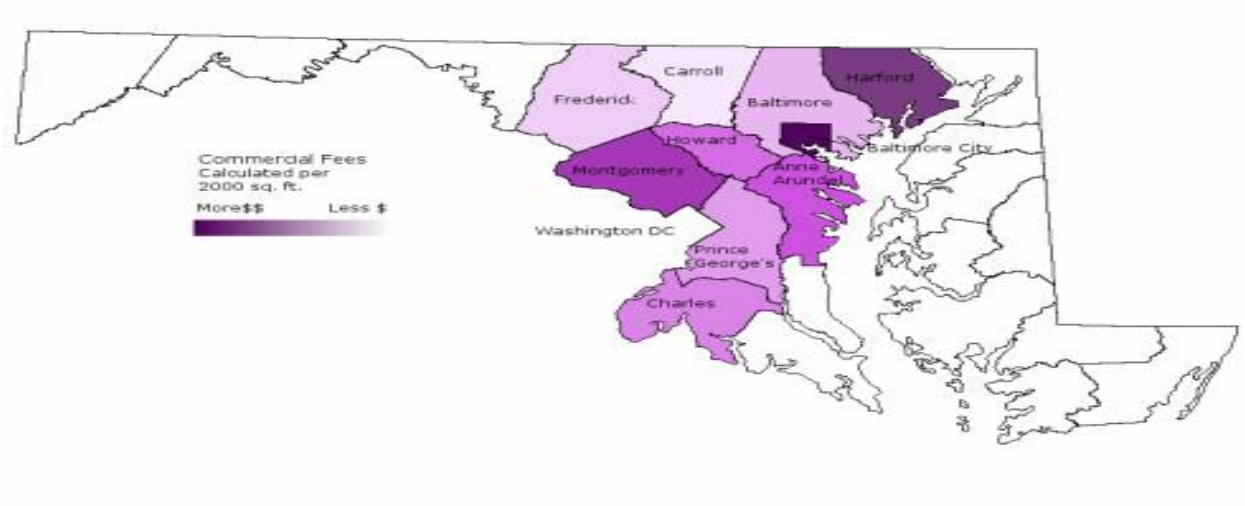


Figure1.2: Self-design

2.0. Jurisdictions in Maryland with Stormwater Utility Fees

Several jurisdictions in Maryland have incorporated stormwater utility fees in their counties, and this includes Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard County, Montgomery County, Prince George's County, Baltimore City, and the City of Rockville. The map below shows the various jurisdictions.



Map 2.0: (Source: Rain Underground, 2018)

2.1. Factors to Consider in Creating Stormwater Utility

Policy consideration is an integral factor to consider at the inception of the stormwater management program. State stormwater policy is an essential factor that can enhance or impede the establishment of stormwater utility fees. The policy concern is a critical issue that will contribute to the framework definition, and it will also contribute to the evaluation of stormwater management. The establishment of a stormwater utility fee is dependent on a variety of factors, such as the benefits and challenges that will be encountered in the process.

2.2. The Benefits of Establishing Stormwater Utility Fees

A study conducted on considerations in establishing a stormwater utility discussed the benefits, challenges, and processes of setting up stormwater utility fees (Brisman et al., 2002). The study showed that raising funds through the stormwater utility fees has several benefits that provide municipalities with a stable funding source that allows long-range planning, preventative maintenance, and large-scale capital improvements. The establishment of stormwater fees is a dependable revenue source that will generate funds for a stable operation cost. This utility fee is a significant investment that is essential for stormwater management. The establishment of stormwater utility ensures that there is accountability as the administration is required to account for the utility fees expenditures based on infrastructural assets.

The method incorporated into the establishment of stormwater utility ensures that local property taxes are not increased (Brisman et al., 2002). Also, stormwater utilities are equitable because individual property owners take responsibility for the expenses because the stormwater utility based on personal owner stormwater impact. It provides improved equity among property owners in a community since it allows for the allocation of operation and maintenance costs (Smart Prosperity Institute, 2016). Furthermore, the stormwater program creation is an avenue for increased public awareness to educate community members on the importance of keeping the waterways clean, thereby spreading the information. Stormwater utilities can incorporate credits (which are also known as economic incentives) to property owners based on the impermeable surface on a property. And through the establishment of green infrastructure on an individual feature such as the design of rain gardens, permeable pavements, ponds, and other best management practices (BMPs) (Hoss, Fischbach, & Molina-Perez, 2016; Kim & Li, 2016).

A 2001 stormwater utility study conducted in Brevard County, Florida, showed that different BMPs are economical and be applicable to flat topographies. According to the study, the three main suggested economic techniques that have proven effective are the engineering construction of baffle boxes, continuous deflective separation (CDS) units, and inlet devices, which are efficient for the removal of nutrients and suspended solids. The maintenance of the baffle box involves the constant use of vacuum trucks for cleaning (England et al., 2001).

The stormwater utility fee provides credits for the utilization of stormwater best management practices (BMPs), and the reduction of the effect of flooding in coastal areas is essential for the enhancement of water quality (England et al., 2001). The stormwater utility best management practices involve the construction of treatment techniques devices such as baffle boxes, CDS units (England et al., 2001; Birch & Matthai, 2009), and the incorporation of natural filtration methods, which are the green infrastructure.

3.0. The Challenges of Establishing Stormwater Utility Fees

The challenges of creating and sustaining stormwater utility fees in municipalities are numerous because the public may be wary of a new charge and may not understand the need for it (Environmental Commissioner of Ontario (ECO), 2016). Municipalities can minimize this challenge through effective public communications about the rationale and implementation of the fee, such as a stormwater advisory committee and outreach and education programs (Walsh et al., 2016). The anticipated challenges must be envisioned with the necessary procedures to overcome this challenge adequately planned.

3.1. Findings

The three most common methods for calculating stormwater utility fees are an equivalent residential unit (ERU), tier fee, and flat fee structure. The different fee types determine the amount of the municipal revenue collected from each land use owner. The main factors to consider when determining stormwater management utility fees (SWMUFs) are cost, ease of administration, and relation to stormwater contribution. The advantage of flat fees and area fees is that it is less labor-intensive for the municipality, but the main disadvantage is that it does not reflect the stormwater impact of each parcel. The equivalent residential unit and residential equivalency factor (REF) fee types deal directly with the stormwater contribution from parcels, and it requires the creation of fee structure before the charged (BGR, 2017; Fedorchak, Dymond, & Campbell, 2017). The figure below describes the stormwater fee types, and it also shows the number of municipalities that implement such fee type**.**

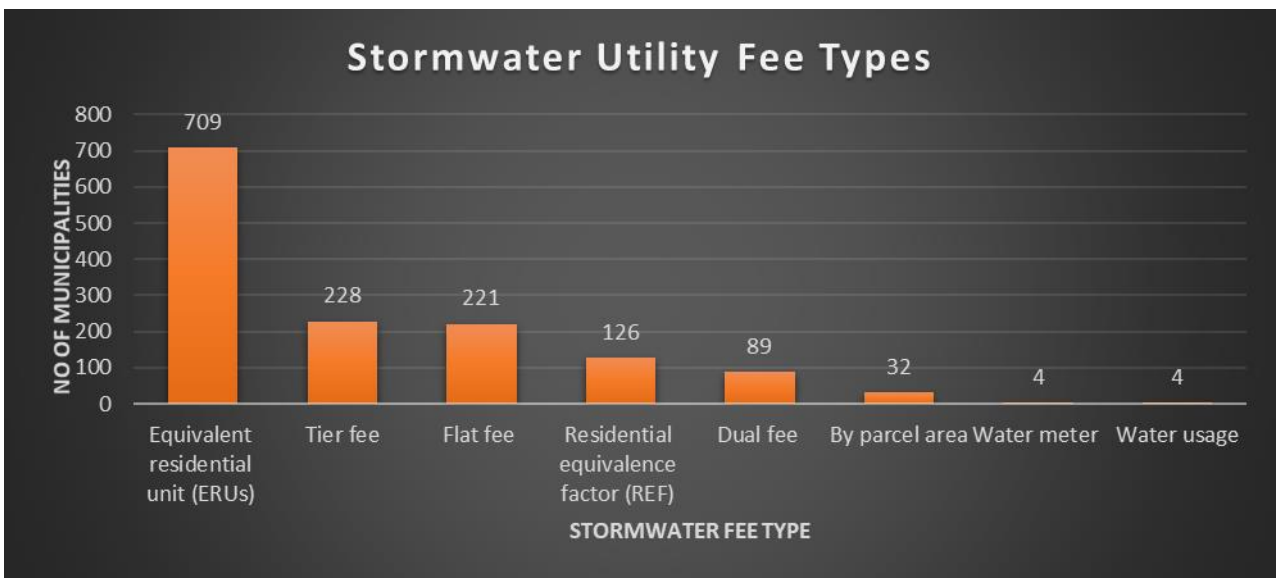


Figure 3.1 (Source: Fedorchak, Dymond, & Campbell, 2017)

The flat fee is a fixed charge in which each parcel pays a similar sum, and it is a straightforward fee structure to implement because the calculation method is more comfortable (Kea, Dymond, & Campbell, 2016). Still, its main demerit is that it does not consider the impact of the quantity of stormwater runoff from an individual property on the drainage system concerning the amount of the fee charged. The tiered fee charges are classified based on the impervious area on parcels and land use.

The equivalent residential unit (ERUs) is the charges that are dependent on the average impervious area on a single-family residence parcel. The ERUs system is the most commonly used by over 80% of municipalities (Tasca, Finotti, & Goerl, 2019). For example, in Howard County, Maryland, the stormwater utility estimate fee is calculated monthly by using equivalent residential units (ERUs) method. Howard County water department determines the bill for each property through geographic information systems (GIS) analysis by using photographic flyover data (Howard County Maryland, 2018; Jato-Espino, Sillanpää, Charlesworth, & Andrés-Doménech, 2016). A single-family residential parcel is equal to one ERU. The surveyed data is analyzed to determined and calculate the appropriate bill for a property owner. A case study of two

municipalities conducted in Virginia showed evidence that the ERU charging system is best for stormwater fees (Fedorchak, Dymond, & Campbell, 2017). The several studies have been conducted on the type of rate structure that is suitable for users.

Other methods for calculating stormwater utility fees are residential equivalency factor, dual fee, by parcel area, water meter, and water usage. The residential equivalency factor (REF) calculates the amount of runoff from each parcel using the national resources conservation service or rational method (Kea, Dymond, & Campbell, 2016). Dual fee separates parcels into residential or non-residential and charged each classification differently. By parcel, the area is rate based on the side of the parcel. The water meter is charged based on water meter size. Water usage is the amount of domestic water used (Fedorchak, Dymond, & Campbell, 2017).

3.2. Recommendations

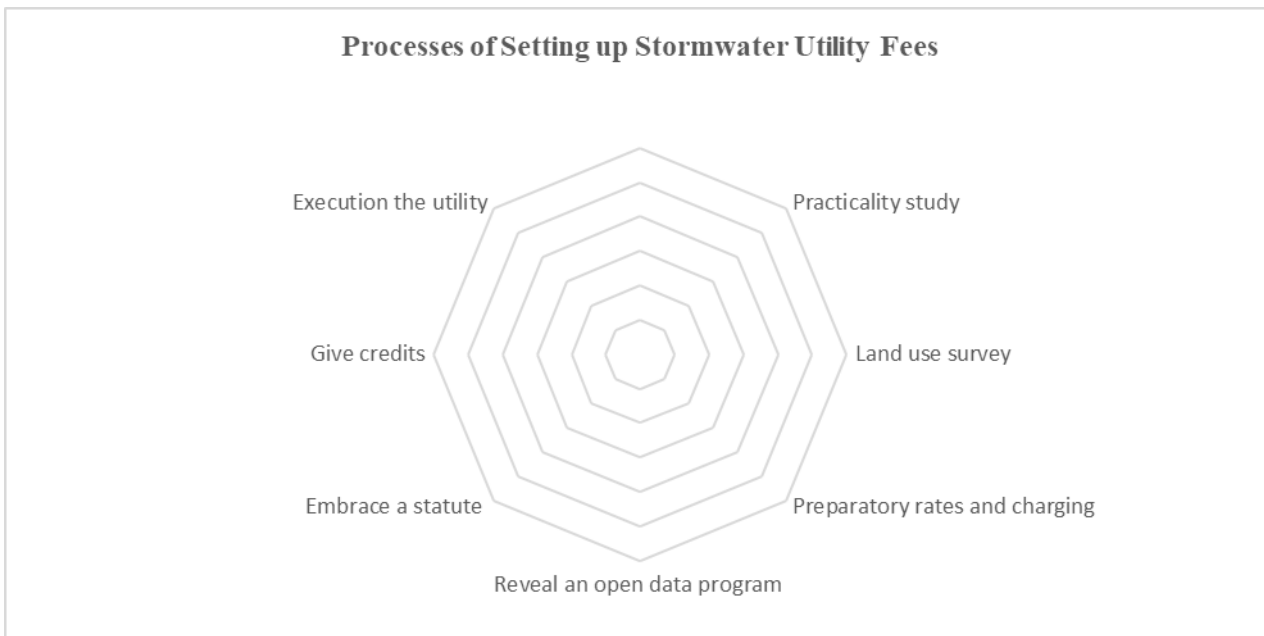


Figure 3.2 Self-design

3.3. Development of a practicality/feasibility Study

A study conducted in the village of Winnetka reported that performing a feasibility study involves the identification and discussion of stormwater issues affecting the community with stakeholders (Village of Winnetka, Illinois, 2013). The first step in creating stormwater utility fees in a jurisdiction is to develop a feasibility study that gives the community with enough information to decide whether to proceed to implementation. It will address preliminary revenue requirements and an initial assessment of the billing area to determine the billing rate. The study result is then presented to municipal staff and officials to decide whether to proceed with the development of the utility (Chicago Metropolitan Agency for Planning (CMAP), 2013).

4.0. Preparatory rates and charging

Stormwater utilities are created by local statutes, which must establish the various components of the service and the rate structure. Also, If the municipality decides after the feasibility study to continue the development of a stormwater utility and a charging system will develop. The user data will involve the collection of data that requires parcel area, for instance, the personal ownership and impervious area for each parcel, and developing a system to bill users.

4.1. Open Data Program

This is a form of social marketing entrepreneurial strategy, and it is critical throughout the stormwater utility development process. Also, a well-funded stormwater program can help reduce flooding, improve drought conditions, create better fishing and recreation, and improve water quality. Initial engagement with the community is an essential step to a successful program (Kim & Li, 2016). This education phase is critical to avoid legal issues with residents in the future. An organized public information and education program components are: identifying key users and groups, establishing an advisory committee, including a cross-section of the community representation from the university, business, non-profits, churches, developers, and shopping center owners. Also, it involves the creation of a stormwater utility web site, preparing pamphlets and presentations, meeting with key user groups and the media, and distributing information before initial billing. The public outreach awareness program must emphasize the advantages of stormwater management, which include health safety through drinking clean quality water and aquatic life safety.

4.2. Embrace a Statute

The effective implantation of stormwater utility fees in a municipality requires the establishment of a statute (Kim & Li, 2016). A statute (law) will provide legal authority for the establishment of the utility.

4.3. Give Credits

The credits are often built into the statute and can be used to provide incentives for specific practices or relief from utility fees to certain types of land uses. They can include the installation of approved retention/detention pond and other best management practices (BMPs) (Williams, Frost, & Xenopoulos, 2013), installation of approved BMPs such as rainspout disconnections or porous pavers, and educational programs for employees. The credits will often be granted for undeveloped pervious properties.

4.4. Execution

The first bill is the most important as many customers do not focus on the new stormwater fee until they receive their first bill. Customers should be notified several months in advance of the date of billing initiation and their estimated cost. A telephone hotline, email service, and website should be created to address questions and concerns. Also, the municipality should be prepared to address legal challenges to its stormwater fee (Brisman et al., 2001; CMAP, 2013).

5.0. Conclusion

In conclusion, stormwater management utility fees are an essential program that needs to be implemented in all parts of the countries and even in all parts of the world to ensure that pollutants are removed from stormwater adequately. Also, this provides that there is improved water quality in the United States waterways. Efforts to control stormwater are being put in place in the state of Maryland and other states as

well through the construction of ponds and incorporating green infrastructures by individuals on their landed property. The department of public works is also establishing stormwater control measures by ensuring that awareness programs are created to educate its citizens about stormwater fees. The public works department at the Bureau of stormwater management has also created websites for the quick access of people to understand that stormwater utility is a fee and not a tax for every property owner. This literature review has shown that stormwater management is still an ongoing problem and that there is a need for improvement in every jurisdiction. Several research studies have proved that stormwater utility fees are the best method to ensure that there is clean water and following the clean water act (CWA).

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